County of San Diego

SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD

2012 OCT -4 A 11:44

DEPARTMENT OF PUBLIC WORKS

RICHARD E. CROMPTON
DIRECTOR

5510 OVERLAND AVE, SUITE 410
SAN DIEGO, CALIFORNIA 92123-1237

(858) 694-2212 FAX: (858) 694-3597
Web Site: www.sdcounty.ca.gov/dpw/

October 4, 2012

David Gibson
California Regional Water Quality Control Board, San Diego Region
9174 Sky Park Court, Suite 100
San Diego, CA 92123

Dear Mr. Gibson:

SAN DIEGO RIVER WATERSHED COMPREHENSIVE LOAD REDUCTION PLAN

Attached please find two (2) electronic copies of the San Diego River Watershed Comprehensive Load Reduction Plan (CLRP). The CLRP was prepared by the County of San Diego, the Cities of El Cajon, La Mesa, Santee, San Diego, and the California Department of Transportation in response to the *Revised Total Maximum Daily Loads for Indicator Bacteria, Project 1 – Twenty Beaches and Creeks in the San Diego Region*.

If you have any questions, please contact Todd Snyder, Land Use & Environmental Planning Manager at (858) 694-3482 or todd.snyder@sdcounty.ca.gov.

Sincerely,

CID TESORO
Manager

CT:sn:js

Attachments: San Luis Rey River Watershed Comprehensive Load Reduction Plan, CD

CC (without attachments):
Constantine Kontaxis, Caltrans
Clem Brown, City of San Diego
Helen Davies, City of Santee
Jaime Campos, City of El Cajon
Joe Kuhn, City of La Mesa
Todd Snyder, County of San Diego

County of San Diego

SARAH E. AGHASSI
DEPUTY CHIEF ADMINISTRATIVE OFFICER

LAND USE AND ENVIRONMENT GROUP
1600 PACIFIC HIGHWAY, ROOM 212, SAN DIEGO, CA 92101
(619) 531-6256 • FAX (619) 531-5476

San Diego River Watershed Comprehensive Load Reduction Plan (CLRP) Submittal

I certify, under penalty of law, that this San Diego River Watershed Comprehensive Load Reduction Plan and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for known violations.

Sarah Aghassi (signature)
SARAH E. AGHASSI
Deputy Chief Administrative Officer

10/1/12
Date

STATEMENT OF CERTIFICATION

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KRIS MCFADDEN
Deputy Director
Transportation & Storm Water Department

9/27/12
Date

Transportation & Storm Water Department
9370 Chesapeake Drive, Suite 100, MS 1900 • San Diego, CA 92123
Hotline (619) 235-1000 Fax (858) 541-4350

STATEMENT OF CERTIFICATION

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PEDRO ORSO DELGARDO
Director of Development Services/Deputy City Manager

9/27/12
Date

CITY OF EL CAJON
www.ci.el-cajon.ca.us
PUBLIC WORKS DEPARTMENT

San Diego River Watershed
Comprehensive Load Reduction Plan (CLPR)

CERTIFICATION

"I Certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Rob Turner — 10/2/12

Signature — Date

Rob Turner, Deputy City Manager/Director of Public Works — (619) 441-1781

Printed Name, Title — Phone Number

200 CIVIC CENTER WAY • EL CAJON, CA 92020-3916 • TEL: (619) 441-1653 • FAX: (619) 579-5254

DEPARTMENT OF TRANSPORTATION
DISTRICT 11
4050 TAYLOR STREET, M.S. 242
SAN DIEGO, CA 92110
PHONE (619) 688-0100
FAX (619) 688-4237
TTY 711
www.dot.ca.gov

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September 27, 2012

STATEMENT OF CERTIFICATION

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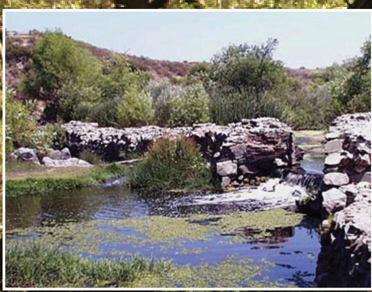
I certify, under penalty of law, that this San Diego River Watershed Comprehensive Load Reduction Plan and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for known violations.

BRUCE L. APRIL
Deputy District Director, Environmental

San Diego River Watershed Comprehensive Load Reduction Plan



Submitted by

County of San Diego and
City of San Diego
City of La Mesa
City of El Cajon
City of Santee
Caltrans

Prepared by

Geosyntec consultants

3990 Old Town Avenue
Suite A-101
San Diego, CA 92110
T 619.297.1530

www.geosyntec.com

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GLOSSARY

AB411 – Assembly Bill 411

AED – Allowable exceedance days

AEF – Allowable exceedance frequency

ARC – Armand Ruby Consultants

BMP – Best management practice

CCS – Comprehensive Compliance Schedule

CLRP – Comprehensive Load Reduction Plan

CPI – Catchment prioritization index

EMC – Event mean concentration

FC – Fecal Coliform

FIB – Fecal indicator bacteria

GM – Geometric mean

HA – Hydrologic area

LID – Low impact development

MP – Monitoring Plan

MPN – Most probable number

MST – Microbial source tracking

NCPI – Nodal catchment priority index

NRCS – Natural Resources Conservation Service

NSE – Natural source exclusion

POC – Pollutant(s) of Concern

Responsible Party – Municipal separate storm sewer system

ROW – Right of way

RTFH - Regional Task Force on the Homeless

RWQCB – Regional Water Quality Control Board

SBPAT – Structural BMP Prioritization and Analysis Tool

SCCWRP – Southern California Coastal Water Research Project

SDRWQCB – San Diego Regional Water Quality Control Board

SDR – San Diego River

SSM – Single sample maximum

SUSMP - Standard Urban Stormwater Mitigation Plan

SWMM – Storm Water Management Model

TDS – Total dissolved solids

TSS – Total suspended solids

TLR – Target load reduction

TMDL – Total maximum daily load

WLA – Waste load allocation

WQ – Water Quality

WQO – Water quality objective

WY – Water Year

EXECUTIVE SUMMARY

TMDL Requirements

The Total Maximum Daily Load (TMDL) for Indicator Bacteria adopted by the San Diego Regional Water Quality Control Board (Resolution No. R9-2010-0001) requires Responsible Parties in the San Diego River (SDR) Watershed (Cities of San Diego, El Cajon, La Mesa, and Santee, County of San Diego, and Caltrans) to prepare a Load Reduction Plan (LRP) outlining a proposed program of activities that will be capable of achieving TMDL-specified bacteria load reductions. The purpose of the Bacteria TMDL is to protect the health of those who recreate at beaches receiving runoff from the SDR Watershed by reducing the amount of bacteria discharged to the beach through urban runoff, stormwater, and other sources. To qualify for an extended 20-year wet weather compliance timeline, the Responsible Parties opted to develop a Comprehensive Load Reduction Plan (CLRP) and address multiple constituents. Under the extended timeline, the TMDL requires Responsible Parties to attain required load reductions during both dry weather and wet weather conditions within a 10- and 20-year compliance timeline, respectively. The compliance points for this watershed are the Pacific Ocean shoreline at the mouth of SDR, as well as two locations each within the main stems of SDR and Forester Creek.

Technical Approach

To increase the efficiency of limited planning resources, and to quality for an extended 20-year wet weather compliance timeline, this CLRP addresses multiple pollutants of concern in the watershed in addition to fecal indicator bacteria (specifically, nitrogen and phosphorous).

To identify a program of activities that will be capable of achieving TMDL-required bacteria load reductions during wet weather, the Responsible Parties used a robust, public-domain computer model with the ability to simulate hydrologic and pollutant loadings and to evaluate various best management practice (BMP) implementation scenarios. The wet weather model used for the SDR Watershed was the Structural BMP Prioritization and Analysis Tool (SBPAT), a GIS- and EPA SWMM-based water quality model, modified to incorporate local water quality data and runoff characteristics, as well as current information on BMP effectiveness from the International BMP Database. The water quality model was used to estimate the target bacteria load reductions for various BMP implementation scenarios that are predicted to achieve compliance with the TMDL's allowable exceedance day-based Waste Load Allocations (WLAs). Analyses were based on the TMDL compliance year (i.e., 1993 Water Year (WY)).

BMP Implementation

The CLRP is a compliance plan that identifies a suite of potential nonstructural and structural BMPs. The CLRP does not oblige the Responsible Parties to construct the measures but identifies those that are predicted to be effective in attenuating pollutant loading to reach target load objectives. Candidate BMPs were identified based on their cost and potential effectiveness in reducing bacteria, nitrogen, and phosphorous pollutant loading in the watershed, with the goal of achieving estimated target load reductions for both wet and dry weather.[1] Nonstructural BMPs are emphasized as the preferred implementation approach, particularly in the initial phases of CLRP implementation, because they are the most cost-effective way of reducing pollutant loading.

Additional factors considered in identifying candidate nonstructural BMPs included: feasibility of implementation, potential load reduction effectiveness, regional preferences, and results from local pollutant source identification studies. Additional factors considered in identifying and locating potential structural BMPs included: geographic prioritization of the watershed based on water quality need, the appropriateness of various BMP types based on load reduction capability and other constraints using the SBPAT modeling tool, projected implementation costs, and best professional judgment.

BMPs specified in this CLRP were identified and prioritized in order to demonstrate a pathway toward compliance with Bacteria TMDL requirements. Responsible Parties will implement identified BMPs (or other similarly performing BMPs) as resources are available. Implementation of activities and BMPs will be prioritized along with other essential Responsible Party obligations such as, but not limited to, public infrastructure rehabilitation and maintenance, compliance with other government-mandated regulations, and public safety. BMPs may require economic justifications as related to available funding and perceived holistic benefit to taxpayers and residents.

Nonstructural BMPs

Nonstructural BMPs are management programs or activities designed to reduce or eliminate pollutant loading by addressing its source. As it is desired that nonstructural BMPs target the most significant sources of bacteria in the SDR Watershed, the Responsible Parties first identified and prioritized bacteria sources by considering various factors, including: 1) the magnitude and prevalence of the sources, potential threat to public health, and proximity to receiving water bodies, 2) results from microbial tracking studies conducted in the watershed and region, and 3) best professional judgment. The Responsible Parties then identified and selected nonstructural BMPs that would most effectively address the highest priority bacteria sources based on limited (though state-of-the-practice) available load reduction effectiveness data (these options are beyond the minimum control measures that are already included as part of the MS4 permit). Candidate nonstructural BMPs identified in this CLRP include:

- Irrigation Runoff Reduction

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[1] The TMDL defines wet weather days as days with greater than or equal to 0.2" of precipitation as well as the three following days.

- Residential/Small-Scale Low Impact Development (LID) Incentive Program
- Pet Waste Management
- Onsite Wastewater Treatment Source Reduction
- Identification and Control of Sewer Discharge to the Municipal Separate Storm Sewer System (MS4) (which may include sewer upgrades)
- Commercial/Industrial Good Housekeeping Enhancements
- Animal Facility Waste Management Enhancements
- Homelessness Waste Management Program
- Redevelopment and New Development LID Implementation (Standard Urban Stormwater Mitigation Plan [SUSMP])
- Drain Inlet and Conveyance System Cleaning
- Street Sweeping

These nonstructural BMPs are intended to address bacteria during both dry and wet weather.

Structural BMPs

Structural BMPs are engineered systems designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media absorption, or any other physical, biological, or chemical process. There are generally two types of structural BMPs described in the CLRP, defined essentially by the size and extent of the tributary drainage area. “Regional” structural BMPs are treatment or volume mitigation BMPs implemented to treat larger subwatershed or catchment scale drainage areas. Although there is a wide range of structural BMP technologies, very few are capable of effectively reducing bacteria, nitrogen, and phosphorous, the pollutants of concern for this watershed. As such, the candidate regional structural BMP technologies identified in this CLRP are limited to the following:

- Subsurface Flow (SSF) wetlands
- Infiltration Basins and Underground Infiltration Galleries
- Wet ponds
- Gross Solids and Trash Removal (included in the plan but not to address pollutants of concern)

Locations of proposed regional structural BMPs are shown in Figure ES-1. Candidate regional structural BMPs Figure ES-1 below:

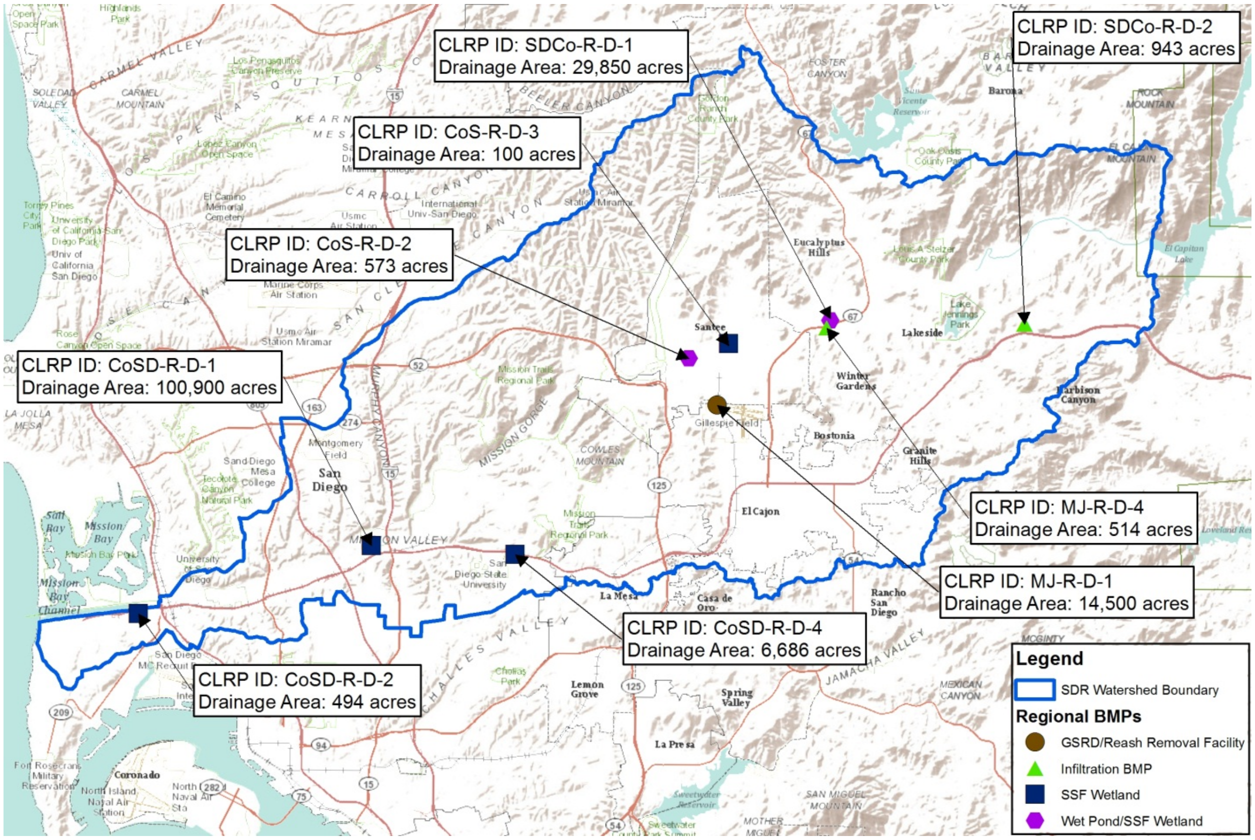

Figure ES-1. Candidate regional structural BMPs

The second type of structural BMP included in this CLRP is “distributed” structural BMPs. Distributed Structural BMPs are treatment or volume mitigation BMPs implemented at the neighborhood, parcel or site scale. Distributed structural BMPs include green streets, rainwater harvesting, and other Low Impact Development-type solutions. Distributed BMP projects are proposed to treat 25 percent of the municipal land use area within the high priority catchments, as shown on Figure ES-2 below:

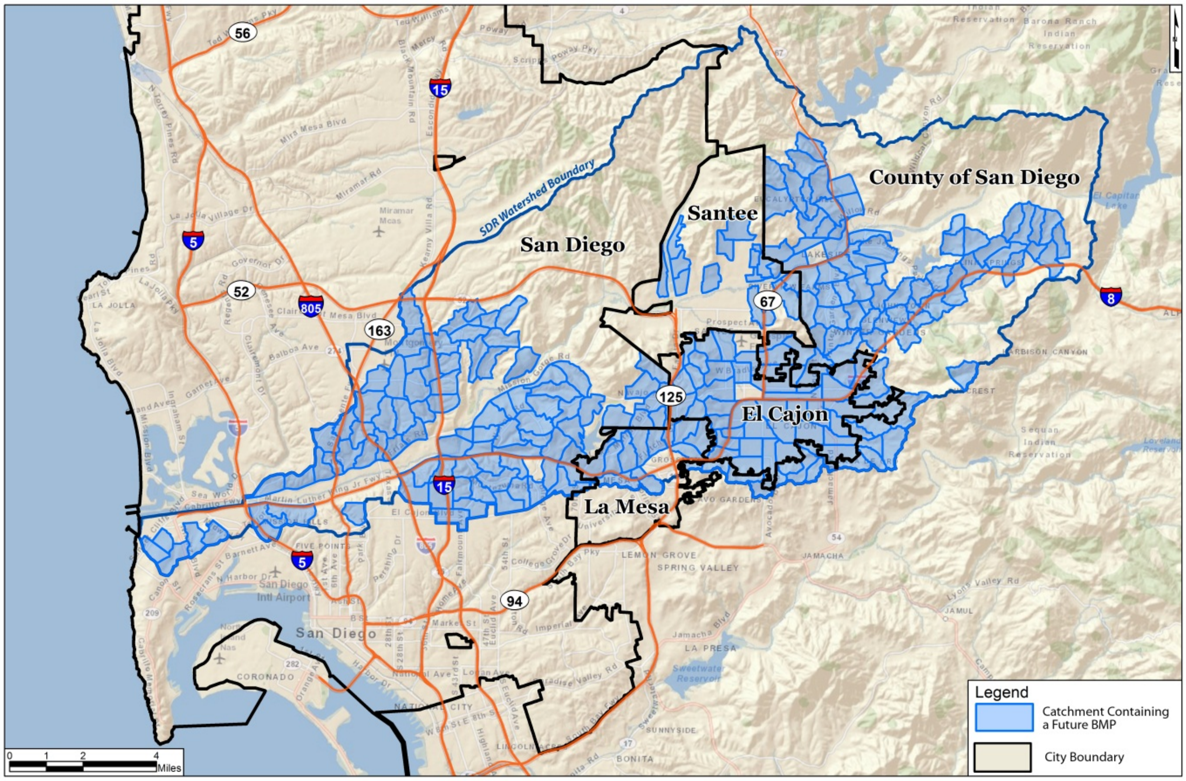

Figure ES-2. Proposed catchments prioritized for distributed BMPs

Stream restoration/enhancement projects that were implemented after 2003 within the SDR Watershed were given credit in the CLRP as these projects treat stormwater that comes in contact with enhanced and/or created vegetation. These projects are shown in Figure ES-3.

Stream Restoration/Enhancement projects include the following:

- Forester Creek
- Woodglen Vista Creek
- Las Colinas Channel (future proposed project)

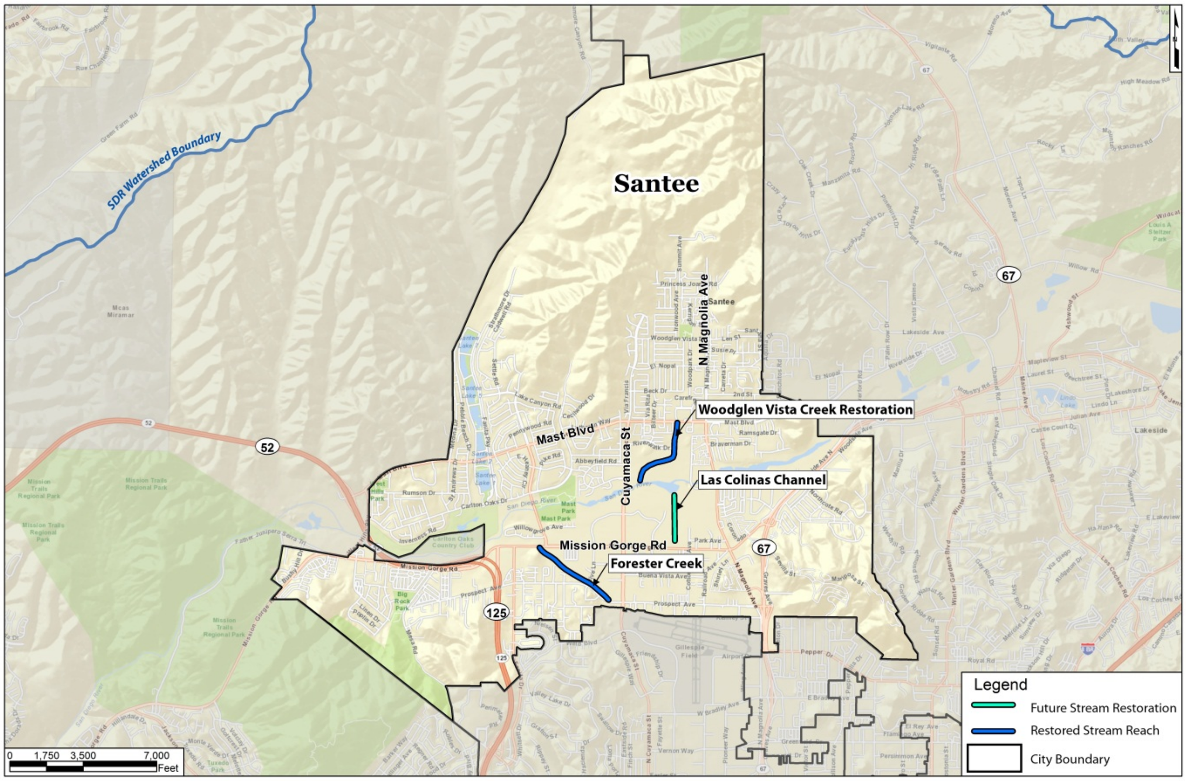

Figure ES-3. Stream Restoration Projects

The CLRP also includes BMPs that have been planned or constructed by Responsible Parties since 2003[2], when the Regional Water Quality Control Board (RWQCB) initiated the Bacteria TMDL, which are shown in Figure ES-4.

Though the majority of the structural BMPs proposed in the CLRP are sited on public property, as part of the adaptive approach taken by this CLRP, additional BMPs sited on private parcels are included for Responsible Parties interested in this option. These optional BMPs may be considered at the discretion of individual jurisdictions if needed to meet load reduction targets.

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[2] Since the Bacteria TMDL was initiated in 2003, the existing loads and required load reductions are reflective of the 2003 condition, and BMPs planned and constructed after that date were not taken into account. Therefore, it is appropriate to take credit for the load reductions resulting from these projects.

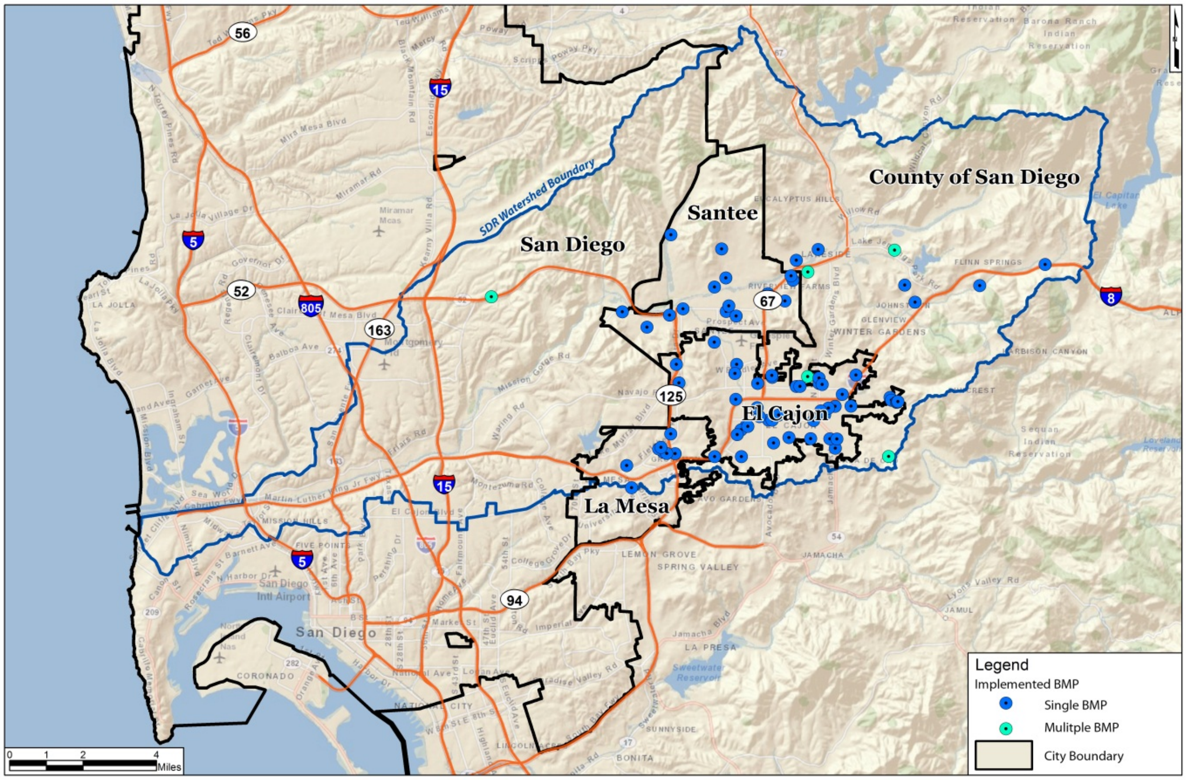

Figure ES-4. Implemented structural BMPs

With respect to dry weather conditions, most structural BMPs would be designed to also address and mitigate dry weather flows from their tributary drainage areas. Low-flow diversions to the sewer are also proposed as a structural option to treat dry weather flows.

Compliance Determination

The TMDL defines compliance as attainment of receiving water quality standards at the compliance point, with allowable exceedance under dry and wet weather conditions. The implementation strategies described in this CLRP are designed to meet load allocations based on the TMDL-specified allowable exceedance frequencies (22% for wet weather, and 0% for dry weather) of the single sample maximum recreation objectives, expressed as allowable annual exceedance days (19 days for wet weather and 0 days for dry weather).

At this time, the Responsible Parties are actively engaged with partners in Orange, Riverside, and San Diego Counties in a multi-year monitoring project to assess the suitability of the TMDL's allowable exceedance frequencies by examining naturally occurring levels of various pollutants in undeveloped, or “reference”, watersheds throughout the San Diego region. The TMDL specifically calls for TMDL limits and requirements to be re-examined for appropriateness as more and better water quality data and scientific information become available in the future.

Interim Compliance

The Bacteria TMDL requires an interim goal of 50 percent reduction in exceedance days at the compliance points by 2018 for dry weather conditions and by 2021 for wet weather conditions. Interim reductions translate to 21 allowable annual exceedance days during the dry weather period (based on recent monitoring data collected at the AB411 site) by 2018 and 44 allowable annual exceedance days in wet weather (based on data from the 1993 target year, assumed to be the existing condition in the Bacteria TMDL) by 2021.[3]

Final Compliance

The TMDL requires full compliance with the allowable exceedance frequencies (22% for wet weather and 0% for dry weather) by 2021 for dry weather and 2031 for wet weather. These allowable exceedance frequencies were translated to allowable exceedance days for the purposes of this CLRP. Current exceedance days, as well as interim and final allowable exceedance days are shown in Figure ES-5 and Figure ES-6 for wet and dry weather, respectively. The number of current exceedance days for wet weather was taken from page A56 of the Bacteria TMDL, whereas for dry weather, it was calculated based on monitoring data collected at the SDR AB411 site between 2004 and 2009.

[3] “Existing” exceedance days were determined based on guidance from the Bacteria TMDL. For dry weather, available monitoring data from the AB411 site for years 2004-2009 were used. For wet weather, number of “existing” exceedance days was provided on page A56 of the Bacteria TMDL based on modeled estimates of the TMDL critical year, 1993.

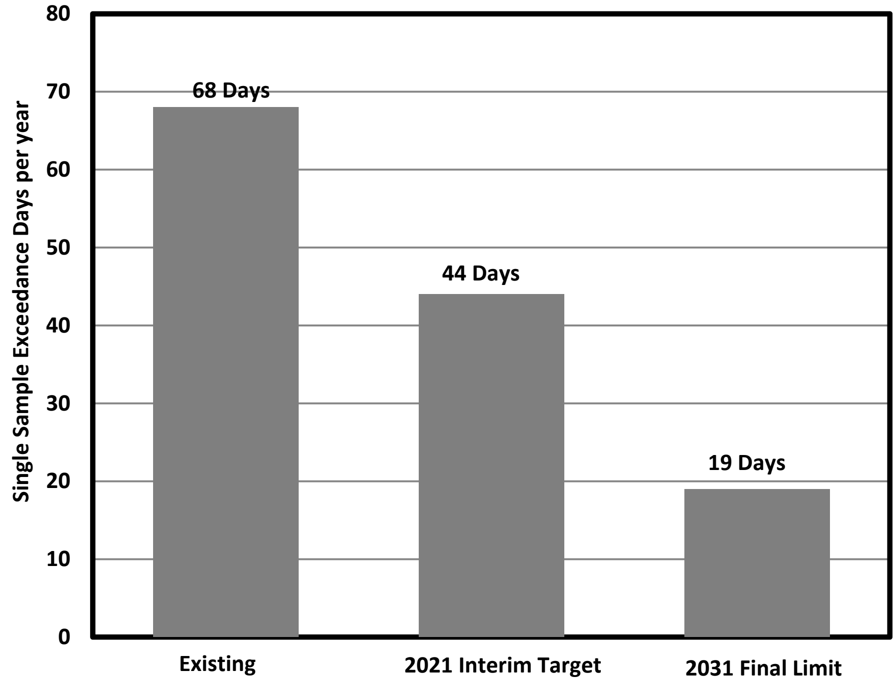

Figure ES-5. Current exceedances, interim target and final limit for wet weather

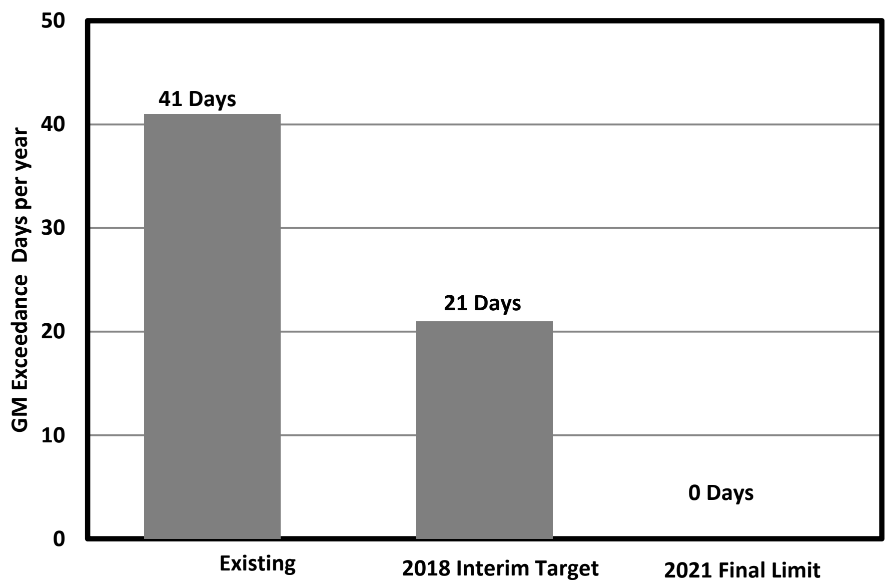

Figure ES-6. Current exceedances, and interim target and final limit for dry weather

Table ES-1 summarizes predicted wet weather load reductions resulting from the implementation of the structural and nonstructural BMPs described in this CLRP. The following table includes two adjustments: (1) the "load reduction adjustment" which addresses potential overlapping benefits (such as load reductions from nonstructural BMP implementation in areas that are also mitigated by structural BMPs), and (2) an "effectiveness fraction" that limits and reduces annual load reduction estimates to only that which mitigates loads and concentrations *to allowable levels*. (While BMPs contribute to total annual load reductions during all storms, load reductions achieved during allowable exceedance days were considered "ineffective" and were excluded from estimates of effective load reduction through the application of the effectiveness fraction.)

The summary of predicted dry-weather performance of this CLRP is shown in Table ES-2 below. The overlapping benefits adjustment was also performed for dry weather analysis.

This analysis was conducted based on several reasonable assumptions and with a good faith effort to achieve compliance with TMDL requirements; however, though a range of expected load reductions is provided to acknowledge some of the variability in the data sources used for the analysis, there are several sources of uncertainty as well as uncontrollable factors that, in combination, limit the ability to ensure compliance. These include the magnitude of natural sources, bacteria regrowth, the uncertainty in the underlying data used for the analysis, and the inherent variability of hydrology and stormwater quality.

Table ES-1. Summary of wet weather load reductions

BMP CATEGORY	FC Load Reduction (10^{12} MPN/YEAR) 1993 WY Load[1] [Low-High Range]
Regional Structural BMPs	880 [510 – 1,000]
Stream Restoration Projects	95 [22 – 170]
Distributed Structural BMPs	1,400 [780 – 1,600]
Nonstructural BMPs	2,000 [710 – 3,200]
Private Property BMPs[2]	490 [280 – 560]
Subtotal	4,800 [2,300 – 6,600]
Overlapping Benefits Adjustment[3]	-620 [-280 - -880]
Load Reduction Effective Fraction[4]	0.23
Load Reduction Sum	**970** **[460 – 1,300]**
Target Load Reduction[5]	**1,150**

[1] Range of WY1993 water quality benefits represent 25th and 75th percentile results. Average WY1993 water quality benefits are represented by 50th percentile results. Range reflects variability in baseline pollutant loading (primarily driven by land use EMC's) as well as variability in BMP effectiveness.
[2] Private property BMPs are an optional strategy and may be considered at the discretion of individual jurisdictions only if needed to meet load reduction targets.
[3] Adjustment made to avoid double counting of overlapping load reductions between non-structural and structural BMPs and between distributed and regional BMPs; improves reliability of results.
[4] Adjustment made to account for fraction of load reduction that is considered to be “effective” for reducing likelihood of exceedance in non-AEDs, therefore more improves reliability for comparing with TLR.
[5] Target Load Reduction was estimated to achieve compliance with TMDL AEDs for fecal coliform for TMDL compliance year 1993

Table ES-2. Summary of dry weather load reductions[1]

BMP CATEGORY	
Stream Restoration/Enhancement	1.7% - 9.4%
Nonstructural BMPs	7.9% - 39%
Low Flow Diversions[2]	42% - 22%
Regional Structural BMPs[2]	40% - 24%
Distributed Structural BMPs[2]	2.8% - 1.7%
Filter + UV Treatment or similar (if needed)	0% - 3.7%
Load Reduction/Geographical Coverage	**94% - 100%**
Target Load Reduction	**>94% - 95%**

[1] Estimates are based on an assumption that NS BMPs are between 8% and 43% effective.
[2]Adjusted for overlapping coverage/benefits i.e. area/loads addressed by Distributed Structural BMPs that were already addressed by either Nonstructural BMPs or low flow diversions or Regional Structural BMPs were not reported in the above table while reporting benefits from Distributed Structural BMPs.

Water Quality Monitoring

As required by the TMDL, this CLRP includes a Monitoring Plan (MP) outlining water quality monitoring activities that will occur over the TMDL compliance schedule. The TMDL requires minimum compliance monitoring to assess progress toward achieving compliance with the TMDL. In addition, the Responsible Parties will consider implementing special monitoring studies in order to inform future BMP implementation, assess CLRP effectiveness, and guide an adaptive management process.

Estimated CLRP Program Costs

Estimated 20-year program costs in 2011[4] dollars for the required elements of the CLRP are presented in Table ES-3 below. Economic costs calculations were performed using a discount rate of 5 percent. A range of costs was developed to account for various BMP design alternatives, BMP configurations, site-specific constraints and the uncertainty of available BMP unit costs from literature or estimated BMP unit costs.

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[4] Present value costs were developed in 2011 dollars, the year in which TMDL was effective and CLRP study was initiated.

Table ES-3. 20-Year Cost Estimate to Achieve Bacteria TMDL Compliance in 2011 Dollars

Cost Category	Lower Limit ($M)	Upper Limit ($M)
Nonstructural BMPs	$38M	$104M
Infrastructure Improvement	$144M	$423M
Regional Structural BMPs	$59M	$141M
Distributed Structural BMPs	$66M	$219M
Stream Restoration Projects	$42M	$42M
Dry-Weather Diversion/Treatment	$19M	$43M
Private Property BMPs[1]	$216M	$360M
Special Studies	$3M	$6.5M
Monitoring	$3M	$3M
Total Cost Estimates	**$590M**	**$1,340M**

[1] Private property BMPs are an optional strategy and may be considered at the discretion of individual jurisdictions if needed to meet load reduction targets.

Implementation Schedule

Figure ES-7 describes the schedule requirements associated with the TMDL. This timeline is based on the approval of the TMDL by the Office of Administrative Law in April 2011 and the requirements specified in the TMDL. During this timeline both structural and nonstructural BMPs will be implemented.

The timing and detailed plans for each BMP will be determined by the jurisdiction responsible for it, though BMPs that cross multiple jurisdictions will be planned and implemented through a collaborative process.

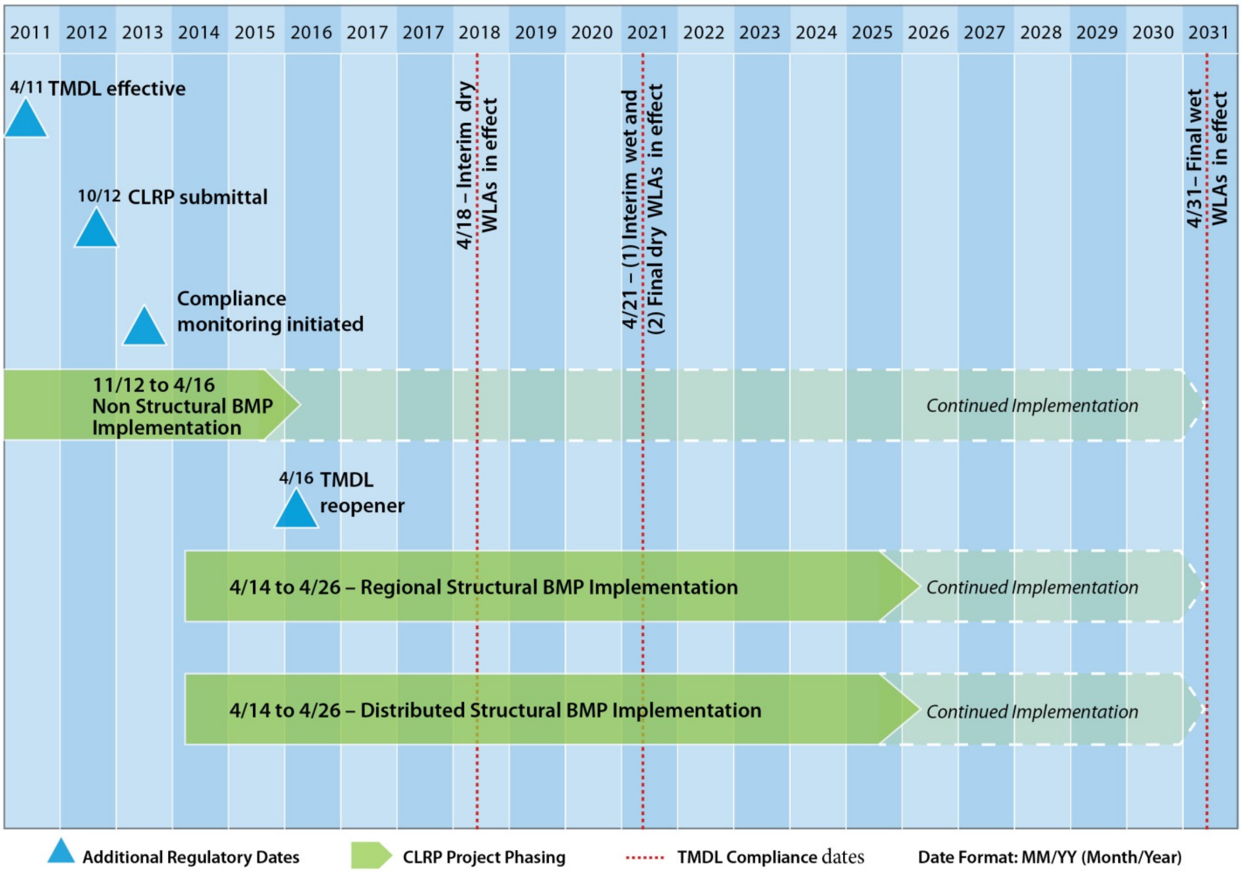

Figure ES-7. CLRP Schedule

1. TMDL REQUIREMENTS AND PLAN OBJECTIVES

This Comprehensive Load Reduction Plan (CLRP) for the San Diego River (SDR) Watershed has been prepared to comply with Resolution No. R9-2010-0001, "Total Maximum Daily Load for Indicator Bacteria, Project 1 – Twenty Beaches and Creeks in the San Diego Region (Including Tecolote Creek)" (Bacteria TMDL) which became effective on April 4, 2011 (SDRWQCB 2010). The Bacteria TMDL requires that owners and operators of municipal separate storm sewer systems (MS4) in the SDR Watershed (Responsible Parties) develop either a bacteria-specific or comprehensive, multi-pollutant approach for reducing loads of Fecal Indicator Bacteria (FIB) – enterococcus, fecal coliform, and total coliform – from storm drain discharges. The SDR Responsible Parties (the Cities of San Diego, El Cajon, La Mesa, and Santee, County of San Diego, and Caltrans) have chosen to develop a comprehensive, multi-pollutant approach to implementation. This will provide efficient use of limited planning resources and will allow the Responsible Parties to take advantage of an extended 20-year compliance schedule as allowed in the TMDL. In addition to fecal indicator bacteria, this CLRP addresses other water quality impairments in the SDR Watershed, including nitrogen and phosphorous, and is expected to more comprehensively improve water quality than a plan focused solely on bacteria. As required by the TMDL, the CLRP outlines a proposed program of activities that will be capable of achieving the required bacteria load reductions. The compliance point for this watershed is the Pacific Ocean Shoreline at the mouth of the San Diego River, as well as two points each in the main stems of SDR and Forester Creek.

The SDR CLRP will guide the Responsible Parties as they plan and implement structural and nonstructural best management practices (BMPs) in order to achieve the necessary load reductions from storm drain discharges to achieve the MS4 waste load allocation (WLA) specified in the TMDL. For purposes of this CLRP, open space, agricultural land uses, tribal lands, federal lands, and state parks were not considered to be within the jurisdiction of the Responsible Parties. It must be recognized that each of the above land uses and jurisdictions contributes significantly to the loading of bacteria, nitrogen, and phosphorous in the watershed.

The CLRP is a compliance plan that identifies a suite of potential structural and nonstructural BMPs. BMPs were identified and selected based on their potential effectiveness in reducing bacteria, nitrogen, and phosphorous pollutant loading in the Watershed to meet required compliance levels. Activities and BMPs described in this CLRP were identified to demonstrate a roadmap toward compliance with the Bacteria TMDL. Responsible Parties will implement identified activities and BMPs as resources are available. Implementation of activities and BMPs will be prioritized along with other essential Responsible Party obligations such as, but not limited to, public infrastructure rehabilitation and maintenance, compliance with other government-mandated regulations, and public safety. BMPs may require individualized economic justifications as related to available funding and perceived holistic benefit to taxpayers and residents.

Nonstructural BMPs will be emphasized as the preferred implementation approach, particularly in the initial phases of CLRP implementation, because they are the most cost-effective way of reducing pollutant loading. The nonstructural BMPs included in the CLRP were selected based on potential effectiveness, regional preferences, feasibility of implementation, as well as results from local pollutant source identification studies.

Structural BMPs are capital projects that, by their nature, are more complicated, costly, and time-consuming to implement. Selection and location of structural BMPs identified in the CLRP were based on water quality need, BMP types, cost of implementation, and feasibility of implementation using the SBPAT computer modeling tool and best professional judgment. This CLRP was developed under the assumption that, with the exception of specific, optional private property BMPs, structural BMPs would occur only on public properties or in areas where right-of-way acquisition or easements would not be required. It is recognized, however, that the quantification of water quality benefits and assessment of compliance is based on currently available technical information, state-of-the-practice modeling analyses, and engineering judgments with inherent levels of uncertainty. As such, and consistent with the Responsible Parties' intent to implement an adaptive and iterative process geared toward continuous improvement, should the level of implementation presented in this CLRP be insufficient to achieve the required TMDL compliance levels, some Responsible Parties may consider implementation of structural BMPs on private properties. This would significantly increase the estimated cost for compliance as such projects could require the acquisition of private properties or easements.

It is understood that this CLRP is based on the current requirements of the TMDL, and that, in the event that TMDL requirements are changed due to revisions of Basin or Ocean Plan recreation objectives or changes in definitions of key TMDL terms (i.e. wet days), this CLRP may require revision as well.

The CLRP will show that, upon implementation, load reductions required by the TMDL will be achieved. The remainder of the CLRP will:

- Present the strategy for Responsible Parties to achieve required load reductions and describe the rationale for choosing this strategy;
- Present bacteria load reduction quantification;
- Present the implementation schedule and discuss BMP phasing;
- Describe how progress will be measured (compliance monitoring);
- Address the restoration of impaired beneficial uses in receiving waters for other 303(d)-listed pollutants;

- Estimate Responsible Party contributions;
- Estimate the difference in bacteria loads between Responsible Party sources and 'other' sources;
- Demonstrate the ability to achieve compliance with TMDL targets and identify program conditions for termination; and
- Assume a 20-year compliance schedule, which will be justified within this document as required by the San Diego Regional Water Quality Control Board (SDRWQCB).

2. WATERSHED CHARACTERISTICS

2.1 General Physical Setting

The SDR Watershed is located in central San Diego County and is bordered to the north by the Peñasquitos and San Dieguito River Watersheds and to the south by the Pueblo San Diego and Sweetwater River Watersheds. The San Diego River originates in the Cuyamaca Mountains near Santa Ysabel, over 6,000 feet above mean sea level, along the western border of the Anza Borrego Desert Park. The River extends over 52 miles across central San Diego County forming a watershed with an area of approximately 277,543 acres or 434 square miles. The River ultimately discharges to the Pacific Ocean at Dog Beach in Ocean Beach, a community within the City of San Diego. Of the nine major watersheds in the San Diego region (including the Tijuana watershed, partially located south of the United States border), the SDR Watershed is the fourth largest. A map of the watershed is included in Appendix A.

The San Diego River Watershed Management Area (WMA) (Hydrological Unit (HU) 907) is the second largest WMA lying entirely within San Diego County and encompasses 277,554 acres. The WMA consists of four hydrologic areas (HAs): Lower San Diego (907.1), San Vicente (907.2), El Capitan (907.3), and Boulder Creek (907.4). These HAs are also broken down into 14 hydrologic subareas (HSAs). This CLRP addresses runoff from the Lower San Diego HA, 907.1, downstream of San Vicente Reservoir and El Capitan Reservoir, approximately 173 square miles. Other entities are present in the Watershed over which the Responsible Parties do not have regulatory authority. These include school districts, Metropolitan Transit System, hospitals, and mobile home parks. Based on an estimate using data provided for the City of Santee, these may cover four percent of the watershed area.

Using block group level population data from the 2010 Census Summary File for California (U.S. Census Bureau, 2011), the population in the San Diego River WMA was estimated to be 517,219 persons or 1,193 persons per square mile. The major population center in the watershed is in the Lower San Diego HA, which reflects the more urban residential land use categories in the lower watershed area.

Land use within the overall San Diego River WMA is predominantly undeveloped (44%). Other land use classifications include open space / parks and recreation (23%), residential and spaced rural residential (19%), and transportation (6%). Agriculture, commercial, commercial recreation, industrial, military, public facility, and water land uses each make up less than 2% of the land use acreage (San Diego Association of Governors (SANDAG), 2009).

The Lower San Diego HA is comprised of primarily residential and spaced rural residential (30%) and open space/parks and recreation (25%) land uses. Vacant and undeveloped land accounts for 18% of the land use in the Lower San Diego HA. Watershed land use becomes progressively less urbanized from west to east in the watershed.

There are several jurisdictions that cover the San Diego River WMA. Most of the watershed is primarily unincorporated land (75%) under County of San Diego jurisdiction. The remaining jurisdictional areas of the watershed include the City of El Cajon, City of La Mesa, City of Poway (587 acres of which is classified as open space parks or preserves), City of San Diego, and City of Santee. Although the County of San Diego generally would have land use authority in unincorporated areas, a significant percentage of this unincorporated area is under the jurisdiction of the federal government and, thus, effectively outside the jurisdictional land use authority of the County. Therefore, the ability of the San Diego River Responsible Parties to influence water quality-related decisions on these federal lands is limited[5].

2.2 Water Quality - Impairments

In 2002, the SDRWQCB determined that there were three locations/reaches in the SDR Watershed that were impaired for FIB and included them on the 303(d) list. These listings were Forester Creek (lower one mile), Lower San Diego River, and the Pacific Ocean Shoreline at Dog Beach. These listings were the basis for inclusion of the SDR Watershed in the Bacteria TMDL. This CLRP meets the requirements of the Bacteria TMDL by addressing bacteria at the shoreline and along the creek/river reaches. In addition to FIB, this CLRP also addresses total nitrogen and total phosphorus listings within the main stem of the SDR, which were identified as priority pollutants by the SDR Watershed Responsible Parties.

Below is a brief discussion of current wet weather and dry weather water quality in the Watershed as it relates to these priority pollutants. A more detailed review of water quality monitoring data is included in the Data Review Memo in Appendix B.

2.2.1 Wet Weather Water Quality

Rainfall in San Diego County can vary significantly depending on proximity to the coast. Coastal portions may receive less than 9 inches of rainfall on average annually, while the foothill areas may range from 14 to 17 inches and mountain areas may range from 20 to 40 inches depending on slope and elevation (Weston 2011). The wet season is defined in the SDRWQCB permit as the period from October 1 through April 30 and often 85 to 90 percent of the annual average rainfall falls in this part of the year (Weston 2011).

Water quality assessments summarized in the most recent Urban Runoff Monitoring Annual Report for the SDR Watershed identified FIB as a high priority constituent during wet weather at all receiving water monitoring locations (Weston 2012). Nutrients were found to be low priority during wet weather (Weston 2012).

Bacteria loading is significantly higher during wet weather than dry weather, with monitoring data from years 2004-10 measured at the SDR outlet indicating average FIB concentrations of

[5] Federal lands account for an estimated 2% of the municipal bacteria loads.

approximately 252, 554 and 3101 MPN/100 mL for enterococcus, fecal coliform and total coliform, respectively. These values can be compared to 63, 119 and 422 MPN/100 mL respectively, during dry weather. Based on analysis of recent monitoring data (2004-2010) from the SLR AB411 site, 31% of wet weather samples exceeded water quality objectives (WQOs).[6]

2.2.2 Dry Weather Water Quality

The dry season in San Diego County is defined in the SDRWQCB Permit as the period between May 1 and September 30. Though the vast majority of rainfall (85 to 90 percent) usually occurs during the wet season, residual storms and summer showers account for the rest of the rainfall that occurs during the dry season (Weston 2011).

Similar to wet weather, bacteria were identified as a high priority constituent for dry weather in the most recent Urban Runoff Monitoring Annual Report for the SDR Watershed at all receiving water monitoring locations. Nutrients were also identified as high priority constituents during dry weather (Weston 2012).

Based on an analysis of monitoring data (described further in Section 3.2.3.1.1 and Appendix B), summer-dry FIB concentrations and exceedance frequencies are generally greater than those during winter-dry conditions.

[6] Wet days are defined in the TMDL as days having at least 0.2" precipitation, or the three days following such a day. As a result of this threshold, days with minor storms may not be considered "wet." This could lead to greater than expected exceedances during dry weather since days with minor storms would likely exceed water quality objectives more frequently than days with no precipitation (especially considering the lower limits placed on dry weather days). This threshold may also lend to higher exceedance percentages for wet weather, since it includes only days with larger storms, which would tend to exceed more frequently than days with minor storms, as wet weather days.

3. IMPLEMENTATION PLAN APPROACH

3.1 Load Reduction Strategy

The implementation of this CLRP is designed to bring Responsible Parties into compliance with Bacteria TMDL requirements, while simultaneously providing load reductions of nitrogen and phosphorous in the SDR Watershed. The aim of the CLRP is to actively work towards interim and final Bacteria TMDL targets by addressing priority pollutant sources using a watershed approach to identify structural and nonstructural management opportunities that are predicted to cost effectively meet water quality objectives and attain compliance.

The overall strategy and process for this CLRP involves the following:

- Identify priority pollutant sources and land uses (and corresponding gaps in knowledge) through review of relevant studies, monitoring data, and application of the Structural BMP Prioritization and Analysis Tool (SBPAT) modeling;
- Treat priority pollutant sources during wet and dry weather conditions, including prioritizing human fecal sources of bacteria first (due to the greater illness risk they present), and anthropogenic, non-human bacteria sources second, through early implementation of nonstructural BMPs;
- Gather additional data necessary to guide further implementation activities, fill in knowledge gaps, and identify necessary improvements in the TMDL;
- Address pollutant load reduction needs not addressed by nonstructural BMP implementation through identification of candidate structural BMPs on public parcels;
- Consider private parcels as potential locations for BMPs if the aforementioned strategies fail to meet CLRP objectives. Private property BMPs are an optional strategy and may be considered at the discretion of individual jurisdictions only if needed to meet load reduction targets; and
- Conduct receiving water monitoring and BMP effectiveness assessments throughout the compliance period to identify adjustments and changes necessary to support an adaptive management process and achievement of TMDL goals.

Further detail on how each of the above items is achieved through this CLRP is included below as well as in the Comprehensive Compliance Schedule described in Section 4.2.

3.1.1 Primary Pollutant of Concern (POC) – Bacteria

The primary purpose of this CLRP is to address bacteria loading within the SDR watershed, therefore this plan must identify measures that have a reasonable probability of meeting the bacteria numeric targets. The targets require meeting REC-1 water quality objectives (WQOs) for FIB which include an allowable exceedance frequency (AEF). The AEF is defined as the percent of days that FIB concentrations may exceed the WQOs annually. Bacteria numeric targets identified in the San Diego Basin Plan include single sample maximums (SSMs) and 30-

day geometric means (GMs). The WQOs and AEFs for beaches and creeks are listed in Table 1 and Table 2.

AEFs for dry weather GMs are 0 percent. In other words, GMs at the compliance monitoring point are not allowed to exceed the WQOs.

For wet weather SSMs, the AEF is 22 percent. The SDRWQCB set the SSM AEF based on historic exceedance rates observed at a reference beach in Los Angeles County (Leo Carrillo Beach). This AEF was then multiplied by the number of wet days at a SDR rain gauge (86 days) during 1993, the TMDL critical year (the 'wettest' year between 1990 and 2002, based on total number of wet days) to determine the number of allowable exceedance days (AEDs). Therefore, the allowable number of wet weather exceedance days at the end of the 20-year compliance timeline is 19 (SDRWQCB 2010, p. A25). This AED value was then used in the TMDL, through modeling simulation of historical conditions, to determine the mass-load based TMDL and WLAs by discharge category, including MS4s. Since the AED was most directly used as the basis for the WLAs and is therefore considered to be protective, this CLRP uses AEDs as the metric to evaluate TMDL compliance on an annual basis.[7]

For the SDR Watershed, TMDL-required FIB load reductions (as a percent of current loading rates) for wet weather are applied equally to MS4 and agricultural sources[8]. For dry weather, the TMDL assigns load reductions entirely to MS4 sources, as the TMDL assumes that 100% of the dry weather bacteria load is from MS4 discharges.[9]

Table 1. TMDL SSM numeric targets

Indicator Bacteria	Numeric Target (MPN/100 mL)	Allowable Exceedance Frequency (wet)	Allowable Exceedance Days (wet)
Fecal Coliform	400	22%	19
Total Coliform	10,000	22%	19
Enterococci	104/61[1]	22%	19

[1] 104 MPN/100 mL is the limit for beaches, and 61 MPN/100 mL is the limit for creeks, including SDR and Forester Creek.

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[7] Compliance will not only be controlled by Responsible Party load reductions, but by agricultural load reductions, variability in natural and/or unregulated loads, and annual hydrology (for example, if the actual number of wet days exceeds those of the TMDL critical year).
[8] Resolution No R9-2010-0001, Attachment A, p. A29
[9] Other potential dry weather sources like dry weather flows from non-MS4 areas, stream sediments, homeless encampments along the riparian corridor, birds, beach sand, beach wrack, pets on beach, bather shedding, failing septic systems, etc. are not currently considered by the Bacteria TMDL. These sources, which are generally unrelated to discharges from MS4s, have been shown to contribute to bacteria concentrations in other Southern California coastal watersheds. Additionally, groundwater flows, irrigation runoff, and other sources of dry weather flows contribute to mobilization of POCs.

Table 2. TMDL wet and dry weather Geometric Mean numeric targets

Indicator Bacteria	Numeric Target (MPN/100 mL)	Allowable Exceedance Frequency
Fecal Coliform	200	0%
Total Coliform	1,000	0%
Enterococci	35/33	0%

[1] 35 MPN/100 mL is the limit for beaches, and 33 MPN/100 mL is the limit for creeks, including SDR and Forester Creek.

3.1.2 Other POCs and Impairments

In addition to addressing bacteria, the TMDL specifies that a CLRP must be "capable of restoring the beneficial uses in receiving waters for other impairing pollutants in the watershed, and achieving the goals and objectives of any other water quality improvement projects included in the CLRPs within the time frame of the compliance schedule."[10]

The Pacific Ocean shoreline site at the SDR mouth is not listed for impairments other than FIB. SDR River and Forester Creek are also listed as having impairments due to FIB as well as nutrients.

Though structural BMPs proposed in this CLRP are designed primarily to reduce bacteria loading, reductions in other POCs will also be achieved. Since this CLRP is intended to address loading from Responsible Parties, load reductions were also estimated for those non-bacteria pollutants that are typically found in urban runoff at elevated concentrations. In SDR, this includes eutrophication, nitrogen, and phosphorous (nutrients). Section 4.1.1.2 summarizes the reductions that will be achieved by the structural BMPs identified in this CLRP. In addition to the reductions of pollutants by structural BMPs, the nonstructural BMP programs described in this CLRP will directly address a variety of pollutants and pollutant-generating activities.

3.1.3 Watershed-based Planning Program Description

This CLRP was developed with an emphasis on encouraging collaborative, watershed-based planning within the jurisdictional planning departments of the Responsible Parties.

This focus is evidenced in the methodology used to develop the proposed suite of BMPs presented in this CLRP. Pollutant load reduction opportunities were determined irrespective of

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[10] It is understood that since the Responsible Parties are not the sole dischargers in the watershed and though this CLRP is intended to mitigate bacteria loads from Responsible Party discharges to meet TMDL requirements, restoration of beneficial uses in receiving waters subject to the TMDL will require reduction of bacteria and nutrient load contributions from all dischargers, not only the Responsible Parties for this CLRP.

jurisdictional boundaries. Once high priority areas and sources were identified Responsible Parties identified the most feasible and effective BMPs to maximize pollutant removal and meet target load reduction requirements.

Through the involvement of key jurisdictional representatives, this comprehensive plan was developed efficiently and in a manner that allowed for multiple iterations and integrated needs and opportunities through the entire watershed. Additionally, this process served as a means of establishing lasting relationships and instilling knowledge amongst the Responsible Parties to help foster continued holistic management of water quality within the region.

3.1.3.1 Integrated Water Resources Benefits

While this CLRP was developed primarily to meet TMDL requirements, it was guided by an understanding that a single water quality enhancement project can provide a multitude of water resource benefits. This, and the desire of Responsible Parties to maximize project benefits beyond water quality improvement and TMDL compliance, played an important role in determining the ultimate strategy of the CLRP. Benefits that can be achieved through implementation of the proposed project in addition to those quantified in accordance with the TMDL include:

- *Beneficial Reuse of Urban Runoff:* Water that is captured and stored in BMPs has the potential to be beneficially reused and thus offset demand for potable water, a critical need within San Diego County.
- *Recreation:* Larger regional BMPs have the potential to include multi-use elements. In final design of these BMPs there is the opportunity to include features such as trails and bike paths, based on community needs, project partnerships, and site appropriateness that are mutually beneficial to water quality. Distributed BMPs proposed in this CLRP were envisioned as “green streets”, which can enhance the vitality of a commercial or residential avenue and improve the overall quality of life in a neighborhood.
- *Wildlife Habitat:* In addition to their water quality benefits, BMPs such as regional subsurface flow wetlands may provide additional wetland habitat throughout the SDR Watershed that may attract native species.
- *Urban Heat Islands:* Distributed green streets BMPs may mitigate urban heat island effects by increasing pervious, vegetated areas within heavily urbanized portions of the Watershed.
- *Educational Opportunities:* Nonstructural BMP programs such as Irrigation Runoff Reduction, the Pet Waste Program, and Animal Facilities Management provide the opportunity for public outreach and educational programs that will target behavioral changes, sustainable control at the “source”, as well as increased public awareness of and investment in water quality improvement projects.

3.1.3.2 Outreach

Community outreach and public involvement will be an integral component to the success of the nonstructural BMPs. One of the primary goals for implementing nonstructural BMPs is to enact behavior change in the people living, working, and recreating in the SDR Watershed to reduce pollutant loads to the MS4. In addition, the SDR Watershed Responsible Parties in this CLRP will consider collaborating with other dischargers, such as the Agricultural Community and members of phase II stormwater programs (e.g. educational institutions, tribes, and utilities) to implement education outreach programs to their target audiences to reduce pollutant loading.

3.1.3.3 Lead Watershed Contact

The County of San Diego will serve as the Lead Watershed Contact for the TMDL Responsible Parties in the SDR Watershed. The Lead Watershed Contact's primary duties will be to serve as the liaison between the Responsible Parties and SDRWQCB.

3.1.3.4 Periodic Review/Adaptive Management

The CLRP and the Comprehensive Compliance Schedule (discussed in further detail in Section 4.2) will be reviewed and discussed by the Responsible Parties as appropriate to track the progress being made towards meeting TMDL requirements and to identify any modifications that may be necessary. If needed modifications are identified based on this review, they will be incorporated into a revised version of the CLRP which will also include an implementation schedule for any modifications to nonstructural or structural BMPs. For example, the City of Santee obtained grant funds to develop a project where infiltration strips will be added to concrete channels to facilitate the elimination (and/or treatment) of dry weather flows. This project, which will be implemented as funds become available, could potentially provide an additional BMP opportunity in concrete channels throughout the Watershed. At present, there is insufficient data on whether this concept will provide long term effectiveness to allow it to be incorporated into this CLRP.

As stated earlier, this CLRP was developed with the assumption that, with the exception of optional private property BMPs, implementation of structural BMPs would occur only on public properties, through joint collaboration with private property, or in areas where right-of-way acquisition would not be required. However, consistent with the Responsible Parties' intent to implement an adaptive and iterative process geared toward continuous improvement, should the level of implementation presented in this CLRP be insufficient to achieve identified waste load allocations, some Responsible Parties may consider implementation of structural BMPs on private properties. This approach may significantly increase the estimated cost for compliance if project must acquire private properties or easements. If needed, CLRP revisions will be submitted as part of other regularly scheduled watershed deliverables to the SDRWQCB. Responsible parties are individually responsible for reviewing and modifying their jurisdictional ordinances and activities as necessary to maintain consistency with the CLRP.

3.2 Plan Components

3.2.1 Baseline Loads

Wet weather fecal coliform (FC) load estimates for the SDR Watershed were determined using the Structural BMP Prioritization and Analysis Tool (SBPAT), which uses a stochastic Monte Carlo method[11] to model water quality (using land use Event Mean Concentrations [EMCs] and BMP effluent concentrations) coupled with continuous hydrologic simulation (based on USEPA's SWMM model) to calculate annual loads[12]. In order to have a comparison with current bacteria loads and future reductions (in order to meet the TMDL requirements), baseline bacteria loads were calculated for the SDR watershed. Section 3.2.5 describes this methodology as well as data used as input for the model (see SBPAT Users' Manual [Geosyntec 2008] for additional information). In order to maintain consistency with the TMDL, which bases load reduction calculations on Water Year (WY) 1993, baseline loads for the CLRP analysis were also calculated based on rainfall from WY 1993. Land uses were based on 2009 conditions, since this was the most current land use data available and most representative of current conditions. Land use EMCs for modeled pollutants were taken from the SBPAT default database and augmented with recent local EMC data provided by the City and County of San Diego, as described in Appendix C. The Data Review Memo (Appendix B) contains more detailed descriptions of the GIS, rainfall, water quality and other data sources used in this analysis.

The assumptions used to calculate wet weather baseline loads differ somewhat between the TMDL model and SBPAT's land use EMC method. In order to evaluate the efficacy of using SBPAT for estimating baseline loads, the annual baseline loads estimated by SBPAT were compared to those presented in the TMDL. As shown in Figure 1, both estimates are considered to be within the typically expected range of uncertainty associated with estimating bacteria loads.[13]

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[11] The Monte Carlo method is a computational algorithm that utilizes repeated random sampling to compute results, i.e., input data are "polled" or sampled from defined statistical distributions, model calculations (in this case, pollutant load estimates) are made, and output results are tallied; this process is then repeated thousands of times to produce output distributions.

[12] Baseline wet weather loading of FC was utilized as a surrogate for all FIB since there is an acceptable database of both land use-based stormwater runoff concentrations and structural BMP performance.

[13] Target load reduction calculations (discussed in Section 3.2.2) were performed using both a monitoring data method as well as a land use-based method. Ideally, the baseline load calculation would also take into account both dataset types, however the baseline loads were calculated for WY 1993, and monitoring data for this year was not available. Based on the target load reduction calculations, the land use based method may overestimate loads for this watershed, and consideration of monitoring data could bring the baseline load estimates closer to the estimate presented in the TMDL.

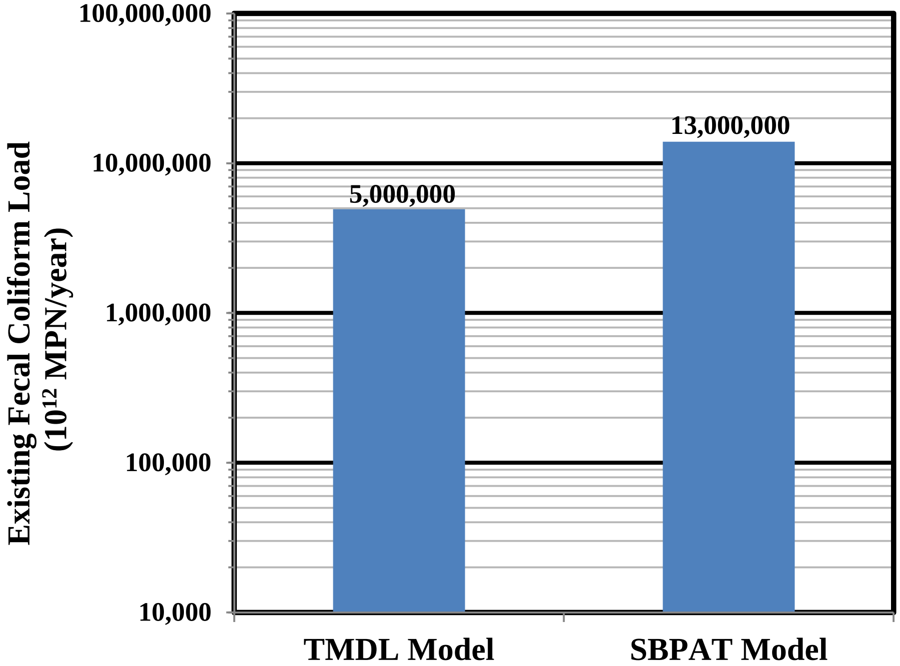

Figure 1. Comparison of baseline loads for SDR watershed for WY 1993 calculated by TMDL model versus SBPAT method

This CLRP uses dry weather baseline loads from the Bacteria TMDL because SBPAT's land use EMC method for wet weather conditions is not applicable to dry weather load determination. The TMDL developed these estimates using a steady-state mass balance model that simulates transport of bacteria in impaired creeks and creeks flowing to impaired coastal areas (SDRWQCB 2010, p. A18).

Table 3 shows wet weather and dry weather baseline loads. Wet weather loads are tabulated for the entire SDR Watershed as well as aggregated for all Responsible Party jurisdictions. This CLRP is intended to address Responsible Party TMDL compliance. Further detail on categorization of loads is provided below. The distinction between MS4 and non-MS4 loads is not necessary for dry weather loads since the TMDL defines all dry weather loads as coming from the MS4s.

Table 3. Wet and dry weather baseline loads for WY 1993 used for CLRP analysis

Source	Fecal Coliform Baseline Load Estimate (10^{12} MPN/yr)
Wet Weather	
SBPAT – Whole SDR Watershed	13,000
SBPAT – **Estimated Responsible Party contribution**	12,000
Dry Weather	
Bacteria TMDL[1]	59
Responsible Party contribution	59[2]

[1]TMDL modeling analysis was not revisited or modified for the CLRP
[2]Consistent with the TMDL, the CLRP assumes that 100% of the dry weather loads are from MS4 sources.

Figure 2 shows the estimated modeled breakdown of SDR wet weather watershed loads by jurisdiction in terms of percent of the total load. For the purposes of the baseline loading analysis, as well as subsequent target load reduction and BMP implementation analyses presented in this CLRP, municipal loads attributable to federal lands are not considered part of the Responsible Party load since the Responsible Parties do not have jurisdiction over these lands. Similarly, loading from agricultural land uses is not considered part of the MS4 Responsible Party load because the TMDL stipulates that agricultural land uses within the SDR watershed must not exceed existing loads. Table 4 shows a breakdown of MS4 wet weather loads by jurisdiction. The breakdown is based on 2009 land use data and for WY 1993.[14]

[14] Based on discussions during conference call with Responsible Parties and TetraTech, December 9th, 2011

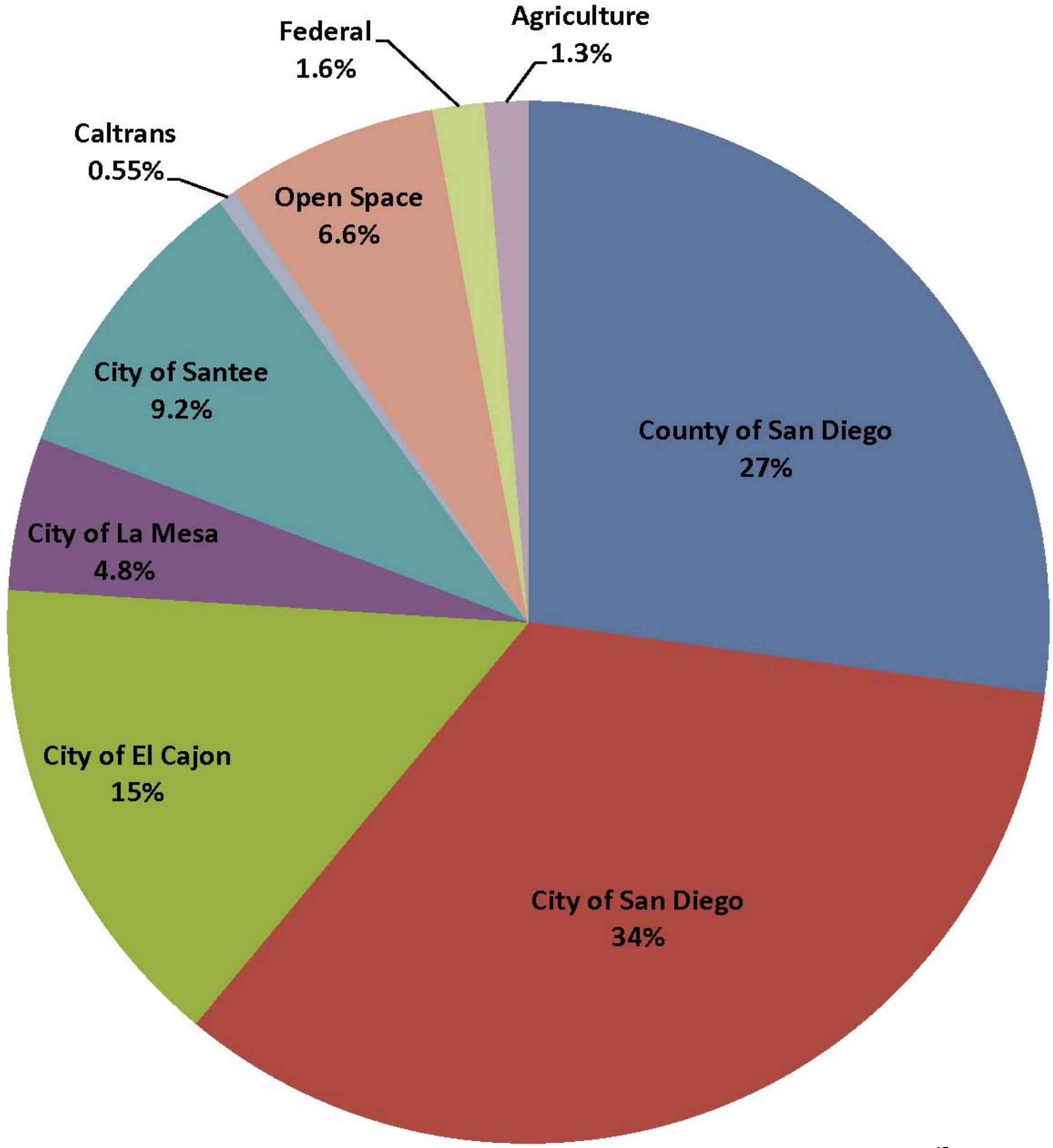

Figure 2. Estimated sources of wet weather FC loads in the SDR Watershed, WY 1993[15]

[15] Approximately four percent of the watershed load is generated from sources over which the Responsible Parties do not have direct regulatory authority, based on an analysis of data provided for the City of Santee. These include school districts, MTS, hospitals, and mobile home parks.

Table 4. Breakdown of wet weather fecal coliform loads by jurisdiction based on WY 1993.

Jurisdiction	Fecal Coliform Baseline Load Estimate (10^{12} MPN/yr)[1]
County of San Diego	3,700
City of San Diego	4,600
City of El Cajon	2,000
City of La Mesa	640
City of Santee	1,200
Caltrans	73
Open Space	890
Federal	220
Agriculture	180

[1] Approximately four percent of the watershed load is generated from sources over which the Responsible Parties do not have direct regulatory authority, based on an analysis of data provided for the City of Santee. These include school districts, MTS, hospitals, and mobile home parks.

3.2.2 Bacteria Target Load Reductions (TLRs)

This CLRP uses "target load reductions" (TLRs) as a metric to evaluate performance of the suite of candidate BMPs to assess the likelihood of compliance with TMDL WLAs. It represents an average load reduction for the TMDL compliance year 1993 that would hypothetically be needed to achieve compliance with TMDL numeric targets, which are expressed in terms of WQOs and number of AEDs (see Section 3.1.1 for further discussion). For this CLRP, TLRs were calculated based on SSM targets. The sections below describe how TLRs for this CLRP were determined.

3.2.2.1 Wet Weather TLRs

Both land uses (upland loading) and observed (in-stream) monitoring results were utilized and considered, using a weight of evidence approach, to estimate wet weather TLRs.

The TLR for wet weather FC loading was calculated based on the load duration curve method described in the TMDL, with specific inputs and methods selected to be consistent with the SBPAT method used to assess BMP load reduction in this CLRP. The steps in this process are described below.

1. **Calculate daily wet weather FC loading in the baseline condition.** Hydrologic results from the EPA Storm Water Management Model (SWMM) for each wet day[16] in WY 1993 were used to tabulate the volume of runoff from each land use parcel in the watershed. Hydrologic input datasets are presented in the Data Review Memo (Appendix B). Lognormal distributions of EMCs for FC were used to assign an FC concentration to the load from each parcel based on land use. Land use EMCs were based on data from the City and County of San Diego, as well as from Los Angeles County. EMC values, as well as their sources, are discussed in further detail in the San Diego Land Use EMC Memo (Appendix C).
2. **Tabulate daily loads by ownership and land use in the baseline condition (without controls).** This step was used to determine baseline loads discharged by each responsible discharger (i.e. Responsible Parties, agriculture, open space, orchards, etc.).
3. **Rank daily loads and identify AEDs and non-AEDs for WY 1993.** The first 19 highest loading days in WY 1993 were considered to be AEDs for the purpose of this calculation. The remaining loading days were considered to be non-AEDs.
4. **Tabulate allowable loads for the watershed by ownership and land use.** Allowable loads are estimated to be the sum of:
    a. Bacteria loading for the 19 highest loading days, considered AEDs, were considered allowable loads.
    b. For the remainder of the days (those with a load ranking greater than 19 days), the TMDL FC water quality objective of 400 MPN/100 mL was assigned as the average concentration. This was done to reflect the highest concentration that is allowed in the Watershed during non-AEDs.
5. **Calculate the TLR and aggregate by responsible discharger.** The difference between the baseline loading scenario (Step 2) and the allowable loads (Step 4) for each land use parcel for each loading event in WY 1993 was calculated to determine a load reduction for each land use area. The total watershed TLR was then calculated based on the sum of these load reductions. This total TLR was also split based on ownership of each land use area in order to assign a TLR to each responsible discharger.
6. **Perform Monte Carlo calculations for Step 1 through 5.** For each Monte Carlo run (see footnote in Section 3.2.1), EMCs were randomly selected from each land use EMC distribution (see Step 1) and applied independently to each land use; calculations and tabulations were refreshed. The result of this step is an ensemble of TLR estimates, from which percentiles of TLR can be estimated.

The Load Reduction Curve in Figure 3 illustrates this methodology. The wet weather TLR for this CLRP was set to the 50th percentile value of the Responsible Party TLRs calculated using the Monte Carlo iterations. The wet weather TLR for Responsible Parties is equal to 1,750 x 10^{12}

[16]TMDL defines wet day as rainfall events of 0.2 inches or greater and the following 72 hours

MPN/yr, corresponding to 15 percent of the annual Responsible Party load or 98 percent of Responsible Party loads in the non-allowable exceedance days (i.e., 15% of Responsible Party loads for WY 1993 need to be reduced in order to achieve the TMDL AEDs with 50% likelihood).

Each bar in the chart below represents a wet day according to the TMDL from WY 1993. The days are ranked from high to low in terms of amount of fecal coliform loads and that amount of load is represented by the height of the bar (on a logarithmic scale). The top of each bar (purple) represents the load that is attributed to the MS4s, and therefore must be controlled (after the 19 AEDs).

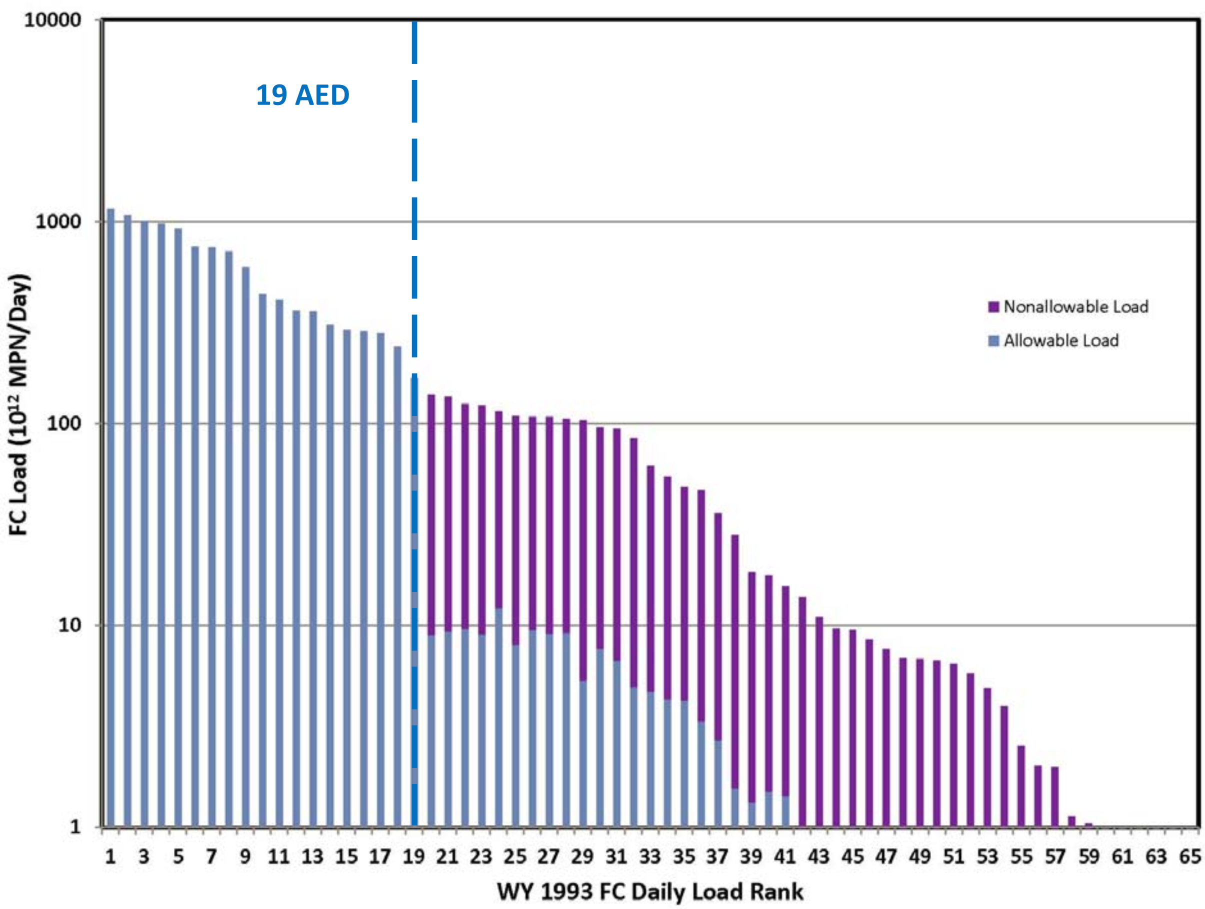

Figure 3. WY 1993 Load Reduction Curve and Determination of FC TLR (Wet Weather)

The second TLR value was estimated based on actual in-stream data, using FIB monitoring data collected between 2004 and 2008 from the AB411 monitoring point at the SDR shoreline, which is also a TMDL compliance point for this CLRP. This monitoring data-based TLR was determined based on an estimation of the percent loading reduction required to bring historic wet-weather compliance monitoring data into compliance with final WLAs. This analysis is based on the governing assumption that percent watershed load reduction directly translates to percent concentration reduction at the SDR AB411 beach monitoring site, an approach that itself is based on the assumption that the beach is a receiving water system with bacteria concentrations that are controlled by drainage area runoff discharge loads. This assumption is consistent with findings from multiple wet-weather beach bacteria monitoring studies, including the SCCWRP study on reference beach sites (SCCWRP, 2006) and the staff report for the Los Angeles Harbor Bacteria TMDL (LARWQCB, 2004). This approach inherently assumes that the SDR shoreline area will continue to exhibit an assimilative capacity that is consistent with historic levels. While other bacteria sources (e.g., beach and marine sources) and processes (e.g., settling, resuspension, die-off, regrowth, etc.) are also involved, these are less well understood and less predictable. Therefore these simplifying assumptions were made to allow for a rough quantitative estimate of receiving water response to various proposed implementation actions. No additional assumptions of receiving water dilution or die-off were made.

To calculate TLRs from this dataset, the data were first split into wet and dry weather data using the TMDL definition of a wet day, which is a day with at least 0.2 inches of precipitation plus the following three days (precipitation data from the Lindbergh California Climate Data Archive rain gauge were used to determine wet and dry days). These data were compared to TMDL water quality objectives to determine which days exceeded standards.

Next, wet weather sample results for each water year were multiplied by a reduction factor, and the number of days that still had exceedances after this reduction factor was applied was counted. Using the ratio of these exceedances to the total number of wet weather samples taken, an exceedance rate for the water year was calculated. This rate was then multiplied by the total number of wet weather days within the water year to calculate an estimate of the total exceedance days (EDs) for the water year. Since the TMDL AED for wet weather single sample limits in SDR is 19, the total calculated EDs for each water year was compared to this value. If the number of EDs was still higher than the AED value, the reduction factor was increased until the EDs were at or below the AED value. The reduction factor needed to reduce EDs for each water year to at or below the AED value, which was 30%, was chosen as the TLR.

There are several sources of uncertainty to this approach, including the limited number of wet weather samples each year, the limited number of years with available wet weather sample results, and the fact that results are based on grab samples which are expected to be influenced by tidal mixing and other dynamic processes. In addition, all years were considered equally, though recent MS4 activities may have resulted in water quality improvements that may have been reflected in more recent monitoring results. Finally, as described above, this approach assumes the surf zone receiving water is a closed system with MS4 discharges as the sole FIB source, such that watershed load reductions directly translate to receiving water concentration reductions, whereas, in reality, fate and transport processes may amplify or attenuate these loads prior to reaching the AB411 monitoring location, where mixing processes are expected to be highly dynamic.

Both technical approaches utilize actual, monitored data, have direct relevance, and must be considered. The average of the two TLR calculation methods assumes, for lack of evidence to the contrary, equal weighting. This average is used to establish the target for the proposed plan. The average reduction percentage for the two analyses is 64 percent. This corresponds to Responsible Party wet weather TLR of 1,150 x 10^{12} MPN/yr.

Table 5 summarizes the wet weather TLRs calculated by the two different methods described above, as well as the average value expressed in a load reduction percent, as well as an absolute load reduction.

Table 5. Wet weather TLRs calculated using Load Duration Curve Method and based on AB411 monitoring data

Source	Target Load Reduction
Load Duration Curve Method	98%
Monitoring Data – Single Sample	30%
Average reduction (%)	**64%**
Average reduction (load)	**1,150 x 10^{12} MPN/yr**

3.2.2.2 Dry Weather TLRs

Dry weather TLR estimates were developed through two approaches and were compared to determine a single dry weather TLR for this CLRP. The first approach used the Bacteria TMDL, which reports separate TLRs for each FIB based on the TMDL dry weather modeling analysis. However, the TMDL defines an exceedance day as a day in which any one of the FIBs exceed the WQO. This "aggregated" exceedance rate is typically higher than (and at least equal to) the exceedance rate for any individual FIB. Therefore, the TLR that would be necessary to meet all FIB WQOs is considered to be greater than the highest load reduction listed in the TMDL for any one of the individual FIBs, which in this case is enterococcus (94 percent reduction).

Similar to the second wet weather TLR estimation approach described above, the second dry weather approach was based on an analysis of monitoring data collected from the AB411 monitoring point at the SDR shoreline[17], which is also a TMDL compliance point for this CLRP. To calculate TLRs from this dataset, the data were first split into wet and dry weather data using the TMDL definition of a wet day, which is a day with at least 0.2 inches of precipitation plus the following three days (precipitation data from the Lindbergh California Climate Data Archive rain gauge were used to determine wet and dry days). For the dry weather SSM limits, there are no allowable exceedances (in other words, the AED is 0). Therefore, the reduction was

[17] AB411 data collected between 2004 and 2009, consisting of approximately 350 samples were used for this analysis.

calculated as the maximum concentration reduction needed to lower FIB concentrations to at or below the WQO. This approach assumes the surf zone receiving water is a closed system with MS4 discharges as the sole FIB source, such that watershed load reductions directly translate to receiving water concentration reductions. Based on this analysis, the estimated FIB TLR is 95 percent.

Table 6 shows results of this calculation as well as the TLRs presented in the TMDL. Based on these two approaches, the dry weather TLR for this CLRP is between >94-95 percent.

Table 6. Dry weather TLRs from Bacteria TMDL and calculated based on AB411 monitoring data

Source	Enterococcus	Fecal Coliform	Total Coliform
Bacteria TMDL	94%	69%	74%
Bacteria TMDL for FIB		>94%	
Monitoring Data – Single Sample		FIB, 95%	

3.2.3 Subwatershed Characterization

3.2.3.1 Source Prioritization

Data from various monitoring programs and studies conducted in the SDR Watershed were reviewed to obtain information on possible sources of FIB contamination and their potential to contribute to FIB exceedances. Prioritization helps guide decisions on appropriate types of controls for both dry and wet weather.

3.2.3.1.1 Monitoring data

Historical data collected at the AB411 beach monitoring site were used to characterize current conditions in the watershed in order to inform load reduction strategies. The Data Review Memo (Appendix B) discusses the specific datasets reviewed and the ways in which they were used. The analyses conducted using monitoring data include:

1) *Correlations between AB411 data and seasons:* Seasonal variations were found in the AB411 data. Specifically, a greater percentage of exceedances were found to occur during summer-dry weather than winter-dry weather. If this trend is found to continue as BMP controls are implemented, further investigation and specific targeting of these sources may be pursued.
2) *Correlations between AB411 data and tidal fluctuations:* No consistent trends were observed between AB411 data and tidal fluctuations. This analysis indicates that sources on the beach (i.e. wrack) could be less significant than watershed sources.

3.2.3.1.2 Literature Review

The following are the main SDR studies that were reviewed for data on bacteria sources and some of their major conclusions.

Source Prioritization Process for Bacteria

Based on discussions from several meetings held in 2011 by a regional workgroup of San Diego County Stormwater Copermittee representatives as well as a literature review, Armand Ruby Consultants (ARC) prepared a report documenting a bacteria source prioritization process (ARC 2011). This report recommends splitting bacteria sources into categories of dry versus wet, as well as human, anthropogenic, non-human, and non-anthropogenic. It also recommends focusing on sources with a potential pathway into an MS4 or receiving waters.

Following the method outlined in the ARC report, the SDR Watershed Responsible Parties ranked potential bacteria sources based on the following weighted factors:

- Human health risk
- Magnitude
- Geographical distribution
- Frequency

The scores were tabulated and then ranked separately within each of the three categories. Table 7 shows the ranking of dry and wet weather sources for bacteria sources in the SDR Watershed.

Table 7. Rankings for dry and wet weather bacteria sources

Source	Dry Weather Rank	Wet Weather Rank
Human		
Sanitary sewer overflows (SSOs)	1	2
Homeless Encampments	2	3
Leaky Sewer Pipes (Exfiltration)	3	1
Bathers	4	8
Boaters	5	9
RVs (mobile)	6	10
Porta-Potties	7	7
Dumpsters	8	4
Trash cans	9	5
Garbage trucks	10	6
Illegal Dumping	11	11
Leaky Failing Septic Systems	12	12
Illicit Connections	13	13
Pools	14	16
Hot Tubs	15	17
Illegal Discharges	16	14
Gray Water Discharges	17	15
Biosolids Re-use	N/A	N/A
Landfills	N/A	N/A
Anthropogenic, Non-Human		
Pets	1	1
Rodents (Mice, Rats), Rabbits, etc.	2	2
Birds (Gulls, Pigeons, etc.)	3	3
Garbage Trucks	4	5
Dumpsters	5	6
Trash Cans	6	7
Manure/Compost	7	9
Vectors	8	11
Washwater	9	13
MS4s Infrastructure - Biofilm/Regrowth	10	4
Reclaimed Water	11	15
Green Waste	12	10
Litter	13	12
Outdoor Dining/ Fast Food	14	16
Grease Bins	15	14
Soil	16	8

Source	Dry Weather Rank	Wet Weather Rank
Livestock	N/A	N/A
Manure Re-use Non-Ag	N/A	N/A
Landfills	N/A	N/A
Livestock	N/A	N/A
Manure Re-use	N/A	N/A
Irrigation Tailwater	N/A	N/A
Soil and Decaying Plant Matter	N/A	N/A
Food Processing	N/A	N/A
Bio-Tech Manure Management	N/A	N/A
Non-Anthropogenic		
Wildlife (Birds and Others)	1	1
Wrackline (Flies, Decaying Plants)	2	2
Plants	3	4
Algae	4	3
Soil	5	5

Source Identification Studies

In response to frequent exceedances of bacterial standards at the SDR AB411 site at Dog Beach, the San Diego River-Ocean Beach Water Quality Improvement Project (Weston 2007), focusing primarily on dry weather bacterial loading, was initiated. Based on a previous study, Phase I of the project assumed that bird and dog feces were not the primary source of contamination, and targeted infrastructure issues (such as leaking sanitary sewers or storm drain systems), urban runoff, and human inputs in the SDR Watershed as potential sources of bacterial loads to the beach.

During Phase I, three potential areas of chronic bacterial inputs to SDR were identified, with potential sources including aging infrastructure (though investigations of sewer lines near Dog Beach showed no evidence of leaks), homeless populations, wildlife, and two stormwater outfalls serving the community of Ocean Beach. These outfalls were also identified as having the greatest potential to influence water quality during dry weather conditions at Dog Beach, since observations of flow from these outfalls confirmed that their discharge could reach the beach. During wet weather, it was noted that increased flow from SDR did impact water quality at the beach, though these wet weather inputs were not investigated extensively for this study.

Based on the results of this source tracking work, it was concluded that the River may not be the primary source of bacterial loading to Dog Beach during dry weather and that local sources such as beach wrack (kelp) and sand berms located on Ocean Beach (south of Dog Beach), which are made from a mix of sand and kelp, may be significant contributors to dry weather beach bacteria loading as well.

Source tracking work was also presented in Phases I and II of the San Diego River Source Tracking Investigation (Weston 2009a, Weston 2009b). Phase I of this study identified low-density residential land uses and transportation corridors as having high bacteria concentrations in runoff during both wet and dry weather. Catchbasins, especially those close to restaurants and in areas where over-irrigation was observed, were identified as potentially significant sources of bacteria loads during both wet and dry weather. During wet weather specifically, trash, and poorly maintained restaurant grease traps were also identified as potential sources.

Both Phases of the San Diego Source Tracking Investigation as well as the San Diego River-Ocean Beach Water Quality Improvement Project included source identification studies to look for the presence of human-specific bacterial contributions. The San Diego River-Ocean Beach study looked at MS4s, and did not identify the presence of human sewage contamination (1 of 18 samples were found to have a weak human fecal signal). Phase I of the San Diego Source Tracking study sought to determine if there was evidence of human fecal contamination in the San Diego River by testing samples collected during two dry weather events, and similarly found no evidence of human-specific fecal waste. Phase II of the study found human contributions during wet weather sampling of SDR. Review of these studies, however, was unable to confirm the reliability of these source identification results due to a lack of available data on quality assurance and control (see CLRP Appendix D). Based on this review, and since the Phase I study focused on dry weather only, this CLRP uses results compiled from the Lower SLR River Bacteria Source Identification Project (MACTEC 2011), as well as other source studies as references for human contributions to the Watershed. This analysis is described in further detail in Appendix D.

Some key conclusions from the Lower SLR study which may be applicable to the SDR Watershed include:

- Strong gull bacteria signals during both wet and dry weather; and
- Higher percentages of human contributions during wet weather as compared to dry weather, with spatial distribution of human contributions implicating urbanized areas (with sources such as homeless populations and illicit discharges to storm sewers) as potentially significant contributors.

San Diego County Enterococcus Regrowth Study

The purpose of this regional study financed by the San Diego Stormwater MS4 Copermittees (SCCWRP 2012) was to investigate the ability of enterococcus to grow on different surfaces, prioritize sources of enterococci, and analyze factors that might affect enterococci concentrations and community make-up during dry weather. In addition, water samples from creeks and storm drains were tested for human marker HF183 to determine if human fecal contamination was present.

Study results showed high levels of enterococci associated with vegetation, algae, decaying organic matter, and wrack, and found that the bacteria were able to grow on sterile concrete coupons placed within the storm drain. Identification of the enterococci isolates from the study sites indicated that the majority (>80 percent) of the community was composed of species primarily found on plants and in soil, and not often associated with human fecal matter. Also, the majority (>80 percent) of enterococci isolated from the beach water sampled were found to be composed of the same strains found growing within storm drains, indicating that naturally occurring (as opposed to those resulting from human fecal contamination) enterococci could be a significant source of the elevated levels found at beaches. A subset of water samples was tested for HF183, and none of the results indicated the presence of this marker. Neither of the two sites sampled for this study (Moonlight State Beach in Encinitas, and Rock Pile Beach in La Jolla) are located within the SDR Watershed (the closest site, Rock Pile Beach, is approximately 6 miles north of the SDR outlet). However, the ability of the bacteria to re-grow within storm drains and the association with natural sources are likely to be similar regardless of watershed, so the potential for a significant natural source of enterococci to the SDR Watershed is probable.

Conclusions
Based on the number of potential human sources identified in the ARC prioritized source list, as well as conclusions from the Lower SLR MST study, and the Phase II SDR study suggesting the likely presence of human-related bacteria within the SDR watershed during both wet and dry weather, the CLRP identifies targeting human sources as a top priority. In addition to the benefit of decreasing bacteria loads and helping to meet TMDL requirements, focused efforts on reducing human inputs would most directly address the primary causes of human health impairments in receiving waters.

The top potential sources of human-related bacteria to the SDR Watershed based on these studies include:

- Sanitary sewer overflows
- Leaking sewer pipes
- Homeless populations, and
- Leaking septic systems.

In addition to being identified by Responsible Parties as a top priority source for both wet and dry weather, sanitary sewers have been shown to be a significant source of human-related bacteria contamination in storm sewer systems in other Southern California watersheds (Sercu 2011).

The San Diego River-Ocean Beach study, the Lower SLR MST study, and the Responsible Parties identified homeless encampments as a potentially significant source of human-related fecal contamination. The Regional Task Force on the Homeless (RTFH) conducts annual surveys of the homeless population in San Diego County. Based on its 2011 Point-In-Time Count, there are more than 3800 homeless people living in vehicles or hand-built structures in the Cities of San Diego, El Cajon, La Mesa, and Santee, and the unincorporated areas of Lakeside and Alpine, potentially within the SDR Watershed.

Though TMDL numeric limits are directed at FIB in general, and not human-related bacteria specifically, effectively addressing human and anthropogenic/non-human sources and documenting the progress made to date may help support a Natural Source Exclusion (NSE) approach when revisions to the TMDL are considered in the future. The likelihood of an NSE being applicable to the SDR Watershed is supported by results from the regional re-growth Study and the ARC priority list, which indicate that natural sources, such as birds, may play a key role in bacteria impairments within the SDR Watershed.

3.2.3.2 Spatial Characterization and Mapping

Data from various monitoring programs in SDR Watershed were compiled and mapped by monitoring site in order to identify any trends in dry weather concentrations and land use, as well as to roughly validate wet weather prioritization results produced by SBPAT (see Section 3.2.5 for further detail). The Data Review Memo (Appendix B) includes maps produced during this analysis.

Mapping of dry weather monitoring data against land use data showed that higher bacteria concentrations were distributed throughout the watershed, primarily in residential and agricultural land use areas. Similarly, wet weather monitoring data results were high throughout the watershed, and roughly coincided with higher priority catchments identified by SBPAT.

3.2.4 Candidate Nonstructural Controls

Nonstructural BMPs are management actions or programs designed to reduce or eliminate pollutant loading at the source. Nonstructural BMPs can be municipal programmatic or regulatory measures, public education and outreach, financial incentives, or other source management programs designed to effect behavioral changes. To identify and prioritize a list of candidate nonstructural BMPs for inclusion in the CLRP, the following six step strategy was undertaken. The strategy is displayed in Figure 4 and described in greater detail in the Nonstructural BMP Memo contained in Appendix E.

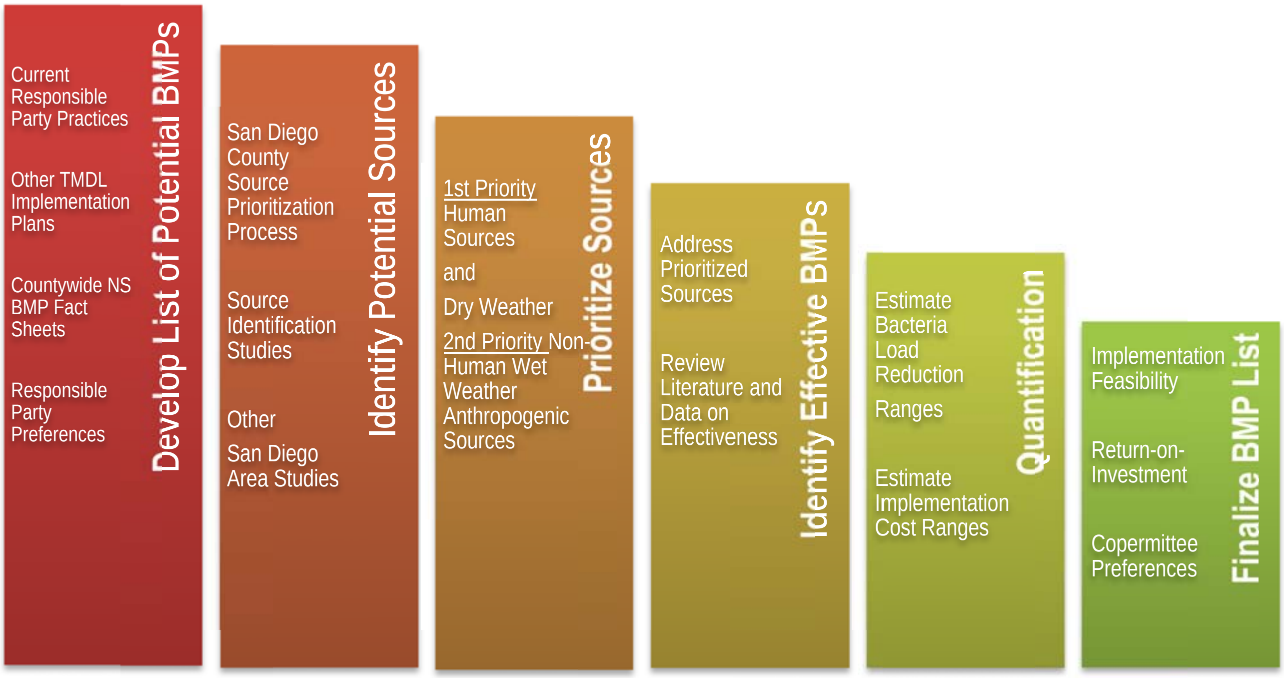

Figure 4. Nonstructural BMP identification and prioritization strategy

Step one of the strategy included development of a list of potential new or enhanced BMPs to address priority pollutants in the SDR Watershed. The list was populated based on a review of nonstructural BMPs currently being implemented by agencies within the SDR, other Bacteria TMDL implementation plans, Nonstructural BMP Facts Sheets prepared for San Diego Copermittees' Program Planning Subcommittee, and interviews with the Responsible Parties.

The second step identified potential bacteria sources based on the findings of the San Diego County Source Prioritization process (ARC 2011), the Lower SLR MST study (MACTEC 2011) and other San Diego area source studies.

The third step categorized sources into 1st (human or dry weather) and 2nd (non-human anthropogenic wet weather) priorities and non-anthropogenic sources, which are outside the responsibility of the Responsible Parties. Human sources are 1st priority because of the increased potential for public health risk. Dry weather sources are also considered 1st priority because of the increased recreational contact during dry seasons and the earlier compliance date required by the TMDL.

The fourth step identified potential BMPs that would be effective at addressing the prioritized sources based on literature and data reviews.

The BMPs identified in the fourth step were then quantified in the fifth step to find the range of bacteria load reduction benefits and estimated implementation costs. Section 4.1.1.1 includes the methods of quantification, along with the estimated load reduction benefits from each candidate

BMP. Section 4.3.2 describes the implementation costs as well as the procedures used to estimate them.

The final step was to create a list of nonstructural BMP candidates, based on discussions with the Responsible Parties, considering implementation feasibility and return-on-investment.

Table 8 presents the final list of 1st and 2nd priority candidate nonstructural BMPs. The table also highlights whether the candidate BMPs are enhancements to current programs or new initiatives, as well as the land uses targeted and pollutant-generating activities addressed (see Section 3.2.3.1 for further discussion of pollutant sources). The Nonstructural Memo (Appendix E) includes a detailed description of each candidate nonstructural BMP and a discussion of its potential effectiveness.

Table 8: Priority nonstructural BMPs, Nonstructural Memo (Appendix E)

Nonstructural BMP	Enhanced	Weather	Targeted Land Use	Quantified	Pollutant Generating Activities
1st Priority (Human Sources or Dry Weather Anthropogenic Sources)					
Identification and control of sewage discharge to MS4	X	Dry	MS4 conveyance system	Yes	Leaking sewers, illegal discharges, illicit connections, illegal dumping, RVs
Homelessness Waste Management Program	X	Wet	Urban areas	Yes	Homeless encampments
Onsite Wastewater Treatment System Source Reduction	X	Wet	Rural residential	No	Leaky, failing septic systems
Irrigation Runoff Reduction & Good Landscaping Practices	X	Dry	Residential and commercial	Yes	Irrigation runoff, fertilizers/compost, soil and decaying plant matter, green waste
Commercial/Industrial Good Housekeeping	X	Dry	Commercial and industrial	Yes	Dumpsters, outdoor garbage areas, garbage trucks, grease bins, outdoor dining/fast food, washwater
2nd Priority (Non-Human Wet Weather Anthropogenic Sources)					
Residential/Small-Scale Low Impact Development (LID) Incentive Program	X	Wet	Residential	Yes	Residential roofs
Pet Waste Program	X	Wet	Parks, recreational & residential	Yes	Pets
Animal Facilities Management	X	Wet	Commercial and rural residential	No	Livestock, manure
Street and Median Sweeping	X	Wet	Residential and commercial	Yes	Littering, sedimentation, aerial deposition, leaf litter
MS4 Cleaning	X	Wet	MS4 drain inlets	No	Biofilm/regrowth, trash, organic matter, sediment
Redevelopment and LID Implementation	Existing, unchanged program	Wet	Land uses covered under SUSMP	Yes	Urban land development planning and design

3.2.5 Candidate Structural Controls (Bacteria Focus)

The Responsible Parties used SBPAT to identify potential locations and types of structural BMPs. SBPAT screens areas based on need (e.g., pollutant load generation and downstream impairments), and then identifies opportunities (e.g., appropriateness of the area, adjacent storm drains) for BMP implementation. SBPAT uses a GIS-based decision support tool that relies on four steps for identifying BMP implementation opportunities (Figure 5):

1. ***Catchment Prioritization*** - Prioritize catchments based on water quality management need (e.g., pollutant-loading, receiving water issues) (Section 3.2.5.2).

2. ***Identification of Structural BMP Opportunities*** - Identify potential BMP options within high priority catchments based on factors such as parcel size, land ownership, proposed projects, and proximity to storm drains (Section 3.2.5.3).

3. ***Structural BMP Prioritization*** - Identify appropriate BMP types based on factors such as cost, maintenance, and reduction effectiveness for the pollutants of concern (Section 3.2.5.4).

4. ***Site-Specific BMP Evaluation*** - Develop site-specific implementation strategies based on desktop analyses and field investigation.

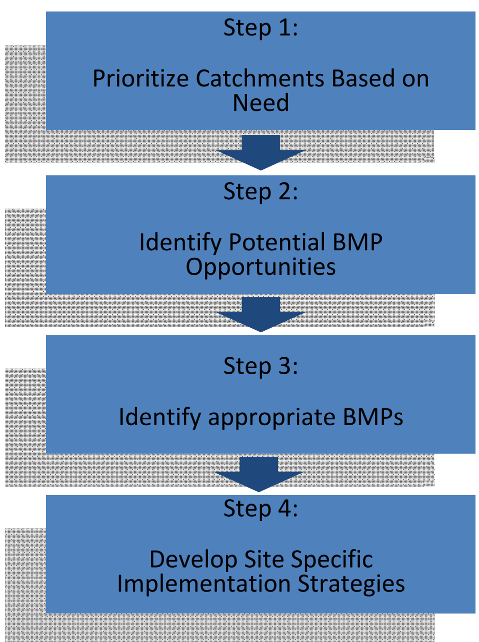

Figure 5. Steps for Identification of Candidate Structural BMPs

The following sections summarize the implementation of these analytical steps in the SDR Watershed. A more detailed explanation of the methodology can be found in the SBPAT User's Guide (Geosyntec 2008).

3.2.5.1 Model Inputs

The SBPAT model requires two databases for operation. The first database is a file-based geodatabase that contains spatial data, lookup tables, and runtime defaults. The second database is a personal geodatabase that is automatically created during Step 1 of the Prioritization Methodology and serves as a repository for custom input variables and interim model results.

The SBPAT model requires a number of spatial and non-spatial datasets for input into the SBPAT pre-processor prior to beginning Step 1. Spatial datasets include catchments, land use, parcel, rain gage location, soils, storm drains and precipitation. Non-spatial data sets included in the FGDB prior to pre-processing include data related to land use, pollutants, EMCs, BMPs, ownership and SWMM model parameters.

Appendix B (Data Memo) discusses these data sets and their data sources.

Land use-based EMCs are an integral component for prioritization and load reduction determinations. Appendix C presents the basis for the EMC data used in this analysis.

3.2.5.2 Catchment Prioritization

This step identifies catchments within the SDR Watershed that have the potential to generate the highest pollutant load during wet weather events. This analysis relies on EMC data applicable to different land uses (see Appendix C for more detail on EMCs).

While this CLRP is primarily intended to meet the requirements of the Bacteria TMDL, other pollutants of concern were considered when prioritizing catchments and selecting BMPs, consistent with the TMDL description of a CLRP (Step 2). Since one of the guiding principles of this CLRP is that it be integrated, and since selecting BMPs that address multiple pollutants follows this principle, this catchment prioritization step also considered nitrogen (nitrate) and phosphorus (using total suspended solids as a proxy)[18].

3.2.5.2.1 Catchment Prioritization Index (CPI)

The entire SDR Watershed downstream of the San Vicente and El Capitan reservoirs was divided into 531 subcatchments, which were an average of 210 acres in size. Using the input data discussed above, SBPAT calculated a catchment prioritization index (CPI) score for each subcatchment in the SDR Watershed. This score is based on the potential for each catchment to

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[18] The SBPAT catchment prioritization step does not include an option for phosphorus. Because of this, TSS was used as a proxy for phosphorus, since the majority of phosphorus is associated with solids. The load reduction analysis step in SBPAT does include phosphorus, so no proxy was necessary for this portion of the analysis.

contribute pollutant loads, and can therefore be used to focus BMP efforts. Each catchment was given a CPI score between 1 and 5, with 5 representing the highest priority. For a more detailed explanation of the CPI calculation, see Step 1 of the SBPAT User's Guide (Geosyntec 2008). The following is a brief summary of the key elements of this step.

- Pollutant-specific CPI scores were calculated for each land use within a catchment as the product of pollutant EMCs, 85th-percentile precipitation, volumetric runoff coefficients, and land use runoff coefficients. These scores were then weighted by the area of each land use category within the catchment. Table 3 in the EMC Memo (Appendix C) shows the data used for each land use type.
- Individual pollutant CPI scores for each catchment were combined into an integrated CPI score using the weights listed in Table 9.
- CPI scores were then further refined based on whether a catchment drained to an impaired water body, or a water body with an assigned TMDL. Weights of two and three, respectively, were assigned for catchments draining to impaired water bodies and water bodies with assigned TMDLs.

Table 9. Pollutant Group Weights for Normalized Pollutant CPI Calculation

Pollutant	Weight
Nitrogen (Nitrate)	10
Bacteria (Fecal Coliform)	20
Total Suspended Solids (representing Phosphorus)	10

Figure 6 shows a distribution of the final integrated CPI scores reflecting the Responsible Parties' priorities.

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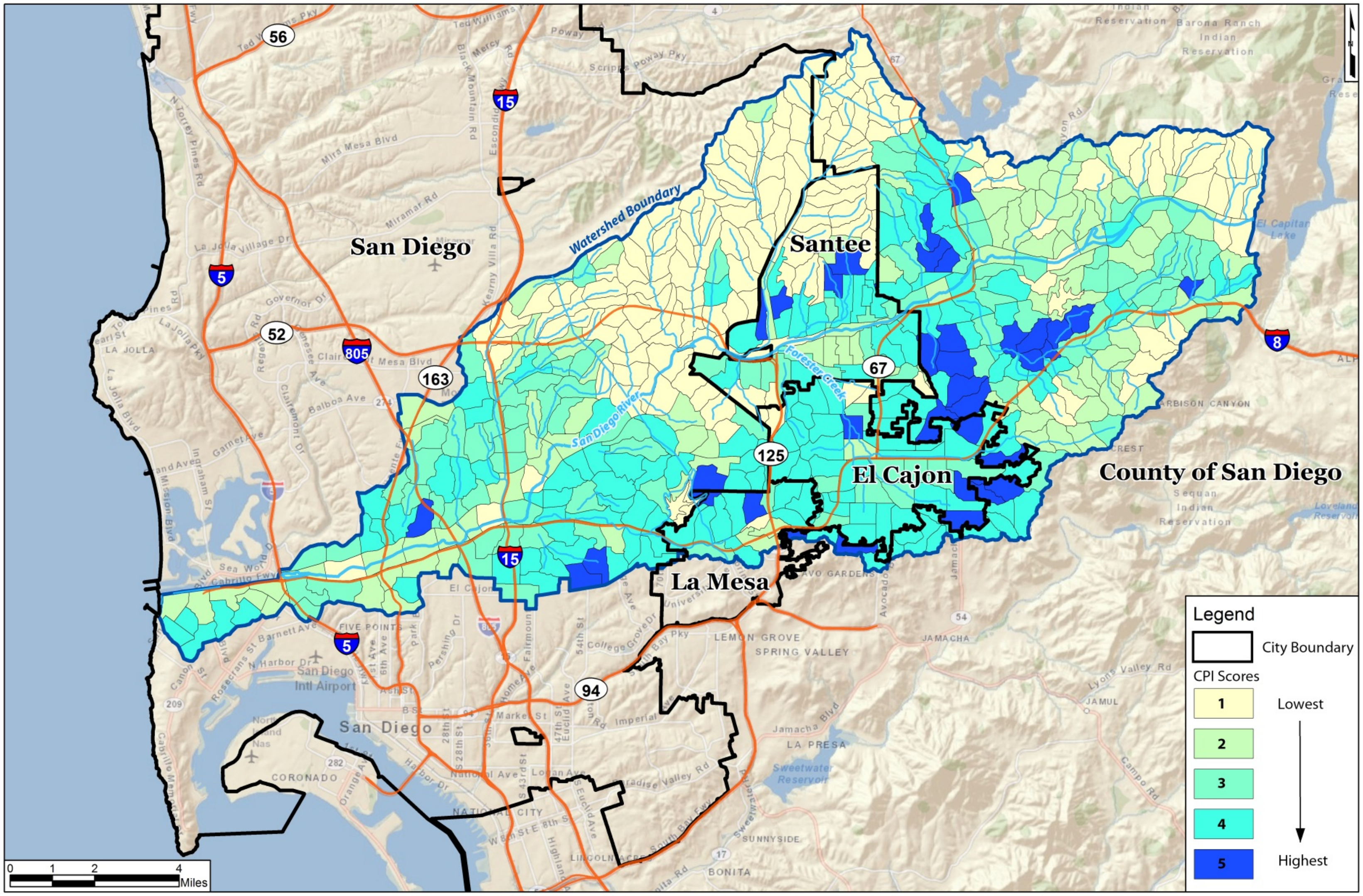

Figure 6. Integrated CPI scores

3.2.5.2.2 Nodal Catchment Prioritization Index (NCPI)

A "nodal" catchment prioritization index, or NCPI, identifies catchments that are downstream of multiple, hydrologically linked high-priority catchments that may be utilized for potential regional BMP implementation. Using the downstream catchment attribute, an NCPI score for each catchment was computed using an area-weighted average of the CPI scores for tributary catchments. Figure 7 illustrates the final NCPI results.

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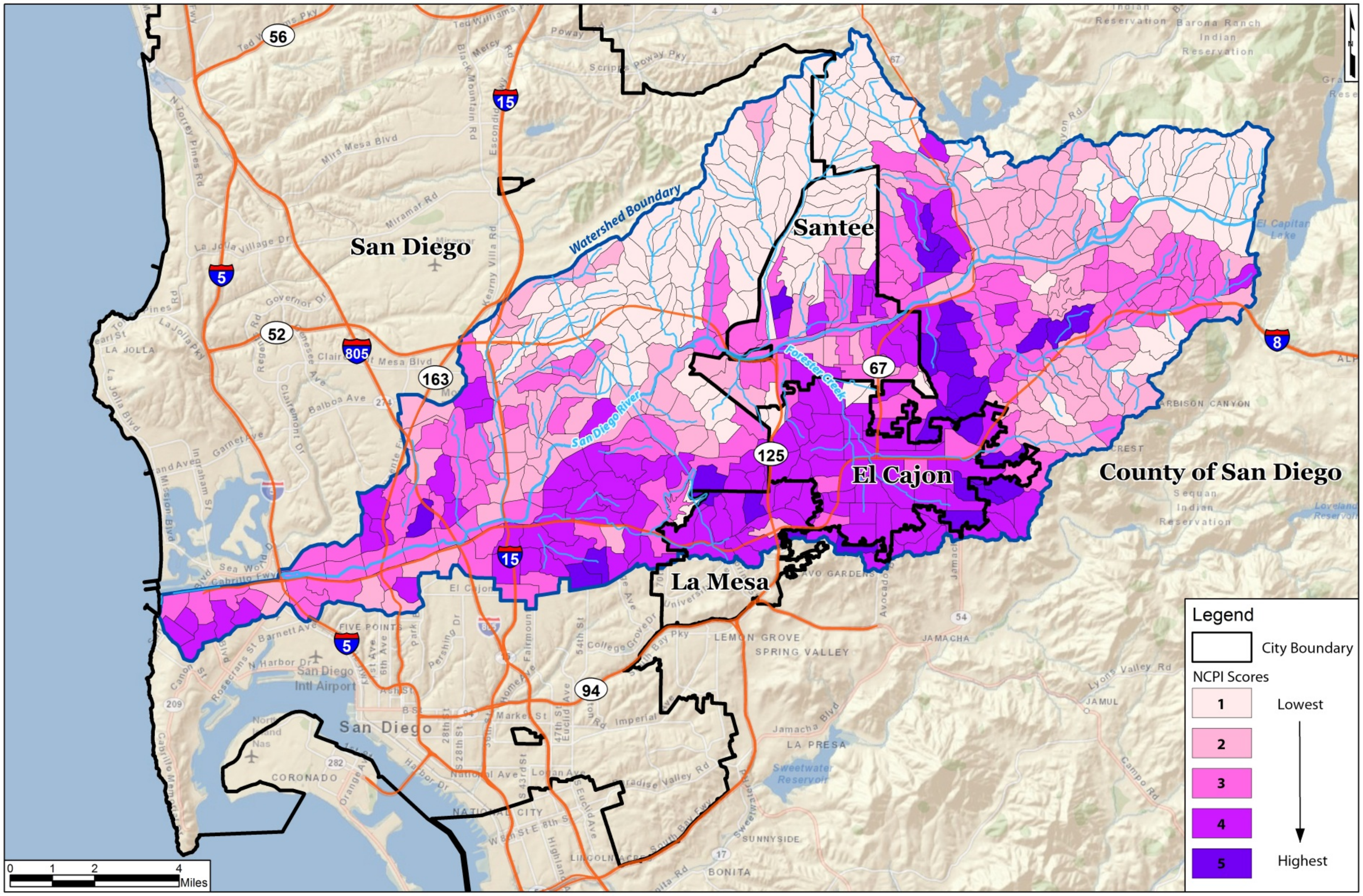

Figure 7. NCPI scores

Catchments with high NCPI scores are generally those with an upstream tributary area that contains a relatively large proportion of high priority catchments. A comparison of the spatial distribution of NCPI scores (Figure 7) with CPI scores (Figure 6) shows general agreement regarding the classification of priority catchments. High priority NCPI catchments are typically down-gradient of, or are themselves, high priority catchments as determined by the CPI score.

3.2.5.2.3 Prioritization Results

Based on the analysis described above, Table 10 summarizes the distribution of CPI scores and Nodal CPI scores with 1 being the lowest priority and 5 being the highest.

Table 10. Distribution of CPI/NCPI scores

	Total Number of Catchments 531	
Score	***CPI***	***NCPI***
1	153	140
2	97	114
3	97	122
4	145	124
5	39	31

The catchments that met the following criteria were selected to move on to Step 2 of the SPBAT analysis:

- **Regional:** had a CPI ***or*** NCPI score of 3 or higher[19];
- **Distributed:** had a CPI score of 3 or higher and had greater than 50 percent Responsible Party area within the catchment.

CPI or NCPI score of 3 or higher was selected in order to have enough projects to satisfy the TLR.

[19] Per SBPAT methodology only catchments with high NCPI score are screened for Regional opportunities but, because of the relatively large area of each catchment, catchments with High CPI score are also screened for regional opportunities in this analysis.

3.2.5.3Identification of Structural BMP Opportunity Sites

Step 2 of the SPBAT methodology focuses on locating potential BMP opportunities within the high priority catchments identified in Step 1. SBPAT uses different approaches for catchments identified as high priority for regional BMPs versus those identified as high priority for distributed BMPs. Each process is described below.

3.2.5.3.1 Regional BMPs

Regional Structural BMPs are treatment or volume mitigation BMPs implemented to treat subwatershed or catchment scale drainage areas. SBPAT screens parcels within the regional priority catchments identified in Step 1 (Section 3.2.5.2) to determine if they have potential as sites for a regional structural BMP. Potentially feasible parcels are those meeting the following criteria:

- Owned (or potentially considered high priority acquisition parcel) by a TMDL Responsible Party;
- Within 100 feet of a storm drain or stream reach; and
- Based on best professional judgment have available area for siting a regional BMP after screening out areas with steep slopes (greater than 20 percent) and wetlands (based on National Wetlands Inventory database downloaded from the San Diego Geographic Information Source (SanGIS) within the parcel.

Parcels that met the above criteria were evaluated further in Step 3 (Section 3.2.5.4).

3.2.5.3.2 Distributed BMPs

Distributed Structural BMPs are treatment or volume mitigation BMPs implemented at the neighborhood, parcel or site scale and include features such as green streets, rainwater harvesting, and Low Impact Development-type solutions. Catchments selected for distributed BMPs (based on their CPI scores) are screened for potential distributed BMP opportunities. Non-travelled public rights of way (ROWs) within the high priority catchments were identified as potential locations for distributed BMP retrofits. Based on random sampling of ROWs within the high priority catchments, and using best professional judgment, 40 percent of the ROW was identified to be non-travelled and 10 percent of the non-travelled ROW was assumed, on average, to be available for a BMP retrofit. Given the above two findings, 4 percent of the ROW within high priority catchments was assumed to be available for a distributed BMP retrofit. For catchments within City of Santee's jurisdiction, specific locations for distributed BMPs provided by the City of Santee were incorporated into the CLRP in lieu of an estimated average distributed BMP retrofit area.

3.2.5.4Structural BMP Selection

BMPs for each parcel identified in Step 2 (Section 3.2.5.3) were selected through a careful consideration of which BMP type would be most effective at reducing pollutants of concern

(FIB, nitrogen [nitrate], and phosphorous) through an iterative process. Responsible Parties reviewed and revised two iterations of implementation scenarios based on project feasibility and effectiveness. The Structural BMP Memo (Appendix F) discusses the BMPs chosen for consideration.

3.2.5.4.1 Regional BMP Selection

Site specific regional BMPs for the screened parcels were selected considering the following criteria:

- *BMP Performance*: Which BMP type is most effective at reducing concentrations of FIB, nitrogen (nitrate), and phosphorous at this parcel?
- *Site-specific Constraints*: Which BMP type is feasible on the parcel given the location, parcel ownership, and physical characteristics of the site?
- *Costs*: Which BMP type is most cost-effective, both in capital expenditures and expected annual operations and maintenance costs?

The BMPs selected for pollutant removal modeling and cost estimation included subsurface flow wetlands, wetland/wet ponds, and infiltration basins, since these are the only structural BMP technologies capable of removing significant loads of FIB, nitrogen (nitrate), and phosphorous. The Structural BMP Memo (Appendix F) provides a detailed discussion of each of these types of BMPs and the BMP selection process. Regional BMP sheets that show the screened parcel and candidate BMP type for that parcel are shown in Figures 15 through 23. Figure 8 shows the candidate regional structural BMPs.

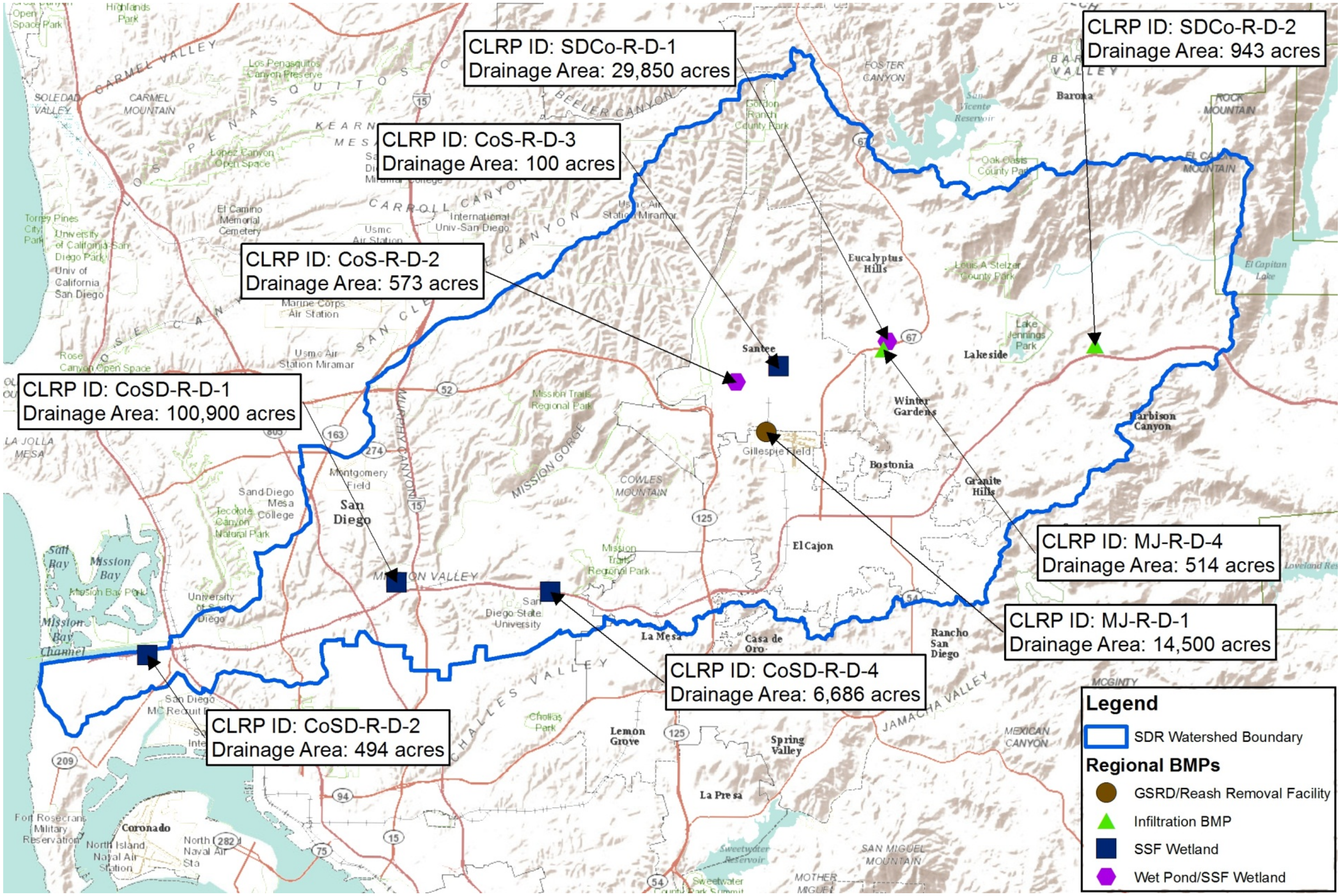

Figure 8. Candidate Regional Structural BMPs

3.2.5.4.2 Distributed BMP Selection

Distributed BMP types for retrofits within high priority catchments were selected based on the feasibility of infiltration within the retrofit area. Retrofit area is considered feasible for infiltration if more than 50 percent of the retrofit area is categorized as NRCS A, B, or C type soils. The following guidelines were used for identifying candidate distributed BMPs:

- *Infiltration feasible*: Assumed that 50 percent of the drainage area would be treated with infiltration BMPs and the remaining 50 percent would be treated with a non-infiltration bmp.
- *Infiltration infeasible*: Treated with non-infiltration BMPs.

While the Structural BMP Memo (Appendix F) presents an extensive list of infiltration and non-infiltration BMPs, quantification and costs in this CLRP were based on an assumption that bioretention will be implemented for infiltration BMPs and bioretention swales with underdrains will be implemented for non-infiltration BMPs. While designing and implementing site specific distributed BMPs as part of the implementation plan, different BMPs may be selected provided that the pollutant reductions achieved through the implemented projects will be equal to or greater than those modeled in this report. A list of the modeled distributed BMPs is shown in Table 11. A map showing proposed catchments for regional distributed structural BMPs is shown in Figure 9. Proposed catchments prioritized for distributed projects.

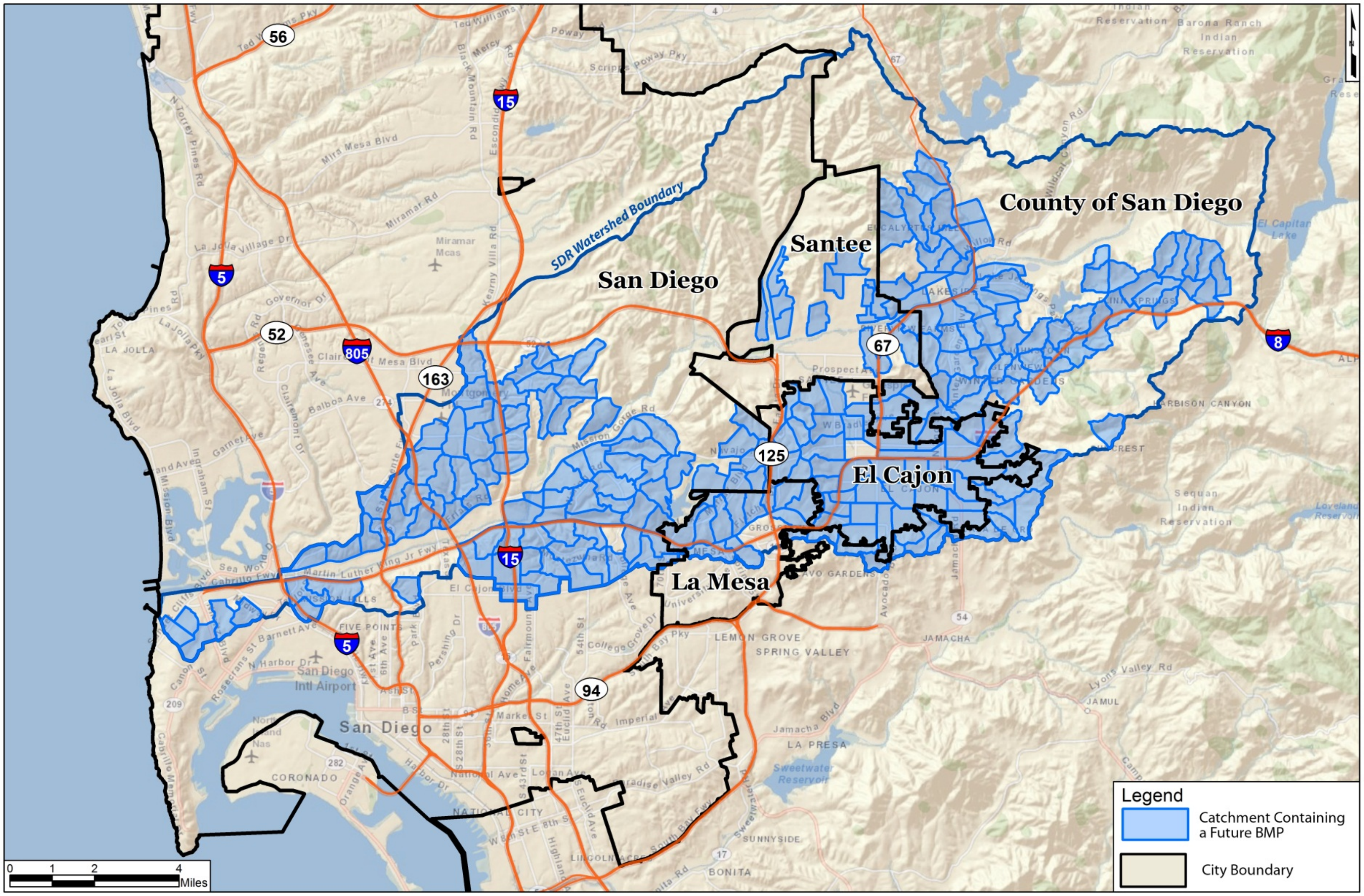

Figure 9. Proposed catchments prioritized for distributed projects

Table 11. Modeled Distributed BMPs[1,2,3]

Jurisdiction	Location/Name	BMPs Planned	Assumed Drainage Area (acres)	Catchment ID
County of San Diego	Bradley Avenue/SR67 Interchange	Curb Inlet Filters	NA[4]	1463
County of San Diego	Woodside Avenue	Curb Inlet Filters	NA	1185
County of San Diego	Flinn Springs Road at Oak Creek Road	Curb Inlet Filters/ Bioretention Swale	NA	1051
City of San Diego	Allied Gardens, 5155 Greenbrier Ave	Green Lot- Filtration	NA	2397
City of San Diego	Park Ridge Blvd, south of Murray Park Dr	Hydrodynamic Separator	NA	2278
City of San Diego	Cabrillo Heights Watershed Protection, 8308 Hurlbut St	Rain Garden	NA	2437
City of Santee	Fanita Parkway, Between Mast and Ganley	Wet Ponds	309	3200, 3201
City of Santee	San Diego River Trail - East project	Bioretention Swale	180	3210, 3211,3801
City of Santee	Mast Park West	3 - Bioretention Projects	100	3202
City of Santee	Woodglen Vista Park Improvement	Bioretention Project	100	3197
City of Santee	Mission Creek Drive & Mission Creek Trail	2 - Bioretention Projects	120	3237
City of Santee	Magnolia Avenue, County Parcel	Bioretention Project	230	3260
City of Santee	Blackhorse Estates - proposed retrofit	Detention Basin with infiltration	40	3263
City of Santee	Ladera (Morning View) Basin	Detention Basin with infiltration	20	3264
City of Santee	Sycamore Creek – Right of Way	Bioretention Swale	37	3212
City of Santee	Shoredale Basin	Detention Basin	15	3206

[1] Benefits for future distributed projects are quantified and claimed based on an assumption that distributed BMPs will be designed for 25% of municipal land uses within high priority catchments (does not include catchments from City of Santee).
[2] Projects presented in this list are in planning phase and are a subset of future distributed projects.
[3] Additional future distributed projects will be developed during the implementation phase.
[4] NA = Not Analyzed

3.2.5.4.3 Implemented BMPs

Baseline loads in the CLRP included loads from development that occurred between the TMDL year (2003) and 2009, since the CLRP baseline load was developed using 2009 land use. As such, control BMPs that were implemented between the TMDL year (2003) and 2009 as mitigation to this anticipated development were considered as part of the overall pollutant load reduction to be achieved by the CLRP. Table 12 presents a list of these projects, and a map with their locations is shown in Figure 10.

No credit is given in the CLRP for BMPs to be implemented as mitigation to new development after 2009 as it is assumed that the loads mitigated by the BMPs will offset the additional loads generated by new development (i.e. no net decrease in pollutant load).

Table 12. Implemented BMPs[1,2,3,4]

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
County of San Diego	9410 Adlai Terrace, Lakeside	Extended Detention Basin	9.0	1078	SF Residential
County of San Diego	Canita Lomas and Liberatore Lane, El Cajon	Subsurface Infiltration	20.0	1460	SF Residential
County of San Diego	420 Hart Dr, El Cajon and PO Box 1507, Cardiff	Grass Swale	0.5	1476	MF Residential
County of San Diego	9108 Lake Valley Road, Lakeside	Vegetated Filter Strip	1.0	1067	Institutional/ Education
County of San Diego	Laurel Canyon Rd a Vista Laurel Pl, Lakeside	Bioretention and Grass Swale	5.5	1175	SF Residential
County of San Diego	9728 Marilla Drive, Lakeside	Bioretention Swale	4.4	1096	SF Residential
County of San Diego	1178 Persimmon Ave, El Cajon	Grass Swale	1.0	1474	MF Residential
County of San Diego	14878 Olde Highway 80, Lakeside	Permeable Paving, Porous Concrete	2.0	1050	Institutional/Educatio n
County of San Diego	15724 Olde Highway 80, El Cajon	Bioretention Swale	1.0	1041	Rural Residential

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
County of San Diego	10007 Riverford Road, Lakeside	Bioretention Swale	3.0	1188	Industrial
County of San Diego	11905 Riverside Drive, Lakeside	Wet pond	76.0	1187	MF Residential
City of El Cajon	1501 East Washington Ave, El Cajon	detention basin and filter inserts	0.6	4498	Commercial
City of El Cajon	327/359 El Cajon Blvd, El Cajon	detention basins and inlet filters	1.9	4496	Commercial
City of El Cajon	245 E. Main St. El Cajon	downspout filters	0.1	4501	Commercial
City of El Cajon	1062 N. Second St, El Cajon	grass filter strip	0.6	4513	Commercial
City of El Cajon	605 W. Lexington Ave, El Cajon	gravel filter, rock energy dissipater, and bio-detention basin	0.2	4496	Commercial
City of El Cajon	1401/1409 East Main St, El Cajon	hydrodynamic separation system, inlet filters, and underground detention box	4.0	4484	Commercial

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
City of El Cajon	442/444 El Cajon Blvd, El Cajon	pervious swale and media filter vaults	0.2	4495	Commercial
City of El Cajon	335/355 North Second St, El Cajon	vegetated swale and outlet filter	0.5	4483	Commercial
City of El Cajon	1190 N. Second St., El Cajon	grass filter strip	0.2	4513	SF Residential
City of El Cajon	1032 Broadway, El Cajon	inlet filter and grass buffer strip	0.3	4502	Commercial
City of El Cajon	343 E Main St, El Cajon	vegetated swales and filter inserts	0.3	4501	Commercial
City of El Cajon	938 E. Washington Ave, El Cajon	pervious swale	0.4	4501	Commercial
City of El Cajon	1301 N. Marshall Ave, El Cajon	gravel infiltration basin	0.4	4510	Commercial
City of El Cajon	608 Sandra Lane, El Cajon	grass-lined channel	0.4	4489	SF Residential
City of El Cajon	1090 Broadway, El Cajon	grass filter strip and inlet filter inserts	0.4	4513	Commercial
City of El Cajon	613 Sandra Lane, El Cajon	detention basin	0.5	4489	SF Residential

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
City of El Cajon	403/431 Wisconsin Lane, El Cajon	sand media filter, underground detention basin, and inlet filter	0.5	4487	SF Residential
City of El Cajon	1470 E. Madison Ave, El Cajon	Pervious concrete swale	0.6	4484	Commercial
City of El Cajon	475/487 Foundation Lane, El Cajon	vegetated swale and inlet filter	0.6	4482	SF Residential
City of El Cajon	635 Sandra Lane , El Cajon	Detention basin	0.6	4489	SF Residential
City of El Cajon	1700 E. Main St, El Cajon	Vegetated swales, inlet filter, and infiltration basin	0.6	4507	Commercial
City of El Cajon	1108/1116 Anita Lee Lane, El Cajon	Grassy swales and curb outlet filters	0.6	4494	SF Residential
City of El Cajon	670 El Cajon Blvd, El Cajon	Underground detention pipe and hydrodynamic separator	0.7	4495	MF Residential
City of El Cajon	1273/1275 E. Main St, El Cajon	Vegetated swale and porous pavement,	0.7	4483	Commercial

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
City of El Cajon	912/930 Jamacha Rd, El Cajon	Infiltration system, vegetated swale, and storm drain inlet filters	0.8	4497	MF Residential
City of El Cajon	1341 E Main St, El Cajon	vegetated swales, gravel infiltration areas, and inlet filter inserts	0.8	4483	Commercial
City of El Cajon	1380 El Cajon Blvd, El Cajon	underground detention system	0.9	4493	Commercial
City of El Cajon	1326/1350 Wendell Cutting Ct, El Cajon	vegetated swales, underground detention, and inlet filter	1.0	4508	SF Residential
City of El Cajon	2095 East Madison Ave, El Cajon	biofilters and detention basin	1.0	4489	Commercial
City of El Cajon	1539 E. Main Street, El Cajon	underground detention pipe, pervious swale, and inlet filters	1.1	4508	MF Residential
City of El Cajon	2000/2010 Gillespie Way, El Cajon	detention area in parking lot, vegetated swale, and filter inserts	1.7	4504	Industrial

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
City of El Cajon	1225/1285 East Washington Ave, El Cajon	Biofilters for each new housing unit (perimeter)	1.8	4479	SF Residential
City of El Cajon	2766 Navajo Rd., El Cajon	Hydrodynamic separation system and underground detention box	2.5	4240	Institutional/ Education
City of El Cajon	Grossmont College Drive, El Cajon	hydrodynamic separation system and detention area	2.7	4244	Institutional/ Education
City of El Cajon	1630/1632 E Madison Ave, El Cajon	vegetated detention basin and inlet filters	4.1	4484	Institutional/ Education
City of El Cajon	198 W Main St, El Cajon	vegetated swales, hydrodynamic separator system, trash enclosure dry wells, and trench drain, downspout, inlet filters	4.7	4496	Commercial
City of El Cajon	1001 W. Bradley Ave, El Cajon	pervious swales, inlet filter, and detention basin	4.8	4510	Industrial

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
City of El Cajon	2062/2096 Ingamac Way Ave, El Cajon	extended detention basin and grassy swales	4.9	4489	SF Residential
City of El Cajon	1435 E. Washington Ave, El Cajon	vegetated swale, two extended detention basin, and storm drain inlet filters	6.1	4498	SF Residential
City of El Cajon	Anjuli Ct, El Cajon	Hydrodynamics separator system	6.4	4241	SF Residential
City of El Cajon	965 Arnele Ave, El Cajon	vegetated bioswales, pervious buffer strip, and bioretention swale.	6.9	4511	Commercial
City of El Cajon	298 Fletcher Pkwy, El Cajon	inlet filters, CDS hydrodynamic separator units, and filtration strip next to Garden Center	8.3	4502	Commercial
City of El Cajon	1935/1941 Granite Hills Dr., El Cajon	detention basin and vegetated channel	9.1	4484	SF Residential

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
City of El Cajon	189 Roanoke Rd, El Cajon	vegetated swales and storm drain inlet filters	10.7	4500	Institutional/ Education
City of La Mesa	8085 University Avenue, La Mesa	Vegetated Swale, Vortex Seperator	1.0	5294	Commercial
City of La Mesa	8010 Parkway Dr., La Mesa	Media Filter	10.5	5291	Commercial
City of La Mesa	8860/8870 Center Dr., La Mesa	Media Filter, Bioswale	3.2	5288	MF Residential
City of La Mesa	8727/8655 Fletcher Parkway, La Mesa	Media Filter, Drainage inserts	7.0	5287	SF Residential
City of La Mesa	9001 Wakarusa St., La Mesa	Wetland/Detention Area	3.6	5454	Institutional/ Education
City of La Mesa	8881 Dallas St., La Mesa	Bioswale, Media Filter	2.7	5285	Institutional/ Education
City of La Mesa	5555 Grossmont center Dr., La Mesa	Media Filter	15.0	5288	Commercial
City of La Mesa	8725 Fletcher Parkway, La Mesa	Media Filter	0.5	5287	Transportation

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
City of Santee	Aubrey Glen, Hiser Road and Mission Gorge Road	Hydrodynamic Separator System	8.0	3247	MF Residential
City of Santee	Autowerks, APN: 383-112-53	Drainage inserts and grass swales	2.5	3251	Commercial
City of Santee	Autumnwood II, APN: 381-681-20	Hydrodynamic Separator System	10.0	3237	MF Residential
City of Santee	Boys and Girls Club, 8820 Tamberley Way	Grassy swale, drainage inserts.	1.0	3802	Institutional/ Education
City of Santee	Cabins at Lake 7, APN: 378 020 49, 376 010 07	Wet pond	20.0	3200	Institutional/ Education
City of Santee	Chapparel (Mission View Estates), West of Mesa Road	Bioswales and media filter	2.0	3250	MF Residential
City of Santee	Ciraolo Industrial Building, APN: 381-540-10 and 11	Inlet filters, grass swale, downspout filters	2.0	3262	Industrial
City of Santee	Hartford Insurance, APN: 381-050-59	Vegetated swale, rocky swale, and drainage inserts	6.0	3258	Commercial

Jurisdiction	BMP Location	BMPs Implemented	Assumed Drainage Area (acres)	Catchment ID	Baseline Land Use (2009)
City of Santee	Morningside, APN: 384-081-16	Hydrodynamic Separator System	6.0	3258	MF Residential
City of Santee	Rayo Wholesale, Rayo II, 11495 Woodside Avenue	Grass swale, Grassy detention basin with sand cone filter	3.0	3264	Industrial
City of Santee	Town Center Community Park, APN: 381-050-51, 52, and 381-051-06, 07	Media Filter, bioswales, buffer strips, inlet filters	12	3207	Institutional/ Education
City of Santee	Toyota, APN: 383-124-11	Extended detention basin, bioretention, inlet filters	3.0	3255	Commercial
Caltrans	SR 52 Unit 5A	Bioswales	9.8		Transportation
Caltrans	SR 52 Unit 5A	Detention Basin	9.3		Transportation
Caltrans	SR 52 : 52/15 Seperation To Mast Boulevard	Bioswales	4		Transportation
Caltrans	SR 52: Cuyamaca Street To Magnolia Avenue	Bioswales	21.5		Transportation
Caltrans	SR 52: Cuyamaca Street To Magnolia Avenue	Detention Basin	9.2		Transportation

[1] Projects presented in this list were implemented between 2003 and 2009 and were given credit in the CLRP.
[2] Assumed drainage areas were either provided by the TMDL Responsible Party or estimated based on best professional judgment after review of project locations and typical drainage areas associated with a similar BMP.
[3] Modeled land uses were obtained using the project location and the 2009 land use layer.
[4] Projects are quantified based on an assumption that the projects in the list were designed and installed to be in compliance with SUSMP criteria.

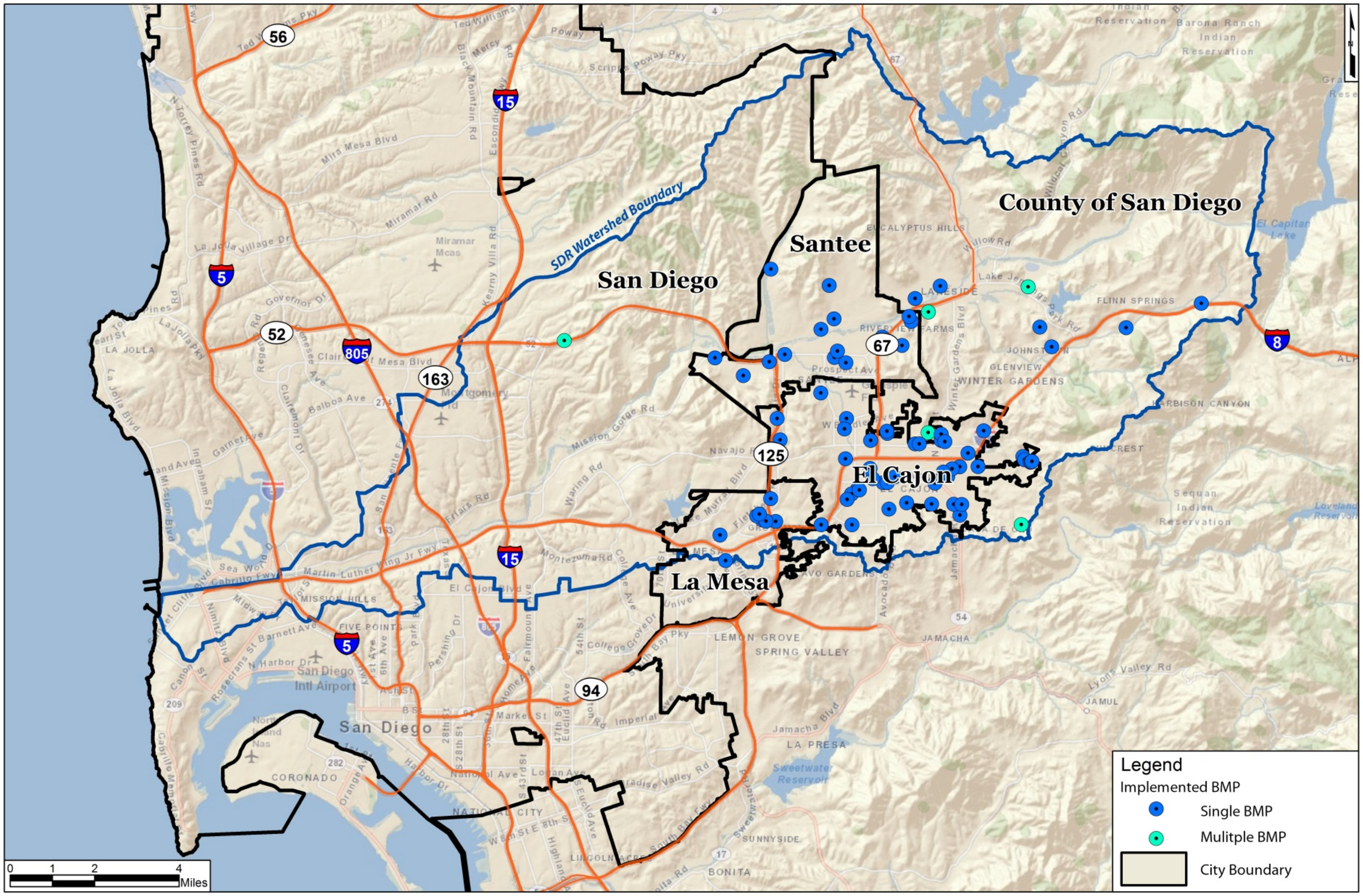

Figure 10. Implemented structural BMPs for Cities of La Mesa, El Cajon, Santee and County of San Diego

3.2.5.4.4 Stream Restoration/Enhancement Projects

Stream restoration/enhancement projects that were implemented after 2003 to add or replace impacted habitat with habitat having similar functions of equal or greater ecological value within the SDR Watershed were given credit in the CLRP as these projects treat stormwater that comes in contact with enhanced and/or created vegetation.

Stream Restoration/Enhancement projects include the following:

- Forester Creek
- Woodglen Vista Creek
- Las Colinas Channel (future proposed project)

Locations of stream restoration projects are shown in Figure 11.

Geosyntec consultants

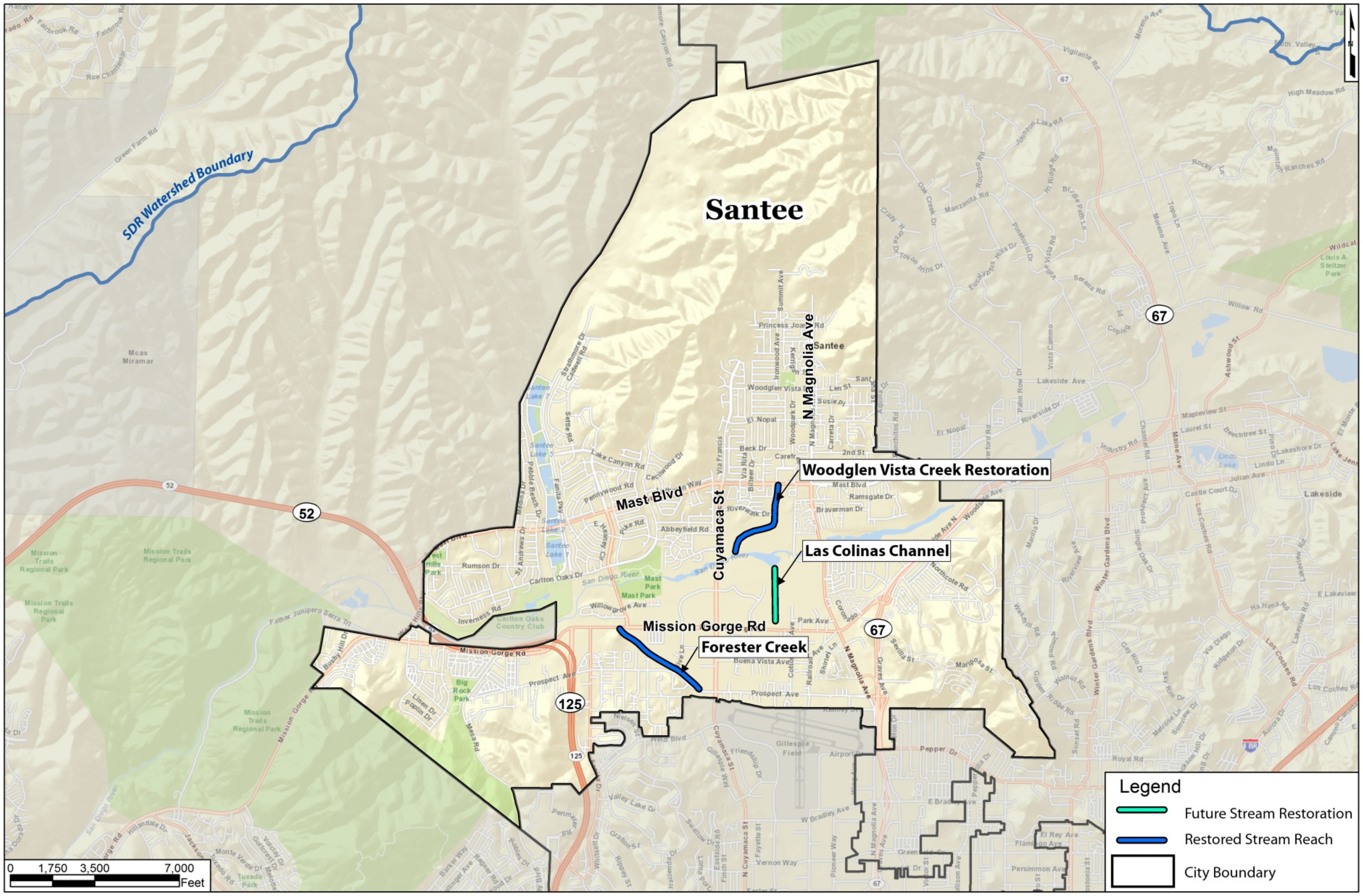

Figure 11. Stream Restoration/Enhancement Projects

4 IMPLEMENTATION PLAN

4.1 BMP Implementation Benefits

In order to assess the ability of the suite of candidate BMPs to meet TMDL compliance requirements, load reductions expected to result from their implementation were estimated, as described below.[20] The following sections also present phasing and estimated costs for the suite of candidate BMPs. Again, fecal coliform was used as the proxy for all FIB.

4.1.1 Quantification of Load Reductions

4.1.1.1 Nonstructural BMPs

Appendix G describes load reduction quantification values, results, assumptions, and methods for the candidate nonstructural BMPs included in this CLRP. The load reduction quantification approach is illustrated in Figure 12 and involves similar steps for the suite of nonstructural BMPs included in this CLRP. The first step is to calculate the load generated by the targeted bacteria source that the BMP will address. For many of the BMPs, the targeted bacteria source load was a percentage of the total Responsible Party bacteria baseline load (either wet or dry, depending on what the specific BMP is expected to address) which was taken from source tracking studies. This was the preferred approach. If studies establishing a percentage of the total bacteria load from a targeted source were not available for a particular BMP, an alternate approach to calculate the targeted bacteria source load was applied based on the amount of bacteria found in targeted source materials and the total quantity of targeted source materials present (i.e. MPN of bacteria per acre of residential rooftop and total acres of residential rooftop in SDR watershed).

Once the targeted bacteria source load was calculated, the potential load reduction benefit was calculated using the estimated effectiveness of the selected BMP. These values were based on literature when available, and if not, on best professional judgment. In both cases, predicted levels of uncertainty are high. Besides reducing the bacteria load from the Responsible Parties, these nonstructural BMPs will also reduce other priority pollutants, including metals, nutrients, and trash. The following sections provide a brief description of the specific quantification approach for each nonstructural BMP, along with relevant assumptions and assumption explanations.

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[20] Instream fate and transport processes (such as die-off, regrowth, sedimentation, and resuspension) were not accounted for given the uncertainty of their net effect. More data would be needed to justify any estimates from these processes. Furthermore, with much of the urbanization being close to the mouth of the watershed and the loads generally being the highest during wet weather when travel times are shortest (and so die-off would also be low), this assumption is considered appropriate.

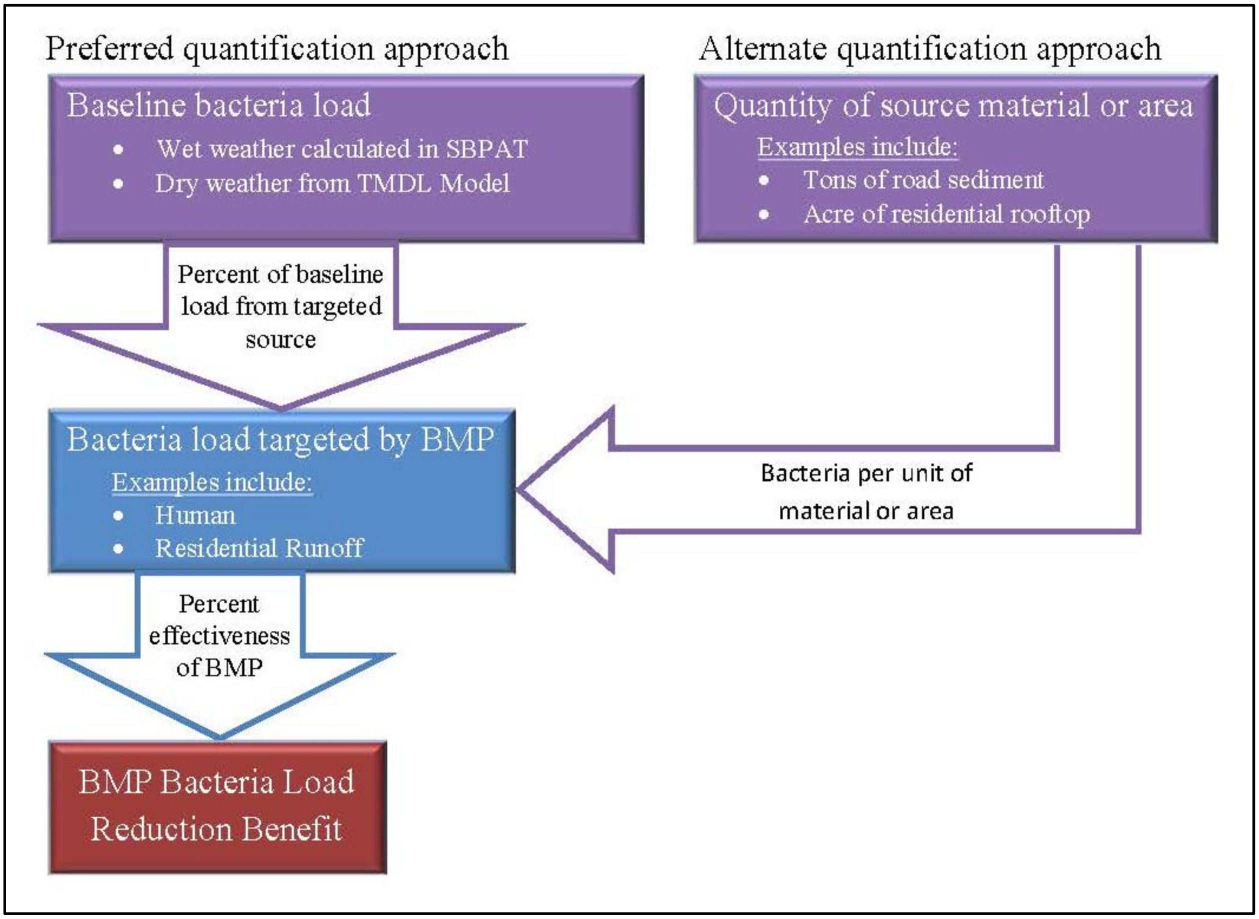


Figure 12. Nonstructural quantification approach

4.1.1.1.1 Identification and control of sewage discharge to MS4s

The TMDL model (SDRWQCB 2010) estimates the Responsible Party monthly average total FIB load during dry weather. The quantification of the dry weather load from human sources was divided into two parts: winter dry weather and summer dry weather. This distinction resulted from the findings of the Lower SLR MST study (MACTEC 2011) and is described in the Bacteria Source memo included in Appendix D. These references demonstrated that during winter dry weather, a defensible estimate of the percent of fecal bacteria having human sources was 5 to 20 percent, while it was 1 to 10 percent during summer dry weather. Out of the seventeen human bacteria dry weather sources identified in the San Diego County Source Prioritization process (ARC 2011), eight are targeted by this BMP, including two of the top three sources. Based on these findings it is estimated that 50-75% of the human bacteria load is contained within these pollutant generating activities. Geosyntec Consultants used best professional judgment to estimate the portion coming from sewage discharges. The Responsible Parties also used best professional judgment to estimate an assumed reduction in sewage discharge based on implemented controls. This reduction rate was then applied to the annual estimated sewage bacteria load to calculate a total reduction.

4.1.1.1.2 Homelessness Waste Management Program

The quantification for the load reduction generated by homeless waste management programs followed a similar procedure as for the sewage controls. However, since management programs extend beyond Responsible Party MS4 boundaries and into the river itself, benefits achieved in the river and the MS4 are quantified. Therefore the total watershed wet weather baseline load was used instead of just the Responsible Party baseline load (see Section 3.2.1 for discussion of baseline loads) for the purpose of calculating the reduction. The Bacteria Source memo (Appendix D) includes a wet weather estimate of fecal bacteria having a human source as 5-20 percent. The percent of these human sources that arise from homeless activities are assumed based on the San Diego County Source Prioritization process (ARC 2011), discussions with the San Diego River Park Foundation, and the best professional judgment of Geosyntec Consultants. Best professional judgment was also used to estimate the effectiveness of enhancements made to the homeless waste management program.

4.1.1.1.3 Irrigation Runoff Reduction and Good Landscaping Practices

The portion of the Responsible Party average dry weather FIB load resulting from commercial and residential runoff was estimated using the best professional judgment of Geosyntec Consultants. Based on findings from the San Diego River source tracking study (Weston 2009a), 59-80 percent of commercial and residential runoff is from irrigation. The implementation of this BMP is estimated to reduce irrigation runoff from commercial and residential areas by 25 to 50 percent as found by Berg et al. (2009) in a study in Orange County.

4.1.1.1.4 Commercial/Industrial Good Housekeeping

The dry weather loading of fecal coliform from commercial activities runoff was determined using the same approach as for irrigation runoff. The runoff load attributed to commercial areas was estimated using the best professional judgment of Geosyntec Consultants. The San Diego River study found that 15-27 percent of commercial flows are from commercial activities targeted by good housekeeping, such as dumpster leaks and wash-down. The reduction achieved through enhancements was based on the current rate of inspection coverage and effectiveness found in the San Diego County JURMP annual report.

Figure 13. San Diego County Rain Barrel Program

4.1.1.1.5 Residential/Small-Scale Low Impact Development (LID) Incentive Program

Two main BMPs have been quantified for the LID incentive program: 1) a rain barrel program and 2) a downspout disconnect program. The average performance, during wet weather, of these programs per rooftop acre was modeled in SBPAT for the TMDL Critical WY (1993), consistent with the baseline load calculations (see Section 3.2.1 for discussion). The area of implementation was determined based on land use information and a preliminary assessment of rooftops in the SDR Watershed. The extent of single-family residential areas that will be converted to rain barrels and an equal amount that will disconnect their downspouts was estimated based on the expected effectiveness of the given incentives program.

4.1.1.1.6 Pet Waste Program

The Responsible Party fecal coliform wet weather load, as described above, was reduced by the percent of bacteria having canine sources during wet weather to calculate the load targeted by the pet waste program. The Nonstructural BMP Memo includes a description of the various studies supporting the canine source assumption. Studies in Austin, Texas (City of Austin, 2008) and San Diego (City of San Diego, 2011a), also described in the Nonstructural BMP Memo (Appendix E), present an estimated behavior change based on the implementation of this BMP. The quantification was then split, based on coverage area, between the pet waste program currently implemented since the initiation of the TMDL in 2003 and the additional enhancements discussed in the Nonstructural BMP Memo.

Figure 14. City of San Diego Pet Waste Dispenser

4.1.1.1.7 Redevelopment and LID Implementation

This CLRP assumes that a portion of already developed areas in the SDR Watershed has been and will be redeveloped from when the TMDL was initiated to the end of the compliance period. This redevelopment is subject to the post-construction treatment requirements contained in the San Diego MS4 Permit and will therefore result in load reduction benefits. A Standard Urban Stormwater Management Plan (SUSMP)-sized bioretention system with underdrains was modeled in SBPAT for residential, commercial, industrial, education, and transportation land uses during the TMDL Critical Water Year (1993) to give the load reduction per acre converted. The rate of redevelopment requiring SUMSP LID implementation for each of these land uses was extrapolated based on the rate analysis done for the Ballona Creek IP. During the 20 year compliance timeline this rate will result in redevelopment of approximately 6% of the MS4 area. For each land use, the load reduction per acre was multiplied by the land use specific redevelopment rate, the number of land use acres, and the number of years from when the TMDL was initiated to the end of the compliance period (see Quantification Table in Appendix G for further detail).

4.1.1.1.8 Street and Median Sweeping

Since 2003 and the initiation of the TMDL, the Responsible Parties have implemented increased routes, frequencies, and equipment upgrades which have resulted in approximately doubling the quantity of street sediment removal. Removal quantities received for the City of San Diego and the City of La Mesa were scaled to determine the total tons of street sediment removed per year. This quantity of street sediment, removed by the enhancements, was reduced to a portion that would have been mobilized to the MS4 during wet weather events, as described in Pitt et al., 2004. The mobilized quantity was then multiplied by the concentration of fecal coliform in street sediment as described in the Nonstructural BMP Memo (Appendix E) to calculate the load reduction of the street sweeping enhancements.

4.1.1.1.9 Other Nonstructural BMPs

Load reductions for some candidate nonstructural BMPs are not as readily quantifiable as those described above. For example, there is a lack of knowledge about the extent of pollutant loading from septic systems and animal facilities. In such instances, this CLRP implementation would benefit from a study to gather data on the potential pollutant loading from sources that lack data prior to wide scale implementation of nonstructural BMPs. Catch basin cleaning is an effective nonstructural BMP that has been implemented in some form since before the inception of this TMDL; however, it is possible that future improvements to this program (and other programs) could result in additional load reductions.

4.1.1.1.10 Caltrans Specific Programs

The quantification of the load reduction for BMPs currently being implemented by Caltrans followed a similar approach as those described above and is included in Appendix H. Homelessness waste management, trash management, street and median sweeping, and MS4 cleaning had sufficient data and methodology to be quantified. Additional programs which could provide additional reductions but are not quantifiable at this time, including the pet waste program, identification and repair of unstable slopes, enhanced LID implementation, land conservation and stewardship, irrigation runoff reduction and good landscaping practices, identification and control of illicit discharges, and general watershed cleanliness and upkeep.

4.1.1.2 Structural BMPs

Methods for quantifying load reductions expected from structural BMPs were different for wet and dry weather conditions. SBPAT was used to conduct wet weather analyses; however, dry weather analyses was conducted using spatial coverage of structural BMPs to estimate dry weather flow treatment.

4.1.1.2.1 Wet Weather

Design criteria for each selected BMP were first defined considering site constraints, BMP performance data, and local regulations. For example, for regional BMPs, if required area to provide full SUSMP-level treatment was not available, estimated load reductions were based on available area (publicly owned) and benefits were calculated accordingly. Once a BMP was identified (as described in Section 3.2.5) and design criteria defined for each feasible BMP opportunity site, SBPAT was used to evaluate the impact of implementing this suite of BMPs on water quality in the region. This recognizes that even where there is limited land, a smaller regional facility, particularly one with upstream/distributed BMPs to reduce hydrologic loading, can be highly beneficial. Details of this methodology are discussed below.

Regional BMPs

BMP design criteria for each specific project were developed using the following generalized design criteria. Design criterion specific to each individual project is presented in their respective BMP sheets which are shown in Figures 15-23.

Infiltration Basin Design Criteria:

- Drawdown time: 48 hours
- Infiltration rate: Per San Diego County treatment BMP design guidelines (County 2011), typical soil infiltration rates based on the NRCS soil texture were used with a factor of safety of two (2)
- Design volume: determined by space available for the BMP
- Depth: governed by the drawdown time and infiltration rate.

Subsurface Flow (SSF) Wetland Design Criteria:

- Hydraulic residence time: 24 hours
- Depth of wetland: 3 - 4 feet
- Porosity: 0.35 - 0.4
- Equalization basin drawdown time: 48 hours
- Design volume: governed by the design depth and space available
- Treatment flow rate: governed by volume and hydraulic residence time.

Wetland/Wet Pond Design Criteria:

- Permanent pool hydraulic residence time: 24 hours
- Permanent pool depth: 4 - 5 feet
- Permanent pool volume: governed by space available and depth.

Design criteria specific to each project is presented in their respective BMP sheets, which are included below in Figures 15 through 24.

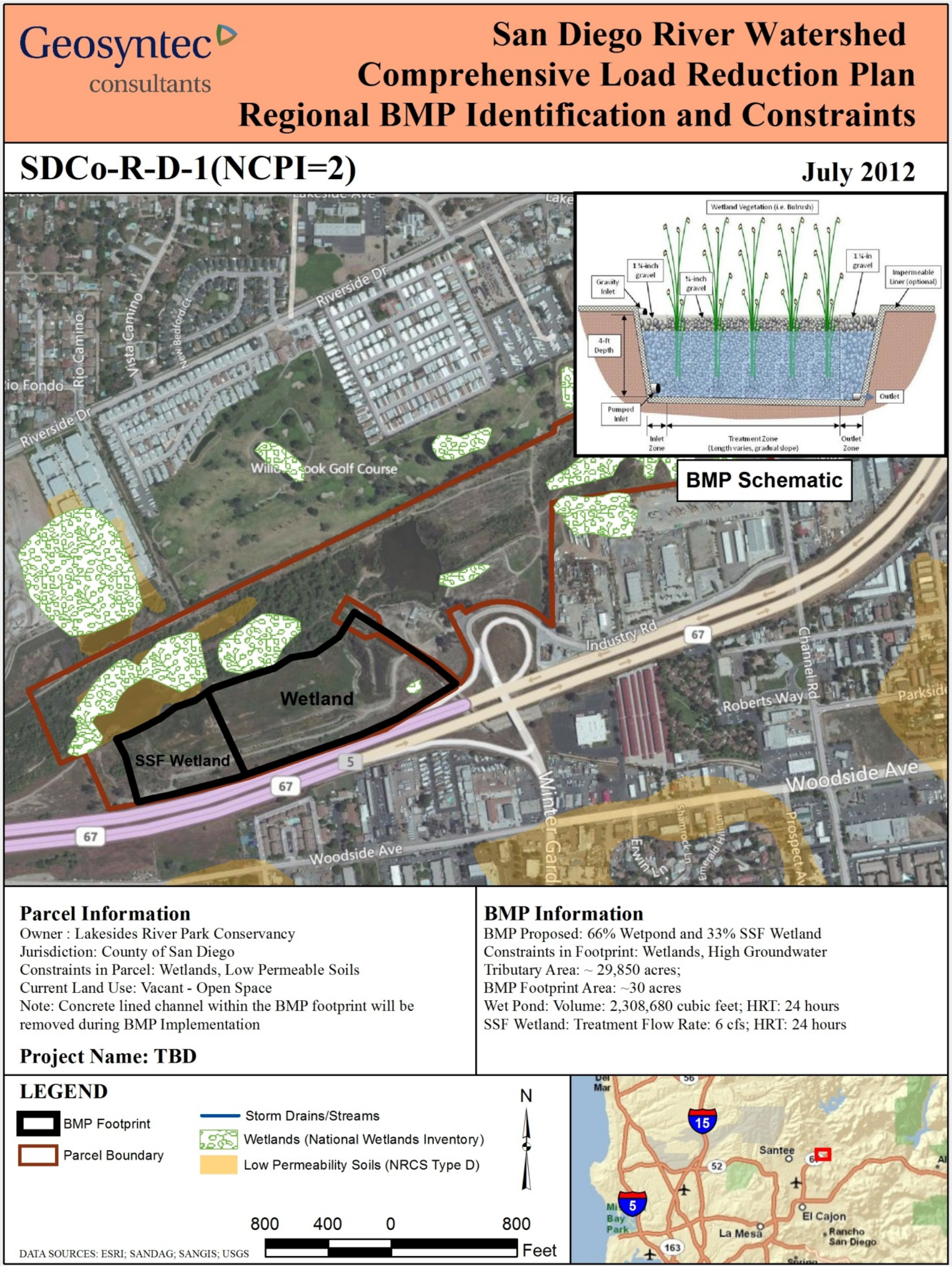


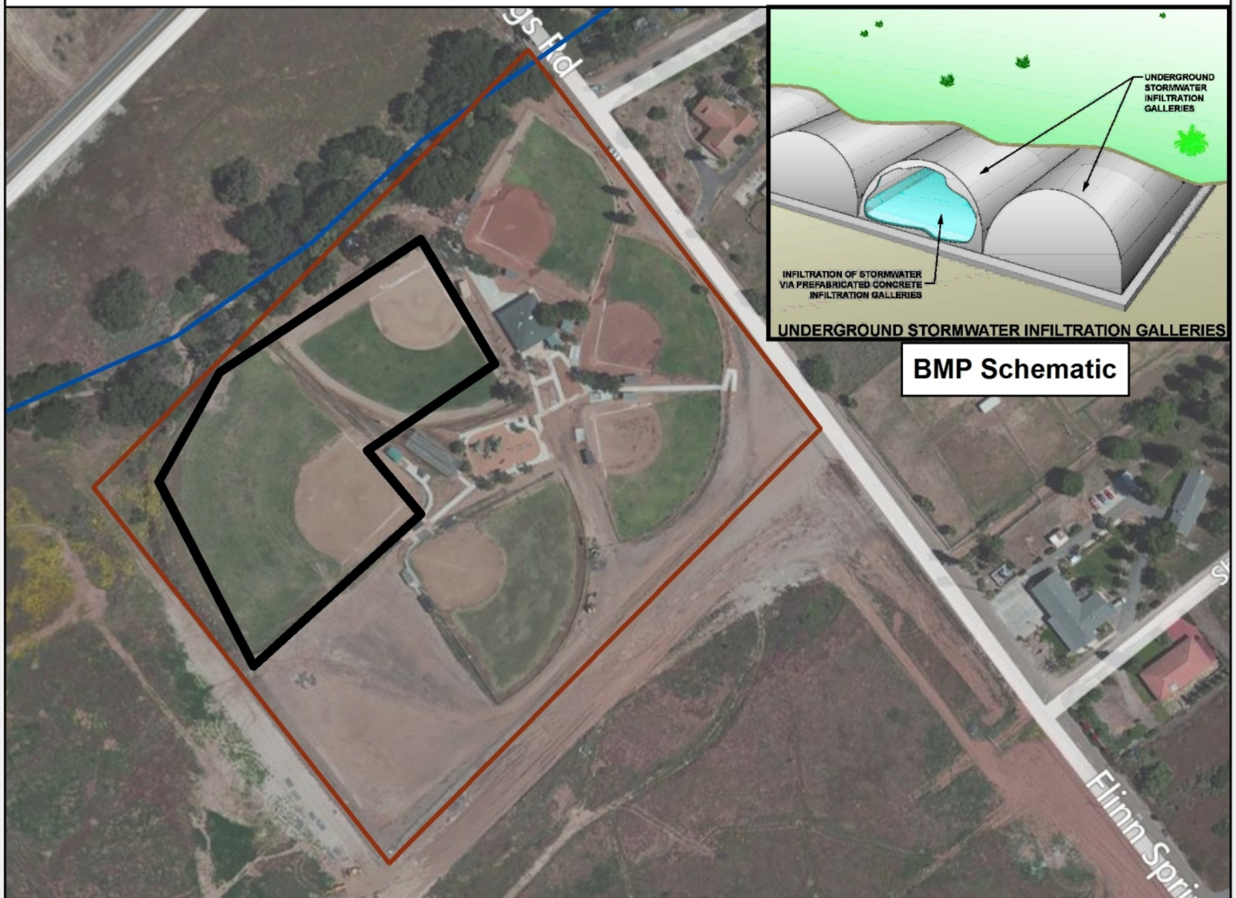
Figure 15. Design criteria for SDCo-R-D-1

San Diego River Watershed
Comprehensive Load Reduction Plan
Regional BMP Identification and Constraints

Geosyntec consultants

SDCo-R-D-2(NCPI=3)

July 2012



Parcel Information
Owner : County of San Diego
Jurisdiction: County of San Diego
Constraints in Parcel: None
Current Land Use: Baseball Fields
Note: Reported CLRP costs includes costs for reinstalling two baseball fields after installation of the BMP

Project Name: TBD

BMP Information
BMP Proposed: Subsurface Infiltration
Constraints in Footprint: None
Tributary Area: ~ 943 acres;
BMP Footprint: ~ 2.5 acres
Water Quality; Depth: 4 Feet; Volume: ~6.6 acre-feet
Infiltration Rate Assumed: 1 in/hr

LEGEND
BMP Footprint
Parcel Boundary
Storm Drains/Streams
Wetlands (National Wetlands Inventory)
Low Permeability Soils (NRCS Type D)

N

200 100 0 200 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

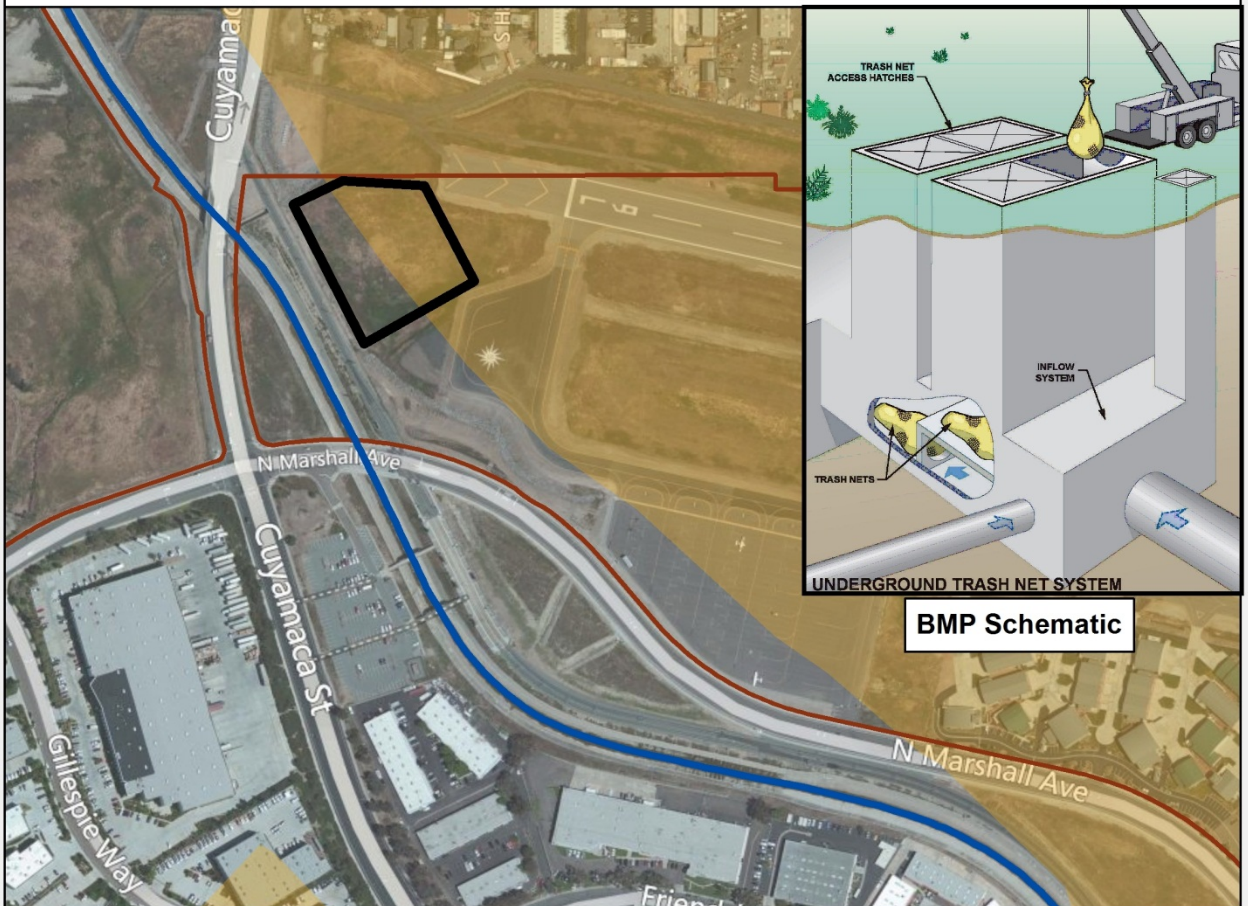
Figure 16. Design criteria for SDCo-R-D-2

Geosyntec consultants

San Diego River Watershed Comprehensive Load Reduction Plan Regional BMP Identification and Constraints

MJ-R-D-1 (NCPI=4)

July 2012



Parcel Information

Owner : County of San Diego
Jurisdiction: City of El Cajon
Constraints in Parcel: Low permeable soils
Current Land Use: Vacant Space

Project Name: TBD

BMP Information

BMP Proposed: Gross Solids and Trash Removal
Constraints in Footprint: Low permeable soils
Tributary Area: ~ 14,509 acres;
BMP Footprint Area: ~ 2.5 acres
Diversion Flow Rate: 100 cfs
Treatment Flow Rate: 100 cfs

LEGEND

BMP Footprint
Parcel Boundary
Storm Drains/Streams
Wetlands (National Wetlands Inventory)
Low Permeability Soils (NRCS Type D)

N

400 200 0 400 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

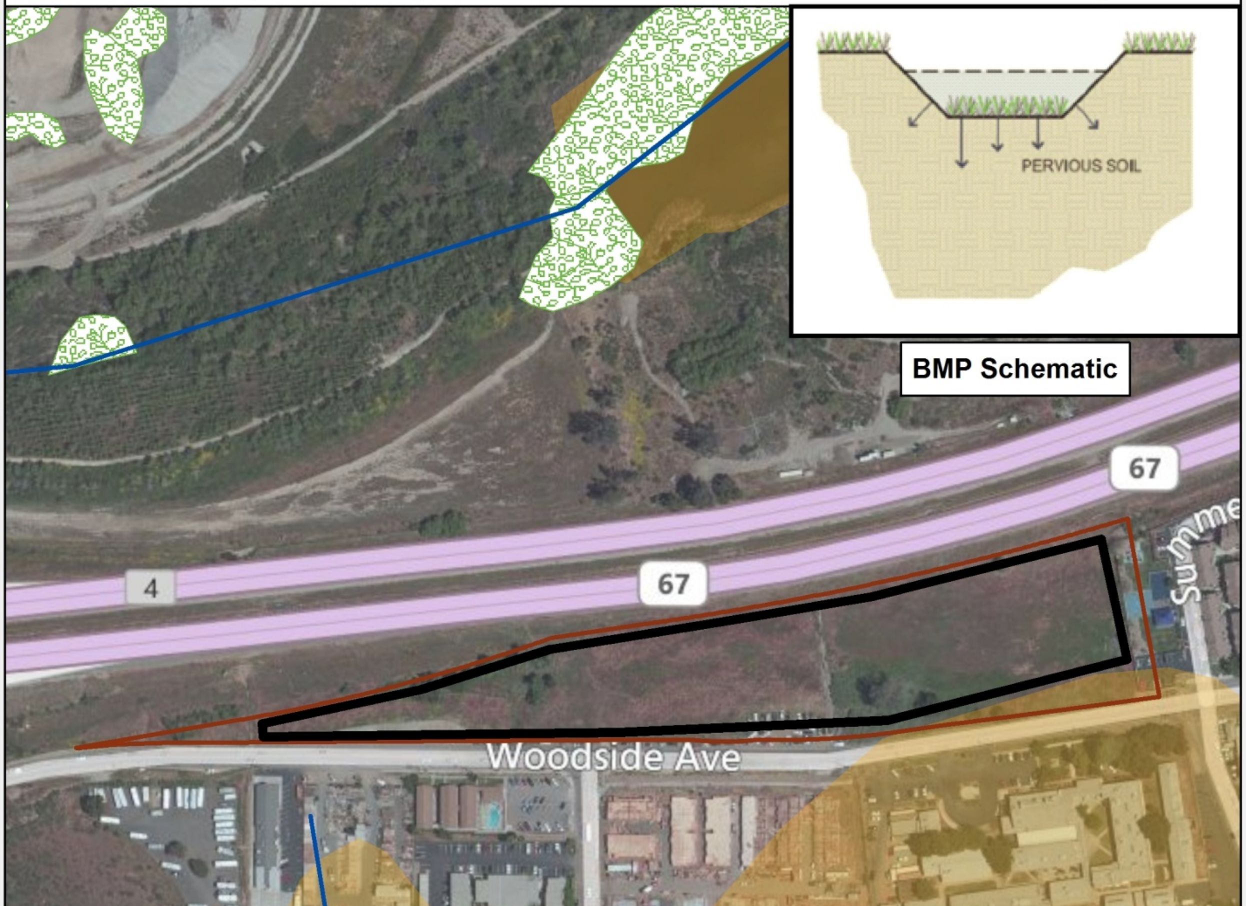
Figure 17. Design criteria for MJ-R-D-1

Geosyntec consultants

San Diego River Watershed Comprehensive Load Reduction Plan Regional BMP Identification and Constraints

MJ-R-D-4 (NCPI=4)

July 2012



Parcel Information

Owner : City of San Diego
Jurisdiction: County of San Diego
Constraints in Parcel: Low Permeable Soils
Current Land Use: Vacant Space
Future Land Use: Vegetated Infiltration Basin

Project Name: TBD

BMP Information

BMP Proposed: Infiltration Basin
Constraints in Footprint: None
Tributary Area: ~ 514 acres
BMP Footprint Area: ~5.8 acres
Water Quality; Depth: 3 Feet; Volume: 13.1 acre-feet
Infiltration Rate Assumed: 0.75 in/hr

LEGEND

BMP Footprint
Parcel Boundary
Storm Drains/Streams
Wetlands (National Wetlands Inventory)
Low Permeability Soils (NRCS Type D)

N

300 150 0 300 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

Figure 18. Design criteria for MJ-R-D-4

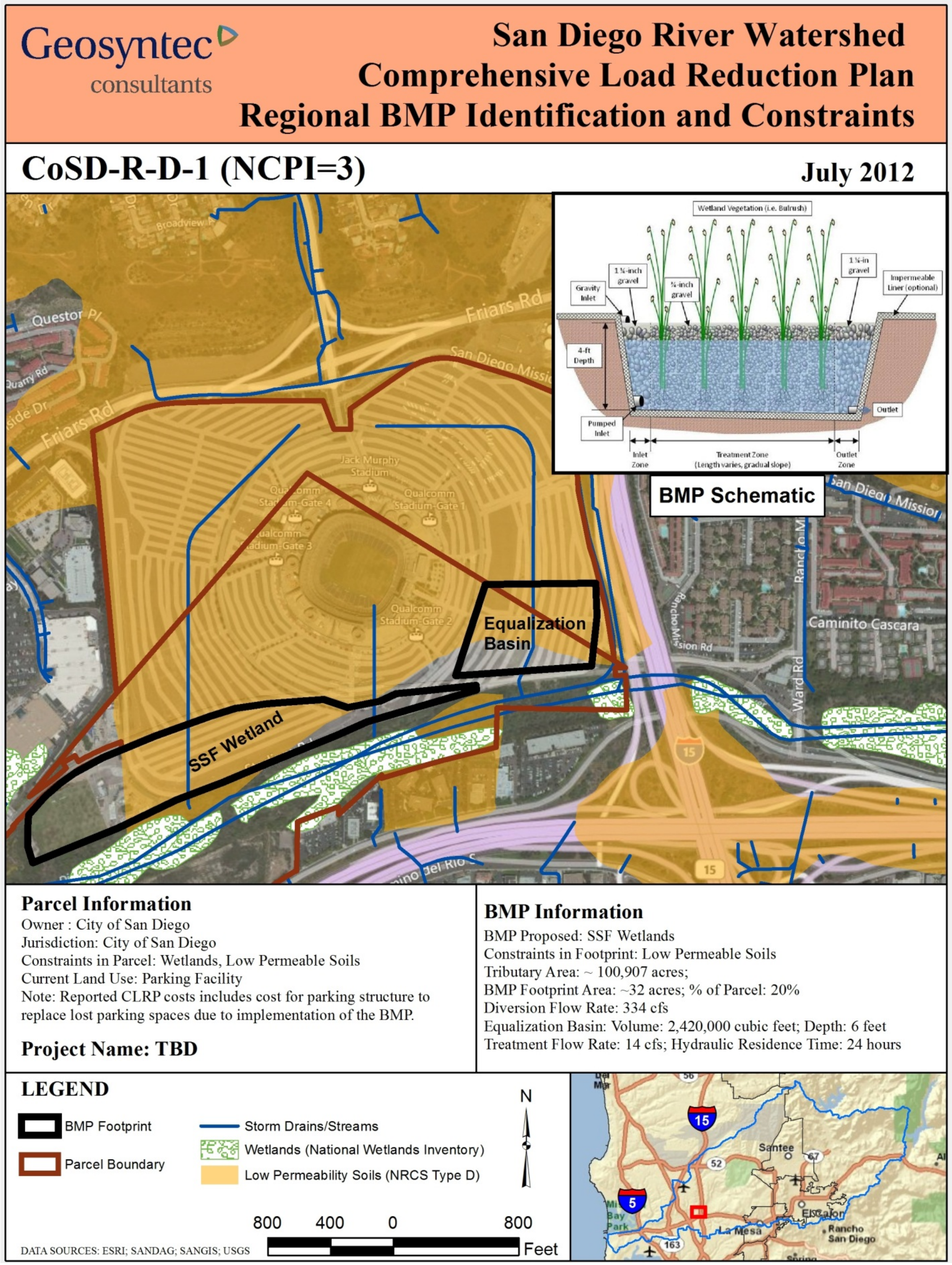


Figure 19. Design criteria for CoSD-R-D-1

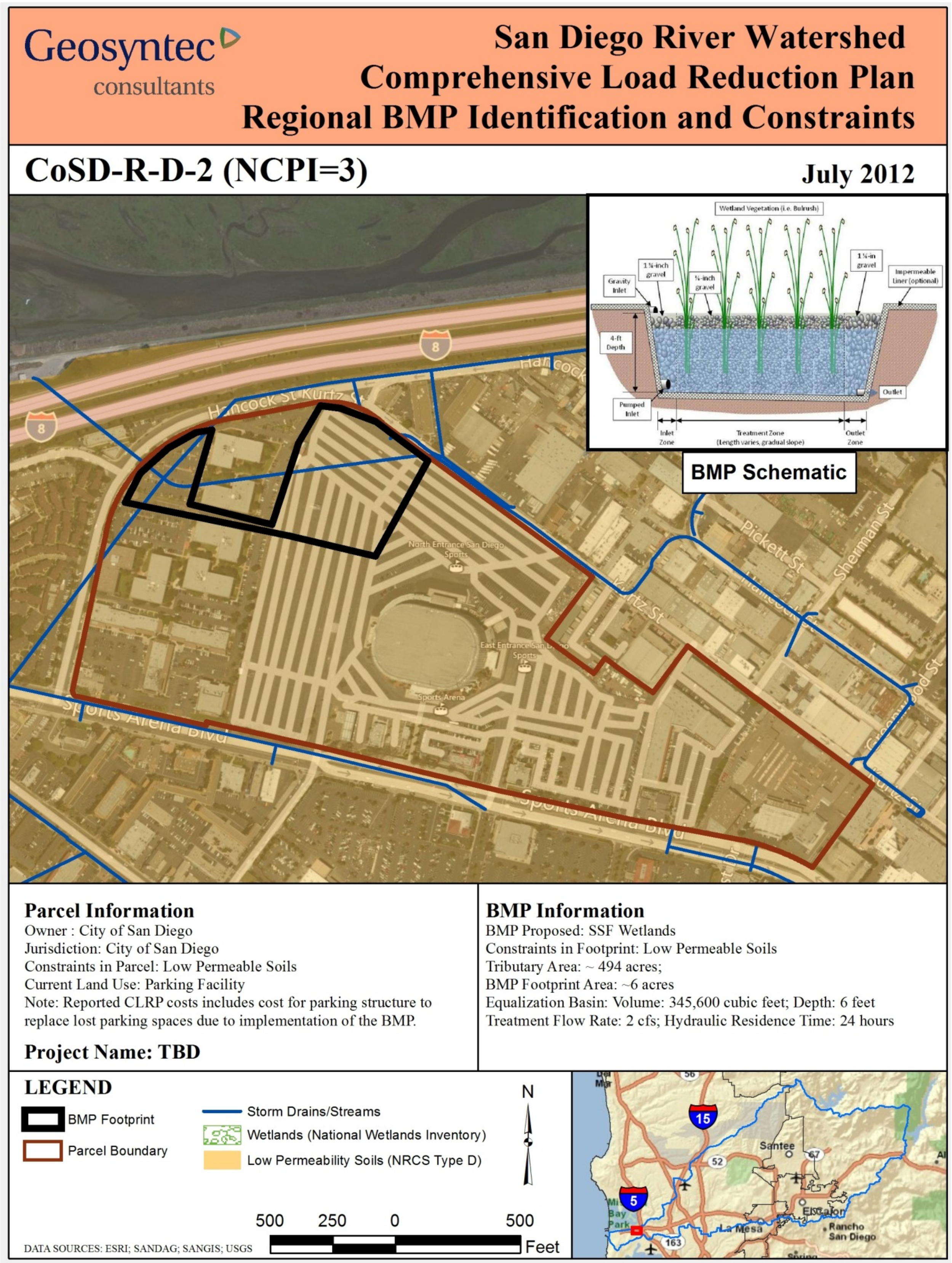


Figure 20. Design criteria for CoSD-R-D-2

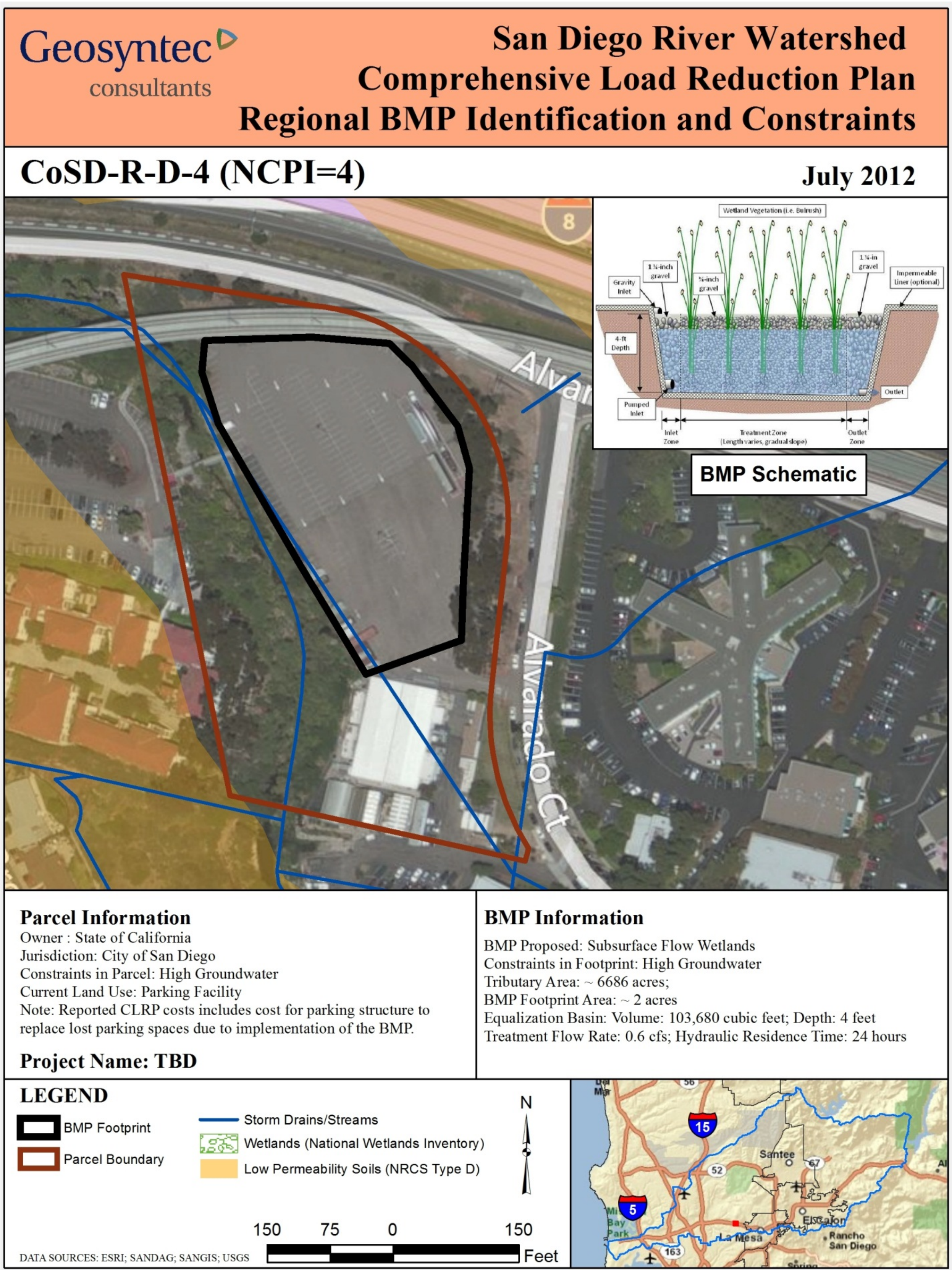


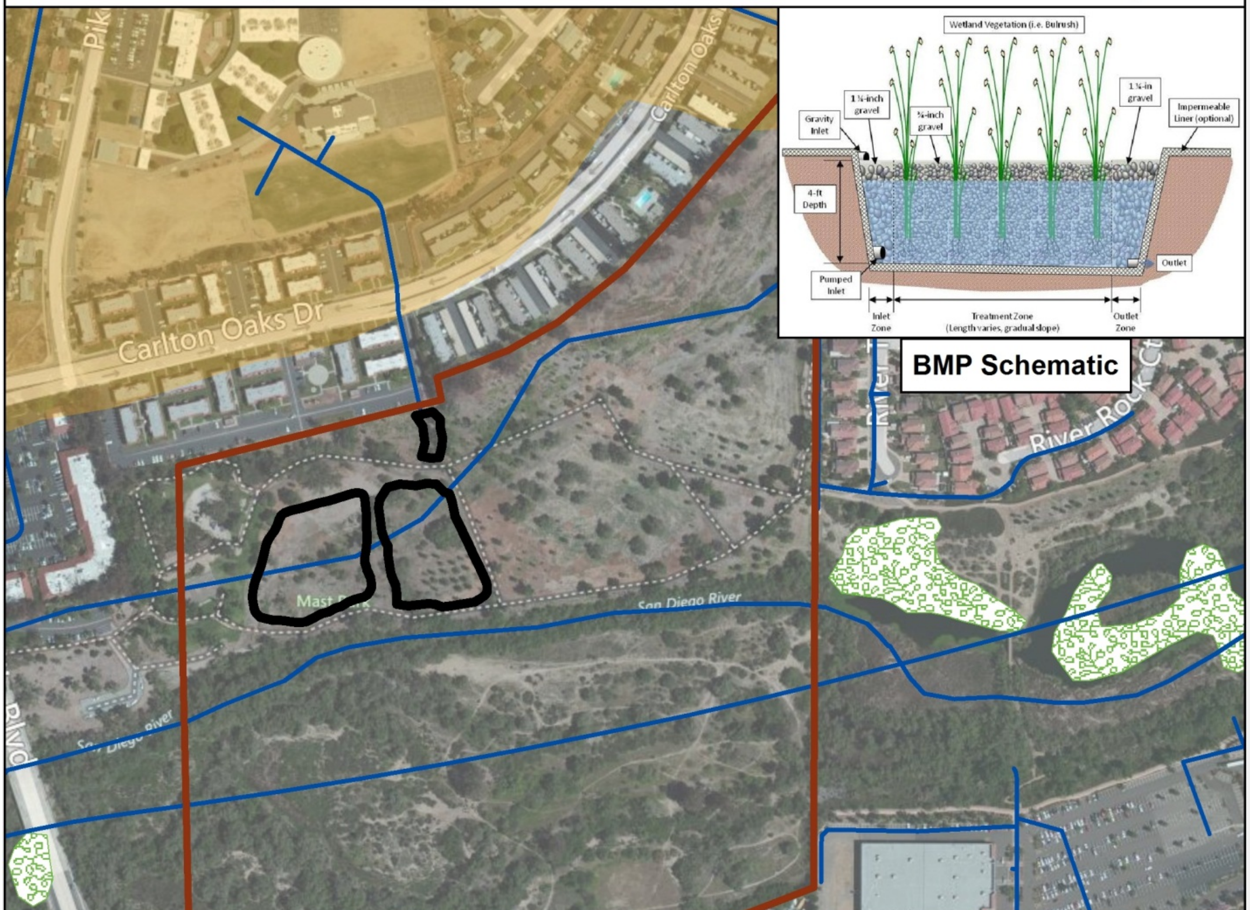
Figure 21. Design criteria for CoSD-R-D-4

Geosyntec consultants

San Diego River Watershed Comprehensive Load Reduction Plan Regional BMP Identification and Constraints

CoS-R-D-2 (NCPI=2)

July 2012



Parcel Information

Owner : City of Santee
Jurisdiction: City of Santee
Constraints in Parcel: High Groundwater
Current Land Use: Park

Project Name: TBD

BMP Information

BMP Proposed: SSF Wetlands
Constraints in Footprint: High Groundwater
Tributary Area: ~ 573 acres;
BMP Footprint Area: ~3 acres
Equalization Basin: Volume:173,000 cubic feet; Depth: 4 feet
Treatment Flow Rate: 1.0 cfs; Hydraulic Residence Time: 24 hours

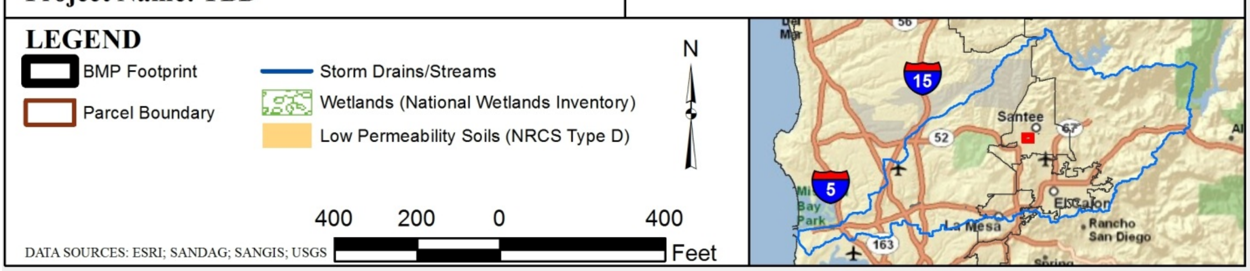
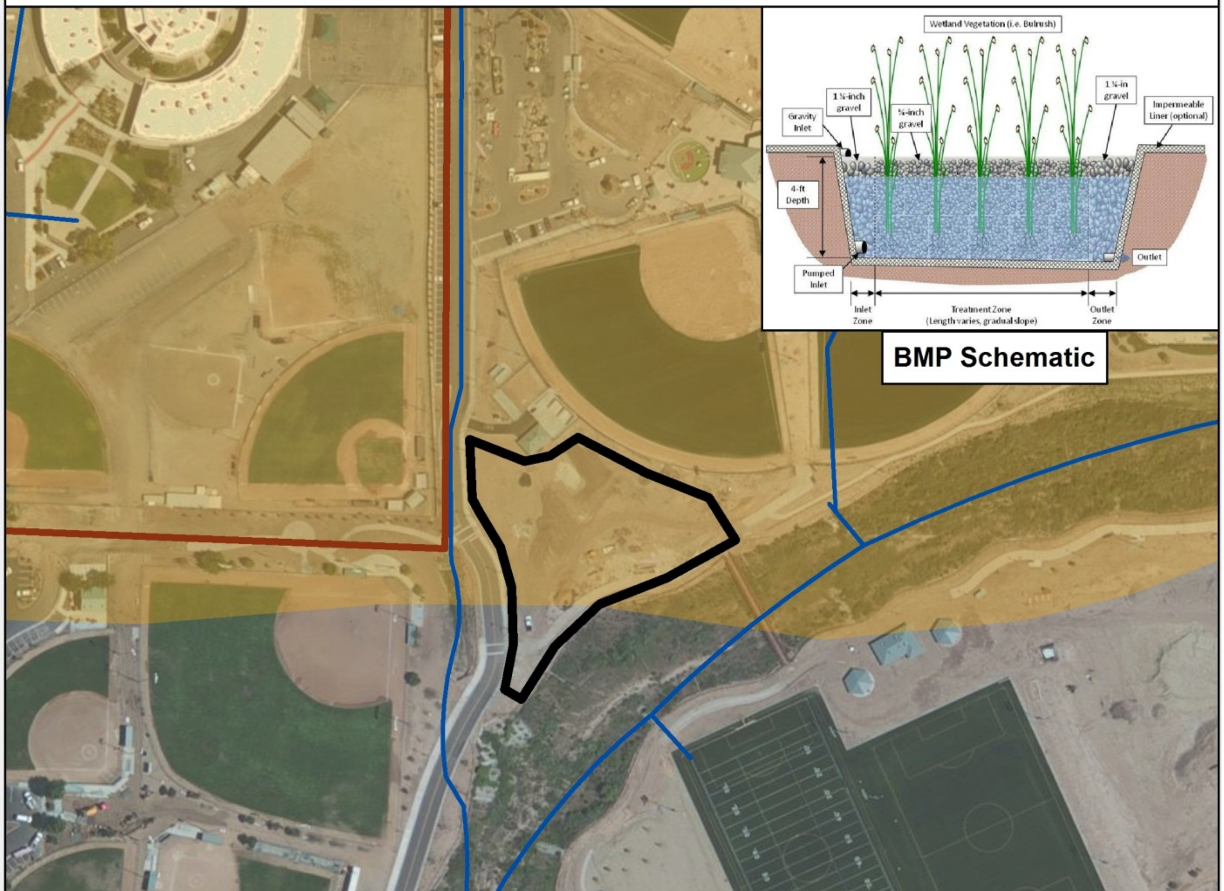


Figure 22. Design criteria for CoS-R-D-2

Geosyntec consultants

San Diego River Watershed Comprehensive Load Reduction Plan Regional BMP Identification and Constraints

CoS-R-D-3 (NCPI=3)



Parcel Information

Owner : City of Santee
Jurisdiction: City of Santee
Constraints in Parcel: Low Permeable Soils; High Groundwater
Current Land Use: Park and Sports Fields

Project Name: TBD

BMP Information

BMP Proposed: SSF Wetlands
Constraints in Footprint: High Groundwater; Low Permeable Soils
Tributary Area: ~ 100 acres;
BMP Footprint Area: ~1.3 acres
Equalization Basin: Volume:170,000 cubic feet; Depth: 4 feet
Treatment Flow Rate: 0.4 cfs; Hydraulic Residence Time: 24 hours

LEGEND

BMP Footprint
Parcel Boundary
Storm Drains/Streams
Wetlands (National Wetlands Inventory)
Low Permeability Soils (NRCS Type D)

N

200 100 0 200 Feet

DATA SOURCES: ESRI; SANDAG; SANGIS; USGS

Figure 23. Design criteria for CoS-R-D-3

Once design criteria were established, SBPAT was used to determine the pollutant reduction that could be achieved through the implementation of these BMPs. See the SBPAT User's Guide for further information (Geosyntec 2008).

Table 13 lists the total estimated pollutant removal benefits from these BMPs.

Table 13. Structural BMP (regional) pollutant reduction

	FIB-FC Load Benefits (10^{12} MPN reduction/year)		**Nitrate Load Benefits (lb reduction/year)**	**TP Load Benefits (lb reduction/year)**
	WY 1993 [Low - High]	***Annual Average [Low - High Years]***	***Annual Average [Low - High Years]***	***Annual Average [Low - High Years]***
SDCo-R-D-1	170 [99 - 196]	134 [80 - 165]	3,737 [2018 - 4,708]	1,017 [682 - 1,302]
SDCo-R-D-2	17 [10 - 20]	11 [8 - 14]	744 [401 - 937]	298 [200 - 381]
MJ-R-D-1	269 [156 - 309]	167 [126 - 205]	810 [437 - 1,021]	773 [518 - 989]
MJ-R-D-4	84 [49 - 97]	54 [40 - 66]	579 [313 - 730]	200 [134 - 257]
CoSD-R-D-1	278 [161 - 320]	192 [131 - 236]	3,120 [1685 - 3,931]	1,070 [717 - 1,370]
CoSD-R-D-2	21 [12 - 24]	8 [10 - 10]	135 [73 - 170]	67 [45 - 86]
CoSD-R-D-4	13 [8 - 15]	9 [6 - 11]	120 [65 - 151]	48 [32 - 61]
CoS-R-D-2	21 [12 - 24]	16 [10 - 20]	206 [111 - 260]	63 [42 - 80]
CoS-R-D-3	6 [4 - 7]	5 [3 - 6]	69 [37 - 87]	26 [17 - 33]
Total	879 [510 - 1011]	596 [413 - 733]	9,520 [5141 - 11,995]	3,562 [2387 - 4,559]

[1] Range of WY1993 and annual WQ benefits represent 25th and 75th percentile load reduction results. Range reflects variability in baseline pollutant loading (EMC's) as well as variability in BMP effectiveness.
[2] Reported benefits for individual BMPs also include benefits from pretreatment where applicable.
[3] Values are presented as gross load reductions, prior to adjustments to account for overlapping benefits and application of the effective fraction (see Sections 4.1.1.2.5 and 4.1.1.2.6 for further detail on these adjustments)..

Distributed BMPs

As described in Section 3.2.5.4.2, distributed BMPs were modeled as bioretention and bioretention swales with underdrains according to their infiltration capacity. Design criteria for quantifying the distributed parameters were developed using the following assumptions:

- Distributed BMPs within a catchment would be implemented to treat 25 percent of the MS4 area within a given catchment;
- Four (4) percent of the contributing area would be needed for treating full SUSMP rainfall depth of 0.75 inches from the contributing area with distributed BMPs. This assumption was based on previous experiences with implementation of similar distributed BMPs;
- For catchments where sufficient land was not available, the design storm was taken to be a fraction of this 0.75 inch storm according to what percent of the contributing area was potentially available for BMP installation;
- Other design criteria for Bioretention:
  - Design Volume: governed by available space and contributing area
  - Retention Depth : 12 inches
  - Infiltration Rate: governed by site constraints.
- Other design criteria for Bioretention swale with underdrains:
  - Design Flow Rate: governed by available space and contributing area
  - Hydraulic Residence Time: 10 min
  - Longitudinal Slope: 0.03 ft/ft
  - Manning’s Roughness Coefficient: 0.25
  - Water Quality Flow Depth: 4 inches
  - Retention Depth: 2 inches
  - Infiltration Rate: governed by site constraints.

Distributed BMPs were grouped according to ranges in design storms, and each group was modeled once using the mean design storm for the group to limit the number of runs in SBPAT. For City of Santee projects, drainage area is estimated based on the area draining to the identified BMP locations. Model results, including pollutant removal and costs, were summed to determine the overall impact of the distributed BMPs.

Table 14 lists the total estimated pollutant removal benefits from these BMPs.

Table 14. Structural BMP (distributed) pollutant reduction[1,2,3]

	FIB-FC Load Benefits (10^{12} MPN Reduction/Year)		Nitrate Load Benefits (lb reduction/year)	TP Load Benefits (lb reduction/year)
	WY 1993 [Low - High]	*Annual Average [Low - High Years]*	*Annual Average [Low - High Years]*	*Annual Average [Low - High Years]*
Total	1368 [766 – 1560]	740 [330 - 910]	8,600 [4,650 - 10,900]	3,040 [2,010 - 3,900]

[1] Range of WY1993 and annual WQ benefits represent 25th and 75th percentile load reduction results. Range reflects variability in baseline pollutant loading (EMC's) as well as variability in BMP effectiveness.
[2] Reported benefits for individual BMPs also include benefits from pretreatment where applicable.
[3] Values are presented as gross load reductions, prior to adjustments to account for overlapping benefits of multiple BMPs addressing the same areas. Additionally, results for WY 1993 include load reductions estimated for that WY, not only the fraction of load reductions that are considered effective for reducing exceedance days.

Implemented BMPs (Phase I Implementation)

To model the impacts of the existing/planned BMPs listed in Table 12, each BMP was assigned a land use and drainage area either from the information provided by the Responsible Parties or based on best professional judgment using the land use layer, parcel information, and typical drainage areas for a particular BMP. Using the land use and drainage area information, these projects were quantified in SBPAT based on an assumption that they were designed based on SUSMP criteria. Model results from this analysis were summed to determine the overall benefits from this category of BMP. Table 15 lists the total estimated pollutant removal benefits from these BMPs.

Table 15. Structural BMP (existing/planned) pollutant reduction[1,2,3]

	FIB-FC LoadBenefits (10^{12} MPN Reduction/Year)		Nitrate Load Benefits (lb reduction/year)	TP Load Benefits (lb reduction/year)
	WY 1993 [Low - High]	*Annual Average [Low - High Years]*	*Annual Average [Low - High Years]*	*Annual Average [Low - High Years]*
Total	29 [16 – 33]	NA[4]	NA	NA

[1] Range of WY1993 and annual WQ benefits represent 25th and 75th percentile load reduction results. Range reflects variability in baseline pollutant loading (EMC's) as well as variability in BMP effectiveness.
[2] Reported benefits for individual BMPs nclude the benefits from pretreatment where applicable (i.e., previous treatment is added).
[3] Values are presented as gross load reductions, prior to adjustments to account for overlapping benefits of multiple BMPs addressing the same areas. Additionally, results for WY 1993 include load reductions estimated for that WY, not only the fraction of load reductions that are considered effective for reducing exceedance days.
[4] NA = Not Analyzed

4.1.1.2.2 Dry Weather

SBPAT is currently set up to only model wet weather pollutant reductions using wet weather land use EMCs and precipitation data. It was not used to determine the dry weather benefits of the proposed BMPs. Instead, dry weather benefits were evaluated based on the assumptions that the proposed BMPs would be capable of treating or infiltrating the dry weather flows from the MS4 areas that drain to them, that all dry weather flows are generated within the MS4 drainage area, and that dry weather MS4 runoff concentrations are relatively uniform among urban land use types (i.e. dry weather loads and land use type are assumed to be interchangeable; this assumption will be revisited based on source investigation studies performed during the implementation phase). As noted previously (see footnote in Section 3.1.1), there are a number of other potential sources of dry weather bacteria loading as well as dry weather flows that are unrelated to discharges from the MS4 or otherwise uncontrollable (such as flows resulting from storms less than 0.2”) and which are not considered by the Bacteria TMDL.

Low-flow diversion projects to the sewer are proposed as a possible structural BMP option for treating dry weather flows. Locations were proposed based on review of storm drain and sewer networks. Consistent with the adaptive and iterative process of the CLRP the locations may need to be revised based on findings from dry weather source investigation studies. Based on these assumptions, it was estimated that the percent reduction of dry weather loads was equivalent to the percentage of the Responsible Party area that was treated by the proposed BMPs (i.e. if 90% of the MS4 area drained to proposed structural BMPs it is assumed that 90% of the watershed dry weather flow is treated by the proposed structural BMPs). If, based on results of ongoing dry weather monitoring, further treatment is deemed necessary, disinfection or similar treatment may be considered to treat the dry weather flows that are not sufficiently treated by existing or proposed structural BMPs. Locations of these potential future as-needed treatment systems will be determined based on source investigation.

A map showing capture area for structural BMPs is shown in Figure 24.

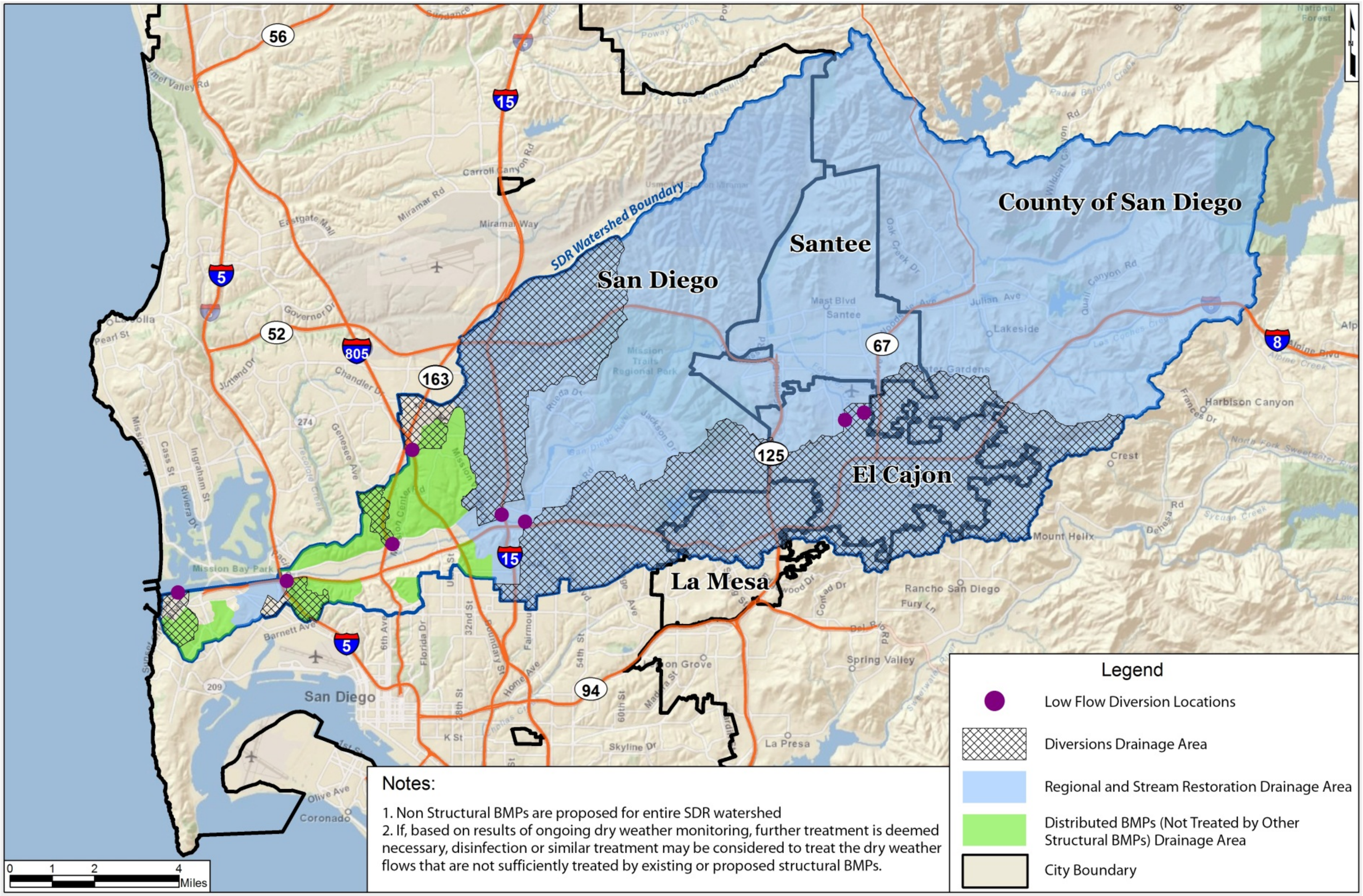


Figure 24. Dry weather flow area treated by proposed structural BMPs

4.1.1.2.3 Stream Enhancement/Restoration Projects

As described in Section 3.2.5.4.4, stream enhancement/restoration projects, implemented from 2003 and through future proposed projects, were incorporated into the CLRP's load reduction estimates. The intent is not to design these projects to be inundated with untreated water, but to acknowledge the benefits these sites achieve when stormwater comes in contact with these sites. Wet weather benefits for these projects are estimated based on analysis of the project features. However, future flow and bacteria monitoring data should be used to confirm or revise these assumed benefits. The following potential net pollutant load reduction mechanisms were quantified for stream restoration projects:

- Increased volume reductions
- Increased hydraulic residence time
- Increased settleable solids
- Increase in decay coefficient to account for plant assimilative capacity.

Based on project features for each project, a low and high range of benefits are estimated using the two alternatives discussed below. The low and high values from the 4 estimates are used to estimate the load reductions for the project:

- For alternatives, the design flow rate and design volume of both the restored channel and the pre-project channel are assumed considering general water quality design guidelines and typical sediment resuspension velocities.
- For the first alternative, SBPAT BMP performance algorithms- which are based on hydrologic capture calculations conducted using SWMM- and effluent water quality data are used to estimate benefits:
  - A wetlands algorithm is used to estimate benefits associated with enhanced and/or created vegetation;
  - An infiltration algorithm is used to estimate benefits associated with volume reductions.
- For the second alternative, the change in volume reductions, first order decay coefficients, and load reductions associated with settleable solids are estimated based on system design features and a focused literature review.
- For the purpose of quantifying load reductions, it is assumed that restoration projects address dry weather and small storm flows predominantly. If the project is located on a floodplain bench and is only inundated in larger storm events, then benefits should not be claimed for the purpose of summing effective load reductions for comparison to the TLR.

Table 16 presents a summary of the WY 1993 FC benefits for stream restoration projects.

Table 16. Stream restoration projects load reduction[1]

Location/Name	Water Quality (FIB-FC Load) Benefits (10^12 MPN Reduction/Year) WY 1993 [Low - High]
Forester Creek	73 [17 – 128]
Woodglen Vista Creek	17 [3.7 – 31]
Las Colinas Channel	5.1 [1.1 – 9.1]
Totals	95 [22 – 170]

[1] Values are presented as gross load reductions, prior to adjustments to account for overlapping benefits of multiple BMPs that may treat runoff from overlapping drainages, as well as nonstructural BMP "overlap." Additionally, as discussed in further detail in Section 4.1.1.2.6, results for WY 1993 include wet weather load reductions estimated for all wet weather days in the WY, not only the fraction of load reductions that are considered effective for reducing exceedance days; therefore, "effective fraction" adjustments were not made.

4.1.1.2.4 Private Property BMPs

As part of the adaptive approach taken by this CLRP, additional BMPs are included for Responsible Parties interested in this option. These BMPs would be considered for implementation towards the end of the implementation phase based on BMP effectiveness assessments conducted on already implemented BMPs.

These additional BMPs would be sited on parcels that are currently privately owned that are suitable for BMP implementation and available for purchase. Land costs for these BMPs are included in the capital costs. These projects are quantified based on an assumption that 0.5% of Responsible Party area within the high priority catchments (CPI>=3) will be purchased and the BMPs will be designed to treat 25% of the Responsible Party area within the catchment.

Private Property BMPs were quantified based on an assumption that 5% of the responsible party area within the high priority catchment will be treated with bioretention and 20% of the responsible party area will be treated with bioretention swales with underdrains. Design criteria for quantifying these BMPs were developed using the following assumptions:

- Bioretention:
  - Design Volume: 0.37 inches
  - Retention Depth : 12 inches

    - Infiltration Rate: 0.25 in/hr.
- Bioretention swale with underdrains:
    - Design Flow Rate: 0.1 in/hr.
    - Hydraulic Residence Time: 10 min
    - Longitudinal Slope: 0.03 ft/ft
    - Manning's Roughness Coefficient: 0.25
    - Water Quality Flow Depth: 4 inches
    - Retention Depth: 2 inches
    - Infiltration Rate: governed by site constraints.

Table 17 lists the total estimated pollutant removal benefits from these BMPs.

Table 17. Private Property BMPs (distributed) pollutant reduction[1,2]

	FIB-FC Load Benefits (10^{12} MPN Reduction/Year)		Nitrate Load Benefits (lb reduction/year)	TP Load Benefits (lb reduction/year)
	WY 1993 [Low - High]	*Annual Average [Low - High Years]*	*Annual Average [Low - High Years]*	*Annual Average [Low - High Years]*
Total	490 [280 – 560]	280 [120 - 340]	3,200 [1,700 – 4,000]	1,200 [760 – 1,500]

[1] Range of WY1993 and annual WQ benefits represent 25th and 75th percentile load reduction results. Range reflects variability in baseline pollutant loading (EMC's) as well as variability in BMP effectiveness.
[2] Values are presented as gross load reductions, prior to adjustments to account for overlapping benefits of multiple BMPs that may treat runoff from overlapping drainages, as well as nonstructural BMP "overlap". . Additionally, results for WY 1993 include load reductions estimated for that WY, not only the fraction of load reductions that are considered effective for reducing exceedance days; therefore, "effective fraction" adjustments were not made.

4.1.1.2.5 Overlapping Benefits Adjustment Analysis

To improve the reliability of load reduction estimates, an adjustment analysis was performed to avoid double counting of load reductions between nonstructural and structural BMPs and between distributed and regional BMPs placed (or applied) in the same drainage areas. For example, if a given area has proposed both nonstructural BMPs and structural BMPs, the estimated load reductions were not assumed to be additive, but rather limited by effluent concentrations from structural BMPs. Each BMP in the proposed plan was evaluated to identify overlapping load reductions, which were then removed from the total reported benefits to more accurately compare the benefits with the target.

The following assumptions were used for performing the overlapping benefits adjustment analysis:

- Load reductions are uniformly distributed based on ratio of baseline uncontrolled load.
- Structural BMPs were either categorized as an effluent-based BMP (i.e., BMPs that provide load reduction via treatment only, not volume reduction) or as a volume-reduction BMP (i.e., BMPs that operate on volume reduction primarily).
- For volume-reduction BMPs the overlapping benefits in the captured runoff volume were estimated using the upstream non-overlapping benefits in the captured runoff and the percent load reduction achieved by the BMP.
- For effluent-based BMPs the overlapping benefits in the captured runoff volume were estimated using the upstream non-overlapping benefits in the captured runoff and the total load reduction achieved by the BMP.
- Non-overlapping benefits associated with upstream BMPs in the bypass runoff volume (runoff that exceeds upstream structural BMP design criteria) were considered non-overlapping benefits for the BMP being analyzed.

Based on this analysis, overlapping benefits for the ultimate condition are estimated to be 12 percent of the 25th percentile reported load reductions, 13 percent of average reported load reductions and 13 percent of the 75th percentile total reported load reductions.

This overlapping benefits adjustment analysis is intended to more accurately represent the load reduction estimates when multiple BMPs were applied for use in planning-level assessment and as a conservative estimate for assessing compliance. The degree of precision is intended to be consistent with the degrees of uncertainty relative to sources of loading, BMP performance, ultimate BMP design, and other factors.

4.1.1.2.6 Load Reduction Effective Fraction

BMPs provide load reductions at varying levels across the full range of storm events. Calculations of the total load reduction achieved by the suite of proposed BMPs for WY 1993, therefore, include load reductions achieved during the AEDs (the 19 highest loading days) as well as the remaining loading days, potentially leading to an overestimate of the ability of the proposed BMPs to achieve the TLR (since TLRs do not include AED loads – see Section 3.2.2.1 for further detail). Hence a “load reduction effective fraction” was developed to estimate the load reductions that consider the number of ‘non-allowable’ exceedance days. These adjusted loads were compared to the TLR.

For the purpose of developing an appropriate effective fraction, WY 1993 loading events were binned into three categories:

- *Effective load reductions*: These are load reductions that occur within the smallest range of loading days, generally occurring beyond the 19 largest bacteria loading days. The load reductions achieved in these days are considered to be nearly completely effective for reducing exceedance days.

- *Partially effective load reductions*: These are defined as load reductions that occur in the 19 highest loading days that are followed by a non-allowable exceedance day at some point in the next three days (based on the definition of a wet day in the TMDL). While an exceedance may still be registered in the allowable exceedance day, the load reductions estimated for that day are anticipated to have a residual effect on concentrations in the overall watershed system and at the receiving water monitoring point. The residual response in load reductions is expected to potentially provide some partial effectiveness in reducing the loads in the non-allowable exceedance days.
- *Ineffective load reductions*: This category includes load reductions from 19 highest loading days that do not have non-allowable exceedance days within 3 days. Load reductions provided in BMPs during these events were considered to be minimally effective in reducing exceedance days.

To develop an effective fraction for use in this CLRP, a number of case study analyses were conducted that evaluated the timing and magnitude of loading and load reduction events for BMPs in WY 1993.

Based on review of 7 case studies and best professional judgment, a range of effective fractions was developed. From this analysis, it was determined that for typical wet weather structural BMPs proposed as part of this CLRP, approximately 12 to 38 percent, with an average of 23 percent, of load reductions would be expected to be "effective load reductions" (defined for this study as load reductions for events beyond the 19th largest baseline watershed loading day). These load reductions are considered to be effective in reducing exceedance days.. Partially effective load reductions have not been claimed in estimating the effective fraction at this time. This may be considered a conservative assumption. Based on this data, an effective fraction of 0.23 was used for the load reduction analysis for this CLRP.

For nonstructural BMPs, the actual BMP plans are less defined, are highly varied in nature, and are generally not as well suited for temporal quantitative analysis as structural BMPs. However in some instances load reduction estimates are true load reductions from the waste stream. For the purpose of this analysis, it is assumed that nonstructural BMPs would have similar temporal distributions of load reductions and therefore a similar range of effective fractions would be appropriate for adjusting the load reductions achieved by these BMPs.

The development of effective fractions is an approximate process intended to improve the interpretation of load reduction estimates and more accurately assess the likelihood of compliance. However, it is not intended to definitively link loading reductions to receiving water exceedances. The degree of precision is intended to be consistent with the degrees of uncertainty relative to sources of loading, BMP performance, ultimate BMP design, receiving water dilution and attenuation effects, and other factors.

4.1.1.3 In-stream Compliance Monitoring Locations

Within the SDR Watershed, the TMDL includes bacterial impairments for the Pacific Shoreline at the SDR Mouth at Dog Beach, as well as for Lower SDR and Forrester Creek. These are the locations within the SDR Watershed that are subject to the requirements of the Bacteria TMDL. Table 18 below shows the summary of predicted wet weather benefits for the implementation plan by 2031 as well as the estimated TLR for the downstream compliance monitoring locations designated by the Responsible Parties, in accordance with TMDL guidance, for each impaired water body (a map of compliance monitoring locations is included with the Monitoring Plan in Appendix I). Since the suite of BMPs proposed in this CLRP are expected to achieve up to 100% coverage of the Watershed, it is anticipated that dry weather numeric objectives will be met at the in-stream compliance monitoring locations.

Table 18. Summary of Wet Weather Load Reductions

Compliance Monitoring Location	FC Load (10^{12} MPN)	
	Target Load Reduction[1]	Proposed Plan Benefits[2, 3, 4] [Low – High Range][5]
Forrester Creek	310	240 [120 – 310]
SDR – MLS	1,100	930 [450 – 1250]
Dog Beach	1,150	970 [460 – 1,300]

[1] Target Load Reductions (TLR) estimated based on objective of conforming baseline MS4 loads (WY1993) to TMDL Allowable Exceedance Day (AED) requirements, which requires taking credit for "effective" load reductions, which occur only on non-allowable exceedance days. These TLRs amount to 15% of baseline MS4 loads based on analysis of 3 monitoring locations.
[2] Adjustment was made to avoid double counting of overlapping load reductions between nonstructural and structural BMPs and between distributed and regional BMPs; this improves the reliability of results.
[3] Adjustment was made to account for fraction of load reduction that is considered to be "effective" for reducing likelihood of exceedance in non-AEDs, thereby improving reliability when compared with the TLR.
[4] Additional BMPs may be placed on currently privately-owned property if needed to meet targets.
[5] Range of WQ benefits represent 25th and 75th percentile results for WY 1993. Range reflects variability in baseline pollutant loading (EMC's) as well as variability in BMP effectiveness.

4.1.2 Implications for TMDL Compliance

Table 19 below shows the summary of predicted wet weather load reductions from each BMP type proposed for implementation within the SDR Watershed by 2031 as well as the estimated TLR. The table presents the average, low, and high ranges of load reduction. Ranges reflect variability in baseline pollutant loading (e.g., EMCs) as well as variability in BMP effectiveness and are represented by the 25th and 75th percentile prediction estimates. In order to compare the load reductions to the target, the sum of benefits is first adjusted for application of multiple

BMPs (as described in Section 4.1.1.2.4) and then multiplied by the effective fraction (as described in Section 4.1.1.2.5). As shown in Table 19, effective load reductions achieved by 2031 for the critical year (WY 1993) for the high range is greater than the target.

This analysis was conducted using available data, reasonable assumptions, sound engineering and scientific practices to develop a strategy that is anticipated to achieve compliance with TMDL requirements. However, a range of expected load reductions were reported to acknowledge the variability in analysis. There is uncertainty and other uncontrollable factors that, individually or in combination, limit absolute certainty in definitive load reductions as predicted in this analysis. Some of these factors include the magnitude of natural sources, bacteria regrowth, the uncertainty in the underlying data used for the analysis, and the inherent variability of hydrology and stormwater quality, as well as targeting of 50th percentile target load reductions for WY 1993. While every attempt was used to provide a realistic range of potential results, these factors may affect the time and number or type of BMPs that may need to be applied to achieve TMDL compliance.

Table 19. Summary of Wet Weather Load Reductions

BMP CATEGORY	FC Load Reduction (10^{12} MPN/YEAR) 1993 WY Load[1] [Low-High Range]
Regional Structural BMPs	880 [510 – 1,000]
Stream Restoration Projects	95 [22 – 170]
Distributed Structural BMPs	1,400 [780 – 1,600]
Nonstructural BMPs	2,000 [710 – 3,200]
Private Property BMPs[4]	490 [280 – 560]
Subtotal	4,800 [2,300 – 6,600]
Overlapping Benefits Adjustment[2]	-620 [-280 - -880]
Load Reduction Effective Fraction[3]	0.23
Load Reduction Sum	**970** **[460 – 1,300]**
Target Load Reduction	**1,150**

[1] 1993 WY MS4 loading is estimated at 12,000 x 10^{12} MPN/year (90% of total watershed load).
[2] Adjustment made to avoid double counting of overlapping load reductions between nonstructural and structural BMPs and between distributed and regional BMPs; this improves the reliability of results.
[3] Adjustment made to account for fraction of load reduction that is considered to be "effective" for reducing likelihood of exceedance in non-AEDs, therefore more improves reliability for comparing with TLR.
[4] Private property BMPs are an optional strategy and may be considered at the discretion of individual jurisdictions only if needed to meet load reduction targets.

TLRs for dry weather were estimated to be >94 to 95 percent of the Responsible Party load. As shown in the Nonstructural BMP Quantification Table in Appendix G, dry weather load reductions from quantified nonstructural BMPs are estimated to result in a load reduction of 8 to

43 percent of the total MS4 load. A summary of dry weather load reductions expected from the suite of BMPs proposed in this CLRP is included in Table 20.

Table 20. Summary of Dry Weather Load Reductions

BMP CATEGORY	
Stream Restoration/Enhancement	1.7% - 9.4%
Nonstructural BMPs	7.9% - 39%
Low Flow Diversions[1]	42% - 22%
Regional Structural BMPs[1]	40% - 24%
Distributed Structural BMPs[1]	2.8% - 1.7%
Filter + UV Treatment or similar (if needed)	0% - 3.7%
Load Reduction/Geographical Coverage[2]	**94% - 100%**
Target Load Reduction	**>94% - 95%**

[1] Adjusted for overlapping coverage/benefits i.e. area/loads addressed by Distributed Structural BMPs that were already addressed by either Nonstructural BMPs or low flow diversions or Regional Structural BMPs were not reported in the above table while reporting benefits from Distributed Structural BMPs.
[2] In this CLRP dry weather loads and coverage are assumed to be interchangeable, i.e. 10 percent of the existing dry weather loads are assumed to be contributed by 10 percent of the responsible parties area, this assumption will be revisited based on source investigation studies to be performed during the implementation phase.

Furthermore, it should be noted that, as described in Section 4.1.1.1.7, load reductions from some nonstructural BMPs could not be quantified although they are expected to be effective in reducing bacteria inputs to receiving waters. Though not reflected in the reductions above, these unquantified BMPs are anticipated to contribute to achieving interim and long term targets.

4.2 Comprehensive Compliance Schedule (CCS)

Since this CLRP is intended to address impairments other than just FIB, a 20-year alternative compliance schedule is proposed in lieu of the standard 10-year compliance schedule, consistent with the option presented in the Bacteria TMDL (SDRWQCB 2010, p. A68). Since impairments for nitrogen (nitrate) and phosphorous will also be addressed by the suite of candidate structural and nonstructural BMPs described in previous sections, the longer compliance schedule to plan and implement these controls is appropriate.

The following section describes the proposed phased implementation plan, which includes nonstructural and structural BMP implementation, the rationale for how these phases were planned, and proposed interim load reduction milestones.

4.2.1 Phasing Plan

Implementation of the candidate BMPs described in this CLRP will occur in two phases. The first phase will consist of aggressive implementation of nonstructural BMPs, focusing on those that target human sources. Implementation of NS BMP programs identified in this CLRP has been initiated in some jurisdictions, and will primarily occur through April 2016, with ongoing implementation activities extending beyond this period through the end of the TMDL compliance timeline as needed. The second phase, between Years 6 and 15, will consist of ongoing implementation of nonstructural BMPs and initiation of structural BMPs as necessary. An additional Phase 0 includes projects that have already been implemented and for which load reduction credit is taken in this CLRP. Water quality monitoring will continue throughout the compliance period to assess the effectiveness of implemented BMPs and to inform management decisions.

Figure 25 shows a timeline illustrating this implementation schedule along with key TMDL dates.

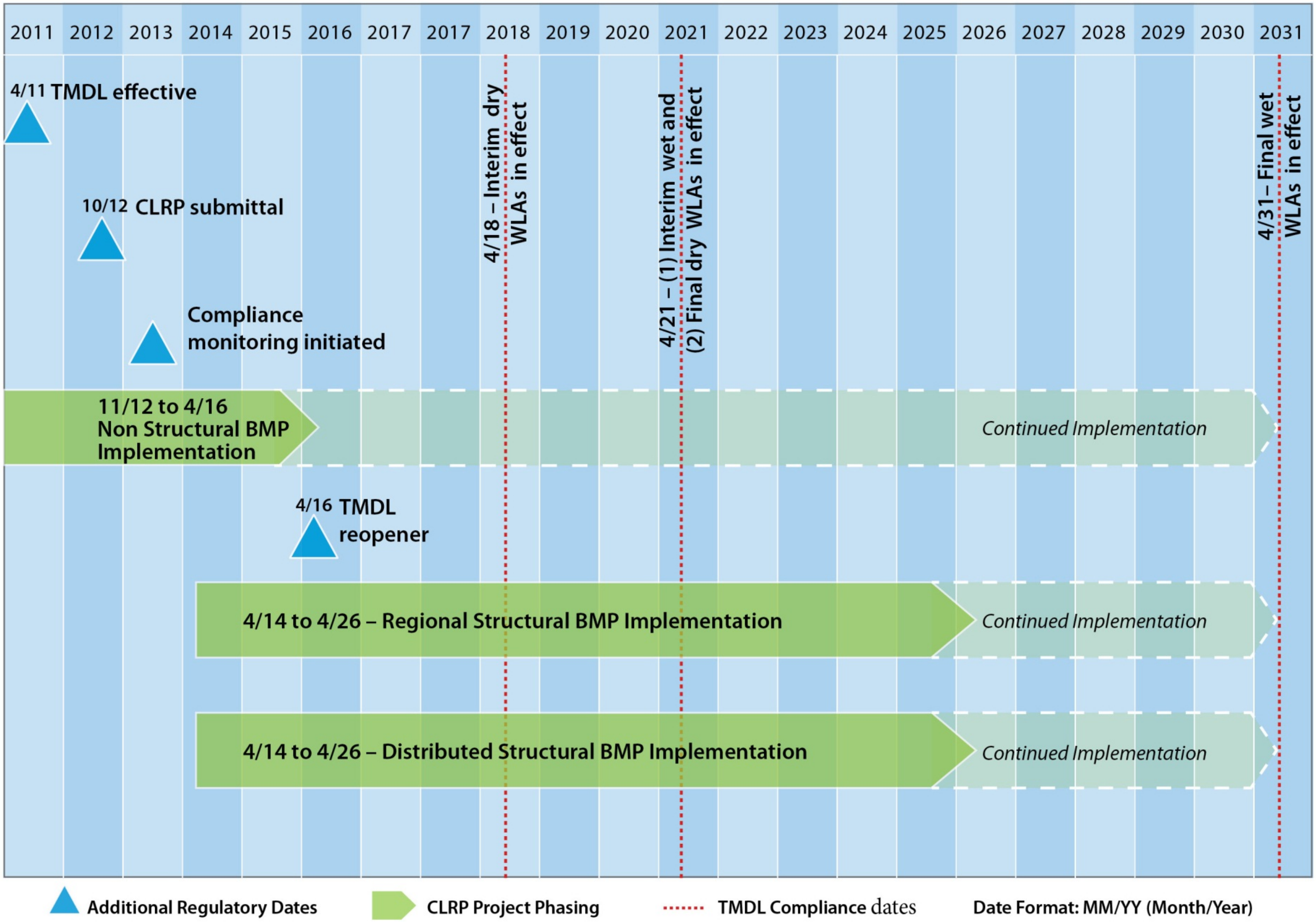
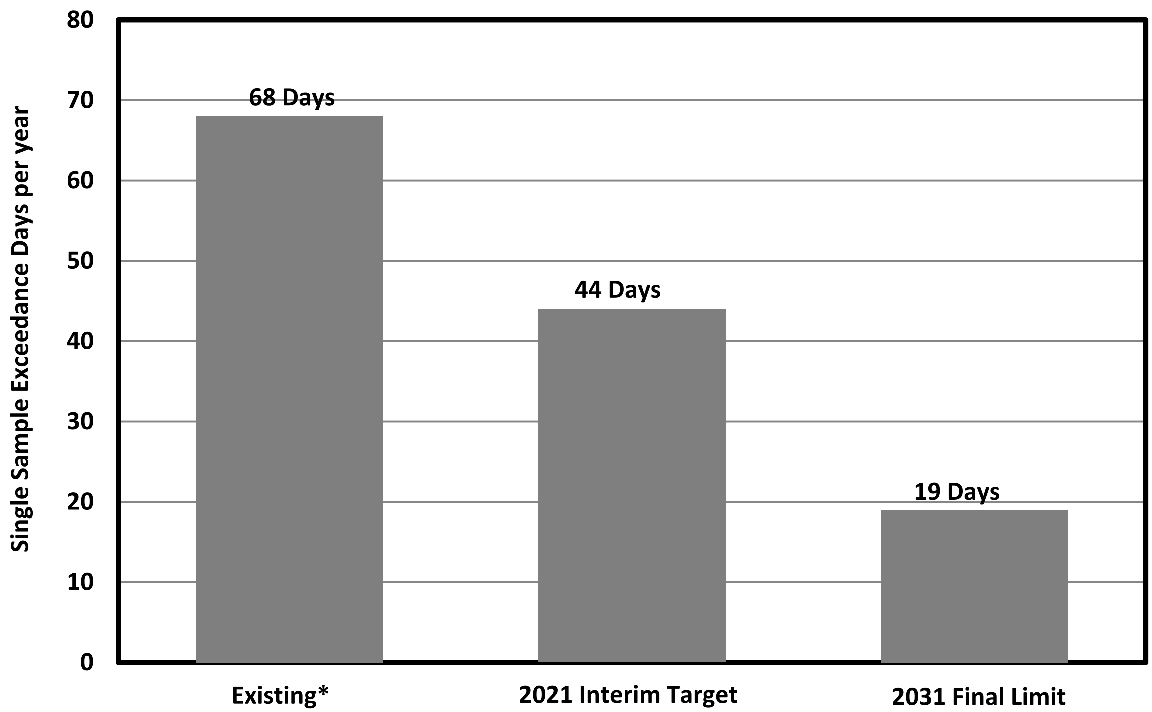


Figure 25. CLRP Schedule

The phasing plan described above is intended to provide an achievable schedule for implementation of the proposed BMPs that will also address interim compliance targets. As described in the Bacteria TMDL, since this CLRP is intended to address other pollutant constituents, an alternative compliance schedule has been proposed with interim dry weather targets (50 percent reduction in exceedances) achieved at 7 years after the TMDL approved date, and interim wet weather targets (50 percent reduction in exceedances) achieved at 10 years after the TMDL approved date, as illustrated in Figure 25. These interim targets, expressed in number of exceedance days, along with estimates of current exceedances days and final targets are shown in Figure 26 and Figure 27. A detailed description of how these targets were calculated is included in the Monitoring Plan found in Appendix I.



* Based on “existing” exceedance rates reported on page A56 of TMDL (based on model estimates for TMDL critical year, 1993), multiplied by 90 wet days per year based on TMDL critical year (1993)

Figure 26. Current exceedances, interim and final targets for wet weather

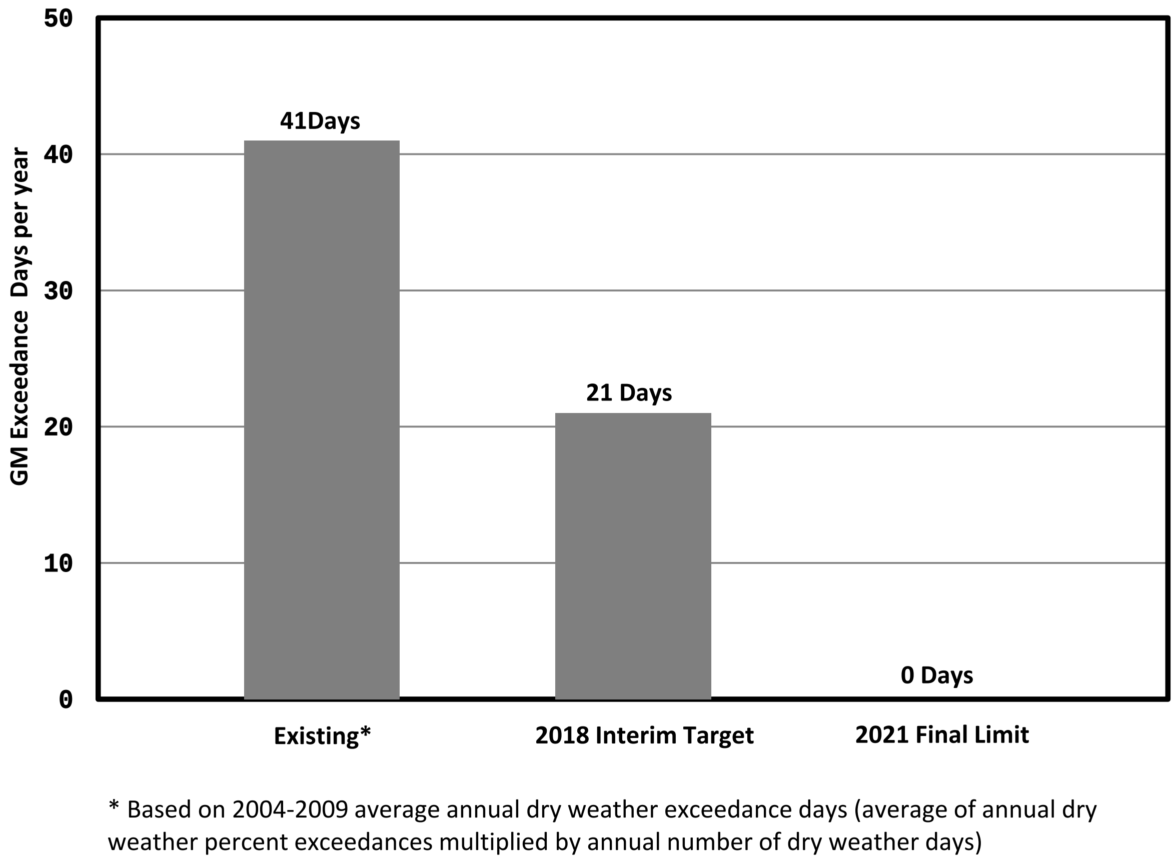


Figure 27. Current exceedances, interim and final targets for dry weather

Based on current monitoring data, it is possible that no additional controls will be needed to meet interim wet weather targets. Load reductions needed to meet interim dry weather targets will be achieved primarily through nonstructural BMPs for which implementation will begin prior to interim target dates, as described above.

4.2.2 Water Quality Monitoring

A Monitoring Plan (MP) that outlines monitoring activities that will occur as part of this CLRP was developed for the SDR Watershed and is included in Appendix I. The MP will be used to determine compliance with the TMDL, as well as to support effective BMP implementation and adaptive management.

4.3 Costs

Activities and BMPs specified in this CLRP are identified in order to demonstrate a plan toward compliance with the Bacteria TMDL. In order to quantify the financial resources necessary to reach compliance with the TMDL this CLRP includes estimates of programmatic, capital, and operation and maintenance costs associated with the identified BMPs.

Responsible Parties will implement identified activities and BMPs as resources are available. Implementation of activities and BMPs will be prioritized along with all other essential Responsible Party obligations such as, but not limited to, public infrastructure rehabilitation and maintenance, compliance with other government-mandated regulations, and public safety. BMPs may require individualized economic justifications as related to available funding and perceived holistic benefit to taxpayers and residents.

Planning-level cost opinions were developed based on the candidate BMPs and program concepts presented above. Though load reductions for certain implemented BMPs (see Section 3.2.5.4.3) are counted towards the total TLR for the Responsible Parties, costs for these projects are not included in this analysis.

Cost opinions are presented as an aid for decision makers, and contain considerable uncertainties. Given the iterative and adaptive nature of the implementation plan and the many variables associated with the projects and programs, the budget forecasts, especially for later phases, are order-of magnitude estimates, and are subject to change based on BMP effectiveness assessments.

Table 21 presents a summary of the estimated costs over 20 years in 2011[21] dollars to implement the candidate BMPs described in this CLRP. Costs were discounted to 2011 dollars by performing present value analysis using an assumed discount rate of 5 percent. Range of costs were developed to account for various BMP design alternatives, BMP configurations, site-specific constraints and uncertain nature of available BMP unit costs from literature or estimated BMP unit costs.

[21] Present value costs were developed in 2011 dollars, the year in which TMDL was effective and CLRP study was initiated.

Table 21. 20-Year Cost Estimate in 2011$ to Achieve Bacteria TMDL Compliance

Cost Category	Lower Limit ($M)	Upper Limit ($M)
Regional Structural BMPs	$59M	$141M
Distributed Structural BMPs	$66M	$219M
Nonstructural BMPs	$38M	$104M
Stream Restoration Projects	$42M	$42M
Dry-Weather Diversion/Treatment	$19M	$43M
Infrastructure Improvement	$144M	$423M
Private Property BMPs[1]	$216M	$360M
Special Studies	$3M	$6.5M
Monitoring	$3M	$3M
Total Cost Estimates	**$590M**	**$1,340M**

[1] Private property BMPs are an optional strategy and may be considered at the discretion of individual jurisdictions only if needed to meet load reduction targets.

4.3.1 Nonstructural BMP Costs

4.3.1.1 Capital Costs

Nonstructural BMPs, by their nature, have relatively few quantifiable capital costs. Of the candidate BMPs identified in this CLRP, three BMPs – Irrigation Runoff Reduction, Residential LID, and the Pet Waste program – have capital costs associated, which are presented in Appendix G.

Irrigation Runoff Reduction and Residential LID both utilize an incentive program to encourage 5 to 15 percent of the households in the SDR Watershed to install BMPs. Incentives can range from 50 to 100 percent of the conversion costs, $100-200 for the irrigation controllers and $200-500 for rain barrels and the disconnection of downspouts, to achieve the desired conversion rate. The total capital cost, as reported in Appendix G, for these two programs can be calculated by multiplying the total number of conversions by the cost per conversion.

The capital cost to enhance the pet waste program, includes new dispensers, signs and program implementation costs. A range of $500-1000 per installation determined during City of San Diego Pet Waste study (City of San Diego 2011a) was multiplied by the estimate number of stations needed for the presented areal coverage. The total cost is listed in Appendix G.

Possible incentive programs for upgrade or repair of septic systems and the installation of BMPs for animal facilities would need additional capital costs based on the extent of implementation and the amount of the incentives.

4.3.1.2 Operation and Maintenance

Operation and maintenance (O&M) costs for nonstructural BMPs were determined by the staff hours assumed to be needed for the tasks or by scaling current staff hours by the identified level of enhancement. Table 22 shows the number of staff hours that were assumed to be necessary for the nonstructural BMP enhancements and new initiatives, estimated from other programs and Responsible Party input. The number of staff hours was multiplied by an average annual employee cost, including salary, overhead, and benefits, to estimate O&M costs for the BMPs and is shown in Appendix G. The additional staff hours needed does not assume that new staff will be hired, as options will be considered including contracting the services to private companies.

Table 22. Priority nonstructural BMPs O&M annual staff-hours

Nonstructural BMP	# of employees	% of full time
Identification and Control of Sewer Discharges to MS4	7-9	80%
Homelessness Waste Management Program	8	20%, plus overtime
Irrigation Runoff and Good Landscaping	1-3	100%
New Residential/Small-Scale LID Incentive Program	1-3	100%
Street and Median Sweeping	1	20%
MS4 System Cleaning	1	25%

The O&M costs Commercial/Industrial Good Housekeeping and Animal Facilities Management were estimated by scaling the cost of existing BMP implementation by the level of enhancement identified in this plan. The current costs of the BMPs were taken from the Fiscal Analysis of the JURMP annual reports. These enhanced O&M costs are included in Appendix G.

The Pet Waste Program O&M costs were calculated based on volunteer implementation and Responsible Party implementation. If maintained by volunteers, program expenses were estimated at $100 per station per year. Program expenses for the Responsible Parties to maintain were estimated at $100 per station per month.

The additional O&M cost for the enhancement to the Caltrans BMPs, was estimated by scaling the current level of implementation and these costs are included in Appendix G.

Stormdrain and Sewer repair and replacement annual O&M costs have been included as a separate line item in Appendix G to show the estimated cost to repair and replace two percent of the system annually. These costs were estimated based on scaling cost information from the City of Vista's current program to cover implementation throughout the SDR Watershed, as well as from information provided by Responsible Parties for currently planned implementation projects when available.

4.3.2 Structural BMP Costs

Capital and O&M costs were based on generalized construction cost estimates derived from regression equations found in literature (Geosyntec 2008) and from construction estimates derived from RS Means[22]. However, since sources of cost information are limited and may not necessarily apply to site-specific conditions, these cost estimates should be considered planning-level only. Further detail on how these cost estimates were developed can be found in the SBPAT Users and Technical Manual (Geosyntec 2008). Default SBPAT unit costs were revised to include a range, rather than a single value, and were adjusted using the Consumer Price Index (CPI) to reflect increases in the costs of raw materials and labor that has occurred since SBPAT was developed.

Estimated unit capital costs from SBPAT do not include many site- and project-specific multipliers or contingencies, such as mobilization, permitting, construction escalations, engineering, construction management, etc. These costs also do not account for added expenses associated with retrofit, such as the potential need for pump stations, relocating utilities, storm drain construction, etc. Therefore, the costs estimated from SBPAT are multiplied by 2.0 to 4.0 to account for these factors. The multipliers were developed based on best professional judgment and are supported by the findings reported in the Center for Watershed Protection Manual (2007). Land value is not included in this summarized cost information with the exception of private property BMPs.

Table 23 includes a summary of costs estimated for regional structural BMPs. Costs for existing structural BMPs are not listed since these have already been implemented. These costs were developed by discounting the capital costs to year six since the BMPs are planned to be implemented from year six. O&M costs extend from years 6 through 20. All economic cost calculations were performed using a discount rate of five percent. The discount rate was assumed to account for both a return on investment and inflation.

These costs as well as costs for other structural BMP types are included in Table 21. Costs for private property BMPs shown in Table 21 include land costs. Private property BMP costs were

[22] RS Means is a unit cost database that is updated annually (http://meanscostworks.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.

developed by discounting the land costs to year 12, discounting BMP capital costs to year 16 and extending O&M costs from years 16 through 20. All economic cost calculations were performed using a discount rate of five percent.

The land cost used to develop the cost opinion for private property BMPs was based on a unit cost of $128.70/ft^2 for vacant land in LA County (Cutter et al. 2008; adjusted to 2005 dollars). Considering the economic conditions from 2005 to 2011 it is assumed the unit land costs in 2011 were similar to 2005. The land unit cost range was obtained by assuming that the unit cost estimate could vary by a contingent amount of plus or minus 25%, to represent the highly uncertain nature of land prices.

Table 23. Regional Structural BMP Costs

Location/Name	Preliminary Range of Potential Capital Costs (2011 $)	Preliminary Range of Potential O&M Costs (2011 $)
SDCo-R-D-1	$9,800,000 - $32,600,000	$200,000 - $700,000
SDCo-R-D-2	$1,700,000 - $4,800,000	$100,000 - $300,000
MJ-R-D-1	$9,800,000 - $32,800,000	$430,000 - $900,000
CoSD-R-D-1	$26,700,000 - $45,400,000	$830,000 - $2,800,000
CoSD-R-D-2	$4,900,000 - $7,600,000	$120,000 - $400,000
CoSD-R-D-4	$1,600,000 - $2,400,000	$40,000 - $100,000
MJ-R-D-4	$1,300,000 - $4,300,000	$280,000 - $900,000
CoS-R-D-2	$900,000 - $2,900,000	$100,000 - $300,000
CoS-R-D-3	$300,000 - $1,000,000	$10,000 - $50,000
Totals	$57,000,000 - $134,000,000	$2,000,000 - $7,000,000

5 REPORTING

As required by the TMDL, the Responsible Parties will submit periodic progress reports to the Regional Board as part of other required watershed deliverables. Progress reports will summarize CLRP effectiveness assessments conducted using the program effectiveness assessment framework described within the Responsible Party MS4 Permit annual reports.

Effectiveness assessments will be based on surveys and pollutant loading estimations, as well as on data collected during compliance monitoring activities (as described in the MP) and other monitoring activities, such as those associated with the Responsible Party NPDES MS4 Permit. Once WQOs have been attained, a reduced level of monitoring may be appropriate.

6 LIMITATIONS

This work was conducted in accordance with the scope of work, purpose, terms, and conditions described in the Terms of Reference, described above. The results and conclusions contained in this CLRP are based on the analyses presented herein and information compiled and collected by Geosyntec; no independent verification or validation of data or referenced studies was conducted as part of this effort.

No warranty, expressed or implied, is made regarding the professional opinions expressed in this report or concerning the completeness of the data presented to Geosyntec.

Best Professional Judgment is based on the collective knowledge of the consultant and Responsible Party staff and available research, and represents an opinion at the time of publication.

Geosyntec is not liable for any use of the information contained in this report by persons other than the County of San Diego and SDR Responsible Parties for purposes described above in Section 1. Users recognize the high level of uncertainty in predictions of effectiveness and understand there are uncertainties in hydrology, data, and external factors that may impact compliance upon completion of the implementation tasks.

Use of this information for any purposes other than referenced in this report without the expressed, written consent of the County of San Diego and Geosyntec is not authorized.

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