ENHANCED WATERSHED MANAGEMENT PROGRAM (EWMP)

for the Beach Cities Watershed Management Area (Santa Monica Bay and Dominguez Channel Watersheds)

Submitted to:
Los Angeles Regional Water Quality Control Board

Submitted by:
Beach Cities EWMP Group

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AED	Allowable Exceedance Days
ASBS	Area of Special Biological Significance
ASCE	American Society of Civil Engineers
BMP	Best Management Practice
Caltrans	California Department of Transportation
CERCLA	Comprehensive Environmental Response, Compensation, & Liability Act
CFCC	California Financing Coordinating Committee
cfs	Cubic feet per second
CIMP	Coordinated Integrated Monitoring Program
CML	Compliance Monitoring Location
CNT	Center for Neighborhood Technology
COMM	Commercial and Sport Fishing
Conc.	Concentration
CSMP	Coordinated Shoreline Monitoring Plan
CTR	California Toxic Rules
cu-ft	Cubic feet
CWA	Clean Water Act
CWSRF	Clean Water State Revolving Fund
DC	Dominguez Channel
DCu	Dissolved Copper
DDT	Dichloro-diphenyl-trichloroethane
DP	Dissolved Phosphorus as P
DZn	Dissolved Zinc
EIFD	Enhanced Infrastructure Financing Districts
EMC	Event Mean Concentration
EWMP	Enhanced Watershed Management Program
FAA	Federal Aviation Administration
FC	Fecal coliform
FIB	Fecal Indicator Bacteria
ft	Foot
GIS	Geographic Information System
GM	Geometric Mean
GO	General Obligation
gpm	Gallons per minute
HFS	High Flow Suspension
HSPF	Hydrological Simulation Program - Fortran
IBD	International BMP Database
IC/ID	Illicit Connection/Illicit Discharge
IDDE	Illicit Discharge Detection and Elimination
IGP	Industrial General Permit
in	inch
IND	Industrial Service Supply
in/hr	Inches per hour

IPM	Integrated Pest Management
J5&6	Jurisdictional Groups 5 and 6
JPA	Joint Powers Authority
LACFCD	Los Angeles County Flood Control District
LADWP	Los Angeles Department of Water and Power
LARWQCB	Los Angeles Regional Water Quality Control Board
lb	Pound
LID	Low Impact Development
LSPC	Loading Simulation Program C++
MAR	Marine Habitat
MB	Manhattan Beach
MCM	Minimum Control Measure
MEP	Maximum Extent Practical
MIGR	Migration of Aquatic Organisms
min	Minute
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
MUN	Municipal and Domestic Supply
NAV	Navigation
NH3	Ammonia as N
NO3	Nitrate as N
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
OM&R	Operations, Maintenance, and Replacement
PCB	Polychlorinated Biphenyl
PIPP	Public Information and Participation Program
RAA	Reasonable Assurance Analysis
RARE	Rare, Threatened, or Endangered Species
RB	Redondo Beach
REC-1	Water Contact Recreation
REC-2	Non-Contact Water Recreation
RWL	Receiving Water Limitation
SBPAT	Structural BMP Prioritization and Analysis Tool
SCCWRP	Southern California Coastal Watershed Research Project
SCPWA	Southern California Public Water Authority
SFPUC	San Francisco Public Utilities Commission
SHELL	Shellfish Harvesting
SMB	Santa Monica Bay
SMBBB	Santa Monica Bay Beaches Bacteria
SPWN	Spawning, Reproduction, and/or Early Development
SUSMP	Standard Urban Stormwater Management Program
SWMM	Storm Water Management Model, originally developed by USEPA
SWQDv	Storm Water Quality Design Volume
SWQPA	State Water Quality Protection Area

SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TCu	Total Copper
TKN	Total Kjeldahl Nitrogen as N
TP	Total Phosphorus
TPb	Total Lead
TIE	Toxicity Identification Evaluation
TLR	Total Load Reduction
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
TZn	Total Zinc
USEPA	United States Environmental Protection Agency
WARM	Warm Freshwater Habitat
WBPC	Water Body-Pollutant Combination
WDR	Waste Discharge Requirement
WER	Water Effects Ratio
WERF	Water Environment Research Foundation
WET	Wetland Habitat
WHAT	Web-Based Hydrograph Analysis Tool
WILD	Wildlife Habitat
WLA	Waste Load Allocation
WMA	Watershed Management Area
WMG	Watershed Management Group
WMMS	Watershed Management Modeling System
WMP	Watershed Management Program
WQBEL	Water Quality-Based Effluent Limitation
yr	Year

EXECUTIVE SUMMARY

PURPOSE AND OBJECTIVES

Following adoption of the 2012 Los Angeles Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit[1] (Permit), the Cities of Hermosa Beach, Manhattan Beach, Redondo Beach and Torrance, together with the Los Angeles County Flood Control District (LACFCD), collectively referred to as the Beach Cities Watershed Management Group (Beach Cities WMG) agreed to collaborate on the development of an Enhanced Watershed Management Program (EWMP) for the Santa Monica Bay (SMB) and Dominguez Channel Watershed areas within their jurisdictions (referred to herein as the Beach Cities EWMP Area). The Machado Lake Watershed is being addressed separately by the City of Torrance, and is not addressed in this EWMP.

This EWMP is intended to facilitate effective, watershed-specific Permit implementation strategies in accordance with Permit Part VI.C. Watershed Management Program. This EWMP:

- Summarizes watershed-specific water quality priorities identified by the Beach Cities WMG;
- Outlines the program plan, including specific strategies, control measures and best management practices (BMPs)[2], necessary to achieve water quality targets (Water Quality-Based Effluent Limitations [WQBELs] and Receiving Water Limitations [RWLs]); and
- Describes the quantitative analyses completed to support target achievement and Permit compliance.

In compliance with Section VI.C.4.b of the Permit, the Beach Cities WMG submitted to the Los Angeles Regional Water Quality Control Board (LARWQCB) a Notice of Intent (NOI) (**Appendix A**) to develop an EWMP on June 28, 2013, with a revised NOI submitted December 17, 2013 in response to comments received from LARWQCB staff. On March 27, 2014, the Beach Cities WMG received a letter from the Executive Officer of the LARWQCB approving the revised NOI submittal. In compliance with Section VI.C.4.c.iv of the Permit, the Beach Cities WMG then submitted a draft EWMP Work Plan to the LARWQCB on June 26, 2014. LARWQCB comments were not received on the EWMP Work Plan; therefore work proceeded on EWMP development consistent with the approach outlined in the EWMP Work Plan. The Beach Cities WMG was required by Section VI.C.4.c.iv of the Permit to submit a draft EWMP no later than June 30, 2015. This document has been developed to serve as the Beach Cities Draft EWMP and is consistent with the Work Plan previously submitted to the LARWQCB.

Watershed Management Programs (WMPs) are a voluntary opportunity afforded by Section VI.C.1 of the Permit for Permittees to collaboratively or individually develop comprehensive watershed-

[1] Order No. R4-2012-0175 NPDES Permit No. CAS004001 Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4.

[2] For simplification, the term "BMP" will be used to collectively refer to strategies, control measures, and/or best management practices. The Permit also refers to these measures as Watershed Control Measures.

specific control plans and are intended to facilitate Permit compliance and water quality target achievement. Enhanced WMPs (EWMPS) are WMPs which comprehensively evaluate opportunities for collaboration on multi-benefit regional projects that retain all non-stormwater runoff and runoff from the 85th percentile, 24 hour storm event while also achieving benefits associated with issues such as flood control and water supply. Where it is not feasible for regional projects to retain the 85th percentile 24 hour storm, the EWMP must demonstrate through a Reasonable Assurance Analysis, that applicable water quality targets should be achieved. Permittees within the Beach Cities Watershed Management Area (WMA) have elected to prepare an EWMP. The EWMP allows Permittees to collaboratively or individually develop comprehensive watershed-specific control plans which a) prioritize water quality issues, b) identify and implement focused strategies, control measures and BMPs, c) execute an integrated monitoring and assessment program, and d) allow for modification over time. In general, WMPs and EWMPs are intended to facilitate Permit compliance and water quality target achievement and goals that: 1) discharges from covered MS4s achieve applicable WQBELs and RWLs and do not include prohibited non-stormwater discharges; and 2) control measures are implemented to reduce the discharge of pollutants to the maximum extent practicable (MEP). Per Permit Section VI.C.1.e, WMPs and EWMPs are to be developed based on the LARWQCB's WMAs or subwatersheds thereof.

Consistent with Permit requirements, this EWMP is written to:

1. Be consistent with Permit provisions for EWMPs in Part VI.C.1.a.-f and Part VI.C.5-C.8;
2. Incorporate applicable State agency input on priority setting and other key implementation issues;
3. Provide for meeting water quality standards and other Clean Water Act obligations;
4. Include multi-benefit regional projects which retain stormwater from the 85th percentile 24 hour storm where feasible;
5. Include watershed control measures which achieve compliance with all interim and final WQBELs in drainage areas where retention of the 85th percentile 24 hour storm is infeasible with reasonable assurance;
6. Maximize the effectiveness of funding;
7. Incorporate effective innovative technologies;
8. Ensure existing requirements to comply with technology based effluent limitations and core requirements are not delayed; and
9. Ensure a financial strategy is in place.

This EWMP is applicable to the Beach Cities WMG EWMP Area, which consists of all of the incorporated MS4 areas of the cities of Redondo Beach, Manhattan Beach, Hermosa Beach and Torrance (excluding the Machado Lake Watershed) and includes the infrastructure of the LACFCD within those jurisdictions (**Figure ES-1**). This area includes portions of two distinct HUC-12

watersheds[3], Santa Monica Bay Watershed and Dominguez Channel Watershed, as summarized in **Table ES-1**. The Wylie Sump, Bishop Montgomery Basin, and Ocean Basin are all retention basins with no outlet. Therefore, their drainage areas have been excluded from the EWMP Reasonable Assurance Analysis (RAA). The Del Amo Retention Basin also has no outlet, and is sized to capture runoff from at least the 85th percentile, 24 hour storm event. Because the Del Amo Retention Basin is within the Machado Lake Watershed, this drainage area is excluded from the EWMP.

- The western portion of the Beach Cities EWMP Area consists of approximately 7,840 acres of land that drains to Santa Monica Bay (SMB). This accounts for 52% of the total Beach Cities WMG area, and includes portions of the cities of Manhattan Beach, Redondo Beach, and Torrance, and the entirety of the City of Hermosa Beach. This portion of the study area is hereinafter referred to as the "SMB Watershed".
- The northeastern portion of the Beach Cities EWMP Area is tributary to Dominguez Channel (including Torrance Carson Channel) and is comprised of approximately 7,380 acres of land. This watershed accounts for 48% of the total Beach Cities EWMP Area, and includes portions of the cities of Manhattan Beach, Redondo Beach, and Torrance. Storm drains from the Cities of Manhattan Beach and Redondo Beach drain through the City of Lawndale before discharging to Dominguez Channel. The City of Torrance's MS4 discharges directly to Dominguez Channel and Torrance Carson Channel (Torrance Lateral). Collectively, this portion of the study area is hereinafter referred to as the "Dominguez Channel Watershed".

Table ES-1. Beach Cities WMG Area Distribution by Participating Agency

Participating Agency	Area (acres)		
	Santa Monica Bay Watershed	Dominguez Channel Watershed	Total EWMP Area (% of total)
City of Redondo Beach	2,614	1,217	3,831 (25%)
City of Manhattan Beach	2,078	350	2,428 (16%)
City of Hermosa Beach	832	-	832 (5%)
City of Torrance	2,314	5,812	8,126 (53%)
Total	**7,837**	**7,379**	**15,217 (100%)**

The EWMP approach, including model selection, data inputs, critical condition selection, calibration performance criteria, and output types is consistent with the LARWQCB Reasonable Assurance Analysis Guidance Document (LARWQCB, 2014) and also leverages previous efforts where relevant models have already been developed. The individual water quality targets, BMPs, Reasonable Assurance Analyses, schedules, and costs for each of the watersheds are summarized in watershed-specific sections that follow.

[3] A HUC-12 watershed is defined by a 12-digit hydrologic unit code (HUC) delineation, which identifies the watershed area based on six levels of classification: regional, sub-region, hydrologic basin, hydrologic sub-basin, watershed, and subwatershed.

SANTA MONICA BAY WATERSHED

Receiving waters for stormwater runoff from the Beach Cities EWMP Area were screened for water quality priorities by reviewing Total Maximum Daily Loads (TMDLs), the State's 303(d) list, and additional water quality data. Each identified water quality priority for a given receiving water body was categorized as a water body-pollutant combination. Water body-pollutant combinations were classified into one of three categories, in accordance with Section VI.C.5(a).ii of the Permit. **Table ES-2** presents the prioritized water body-pollutant combinations within the SMB Watershed portion of the Beach Cities EWMP Area. Water body-pollutant combinations categorized below are subject to change based on future data collected as part of the Coordinated Integrated Monitoring Program (CIMP) or other monitoring program.

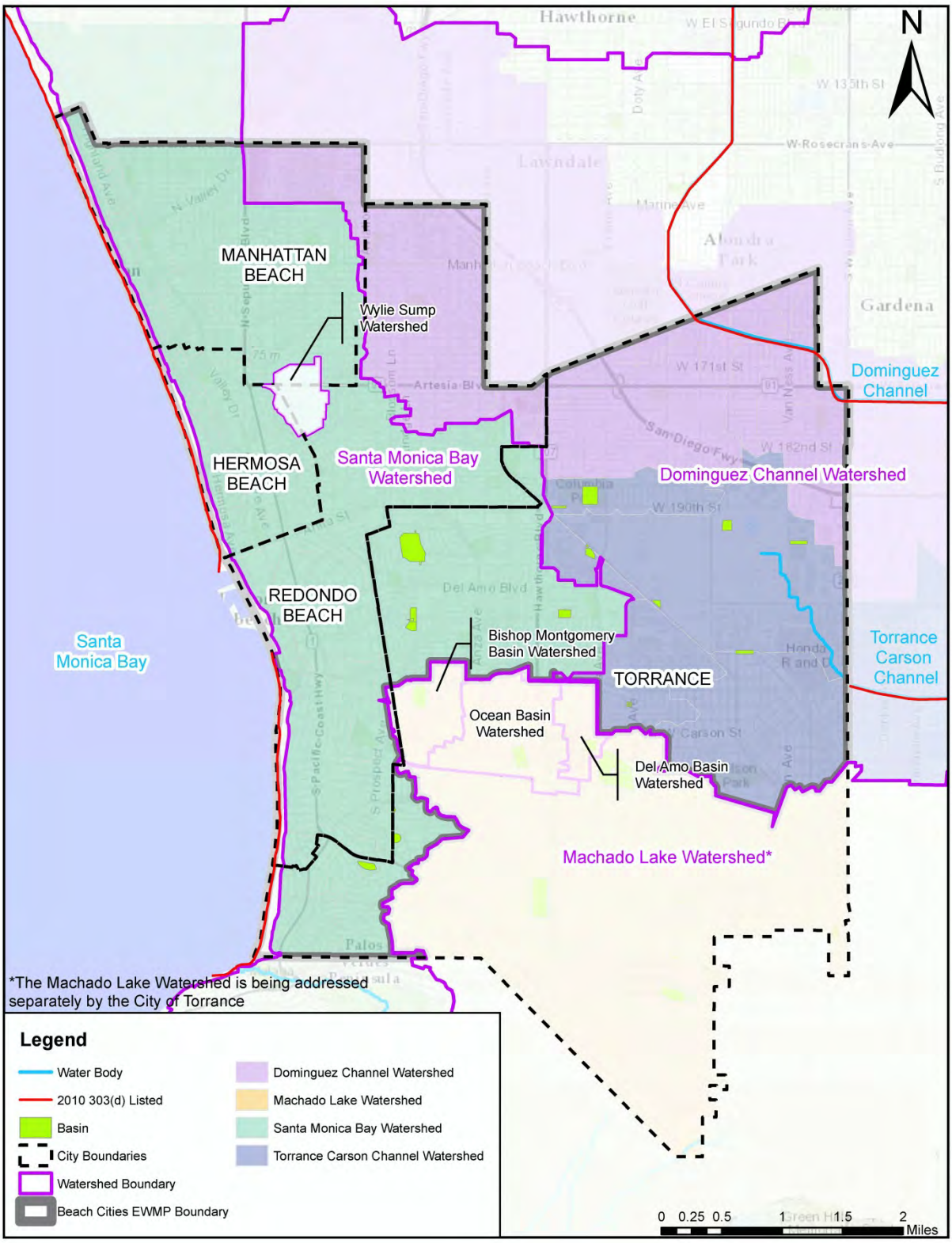


Figure ES-1. Beach Cities EWMP Area

Table ES-2. Water Body-Pollutant Combination Prioritization for the Santa Monica Bay Watershed

Category	Water Body	Pollutant	Reason for Categorization
1: Highest Priority	Santa Monica Bay Beaches	Dry Weather Bacteria	SMB Beaches Dry Weather Bacteria TMDL
		Wet Weather Bacteria	SMB Beaches Wet Weather Bacteria TMDL
	Santa Monica Bay	Trash/Debris	SMB Debris TMDL
		DDTs	SMB PCBs and DDT TMDL
		PCBs	SMB PCBs and DDT TMDL
2: High Priority	N/A	None	No other 303(d) listings exist for the Beach Cities portion of SMB
3: Medium Priority	N/A	None	Outfall and receiving water monitoring data are not available for the Beach Cities portion of SMB

The Reasonable Assurance Analysis was performed on bacteria in each of the defined analysis regions (**Figure ES-2**), as it was the controlling pollutant within the SMB Watershed. Bacteria targets are summarized in **Table ES-3**.

Trash was not modeled as part of the Reasonable Assurance Analysis; instead, the Reasonable Assurance Analysis describes how the Beach Cities WMG Agencies will comply with the TMDL through their Trash Monitoring and Reporting Programs which are aimed at meeting the zero trash discharge definition in the TMDL (see Section 2.2.2 herein).

The MS4 compliance targets for dichloro-diphenyl-trichloroethanes (DDTs) and polychlorinated biphenyls (PCBs) established in the Santa Monica Bay DDT & PCB TMDL were based on the assumption that the existing stormwater pollutant loads for DDT and PCBs were equal to or lower than what was needed to protect the Santa Monica Bay from these legacy pollutants (i.e., based on data used in the TMDL, no MS4 pollutant load reduction is expected to be required to demonstrate compliance with the TMDL). Therefore, it is assumed that no reductions in DDT and PCB loading from the Beach Cities WMG MS4s are required to meet the TMDL and reasonable assurance of compliance is assumed to be demonstrated without modeling. Monitoring of these pollutants will occur under the Beach Cities CIMP. Once three years of water quality data are collected, further source assessment will be considered and the categorization and prioritization of PCBs and DDT as MS4-related pollutants of concern will be reevaluated. If the CIMP monitoring data show that Beach Cities discharges are not in compliance with the TMDL, an RAA will be conducted for these pollutants and the EWMP will be revised accordingly.

Table ES-3. Water Quality Targets for Modeled Pollutants in the Santa Monica Bay Watershed

Water Body	Pollutant	RWL/WQBEL from the Permit	Note on Modeling Assumptions
Santa Monica Bay Beaches	Fecal Coliform (modeled as surrogate for all three fecal indicator bacteria in the Santa Monica Bay Beaches Bacteria [SMBBB] TMDL)	Allowable Exceedance Days per season per year (varies by beach Compliance Monitoring Location)	Used 90th percentile rain year (based on wet days) as the critical condition. Accounted for site-specific exceedance rates and the number of discharge days modeled for each Compliance Monitoring Location.

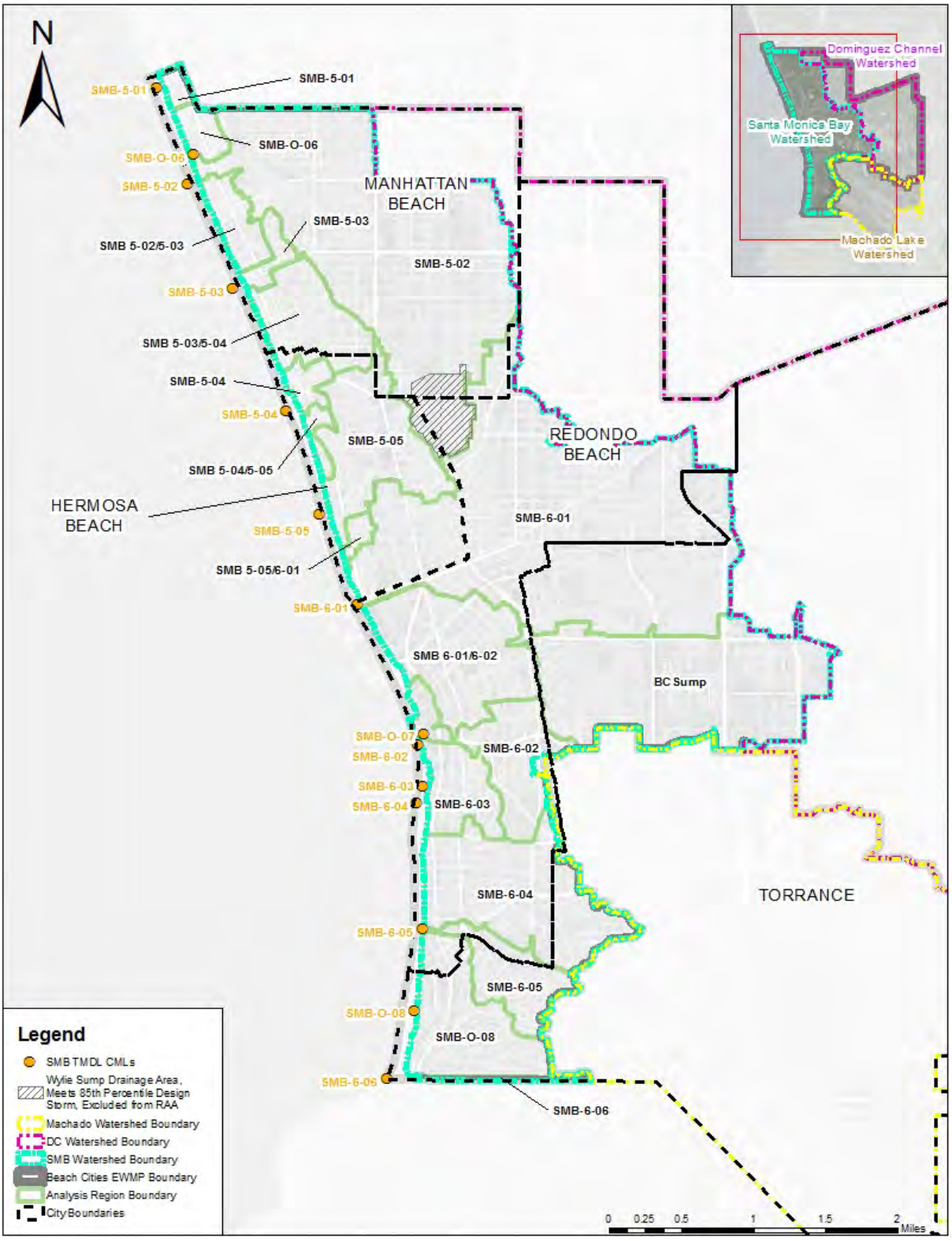


Figure ES-2. Analysis Regions and Compliance Monitoring Locations within the SMB Watershed portion of the Beach Cities EWMP Area

Targets – Santa Monica Bay

Target load reductions (TLRs) represent a numerical expression of the Permit compliance metrics that can be modeled and can serve as a basis for confirming, with reasonable assurance, that implementation of the proposed BMPs will result in attainment of the applicable TMDL-based WQBELs and RWLs in the Permit for Category 1 pollutants, or the Water Quality Objectives for Category 2 and Category 3 pollutants. For bacteria, the target load reductions are expressed as Allowable Exceedance Days (AEDs) per year. TLRs for both interim and final compliance deadlines are presented for all analysis regions including both open beach and point zero compliance monitoring locations (CMLs) (**Table ES-4**).

Table ES-4. TLRs for Fecal Coliform in the Santa Monica Bay Watershed

Analysis Region	Baseline Condition for the Critical Year			Allowed Condition for the Critical Year			Target Load Reduction for the Critical Year[6]			
							Interim Target Load Reduction		Final Target Load Reduction	
	Annual Runoff (ac-ft)	Average Pollutant Conc.[5] (MPN/ 100mL)	Annual Pollutant Load (10^{12} MPN)	Annual Runoff (ac-ft)	Average Pollutant Conc.[5] (MPN/ 100mL)	Annual Pollutant Load (10^{12} MPN)	Absolute Load (10^{12} MPN)	% of Baseline Annual Load	Absolute Load (10^{12} MPN)	% of Baseline Annual Load
SMB-5-01[1]	39	15,400	7.4	39	15,400	7.4	Interim target load reduction assessed on a watershed-wide basis		0	0%
SMB-O-06	90	20,700	23.0	90	20,700	23.0			0	0%
SMB-5-02	1516	28,600	534.8	1516	15,400	287.2			247.6	46.3%
SMB-5-02/ SMB-5-03[2]	123	23,000	34.9	123	23,000	34.9			0	0%
SMB-5-03[1]	65	36,200	29.0	65	36,200	29.0			0	0%
SMB-5-03/ SMB-5-04[2]	251	28,800	89.3	251	28,800	89.3			0	0%
SMB-5-04[1]	51	27,200	17.1	51	27,200	17.1			0	0%
SMB-5-04/ SMB-5-05[2]	37	17,800	8.2	37	17,800	8.2			0	0%
SMB-5-05[1]	472	31,400	182.8	472	31,400	182.8			0	0%
SMB-5-05/ SMB-6-01[2]	36	15,100	6.7	36	15,100	6.7			0	0%
SMB-6-01[3]	2118	27,100	706.6	2118	15,100	394.3			312.1	44.2%
BCSump[3]	1191	25,800	379.4	1191	13,700	201.4			178	46.9%
SMB-6-01/ SMB-6-02[2]	621	21,200	162.5	621	21,200	162.5			0	0%
SMB-6-02[1,4]	358	22,600	99.6	358	22,600	99.6			0	0%
SMB-6-03	206	24,500	62.2	206	24,500	62.2			0	0%
SMB-6-04	621	27,400	209.9	621	27,400	209.9			0	0%
SMB-6-05[1]	230	32,000	90.9	230	32,000	90.9			0	0%
SMB-O-08	425	26,500	138.9	425	26,500	138.9			0	0%
SMB-6-06[1]	19	28,000	6.7	19	28,000	6.7			0	0%
SMB Watershed	**8468**	**26,700**	**2789.9**	**8468**	**19,600**	**2052.1**	**368.9**	**13%**	**737.7**	**26%**

[1] Anti-degradation site.

[2] For the unmonitored tributary areas located in-between the CML tributary areas, TLRs were assigned from the geographically smaller of the two adjacent CML analysis regions.

[3] "BCSump" was defined as a separate analysis region for modeling purposes. The baseline load for "BCSump" analysis region was combined with the baseline load of the "SMB-6-01" analysis region to equal the total baseline load contributing to the SMB-6-01 CML ("SMB-6-01+BCSump").

[4] The drainage area to Outfall SMB-O-07 is encompassed by analysis region SMB-6-02; therefore SMB-O-07 was analyzed as part of analysis region SMB-6-02.

[5] The average pollutant concentration is estimated as the total pollutant load divided by total runoff volume.

[6] RAA demonstration is made based on the achievement of the TLR values in terms of absolute load removed by the proposed suite of BMPs in each analysis region. The allowed conditions in terms of runoff volume and concentration are shown for informational purposes only.

Nine CMLs were assigned zero TLRs to reflect their historic good water quality (consistent with anti-degradation-based wet weather allowable exceedance days). Although the SMBBB TMDL requires only the maintaining of beach water quality at anti-degradation compliance locations, the Beach Cities EWMP will seek to implement nonstructural and Low Impact Development (LID)-based BMPs within the SMB portion of their EWMP area; this will further protect and potentially improve water quality at these beaches and is consistent with the Jurisdictional Group 5 and 6 (J5&6) Implementation Plan (Geosyntec Consultants, 2011).

BMPs – Santa Monica Bay

EWMPs offer Permittees the opportunity to identify and implement focused strategies, control measures and BMPs to achieve applicable water quality targets (WQBELs and RWLs) and to reduce the discharge of pollutants to the maximum extent practicable. In order to demonstrate reasonable assurance, BMPs were identified and prioritized. Prioritization was based on cost (low cost BMPs were prioritized); BMP effectiveness for the pollutants of concern (BMPs that had greater treatment efficiency for the specific pollutants of concern were prioritized); and implementation feasibility as determined by the Beach Cities agencies. In general, nonstructural (e.g., programmatic) BMPs were prioritized over structural BMPs due to their lower relative cost.

The following is an overview of the types of BMPs contemplated in this EWMP within the Santa Monica Bay Watershed.

Programmatic BMPs: These source controls include a combination of BMPs such as new or enhanced pet waste controls (ordinance, signage, education/outreach, mutt mitts, etc.), Clean Bay Restaurant Program, human waste source tracking and remediation (e.g., leaking sewer investigations including implementation of each agency's Sanitary Sewer Management Plan consistent with Statewide Waste Discharge Requirements [WDRs], etc.), enhanced street sweeping (e.g., 100% vacuum sweepers, increased frequency, posting of 'No Parking' signs for street sweeping, etc.), increased catch basin and storm drain cleaning, and other new or enhanced nonstructural BMPs that target the pollutants addressed in this EWMP.

Public Retrofit Incentives: These BMPs include programs directed at incentivizing the public to decrease the amount of stormwater runoff from their property, specifically via downspout disconnection programs that redirect roof runoff to vegetated or otherwise pervious areas.

Redevelopment: Beginning in 2001, redevelopment projects were required by the Permit (via the Standard Urban Stormwater Management Program [SUSMP]) to incorporate stormwater treatment BMPs into their projects if their project size exceeded specified thresholds. The 2001 MS4 Permit SUSMP redevelopment requirements were applied between 2003 (the point at which the Bacteria TMDL was implemented) and 2015 for the SMB EWMP area. Additionally, the 2012 MS4 Permit established new criteria for redevelopment projects, requiring certain sized projects to capture, retain, or infiltrate the 85th percentile design storm or the 0.75-inch design storm, whichever is greater, via the implementation of LID BMPs. These were taken into account as well.

Non-MS4 Permitted Parcels or Areas: In general, this BMP assumes that regulated parcels/areas would be in compliance with the NPDES Statewide Storm Water Permit Waste Discharge

Requirements (WDRs) from State of California Department of Transportation (Order No. 2012-0011-DWQ, NPDES No. CAS000003) and the California NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Industrial General Permit [IGP], Order 2014-0057-DWQ).

Structural BMPs: Both existing and proposed regional and distributed structural BMPs are included in this EWMP to address water quality targets in the SMB Watershed. Because bacteria were identified as the controlling pollutant of concern, infiltration BMPs were prioritized as they are most effective for addressing bacteria. General design criteria for proposed structural BMPs are summarized in **Table ES-5**.

Table ES-5. Proposed Structural BMPs in the Santa Monica Bay Watershed

Analysis Region	Project Name[1]	Description	Design Storage Volume (cu-ft)	Tributary Area (acres)
SMB-5-02	Manhattan Beach Infiltration Trench[3]	Located along the coast of Manhattan Beach, the sub-surface trench has a potential surface area of 2.2 ac, an average depth of 2.1 ft with a diversion rate of 160 cfs and an infiltration rate under the trench of 13 in/hr.	198,000	1,475[2]
SMB-5-02	Distributed Green Streets	The distributed green streets, proposed to address runoff from 5% of single family residential, multi-family residential, and commercial land uses, are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	205,500	66
SMB-6-01	Hermosa Beach Infiltration Trench	Located along the coast of Hermosa Beach, the sub-surface trench has a potential surface area of 0.2 ac, an average depth of 1.7 ft, a diversion flowrate of 25 cfs, and an infiltration rate of 12.5 in/hr.	13,300	2,000[2]
SMB-6-01	Hermosa Beach Greenbelt Infiltration[3]	Located in Hermosa Beach, between Valley Dr. and Ardmore Ave., the sub-surface trench has a potential surface area of 1.5 ac, an average depth of 5 ft, a diversion flowrate of 48 cfs, and an assumed infiltration rate of 12 in/hr.	319,000	1,800[2]
SMB-6-01	Park #3	Located northwest of Blossom Lane and 190th street, the sub-surface infiltration basin has a potential surface area of 0.4 ac, an average depth of 5ft , a diversion flowrate of 13 cfs, and an infiltration rate of 1 in/hr.	87,100	1,430[2]
SMB-6-01	Distributed Green Streets	The distributed green streets, proposed to address runoff from 25% of single family residential, multi-family residential, and commercial land uses, are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	605,200	190

[1] All projects listed in this table were modeled in the RAA and sized to collectively comply with the WQBELs and RWLs in combination with other existing and proposed structural and non-structural BMPs

[2] This includes upstream BMPs and associated tributary drainage areas

[3] Alternative project locations have also been identified

Distributed green streets BMPs are proposed and were modeled as part of the Reasonable Assurance Analysis within select analysis regions, at analysis region-specific implementation levels (e.g., runoff from 14% of single family residential, multi-family residential, and commercial land uses would be treated by green streets BMPs). It should be noted that if at any time in the future, specific distributed green streets or regional/centralized BMPs are found to be infeasible for implementation, alternative BMPs or operational changes will be planned within the same subwatershed and within the same timeline, to meet an equivalent subwatershed load reduction. In addition, if monitoring data indicate that more easily implementable, alternative BMPs can provide equivalent (or superior) load reductions, these alternative BMPs may be implemented at the discretion of the WMG Agencies. The Beach Cities WMG will provide timely notification and project details to the Regional Board in the case of any project substitutions.

Demonstration of Compliance – Santa Monica Bay

To demonstrate wet weather compliance, a Reasonable Assurance Analysis was conducted in which the following steps were taken:

1. For each analysis region, develop TLRs for 90th percentile year based on Permit requirements and LARWQCB guidance;
2. Identify structural and non-structural BMPs that were either implemented after applicable TMDL effective dates or are planned for implementation in the future:
    a. Assume a load reduction for non-modeled non-structural (or programmatic) BMPs (five percent of baseline pollutant load);
    b. Calculate load reductions for public incentives for retrofits on private property (e.g., downspout disconnects) and redevelopment (e.g., low impact development requirements);
    c. Calculate load reductions attributable to anticipated new permit compliance activities of non-MS4 Permittees (e.g., Industrial General Permit holders and California Department of Transportation [Caltrans]); and
    d. Calculate load reductions for proposed regional BMPs that were identified in existing plans;
3. Compare total estimated load reduction for each analysis region with the TLRs; and
4. Meet the TLRs by backfilling the remaining load reduction with new regional or distributed green streets BMPs, and with green streets that address a certain percentage of specific developed land uses.

Results of the Reasonable Assurance Analysis for each analysis region in the SMB watershed are presented in **Table ES-6** below. The values provided correspond to the load reductions attributable to the BMP types following the applicable final and interim compliance deadlines. As shown, the final TLR is met in all SMB watershed analysis regions with varying applications of non-structural and regional BMPs. The interim 50% TLR is met through a combination of nonstructural and existing regional BMPs.

For dry weather bacteria compliance, a qualitative analysis was conducted to show compliance at each of the CMLs. Many CMLs have an effective diversion such that they are consistently operational, well maintained, and sized to effectively eliminate discharges to the surf zone during year-round dry weather days. For the remaining smaller outfalls a systematic screening conducted in 2002 demonstrated that there was no discharge to the wave wash during summer dry weather from these storm drains. Rescreening of outfalls will be conducted as part of the Non-Stormwater Screening and Monitoring in the Coordinated Integrated Monitoring Program and will include both summer dry weather and winter dry weather screening. For the CMLs in the SMB Watershed that have anti-degradation based allowed exceedance days for both winter-dry and summer-dry weather, reasonable assurance is assumed to be demonstrated through the basis that the TMDL established their allowed exceedance days based on historic conditions (i.e., no water quality improvements were necessary).

Table ES-6. Santa Monica Bay Watershed – Fecal Coliform Reasonable Assurance Analysis Results – Interim and Final Compliance

Analysis Region	Implementation Benefits (average load reduction as % of baseline load for critical year)							TLR	Compliance (TLR Met)?
	Non-Structural BMPs (Non-Modeled)	Public Retrofit Incentives + Redevelopment	Non-MS4	Regional BMPs	Distributed BMPs	Distributed BMP Implementation Level	Estimated Load Reduction		
SMB-5-01	5%	2%	0%	0%	0%	N/A	**7%**	**0%**	Yes
SMB-O-06	5%	2%	0%	0%	0%	N/A	**7%**	**0%**	Yes
SMB-5-02	5%	4%	2%	36%	3%	5% MFR/COM/SFR	**50%**	**46%**	Yes
SMB-5-02/5-03	5%	3%	0%	0%	0%	N/A	**8%**	**0%**	Yes
SMB-5-03	5%	3%	0%	0%	0%	N/A	**8%**	**0%**	Yes
SMB-5-03/5-04	5%	4%	0%	5%	0%	N/A	**15%**	**0%**	Yes
SMB-5-04	5%	5%	0%	1%	1%[2]	N/A	**12%**	**0%**	Yes
SMB-5-04/5-05	5%	4%	0%	2%	0%	N/A	**11%**	**0%**	Yes
SMB-5-05	5%	4%	5%	3%	0%	N/A	**18%**	**0%**	Yes
SMB-5-05/6-01	5%	3%	0%	2%	0%	N/A	**10%**	**0%**	Yes
SMB-6-01+ BCSump[1]	5%	3%	3%	33%	2%	25% MFR/COM/SFR	**46%**	**45%**	Yes
SMB-6-01/6-02	5%	2%	4%	0%	0%	N/A	**11%**	**0%**	Yes
SMB-6-02	5%	3%	1%	4%	0%	N/A	**13%**	**0%**	Yes
SMB-6-03	5%	3%	5%	10%	0%	N/A	**23%**	**0%**	Yes
SMB-6-04	5%	4%	3%	0%	0%	N/A	**12%**	**0%**	Yes
SMB-6-05	5%	3%	6%	0%	0%	N/A	**15%**	**0%**	Yes
SMB-O-08	5%	2%	0%	0%	0%	N/A	**7%**	**0%**	Yes
SMB-6-06	5%	5%	0%	0%	0%	N/A	**10%**	**0%**	Yes
Final Compliance Deadline (2021)	**5%**	**3%**	**3%**	**21%**	**1%**	**N/A**	**33%**	**26%**	**Yes**
Interim Compliance Deadline (2018)	**2.5%**	**0.8%**	**1.5%**	**9.6%**	**0%**	**N/A**	**14.4%**	**13%**	**Yes**

[1] "BCSump" was defined as a separate analysis region for modeling purposes. The baseline load for "BCSump" analysis region was combined with the baseline load of the "SMB-6-01" analysis region to equal the total baseline load contributing to the SMB-6-01 CML ("SMB-6-01+BCSump").

[2] Distributed green street BMP load reduction in SMB-5-04 is a result of the existing filter/infiltration boxes retrofitted on the east side of Hermosa Avenue in the City of Hermosa Beach.

Schedule – Santa Monica Bay

In order to meet the compliance deadlines for the water body-pollutant combinations discussed above based on load reduction projections in the Reasonable Assurance Analysis, the proposed structural BMPs within the SMB Watershed would be implemented as described in **Figure ES-3**.

Figure ES-3. Proposed Project Sequencing in the Santa Monica Bay Watershed

COLOR KEY	Funding Phase	Design Phase	Construction/ Installation Phase

	BMP Location/Name	Timeline						
		2015	2016	2017	2018	2019	2020	2021
Santa Monica Bay Watershed	Catch basin retrofits for trash							
	Manhattan Beach Infiltration Trench[1]							
	Manhattan Beach Green streets application in SMB-5-02							
	Hermosa Beach Greenbelt Infiltration[1]							
	Hermosa Beach Infiltration Trench							
	Redondo Beach Park #3							
	Green streets application in SMB-6-01 for All Cities							

[1] Alternative project locations have also been identified

Dominguez Channel Watershed

Within the Dominguez Channel Watershed, water body-pollutant combinations were classified into one of three categories, in accordance with Section VI.C.5(a).ii of the Permit. **Table ES-7** presents the prioritized water body-pollutant combinations within the Dominguez Channel Watershed portion of the Beach Cities EWMP Area. Water body-pollutant combinations categorized below are subject to change based on future data collected as part of the CIMP or other monitoring program.

Table ES-7. Water Body-Pollutant Prioritization for the Dominguez Channel Watershed

Category	Water Body	Pollutant	Reason for Categorization
1: Highest Priority	Dominguez Channel (including Torrance Lateral) [1]	Toxicity	Dominguez Channel Toxics TMDL
		Total Copper	Dominguez Channel Toxics TMDL
		Total Lead	Dominguez Channel Toxics TMDL
		Total Zinc	Dominguez Channel Toxics TMDL
	Dominguez Channel Estuary	Total Copper	Dominguez Channel Toxics TMDL
		Total Lead	Dominguez Channel Toxics TMDL
		Total Zinc	Dominguez Channel Toxics TMDL
		Cadmium	Dominguez Channel Toxics TMDL
		DDT	Dominguez Channel Toxics TMDL
		Total PAHs	Dominguez Channel Toxics TMDL
		PCBs	Dominguez Channel Toxics TMDL
2: High Priority	Dominguez Channel (including Torrance Lateral)	Indicator Bacteria	303(d) List
		Ammonia	303(d) List
	Dominguez Channel Estuary	Indicator Bacteria	303(d) List
		Ammonia	303(d) List
3: Medium Priority	Dominguez Channel (including Torrance Lateral)	Cyanide	Historic exceedances of the California Toxics Rule (CTR) continuous concentration water quality objective (5.2 ug/L)
		pH	Historic exceedance of the Basin Plan Objective (6.5 – 8.5)
		Selenium	Historic exceedances of the CTR continuous concentration water quality objective (5.0 ug/L)
		Mercury	Historic exceedances of the CTR human health criterion for organisms only (0.051 ug/L)
		Cadmium	Historic exceedances of the CTR continuous concentration water quality objective (2.2 ug/L)
	Dominguez Channel Estuary	Arsenic	Historic exceedances of the Effects Range-Low (ERL) proposed sediment quality guidelines from the National Status and Trends database (8.2 mg/kg sediment)
		Chromium	Historic exceedances of the ERL proposed sediment quality guidelines from the National Status and Trends database (81 mg/kg sediment)
		Silver	Historic exceedances of the CTR continuous saltwater objective (1.9 ug/L)
		Nickel	Historic exceedances of the CTR maximum saltwater objective (74 ug/L) and the CTR continuous saltwater objective (8.2 ug/L)
		Mercury	Historic exceedances of the ERL proposed sediment quality guidelines from the National Status and Trends database (0.15 mg/kg sediment) and the CTR human health criterion for organisms only (0.051 ug/L)
		Thallium	Historic exceedances of the ERL proposed sediment quality guidelines from the National Status and Trends database (6.3 ug/L sediment)

For the purposes of the wet weather Reasonable Assurance Analysis, the EWMP area directly draining to Dominguez Channel was combined into a single analysis region to establish TLRs and into two analysis regions, one including the portion of the Cities of Redondo Beach and Manhattan Beach (Dominguez Channel – Redondo Beach/Manhattan Beach [DC–RB/MB]) and one including the portion of the City of Torrance (DC – Torrance), to evaluate the performance of BMPs. For the purposes of the dry weather Reasonable Assurance Analysis for which bacteria are the only water body-pollutant combination, the EWMP area draining to Dominguez Channel was combined into the same single analysis region. The Dominguez Channel watershed analysis regions are shown in **Figure ES-4.**

The wet weather Reasonable Assurance Analysis was performed on copper, lead, zinc, and bacteria (fecal coliform) within the Dominguez Channel Watershed. Water quality targets were identified for Dominguez Channel Watershed in the same manner as in SMB Watershed. According to the Dominguez Channel WMA EWMP (DC WMG, 2015), relationships between TSS and historical organics were evaluated to determine if TSS could be used as a surrogate for historical organics. As there were significant non-detects in the available water quality data, a relationship between historic organics and TSS could not be established in the available Dominguez Channel monitoring data. Other studies have shown that relationship between TSS and historical organics can exist; however, the water quality depends on the storm event, soil disturbance, and other factors. It was assumed that if water column pollutant targets were met in Dominguez Channel, the targets would also be met downstream in the Dominguez Channel Estuary, which is the receiving water to Dominguez Channel. Sediment-borne pollutants would also be reduced by the same BMPs that are being used to address the water column pollutants. For these reasons, it was not necessary to perform a separate Reasonable Assurance Analysis for the Dominguez Channel Estuary. If monitoring data show that Dominguez Channel discharges are not meeting sediment objectives, a Reasonable Assurance Analysis will be conducted for sediment and the EWMP will be revised accordingly.

For metals, the waste load allocation (WLA) assigned to MS4 discharges, as shown in **Table ES-8,** is a mass-based allocation based on the freshwater targets for Dominguez Channel and Torrance Lateral (using ambient hardness at the time of sampling) multiplied by the daily volume and is shared amongst all MS4 Permittees that discharge to the freshwater portion of Dominguez Channel and Torrance Lateral. The water quality targets for prioritized water body-pollutant combinations are summarized in **Table ES-8**.

Table ES-8. Water Quality Targets for the Dominguez Channel Watershed

Water Body	Pollutant	RWL/WQBEL from the Permit or Assumed Based on Other Similar Los Angeles Region TMDLs[1]	Approach for Applying the Critical Period
Dominguez Channel	Fecal Coliform	19% allowed exceedance of the REC-1 water quality objective, (400 MPN/100mL) on non-high flow suspension days	90th percentile year (based on wet days) was used as the critical condition. Allowable number of wet weather exceedance days for the critical year was set to 19% of non-high flow suspension wet days, rounding down.

Water Body	Pollutant	RWL/WQBEL from the Permit or Assumed Based on Other Similar Los Angeles Region TMDLs[1]	Approach for Applying the Critical Period
	Total Copper	WQBEL=9.7 ug/L Waste load allocation (WLA)= Concentration*Daily Volume	90th percentile daily load during wet weather was used as the critical condition. This calendar day was identified for each metal by ranking daily loads for metal wet days between 2003 and 2012.
	Total Lead	WQBEL=42.7 ug/L WLA= Concentration*Daily Volume	
	Total Zinc	WQBEL=69.7 ug/L WLA= Concentration*Daily Volume	

[1] MS4 Permittees may demonstrate compliance with the freshwater metals allocations for Dominguez Channel and Torrance Lateral via any one of three different means:

a. Final allocations are met.
b. CTR total metals criteria are met instream.
c. CTR total metals criteria are met in the discharge.

Although toxicity was identified as a Category 1 water body-pollutant combination, it was not modeled for Dominguez Channel and the Torrance Lateral since it is not a wet weather parameter that can be modeled using currently available Reasonable Assurance Analysis tools for the Los Angeles Region. Instead, the Reasonable Assurance Analysis qualitatively describes how the Beach Cities WMG Agencies will comply with the TMDL WQBELs. Toxicity will continue to be monitored under the Beach Cities' CIMP. Although ammonia was identified as a Category 2 water body-pollutant combination (**Table ES-7**), monitoring data since 2003 show that all water quality samples at monitoring locations S28 and TS19 meet the freshwater Basin Plan Objective for ammonia, and as a result, ammonia was not modeled as part of the Beach Cities' Reasonable Assurance Analysis. Similarly, the Category 3 water body-pollutant combinations cyanide, pH, selenium, mercury, and cadmium, all within the Torrance Lateral, were not modeled either due to a lack of demonstrated MS4 linkage or due to data limitations. These Category 2 and 3 parameters will also be monitored under the Beach Cities' CIMP and if future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to exceedances of these pollutants in the receiving water, the EWMP will be revised to address these pollutants.

Dominguez Channel is also 303(d)-listed for diazinon, although data are not available on the SWRCB's website since this listing was made prior to 2006. However, as the Dominguez Channel Toxics TMDL staff report states, the USEPA banned diazinon on December 31, 2005. The Dominguez Channel Toxics TMDL staff report (Section 2.6.1) states, "Whereas elevated diazinon levels had been observed concurrently with toxicity in 2002-2005 wet weather samples and therefore diazinon was presumed to be contributing to adverse toxicity results; post-2005 results show no diazinon concentrations above the freshwater guideline. Therefore, it is appropriate to develop freshwater metals and toxicity TMDLs for wet weather; however, the more recent toxicity results are not attributable to diazinon and therefore no diazinon TMDLs have been developed for Dominguez Channel." Dominguez Channel and Torrance Lateral data from 2006-2013, which includes 85 total samples between the two monitoring sites, show no exceedances of the chronic diazinon criteria established by the California Department of Fish and Game (0.10 ug/L). Due to the fact that monitoring data since 2006 show that all samples at S28 and TS19 meet the applicable water quality criteria for diazinon, diazinon could reasonably be removed from the State's 303(d)

list for Dominguez Channel and therefore is not included as a Category 2 pollutant for Dominguez Channel (including Torrance Lateral).

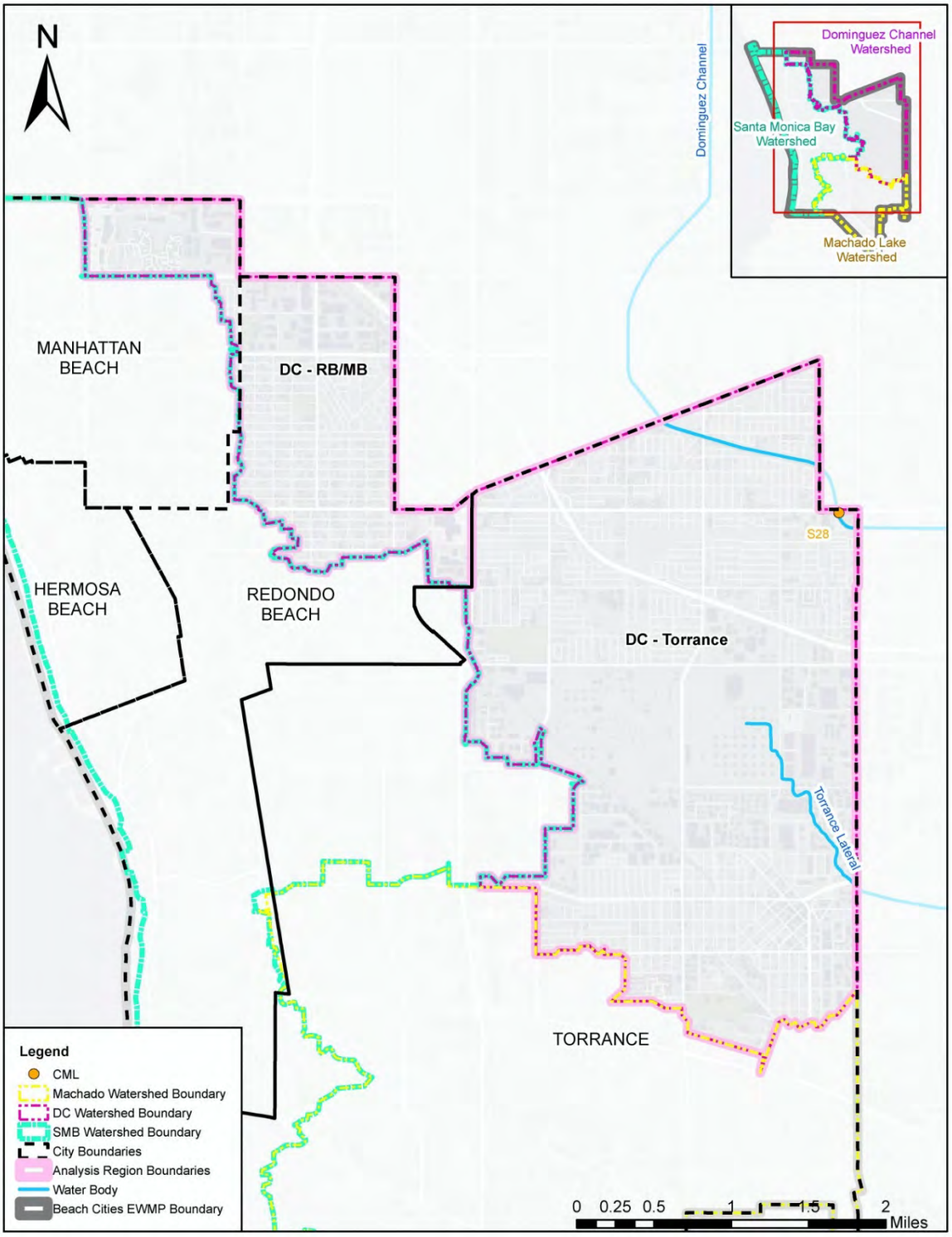


Figure ES-4. Analysis Regions within the Dominguez Channel Watershed portion of the Beach Cities EWMP Area

Targets – Dominguez Channel

As discussed previously, TLRs represent a numerical expression of the Permit compliance metrics (e.g., allowed mass per day for metals for wet weather and allowable exceedance days per year for bacteria) that can be modeled and can serve as a basis for confirming, with reasonable assurance, that implementation of the proposed BMPs will result in attainment of the applicable TMDL-based WQBELs and RWLs in the Permit for Category 1 pollutants, or the Water Quality Objectives for Category 2 and Category 3 pollutants. TLRs were developed for the single combined analysis region (**Table ES-9**).

Table ES-9. TLRs and Baseline Conditions for Pollutants in the Dominguez Channel Watershed

Pollutant	Compliance Deadline	Baseline Data for Critical Condition			Allowable Discharge for Critical Condition			Interim Target Load Reduction[4]		Final Target Load Reduction[4]	
		Runoff Volume	Pollutant Conc.[3]	Pollutant Load	Runoff Volume	Pollutant Conc. [3]	Pollutant Load	Absolute Load	% of Baseline Load	Absolute Load	% of Baseline Load
Copper	2032	301 ac-ft/day	25.8 ug/L	21 lb/day	301 ac-ft/day	9.7ug/L	8 lb/day	N/A[1]		13 lb/day	62%
Lead	2032	275 ac-ft/day	11.6 ug/L	8.7 lb/day	275 ac-ft/day	42.7 ug/L	32 lb/day			0 lb/day	0%
Zinc	2032	291 ac-ft/day	290.2 ug/L	230 lb/day	291 ac-ft/day	69.7 ug/L	55 lb/day			175 lb/day	76%
Fecal coliform	2022[2]	6,048 ac-ft/year	20,080 MPN/100 mL	1,498 *10^{12} MPN/yr	6,048 ac-ft/year	18,413 MPN/100mL	1,373*10^{12} MPN/yr	124*10^{12} MPN/yr	8.3%	-	-
	2027[2]	6,048 ac-ft/year	20,080 MPN/100 mL	1,498 *10^{12} MPN/yr	6,048 ac-ft/year	16,667 MPN/100mL	1,243*10^{12} MPN/yr	255*10^{12} MPN/yr	17%	-	-
	2032[2]	6,048 ac-ft/year	20,080 MPN/100 mL	1,498 *10^{12} MPN/yr	6,048 ac-ft/year	13,454 MPN/100 mL	1,004*10^{12} MPN/yr	-	-	493*10^{12} MPN/yr	33%

[1] The interim deadline for Dominguez Channel Toxic TMDL was March 23, 2012. Hence the interim target load reduction is not applicable since this date has passed.

[2] Proposed, non-TMDL compliance schedule.

[3] Fecal coliform concentrations are estimated as the total annual load divided by the total annual runoff volume. The pollutant concentrations presented for the Dominguez Channel Toxics TMDL are a direct output from the LSPC model used for the RAA.

[4] RAA demonstration is made based on the achievement of the TLR values in terms of absolute load removed by the proposed suite of BMPs in each analysis region. The allowed conditions in terms of runoff volume and concentration are shown for informational purposes only.

BMPs – Dominguez Channel

Both existing and proposed regional and distributed BMPs are included in this EWMP to address water quality targets in the Dominguez Channel Watershed. Distributed green streets BMPs are proposed and were modeled as part of the Reasonable Assurance Analysis within the DC-RB/MB analysis region, at an implementation level of 14% (i.e., runoff from 14% of single family residential, multi-family residential, commercial, and industrial land uses would be treated by green streets BMPs). General design criteria for proposed structural BMPs are summarized in **Table ES-10**.

Table ES-10. Proposed Structural BMPs in the Dominguez Channel Watershed

Analysis Region	Project Name[1]	Description	Design Storage Volume (cu-ft)	Tributary Area (acres)
DC – MB/RB	Powerline Easement Infiltration*	Located along powerline easements and/or adjacent to Marine Avenue and Manhattan Beach Boulevard, the sub-surface biofilter has a potential surface area of 7.2 ac, an average depth of 5 ft, a diversion flowrate of 132 cfs, and a negligible infiltration rate.	N/A (Flow-through BMP)	1,500
DC – MB/RB	Artesia Blvd. and Hawthorne Blvd. Filtration	Located near the intersection of Artesia Blvd. and Hawthorne Blvd., the sub-surface biofilter has a potential surface area of 1 ac, an average depth of 5 ft, a diversion flowrate of 13.6 cfs, and a negligible infiltration rate.	N/A (Flow-through BMP)	130
DC-MB/RB	Distributed Green Streets BMPs	The distributed green streets (to address runoff from 14% of single family residential, multi-family residential, commercial, and industrial land uses) are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	636,300	200
DC-Torrance	Catch Basin Inlet Filters	The City of Torrance plans to retrofit catch basins with inlet filters.	N/A	5,760

[1] All projects listed in this table (except for the catch basin inlet filters in DC-Torrance) were modeled in the RAA and sized to collectively comply with the WQBELs and RWLs in combination with other existing and proposed structural and non-structural BMPs. Within the DC-Torrance analysis region, catch basin inlet filters are assumed to achieve WQBEL/RWL compliance based on a review of literature/studies on their performance. The total load reduction from inlet filters will be evaluated in the future through CIMP monitoring, as part of the EWMP adaptive management process. At that time, the catch basin BMPs will be modified, with additional filters installed as necessary and additional structural/non-structural BMPs proposed as needed to meet the TLRs required to achieve water quality objectives by the compliance deadlines.

*Alternative project location has also been identified

It should be noted that if at any time specific distributed green streets or regional/centralized BMPs are found to be infeasible for implementation, or new innovative BMPs are developed, alternative BMPs or operational changes will be planned within the same analysis region and within the same timeline, to meet an equivalent analysis region load reduction. The performance of the proposed catch basin inlet filters within the City of Torrance will also be evaluated as potential alternatives to the proposed structural BMPs within the Cities of Redondo Beach and Manhattan Beach. The

Beach Cities WMG will provide timely notification and project details to the Regional Board in the case of any project substitutions.

Demonstration of Compliance – Dominguez Channel

To demonstrate wet weather compliance, the Reasonable Assurance Analysis was performed according to the following steps:

1. For each analysis region, develop TLRs for the critical condition (90th percentile year for bacteria and 90th percentile load day for metals) based on Permit requirements and LARWQCB guidance;
2. Identify structural and non-structural BMPs that were either implemented after applicable TMDL effective dates or are planned for implementation in the future:
    a. Assume a load reduction for non-modeled non-structural (or programmatic) BMPs (five percent of baseline pollutant load);
    b. Calculate load reductions for public incentives for private retrofit (e.g., downspout disconnects) and redevelopment;
    c. Calculate load reductions attributable to anticipated new permit compliance activities of non-MS4 entities (e.g., Industrial General Permit holders and Caltrans); and
    d. Calculate load reductions for proposed regional BMPs that were identified in existing plans;
3. Compare total estimated load reduction for each analysis region with the TLRs; and
4. Meet the TLRs by backfilling the remaining load reduction with new regional or distributed green streets BMPs, with green streets modeled by assuming treatment of runoff from a percentage of specific developed land uses. Within the DC-Torrance analysis region, an estimated load reduction attributable to distributed catch basin inlet filters was derived from a review of literature/studies on their performance (**Appendix B**). If the estimated performance is supported by future monitoring data, these filters may be used as alternative BMPs in other portions of the Dominguez Channel Watershed.

Results of the wet weather Reasonable Assurance Analysis for each analysis region are presented in **Table ES-11** below. The values provided correspond to the load reductions attributable to the BMP types following the applicable compliance deadline. As shown, the TLRs are predicted to be met in the DC-RB/MB analysis region for metals and fecal coliforms with varying applications of non-structural and regional BMPs as described previously. Within the DC-Torrance analysis region, the TLRs will be met through implementation of catch basin inlet filters as needed. Monitoring and subsequent adaptive management will be employed to evaluate the achieved load reductions prior to each of the compliance deadlines, installing additional filters as needed until compliance is achieved for every applicable WQBEL or RWL.

For dry weather, bacteria is the only applicable pollutant in the Dominguez Channel Watershed, and it is a Category 2 water body-pollutant combination (i.e., 303(d)-listed but not currently subject to a TMDL).

The City of Torrance's dry weather load reduction strategy will focus on non-structural source control and pollution prevention measures that are designed to reduce the amount of pollutants and understand the effect of pollutants entering runoff though education, enforcement and behavioral modification programs.

Within the Cities of Redondo Beach and Manhattan Beach, the implementation of the two regional BMPs at both outlets from the DC-RB/MB analysis region to address wet weather pollutants will control dry weather flows by capturing the small flows in the pre-treatment volume and either retaining them or treating them in the media filter.

In addition, each of the EWMP WMG cities has water conservation regulations which will reduce dry weather runoff at its source. Collectively, by controlling dry weather MS4 flows prior to entering Dominguez Channel using the proposed suite of BMPs, bacteria will be addressed. If necessary, the EWMP Group agencies retain the option of installing low flow diversions sized to effectively eliminate discharges to the receiving water year-round dry weather days. Therefore, reasonable assurance of meeting the applicable RWLs was demonstrated in this EWMP through a qualitative assessment of the proposed BMPs and their overall approach of eliminating or substantially reducing MS4 discharges during dry weather.

Table ES-11. Dominguez Channel Watershed – Reasonable Assurance Analysis Results – Interim and Final Compliance

Pollutant	Date	Implementation Benefits (average load reduction as % of baseline for the critical condition[1])						Estimated Load Reduction	TLR	Compliance (TLR Met)?
		Non-Structural BMPs (Non-Modeled)	Public Retrofit Incentives + Redevelopment	Non-MS4	Regional BMPs	Distributed BMPs	Distributed BMP Implementation Level			
Analysis Region DC-RB/MB										
Zinc	2032 (Final)	5%	9%	6%	39%	20%	14% SFR, MFR, COM, IND	**79%**	**76%**	Yes
Copper	2032 (Final)	24%[2]	0%	5%	30%	26%		**85%**	**62%**	Yes
Fecal coliform	2022 (Interim)	2.1%	1.5%	0.7%	0%	4.1%	3% SFR, MFR, COM, IND	**8.4%**	**8.3%**	Yes
	2027 (Interim)	3.5%	2.4%	1.3%	0%	10%	7% SFR, MFR, COM, IND	**17%**	**17%**	Yes
	2032 (Final)	5%	3.2%	1.8%	45%	20%	14% SFR, MFR, COM, IND	**74%**	**33%**	Yes
Analysis Region DC-Torrance										
Zinc	2032 (Final)	5%	0%	0%	0%	75% per filter	Catch basin inlet filters	See note 3	**76%**	See note 3
Copper	2032 (Final)	14%[2]	0%	0%	0%	75% per filter	Catch basin inlet filters	See note 3	**62%**	See note 3
Fecal coliform	2022 (Interim)	2.1%	0%	0%	0%	33% per filter	Catch basin inlet filters	See note 3	**8.3%**	See note 3
	2027 (Interim)	3.5%	0%	0%	0%	33% per filter	Catch basin inlet filters	See note 3	**17%**	See note 3
	2032 (Final)	5%	0%	0%	0%	33% per filter	Catch basin inlet filters	See note 3	**33%**	See note 3

[1] The critical condition is TMDL year 1995 for fecal coliform, 11/30/2007 for copper, 2/5/2010 for lead, and 2/26/2006 for zinc.

[2] Load reduction attributable to copper brake pad phase-out, after accounting for other BMPs, up to 55%.

[3] Load reduction sum cannot be estimated at this time. The individual load reduction for each inlet filter's drainage area is shown under the "Distributed BMPs" column. Initially, 200 of 643 catch basins are planned to be retrofitted in high priority catchments. The total load reduction from inlet filters will be evaluated in the future through CIMP monitoring, as part of the EWMP adaptive management process. At that time, the catch basin BMPs will be modified, with additional filters installed as necessary and additional structural/non-structural BMPs proposed as needed to meet the TLRs required to achieve water quality objectives by the compliance deadlines.

Schedule – Dominguez Channel

In order to meet the compliance deadlines for the water body-pollutant combinations based on load reduction projections in the Reasonable Assurance Analysis, the proposed structural BMPs within the Dominguez Channel Watershed would be implemented per the timeline provided in **Figure ES-5.** Project construction is proposed to be complete with project start-up beginning in 2020, at which point load reduction credit begins in the Reasonable Assurance Analysis.

Figure ES-5. Project Sequencing in the Dominguez Channel Watershed

COLOR KEY	Funding Phase	Design Phase	Construction/ Installation Phase

BMP Location/Name			Timeline													
			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Dominguez Channel Watershed	Catch basin inlet filters in DC-Torrance																
	Green Streets (Redondo Beach and Manhattan Beach)	Treatment of 3% of Land Uses															
		Treatment of Additional 4% of Land Uses															
		Treatment of Additional 7% of Land Uses															
	Redondo Beach Powerline Easement Filtration[1,2]																
	Artesia Boulevard and Hawthorne Boulevard Filtration[2] in Redondo Beach																

[1]Alternative project locations have also been identified.

[2]Current regional BMP project sequencing in Dominguez Channel helps achieve dry weather bacteria TMDL compliance. If compliance is met through other means, regional BMP scheduling in Dominguez Channel may be pushed back so that regional projects are instead complete by March 2032.

COMPLIANCE SCHEDULE

Table ES-12 summarizes the existing and proposed implementation actions and dates within the Santa Monica Bay and Dominguez Channel Watersheds, for each identified water body-pollutant combination. The compliance schedule for Category 1 water body-pollutant combinations is consistent with the associated TMDLs. The compliance schedule for the Category 2 water body-pollutant combinations has been selected to achieve the proposed wet and dry weather bacteria milestones, with implementation actions not exceeding one year, in accordance with the Permit (Section ii(5)9B). As described in **Table ES-12,** the compliance schedule for the Category 3 water body-pollutant combinations will be dependent on the results of the CIMP.

Table ES-12. Compliance Schedule for the Santa Monica Bay and Dominguez Channel Watersheds

Category	Watershed	Pollutant(s)	Wet/Dry Weather	Date	Implementation Action
1: Highest Priority	Dominguez Channel and Dominguez Channel Estuary	Toxicity[1] Total Copper[1,2] Total Lead[1,2] Total Zinc[1,2] Cadmium[2]	Wet/Dry	Current[4]	Interim: Comply with the interim water quality-based effluent limitations as listed in the TMDL[3]
				March 2032	Final: Comply with the final water quality-based effluent limitations as listed in the TMDL[3]
	Santa Monica Bay	Bacteria	Dry	July 2006	Final: Summer-dry single sample Allowable Exceedance Days (AED) met; compliance is currently in effect and attained through diversions and non-structural BMPs.
				November 2009	Final: Winter-Dry period Single Sample AED met; compliance is currently in effect and attained through diversions and non-structural BMPs.
			Wet	July 2018	Interim: 50% single sample ED reduction
				July 2021	Final: Geometric Mean [GM] targets met Final: Single sample AED targets met
		Trash/Debris	N/A	March 2016	Interim: 20% load reduction met through implementation of trash excluders
				March 2017	Interim: 40% load reduction met through implementation of trash excluders
				August 2018	Interim (Cities of Hermosa Beach and Redondo Beach): Determination of compliance strategy for installing full capture trash systems
				March 2019	Interim (Cities of Hermosa Beach and Redondo Beach): Installation of full capture trash systems serving 50% of the MS4 drainage area to Santa Monica Bay outside of Regional EWMP BMPs
				August 2019	Interim (City of Manhattan Beach): Determination of compliance strategy for installing full capture trash systems.
				March 2020	Interim (City of Manhattan Beach): Installation of full capture trash systems serving 50% of the MS4 drainage area to Santa Monica Bay outside of Regional EWMP BMPs
					Final (Cities of Hermosa Beach and Redondo Beach): 100% reduction in trash from baseline through the installation of full capture trash systems serving MS4 drainage area to Santa Monica Bay.
				March 2023	Final (City of Manhattan Beach): 100% reduction in trash from baseline through the installation of full capture trash systems serving MS4 drainage area to Santa Monica Bay.

Category	Watershed	Pollutant(s)	Wet/Dry Weather	Date	Implementation Action
		DDTs	N/A	N/A	Since the TMDL effectively implements an anti-degradation approach (i.e., historic low MS4 concentrations or loads must be kept the same or lower), and the Beach Cities EWMP Agencies are currently presumed to be achieving the WLAs (thus negating the need for Reasonable Assurance Analysis), no compliance schedule is proposed.
		PCBs	N/A	N/A	
2: High Priority	Dominguez Channel and Dominguez Channel Estuary	Bacteria	Dry	December 2023	Interim: 50% load reduction
				December 2025[5]	Final: 100% compliance may be demonstrated by the Permittee in one of three ways: 1. Meeting the allowed exceedance days (5 days during the dry weather period); or 2. Meet the allowed exceedance percentage (1.6% during a dry weather period) within the total drainage area served by the MS4. 3. Diversions are in place such that they are consistently operational, well maintained, and sized to effectively eliminate discharges to the receiving water year-round dry weather days.
			Wet	December 2016	Provide documentation supporting minimum control measure (MCM) enhancements implemented over the past year[6]
				December 2017	Provide documentation supporting MCM enhancements implemented over the past year[6]
				December 2018	Identify planned green streets locations to treat runoff from 3% of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
				December 2019	City Council approval of Plans & Specifications for green streets to treat runoff from 3% of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach. Begin installation of catch basin inlet filters in the DC-Torrance analysis region.
				December 2020	Develop concept reports for regional BMPs in the cities of Redondo Beach and Manhattan Beach. Begin construction on green streets to treat runoff from 3% of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
				December 2021	Submit grant application for any one of the proposed regional projects in the cities of Redondo Beach and Manhattan Beach.
				December 2022	Interim Milestone: 25% of target load reduction

Category	Watershed	Pollutant(s)	Wet/Dry Weather	Date	Implementation Action
				December 2023	Identify planned green streets locations to treat runoff from an additional 4% (7% total) of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
				December 2024	Begin construction on planned green streets to treat runoff from an additional 4% (7% total) of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach. Continue installation of catch basin inlet filters in the DC-Torrance analysis region.
				December 2025	Release Request for Proposals for regional BMP designs in Redondo Beach and/or Manhattan Beach
				December 2026	Complete construction on planned green streets to treat runoff from an additional 4% (7% total) of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
				December 2027	Interim Milestone: 50% of target load reduction
				December 2028	Produce regional BMP design reports; identify locations for green streets implementation to treat runoff from an additional 7% (14% total) of SFR, MFR, COM, and IND land uses in the cities of Redondo Beach and Manhattan Beach.
				December 2029	Begin regional BMP permitting process for project in Redondo Beach or Manhattan Beach.
				December 2030	Begin construction on planned green streets to treat runoff from an additional 7% (14% total) of SFR, MFR, COM, and IND land uses in the cities of Redondo Beach and Manhattan Beach.
				December 2031[7]	Begin regional BMP construction of project in Redondo Beach or Manhattan Beach.
				March 2032[8]	Final Milestone: 100% compliance may be demonstrated by the Permittee in one of three ways: 1. Meeting the allowed exceedance days (10 days during a wet weather period, plus high flow suspension days) 2. Meeting the target load reduction (33%); or 3. Meeting the allowed exceedance percentage (19% during a wet weather period) within the total drainage area served by the MS4.

Category	Watershed	Pollutant(s)	Wet/Dry Weather	Date	Implementation Action
3: Medium Priority[9]	Dominguez Channel and Dominguez Channel Estuary	Cyanide pH Selenium Mercury Cadmium Arsenic Chromium Silver Nickel Thallium	N/A	March 2032[8]	Final: Comply with the applicable water quality standards as listed in **Table ES-7.** As required by the Permit, monitoring for these pollutants will occur under the CIMP. If monitoring data suggest that the Beach Cities Agencies' MS4s may cause or contribute to exceedances of these pollutants in the receiving water,[10] these contributions will be addressed through modifications to the EWMP as a part of the adaptive management process, as described in Permit section VI.C.2.a.iii.

[1] Toxicity, copper, lead, and zinc are listed as Category 1 wet weather pollutants in Dominguez Channel.

[2] Copper, lead, zinc, and cadmium are listed as Category 1 pollutants in Dominguez Channel Estuary with annual average WQBELs that apply to both wet and dry weather.

[3] Dominguez Channel Estuary WQBELs for total copper, lead, zinc, and cadmium are addressed by the implementation actions taken for Dominguez Channel wet weather WQBELs.

[4] According to monitoring data at Dominguez Channel Mass Emission Station S28, the copper, lead, and zinc exceedance rates of the interim WQBELs are 9%, 3% 10% respectively, based on qualified sampling events between 2002 and 2013. At the Torrance Lateral Mass Emission Station TS19, the copper, lead, and zinc exceedance rates of the interim WQBELs are 5%, 0%, and 8% respectively. These monitoring locations receive flow contributions from the Beach Cities WMG, as well as other WMGs. CIMP monitoring and subsequent adaptive management will evaluate if the Beach Cities WMG are exceeding the interim Category 1 WQBELs and evaluate compliance with the Dominguez Channel Toxics TMDL.

[5] The proposed compliance schedule for dry weather bacteria is the minimum time expected to be necessary for the agencies to plan, design, permit, construct, monitor, and adaptively manage the proposed dry weather BMPs, and is also consistent with the 10-year MS4 compliance schedule for dry weather from the TMDL for indicator bacteria in the San Gabriel River, Estuary and Tributaries, adopted by the LARWQCB in 2015 (Water Quality Control Plan, Attachment A to Resolution No. R15-005, adopted by the RWQCB in 2015).

[6] Proposed milestones for MCM enhancement implementation are detailed in **Table 2-8**.

[7] If regional BMPs are deemed necessary for dry weather compliance, their construction dates will be moved up to meet the dry weather deadlines.

[8] The proposed compliance schedule for wet weather bacteria and all Category 3 pollutants was selected to be consistent with the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL (Dominguez Channel Toxics TMDL) (RWQCB, 2011). This compliance schedule is the minimum time expected to be necessary for the agencies to plan, design, permit, construct, monitor, and adaptively manage the proposed wet weather BMPs.

[9] Cyanide, pH, selenium, mercury, and cadmium are Category 3 pollutants in Dominguez Channel. Arsenic, chromium, silver, nickel, mercury, and thallium are Category 3 pollutants in Dominguez Channel Estuary.

[10] This will be assumed to be the case if monitoring data show that outfall concentrations and receiving water concentrations are in excess of the applicable water quality criteria for the same monitoring event.

Planning Level Cost Opinion

Planning-level cost opinions associated with implementation of the proposed structural best management practices within the Beach Cities WMG area are provided based on results from the Reasonable Assurance Analysis for the Beach Cities EWMP. Cost opinions are presented as an aid for decision makers, and contain considerable uncertainties. Given the iterative and adaptive nature of the EWMP and the many variables associated with the projects, the budget forecasts are order-of magnitude opinions, and are subject to change based on site-specific BMP feasibility assessment findings, preliminary and final BMP designs and landscaping, BMP effectiveness assessments, results of outfall and receiving water monitoring, and special studies such as those that might result in site specific objectives which could modify water quality objectives or TMDL Waste Load Allocations for a specific water body-pollutant combination.

EWMP planning-level cost opinions were developed for the proposed structural BMPs in addition to programmatic costs. Costs approximated for structural BMPs include "hard" costs for tangible assets and "soft" costs, which include considerations such as design and permitting. **Table ES-13** summarizes the total 20-year life-cycle costs for each proposed structural BMP, which are composed of the cost to construct or implement each structural BMP plus the associated annual O&M costs over 20 years. In order to account for possible variations in BMP design, BMP configurations, and site-specific constraints, as well as for uncertainties in available BMP unit costs from literature or estimated BMP unit costs, a range of costs is presented. These cost opinions are provided for information only, and it is recognized that should monitoring information demonstrate that alternative, less-expensive BMPs are equally (or superior) to those described herein, that these alternative BMPs may be implemented at the discretion of the WMG agencies. Not included in these costs are the annual monitoring costs for implementing the CIMP or the costs associated with implementing baseline and enhanced MCMs.

Table ES-13. Cost Opinion for Proposed Structural BMPs in Santa Monica Bay and Dominguez Channel Watersheds

Watershed/ Analysis Region		Location of BMP	Project Name	Construction Cost Range		Annual O&M Range		Total 20-Year Life-Cycle[1] Range	
				Low	High	Low	High	Low	High
Santa Monica Bay Watershed	SMB-5-02, Alternative 1	Manhattan Beach	Manhattan Beach Infiltration Trench[2]	$3.7M	$6.8M	$140K	$190K	$6.5M	$11M
		Manhattan Beach	Distributed Green Streets	$2.4M	$6.5M	$110K	$220K	$4.6M	$11M
		SMB-5-02 Alternative 1 Combined Costs		**$6.1M**	**$13M**	**$250K**	**$410K**	**$11M**	**$22M**
	SMB-6-01	Hermosa Beach	Hermosa Beach Infiltration Trench	$500K	$1.1M	$18K	$32K	$860K	$1.7M
		Hermosa Beach	Hermosa Beach Greenbelt Infiltration[2]	$5.5M	$8.0M	$81K	$90K	$7.1M	$9.8M
		Redondo Beach	Park #3	$1.9M	$3.0M	$28K	$33K	$2.5M	$3.7M
		Hermosa Beach	Distributed Green Streets	$7.0M	$19M	$310K	$640K	$13M	$32M
		SMB-6-01 Combined Costs		**$15M**	**$31M**	**$440K**	**$800K**	**$23M**	**$47M**
	All Analysis Regions	Hermosa Beach	Trash exclusion devices	$160K	$430K	$50K	$64K	$1.1M	$1.7M
		Redondo Beach	Trash exclusion devices	$1.1M	$3.1M	$360K	$460K	$8.3M	$12M
		Manhattan Beach	Trash exclusion devices	$590K	$1.7M	$210K	$270K	$4.8M	$7.1M
	Combined Costs in Santa Monica Bay Watershed			**$23M**	**$50M**	**$1.3M**	**$2.0M**	**$49M**	**$90M**
Dominguez Channel Watershed	DC-RB/MB	Redondo Beach	Powerline Easement Infiltration[2]	$11M	$16M	$160K	$180K	$14M	$20M
		Redondo Beach	Artesia Blvd Infiltration	$2.0M	$3.1M	$30K	$35K	$2.6M	$3.8M
		Redondo Beach + Manhattan Beach	Distributed Green Streets	$7.4M	$20M	$330K	$670K	$14M	$33M
		DC-RB/MB Combined Costs		**$20M**	**$39M**	**$520K**	**$890K**	**$31M**	**$57M**
	DC-Torrance	Torrance	Catch basin inlet filters	$240K	$360k	$130K	$170k	$2.8M	$3.7M
		DC-Torrance Combined Costs		**$240K**	**$360k**	**$130K**	**$170k**	**$2.8M**	**$3.7M**
	Combined Costs in Dominguez Channel Watershed			**$20M**	**$39M**	**$650K**	**$1.1M**	**$33M**	**$61M**
Combined Costs of All Proposed Structural BMPs				**$43M**	**$89M**	**$2.0M**	**$3.1M**	**$82M**	**$150M**

M = Million dollars, K = Thousand dollars

[1] Life-cycle costs include construction costs and 20 years of annual O&M (in 2015 dollars) and are not discounted.

[2] Alternative project locations have also been identified, but are not included in combined cost opinion

FINANCING DISCUSSION

The availability of funds will be critical for the implementation of the EWMP. Section 7 of this EWMP provides an overview of potentially available funding sources to pay for programs proposed in the EWMP. Examples show that a multi-pronged funding strategy using multiple sources rather than rely on a single storm drain fee may be the most prudent approach. A list of potential fees and charges has been developed, which will be further considered and explored by the Beach Cities WMG in the future:

- Vehicle license and vehicle rental fees
- Solid waste management surcharge
- Water service surcharge (under AB850)
- Property assessment
- Fines (not a stable source, it is an exemption under Proposition 26)
- Financial subsidy to encourage private sector participation to develop local and district projects
- One time capital recovery fee
- Dedicated storm drain fee
- Taxes (e.g. fuel taxes)
- A TMDL fee / tax could be developed based on the pollutant contribution from polluters / activities

In addition, Public Private Partnerships and alternative delivery and financing methods may facilitate and streamline implementation, and could result in program cost reductions.

From the analysis of potential costs in this section as summarized in **Table ES-13**, it is clear that projected costs of implementing the EWMP are substantial and orders of magnitude higher than have previously been expended by the agencies under the previous MS4 Permit. Thus availability of funds will be critical for the implementation of the EWMP. Currently, the Beach Cities do not have sufficient funds or dedicated funding streams to construct and maintain the projects proposed in this EWMP.

The Beach Cities agencies are working with the Los Angeles County Division of the League of California Cities and the California Contract Cities Association to partner with other affected agencies to collectively influence State policies, pursue changes in legislation and lobby high level officials for additional stormwater funding. Working together with the other cities will increase effectiveness, communication, collaboration, and reduce redundant efforts. The LACFCD will also work with the Beach Cities in their efforts to address source controls; assess, develop, and pursue funding for structural BMPs, and promote the use of water reuse and infiltration. As regional project scopes are further refined, the LACFCD will determine on a case-by-case basis their contribution to the projects.

In addition to working with other affected cities on a regional level, the Beach Cities WMG individually and collaboratively are committed to pursue funding sources at a local level including but not limited to:

- *Grants* - Collaboration and coordination between the Beach Cities will be important to increase accessible grant funding opportunities for stormwater projects, however alternative funding sources will also be needed to provide stable O&M revenues since grants typically do not provide for O&M.
- *Interagency Partnerships* – Interagency partnerships, like the Beach Cities WMG, can allow agencies to leverage local funding resources to make cost intensive projects possible.
- *Local Bond Issuance* - Two types of local bonds can be utilized. General Obligation (GO) bonds are issued by local governments and repaid through a property tax surcharge. Revenue bonds are tax-exempt securitized bonds repaid through utility rate increases charged directly to customers.
- *Local Stormwater Assessments* - Stormwater charges are potentially the most critical local funding source to finance stormwater programs. These charges include stormwater fees and taxes.
- *Direct Subsidies* - Direct financial subsidies to local projects do not contribute to cash revenue generation. However, subsidies can create a financial incentive to encourage local participation without providing the full cost for project implementation. Such an approach can increase financial efficiency by leveraging financial input from communities.

These potential sources of funding are discussed in greater detail in Section 7.

1 INTRODUCTION

Following adoption of the 2012 Los Angeles Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit[4] (Permit), the Cities of Hermosa Beach, Manhattan Beach, Redondo Beach and Torrance, together with the Los Angeles County Flood Control District (LACFCD), collectively referred to as the Beach Cities Watershed Management Group (Beach Cities WMG) agreed to collaborate on the development of an Enhanced Watershed Management Program (EWMP) for the Santa Monica Bay (SMB) and Dominguez Channel areas within their jurisdictions (referred to herein as the Beach Cities EWMP Area). This EWMP is intended to facilitate effective, watershed-specific Permit implementation strategies in accordance with Permit Part VI.C. and summarizes the SMB and Dominguez Channel-specific water quality priorities identified jointly by the Beach Cities WMG, outlines the program plan, including specific strategies, control measures and best management practices (BMPs)[5], necessary to achieve water quality targets (Water Quality-Based Effluent Limitations [WQBELs] and Receiving Water Limitations [RWLs]), and describes the quantitative analyses completed to support target achievement and Permit compliance.

In compliance with Section VI.C.4.b of the Permit, the Beach Cities WMG submitted to the Los Angeles Regional Water Quality Control Board (LARWQCB) a Notice of Intent (NOI) to develop an EWMP on June 28, 2013 with a revised NOI submitted December 17, 2013. On March 27, 2014, the Beach Cities WMG received a letter from the Executive Officer of the LARWQCB approving the revised NOI submittal. In compliance with Section VI.C.4.c.iv of the Permit, the Beach Cities WMG then submitted a draft EWMP Work Plan to the LARWQCB on June 26, 2014. Comments were not received. As the next step in EWMP development, the Beach Cities WMG was required by Section VI.C.4.c.iv of the Permit to submit a draft EWMP no later than June 30, 2015. This document has been developed to serve as the Beach Cities Draft EWMP and is consistent with the Work Plan previously submitted to the LARWQCB.

1.1 PURPOSE AND REGULATORY FRAMEWORK

Watershed Management Programs (WMPs) are a voluntary opportunity afforded by Section VI.C.1 of the Permit for Permittees to collaboratively or individually develop comprehensive watershed-specific control plans and are intended to facilitate Permit compliance and water quality target achievement. Enhanced WMPs (EWMPS) are WMPs which comprehensively evaluate opportunities for collaboration on multi-benefit regional projects that retain all non-stormwater runoff and runoff from the 85th percentile, 24 hour storm event while also achieving benefits associated with issues such as flood control and water supply. Additional details on the regulatory background for NPDES

[4] Order No. R4-2012-0175 NPDES Permit No. CAS004001 Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4.

[5] For simplification, the term "BMP" will be used to collectively refer to strategies, control measures, and/or best management practices. The Permit also refers to these measures as Watershed Control Measures.

Permit and Water Quality Standards and the Permit specifics of WMPs and EWMPs are provided below.

1.1.1 NPDES Permit

The 1972 Clean Water Act (CWA) established the NPDES Program to regulate the discharge of pollutants from point sources to waters of the United States. In 1990, the United States Environmental Protection Agency (USEPA) developed Phase I of the NPDES Stormwater Permitting Program, which established a framework for regulating municipal and industrial discharges of stormwater and non-stormwater that had the greatest potential to negatively impact water quality within waters of the United States. In particular, under Phase I, USEPA required NPDES Permit coverage for discharges from medium and large MS4 servicing populations greater than 100,000 persons. Operators of MS4s regulated under the Phase I NPDES Stormwater Program were required to obtain permit coverage for municipal discharges of stormwater and non-stormwater to waters of the United States.

The LARWQCB designated the MS4s owned and/or operated by the incorporated cities and Los Angeles County unincorporated areas within the Coastal Watersheds of Los Angeles County as a large MS4 due to the total population of Los Angeles County. All MS4s within the Coastal Watersheds of Los Angeles County except for the City of Long Beach MS4 are subject to the waste discharge requirements set forth in Order No. R4-2012-0175 Permit No. CAS004001. General permit requirements, which are relevant to and must be ensured by WMPs, include (i) a requirement to effectively prohibit non-stormwater discharges through the MS4, (ii) requirements to implement controls to reduce the discharge of pollutants to the maximum extent practicable, and (iii) other provisions the LARWQCB has determined appropriate for the control of such pollutants.

1.1.2 Water Quality Standards and Total Maximum Daily Loads (TMDLs)

The CWA also required that the RWQCB establish water quality standards for each water body in its region. Water quality standards include beneficial uses, water quality objectives and criteria that are established at levels sufficient to protect those beneficial uses, and an anti-degradation policy to prevent degrading waters. The LARWQCB adopted a Water Quality Control Plan - Los Angeles Region (hereinafter Basin Plan) on June 13, 1994 addressing this portion of the CWA which designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters in the Los Angeles Region. Pursuant to California Water Code section 13263(a), the requirements of the Permit implement the Basin Plan.

The State Water Resources Control Board (State Water Board) adopted the Water Quality Control Plan for Ocean Waters in California, California Ocean Plan (hereinafter Ocean Plan) in 1972 and adopted the most recent amended Ocean Plan on September 15, 2009. The Ocean Plan also establishes water quality objectives and a program of implementation to protect beneficial uses at all MS4 discharge points within Los Angeles County coastal watersheds with the exception of Long Beach.

CWA Section 303(d)(1) requires each state to identify the waters within its boundaries that do not meet water quality standards. Water bodies that do not meet water quality standards are considered impaired and are placed on the state's "CWA Section 303(d) List". For each listed water body, the state is required to establish a TMDL for each pollutant impairing the water quality standards in that water body. TMDLs establish the allowable pollutant loadings for a water body and provide the basis upon which to establish water quality-based controls (required by NPDES Permits). The 2010 CWA Integrated Report and updated 303(d) list were approved by the State Water Resources Control Board (SWRCB) on August 4, 2010 and by the USEPA on October 11, 2011. Provisions regarding TMDLs are included in NPDES Permits once they have been developed and adopted. Specific TMDLs applicable to the Beach Cities EWMP Area are discussed in more detail in Sections 2 and 3.

1.1.3 WMPs and Enhanced WMPs

The voluntary WMPs and EWMPs allow Permittees to collaboratively or individually develop comprehensive watershed-specific control plans which a) prioritize water quality issues, b) identify and implement focused strategies, control measures and BMPs, c) execute an integrated monitoring and assessment program, and d) allow for modification over time. In general, WMPs and EWMPs are intended to facilitate Permit compliance and water quality target achievement with the goals that: 1) discharges from covered MS4s achieve applicable WQBELs and RWLs and do not include prohibited non-stormwater discharges; and 2) control measures are implemented to reduce the discharge of pollutants to the maximum extent practicable (MEP). Per Permit Section VI.C.1.e, WMPs and EWMPs are to be developed based on the LARWQCB's Watershed Management Areas (WMAs) or subwatersheds thereof.

Permittees within a WMA may elect to prepare an EWMP, which is defined in the Permit as a WMP that comprehensively evaluates opportunities for collaboration amongst Permittees and other partners on multi-benefit regional projects that, wherever feasible, retain, 1) all non-stormwater runoff, and 2) all stormwater runoff from the 85th percentile 24 hour storm event while also achieving benefits associated with issues such as flood control and water supply. Where regional projects cannot achieve these standards, the EWMP must demonstrate through a Reasonable Assurance Analysis (RAA), that applicable water quality targets are achieved.

The Permit specifies that an EWMP shall:

1. Be consistent with Permit provisions in Part VI.C.1.a.-f and Part VI.C.5-C.8,
2. Incorporate applicable State agency input on priorities and key implementation factors,
3. Provide for meeting water quality standards and other CWA obligations,
4. Include multi-benefit[6] regional projects which retain stormwater from the 85th percentile 24 hour storm

[6] Potential multiple benefits include neighborhood greening, water conservation and/or supply, groundwater recharge, public education and/or awareness, etc.

5. Include watershed control measures which achieve compliance with all interim and final WQBELs in drainage areas where retention of the 85th percentile 24 hour storm is infeasible with reasonable assurance,
6. Maximize the effectiveness of funding,
7. Incorporate effective innovative technologies,
8. Ensure existing requirements to comply with technology based effluent limitations and core requirements are not delayed, and
9. Ensure a financial strategy is in place.

1.2 Applicability of EWMP

The agencies of the Beach Cities WMG have been working together since 2004 to implement the previously developed Jurisdictional Groups 5 and 6 Implementation Plan for the Santa Monica Bay Beaches Bacteria (SMBBB) TMDLs, including a BMP Siting Study (Geosyntec, 2011a) and Dry Weather Source Characterization and Control Study (Geosyntec, 2011b) for two high priority subwatersheds, along with joint implementation of programmatic solutions. Since 2004, the Beach Cities have also been jointly funding receiving water monitoring consistent with the Coordinated Shoreline Monitoring Plan for the SMBBB TMDLs along the shoreline of the Beach Cities WMG EWMP Area. These ongoing efforts by the Beach Cities WMG to comply with the SMBBB TMDLs have been an effective facilitator for the development of the EWMP.

This EWMP is applicable to the Beach Cities EWMP Area, which consists of all of the incorporated MS4 areas of the cities of Redondo Beach, Manhattan Beach, Hermosa Beach and Torrance and includes the infrastructure of the LACFCD within those jurisdictions (**Figure 1-1**), with the exception of the Machado Lake Watershed which is being addressed separately by the City of Torrance, and is not addressed in this EWMP. A small portion of the City of Redondo Beach is located within the Machado Lake Watershed boundary but has requested to be removed from the Machado Lake Implementation Plan and other compliance requirements pertaining to the Machado Lake Watershed. Further details are described in Section 1.2.1.

The beach areas within the geographic area of the Beach Cities WMG do not have any storm drain infrastructure that collect and discharges beach runoff directly to the receiving water and are therefore considered non-point sources and not subject to the MS4 Permit or EWMP requirements. Similarly, the Hermosa Beach and Manhattan Beach piers are not part of the MS4; they are non-point sources excluded from the MS4 Permit scope and therefore the EWMP. The Redondo Beach Pier including the King Harbor Marina are included in the geographic scope of the Beach Cities WMG EWMP as these areas are equipped with MS4 infrastructure. The Wylie Sump, Bishop Montgomery Basin, and Ocean Basin are all retention basins with no outlet. Therefore, their drainage areas have been excluded from the EWMP, with no analyses required. The Del Amo Retention Basin also has not outlet, and is sized to capture runoff from at least the 85th percentile, 24 hour storm event. Because the Del Amo Retention Basin is within the Machado Lake Watershed, this drainage area is excluded from the EWMP.

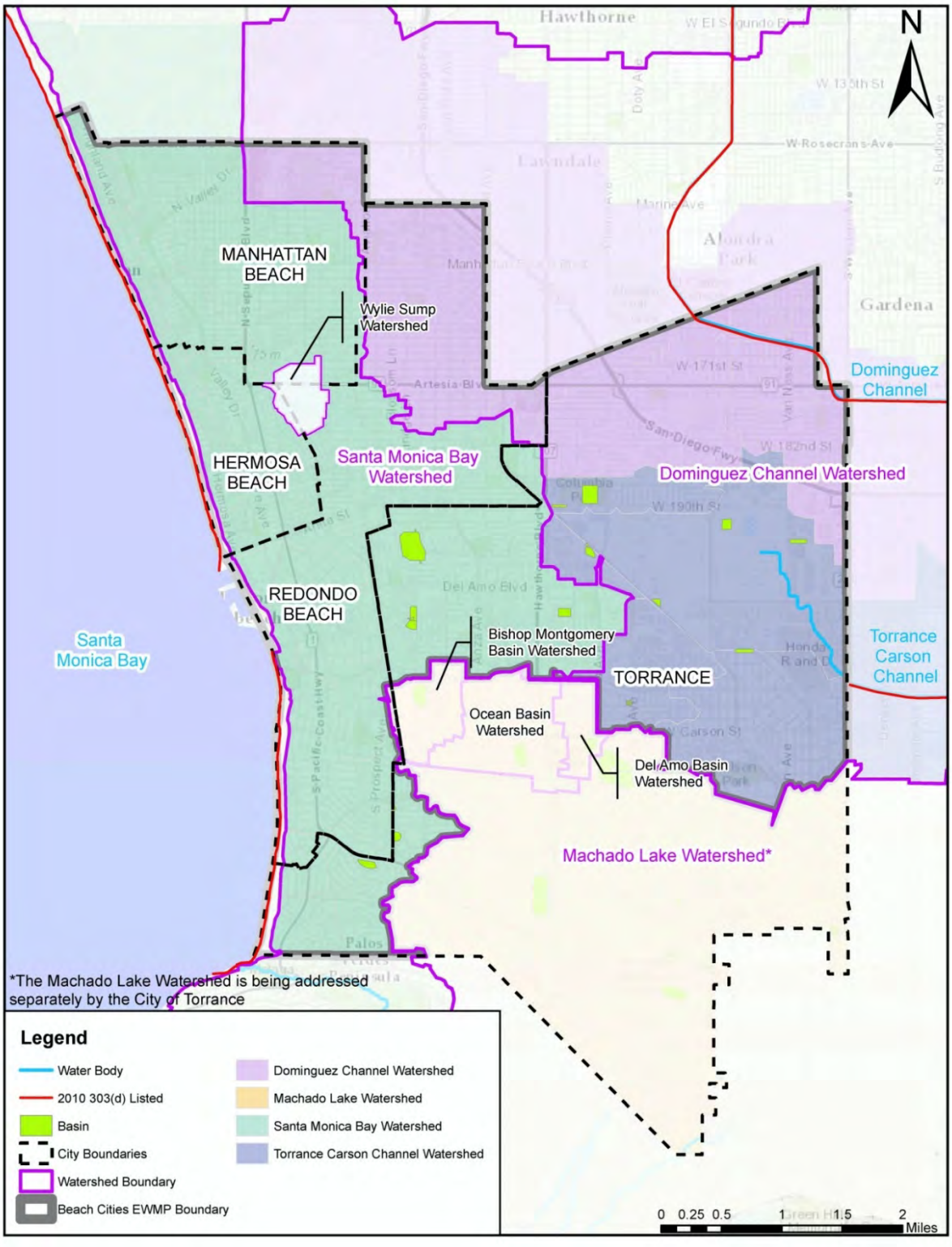


Figure 1-1. Beach Cities EWMP Area

1.2.1 City of Redondo Beach Contribution and Compliance Strategy In the Machado Lake Watershed

Machado Lake is a 40 acre lake located in the Ken Malloy Harbor Regional Park and is managed by the City of Los Angeles, Department of Recreation and Parks. The Machado Lake watershed includes portions of Lomita, Torrance, Carson, City of Los Angeles, County of Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Rolling Hills, Rolling Hills Estates and California Department of Transportation.

Machado Lake is listed on the 1998, 2002, and 2006, and 2010 Clean Water Act Section 303(d) lists of impaired water bodies due to eutrophic conditions, algae and odors (Nutrients); chlordane, dichlorodiphenyltrichloroethane (DDT), dieldrin, Chem A, and PCBs in tissue; and impaired sediment due to chlordane, DDT, and PCBs (Toxics). The listed impairments are caused by the overloading of nutrients, such as nitrogen and phosphorus, resulting in excessive algal growth which leads to increased turbidity, decreased levels of oxygen, and odor problems. The Los Angeles Regional Water Quality Control Board (RWQCB) established TMDLs for Machado Lake for algae, ammonia and odors (Nutrients) on May 1, 2008, and for Pesticides and PCBs (Toxics) on September 2, 2010. In addition, on June 7, 2007, the RWQCB adopted an amendment to the Water Quality Control Plan for the Los Angeles Region (Basin Plan) incorporating a TMDL for Trash in Machado Lake (March 6, 2008 was the effective date of the Machado Lake Trash TMDL).

The Machado Lake TMDL describes the watershed as:

"Machado Lake is a receiving body of urban and storm water runoff from the storm drain system covering an approximately 20-square mile watershed. The Wilmington Drain collects runoff from the surrounding cities of Lomita, Torrance, Carson, and Los Angeles, and then discharges over 50 percent of the watershed into Machado Lake at the northeast corner. The rest of the waters enter the lake through other storm drains including the Project No. 77 channel, the Harbor City Relief Drain located at the west end of the lake, the City of Los Angeles drains for runoff from streets, and the Harbor Park Municipal Golf Course. The Wilmington Drain Project 77 and the Harbor City Relief Drain collect storm water from the communities of Harbor City, Lomita, Carson, Torrance, and Wilmington, and from the Walteria Lake drainage area. In addition, two project 643 outlets discharge to the wetlands area. During the dry season, Machado Lake is replenished via a City of Los Angeles Department of Water And Power potable water pipeline and dry weather runoff."

The City of Redondo Beach is situated in the western portion of the Machado Lake subwatershed and makes up 0.018% (approximately 0.94 acres) of the total watershed area. This has been reduced from previously reported percentages based on a staff field visit the week of January 4, 2016 during a heavy rain event when stormwater runoff from a small area was observed to drain to the Santa Monica Bay, not Machado Lake, as previously assumed. The City of Redondo Beach has no direct discharges into Machado Lake and has 0 (zero) point source area miles, which results in a calculated waste load allocation of zero for the City's drainage area. The City's contributory drainage area consists of no catch basins or storm drains.

Two corrected watershed maps identifying the drainage area are attached as Appendices C and D in this EWMP. The drainage from the City's area to Machado Lake has been determined to be "de minimus" and poses an insignificant threat to Machado Lake water quality and pollutant loading.

The City of Redondo Beach will manage and included this described area as part of the City's Santa Monica Bay Beaches Bacteria (SMBBB) TMDL and overall MS4 NPDES program, including the implementation of all minimum control measures and oversight.

The City of Redondo Beach sent a letter to the State Water Resources Control Board dated October 31, 2007 (Appendix E) requesting to be exempted from the Machado Lake Trash TMDL and sent another letter to the RWQCB on December 18, 2008 (Appendix F) requesting the City be removed as a responsible agency under the Machado Lake TMDL requirements. The Watershed agencies agreed to this; therefore, they did not included the City of Redondo Beach in the Machado Lake Trash TMDL Monitoring and Reporting Plan.

Based on these items, the City of Redondo Beach has requested to be deemed "in-compliance" with their Machado Lake Watershed drainage area and be removed from the Machado Lake Watershed Implementation Plan for the following reasons:

- The City of Redondo Beach's drainage area is only 0.018% (approximately 0.94 acres) of the total Machado Lake Watershed area. This area has been determined to be "de minimus" and post an insignificant threat to Machado Lake Watershed water quality and pollutant loading. The portion of the City's contributory drainage area consists of no catch basins or storm drains.

- The City of Redondo Beach proposes that it would be more reasonable for the City to focus its resources to implement the SMBBB TMDL and other relevant TMDLs. The majority of the City land area discharges into the Santa Monica Bay, which would make it more feasible and effective to use resources on projects and programs that will have the most impact on water quality improvements. The insignificant area draining into Machado Lake would be subject to the same control measures of the implementation plan developed for the SMBBB TMDL and all other MS4 NPDES measures. As a result, this area would benefit from the appropriate BMPs designed for the entire City.

1.3 EWMP Development Process

Section VI.C.1.f.v of the Permit requires a stakeholder process for collaboration on EWMP development. The development process must:

- Provide appropriate opportunity for stakeholder input;
- Include participation in the Permit-wide Technical Advisory Committee (TAC); and
- Incorporate applicable State agency input on priority setting and other key implementation issues.

The Beach Cities WMG has conducted public outreach to engage the public, LARWQCB staff, and other interested parties to support EWMP development. Input has been incorporated as appropriate. These efforts are described in more detail below.

Public Workshops. Public workshops were held on May 21, 2014 at the Joslyn Center in Manhattan Beach and on May 27, 2015 at the Redondo Beach Public Library. An informational presentation was provided followed by a question and answer period to encourage stakeholder input. Concerns were noted and considered during EWMP development by the Beach Cities WMG.

Technical Advisory Committee (TAC). The Beach Cities WMG has, and will continue to, actively participate in the Los Angeles region TAC and applicable subcommittees throughout the EWMP process.

LARWQCB Presentations. The Beach Cities WMG presented the proposed RAA approach to LARWQCB staff on April 9 and June 6, 2014. LARWQCB staff provided feedback during these meetings and in general they were supportive of the proposed approach. One additional meeting was held on July 31, 2014 to discuss Torrance-specific matters.

The EWMP also addressed other State agency priorities, including the following:

California Water Action Plan (2014). The California Water Action Plan proposes several statewide actions that are well aligned with the expected benefits of the proposed projects in this EWMP, including:

- Expand Water Storage Capacity and Improve Groundwater Management (infiltration BMPs): This action aims to address the need to expand the state's storage capacity, whether in surface or groundwater to provide widespread public and environmental benefits. The California Water Action Plan states that "state agencies will work with tribes and federal, regional and local agencies on other actions related to promoting groundwater recharge and increasing storage, including improving interagency coordination, aligning land use planning with groundwater recharge..." The regional and distributed BMP projects proposed in the Beach Cities EWMP may contribute to groundwater recharge and expanding storage capacity throughout the Beach Cities WMG.

- Increase Operational and Regulatory Efficiency: Monitoring data collected under the CIMP to measure progress toward achieving RWLs and WQBELs and to determine if modifications to the Beach Cities EWMP are necessary may provide the benefit of increased operational and regulatory efficiency. Improving data availability may also improve coordination of operations of all major water supply, flood control, hatchery facilities, and habitat restoration projects.

2014 Greater Los Angeles County Integrated Regional Water Management Plan (GLAC IRWM Plan). The goal of the GLACR IRWM Plan is to achieve sustainable management of water resources in the Greater Los Angeles County. The plan lists several regional objectives to achieve this goal. The Beach Cities EWMP contributes to some of the objectives outlined in the plan, including the following:

- Water Quality: This objective aims to comply with water quality regulations by improving the quality of urban runoff, stormwater, and wastewater. The Beach Cities EWMP contributes to this objective by proposing new distributed and regional stormwater capture opportunities in areas prioritized by statewide and regional regulations and water quality conditions.

- Open Space and Recreation: This objective aims to protect, restore, and enhance natural process and habitats. Several of the regional EWMP projects (i.e. Park #3 BMP and the Powerline Easement in Analysis Region SMB-6-01) provide opportunity for expanded habitat and increased green space.

STORMS Storm Water Strategy (California Water Boards, 2015). The Storm Water Strategy assists in achieving the actions identified in the California Water Action Plan, including the aforementioned action of expanding water storage capacity and improving groundwater management. The Storm Water Strategy supports efforts to improve interagency coordination and identify needs for groundwater recharge opportunity. The Storm Water Strategy also lists six overarching objectives. The Beach Cities EWMP contributes to some of these objectives, including the following:

- Increase Stakeholder Collaboration on a Watershed Scale: the Beach Cities WMG agreed to collaborate on the development of this EWMP for the Santa Monica Bay and Dominguez Channel Watershed areas within their jurisdictions to facilitate effective, watershed-specific Permit implementation strategies in accordance with Permit Part VI.C.

- Establish Financially Sustainable Storm Water Programs: This EWMP provides an overview of potentially available funding sources for programs proposed in the EWMP. The funding sources identified for consideration are grants, interagency partnerships, bonds, State Revolving Funds, local funding opportunities, and public private partnerships.

- Increase Source Control and Pollution Prevention: This EWMP identifies the cumulative benefits from non-modeled programmatic source control BMPs that target the pollutants addressed in this EWMP.

Final Storm Water Resource Plan Guidelines (Guidelines) (December 2015). The Guidelines establish guidance for public agencies to develop Storm Water Resource Plans (Plans) consistent with Water Code sections 10561 through 10565. The Water Code states that a Plan is required as a condition to receive funding for stormwater and dry weather runoff capture projects from any bond approved by voters after January 2014, which also applies to Proposition 1 funding. The Guidelines provide guidance such as clarification on the applicability of the Guidelines, appropriate geographic scale of watersheds for stormwater resource planning, guidance on agencies and organizations to be consulted during Plan development, methods for identifying and prioritizing stormwater and runoff capture projects, project scheduling and implementation strategies, and so forth.

A Self-Certified Checklist provided in the Guidelines includes a complete list of the elements of a Stormwater Resource Plan that are considered mandatory per the California Water Code. Fulfilling the mandatory requirements would make the Beach Cities WMG eligible for Proposition 1 Stormwater Grant funding which would be applied toward the proposed Beach Cities EWMP projects. The mandatory required elements highlighted in the Checklist and Self-Certification are either entirely fulfilled by the Beach Cities EWMP (including appended documents) or will be fulfilled on a project-specific basis. For example, maximizing flood control will be part of detailed design at the project level.

1.4 Report Organization

This Beach Cities EWMP addresses the required EWMP elements from Section VI.C. of the Permit for both the SMB and Dominguez Channel Watersheds. Because the SMB and Dominguez Channel Watersheds have their own unique water quality conditions, their technical evaluations were performed independently and are documented in separate sections in this EWMP. This includes the water quality prioritization, RAA, and BMP identification. Section 2 summarizes the technical aspects of the EWMP for Santa Monica Bay watershed while Section 3 covers the same technical elements for Dominguez Channel Watershed. Section 4 presents individual EMWP implementation schedules for both watersheds. In Section 5, the adaptive management process proposed by the Beach Cities WMG is described, and in Section 6, the cost opinions associated with EWMP implementation are summarized. Section 7 describes potential funding sources and financial strategies. Sections 8 and 9 include the legal authority and references, respectively.

1.5 Terms of Reference

This work was conducted by Geosyntec Consultants for the Beach Cities WMG with the purpose of developing a comprehensive control plan to facilitate Permit compliance and achievement of water quality standards and serves as the deliverable for Task 4.5 of the Beach Cities WMP contract. This work was managed by Ken Susilo, P.E., D.WRE., CPSWQ, with support from Megan Otto, P.E., Chris Wessel, P.E., Stacy Luell, P.E, Stacey Schal, Curtis Fang, and Scott Mansell, Ph.D. Peer review was provided by Megan Otto, P.E., Chris Wessel, P.E., and Lucas Nguyen. Senior review was provided by Brandon Steets, P.E. and Ken Susilo, P.E., in accordance with Geosyntec's quality assurance policies.

2 SANTA MONICA BAY WATERSHED

2.1 BACKGROUND

2.1.1 GEOGRAPHICAL CONTEXT

The western portion of the Beach Cities EWMP Area consists of approximately 7,840 acres of land that drains to SMB. This accounts for 52% of the total Beach Cities WMG area, and includes portions of the cities of Manhattan Beach, Redondo Beach, and Torrance, and the entirety of the City of Hermosa Beach (**Figure 2-1**). This portion of the study area is hereinafter referred to as the SMB Watershed. The majority of the SMB Watershed consists of residential land uses (**Figure 2-2**).

The LACFCD is not responsible for land within the Beach Cities EWMP Area, but does own and maintain infrastructure within all three watersheds. Background information on the LACFCD is provided in **Appendix G**. **Table 2-1** provides a breakdown of the Beach Cities EWMP Area by agency and watershed. This section of the EWMP focuses on the SMB Watershed only.

Table 2-1. Beach Cities WMG EWMP Area Distribution by Participating Agency

Participating Agency	Area (acres)		
	Santa Monica Bay Watershed	Dominguez Channel Watershed	Total EWMP Area (% of total)
City of Redondo Beach	2,614	1,217	3,831 (25%)
City of Manhattan Beach	2,078	350	2,428 (16%)
City of Hermosa Beach	832	-	832 (5%)
City of Torrance	2,314	5,812	8,126 (53%)
Total	7,837	7,379	15,217 (100%)

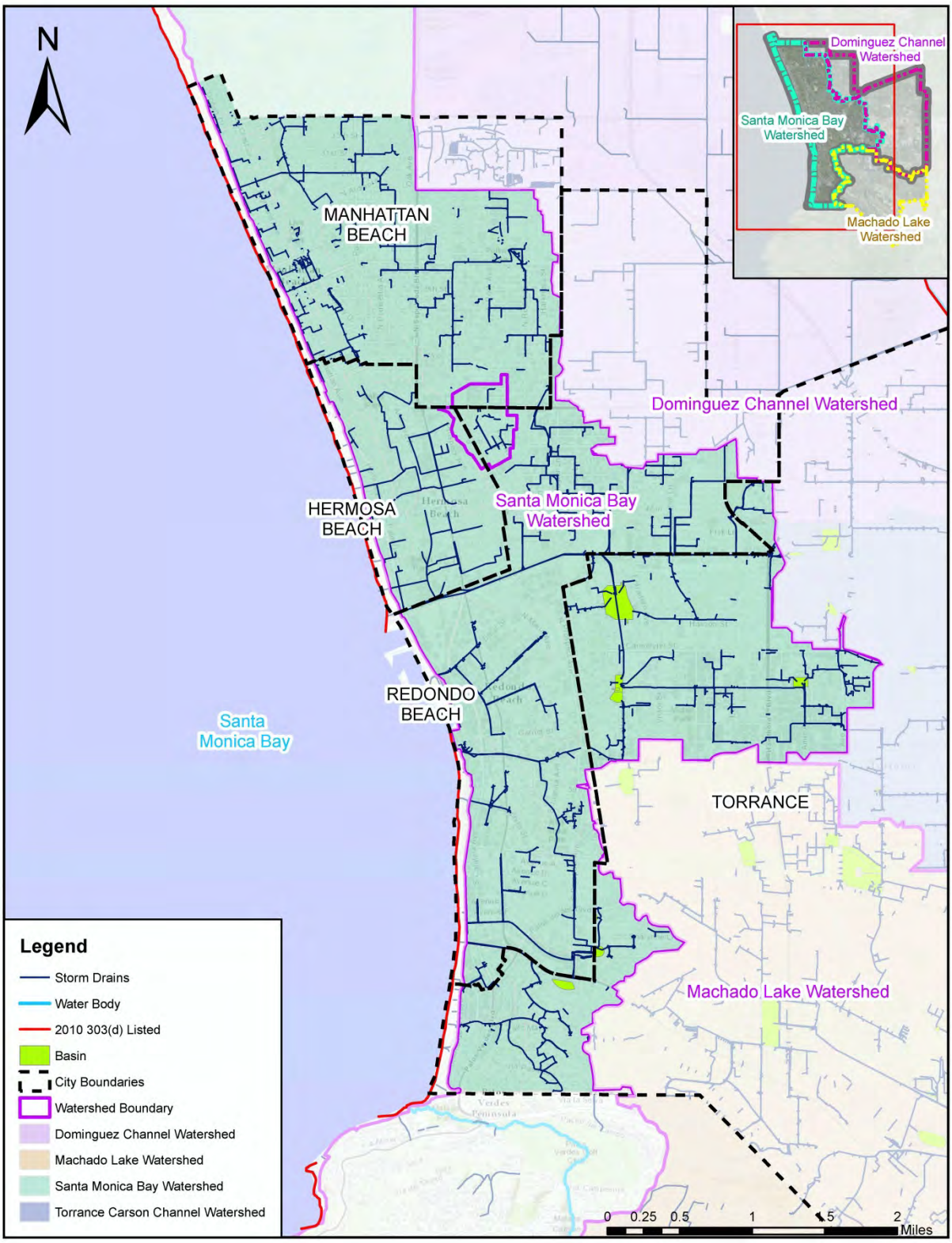


Figure 2-1. Beach Cities WMG MS4 Infrastructure within the Santa Monica Bay Watershed

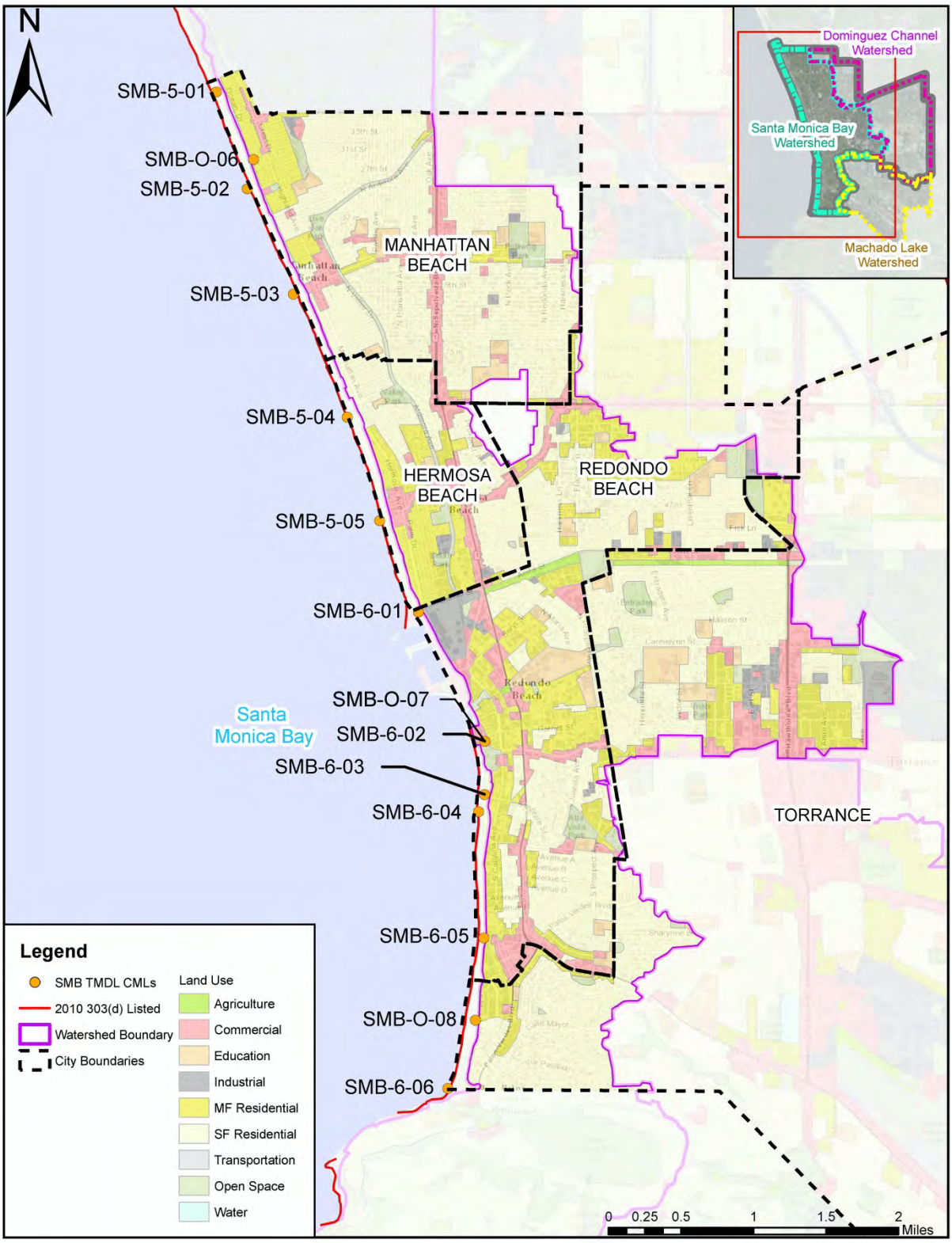


Figure 2-2. Beach Cities WMG Land Uses within the Santa Monica Bay Watershed

2.2 Identification of Water Quality Priorities

As part of the EWMP, the Permit requires the Beach Cities WMG to identify water quality priorities within their WMA. To accomplish this per Permit Section VI.C.5.a, the Beach Cities WMG conducted the following for the Santa Monica Bay watershed portion of the Beach Cities EWMP Area:

1. Characterize the water quality of stormwater and non-stormwater discharges from the MS4 as well as receiving water bodies;
2. Prioritize water body-pollutant combinations (WBPCs); and
3. Assess sources for high priority water body.

A summary of results is provided below.

2.2.1 Water Quality Characterization

Beneficial Uses

The Basin Plan (LARWQCB, 1995, updated 2011) identifies receiving waters within the Los Angeles region and sets regulatory objectives for these receiving waters. Within the SMB Watershed, identified receiving water bodies include SMB itself as well as coastal beaches within the Beach Cities WMG Area. Regulations set forth in the California Ocean Plan (SWRCB, 2012) are therefore also applicable to the SMB Watershed.

Both the Basin Plan and Ocean Plan regulate waste discharges to protect the quality of surface waters for use and enjoyment by the general public. Regulations set forth in the Basin Plan are based on assigned beneficial uses for each receiving water body. Beneficial use designations for receiving waters within the Beach Cities WMG Area include:

- **Municipal and Domestic Supply (MUN)**: Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
- **Industrial Service Supply (IND)**: Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.
- **Navigation (NAV)**: Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.
- **Water Contact Recreation (REC-1)**: Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, what water activities, fishing, or use of natural hot springs.
- **Non-Contact Water Recreation (REC-2)**: Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

- **High Flow Suspension (HFS)**: Applies to water contact recreational activities associated with the swimmable goal regulated under the REC-1 use, non-contact water recreation involving incidental water contact regulated under the REC-2 use, and the associated bacteriological objectives set to protect those activities.
- **Commercial and Sport Fishing (COMM)**: Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.
- **Warm Freshwater Habitat (WARM)**: Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
- **Marine Habitat (MAR)**: Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).
- **Wildlife Habitat (WILD)**: Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
- **Rare, Threatened, or Endangered Species (RARE)**: Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.
- **Migration of Aquatic Organisms (MIGR)**: Uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.
- **Spawning, Reproduction, and/or Early Development (SPWN)**: Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
- **Shellfish Harvesting (SHELL)**: Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.
- **Wetland Habitat (WET)**: Uses of water that support wetland ecosystems, including, but not limited to, preservation or enhancement of wetland habitats, vegetation, fish, shellfish, or wildlife, and other unique wetland functions which enhance water quality, such as providing flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.

According to the Ocean Plan (SWRCB, 2012), "The beneficial uses of the ocean waters of the State that shall be protected include industrial water supply (IND); water contact recreation (REC-1) and non-contact recreation (REC-2), including aesthetic enjoyment; navigation (NAV); commercial and sport fishing (COMM); mariculture; preservation and enhancement of designated Areas of Special Biological Significance (ASBS); rare and endangered species (RARE); marine habitat (MAR); fish migration (MIGR); fish spawning (SPWN) and shellfish* harvesting (SHELL)." Additional beneficial uses are defined as follows:

- **Mariculture**: The culture of plants and animals in marine waters independent of any pollution source.
- **ASBS**: Those areas designated by the State Water Board as ocean areas requiring protection of species or biological communities to the extent that maintenance of natural water quality is assured. ASBS are also referred to as State Water Quality Protection Areas – Areas of Special Biological Significance (SWQPA-ASBS).

Table 2-2 summarizes the existing beneficial uses for the Santa Monica Bay water bodies in the Beach Cities WMG Area, as designated in the Basin Plan.

Table 2-2. Beach Cities EWMP Area - Santa Monica Bay Watershed Water Bodies and Beneficial Uses

Water Body	MUN	IND	NAV	REC1	REC2	HFS	COMM	WARM	MAR	WILD	RARE	MIGR	SPWN	SHELL	WET[2]
Santa Monica Bay Nearshore + Offshore[1]		E	E	E	E		E		E	E	E	E	E	E	
Manhattan Beach			E	E	E		E		E	E			P	E	
Hermosa Beach			E	E	E		E		E	E			E[3]	E	
King Harbor		E	E	E	E		E		E	E	E				
Redondo Beach		E	E	E	E		E		E	E	E	E	E[3]	E	
Torrance Beach			E	E	E		E		E	E		E	E[3]	E	

E = Existing beneficial use

[1] The Preservation of Biological Habitats (BIOL) beneficial use is not included since no Areas of Special Biological Significance are present within the Beach Cities WMG Area.

[2] Water bodies designated as WET may have wetlands habitat associated with only a portion of the water body. Any regulatory action would require a detailed analysis of the area.

[3] Most frequently used grunion spawning beaches. Other beaches may be used as well.

SMB Watershed Data Analysis

An evaluation of existing water quality conditions, including characterization of stormwater discharges from the MS4 as well as receiving water quality was carried out as part of this EWMP to support identification and prioritization/sequencing of management actions, to the extent possible based on available data. To evaluate water-quality conditions within the SMB Watershed, a review of previous studies was conducted to characterize receiving water bodies within the Beach Cities WMG Area. Monitoring data analyzed were limited to bacteria data collected as part of the SMB Beaches Bacteria TMDL CSMP and limited PCB and DDT data collected as part of the 2008 Bight Regional Monitoring Program. A summary of this analysis is provided below. Additional details can be found in the Beach Cities EWMP Work Plan.

2.2.2 Water Body-Pollutant Classification

Receiving waters for stormwater runoff from the Santa Monica Bay Watershed portion of the Beach Cities EWMP Area were screened for water quality priorities by reviewing TMDLs, the State's

303(d) list, and additional water quality data. Each identified water quality priority for a given receiving water body was categorized as a WBPC. WBPCs were classified into one of three categories, in accordance with Section VI.C.5(a).ii of the Permit. No 303(d) listings exist beyond the TMDL WBPCs, and no other recent monitoring data are available beyond the SMBBB TMDL Coordinated Shoreline Monitoring Plan (CSMP) data; therefore, no Category 2 or 3 WBPCs have been identified for the Beach Cities portion of SMB at this time.

Category 1 – Highest Priority

WBPCs under Category 1 (highest priority) are defined in the Permit as "water body-pollutant combinations for which WQBELs and/or RWLs are established in Part VI.E and Attachments L through R of [the Permit]." These WBPCs include:

- SMB beaches for bacteria (wet and dry weather): These are considered Category 1 due to the SMBBB TMDL.
- SMB offshore/nearshore for dichloro-diphenyl-trichloroethanes (DDTs) and polychlorinated biphenyls (PCBs)[7]: These are considered Category 1 due to the USEPA TMDL for DDT and PCBs for SMB Offshore/Nearshore. However, the TMDL relies on a limited dataset to establish stormwater load allocations, relying on a single study (Curren *et al*., 2011) from a single creek (Ballona Creek, which is outside the Beach Cities watershed area) to establish MS4 WLAs throughout the entire SMB Watershed. It does not present sufficient data to assign MS4 contributions to the DDT and PCB concentrations observed in SMB; therefore, standard RAA modeling for these pollutants cannot reasonably be conducted at this time.

  Despite the lack of data for RAA modeling purposes, the load-based WQBELs for DDT and PCBs established by the TMDL were set to be the existing stormwater loads (i.e., based on data used in the TMDL, no MS4 load reduction is expected to be required to achieve TMDL compliance)[8]. Therefore, it is assumed that no reductions in DDT and PCB loading from the Beach Cities WMG MS4s are required to meet the TMDL and reasonable assurance of compliance is assumed to be demonstrated without modeling. Monitoring of these pollutants will occur under the Beach Cities CIMP.

[7] SMB Offshore/Nearshore is 303(d)-listed for fish consumption advisory due to DDT and PCBs. Therefore, the fish consumption advisory will be assumed to be addressed by the DDT and PCB categorization. SMB Offshore/Nearshore is also 303(d) listed for toxicity. USEPA's data evaluation showed only 3 out of 116 samples exhibited toxicity (USEPA, 2012). USEPA made a finding in the TMDL that, following the California listing policy, Santa Monica Bay is meeting the toxicity objective and there is sufficient evidence to de-list sediment toxicity. EPA therefore concluded in the TMDL that there is no significant toxicity in Santa Monica Bay and recommended that Santa Monica Bay not be identified as impaired by toxicity in the California's next 303(d) list.

[8] The TMDL states, "Because existing stormwater loads from the watersheds are lower than the calculated total allowable loads to achieve sediment targets, the waste load allocations for stormwater in this TMDL are based on existing load estimates of 28 g/yr for DDT and 145 g/yr for PCBs." These WLAs are further divided among Los Angeles County MS4, CalTrans, the Construction General Permit, and the Industrial General Permit. The assigned WLAs for the entire LA County MS4 within the Santa Monica Bay Watershed is 27.08 g/yr for DDT and 140.25 g/yr for PCBs, which are equivalent to the TMDL-estimated existing MS4 stormwater loads.

- SMB offshore/nearshore for debris: This is considered Category 1 due to the TMDL for Debris for SMB Offshore/Nearshore. Section VI.E.5.b(i) of the Permit states, "Pursuant to California Water Code section 13360(a), Permittees may comply with the trash [debris] effluent limitations using any lawful means. Such compliance options are broadly classified as full capture, partial capture, institutional controls, or minimum frequency of assessment and collection… and any combination of these may be employed to achieve compliance." While trash was not modeled as part of the RAA, the RAA qualitatively described how the Beach Cities WMG Agencies will comply with the SMB Debris TMDL WQBELs by stating the following: "Compliance with the Debris TMDL will be met through a phased retrofit of all catch basins throughout the SMB EWMP area to meet each interim compliance deadline (20% load reduction per year between 2016 and 2019) as well as the final compliance deadline (100% load reduction) in 2020. Consistent with the Trash Monitoring and Reporting Plans (TMRP) from each of the Beach Cities agencies (Beach Cities WMP, 2014), "vertical insert[s] with 5-mm openings and flow activated opening screen covers are the best suited for implementation within the City to achieve compliance with Trash TMDLs." To date, data for trash discharges from the MS4 are unavailable for the SMB Watershed.

  The SMB Debris TMDL can be satisfied through the submittal of the TMRP and the Plastic Pellet Monitoring and Reporting Program (PMRP) or via the CIMP. Trash Monitoring and Reporting Plans (TMRPs) were submitted to the Regional Board by each Beach Cities WMG Agency before the TMDL-specified deadline of September 20, 2012. Additionally, each Beach Cities WMG Agency submitted a request to the Regional Board by September 20, 2013 to be exempt from the TMDL requirement to conduct monitoring for plastic pellets based on absence of industrial activities related to the manufacturing, handling, or transportation of plastic pellets within their jurisdictions in the SMB watershed. A review letter on the draft CIMP, dated May 22, 2015, approved the TMRP and PMRP exemption requests from the City of Hermosa Beach, the PMRP exemption request from the City of Torrance, the PMRP exemption request from the City of Manhattan Beach, and the three year extension of the final TMRP compliance date for the City of Manhattan Beach (LARWQCB, 2015). The Board approved the TMRP for the City of Redondo Beach on May 22, 2015. The City of Redondo Beach request for exemption from the PMRP was approved by the Board on November 12, 2015 [LARWQCB, 2015c]. Monitoring for trash in the City of Redondo Beach, City of Manhattan Beach, City of Hermosa Beach, and City of Torrance will begin in the SMB Watershed in accordance with each Agency's respective TMRP. Exemption of the Beach City WMG Agencies from the PMRP means that monitoring for plastic pellets within the SMB Watershed will not be conducted by the Beach Cities.

"Highest Priority" WBPCs have been assigned based strictly on the Permit definition. Not all of these pollutants (e.g., DDT and PCBs) have been definitively linked to MS4 sources. As a result, this categorization and prioritization will be reevaluated based on results from the future water quality monitoring efforts conducted under the Coordinated Integrated Monitoring Program (CIMP).

Category 2 – High Priority

WBPCs under Category 2 (high priority) are defined in the Permit as, "Pollutants for which data indicate water quality impairment in the receiving water according to the State's Water Quality

Control Policy for Developing California's Clean Water Act Section 303(d) List (State Listing Policy) (SWRCB, 2004) and for which MS4 discharges may be causing or contributing to the impairment." There are no Category 2 WBPCs in the SMB Watershed portion of the Beach Cities EWMP area.

Category 3 – Medium Priority

WBPCs under Category 3 (medium priority) are defined in the Permit as, "Pollutants for which there are insufficient data to indicate water quality impairment in the receiving water according to the State's Listing Policy, but which exceed applicable RWLs contained in this Order and for which MS4 discharges may be causing or contributing to the exceedance." There are no Category 3 WBPCs in the SMB Watershed portion of the Beach Cities EWMP area.

The Beach Cities WMG agencies understand that data collected as part of their approved CIMP may result in future Category 3 designations in instances when RWLs are exceeded and MS4 discharges are identified as contributing to such exceedances. Under these conditions, the Beach Cities WMG agencies will adhere to Section VI.C.2.a.iii of the Permit and the EWMP will be updated.

Figure 2-3 provides a brief conceptual overview of the process used to identify and categorize the WBPCs within the Beach Cities EWMP Area.

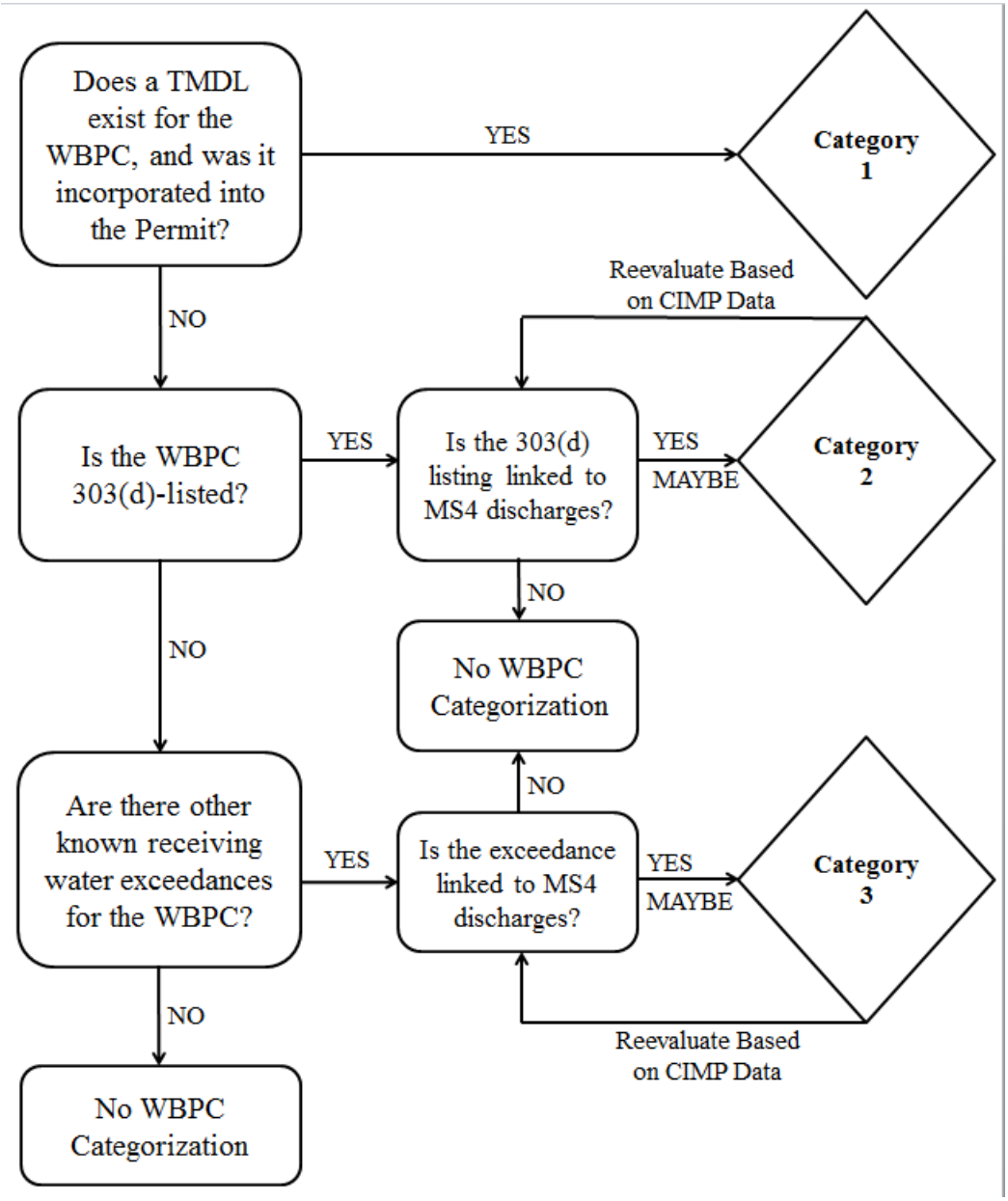


Figure 2-3. Process for Categorizing Water Body-Pollutant Combinations

Table 2-3 presents the prioritized WBPCs within the SMB Watershed portion of the Beach Cities EWMP Area. WBPCs categorized below are subject to change based on future data collected as part of the CIMP or other monitoring program. Grouped RWLs for the SMB Beaches Bacteria TMDL are also expressed in the Permit in terms of allowable exceedance days (AEDs), which vary by season and by Coordinated Shoreline Monitoring Plan (CSMP) monitoring station. These AEDs, as revised per the Reconsideration of the SMB Beaches Bacteria TMDL (LARWQCB, 2012b), are summarized in **Table 2-4**. The final grouped RWLs are effective for dry weather and will be effective July 15, 2021 for wet weather. The CSMP monitoring stations are shown in **Figure 2-5.**

Table 2-3. Water Body-Pollutant Combination Prioritization and Pollutant Interim and Final Compliance Targets for Santa Monica Bay Watershed Portion of the Beach Cities EWMP Area

Category	Water Body	Pollutant	Reason for Categorization	WQBEL/RWL/ Objective Basis	Interim WQBEL/ RWL	Final WQBEL/ RWL/Objective
1: Highest Priority	Santa Monica Bay Beaches	Dry Weather Bacteria	SMB Beaches Dry Weather Bacteria TMDL	Daily and Weekly Sampling Schedule	N/A	Summer-Dry Single Sample Allowable Exceedance Days (AED)[1] met Winter-Dry period Single Sample AED[1] met
		Wet Weather Bacteria	SMB Beaches Wet Weather Bacteria TMDL	Daily and Weekly Sampling Schedule/	50% cumulative percentage reduction from total required exceedance day reduction[2]	Single Sample and Geometric Mean AED[1] and GM target met
	Santa Monica Bay	Trash/ Debris	SMB Debris TMDL	Annual monitoring	Incremental reduction from baseline waste load allocation[3] (6815.6 gals/year)	100% reduction from baseline waste load allocation[3] (6815.6 gals/year)
		DDTs	SMB PCBs and DDT TMDL	3-Year Average	N/A	27.08 g/year[4]
		PCBs	SMB PCBs and DDT TMDL	3-Year Average	N/A	140.25 g/year[4]
2: High Priority	N/A	None	No other 303(d) listings exist for the Beach Cities portion of SMB			
3: Medium Priority	N/A	None	Outfall and receiving water monitoring data are not available for the Beach Cities portion of SMB			

[1]Per the Basin Plan Objective REC1 Water Bodies Limit for Bacteria. Please refer to Table 2-4 for allowable exceedance day limits of each subwatershed.
[2] Total required exceedance day reduction is defined as the difference between existing exceedance day and the allowable exceedance day for each subwatershed
[3] Baseline WLA is the sum of baseline WLA from Manhattan Beach, Redondo Beach and Hermosa Beach
4This limit is applicable to all of Santa Monica Bay.

Table 2-4. Bacteria RLWs for Beach Cities WMG Shoreline Monitoring Stations

Station	Station Name	Summer Dry Weather (Apr 1 – Oct 31)		Winter Dry Weather (Nov 1 – Mar 31)[a]		Wet Weather (Year-Round)	
		Daily Sample[b]	Weekly Sample	Daily Sample[b]	Weekly Sample	Daily Sample[b]	Weekly Sample
SMB 5-01[c]	Manhattan State Beach at 40th St (El Porto Beach)	0	0	1	1	4	1
SMB 5-02	Terminus of 28th Street Drain in Manhattan Beach	0	0	9	2	17	3
SMB 5-03	Manhattan Beach Pier	0	0	3	1	6	1
SMB 5-04[c]	Near 26th Street on Hermosa Beach	0	0	3	1	12	2
SMB 5-05[c]	Hermosa Beach Pier	0	0	2	1	8	2
SMB 6-01	Herondo Storm Drain	0	0	9	2	17	3
SMB 6-02[c]	Redondo Municipal Pier – 100 Yards South	0	0	3	1	14	2
SMB 6-03	4'x4' Outlet at Projection of Sapphire Street	0	0	5	1	17	3
SMB 6-04[c]	120' North of Topaz groin	0	0	9	2	17	3
SMB 6-05	Storm Drain at Projection of Avenue I	0	0	4	1	11	2
SMB 6-06[c]	Malaga Cove, Palos Verdes Estates	0	0	1	1	3	1

[a] The number of allowable exceedance days established in the revised TMDL have increased from the values outlined in the original TMDL.

[b] SMB 5-02 and SMB 6-01 are the only monitoring sites that have been sampled daily (5 days/week), although SMB 6-01 switched to weekly sampling in 2013. All other monitoring sites were sampled weekly (on average).

[c] SMB 5-01, 5-04, 5-05, 6-02, 6-04, and 6-06 are all open beach monitoring locations which are not associated with major storm drain outfalls.

Sections VI.C.2 and VI.C.3 of the Permit describes how compliance with RWLs/WQBELs is attained for the prioritized WBPCs identified. **Appendix H** sets forth the EWMP framework for evaluating and addressing receiving water exceedances and a brief summary is included below.

Different actions are required to demonstrate compliance for different types of WBPCs. Specifically; the following classifications are addressed by the Permit:

- WBPCs addressed by a TMDL.
- 303(d)-listed WBPCs: Pollutants in the same class as those identified in a TMDL and for which the water body is 303(d)-listed (Section VI.C.2.a.i), and pollutants not in the same class as those identified in a TMDL, but for which the water body is 303(d)-listed (Section VI.C.2.a.ii).
- Non 303(d)-listed WBPCs: Pollutants for which there are exceedances of RWLs, but for which the water body is not 303(d)-listed (Section VI.C.2.a.iii).

For Category 1 WBPCs, adherence to all implementation actions and compliance dates identified in the approved EWMP will constitute compliance with applicable TMDL-based interim water quality based effluent limits and interim receiving water limits. For any Category 2 and 3 WBPCs that are identified in the future through the adaptive management process, adherence to all implementation actions, milestones, and compliance schedules identified in the updated EWMP will constitute compliance with applicable receiving water limits. This approach is outlined in **Appendix H**.

2.2.3 Source Assessment

The following data sources were reviewed as part of the source assessment for the WBPCs listed previously:

- Findings from the Permittees' Illicit Connections and Illicit Discharge Elimination Programs (IC/ID);
- Findings from the Permittees' Industrial/Commercial Facilities Programs;
- Findings from the Permittees' Development Construction Programs;
- Findings from the Permittees' Public Agency Activities Programs;
- TMDL source investigations;
- Watershed model results;
- Findings from the Permittees' monitoring programs, including but not limited to TMDL compliance monitoring and receiving water monitoring; and
- Any other pertinent data, information, or studies related to pollutant sources and conditions that contribute to the highest water quality priorities.

The following source assessment is broken down by pollutants applicable to the SMB Watershed.

Indicator Bacteria

The SMBBB TMDLs for dry and wet weather were the first bacteria TMDLs adopted by the LARWQCB. The SMBBB TMDLs were recently opened for reconsideration, although the source assessment was not part of this update. As a result, the general findings from the original source assessment remain unchanged. These findings are summarized in the 2012 Basin Plan Amendment for the reopened SMBBB TMDL (Attachment A to Resolution No. R12-007):

> "With the exception of isolated sewage spills, dry weather urban runoff and stormwater runoff conveyed by storm drains and creeks is the primary source of elevated bacterial indicator densities to SMB beaches. Limited natural runoff and groundwater may also potentially contribute to elevated bacterial indicator densities during winter dry weather" (LARWQCB, 2012b).

The SMBBB TMDL source assessment (LARWQCB, 2002) maintained that dry weather urban runoff and stormwater runoff were the primary sources of elevated bacteria concentrations at SMB beaches at the time of the TMDL. Although definitive information regarding the specific sources of bacteria within the watershed was not presented, speculation provided in the dry weather staff report provided some insight into possible sources at the time:

> "Urban runoff from the storm drain system may have elevated levels of bacterial indicators due to sanitary sewer leaks and spills, illicit connections of sanitary lines to the storm drain system, runoff from homeless encampments, illegal discharges from recreational vehicle holding tanks, and malfunctioning septic tanks among other things. Swimmers can also be a direct source of bacteria to recreational waters. The bacteria indicators used to assess water quality are not specific to human sewage; therefore, fecal matter from animals and birds can also be a source

> of elevated levels of bacteria, and vegetation and food waste can be a source of elevated levels of total coliform bacteria, specifically" (LARWQCB, 2002).

Information on non-MS4 sources of surf zone bacteria along specific SMB beaches was provided by the City of Malibu in its comment letter on the SMBBB TMDL reconsideration, based on a comprehensive review of local and Southern California source identification studies (City of Malibu, 2012):

> "A number of recent Santa Monica Bay studies have further identified and confirmed natural (non-anthropogenic) sources of fecal indicator bacteria including plants, algae, decaying organic matter, beach wrack and bird feces – implicating these as potentially significant contributors to exceedances (Imamura *et al* 2011, Izbicki 2012b). Beach sands, sediments and beach wrack have been shown to be capable of serving as reservoirs of bacteria, possibly by providing shelter from UV inactivation and predation by allowing for regrowth (Imamura *et al* 2011, Izbicki *et al* 2012b, Lee *et al* 2006, Ferguson *et al* 2005, Grant *et al* 2001, Griffith 2012, Litton *et al* 2010, Phillips *et al* 2011, Jiang *et al* 2004, Sabino *et al* 2011, and Weston Solutions 2010). In fact, enterococci include non-fecal or "natural" strains that live and grow in water, soil, plants and insects (Griffith, 2012). Thus, elevated levels of enterococci in water could be related to input from natural sources. The phenomenon of regrowth of bacteria from either anthropogenic or natural sources has been suggested by several studies as a possible source of beach bacteria exceedances (Griffith 2012, Litton *et al* 2010, Weston Solutions 2010, Izbicki *et al* 2012b, Weisberg *et al* 2009)."

In 2009, a dry weather bacterial source identification study was undertaken at the Redondo Beach Pier (Los Angeles County Sanitation District [LACSD], 2009). This study implemented a multi-tiered toolbox approach to investigate sources of dry weather fecal indicator bacteria (FIB) exceedances near Redondo Beach Pier (CSMP monitoring location SMB 6-02).). Utilizing microbial source tracking, the sampling focused on the shoreline near the pier, a storm drain under the pier, and ponded water near the storm drain. Investigators found a lack of human fecal markers within the surf zone:

> "Lack of detectable human viruses and the de minimus quantities detection of human-associated *Bacteroidales* in the ocean water strongly implied that a human source was not present. Other sources of FIB may include bacterial persistence in the sand and sea wrack, as well as endogenous sea life and birds. Tide, wave action, wind, and other natural fluctuations may be affecting FIB levels at the shoreline monitoring locations next to the pier."

However, the study also indicated that,

> "…the storm drain under the pier and the pond that forms at the storm drain outlet are probably impacted by human fecal pollution but are not contributing to microbial contamination of the ocean water during the dry season. This conclusion is most strongly supported by the differences between the FIB concentrations and *Bacteroidales* populations at the shoreline sites compared to the pond and storm drain samples, particularly with respect to human-associated *Bacteroidales*."

Another dry weather MS4 microbial source tracking study was conducted in 2010, focusing on two high priority analysis regions (SMB-5-02 and 6-01) within the Beach Cities EWMP Area (Geosyntec Consultants, 2010). Although both of these shoreline monitoring locations are served by low flow diversions, the purpose of the study was to investigate FIB sources to inform identification of new source control measures. Observational results indicated that non-human sources include pet waste, irrigation runoff, and in-drain sources (i.e., re-growth, sediment, etc.). Similar to the Redondo Beach pier study, human *Bacteroidales* marker (HBM) was also identified in some MS4 dry weather samples, suggesting that human fecal sources may also be present. Although specific sources of human waste were not definitively identified in the study, "sources were surmised to include direct contamination (i.e., illicit connections, RV discharges, homeless deposits), and indirect contamination (i.e., sewer exfiltration)."[9]

To address the identification of dry weather bacteria sources within or to the MS4s, the Beach Cities WMG agencies have implemented measures to divert dry weather flows from all storm drains discharging at point zero shoreline monitoring locations. A total of seven low flow diversions are operational within the Beach Cities EWMP area. No wet weather bacteria source identification studies have been conducted in the Beach Cities EWMP area to date. Wet weather bacteria sources are believed to be derived from the entire watershed, and potentially include a mixture of human sources, non-human anthropogenic sources (e.g., pet waste), and non-anthropogenic sources (e.g., birds and other urban wildlife, storm drain biofilms/regrowth, beach sands and wrack). A wet weather stormwater monitoring study by the Southern California Coastal Water Research Project (SCCWRP) investigated bacteria concentrations in stormwater runoff from various land uses in the Los Angeles region (Stein *et al*, 2007). Results showed that wet weather runoff event mean concentrations (EMCs) for fecal coliform bacteria were highest for agricultural land uses, followed by commercial and educational, single family residential, multi-family residential, open space, industrial, and transportation. In this study, results showed that bacteria concentrations in stormwater are highly variable, with concentrations often varying by one to two orders of magnitude during a single storm, and by up to five orders of magnitude on seasonal and inter-annual scales.

Additional local monitoring data will be needed to quantify the contribution of MS4 discharges – particularly relative to the many other identified sources that have been documented along SMB beaches – to the elevated bacteria concentrations measured at Beach Cities WMG compliance monitoring locations during dry and wet weather. Additional data are also needed to identify the sources of bacteria within MS4 discharges as well as their potential to contribute to recreational illness risks; such source tracking data have the potential to affect the TMDL waste load allocations (WLAs) through a future reopener[10]. And the combination of MS4 outfall monitoring (through the

[9] The LACSD and Geosyntec microbial source tracking studies predate the 2013 California Source Identification Pilot Project, which identifies and recommends new, more definitive microbial source tracking markers for multiple source types, including human waste. Therefore new analytical methods may need to be applied to these previously studied areas to verify or update prior findings.

[10] For example, if human fecal sources are found to be undetected in MS4 discharges to SMB beaches using a rigorous sampling design, the latest analytical markers, and a credible laboratory, then TMDL revisions may be proposed.

CIMP) and source identification (through special studies) could support future BMP planning and EWMP updates.

DDT and PCBs

As stated previously, limited data are available characterizing DDT and PCBs within Santa Monica Bay, particularly since direct discharges of these pollutants from publically owned treatment works (POTWs) have ceased. The largest concentration of DDT and PCBs within SMB is contained within the Palos Verdes shelf, which is being addressed by the USEPA as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. Loadings from the shelf to the bay are large and have been well characterized (USEPA, 2012).

With respect to stormwater, the TMDL does not specifically characterize MS4 loadings, though it does recognize that "DDT and PCBs are no longer detected in routine stormwater sampling from Ballona Creek or Malibu Creek." However, the TMDL also states that current detection limits used to analyze DDT and PCB concentrations are too high to appropriately assess the water quality. Despite a lack of supporting data, however, EPA assumed that stormwater inputs of DDT and PCBs come from urban areas (USEPA, 2012).

No other data or source information are available at this time. Once three years of water quality data are collected under the CIMP and evaluated consistent with the recommendations by USEPA in the TMDL to utilize a three-year averaging period, then further source assessment will be considered and the categorization and prioritization of PCB and DDTs as MS4-related pollutants of concern will be reevaluated.

Trash

Source information for trash within SMB is provided by the SMB Nearshore Debris TMDL. A detailed source breakdown is not provided, but other debris TMDLs attribute trash to general areas such as "litter from adjacent land areas, roadways, and direct dumping and deposition" (LARWQCB, 2008) while also attributing trash inputs to point sources such as storm drains.

The plastic pellet portion of the SMB Debris TMDL is not applicable to the Beach Cities WMG, as the respective Agencies have applied and have gained approval to be exempt from this portion of the TMDL.

2.2.4 PRIORITIZATION

Based on the water quality characterization above, the WBPCs have been classified into one of three categories, in accordance with Section IV.C.5(a)ii of the Permit: highest priority, high priority, and medium priority (**Table 2-3**). This categorization is intended to prioritize WBPCs in order to guide the implementation of structural and institutional BMPs. An RAA was performed on the WBPCs in Categories 1, as there are no Category 2 or 3 pollutants in the SMB Watershed within the Beach Cities WMG. WBPCs will be further prioritized based on the applicable compliance schedules, as discussed in Section 4.

2.3 Selection of Appropriate Best Management Practices

2.3.1 Objectives

The Permit requires the Beach Cities WMG to identify strategies, control measures, and BMPs to implement within their EWMP AREA. Specifically, the Permit specifies that BMPs are expected to be implemented so that MS4 discharges meet effluent limits as established in the Permit and to reduce impacts to receiving waters from stormwater and non-stormwater runoff. This expectation assumes the implementation of both types of BMPs – non-structural and structural – by the Beach Cities WMG.

The objectives of selecting and incorporating BMPs into the Beach Cities EWMP include:

1. Preventing and/or eliminating non-stormwater discharges to the MS4 that are a source of pollutants from the MS4 to receiving waters;
2. Achieving all applicable interim and final WQBELs and/or RWLs pursuant to corresponding compliance schedules; and
3. Ensuring that discharges form the MS4 do not cause or contribute to exceedances of RWLs.

2.3.2 Definition of Best Management Practices

The Permit defines BMPs as "practices or physical devices or systems designed to prevent or reduce pollutant loading from stormwater or non-stormwater discharges to receiving waters, or designed to reduce the volume of stormwater or non-stormwater discharged to the receiving water." These BMPs may include:

1. Structural and/or non-structural BMPs and operation and maintenance procedures that are designed to achieve applicable WQBELs and/or RWLs;
2. Retrofitting areas of existing development known or suspected to contribute to the highest water quality priorities with regional or sub-regional BMPs;
3. Stream and/or habitat rehabilitation or restoration projects where stream and/or habitat rehabilitation or restoration are necessary for, or will contribute to demonstrable improvements in the physical, chemical, or biological receiving water conditions and restoration and/or protection of water quality standards in receiving waters.

Structural BMPs involve the construction of a physical control measure to alter the hydrology or water quality of incoming stormwater or non-stormwater. There are two categories of structural BMPs, defined by the runoff area treated by the BMP: regional BMPs[11] and distributed BMPs. Regional BMPs are designed to treat runoff from a large drainage area expected to include multiple parcels and various land uses. These may include infiltration basins, treatment plants, and subsurface flow wetlands, among others. Distributed BMPs are designed to treat runoff from

[11] The term "regional BMP" does not necessarily indicate that the project can capture and retain the 85th percentile storm, as described in the Permit. The term "regional EWMP project" is therefore used for those regional BMPs that are expected to be able to capture and retain the 85th percentile storm.

smaller drainage areas and are normally installed to collect runoff close to the source from a limited number of parcels. Distributed BMPs typically include swales, bioretention facilities, biofiltration facilities, and cisterns, among others. Relevant regional and distributed structural BMPs are described below.

Non-structural BMPs prevent or reduce the release of pollutants or transport of pollutants within the MS4 area but do not involve construction of physical facilities. Non-structural BMPs are often implemented as programs or strategies which seek to reduce runoff and/or pollution close to the source. Examples include but are not limited to: street sweeping, downspout disconnect programs, pet waste cleanup stations, irrigation ordinances, or illicit discharge elimination. Minimum control measures (MCMs) as set forth in the Permit are a subset of non-structural BMPs even though some MCMs include measures that require the implementation of structural BMPs by private parties.

2.3.3 Incorporated Provisions

Permit Section VI.C.5.b.iv sets forth the provisions regarding the types of BMPs that must be considered in development of the EWMP. These provisions are described in more detail below.

Minimum Control Measures

The Beach Cities WMG has assessed the MCMs defined in the Permit to identify opportunities for focusing resources on the high priority issues in each watershed. The Permit requires the permittees to implement prescribed MCMs in each of six categories/programs: Public Information & Participation Program (PIPP), Industrial/Commercial Facilities, Planning & Land Development, Development Construction, Public Agency Activities, and Illicit Connection & Illicit Discharges Elimination. These measures include procedures such as outreach programs, inspections, and reporting requirements designed to reduce runoff-related pollution within each permittees' MS4 area. MCMs in each of these categories are already being implemented by the Beach Cities WMG as prescribed under the previous MS4 Permit (Order 01-182), and in some cases MCM program enhancements have been implemented to address watershed priorities for TMDL implementation. Details on the selected MCMs, including proposed modifications to any programs, are provided in Section 2.6.2 (Santa Monica Bay Watershed) and Section 3.6.2 (Dominguez Channel Watershed).

Non-Stormwater Discharge Measures

The Permit requires Permittees to identify non-stormwater discharges that cause or contribute to exceedances of RWLs, and to then identify and implement BMPs to effectively eliminate the source of pollutants. These BMPs may include measures to prohibit non-stormwater discharge to the MS4, additional structural BMPs to reduce pollutants in the non-stormwater discharge, diversion to a sanitary sewer for treatment, or strategies to require the non-stormwater discharge to be separately regulated under a general NPDES permit. As previously stated, the Beach Cities WMG agencies currently operate seven low flow diversions along the Santa Monica Bay to eliminate non-stormwater discharges.

The non-stormwater screening process consists of the steps shown in **Figure 2-4**. Further details on the Beach Cities WMGs approach to meet this requirement are provided in the CIMP for the Beach Cities Watershed Management Group (Beach Cities Watershed Management Group, 2014).

The watershed control measures proposed for non-stormwater discharges meet the requirements as set forth in Parts III.A and VI.D .4.d and VI.D.10 of the LA County MS4 Permit.

The following schedule is proposed to eliminate unauthorized non-stormwater discharges that are either causing or contributing to receiving water exceedances in Santa Monica Bay watershed:

- December 28, 2016—Source investigation will be completed on 50% of the major outfalls with significant non-stormwater discharges in the Beach Cities EWMP Area (including outfall SMB-O-7).
- March 28, 2017— Outfall monitoring will be initiated as required for the investigated outfalls, based on results of source investigation in accordance with Section 5.6 of the Beach Cities CIMP, to determine compliance with applicable non-stormwater WQBELs derived from TMDL WLAs.
- June 26, 2017—Elimination of all significant, unauthorized non-stormwater contributions will be completed for the investigated outfalls.
- December 28, 2017—Source investigations will be completed on the remaining 50% of the major outfalls with significant non-stormwater discharges in the Beach Cities EWMP area, (source investigation will be 100% complete by this date).
- March 28, 2018—Outfall monitoring will be initiated as required for the remaining 50% of investigated outfalls, based on results of source identification in accordance with Section 5.6 of the Beach Cities CIMP, to determine compliance with applicable non-stormwater WQBELs derived from TMDL WLAs.
- June 26, 2018—Elimination of all significant, unauthorized non-stormwater contributions will be completed for 100% of the major outfalls in the Beach Cities EWMP Area.

Source investigations will take place in accordance with Section 5.5 of the Beach Cities CIMP. Non-stormwater discharge elimination will be prioritized in Santa Monica Bay due to the fact that the dry weather final compliance date for the Santa Monica Bay Beaches Bacteria TMDL has passed.

TMDL-Specific Control Measures

The Beach Cities WMG has evaluated BMPs that have been previously identified in TMDLs and corresponding implementation plans. Those BMPs that have been constructed are discussed in Section 2.6.4 (Santa Monica Bay Watershed) and Section 3.6.4 (Dominguez Channel Watershed). Other measures identified in TMDLs and TMDL implementation plans were evaluated as part of the RAA process in order to determine what combination of measures would achieve compliance with Permit-specified WQBELs and/or RWLs.

Additional BMPs

In addition to the MCMs, non-stormwater discharge measures, and TMDL control measures, the Beach Cities WMG has identified additional BMPs to achieve compliance with Permit-specified WQBELs and/or RWLs. These BMPs are discussed in more detail in Section 2.6 (Monica Bay Watershed) and Section 3.6 (Dominguez Channel Watershed) below.

Demonstration of BMP Performance – Introduction to the Reasonable Assurance Analysis

The EWMP is a planning document intended to lay out a framework of activities that will comply with water quality requirements. Therefore, it is necessary to demonstrate that selected BMPs are reasonably expected to meet defined goals and objectives. This demonstration of performance is described through a technically robust and rigorous RAA. Through this analysis the Beach Cities WMG identified and evaluated BMP implementation scenarios within the Beach Cities EWMP Area for each WBPC identified in Section 2.2. The RAA process demonstrates that implementation of EWMP-defined activities should result in the attainment of applicable Permit-specified WQBELs, and will also prevent discharges from causing or contributing to exceedances of applicable RWLs. Since the modeling conducted as part of the RAA serves as the basis not only for BMP evaluation but also BMP identification, Section 2.4 is devoted to providing details on the RAA process. Results from the RAA are presented in Section 2.7.

Legal Authority

The Permit-required legal authority that the Beach Cities WMG has to implement the BMPs identified in the EWMP is discussed in Section 8.

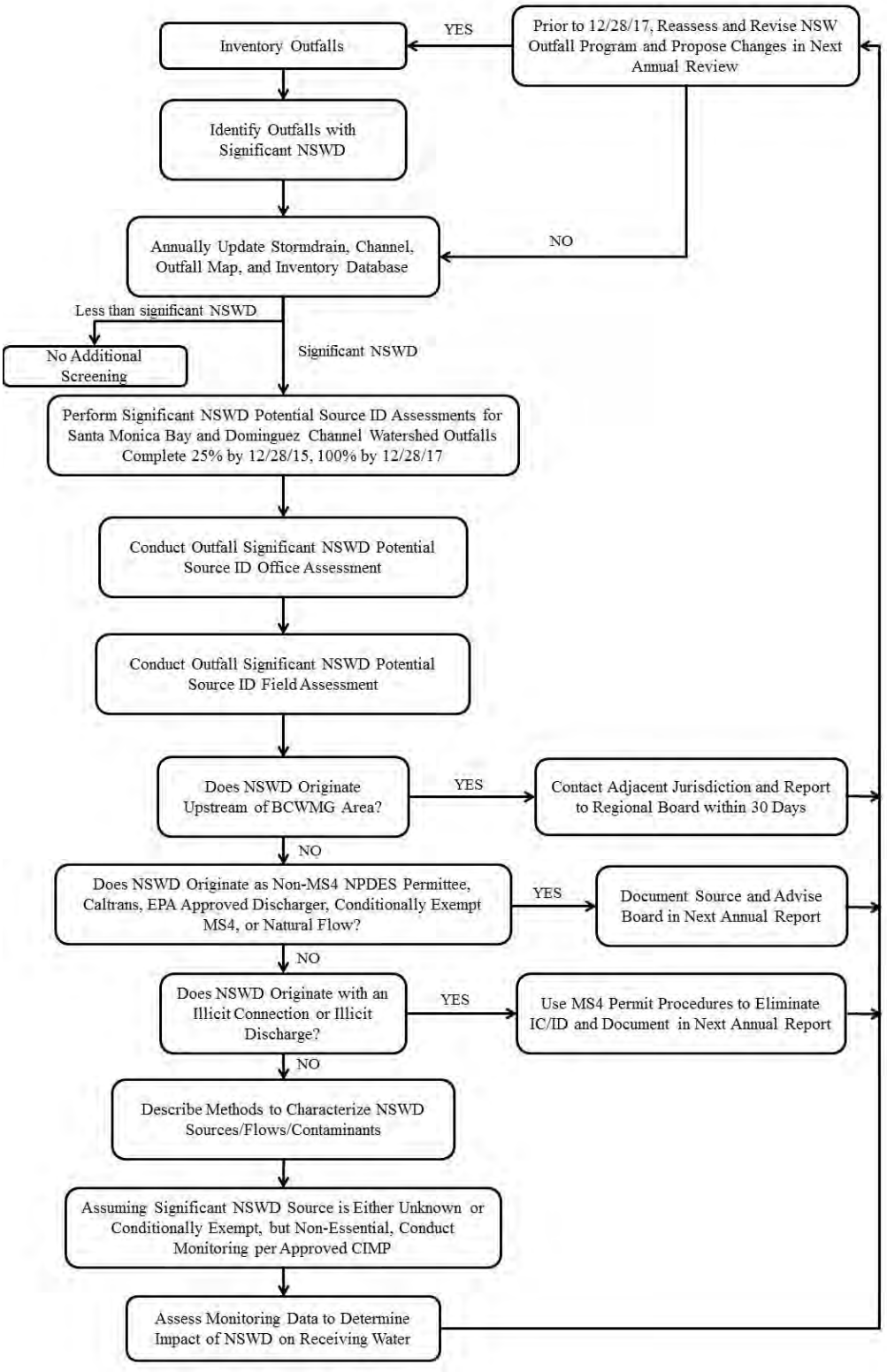


Figure 2-4. Non-Stormwater Outfall Screening Program

2.4 Reasonable Assurance Analysis Approach

The following subsections provide a summary of the modeling tools and approach, modeling data, calibration, and validation.

2.4.1 Description of RAA Tools and Approach

The approaches for performing the RAA in both dry and wet weather are described below.

Dry Weather

Demonstrating "reasonable assurance" of compliance with dry weather limits for the SMBBB TMDL requires a methodology that accounts for many factors which cannot be accurately modeled based on urban runoff processes alone (Thoe et al, 2014), despite the extensive summer-dry and winter-dry weather beach-specific monitoring datasets that are available. Therefore, to perform the RAA for dry weather for the Beach Cities WMG area, a semi-quantitative methodology has been developed to follow a permit compliance structure, as independent lines of evidence for demonstrating that MS4 discharges could not be causing or contributing to receiving water exceedances at the beaches. Because FIB are considered the "controlling" pollutants of concern during dry weather in the Beach Cities WMG area (i.e., if MS4 discharges are compliant for bacteria during dry weather, they will be compliant for all TMDL and 303(d) pollutants during dry weather), the methodology was developed to focus on bacteria (Beach Cities WMG, 2014).

The following criteria form the proposed dry weather RAA methodology. This methodology was presented to LARWQCB staff on April 9, 2014, and verbal feedback received at the time was supportive. If one criterion is met for CSMP compliance monitoring location (CML), then "reasonable assurance" is considered to be demonstrated.

1. A dry weather low flow diversion, disinfection system, or infiltration system is located at the CML. To meet this criterion, any such system should have records to show that it is consistently operational, well maintained, and sized to effectively eliminate freshwater surface discharges to the surf zone during year-round dry weather days.
2. There are no MS4 outfalls owned by the Beach Cities WMG Agencies within the CML's drainage area, and therefore MS4 discharges could not be contributing to pollutant concentrations at the CML.
3. Non-stormwater MS4 outfall discharges do not reach the wave wash and thus are effectively eliminated within the CML's drainage area. For this criterion to be met, supporting records from the non-stormwater outfall screening program should be supplied.

Wet Weather

The wet-weather RAA process consists generally of the following steps:

- Identify WBPCs for which the RAA will be performed;
- Identify the MS4 service area (exclude lands of agencies not party to this EWMP such as separately-permitted lands, Federal land, State land, etc.);

- For each analysis region (**Figure 2-5**), develop target load reductions (TLRs) for 90th percentile year for bacteria in SMB watershed based on LARWQCB RAA Guidelines, limit expressions in the Permit, and critical periods identified in the TMDLs;
- Identify structural and non-structural BMPs that were either implemented after applicable TMDL effective dates or are planned for implementation in the future;
- Evaluate the performance of these BMPs in terms of annual pollutant load reductions;
- Compare these estimates with the TLRs; and
- Revise the BMP implementation scenario until TLRs are met.

TLRs, as discussed previously, represent a numerical expression of the Permit compliance metrics (e.g., bacteria allowable exceedance days [AEDs] per year for wet weather) that can be modeled and can serve as a basis for confirming, with reasonable assurance, that implementation of the proposed BMPs will result in attainment of the applicable TMDL-based WQBELs and RWLs in the Permit for Category 1 pollutants, or the Water Quality Objectives for Category 2 and Category 3 pollutants.

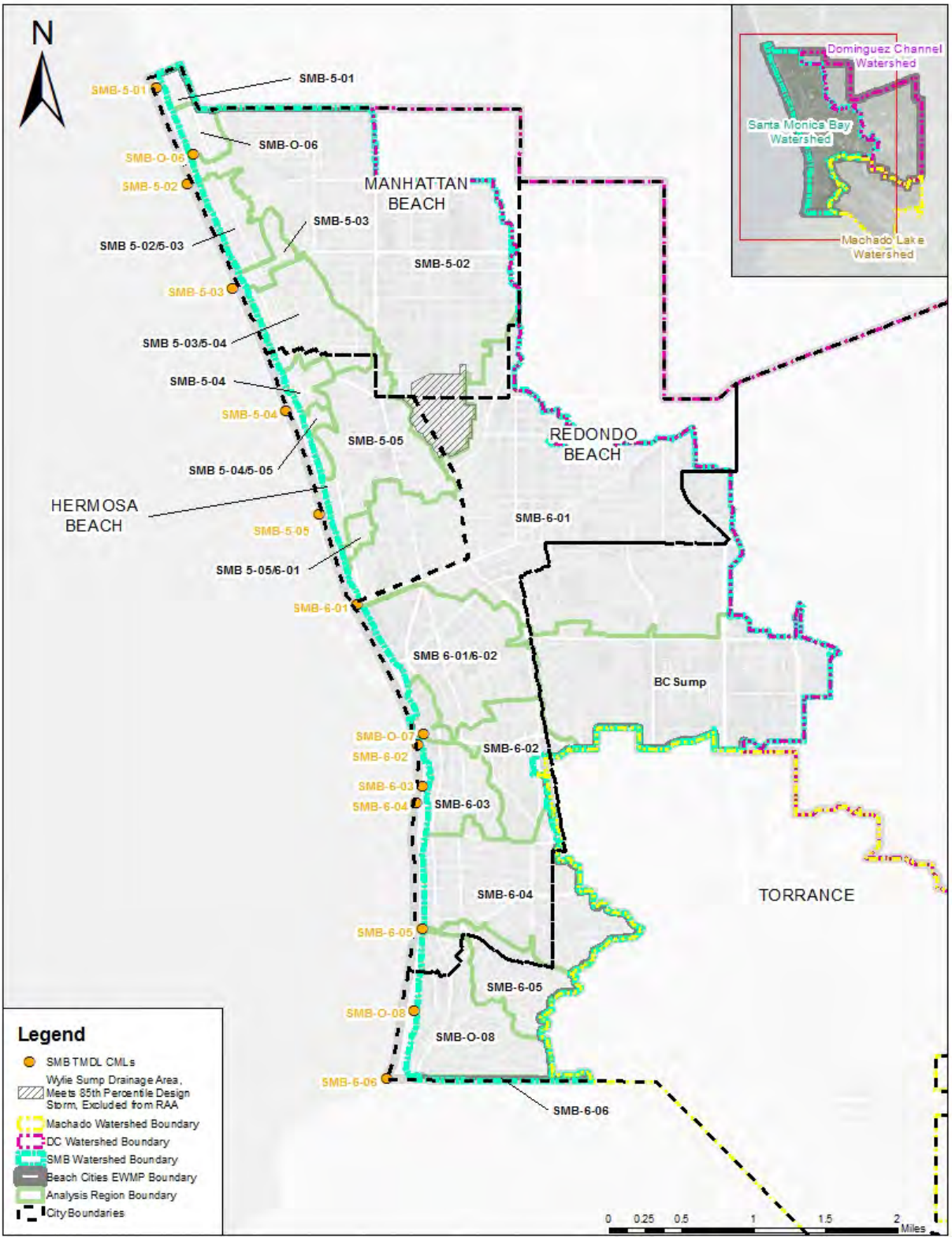


Figure 2-5. Analysis Regions and Monitoring Locations within the SMB Watershed portion of the Beach Cities EWMP Area

Structural BMP Prioritization and Analysis Tool (SBPAT) Model

The recommended RAA approach leverages the strengths of the publicly available, Permit-approved, Geographical Information System (GIS)-based model that has already been developed for the region and previously utilized in Jurisdictional Group 5 and 6 (J5&6): the Structural BMP Prioritization and Analysis Tool (SBPAT)[12].

SBPAT is a public domain, "open source," GIS-based water quality analysis tool intended to: 1) facilitate the prioritization and selection of BMP project opportunities and technologies in urbanized watersheds; and 2) quantify benefits, costs, variability, and potential compliance risk associated with stormwater quality projects. The decision to use SBPAT for the SMB EWMP RAA in the manner described below is based on the model capabilities and the unique characteristics of the SMB, specifically:

1. **Modeling of SMB hydrologic and watershed processes** – SBPAT utilizes EPA's Stormwater Management Model (SWMM) as the hydrologic engine, and SBPAT has been calibrated to local rainfall and Santa Monica Bay (SMB) stream flow gauges, consistent with requirements of the RAA Guidelines;
2. **SMB pollutants of concern and their compliance metric expression** – SBPAT has been utilized for planning applications related to Bacteria TMDL compliance (and specifically exceedance-day predictions, based on SMB criteria), including a demonstrated linkage of modeled bacteria loads to measured exceedance days;
3. **Availability of new open space water quality loading data** – Recently developed EMC data are consistent with SBPAT and were also updated to reflect new data developed in SMB as part of this RAA-development effort;
4. **Capability to conduct opportunity and constraints screening** – SBPAT was designed to support structural BMP placement, prioritization, and cost-benefit quantification, and was previously successfully used for such purposes in the SMB EWMP Group area and other nearby SMB subwatersheds;
5. **Characterization of water quality variability** – SBPAT is capable of quantifying model output variability and confidence levels, which is a requirement of the LARWQCB's RAA Guidance; and
6. **Supports quantification of both structural and non-structural BMPs, and demonstrating compliance at both interim and final compliance dates** – SBPAT's modeling framework is easily compatible with methods for addressing non-structural BMPs and provides quantitative results for multiple BMP phasing milestones, as required by the Permit.

[12] SBPAT is specifically referenced in the MS4 Permit Part VI.C.5.b.iv and was presented at the first two Permit Group TAC RAA Subcommittee meetings. Furthermore, SBPAT has been used for reasonable assurance analysis purposes in the Los Angeles region for four TMDL Implementation Plans, two WMPs, four EWMPs, and, in the San Diego region, for two Combined Load Reduction Plans and two Water Quality Improvement Plans.

The quantification analysis component of SBPAT includes a number of features. The model:

- Calculates and tracks inflows to BMPs, treated discharge, bypassed flows, evaporation, and infiltration at each 10 minute time step;
- Distinguishes between individual runoff events by defining six-hour minimum inter-event time in the rainfall record (in order to track rain events), while also tracking inter-event antecedent conditions;
- Tracks volume captured by and bypassing BMPs, and summarizes and records these volumes by storm event; and
- Produces a table of each BMP's hydrologic performance, including concentrations and loads by storm event, and consolidates these outputs on an annual basis.

2.4.2 *Modeling Data*

Data used for the quantification/analysis module include both fixed and stochastic parameters. The model utilizes Los Angeles region land use EMCs, USEPA SWMM, USEPA/American Society of Civil Engineers/Water Environment Research Foundation (USEPA/ASCE/WERF) International BMP Database (IBD) BMP effluent concentrations, watershed/GIS data, and a Monte Carlo approach (relying on repeated random sampling) to quantify water quality benefits and uncertainties. Model data flow is provided below in **Figure 2-6**.

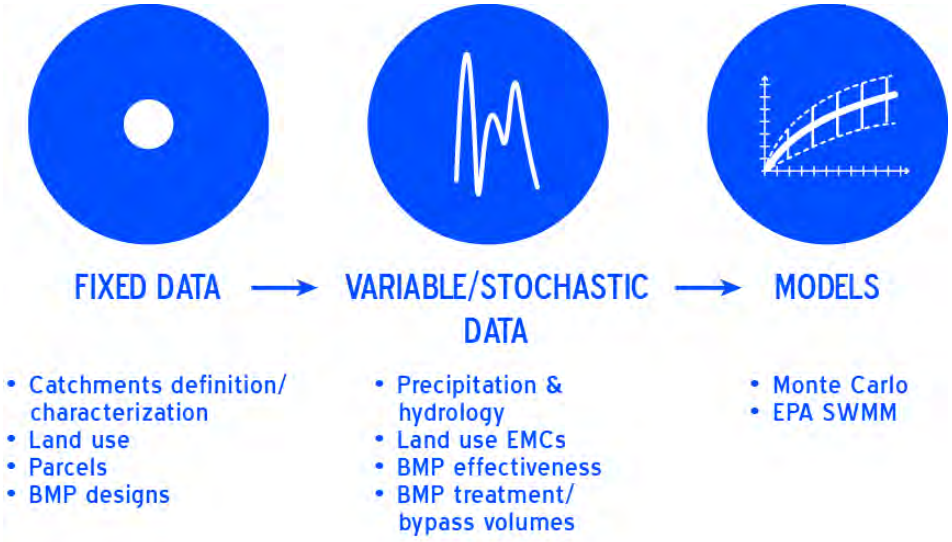


Figure 2-6. SBPAT Model Data Flow

Each model simulation integrates Monte Carlo methods that rely on repeated random sampling to obtain numerical results. Model simulations are run 20,000 to 50,000 times to calculate a distribution of outcomes that can support the definition of confidence levels and quantify variability. Consistent with the SBPAT usage, Monte Carlo methods are used in physical and mathematical problems when it is difficult to obtain a closed-form expression or when a

deterministic algorithm is not desired. A schematic of SBPAT's Monte Carlo process is provided in **Figure 2-7**.

Model documentation, as well as links to related technical articles and presentations, is provided at www.sbpat.net.

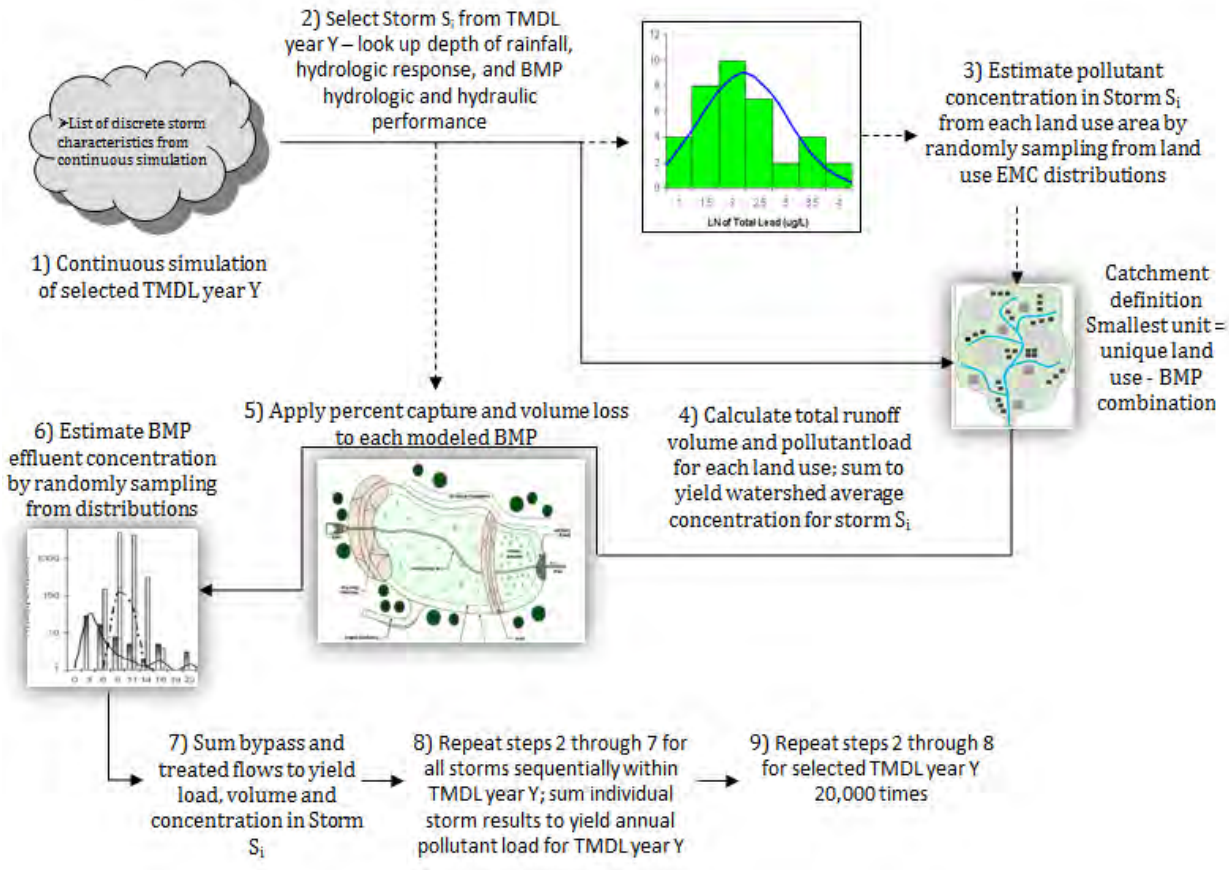


Figure 2-7. SBPAT Monte Carlo Method Components

The spatial domain of the RAA includes the land within the Beach Cities EWMP area tributary to SMB and Dominguez Channel. Adjustments were made to account for contributions from agencies not party to this EWMP (e.g., State/Federal, California Department of Transportation [Caltrans], Industrial General Permit holders, etc.) and are described in more detail later in this document.

GIS layers used in SBPAT included, but were not limited to, the following:

- Storm drains;
- Soils;
- Rain gauge polygons;
- Parcels;
- Land use; and
- Catchments.

SBPAT utilizes a customized version of SWMM for continuously simulating study area hydrology and BMP hydraulics. Long-term, hourly rainfall data and average monthly evapotranspiration values are used along with land use-linked catchment imperviousness and soil properties to estimate runoff volumes. Revised and recalibrated SBPAT database values and EWMP-defined BMP information are used to estimate the volume of runoff generated from watershed areas and captured by BMPs. Storm events are individually tracked for the entire simulation so that the volumes of runoff infiltrated, evapotranspired, captured, and released (if applicable) by BMPs are estimated for every storm event. Hourly rainfall data from LAX (NCDC ID45114) were used in the portion of the Beach Cities EWMP area draining to Santa Monica Bay. Hourly rainfall data from a Los Angeles County rainfall gauge at Manhattan Beach (Station ID 1070) was used for the portion of the Beach Cities EWMP area draining to Dominguez Channel. Rain gauges are shown in **Figure 2-8.**

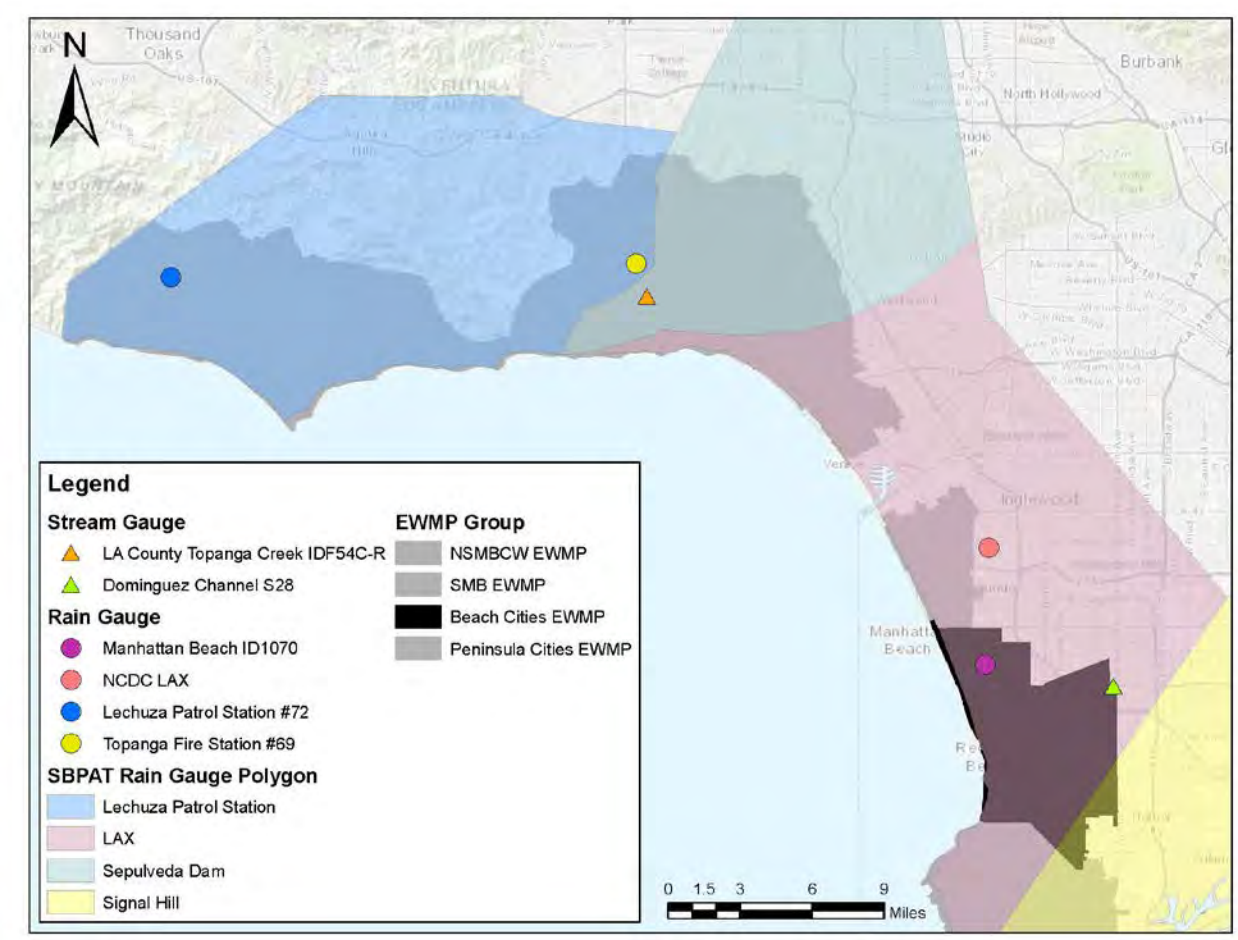


Figure 2-8. SBPAT Rain and Stream Gauges

Critical Condition Definition

Consistent with the SMBBB TMDL and the LARWQCB RAA Guidance Document, the RAA was performed on the 90th percentile critical year. This year was determined by evaluation of local rainfall records for all four EWMP Groups located along Santa Monica Bay over the 1989 to 2011 period of record, evaluating "TMDL years" as defined by the SMBBB TMDL (i.e., November 1 –

October 31). Of the local rain gauges evaluated, the Manhattan Beach gauge (Station ID 1070) (**Figure 2-8**), was determined to be the most representative of the Beach Cities WMG area. The rainfall record was analyzed to determine the 90th percentile year based on both the number of wet days (days with >=0.10-inch for rainfall and the three days following, per the SMBBB TMDL) as well as total annual rainfall. **Table 2-5** below presents these results. The 90th percentile year was determined to be either 1995 or 2005 based on wet days (73 total). TMDL year 1995 was selected to be the most conservative of these two years because while it is the 90th percentile year based on number of wet days, 1995 also had slightly more total rainfall than 2005. Therefore, the RAA was performed on TMDL year 1995. Although detailed results are only provided for the Beach Cities WMG, the 90th percentile year was determined to be 1995 across all four SMB EWMP Groups (Santa Monica Bay, North Santa Monica Bay Coastal Watersheds, Beach Cities, and Peninsula). A summary of annual rainfall data for the gauge above is provided in **Appendix Q**.

Table 2-5. Rainfall Summary at Manhattan Beach Precipitation Gauge (Station ID 1070)

90th Percentile TMDL Year (Type)	TMDL Year	Wet Days*	Total Rainfall (in)
Number of Wet Days	1995	73	22.0
Total Annual Rainfall	2005	73	21.9

*Compliance with the wet weather SMBBB TMDL is based on the number of allowable exceedance days.

The priority WBPCs for the Beach Cities EWMP area, combined with data availability, establishes the specific WBPCs addressed by the RAA. As previously described, SBPAT links the long-term hydrologic output from SWMM to a stochastic Monte Carlo water quality model to develop statistical descriptions of stormwater quantity and quality. Through this approach, the predicted runoff volumes for each storm are randomly sampled from the long-term storm event runoff volume record produced by SWMM. Land use-based wet weather pollutant EMC values (see **Appendix I)** and BMP effluent concentrations (see **Appendix J**) for each storm are then randomly sampled from their lognormal statistical distributions. The runoff volumes (including volumes treated and bypassed by BMPs), land use EMCs, and BMP effluent concentrations are combined to determine the total pollutant loads and load reductions (i.e., difference between existing and post-BMP load estimates) for each sampled storm event. This procedure is then repeated thousands of times, each time recording the volume, pollutant concentrations, loads, and load reductions for each selected storm event. The statistics of these recorded results are then used to characterize the average daily values as well as the average (mean) values for the annual volume, pollutant loads, and pollutant concentrations in stormwater runoff from the modeled area, with and without BMPs implemented.

The IBD is a comprehensive source of BMP performance information (www.bmpdatabase.org), comprised of data from a peer-reviewed collection of studies that have monitored the effectiveness of a variety of BMPs in treating water quality pollutants for a variety of land use types. Water quality performance data from the IBD were used to develop effluent concentrations (averages and standard deviations) for the BMPs and constituents in **Table 2-6**. As with land use EMCs, the effluent quality of BMPs is highly variable. To account for this variability in SBPAT, effluent quality data were analyzed and descriptive statistics were generated for use in the Monte Carlo statistical sampling technique. **Appendix J** contains detailed information on the BMP effluent statistics.

Table 2-6. BMPS and Constituents Modeled in SBPAT[1]

BMPs	Constituents
Constructed Wetland / Retention Pond (with Extended Detention)	Fecal Coliform (FC)
Constructed Wetland / Retention Pond (without Extended Detention)	Total lead (TPb)
Dry Extended Detention Basin	Total suspended solids (TSS)
Hydrodynamic Separator	Total phosphorus (TP)
Media Filter	Dissolved phosphorus as P (DP)[3]
Subsurface Flow Wetland	Ammonia as N (NH3)
Treatment Plant	Nitrate as N (NO3)
Bioswale	Total Kjeldahl nitrogen as N (TKN)
Bioretention with underdrain	Dissolved copper (DCu)
Bioretention (volume reduction only)[2]	Total copper (TCu)
Cistern (volume reduction only)[2]	Dissolved zinc (DZn)
Green Roof (volume reduction only)[2]	Total zinc (TZn)
Porous Pavement (volume reduction only)[2]	
Low Flow Diversion (volume reduction only)[2]	

[1] Constituents are addressed for BMPs that provide treatment (i.e., excluding those identified as "volume reduction only").

[2] For these BMPs, it is assumed that 100% of pollutant loads associated with the volume of water infiltrated is treated by the BMP. Water that bypasses or otherwise discharges from the BMP is assumed to receive no treatment.

[3] Dissolved phosphorus and orthophosphate datasets were combined to provide a larger dataset and because the majority of orthophosphate is typically dissolved and many datasets either report dissolved phosphorus or orthophosphate, but not both.

2.4.3 CALIBRATION

Hydrology

The hydrology component of SBPAT was calibrated for the only location in the entire greater SMB watershed where all data requirements (daily flow, hourly precipitation, and daily beach bacteria concentrations) were met - the Topanga Creek subwatershed. No other SMB areas have sufficient data available. The Topanga Creek subwatershed is located north of the Beach Cities WMG area.

Since primary output for SBPAT's prediction of the SMB watershed are annual volumes and pollutant loads, the calibration focused on accurate prediction of annual discharge volumes from the Topanga Creek subwatershed outlet, with estimated baseflow removed. Hourly rainfall data were used for the nearby Lechuza Patrol Station #72 gauge (gauge reference ID 352b, see **Figure 2-8**, in Malibu, with these data adjusted upward based on an annual rain depth ratio between the higher elevation Topanga Fire Station #69 gauge (gauge reference ID 6) and the coastal Lechuza gauge. Los Angeles County's Topanga Creek streamflow gauge (gauge reference ID F54C-R) was used to estimate measured annual discharge volumes for comparison with modeled volumes. The effective impervious percentage for the open space land use category and the saturated hydraulic conductivity of all mapped soil types served as calibration parameters.

Previous hydrologic calibration reported in the Beach Cities EWMP Work Plan (Beach Cities WMG, 2014) was refined to include additional precipitation and streamflow data. The refined calibration used a vacant undifferentiated land use effective imperviousness value of 1 percent. The refined calibration required the evaluation of various saturated hydraulic conductivity multipliers that would result in increased model runoff (i.e., each soil type's original hydraulic saturated conductivity was multiplied by the same value). The calibration was performed iteratively with multipliers ranging from 0.1 to 2.0 until the average annual modeled volume produced an acceptable error value when compared to the average annual observed volumes. A multiplier of 0.20 was selected as most appropriate. **Figure 2-9** is a depiction of the refined hydrologic calibration results, including the 0.20 saturated hydraulic conductivity multiplier. The emphasis of the calibration effort focused on accurate, unbiased prediction of "non-extreme" annual conditions (annual volumes exceeding a 25-year frequency, 4 percent probability, were excluded from the calibration effort). Based on available data, the period of calibration was 12 years, between 2001 and 2012, with water years 2005 and 2008 excluded due to outlying streamflow measurement results[13]. These calibrated input parameter values were used throughout the SMB watersheds in the wet weather RAAs. **Figure 2-10** presents these same results in a flow duration curve format, which compares the distribution of annual discharge volume magnitudes throughout the period analyzed between the modeled and observed data.

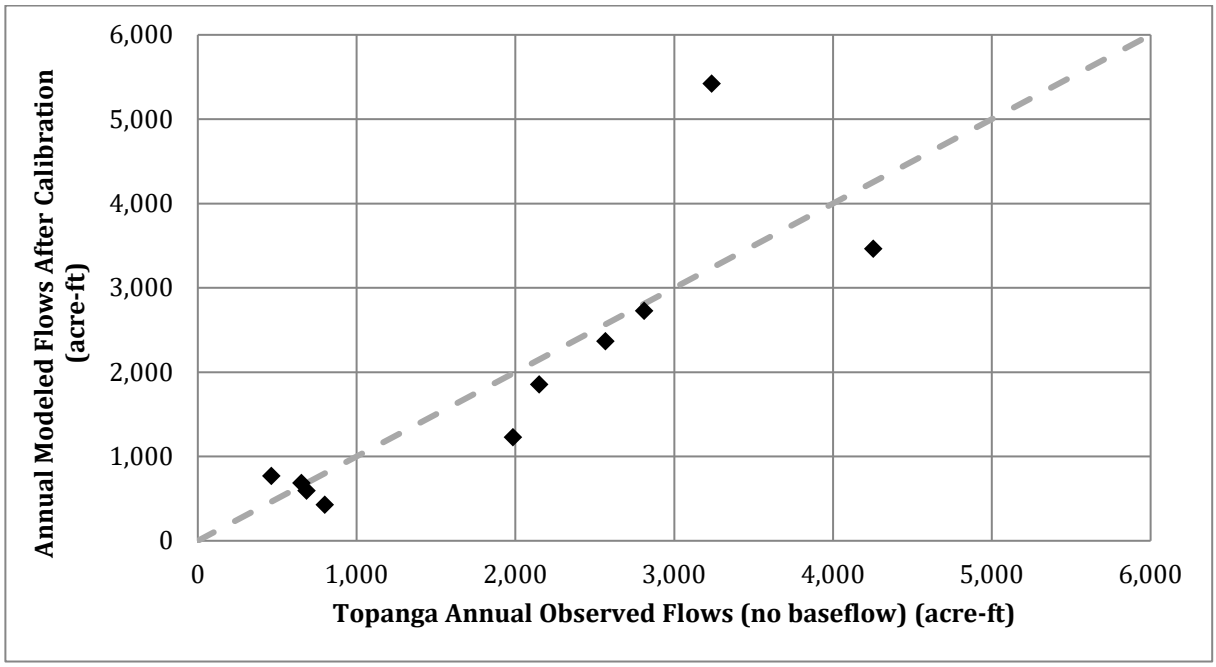


Figure 2-9. Annual Runoff Volumes for Topanga Creek Subwatershed: Modeled vs. Observed.

[13] The stream gauge annual volume measurement in 2008 was unexplainably high (corresponding to a runoff coefficient greater than one), and the 2005 year included a 15-day period of near-record rainfall levels that were anomalously high (where the mean annual rainfall depth fell between December 27 and January 10, and major landslides were reported in coastal Ventura County).

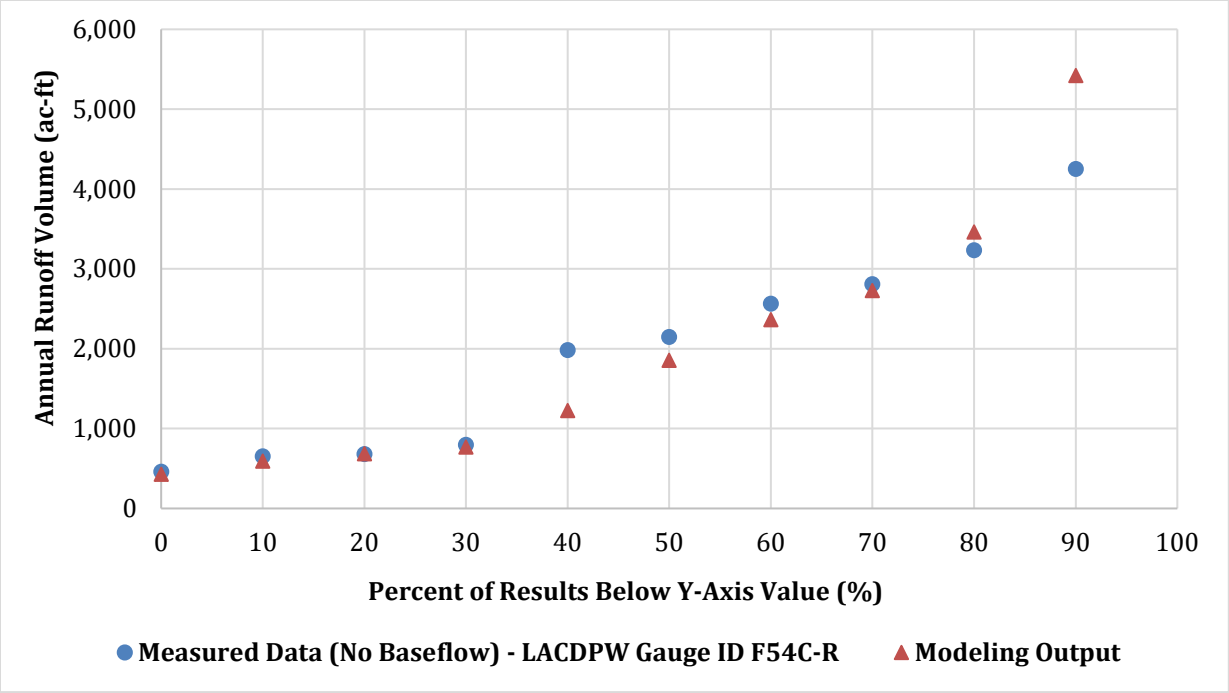


Figure 2-10. Annual Runoff Volumes for Topanga Creek Subwatershed: Modeled vs. Observed (Flow Duration Curve Format).

Following calibration, average relative prediction error (or the percent differences between the average annual observed and modeled annual runoff volume) was calculated to be -0.24%. According to the LARWQCB's RAA Guidance Document, which is based on Donigian, 2000, SBPAT model performance with respect to hydrology as a result of this calibration is in the "very good" category.

Water Quality

The RAA Guidelines require water quality calibration based on available monitoring data from each analysis region over the most recent 10 years. However, in the SMB EWMP analysis regions, freshwater (i.e., mass emission type) monitoring stations with fecal coliform data[14] are not available from a recent 10 year period. Therefore, calibration that meets the guidelines is not possible at this time. After several years of CIMP monitoring data have been collected, this may be reevaluated as part of the EWMP adaptive management process. Also, since a conventional water quality calibration was not possible at this time, a validation of baseline exceedance day output was performed for the Leo Carrillo reference watershed using recent beach bacteria monitoring results, as described below. The reference watershed was used for this validation because it is the basis of the TMDL Waste Load Allocations, which the RAA TLRs are intended to represent.

[14] Fecal coliform data and objectives were used to represent all fecal indicator bacteria because fecal coliform has the most robust land use and BMP effluent EMC datasets.

2.4.4 VALIDATION

A validation step was performed to demonstrate that modeled annual fecal coliform loads are indeed predictive of the compliance metric, or annual exceedance days for fecal indicator bacteria. For bacteria modeling, verifying the linkage between modeled *fecal coliform loads* (i.e., discharged from the watershed outlets) and total observed wet weather *exceedance days* (in the receiving water, based on REC1 daily maximum water quality objectives) was critical to establish reasonable assurance that CMLs would be in compliance with the Permit limits. To establish this linkage, an analysis was conducted using shoreline monitoring data at Topanga Canyon[15] (SMB-1-18) between 2005 and 2013. **Figure 2-11** illustrates that decreasing fecal coliform loads should result in measurable reductions in exceedance days, and that there is a reasonable correlation between total annual modeled fecal coliform loads and total annual observed wet weather exceedance days. Each point shown represents one TMDL year.

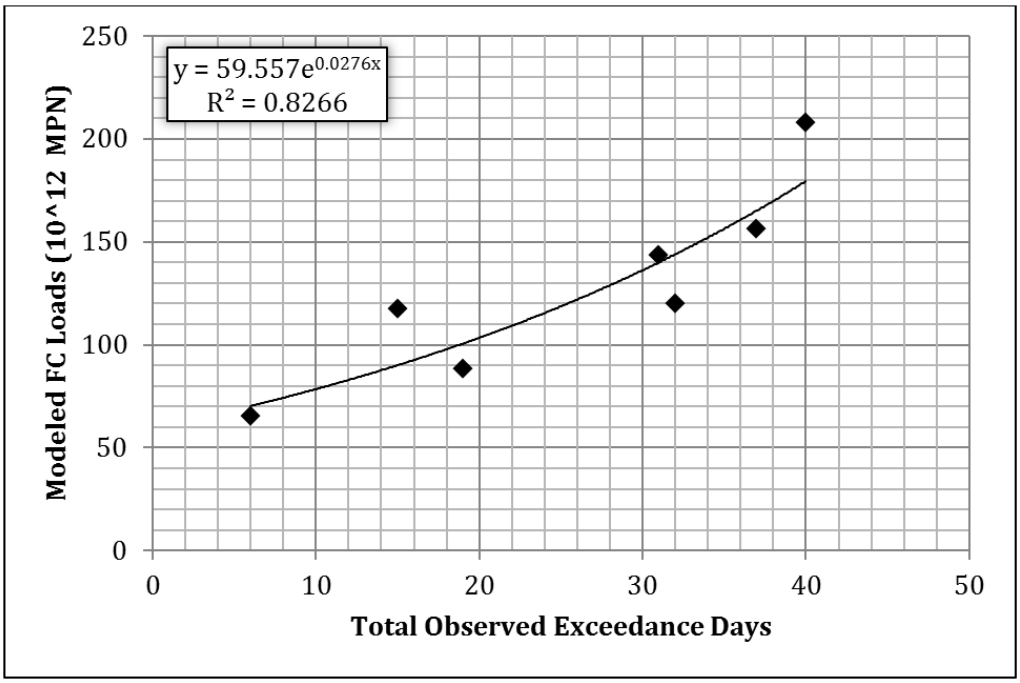


Figure 2-11. Correlation between Modeled Fecal Coliform Loads and Observed Exceedance Days (each point represents one TMDL year, 2005-2013)

2.5 BASELINE LOADS AND TARGET LOAD REDUCTIONS

The process for establishing TLRs for the modeled WBPC (bacteria in Santa Monica Bay) is described in the following section. For analysis regions with SMBBB TMDL CMLs that have anti-degradation-based allowable exceedance days for wet weather, a target load reduction of zero was

[15] This subwatershed is 88 percent open space and was selected for water quality validation due to it being the hydrologic calibration subwatershed as well as because it had *daily* shoreline monitoring data, which was necessary in order to have a sufficiently robust dataset of annual wet weather exceedance days.

assumed consistent with the TMDL's approach which acknowledges that historic bacteria exceedance rates for each of these analysis regions are lower than that of the reference beach, on average. This assumption of zero target load reduction applies for seven of the 11 total SMBBB TMDL CMLs in this Beach Cities watershed – i.e., SMB-5-1, SMB-5-3, SMB-5-4, SMB-5-5, SMB-6-2, SMB-6-5, and SMB-6-6. Historic wet weather monitoring data (2005 – 2013) at these sampling locations confirm this understanding, as the long-term exceedance rate at all seven sites varies between 6.4 and 22%, below the long-term wet weather exceedance rate at the reference beach (26%). Bacteria reductions were still modeled using SBPAT in these analysis regions, but BMP modeling results were not compared with a target load reduction; i.e., quantification only serves to express the additional water quality benefits of existing and proposed BMPs in these analysis regions.

2.5.1 BACTERIA

In order to establish a TLR for each modeled Santa Monica Bay analysis region, a modeling methodology was developed and tested to relate the annual number of modeled calendar days with rainfall-generated runoff (or "discharge days") to the expected annual bacteria exceedance days, which is the Permit's WQBEL expression for the SMBBB TMDL. To be consistent with the SMBBB TMDL for wet weather, which established the allowed exceedance day Waste Load Allocations based on monitoring results from the Leo Carrillo reference beach, this modeling methodology was first tested on Leo Carrillo and its Arroyo Sequit subwatershed for the same critical year as the TMDL (TMDL year 1993). The goal of this analysis was to validate the modeling methodology by comparing its predicted exceedance days for Leo Carrillo with the 17 exceedance days from the TMDL, for TMDL year 1993. This analysis occurred in three steps:

1. The calibrated SBPAT model, using the nearby Lechuza Patrol Station gauge for TMDL year 1993 (consistent with the TMDL), resulted in 59 discharge days for Arroyo Sequit.
2. Based on 2003 to 2013 Leo Carrillo monitoring data, 27% of wet weather samples exceeded the single sample recreational Water Quality Objectives on days with rainfall greater than 0.10-in. In other words, 27% of wet weather days when runoff discharges might be expected (i.e., days with rainfall), FIB concentrations at the beach exceeded the objectives.
3. Multiplying 59 discharge days by the 27% exceedance percentage results in 16 predicted wet weather exceedance days for Leo Carrillo for TMDL Year 1993. This result is within 6% of the 17 exceedance days that were determined through the original analysis in the SMBBB wet weather TMDL, thereby validating the proposed exceedance day calculation methodology.

After validation of the modeling methodology using the reference watershed, it was applied to all SMB analysis regions to predict baseline exceedance days for the 90th percentile year, or TMDL year 1995. Once baseline exceedance days were estimated for every analysis region, the exceedance day count was compared with allowed exceedance days from the TMDL (i.e., 17 for all non-anti-degradation compliance monitoring beaches). To determine the TLR necessary for each analysis region to meet the allowed exceedance days, a virtual retention BMP was modeled at the outlet of

each analysis region. This approach was presented to LARWQCB staff on June 6, 2014 and verbal feedback received during the meeting was supportive.

Each virtual retention BMP included a diversion with a virtual hydraulic capacity that results in in a model-derived bypass frequency (or number of discharge days), during TMDL year 1995 that meets the allowable exceedance day criteria. Each diversion is modeled as a full capture system. The net load reduction resulting from this BMP scenario (i.e., baseline analysis region load minus analysis region load with the diversion system and retention BMP in place) for the 90th percentile year (1995) becomes the TLR for each analysis region. For the RAA, reasonable assurance of compliance is established when load reductions associated with proposed BMPs equal the TLR for each analysis region.

In summary, the following approach was implemented to calculate a TLR for each modeled analysis region (see **Appendix K** for example calculation):

1. Each analysis region was modeled in SBPAT for the 90th percentile year (TMDL 1995).
2. The existing, baseline condition (i.e., without any outlet retention BMP) was modeled for each analysis region, resulting in a mean baseline fecal coliform (FC) load for the 90th percentile year (baseline load).
3. The exceedance percentage of samples collected during days with precipitation greater than 0.1 inches was determined for each analysis region.
4. The allowable number of discharge days for each analysis region was calculated by dividing 17 TMDL allowable exceedance days by the exceedance percentage calculated in Step 3.
5. An instream diversion to a large virtual retention BMP at the outlet of each analysis region was iteratively sized so that it only bypasses during the number of allowable discharge days determined in Step 4.
6. Each diversion and virtual retention BMP was then modeled in SBPAT to produce a mean FC load for the 90th percentile year (allowed load).
7. For each analysis region , the difference between the baseline load (step 2) and the allowed load (step 6) resulted in a TLR for the 90th percentile year, which was the target load reduction required to meet the 17 allowable TMDL exceedance days for wet weather.

By implementing the steps described above, TLRs were developed for all analysis regions within the MS4, including both open beach and point zero CMLs. These TLRs are presented in **Table 2-7** for both the interim and final compliance deadlines. TLRs for the interim compliance deadlines are assumed to be 50% of the final TLR. TLRs for analysis regions located between two point zero CMLs, but not representing an open beach site, were assigned the TLR of the geographically smaller of the two adjacent CML analysis regions.

It should be noted that a zero percent TLR was calculated in the analysis region draining to CML SMB-6-03. This analysis region and CML had a lower average wet weather exceedance rate than the reference watershed based on a recent nine year period (2005-2013), produced relatively few modeled stormwater discharge days, and had few years with measured wet weather exceedance

days greater than allowable exceedance days (i.e., only three of the recent nine years exceeded the allowed days, and each year by just one exceedance day).

Similarly, a zero percent TLR was also calculated in the analysis region draining to CML SMB-6-04. The frequency of exceedance at SMB-6-04 (27.6%) was lower than that of the surrounding anti-degradation sites SMB-6-02 (33.3%) and SMB-6-05 (31.0%) and also lower than the exceedance rate of SMB-6-03 (37.9%), which was calculated to have a TLR of zero. Further, SMB-6-04 is an open beach CML with no major MS4 outfall at the sampling location.

As stated earlier, nine CMLs with anti-degradation-based wet weather allowable exceedance days were assigned zero TLRs to reflect their historic good water quality. Although the SMBBB TMDL requires only that beach water quality at anti-degradation compliance locations be maintained, the Beach Cities EWMP will seek to implement nonstructural and Low Impact Development (LID)-based BMPs within the SMB portion of their EWMP area which will protect and potentially improve water quality at these beaches and is consistent with the J5&6 Implementation Plan (Geosyntec Consultants, 2011) for the SMBBB TMDL. These measures, though not required for RAA demonstration, are quantified in Section 2.6.3 below.

Table 2-7. Target Load Reductions for Fecal Coliform for each Modeled Analysis Region in Santa Monica Bay Watershed - TMDL Year 1995

Analysis Region	2003-2013 Historical Exceedance Frequency (Daily Rainfall >0.10-in)	Allowable Discharge Days (Daily Rainfall > 0.10-in)	Diversion Flowrate (cfs)	Baseline Condition for the Critical Year			Allowed Condition for the Critical Year[6]			Target Load Reduction for the Critical Year[6]			
				Annual Runoff (ac-ft)	Average Pollutant Concentration[5] (MPN/ 100mL)	Annual Pollutant Load (10^{12} MPN)	Annual Runoff (ac-ft)	Average Pollutant Concentration[5] (MPN/ 100mL)	Annual Pollutant Load (10^{12} MPN)	Interim Target Load Reduction		Final Target Load Reduction	
										Absolute Load (10^{12} MPN)	% of Baseline Annual Load	Absolute Load (10^{12} MPN)	% of Baseline Annual Load
SMB-5-01[1]	10.3%	4	0	39	15,400	7.4	39	15,400	7.4	Interim target load reduction assessed on a watershed-wide basis		0	0%
SMB-O-06	N/A	4	0	90	20,700	23.0	90	20,700	23.0			0	0%
SMB-5-02	67.9%	17	53	1516	28,600	534.8	1516	15,400	287.2			247.6	46.3%
SMB-5-02/ SMB-5-03[2]	N/A	12	0	123	23,000	34.9	123	23,000	34.9			0	0%
SMB-5-03[1]	17.2%	6	0	65	36,200	29.0	65	36,200	29.0			0	0%
SMB-5-03/ SMB-5-04[2]	N/A	9	0	251	28,800	89.3	251	28,800	89.3			0	0%
SMB-5-04[1]	31.0%	12	0	51	27,200	17.1	51	27,200	17.1			0	0%
SMB-5-04/ SMB-5-05[2]	N/A	10	0	37	17,800	8.2	37	17,800	8.2			0	0%
SMB-5-05[1]	31.0%	8	0	472	31,400	182.8	472	31,400	182.8			0	0%
SMB-5-05/ SMB-6-01[2]	N/A	13	0	36	15,100	6.7	36	15,100	6.7			0	0%
SMB-6-01[3]	63.9%	17	70	2118	27,100	706.6	2118	15,100	394.3			312.1	44.2%
BCSump[3]	63.9%	17	40	1191	25,800	379.4	1191	13,700	201.4			178	46.9%
SMB-6-01/ SMB-6-02[2]	N/A	16	0	621	21,200	162.5	621	21,200	162.5			0	0%
SMB-6-02[1,4]	33.3%	14	0	358	22,600	99.6	358	22,600	99.6			0	0%
SMB-6-03	37.9%	17	0	206	24,500	62.2	206	24,500	62.2			0	0%
SMB-6-04	27.6%	17	0	621	27,400	209.9	621	27,400	209.9			0	0%
SMB-6-05[1]	31.0%	11	0	230	32,000	90.9	230	32,000	90.9			0	0%
SMB-O-08	N/A	7	0	425	26,500	138.9	425	26,500	138.9			0	0%
SMB-6-06[1]	10.3%	3	0	19	28,000	6.7	19	28,000	6.7			0	0%
SMB Watershed-Wide	N/A	N/A	N/A	**8468**	**26,700**	**2789.9**	**8468**	**19,600**	**2052.1**	**368.9**	**13%**	**737.7**	**26%**

[1] Anti-degradation site.
[2] For the unmonitored tributary areas located in-between the CML tributary areas, TLRs were assigned from the geographically smaller of the two adjacent CML analysis regions.
[3] "BCSump" was defined as a separate analysis region for modeling purposes. The baseline load for "BCSump" analysis region was combined with the baseline load of the "SMB-6-01" analysis region to equal the total baseline load contributing to the SMB-6-01 CML ("SMB-6-01+BCSump").
[4] The drainage area to Outfall SMB-O-07 is encompassed by analysis region SMB-6-02; therefore SMB-O-07 was analyzed as part of analysis region SMB-6-02.
[5] Average pollutant concentrations are estimated as the total annual load divided by the total annual runoff volume.
[6] RAA demonstration is made based on the achievement of the TLR values in terms of absolute load removed by the proposed suite of BMPs in each analysis region. The target load reductions in terms of runoff volume and concentration are shown for informational purposes only.

2.6 Best Management Practices

2.6.1 Methods to Select and Prioritize BMPs

In order to demonstrate reasonable assurance, BMPs were identified in a prioritized manner. Prioritization was based on cost (low cost BMPs were prioritized first); BMP effectiveness for the pollutants of concern (BMPs that had greater treatment efficiency for the pollutant of concern in a particular analysis region were prioritized over other BMPs); and implementation feasibility as determined by the Beach Cities WMG. In general, nonstructural BMPs were prioritized over structural BMPs due to their lower relative cost, and then structural BMPs were identified that would likely result in the greatest load reduction per dollar.

The RAA was performed according to the following steps:

1. Calculate load reductions associated with existing structural BMPs;
2. Assume a load reduction for non-modeled non-structural BMPs (five percent of baseline pollutant load);
3. Calculate load reductions for public retrofit incentives (e.g., downspout disconnects) and redevelopment;
4. Calculate load reductions attributable to anticipated new permit compliance activities of non-MS4 entities (e.g., Industrial General Permit holders and Caltrans);
5. Calculate load reductions for proposed regional BMPs that were identified in existing plans; and
6. Meet the TLR by backfilling the remaining load reduction with new regional or distributed green streets BMPs, with green streets modeled by assuming treatment of runoff from a percentage of specific developed land uses.

The following schedule assumptions were made:

- Only BMPs implemented after the TMDL effective date (2003) were included;
- Redevelopment BMPs were assumed to use different sizing criteria before and after 2015 (EWMP submittal date), consistent with the Permit's post-construction requirements; and
- Modeled load reduction output are reported for both the interim (2018) and final (2021) TMDL compliance dates.

2.6.2 Recommended MCMs and Nonstructural BMPs

The Permit allows permittees developing an EWMP the opportunity to customize the MCMs specified in the Permit to focus resources on high priority issues within their watersheds. Modifications to the MCMs must be appropriately justified and still be consistent with 40 CFR § 122.26(d)(2)(iv)(A)-(D). A control measure may only be eliminated based on the justification that it is not applicable to a particular permittee (per Section IV.C.5.b.iv.1(c). Customized measures, once approved as part of the EWMP, will replace in part or in whole the prescribed MCMs in the Permit. The Planning & Land Development Program is not eligible for customization in that it may be no

less stringent than the baseline requirements in the Permit. However, it can be enhanced over the baseline permit requirements if desired. The Permit-specified MCMs (baseline MCMs) build upon the MCMs in the previous MS4 Permit (Order 01-182). Although similar in many ways to the previously required MCMs, in most cases the baseline MCMs contain more prescriptive record-keeping and/or implementation requirements.

Summary assessments of each MCM contained in the Permit are provided in **Table 2-8**, as well as a determination as to whether the Beach Cities WMG will implement the MCM provisions as defined in the Permit, or whether modifications will be made. Additional modifications may also be made through the Adaptive Management Process, outlined in Section 5.

General Framework for MCM Customization

An approach for evaluating existing institutional MCMs was developed as part of the Beach Cities EWMP Work Plan and was used to evaluate existing MCMs and develop the customized MCMs. The following steps provide a general framework for MCM customization:

1. Identify MCMs for potential customization. This may include identifying:
    a. MCM requirements prescribed by the Permit which are not already being implemented by the permittee;
    b. Currently implemented MCMs which have been enhanced over the previous Permit as part of TMDL implementation, e.g., Clean Bay Restaurant Program;
    c. Programmatic solutions/non-structural controls identified in TMDL implementation plans which may not yet have been implemented; and
    d. MCMs which are currently being implemented but which may be excessive in scope. For example, commercial inspections being conducted of retail gasoline facilities which are already heavily regulated through other environmental programs in areas that have no receiving water impairments for the pollutants of concern may be carried out less frequently, or discontinued indefinitely.
2. Identify MCMs which are not applicable. A control measure may be eliminated based on the justification that it is not applicable to a particular permittee. For example if it is the policy of a permittee not to use pesticides in public agency activities, then there is no need for tracking of pesticide use and this MCM may be proposed for elimination.
3. Assess the effectiveness of the incremental baseline MCM requirements with respect to water quality priorities. The data necessary to quantify this will vary greatly by MCM, but may include information such as: receiving water quality, inspection and reporting records, number of qualifying projects (e.g., number of construction projects greater than 1 acre), number of pet station bags used, amount of material picked up by street sweeping activities, number of employees trained, and maintenance records. Additionally, the California Stormwater Quality Association (CASQA) provides a tool to estimate the effectiveness of stormwater management programs (CASQA, 2015). The tool recommends possible assessment metrics that can be used for various stormwater programs.

4. Quantify the additional resources required to implement the incremental baseline MCMs. This may include estimating additional staff resources in terms of full-time employees, consulting resources, and contracted services.
5. Assess the effectiveness and resources required to implement the customized MCM. The process to quantify these will be the same as the process used to quantify the baseline effectiveness of the existing MCM.
6. Compare the assessed effectiveness and resources required to implement the incremental baseline MCMs and the customized MCMs. Customization can be justified in several ways:
    a. If the customized MCM effectiveness is equal to or greater than the baseline MCM, customization can be justified.
    b. If an MCM requirement is not applicable, then elimination is justified.
    c. If the incremental MCM requires additional resources that are disproportionate to the increased effectiveness achieved, then retention of the existing MCM may be justified.
7. Document the customized MCM justification.

MCMs were evaluated based on their effectiveness in addressing the WBPCs specific to the Beach Cities EWMP Area and based on the Beach Cities WMGs knowledge and experience with existing MCMs. In many ways, the Group's practical experience with MCM implementation over time provides the best insight as to what MCM modifications/ enhancements will be most helpful to target the WBPCs of concern in the Beach Cities EWMP Area.

Table 2-8 summarizes the proposed MCM modifications common to the Beach Cities EWMP WMG, which include promotion of Ocean Friendly Landscaping Workshops as part of the residential outreach permit requirement, distribution of a Clean Bay Restaurant Program brochure to promote public education, establishment of a stormwater website for J5&6, implementation of the Clean Bay Restaurant Program as an assistance program for small businesses, and annual restaurant inspection as commercial pollutant sources. The LACFCD will implement the MCMs identified in VI.D.44 of the MS4 Permit with no additional modifications.

In addition to the MCM modifications being implemented by the WMG as a group, the Beach Cities WMG has identified additional individual city-specific MCM enhancements, which include organization of educational and cleanup-oriented events, installation of pet waste collection stations as a part of the residential outreach requirement, a ban on plastic bags in Manhattan Beach and polystyrene food containers in Hermosa Beach, and development of environmentally oriented city websites. City-specific MCMs enhanced beyond the 2012 Permit requirements are specified in **Table 2-8.** Details and descriptions of these enhancements are provided in **Appendix L**. The MCM enhancements shown in **Table 2-8** and **Appendix L** are examples and are not comprehensive. The Beach Cities WMG agencies' LID Ordinances and Green Street Policies are included as **Appendix M** and **Appendix N**, respectively.

Table 2-8. MCM Modifications and Agency-Specific Enhancements for Beach Cities EWMP Area

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement							
			City of Manhattan Beach		City of Redondo Beach		City of Hermosa Beach		City of Torrance	
			MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?
D.2 Progressive Enforcement (Applies D.6, D.7, D.8, and D.10)										
Develop and maintain a Progressive Enforcement Policy	X								X	Milestone: 1/1/2016
Conduct follow-up inspection within 4 weeks of date of initial inspection	X									
Take progressive enforcement	X								X	Milestone: 1/1/2016
Retain records	X									
Refer violations to LARWQCB	X									
Investigate complaints from LARWQCB	X									
Assist LARWQCB with Enforcement Actions	X									
D.5 Public Information and Participation Program (PIPP)										
Participate in a Countywide PIPP, WMP PIPP, or individual PIPP that measurably increases knowledge and changes behavior, and involves a diversity of socio economic and ethnic communities	X								X	Implemented
Maintain reporting hotline	X								X	Implemented
Publish hotline info on web, telephone book	X									
ID staff/department that serve as the contact (publish this info)	X									
Organize events (e.g., clean ups)	X	X	X	Implemented	X	Implemented	X	Implemented	X	Implemented
Residential Outreach (Individually or with group):	X	X	X	Implemented	X	Implemented	X	Implemented	X	Implemented
Public Service Announcements	X	X	X	Implemented	X	Implemented	X	Implemented		
(Develop) Public education materials on: vehicle fluids; household waste; construction waste; pesticides, fertilizers, and integrated pest management (IPM); green wastes; and animal wastes	X		X	Implemented except for IPM materials (Milestone of June 2017 for IPM)			X	All except IPM are implemented (Milestone of June 2017 for IPM materials)	X	Implemented
Distribute public education materials at points of purchase	X	X			X	Implemented	X	Implemented	X	Implemented
Maintain stormwater website	X	X	X	Implemented			X	Implemented	X	Implemented
Provide schools with materials to educate children (K-12); can use state produced materials	X		X	Implemented			X	Implemented	X	Implemented
D.6 Industrial/ Commercial										
Track Critical Sources - maintain inventory (watershed based or lat/long recorded)	X									
Educate - notify critical sources of BMP requirements	X									
Implement a Business Assistance Program for select sectors or small businesses - technical assistance, and distribute materials to specific sectors	X	X	X	Implemented					X	Milestone: 1/1/2016
Inspect Commercial Sources	X	X							X	Implemented
Inspect Industrial Sources - Initial mandatory inspection	X		N/A				N/A		X	Implemented
Secondary mandatory inspection	X		N/A				N/A			

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement							
			City of Manhattan Beach		City of Redondo Beach		City of Hermosa Beach		City of Torrance	
			MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?
No Exposure - evaluate and conduct 2nd inspection at 25% of facilities	X		N/A				N/A			
As needed, conduct Progressive Enforcement follow-up inspections (see Part VI.D.2)	X									
D.7 Planning and Land Development										
Update ordinance/design standards to conform with new requirements (LID)	X						X	Implemented LID ordinance enhanced beyond permit minimum	X	Implemented
Optional: Establish alternative compliance for technical infeasibility, e.g., allow onsite biofiltration or offsite infiltration or groundwater replenishment or retrofit	X									
Optional if allowing offsite mitigation: Develop a prioritized list of offsite mitigation projects	X									
Optional if allowing offsite mitigation: Develop a schedule for completion of offsite projects (must be with 4 yr of the Certificate of Occupancy of the first project that contributed funds)	X									
Optional if allowing offsite mitigation: Notice offsite projects to RB website	X									
Optional if allowing offsite mitigation: List of mitigation projects descriptions and estimated pollutant and flow reductions	X									
Optional if allowing offsite mitigation: Provide aggregated comparison of alternative compliance to results that would have been expected with on-site retention of the SWQDv	X									
Optional: Submit documentation that a previously adopted LID ordinance provides equivalent pollutant loading and flow reduction	X									
Plan Review process - check LID and BMP sizing, etc.,	X				X	Implemented	X	Implemented	X	Implemented
Establish internal agreements with structure for communication and authority for departments overseeing plan approval and project construction	X									
Require O&M plan for LID, treatment and hydromod BMPs	X									
Implement tracking and enforcement program for LID, treatment and hydromod BMPs	X									
Inspect all development sites upon completion and prior to occupancy certificates	X									
Verify O&M of BMPs operated by Permittee through inspection	X									
Develop maintenance inspection checklist	X									
Require private parties that operate BMPs to submit verification of O&M; enforce as needed	X									

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement							
			City of Manhattan Beach		City of Redondo Beach		City of Hermosa Beach		City of Torrance	
			MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?
As needed, conduct Progressive Enforcement follow-up inspections (see Part VI.D.2)	X									
D.8 Development Construction Program										
Update erosion and sediment control ordinance/procedures to conform with new requirements	X						X	Implemented	X	Implemented
Sites < 1 acre; inspect based upon water quality threat	X						X	Implemented		
Establish priority inspection process	X								X	Implemented
Site < 1 acre; Require sites with soil disturbing activities to implement minimum BMPs	X									
Require construction sites to prepare erosion sediment control plan(ESCP); review and approve (≥ 1 acre)	X									
Verify construction sites coverage under the CGP and 401 cert	X									
Develop/implement ESCP review checklist	X									
Require construction sites to adhere to standards and make standards readily available	X									
Conduct inspections at public and private sites (at least 1x/2 weeks for high threat sites (more frequently when rain is predicted or occurs; at least monthly for lower threat; also must inspect during all phases of construction - at least 3 times)	X									
Develop/implement SOPs/inspection checklist	X									
Track number of inspections for inventoried sites and verify minimum inspections are completed	X									
As needed, conduct Progressive Enforcement follow-up inspections (see Part VI.D.2)	X									
Train plan review staff and inspectors	X						X	Implemented	X	Implemented
Staff must be knowledgeable in QSD/P key objectives, local BMPs standards	X									
D.9 Public Agency Activities										
Require public construction sites to implement Planning and Land Development requirements, implement Erosion and Sediment Control BMPs, and obtain Construction General Permit coverage	X								X	Implemented
Maintain inventory of Permittee owned facilities (including parks and recreation facilities,)	X									
Update inventory	X									
Develop retrofit opportunity inventory; evaluate and rank	X		X	Implemented					X	Milestone: 1/1/2016
Cooperate with private land owners to encourage site specific retrofitting; includes pilot projects and outreach	X									
Obtain IGP coverage for public facilities where appropriate	X									

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement							
			City of Manhattan Beach		City of Redondo Beach		City of Hermosa Beach		City of Torrance	
			MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?
Develop procedures to assess impact of flood mgmt. projects on water quality of receiving waters; evaluate to determine if retrofitting is feasible	X									
Evaluate existing structural flood control facilities to determine if retrofitting facility to provide additional pollutant removal is feasible	X									
Implement source control BMPs at Permittee owned facilities/activities	X									
Require city-hired contractors to implement source control BMPs	X									
Prevent vehicle/equipment washing discharges to the MS4, including firefighting and emergency response vehicles	X								X	Implemented
Ensure new/redeveloped/replaced wash facilities are plumbed to the sanitary sewer or self-contained.	X									
Implement IPM program	X						X	Implemented		
Ordinances, policies, and procedures reflect IPM techniques and include commitments and schedules to reduce the use of pesticides that cause impairments	X								X	Implemented
Annually update in inventory of pesticides used by agency; quantify pesticides used by staff and contractors; demonstrate IPM alternatives to reduce pesticide use	X								X	Implemented
Use SOPs for pesticide application	X								X	Implemented
Ensure no application of pesticides or fertilizers when two or more days with a 50% chance of rain is predicted by NOAA; within 48 hr of 1/2 inch of rain; or when water is flowing off the site	X									
Ensure staff applying pesticides are certified or working under supervision of a certified applicator in the appropriate category	X									
Update catch basin map add GPS locations and update priority	X									
Inspect/Clean catch basin in areas not subject to Trash TMDL- Priority A: 3x during wet season, 1x during dry 1x; Priority B: 1x during wet 1x and 1x during dry; Priority C: 1x per yr. Maintain records.	X									
Required trash management at public events	X						X	Implemented	X	Implemented
Place and maintain trash receptacles/capture devices at newly identified high trash generating areas	X		X	Implemented	X	Implemented	X	Implemented	X	Implemented
Label storm drains	X								X	Implemented
Inspect labels prior to each wet season	X									
Record and relabel illegible labels within 180 days of inspection	X									
Post signs at access points to water bodies (open channels, creeks; lakes)	X									

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement							
			City of Manhattan Beach		City of Redondo Beach		City of Hermosa Beach		City of Torrance	
			MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?
In areas not subject to the Trash TMDL, install trash excluders on catch basins or outfalls in areas defined as Priority A, or implement substantially equivalent BMPs	X		X	Implemented	X	Implemented	X	Implemented	X	Milestone: 1/1/2016
Inspect and Remove trash and debris from open channels and other drainage structures 1x/yr before rainy season.	X									
Eliminate discharge of contaminants during MS4 maintenance	X									
Implement controls to limit infiltration of seepage from sanitary sewers to the storm drains	X									
Implement routine preventative maintenance for both systems, survey sanitary sewer and MS4. May use SSO General Waste Discharge Requirement [WDR] to fulfill this requirement.	X									
Implement inspection and maintenance program for Permittee owned BMPs	X									
Manage residual water in treatment control BMPs removed during maintenance	X									
Street sweeping - Priority A: 2x/mo; B: 1x/mo; C: as needed, not less than 1x/yr	X		X	Implemented	X	Implemented	X	Implemented	X	Implemented
Implement road construction maintenance BMPs (e.g., restrict paving activity to exclude periods of rain)	X									
Inspect and/or clean Permittee owned parking lots 2x/mo	X								X	Implemented
Train employees and contractors on stormwater requirements	X								X	Implemented
Train employees and contractors on pesticide use	X									
D.10 Illicit Connections and Illicit Discharges Elimination										
Continue IC/ID program	X		X	Implemented	X	Implemented	X	Implemented	X	Implemented
Written procedures for conducting investigations and eliminations	X								X	Milestone: 1/1/2016
Initiate investigation within 72 hours from becoming aware of the discharge	X								X	Implemented
Implement solutions to eliminate discharge; conduct follow-up investigation to verify elimination; follow Progressive Enforcement Plan (see Part VI.D.2)	X		X	Implemented	X	Implemented	X	Implemented	X	Implemented
When discharge originates upstream of jurisdiction, notify the upstream jurisdiction and LARWQCB within 30 days	X									
Initiate investigation within 21 days for illicit connection	X									
Permit or document illicit connection that only discharge stormwater or allowed non-stormwater	X									
Eliminate illicit connection within 180 days of investigation	X									
Facilitate public reporting via hotline	X								X	Implemented

2012 Permit Requirement	Baseline Requirement Maintained by all Cities	General Beach Cities MCM Enhancement (all Cities)	City-Specific MCM Enhancement							
			City of Manhattan Beach		City of Redondo Beach		City of Hermosa Beach		City of Torrance	
			MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?	MCM	Milestone/ Already Implemented?
Signage adjacent to open channels provide info re: public reporting	X									
Document calls and actions associated with hotline	X								X	Implemented
Implement procedures on responding to complaints; evaluate and update procedures	X								X	Implemented
Implement a spill response plan	X								X	Implemented
Train staff and contractors on ID/IC	X								X	Implemented
Create a list of positions and contractors that require ID/IC training	X									

2.6.3 Quantified Non-Structural BMPs

Non-structural BMPs have been categorized as follows for purposes of RAA. Specific model inputs are summarized in tabular format below.

Non-Modeled Programmatic BMPs

These source controls include a combination of BMPs such as new or enhanced pet waste controls (ordinance, signage, education/outreach, mutt mitts, etc.), Clean Bay Restaurant Program, human waste source tracking and remediation (e.g., leaking sewer investigations including implementation of each agency's Sanitary Sewer Management Plan consistent with Statewide WDRs, etc.), enhanced street sweeping (e.g., 100% vacuum sweepers, increased frequency, posting of 'No Parking' signs for street sweeping, etc.), increased catch basin and storm drain cleaning, and other new or enhanced nonstructural BMPs that target the pollutants addressed in this EWMP. A combined credit of 2.5 – 7.5% load reduction (average of 5%) was applied for all pollutants to represent the cumulative benefit from these BMPs.

Modeled Redevelopment

Beginning in 2001, redevelopment projects were required by the Permit (via the Standard Urban Stormwater Management Program [SUSMP]) to incorporate stormwater treatment BMPs into their projects if their project size exceeded specified thresholds. The 2001 MS4 Permit SUSMP redevelopment requirements were applied between 2003 (the point at which the Bacteria TMDL was implemented) and 2015 for the SMB EWMP area. Redevelopment in this period was modeled as flow-through media filters at a 0.2 in/hr design event.

The 2012 MS4 Permit established new criteria for redevelopment projects, requiring certain sized projects to capture, retain, or infiltrate the 85th percentile design storm or the 0.75-inch design storm, whichever is greater, via the implementation of LID BMPs. To account for these redevelopment requirements, BMPs were modeled in SBPAT assuming land use-specific annual redevelopment rates for projects that triggered former SUSMP requirements or will trigger the Permit's LID BMP requirements (**Table 2-9**).

Table 2-9. Estimated Annual Redevelopment Rates

Land Use	Annual Redevelopment Rate (% of total land use area)		
	Cities of Redondo Beach and Torrance[1]	City of Hermosa Beach	City of Manhattan Beach
Residential	0.18	0.31	0.10
Commercial	0.15	0.79	0.38
Industrial	0.34	0.79	0.38
Education	0.16	0.16	0.16
Transportation	2.7	2.7	2.7

[1] Regionally developed redevelopment rates were applied to the City of Torrance and Redondo Beach (City of Los Angeles Bureau of Sanitation, 2012).

Redondo Beach and Torrance areas used regionally developed redevelopment rates. For Hermosa Beach, the recent 4-year rate for redevelopment of residential areas was used based on city-specific

LID implementation tracking data. The rate of redevelopment in all commercial land use categories tracked by SUSMP was combined to give an overall rate for both commercial and industrial (as that City has very few light industrial parcels), for historical as well as future redevelopment.

For Manhattan Beach, a City-specific redevelopment rate of 3.8 percent for commercial redevelopment was provided based on historical SUSMP data over the past ten years. This value was also assumed for historical industrial redevelopment as well as future commercial and limited industrial redevelopment. For the residential land use, because there are insufficient data to project LID rates, a nominal 0.10 percent was assumed.

BMPs were assumed to be implemented and to continue to be implemented in the future, at these rates across two distinct time periods:

- **2003 (SMBBB TMDL Effective Date) - 2015:** The SUSMP requirements, based on the 2001 MS4 Permit, were assumed to be implemented over this period as flow-through media filters at a 0.2 in/hr design intensity (Los Angeles County Department of Public Works, 2002).
- **2015 – 2021 (SMBBB TMDL Final Compliance Deadline):** The 2012 MS4 Permit post-construction requirements were assumed to be implemented over this period as 50% biofiltration and 50% bioretention. Biofiltration (bioretention with underdrains) were modeled using bioswale BMP types with effluent EMCs set to bioretention and sized to retain 150 percent of the 1-year, 1-hour design storm (approximately 0.3 in/hr)[16] because they do not retain all the design storm volume on site (they are flow-through systems), while bioretention units were sized to retain 100 percent of the 85th percentile, 24-hour design storm depth, calculated as the mean for each analysis region.

2015 is used as a transition date since the LID post-construction requirements from the 2012 MS4 Permit are required to be in full effect via local LID ordinances by this time.

In order to estimate load reductions associated with these redevelopment BMPs, the land use percentages shown in **Table 2-1** were multiplied by the respective land use areas in each analysis region, resulting in an assumed area treated by LID BMPs each year. This area was multiplied by the applicable number of years, since new BMPs are assumed to be implemented each year. The total land use area assumed to be redeveloped for each analysis region was then modeled as being treated by the BMPs described below (**Table 2-10**) and the total load reduction was quantified. The default design parameter assumptions for the biofiltration redevelopment projects were that the longitudinal slopes were 0.03 ft/ft, Manning's n was 0.25, hydraulic residence time was 10 min, and water quality flow depth was 4 inches.

[16] 150% of the 1-year, 1-hour design storm was used per Section VI.D.7.c.iii of the Permit.

Modeled Public Retrofit Incentives

These BMPs include programs directed at incentivizing the public to decrease the amount of stormwater runoff from their property, specifically via downspout disconnects. Public incentives for retrofitting existing development were modeled in SBPAT between 2015, when the EWMP will begin to be implemented, and the respective TMDL final compliance date. Public retrofit incentives were assumed to be a downspout disconnection program, modeled as bioswales sized to a design storm intensity of 0.2 in/hr (**Table 2-10**). The default design parameter assumptions for the biofiltration redevelopment projects were that longitudinal slopes were 0.03 ft/ft, Manning's n was 0.25, hydraulic residence time was 10 min, and water quality flow depth was 4 in.

It was assumed that 10 percent of single family residential areas would be converted to disconnected downspout systems over 2015 to 2021, and that, based on GIS analysis, 38 percent of the single family residential area consists of rooftops that can be effectively disconnected. Therefore, 3.8 percent of single family residential neighborhoods were modeled as treated by bioswales in order to account for public retrofit incentives.

Table 2-10. Redevelopment and Public Retrofit Incentives Model Assumptions

Implementation Level	BMP Type	Design Storm	Longitudinal Slope (ft/ft)	Manning n	Hydraulic Residence Time (min)	Water Quality Flow Depth (in)	Effective Retention Depth (in)	Infiltration Rate (in/hr)
Redevelopment (2003-2015)	Media Filter	0.2 in/hr	-	-	-	-	-	-
Redevelopment (2015-2021)	Biofilters[1]	0.3 in/hr	0.03	0.25	10	4	2	Based on analysis region-specific soil type
	Bioretention	0.75 in	-	-	-	-	12	0.15
Public Retrofit Incentives (2015-2021)	Bioswales representing downspout disconnects	0.2 in/hr	0.03	0.25	10	4	2	Based on analysis region-specific soil type

[1] Modeled as bioswales using bioretention effluent EMCs

Modeled Non-MS4 Permitted Parcels or Areas

SBPAT was used to quantify the load reduction assuming that regulated parcels/areas would be in compliance with the NPDES Statewide Storm Water Permit Waste Discharge Requirements (WDRs) from State of California Department of Transportation (Order No. 2012-0011-DWQ, NPDES No. CAS000003) and the California NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Industrial General Permit [IGP], Order 2014-0057-DWQ) (**Figure 2-12**).

A load reduction was obtained from these areas by simulating treatment plants sized to treat the IGP's design storm requirement, the 85th percentile, 24-hour storm event (0.2 in/hr), with an effluent concentration set equal to the water quality standard (**Table 2-11**). For fecal coliform, 400 MPN/100mL was used.

Table 2-11. Non-MS4 Parcels – Modeled as Treated by Treatment Plants (i.e., BMPs that will treat stormwater to the Water Quality Objectives)

Implementation Level	BMP Type	Treatment Flowrate (cfs)	Design Storm (in/hr)	Average Basin Depth (ft)	Equalization Volume (cu-ft)	Diversion Flowrate (cfs)	Infiltration Rate (in/hr)
Non-MS4 Parcels	Treatment Plant	10,000	0.20	100.00	1,000	10,000	0.00001

2.6.4 Structural BMPs

Existing (constructed between 2003 and 2014) and proposed structural BMPs (regional and distributed) were modeled in SBPAT based on best available design information. The following sections outline the structural BMPs that were modeled as well as their drainage areas, design details in SBPAT, and any relevant assumptions. Modeled regional BMPs are depicted in **Figure 2-13**. Modeled distributed BMPs are depicted in **Figure 2-14**.

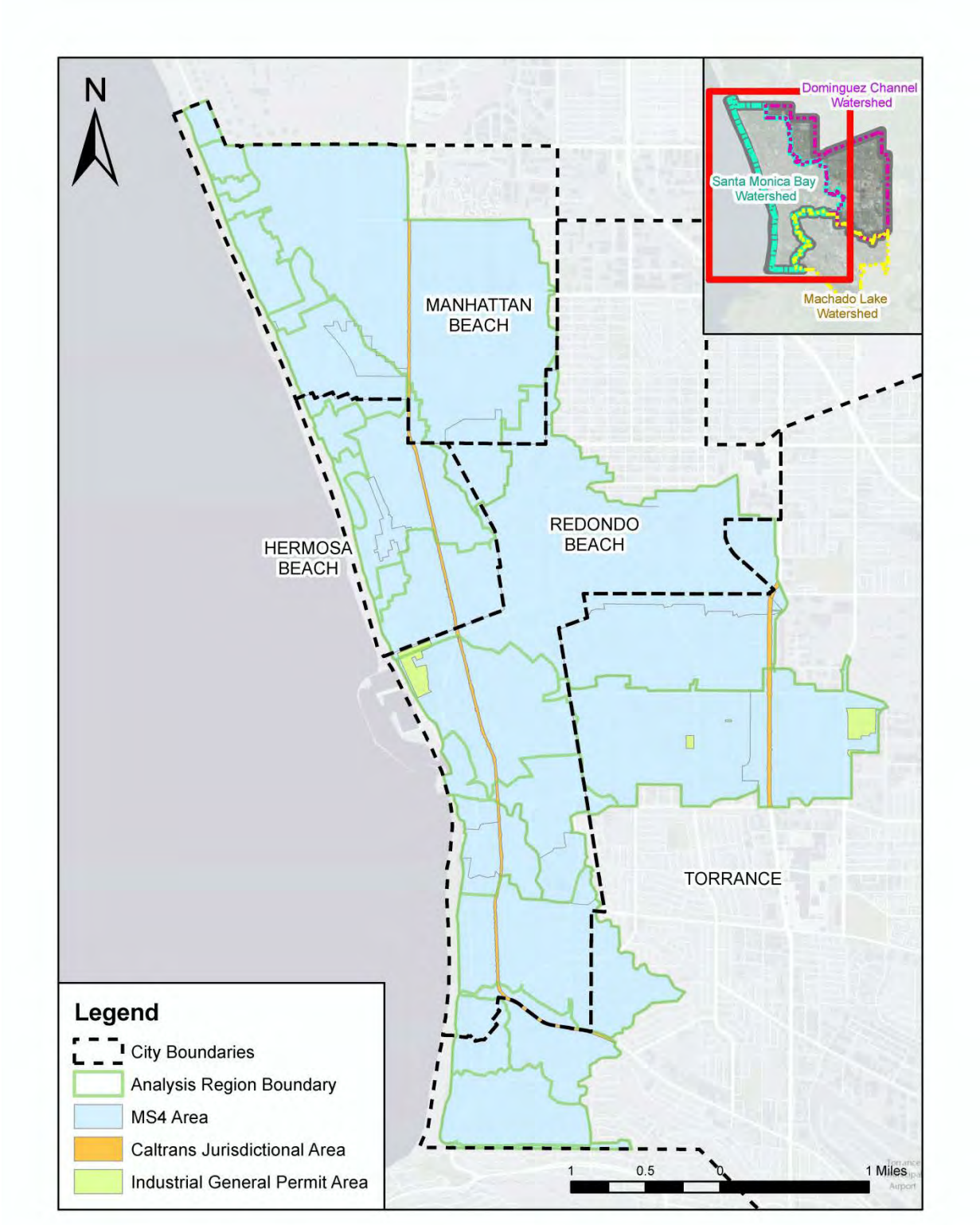


Figure 2-12. IGP and Caltrans Area within the Santa Monica Bay portion of the Beach Cities EWMP Area

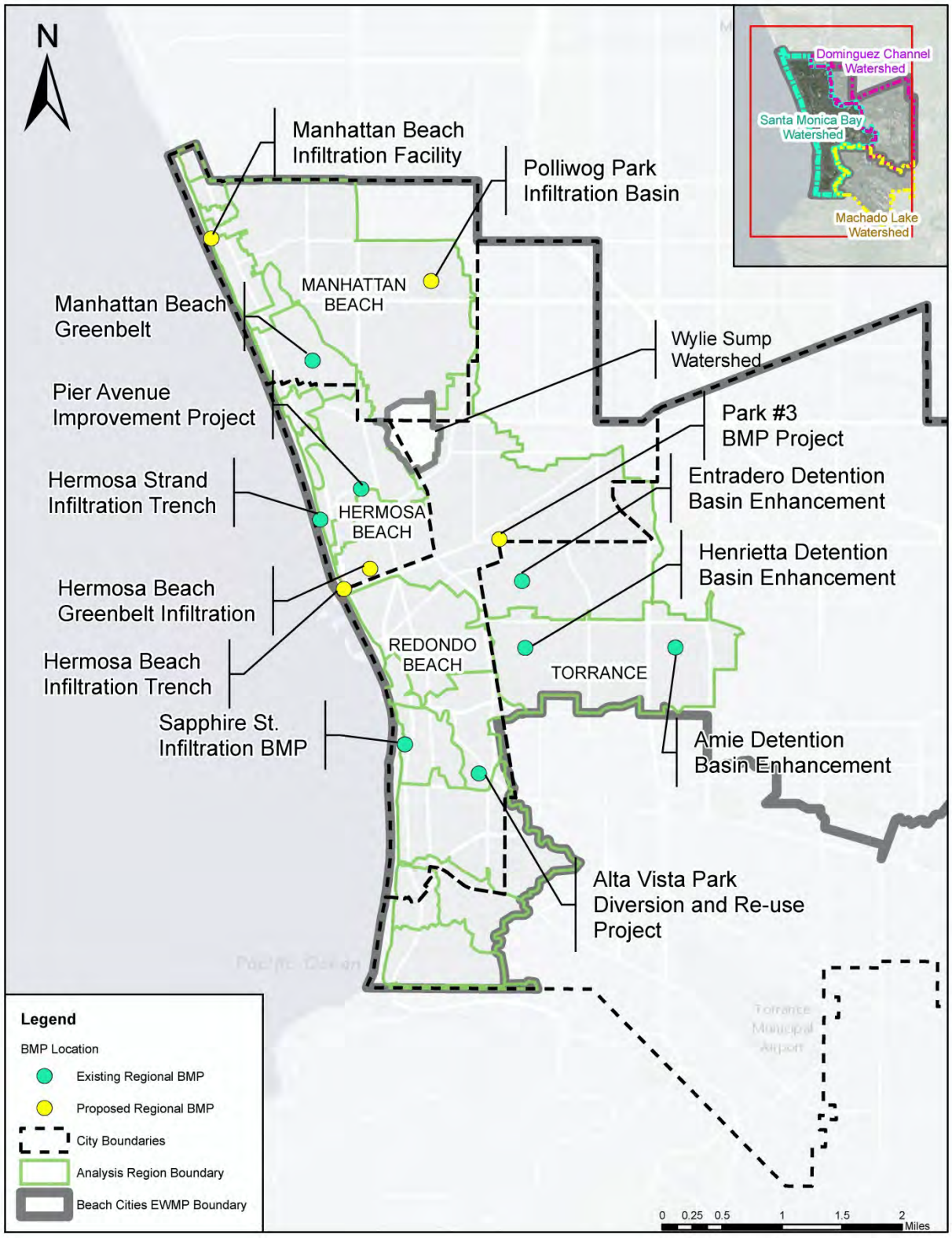


Figure 2-13. Existing and Proposed Regional BMPs within EWMP Area

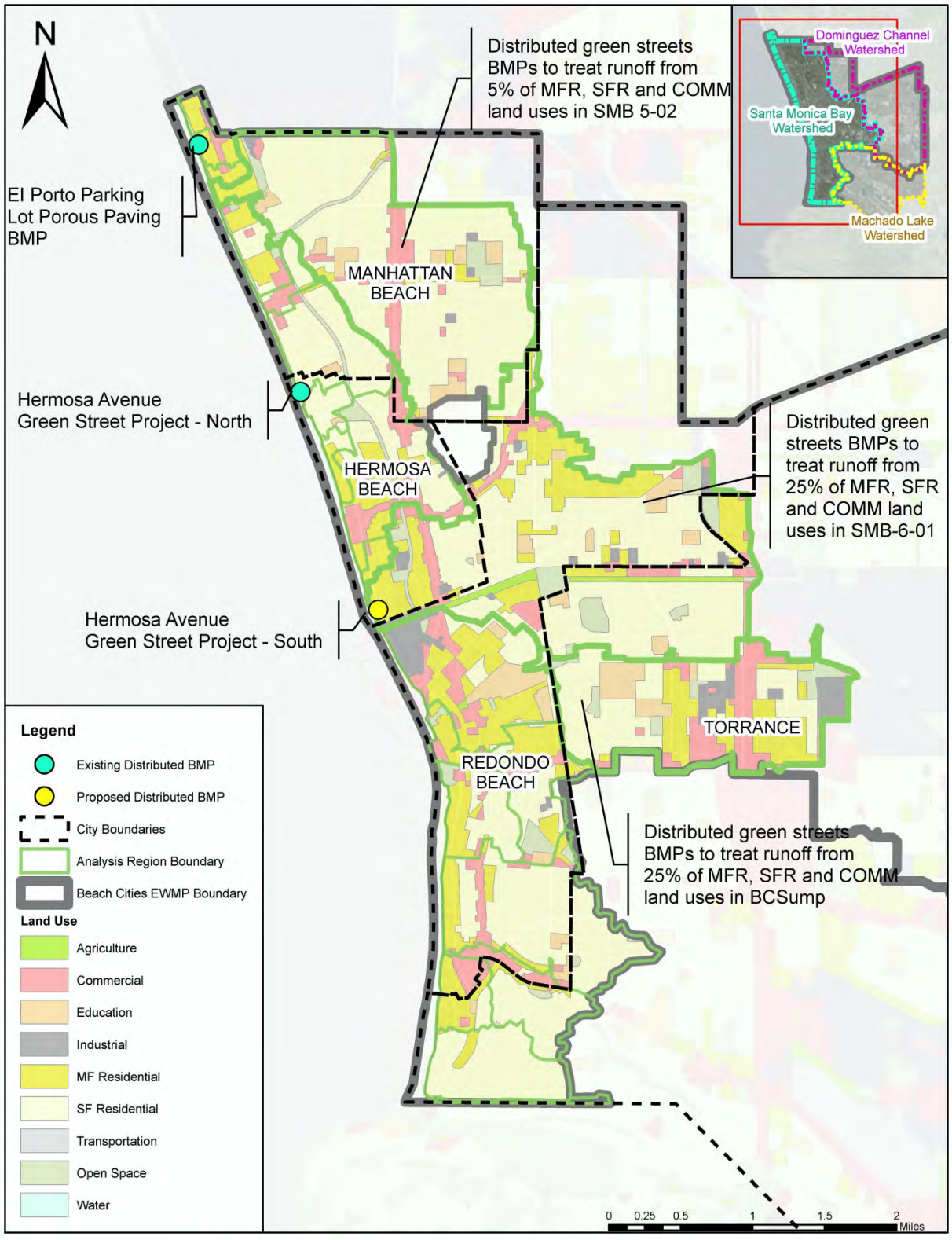
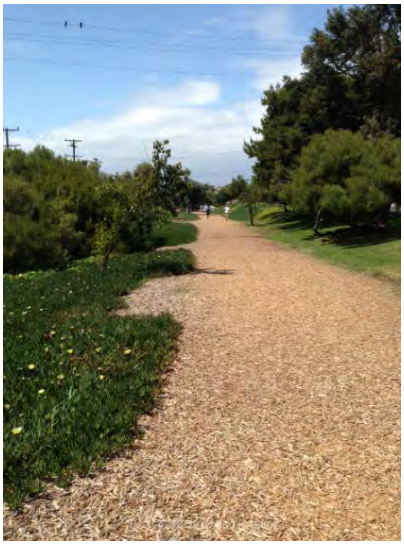


Figure 2-14. Existing and Proposed Distributed BMP Locations within the EWMP Area

Existing Regional BMPs

Analysis Regions SMB-5-02 and SMB-5-03/SMB-5-04



The Manhattan Beach Green Belt Infiltration Project tributary area spans analysis regions SMB-5-02 and SMB-5-03/SMB-5-04. The Project, completed in February 2013, utilizes the linear greenbelt parkland that runs through the City to intercept and infiltrate dry weather and wet weather low flows from existing storm drains that intersect the parkway. The Project was designed to reduce the downstream peak flow and runoff volume from the 55.2 acres of contributing developed residential land use while also increasing groundwater recharge and subsequently increasing the effective permeability of the developed area. The 55.2 acre drainage area is part of the 161 acre tributary area that drains to the 1st Street outfall and Santa Monica Bay , which is part of the approximately 205 acres of drainage influencing the SMB-5-04 open beach monitoring site under the CSMP (2004).

Analysis Region SMB-5-05

The Pier Avenue Improvement Project captures and treats stormwater/urban runoff from residential areas on surrounding streets and commercial development in the downtown corridor along Pier Avenue (36-acre drainage area). The Project includes drainage improvements for treatment and infiltration of dry and wet-weather flows up to the design storm to reduce pollutant loading at the beach and to reduce flooding.

The Hermosa Strand Infiltration Trench project receives runoff from a 76.2-acre, intensely developed mixed commercial and residential coastal subdrainage area conveyed via the Pier Avenue storm drain. The Pier Avenue storm drain was retrofit with a diversion structure and tide gate to direct dry-weather flows and wet weather low flows from the storm drain into a pump well, through a baffle-box pretreatment unit, then into the subsurface infiltration trench 1,000 feet long constructed on the beach adjacent to the Strand. The diversion pump was designed to divert up to 250 gallons per minute (GPM), which is significantly greater than would be required solely to divert dry weather runoff from the drainage area, thereby allowing for diversion of some wet weather flows.

Analysis Region SMB-6-01

Three existing regional BMPs were modeled within analysis region SMB-6-01. These include Amie Basin, Entradero Basin, and Henrietta Basin in their post-enhancement state. Since the basins were in existence prior to the 2003 TMDL effective date, pollutant removal credit was not assigned to the basins for their pre-2003 function, rather only the basin improvement design parameters that 1) improved water quality and 2) were implemented post-2003 were modeled. Infiltration rate, depth, volume, and discharge rate of the basins and their extended storage were extracted from

analysis of the stage-discharge curves provided in the Stormwater Basin Enhancement Project Design Memorandum (CWE Corp., 2012).

Amie Basin, post-enhancements. Amie Detention Basin is an existing BMP that captures runoff from 409 acres of upstream land in analysis region BCSump, which drains to SMB-6-01. Based on boring test results, the average on-site infiltration rate is reported as 0.0082 in/hr. Due to its limited infiltration capacity, Amie Detention Basin is not designed for the purpose of on-site infiltration. Instead, its primary purpose is to discharge runoff slowly to the downstream Henrietta Detention Basin. The basin enhancements, completed in August 2015 (City of Torrance, 2014), increased the extended retention volume by reducing the permanent pool volume by 25% by creating additional flow paths within the basin. Due to the nature of the basin enhancements, Amie Detention Basin was modeled as a wet pond with extended detention capacity.

Entradero Basin, post-enhancements. Entradero Detention Basin is an existing BMP that treats runoff from 436 acres of upstream land in analysis region SMB-6-01 and is sized to capture the 0.75 inch storm. Based on boring test results, the average on-site infiltration rate is 1.28 in/hr. To increase the infiltration capacity, the post-enhancement design project, which was completed in August 2015 (City of Torrance, 2014), significantly increased the infiltration surface area from 0.03 acres to 1.44 acres. Entradero Detention Basin was modeled as an infiltration basin. The basin includes a small permanent pool (1500 cubic feet), the volume of which was excluded from the calculation of total storage capacity.

Henrietta Basin, post-enhancements. Henrietta Detention Basin is an existing BMP that treats runoff from Amie Detention Basin as well as an additional 153 acres of upstream land in analysis region BCSump for up to 0.75 inches storm. Based on boring test results, the average on-site infiltration rate is 2.1 in/hr. To further increase the infiltration capacity, recent design enhancements (completed in August 2015 (City of Torrance, 2014)) increased the maximum basin depth from 23 feet to 30 feet, and created additional flow path within the basin. In SBPAT, the Henrietta basin is modeled as an infiltration basin. The basin included a small permanent pool (6900 cubic feet), the volume of which was excluded from the total storage capacity.

Analysis Region SMB-6-02

The Alta Vista Park Diversion and Re-Use Project is located in Redondo Beach and is designed to divert wet weather flows up to a rainfall event of 0.3 inches in 24 hours, collected from its 101-acre watershed. HDPE pipes comprise the approximately 100,000 gallons of underground storage. Excess overflows from the tank go into a 4,200 square feet infiltration bed located under the tank. The Project diversion facilities include structures that divert up to 4.5 cfs of the storm flow through a gross pollutant removal device.

Analysis Region SMB-6-03

The Sapphire Street Infiltration BMP consists of a low flow diversion and infiltration bed. The low flow diversion is intended to divert all dry weather flow and wet weather runoff from a storm up to 0.1 inches in 24 hours. The diversion facilities include a structure that will divert up to 11 cfs of the storm flow through a CDS unit. A smaller amount, up to 160 gpm, are diverted to a pump station that pumps the water to two stormwater bioretention filtration units, where it is then conveyed to the infiltration bed.

Summary of Existing Regional BMPs

The existing regional BMPs, including their location, analysis region, model inputs, and expected performance, are summarized in **Table 2-12** and **Table 2-13**. Wylie Sump and its tributary area were excluded from the RAA analysis because it is an 85th percentile capture project and also does not produce outflow and would therefore have no impact on the TLR or contribute any loads. The Wylie Sump receives runoff from 38 acres of the City of Manhattan Beach, 20 acres of Hermosa Beach, and 73 acres of Redondo Beach. There are no other 85th percentile capture projects in the Santa Monica Bay Watershed portion of the Beach Cities EWMP Area.

Table 2-12. Parameters and Performance for Existing Regional BMPs Modeled as Infiltration Basins

Location of BMP	Analysis Region	Project Name	Model Inputs					Expected Performance (load reduction as a % of analysis region baseline load)
			Design Storage Volume (cu-ft)	Design Storm (in)	Average Depth (ft)	Diversion Rate (cfs)	Infiltration Rate (in/hr)	
Manhattan Beach	SMB-5-03/ SMB-5-04	Manhattan Beach Green Belt Infiltration	-	0.45	2.6	6.7	2.1	4.7%
	SMB5-02							1.1%
Hermosa Beach	SMB-5-05	Pier Avenue Improvement Project infiltration systems	-	0.21	2.6	11	0.77	2.3%
Hermosa Beach	SMB-5-03/ SMB-5-04	Hermosa Strand Infiltration Trench	1,400	-	-	2.9	0.56	0.5%
	SMB-5-04/ SMB-5-05							1.9%
	SMB-5-05/ SMB-6-01							2.0%
	SMB5-04							1.4%
	SMB5-05							0.9%
	SMB6-01							0.2%
Torrance	SMB-6-01	Entradero Detention Basin Enhancement	88,860	-	2.0	16	1.3	2.6%
		Henrietta Detention Basin Enhancement	383,000	-	12.0	54	2.1	4.6%
Redondo Beach	SMB-6-02	Alta Vista Park Diversion and Re-Use Project	-	0.30	3.0	4.5	0.18	3.8%
Redondo Beach	SMB-6-03	Sapphire St Infiltration BMP	-	0.10	1.5	11	0.74	9.5%

Table 2-13. Parameters and Performance for Existing Regional BMPs Modeled as Wet Ponds with Extended Detention

Location of BMP	Analysis Region	Project Name	Model Assumptions						Expected Performance (load reduction as a % of analysis region baseline load)
			Volume (cu-ft)	Surcharge Depth (ft)	Surcharge Drawdown Time (hr)	Permanent Pool Volume (cu-ft)	Permanent Pool Depth (ft)	Diversion Flowrate (cfs)	
Torrance	SMB-6-01	Amie Detention Basin Post Enhancement	5,600,000	45	160	99,750	5	46	8.8%

Proposed Regional BMPs

Analysis Region SMB-5-02 Regional BMP Parameters and Criteria

One regional BMP (Alternative 1) is being proposed and was modeled within analysis region SMB-5-02 (**Figure 2-15**) — Manhattan Beach Infiltration Trench Project (see **Table 2-13**). The Manhattan Beach Infiltration Trench site is proposed along a public beach adjacent to a walking/bike path and consists of recreational open space. The project has an approximate infiltration footprint of 2.2 acres and drainage area of 1,600 acres. The storage volume of the project was estimated as 4.6 acre-feet, with an estimated drawdown time of 72 hours. Additional benefits achieved by this project include infiltration to help prevent intrusion of shallow saline groundwater associated with sea level rise in order to protect subsurface infrastructure from corrosion, as well as potential dune habitat restoration. This BMP can also increase public awareness through educational signage.

An alternative design (Alternative 2) is for a beach infiltration trench at 80% of Alternative 1 in combination with an infiltration-based BMP at Polliwog Park, which would achieve approximately 10% of the target load reduction needed for analysis region SMB-5-02 and could potentially offset 20% of the required storage capacity of the Manhattan Beach Infiltration Project (**Figure 2-15**). In other words, the load reduction of Polliwog Park infiltration is equivalent to that of Manhattan Beach Infiltration Trench at 20% of its full Alternative 1 treatment volume. The addition of the Polliwog Park BMP would result in the additional benefits of neighborhood greening, mitigating issues such as the urban heat island effect, and also raising public education/awareness. The construction of a wetland would provide the additional benefit of expanding riparian habitat, and also help mitigate downstream flood control issues.

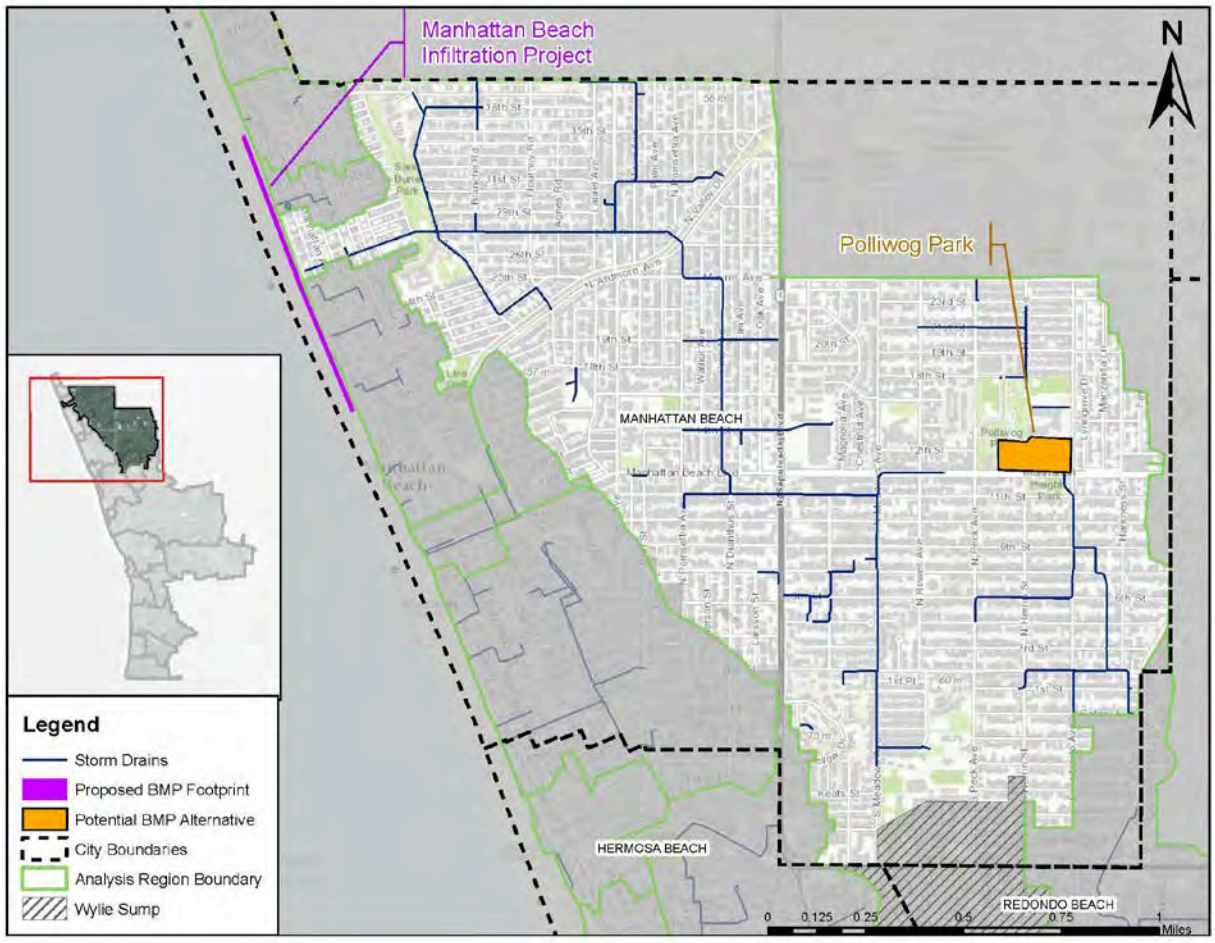


Figure 2-15. Proposed Regional Projects, Analysis Region SMB-5-02

Analysis Region SMB-6-01 Regional BMP Parameters and Criteria

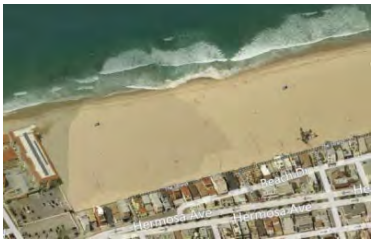
Three regional BMPs (and one potential alternative) are proposed within Analysis Region SMB-6-01, as described below, and depicted in **Figure 2-16**.

Park #3. The Park #3 Project was identified as a potentially suitable site for several different BMP types, including infiltration, wetlands, or a detention basin. Park #3 is located northwest of Blossom Ln. and 190th St, and has an approximately footprint of 0.4 acres and drainage area of 1,430 acres. The storage volume of the project was estimated as 87,100 cubic feet. Diversion flowrate was assumed to be 0.015% of the volume for preliminary planning purposes. This BMP would provide the additional benefits of neighborhood greening, mitigating issues such as the urban heat island effect and also raising public education/awareness. The construction of a wetland would provide the additional benefit of expanding riparian habitat, and also help mitigate downstream flood control issues.

Hermosa Beach Greenbelt Project. The Greenbelt site in Hermosa Beach was identified as a potentially suitable site for several different BMP types, including infiltration, wetlands, or a detention basin. The Greenbelt is situated between Valley Dr. and Ardmore Ave. and has a potential footprint of 1.5 ac and an approximate tributary area of 1,800 acres. The project storage volume is a function of its footprint. The diversion flowrate was assumed to be 0.015% of the volume for preliminary planning purposes.

Powerline Easement. A potential alternative location to the Hermosa Beach Greenbelt Project facility is located south of Herondo Street between N. Francisca Ave. and N. Catalina Ave., within a powerline easement.[17] Both potential locations for the greenbelt project would provide the additional benefits of neighborhood greening, mitigating issues such as the urban heat island effect and also raising public education/awareness. The construction of a wetland would provide the additional benefit of expanding riparian habitat, and also help mitigate downstream flood control issues.

[17] If this proposed design is to be developed within the powerline easements, certain considerations should be made. To alleviate concerns of saturating soils around powerline footings, and to allow for powerline maintenance activities to occur, stormwater facilities should be installed at least 100 feet from any tower and 10 feet from any pole. Special consideration and increased distances may be necessary when working around "dead-end" towers, or towers where transmission lines change direction. Access road clearance should also be maintained and basin depth must be considered for safety and illegal dumping purposes.



Hermosa Beach Infiltration Trench. The Hermosa Beach Infiltration Trench project has a tributary area of 2000 acres. The project may be designed to reduce downstream water volumes and facilitate compliance with the dry-and wet-weather WLAs allotted in the SMBBB TMDL at the SMB-6-01 CML. If upstream projects (e.g., LID projects) and other City activities are implemented, TMDL compliance may be able to be achieved under reduced design requirements. Additional benefits achieved by this project include infiltration to help prevent intrusion of shallow saline groundwater associated with sea level rise in order to protect subsurface infrastructure from corrosion, as well as potential dune habitat restoration. This BMP can also increase public awareness through educational signage.

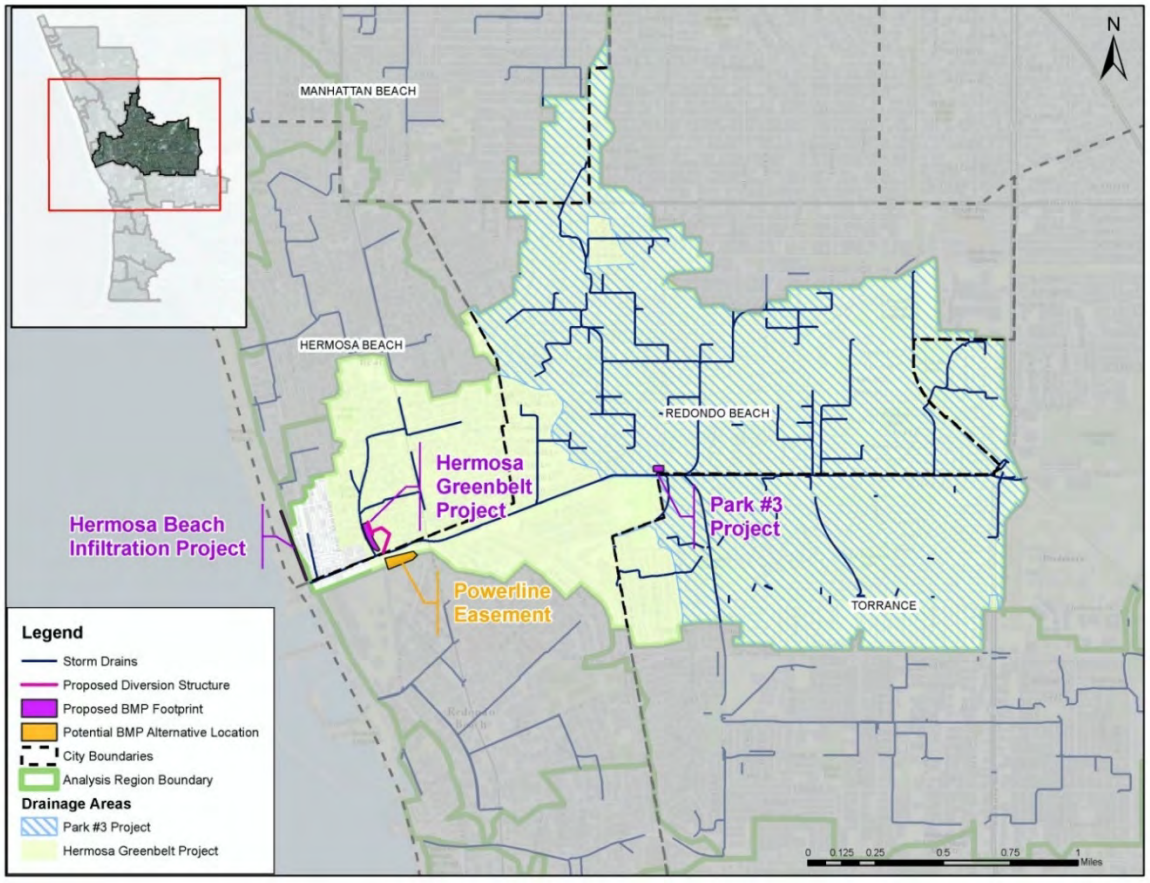


Figure 2-16. Proposed Regional Projects, Analysis Region SMB-6-01

Summary of Proposed Regional BMPs

Four regional BMPs are proposed in the Santa Monica Bay Watershed portion of the Beach Cities EWMP Area. None of these projects could be feasibly sized to meet the 85th percentile design criteria. However, the BMPs were sized to collectively meet the target load reductions necessary to achieve compliance with the WQBELs and RWLs, in combination with other existing and proposed structural and non-structural BMPs. Proposed regional BMPs, including their location, analysis region, project name, model inputs, and expected performance, are summarized in **Table 2-14.**

Table 2-14. Parameters and Performance for Proposed Regional BMPs Modeled as Infiltration Basins

Analysis Region	Location of BMP	Project Name	Model Assumptions					Expected Performance (load reduction as a % of analysis region baseline load)
			Design Storage Volume (cu-ft)	Design Storm (in)	Average Depth (ft)	Diversion Rate (cfs)	Infiltration Rate (in/hr)	
SMB-5-02	Manhattan Beach	Manhattan Beach Infiltration Trench, Alt 1	198,000	-	2.1	160	13	36.5%
		Manhattan Beach Infiltration Trench, Alt 2	158,400*	-	2.1	160	13	32.1%[1]
		Polliwog Park Infiltration, Alt 2	148,000	-	4.0	11	0.7	4.4%
SMB-6-01	Hermosa Beach	Hermosa Beach Greenbelt Infiltration	319,000	-	5.0	48	12	15.1%
		Hermosa Beach Infiltration Trench	13,300	-	1.70	25	13	0.4%
	Redondo Beach	Park #3 BMP Project	87,100	-	5.00	410	1.0	1.3%

[1] The treatment volume of Manhattan Beach Infiltration Trench in Alternative 2 is set at 80% of the Alternative 1 volume so that load reductions achieved by BMP configurations in Alternative 1 and Alternative 2 are identical.

Existing Distributed BMPs

In 2008-09, the City of Hermosa Beach retrofitted the east side of Hermosa Avenue between 27th and 35th Streets with a series of seven filter/infiltration boxes to intercept, filter, and infiltrate low flows conveyed down side streets from the areas east of Hermosa Avenue prior to entry into catch basin inlets on Hermosa Avenue. The infiltration boxes were modeled in the RAA analysis as two bioretention systems due to their infiltration capabilities and combined into two systems (System A and System B) — one system per analysis region SMB-5-04 and SMB-5-03/SMB-5-04, respectively. The City of Manhattan Beach also replaced several downtown asphalt parking lots with pervious concrete. See **Table 2-15** and **Figure 2-14** for design assumptions and BMP locations.

Proposed Distributed BMPs

Proposed distributed BMPs, including green streets, were modeled by assuming that stormwater runoff from high priority land use areas can be treated in the right-of-way, and 50%-50% use of biofilters and bioretention. Biofilters (also known as bioretention with underdrains) were sized to 150% of the 85th percentile, 24-hour design storm (0.3 in/hr) because they do not retain on site (they are flow-through systems), while bioretention units were sized to 100% of the 85th percentile, 24-hour design storm depth, calculated as the mean for each analysis region. Biofilters were modeled using bioswale volume reduction and bioretention effluent EMCs. Default modeling assumptions included longitudinal slopes of 0.03 ft/ft, Manning's n of 0.25, hydraulic residence time of 10 min, and water quality flow depth of 4 in.

Distributed green streets were implemented at similar rates (as a percentage of land use area) in residential and commercial land uses. Distributed BMPs were applied at levels unique to each analysis region, iteratively determined based on compliance with TLRs, after accounting for load reductions attributable to nonstructural and regional BMPs. They were applied by assuming treatment of stormwater from analysis region-specified percentages of single family, multi-family, and commercial land use areas, until TLRs are met. These land use and BMP type combinations were chosen based on their ability to result in maximum bacteria load reduction.

In order to minimize redundancy of BMP coverage and avoid double-counting BMP benefits, distributed BMPs were not applied in the drainage area footprints of existing regional BMPs. However, they were modeled in the drainage area of proposed BMPs, as long as both were included in the same model run to avoid double counting. Performance of existing and proposed distributed BMPs are shown in **Table 2-16**.

Table 2-15. Existing and Proposed Distributed BMPs

Implementation Level	Analysis Region(s)	BMP Type	Design Storm	Longitudinal Slope (ft/ft)	Manning n	Hydraulic Residence Time (min)	Water Quality Flow Depth (in)	Effective Retention Depth (in)	Infiltration Rate (in/hr)
Existing Manhattan Beach Porous Paving Project – El Porto Lot	SMB-5-01	Porous Pavement	Removal of existing asphalt and replacement with 10 inches of porous concrete						
Existing Distributed Green Streets BMPs (2003-2015)[1]	SMB-5-04 (System A)	Bioretention	0.038	-	-	-	-	35	10
	SMB-5-03/SMB-5-04 (System B)	Bioretention	0.026	-	-	-	-	35	10
Proposed Distributed Green Street BMPs (2015-2021)	MFR and COM/SFR land uses in BCSump, SMB-5-02, and SMB-6-01	Biofilters[2]	0.3 in/hr	0.03	0.25	10	4	2	Based on analysis region-specific soil type
		Bioretention	Varies by analysis region (0.77 to 0.82 in)	-	-	-	-	12	0.15

[1] In 2008-09 the City of Hermosa Beach retrofit the east side of Hermosa Avenue with a series of seven (7) filter/infiltration boxes to intercept, filter, and infiltrate low flows conveyed down side streets from the areas east of Hermosa Avenue prior to entry into catch basin inlets on Hermosa Avenue. The infiltration boxes were modeled as two bioretention systems due to their infiltration capabilities and combined into two systems (System A and System B) — one system per defined subcatchment.

[2]Modeled as a bioswale using bioretention EMCs.

Table 2-16. Existing and Proposed Distributed BMP Performance

Analysis Region	Implementation Level	Status	Estimated load reduction (as % of analysis region baseline load)
SMB-5-04	N/A - Existing	Existing	1%
SMB-5-03/ SMB-5-04	N/A - Existing	Existing	0.1%
SMB-5-02	5% on MFR/COM/SFR land uses	Proposed	3%
SMB-6-01+BCSump[1]	25% on MFR/COM/SFR land uses	Proposed	2%

[1] "BCSump" was defined as a separate analysis region for modeling purposes. The baseline load for "BCSump" analysis region was combined with the baseline load of the "SMB-6-01" analysis region to equal the total baseline load contributing to the SMB-6-01 CML ("SMB-6-01+BCSump").

2.7 Reasonable Assurance Analysis Results

2.7.1 Wet Weather

Quantitative analyses were conducted for each analysis region separately and are summarized below. Average BMP load reduction results for each analysis region are presented in **Table 2-17** below. Detailed results for all BMPs in terms of volume, concentration, and load for each WBPC and analysis region can be found in the electronic data files submitted along with the Beach Cities EWMP. An example illustrating the modeling results of applicable pollutant concentrations at the downstream outlet of the watershed system is included in Appendix K. The values provided correspond to the fecal coliform load reductions attributable to the BMP types at both the interim (2018) and final (2021) TMDL compliance deadlines. As shown, the TLRs were met in all analysis regions as a result of varying levels of implementation of non-structural and regional BMPs as described previously. The interim 50% TLR is met through a combination of nonstructural and existing regional BMPs. It should be noted that if at any time specific distributed green streets or regional/centralized BMPs are found to be infeasible for implementation, alternative BMPs or operational changes will be planned within the same subwatershed and within the same timeline, to meet an equivalent subwatershed load reduction, unless the TLRs or compliance schedules are modified.

Because USEPA's Santa Monica Bay DDT and PCBs TMDL effectively implements an anti-degradation approach to set MS4 WLAs to maintain and protect the receiving waters and meet water quality standards, the existing MS4 PCB and DDT loads from the Beach Cities EWMP Area are reasonably assumed to be in compliance with the applicable WLAs. Therefore, a target load reduction of zero has been set for PCBs and DDT. In spite of the zero required load reduction for PCBs and DDT in Santa Monica Bay for the Beach Cities EWMP Group, the BMPs proposed in this EWMP are expected to reduce sediment and sediment-associated pollutants such as DDTs and PCBs, so the non-quantified but greater-than-zero anticipated BMP load reductions for DDTs and PCBs will exceed the TMDL WLA. Therefore, compliance with the TMDL-based permit limits for DDTs and PCBs has been demonstrated through this narrative RAA evaluation.

Table 2-17. Santa Monica Bay Watershed – Fecal Coliform RAA Results – Interim and Final Compliance

Analysis Region	Implementation Benefits (average load reduction as % of baseline load for critical year)							TLR	Compliance (TLR Met)?
	Non-Structural BMPs (Non-Modeled)	Public Retrofit Incentives + Redevelopment	Non-MS4	Regional BMPs	Distributed BMPs	Distributed BMP Implementation Level	Estimated Load Reduction		
SMB-5-01	5%	2%	0%	0%	0%	N/A	**7%**	**0%**	Yes
SMB-O-06	5%	2%	0%	0%	0%	N/A	**7%**	**0%**	Yes
SMB-5-02	5%	4%	2%	36%	3%	5% MFR/COM/SFR	**50%**	**46%**	Yes
SMB-5-02/5-03	5%	3%	0%	0%	0%	N/A	**8%**	**0%**	Yes
SMB-5-03	5%	3%	0%	0%	0%	N/A	**8%**	**0%**	Yes
SMB-5-03/5-04	5%	4%	0%	5%	0%	N/A	**15%**	**0%**	Yes
SMB-5-04	5%	5%	0%	1%	1%[2]	N/A	**12%**	**0%**	Yes
SMB-5-04/5-05	5%	4%	0%	2%	0%	N/A	**11%**	**0%**	Yes
SMB-5-05	5%	4%	5%	3%	0%	N/A	**18%**	**0%**	Yes
SMB-5-05/6-01	5%	3%	0%	2%	0%	N/A	**10%**	**0%**	Yes
SMB-6-01+ BCSump[1]	5%	3%	3%	33%	2%	25% MFR/COM/SFR	**46%**	**45%**	Yes
SMB-6-01/6-02	5%	2%	4%	0%	0%	N/A	**11%**	**0%**	Yes
SMB-6-02	5%	3%	1%	4%	0%	N/A	**13%**	**0%**	Yes
SMB-6-03	5%	3%	5%	10%	0%	N/A	**23%**	**0%**	Yes
SMB-6-04	5%	4%	3%	0%	0%	N/A	**12%**	**0%**	Yes
SMB-6-05	5%	3%	6%	0%	0%	N/A	**15%**	**0%**	Yes
SMB-O-08	5%	2%	0%	0%	0%	N/A	**7%**	**0%**	Yes
SMB-6-06	5%	5%	0%	0%	0%	N/A	**10%**	**0%**	Yes
Final Compliance Deadline (2021)	**5%**	**3%**	**3%**	**21%**	**1%**	**N/A**	**33%**	**26%**	**Yes**
Interim Compliance Deadline (2018)[3]	**2.5%**	**0.8%**	**1.5%**	**9.6%**	**0%**	**N/A**	**14.4%**	**13%**	**Yes**

[1] "BCSump" was defined as a separate analysis region for modeling purposes. The baseline load for "BCSump" analysis region was combined with the baseline load of the "SMB-6-01" analysis region to equal the total baseline load contributing to the SMB-6-01 CML ("SMB-6-01+BCSump").

[2] Distributed green street BMP load reduction in SMB-5-04 is a result of the existing filter/infiltration boxes retrofitted on the east side of Hermosa Avenue in the City of Hermosa Beach.

[3] The total interim load reduction is the sum of the load reductions calculated for each analysis region by 2018. The TLR is met through a combination of nonstructural and existing regional BMPs.

Time Series Output

Electronic input and output SWMM files and Excel summary spreadsheets will be provided to the LARWQCB upon submittal of this Draft EWMP

Consistency with LARWQCB Guidance

The approaches described above, including model selection, data inputs, critical condition selection (90th percentile year), calibration performance criteria, and output types were selected for consistency with the LARWQCB RAA Guidance Document (LARWQCB, 2014).

2.7.2 Dry Weather

For dry weather bacteria compliance, a qualitative analysis was conducted to show compliance at each of the CMLs. **Table 2-18** outlines the results of this analysis. Many CMLs have an effective diversion[18] such that they are consistently operational, well maintained, and sized to effectively eliminate discharges to the surf zone during year-round dry weather days. For the remaining smaller outfalls a systematic screening conducted in 2002 demonstrated that there was no discharge to the wave wash during summer dry weather from these storm drains. Rescreening of outfalls will be conducted as part of the Non-Stormwater Screening and Monitoring in the Coordinated Integrated Monitoring Program and will include both summer dry weather and winter dry weather screening. For the CMLs in the SMB Watershed that have anti-degradation based allowed exceedance days for both winter-dry and summer-dry weather, reasonable assurance is assumed to be demonstrated through the basis that the TMDL established their allowed exceedance days based on historic conditions (i.e., no water quality improvements were necessary).

If following dry weather outfall re-screening, dry weather reasonable assurance has not been demonstrated by the evaluation criteria shown in **Table 2-18**, the Beach Cities EWMP Group's compliance approach is consistent with the Permit requirement to eliminate 100 percent of non-exempt dry weather MS4 discharges. The Group's implementation approach for achieving this is to use a suite of non-structural source controls (e.g., water conservation incentives, enhanced illicit discharge detection and elimination [IDDE] efforts, and enhanced education/outreach and inspection/enforcement to prevent non-exempt sources of stormwater flow) and source investigations. By eliminating flows, this is equivalent to 100 percent load reduction for all pollutants, thereby demonstrating reasonable assurance of meeting all applicable TMDL limits and water quality objectives in the Permit during dry weather. Elimination of discharges is a pathway for compliance with RWLs and WQBELs in the MS4 Permit (per Section VI.E.2.e.i.(3)); without discharges there can be no "cause or contribute" to receiving water issues.

Since the dry weather compliance deadlines for the SMBBB TMDL have passed, this analysis is provided for informational purposes only, and is not intended to support or justify a new

[18] The seven existing low flow diversions include Polliwog Park, SMB 5-2 (28th Street), SMB 5-3 (Manhattan Beach Boulevard), SMB 5-5 (south of Pier Avenue), SMB 6-1 (Herondo Street), SMB 6-3 (Sapphire Street), and SMB 6-5 (Avenue I).

compliance schedule, additional non-structural or structural BMPs, or an evaluation of whether any newly proposed BMPs will provide a dry weather benefit.

Table 2-18. Dry Weather RAA Evaluation of Santa Monica Bay Watershed CMLs

CML	Effective Diversion/Disinfection at Analysis Region Outlet?	WMG MS4 Outfall Absent?	NSW MS4 Discharges Absent?	Reasonable Assurance Demonstrated?
SMB-5-01	No	Yes	To be determined pending results of non-stormwater screening	**Yes**
SMB-5-02	Yes	No		**Yes**
SMB-5-03	Yes	Yes		**Yes**
SMB-5-04	No	No		**TBD**
SMB-5-05	Yes	No		**Yes**
SMB-6-01	Yes	No		**Yes**
BCSump	Yes	No		**Yes**
SMB-6-02	Yes	No		**Yes**
SMB-6-03	Yes	No		**Yes**
SMB-6-04	No	No		**TBD**
SMB-6-05	Yes	No		**Yes**
SMB-6-06	No	No		**TBD**

2.8 Multiple Benefits

Not only is reasonable assurance demonstrated for the water quality objectives, but some of the proposed projects also provide multiple benefits beyond pollutant load reduction. Such benefits are described per individual project in Section 2.6.4 and described in general below.

2.8.1 Neighborhood Greening

Increased green space can positively impact the aesthetics, and even the property value, of highly urbanized areas. Property value tends to increase when an urban neighborhood has green space or trees in sight (Center for Neighborhood Technology [CNT], 2010).

Green infrastructure and green space can also alleviate urban heat-island effects by reducing temperatures by about 5°F through shade and evaporation (CNT, 2010). Urban heat-island effects describe the process by which urbanized regions become warmer than their rural surroundings due to an increase in black top and hardscape surfaces, an increase in vehicular and industrial emissions, and a reduction in shade and green space. Reduced temperatures will in turn reduce both energy consumption needs and the heat and pollution-related risks to human health (CNT, 2010).

2.8.2 Water Conservation/Supply

Stormwater retained in the regional structural BMPs can be reused for irrigation and other on-site, non-potable uses, thus promoting water conservation and offsetting reliance on the potable water supply.

2.8.3 Groundwater Recharge

Stormwater capture may increase groundwater supplies in cases where BMPs are designed for water supply augmentation and captured stormwater is recharged to groundwater basins that are used as drinking water sources. Green infrastructure allows captured runoff to infiltrate to useable groundwater basin storage. Due to the proximity to coastal aquifers, there may be limited groundwater recharge benefit in the proposed BMPs. However, this design option and potential benefit can be further explored as more site information is collected during the feasibility assessment and design phase for each BMP.

2.8.4 Public Education/Awareness

Public education and outreach engages the public's interest in preventing stormwater pollution and is achieved most effectively through an understanding of the varying levels of public background knowledge about stormwater management and pollution prevention (USEPA, 2014).

Public outreach is a major facet of the public retrofit incentives element of the RAA approach, which is directed at incentivizing the public to decrease the amount of stormwater runoff from their property, specifically via downspout disconnects. Outreach for this incentive may occur in the form of direct conversations, a variety of media, and/or short training courses, for example. Structural BMPs proposed in the EWMP will also serve as public education opportunities in the form of on-site educational materials, such as signage posted at construction and completed sites.

2.8.5 Flood control

Flood control benefits can exist in the context of:

- **Localized flooding,** caused by runoff before it enters a drain, causing property damage or traffic hazards. Regional BMPs can have significant impact on mitigating risk to localized flooding issues.
- **Riverine flooding,** occurring when flow exceeds the carrying capacity of the river, resulting in risk of overbank flow. Large regional BMPs will reduce pressure on the flood control capacity of streams.
- **Coastal Flooding**, occurring when local drainage infrastructure is overwhelmed during coast storm surges. Regional BMPs can significantly reduce pressure on local drainage, reducing risk of flooding to low lying coastal neighborhoods during coastal storm surges.

Depending on the type, size and location of the BMP, multiple benefits for one or more of the flood control scenarios may be provided. Cities and towns are beginning to recognize that green infrastructure practices provide a feasible and cost-effective alternative that manages precipitation on-site and reduces loads in local storm sewers and waterways. These solutions can not only reduce localized flooding, but can also significantly reduce negative downstream impacts in a way that traditional grey infrastructure solutions are less able to do (American Rivers, et al., 2012).

2.9 Parallel Compliance Efforts

During the remaining compliance period, the Beach Cities WMG may also elect to perform special studies to evaluate the SMBBB dry and wet weather WLAs. Various pathways are available to reopen the TMDL and modify the WLAs, including use of microbial source tracking to support a natural source exclusion, and quantitative microbial risk assessment to develop site specific objectives as allowed by the recent USEPA recreational criteria update. Furthermore, TMDL WLA changes are anticipated if the pending statewide bacteria objectives are adopted. The proposed changes for marine water include removal of the total coliform, fecal coliform, and fecal-to-total coliform ratio objectives, changing the enterococcus single sample maximum of 104 MPN/100ML to a statistical threshold value (10% allowed exceedances in a 30 day period) of 110 MPN/100mL, and other clarification and implementation guidance. Through the adaptive management process, the RAA may be reevaluated after any changes to the statewide objectives, TMDL WLAs, and/or Permit limits.

3 DOMINGUEZ CHANNEL WATERSHED

3.1 BACKGROUND

3.1.1 GEOGRAPHICAL CONTEXT

The northeastern portion of the Beach Cities EWMP Area is tributary to Dominguez Channel[19] (including Torrance Carson Channel) and is comprised of approximately 7,380 acres of land (**Figure 3-1**), the majority of which is comprised of residential land uses (**Figure 3-2**). This watershed accounts for 48% of the total Beach Cities EWMP Area, and includes portions of the Cities of Manhattan Beach, Redondo Beach, and Torrance. Storm drains from the Cities of Manhattan Beach and Redondo Beach drain through the City of Lawndale before discharging to Dominguez Channel. The City of Torrance's MS4 discharges directly to Dominguez Channel and Torrance Carson Channel (Torrance Lateral). Collectively, this portion of the study area is hereinafter referred to as the Dominguez Channel Watershed.

LACFCD is not responsible for land within the Beach Cities EWMP Area, but does own and maintain infrastructure within all three watersheds. Background information on the LACFCD is provided in **Appendix G. Table 3-1** provides a breakdown of the Beach Cities EWMP Area by city and tributary watershed. This section of the EWMP focuses on the Dominguez Channel Watershed only.

Table 3-1. Beach Cities WMG Area Distribution by Participating Agency

Participating Agency	Area (acres)		
	Santa Monica Bay Watershed	Dominguez Channel Watershed	Total EWMP Area (% of total)
City of Redondo Beach	2,614	**1,217**	3,831 (25%)
City of Manhattan Beach	2,078	**350**	2,428 (16%)
City of Hermosa Beach	832	**-**	832 (5%)
City of Torrance	2,314	**5,812**	8,126 (53%)
Total	**7,837**	**7,379**	**15,217 (100%)**

[19] Other portions of the Dominguez Channel Watershed, including Los Angeles County Unincorporated areas, are addressed by separate EWMP groups.

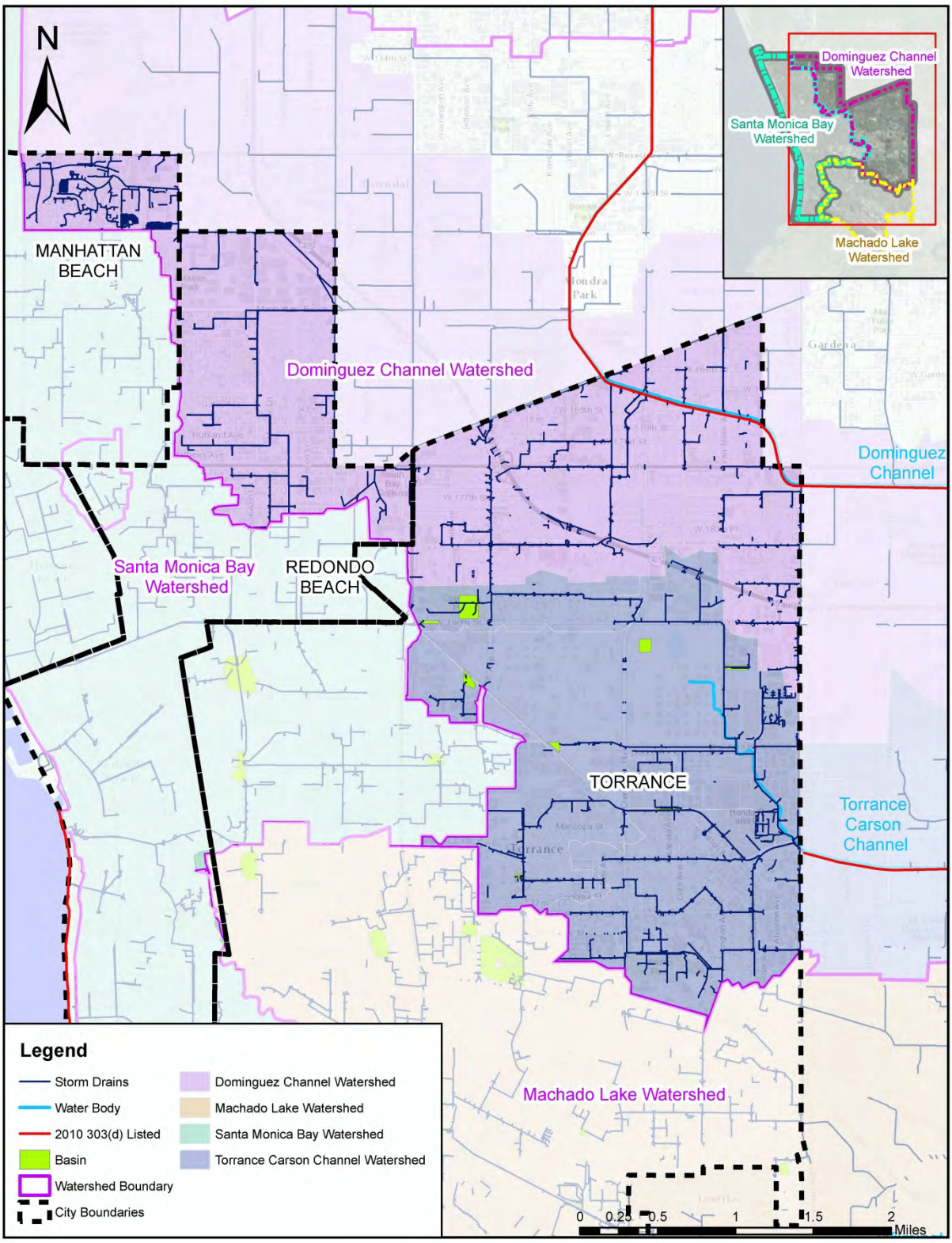


Figure 3-1. Beach Cities WMG MS4 Infrastructure within the Dominguez Channel Watershed

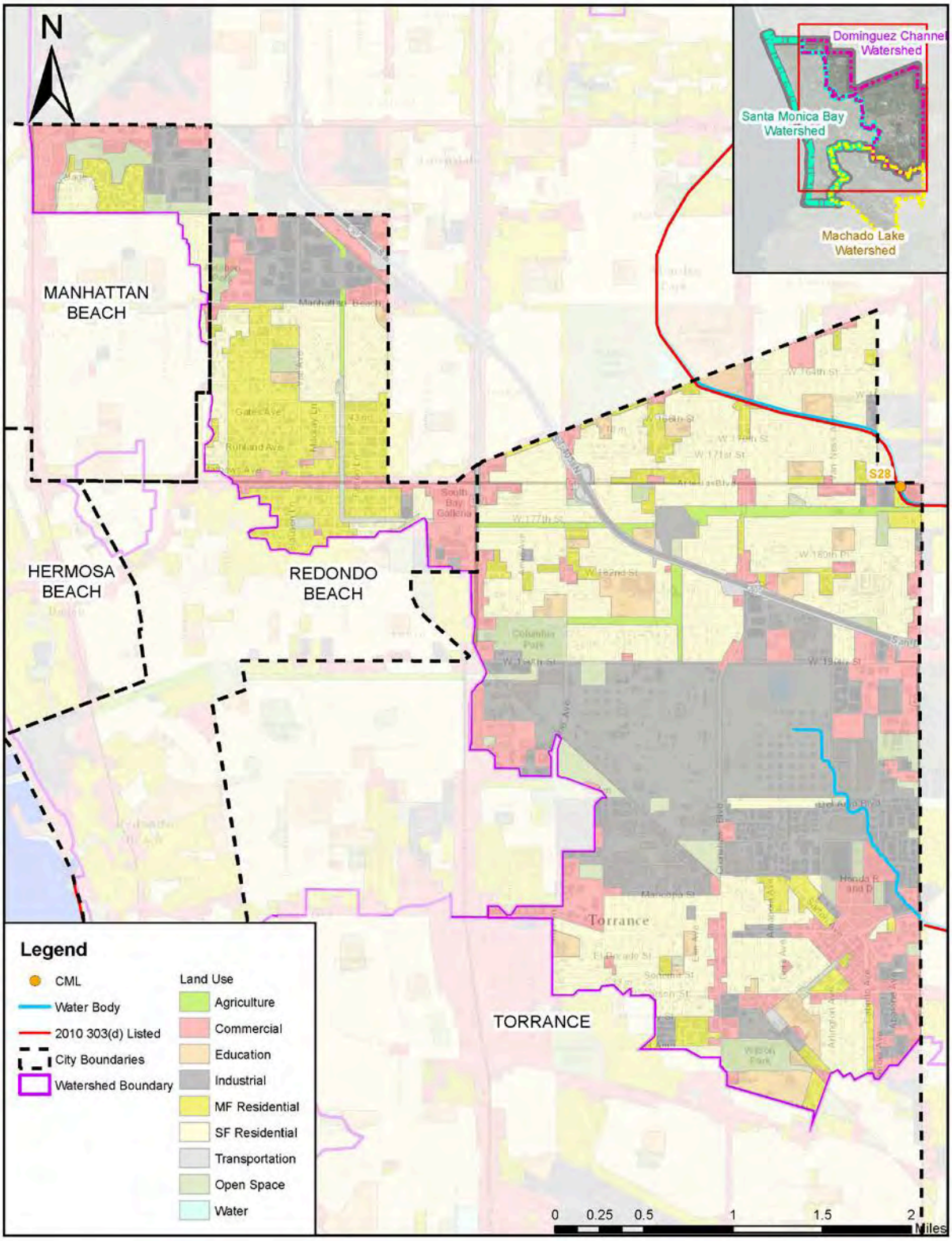


Figure 3-2. Beach Cities WMG Land Uses within the Dominguez Channel Watershed

3.2 Identification of Water Quality Priorities

As part of the EWMP, the Permit requires the Beach Cities WMG to identify water quality priorities within their EWMP AREA. To accomplish this per Permit Section VI.C.5.a, the Beach Cities WMG conducted the following for the Dominguez Channel Watershed portion of the Beach Cities EWMP Area:

1. Characterize the water quality of stormwater and non-stormwater discharges from the MS4 as well as receiving water bodies;
2. Prioritize WBPCs; and
3. Assess sources for high priority water body.

A summary of results is provided below.

3.2.1 Water Quality Characterization

Beneficial Uses

As discussed in Section 2.2.1, the Basin Plan (LARWQCB, 1995, updated 2011) identifies receiving waters within the Los Angeles region and sets regulatory objectives for these receiving waters. The Basin Plan regulates waste discharges to protect the quality of surface waters for use and enjoyment by the general public. Regulations set forth in the Basin Plan are based on assigned beneficial uses for each receiving water body. Beneficial use designations for receiving waters within the Beach Cities WMG Area are defined in Section 2.2.1 and summarized in **Table 3-2** below.

Table 3-2. Beach Cities EWMP Area – Dominguez Channel Watershed Water Bodies and Beneficial Uses

Water Body	MUN	IND	NAV	REC1	REC2	HFS	COMM	WARM	MAR	WILD	RARE	MIGR	SPWN	SHELL	WET[3]
Dominguez Channel	P[1]			P	E	E		P		P	E				
Torrance Lateral[2]	P[1]			P	E	E		P		P	E				

E = Existing beneficial use
P = Potential beneficial use

[1] Designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date.

[2] Listed in Basin Plan Table 1 as a "major surface water," tributary to Dominguez Channel Estuary.

[3] Water bodies designated as WET may have wetlands habitat associated with only a portion of the water body. Any regulatory action would require a detailed analysis of the area.

The high flow suspension beneficial use, which was approved by the USEPA as a Basin Plan Amendment in 2004, applies to Dominguez Channel and its tributaries. During days on which this beneficial use suspension is in effect, bacteriological objectives applicable to Dominguez Channel and its tributaries are suspended. The high flow suspension applies on days with rainfall greater than or equal to ½ inch and the 24 hours following the end of such an event.

Dominguez Channel Watershed Data Analysis

An evaluation of existing water quality conditions, including characterization of stormwater and non-stormwater discharges from the MS4 as well as water quality of the receiving water bodies within the Beach Cities WMG Area, was carried out as part of this EWMP to support identification and prioritization/sequencing of management actions, to the extent possible based on available data. Analyzed raw monitoring data were limited to data collected as part of the Mass Emission Station monitoring program established by the Los Angeles County Department of Public Works (LACDPW). No other data within Dominguez Channel were known to exist. Data were analyzed from two relevant monitoring stations: the Dominguez Channel Mass Emission Station (Station S28), located in Dominguez Channel at Artesia Blvd on the Torrance city boundary; and Tributary Station "Project No. 1232" (Station TS19), located in Torrance Carson Channel (Torrance Lateral) within the City of Carson. The ten most recent years of data (2003 to 2013) from Mass Emission Station S28 were used; all available data (2008 to 2011) from Station TS19 were used.

3.2.2 Water Body-Pollutant Classification

Receiving waters for stormwater runoff from the Dominguez Channel Watershed portion of the Beach Cities EWMP area were screened for water quality priorities by reviewing TMDLs, the State's 303(d) list, and recent available water quality data. Each identified water quality priority for a given receiving water body was categorized as a WBPC. WBPCs were classified into one of three categories, in accordance with Section VI.C.5(a).ii of the Permit, and further detailed in Section 2.2.2 herein.

Figure 2-3 in Section 2.2.2 provides a conceptual overview of the process used to identify and categorize the WBPCs within the Beach Cities EWMP Area. In order to categorize and prioritize the WBPCs within the Dominguez Channel Watershed portion of the Beach Cities EWMP Area, relevant TMDLs, 303(d) listings, recent available monitoring data, and water quality objectives from the Basin Plan were considered.

Category 1 – Highest Priority

WBPCs under Category 1 (highest priority) are defined in the Permit as "water body-pollutant combinations for which WQBELs and/or RWLs are established in Part VI.E and Attachments L through R of [the Permit]." These WBPCs include:

- Dominguez Channel for copper, lead, and zinc in wet weather: These WBPCs are considered Category 1 due to the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxics and Metals TMDL (Dominguez Channel Toxics TMDL) (LARWQCB, 2011).
- Dominguez Channel for toxicity: This is considered Category 1 due to the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxics and Metals TMDL. Toxicity was not modeled for Dominguez Channel and Torrance Lateral as part of the RAA due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of toxicity. Toxicity will continue to be monitored under the Beach Cities' CIMP.
- Dominguez Channel Estuary for copper, lead, zinc, cadmium, DDT, PAHs, and PCBs: These WBPCs are considered Category 1 due to the Dominguez Channel Toxics TMDL (LARWQCB,

2011). According to the Dominguez Channel WMA EWMP (DC WMG, 2015), relationships between TSS and historical organics were evaluated to determine if TSS could be used as a surrogate for historical organics. As there were significant non-detects in the available water quality data, a relationship between historic organics and TSS could not be established in the available Dominguez Channel monitoring data. Other studies have shown that relationship between TSS and historical organics can exist; however, the water quality depends on the storm event, soil disturbance, and other factors. It was assumed that if water column pollutant targets were met in Dominguez Channel, the targets would also be met downstream in the Dominguez Channel Estuary, which is the receiving water to Dominguez Channel. Sediment-borne pollutants would also be reduced by the same BMPs that are being used to address the water column pollutants. For these reasons, it was not necessary to perform a separate Reasonable Assurance Analysis for the Dominguez Channel Estuary. If monitoring data show that Dominguez Channel discharges are not meeting sediment objectives, a Reasonable Assurance Analysis will be conducted for sediment and the EWMP will be revised accordingly.

Category 2 – High Priority

Category 2 (high priority) WBPCs are defined as "pollutants for which data indicate water quality impairment in the receiving water according to the State's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (State Listing Policy) (SWRCB, 2004) and for which MS4 discharges may be causing or contributing to the impairment." Aside from those WBPCs already identified as Category 1, the remaining WBPC list can be condensed by excluding pollutants which are not stormwater related (i.e., MS4 discharges are unlikely to cause or contribute to the impairment) as well as pollutants which are already being addressed (directly or indirectly) by one of the TMDLs. Therefore, the Category 2 WBPCs are limited to the following:

- Dominguez Channel (including Torrance Lateral) for indicator bacteria. This qualifies as a Category 2 WBPC based on the 303(d) listing for indicator bacteria.
- Dominguez Channel (including Torrance Lateral) for ammonia. In conformance with Permit requirements, this qualifies as a Category 2 WBPC based on the 303(d) listing for ammonia. However, monitoring data since 2003 show that all water quality samples at S28 and TS19 meet the freshwater Basin Plan Objective for ammonia. As a result, ammonia will not be modeled as part of the Beach Cities' RAA. Monitoring for ammonia will occur under the CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to ammonia exceedances in the receiving water, the EWMP will be revised accordingly.

- Dominguez Channel (including Torrance Lateral) for diazinon. Dominguez Channel is also 303(d)-listed for diazinon, although data are not available on the SWRCB's website since this listing was made prior to 2006. However, as the Dominguez Channel Toxics TMDL staff report states, the USEPA banned diazinon on December 31, 2005. The Dominguez Channel Toxics TMDL staff report (Section 2.6.1) states, "Whereas elevated diazinon levels had been observed concurrently with toxicity in 2002-2005 wet weather samples and therefore diazinon was presumed to be contributing to adverse toxicity results; post-2005 results show no diazinon concentrations above the freshwater guideline. Therefore, it is appropriate to develop freshwater metals and toxicity TMDLs for wet weather; however, the more recent toxicity

results are not attributable to diazinon and therefore no diazinon TMDLs have been developed for Dominguez Channel." Dominguez Channel and Torrance Lateral data from 2006-2013, which includes 85 total samples between the two monitoring sites, show no exceedances of the chronic diazinon criteria established by the California Department of Fish and Game (0.10 ug/L). Due to the fact that monitoring data since 2006 show that all samples at S28 and TS19 meet the applicable water quality criteria for diazinon, diazinon could reasonably be removed from the State's 303(d) list for Dominguez Channel and therefore is not included as a Category 2 pollutant for Dominguez Channel (including Torrance Lateral).

- Dominguez Channel Estuary for indicator bacteria. This qualifies as a Category 2 WBPC based on the 303(d) listing for indicator bacteria.
- Dominguez Channel Estuary for ammonia. In conformance with Permit requirements, this qualifies as a Category 2 WBPC based on the 303(d) listing for ammonia. However, monitoring data since 2003 show that all water quality samples at S28 and TS19 meet the freshwater Basin Plan Objective for ammonia (**Appendix R**). As a result, ammonia was not modeled as part of the Beach Cities' RAA. Monitoring for ammonia will occur under the CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to ammonia exceedances in the receiving water, the EWMP will be revised accordingly.

Category 3 – Medium Priority

Category 3 (Medium Priority) designations are applied to WBPCs which are not 303(d)-listed but which exceed applicable RWLs contained in the Permit and for which MS4 discharges may be causing or contributing to the exceedance.

The annual monitoring reports published by LACDPW list exceedances of each sampled constituent relative to various water quality criteria, including Basin Plan Objectives (BPOs) and California Toxics Rule (CTR) criteria.[20] Raw data from S28 and TS19 have been reevaluated. Aside from the constituents described previously, measured exceedances at S28 and TS19 are summarized in **Table 3-3.** A single exceedance of the Department of Fish and Game's chronic criterion for chlorpyrifos (0.05 mg/L) occurred in October 2005 at S28. This exceedance occurred prior to EPA's December 31, 2005 chlorpyrifos ban. Since this time, 85 total samples from S28 and TS19 have been analyzed for chlorpyrifos and no exceedances have been recorded.

[20] Because of some additional water quality criteria used to evaluate exceedances in the County's annual monitoring reports (e.g., applying Ocean Plan Objectives to freshwater bodies; applying MUN-specific BPOs to potential-MUN-designated water bodies), exceedances were over-reported. As a result, pollutants evaluated as part of this appendix were limited to those pollutants which had at least one reported exceedance since 2003. For pollutants with a reported exceedance since 2003, all historic water quality data from that time forward was evaluated against appropriate water quality criteria. For pollutants with no reported exceedances, it was assumed that LACDPW's exceedance analyses were accurate.

Table 3-3. LACDPW Monitoring Results Summary

Pollutant	Dominguez Channel Mass Emission Station (S28)			Torrance Lateral Tributary Station (TS19)			Water Quality Criteria (Source)
	No. of Samples	No. of Exceedances	% Exceed	No. of Samples	No. of Exceedances	% Exceed	
Cyanide	61	24	39%	25	8	32%	5.2 ug/L (CTR continuous concentration)
pH	66	13	20%	26	11	42%	6.5 – 8.5 (BPO)
Selenium	66	3	5%	26	2	8%	5.0 ug/L (CTR continuous concentration)
Mercury	66	5	8%	26	3	12%	0.051 ug/L (CTR human health criterion, organisms only)
Dissolved Oxygen	60	1	2%	25	0	0%	5.0 mg/L (BPO)
Cadmium	66	3	5%	26	1	4%	2.2 ug/L (CTR continuous concentration)

In addition, based on water quality data analyses conducted by Dominguez Channel EWMP Group in the Dominguez Channel Estuary, arsenic, chromium, silver, nickel, mercury, and thallium are also considered Category 3 pollutants in the Dominguez Channel Estuary. Details are found in the Dominguez Channel EWMP (DC WMG, 2015).

Although data are not currently available to evaluate a linkage between Beach Cities WMG MS4 discharges and these receiving water exceedances, the following WBPCs are considered Category 3 based on the receiving water exceedances described above:

- Dominguez Channel (including Torrance Lateral) for cyanide, due to exceedances of the CTR continuous concentration criterion for cyanide summarized in **Table 3-3**. Cyanide was not modeled for Dominguez Channel and Torrance Lateral due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of cyanide. Cyanide will continue to be monitored under the Beach Cities' CIMP.
- Dominguez Channel (including Torrance Lateral) for pH, due to exceedances of the Basin Plan Objective for pH summarized in **Table 3-3**. However, due to the fact that there is currently no evidence supporting a linkage between MS4 discharges and exceedances of the pH criteria, pH was not modeled as part of the Beach Cities' RAA. Monitoring for pH will occur under the CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to pH exceedances in the receiving water, the EWMP will be revised accordingly.
- Dominguez Channel (including Torrance Lateral) for selenium, due to exceedances of the CTR continuous concentration criterion for selenium summarized in **Table 3-3**. However, due to the

fact that there is currently no evidence supporting a linkage between MS4 discharges and exceedances of selenium[21], selenium was not addressed in the Beach Cities' RAA. Monitoring for selenium will occur under the CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to selenium exceedances in the receiving water, the EWMP will be revised accordingly.

- Dominguez Channel (including Torrance Lateral) for mercury, due to exceedances of the CTR human health criterion for mercury summarized in **Table 3-3**. Mercury was not modeled for Dominguez Channel and Torrance Lateral as part of the RAA due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of mercury. Mercury will continue to be monitored under the Beach Cities' CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to mercury exceedances in the receiving water, the EWMP will be revised accordingly.
- Dominguez Channel (including Torrance Lateral) for cadmium, due to exceedances of the CTR continuous concentration criterion for cadmium summarized in **Table 3-3**. Cadmium was not modeled for Dominguez Channel and Torrance Lateral as part of the RAA due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of cadmium. Cadmium will continue to be monitored under the Beach Cities' CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to cadmium exceedances in the receiving water, the EWMP will be revised accordingly.
- Dominguez Channel Estuary for arsenic, due to exceedances of the proposed Effect Range Low (ERL) sediment quality guideline for arsenic. Arsenic was not modeled for Dominguez Channel Estuary as part of the RAA due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of arsenic. Arsenic will continue to be monitored under the Beach Cities' CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to arsenic exceedances in the receiving water, the EWMP will be revised accordingly.
- Dominguez Channel Estuary for chromium, due to exceedances of the proposed ERL sediment quality guideline for chromium. Chromium was not modeled for Dominguez Channel Estuary as part of the RAA due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of chromium. Chromium will continue to be monitored under the Beach Cities' CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to chromium exceedances in the receiving water, the EWMP will be revised accordingly.
- Dominguez Channel Estuary for silver, due to exceedances of the CTR continuous saltwater concentration criterion for silver. Silver was not modeled for Dominguez Channel Estuary as part of the RAA due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of silver. Silver will continue to be monitored under

[21] Water quality results from urban runoff throughout Southern California show average selenium concentrations to be well below the referenced CTR criterion of 5 ug/L. A 2003 study by SCCWRP examined selenium concentrations in runoff from five different developed land uses types. Findings showed that even 90th percentile concentrations for each land use were all below the 5 ug/L threshold, with the largest 90th percentile concentration being 2.9 ug/L from agricultural land (Ackerman and Schiff, 2003).

the Beach Cities' CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to silver exceedances in the receiving water, the EWMP will be revised accordingly.

- Dominguez Channel Estuary for nickel, due to exceedances of the CTR continuous and maximum saltwater concentration criteria for nickel. Nickel was not modeled for Dominguez Channel Estuary as part of the RAA due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of nickel. Nickel will continue to be monitored under the Beach Cities' CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to nickel exceedances in the receiving water, the EWMP will be revised accordingly.
- Dominguez Channel Estuary for mercury, due to exceedances of the proposed ERL sediment quality guideline and the CTR human health criterion for mercury. Mercury was not modeled for Dominguez Channel Estuary as part of the RAA due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of mercury. Mercury will continue to be monitored under the Beach Cities' CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to mercury exceedances in the receiving water, the EWMP will be revised accordingly.
- Dominguez Channel Estuary for thallium, due to exceedances of the CTR human health criterion for thallium. Thallium was not modeled for Dominguez Channel Estuary as part of the RAA due to the fact that there is currently a lack of evidence supporting a linkage between MS4 discharges and exceedances of thallium. Thallium will continue to be monitored under the Beach Cities' CIMP. If future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to thallium exceedances in the receiving water, the EWMP will be revised accordingly.

Table 3-4 summarizes the prioritized WBPCs within the Dominguez Channel Watershed portion of the Beach Cities EWMP Area.

Table 3-4. Water Body-Pollutant Combination Prioritization and Pollutant Interim and Final Compliance Targets for Dominguez Channel Watershed

Category	Water Body	Pollutant	Reason for Categorization	WQBEL/RWL/ Objective Basis	Interim WQBEL/ RWL	Final WQBEL/RWL/ Objective
1: Highest Priority	Dominguez Channel (including Torrance Lateral) [1]	Toxicity	Dominguez Channel Toxics TMDL	Monthly Average	2 TUc [2]	1 TUc
		Total Copper	Dominguez Channel Toxics TMDL	Wet Weather Single Event	207.51 ug/L[2]	9.7 ug/L
		Total Lead	Dominguez Channel Toxics TMDL	Wet Weather Single Event	122.88 ug/L[2]	42.7 ug/L
		Total Zinc	Dominguez Channel Toxics TMDL	Wet Weather Single Event	898.87 ug/L[2]	69.7 ug/L
	Dominguez Channel Estuary	Total Copper	Dominguez Channel Toxics TMDL	Annual Average	220 mg/kg sediment[2]	22.4 kg/yr
		Total Lead	Dominguez Channel Toxics TMDL	Annual Average	510.0 mg/kg sediment[2]	54.2 kg/yr
		Total Zinc	Dominguez Channel Toxics TMDL	Annual Average	789.0 mg/kg sediment[2]	271.8 kg/yr
		Cadmium	Dominguez Channel Toxics TMDL	Daily Maximum	n/a	1.2 mg/kg sediment
		DDT	Dominguez Channel Toxics TMDL	Annual Average	1.727 mg/kg sediment[2]	0.25 g/yr
		Total PAHs	Dominguez Channel Toxics TMDL	Annual Average	31.60 mg/kg sediment[2]	0.134 kg/yr
		PCBs	Dominguez Channel Toxics TMDL	Annual Average	1.490 mg/kg sediment[2]	0.207 g/yr

Category	Water Body	Pollutant	Reason for Categorization	WQBEL/RWL/ Objective Basis	Interim WQBEL/ RWL	Final WQBEL/RWL/ Objective
2: High Priority	Dominguez Channel (including Torrance Lateral)	Indicator Bacteria	303(d) List	Exceedance Rate over 30-day Period	n/a	*See Footnote 3*
		Ammonia	303(d) List	1-hour Average	n/a	$Effluent\ Limit\left(\frac{mg\ N}{L}\right) = \frac{0.411}{1+10^{7.204-pH}} + \frac{58.4}{1+10^{pH-7.204}}$ (Equation 1)
	Dominguez Channel Estuary	Indicator Bacteria	303(d) List	Single Event and Geometric Mean	n/a	*See Footnote 3*
		Ammonia	303(d) List	1-hour Average	n/a	0.233mg N/L or limit calculated using Equation 1, whichever is greater
3: Medium Priority	Dominguez Channel (including Torrance Lateral)	Cyanide	Historic exceedances of the California Toxics Rule (CTR) continuous concentration water quality objective (5.2 ug/L)	Continuous Monitoring	n/a	5.2 ug/L
		pH	Historic exceedance of the Basin Plan Objective (6.5 – 8.5)	Continuous Monitoring	n/a	6.5 - 8.5

Category	Water Body	Pollutant	Reason for Categorization	WQBEL/RWL/ Objective Basis	Interim WQBEL/ RWL	Final WQBEL/RWL/ Objective
		Selenium	Historic exceedances of the CTR continuous concentration water quality objective (5.0 ug/L)	Continuous Monitoring	n/a	5.0 ug/L
		Mercury	Historic exceedances of the CTR human health criterion for organisms only (0.051 ug/L)	Continuous Monitoring	n/a	0.051 ug/L
		Cadmium	Historic exceedances of the CTR continuous concentration water quality objective (2.2 ug/L)	Continuous Monitoring	n/a	2.2 ug/L
	Dominguez Channel Estuary	Arsenic	Historic exceedances of the Effects Range-Low (ERL) proposed sediment quality guidelines from the National Status and Trends database (8.2 mg/kg sediment)	Continuous Monitoring	n/a	8.2 mg/kg sediment

Category	Water Body	Pollutant	Reason for Categorization	WQBEL/RWL/ Objective Basis	Interim WQBEL/ RWL	Final WQBEL/RWL/ Objective
		Chromium	Historic exceedances of the ERL proposed sediment quality guidelines from the National Status and Trends database (81 mg/kg sediment)	Continuous Monitoring	n/a	81 mg/kg sediment
		Silver	Historic exceedances of the CTR continuous saltwater objective (1.9 ug/L)	Continuous Monitoring	n/a	1.9 ug/L
		Nickel	Historic exceedances of the CTR maximum saltwater objective (74 ug/L) and the CTR continuous saltwater objective (8.2 ug/L)	Continuous Monitoring	n/a	8.2 ug/L (continuous) 74 ug/L (maximum)
		Mercury	Historic exceedances of the ERL proposed sediment quality guidelines from the National Status and Trends database (0.15 mg/kg sediment) and the CTR human health	Continuous Monitoring	n/a	0.15 mg/kg sediment 0.051 ug/L

Category	Water Body	Pollutant	Reason for Categorization	WQBEL/RWL/ Objective Basis	Interim WQBEL/ RWL	Final WQBEL/RWL/ Objective
			criterion for organisms only (0.051 ug/L)			
		Thallium	Historic exceedances of the CTR human health criterion for organisms only (6.3 ug/L)	Continuous Monitoring	n/a	6.3 ug/L

[1] Wet weather only, based on the Dominguez Channel Toxics TMDL

[2] The interim deadline for Dominguez Channel Toxic TMDL is 3/23/2012. Hence the interim target is no longer applicable

[3] Per the Basin Plan Objective REC1 Water Bodies Limit for Indicator Bacteria.

The Beach Cities WMG agencies understand that data collected as part of their approved CIMP may result in future Category 3 designations in instances when RWLs are exceeded and MS4 discharges are identified as contributing to such exceedances. Under these conditions, the Beach Cities WMG agencies will adhere to Section VI.C.2.a.iii of the Permit.

Sections VI.C.2 and VI.C.3 of the Permit describe how compliance with RWLs and WQBELs is attained for the prioritized WBPCs identified. **Appendix H** sets forth the EWMP framework for evaluating and addressing receiving water exceedances and a brief summary is included below.

Different actions are required to demonstrate compliance for different types of WBPCs. Specifically; the following classifications are addressed by the Permit:

- WBPCs Addressed by a TMDL;
- 303(d)-listed WBPCs: Pollutants in the same class as those identified in a TMDL and for which the water body is 303(d)-listed (Section VI.C.2.a.i), and pollutants not in the same class as those identified in a TMDL, but for which the water body is 303(d)-listed (Section VI.C.2.a.ii); and
- Non 303(d)-listed WBPCs: Pollutants for which there are exceedances of RWLs, but for which the water body is not 303(d)-listed (Section VI.C.2.a.iii).

For WBPCs already addressed by a TMDL, adherence to all requirements and compliance dates as set forth in the approved EWMP will constitute compliance with applicable interim TMDL-based water quality based effluent limits and interim receiving water limits. 303(d)-listed WBPCs are equivalent to the identified Category 2 combinations. For any Category 2 and 3 WBPCs that are identified in the future through the adaptive management process, adherence to all implementation actions, milestones, and compliance schedules identified in the updated EWMP will constitute compliance with applicable receiving water limits. This approach is outlined in **Appendix H**. Category 2 and 3 parameters will also be monitored under the Beach Cities' CIMP and if future monitoring data suggest that the Beach Cities' MS4s may cause or contribute to exceedances of these pollutants in the receiving water, the EWMP will be revised to address these pollutants.

3.2.3 Source Assessment

The following data sources have been reviewed as part of the source assessment for the WBPCs listed previously:

- Findings from the Permittees' IC/ID Programs;
- Findings from the Permittees' Industrial/Commercial Facilities Programs;
- Findings from the Permittees' Development Construction Programs;
- Findings from the Permittees' Public Agency Activities Programs;
- TMDL source investigations;
- Watershed model results;
- Findings from the Permittees' monitoring programs, including but not limited to TMDL compliance monitoring and receiving water monitoring; and

- Any other pertinent data, information, or studies related to pollutant sources and conditions that contribute to the highest water quality priorities.

Since sources of pollutants for the various water bodies within the Beach Cities WMG Area are essentially identical based on similarity of land uses (e.g., sources of trash within SMB Watershed and Dominguez Channel Watershed are believed to be the same), the following source assessment is broken down by pollutants applicable to the Dominguez Channel Watershed.

Copper, Lead, and Zinc

The Dominguez Channel Toxics TMDL (which applies to wet weather only) provides general information on sources of metals within the Dominguez Channel Watershed, but does not provide a detailed source assessment. The TMDL states that "the major pollutant sources of metals into Dominguez Channel and Torrance Lateral freshwaters are stormwater and urban runoff discharges. Nonpoint sources include atmospheric deposition" (LARWQCB and USEPA, 2011).

SCCWRP conducted a detailed study of various wet weather pollutants throughout the Los Angeles region, including Dominguez Channel (Stein et al., 2007). They found that industrial land use sites contributed a substantially higher flux of copper and zinc compared to other land uses evaluated, followed by agriculture, recreational, transportation (for copper), and high density residential (for zinc). Wet weather EMCs for copper and zinc, based on the Los Angeles County land use EMC dataset (Geosyntec Consultants, 2012) were similar to SCCWRP's findings, showing that the highest runoff concentrations are expected from industrial, transportation, and commercial land uses, excluding agriculture. With respect to copper, research has shown that brake pads are a significant source of copper in urban stormwater (TDC Environmental, 2013). Copper and other pollutants are deposited on roads and other impervious surfaces and then transported to aquatic habitats via stormwater runoff.

Pollutant loads of copper from urban land uses is expected to decrease due to Senate Bill (SB) 346 which was signed into law on September 25, 2010. This legislation phases out copper in vehicle brake pads over a period of years; milestones include the following dates:

- January 1, 2021: Limits the use of copper in motor vehicle brake pads to no more than five percent by weight; and
- January 1, 2025: Limits the use of copper in motor vehicle brake pads to no more than 0.5 percent by weight.

A separate study focusing on zinc showed that the major sources of zinc in urban runoff are outdoor zinc surfaces (including galvanized surfaces) and tire wear debris (TDC Environmental, 2013).

For lead, SCCWRP found that the greatest land use contributors were agricultural (minimal in Dominguez Channel Watershed), high density residential, and recreational (horse) land uses (Stein et al., 2007). Based on the Los Angeles County land use EMC dataset (Geosyntec Consultants, 2012), the highest lead contributing land uses are agriculture, industrial, commercial, and single family residential. Lead was also formerly used as an additive in gasoline and is still used in general aviation gasoline (Avgas) for small piston-engine aircraft. According to Federal Aviation

Administration (FAA), Avgas emissions are the largest contribution to relatively low levels of lead emission in the U.S. (FAA, 2015). This has contributed to the contamination of some soils near highways and streets and in drainage ways in urban areas. Exhaust particulates, fluid losses, drips, spills, and mechanical wear products continue to contribute lead to street dust.

For both copper and lead, the SCCWRP and Los Angeles County datasets indicate that average EMCs exceed applicable CTR continuous concentration criteria for each land use sampled. For zinc, some land uses (single family residential, education, and vacant) have average EMCs below the CTR continuous concentration criterion, while others (commercial, industrial, transportation, multi-family residential, and agriculture) exceed this criterion.

These land use EMC datasets were used to support BMP placement as part of the RAA.

Toxicity

As is the case with metals, the Dominguez Channel Toxics TMDL does not provide a detailed source assessment for toxicity within the Dominguez Channel Watershed, nor is a linkage provided to other specific surrogate pollutants, such as total suspended solids or dissolved metals. The source assessment simply states that "the major sources of organo-chlorine pesticides [and] PCBs…into Dominguez Channel are stormwater and urban runoff discharges. Nonpoint sources include atmospheric deposition and fluxes from contaminated sediments into the overlying water" (LARWQCB and USEPA, 2011).

Pesticides are used in urban settings for structural pest control, landscape maintenance (parks, golf courses, cemeteries, and right-of-ways), vector control, and public health pest control. Two specific pesticides, diazinon and chlorpyrifos, were banned by the USEPA on December 31, 2005. As a result, mass emission monitoring at S28 has resulted in no measured exceedance of the 1 toxicity unit criteria for chlorpyrifos or diazinon in Dominguez Channel since 2006. Similarly, both DDT and PCBs were banned from general production and use in the 1970s, resulting in the elimination of direct discharges of these chemicals to Dominguez Channel, SMB, and other local surface water bodies, except from legacy sources.

Additional sources of toxicity within the Dominguez Channel Watershed are unknown at this time. Therefore, toxicity monitoring will be conducted under the Beach Cities CIMP to help assess if MS4 discharges are causing or contributing toxicity exceedances in Dominguez Channel. In addition, a toxicity identification evaluation (TIE) will be performed as necessary to identify the compound(s) responsible for any observed toxicity.

Indicator Bacteria

Although the Dominguez Channel is 303(d) listed for indicator bacteria, a bacteria TMDL has not yet been developed for the watershed. The source assessment for indicator bacteria within the Santa Monica Bay watershed portion of the Beach Cities EWMP area is provided in Section 2.2.3, and many of these urban anthropogenic and non-anthropogenic sources apply to the Dominguez Channel portion of the Beach Cities EWMP Area as well.

Additional local monitoring data will be needed to quantify the contribution of MS4 discharges – particularly relative to the many other identified non-anthropogenic sources that have been documented. Additional data are also needed to identify the sources of bacteria within MS4 discharges as well as their potential to contribute to recreational illness risks; such source tracking data have the potential to affect the TMDL WLAs through a future reopener. For example, if human fecal sources are found to be undetected in MS4 discharges to Dominguez Channel using a rigorous sampling design, the latest analytical markers, and a credible laboratory, then TMDL revisions may be proposed. And the combination of MS4 outfall monitoring (through the CIMP) and source identification (through special studies) will be essential to support future BMP planning and EWMP updates.

Ammonia

Monitoring data since 2003 show that all water quality samples at S28 and TS19 meet the freshwater Basin Plan Objective for ammonia. Because ammonia does not exceed water quality standards, a source assessment has not been completed at this time.

Generally, ammonia enters urban creeks via anthropogenic sources or discharges such as municipal effluent discharges, agricultural runoff, and natural sources such as nitrogen fixation, the excretion of nitrogenous wastes from animals, and runoff from agricultural lands (USEPA, 2013a).

Diazinon

Dominguez Channel and Torrance Lateral data from 2006-2013, which includes 85 total samples between the two monitoring sites, show no exceedances of the chronic diazinon criteria established by the California Department of Fish and Game (0.10 ug/L). No diazinon TMDLs have been developed at this time. Due to the fact that monitoring data since 2006 show that all samples at S28 and TS19 meet the applicable water quality criteria for diazinon, a source assessment has not been completed at this time.

Generally, diazinon in urban creeks may be attributed to urban runoff that contains pesticides as a result of such activities as application by businesses and individuals who apply them for structural pest control, landscape maintenance, agricultural, and other pest management purposes (Werner, et al., 2002).

3.2.4 PRIORITIZATION

Based on the water quality characterization above, the WBPCs have been classified into one of three categories, in accordance with Section IV.C.5(a)ii of the Permit: highest priority, high priority, and medium priority (**Table 3-4**). This categorization is intended to prioritize WBPCs in order to guide the implementation of structural and institutional BMPs. An RAA was performed on the WBPCs in Categories 1 and 2. WBPCs will be further prioritized based on the applicable compliance schedules, as discussed in Section 4.

3.3 Selection of Appropriate Best Management Practices

3.3.1 Objectives

The Permit requires the Beach Cities WMG to identify strategies, control measures, and BMPs to implement within their EWMP area. Specifically, the Permit specifies that BMPs are expected to be implemented so that MS4 discharges meet effluent limits as established in the Permit and to reduce impacts to receiving waters from stormwater and non-stormwater runoff. This expectation assumes the implementation of both types of BMPs – non-structural and structural – by the Beach Cities WMG.

The objectives of selecting and incorporating BMPs into the Beach Cities EWMP include:

1. Preventing and/or eliminating non-stormwater discharges to the MS4 that are a source of pollutants from the MS4 to receiving waters;
2. Achieving all applicable interim and final WQBELs and/or RWLs pursuant to corresponding compliance schedules; and
3. Ensuring that discharges form the MS4 do not cause or contribute to exceedances of RWLs.

3.3.2 Definition of Best Management Practices

See Section 2.3.2.

3.3.3 Incorporated Provisions

Minimum Control Measures

See Section 2.3.3.

Non-Stormwater Discharge Measures

The Permit requires Permittees to identify non-stormwater discharges that cause or contribute to exceedances of RWLs, and to then identify and implement BMPs to effectively eliminate the source of pollutants. These BMPs may include measures to prohibit non-stormwater discharge to the MS4, additional structural BMPs to reduce pollutants in the non-stormwater discharge, diversion to a sanitary sewer for treatment, or strategies to require the non-stormwater discharge to be separately regulated under a general NPDES permit. In contrast to Santa Monica Bay, Dominguez Channel Watershed does not have low flow diversions; however, within the Cities of Redondo Beach and Manhattan Beach, the implementation of two regional BMPs at both outlets from the EWMP area (see Section 3.6.4) will control dry weather flows by capturing the small flows in the pre-treatment volume and either retaining them or treating them in the media filter. In addition, the cities each have water conservation ordinances which include elimination of irrigation overspray.

The non-stormwater screening process consists of the steps shown in **Figure 2-4**. Further details on the Beach Cities WMGs' approach to meet this requirement are provided in the CIMP for the Beach Cities Watershed Management Group (Beach Cities Watershed Management Group, 2014). The watershed control measures proposed within Dominguez Channel that are expected to

eliminate non-stormwater discharges meet the requirements as set forth in Parts III.A and VI.D.4.d and VI.D.10 of the LA County MS4 Permit.

The following schedule is proposed to eliminate unauthorized non-stormwater discharges that are either causing or contributing to receiving water exceedances in Dominguez Channel Watershed:

- December 2023: 50% volume reduction of significant non-stormwater discharges.
- December 2025: 100% elimination of all significant non-stormwater contributions.

Since there is no bacteria TMDL for Dominguez Channel, the final compliance date for dry weather bacteria was selected to be consistent with the draft TMDL for indicator bacteria in the San Gabriel River, Estuary and Tributaries, adopted by the LARWQCB in 2015, which requires that compliance is achieved with applicable MS4 WLAs 10 years after the effective date of the TMDL (Water Quality Control Plan, Attachment A to Resolution No. R15-0xx, adopted by the RWQCB in 2015).

TMDL-Specific Control Measures

See Section 2.3.3.

Additional BMPs

See Section 2.3.3.

Demonstration of BMP Performance – Introduction to the Reasonable Assurance Analysis

See Section 2.3.3.

Legal Authority

The Permit-required legal authority that the Beach Cities WMG has to implement the BMPs identified in the EWMP is discussed in Section 8.

3.4 Reasonable Assurance Analysis Approach

The general approach used for Dominguez Channel is described below with references to relevant portions of Section 2 where the approaches or data used in the Santa Monica Bay Watershed are similar (e.g., for calculating bacteria TLRs).

3.4.1 Description of RAA Tools and Approach

The approaches for performing the RAA in both dry and wet weather are described below.

Dry Weather

For the purposes of the dry weather RAA, the EWMP area draining to Dominguez Channel was combined into a single analysis region, for which bacteria was the only applicable dry weather WBPC specific to both Dominguez Channel and Dominguez Channel Estuary and total lead, copper, and zinc were dry weather WBPCs specific to Dominguez Channel Estuary.

The Beach Cities WMG dry weather compliance approach for Dominguez Channel and subsequently Dominguez Channel Estuary is to eliminate non-exempt dry weather MS4 discharges using a suite of non-structural source controls (e.g., water conservation incentives, enhanced IDDE efforts, and enhanced education/outreach and inspection/enforcement to prevent sources of non-stormwater flow), source investigations following dry weather outfall screening, and structural BMPs that are primarily designed to support wet weather reasonable assurance demonstration. If monitoring shows that this combination of nonstructural and structural BMPs does not eliminate non-exempt dry weather flows, additional measures such as low flow diversion to sanitary sewers will be constructed as necessary so that dry weather flows are eliminated. By eliminating dry weather flows, this is equivalent to 100% load reduction for all pollutants, thereby demonstrating reasonable assurance of meeting all applicable Permit limitations during dry weather. Elimination of discharges is a pathway for compliance with RWLs and WQBELs in the MS4 permit (per section VI.E.2.e.i.(3)); without discharges there can be no "cause or contribute" to receiving water issues.

Wet Weather

The modeled wet-weather RAA applied in the Dominguez Channel watershed consists generally of the following steps:

- Identify WBPCs for which the RAA will be performed;
- Identify the MS4 service area (exclude lands of agencies not party to this EWMP such as Federal land, State land, etc.);
- For each analysis region, develop TLRs for the critical condition;
- Identify structural and non-structural BMPs that were either implemented after applicable TMDL effective dates or are planned for implementation in the future;
- Evaluate the performance of these BMPs in terms of annual pollutant load reductions;
- Compare these estimates with the TLRs; and
- Revise the BMP implementation scenario until TLRs are met.

For the purposes of the wet weather RAA, the EWMP area draining to Dominguez Channel was combined into a single analysis region to establish TLRs and into two analysis regions, one including the portion of the Cities of Redondo Beach and Manhattan Beach (Dominguez Channel – Redondo Beach/Manhattan Beach [DC-RB/MB]) and one including the portion of the City of Torrance (DC – Torrance), to evaluate the performance of BMPs. The Dominguez Channel Watershed analysis regions are shown in **Figure 3-3.**

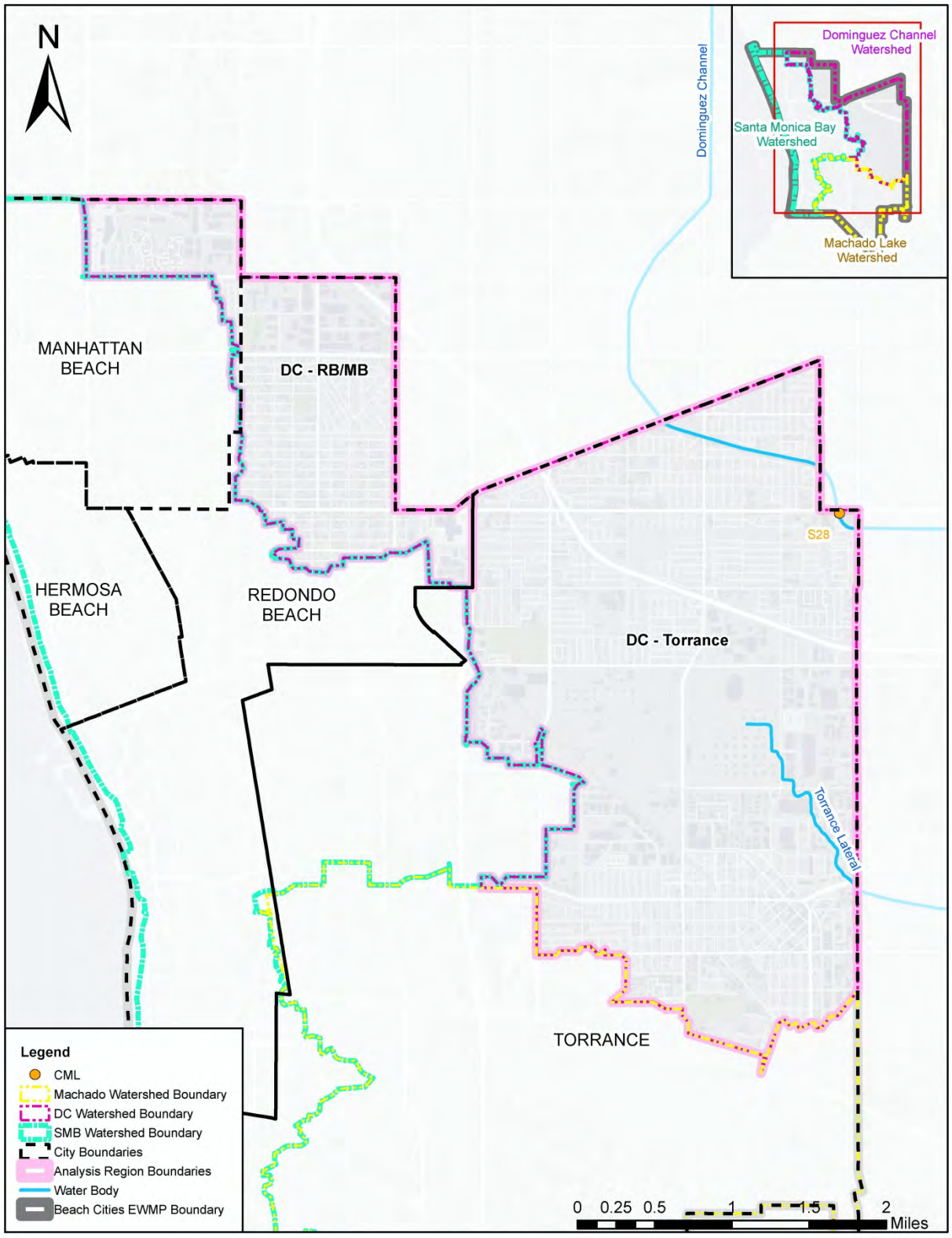


Figure 3-3. Analysis Regions within the Dominguez Channel Watershed portion of the Beach Cities EWMP Area

In general, the approach, including model selection, data inputs, critical condition selection (90th percentile year for bacteria and 90th percentile load day for metals), calibration performance criteria, and output types have been selected for consistency with the LARWQCB RAA Guidance Document (LARWQCB, 2014) and to leverage previous efforts where relevant models have already been developed. Previous efforts include the development of a Loading Simulation Program C++ (LSPC) model for the LACFCD in connection with Watershed Management Modeling System (WMMS). LSPC is a publically available watershed model that was developed for the LACFCD in connection with WMMS. This model uses Hydrologic Simulation Program Fortran (HSPF) algorithms to simulate hydrology, sediment transport, water quality on land, and fate and transport within streams. GIS is used for the spatial component of the analysis in addition to visualization. The LSPC model used for the RAA was recently calibrated by CWE to stream gauge S28 which receives runoff from almost all of the Dominguez Channel Watershed.

To leverage these previous calibration efforts, the portion of the LSPC model within the Dominguez Channel Watershed EWMP Area was used to calibrate SBPAT's hydrology. SBPAT was used to establish all TLRs in the Dominguez Channel Watershed. SBPAT was also used to perform the RAA for the portion of the Cities of Redondo Beach and Manhattan Beach within the Dominguez Channel Watershed. The RAA for the portion of the City of Torrance within the Dominguez Channel Watershed was performed using SWMM to determine baseline loading and static spreadsheet-based calculations based on a literature review to estimate load reductions from the proposed BMPs. The SWMM model used for baseline loading was calibrated using the recently calibrated LSPC model. **Table 3-5** below summarizes the TLR and RAA models used across the Dominguez Channel Watershed for this EWMP. These models are discussed in more detail below.

Table 3-5. RAA Models Used in the Dominguez Channel Watershed

City	Model Selection		
	Set Target Load Reduction	Perform RAA	Calibration Data Source
Manhattan Beach	SBPAT	SBPAT	Recently calibrated LSPC model
Redondo Beach	SBPAT	SBPAT	Recently calibrated LSPC model
Torrance	SBPAT	SWMM for baseline/static spreadsheet-based calculations for load reductions	Recently calibrated LSPC model

As in the Santa Monica Bay watershed, the Beach Cities RAA was conducted within the Dominguez Channel Watershed to demonstrate reasonable assurance of compliance with Permit specified TMDL RWLs and WQBELs, as well as other RWLs and water quality objectives for non-TMDL WBPCs. In instances where critical conditions were not explicitly defined in the Permit (e.g., a critical condition of "wet weather" without an associated rainfall or flow-based criterion), steps were taken to establish a link between the expressed Permit limit and the modeled pollutant concentrations and loads (i.e., rainfall, runoff, and pollutant concentrations in the runoff). **Table 3-6** summarizes these steps for the modeled WBPC in the Dominguez Channel Watershed with a Permit-established limit. According to the Dominguez Channel WMA EWMP (DC WMG, 2015),

relationships between TSS and historical organics were evaluated to determine if TSS could be used as a surrogate for historical organics. As there were significant non-detects in the available water quality data, a relationship between historic organics and TSS could not be established in the available Dominguez Channel monitoring data. Other studies have shown that relationship between TSS and historical organics can exist; however, the water quality depends on the storm event, soil disturbance, and other factors. It was assumed that if water column pollutant targets were met in Dominguez Channel, the targets would also be met downstream in the Dominguez Channel Estuary, which is the receiving water to Dominguez Channel. Sediment-borne pollutants would also be reduced by the same BMPs that are being used to address the water column pollutants. For these reasons, it was not necessary to perform a separate Reasonable Assurance Analysis for the Dominguez Channel Estuary. If monitoring data show that Dominguez Channel discharges are not meeting sediment objectives, a Reasonable Assurance Analysis will be conducted for sediment and the EWMP will be revised accordingly. Because no evidence currently exists to support a linkage between ongoing MS4 discharges and exceedances of toxicity, mercury, cadmium, cyanide, selenium, or pH in Dominguez Channel, these pollutants were not modeled as part of this analysis.

Table 3-6. Wet Weather Permit Limits (Final Compliance Limits for Modeled Pollutants)

Pollutant	RWL/WQBEL from the Permit or Assumed Based on Other Similar Los Angeles Region TMDLs	Approach for Applying the Critical Period
Fecal Coliform	19% allowed exceedance of the REC-1 water quality objective, (400 MPN/100mL) on non-high flow suspension days[2].	90th percentile year (based on wet days[1]) was used as the critical condition. Allowable number of wet weather exceedance days for the critical year was set to % of non-high flow suspension wet days, rounding down.
Total Copper	WQBEL= 9.7 ug/L *Daily Volume[3]	90th percentile daily load during wet weather was used as the critical condition. This calendar day was identified for each metal by ranking daily metal loads for wet days[1] between 2003 and 2012.
Total Lead	WQBEL= 42.7 ug/L *Daily Volume[3]	
Total Zinc	WQBEL= 69.7 ug/L *Daily Volume[3]	

[1] For bacteria, wet days were defined as days with 0.1" or greater of rainfall plus the next three days. For metals, the TMDL defines wet weather as days in which the maximum daily flow at the S-28 gauge on Dominguez Channel is 63 cfs or greater; for the purpose of this RAA, this was assumed to equate to days in which the SBPAT model (which responds to rainfall events greater than 0.1", had a non-zero flow).

[2] High Flow Suspension days are defined based on the criteria used in bacteria TMDLs in the region in which days in which 0.5" or greater of rainfall occurs, and the day following such an event, are both high flow suspension days.

[3] The MS4 permit provides both the concentration-based effluent limitations above as well as load based limitations on page N-6 which come from the Dominguez Channel Toxics TMDL. The load-based limitations are based on multiplying the metal concentration-based limitations by the runoff volume on the 90th percentile day. However, the TMDL does not provide quantitative load-based effluent limitations, but instead states that the WLAs are the water quality effluent target multiplied by the daily flow volume. The MS4 permit states that the load-based limitations can be recalculated based on the flow volume at the time of sampling. Therefore, the load-based effluent limitations will change based on the daily flow volume, so the WQBEL is written to account for flow variability.

Cities of Redondo Beach and Manhattan Beach (DC-RB/MB Analysis Region). SBPAT was used for the portion of the Dominguez Channel Watershed within the Cities of Redondo Beach and Manhattan Beach to evaluate BMP scenarios and demonstrate reasonable assurance of achieving applicable Permit limits. SBPAT was used in the same capacity for the Santa Monica Bay watershed and is described in detail in Section 2.4.1 above.

City of Torrance (DC-Torrance Analysis Region). In general, the RAA approach used within the City of Torrance portion of the Dominguez Channel Watershed was conducted using static spreadsheet calculations coupled with a literature review on the performance of catch basin inlet filters to determine reasonable removal percentages for metals and bacteria.

3.4.2 Modeling Data

The critical condition definition and a summary of data associated with the models used in the RAA are described below.

Critical Condition Definition

Bacteria. Consistent with all existing Los Angeles region bacteria TMDLs for freshwater bodies, as well as the LARWQCB RAA Guidance (LARWQCB, 2014), the RAA for bacteria was performed on the 90th percentile critical wet year in the Dominguez Channel Watershed. This was determined in the same manner as the Santa Monica Bay portion of the EWMP area as described in Section 2.4.2 using the same rain gauge and the same period of record. The 90th percentile TMDL year (Nov 1-Oct 31), based on the number of wet days based on gage D1070 was determined to be 1995 (see **Appendix Q**).

Metals. The critical condition for metals is based on the 90th percentile metal load day on wet days (see **Appendix Q**). Wet days in the Dominguez Channel Toxics TMDL are defined as days where the maximum daily flow at the S-28 stream gauge in lower Dominguez Channel is 62.7 cfs or greater. Consistent with RAA Guidelines, the most recent 10 year period with available rainfall data was selected; this period was 2003 to 2012 (Nov 1, 2002-Oct 31, 2012). The stream gauge data at this S-28 prior to October 2011 are segmented and do not cover the entire period. This could result in actual wet days that do not get classified as wet days if stream gage data are missing from that day, and could bias the TLR calculations and RAA analysis. Therefore, wet days for this analysis were based on days where the calibrated SBPAT model (which models only wet weather, i.e., no dry weather runoff or baseflows are modeled) predicted non-zero flow. This was compared to the bacteria wet day definition in which days with 0.1" or greater rainfall plus the next three days were counted as wet days. Storms that were greater than 0.1" produced runoff in SBPAT throughout the modeled period, thereby confirming that predicted flow in SBPAT was a reasonable representation of wet days. The calibrated SBPAT model (discussed below) was used to determine the daily metal load on wet days. These days were ranked by their daily metals load for each metal to determine the 90th percentile load day for TLR calculation. The 90th percentile load days were found to be Nov 30, 2007, February 5, 2010, and February 26, 2006 for copper, lead, and zinc, respectively. Other data related to the SBPAT model are discussed in detail in Section 2.4.2.

3.4.3 CALIBRATION

Hydrology

No stream gauge exists that measures flow from only the Dominguez Channel portion of the EWMP area. However, a stream gauge does exist on lower Dominguez Channel above the Torrance Lateral. This gauge captures flow from 24,275 acres. Approximately 3,687 acres of the EWMP area drain to this gauge. The rest of the EWMP area drains to the Torrance Lateral and is therefore downstream of this gauge. The EWMP area upstream of this gauge constitutes only 15% of the total area draining to the gauge. Therefore, in lieu of local measured stream flow data from within the EWMP area, a Los Angeles County LSPC model of the Dominguez Channel Watershed which had previously been calibrated to the S28 stream gauge on Dominguez Channel was used as a stream flow calibration comparison dataset for SBPAT. As future monitoring data become available, this calibration may be reassessed as part of the EWMP adaptive management process.

The Los Angeles County LSPC model was previously calibrated by CWE to gauge S28 for the Dominguez Channel watershed using the calibration parameters in Table 3.0 of the RAA Guidelines. A ten-year calibration period was used (2003-2012). The percent difference for both daily and monthly runoff volumes between the LSPC model and the stream gauge was less than 10%, which is in the 'very good' category in the RAA guidelines (CWE, 2015). The mean annual runoff volume in the LSPC model (7,210 acre-ft) was within 12% of the stream gauge volume (8,210 acre-ft) which is in the 'good' range in the RAA Guidelines.

For modeling the portion of the Beach Cities EWMP area which drains to Dominguez Channel, the calibrated LSPC model was clipped to the Dominguez Channel analysis region (including Torrance, see Figure 1), while keeping all other model parameters unchanged. Because SBPAT only includes storm generated runoff and LSPC includes dry weather flows (irrigation was turned off for the purposes of this analysis), any dry weather flows were first removed from the LSPC annual volumes using the Web-based Hydrograph Analysis Tool (WHAT) for porous aquifers with ephemeral streams; this tool was developed by Purdue University to separate base flows and runoff. Because dry weather flows are minimal in Dominguez Channel Watershed in the LSPC model, this resulted in a decrease in volume of only 6%.

The SBPAT calibration of the Dominguez Channel analysis region focused on accurate prediction of annual discharge volumes predicted by the LSPC model for TMDL years 1989-2011. The dominant rain gauge used by LSPC (Manhattan Beach Station ID 1070) was also used by SBPAT. This gage had less than 2% difference in total rainfall volume than the aggregate of the surrounding rain gauges making it a good representative gauge for the EWMP area. The calibration parameters were the soil saturated hydraulic conductivities and the land use imperviousness, which were changed by a uniform multiplier for all soil and land use types in all subcatchments to match the LSPC predictions. **Table 3-7** shows the mean annual volume predicted by the calibrated SBPAT model versus the mean annual volume predicted by the calibrated LSPC model for the Dominguez Channel portion of the Beach Cities EWMP area. **Figure 3-4** compares the annual volumes predicted by SBPAT to the annual volumes predicted by LSPC for all years between 1989 and 2011. **Figure 3-5** presents these same results in a flow duration curve format. The difference in mean annual volume between LSPC

and the calibrated SBPAT model was 2%, and the difference for the 90th percentile year was 1%, both of which are in the "very good" category for calibration in the RAA Guidelines.

Table 3-7. Mean Annual Volume Predicted by SBPAT and LSPC and Measured at the S28 Stream Gauge

Model/Source	Average Annual Volume (acre-ft)
SBPAT	2,943
LSPC	2,890
Stream Gauge	-
Difference (%)	2%

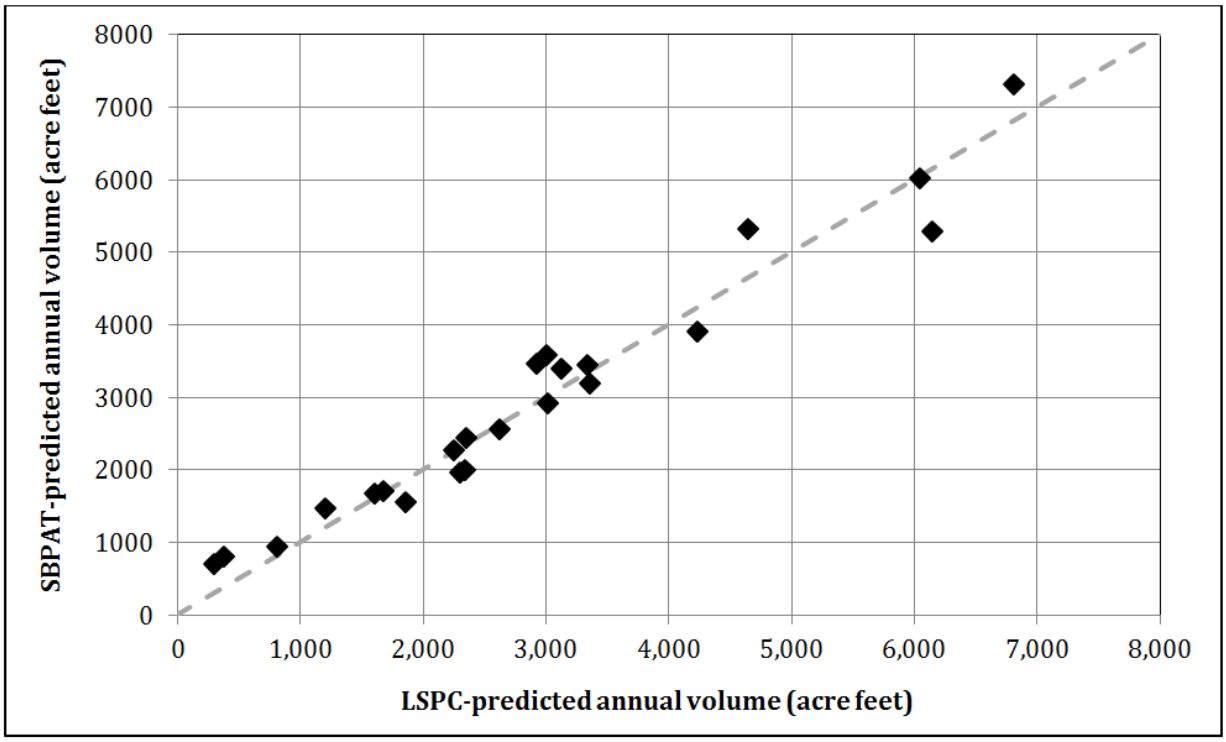


Figure 3-4. Annual Runoff Volumes Predicted by LSPC and SBPAT

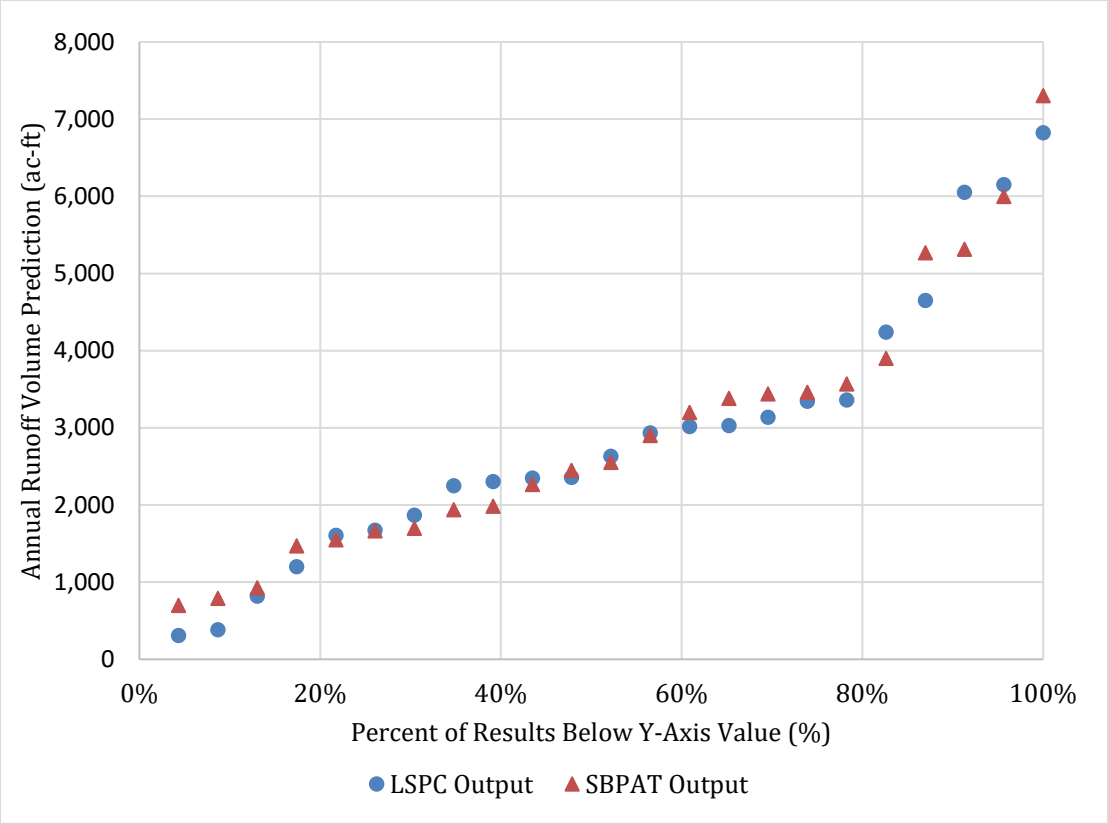


Figure 3-5. Annual Runoff Volumes Predicted by LSPC and SBPAT

Water Quality

The RAA Guidelines require water quality calibration based on available monitoring data from the most recent 10 years. However, in the portion of the Beach Cities EWMP draining to Dominguez Channel, recent water quality monitoring data are not available for the applicable pollutants for a nearby receiving water monitoring station (the Dominguez Channel mass emission station S28 (**Figure 3-2**) is located downstream of a portion of the Beach Cities EWMP area, but upstream of the rest and includes large areas outside the EWMP area), so a conventional water quality calibration was not feasible. In the future as new local monitoring data become available, SBPAT's water quality input parameters may be calibrated as part of the EWMP adaptive management process. In the meantime, to meet current model verification needs for the RAA, SBPAT's log-normal land use EMC statistics were compared with the original land use monitoring datasets upon which were based. This land use based comparison is consistent with the calibration method applied for the original county-wide LSPC model (Los Angeles County Department of Public Works, 2010).

The land use EMCs used in SBPAT were calculated from data collected by Los Angeles County between 1996 to 2000 (County of Los Angeles, 2000) for metals, and land use-specific data collected by SCCWRP (SCCWRP, 2007) between 2000 to 2005 for fecal coliform. An example of the fecal coliform distribution for high density residential land use from the SCCWRP results and the

distributions used in SBPAT for multi-family land use are shown in **Figure 3-6** for fecal coliform bacteria. An additional example of the zinc distribution for high density residential land use from Los Angeles County results and the distributions used in SBPAT is shown in **Figure 3-7**. As shown by the percentiles, the pollutant EMC distribution is well representative of measured data. The example is provided for high density residential land use since this is the dominant developed land use in the Dominguez portion of the Beach Cities WMG area. Modeled EMC values are consistent with the recommended values for land use-specific loading in Table 3.3 of the RAA Guidelines.

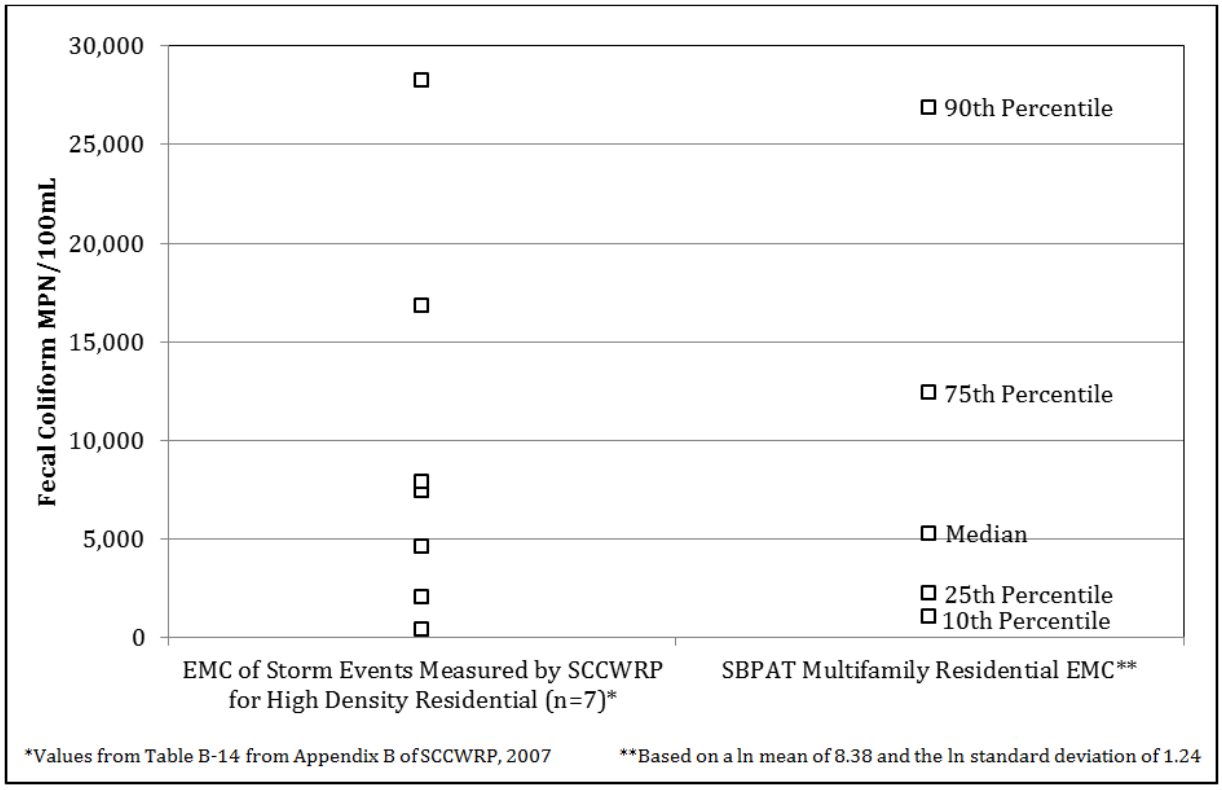


Figure 3-6. Comparison of Fecal Coliform High Density Residential EMC Values between SCCWRP Measurements (n=7) and Multi-Family Residential EMC distribution in SBPAT[22]

[22] A full log distribution is used by the model, but non-parametric summary statistics are shown for comparison.

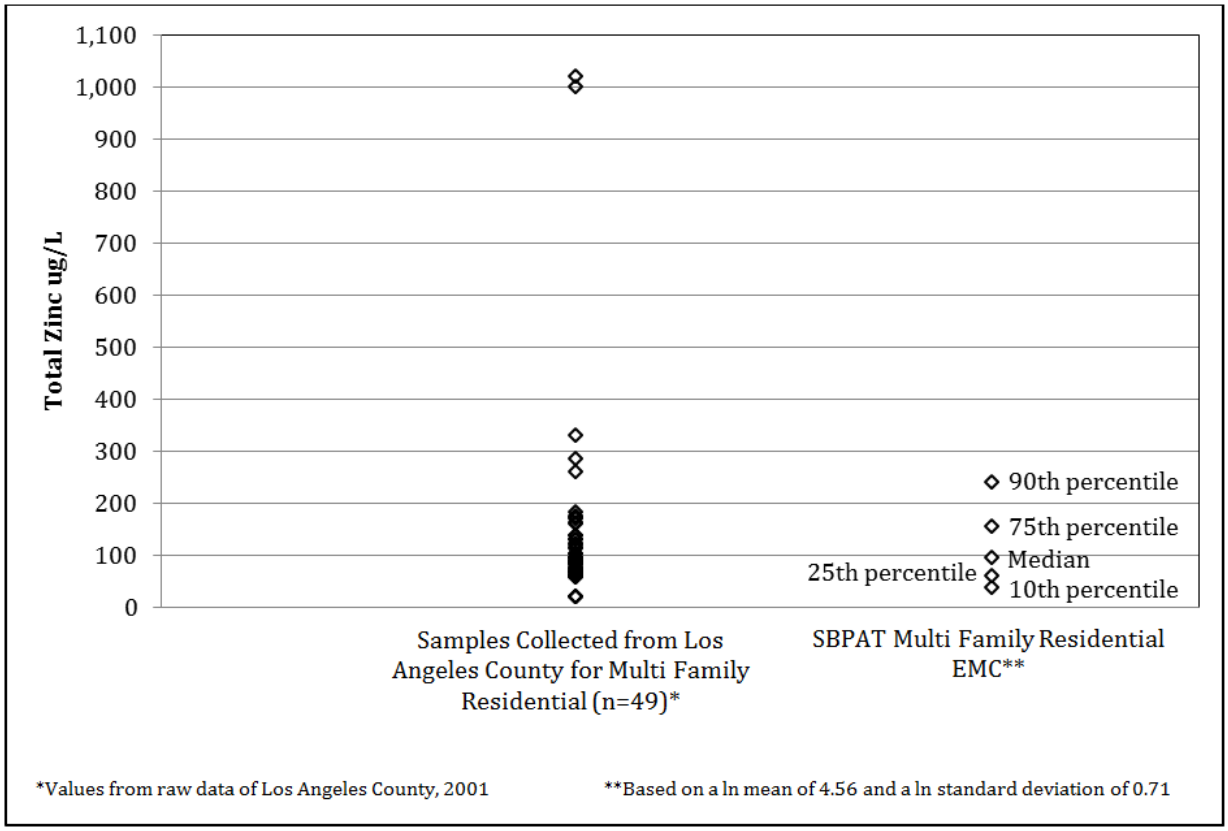


Figure 3-7. Comparison of Total Zinc Multi Family Residential EMC Values between Los Angeles County Measurements (n=4) and Multi-Family Residential EMC distribution in SBPAT[23]

3.4.4 VALIDATION

A validation step was performed to demonstrate that modeled annual fecal coliform loads are indeed predictive of the compliance metric, or annual exceedance days for fecal indicator bacteria. For bacteria modeling, verifying the linkage between modeled *fecal coliform loads* (i.e., discharged from the watershed outlets) and total observed wet weather *exceedance days* (in the receiving water, based on REC1 daily maximum water quality objectives) was critical to establish reasonable assurance that CMLs would be in compliance with the Permit limits. To establish this linkage, an analysis was conducted using shoreline monitoring data at Topanga Canyon[24] (SMB-1-18) between 2005 and 2013. As presented in Section 2.4.4, **Figure 2-11** in Section 2.4.4 illustrates that decreasing fecal coliform loads should result in measurable reductions in exceedance days, and that there is a reasonable correlation between total annual modeled fecal coliform loads and total annual observed wet weather exceedance days. Each point shown represents one TMDL year.

[23] A full log distribution is used by the model, but non-parametric summary statistics are shown for comparison.

[24] Fecal coliform data and objectives were used to represent all fecal indicator bacteria because fecal coliform has the most robust land use and BMP effluent EMC datasets.

3.5 Baseline Loads and Target Load Reductions

Baseline loads for the critical period for bacteria and metals from the entire EWMP area draining to Dominguez Channel were computed using SBPAT. For bacteria, the critical period was the 90th percentile wet TMDL year, which was computed to be 1995 as discussed in Section 3.4.2. For metals, the critical condition is the 90th percentile metal load day between 2003 and 2012. These dates were found to be November 30, 2007, February 5, 2010, and February 26, 2006 for copper, lead, and zinc, respectively, as discussed in Section 3.4.2. The computed baseline conditions for runoff volume, pollutant concentration, and pollutant loading based on 90th percentile critical condition are shown in **Table 3-8** below.

Table 3-8. Baseline Runoff, Concentration, and Load for Pollutants in the Dominguez Channel Watershed for the Critical Condition

Pollutant	90th Percentile Critical Condition	Baseline Runoff	Average Baseline Concentration [1]	Baseline Load
Copper	11/30/2007	301 ac-ft/day	25.8 µg/L	21 lb/day
Lead	2/5/2010	275 ac-ft/day	11.6 µg /L	8.7 lb/day
Zinc	2/26/2006	291 ac-ft/day	290.2 µg /L	230 lb/day
Bacteria	11/1/1994-10/31/1995	6,048 ac-ft/yr	20,080 MPN/100 mL	1,498*10^{12} MPN/yr

[1] Average pollutant concentrations are estimated as the total annual load divided by the total annual runoff volume.

The process for establishing TLRs for the modeled WBPCs (copper, lead, zinc, and bacteria in Dominguez Channel) is described in the following section. TLRs were set for the entire Dominguez Channel analysis region, including the cities of Manhattan Beach, Redondo Beach, and Torrance. Because no evidence currently exists to support a linkage between MS4 discharges and exceedances of toxicity, mercury, cadmium, cyanide, selenium, or pH in Dominguez Channel, these pollutants were not modeled as part of this analysis. This potential linkage will be re-evaluated based on results of future monitoring efforts.

3.5.1 Metals

For the Dominguez Channel and Greater LA Harbor Toxics and Metals TMDL, the final WQBELs in the Permit are expressed as allowed daily loading of total copper, total lead, and total zinc during wet weather. The WQBEL loads were calculated as the CTR freshwater chronic criteria-based numeric target concentrations (9.7, 42.7, 62.7 ug/L for total copper, total lead, and total zinc, respectively) multiplied by the daily flow volume at the time of sampling.

The following approach was implemented to calculate a wet weather TLR for each metal in the Dominguez Channel portion of the Beach Cities EWMP area:

1. The analysis region was modeled in SBPAT for TMDL years 2003 to 2012.
2. Including only wet[25] days, the day with the 90th percentile metal load (the critical daily load) was determined (see **Appendix Q**).
3. The target load was calculated by multiplying the allowed concentration by the runoff volume on that day which is the WQBEL expressed in the permit.
4. The difference between the baseline load (step 2) and the target load (step 3) resulted in a TLR for the 90th percentile load day, which was the load reduction required to meet the allowable TMDL concentration.

Appendix K provides an example calculation for this TLR process.

Zinc was found to require the greatest TLR and was also found to be the controlling pollutant for BMP implementation, meaning that meeting the zinc requirement required the most stringent BMP implementation, which will likely produce load reductions for the other pollutants greater than the TLR. The TLR for lead was found to be zero because the baseline concentration on the 90th percentile critical day was found to be less than the allowed concentration. TLRs for each of the metals are shown in **Table 3-9**.

3.5.2 Fecal Coliform Bacteria

Since no TMDL exists for this WBPC, an approach was developed to compute a wet weather bacteria TLR consistent with freshwater bacteria TMDLs in the region, which use allowable exceedance days (per year) and the 90th percentile critical year as the basis for their WLAs. The TLR calculation for bacteria for Dominguez Channel EWMP area was similar to the method used in the SMB portion. The method relates the annual number of modeled calendar days with rainfall-generated runoff (or "discharge days") to the expected annual bacteria exceedance days. The validation of this methodology on the Arroyo Sequit reference watershed is described in Section 2.5.1.

The TLR-development methodology was applied to the EWMP area to predict the number of baseline exceedance days for the 90th percentile year, or TMDL year 1995. Once the number of baseline discharge days were estimated, the number of allowed discharge days was established. Consistent with other Los Angeles region freshwater bacteria TMDLs, it was assumed that 19% of non-high flow suspension days were allowed to exceed the REC1 single sample limit, or 400 MPN/100mL for fecal coliforms[26].The D1070 rain gauge, which was used to determine the 90th percentile year and used to model both the Dominguez Channel and Santa Monica Bay portions of the EWMP area, was used to determine the number of wet days and high flow suspension days in TMDL year 1995. Wet day definition and high flow suspension day definition were based on other

[25] Wet days defined as days in which gauge S28 has flows equal than or greater than 62.7 cfs. Due to insufficient continuous flow data at this gauge, wet days were estimated as days in which flows in SBPAT were non-zero excluding days with less than 0.1 inch of rainfall. This is discussed in more detail in Section 3.4.2.

[26] Fecal coliform, and its previous freshwater Basin Plan objective value (400 mpn/100mL), is used as the modeled surrogate for *E. coli* due to its more robust available modeling datasets.

bacteria TMDLs in the region, where wet days are days in which 0.1" or greater of rainfall occur, plus the following 3 days, and high flow suspension days are days in which 0.5" or greater of rainfall occur plus the following day. In TMDL year, 1995, a total of 73 wet days (19 of which were high flow suspension days) occurred using this methodology. Because the REC1 single sample limits are suspended on high flow suspension days, the total number of applicable wet days is 54. Using the 19% allowable exceedance rate, the number of allowable exceedance days was set to 10 (19% x 54 wet days). Thus, 10 wet days (that are not high flow suspension days) were allowed to exceed 400 MPN/100mL. Any remaining exceedance days must be removed using BMPs.

To determine the TLR necessary to meet the allowed discharge days, a virtual retention BMP was modeled in SBPAT at the outlet of the EWMP area. This approach was presented to LARWQCB staff on June 6, 2014 and verbal feedback received during the meeting was supportive.

For the outlet virtual retention BMP included a diversion with a virtual hydraulic capacity that results in a model-derived bypass frequency (or number of discharge days), during TMDL year 1995 that meets the allowable exceedance day criteria. The diversion is modeled as a full capture system. High flow suspension days were not included in the number of exceedance days, and the concentration on each discharge day was confirmed to be greater than 400 MPN/100mL to ensure it was actually an exceedance day. The diversion is modeled as a full capture system. The load reduction resulting from this BMP scenario (i.e., baseline analysis region load minus analysis region load with the diversion system and retention BMP in place) became the TLR. "Reasonable assurance" of compliance with the allowed discharge days was then considered to have been met when actual and proposed BMPs combined to achieve the TLR for each analysis region. The calculated TLR for bacteria is shown in **Table 3-9**.

In summary, the following approach was implemented to calculate a wet weather bacteria TLR in the Dominguez Channel analysis region:

1. The analysis region is modeled in SBPAT for the 90th percentile year (TMDL year 1995) (see **Appendix Q**).
2. The existing, baseline condition (i.e., without any outlet retention BMP) is modeled for the analysis region, resulting in a mean baseline fecal coliform (FC) load for the 90th percentile year (baseline load).
3. The allowable number of non-high flow suspension discharge days is calculated to be 10 (19% of 54 non-high flow suspension wet weather days in TMDL year 1995).
4. An in-stream diversion to a large, virtual retention BMP at the outlet of the analysis region is iteratively sized so that the number of non-high flow suspension discharges meets the criteria established in Step 3.
5. The diversion and retention BMP is then modeled in SBPAT to produce a mean FC load for the 90th percentile year (allowed load).
6. The difference between the baseline load (step 2) and the allowed load (step 5) results in a TLR for the 90th percentile year, which is the load reduction required to meet the 10 allowable exceedance days for wet weather.

7. In order to meet the allowable exceedance days of 10, the TLR (as a percentage of the baseline 90th percentile year load) is 33%.

Table 3-9. Target Load Reductions and Baseline Conditions for Pollutants in the Dominguez Channel Watershed for the Critical Condition

	Baseline Data for Critical Condition			Allowable Discharge for Critical Condition			Target Load Reduction[2]	
Pollutant	Runoff Volume	Pollutant Conc.[1]	Pollutant Load	Runoff Volume	Pollutant Conc. [1]	Pollutant Load	Absolute Load	% of Baseline Load
Copper	301 ac-ft/day	25.8 µg/L	21 lb/day	301 ac-ft/day	9.7 µg /L	8 lb/day	13 lb/day	62%
Lead	275 ac-ft/day	11.6 µg /L	8.7 lb/day	275 ac-ft/day	42.7 µg /L	32 lb/day	0 lb/day	0%
Zinc	291 ac-ft/day	290.2 µg /L	230 lb/day	291 ac-ft/day	69.7 µg /L	55 lb/day	175 lb/day	76%
Bacteria	6,048 ac-ft/yr	20,080 MPN/100 mL	$1{,}498*10^{12}$ MPN/yr	6,048 ac-ft/yr	13,454 MPN/100 mL	$1{,}004*10^{12}$ MPN/yr	$493*10^{12}$ MPN/yr	33%

[1] Bacteria concentration is estimated as the total annual load divided by the total annual runoff volume. The pollutant concentrations presented for the Dominguez Channel Toxics TMDL are a direct output from the LSPC model used for the RAA.

[2] RAA demonstration is made based on the achievement of the TLR values in terms of absolute load removed by the proposed suite of BMPs in each analysis region. The allowed conditions in terms of runoff volume and concentration are shown for informational purposes only.

3.6 Best Management Practices

3.6.1 Methods to Select and Prioritize BMPs

In order to demonstrate reasonable assurance, BMPs were identified in a prioritized manner. Prioritization was based on cost (low cost BMPs were prioritized); BMP effectiveness for the pollutants of concern (BMPs that had greater treatment efficiency for the pollutant of concern in a particular analysis region were prioritized over other BMPs); and implementation feasibility as determined by the Beach Cities agencies. In general, nonstructural BMPs were prioritized over structural BMPs due to their lower relative cost, and then structural BMPs were identified that would likely result in the greatest load reduction per dollar.

The RAA was performed according to the following steps:

1. Calculate load reductions associated with existing structural BMPs;
2. Assume a load reduction for non-modeled non-structural BMPs(five percent of baseline pollutant load);

3. Calculate load reductions for public retrofit incentives (e.g., downspout disconnects) and redevelopment;
4. Calculate load reductions attributable to anticipated new permit compliance activities of non-MS4 entities (e.g., Industrial General Permit holders and Caltrans);
5. Calculate load reductions for proposed regional BMPs that were identified in existing plans; and
6. Meet the TLR by backfilling the remaining load reduction with new regional or distributed green streets BMPs, with green streets modeled by assuming treatment of runoff from a percentage of specific developed land uses.

The following schedule assumptions were made:

- Only BMPs implemented after the TMDL effective date (2012) were included;
- Redevelopment BMPs were assumed to use different sizing criteria before and after 2015 (EWMP submittal date), consistent with the Permit's post-construction requirements; and
- Modeled load reduction outputs are reported for the proposed interim bacteria (2018, 2023, and 2027) and final proposed bacteria/toxics TMDL (2032) compliance dates.

3.6.2 Recommended MCMs and Nonstructural BMPs

See Section 2.6.2. All information provided in **Table 2-8**, excluding the City of Hermosa Beach (which is not in the Dominguez Channel Watershed), also pertains to the Dominguez Channel Watershed.

3.6.3 Quantified Non-Structural BMPs

Non-structural BMPs have been categorized as follows. Specific model inputs are summarized below. No modeling of non-structural BMPs was conducted in the City of Torrance, as all load reductions were quantified based on literature references.

Non-Modeled Programmatic BMPs

These source controls include a combination of BMPs such as new or enhanced pet waste controls (ordinance, signage, education/outreach, mutt mitts, etc.), Clean Bay Restaurant Program, human waste source tracking and remediation (e.g., leaking sewer investigations, etc.), enhanced street sweeping (e.g., 100% vacuum sweepers, increased frequency, posting of 'No Parking' signs for street sweeping, etc.), increased catch basin and storm drain cleaning, and other new or enhanced nonstructural BMPs that target the pollutants addressed in this EWMP. The City of Torrance, for instance, has committed to such BMPs as smart gardening program enhancements, TMDL-specific stormwater training, enhancement of commercial and industrial facility inspections, enhancement escalation procedures, improved street sweeping technology, and reduction of irrigation return flow. A combined credit of 5% load reduction was applied for all pollutants to represent the cumulative benefit from non-modeled programmatic BMPs.

In addition, a separate load reduction is assumed for copper due to the elimination of copper in brake pads. In 2010, California Senate Bill 346 (SB 346) was enacted to eliminate nearly all use of copper in brake pad manufacturing. In 2013, TDC Environmental prepared a draft detailed study for the California Stormwater Quality Association (CASQA) describing the expected percent reduction for copper as a result of the passage of SB 346 (TDC Environmental, 2013). The TDC study identifies three possible implementation scenarios, the least aggressive of which estimates that a 55% load reduction in copper will be achieved by 2032 due to the brake pad phase out. Therefore, a 55% load reduction was assumed for copper in the Greater LA Harbor analysis region; however, to avoid double counting load reductions, this reduction was applied to the copper load *after* accounting for all future nonstructural and structural BMP load reductions.

Modeled Redevelopment

Beginning in 2001, redevelopment projects were required by the Permit (via the SUSMP) to incorporate stormwater treatment BMPs into their projects if their project size exceeded specified thresholds. The 2001 MS4 Permit SUSMP redevelopment requirements were applied between 2012 (the point at which the Metals TMDL was implemented) and 2015 for the Dominguez Channel EWMP area. Redevelopment in this period was modeled as flow-through media filters at a 0.2 in/hr design event**.**

The 2012 MS4 Permit established new criteria for redevelopment projects, requiring certain sized projects to capture, retain, or infiltrate the 85th percentile design storm or the 0.75-inch design storm, whichever is greater, via the implementation of LID BMPs. To account for these redevelopment requirements in the Cities of Redondo Beach and Manhattan Beach, BMPs were modeled in SBPAT assuming land use-specific annual redevelopment rates for projects that triggered former SUSMP requirements or will trigger the Permit's LID BMP requirements (**Table 3-10).** No load reduction from this non-structural BMP was quantified for the City of Torrance.

Table 3-10. Estimated Annual Redevelopment Rates

Land Use	Annual Redevelopment Rate (% of total land use area)	
	Cities of Redondo Beach and Torrance[1]	City of Manhattan Beach
Residential	0.18	0.10
Commercial	0.15	0.38
Industrial	0.34	0.38
Education	0.16	0.16
Transportation	2.7	2.7

[1]Regionally developed redevelopment rates were applied to the City of Torrance and Redondo Beach (City of Los Angeles Bureau of Sanitation, 2012).

A City-specific redevelopment rate of 3.8 percent for commercial redevelopment in Manhattan Beach was provided based on historical SUSMP data over the past ten years. This value was also assumed for historical industrial redevelopment and both commercial and industrial redevelopment moving forward. For residential land use, because there are insufficient data to

project LID rates, a nominal 0.10 percent was assumed and is subject to change based on the model outcomes and discussions with City staff as the LID ordinance is finalized.

BMPs were assumed to be implemented and to continue be implemented in the future, at these rates across five distinct time periods in the Dominguez Channel watershed:

- **2012 (Dominguez Channel Toxics TMDL Effective Date) – 2015:** The SUSMP requirements, based on the 2001 MS4 Permit, were assumed to be implemented over this period as flow-through media filters at a 0.2 in/hr design intensity (Los Angeles County Department of Public Works, 2002).
- **2015 - 2032 (Final Dominguez Channel Toxics TMDL Compliance Deadline and Proposed Final Bacteria Compliance Deadline):** The 2012 MS4 Permit post-construction requirements were assumed to be implemented over this period as 50% biofiltration and 50% bioretention. Biofiltration (bioretention with underdrains) were modeled using bioswale BMP types with effluent EMCs set to bioretention and sized to retain 150 percent of the 1-year, 1-hour design storm (approximately 0.3 in/hr) because they do not retain all the design storm volume on site (they are flow-through systems), while bioretention units were sized to retain 100 percent of the 85th percentile, 24-hour design storm depth, calculated as the mean for each analysis region.

2015 is used as a transition date since the LID post-construction requirements from the 2012 MS4 Permit are required to be in full effect via local LID ordinances by this time.

In order to estimate load reductions associated with these redevelopment BMPs, the land use percentages shown in **Table 3-10** were multiplied by the respective land use areas in each analysis region, resulting in an assumed area treated by LID BMPs each year. This area was multiplied by the applicable number of years, since new BMPs are assumed to be implemented each year. The total land use area assumed to be redeveloped for each analysis region was then modeled as being treated and the total load reduction was quantified. The default design parameter assumptions for the biofiltration redevelopment projects were that the longitudinal slopes were 0.03 ft/ft, Manning's n was 0.25, hydraulic residence time was 10 min, and water quality flow depth was 4 in.

Modeled Public Retrofit Incentives

These BMPs include programs directed at incentivizing the public to decrease the amount of stormwater runoff from their property, specifically via downspout disconnects. Public incentives for retrofitting existing development were modeled in SBPAT between 2015, when the EWMP will begin to be implemented, and the respective TMDL final compliance date. No quantification of these load reductions was done for the City of Torrance, although they may be taken into account in future iterations. Public retrofit incentives were assumed to be a downspout disconnection program, modeled as bioswales sized to a design storm intensity of 0.2 in/hr (see **Table 2-10**). The default design parameter assumptions for the biofiltration redevelopment projects were that longitudinal slopes were 0.03 ft/ft, Manning's n was 0.25, hydraulic residence time was 10 min, and water quality flow depth was 4 in.

Assumptions included that 10 percent of single family residential areas would be converted to disconnected downspout systems over 2015 to 2021, and that, based on GIS analysis, 38 percent of

the single family residential area consists of rooftops that can be effectively disconnected. Therefore, 3.8 percent of single family residential neighborhoods were modeled as treated by bioswales in order to account for public retrofit incentives.

Modeled Non-MS4 Permitted Parcels or Areas

SBPAT was used to quantify the load reduction assuming that regulated parcels/areas would be in compliance with the NPDES Statewide Storm Water Permit Waste Discharge Requirements (WDRs) from State of California Department of Transportation (Order No. 2012-0011-DWQ, NPDES No. CAS000003) and the California NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Industrial General Permit [IGP], Order 2014-0057-DWQ) (**Figure 3-8**). The load reduction from these areas was quantified in analysis region DC-RB/MB. This load reduction was obtained from these areas by simulating treatment plants sized to treat the IGP's design storm requirement, the 85th percentile, 24-hour storm event, with an effluent concentration set equal to the water quality standard (see Section 2.6.3). For fecal coliform, 400 MPN/100mL was used. In the Dominguez portion of the Beach Cities EWMP, these constituted only a small fraction of the total area.

3.6.4 Structural BMPs

Structural BMPs have been categorized as follows. Proposed distributed BMPs in the Dominguez Channel Watershed area of the Beach Cities EWMP are shown in **Figure 3-9**, and existing and proposed regional BMPs are shown in **Figure 3-10**.

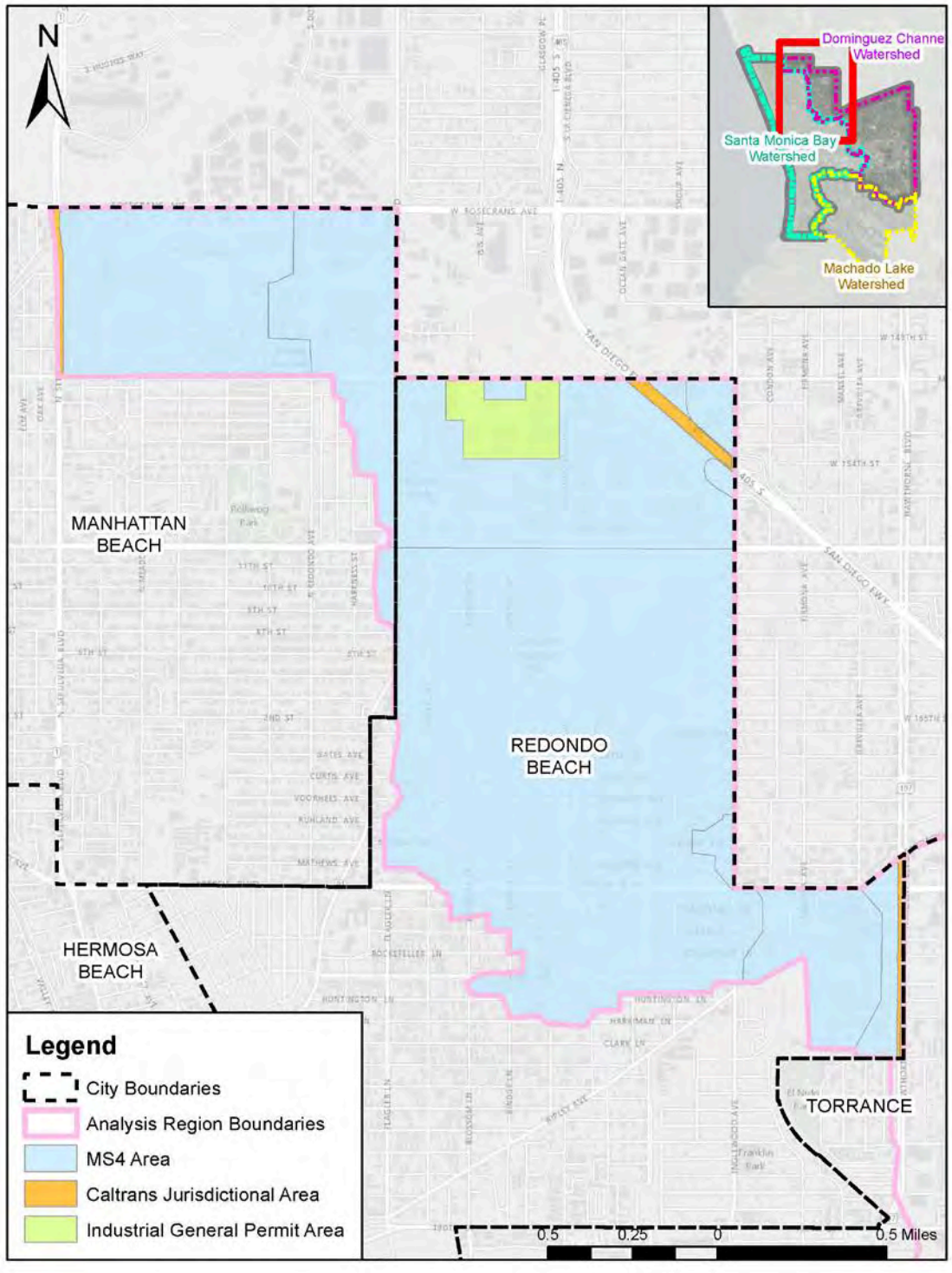


Figure 3-8. IGP and Caltrans Area within the Dominguez Channel portion of the Beach Cities EWMP Area

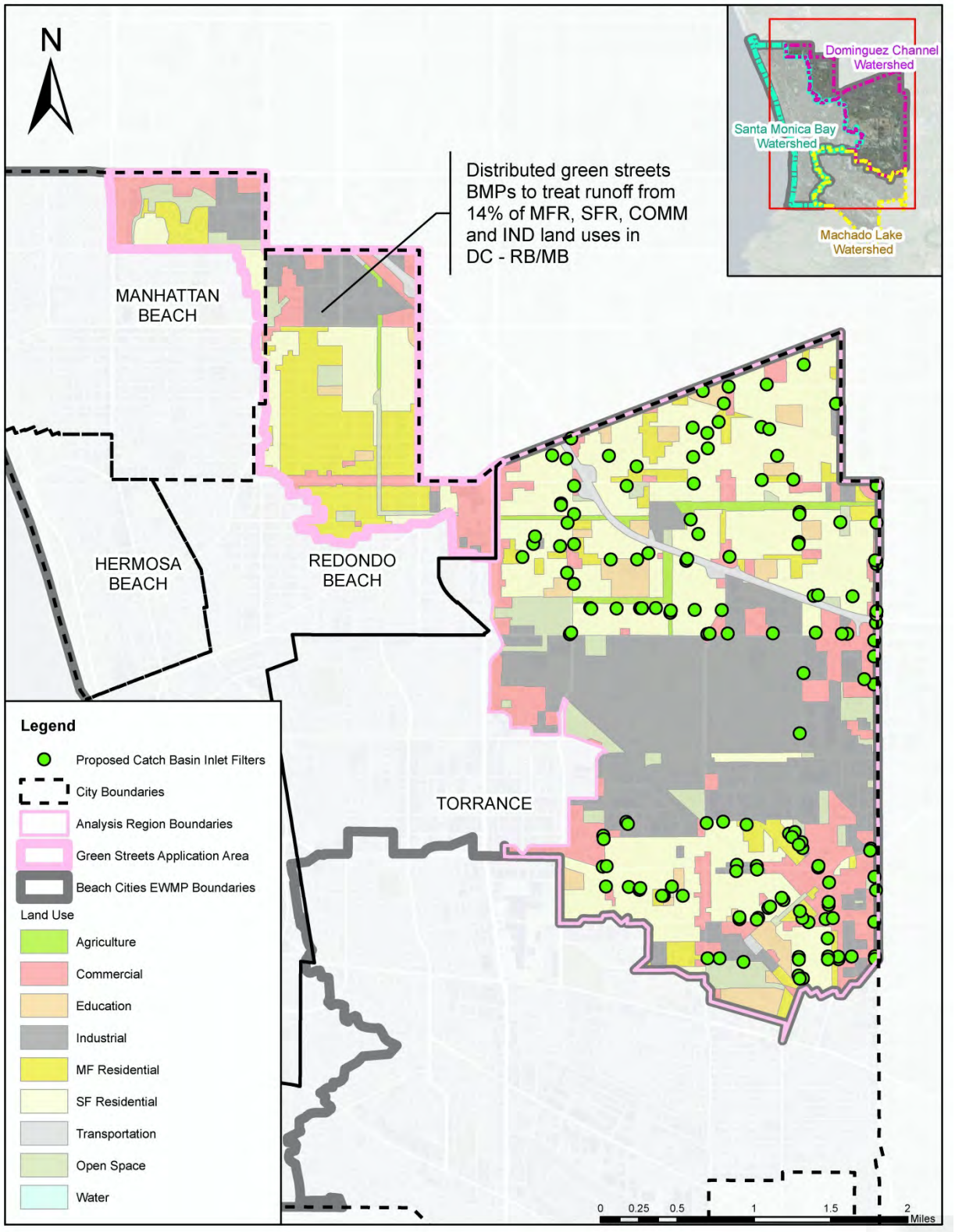


Figure 3-9. Proposed Distributed BMPs within the Dominguez Channel Watershed

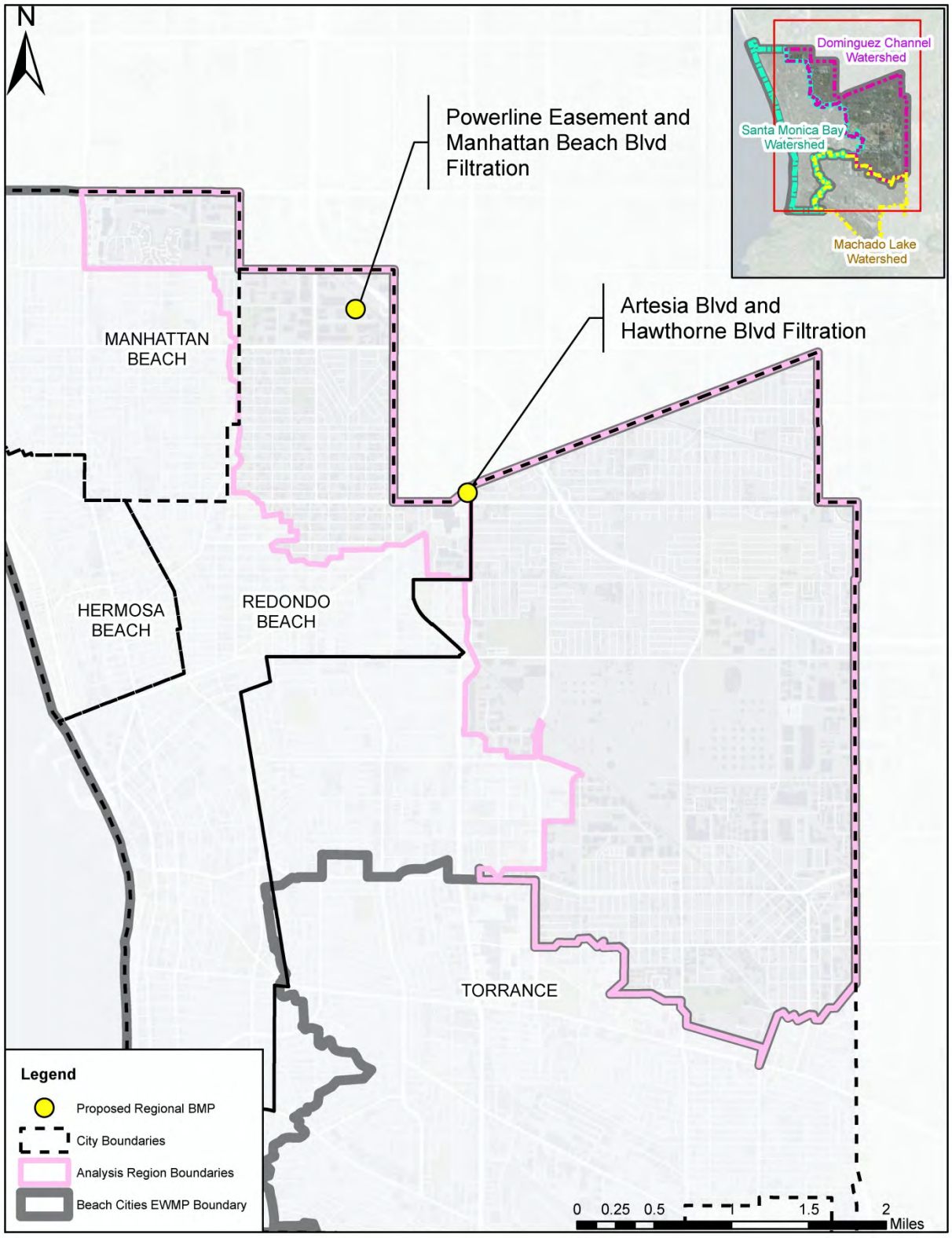


Figure 3-10. Proposed Regional BMPs within the Dominguez Channel Watershed

Existing Regional BMPs

There are no existing regional BMPs in either Dominguez Channel analysis region; as such, none were modeled in SBPAT.

Proposed Regional BMPs

Two regional BMPs are being proposed in the Dominguez Channel Watershed, both within the City of Redondo Beach in Analysis Region DC-RB/MB.

Analysis Region DC – RB/MB

Two proposed regional BMPs in the DC-RB/MB analysis region were modeled in SBPAT based on conceptual design information and discussions with the Beach Cities WMG (**Figure 3-11**). While the BMPs are conceptual at this point, they will include media filtration such as proprietary media filters or bioretention. Infiltration is not feasible due to the low saturated flow rates in the areas where regional BMPs could be constructed (0.3-0.4 in/hr).

Powerline Easement Filtration. This regional BMP would include a filtration system (i.e., media filter, biofilter, or bioretention with underdrains) or systems along the powerline easement. This BMP could be constructed to capture runoff from the EWMP areas draining towards the intersection of Manhattan Beach Blvd and Inglewood Ave. In order to determine a conservative estimate of the footprint available for this BMP, an analysis was conducted along the powerline easement and along Manhattan Beach Blvd that included the following criteria:

- 100 ft away from large utility poles; and
- 25 ft away from roads, railroads, and buildings.

These criteria aim to address some of the concerns with BMP construction within a powerline easement, as was previously described. The resulting approximate footprint shown in **Figure 3-11** should be considered approximate and large enough to allow for construction in the roadway right-of-way or easement or both. It is noted that this is meant to be a conservative estimate given the above criteria and would be sited to capture runoff from the drainage area shown in **Figure 3-11.** The total footprint area calculated for this BMP was 313,500 square feet. It was assumed that approximately 15% of this area would be used for pretreatment (10%) and side slopes (5%) so only 85% of the area was used as the footprint available for filtration. The BMP was modeled as a flow through BMP, with the only storage available being the pretreatment. A media filter was chosen to represent this BMP. The treatment rate was set to 10 inches per hour multiplied by the available footprint. This constitutes a design flow of approximately 48% of the 0.2 in/hr 85th percentile design intensity in the Permit. The BMP was assumed to be 5 feet deep, and the diversion flow rate was estimated based on the flow rate from 0.2 in/hr on the drainage area using the rational method. Modeling criteria are shown in **Table 3-11**.

A potential alternative location to the Powerline Easement Filtration facility is the green space adjacent to Manhattan Beach Blvd and Marine Avenue. Due to limited spatial availability, high-capacity filter media would be required for the alternative location in order to achieve the same reduction objective as the Powerline Easement Filtration facility.

Both potential locations for this BMP would provide the additional benefits of neighborhood greening, potentially mitigating issues such as the urban heat island effect and also raising public education/awareness.

Artesia Blvd and Hawthorne Blvd Filtration. This regional BMP would include a filtration system or systems near the intersection of Artesia Blvd and Hawthorne Blvd. It was assumed that this BMP could be constructed to capture runoff from the EWMP areas draining towards this intersection. A conceptual footprint was developed based on the space available in medians, park strips, and areas that could be converted for subsurface filtration systems. The approximate footprint is shown in **Figure 3-11**.

The total footprint area calculated for this BMP was 43,700 square feet. It was assumed based on other similar BMPs in the Los Angeles region that approximately 15% of this area would be used for pretreatment (10%) and side slopes (5%), so only 85% of the area was used as the footprint available for filtration. The BMP was modeled as a flow-through BMP, with the only storage available being the pretreatment. A treatment plant type BMP was chosen for the modeling, and the EMCs from distributed media filters were assigned to the treatment plant to simulate a regional media filter. The treatment rate was set to 10 inches per hour multiplied by the available footprint. This constitutes a design flow of approximately 63% of the 0.2 in/hr intensity in the Permit. The BMP was assumed to be 5 feet deep, and the diversion flow rate was estimated based on the flow rate from 0.2 in/hr on the drainage area using the rational method. Modeling criteria are shown in **Table 3-11**.

This BMP would provide the additional benefit of neighborhood greening, potentially mitigating issues such as the urban heat island effect and also raising public education/awareness.

Analysis Region Dominguez Channel – Torrance (DC-Torrance)

No regional BMPs are proposed in the DC-Torrance analysis region.

Summary of Proposed Regional BMPs

Two regional BMPs are proposed in the Dominguez Channel portion of the Beach Cities EWMP Area. None of these projects could be feasibly sized to meet the 85th percentile design criteria. However, the BMPs were sized to collectively meet the target load reductions necessary to achieve compliance with the WQBELs and RWLs, in combination with other existing and proposed structural and non-structural BMPs. Proposed regional BMPs, including their location, analysis region, project name, model inputs, and expected performance, are summarized in **Table 3-11.**

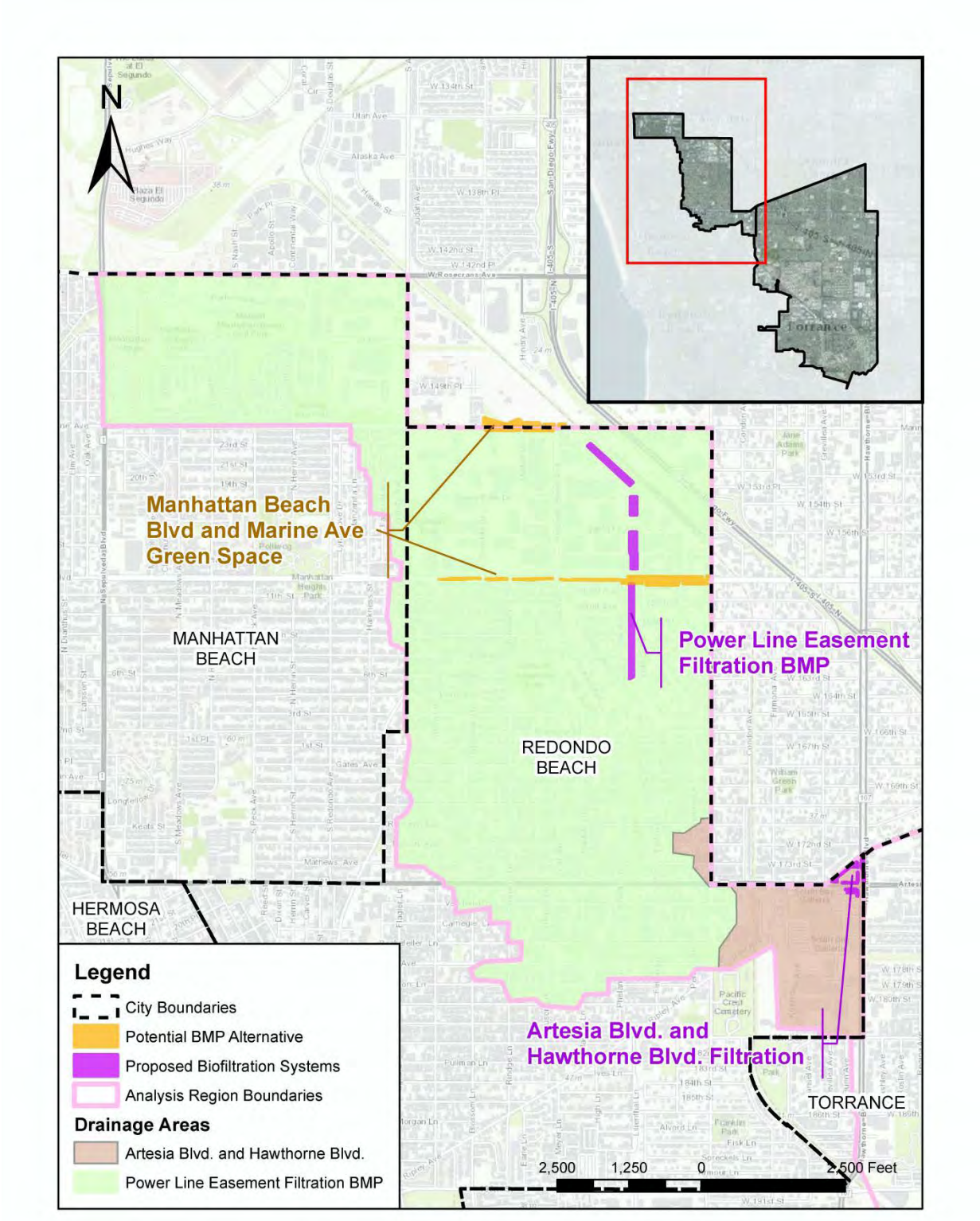


Figure 3-11. Proposed Regional BMPs, DC-RB/MB Analysis Region

Table 3-11. Parameters and Performance for Proposed Regional BMPs Modeled as Media Filters

Location of BMP	Analysis Region	Project Name	Model Assumptions						Expected Performance (load reduction as a % of analysis region baseline load)
			Design Storm (in/hr)	Treatment Flow Rate (cfs)	Average Basin Depth (ft)	Equalization Volume (cu-ft)	Diversion Flow Rate (cfs)	Infiltration Rate (in/hr)[1]	
Redondo Beach	DC-RB/MB	Powerline Easement Filtration	0.09	62	5	141,086	132	0.00001	Fecal coliform: 36% Zinc: 34% Copper: 26%
Redondo Beach	DC-RB/MB	Artesia Blvd and Hawthorne Blvd. Filtration	0.13	8.6	5	19,682	13.6	0.00001	Fecal coliform: 9% Zinc: 5% Copper: 4%

[1] Model requires some infiltration, but infiltration minimized to essentially 0.

Existing Distributed BMPs

No existing distributed BMPs were accounted for or modeled in the Dominguez Channel portion of the Beach Cities EWMP area.

Proposed Distributed BMPs

Proposed distributed BMPs are depicted in **Figure 3-9**. Distributed green streets BMPs are proposed and were modeled as part of the RAA within the DC-RB/MB analysis region, at an implementation level of 14% (i.e., runoff from 14% of single family residential, multi-family residential, commercial, and industrial land uses would be treated by green streets BMPs designed as described in Section 2.6.4).

Approximately 200 catch basin inlet filters (media filtration devices with a variety of media types and configurations such as cartridge filters, vertical bed filters, etc.) are proposed within the DC-Torrance analysis region. Infiltration of runoff is not feasible in the DC-Torrance analysis region due to the prevalence of Montezuma Clay Adobe soils. Roads represent a potentially significant source of pollutant loads, and therefore treating road runoff is considered a key strategy for multi-pollutant TMDL implementation. Implementing catch basin inlet filters throughout the DC-Torrance Watershed is highly applicable because of the high density of catch basins. The predicted load reduction attributable to catch basin inlet filters was estimated on a percent load removal basis, extracted from a review of relevant literature.

Fact sheets and literature available on commercially available catch basin inlet filters suggest that catch basin inlet filters are effective at capturing and removing pollutants from stormwater runoff including sediments, heavy metals, and bacteria. A study titled, Optimization of Stormwater Filtration at the Urban/Watershed Interface by the University of California, Irvine, Department of Environmental Health (2005), estimated a 99% removal efficiency of lead concentrations by a grate inlet skimmer box/round curb inlet basket. Another study conducted by the City of El Monte at Longo Toyota in 2002 concluded that the grate inlet skimmer box/round curb inlet baskets were effective in removing 95% of zinc and copper concentrations and 87% of lead concentrations.

A more recent independent test conducted in 2013-2014 by the City of Lake Forest showed that the tested catch basin inlet filters achieve 75% removal of heavy metals. The product tested was the Ultra Filter Sock Heavy Metal Drain Filter.

For bacteria, the 2005 UC Irvine study found a fecal coliform removal efficiency of 33% by the grate inlet skimmer box/round curb inlet basket.

In addition, the City of Torrance is in the process of developing the Green Street Program and the ordinances to implement green street design features as part of street redevelopment. While implementing redevelopment of arterial streets, the City of Torrance would assess opportunities for Green Street design features to facilitate treatment through filtration or infiltration. Green street elements may include infiltration trench that provides water quality treatment, reduction in peak flow discharges, and potential groundwater recharge. Other green street elements that may be considered include bioretention/biofiltration practices to achieve water quality treatment through

filtration by vegetation and soils to remove pollutants with perforated underdrain to convey the treated runoff. The City of Torrance is committed to developing the Green Street Policy by July 2015, as required by the MS4 Permit.

3.7 Reasonable Assurance Analysis Results

3.7.1 Discussion of Limiting Pollutants

Zinc was determined to be the controlling pollutant, therefore the cumulative BMP load reductions for copper, lead, and bacteria are each greater than their respective TLRs. Ammonia, cyanide, pH, selenium, mercury, and cadmium were not modeled as part of the Beach Cities' RAA; however, the implementation of the proposed BMPs is expected to achieve similarly substantive load reductions for these pollutants as for zinc. Meeting the zinc requirement required the most stringent BMP implementation, which is expected to also address all Category 1, 2 and 3 pollutants in Dominguez Channel.

3.7.2 Wet Weather

For all pollutants in the DC-RB/MB analysis region, cumulative load reductions are predicted to meet the interim and final TLRs. The non-structural BMPs achieve a relatively minor load reduction for zinc compared to the regional BMPs and the distributed green streets. After accounting for the load reductions attributed to non-modeled programmatic, public incentives and redevelopment, non-MS4 compliance, and regional BMPs, the implementation of distributed green street BMPs to treat stormwater from 14% of residential, commercial, and industrial land uses within Redondo Beach and Manhattan Beach was required to meet the zinc TLR (the limiting pollutant). **Table 3-12** below summarizes the estimated load reductions achieved by the proposed BMPs for both the interim and final compliance deadlines.

Within the DC-Torrance analysis region, cumulative load reductions are dependent on the level of implementation of the planned catch basin inlet filters. At this time, inlet filters are planned for 200 of 643 catch basins in the analysis region, targeting high priority areas. Since the estimated load reduction is applicable per filter, and not to the entire analysis region, monitoring and subsequent adaptive management will be employed through CIMP monitoring to evaluate the achieved load reductions prior to each of the compliance deadlines, installing additional filters as needed or proposing additional structural/non-structural BMPs until compliance is achieved for every applicable WQBEL or RWL. At this time, the City of Torrance is not committing to any regional or distributed BMPs, aside from catch basin inlet filters and a review of green streets opportunities.

It should be noted that if at any time specific distributed green streets or regional/centralized BMPs are found to be infeasible for implementation, alternative BMPs or operational changes will be planned within the same analysis region and within the same timeline, to meet an equivalent load reduction. The performance of the proposed catch basin inlet filters within the City of Torrance will also be evaluated as potential alternatives to the proposed structural BMPs within the Cities of Redondo Beach and Manhattan Beach.

Zinc

The zinc load reductions were quantified on the 90th percentile wet load day which was determined during TLR calculations (**Table 3-12**). Load reductions vary by day due to storm timing and size and due to some variability in the randomly generated pollutant concentrations in the model. To ensure that the load reductions estimated on the 90th percentile load day are not significantly greater than typical daily load reductions, and to get an idea of the variability, the average of the daily load reductions during the 10 year modeling period were also calculated. The predicted zinc load reduction achieved on the 90th percentile load day in the DC-RB/MB analysis region is estimated to be 79%, which is greater than the TLR of 76%. Most of the zinc reduction comes from the proposed regional infiltration BMPs. For comparison, the average daily load reduction was 98%. Because the 90th percentile day has more flow than an average day, the capture rate of the BMPs would be expected to be lower on this day than for smaller storms, thereby justifying the decreased load removal on the 90th percentile day.

The estimated zinc load reduction in analysis region DC-Torrance is 85%, including both non-structural and distributed (catch basin inlet filters) BMPs, which is greater than the TLR of 76%. As noted above, the estimated load reduction cannot be applied to the entire analysis region. Therefore, adaptive management will be strongly employed to evaluate the achieved load reductions prior to each of the compliance deadlines, installing additional filters as needed.

Copper

The copper load reductions were quantified on the 90th percentile wet load day which was determined during TLR calculations (**Table 3-12**). Similar to zinc, the average of the daily load reductions during the 10 year modeling period are also shown to account for variability. The load reduction achieved on the 90th percentile load day in the DC-RB/MB analysis region is predicted to be 85%, which is greater than the TLR of 62%.

The estimated copper load reduction in the DC-Torrance analysis region is predicted to be 89%, which also exceeds the copper TLR of 62%. As noted above, the estimated load reduction cannot be applied to the entire analysis region. Therefore, adaptive management will be strongly employed to evaluate the achieved load reductions prior to each of the compliance deadlines, installing additional filters as needed.

Fecal Coliform

The average bacteria load reduction for TMDL year 1995 was quantified and compared to the TLR calculated for the 90th percentile critical year (1995) (**Table 3-12**). The predicted load reduction of 74% within the DC-RB/MB analysis region is greater than the TLR of 33%. Most of the reduction comes from the regional BMP filtration systems.

In the City of Torrance, the estimated bacteria load reduction is 38%, which is greater than the TLR of 33%. As noted above, the estimated load reduction cannot be applied to the entire analysis region. Therefore, adaptive management will be strongly employed to evaluate the achieved load reductions prior to each of the compliance deadlines, installing additional filters as needed.

Lead

Although the load reductions for lead were not quantified because no load reductions were required to meet the TMDL WQBEL, the implementation of the proposed BMPs will result in similarly substantive load reductions for lead as for other metals. FAA and USEPA efforts to phase out lead from Avgas will further reduce lead in stormwater runoff in the future.

Time Series Output

Electronic input and output SWMM files and Excel summary spreadsheets will be provided to the LARWQCB upon submittal of this Draft EWMP.

Table 3-12. Dominguez Channel Watershed – RAA Results – Interim and Final Compliance

Pollutant	Date	Implementation Benefits (average load reduction as % of baseline for the critical condition[1])							TLR	Compliance (TLR Met)?
		Non-Structural BMPs (Non-Modeled)	Public Retrofit Incentives + Redevelopment	Non-MS4	Regional BMPs	Distributed BMPs	Distributed BMP Implementation Level	Estimated Load Reduction		
Analysis Region DC-RB/MB										
Zinc	2032 (Final)	5%	9%	6%	39%	20%	14% SFR, MFR, COM, IND	**79%**	**76%**	Yes
Copper	2032 (Final)	24%[2]	0%	5%	30%	26%		**85%**	**62%**	Yes
Fecal coliform	2022 (Interim)	2.1%	1.5%	0.7%	0%	4.1%	3% SFR, MFR, COM, IND	**8.4%**	**8.3%**	Yes
	2027 (Interim)	3.5%	2.4%	1.3%	0%	10%	7% SFR, MFR, COM, IND	**17%**	**17%**	Yes
	2032 (Final)	5%	3.2%	1.8%	45%	20%	14% SFR, MFR, COM, IND	**74%**	**33%**	Yes
Analysis Region DC-Torrance										
Zinc	2032 (Final)	5%	0%	0%	0%	75% per filter	Catch basin inlet filters	See note 3	**76%**	See note 3
Copper	2032 (Final)	14%[2]	0%	0%	0%	75% per filter	Catch basin inlet filters	See note 3	**62%**	See note 3
Fecal coliform	2022 (Interim)	2.1%	0%	0%	0%	33% per filter	Catch basin inlet filters	See note 3	**8.3%**	See note 3
	2027 (Interim)	3.5%	0%	0%	0%	33% per filter	Catch basin inlet filters	See note 3	**17%**	See note 3
	2032 (Final)	5%	0%	0%	0%	33% per filter	Catch basin inlet filters	See note 3	**33%**	See note 3

[1] The critical condition is TMDL year 1995 for fecal coliform, 11/30/2007 for copper, 2/5/2010 for lead, and 2/26/2006 for zinc.

[2] Load reduction attributable to copper brake pad phase-out, after accounting for other BMPs, up to 55%.

[3] Load reduction sum cannot be estimated at this time. The individual load reduction for each inlet filter's drainage area is shown under the "Distributed BMPs" column. Initially, 200 of 643 catch basins are planned to be retrofitted in high priority catchments. The total load reduction from inlet filters will be evaluated in the future through CIMP monitoring, as part of the EWMP adaptive management process. At that time, the catch basin BMPs will be modified, with additional filters installed as necessary and additional structural/non-structural BMPs proposed as needed to meet the TLRs required to achieve water quality objectives by the compliance deadlines.

3.7.3 Dry Weather

For dry weather, the applicable pollutants in the Dominguez Channel Estuary are total copper, total lead, and total zinc as Category 1 WBPCs (i.e. WQBELs and/or RWLs are established in Part VI.E and Attachments L through R of [the Permit]) and the applicable pollutant in both the Dominguez Channel and Dominguez Channel Estuary is bacteria as a Category 2 WBPC (i.e., 303(d)-listed but not currently subject to a TMDL).

The City of Torrance's dry weather load reduction strategy will focus on non-structural source control and pollution prevention measures that are designed to reduce the amount of pollutants and understand the effect of pollutants entering runoff though education, enforcement and behavioral modification programs.

Within the Cities of Redondo Beach and Manhattan Beach, the implementation of the two regional BMPs at both outlets from the DC-RB/MB analysis region to address wet weather pollutants will control dry weather flows by capturing the small flows in the pre-treatment volume and either retaining them or treating them in the media filter.

In addition, each of the EWMP Group cities has water conservation regulations which will reduce dry weather runoff at its source. Collectively, by controlling dry weather MS4 flows prior to entering Dominguez Channel using the proposed suite of BMPs, bacteria will be addressed. If necessary, the EWMP Group agencies retain the option of installing low flow diversions sized to effectively eliminate discharges to the receiving water year-round dry weather days. Therefore, reasonable assurance of meeting the applicable RWLs was demonstrated in this EWMP through a qualitative assessment of the proposed BMPs and their overall approach of eliminating or substantially reducing MS4 discharges during dry weather.

3.8 Multiple Benefits

The proposed projects in the Dominguez Channel Watershed not only demonstrate reasonable assurance for the water quality objectives, but also provide multiple benefits beyond pollutant load reduction. Multiple benefits provided by the projects proposed in the Santa Monica Bay watershed are also applicable to those proposed in the Dominguez Channel Watershed, including neighborhood greening, water conservation/supply, and public education and awareness (see Section 2.8 for more detail). However, infiltration in Dominguez Channel Watershed is infeasible due to low saturated flowrates of the soil at the potential structural BMP locations; therefore, groundwater recharge is not considered an added benefit to the proposed structural BMPs in the Dominguez Channel Watershed.

3.9 Parallel Compliance Efforts

During the remaining compliance period, the Beach Cities WMG may also elect to perform special studies to evaluate the Dominguez Channel Toxics TMDL WLAs and/or REC-1 indicator bacteria RWLs. For example, a reevaluation of the site-specific Water Effects Ratio (WER) used to calculate the targets for copper and zinc may result in modifications to the target load and TLR. Another example might include the application of a non-structural pollutant load reduction credit in the case

that state legislation restricting zinc in manufactured rubber tires is passed. Through the adaptive management process, the RAA may be reevaluated after any changes to bacteria statewide objectives, TMDL WLAs, and/or Permit limits.

4 IMPLEMENTATION SCHEDULE

4.1 COMPLIANCE SCHEDULE

The following sections present the proposed compliance schedules and project sequencing necessary to meet the interim and final compliance deadlines for the Beach Cities EWMP WPBCs.

4.1.1 SANTA MONICA BAY WATERSHED

Bacteria, debris, and PCBs and DDTs have been identified as Category 1 WBPCs in the Santa Monica Bay Watershed. No Category 2 or 3 WBPCs are specified in this watershed. The interim and final compliance deadlines in the Santa Monica Bay watershed are summarized in **Table 4-1**.

Table 4-1. Compliance Deadlines associated with Santa Monica Bay Watershed WBPCs

Category	Pollutant(s)	Date	Action
1: Highest Priority	Dry Weather Bacteria	July 2006	Final: Summer-dry single sample Allowable Exceedance Days (AED) met; compliance is currently in effect and attained through diversions and non-structural BMPs.
		November 2009	Final: Winter-Dry period Single Sample AED met; compliance is currently in effect and attained through diversions and non-structural BMPs.
	Wet Weather Bacteria	7/15/2018	Interim: 50% single sample ED reduction
		7/15/2021	Final: Geometric Mean [GM] targets met Final: Single sample AED targets met
	Trash/Debris	3/20/2016	Interim: 20% load reduction
		3/20/2017	Interim: 40% load reduction
		8/20/2018	Interim (Cities of Hermosa Beach and Redondo Beach): Determination of compliance strategy for installing full capture trash systems
		3/20/2019	Interim (Cities of Hermosa Beach and Redondo Beach): Installation of full capture trash systems serving 50% of the MS4 drainage area to Santa Monica Bay outside of Regional EWMP BMPs
		8/20/2019	Interim (City of Manhattan Beach): Determination of compliance strategy for installing full capture trash systems.
		3/20/2020	Interim (City of Manhattan Beach): Installation of full capture trash systems serving 50% of the MS4 drainage area to Santa Monica Bay outside of Regional EWMP BMPs
			Final (Cities of Hermosa Beach and Redondo Beach): 100% reduction in trash from baseline through the installation of full capture trash systems serving MS4 drainage area to Santa Monica Bay.
		3/20/2023	Final (City of Manhattan Beach): 100% reduction in trash from baseline through the installation of full

Category	Pollutant(s)	Date	Action
			capture trash systems serving MS4 drainage area to Santa Monica Bay.
	DDTs	N/A	Since the TMDL effectively implements an anti-degradation approach (i.e., historic low MS4 concentrations or loads must be kept the same or lower), and the Beach Cities EWMP Agencies are currently presumed to be achieving the WLAs (thus negating the need for RAA), no compliance schedule is proposed.
	PCBs	N/A	
2: High Priority	N/A	N/A	N/A
3: Medium Priority	N/A	N/A	N/A

The final wet weather compliance deadline for the SMBBB TMDL is proposed to be met through a combination of non-structural, distributed green streets BMPs, and existing, planned, and proposed regional BMPs. The interim compliance deadline for the SMBBB TMDL requires a 50 percent reduction in exceedance days by July 2018; this will be met by achieving 50 percent of the final bacteria TLR (13.2%) on a watershed-wide basis, through a combination of non-structural BMPs including redevelopment, public retrofit incentives, non-MS4 parcels/areas NPDES Permit compliance, and programmatic BMPs, as well as and existing regional BMPs. Neither the load reductions from distributed green streets BMPs, nor planned/proposed regional BMPs, are necessary to meet the interim TLR. **Table 2-17** previously summarized the breakdown of estimated load reductions at the interim and final compliance deadlines. At the time of the interim compliance deadline, 2018, a 14.4% load reduction is estimated based on a combination of existing regional BMPs and existing and proposed non-structural BMPs, which is greater than the interim TLR of 13.2%.

Compliance with the Debris TMDL will be met through a phased retrofit of all catch basins throughout the Beach Cities EWMP Area to meet each interim and final compliance deadline.

4.1.2 Dominguez Channel Watershed

Toxicity, copper, lead, and zinc have been identified as Category 1 WBPCs in the Dominguez Channel Watershed. Additionally, indicator bacteria and ammonia have been identified as a Category 2 WPBC, and cyanide, pH, selenium, mercury, and cadmium have been identified as Category 3 WBPCs. The compliance schedules associated with each WBPC are summarized in **Table 4-2**. The compliance schedule for Category 1 WBPCs is consistent with the associated TMDL. The compliance schedule for the Category 2 WBPC has been selected to achieve the proposed wet and dry weather bacteria milestones, with implementation actions not exceeding one year, in accordance with the Permit (Section ii(5)9B). As described in **Table 4-2**, the compliance schedule for the Category 3 WBPCs will be dependent on the results of the CIMP.

Table 4-2. Implementation Actions and Dates associated with Dominguez Channel Watershed WBPCs

Category	Pollutant(s)	Wet/Dry Weather	Date	Implementation Action
1: Highest Priority	Toxicity[1] Total Copper[1,2] Total Lead[1,2] Total Zinc[1,2] Cadmium[2]	Wet/Dry	Current[4]	Interim: Comply with the interim water quality-based effluent limitations as listed in the TMDL[3]
			March 2032	Final: Comply with the final water quality-based effluent limitations as listed in the TMDL[3]
2: High Priority	Indicator Bacteria	Dry	December 2023	Interim: 50% load reduction
			December 2025[5]	Final: 100% compliance may be demonstrated by the Permittee in one of three ways: 1. Meeting the allowed exceedance days (5 days during the dry weather period); or 2. Meet the allowed exceedance percentage (1.6% during a dry weather period) within the total drainage area served by the MS4. 3. Diversions are in place such that they are consistently operational, well maintained, and sized to effectively eliminate discharges to the receiving water year-round dry weather days.
		Wet	December 2016	Provide documentation supporting MCM enhancements implemented over the past year[6]
			December 2017	Provide documentation supporting MCM enhancements implemented over the past year[6]
			December 2018	Identify planned green streets locations to treat runoff from 3% of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
			December 2019	City Council approval of Plans & Specifications for green streets to treat runoff from 3% of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach. Begin installation of catch basin inlet filters in the DC-Torrance analysis region.
			December 2020	Develop concept reports for regional BMPs in the cities of Redondo Beach and Manhattan Beach. Begin construction on green streets to treat runoff from 3% of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
			December 2021	Submit grant application for any one of the proposed regional projects in the cities of Redondo Beach and Manhattan Beach.
			December 2022	Interim Milestone: 25% of target load reduction
			December 2023	Identify planned green streets locations to treat runoff from an additional 4% (7% total) of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.

Category	Pollutant(s)	Wet/Dry Weather	Date	Implementation Action
			December 2024	Begin construction on planned green streets to treat runoff from an additional 4% (7% total) of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach. Continue installation of catch basin inlet filters in the DC-Torrance analysis region.
			December 2025	Release Request for Proposals for regional BMP designs in Redondo Beach and/or Manhattan Beach
			December 2026	Complete construction on planned green streets to treat runoff from an additional 4% (7% total) of SFR, MFR, COM, and IND land uses in cities of Redondo Beach and Manhattan Beach.
			December 2027	Interim Milestone: 50% of target load reduction
			December 2028	Produce regional BMP design reports; identify locations for green streets implementation to treat runoff from an additional 7% (14% total) of SFR, MFR, COM, and IND land uses in the cities of Redondo Beach and Manhattan Beach.
			December 2029	Begin regional BMP permitting process for project in Redondo Beach or Manhattan Beach.
			December 2030	Begin construction on planned green streets to treat runoff from an additional 7% (14% total) of SFR, MFR, COM, and IND land uses in the cities of Redondo Beach and Manhattan Beach.
			December 2031[7]	Begin regional BMP construction of project in Redondo Beach or Manhattan Beach.
			March 2032[8]	Final Milestone: 100% compliance may be demonstrated by the Permittee in one of three ways: 1. Meeting the allowed exceedance days (10 days during a wet weather period, plus high flow suspension days) 2. Meeting the target load reduction (33%); or 3. Meeting the allowed exceedance percentage (19% during a wet weather period) within the total drainage area served by the MS4.
3: Medium Priority[9]	Cyanide pH Selenium Mercury Cadmium Arsenic Chromium Silver Nickel Thallium	N/A	March 2032[8]	Final: Comply with the applicable water quality standards as listed in **Table 3-4.** As required by the Permit, monitoring for these pollutants will occur under the CIMP. If monitoring data suggest that the Beach Cities Agencies' MS4s may cause or contribute to exceedances of these pollutants in the receiving water[10], these contributions will be addressed through modifications to the EWMP as a part of the adaptive management process, as described in Permit section VI.C.2.a.iii.

[1] Toxicity, copper, lead, and zinc are listed as Category 1 wet weather pollutants in Dominguez Channel.
[2] Copper, lead, zinc, and cadmium are listed as Category 1 pollutants in Dominguez Channel Estuary with annual average WQBELs that apply to both wet and dry weather.
[3] Dominguez Channel Estuary WQBELs for total copper, lead, zinc, and cadmium are addressed by the implementation actions taken for Dominguez Channel wet weather WQBELs.
[4] According to monitoring data at Dominguez Channel Mass Emission Station S28, the copper, lead, and zinc exceedance rates of the interim WQBELs are 9%, 3% 10% respectively, based on qualified sampling events between 2002 and 2013. At the Torrance Lateral Mass Emission Station TS19, the copper, lead, and zinc exceedance rates of the interim WQBELs are 5%, 0%, and 8% respectively. These monitoring locations receive flow contributions from the Beach Cities WMG, as well as other WMGs. CIMP monitoring and subsequent adaptive management will evaluate if the Beach Cities WMG are exceeding the interim Category 1 WQBELs and evaluate compliance with the Dominguez Channel Toxics TMDL.
[5] The proposed compliance schedule for dry weather bacteria is the minimum time expected to be necessary for the agencies to plan, design, permit, construct, monitor, and adaptively manage the proposed dry weather BMPs, and is also consistent with the 10-year MS4 compliance schedule for dry weather from the TMDL for indicator bacteria in the San Gabriel River, Estuary and Tributaries, adopted by the LARWQCB in 2015 (Water Quality Control Plan, Attachment A to Resolution No. R15-005, adopted by the RWQCB in 2015).
[6] Proposed milestones for MCM enhancement implementation are detailed in **Table 2-8**.
[7] If regional BMPs are deemed necessary for dry weather compliance, their construction dates will be moved up to meet the dry weather deadlines.
[8] The proposed compliance schedule for wet weather bacteria and all Category 3 pollutants was selected to be consistent with the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL (Dominguez Channel Toxics TMDL) (RWQCB, 2011). This compliance schedule is the minimum time expected to be necessary for the agencies to plan, design, permit, construct, monitor, and adaptively manage the proposed wet weather BMPs.
[9] Cyanide, pH, selenium, mercury, and cadmium are Category 3 pollutants in Dominguez Channel. Arsenic, chromium, silver, nickel, mercury, and thallium are Category 3 pollutants in Dominguez Channel Estuary.
[10] This will be assumed to be the case if monitoring data show that outfall concentrations and receiving water concentrations are in excess of the applicable water quality criteria for the same monitoring event.

Table 3-12 previously summarized the load reductions achieved for the quantified WBPCs for the interim and final compliance deadlines.

Zinc has been identified as the controlling pollutant for BMP implementation, as it would likely produce load reductions for the other pollutants greater than their individual TLRs. Therefore, it is assumed that the nonstructural and structural BMPs proposed to meet the zinc final TLR by 2032 would also achieve compliance with the other metals TLRs. Therefore, distributed green streets BMPs at a final implementation level of 14%[27] and all regional BMPs are planned to be implemented no later than 2032 (with the exception of the Powerline Easement Project, as discussed below). At the time of the proposed final compliance deadline (2032), the proposed projects result in a 79% (DC-RB/MB analysis region) to 80% (DC-Torrance analysis region) load reduction, both of which are greater than the TLR of 76%. Copper TLRs are also proposed to be met in both analysis regions, in combination with the adaptive management approach discussed previously.

For bacteria, within the DC-RB/MB analysis region, the proposed final wet weather compliance deadline of March 2032 is proposed to be met through the suite of non-structural and structural BMPs, including distributed green streets BMPs at a 14% implementation level[28]. At the time of the proposed final compliance deadline (2032), this implementation plan results in a load reduction of 74% in analysis region DC-RB/MB, which is greater than the TLR of 33%. A 38% bacteria load reduction is estimated in the DC-Torrance analysis region. As shown in **Table 3-12**, the interim deadlines for bacteria are also proposed to be met through a combination of non-structural and distributed green streets BMPs, phased in over the compliance period.

It should be noted that although the inlet filters proposed in the DC-Torrance analysis region are not planned for 100% of catch basins (200 of 643 are currently planned in high priority drainage areas), the achieved load reduction will be evaluated through adaptive management, with additional filters to be installed as necessary to meet the TLRs by the specified compliance deadlines.

4.2 Project Sequencing

In order to meet the compliance deadlines for the WBPCs discussed above based on load reduction projections in the RAA, the proposed structural BMPs within the Santa Monica Bay and Dominguez Channel Watersheds would be implemented per the timeline provided in **Figure 4-1**.

[27] An "implementation level" of 14% is defined here to mean that runoff from 14% of land use areas (commercial, single family residential, multi-family residential, and industrial land uses) would be treated by green street BMPs (bioretention and biofiltration systems) designed as described in Section 2.6.3.

[28] An "implementation level" of 7% is defined here to mean that runoff from 7% of land use areas (commercial, single family residential, multi-family residential, and industrial land uses) would be treated by green street BMPs (bioretention and biofiltration systems) designed as described in Section 2.6.3.

Figure 4-1. Proposed Project Sequencing

COLOR KEY	Funding Phase	Design Phase	Construction/ Installation Phase

	BMP Location/Name		Timeline																	
			2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Santa Monica Bay Watershed	Catch basin retrofits for trash																			
	Manhattan Beach Infiltration Trench[1]																			
	Manhattan Beach Green streets application in SMB-5-02																			
	Hermosa Beach Greenbelt Infiltration[1]																			
	Hermosa Beach Infiltration Trench																			
	Redondo Beach Park #3																			
	Green streets application in SMB-6-01 for All Cities																			
Dominguez Channel Watershed	Catch basin inlet filters in DC-Torrance																			
	Green Streets (Redondo Beach and Manhattan Beach)	Treatment of 3% of Land Uses																		
		Treatment of Additional 4% of Land Uses																		
		Treatment of Additional 7% of Land Uses																		
	Redondo Beach Powerline Easement Filtration[1,2]																			
	Artesia Boulevard and Hawthorne Boulevard Filtration[2] in Redondo Beach																			

[1]Alternative project locations have also been identified

[2]Current regional BMP project sequencing in Dominguez Channel helps achieve dry weather bacteria TMDL compliance. If compliance is met through other means, regional BMP scheduling in Dominguez Channel may be pushed back so that regional projects are instead complete by March 2032.

5 ASSESSMENT AND ADAPTIVE MANAGEMENT FRAMEWORK

Adaptive management is a critical component of the EWMP implementation process, and EWMP updates are required at two-year cycles by the Permit. The CIMP will gather additional data on receiving water conditions and stormwater/non-stormwater quality. These data will support adaptive management at multiple levels, including: (1) tracking improvements in water quality over the course of EWMP implementation and (2) generating data not previously available to support model updates. Furthermore, over time, the experience gained through intensive BMP implementation will provide lessons learned to support modifications to the control measures identified in the EWMP.

The adaptive management process also includes a schedule for developing and reporting on the EWMP updates, the approach to conducting the updates, and the process for implementing any modifications to the RAA and EWMP to reflect the updates.

The adaptive management approach for the Beach Cities EWMP area is designed to address the EWMP planning process and the relationship between monitoring, scheduling, and BMP planning. The adaptive management process outlines how the EWMP will be modified in response to monitoring results, updated modeling results, and lessons learned from BMP implementation. It is designed to accomplish three goals:

1. Clarify the short-term and long-term commitments of the Beach Cities WMG within the EWMP.
2. Provide a structured decision-making process for modifications to the EWMP based on the results of monitoring data.
3. Propose a structure for evaluating compliance with water-quality based permit requirements within an adaptive structure.

As outlined in Section 4, the schedule and milestones for the EWMP have been designed around meeting the interim and final TMDL requirements for bacteria and metals. While the EWMP identifies actions that will lead to compliance with the final TMDL limitations, the specific actions taken will be informed by monitoring data collected under the CIMP, special studies that may be conducted during implementation, and any applicable regulatory changes that could influence the remaining interim and final milestones and schedule. For example, the Statewide Bacteria Amendments have the potential to modify water quality objectives in the Ocean Plan and Basin Plan, as well as the TMDL WLAs and their WQBEL and/or RWL expressions in the Permit. These changes could affect the required load reductions for bacteria as well as the watershed control measures identified herein.

Monitoring data will be utilized to measure progress towards achieving RWLs and WQBELs. An evaluation of monitoring data will be carried out on a biennial basis in accordance with **Figure 5-1** to determine if modifications to the EWMP are necessary. Modifications that are warranted because final milestones are achieved *more quickly* than anticipated can be made at any time (i.e. no more actions are needed if fewer control measures result in meeting RWLs and/or WQBELs).

Modifications that are warranted because insufficient progress is being made will be noted every two years in the annual report and a schedule for implementation will be provided. A full update to the EWMP and the RAA is not anticipated as the schedule for bacteria compliance is only six years long. Updating the EWMP and RAA is a significant and costly undertaking that is not necessary unless conditions change significantly and additional modeling is needed to inform implementation decisions. However, at any point, the Beach Cities Agencies could choose to update the EWMP and the associated RAA, particularly if deemed appropriate based on monitoring data.

If at any point during the implementation period any of the permit conditions are modified in response to a regulatory action, TMDL modification, or local studies, the receiving water and outfall monitoring data will be compared to the new RWLs and WQBELs. The same procedure will be followed for evaluating the data and adapting the EWMP, but the new RWLs and WQBELs will be used for the analysis.

The process outlined in **Figure 5-1** applies during the implementation period for the EWMP. At the end of the implementation period for the TMDLs, if the final RWL and/or WQBELs are not being met, either the TMDL must be modified to adjust the schedule or the permittees will need to apply for a Time Schedule Order or other mechanism to get an extension of the compliance deadlines.

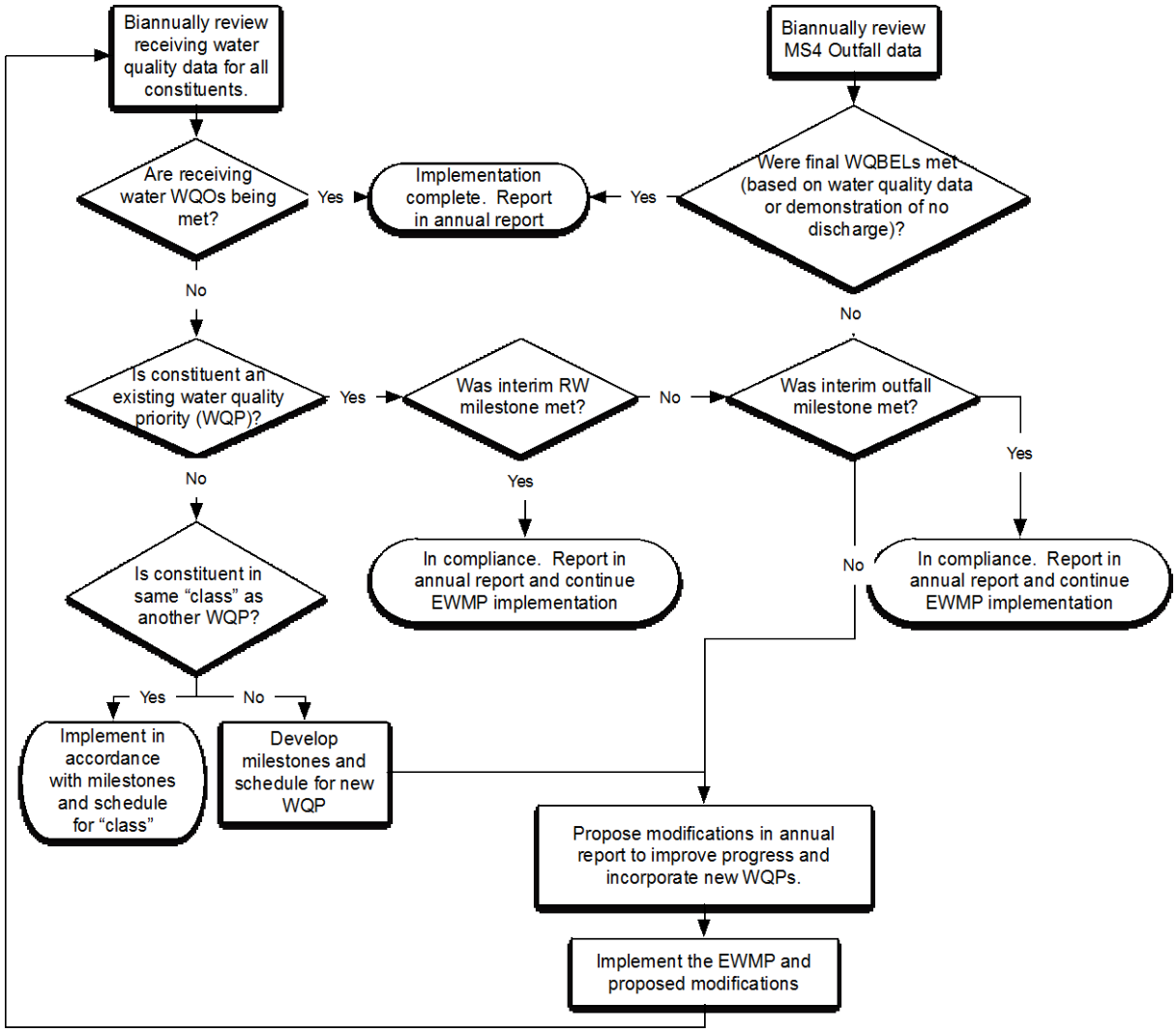


Figure 5-1. Adaptive Management Approach

6 FINANCIAL ANALYSIS

In June of 2014, the Beach Cities WMG submitted the Beach Cities EWMP Work Plan to the LARWQCB (Beach Cities WMG, 2014). The EWMP Work Plan described the approach to cost estimation and scheduling for the EWMP, which is addressed in this section. This section provides an order-of-magnitude estimate of the financial resources that may be required to attain compliance with the 2012 MS4 Permit's RWLs and WQBELs, as well as a recommended project scheduling in order to meet TMDL compliance deadlines and interim deadlines. Planning-level cost opinions associated with implementation of the proposed structural BMPs within the Beach Cities WMG area are provided based on RAA results.

Prior to and separate from the EWMP, BMP cost effectiveness (i.e., pollutant load removed per dollar cost) were developed and evaluated by Geosyntec using SBPAT for a variety of BMP implementation scenarios. For example, it was found that regional infiltration BMPs, followed by regional flow-through treatment BMPs, followed by distributed green streets provide the greatest cost effectiveness, in part due to the economies of scale that benefit regional BMPs. Within those categories, greater BMP cost effectiveness is achieved for a given pollutant in order of the tributary land uses' EMC and runoff coefficient product (for example, for bacteria, commercial land use has a very high EMC and runoff coefficient; therefore, a given BMP type is most cost effective when placed downstream of a commercial area). This relative cost effectiveness understanding was applied by Geosyntec in identifying and prioritizing BMP implementation scenarios for agency consideration in this WMG. The most cost effective yet implementable BMPs were then sequentially incorporated into the EWMP (i.e., with the most cost effective BMPs added first) until reasonable assurance of compliance was demonstrated.

Cost opinions are presented as an aid for decision makers, and contain considerable uncertainties. Given the iterative and adaptive nature of the EWMP and the many variables associated with the projects, the budget forecasts are order-of magnitude opinions, and are subject to change based on site-specific BMP feasibility assessment findings, preliminary and final BMP designs and landscaping, BMP effectiveness assessments, results of outfall and receiving water monitoring, and special studies such as those that might result in site specific objectives which could modify water quality objectives or TMDL Waste Load Allocations for a specific WBPC.

A financial strategy and details regarding potential funding sources and programs to support the financial resources required for the structural BMPs being proposed in the EWMP are also provided herein. These funding sources and programs may be utilized depending on applicability and feasibility.

6.1 BMP COST METHODOLOGY AND ASSUMPTIONS

6.1.1 HARD COST ASSUMPTIONS

Costs estimated for structural BMPs include "hard" costs for tangible assets and are determined using a line item unit cost approach, which separately accounts for each material cost element required for the installation of a given BMP. Quantities for each line item were calculated based on

BMP storage/treatment volumes and typical design configurations. A safety factor was applied to the BMP footprints for calculation of design parameters, for both the low and high cost estimates. Unit costs were taken from RS Means [29], past projects based in Southern California, recent construction cost/bid information, and vendors. Line item unit costs of the proposed structural BMPs are included in **Appendix O**. Since the majority of proposed BMPs were located on publicly owned land to reduce land acquisition costs to the extent possible, land acquisition costs were not considered as part of this analysis.

6.1.2 Soft Cost Assumptions

Structural BMP cost opinions also include "soft" costs, which include considerations such as design and permitting. Soft costs are project costs that cannot be calculated on a unit cost basis. For conceptual cost estimating, these costs are generally calculated as a percentage of total capital costs. The soft costs considered for each BMP were:

- **Utility Realignment**— Costs associated with the relocation of utilities that are located within the proposed BMP footprint or inhibit construction activities.
- **Mobilization and Demobilization** – The costs associated with activation/deactivation of equipment and manpower resources for transfer to/from a construction site until completion of the contract.
- **Planning, Permitting, Bond, and Insurance Costs** – Cost, including planning and permit fees and personnel hours, of obtaining required permits for BMP installation. Examples of permits needed may include erosion and sediment control, stormwater, construction, and public space permits. Potential bond and insurance costs are also included.
- **Engineering and Planning** – Costs associated with BMP and site design, as well as access for maintenance, environmental mitigation, buried objects, safety/security, traffic control, limited space, and site restoration.
- **Construction Management** – The costs associated with management and oversight of the construction of the BMP, from project initiation until completion of the contract.

Estimated soft costs as percent of total project capital costs are presented in **Table 6-1**. These percentages were based on literature, best professional judgment, and data from past projects (Brown and Schueler, 1997; International Cost Engineering Council, 2014).

[29] RS Means is a unit cost database that is updated annually (http://www.rsmeansonline.com/). When costs from literature are not available project's design criteria and unit costs from the database were used to estimate the project's cost.

Table 6-1. Range of Soft Costs for Proposed Structural BMP Projects as a Percent of Capital

Cost Item	Cost Range	
	Low	High
Utility Realignment	0%	3%
Mobilization/Demobilization[1]	3%	10%
Planning, permitting, bond, and insurance costs	5%	10%
Engineering and Planning	20%	40%
Construction Management	8%	15%

[1] $2,000 minimum fee

6.1.3 *Operations and Maintenance*

Annual Operations and Maintenance (O&M) costs were assumed to be two percent of the capital cost for subsurface infiltration basins, two percent of the capital cost for sub-surface biofilters, five percent of the capital cost for subsurface infiltration trenches, and six percent of the capital cost for green streets (USEPA, 2005; Weiss et al., 2007). O&M opinions for underground infiltration basins include cleaning and removal of debris after major storm events, mowing and maintenance of surface vegetated areas, and sediment cleanout. O&M necessary for maintaining sub-surface biofilters includes landscape maintenance, media and gravel replacement once clogged when surface scarification is no longer effective, pest control, sediment and pre-treatment cleanout. O&M for underground infiltration trenches includes cleaning and removal of debris, repairs to inlet/control structures, and pre-treatment cleanup. O&M for green streets includes repairs to eroded areas, incremental landscape maintenance, media and gravel replacement once clogged and surface scarification is no longer effective, removal of trash and debris, and removal of aged mulch with installation of a new layer. O&M costs have been summarized as 20-year lifecycle costs, with no discounting applied, also including post-construction monitoring.

Additional maintenance will be necessary after the 20-year lifecycle. Extended maintenance for subsurface infiltration includes excavation and washing of all drain rock on a 25-year cycle and is estimated to be approximately 60 percent of capital costs. All drainage elements should be replaced on a 50-year cycle, at approximately 125 percent of capital costs. Cisterns should be replaced after a useful life of approximately 50 years, at 125 percent of the capital cost. Green streets should be excavated, disposing of existing soil media, and backfilled with new soil media every 25 to 50 years at approximately 90 percent of capital costs.

Typical maintenance for trash exclusion devices includes removal of trash and sediment, and catch basins should be cleaned at a minimum of once or twice per year. Trash exclusion devices can be plugged if they are overloaded with sediment or debris, greatly reducing their efficiency. Inspection and cleanout is recommended after major storm events, or storms with a rainfall intensity of greater than one inch in 12 hours.

6.1.4 Additional Design Assumptions

Additional design details were assumed for the purpose of the cost estimation presented herein, including, but not limited to:

- The percentage of excavated material requiring hauling;
- The type and length of BMP inflow and outflow conveyance structures;
- The type and quantity of vegetation required for the post-BMP condition;
- The percentage of the parcel area requiring hydroseeding for the post-BMP condition;
- The type of pre-treatment used for each BMP.

6.2 Proposed Structural BMPs

As previously described, regional and distributed structural BMP options are proposed to achieve compliance with the RWLs and WQBELs. **Table 6-2** summarizes the basic, concept-level design assumptions for each of the proposed structural BMPs which formed the basis for the conceptual cost opinions.

Table 6-2. Proposed BMP Design Assumptions for Conceptual Cost Opinions

Analysis Region	BMP Name[1]	BMP Description	Design Storage Volume (cu-ft)	Tributary Area (acres)
SMB-5-02	Manhattan Beach Infiltration Trench – Alternative 1	Located along the coast of Manhattan Beach, the sub-surface trench has a potential surface area of 2.2 ac, an average depth of 2.1 ft with a diversion rate of 160 cfs and an infiltration rate under the trench of 13 in/hr.	198,000	1,475[2]
SMB-5-02	Manhattan Beach Infiltration Trench – Alternative 2	Located along the coast of Manhattan Beach, the sub-surface trench has a potential surface area of 1.6 ac, an average depth of 2.1 ft with a diversion rate of 128 cfs and an infiltration rate under the trench of 13 in/hr.	158,400	1,475[2]
SMB-5-02	Polliwog Park Infiltration Gallery – Alternative 2	Located adjacent to Manhattan Beach Boulevard in Manhattan Beach, the sub-surface infiltration gallery has a potential surface area of 1 ac, an average depth of 4 ft, a diversion flowrate of 11 cfs, and an infiltration rate of 0.74 in/hr.	148,100	470
SMB-5-02	Distributed Green Streets – Alternative 1	The distributed green streets, proposed to address runoff from 5% of single family residential, multi-family residential, and commercial land uses, are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	205,500	66
SMB-5-02	Distributed Green Streets – Alternative 2	The distributed green streets, proposed to address runoff from 5% of single family residential, multi-family residential, and commercial land uses, are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	142,100	45
SMB-6-01	Hermosa Beach Infiltration Trench	Located along the coast of Hermosa Beach, the sub-surface trench has a potential surface area of 0.2 ac, an average depth of 1.7 ft, a diversion flowrate of 25 cfs, and an infiltration rate of 12.5 in/hr.	13,300	2,000[2]
SMB-6-01	Hermosa Beach Greenbelt Infiltration[3]	Located between Valley Dr. and Ardmore Ave., the sub-surface trench has a potential surface area of 1.5 ac, an average depth of 5 ft, a diversion flowrate of 48 cfs, and an assumed infiltration rate of 12 in/hr.	319,000	1,800[2]
SMB-6-01	Park #3	Located northwest of Blossom Lane and 190th street, the sub-surface infiltration basin has a potential surface area of 0.4 ac, an average depth of 5ft , a diversion flowrate of 13 cfs, and an infiltration rate of 1 in/hr.	87,100	1,430[2]

Analysis Region	BMP Name[1]	BMP Description	Design Storage Volume (cu-ft)	Tributary Area (acres)
SMB-6-01	Distributed Green Streets	The distributed green streets, proposed to address runoff from 25% of single family residential, multi-family residential, and commercial land uses, are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	605,200	190
SMB 5-02, SMB 6-01, DC – MB/RB	Trash exclusion devices	The City of Redondo Beach plans to retrofit 1,085 catch basins (634 of which are County-owned), the City of Hermosa Beach will retrofit 151 (79 of which are County-owned), and the City of Manhattan Beach plans to retrofit 640 (200 of which are County-owned) catch basins. All cities will retrofit catch basins with automatic retractable screens (ARS) and connector pipe screen full capture trash systems (CPS).	N/A	-
DC – MB/RB	Powerline Easement and Manhattan Beach Blvd Infiltration	Located along powerline easements and/or adjacent to Marine Avenue and Manhattan Beach Boulevard, the sub-surface biofilter has a potential surface area of 7.2 ac, an average depth of 5 ft, a diversion flowrate of 132 cfs, and a negligible infiltration rate.	N/A (Flow-through BMP)	1,500
DC – MB/RB	Artesia Blvd. and Hawthorne Blvd. Filtration	Located near the intersection of Artesia Blvd. and Hawthorne Blvd., the sub-surface biofilter has a potential surface area of 1 ac, an average depth of 5 ft, a diversion flowrate of 13.6 cfs, and a negligible infiltration rate.	N/A (Flow-through BMP)	130
DC-MB/RB	Distributed Green Streets	The distributed green streets are assumed to have 6 in of ponding, 1.5 ft of amended soil, 3 in of mulch, and an infiltration rate of 0.15 in/hr.	636,300	200
DC-Torrance	Catch basin inlet filters	The City of Torrance plans to retrofit 200 of 643 catch basins with inlet filters.	N/A	5,760

[1] All projects listed in this table (except for the catch basin inlet filters in DC-Torrance) were modeled in the RAA and sized to collectively comply with the WQBELs and RWLs in combination with other existing and proposed structural and non-structural BMPs. Within the DC-Torrance analysis region, catch basin inlet filters are assumed to achieve WQBEL/RWL compliance based on a review of literature/studies on their performance. The total load reduction from inlet filters will be evaluated in the future through CIMP monitoring, as part of the EWMP adaptive management process. At that time, the catch basin BMPs will be modified, with additional filters installed as necessary and additional structural/non-structural BMPs proposed as needed to meet the TLRs required to achieve water quality objectives by the compliance deadlines.

[2] This includes upstream BMPs and associated tributary drainage areas

[3] Alternative project locations have also been identified

6.2.1 Cost Opinion - SMB Watershed - Analysis Region SMB-5-02

For the SMB subwatershed tributary to compliance monitoring location SMB-5-02, two implementation alternatives were identified in the RAA. Alternative 1 includes the Manhattan Beach Infiltration Trench and distributed green streets at a 5% application rate[30]. Alternative 2 includes a reduced volume of the Manhattan Beach Infiltration Trench (i.e., reducing the volume by approximately 20%), the Polliwog Park Infiltration Gallery project, and distributed green street BMPs at a 5% application rate.

Table 6-3 outlines the costs associated with Alternative 1 and **Table 6-4** outlines the costs associated with Alternative 2. Based on projected cost alone, Alternative 1 (larger beach infiltration trench, without Polliwog Park project) is the preferred option, however a preliminary engineering study is needed to verify the feasibility of Alternative 1 so Alternative 2 is included to demonstrate an alternate approach to reasonable assurance. Trash exclusion devices will also be implemented in the SMB 5-02 analysis region. These costs were determined for each city (Redondo Beach, Manhattan Beach, and Hermosa Beach) and are presented in Section 6.2.5.

Further cost opinion details are provided in **Appendix O**.

[30] An "application rate" of 5% is defined here to mean that 5% of RAA-specified land use areas (commercial, single family residential, and multi-family residential land uses) would be treated by green street BMPs (bioretention and biofiltration systems) designed as described in Section 2.6.3.

Table 6-3. Estimated Construction and O&M Costs for Structural BMPs in Analysis Region SMB-5-02, Alternative 1

Project Name	Manhattan Beach Infiltration Trench		Distributed Green Streets	
Location of BMP	Manhattan Beach		Manhattan Beach	
Cost Range	Low	High	Low	High
Capital Subtotal	$2,700,000	$3,800,000	$1,800,000	$3,600,000
Utility Realignment	$0	$110,000	$0	$110,000
Mobilization/Demobilization	$81,000	$380,000	$53,000	$360,000
Planning, permitting, bond, and insurance costs	$140,000	$380,000	$89,000	$360,000
Engineering and Planning	$540,000	$1,500,000	$350,000	$1,500,000
Construction Management	$220,000	$570,000	$140,000	$550,000
Total Estimated Project Construction Cost	**$3,700,000**	**$6,800,000**	**$2,400,000**	**$6,500,000**
Annual O&M	$140,000	$190,000	$110,000	$220,000
Total 20-year Lifecycle Cost	**$6,100,000 (low) to $13,000,000 (high)**			

Table 6-4. Estimated Construction and O&M Costs for Structural BMPs in Analysis Region SMB-5-02, Alternative 2

Project Name	Manhattan Beach Infiltration Trench		Polliwog Park Infiltration Gallery		Distributed Green Streets	
Location of BMP	Manhattan Beach		Manhattan Beach		Manhattan Beach	
Cost Range	Low	High	Low	High	Low	High
Capital Subtotal	$2,200,000	$3,300,000	$2,100,000	$2,500,000	$1,200,000	$2,500,000
Utility Realignment	$0	$98,000	$0	$74,000	$0	$75,000
Mobilization/Demobilization	$67,000	$330,000	$64,000	$250,000	$37,000	$250,000
Planning, permitting, bond, and insurance costs	$110,000	$330,000	$110,000	$250,000	$61,000	$250,000
Engineering and Planning	$450,000	$1,300,000	$430,000	$990,000	$240,000	$1,000,000
Construction Management	$180,000	$490,000	$170,000	$370,000	$98,000	$380,000
Total Estimated Project Construction Cost	**$3,000,000**	**$5,800,000**	**$2,900,000**	**$4,400,000**	**$1,700,000**	**$4,500,000**
Annual O&M	$110,000	$160,000	$43,000	$50,000	$73,000	$150,000
Total 20-year Lifecycle Cost	**$7,600,000 (low) to $15,000,000 (high)**					

6.2.2 Cost Opinion - SMB Watershed – Analysis Region SMB-6-01

The RAA within analysis region SMB-6-01 predicts that the TLR will be met with reasonable assurance through implementation of the proposed Hermosa Beach Infiltration Trench, Hermosa Beach Greenbelt Infiltration, Park #3, and a combination of green street BMPs at an application rate of 25%[31]. **Table 6-5** outlines the costs associated with this structural BMP combination which, when implemented with the existing structural regional BMPs and non-structural control measures[32] detailed in the RAA modeling efforts, will achieve TLR compliance at CML SMB-6-01.

Trash exclusion devices will also be implemented in the SMB 6-01 analysis region. These costs were determined for each city (Redondo Beach, Manhattan Beach, and Hermosa Beach) and are presented in Section 6.2.5. Further cost estimate details are provided in **Appendix O.**

[31] An "application rate" of 25% is defined here to mean that runoff from 25% of RAA-specified land use areas (commercial, single family residential, and multi-family residential land uses) would be treated by green street BMPs (bioretention and biofiltration systems) designed as described in Section 2.6.3.

[32] Non-structural control measures include redevelopment, public retrofit incentives, non-MS4 parcels/areas, and programmatic BMPs.

Table 6-5. Estimated Construction and O&M Costs for Structural BMPs in Analysis Region SMB-6-01

Project Name	Hermosa Beach Infiltration Trench		Hermosa Beach Greenbelt Infiltration		Park #3		Distributed Green Streets	
Location of BMP	Hermosa Beach		Hermosa Beach or Redondo Beach		Redondo Beach		Hermosa Beach, Manhattan Beach, Redondo Beach, Torrance	
Cost Range	Low	High	Low	High	Low	High	Low	High
Capital Subtotal	$370,000	$640,000	$4,100,000	$4,500,000	$1,400,000	$1,700,000	$5,200,000	$11,000,000
Utility Realignment	$0	$19,000	$0	$130,000	$0	$50,000	$0	$320,000
Mobilization/Demobilization	$11,000	$64,000	$120,000	$450,000	$42,000	$170,000	$160,000	$1,100,000
Planning, permitting, bond, and insurance costs	$18,000	$64,000	$200,000	$450,000	$70,000	$170,000	$260,000	$1,100,000
Engineering and Planning	$74,000	$260,000	$810,000	$1,800,000	$280,000	$660,000	$1,000,000	$4,200,000
Construction Management	$29,000	$96,000	$320,000	$670,000	$110,000	$250,000	$410,000	$1,600,000
Total Estimated Project Construction Cost	**$500,000**	**$1,100,000**	**$5,500,000**	**$8,000,000**	**$1,900,000**	**$3,000,000**	**$7,000,000**	**$19,000,000**
Annual O&M	$18,000	$32,000	$81,000	$90,000	$28,000	$33,000	$310,000	$640,000
Total 20-year Lifecycle Cost	**$15,000,000 (low) to $31,000,000 (high)**							

6.2.3 Cost Opinion - Dominguez Channel Watershed – Analysis Region DC-RB/MB

According to the Beach Cities RAA model analysis of the Redondo Beach and Manhattan Beach areas within the Dominguez Channel Watershed, it is predicted that the TLR will be met with reasonable assurance through implementation of the proposed Powerline Easement Infiltration Project, Artesia Boulevard Infiltration Project, and a combination of green street BMPs at an application rate of 14%[33]. **Table 6-6** outlines the costs associated with these proposed projects which, when implemented with non-structural control measures[34] detailed in the RAA modeling efforts, are predicted to achieve TLR compliance within the Manhattan Beach and Redondo Beach areas within the Dominguez Channel Watershed.

Trash exclusion devices will also be implemented in the DC-RB/MB analysis region. These costs were approximated for each city (Redondo Beach, Manhattan Beach, and Hermosa Beach) and are presented in Section 6.2.5. Further cost estimate details are provided in **Appendix O.**

[33] An "application rate" of 14% is defined here to mean that runoff from 14% of RAA-specified land use areas (commercial, single family residential, and multi-family residential land uses) would be treated by green street BMPs (bioretention and biofiltration systems) designed as described in Section 2.6.3.

[34] Non-structural control measures include redevelopment, public retrofit incentives, non-MS4 parcels/areas, and programmatic BMPs.

Table 6-6. Estimated Construction and O&M Costs for Structural BMPs in Analysis Region DC-RB/MB[1]

Project Name	Powerline Easement Infiltration		Artesia Blvd Infiltration		Distributed Green Streets	
Location of BMP	**Redondo Beach**		**Redondo Beach**		**Redondo Beach/Manhattan Beach**	
Cost Range	**Low**	**High**	**Low**	**High**	**Low**	**High**
Capital Subtotal	$8,200,000	$9,200,000	$1,500,000	$1,800,000	$5,500,000	$11,000,000
Utility Realignment	$0	$270,000	$0	$53,000	$0	$340,000
Mobilization/Demobilization	$250,000	$920,000	$45,000	$180,000	$160,000	$1,100,000
Planning, permitting, bond, and insurance costs	$410,000	$920,000	$75,000	$180,000	$270,000	$1,100,000
Engineering and Planning	$1,600,000	$3,700,000	$300,000	$710,000	$1,100,000	$4,500,000
Construction Management	$660,000	$1,400,000	$120,000	$260,000	$440,000	$1,700,000
Total Estimated Project Construction Cost	**$11,000,000**	**$16,000,000**	**$2,000,000**	**$3,100,000**	**$7,400,000**	**$20,000,000**
Annual O&M	$160,000	$180,000	$30,000	$35,000	$330,000	$670,000
Total 20-year Lifecycle Cost	**$20,000,000 (low) to $39,000,000 (high)**					

[1] Costs for the Powerline Easement Infiltration project and Artesia Boulevard Infiltration project were estimated based on cost information for lined biofilters with engineered media; the design elements of which cover a range of infiltration options.

6.2.4 Cost Opinion - Dominguez Channel Watershed – Analysis Region DC-Torrance

An analysis of the proposed catch basin inlet filters predicts an estimated load reduction attributable to each inlet filter installed. **Table 6-7** outlines the approximate high and low capital and O&M costs associated with 200 retrofits. Further cost estimate details are provided in **Appendix O**.

Table 6-7. Estimated Construction and O&M Costs for Structural BMPs in Analysis Region DC-Torrance

Project Name	Catch Basin Inlet Filters	
Location of BMP	**Torrance**	
Cost Range	**Low**	**High**
Capital Subtotal	$240,000	$360,000
Total Estimated Project Construction Cost	**$240,000**	**$360,000**
Annual O&M	$130,000	$170,000
Total 20-year Lifecycle Cost	**$2,840,000 (low) to $3,760,000 (high)**	

6.2.5 Cost Opinion – Trash Exclusion Devices – All Analysis Regions

The Cities of Manhattan Beach, Redondo Beach, and Hermosa Beach plan to retrofit catch basins with trash exclusion devices (either automatic retractable screens [ARSs] and/or connector pipe screen [CPS] full capture trash systems in the Santa Monica Bay watershed). The City of Redondo Beach plans to retrofit 1,085 catch basins (634 of which are County-owned), the City of Hermosa Beach will retrofit 151 catch basins (79 of which are County-owned), and the City of Manhattan Beach plans to retrofit 640 catch basins (200 of which are County-owned) catch basins. These catch basin retrofits will be located in SMB-5-02, SMB-6-01, as well as in the other analysis regions in SMB; these catch basin retrofits will work in combination with other regionally sited BMPs. The City of Torrance has substantially completed retrofit of its Santa Monica Bay watershed area through several recent grant funded projects so costs for City of Torrance trash exclusion devices are not included. Not included in these costs are the retrofits of catch basins in high priority areas of Dominguez Channel to meet the MCMs in the MS4 Permit for areas without trash TMDLs.

Table 6-8 outlines the costs associated with these retrofits, as approximated by each city. Annual O&M costs for trash exclusion devices reflect additional costs for cleaning the inserts/screens only. An estimate of current costs spent to clean non-retrofitted catch basins was subtracted from the annual O&M estimate, resulting in annual O&M required for the addition of the inserts/screens only. Further cost estimate details are provided in **Appendix O**.

Table 6-8. Estimated Construction and O&M Costs for Catch Basin Retrofits

Location of BMP	Hermosa Beach		Redondo Beach		Manhattan Beach	
Cost Range	**Low**	**High**	**Low**	**High**	**Low**	**High**
Capital Subtotal[1]	$110,000	$370,000	$790,000	$2,600,000	$470,000	$1,600,000
Mobilization[2]	$5,500	$18,000	$40,000	$130,000	$23,000	$78,000
Permitting[3]	$40,000	$40,000	$320,000	$320,000	$100,000	$100,000
Total Estimated Project Construction Cost	**$160,000**	**$430,000**	**$1,100,000**	**$3,100,000**	**$590,000**	**$1,700,000**
Annual O&M	$50,000	$64,000	$360,000	$460,000	$210,000	$270,000
Total 20-year Lifecycle Cost	**$1,900,000 (low) to $5,200,000 (high)**					

[1] Includes cost of both ARS and CPS

[2] 5% of capital subtotal cost

[3] $500 for each County-owned catch basin only

6.2.6 Summary of Cost Opinions

Table 6-9 summarizes the total 20-year life-cycle cost opinions for each proposed structural BMP, which are composed of the cost to construct or implement each structural BMP plus the associated annual O&M costs over 20 years. In order to account for possible variations in BMP design, BMP configurations, and site-specific constraints, as well as for uncertainties in available BMP unit costs from literature or estimated BMP unit costs, a range of costs is presented. **Table 6-9** includes combined costs for proposed structural BMPs by analysis region and by watershed. Not included in these costs are the annual monitoring costs for implementing the CIMP or the costs associated with implementing baseline and enhanced MCMs.

From the analysis of potential costs in this section as summarized in **Table 6-9**, it is clear that projected costs of implementing the EWMP are substantial and orders of magnitude higher than have previously been expended by the agencies under the previous MS4 Permit. Thus availability of funds will be critical for the implementation of the EWMP. Currently, the Beach Cities do not have sufficient funds or dedicated funding streams to construct and maintain the projects proposed in this EWMP.

The Beach Cities agencies are working with the Los Angeles County Division of the League of California Cities and the California Contract Cities Association to partner with other affected agencies to collectively influence State policies, pursue changes in legislation and lobby high level officials for additional stormwater funding. Working together with the other cities will increase effectiveness, communication, collaboration, and reduce redundant efforts. The LACFCD will also work with the Beach Cities WMG in their efforts to address source controls; assess, develop, and pursue funding for structural BMPs, and promote the use of water reuse and infiltration. As regional project scopes are further refined, the LACFCD will determine on a case-by-case basis their contribution to the projects.

In addition to working with other affected cities on a regional level, the Beach Cities WMG individually and collaboratively are committed to pursue funding sources at a local level including but not limited to:

- *Grants* - Collaboration and coordination between the Beach Cities will be important to increase accessible grant funding opportunities for stormwater projects, however alternative funding sources will also be needed to provide stable O&M revenues since grants typically do not provide for O&M.
- *Interagency Partnerships* – Interagency partnerships, like the Beach Cities WMG, can allow agencies to leverage local funding resources to make cost intensive projects possible.
- *Local Bond Issuance* - Two types of local bonds can be utilized. General Obligation (GO) bonds are issued by local governments and repaid through a property tax surcharge. Revenue bonds are tax-exempt securitized bonds repaid through utility rate increases charged directly to customers.
- *Local Stormwater Assessments* - Stormwater charges are potentially the most critical local funding source to finance stormwater programs. These charges include stormwater fees and taxes.

- *Direct Subsidies* - Direct financial subsidies to local projects do not contribute to cash revenue generation. However, subsidies can create a financial incentive to encourage local participation without providing the full cost for project implementation. Such an approach can increase financial efficiency by leveraging financial input from communities.

These potential sources of funding are discussed in greater detail in Section 7.

6.2.7 Closing Discussion

In concluding its review of the LA MS4 Permit in response to petitions on the order, the SWRCB acknowledges that:

> "Addressing the water quality impacts of municipal storm water is a complex and difficult undertaking, requiring innovative approaches and significant investment of resources. We recognize and appreciate the commendable effort of the Los Angeles Water Board to come up with a workable and collaborative solution to the difficult technical, policy, and legal issues, as well as the demonstrated commitment of many of the area's MS4 dischargers and of the environmental community to work with the Los Angeles Water Board in the development and implementation of the proposed solution. We also recognize the extensive work that interested persons from across the state, including CASQA, have invested in assisting us in understanding how the watershed-based alternative compliance approach developed by the Los Angeles Water Board may inform statewide approaches to addressing achievement of water quality requirements. While storm water poses an immediate water quality problem, we believe that a rigorous and transparent watershed-based approach that emphasizes low impact development, green infrastructure, multi-benefit projects, and capture, infiltration, and reuse of storm water is a promising long-term approach to addressing the complex issues involved. We must balance requirements for and enforcement of immediate, but often incomplete, solutions with allowing enough time and leeway for dischargers to invest in infrastructure that will provide for a more reliable trajectory away from storm water-caused pollution and degradation. We believe that the Los Angeles MS4 Order, with the revisions we have made, strikes that balance at this stage in our storm water programs, but expect that we will continue to revisit the question of the appropriate balance as the water boards' experience in implementing watershed-based solutions to storm water grows." [Revised draft Order, April 24, 2015, p.86-87 conclusion][35]

[35] Revised Draft April 24, 2015. State of California State Water Resources Control Board Order WQ 2015-XX In the Matter of Review of Order No. R4-2012-0175, NPDES Permit No. CAS004001 Waste Discharge Requirements for the Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4. Issued by the California Regional Water Quality Control Board, Los Angeles Region. SWRCB/OCC Files A-2236(a)-(kk).

The SWRCB also states that:

> "The WMP/EWMP provisions constitute an effort to set ambitious, yet achievable, targets for Permittees; receiving water limitations, on the other hand, while the ultimate goal of MS4 permitting, may not in all cases be achievable within the five-year permit cycle. Generally, permits are best structured so that enforcement actions are employed when a discharger shows some shortcoming in achieving a realistic, even if ambitious, permit condition and not under circumstances where even the most diligent and good faith effort will fail to achieve the required condition." [Revised draft Order, April 24, 2015, p.35][36]

Additionally, SWRCB in discussing compliance with receiving water limitations provisions stated:

> "Yet, we are sympathetic to the assertions made by MS4 dischargers that the receiving water limitations provisions mandated by our Order WQ 99-05 may result in many years of permit noncompliance, because it may take years of technical efforts to achieve compliance with the receiving water limitations, especially for wet weather discharges. Accordingly, we believe that the MS4 permits should incorporate a well-defined, transparent, and finite alternative path to permit compliance that allows MS4 dischargers that are willing to pursue significant undertakings beyond the iterative process to be deemed in compliance with the receiving water limitations." [Revised draft Order, April 24, 2015, p. 17][37]

The Beach Cities WMG agencies appreciate the SWRCB acknowledgement of the challenges that lie ahead, the understanding of the need for adaptive management in this complex and difficult undertaking, and the significant commitment of resources that must be secured to carry out this ambitious plan to address the water quality impacts of municipal stormwater.

[36] Revised Draft April 24, 2015. State of California State Water Resource's Control Board Order WQ 2015-XX In the Matter of Review of Order No. R4-2012-0175.

[37] Revised Draft April 24, 2015. State of California State Water Resource's Control Board Order WQ 2015-XX In the Matter of Review of Order No. R4-2012-0175.

Table 6-9. Capital, O&M, and 20-year Life-Cycle Cost Opinion for Proposed Structural BMPs by Analysis Region

Watershed/ Analysis Region		Location of BMP	Project Name	Construction Cost Range		Annual O&M Range		Total 20-Year Life-Cycle[1] Range	
				Low	High	Low	High	Low	High
Santa Monica Bay Watershed	SMB-5-02, Alternative 1	Manhattan Beach	Manhattan Beach Infiltration Trench[2]	$3.7M	$6.8M	$140K	$190K	$6.5M	$11M
		Manhattan Beach	Distributed Green Streets	$2.4M	$6.5M	$110K	$220K	$4.6M	$11M
		SMB-5-02 Alternative 1 Combined Costs		**$6.1M**	**$13M**	**$250K**	**$410K**	**$11M**	**$22M**
	SMB-6-01	Hermosa Beach	Hermosa Beach Infiltration Trench	$500K	$1.1M	$18K	$32K	$860K	$1.7M
		Hermosa Beach	Hermosa Beach Greenbelt Infiltration[2]	$5.5M	$8.0M	$81K	$90K	$7.1M	$9.8M
		Redondo Beach	Park #3	$1.9M	$3.0M	$28K	$33K	$2.5M	$3.7M
		Hermosa Beach	Distributed Green Streets	$7.0M	$19M	$310K	$640K	$13M	$32M
		SMB-6-01 Combined Costs		**$15M**	**$31M**	**$440K**	**$800K**	**$23M**	**$47M**
	All Analysis Regions	Hermosa Beach	Trash exclusion devices	$160K	$430K	$50K	$64K	$1.1M	$1.7M
		Redondo Beach	Trash exclusion devices	$1.1M	$3.1M	$360K	$460K	$8.3M	$12M
		Manhattan Beach	Trash exclusion devices	$590K	$1.7M	$210K	$270K	$4.8M	$7.1M
	Combined Costs in Santa Monica Bay Watershed			**$23M**	**$50M**	**$1.3M**	**$2.0M**	**$49M**	**$90M**
Dominguez Channel Watershed	DC-RB/MB	Redondo Beach	Powerline Easement Infiltration[2]	$11M	$16M	$160K	$180K	$14M	$20M
		Redondo Beach	Artesia Blvd Infiltration	$2.0M	$3.1M	$30K	$35K	$2.6M	$3.8M
		Redondo Beach + Manhattan Beach	Distributed Green Streets	$7.4M	$20M	$330K	$670K	$14M	$33M
		DC-RB/MB Combined Costs		**$20M**	**$39M**	**$520K**	**$890K**	**$31M**	**$57M**
	DC-Torrance	Torrance	Catch basin inlet filters	$240K	$360k	$130K	$170k	$2.8M	$3.7M
		DC-Torrance Combined Costs		**$240K**	**$360k**	**$130K**	**$170k**	**$2.8M**	**$3.7M**
	Combined Costs in Dominguez Channel Watershed			**$20M**	**$39M**	**$650K**	**$1.1M**	**$33M**	**$61M**
Combined Costs of All Proposed Structural BMPs				**$43M**	**$89M**	**$2.0M**	**$3.1M**	**$82M**	**$150M**

M = Million dollars, K = Thousand dollars

[1] Life-cycle costs include construction costs and 20 years of annual O&M (in 2015 dollars) and are not discounted.

[2] Alternative project locations have also been identified, but are not included in combined cost opinion

7 Potential Funding Sources and Financial Strategy

The availability of funds will be critical for the implementation of the EWMP. This section provides an overview of potentially available funding sources for programs proposed in the EWMP. The funding sources included in this section for consideration are grants, interagency partnerships, bonds, State Revolving Funds, local funding opportunities, and public private partnerships.

The Beach Cities will establish a Memorandum of Understanding (MOU) for implementation of the EWMP. Development of the MOU will be initiated in March 2016 with the goal of completing the MOU by December 2016. At minimum, the scope of the MOU will address how the group will investigate and pursue funding for regional structural BMP projects described in the EWMP, and will include such details as delineation of responsibility, funding milestones, methods to secure funding, and others. The scope of the MOU may also include but is not limited to other joint EWMP implementation activities such as public information and participation programs.

In addition, each City in the Beach Cities WMG is also committed to pursuit of funding for individual EWMP implementation projects and programs related to water quality improvement within their respective cities, as demonstrated by the following examples:

- The City of Hermosa Beach has committed financial support for continuing work under the Stormwater Funding Options study (Farfsing and Watson, 2014 which will assist the City in identifying and implementing strategies for the establishment of sustainable revenue sources to manage stormwater programs and implement water quality improvement projects. In June 2015, the City passed a sanitary sewer fee for residents and commercial property owners to fund maintenance and rehabilitation of its aging sewer infrastructure that had previously been funded from the City's general fund. This dedicated fee for sanitary sewers will allow the City to redirect part of those general fund dollars, for capital improvements and maintenance of the City's storm drain system, including green street projects. The City won multiple awards for its Pier Avenue green street project and the City Council has recently committed to funding green alleyways between Beach Drive and Hermosa Avenue in an effort to improve water quality and flood impacts near the beach.
- The City of Manhattan Beach, like the City of Hermosa Beach, has committed financial support for continuation of the Stormwater Funding Options study. The City is also committed to implementing its Green Street Policy for capital improvement projects in the public right-of-way, has established a minimum runoff capture design goal for such projects, and will also use the EWMP to identify opportunities for green street BMP retrofits in the high priority area. City staff has an excellent track record and enjoys the support of its Council in the pursuit of funding for and implementation of green infrastructure as evidenced by two previous example projects: a 130,000 square feet porous concrete paving project on seven municipal parking lots, and the Greenbelt Infiltration Project installed within the linear greenbelt parkland.
- The City of Redondo Beach's green streets policy requires green street BMPs to be integrated with capital improvement projects (CIPs), thereby ensuring that BMPs be funded as part of ongoing and future CIPs. An example of this policy is the recent addition of catch basin trash screening devices into the Esplanade Street Resurfacing Project. In addition, the City has a

successful track record of pursuing and implementing water quality improvements grant funding such as the Alta Vista Diversion and Re-use Project and the Sapphire Stormdrain Diversion and Infiltration Project.

- The City of Torrance has appropriated funding for their catch basin inlet filters in the Dominguez Channel Watershed and has appropriated funding to complete their TMRP implementation by the end of 2016 (four years ahead of the TMDL compliance deadline). In addition, the City's green streets policy requires green street BMPs to be integrated with CIPs. The City of Torrance has an established record for pursuing grant funds for Storm Water Quality Projects. Completed projects include Bioswales for City Yard ($150,000 State grant funds), Machado Lake Trash TMDL Project ($1,000,000 State grant funds), and the Stormwater Basin Enhancement Project ($3,300,000 State grant funds and $300,000 Federal grant funds).

The foregoing examples illustrate the willingness of Beach Cities' staff and elected officials to pursue funding for EWMP implementation projects. Additional sources of funding will also be investigated, as described below.

7.1 Grant Opportunities

Grants have historically been a backbone for financing stormwater projects. The majority of the water-related grants are designated for flood control, drinking water, and watershed protection; very few grants are made available for the sole purpose of stormwater permit compliance. For example, the State of California has planned to spend $7.5 billion under the Water Quality, Supply and Infrastructure Improvement Act (2014), but only $200 million have been designated for stormwater capture projects statewide to enhance regional water reliability. In order to increase the likelihood of getting grant funding, a stormwater project might need to be added to a larger project or program that serves different proposes and has different objectives rather than just for stormwater management. Thus, collaboration and coordination between stormwater agencies and other public agencies would be important to increase accessible grant funding opportunities for stormwater projects.

It is noted that many grant funds do not cover 100% of the project costs, but instead, cost sharing from local governments (as much as 50%) is required under grant provisions. Furthermore, grants typically cover only project capital costs, but do not provide funding to cover ongoing operations and maintenance, and replacement costs of the infrastructure. Thus, alternative funding sources would be needed to provide stable O&M revenues as well as costs for replacement for any funded projects. **Table 7-1** presents the potential grant opportunities available that the Beach Cities can apply to fund the EWMP projects. The Beach Cities WMG intends to pursue the following grant opportunities:

The Beach Cities WMG has expressed commitment to pursue grant opportunities. The first joint effort will be for Prop 1 Coastal Conservancy in March 2016 for design of two priority regional projects – the Manhattan Beach Infiltration Trench Project and the Hermosa Beach Greenbelt Infiltration Project. Initiation of this pursuit has already begun, with the grant application expected to be submitted by the March 2016 deadline. The Beach Cities WMG intends to submit the Beach Cities EWMP for incorporation into the Integrated Regional Water Management Plan.

Since SB-985-Stormwater Resource Planning became effective in 2014, local governments have been required to have a stormwater resource plan and be in compliance with provisions of SB-985 in order to receive grants for stormwater and dry-weather runoff capture projects from a bond act approved by the voters after January 1, 2014. The EWMP could potentially be utilized as a functionally equivalent plan but further clarification will need to be provided in the guidance document which is anticipated to be established by the State Water Resource Control Board by July 1, 2016. Agencies and the LARWQCB staff should review and comment on the guidance document to ensure that these plans can be utilized.

Table 7-1. Relevant Grant Opportunities

Program	Department	Purpose	Ineligible Uses	Funding Limits
WaterSMART: Water and Energy Efficiency Grants	US Bureau of Reclamation	Projects should seek to conserve and use water more efficiently, increase the use of renewable energy, protect endangered and threatened species, facilitate water markets, or carry out other activities to address climate related impacts on water or prevent any water-related crisis or conflict.	Normal operations, maintenance, and replacement (OM&R). OM&R is described as system improvements that replace or repair existing infrastructure or function without providing increased efficiency or effectiveness of water distribution over the expected life of the improvement. Construction of a building.	Funding will be awarded at one of two levels: Funding Group I: Up to $300,000 per agreement for a project up to 2 years. Funding Group II: Up to $1,500,000 for an agreement for up to 3 years for a small number of projects.
WaterSMART: Cooperative Water Management Program (CWMP) Grants	US Bureau of Reclamation	The purpose is to improve water quality and ecological resilience and to reduce conflicts over water through collaborative conservation efforts in the management of local watersheds. The primary goal is to address two major concerns synonymous with watershed groups – 1) the need for funding to pay the salary of a full-time coordinator and 2) the limited funding available for project management.	Please visit the following website for evaluation criteria: http://www.usbr.gov/WaterSMART/cwmp/docs/CWMPEvaluationCriteria.pdf	Phase I funds shall be used to establish or enlarge a watershed group, to develop a mission statement for the watershed group, to develop project concepts, and to develop a restoration plan. Phase II funds shall be used to plan and carry out watershed management projects. Phase III funds shall be used to plan and carry out at least one watershed management project.
IRWM Implementation Program Proposition 84 (Chapter 2, §75026)	Department of Water Resources	Award funds for implementation of projects consistent with IRWM Plans to assist local public agencies in meeting long-term water management needs of the state, including the delivery of safe drinking water, flood risk reduction, and protection of water quality and the environment.	Operation and maintenance activities	Bond funding allocation for entire program is $1 billion. Prop 84 allots grant funding to 11 funding areas.

Program	Department	Purpose	Ineligible Uses	Funding Limits
Flood Corridor Program Propositions 1E, 84 and 13	Department of Water Resources	Flood risk reduction through non-structural projects that include wildlife habitat enhancement and/or agricultural land preservation components	Flood protection projects that do not include wildlife habitat enhancement or agricultural land preservation benefits	$5 million per eligible project. 10% non-state, non-federal cost share required; may be reduced to 5% or no-cost share if serving disadvantaged or severely disadvantaged community
Flood Control Subventions Program Propositions 1E and 84	Department of Water Resources	Implementation of federally authorized flood control projects (minor or major) and Watershed Protection Flood Prevention Projects	Flood control projects without federal authorization	Variable state cost-share percentage based on multipurpose objectives for projects, ranging from a minimum of 50% to a maximum of 70%
Statewide Flood Emergency Response Program Proposition 84	Department of Water Resources	Preparing or updating local emergency plan; Coordinating flood emergency planning and preparedness (including training & exercise); Developing communication & coordination response process; Collecting & exchange of flood information; Purchase & installing equipment for interoperable emergency communication.	Projects not included in guidelines. Projects in the Legal Delta.	$10 million for Statewide (outside the legal Delta) for Prop 84.
Santa Monica Bay Restoration Plan Proposition 84 ($18 million allocated)	Santa Monica Bay Restoration Commission	Providing a funding source for implementation of projects that protect Santa Monica Bay beaches and coastal waters, prevent contamination and degradation of coastal waters and watersheds, and protect and restore the Bay's marine, freshwater, and terrestrial habitats.	Projects that do not meet the Clean Beaches Program requirements. O&M projects are not eligible.	A minimum of $150,000 and a maximum of $6 million per project. Approximately $7 million have been made available for the recent request for proposals that closes on January 15, 2016.
California Coastal Conservancy, Prop 1 ($100.5 million allocated)	California Coastal Conservancy	Funding for multi-benefit water quality, water supply, and watershed protection and restoration projects.	Projects that do not comply with the Proposition 1 Grant Program Guidelines. Projects that use potable water for irrigation. O&M projects are not eligible.	$10 million per year grants will be made available over the next 10 years.

Program	Department	Purpose	Ineligible Uses	Funding Limits
Storm Water Grant Program, Prop 1. ($200 million), approved as part of the Water Quality, Supply and Infrastructure Improvement Act (2014).	State Water Resources Control Board and Regional Water Quality Control Boards	Funding for multi-benefit storm water management projects which will improve regional water self-reliance, security, and adapt to the effects on water supply arising from climate change.	Projects that 1) must seek eminent domain as part of their project implementation timeline; 2) do not meet the requirements of the Prop 1 Storm Water Grant Program Guidelines, the Storm Water Resources Plan Guidelines, Water Code, and Prop 1; 3) consist of only education and outreach activities.	Planning projects: min. $50K and max. $500K; Implementation projections: min. $250K and max. $10M.
IRWM Grant Program, Prop 1 ($510M, 2014) and Prop 84 ($232M, remaining).	Department of Water Resources	Funding for planning and implementation of IRWM, and groundwater sustainability.	IRWM plans/projects that do not contribute to addressing climate change risks; do not meet the requirements stated in the Prop 1 and Prop 84 Program Guidelines.	A total of $98M of the Prop 1 funding has been allocated to the Los Angeles Region. The Los Angeles Region has about $40M of remaining balance from Prop. 84 (after 2014 Drought Grant Awards).

7.2 Project-Specific Interagency Partnerships

Stormwater management projects often overlap with the jurisdiction of other public agencies, including water agencies, as well as parks and schools. Interagency partnerships would not only allow agencies involved to leverage one other's available funding resources to make cost intensive projects possible, but would also improve local government funding efficiency. These types of interagency partnership projects could also optimize the potential social, environmental, and economic benefits provided to the community. An interagency partnership also provides an alternative avenue for stormwater agencies to access to grant funding that would otherwise not be available to them. In addition to the above benefits, a partnership with public utility agencies, such as water and refuse collection services, might also provide a mechanism for cost transfer from stormwater agencies to these agencies. For example, the use of stormwater for non-potable water may conserve drinking water. The cost for providing the infrastructure and the ongoing O&M could be partly funded through fees charged by water agencies as part of their cost for water conservation. **Table 7-2** provides a list of potentially viable partnerships and the benefits derived from management of stormwater runoff.

Table 7-2. Added Benefits of Interagency Partnership for Stormwater Management

Potential Partners	Benefits Derived from Stormwater Management
Flood control district	• Flood protection • Climate change mitigation
Water agencies	• Potable water conservation through stormwater use for non-potable water purposes • Surface water pollution prevention • Increase non-potable water storage through installation of underground cisterns
Parks, Coastal Commission	• Terrestrial and marine habitat protection by reducing trash from entering the ocean and other terrestrial habitats • Water pollution prevention • Erosion reduction

7.3 Local Bond Issuance

Bonds have been utilized by local governments to provide funding for stormwater projects. There are two types of bonds that can be utilized. One of them is GO bonds. GO bonds are issued by local governments, which are repaid through a tax surcharge (e.g. property). The City of Los Angeles, for example, has used GO bonds to fund their stormwater projects. The City sold $440 million GO bonds under Proposition O Clean Water Bonds. The bond proceeds were used for implementation of 39 projects but could not be used for ongoing maintenance, operations and replacement of these facilities (Farfsing and Watson, 2014). The challenge of utilizing GO bonds is that GO bond issuance and the amount to be issued must be approved by two-third of the voters. The main drawback of election approval requirement is that the cost of holding an election can be high and the chance of success is often unpredictable.

Another type of bonds that can be used at the local level is revenue bonds. Revenue bonds are tax-exempt securitized bonds that are issued by utility agencies, such as water agencies. These bonds

are repaid through utility rate increases charged directly to customers. Recent enactment of AB-850-Public Capital Facilities: Water Quality allows local publically owned water agencies to finance water quality and water conservation related projects by issuance of revenue bonds through a Joint Powers Authority (JPA). Under the provisions of AB-850, water agencies are allowed to use the bond proceeds to pay for construction, repair, maintenance, and operations of eligible projects. Both stormwater capture and water quality compliance projects are considered as eligible projects that can be financed through bond issuance under the AB-850 mechanism. Additionally, AB-850 authorizes water agencies to repay these bonds through water utility rate increases – the same way as other revenue bonds not issued under the SB-850 mechanism by water agencies. Such rate increases are also subject to Proposition 218 approval under the exempt category (i.e. only a public hearing is required).

Since the enactment of AB-850, a JPA, called Southern California Public Water Authority (SCPWA), has been established by the Los Angeles Department of Water and Power and the Burbank Water and Power (LADWP, 2015). The first two members of the SCPWA are the City of Los Angeles and the City of Burbank. The Beach Cities can consider becoming members of the SCPWA. However, details on how bond proceeds can be directed to pay for eligible stormwater projects identified in the EWMP will need to be further evaluated. It is expected that high level of collaboration and coordination between stormwater and water agencies would be required.

SB-628–Enhanced Infrastructure Financing Districts (EIFD) will allow issuance of general obligation bonds within the EIFD inside a city or a county. The Bill authorizes a legislative body to establish an enhanced infrastructure financing district, adopt an infrastructure financing plan, and issue bonds upon approval by 55% of the voters to finance public capital facilities such as collection and treatment of water for urban uses and flood control projects. Under the provisions of SB-628, a City or a County can establish an EIFD of any size. If a defined EIFD has fewer than 12 registered voters, only a protest hearing is required to be conducted for landowners. The number of votes that each landowner gets will depend on the size of the land they own. The ballot will specify a vote per acre or a portion of an acre. The bonds issued under this bill will be repaid through property tax increase (i.e. tax increment financing). The district will cease to exist in no more than 45 years from the date on which bond issuance is approved.

7.4 State Revolving Funds

Clean Water State Revolving Fund (CWSRF) Program, which is managed by the State Water Resource Control Board and funded by the US Environmental Protection Agency, is an alternative funding source for development of new infrastructure projects that will benefit water quality. The CWSRF finances water quality projects similar to those proposed in the EWMP, including nonpoint source, watershed protection or restoration, estuary management projects (USEPA, 2014). The main advantage of CWSRF is that their interest rates are typically much lower than market rates (e.g. 3% for a 20-year loan instead of 6%). The loans are project-specific and can serve as a good financial resource for funding project design and construction. The cost-saving achieved from utilizing the CWSRF can vary between 17% and 25% of the total project costs compared to conventional loans (USEPA, 2014; SWRCB, 2014). The maximum repayment term is 20 years. The CWSRF also has an Expanded Use program that provides funding for stormwater treatment and

diversion, sediment and erosion control as well as stream restoration projects (CFCC, 2015). This special program offers interest rate at one-half of the general obligation bond rate with a repayment period of up to 30 years. There is no limit in terms of the amount an agency can borrow under this program. The main limitation of the CWSRF is that it cannot be used for project operation and maintenance (O&M) purposes (USEPA, 2013b).

The Infrastructure State Revolving Fund Program managed by the California Infrastructure and Economic Development Bank provides financing for public infrastructure projects for environmental mitigation purposes (CFCC, 2015). The loan can be used for construction or modification of public infrastructure, including educational, cultural, and social facilities, purchase and installation of pollution control equipment, and parks and recreation facilities. The loan size can range between $50,000 and $25 million with a maximum repayment period of 30 years. The interest rate is based on market rate but may be adjusted based on the social and economic status of the area where the project will be implemented.

Access to the State Revolving Funds is limited by the agencies' ability to borrow due to repayment of other debt obligations (e.g. lease burden). It has been reported that a typical median net lease burden for a California county is 1.7% of general fund revenues while the total burden of lease and General Fund obligations is 1.9% (Moody, 2012). Loan repayment will require alternative funding sources if reliance on general fund resources is not an option.

7.5 Local Public Funding Opportunities and Approval Procedures

Stormwater charges are potentially the most critical local funding source to finance stormwater programs in California. These charges include stormwater fees and taxes, as well as other funds generated through general obligation and revenue bond issuance. **Table 7-3** provides an overview of potential local funding sources that may be utilized to provide funds to finance stormwater programs. An important factor to consider when utilizing these funding mechanisms is the respective approval mechanisms as discussed below.

Table 7-3. Local Funding Opportunities

Fees	Taxes	Bonds
• Fixed and volumetric service fees • Property assessments or fees • Developer fees or connection fees (a one-time fee) • Permitting fees	**General taxes** • Property, sales, and other activities **Special taxes** • Parcel taxes to pay for flood protection, stormwater management, watershed protection • Sales tax add-ons • Transient Occupancy Tax to pay for creeks restoration and water quality improvement projects	**General bonds** • Repaid through a property tax surcharge **Revenue bonds** • Issued by local utilities (e.g. water) • Repaid by service fees, developer fees, plus occasional special taxes

Local funding opportunities presented in **Table 7-3** are subject to approval mechanisms that can vary from holding a simple written protest hearing to an election, depending on the type of funding sought after (**Table 7-4**). The types of charges that are deemed to be most suitable for stormwater-related services are property-related fees. For a property-based flood control-related stormwater management fees, an election is required to be conducted under the provisions of Proposition 218. However, there are two categories under Proposition 218 that are exempt from the election approval requirements. They are water-related and refuse collection services. The recent approval of AB2403 has extended the definition of water in Proposition 218 to include stormwater capture projects for infiltration and direct non-potable uses, which means that these projects are also exempt from the election requirement under Proposition 218.

Even with the extended definition of water in the California Constitution, the existing form of Proposition 218 still requires voter approval for stormwater fees which has limited stormwater agencies' ability to generate sufficient revenue to support stormwater projects related to permit compliance. An amendment to Proposition 218 that will allow stormwater fees to be treated like water, sewer, and refuse fees, is being discussed and considered (CSQA, 2015). A new AB-1362, which is designed to include the definition of "stormwater" into the California Constitution's Article XIII C and Article XIII D, was introduced to the State Assembly on February 27, 2015. The introduction of this Bill marks the first step toward such an amendment of Proposition 218.

Given the existing unique regulatory framework and limitation of Proposition 218, some local governments have broken down the stormwater revenue requirements by functions instead of a single property-related fee. Some of them have utilized the exempt category under Proposition 218 to fund stormwater projects with success. The Cities of Signal Hill, Poway, and Solana Beach, for example, have utilized a surcharge on trash collection fees to cover the some of the cost for stormwater-related trash collection and management. A surcharge on water utility fees has also been used by the Cities of Del Mar, Oceanside, and Solana Beach to provide funding to fund stormwater operation as part of the drinking water pollution prevention effort (Farfsing and Watson, 2014).

Pollution prevention is an important component in stormwater management. Given that majority of the pollutants in stormwater runoff originate from vehicles, some local governments have used other non-property-related surcharges to provide funding for stormwater programs. For example, the Orange County Transportation Authority has used the County's sales tax to provide some funding for a water quality improvement and environmental cleanup program. The San Mateo County has also added a surcharge on the vehicle license fee to provide funding for their stormwater pollution management program. It is also foreseeable that pollutant specific, such as a TMDL-related fee could be established to provide funding for TMDL compliance related programs in the future.

In addition to fees that provide steady revenue, another possible revenue source would be to charge fines to property owners that violate discharge limits (volumetric- or TMDL-based). Fines are not considered as a stable financial income, however it discourages behavior or practices that will lead to non-compliance. Furthermore, fines are exempt from election requirements under Proposition 26 and have been commonly used by water agencies to discourage excessive water consumption behavior. The use of fines under Proposition 26 as a financial instrument to management stormwater discharge in urban areas is still uncommon but might worth exploring.

Table 7-4. Local Funding Approval Mechanisms

	Proposition 13 (1978)	Proposition 218 (1996)	Proposition 26 (2010)
General taxes	Flexible	Simple majority for cities and counties, not available to special districts	*(rules from the earlier proposition remain in place)*
General obligation bonds	Two-thirds of local voters	Two-thirds of local voters	Two-thirds of local voters
Special taxes	Two-thirds of local voters	*(rules from the earlier proposition remain in place)*	*(rules from the earlier proposition remain in place)*
Property taxes	1% of purchase price + 2% annual increases	*(rules from the earlier proposition remain in place)*	*(rules from the earlier proposition remain in place)*
Property-related fees and assessments	Flexible	1. All water-related and refuse collection services: strict cost-of-service requirements 2. All water-related and refuse collection services: property-owner protest hearing 3. Floods and stormwater: 50% of property owners or two-third popular vote	*(rules from the earlier proposition remain in place)*
Non-property-related fees	Flexible	Flexible	Stricter requirements (more likely to be a tax)
Wholesale fees	Flexible	Flexible	Stricter cost-of-service requirements

Source: Public Policy Institute of California (PICC), 2014.

7.6 PUBLIC PRIVATE PARTNERSHIPS

Public private partnerships (P3) can be achieved through two approaches. The conventional approach will involve having the private partner to undertake design and construction, and sometimes even operation and maintenance of the facilities. The private partner will recover the cost plus their return-on-investment through a guaranteed revenue stream (e.g. a user fee) over a long period (e.g. 30- 40 years). The main advantage of such an approach is that the upfront financing costs are provided through the private partner while the project performance is guaranteed by the private partner. Also, P3 can be utilized when agencies have restrictions on the amount of debt that they can carry (e.g. agencies want to maintain low lease burden or have high lease burden). Potential cost saving can be achieved through higher financial efficiency during project implementation phase. P3 can also expedite project implementation by simplifying administrative procedures for financing as well as eliminating the need for tendering. The main challenge for implementation of P3 is to get voters to approve a longer revenue stream to repay the private partner. The amendment of Proposition 218 is expected to lower such hurdle for providing such a revenue stream.

The second P3 approach is through direct financial subsidies to local projects that do not contribute to cash revenue generation. However, subsidies can create a financial incentive to encourage local participation without providing the full cost for project implementation. Such an approach can increase financial efficiency by leveraging financial input from communities. A list of cities that utilize financial subsidies to maximize their local stormwater capture capacity is provided in **Table 7-5**. Based on these examples presented in **Table 7-5**, subsidies can be given out in forms of 1) rebates per project with caps for stormwater runoff reduction projects, 2) rebate per rain barrel or cistern, 3) rebate per parcel, 4) stormwater fee reduction, and 5) cost sharing.

Among all the runoff capture subsidy programs listed in **Table 7-5**, the approach adopted by the City and County of San Francisco is considered as the most progressive. The City and County adopted the onsite Water Reuse for Commercial, Multi-family, and Mixed Use Development Ordinance which amended the San Francisco Health Code to allow for the collection, treatment, and use of alternative water sources (including stormwater runoff) for non-potable applications. The City and County has since developed a Non-potable Water Program that allows commercial, mixed use, and multifamily residential property owners to collect, treat and reuse water from various sources onsite, including stormwater runoff. The Program also allows the property owners to act as local non-potable water suppliers to provide non-potable water to buildings in the vicinity. Property owners or developers are required to comply with stringent monitoring and reporting requirements for 10 years in order to maintain such privilege. The San Francisco Public Utilities Commission (SFPUC) has created a grant assistant program that provides up to $250,000 for single building projects and up to $500,000 for district-scale projects meeting specific eligibility criteria to encourage participation.

Table 7-5. Selected Cities that provide Financial Subsidies to encourage the Development of Stormwater Infrastructure in Private Properties

Reference	Runoff Reduction	Runoff Capture and Use
San Francisco, CA (SFPUC, 2015)	**Grants** • Up to $30,000 with 35% match requirement • Up to $100,000 with 25% match requirement	**Grants (treatment is required)** • Up to $250,000 for single building projects • Up to $500,000 for district-scale projects
Palo Alto, CA (City of Palo Alto, 2015)	**Rebates** • Permeable pavement, ≤ $1,000 at $1.5/sq. ft., • Green roofs, ≤ $1,000 at $1.5/sq. ft.	**Rebates (roof runoff)** • Rain barrel $50 each • Cisterns ≤ $1,000 at $1.50/sq. ft.
Seattle, WA (Seattle Public Utilities [SPU], 2015)	• Rebates for onsite facility installation, e.g. rain garden • Stormwater drainage fee reduction	• Rebates for onsite facility installation, e.g. cistern (Roof runoff) • Stormwater drainage fee reduction
Montgomery County, MD (County of Montgomery, 2015)	**Rebates** • Residential, ≤ $2,500 per parcel • Commercial, ≤ $10,000 per parcel	**Rebates (roof runoff)** • Residential, ≤ $2,500 per parcel • Commercial, ≤ $10,000 per parcel
Washington, D.C. (Washington D.C., 2015)	Residential rebates Trees, ≤ $50 or $100 per tree Pervious surface, ≤ $2,500 at $1.25/sq. ft. All customers: Provide ≤55% stormwater fee discount	Residential rebates (roof runoff) Cisterns, ≤ $500 at $1/gallons All customers: Provide ≤55% stormwater fee discount

7.7 Financial Strategy

The above examples describe how the stormwater management program can potentially be funded using multiple approaches rather than a single fee arrangement. Such a strategy could potentially reduce the risk of insufficient support by voters or property owners. Based on the above discussions, a summary of potential financial approaches is provided in **Table 7-6**.

Table 7-6. Funding Approach Summary

Approach	Funding Type	Limitations	Potential Significance (with Respect to Overall Funding)
Grants	New Revenue	• Competitive • No guarantee of funding accessibility • Infrastructure projects only • Application preparation/submission requires significant staff time • Can only be used to pay for infrastructure-related projects • O&M costs are typically excluded	Medium
Project-Specific Interagency Partnerships	New Revenue	• Requires coordination between agencies • Varying project implementation schedules between agencies limit the viability of such an option	High
Local Bond Issuance	Financing	• GO bonds require approval by voters. • Revenue bond requires to be backed by a revenue stream • There is a financing cost • Infrastructure projects only • O&M costs are typically excluded	High
State Revolving Funds	Financing	• Revenue stream is needed to obtain loans • There is a financing cost • Infrastructure projects only • O&M costs are typically excluded	High
Local Public Funding Opportunities	New Revenue	• Requires voter approval • Infrastructure projects only (except for stormwater fee) • O&M costs are typically excluded (except for stormwater fee)	High
Public Private Partnership	Financing	• Revenue stream is needed to allow the private partner to recover their cost as well as provide return on investment	High
	Direct Subsidies / Cost-Sharing	• Funding source is needed to fund a subsidy program • Some projects may underperform due to poor project implementation, O&M, and monitoring	Low

7.8 WATERSHED MANAGEMENT PROGRAM BUDGETS

Table 7-7 provides watershed management program budget information for the Cities of Hermosa Beach, Manhattan Beach, Redondo Beach, and Torrance, as presented in the cities' Annual Reports per NPDES No. CAS 004001 Los Angeles County Municipal Storm Water Permit Order No. 01-182 and certain provisions of Order No. R4-2012-0175.

Table 7-7. Watershed Management Program Budgets for the Beach Cities WMG

	City of Manhattan Beach		City of Redondo Beach		City of Hermosa Beach		City of Torrance	
Program Element	**Expenditures in FY14-15**	**Budget FY15-16**	**Expenditures in FY14-15**	**Budget FY15-16**	**Expenditures in FY14-15**	**Budget FY15-16**	**Expenditures in FY14-15**	**Budget FY15-16**
1. Program Management	$26,567	$15,900	$29,700	$29,700			$126,525 (CDD staff) $36,416 -MS4 Annual Fee	$140,000
a. Administrative staff time	included	included	included	included	$13,000	$13,000	Included	included
b. Administrative consultant support	included	included	included	included	$22,414	$19,800	included	Included
c. NPDES Permit fee and WDR fee	N/A	N/A	N/A	N/A	$10,000	$9,594	N/A	N/A
2. Public Information and Participation								
a. Public Outreach and Education	$8,184	$5,400	$7,700	$7,700	$8,057	$6,600	$6,500	$10,000
b. Employee Training	$9,716	$9,600	$7,700	$7,700	$6,092	$9,300	$2,500	$3,500
c. Used Oil, BCR (Hermosa Beach)/ c. Corporate Outreach (Redondo Beach, Torrance)	N/A	N/A	$6,600	$6,600	$15,692	$15,455	N/A	$1,500
d. Business Assistance	$1,735	$1,500	$7,700	$7,700	$3,085	$3,300	N/A	$1,000
3. Industrial/Commercial			$99,000	$99,000			$126,691 (fire-inspection & enforcement)	$135,000
a. Consultant	$1,112	$ 900	Included	Included	$3,263	$900	N/A	N/A

	City of Manhattan Beach		City of Redondo Beach		City of Hermosa Beach		City of Torrance	
Program Element	**Expenditures in FY14-15**	**Budget FY15-16**	**Expenditures in FY14-15**	**Budget FY15-16**	**Expenditures in FY14-15**	**Budget FY15-16**	**Expenditures in FY14-15**	**Budget FY15-16**
b. Restaurant Inspect (incl. FOG)	$37,500	$35,000	Included	Included	City's cost recovered through fees	City's cost recovered through fees	N/A	N/A
c. Commercial Inspections	$9,500	$12,000	Included	Included	N/A	N/A		
4. Development Planning	$16,783	$2,400	$16,500	$16,500			N/A	N/A
a. Consultant/Special Projects	included	included	Included	Included	$9,797	$2,400	N/A	N/A
b. SUSMP and priority project	included	included	Included	Included	City's cost recovered through fees	City's cost recovered through fees	N/A	N/A
5. Development Construction								
a. Consultant	N/A	N/A	N/A	N/A	N/A	$4,500	N/A	N/A
b. Construction Site Inspections	$12,000	$3,600	$26,400	$26,400	City's cost recovered through fees	City's cost recovered through fees	$45,000 (BMP Investigation, Inspection)	$55,000
6. Public Agency Activities								
a. Public Facility Inventory and BMPs	N/A	N/A	$26,400	$26,400	N/A-	$9,000	$686,305.65	TBD
b. Municipal street sweeping	$346,000	$352,000	$1,045,000	$1,045,000	$164,354	$169,286	$1,240,000	$124,000
c. Downtown cleaning	N/A	N/A	N/A	N/A	$141,577	$153,815	N/A	N/A
d. Catch basin and insert cleaning	$135,000	$138,000	$66,000	$66,000	$20,000	$28,688	$135,000	$135,000
e. Trash collection/recycling	$3,414,000	$3,483,000	$660,000	$660,000	N/A	N/A	$10,340,000 (PW), $402 (Transit)	$10,500,000
f. Capital Costs	N/A	$440,000	N/A	N/A	$957,626	$5,000	$76,000	$4,000,000
g. Consultant assistance	$10,831	$9,000	N/A	N/A	N/A	N/A	N/A	N/A
h. Community Services (Parks)	N/A	N/A	N/A	N/A			$9,570	TBD

	City of Manhattan Beach		City of Redondo Beach		City of Hermosa Beach		City of Torrance	
Program Element	**Expenditures in FY14-15**	**Budget FY15-16**	**Expenditures in FY14-15**	**Budget FY15-16**	**Expenditures in FY14-15**	**Budget FY15-16**	**Expenditures in FY14-15**	**Budget FY15-16**
7. IC/ID Program			$30,800	$30,800			N/A	N/A
a. Sewer line hydro flushing	N/A	N/A	N/A	N/A	$126,885	$126,885	N/A	N/A
b. Sewer CCTV, emergency repairs	N/A	N/A	N/A	N/A	$188,000	$272,325	N/A	N/A
c. IC/ID Program			N/A	N/A	$1,518	$9,000	N/A	N/A
d. Operations and Maintenance	$3,100	N/A	Included	Included	N/A	N/A		
e. Consultant Assistance	$10, 831	$9,000			N/A	N/A		
8. Monitoring and TMDL Compliance			$30,800	$30,800			$150,000	$160,000
a. CIMP Implementation	N/A	$80,000			N/A	$26,222	included	Included
b. CSMP Monitoring and Compliance	$11,130	$11,350			$3,457	N/A	included	included
9. Watershed Planning and Implementation							N/A	N/A
a. WMG Planning	N/A	N/A			$10,276	$14,700	N/A	N/A
b. EWMP and CIMP development	$65,000	$10,000			$27,704	$85,000	N/A	N/A
c. TMDL Consulting Services	$12,500	$61,060			N/A	N/A	N/A	N/A
10. Other	N/A	N/A	$209,000	$209,000	N/A	N/A	$20,000 (PW and Parks)	$25,000 (PW and Parks)
11. Total	$4,131,489	$4,679,710	$2,275,900	$2,275,900	$1,732,797	$984,770	$13,000,910	15,290,000

8 LEGAL AUTHORITY

The Beach Cities WMG Permittees have the necessary legal authority to implement the BMPs identified in the EWMP, as provided in **Appendix P**.

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