TOTAL MAXIMUM DAILY LOADS FOR INDICATOR BACTERIA

IN SAN GABRIEL RIVER, ESTUARY AND TRIBUTARIES

PREPARED BY

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

LOS ANGELES REGION

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ACL	Administrative Civil Liability
BMP	Best Management Practice
Caltrans	California Department of Transportation
CASQA	California Stormwater Quality Association
CDO	Cease and Desist Order
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
CWH	Council for Watershed Health
EPA	Environmental Protection Agency
FIB	Fecal Indicator Bacteria
HFS	High Flow Suspension
LA	Load Allocation
LACDPW	Los Angeles County Department of Public Works
LACSD	Los Angeles County Sanitation District
LARWQCB	Los Angeles Regional Water Quality Control Board
MGD	Million Gallons per Day
ml	Milliliters
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
OAL	Office of Administrative Law
REC-1	Water Contact Recreational Use

REC-2	Non-contact Recreational Use
SCCWRP	Southern California Coastal Water Research Project
SGR	San Gabriel River
SGRRMP	San Gabriel River Regional Monitoring Program
SMB	Santa Monica Bay
SSF	Sub-Surface Flow
SSO	Sanitary Sewer Overflow
TMDL	Total Maximum Daily Load
USACE	United States Army Corps of Engineers
USEPA	Unites States Environmental Protection Agency
WDR	Waste Discharge Requirement
WLA	Waste Load Allocation
WQA	Water Quality Assessment
WQO	Water Quality Objective
WRP	Water Reclamation Plant

1 INTRODUCTION

This document covers the required elements of the Total Maximum Daily Load (TMDL) to address the bacteria water quality impairments in the San Gabriel River (SGR) Estuary, SGR and its tributaries, as well as providing the supporting technical analysis used in the development of the TMDL by the California Regional Water Quality Control Board, Los Angeles Region (Los Angeles Water Board). The goal of this TMDL is to determine and set forth measures needed to remedy impairment of water quality due to elevated bacteria densities in the SGR Estuary, SGR and its tributaries. The target bacteria indicators addressed are fecal coliform, total coliform, *enterococcus* for the San Gabriel River Estuary, and *E. coli* for the San Gabriel River and its tributaries.

1.1 Regulatory Background

The California Water Quality Control Plan, Los Angeles Region (Basin Plan) sets water quality standards for the Los Angeles Region, which (1) designates beneficial uses of surface and ground water, (2) sets numeric and narrative water quality objectives necessary to support beneficial uses, and the state's antidegradation policy, and (3) describes implementation programs to protect all waters in the region. The Basin Plan is the mechanism through which the Los Angeles Water Board implements the Porter-Cologne Water Quality Control Act within the Los Angeles Region and it serves as the State Water Quality Control Plan applicable to regulating bacteria in the SGR Estuary, SGR and its tributaries, as required pursuant to the federal Clean Water Act (CWA).

Section 303(d)(1)(A) of the CWA requires each state to conduct a biennial assessment of its waters, and identify those waters that are not achieving water quality standards. The resulting list is referred to as the 303(d) list. The CWA also requires states to establish a priority ranking for waters on the 303(d) list of impaired waters and to develop and implement TMDLs for these waters.

A TMDL specifies the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and allocates the pollutant loadings to point and nonpoint sources. The elements of a TMDL are described in 40 Code of Federal Regulations (CFR) 130.2 and 130.7 and Section 303(d) of the CWA, as well as in U.S. EPA guidance (U.S. EPA, 1991, U.S. EPA 2000a). A TMDL is defined as the "sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background" (40 CFR §130.2) such that the capacity of the waterbody to assimilate pollutant loads (the loading capacity) is not exceeded. The Regional Water Board is also required to develop a TMDL taking into account seasonal variations and including a margin of safety to address uncertainty in the analysis (40 CFR §130.7(c)(1)). Finally, TMDLs must be included in the State's water quality management plan, or referenced as part of the water quality management plan if contained in separate documents (40 CFR § 130.6(c)(1)).

The U.S. EPA has oversight authority for the 303(d) program and is required to review and either approve or disapprove the state's 303(d) list and each TMDL developed by the state. If the state fails to develop a TMDL in a timely manner or if the U.S. EPA disapproves a TMDL submitted by a state, U.S. EPA is required to establish a TMDL for that waterbody (40 CFR §130.7(d)(2)).

As part of its 1996 and 1998 regional water quality assessments, the Los Angeles Water Board identified over 700 waterbody-pollutant combinations in the Los Angeles Region where TMDLs would be required (LARWQCB, 1996, 1998). Bacterial water quality standards protect human health. Monitoring of all potential waterborne pathogens is infeasible, therefore fecal indicator bacteria are used to predict the presence of pathogens and/or fecal sources. Epidemiological studies have been used to develop recreational water quality criteria given an accepted health risk. EPA's 1986 recreational water quality criteria are based on epidemiological studies that simultaneously measured densities of fecal indicator bacteria (*E. coli*, fecal coliform, total coliform, and/or *Enterococcus*) and rates of highly credible gastrointestinal illness and other adverse health effects in swimmers (Cabelli et al., 1981; Dufour, 1984).

Since the 1950s, numerous epidemiological studies have been conducted around the world to investigate the possible links between swimming in fecal-contaminated waters and health risks (Prüss, 1998; Wade et al., 2003). Most significant associations were found for gastrointestinal illnesses. However, as shown in several large-scale epidemiological studies of recreational waters, other health outcomes such as skin rashes, respiratory ailments, and eye and ear infections are also associated with swimming in fecal-contaminated water. Many of these studies have been conducted in areas of known human sewage contamination; others have been conducted in areas where the sources of fecal contamination were unknown. A Santa Monica Bay study (Haile et al., 1999) found swimming in urban runoff-contaminated waters resulted in an increased risk of chills, ear discharge, vomiting, coughing with phlegm and significant respiratory diseases. These studies demonstrate that there is a causal relationship between illness and recreational water quality, as measured by fecal indicator bacteria densities.

EPA released its final 2012 recreational water quality criteria recommendations to protect the designated primary contact recreation use (U.S. EPA, 2012). The criteria were developed based on more recent scientific information from the National Epidemiological and Environmental Assessment of Recreation Water (NEEAR) data (Wade et al., 2009). The EPA water quality criteria recommendations are intended as guidance in establishing new or revised water quality standards. However, those recommendations are not regulations themselves. States and authorized tribes have the discretion to adopt, where appropriate, other scientifically defensible water quality criteria that differ from EPA's recommended criteria. EPA's 2012 recreational water quality do not differ significantly from the bacteria objectives contained in the Basin Plan. The bacteria objectives in the Basin Plan are scientifically defensible objectives, which were adopted by the Los Angeles Water Board in 2001 (Resolution No. R01-018) in consideration of EPA's 1986 recommendations as well as state regulations regarding bacteriological standards. This SGR Bacteria TMDL is based on current water quality objectives in the Basin Plan.

1.2 Stakeholder Outreach

On February 17, 2015, Los Angeles Water Board staff attended a meeting with staff of the Los Angeles County Department of Public Works to discuss the hydrology of the San Gabriel River watershed and representative rain gage stations across the watershed.

On February 24, 2014, Los Angeles Water Board staff held a stakeholder meeting to receive comments on the development of a TMDL for indicator bacteria in the San Gabriel River and its tributaries. At the meeting, Los Angeles Water Board staff presented background on the TMDL, reviewed recent data, and solicited stakeholder involvement. Seventeen (17) stakeholders, including representatives of municipal stormwater permittees, publicly owned treatment works (POTWs), city and county representatives, and consultants attended the meeting.

In conjunction with the February 24, 2014 stakeholder meeting, the Los Angeles Water Board held a California Environmental Quality Act (CEQA) scoping meeting to solicit input from the interested public and stakeholders on the appropriate scope, content and implementation options of the proposed TMDL for bacteria in the San Gabriel River and its tributaries. At the scoping meeting, the CEQA checklist of significant environmental issues and mitigation measures was discussed. This meeting fulfilled the requirements under CEQA (Public Resources Code, Section 21083.9).

1.3 Environmental Setting

The San Gabriel River receives drainage from 689 square miles of eastern Los Angeles County and has a main channel length of approximately 58 miles. Its headwaters originate in the San Gabriel Mountains with the East, West, and North Forks. The river flows through a heavily developed commercial and industrial area before emptying into the Pacific Ocean at the boundary between Los Angeles and Orange Counties in Long Beach. The main tributaries of the river are Big and Little Dalton Wash, San Dimas Wash, Walnut Creek Wash, San Jose Creek, and Coyote Creek. Part of the Coyote Creek subwatershed is in Orange County and San Bernardino County, and is under the authority of the Santa Ana Water Board. A map of the watershed and bacteria impaired waterbodies, including those on the 303(d) list and those identified as impaired during TMDL development, is presented in Figure 1-1.

San Gabriel River Reach 5. The watershed consists of extensive areas of undisturbed riparian and woodland habitats in its upper reaches, much of which were set aside as wilderness areas by the U.S. Congress in 1968 through Public Law 90-318, which established the San Gabriel Wilderness, within and as a part of the Angeles National Forest. Other areas in the upper watershed are subject to heavy recreational use. The upper watershed also contains a series of reservoirs with flood control dams (Cogswell, San Gabriel, and Morris Dams). Below Morris Dam, the river flows out of the San Gabriel Canyon and into the San Gabriel Valley. About four miles downstream from the mouth of the San Gabriel Canyon is the Santa Fe Dam and Reservoir flood control project. The Los Angeles County Department of Public Works (LACDPW) operates and maintains the Santa Fe Reservoir Spreading Grounds through an easement with the United States Army Corps of Engineers (USACE). The spreading grounds recharge water to the Main San Gabriel Basin underlying the San Gabriel Valley and are bounded by the San Gabriel Mountains on the north, the Puente Hills on the south, the San Jose Hills to the east, and the San Rafael Hills to the west.

The Rio Hondo branches from the San Gabriel River just below Santa Fe Dam and flows westward to Whittier Narrows Reservoir. Flows from the San Gabriel River and Rio Hondo merge at this reservoir during larger flood events. From Whittier Narrows Reservoir, the Rio Hondo flows southwesterly towards the Los Angeles River.

San Gabriel River Reaches 3 and 4. *The area between Santa Fe and Whittier Narrows Dam.* The San Gabriel River between Santa Fe Dam and the Whittier Narrows Basin is soft-bottomed with riprap sides. This area is used for infiltration and is dry during most of the year. Reach 4 of the San Gabriel River runs from the Santa Fe Dam to Ramona Boulevard. Reach 3 of the San Gabriel River runs from Ramona Boulevard to the Whittier Narrows Dam.

Walnut Creek Wash is a tributary to San Gabriel River Reach 3. Puddingstone Reservoir is located on upper Walnut Creek Wash and is operated for flood control, water conservation, and recreation. Immediately below Puddingstone Reservoir, the creek is soft bottomed. The rest of the creek is concrete lined until its confluence with the San Gabriel River. Walnut Creek Wash receives inputs from Big Dalton Wash, which receives inputs from Little Dalton Wash and San Dimas Wash.

San Jose Creek enters San Gabriel River Reach 3 below Walnut Creek Wash. The upper portion of San Jose Creek (Reach 2) extends from White Avenue to Temple Avenue. San Jose Creek Reach 1 extends from Temple Avenue to the confluence with the San Gabriel River. Tributaries to San Jose Creek Reach 1 include the South Fork, Diamond Bar Creek, and Puente Creek. The Pomona Water Reclamation Plant (WRP) discharges to the South Fork of San Jose Creek. San Jose Creek Reach 1 is concrete lined in its upper portion and soft bottomed just before it joins the San Gabriel River. The San Jose Creek WRP discharges to the soft-bottomed portion of the reach.

Waters entering the mainstem from San Jose Creek and Walnut Creek Wash may be diverted through the Whittier Narrows area to the Los Angeles River. Those waters remaining in the San Gabriel River will often recharge at the downstream spreading grounds.

Whittier Narrows Dam. The Whittier Narrows are a natural gap in the hills along the southern boundary of the San Gabriel Valley. The Whittier Narrows Dam is a flood control and water conservation project constructed and operated by the USACE. The Rio Hondo and San Gabriel Rivers flow through Narrows and are impounded by the dam. The purpose of the project is to collect upstream runoff and releases from the Santa Fe Dam for flood control and water conservation. If the inflow to the reservoir exceeds the groundwater recharge capacity of the spreading grounds or the storage capacity of the water conservation or flood control pools, water is released into the San Gabriel River Reach 2.

San Gabriel Reach 2. *Below Whittier Narrows Dam.* The Montebello Forebay is a recharge facility located immediately downstream of Whittier Narrows Dam and allows infiltration into the Central Basin. It runs from just below the Narrows to Firestone Boulevard. Groundwater is recharged either by percolation through the unlined bottom of the river or by the diversion of water to the San Gabriel Coastal Basin Spreading Grounds by way of rubber dams. Water that is not captured in these spreading facilities flows to the ocean.

San Gabriel River Reach 1 and Estuary. The lower part of the river flows through a concrete-lined channel in a heavily urbanized portion of the Los Angeles county. Reach 1 extends from Firestone Boulevard to the Estuary, just above the confluence with Coyote Creek.

Coyote Creek is a concrete-lined, trapezoidal channel that flows along the Los Angeles/Orange County border. The upper portion of Coyote Creek is located in Orange County and San Bernardino County and is under the jurisdiction of the Santa Ana Water Board. The Coyote Creek subwatershed is largely urbanized, but there are areas of open space in the upper watershed, which are mostly used for oil production (SARWQCB, 2004). Coyote Creek joins the San Gabriel River above the tidal prism in Long Beach south of Willow Street.

The Estuary is approximately 3.4 miles long with a soft bottom and concrete and riprap sides. The Estuary receives flow from San Gabriel Reach 1 and Coyote Creek, tidal exchange, and cooling water discharged from two power plants.

1.4 Land Use

Land use within the San Gabriel River Watershed is 36% developed (approximately 25% residential, 0.4% mixed urban, 6.2% commercial, and 4.7% industrial). Undeveloped space (including Vacant and Open space) accounts for approximately 59% of the land use (Figure 1-2). The upper areas of the watershed are primarily undeveloped space and national forest land, while the middle and lower areas are dominated by urban development.

Figure 1-1: The San Gabriel River Watershed

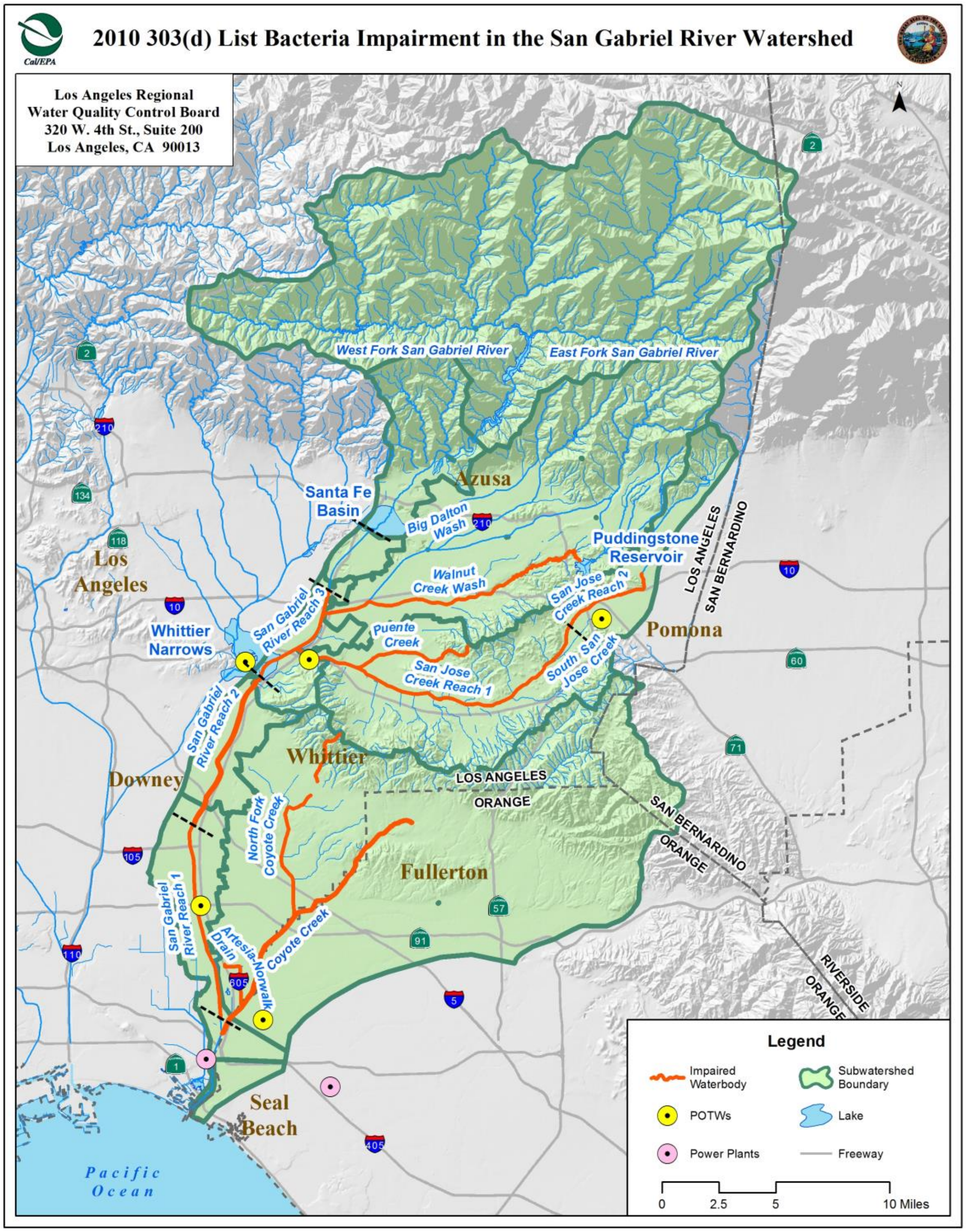
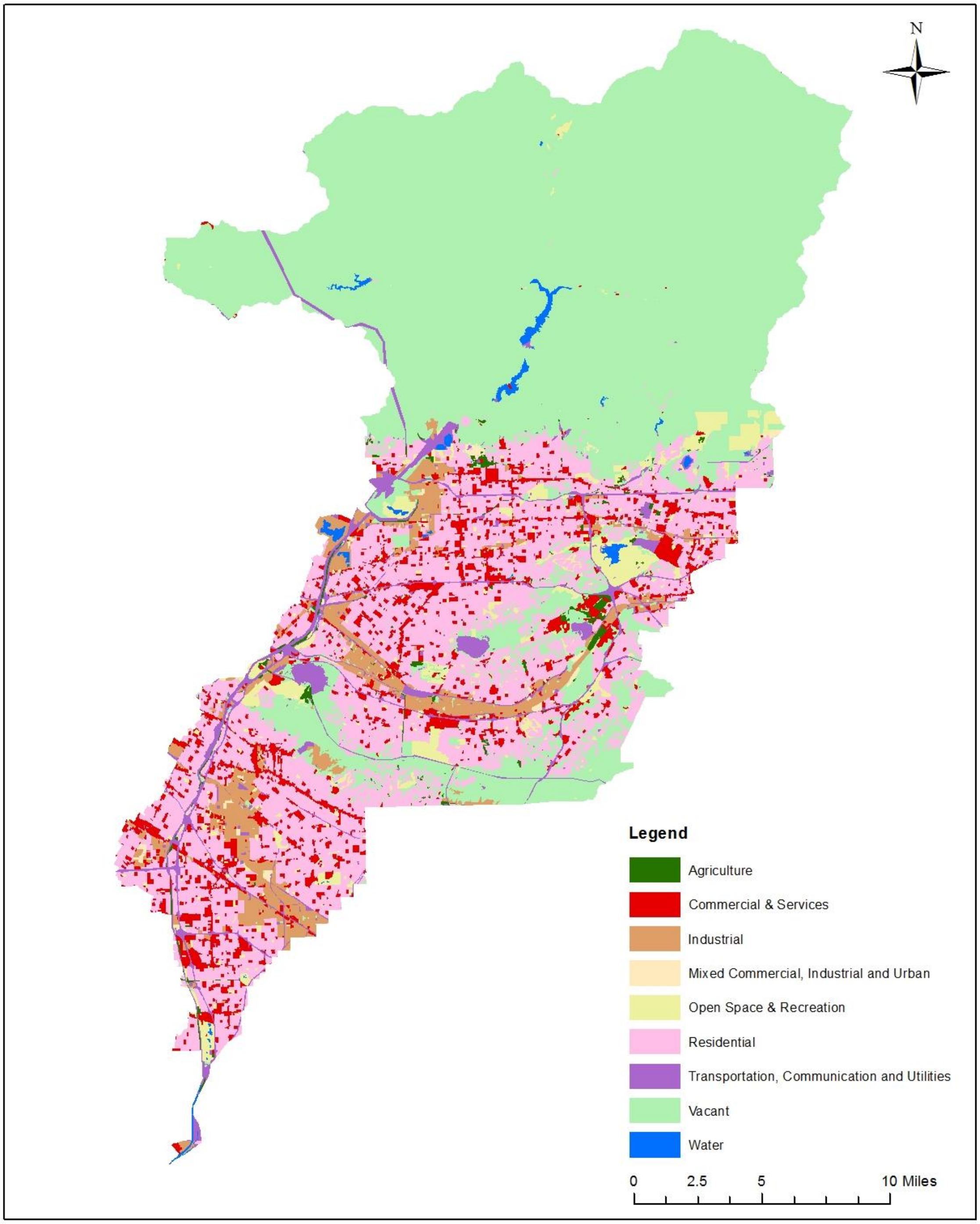


Figure 1-2: San Gabriel River Watershed Land Use Map



1.5 Elements of a TMDL

There are seven federally required elements of a TMDL. Sections 2 through 8 of this document are organized such that each section describes one of the elements, with the analysis and findings of this TMDL for that element. The elements are:

- Section 2: Problem Identification. This section reviews the bacteria data used to add the waterbody to the 303(d) list, and summarizes existing conditions using that evidence along with available new information acquired since the listing. This element identifies those reaches that fail to support the designated beneficial uses due to impacts from the subject pollutant(s); the water quality objectives (WQOs) designed to protect those beneficial uses; and, in summary, the evidence supporting the decision to list each reach, such as the number and severity of exceedances observed.

- Section 3: Numeric Targets. The numeric targets for this TMDL are based upon the WQOs and associated implementation provisions described in the Basin Plan.

- Section 4: Source Assessment. This section estimates bacteria loadings from point sources and nonpoint sources to the San Gabriel River and its tributaries.

- Section 5: Linkage Analysis. This analysis shows how the sources of pollutants discharged to the waterbody are linked to the observed conditions in the impaired waterbody.

- Section 6: Pollutant Allocations. Each pollutant source is allocated an exceedance frequency allowed for its discharge to meet the numeric targets. Point sources are assigned waste load allocations (WLAs) and nonpoint sources are assigned load allocations (LAs). Allocations are designed such that the waterbody will not exceed numeric targets for bacteria. Allocations are based on critical conditions, so that the allocated pollutant loads may be expected to remove the impairments at all times.

- Section 7: Implementation. This section describes the programs, regulatory tools, or other mechanisms by which the waste load allocations and load allocations are to be achieved.

- Section 8: Monitoring. This TMDL includes a requirement for monitoring the waterbody to ensure that water quality standards are attained. It also describes optional special studies to address uncertainties in assumptions made in the development of this TMDL and the process by which new information may be used to refine the TMDL.

2 PROBLEM IDENTIFICATION

This section discusses the water quality standards applicable to this TMDL, and provides some background on their development. A review of more recent water quality data is also provided to verify the current 303(d) listings due to bacteria impairments in the San Gabriel River watershed for bacteria impairments.

2.1 Water Quality Standards

2.1.1 Beneficial Uses

The Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (1994) as amended in 2011 (Resolution No. R11-011) defines beneficial uses for the San Gabriel River and its tributaries. Bacteria loading to the San Gabriel River and its tributaries has resulted in impairments of beneficial uses associated with Water Contact (REC-1) and Non-contact (REC-2) Recreation uses.

The REC-1 beneficial use is defined in the Basin Plan as "[U]ses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs" (Basin Plan, p. 2-1a).

The REC-2 beneficial use is defined as "[U]ses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to picnicking, sunbathing, hiking, beachcombing, camping, boating, tide-pool and marine life study, hunting, sightseeing, or aesthetics enjoyment in conjunction with the above activities" (Basin Plan, p. 2-1a).

A national survey conducted by the Interagency National Survey Consortium and coordinated by the United States Department of Agriculture Forest Service, Recreation, Wilderness, and Demographics Trends Research Group found that 42% of respondents 16 years of age and older swam in recreational waters annually, totaling approximately 89 million individuals (National Survey on Recreation and the Environment 2000–2002).

The San Gabriel River and its tributaries including all of the Section 303(d) listed waterbodies have designated recreational beneficial uses which are listed in Table 2-1.

Table 2-1: Recreational Beneficial Uses of the San Gabriel River Watershed

Stream Reach	REC-1	REC-2	High Flow Suspension
San Gabriel River Estuary	E	E	
Coyote Creek	Pm	I	Yav
Coyote Creek North Fork	Pm	I	Yav
San Gabriel River Reach 1	Em	E	Yav
San Gabriel River Reach 2	Em	E	Yav
San Gabriel River Reach 3	Im	I	Yav
San Gabriel River Reach 4	Im	I	Yav
San Gabriel River Reach 5 (Santa Fe Dam to Huntington Dr.)	Im	I	Yav
San Gabriel River Reach 5 (Huntington Dr. to Van Tassel Canyon)	E	E	
East Fork San Gabriel River	E	E	
West Fork San Gabriel River	E	E	
North Fork San Gabriel River	E	E	
San Jose Creek Reach 1	Pm	I	Yav
San Jose Creek Reach 2	Pm	I	Yav
Puente Creek	P	I	
Walnut Creek Wash	Im	I	
Big Dalton Wash	Pm	I	Yav
Little Dalton Wash	Pm	I	
San Dimas Wash (lower) (Big Dalton Wash to Ham Canyon)	Im	I	Yav
San Dimas Wash (upper) (above Ham Canyon)	Im	I	

m: Acess prohibited by Los Angeles County Department of Public Works in the concrete-channelized areas
av: The High Flow Suspension only applies to water contact recreational activities associated with the swimmable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use, non-contact water recreation involving incidental water contact regulated under the REC-2 use, and the associated bacteriological objectives set to protect those activities Water quality objectives set to protect (1) other

recreational uses associated with the fishable goal as expressed in the federal Clean Water Act section 101(a)(2) and regulated under the REC-1 use and (2) other REC-2 uses (e.g., uses involving the aesthetic aspects of water) shall remain in effect at all times for waters where the (av) footnote appears.

2.1.2 Water Quality Objectives

The Basin Plan contains bacteria water quality objectives to protect REC-1 and REC-2 uses. In 2001, the Los Angeles Water Board updated the bacteria objectives for waters designated as REC-1 to be consistent with U.S. EPA's recommended criteria (published in "Ambient Water Quality Criteria for Bacteria – 1986"), which recommends the use of *E. coli* criteria for freshwater and *enterococcus* criteria for marine waters (see Los Angeles Water Board Resolution No. R01-018). The updated bacteria objectives were subsequently approved by the State Water Board on July 18, 2002 (State Water Board Resolution No. 2002-0142), the Office of Administrative Law (OAL) on September 19, 2002 (OAL File No. 02-0807-01 S), and the U.S. EPA on September 25, 2002. They are also consistent with those contained in state regulations (California Code of Regulations, Title 17, Section 7958 "Bacteriological Standards", which implements Assembly Bill 411 (Statutes of 1997)).

In 2010, the Los Angeles Water Board updated the bacteria objectives for freshwaters designated as REC-1 to remove redundancy and maintain consistency with U.S. EPA's recommendation that *E. coli* replace fecal coliform as an indicator of the presence of pathogens in fresh waters. The Los Angeles Water Board adopted the revised objectives on July 8, 2010 in Resolution No. R10-005, the State Water Board approved the revised objectives on July 19, 2011 in Resolution No. 2011-0031 and OAL (File No. 2011-0923-01 S) approved them on November 1, 2011. The revised objectives became final after U.S. EPA approval on December 5, 2011.

The update of bacteria objectives removes the fecal coliform objectives and uses *E. coli* objectives as the sole objectives for freshwaters designated with the REC-1 beneficial use. In summary, the current Basin Plan bacteria objectives to protect REC-1 include a geometric mean limit and single sample limit for *E. coli* in freshwater and geometric mean and single sample limits for total coliform, fecal coliform, and *enterococcus* in marine water. The numeric targets proposed in the SGR Bacteria TMDL are consistent with these objectives for *E. coli*. Applicable water quality objectives are summarized in Table 2-2.

Table 2-2: Water Quality Objectives for San Gabriel River Estuary, and San Gabriel River (SGR)and its Tributaries

Water Quality Objectives	Estuary (Marine REC-1)	SGR & Tributaries (Freshwater REC-1)
Single Sample Limits		
E. coli	NA	235/100 ml
Fecal coliform	400/100 ml	NA
Enterococcus	104/100 ml	NA
Total coliform*	10,000/100 ml	NA
Geometric Mean Limits		
E. coli	NA	126/100 ml
Fecal coliform	200/100 ml	NA
Enterococcus	35/100 ml	NA
Total coliform	1,000/100 ml	NA

*Total coliform density shall not exceed 1,000/100 ml, if the ratio of fecal-to-total coliform exceeds 0.1.

NA: not applicable

Exceedances of the single sample bacteria limits to protect REC-1 are used to determine impairments. Exceedances of the geometric mean limits to protect REC-1 are also used to determine impairments. Protecting REC-1 beneficial uses will result in the protection of REC-2 beneficial uses because REC-1 bacteria objectives are more stringent than REC-2 bacteria objectives.

2.1.3 Implementation Provisions for Bacteria Objectives

Implementation provisions for the water contact recreation bacteria objectives, defined in the Basin Plan Resolution No. R01-018, are listed below:

> The geometric mean values should be calculated based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period).
>
> If any of the single sample limits are exceeded, the Regional Board may require repeat sampling on a daily basis until the sample falls below the single sample limit in order to determine the persistence of the exceedance.
>
> When repeat sampling is required because of an exceedance of any one single sample limit, values from all samples collected during that 30-day period shall be used to calculate the geometric mean.

Implementation provisions for the water contact recreation bacteria objectives, defined in the Basin Plan Resolution No. R02-22, are listed below:

> The single sample bacteriological objectives shall be strictly applied except when provided for in a Total Maximum Daily Load (TMDL). In all circumstances, including in the context of a TMDL, the geometric mean objectives shall be strictly applied. In the context of a TMDL, the Regional Board may implement the single sample objectives in fresh and marine waters by using a 'reference system/antidegradation approach' or 'natural sources exclusion' approach subject to the antidegradation policies as discussed below. A reference system is defined as an area and associated monitoring point that is not impacted by human activities that potentially affect bacteria densities in the receiving water body.
>
> These approaches recognize that there are natural sources of bacteria, which may cause or contribute to exceedances of the single sample objectives for bacteria indicators. They also acknowledge that it is not the intent of the Regional Water Board to require treatment or diversion of natural water bodies or to require treatment of natural sources of bacteria from undeveloped areas. Such requirements, if imposed by the Regional Board, could adversely affect valuable aquatic life and wildlife beneficial uses supported by natural water bodies in the Region.
>
> Under the reference system/antidegradation implementation procedure, a certain frequency of exceedance of the single sample objectives shall be permitted on the basis of the observed exceedance frequency in the selected reference system or the targeted water body, which is less. The reference system/antidegradation approach ensures that bacteriological water quality is at least as good as that of a reference system and that no degradation of existing bacteriological water quality is permitted where existing bacteriological water quality is better than that of the selected reference system.
>
> Under the natural sources exclusion implementation procedure, after all anthropogenic sources of bacteria have been controlled such that they do not cause or contribute to an exceedance of the single sample objectives and natural sources have been identified and quantified, a certain frequency of exceedance of the single sample objectives shall be permitted based on the residual exceedance frequency in the specific water body. The residual exceedance frequency shall define the background level of exceedance due to natural sources. The 'natural sources exclusion' approach subject to the antidegradation policies may be used if an appropriate reference system cannot be identified due to unique characteristics of the target water body. These approaches are consistent with the State Antidegradation Policy (State Board Resolution No. 68-16) and with federal antidegradation requirements (40 CFR §131.12).

TMDLs and associated waste load allocations (WLAs) and load allocations (LAs) (see Section 6) are vehicles for implementing water quality standards. Therefore, the appropriateness of a reference system/antidegradation approach will be evaluated within the context of TMDL development for a specific water body. WLAs will be incorporated into, but not limited to, National Pollution Discharge Elimination System (NPDES) permits for Municipal Separate Storm Sewer Systems (MS4s), non-storm water general NPDES permits, general industrial and construction storm water permits, and general and individual NPDES permits. LAs for nonpoint sources will be implemented according to the "Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program" (Nonpoint Source Implementation and Enforcement Policy) (SWRCB, 2004) within the context of the TMDL and through the Conditional Waiver for Discharges from Irrigated Lands (Conditional Waiver), and future regulatory mechanisms for irrigated lands or other nonpoint source discharges including conditional waivers of Waste Discharge Requirements (WDRs) and WDRs.

2.1.4 Antidegradation

Both the State of California and the federal government have antidegradation policies for water quality. The State policy is formally referred to as the "Statement of Policy with Respect to Maintaining High Quality Waters in California" (State Water Board Resolution No. 68-16). This policy restricts degradation of surface or ground waters and protects water bodies where existing quality is higher than is necessary for the protection of beneficial uses. The federal Antidegradation Policy (40 CFR §131.12) was developed under the Clean Water Act. This TMDL complies with antidegradation policies by ensuring the protection of beneficial uses and by not setting any WLAs and LAs above existing numbers of exceedance days.

2.2 Water Quality Impairments

During the 1996 Water Quality Assessment, the Los Angeles Water Board evaluated total and fecal coliform monitoring data for beaches and fecal coliform data for inland surface waterbodies. During this assessment, Coyote Creek, San Gabriel River Reach 1, San Gabriel River Reach 2, and San Jose Creek Reach 1 were identified as impaired due to exceedances of the Basin Plan objective for fecal coliform bacteria. As a result of the 1998 Water Quality Assessment, San Jose Creek Reach 2 was also added to the 303(d) list for "high coliform count". San Gabriel Reach 3, Coyote Creek (North Fork), Artesia Norwalk Drain, and Walnut Creek Wash were added to the 303(d) list in 2008 for "indicator bacteria". Currently, ten (10) waterbodies in the SGR watershed are identified on the 2010 303(d) list of impaired waters for "coliform bacteria" or "indicator bacteria" (Table 2-3). During review of recent bacteria monitoring data for this TMDL, Los Angeles Water Board staff found that the San Gabriel River Estuary and Big Dalton Wash are also impaired for indicator bacteria.

Table 2-3: Bacteria Listings in San Gabriel River and its Tributaries (2010 303(d) List)

Water Body	Segment	Size Affected (miles)	303(d) listing Impairment

San Gabriel River Reach 1	Estuary to Firestone Blvd.	6.37	Coliform Bacteria
San Gabriel River Reach 2	Firestone Blvd. to Whittier Narrows Dam	12.28	Coliform Bacteria
San Gabriel River Reach 3	Whittier Narrows Dam to Ramona Blvd.	7.16	Indicator Bacteria
Coyote Creek	Drains to San Gabriel River Reach 1	13.31	Indicator Bacteria
Coyote Creek, North Fork	Drains to Coyote Creek	5	Indicator Bacteria
Artesia Norwalk Drain	Drains to Coyote Creek	2.5	Indicator Bacteria
San Jose Creek Reach 1	San Gabriel River Reach 3 to Temple Ave.	2.67	Coliform Bacteria
San Jose Creek Reach 2	Temple Ave to 1-10 at White Ave.	17.27	Coliform Bacteria
Puente Creek	Drains to San Jose Creek Reach 1	5.8	Indicator Bacteria
Walnut Creek Wash	Drains from Puddingstone Reservoir	11.7	Indicator Bacteria

2.3 Data Review

Recent bacteria water quality data sets were reviewed during the development of this TMDL to confirm 303(d) listed impairments and identify possible impairments in other reaches that should be addressed concurrently. Listing Policy requires a minimum of 5 samples; therefore, where there were 5 or more samples from the same reach, these data were analyzed. These data are summarized in terms of exceedance frequency, which is calculated as the sample exceedance count divided by the sample count. Geometric mean values were not calculated in this report because most of the data sets contain less than 5 samples over a 30-day period. Monitoring data were obtained from the following sources:

- Council for Watershed Health (CWH) monitoring data (October 2006 – March 2013) from monitoring activities conducted through the San Gabriel River Regional Monitoring Program (SGRRMP).
- Los Angeles County Department of Public Works (LACDPW) long-term monitoring data (November 2006 – November 2014) obtained from the San Gabriel River watershed Mass Emission Stations S14 and S13.
- Los Angeles County Sanitation District (LACSD) long-term receiving water monitoring data (August 2002 – May 2014).
- Southern California Coastal Water Research Project (SCCWRP) monitoring data (October 2013 – February 2014) collected for TMDL development in the San Gabriel River watershed.

Detailed locations of these bacteria monitoring stations within the San Gabriel River watershed are illustrated in Figure 2-1.

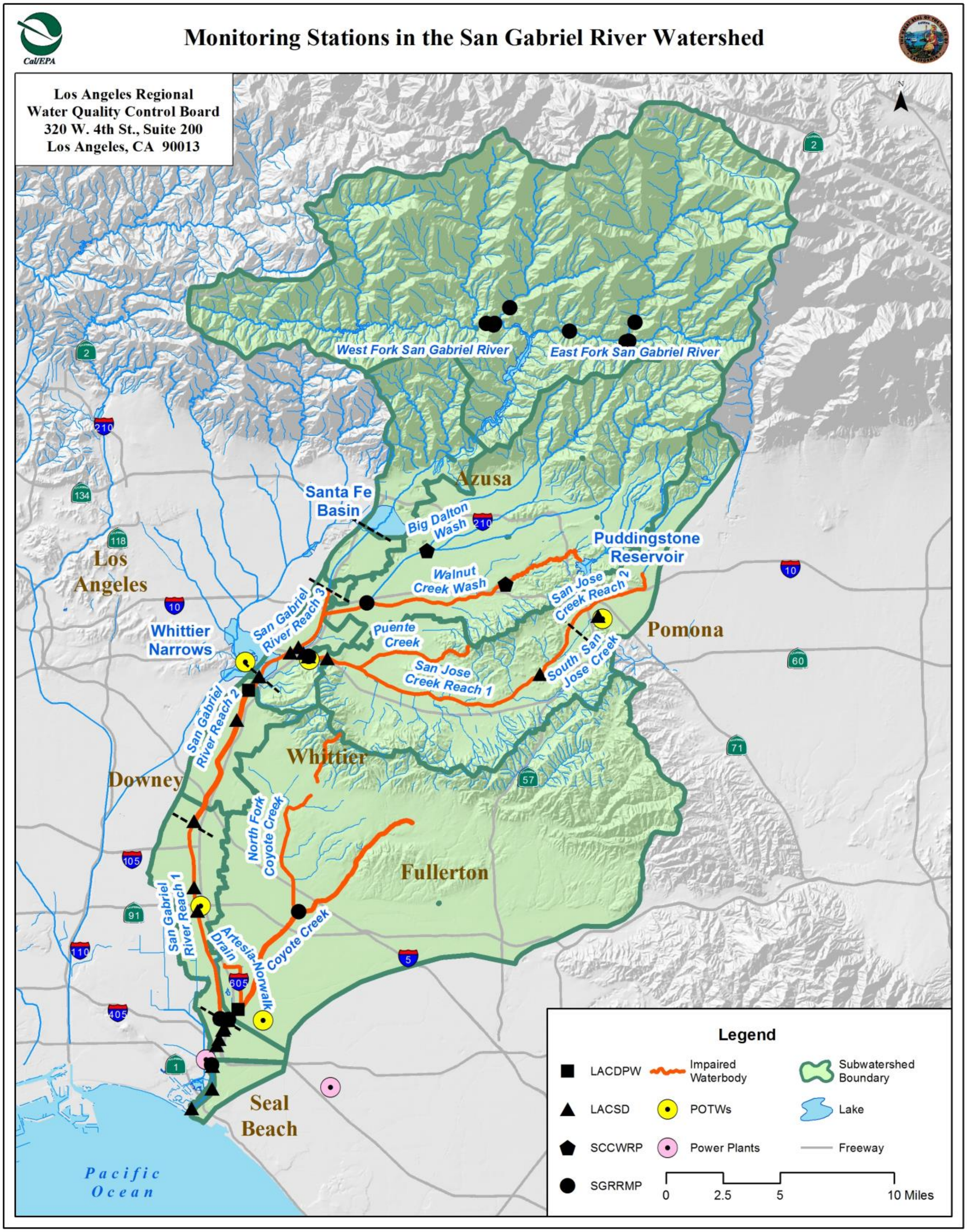


Figure 2-1. Monitoring Stations in the San Gabriel River Watershed

2.3.1 Upper San Gabriel River Reaches (East Fork, North Fork, and West Fork San Gabriel River)

The upper SGR watershed has been monitored weekly through the SGRRMP at eight recreational swimmable sites during summer months (May to September) from 2007 to 2012 to determine the relative safety associated with swimming in the upper SGR watershed. On weekends and holidays hundreds of people can be observed swimming and wading in these reaches. All of the swimmable sites were heavily used by the public during the warm summer months. The monitoring data for *E. coli* are summarized in Table 2-4. The data are further separated into wet and dry weather periods. Few samples (4.2%) exceeded the single sample limit for *E. coli* during summer-dry weather, but up to 18% of samples exceeded the single sample limit for *E. coli* during summer-wet weather.

Table 2-4: Summary of single sample exceedance for *E. coli* conducted by SGRRMP in Upper San Gabriel River watershed

Reach	Season	*E. coli*		
		No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance
Upper SGR		874	44	5.0%
Upper SGR	Wet days	56	10	18%
Upper SGR	Dry days	818	34	4.2%

Under a contract with the Los Angeles Water Board, SCCWRP extended this monitoring effort by continuing sampling at the same SGRRMP's monitoring stations into the winter months (October to February) of 2013-2014. The monitoring data are combined and summarized in Table 2-5. The *E. coli* data are further separated into wet- and dry-weather periods. Few samples (4.0%) exceeded the single sample limit for *E. coli* during dry weather, while nine percent of samples exceeded the single sample limit for *E. coli* during wet weather.

Table 2-5. Summary of single sample exceedance for *E. coli* conducted by SGRRMP and SCCWRP in the Upper San Gabriel River watershed

Reach	Season	*E. coli*		
		No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance
Upper SGR		1016	49	4.8%
Upper SGR	Wet days	166	15	9.0%
Upper SGR	Dry days	850	34	4.0%

2.3.2 San Gabriel River Reach 3

Whittier Narrows (WN) and San Jose Creek (SJC) Water Reclamation Plants (WRPs) discharge treated wastewater into SGR Reach 3. The LACSD monitors indicator bacteria monthly in receiving water at three sites (SJC-R10, SJC-R11, and WN-RA) as part of its NPDES permits. *E.coli* samples were collected from August 2004 to May 2014. Fecal coliform samples were collected from November 2002 to May 2014. Samples were collected at regular intervals to satisfy NPDES permit requirements and largely reflect dry-weather conditions. The data are summarized in Table 2-6. Results show that Reach 3 is impaired by indicator bacteria.

Table 2-6. Summary of single sample exceedance for *E.coli* and fecal coliform conducted by LACSD in San Gabriel River Reach 3

Site Name	*E. coli*			Fecal Coliform		
SGR Reach 3	No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance	No. of Sample	No. of Samples Exceeding 400 MPN/100ml	Percent Exceedance
SJC-R10	12	2	17%	13	1	7.7%
SJC-R11	121	36	30%	291	100	34%
WN-RA	50	17	34%	196	59	30%
Overall	183	55	30%	500	160	32%

2.3.3 San Gabriel River Reach 2

San Jose Creek WRP also discharges tertiary treated wastewater into SGR Reach 2. The LACSD monitors indicator bacteria monthly at two sites (SJC-R12 and SJC-R2). These two receiving water sampling sites are located no further than 100 feet downstream of discharge outfalls. *E.coli* samples were collected from January 2005 to May 2014. Fecal coliform samples were collected from August 2004 to May 2014. The available data are summarized in Table 2-6. Zero single sample exceedances were observed at SJC-R2 for both *E. coli* and fecal coliform. This may be due to the dilution of upstream water by disinfected effluent discharged from the San Jose Creek WRP.

Table 2-7. Summary of single sample exceedance for *E.coli* and fecal coliform conducted by LACSD in San Gabriel River Reach 2

Site Name	*E. coli*			Fecal Coliform		
SGR Reach 2	No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance	No. of Sample	No. of Samples Exceeding 400 MPN/100ml	Percent Exceedance
SJC-R12	6	2	33%	6	2	33%
SJC-R2	97	0	0%	102	0	0%
Overall	103	2	1.9%	108	2	1.9%

In compliance with the municipal separate storm sewer system permit (MS4 permit), the LACDPW conducts a Monitoring and Reporting Program. The monitoring program in the SGR watershed includes one mass emission station (S14) in SGR Reach 2. The S14 station is located at a historic stream gage station (Stream Gage No. F263C-R), below the SGR Parkway in Pico Rivera (LSGWRG, 2015). Grab samples for bacteria were taken in the receiving water.

Available monitoring data (*E. coli*: from October 2012 to November 2014; fecal coliform: from November 2006 to November 2014) are summarized in Table 2-8. The monitoring data are further separated into wet and dry weather conditions. Results show that the number of exceedances exceeded the minimum number of exceedances required for listing.

Table 2-8: Summary of single sample exceedance for *E.coli* and fecal coliform conducted by LACDPW in San Gabriel River Reach 2.

Site	Season	*E. coli*			Fecal Coliform		
	(Waterbody)	No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance	No. of Sample	No. of Samples Exceeding 400 MPN/100ml	Percent Exceedance
S14	**(Reach 2)**	**10**	**9**	**90%**	**47**	**37**	**79%**
S14	Wet Days	9	9	100%	32	29	91%
S14	Dry Days	1	0	0%	15	8	53%

2.3.4 San Gabriel River Reach 1

Los Coyotes (LC) WRP discharges tertiary treated wastewater into SGR Reach 1. The LACSD monitors indicator bacteria monthly at two sites (LC-R3-1 and LC-R4) in receiving water as part of its NPDES permit. LC-R3-1 is located 100 feet upstream of the LC WRP discharge outfall. LC-R4 is located downstream of the discharge outfall. *E.coli* samples were collected from November 2007 to May 2014. Fecal coliform samples were collected from September 2002 to May 2014. The available data are summarized in Table 2-9. Both *E. coli* and fecal coliform collected at downstream site (LC-R4) have a low single sample exceedance frequency (below 10%) in comparison with the frequency at upstream site (LC-R3-1). Again this may be due to the dilution of upstream water by disinfected effluent discharged from the Los Coyotes WRP.

Table 2-9. Summary of single sample exceedance for *E.coli* and fecal coliform conducted by LACSD in San Gabriel River Reach 1

Site Name	*E. coli*			Fecal Coliform		
SGR Reach 1	No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance	No. of Sample	No. of Samples Exceeding 400 MPN/100ml	Percent Exceedance
LC-R3-1 (upstream)	61	13	21%	250	42	17%
LC-R4 (downstream)	79	4	5.1%	289	22	7.6%
Overall	140	17	12%	539	64	12%

San Gabriel River Reach 1 has also been monitored by SGRRMP from May 2007 to August 2012 and SCCWRP from October 2013 to February 2014 for *E. coli* at the same site (SGLT 101, which is near Willow Street and reflects the water quality of Reach 1). The results are summarized in Table 2-10. The number of exceedances for *E. coli* exceeds the minimum number of exceedances required for listing. Based on the data collected by LACSD, SGRRMP, and SCCWRP, the Los Angeles Water Board finds that San Gabriel River Reach 1 is still impaired by indicator bacteria.

Table 2-10. Summary of single sample exceedance for *E.coli* conducted by SGRRMP and SCCWRP in San Gabriel River Reach 1

Reach	Season	*E. coli*		
		No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance
SGLT101	May/07 – Feb/14	141	67	48%
	Wet days	11	10	91%
	Dry days	130	57	44%

2.3.5 San Gabriel River Estuary

LACSD monitors indicator bacteria monthly at five receiving water sites (LC-R9-W, LB-RA-2, LB-R6, LB-R7, and LB-R8) in the estuary. As part of TMDL development, Los Angeles Water Board staff reviewed the total coliform samples collected from January 2000 to May 2014, and fecal coliform samples collected from September 2002 to May 2014. The data are summarized in Table 2-11. Results suggest that the indicator bacteria impairment in the Estuary is caused by fecal coliform. In addition there are fewer exceedances of both total coliform and fecal coliform at farther downstream, such as LB-R6, LB-R7, and LB-R8. This indicates that coliform exceedances may be caused by land sources, instead of sources from the Pacific Ocean.

Overall, the number of exceedances of the single sample objectives for total coliform was less than the minimum number exceedances required for listing. The number of exceedances for fecal coliform exceeds the minimum number of exceedances required for listing.

Table 2-11. Summary of single sample exceedance for total coliform and fecal coliform conducted by LACSD in San Gabriel River Estuary

Site	Total Coliform			Fecal Coliform		
	No. of Sample	No. of Samples Exceeding 10,000 MPN/100ml	Percent Exceedance	No. of Sample	No. of Samples Exceeding 400 MPN/100ml	Percent Exceedance
Estuary	**1484**	**136**	**9.2%**	**1068**	**205**	**19%**
LC-R9-W	420	43	10%	285	78	27%
LB-RA-2	395	72	18%	366	118	32%
LB-R6	171	14	8.2%	139	4	2.9%
LB-R7	171	2	1.2%	138	2	1.4%
LB-R8	327	5	1.5%	140	3	2.1%

The estuary has also been monitored by SGRRMP and SCCWRP at one site (SGLT105 near LB-R6) from October 2006 to January 2014 for *enterococcus* and total coliform. The results are summarized in Table 2-12. The number of exceedances for *enterococcus* exceeds the minimum number of exceedances required for listing. Based on the data collected by LACSD, SGRRMP, and SCCWRP, the Los Angeles Water Board finds that the San Gabriel River Estuary is impaired due to exceedances of bacteria indicators and should be included in this TMDL.

Table 2-12. Summary of single sample exceedance for total coliform and *Enterococcus* conducted by SGRRMP and SCCWRP in San Gabriel River Estuary

Site	Total Coliform			*Enterococcus*		
	No. of Sample	No. of Samples Exceeding 10,000 MPN/100ml	Percent Exceedance	No. of Sample	No. of Samples Exceeding 104 MPN/100ml	Percent Exceedance
SGLT105 (near LB-R6)	718	391	54%	704	136	19%
Wet days	188	124	66%	180	86	48%
Dry days	530	267	50%	524	50	10%

2.3.6 Big Dalton Wash

SCCWRP monitored Big Dalton Wash during winter of 2013-2014. The sampling site (Big Dalton) is located near a cluster of onsite wastewater treatment system (OWTS). The results are summarized in Table 2-13. During wet weather the *E. coli* exceedance frequency was doubled. The increase in indicator bacteria exceedances observed in Big Dalton Wash may result from stormwater flushing fecal material into the channel (SCCWRP, 2014). The number of exceedances of the single sample objectives for *E. coli* is more than the minimum number exceedances required for listing. Therefore, the Los Angeles Board will include Big Dalton Wash in this TMDL.

Table 2-13: Summary of single sample exceedance for *E. coli* conducted by SCCWRP in Big Dalton Wash

Reach	Season	*E. coli*		
		No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance
Big Dalton Wash	Oct/13 – Feb/14	24	12	50%
	Wet days	10	7	70%
	Dry days	14	5	36%

2.3.7 Walnut Creek Wash

Walnut Creek Wash has been monitored by SGRRMP at one site (SGLT103) from May 2007 to August 2012 and by SCCWRP at two sites (SGLT 103 and Covina) from October 2013 to February 2014 for *E. coli*. The results are summarized in Table 2-14. Results suggest that a high exceedance frequency still occurs for *E. coli*.

Table 2-14. Summary of single sample exceedance for *E. coli* conducted by SGRRMP and SCCWRP in Walnut Creek Wash

Reach	Season	*E. coli*		
		No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance
Walnut Creek Wash	May/07 – Feb/14	162	87	54%
	Wet days	141	69	49%
	Dry days	21	18	86%

2.3.8 San Jose Creek Reach 1

Pomona (Pom) WRP discharges tertiary treated wastewater into South Fork San Jose Creek, which drains to San Jose Creek Reach 1. San Jose Creek (SJC) WRP discharges tertiary treated wastewater into San Jose Creek Reach 1. LACSD monitors indicator bacteria monthly at five sites (Pom-RA, Pom-RC, Pom-RD, SJC-C1, and SJC-C2) in receiving water as part of its NPDES permits. The samples were collected from August 2004 to May 2014 for *E. coli*, and from September 2002 to May 2014 for fecal coliform. Station Pom-RA is located 12 feet downstream of the discharge outfall. The results are summarized in Table 2-15. Both *E. coli* and fecal coliform monitored at Pom-RA have a low single sample exceedance frequency in comparison with the frequency at other sampling sites. Again this may be the dilution of upstream water by disinfected effluent discharged from Pomona WRP.

Table 2-15. Summary of single sample exceedance for *E.coli* and fecal coliform conducted by LACSD in San Jose Creek Reach 1

Site Name	*E. coli*			Fecal Coliform		
	No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance	No. of Sample	No. of Samples Exceeding 400 MPN/100ml	Percent Exceedance
Pom-RA	117	8	7%	176	22	13%
Pom-RC	144	43	30%	235	104	44%
Pom-RD	142	68	48%	236	136	58%
SJC-C1	114	77	68%	117	76	65%
SJC-C2	116	48	41%	118	54	46%
Overall	633	244	39%	882	392	44%

San Jose Creek Reach 1 has also been monitored by SGRRMP at one site (SGLT102) from May 2007 to August 2012 and by SCCWRP from October 2013 to February 2014 for *E. coli*. The results are summarized in Table 2-16. Results suggest that a high percentage of exceedances occurs for *E. coli*.

Table 2-16. Summary of single sample exceedance for *E.coli* conducted by SGRRMP and SCCWRP in San Jose Creek Reach 1

Site Name	Season	E. coli		
		No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance
SGLT102	May/07 – Feb/14	142	136	96%
	Wet days	11	11	100%
	Dry days	131	125	95%

2.3.9 Coyote Creek

Long Beach (LB) WRP discharges tertiary treated wastewater into Coyote Creek. LACSD monitors indicator bacteria monthly at two sites (LB-R-A-1 and LB-R-A) in receiving water as part of its NPDES permits. LB-R-A-1 is located upstream of LB WRP's discharge outfall, and LB-R-A is located downstream of the discharge from LB WRP. The samples were collected from November 2007 to May 2014 for *E. coli*, and from September 2002 to May 2014 for fecal coliform. The results are summarized in Table 2-17.

Table 2-17. Summary of single sample exceedance for *E.coli* and fecal coliform conducted by LACSD in Coyote Creek

Site Name	E. coli			Fecal Coliform		
	No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance	No. of Sample	No. of Samples Exceeding 400 MPN/100ml	Percent Exceedance
LB-R-A-1	79	44	56%	294	225	77%
LB-R-A	79	27	34%	294	162	55%
Overall	158	71	45%	588	387	66%

In compliance with the MS4 permit, LACDPW conducts a monitoring program that includes one mass emission station (S13) in Coyote Creek. The S13 monitoring station is located at the existing Army Corps of Engineers stream gage station (Stream Gage F354-R) below Spring Street. Grab samples for bacteria were taken in the receiving water. Available monitoring data (*E. coli*: from October 2012 to March 2014; fecal coliform: from November 2006 to March 2014) are summarized in Table 2-18. The monitoring data are further separated into wet and dry weather periods. Results show that the impairments are caused by both *E. coli* and fecal coliform in Coyote Creek.

Table 2-18: Summary of single sample exceedance for *E.coli* and fecal coliform conducted by LACDPW in Coyote Creek.

Site	Season	*E. coli*			Fecal Coliform		
	(Waterbody)	No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance	No. of Sample	No. of Samples Exceeding 400 MPN/100ml	Percent Exceedance
S13	**(Reach 2)**	**14**	**12**	**86%**	53	44	83%
S13	Wet Days	10	10	100%	34	33	97%
S13	Dry Days	4	2	50%	19	11	58%

Coyote Creek has also been monitored by SGRRMP from May 2007 to August 2012 and by SCCWRP from October 2013 to February 2014 at two sites (SGLT100 and SGLT104) for *E. coli*. The results are summarized in Table 2-19. The number of exceedances for *E. coli* exceeds the minimum number of exceedances required for listing.

Table 2-19: Summary of single sample exceedance for *E.coli* conducted by SGRRMP and SCCWRP in Coyote Creek.

Site Name	Season	*E. coli*		
		No. of Sample	No. of Samples Exceeding 235 MPN/100ml	Percent Exceedance
SGLT104	May/07 – Feb/14	143	43	30%
	Wet days	11	10	91%
	Dry days	132	33	25%
SGLT100	May/07 – Feb/14	143	79	55%
	Wet days	11	11	100%
	Dry days	132	68	52%

Based on the data collected by LACSD, LADPW, SGRRMP, and SCCWRP, Los Angeles Water Board staff finds that Coyote Creek is impaired for *E. coli*.

In summary, all listed reaches in SGR are still impaired by indicator bacteria. Recent data also indicate that Big Dalton Wash and San Gabriel River Estuary are impaired by indicator bacteria; therefore, Big Dalton Wash and San Gabriel River Estuary are included as impaired reaches that are addressed by this TMDL.

3 NUMERIC TARGETS

The SGR Bacteria TMDL has a multi-part numeric target based on the bacteriological water quality objectives for marine and fresh waters to protect the REC-1 beneficial use. Both single sample and geometric mean limits apply.

The numeric targets in the SGR Bacteria TMDL are consistent with the Basin Plan bacteria objectives to protect REC-1 in fresh and marine waters. All applicable numeric targets are contained in Table 3-1.

Table 3-1: Numeric Targets for SGR Estuary and SGR and its Tributaries

Numeric Targets	Estuary (Marine REC-1)	SGR & its Tributaries (Freshwater REC-1)
Single Sample		
E. coli	NA	235/100ml
Fecal coliform	400/100ml	NA
Enterococcus	104/100ml	NA
Total coliform*	10,000/100ml	NA
Geometric mean		
E. coli	NA	126/100ml
Fecal coliform	200/100ml	NA
Enterococcus	35/100ml	NA
Total coliform	1,000/100ml	NA

*Total coliform density shall not exceed 1,000/100 ml, if the ratio of fecal-to-total coliform exceeds 0.1.

NA: not applicable.

To implement the single sample bacteria objectives for waters designated REC-1, and to set allocations based on the single sample targets, an allowable number of exceedance days is set for marine and fresh waters.

3.1 Alternative Targets Considered

Three alternatives were considered for developing the appropriate numeric targets to achieve the water quality standards:

(1) strict application of the water quality objectives as listed in the Basin Plan with no allowable exceedance frequency,
(2) the Natural Sources Exclusion Approach, and

(3) the Reference System/Antidegradation Approach with specific exceedance day frequencies. The factors considered when selecting the recommended alternative included:

- Consistency with state and federal water quality laws and policies,
- Level of beneficial use protection,
- Consistency with current science regarding water quality necessary to protect the beneficial uses, and
- Practicability for the San Gabriel River watershed.

3.2 Recommended Alternative

Some of these alternatives recognize that there are natural sources of bacteria, which may cause or contribute to exceedances of the water quality objectives for bacteria indicators (Schiff et al., 2005). The Los Angeles Water Board acknowledges in the implementation provisions for the bacteria objectives in the Basin Plan that it is not the intention of the Los Angeles Water Board to require treatment or diversion of natural water bodies or to require treatment of natural sources of bacteria from undeveloped areas.

For this TMDL, alternative (3) is the recommended alternative because this alternative allows the Los Angeles Water Board to avoid imposing requirements to divert natural coastal creeks or treat natural sources of bacteria from undeveloped areas. This approach includes allowable exceedance levels during dry weather and wet weather and is consistent with that used in other bacteria TMDLs previously approved in this region. The number of allowable exceedance days is based on the lesser of two criteria: (1) bacteriological water quality at any site is at least as good as at a designated reference site, and (2) there is no degradation of existing bacteriological water quality if historical water quality at a particular site is better than the designated reference site. Applying these two criteria allows the Los Angeles Water Board to avoid imposing requirements to treat natural sources of bacteria from undeveloped areas. The geometric mean targets must be strictly adhered to and may not be exceeded at any time.

The recommended numeric targets will be assessed as the allowable number of single sample exceedance days for each site as well as attainment of the geometric mean objectives because both are relevant to public health. The U.S. EPA allows states to select the most appropriate measure to express the TMDL. According to U.S. EPA in its previous approvals of bacteria TMDLs that followed this approach, allowable exceedance days are considered an "appropriate measure" consistent with the definition in 40 CFR §130.2(i). The number of allowable exceedance days is calculated from reference reaches while observing strict antidegradation policies. Targets will apply at compliance monitoring locations (17 CCR §7961(b)).

Alternative 1 requires strict application of the water quality objectives as listed in the Basin Plan with no allowable exceedances. This alternative is not recommended. Strict application of objectives would fail to consider natural sources of bacteria and required treatment in excess of natural water quality levels.

Alternative 2 is a natural sources exclusion approach. Based on the implementation provisions for the bacteria objectives contained in the Basin Plan, this approach requires an identification and quantification of naturally-occurring sources of bacteria. Additionally, prior to applying this implementation approach, all anthropogenic sources must be controlled such that they do not cause or contribute to exceedances of the bacteria objectives. Once quantified, natural source levels become the baseline bacteria level. The exceedances caused by natural sources are used to quantify the allowable exceedance frequency. However, information sufficient to quantify all naturally occurring sources of indicator bacteria in the SGR watershed does not exist at this time.

3.3 Wet Weather

Wet weather is defined as days with 0.1 inch of rain or more plus three days following the rain event. REC-1 uses associated with the "swimmable" goal as expressed in the federal Clean Water Act are suspended through the High Flow Suspension (HFS) Basin Plan Amendment (LARWQCB, 2003b), which is applied to certain reaches and tributaries that are concrete-lined channels during days with greater than or equal to 0.5 inch of rain and the following 24 hours. Table 3-2 includes the waterbodies in the San Gabriel River watershed that are subject to the HFS.

Table 3-2: SGR Reaches and Tributaries High Flow Suspension (HFS)

Stream Reach	High Flow Suspension
San Gabriel River Estuary	No
Coyote Creek	Yes
Coyote Creek North Fork	Yes
San Gabriel River Reach 1	Yes
San Gabriel River Reach 2	Yes
San Gabriel River Reach 3	Yes
San Jose Creek Reach 1	Yes
San Jose Creek Reach 2	Yes
Puente Creek	No
Walnut Creek Wash	No
Big Dalton Wash	Yes

4 SOURCE ASSESSMENT

This section identifies the potential sources of bacteria in the San Gabriel River watershed. In the context of TMDLs, pollutant sources are categorized as either point sources or nonpoint sources. A point source as defined in the Clean Water Act means any discernible, confined and discrete conveyance, including, but is not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged (40 CFR 122.2). These types of discharges are regulated through a National Pollutant Discharge Elimination System (NPDES) permit, typically issued in the form of State Waste Discharge Requirements (WDRs) by the Los Angeles Water Board. Discharges of stormwater and non-stormwater through municipal separate storm sewer systems (MS4s) are point sources per the Clean Water Act.

Nonpoint sources originate from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. The term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act. Discharges from irrigated agriculture, for example, are nonpoint sources.

4.1 Point Sources

Many point sources to the San Gabriel River and its tributaries are permitted by the Los Angeles Water Board. The NPDES permits in the SGR watershed include municipal separate storm sewer system (MS4) permits, the California Department of Transportation (Caltrans) storm water permit, general construction storm water permits, general industrial storm water permits, major NPDES permits (including publicly owned treatment works), minor NPDES permits, and general NPDES permits. The permits under the jurisdiction of the Los Angeles Regional Water Board are presented in Table 4-1. However, the upper portion of Coyote Creek located in San Bernardino County and Orange County and a portion of the watershed draining to the estuary located in Orange County are under the jurisdiction of the Santa Ana Regional Water Board.

Table 4-1. Summary of Los Angeles Water Board issued NPDES Permits in the San Gabriel River Watershed

Permit Type	Number of Permits
MS4 Permits	2
Caltrans Storm Water Permit	1
General Industrial Storm Water Permits	526
General Construction Storm Water Permits	203
Publicly Owned Treatment Works (POTW)	5
Major Individual NPDES Permits	2
Minor Individual NPDES Permits	6
General NPDES Permits	81

4.1.1 MS4 Permits

Discharges of stormwater and non-stormwater from MS4s to the San Gabriel River and its tributaries are regulated as a point source discharge under NPDES MS4 permits. Stormwater is runoff from rain or snow melt that runs off surfaces such as rooftops, paved streets, highways or parking lots and can carry with it pollutants such as: sediment, trash, and bacteria. The runoff can then drain directly into a local stream or lake. Non-stormwater discharges such as excess landscape irrigation, sidewalk wash water, etc. from urban activities are also conveyed by MS4s to waterbodies. Generally the stormwater and non-stormwater runoff drains into storm drains, which convey the untreated runoff into a local waterbody.

There are currently four Phase I MS4 permits that cover discharges in the San Gabriel River watershed. The County of Los Angeles MS4 Permit was recently reissued on November 8, 2012 (Order No. R4-2012-0175) and became effective on December 28, 2012. There are 86 co-permittees covered under this permit including 84 cities and the County of Los Angeles and Los Angeles County Flood Control District (LACFCD). The permittees in the San Gabriel River subwatershed include 32 cities along with the County of Los Angeles and LACFCD. The City of Long Beach MS4 Permit was renewed on February 6, 2014 as Order No. R4-2014-0024 and became effective on March 28, 2014. This permit solely covers the City of Long Beach's MS4 discharges. In the Santa Ana Region, the Orange County MS4 Permit (Order No. R8-2009-0030 as amended by R8-2010-0062) applies to 26 incorporated cities, the County of Orange, and the Orange County Flood Control District. The San Bernardino County MS4 Permit (Order No. R8-2010-0036) applies to 16 incorporated cities the County of San Bernardino, and the San Bernardino County Flood Control District.

There is currently one statewide Phase II Small MS4 General Permit (Order No. 2013-0001 DWQ) issued by the State Water Board. The permit names two permittees that are located in the San Gabriel River watershed: California State Polytechnic University Pomona and Lanterman Developmental Center. The Water Boards may designate additional Phase II MS4 permittees in the future.

There are many sources of indicator bacteria to the MS4s. Discharges from MS4s are the primary source of bacteria to SGR in both dry and wet weather (Ackerman et. al., 2005 and Grifith et al., 2014.)

In September 2002 and September 2003, SCCWRP conducted monitoring in the San Gabriel River watershed to examine flow distribution and water quality conditions throughout the San Gabriel River and its tributaries (Ackerman et al., 2005). The first monitoring period took place on September 29 and 30, 2002, and the second was on September 14 through 16, 2003. Both monitoring periods represent a snapshot of typical low-flow conditions. Analysis of the September 2002 and September 2003 low-flow measurement periods demonstrated that all sources of flow and loading were from point source discharges or inflows from the MS4. SCCWRP identified 67 active MS4 non-stormwater discharges to the San Gabriel River and its tributaries during the September 29-

30, 2002 event. Of these active non-stormwater MS4 discharges, 14 were located on the San Gabriel River, 18 in Coyote Creek, 28 in San Jose Creek, and 7 in Walnut Creek. During the September 14-16, 2003 monitoring effort, SCCWRP identified 73 active non-stormwater MS4 discharges. Of these, 10 were located in San Gabriel River, 16 were located in Coyote Creek, 33 were located in San Jose Creek, and 14 were located in Walnut Creek. This study resulted in the following major findings: Almost all bacteria loading was contributed by storm drains. Nearly 80% of measured flow in the San Gabriel River watershed was from the WRPs during both surveys. Over 80% of the storm drains discharged at rates less than 1 cubic foot per second, with approximately 5 storm drains accounting for the majority of non-stormwater MS4 discharge. Bacteria concentrations were generally high throughout all stream reaches, with no apparent spatial pattern. Water quality from the storm drains exceeded water quality standards for bacteria in 98% of samples.

The 2014 SCCWRP study also examined the contribution of stormwater and non-stormwater urban runoff (Griffith et al., 2014). In the study, all storm drains, in addition to samples from other locations that exceeded fecal indicator bacteria objectives, were analyzed for the human fecal marker, HF183. In the lower San Gabriel River watershed, fecal indicator bacteria concentrations often exceeded water quality objectives, and frequently contained detectable levels of HF183. The results of this study suggest that storm drains are a source of fecal indicator bacteria and human fecal markers, regardless of weather conditions.

4.1.2 Caltrans Storm Water Permit

Discharges from roadways under the jurisdiction of Caltrans are regulated by a statewide storm water discharge permit that covers all municipal stormwater activities, maintenance facilities, and construction activities (State Board Order No. 2012-0011-DWQ, NPDES Permit No. CAS000003). The Caltrans storm water permit authorizes storm water discharges from Caltrans properties such as the state highway system, park and ride facilities, and maintenance yards. The storm water discharges from most of these Caltrans properties and facilities eventually end up in a municipal owned, county owned, or flood control district owned MS4, which then discharges to SGR.

4.1.3 General Storm Water Permits

In 1990, U.S. EPA issued regulations for controlling pollutants in stormwater discharges from industrial sites (40 CFR Parts 122, 123, and 124) equal to or greater than five acres. The regulations require discharges of stormwater associated with industrial activity to obtain an NPDES permit and to implement Best Available Technology Economically Achievable (BAT) to reduce or prevent pollutants associated with industrial activity. On April 17, 1997, the State Water Resources Control Board (State Water Board) issued a statewide general NPDES permit for Discharges of Stormwater Associated with Industrial Activities Excluding Construction Activities Permit (Order No. 97-03-DWQ, NPDES Permit No. CAS000001). Order No. 97-03-DWQ expires on June 30, 2015 and will be superseded on July 1, 2015 by Order No. 2014-0057-DWQ, which was adopted on April 1, 2014. As of the writing of the TMDL, there are approximately 526 dischargers enrolled under the general industrial storm water permit in the portion of the San Gabriel River watershed in the Los Angeles Region.

The State Water Board first issued a statewide general NPDES permit for Discharges of Stormwater Runoff Associated with Construction Activities on August 19, 1999. The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP must list Best Management Practices (BMPs) the discharger will use to protect storm water runoff and the placement of those BMPs. The permit was reissued on September 2, 2009 (Order No. 2009-0009-DWQ, NPDES Permit No. CAS000002). The permit has been amended on July 17, 2012 (Order No. 2012-0006-DWQ). As of the writing of this TMDL, there are 203 dischargers enrolled under the general construction storm water permit in the portion of San Gabriel River watershed in the Los Angeles Region.

4.1.4 Publicly Owned Treatment Works (POTWs)

The Sanitation Districts of Los Angeles County (LACSD) Joint Outfall System is an integrated network of facilities that includes seven treatment plants, five of which are located in the San Gabriel River Watershed. These five (5) treatment plants are the Long Beach Water Reclamation Plant (WRP), Los Coyotes WRP, Pomona WRP, Whittier Narrows WRP, and San Jose Creek WRP.

- The most upstream plant is the Pomona WRP (Order No. R4-2014-0212). It has a design capacity of 15 million gallons per day (MGD) and discharges tertiary-treated municipal and industrial wastewater to the South Fork of San Jose Creek. During dry weather, virtually all of the treated effluent is reclaimed for landscape and crop irrigation, as well as for industrial processes.
- The San Jose Creek WRP (Order No. R4-2009-0078) has a design capacity of 100 MGD. It discharges an average of 80 MGD of tertiary-treated municipal and industrial wastewater via three discharge points. Discharge No. 001 to San Gabriel River Reach 1, located eight miles south of the plant near Firestone Blvd., is the primary discharge outfall for both east and west plants. The river is concrete-lined from the discharge point to the Estuary, about nine miles downstream. A turnout located approximately midway down the pipe is used to divert reclaimed water to spreading grounds. Discharge No. 002 to San Jose Creek is used for groundwater recharge at Rio Hondo and the San Gabriel Coastal Spreading Grounds. San Jose Creek is unlined from the discharge point to the San Gabriel River. Discharge No. 003 delivers treated effluent to the unlined portion of the San Gabriel River Reach 3 as well as the Rio Hondo and San Gabriel Coastal Spreading Grounds.
- The Whittier Narrows WRP (Order No. R4-2009-0077) has a design capacity of 15 MGD. There is one discharge point to the San Gabriel River. Discharge No. 001 discharges to the river about 700 feet upstream from the Whittier Narrows Dam. The tertiary-treated municipal and industrial wastewater generally flows down the river to the San Gabriel River Spreading Grounds.

- The Los Coyotes WRP (Order No. R4-2007-0048) has a design capacity of 37.5 MGD. Tertiary-treated municipal and industrial wastewater is discharged into the San Gabriel River Reach 1, 1,230 feet upstream of the Artesia freeway. About 12% of the total treated effluent is reclaimed for irrigation.

- The Long Beach WRP (Order No. R4-2007-0047) has a design capacity of 25 MGD. Tertiary-treated municipal and industrial wastewater is discharged to Coyote Creek at a point 2,200 feet upstream from the confluence with the San Gabriel River, above the Estuary. A portion of the treated effluent is reclaimed for irrigation.

Each of these five WRPs has an effluent limit of 2.2 MPN/100 mL for bacteria, which is well below the levels necessary to protect the REC-1 beneficial use. Consequently, the WRPs are not considered to be a source of exceedances of the bacteria water quality objectives in the river.

Sanitary Sewer Overflows (SSOs) and exfiltration from sewer systems has been identified by U.S. EPA as a potential source of pathogens in surface water (U.S. EPA 2000b and 2001). SSOs are addressed through enforcement actions such as Administrative Civil Liabilities (ACLs) and Cease and Desist Orders (CDOs). To provide a consistent, statewide regulatory approach to address SSOs, the State Water Resources Control Board (State Water Board) adopted Statewide General Waste Discharge Requirements (WDRs) for Sanitary Sewer Systems, Water Quality Order No. 2006-0003 (Sanitary Sewer Systems WDR) on May 2, 2006. The Sanitary Sewer Systems WDR requires public agencies that own or operate sanitary sewer systems to develop and implement sewer system management plans and report all SSOs to the State Water Board’s online SSO database.

4.1.5 Major Individual NPDES Permits

Major discharges are POTWs with yearly average flows over 0.5 MGD, industrial sources with yearly average flows over 0.1 MGD, and those with lesser flows but with acute or potential adverse environmental impacts. In addition to the POTWs, there are two major discharges in the watershed, the Haynes generating station, operated by the City of Los Angeles Department of Water and Power (LADWP) and the Alamitos generating station operated by AES Alamitos, L.L.C. Both plants draw in water from the nearby Los Cerritos Watershed Management Area and discharge into the tidal prism just north of Second St. (Westminster Ave). The Alamitos plant draws in water from Los Cerritos Channel and is permitted to discharge up to 1,283 MGD. The Haynes plant draws in water from Alamitos Bay and is permitted to discharge up to 1,014 MGD. Currently, the Alamitos and Haynes stations have no limits for bacteria and are not considered significant sources of bacteria to the watershed.

4.1.6 Minor Individual NPDES Permits

Minor discharges are all other discharges that are not categorized as a Major. Many of these permits are for episodic discharges rather than continuous flows. Minor permits cover miscellaneous wastes such as de-chlorinated filter backwash, treated storm water runoff, animal wastewater, and treated groundwater. Some of these permits contain effluent limits for bacteria. There are six (6) minor NPDES permits in the San Gabriel River watershed.

4.1.7 General NPDES Permits

Pursuant to 40 CFR parts 122 and 123, the State Water Board and the Regional Water Boards have the authority to issue general NPDES permits to regulate a category of point sources if the sources: involve the same or substantially similar types of operations; discharge the same type of waste; required the same type of effluent limitations; and require similar monitoring. The Regional Water Boards have issued general NPDES permits in the San Gabriel River watershed for non-process wastewater, construction dewatering, industrial wastewater, petroleum fuel cleanup sites, and volatile organic compounds (VOCs) cleanup sites. Currently, there are approximately 81 general NPDES permits issued in the San Gabriel River watershed. The State Water Board has issued a statewide general permit for drinking water system discharges (Order WQ 2014-0194-DWQ). Discharges associated with non-process wastewater, petroleum fuel cleanup sites, volatile organic compounds (VOCs) cleanup sites, and hydrostatic test water do not typically require monitoring for bacteria and are not considered significant sources of bacteria to the watershed. Construction dewatering, potable water, and industrial wastewater typically are required to monitor for bacteria under their permits.

4.2 Nonpoint Sources

Nonpoint sources of bacteria in the SGR watershed may include inputs from, but are not limited to, the natural landscape, onsite wastewater treatment systems, horses and livestock, and irrigated agriculture lands. This section provides a discussion of each potential source.

4.2.1 Natural Sources

Natural sources of indicator bacteria are accounted for under the reference system approach for bacteria, and the targets for this TMDL allow for occasional exceedances due to natural sources. Natural sources may be conveyed by the MS4 but are still given an allowable number of exceedance days.

The dataset used to develop the targets for this TMDL included data from a SCCWRP study called Fecal Indicator Bacteria in Reference Streams (Technical Report 542; Tiefenthaler et al., 2008). This dataset included sites representing a wide range of geological, hydrological, and biological conditions, and included samples from the headwaters of Arroyo Seco, which drain a portion of the Angeles National Forest. This is the only available data for natural runoff in the vicinity to the San Gabriel River watershed. The samples from the Arroyo Seco reference site located in Los Angeles River watershed exhibited a low rate of bacterial exceedance during dry weather - as was also observed in other natural areas in the same study. Dry weather concentrations of *E. coli* at the Arroyo Seco headwater site were orders of magnitude lower than those found in the San Gabriel River mainstem or any of its tributaries. The median *E. coli* concentration from the Arroyo Seco headwaters was non-detect (<10 MPN/100mL). Therefore, runoff from the hills of the watershed likely only contributes a very small portion of the dry weather bacteria loading.

Monitoring data from SGRRMP (Table 2-4) and SCCWRP (Table 2-5) collected at swimmable sites in the upper watershed, which is primarily undeveloped open space, indicate that open space loading is not a significant source of bacteria to SGR. SGRRMP results showed that the correlations were poor between the numbers of people, dogs, and birds observed and *E. coli* concentrations (CWH, 2010). The SGRRMP report found that the higher exceedance frequency of *E. coli* during wet-weather period (18%) is likely due to stormwater runoff which carries sediment, and which may serve as a reservoir and growth media for bacteria. The SCCWRP study (Griffith et al., 2014) found a low exceedance frequency of *E. coli* (4.0% to 9.0%) and no detectable levels of human associated fecal marker during the winter sampling season, regardless of the weather condition (dry or wet).

4.2.2 Septic Systems

The majority of sanitary sewer discharges in the watershed are to sanitary sewer collection systems and to a WRP; however onsite wastewater treatment systems (OWTS), also known as septic systems, are also still in use. OWTS are typically designed to treat small quantities of sewage waste typically from a single residence or small business. Many of the septic systems installed today are for parcels where sewer services are not readily available. Correctly sited, operated, and maintained OWTS are highly effective at removing bacteria. However, failure rates have been estimated as high as 20% to 30% in the Malibu Creek watershed (LARWQCB, 2004b). Failures have been attributed to improper siting, design, and maintenance. OWTS can be significant sources of bacteria when the systems provide inadequate treatment and discharge directly to groundwater in close proximity to surface waters or discharge directly to surface water via overland flow. With the current lack of information regarding the exact location and number of operating septic systems, and number of failed septic systems, it is difficult to quantify the bacteria loading associated with septic systems to the watershed, but they are considered potential sources and are assigned LAs.

4.2.3 Golf Course

Golf courses are a potential source of bacteria since, typically, fertilization and watering rates are high. Golf courses also attract large numbers of birds. The bacteria may be transported to waterways by irrigation and stormwater runoff. Most of the golf courses in the SGR watershed are adjacent to waterways. There are 11 golf courses in San Gabriel River watershed (Google map, 2015). Based on available data, the contribution from golf courses cannot be quantified, but they are considered potential sources and are assigned LAs.

4.2.4 Horse and Livestock

Manure produced by horses, cattle, sheep, and goats in the SGR Watershed is a source of both nutrients and fecal coliform bacteria. In the SGR watershed, there are about 1594 acres of horse ranches. These areas were obtained from 2005 Southern California Association of Governments land use data. There are low-density residential properties within the watershed with horses located on the properties. The horse-related activities on these residential properties are not accounted for in the estimation of horse ranch acreage in the watershed. The actual area of horse-impacted land uses may be greater than 1594 acres. About 13.7 acre of dairy/intensive livestock is located in the SGR watershed. Bacteria loads can be introduced directly to the receiving waters in the case of livestock wading in streams, or may occur as nonpoint sources during stormwater runoff. Based on available data, the contribution from horses and livestock cannot be quantified, but they are considered potential sources and are assigned LAs.

4.2.5 Irrigated Lands

Irrigated lands are another source of bacteria. Bacteria sources from irrigated lands may include irrigation with bacteria-polluted water, application of manure, and wild animals living on irrigated lands. Nonpoint source discharges from irrigated lands tend to contain higher quantities of nutrients like nitrogen and phosphorus, which promote bacterial growth. There were no requirements for monitoring discharges from agricultural lands before 2005. On November 3, 2005, the Los Angeles Water Board adopted a Conditional Waiver for Discharges from Irrigated Lands (Order No. R4-2005-0080). The Conditional Waiver was renewed on November 19, 2010 (Order No. R4-2010-0186). Currently, there are no water quality benchmarks for bacteria in the Irrigated Lands Conditional Waiver program. However, the dischargers enrolled in the Conditional Wavier were required by Order No. R4-2010-0186 to conduct a Bacteria Special Study to characterize potential discharges of bacteria from irrigated agriculture lands. Based on the results of that study it was determined that irrigated agricultural lands are a source of bacteria and are assigned LAs.

4.3 Summary of Source Assessment

Based on available data shown in section 2.3, surface runoff (stormwater and non-stormwater discharges) from urbanized areas conveyed via the MS4 is a significant source of bacteria to the SGR and its tributaries. Mass emissions data collected under the Los Angeles County MS4 Permit show elevated levels of bacteria in the river. SCCWRP's data from storm drains and channels draining urban areas also show elevated levels of bacteria, indicating that urban areas are the primary source of bacteria to SGR and its tributaries. Data from throughout the Los Angeles Region further demonstrate that bacteria concentrations are significantly greater in developed areas.

The monitoring data show that bacteria loadings from WRPs are significantly less than stormwater loadings. Based on mass emission station data, watershed-wide monitoring data, and SCCWRP's studies, the Los Angeles Water Board staff concludes that stormwater and non-stormwater runoff from urban areas served by the storm drain system (MS4s) is a significant source of bacteria. Storm drain system discharges may have elevated levels of bacteria indicators due to sanitary sewer leaks and spills, illicit connections of sanitary sewer lines to the storm drain system, runoff from homeless encampments, pet waste, and illegal discharges from recreational vehicle holding tanks, among others. Other point sources were analyzed and found to be less significant or there were not enough data to quantify their contribution. Existing point source discharges that have permits containing effluent limits for bacteria will continue to have effluent limits for bacteria. Existing point source discharges that do not have effluent limits for bacteria in their permits are not assigned WLAs. Any future point source discharges must be evaluated to determine whether reasonable potential exists for the discharge to be a source of bacteria that could cause or contribute to an exceedance of the applicable water quality standards. If reasonable potential analysis (RPA) during permitting process does not indicate reasonable potential then effluent limits do not need to be included in the permit. All nonpoint sources are assigned LAs.

5 LINKAGE ANALYSIS

The source analysis in this report showed that non-stormwater and stormwater discharges, both conveyed by MS4s, are the primary sources of elevated bacterial indicator densities to the San Gabriel River and its tributaries during dry- and wet-weather periods. Certain concepts of the linkage analysis for this TMDL are the same, or similar to, the other bacteria TMDLs in Los Angeles Region. The linkage between the numeric targets and the allocations is supported by the following findings:

1. In Southern California, in dry weather, non-stormwater discharges from urban areas are significant sources of bacteria that principally drive exceedances (LARWQCB, 2002a; 2003b; 2004).

2. In Southern California, in wet weather, stormwater runoff from watershed sources conveyed through MS4s principally causes the bacteria exceedances (LARWQCB, 2002b; 2003b; 2004).

3. Based on three experiments conducted by Noble et al. (1999) to mimic natural conditions in or near Santa Monica Bay (SMB), two in marine water and one in fresh water, bacteria degradation was shown to range from hours to days. Based on the results of the marine water experiments, a first-order decay rate for bacteria of 0.8 d^{-1} (or 0.45 per day) is assumed. Degradation rates were shown to be as high as 1.0 d^{-1} (Noble et al., 1999). These studies show that bacterial degradation and dilution during transport through the watershed do not significantly affect bacterial indicator densities in receiving waters.

Therefore, loading capacity for the San Gabriel River and its tributaries is defined in terms of bacterial indicator densities and is equivalent to the numeric targets in Section 3. This is consistent with the approach used in other Los Angeles Region bacteria TMDLs.

5.1 Critical Condition

The critical condition in a TMDL defines a worst-case condition for the purpose of setting allocations to meet the TMDL numeric target. While a separate element of the TMDL, it may be thought of as an additional margin of safety such that the allocations are set to meet the numeric target during conditions when either pollutant loading is highest (for some pollutants such as bacteria) or when dilution is lowest.

Unlike many TMDLs where the critical condition is during low-flow conditions or summer months, the critical condition for bacteria loading is during wet-weather periods. This is because intermittent or episodic loading from sources such as urban runoff can have maximal impacts at high (i.e., storm) flows (U.S. EPA, 2001). Local and Bight-wide shoreline monitoring data show a higher percentage of daily exceedance of the single sample targets during wet weather, as well as more severe bacteriological impairments indicated by higher magnitude exceedances and exceedances of multiple indicators (Noble et al., 2000, Schiff et al., 2001). This also appears to be the case for the SGR and its tributaries based on the data review in Section 2.3.

The Santa Monica Bay Beaches Bacteria TMDL identified the critical condition within wet weather more specifically, in order to set the allowable number of daily exceedances of the single sample targets. The 90th percentile storm year in terms of wet days was used as the reference year. The 90th percentile year was selected for several reasons. First, selecting the 90th percentile year avoids an untenable situation where the reference system is frequently out of compliance. Second, selecting the 90th percentile year allows responsible jurisdictions and responsible agencies to plan for a 'worst-case scenario', as a critical condition is intended to do. Finally, the Regional Water Board expects that there will be fewer exceedance days in drier years, since structural controls will be designed for the 90th percentile year. The same approach will be used to determine the critical year for this TMDL.

The 90th percentile storm year in terms of wet days was identified by constructing a cumulative frequency distribution of annual wet weather days using historical rainfall data. This means that only 10% of years should have more wet days than the 90th percentile year. The number of wet days was selected instead of total rainfall because a retrospective evaluation of data showed that the number of sampling events during which greater than 10% of samples exceeded the fecal coliform objective on the day after a rain was nearly equivalent for rainstorms less than 0.5 inch and those greater than 0.5 inch, concluding that even small storms represent a critical condition (Noble et al., 2000). This is particularly true since the TMDL's numeric target is based on number of days of exceedance, not on the magnitude of the exceedance.

The 90th percentile storm year in terms of wet days was identified by constructing a cumulative frequency distribution of annual wet weather days based on the analysis of historical rainfall data from 30 rain gauge stations in the SGR watershed (LACPDW, 2015). These stations are consistent with those used in the Los Angeles County Flood Control District's Watershed Management Modeling System (WMMS) and the data spanned from January 1986 to April 2012. With a 90th percentile storm year, only 10% of years should have more wet days than the 90th percentile year. Based on the LACDPW's analysis, rain gauge stations D89, D287, and 47776 are determined to be representative of the watershed. Data from Station D89 is recommended because the rainfall data will be readily available and accessible to all the TMDL stakeholders. The 90th percentile year in terms of wet days was 1994, which had 87 wet days.

5.2 Margin of Safety

An implicit margin of safety was assumed by directly applying the numeric water quality objectives set to protect the water contact recreation (REC-1) beneficial use and the associated implementation procedures as WLAs. This ensures that there is little uncertainty about whether meeting the TMDLs will result in meeting the water quality standards. An implicit margin of safety is incorporated in the allocations through the use of a conservative assumption of zero (0) bacterial decay in discharges from storm drains to the receiving water when determining compliance with allocations.

6 POLLUTANT ALLOCATIONS AND TMDLs

Waste Load Allocations (WLAs) are allocations of bacteria loads to point sources and Load Allocations (LAs) are allocations of bacteria loads to nonpoint sources. WLAs and LAs are expressed as the number of daily or weekly sample days that may exceed single sample targets at appropriate monitoring sites. WLAs and LAs are expressed as allowable exceedance days because the bacteria density and frequency of single sample exceedances are the most relevant to public health protection. Allowable exceedance days are "appropriate measures" consistent with the definition in 40 CFR §130.2(i).

6.1 Selection of Reference Systems

The reference system approach is based on a statistical analysis of the historical exceedance frequency observed at a reference system. The allowable number of exceedance days is based on the historical exceedance frequency in the reference system (expressed as a percentage) multiplied by the number of dry- and wet-weather days in the 90th percentile year (in terms of wet-weather days). In determining an appropriate reference system for the San Gabriel River watershed, staff considered technical reports prepared as part of the development of the recently adopted Bacteria TMDLs in Los Angeles Region.

The Southern California Coastal Water Research Program (SCCWRP) has conducted monitoring and analysis of freshwater reference sites throughout southern California. The monitoring was conducted from the fall of 2004 to the spring of 2007. This monitoring was summarized in three studies, which include "Assessment of Water Quality Concentrations and Loads from Natural Landscapes" (Stein and Yoon, 2007: Technical Report 500), "Fecal Indicator Bacteria (FIB) Levels During Dry Weather from Southern California Reference Streams" (Tiefenthaler et al., 2008; Technical Report 542), and "Microbiological Water Quality at Beaches in Southern California During Wet Weather" (Schiff et al., 2005; Technical Report 448).

The selection of reference sites in these studies was based on four criteria: 1) the sites have no less than 95% undeveloped drainage area; 2) the sites possess a "relatively homogeneous setting"; 3) the sites have "year-round or prolonged dry weather flow"; and 4) the sites are located in watersheds that have not experienced fire during the previous three years. Of the sites sampled in the FIB Reference Stream Study, three sites (i.e., Cheseboro Creek, Cajon Creek, and Stone Creek) were deemed minimally impacted; as such, data from these three sites were excluded. For example, Cheseboro Creek was subject to a fire and has heavily-used trails and Cajon Creek is nearby a major highway. Stone creek was found to have 27.5% disturbed land use in its drainage area, including agricultural and rural residential uses. These sites were re-categorized as "minimally impacted" by SCCWRP during data processing because conditions led them to having worse water quality than reference sites. The resulting data were compiled and used as the basis for determining the reference watershed exceedance probability for the single sample *E. coli* objective during dry weather and wet weather (see Table 6-1). The dry-weather exceedance probability is the probability that the single sample objective will be exceeded on a dry-weather day at a particular location. The wet-weather exceedance probability is the probability that the single sample objective will be exceeded on a wet-weather day at a particular location.

Staff analyzed the raw data for the above three studies and the exceedance probability for *E. coli* was applied to all the fecal indicator objectives. The raw data used to calculate the exceedance probabilities are presented in Appendix A. These exceedance probabilities have also been used in the recently adopted Los Angeles River Watershed and Santa Clara River Estuary and Reaches 3, 5, 6 and 7 Bacteria TMDLs, and the revision of five Bacteria TMDLs in the Los Angeles Region.

Table 6-1. Estimated exceedance probabilities for the freshwater reference system for the San Gabriel River and tributaries

Single Sample *E. coli* Exceedance Probability		
Water Quality Objective (bacterial density/100 mL)	Dry Weather Exceedance Probability	Wet Weather Exceedance Probability
235 /100 mL	0.016	0.19

For the San Gabriel River Estuary, the exceedance probabilities for the single sample marine objectives remained based on the Leo Carrillo beach exceedance probabilities. The exceedances probabilities at Leo Carrillo are 22% for wet weather, 10.4% for winter dry-weather, and 0% for summer dry-weather. This also keeps the three time periods for determining compliance (summer dry-weather, winter dry-weather, and wet-weather) consistent throughout the Santa Monica Bay beaches.

6.2 Calculation of Allowable Exceedance Days

Allowable exceedance days in an impaired reach will equal the water quality objective exceedance probability in the reference system times the number of days during the critical year. For the SCCWRP reference system for freshwaters, allowable exceedance days are set on an annual basis as well as for two other time periods. These two periods are (1) dry-weather and (2) wet-weather (defined as days of 0.1 inch of rain or more plus three days following the rain event). For the Leo Carrillo beach reference system for the Estuary, allowable exceedance days are set on an annual basis as well as for three other time periods. These three periods are (1) winter dry-weather (November 1 to March 31), (2) summer dry-weather (April 1 to October 31) and (2) wet weather (defined as days of 0.1 inch of rain or more plus three days following the rain event). As discussed in section 5.1 "Critical Condition", 1994 is the critical year and there are 87 wet days.

The number of allowable exceedance days during the critical condition (reference year) was calculated for the reference system by multiplying the site-specific exceedance probability by the number of dry or wet days in the reference year, as follows:

Allowable Exceedance Days

= Exceedance Probability in a Reference System × Number of Days in a Reference Year (Equation 6.1)

Based on rainfall data from the D89 meteorological station, 1994 is the reference year. The exceedance probability is appropriate because the weekly sampling is systematic and the rain events are randomly distributed; therefore, sampling will be evenly spread over the dry- and wet-weather events (i.e., the rain day, day after, 2nd day after, 3rd day after) (Schiff et al., 2002).

Using Equation 6.1, the exceedance probability of the freshwater reference system is translated to exceedance days as follows. The exceedance probability of 0.016 for dry weather is multiplied by 278 days, the number of dry weather days in the 1994 storm year, resulting in five (5) exceedance days (4.45 rounded to the next whole integer) when daily sampling is conducted. The exceedance probability of 0.19 for wet weather is multiplied by 87 days, the number of wet weather days in the 1994 storm year, resulting in 17 exceedance days (16.5 rounded to the next whole integer) when daily sampling is conducted.

To estimate the number of exceedance days at the freshwater reference system in the reference year under a weekly sampling regime for dry weather and wet weather, the number of days was adjusted by solving for x and y in Equation 6.2 and 6.3, respectively, as follows:

$$\frac{278\ days}{365\ days} = \frac{x}{52\ weeks} \qquad \text{(Equation 6.2 for dry weather)}$$

$$\frac{87\ days}{365\ days} = \frac{y}{52\ weeks} \qquad \text{(Equation 6.3 for wet weather)}$$

For dry weather, solving for x equals 39.6, which is then multiplied by 0.016, resulting in one (1) exceedance day (0.63 rounded to the next whole integer) during dry weather when weekly sampling is conducted. For wet weather, y equals 12.4 multiplied by 0.19, resulting in three (3) exceedance days (2.4 rounded to the next whole integer) during wet weather when weekly sampling is conducted. Consistent with the Santa Monica Bay Beaches Bacteria TMDL, where the fractional remainder for the calculated allowable exceedance days equals or exceeds 1/10th, then the number of days are rounded up (e.g., 16.5 is rounded up to 17). In instances where the tenths decimal place for the allowable exceedance days (or weeks or months) is lower than 1/10th, then the number of days are rounded down (e.g., 2.03 is rounded down to 2). The dry- and wet-weather allocations for the San Gabriel River and its tributaries for the single sample targets are listed in Table 6-2(a).

To estimate the number of allowable exceedance days in the San Gabriel River Estuary, the exceedance probability of 0.104 for winter dry-weather is multiplied by 79 days, the number of winter dry-weather days in the 1994 storm year, resulting in nine (9) exceedance days (8.22 rounded to the next whole integer) when daily sampling is conducted. The exceedance probability of 0.22 for wet weather is multiplied by 87 days, the number of wet-weather days in the 1994 storm year, resulting in 20 exceedance days (19.14 rounded to the next whole integer) when daily sampling is conducted. The number of dry weather days in the 1994 storm year is 278 days, which can be further separated into summer dry-weather (199 days) and winter dry-weather (79 days). The summer dry-, winter dry-, and wet-weather allocations for the San Gabriel River Estuary for the single sample targets are listed in Table 6-2(b).

Table 6-2. Allowable Exceedance Days for Daily and Weekly Sampling based on the Reference Year

(a) San Gabriel River and its Tributaries

Allowable Number of Exceedance Days	Daily Sampling	Weekly Sampling
Dry weather	5	1
Wet Weather	17	3

(b) San Gabriel River Estuary

Allowable Number of Exceedance Days	Daily Sampling	Weekly Sampling
Summer Dry-Weather	0	0
Winter Dry-Weather	9	2
Wet Weather	20	3

6.3 High Flow Suspension

Certain reaches and tributaries of the San Gabriel River are subject to a High Flow Suspension (HFS) of the recreational beneficial uses, which is applied to concrete-lined channels during days with greater than or equal to 0.5 inch of rain and the following 24 hours. During this period, REC-1 and REC-2 beneficial uses are unsafe and suspended for the affected reaches and tributaries (see Table 3-2). The bacteria objectives are temporarily not attainable during the HFS condition.

For this TMDL, a different number of wet weather days based on the reference year is used in the calculation of allowable exceedance days for the reaches and tributaries subject to the HFS. For the reference year, 87 wet weather days were observed. Of these 87 days, 30 days fall under the definition of a HFS day. These 30 days are excluded from the calculations, since the REC-1 use does not apply on these days in these reaches and tributaries. As such, the remaining number of wet weather days for HFS-affected reaches and tributaries is 47 days. The number dry weather days remains 278 days. With an adjustment to the number of wet weather days, the number of allowable wet weather exceedances for HFS affected reaches and tributaries is also adjusted. The resulting allowable exceedance for wet weather for HFS waterbodies is 9 days based on daily sampling and 2 days based on weekly sampling. The waterbodies are subject to HFS are listed in Table 3-2. The final dry and wet weather allowable exceedances based on daily and weekly sampling are summarized in Table 6-3.

Table 6-3. Allowable Exceedance Days for Daily and Weekly Sampling based on the Reference Year for Non-HFS and HFS Waterbodies in the San Gabriel River Watershed

Allowable Number of Exceedance Days	Daily Sampling	Weekly Sampling
Dry Weather	5	1
Non-HFS* Waterbodies Wet Weather	17	3
HFS Waterbodies Wet Weather	9 (not including HFS days)	2 (not including HFS days)

*HFS = High Flow Suspension

6.4 WLAs

WLAs for the MS4 permittees are equal to allowable exceedance days listed in Tables 6-3. Furthermore, the WLAs include no allowable exceedances of the geometric mean target at any time. The Los Angeles County MS4 permittees in the SGR watershed include Los Angeles County, Los Angeles County Flood Control District, and the Cities of Baldwin Park, Covina, Glendora, Industry, Irwindale, La Puente, Arcadia, Artesia, Azusa, Bradbury, Duarte, Monrovia, Claremont, La Verne, Paramount, Pomona, San Dimas, Artesia, Bellflower, Cerritos, Diamond Bar, Downey, Hawaiian Gardens, La Mirada, Lakewood, Long Beach, Norwalk, Pico Rivera, Santa Fe Springs, Whittier, La Habra Heights, El Monte, South El Monte, Walnut, and West Covina. The Orange County MS4 permittees in the SGR watershed include Orange County, Orange County Flood Control District, and the cities of Anaheim, Brea, Buena Park, Cypress, Fullerton, Garden Grove, La Habra, La Palma, Los Alamitos, Paramount, Placentia, Seal Beach, and Yorba Linda. The San Bernardino County MS4 permittees in the SGR watershed include San Bernardino County, San Bernardino County Flood Control District, and the City of Chino Hills.

Other non-MS4 dischargers, including individual NPDES permits, general NPDES permits, general industrial storm water permits, and general construction storm water permits are not expected to be a significant source of bacteria. Additionally, these discharges are not eligible for the reference system approach set forth in the implementation provisions for the bacteriological objectives in Chapter 3. WLAs for non-MS4 dischargers currently subject to permits with effluent limits for bacteria are equal to the existing effluent limits for bacteria. Non-MS4 dischargers that do not have existing effluent limits for bacteria are not assigned WLAs.

6.5 LAs

LAs for natural sources are equal to allowable exceedance days listed in Tables 6-2 and 6-3. Furthermore, LAs include no exceedances of the geometric mean targets at any time.

LAs for onsite wastewater treatment systems, golf courses, horse and livestock facilities, and irrigated agricultural lands are equal to zero days of allowable exceedances for the single sample and geometric mean targets.

7 IMPLEMENTATION

This section describes the regulatory mechanisms that will be used to implement the TMDL, implementation measures that could be used to attain WLAs and LAs, and an implementation schedule.

7.1. Implementation of WLAs and LAs

The County of Los Angeles, Los Angeles County Flood Control District, the cities of Arcadia, Artesia, Azusa, Baldwin Park, Bellflower, Bradbury, Cerritos, Claremont, Covina, Diamond Bar, Downey, Duarte, El Monte, Glendora, Hawaiian Gardens, Industry, Irwindale, Lakewood, La Mirada, La Habra Heights, La Puente, La Verne, Long Beach, Monrovia, Norwalk, Paramount, Pico Rivera, Pomona, San Dimas, Santa Fe Springs, South El Monte, Walnut, West Covina, Whittier, Orange County, Orange County Flood Control District, Anaheim, Brea, Buena Park, Cypress, Fullerton, Garden Grove, La Habra, La Palma, Los Alamitos, Placentia, Seal Beach, and Yorba Linda, San Bernardino County, San Bernardino County Flood Control District, and Chino Hills are responsible for meeting the WLAs assigned to MS4 discharges. Cities and counties with co-mingled stormwater are responsible for meeting WLAs assigned to MS4 discharges, unless the dischargers demonstrate that their discharges did not cause or contribute to the exceedances. The cities and the county may jointly or individually decide how to achieve the necessary reductions in exceedance days at each compliance point by employing one or more of the implementation strategies discussed in section 7.2 or any other viable strategy. Staff expects that the monitoring and source characterization outlined in the monitoring plan in Section 8 will assist municipalities in focusing their implementation efforts on key land uses, critical sources and storm periods.

WLAs shall be incorporated into MS4 permits as water quality-based effluent limitations (WQBELs). MS4 Permittees may be deemed in compliance with WQBELs if they demonstrate that: (1) there are no violations of the WQBEL at the Permittee's applicable MS4 outfall(s); (2) there are no exceedances of the receiving water limitations in the receiving water at, or downstream of, the Permittee's outfalls; or (3) there is no direct or indirect discharge from the Permittee's MS4 to the receiving water during the time period subject to the WQBEL. If permittees provide a quantitative demonstration as part of a watershed management program that control measures and best management practices (BMPs) will achieve WQBELs consistent with the schedule in Table 7-1, then compliance with WQBELs may be demonstrated by implementation of those control measures and BMPs, subject to Executive Officer approval.

Non-MS4 point sources are individually responsible for meeting their WLAs. WLAs for point sources will be implemented through NPDES permits.

LAs for irrigated agricultural lands will be implemented through requirements in the Conditional Waiver or other orders that are consistent with the LAs and the State's Nonpoint Source Implementation and Enforcement Policy. The LAs for onsite wastewater treatment systems will be regulated by WDRs or waivers of WDRs consistent with the State Onsite Wastewater Treatment System Policy. LAs for horses/livestock facilities and golf courses will be implemented through WDRs or waivers of WDRs consistent with the State's Nonpoint Source Implementation and Enforcement Policy. The Nonpoint Source Implementation and Enforcement Policy specifies that the Regional Water Boards have the authority to regulate nonpoint source discharges through WDRs, waivers, and prohibitions.

7.2. Implementing Strategies for Achieving Allocations

A variety of strategies exist to reduce bacteria concentration and loading to the SGR. Rather than any single strategy, a combination of strategies may be required to reduce bacteria exceedances to acceptable levels. These strategies are categorized as structural Best Management Practices (BMPs) and non-structural BMPs.

7.2.1 Structural BMPs

Structural BMPs involve the use of structural methods to treat or divert water at either the point of generation or point of discharge to either the storm system or to receiving waters. Structural BMPs may be sub-regional or regional in scope.

Sub-Regional Structural BMPs

Sub-regional structural BMPs consist of a single or a series of BMPs designed to treat flows for limited sub-regions within the watershed. Sub-regions can vary in size from small parking lots to several city blocks. These sub-regional implementation strategies typically have multiple pollutant treatment potential (MDRWRA, 2007). Listed below are sub-regional structural BMPs that may be used to comply with the SGR Indicator Bacteria TMDL and a brief description of each.

Local Capture Systems

Local capture systems contribute to the control of bacteria in the watershed by reducing the volume of runoff and reducing peak flows. BMPs within this category include rain barrels, cisterns, and other containers used to hold rainwater for reuse or recharge. These systems are usually designed to capture runoff from relatively clean surfaces, such as roofs, so that the water may be reused without treatment. Tank capacities range from around 55 gallons to several thousand cubic feet and can be above or below ground.

Vegetated Treatment Systems

Vegetated systems involve the use of soils and vegetation to filter and treat stormwater prior to discharge into surface or sub-surface water. Through a combination of biofiltration, retention, infiltration, and evapotranspiration, BMPs within this category can be applied across the watershed to provide a significant contribution to bacteria control for small areas. BMPs in this category include swales, filter strips, bioretention areas, and storm water planters (McCoy et al., 2006). These can be installed as on-site features of developments or in street medians, parking lot islands, or curb extensions.

Infiltration, along with soil soaking and evapotranspiration, reduces the volume of storm water runoff, and therefore reduces required sizes of downstream facilities.

Biofiltration can remove some particulates and the associated bacteria loading from storm water runoff. Additional bioslopes, infiltration trenches, soil grading alterations, bioretention ponds, and the use of selective vegetation can further increase the efficiency of vegetative biofiltration systems. In areas where biofiltration is not practical, modification may include the design of bioslopes and infiltration trenches, which utilize amended soil and promote subsurface flow.

Vegetated bioswales are constructed drainages used to convey stormwater runoff and generally have a trapezoidal or parabolic shape with relatively flat side slopes. Individual vegetated bioswales generally treat small drainage areas (five acres or less). Vegetation in bioswales allows for the filtering of pollutants, and infiltration of runoff into groundwater. Broad swales on flat slopes with dense vegetation are the most effective at pollutant removal and reducing the volume of runoff. Bioswales planted with native vegetation offer higher resistance to flow and provide a better environment for filtering and trapping pollutants from stormwater.

Local Infiltration Systems

Local infiltration systems contribute to bacteria control by reducing the potentially contaminated runoff from houses, streets, parking lots, and agriculture, and mitigating peak flows. Local infiltration systems increase on-site infiltration by including the use of alternative paving materials, retention grading and infiltration pits. The effectiveness of an infiltration system is based primarily on soil characteristics. Specific BMPs in this category include permeable paving, pervious concrete, pervious asphalt, pervious paving blocks, grass pavers, gravel pavers, pervious crushed stone, retention grading, and infiltration pits. Local infiltration systems can be effective for management of stormwater runoff from areas ranging from an individual lot to several city blocks.

Media Filtration

Media filtration in storm water is primarily used to separate out fine particulates and associated pollutants, but might also be used for enhanced treatment to remove bacteria. To maximize bacteria removal benefits, these devices should be strategically placed in locations with high observed or suspected bacteria loadings. During filtration process, stormwater is captured and either directed by gravity or pumped through media such as sand, anthracite, compost, zeolite and combinations of natural and engineered substrates. These systems do not provide volume reduction benefits, but may provide limited flow attenuation for small size storms depending on size and type of device. Media filters could be integrated directly into existing storm drain systems, but are generally off-line facilities requiring a diversion structure.

Agricultural BMPs

Agricultural BMPs focus on sediment and erosion management practices. Irrigation management practices are also important to reduce and/or eliminate dry weather runoff from fields. Listed below are some practices that may be implemented.

- ☐ Avoid bare fields by planting cover crops or leaving plant debris in field
- ☐ Minimize road erosion by grading or using gravel on roads
- ☐ Capture and reuse irrigation/storm water runoff on site
- ☐ Use sediment traps at the end of fields to capture sediment from runoff
- ☐ Mitigate runoff before it leaves property with grassed swales and filter strips
- ☐ Conduct tests of irrigation systems to ensure efficiency and uniformity
- ☐ Inspect irrigation systems for breaks and leaks
- ☐ Divert water from non-cropped areas
- ☐ Use current weather information to determine irrigation requirements
- ☐ Stop irrigation if runoff occurs

Equestrian-Related BMPs

Equestrian -related BMPs contribute to bacteria control by controlling discharges of bacteria at their source. Equestrian related BMPs include buffers and filter strips protecting streams and drainages, improved manure storage areas and designated horse-wash areas with connections to sanitary sewers. Buffers and filter strips provide separation between pollution generating areas and waterbodies and provide biofiltration for runoff from these areas.

Regional Structural BMPs

Regional structural BMPs contain many similarities to sub-regional structural BMPs but differ in both the scope and scale of implementation strategies. Treatment areas can range from several sub-regions to the entire watershed. Regional structural BMPs can provide similar multiple treatment potential to that of sub-regional BMPs. Listed below are regional structural BMPs and a brief description of each.

Regional Infiltration Systems

A regional infiltration facility is generally a large basin capable of detaining the entire volume of a design storm and infiltration volume over a specified period. Regional biofiltration systems, including sub-surface flow wetlands, promote hydrolysis, oxidation, and rhizodegradation from soil filtration through the aerobic and anaerobic zones of the soil matrix (Halverson, 2004). These systems can treat a variety of different pollutants and can be utilized for flood mitigation. Water quality benefits are primarily accomplished by impounding water and allowing it to slowly percolate in surface soil and eventually to groundwater. In the event of a large storm, some flow would bypass infiltration and discharge to the receiving water untreated. However, treatment of a large percentage of flow would still be achieved. Application of a regional facility depends on suitability of soils for infiltration and appropriately-located open space. These facilities can be applied as a stand-alone treatment feature for bacteria control on a subwatershed scale.

Regional Detention Facility

Regional detention systems help reduce flow volume and promote sedimentation (McCoy et al., 2006). Facilities consist of a large basin equipped with outlet structures that regulate rates of water release. They can be used upstream of an infiltration facility, constructed wetland or disinfection plant to equalize flows and reduce sediment loading. These basins can be shallow, lined with vegetation, and separated into multiple bays to improve their water quality functions. Unlike infiltration systems, regional detention facilities do not require favorable soils. Detention facilities can also be deep, steep-wall basins, or underground vaults when space is a limiting factor. However, they are not effective as a stand-alone treatment option for bacteria.

Diversion and/or Treatment

A diversion and/or treatment BMP routes urban runoff away from the storm drain system or waterway, and redirects the flow, through a series of tanks and pumps, into the sanitary sewer system or other treatment system, where the contaminated runoff then receives treatment and filtration before being re-used or discharged. . Depending on the water quality of the flow, it may have to be passed through a waste-water treatment facility that uses UV irradiation, chlorination, ozonolysis or biocides and peracetic acids. Chlorination, wherein chlorine being a strong oxidant breaks the cell membranes of bacteria and kills them, is one of the most commonly used methods of disinfection. UV light with a wavelength of 220 to 320 nanometers can be used to inactivate pathogens. Ozone is an extremely reactive oxidant that inactivates pathogens through lysis and can generated onsite as disinfection tool. Peracetic acids deactivate outer cell membranes and can be applied for de-activation of bacteria and viruses; further, they are a more effective oxidant than chlorine and do not have harmful by-products.

After treatment, water can be channeled to receiving waters, to a nearby pond or lake or routed for a secondary usage.

7.2.2 Non-structural BMPs

Non-structural BMPs are prevention practices designed to improve water quality by reducing bacteria sources. Non-structural BMPs provide for the development of bacteria control programs that include, but are not limited to prevention, education, and regulation. These programs are described below.

Administrative Controls

Administrative controls require less initial investment of time compared to structural BMPs. However, for continuous implementation, administrative actions may require greater time. These actions may include better enforcement of existing pet disposal and litter ordinances, posting additional signage, continuing feral cat population control, proposing stricter penalties, and other actions of an administrative nature.

Outreach and Education

Education and outreach to residents may minimize the potential for contamination of stormwater runoff by encouraging residents to clean up after their pets, pick up litter, minimize runoff from agricultural, residential, and commercial facilities, and control excessive irrigation. The public is often unaware of the fact that excess water discharged on streets and lawns ends up in receiving waters, or of the contamination caused by the polluted runoff.

Local agencies can provide educational materials to the public via television, radio, online, and print media such as brochures, flyers, community newsletters. These agencies can also create information hotlines to outreach to educators and schools, develop community events, and support volunteer monitoring and cleanup programs

Storm Drain Stenciling

Storm drain inlet stenciling is another means of educating the public about the direct discharge of stormwater to receiving waters and the effects of polluted runoff on receiving water quality. Stenciling can be conducted in partnership with other agencies and organizations to garner greater support for educational programs (U.S. EPA, 2005).

Street Cleaning

Street and parking lot cleaning may minimize trash and pollutant loading to urban storm drains. This management measure involves employing pavement cleaning practices such as street sweeping on a regular basis to minimize trash, sediment, debris and other pollutants that might end up in receiving waters.

Storm Drain Cleaning

Routine cleaning of the storm drain system reduces the amount of trash, bacteria and other pollutants entering the river, prevents clogging, and ensures the flood control capacity of the system. A successful storm drain cleaning program includes regular inspection and cleaning of catch basins and storm drain inlets, increased inspection and cleaning in areas with high trash accumulation, accurate recordkeeping, cleaning immediately prior to the rainy season to remove accumulated trash and other pollutants, and proper storage and disposal of collected material (CASQA, 2003).

7.3. Implementation Schedule

The proposed implementation schedule shall consist of a phased approach as discussed below and outlined in Table 7-1. The implementation schedule allows the responsible jurisdictions and responsible agencies time to gather additional monitoring data to better quantify bacteria loading to the San Gabriel River (SGR) and its tributaries and prioritize implementation actions. The schedule would allow 10 years from the TMDL effective date to meet the dry-weather load and waste load allocations and 20 years from the TMDL effective date to meet the wet-weather load and waste load allocations in the SGR and its tributaries.

Table 7-1: Implementation Schedule

Deadline	Task
Effective date of the TMDL	WLAs assigned to non-MS4 point sources must be attained.
1 year after the effective date of the TMDL	Responsible jurisdictions and agencies for the MS4 WLAs must submit a comprehensive monitoring plan, including in-stream and outfall monitoring, for the San Gabriel River Watershed for approval by the Executive Officer. Once the coordinated monitoring plan is approved by the Executive Officer, monitoring shall commence within 6 months.
10 years after effective date of this TMDL	For San Gabriel River Estuary: Achieve compliance with the applicable LAs and MS4 WLAs, expressed in terms of allowable exceedance days of the single sample objectives for summer dry weather (April 1 to October 31) and winter dry weather (November 1 to March 31). For San Gabriel River and its Tributaries: Achieve compliance with the applicable LAs and MS4 WLAs, expressed in terms of allowable exceedance days of the single sample objectives and for dry weather.
20 years after the effective date of this TMDL	Achieve compliance with the allowable exceedance days during wet weather as set forth in Tables 6-2 and 6-3 and geometric mean targets for all seasonal periods specified as identified under "Numeric Target."

8 Monitoring Program

A monitoring program is necessary to determine compliance with the TMDL and to assess attainment of beneficial uses.

8.1 MS4 Permittees

Responsible jurisdictions and agencies for the MS4 WLAs are responsible for developing and implementing a comprehensive in-stream monitoring plan. The monitoring plan should include all applicable bacteria water quality objectives and the sampling frequency must be adequate to assess compliance with the geometric mean objectives. An Integrated Monitoring Program (IMP) or Coordinated Integrated Monitoring Program (CIMP) approved by the Executive Officer may partially or fully be deemed equivalent to a compliance monitoring plan at the Regional Water Board's discretion. Responsible jurisdictions and agencies may build upon existing monitoring programs, IMPs, or CIMPs in the San Gabriel River watershed when developing the bacteria water quality monitoring plan. At a minimum, at least one sampling station shall be located in each impaired reach.

Responsible jurisdictions and agencies for the MS4 WLAs shall also submit an outfall monitoring plan. The outfall monitoring plan shall propose an adequate number of representative outfalls to be sampled, a sampling frequency, and protocol for enhanced outfall monitoring as a result of an in-stream exceedance. Responsible jurisdictions and agencies may use existing outfall monitoring stations in their IMPs or CIMPs to satisfy the monitoring requirements for the MS4 permits and the TMDL.

Responsible jurisdictions and agencies must assess compliance at in-stream monitoring sites. If the number of exceedance days is greater than the allowable number of exceedance days the water body segment shall be considered not attaining the TMDL. Responsible jurisdictions or agencies shall not be deemed non-attaining if the outfall monitoring described in the paragraph above demonstrates that bacterial sources originating within the jurisdiction of the responsible agency have not caused or contributed to the exceedance.

The geometric mean values shall be calculated based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over the calculation period) as a rolling, six-week mean.

If any of the single sample limits are exceeded, the Regional Board may require repeat sampling on a daily basis until the sample falls below the single sample limit in order to determine the persistence of the exceedance.

When repeat sampling is required because of an exceedance of any one single sample limit, values from all samples collected during that calculation period shall be used to calculate the geometric mean.

8.2 Non-MS4 Permittees

NPDES Permittees other than MS4 dischargers shall conduct monitoring as part of their permit requirements for all applicable bacteria water quality objectives to ensure that they are attaining WLAs and that water quality objectives are being met.

8.3 Nonpoint Source Monitoring

The Conditional Waiver for Irrigated Lands or other regulatory mechanism shall require bacteria monitoring for discharges from irrigated agricultural lands. Monitoring shall be implemented as part of WDR and waiver requirements, and through implementation of the Nonpoint Source Implementation and Enforcement Policy, for other nonpoint sources.

9 Cost Considerations

The purpose of this cost analysis is to provide the Regional Water Board with a reasonable range of potential costs of implementing this TMDL and to address stakeholder concerns regarding implementation costs. Estimated costs are presented for various implementation options and are not additive. Responsible parties may implement individual potential treatment alternatives or a combination of alternatives and the costs would vary accordingly. The Regional Water Board is prohibited from determining the method of compliance with an order; therefore, actual costs will be dependent upon the implementation options selected by the parties implementing the TMDL.

This cost estimate attempts to account for a range of economic factors and requires a number of assumptions regarding the extent and cost of implementing many of the proposed measures. This section describes how the costs were estimated for various implementation strategies and provides a summary of costs for each strategy.

In reviewing the cost estimates, it should be noted that there are multiple additional benefits associated with the implementation of these strategies. Many of the structural and non-structural BMPs to address bacteria loading may also reduce the loading of other pollutants, such as metals, which would assist in meeting the requirements of the San Gabriel River Metals TMDL.

9.1 Non-Structural BMPs

The costs for a number of non-structural source control measures have been estimated for the entire Los Angeles Region (Devinny et al., 2004), which has an area of 3,100 square miles. The source control measure costs for the SGR watershed were scaled down proportionally. The SGR watershed is approximately 689 square miles. The watershed is 36% developed (section 1.4), resulting in 248 square miles of developed area that could potentially be treated to comply with the TMDL. The following represent the approximate values for the SGR watershed for source control measures:

- Enforcement of litter ordinances - $0.72 million per year
- Public education - $0.40 million per year
- Improved street cleaning - $0.60 million per year
- Increased storm drain cleaning - $2.16 million per year

9.2 Structural BMPs

In the implementation section of this report (section 7.2), structural BMPs were discussed in terms of regional and sub-regional BMPs. Regional and sub-regional BMPs are very similar except that they differ in scope and scale (e.g., regional infiltration systems vs. local infiltration systems). Therefore, for the purposes of the cost analysis, costs are estimated for general BMP types, which could be scaled up or down depending on if sub-regional or regional BMPs were implemented. In all cases, land acquisition costs were excluded from the cost estimate.

9.2.1 Local Capture Systems

9.2.1.1 Cisterns

Cisterns are a common type of local capture system. To estimate costs of cisterns, it is assumed that cisterns will be installed only at educational institutions (public and private) and public facilities, since these types of controls are more easily implemented on these land uses, as opposed to residential or commercial sites. According to data from the Southern California Association of Govenments (SCAG), educational institutions and public facilities cover 15.6 square miles of the SGR watershed.

For the Ballona Creek Bacteria TMDL, it was estimated that it would take up to 2,260 cisterns to treat the 3.9 square miles of school/government land in the Ballona Creek watershed. Scaling this to the SGR watershed, up to 9040 cisterns could be installed in the SGR Watershed to manage the flow from all educational institutions and public facilities. Assuming a unit cost of $1/gallon and a cistern size of 10,000 gallons, the total capital cost would be approximately $90.4 million.

Operation and maintenance costs for cisterns are based on the amount of water pumped. Based on the Ballona Creek Bacteria TMDL, it is assumed that approximately 70,000 gallons per year of runoff would be captured by each cistern. Additional assumptions include:

- 3 horsepower pump;
- Flow rate of 10 gallons per minute;
- Unit energy cost of $0.10 per kilowatt-hour.

Using the standard equation of W=Power*Volume/Flow, which for these assumptions is:

W = (3hp) * (.745kW/hp) * (70,000gal/yr/cistern) / ((10gal/min) * (60min/hr)) = 261 kW-hr/cistern/yr

For 9040 cisterns and using an energy cost of $0.10 per kilowatt-hour, the total operation and maintenance cost for electrical power is $0.2 million per year.

9.2.1.2 Rain Barrels

Rain barrels are a structural flow source control appropriate for residences.

The City of Los Angeles, Bureau of Sanitation, Watershed Protection Division (Stormwater Program) initiated a pilot program for free rainwater harvesting rain barrels for the Ballona Creek Watershed in July 2009 (City of Los Angeles, 2010). This program provided free 55 gallon rain barrels. The City received over 3,000 applications for 600 rain barrels. The cost of the barrel and installation was estimated at $250 per barrel.

The program was funded by the Safe Neighborhood Parks, Clean Water, Clean Air and Coastal Protection Bond Act of 2000 (Proposition 12) through the Santa Monica Bay Restoration Commission (SMBRC) and the California Coastal Conservancy. The City of Los Angeles has estimated 584,100 gallons can be collected from the 590 barrel pilot program. The cities of the SGR watershed may develop materials to support homeowners in installing their own rain barrels; however, no costs are available for watershed-wide implementation.

9.2.2 Vegetated Treatment Systems

Vegetated swales are a typical vegetated treatment system. Based on case studies, the ratio of swale surface area to drainage area is 1,000 square feet per acre (CASQA, 2003). The mid-range cost to construct a swale for treatment of a 10-acre drainage area is approximately $15,000 (adjusted to 2015 dollars) (CASQA, 2003). Assuming swales are used to treat 20% of the urbanized portion of the SCR watershed (20% of 248 square miles, or 1749 acres), the capital cost would be approximately $47.6 million dollars. The annual maintenance cost is estimated at 5% of the construction cost; annual maintenance costs are estimated at $2.4 million dollars.

9.2.3 Infiltration Systems

Local, on-site or subwatershed-based infiltration projects may be placed in parks, public land, vacant property, and other open spaces within the SGR Watershed. Assuming infiltration devices are used to treat 20% of the developed portion of the watershed, the area to be treated would be equal to 1749 acres. Staff determined that 6350 infiltration trenches, each designed to treat 0.5 inches of runoff from a five-acre area, could be used to treat 1749 acres. Based on an estimated construction cost of $6.38 per cubic feet (CASQA, 2003, adjusted for inflation), it would cost $58,000 per infiltration device to treat 0.5 inches of runoff from a five-acre area. This results in a total cost of $368 million. The annual maintenance cost is estimated at 5% of the construction cost; annual maintenance costs are estimated at $18 million dollars.

9.2.4 Media Filtration

The construction cost of a sand/organic filter system depends on the drainage areas, expected efficiency, and other design parameters. Case studies conducted in 1997 indicate cost ranges from $6,600 to $11,000 to treat a drainage area of 5 acres or less. Assuming that 20% of the developed portion of the watershed will be treated with sand filters designed for a 5-acre drainage area and a unit construction price of $16,000 dollars (adjusted for inflation), the estimated construction cost of sand/organic filters for 20% of the developed portion of the watershed would be $100 million dollars. Annual maintenance costs average approximately 5% of construction costs; annual maintenance costs are estimated at $5 million dollars.

9.2.5 Diversion and/or Treatment

The cost estimates for storm drain diversions are based on the cost analyses for the Santa Monica Bay Beaches Bacteria TMDL, the Marina del Rey Harbor Mothers Beach and Back Basins Bacteria TMDL, and the Los Angeles Harbor Bacteria TMDL (Inner Cabrillo Beach and Main Ship Channel) (LARWQCB, 2002a, 2002b, 2003b, 2004). The annualized capital cost to construct 10 low-flow diversions is estimated at $717,386, assuming financing for 20 years at 7 percent. The operation and maintenance costs, for all 27 diversions, are estimated at $1.7 million. The number of low-flow diversions necessary to attain the SGR Bacteria TMDL is unknown. Flow modeling may determine the optimum number of low-flow diversions necessary to comply with the WLAs.

9.3 Costs of Monitoring

The costs of MS4 monitoring are based on the in-stream monitoring. For the purpose of a cost estimate, it is assumed that one in-stream monitoring station will be sampled in each impaired reach, for a total of 11 freshwater sampling sites, and one sampling site will be located in the estuary. Based on prices of bacteriological analyses from a local laboratory, the cost per sample is $25 each for *E. coli*, *enterocococcus*, fecal coliform or total coliform analysis. Assuming a monitoring frequency of weekly for each monitoring site, the annual cost for in-stream monitoring is estimated at $14,300. MS4 monitoring already occurs in the SGR watershed; consequently, sample collection and data analysis costs are not likely to substantially alter the implementation costs of the TMDL and have not be included in this cost analysis.

The number of outfall monitoring locations in the watershed will be proposed as part of the implementation plan. The cost for freshwater outfall monitoring is estimated at $25 for a single sample event at an outfall (includes *E. coli* only). The cost for estuarine monitoring is estimated at $100 per sample event for a single monitoring station (includes *E. coli, enterococcus,* fecal coliform, and total coliform analyses).

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Appendix A

Data Used to Calculate Freshwater Reference System Exceedance Probabilities

Wet Weather		***E.coli***
	Exceedance	19%
	Number of Data Points	70
	Number > WQO	13

Waterbody	NumQual	E.coli	SampleDate	Study*
Deer Creek	=	86	10/27/04	Beach
Deer Creek	=	140	10/28/04	Beach
Deer Creek	=	10	10/29/04	Beach
Deer Creek	<	10	10/30/04	Beach
Deer Creek	=	220	12/5/04	Beach
Deer Creek	=	150	12/6/04	Beach
Deer Creek	<	10	12/7/04	Beach
Deer Creek	=	10	12/8/04	Beach
Deer Creek	<	10	1/29/05	Beach
Deer Creek	<	10	1/30/05	Beach
Deer Creek	<	10	1/31/05	Beach
Deer Creek	<	10	2/1/05	Beach
Deer Creek	<	10	2/12/05	Beach
Deer Creek	=	10	2/13/05	Beach
Deer Creek	<	10	2/14/05	Beach
Deer Creek	=	10	2/15/05	Beach
Leo Carrillo	=	190	1/29/05	Beach
Leo Carrillo	=	150	1/30/05	Beach
Leo Carrillo	=	370	1/31/05	Beach
Leo Carrillo	=	75	2/1/05	Beach
Leo Carrillo	=	41	2/12/05	Beach
Leo Carrillo	=	870	2/13/05	Beach
Leo Carrillo	=	41	2/14/05	Beach
Leo Carrillo	=	90	2/15/05	Beach
San Mateo	=	31	1/18/05	Beach
San Mateo	=	41	1/25/05	Beach
San Mateo	=	169	2/1/05	Beach
San Mateo	=	52	2/8/05	Beach
San Mateo	=	10	2/16/05	Beach
San Mateo	=	20	2/17/05	Beach
San Onofre	=	6815	10/27/04	Beach
San Onofre	=	3654	10/28/04	Beach
San Onofre	=	684	10/29/04	Beach
San Onofre	=	98	11/9/04	Beach

Waterbody	NumQual	E.coli	SampleDate	Study*
San Onofre	<	10	12/14/04	Beach
San Onofre	=	74	1/18/05	Beach
San Onofre	=	132	1/29/05	Beach
San Onofre	=	20	2/8/05	Beach
San Onofre	=	457	2/12/05	Beach
San Onofre	=	158	2/13/05	Beach
San Onofre	=	84	2/14/05	Beach
San Onofre	=	20	2/15/05	Beach
San Onofre	=	20	2/16/05	Beach
San Onofre	=	84	2/17/05	Beach
Solstice Creek	=	1400	10/27/04	Beach
Solstice Creek	=	120	10/28/04	Beach
Solstice Creek	=	110	10/29/04	Beach
Solstice Creek	=	65	10/30/04	Beach
Solstice Creek	=	3000	12/5/04	Beach
Solstice Creek	=	100	12/6/04	Beach
Solstice Creek	<	10	12/7/04	Beach
Solstice Creek	=	20	12/8/04	Beach
Solstice Creek	=	10	1/29/05	Beach
Solstice Creek	=	20	1/30/05	Beach
Solstice Creek	=	41	1/31/05	Beach
Solstice Creek	=	63	2/1/05	Beach
Solstice Creek	=	52	2/12/05	Beach
Solstice Creek	=	10	2/13/05	Beach
Solstice Creek	=	20	2/14/05	Beach
Solstice Creek	=	10	2/15/05	Beach
Cristianitos Creek	=	1160	1/8/05	NL
Bell Canyon Creek	=	58.5	1/7/05	NL
Bell Creek	=	182.0	1/3/06	NL
Fry Creek	=	12.5	2/12/05	NL
Fry Creek	=	254.9	3/29/06	NL
Sespe Creek	=	10	12/4/04	NL
Bear Creek Matilija	=	10	12/4/04	NL
Arroyo Sequit	=	1583.3	12/28/04	NL
Arroyo Sequit	=	469.9	1/7/05	NL
Arroyo Sequit	=	431.2	4/5/06	NL

* Beach: Microbiological Water Quality at Reference Beaches in Southern California During Wet Weather (SCCWRP Technical Report 448)
NL: Assessment of Water Quality Concentrations and Loads from Natural Landscapes (SCCWRP Technical Report 500)

Dry Weather

	E. coli
	Single Sample Maxium
Exceedance	1.6%
Number of Data Points	450
Number > WQO	7

Waterbody	NumQual	Result	SampleDate	Season	Study*
Arroyo Seco	=	15	6/9/05	Summer	NL
Arroyo Seco	=	10	9/6/05	Summer	NL
Arroyo Seco	<	10	05/31/2006	Summer	FIB
Arroyo Seco	=	52	06/07/2006	Summer	FIB
Arroyo Seco	=	30	06/14/2006	Summer	FIB
Arroyo Seco	=	31	06/21/2006	Summer	FIB
Arroyo Seco	=	41	06/28/2006	Summer	FIB
Arroyo Seco	=	74	07/05/2006	Summer	FIB
Arroyo Seco	<	10	07/11/2006	Summer	FIB
Arroyo Seco	=	122	07/18/2006	Summer	FIB
Arroyo Seco	=	110	07/25/2006	Summer	FIB
Arroyo Seco	=	20	08/01/2006	Summer	FIB
Arroyo Seco	<	10	08/08/2006	Summer	FIB
Arroyo Seco	<	10	08/15/2006	Summer	FIB
Arroyo Seco	<	10	08/22/2006	Summer	FIB
Arroyo Seco	=	10	08/29/2006	Summer	FIB
Arroyo Seco	<	10	09/05/2006	Summer	FIB
Arroyo Seco	<	10	09/12/2006	Summer	FIB
Arroyo Seco	=	31	09/19/2006	Summer	FIB
Arroyo Seco	=	148	09/26/2006	Summer	FIB
Arroyo Seco	=	10	10/03/2006	Summer	FIB
Arroyo Seco	=	10	10/10/2006	Summer	FIB
Arroyo Seco	=	30	10/17/2006	Summer	FIB
Arroyo Seco	<	10	10/24/2006	Summer	FIB
Arroyo Seco	<	10	10/31/2006	Summer	FIB
Arroyo Seco	<	10	11/07/2006	Winter	FIB
Arroyo Seco	<	10	11/14/2006	Winter	FIB
Arroyo Seco	<	10	11/21/2006	Winter	FIB
Arroyo Seco	<	10	11/28/2006	Winter	FIB
Arroyo Seco	<	10	12/05/2006	Winter	FIB
Arroyo Seco	<	10	12/19/2006	Winter	FIB

Waterbody	NumQual	Result	SampleDate	Season	Study*
Arroyo Seco	<	10	12/26/2006	Winter	FIB
Arroyo Seco	<	10	01/02/2007	Winter	FIB
Arroyo Seco	<	10	01/11/2007	Winter	FIB
Arroyo Seco	<	10	01/18/2007	Winter	FIB
Arroyo Seco	<	10	01/23/2007	Winter	FIB
Arroyo Seco	<	10	02/06/2007	Winter	FIB
Arroyo Seco	<	10	02/15/2007	Winter	FIB
Arroyo Seco	<	10	02/20/2007	Winter	FIB
Arroyo Seco	=	10	03/06/2007	Winter	FIB
Arroyo Seco	<	10	03/13/2007	Winter	FIB
Arroyo Seco	<	10	03/20/2007	Winter	FIB
Arroyo Seco	<	10	03/27/2007	Winter	FIB
Arroyo Seco	=	10	04/03/2007	Summer	FIB
Arroyo Seco	=	74	04/10/2007	Summer	FIB
Arroyo Seco	<	10	04/17/2007	Summer	FIB
Arroyo Seco	<	10	04/26/2007	Summer	FIB
Arroyo Seco	<	10	05/01/2007	Summer	FIB
Arroyo Seco	<	10	05/08/2007	Summer	FIB
Bear Creek Matilija	=	10	6/22/05	Summer	NL
Bear Creek Matilija	=	5	9/15/05	Summer	NL
Bear Creek Matilija	=	20	6/2/06	Summer	NL
Bear Creek WFSGR	=	10	6/17/05	Summer	NL
Bear Creek WFSGR	=	5	9/8/05	Summer	NL
Bear Creek WFSGR	=	17.3	6/1/06	Summer	NL
Bell Canyon Creek	=	52	9/2/05	Summer	NL
Bell Canyon Creek	=	173	05/17/2006	Summer	FIB
Bell Canyon Creek	=	10	05/25/2006	Summer	FIB
Bell Canyon Creek	<	10	05/31/2006	Summer	FIB
Bell Canyon Creek	=	241	06/09/2006	Summer	FIB
Bell Canyon Creek	=	63	06/15/2006	Summer	FIB
Bell Canyon Creek	=	20	06/21/2006	Summer	FIB
Bell Canyon Creek	=	820	06/30/2006	Summer	FIB
Bell Canyon Creek	=	209	07/07/2006	Summer	FIB
Bell Canyon Creek	=	20	07/12/2006	Summer	FIB
Bell Canyon Creek	=	75	07/18/2006	Summer	FIB
Bell Canyon Creek	=	373	07/25/2006	Summer	FIB
Bell Canyon Creek	=	146	08/04/2006	Summer	FIB
Boden Canyon Creek	=	63	05/17/2006	Summer	FIB
Boden Canyon Creek	=	18600	05/26/2006	Summer	FIB
Boden Canyon Creek	=	98	06/02/2006	Summer	FIB

Waterbody	NumQual	Result	SampleDate	Season	Study*
Boden Canyon Creek	=	31	06/07/2006	Summer	FIB
Boden Canyon Creek	=	20	06/14/2006	Summer	FIB
Boden Canyon Creek	=	20	06/21/2006	Summer	FIB
Boden Canyon Creek	=	10	06/28/2006	Summer	FIB
Boden Canyon Creek	<	10	03/07/2007	Winter	FIB
Boden Canyon Creek	<	10	03/15/2007	Winter	FIB
Boden Canyon Creek	=	41	03/21/2007	Winter	FIB
Boden Canyon Creek	=	52	03/28/2007	Winter	FIB
Boden Canyon Creek	=	41	04/04/2007	Summer	FIB
Boden Canyon Creek	=	146	04/11/2007	Summer	FIB
Boden Canyon Creek	=	272	04/18/2007	Summer	FIB
Boden Canyon Creek	<	10	04/26/2007	Summer	FIB
Boden Canyon Creek	=	120	05/02/2007	Summer	FIB
Boden Canyon Creek	<	10	05/09/2007	Summer	FIB
Boden Canyon Creek	<	10	05/16/2007	Summer	FIB
Boden Canyon Creek	=	10	05/23/2007	Summer	FIB
Boden Canyon Creek	=	226	05/30/2007	Summer	FIB
Cattle Creek EFSGR	=	10	6/17/05	Summer	NL
Cattle Creek EFSGR	=	25.5	9/8/05	Summer	NL
Cattle Creek EFSGR	=	14.1	6/1/06	Summer	NL
Cold Creek	=	40.5	6/9/05	Summer	NL
Cold Creek	=	5	9/6/05	Summer	NL
Cold Creek	<	10	05/15/2006	Summer	FIB
Cold Creek	<	10	05/26/2006	Summer	FIB
Cold Creek	=	30	05/31/2006	Summer	FIB
Cold Creek	=	20	06/06/2006	Summer	FIB
Cold Creek	=	52	06/13/2006	Summer	FIB
Cold Creek	=	74	06/20/2006	Summer	FIB
Cold Creek	=	41	06/27/2006	Summer	FIB
Cold Creek	<	10	07/06/2006	Summer	FIB
Cold Creek	=	10	07/12/2006	Summer	FIB
Cold Creek	<	10	07/19/2006	Summer	FIB
Cold Creek	=	10	07/26/2006	Summer	FIB
Cold Creek	<	10	08/02/2006	Summer	FIB
Cold Creek	=	20	08/09/2006	Summer	FIB
Cold Creek	=	108	08/16/2006	Summer	FIB
Cold Creek	=	74	08/23/2006	Summer	FIB
Cold Creek	<	10	08/30/2006	Summer	FIB
Cold Creek	=	10	09/06/2006	Summer	FIB
Cold Creek	<	10	09/13/2006	Summer	FIB

Waterbody	NumQual	Result	SampleDate	Season	Study*
Cold Creek	<	10	09/20/2006	Summer	FIB
Cold Creek	<	10	09/27/2006	Summer	FIB
Cold Creek	<	10	10/04/2006	Summer	FIB
Cold Creek	<	10	10/11/2006	Summer	FIB
Cold Creek	=	41	10/18/2006	Summer	FIB
Cold Creek	<	10	10/25/2006	Summer	FIB
Cold Creek	<	10	11/01/2006	Winter	FIB
Cold Creek	<	10	11/08/2006	Winter	FIB
Cold Creek	<	10	11/15/2006	Winter	FIB
Cold Creek	=	10	11/20/2006	Winter	FIB
Cold Creek	<	10	11/29/2006	Winter	FIB
Cold Creek	<	10	12/06/2006	Winter	FIB
Cold Creek	<	10	12/20/2006	Winter	FIB
Cold Creek	<	10	01/03/2007	Winter	FIB
Cold Creek	<	10	01/10/2007	Winter	FIB
Cold Creek	<	10	01/24/2007	Winter	FIB
Cold Creek	<	10	02/07/2007	Winter	FIB
Cold Creek	<	10	02/14/2007	Winter	FIB
Cold Creek	=	10	02/21/2007	Winter	FIB
Cold Creek	<	10	03/01/2007	Winter	FIB
Cold Creek	<	10	03/07/2007	Winter	FIB
Cold Creek	<	10	03/14/2007	Winter	FIB
Cold Creek	<	10	03/21/2007	Winter	FIB
Cold Creek	<	10	03/28/2007	Winter	FIB
Cold Creek	<	10	04/05/2007	Summer	FIB
Cold Creek	<	10	04/11/2007	Summer	FIB
Cold Creek	<	10	04/18/2007	Summer	FIB
Cold Creek	<	10	04/27/2007	Summer	FIB
Cold Creek	=	20	05/02/2007	Summer	FIB
Cold Creek	=	20	05/09/2007	Summer	FIB
Coldbrook NFSGR	=	10	6/17/05	Summer	NL
Coldbrook NFSGR	=	15	9/8/05	Summer	NL
Coldbrook NFSGR	=	14.1	6/1/06	Summer	NL
Cristianitos Creek	=	25.5	6/7/05	Summer	NL
Cucamonga Creek	<	10	05/16/2006	Summer	FIB
Cucamonga Creek	<	10	05/26/2006	Summer	FIB
Cucamonga Creek	<	10	05/30/2006	Summer	FIB
Cucamonga Creek	<	10	06/06/2006	Summer	FIB
Cucamonga Creek	<	10	06/13/2006	Summer	FIB
Cucamonga Creek	<	10	06/20/2006	Summer	FIB

Waterbody	NumQual	Result	SampleDate	Season	Study*
Cucamonga Creek	<	10	06/27/2006	Summer	FIB
Cucamonga Creek	<	10	07/05/2006	Summer	FIB
Cucamonga Creek	<	10	07/11/2006	Summer	FIB
Cucamonga Creek	<	10	07/18/2006	Summer	FIB
Cucamonga Creek	<	10	07/25/2006	Summer	FIB
Cucamonga Creek	=	6	08/01/2006	Summer	FIB
Cucamonga Creek	<	10	08/15/2006	Summer	FIB
Cucamonga Creek	<	10	08/22/2006	Summer	FIB
Cucamonga Creek	=	40	08/29/2006	Summer	FIB
Cucamonga Creek	<	10	09/05/2006	Summer	FIB
Cucamonga Creek	<	10	09/19/2006	Summer	FIB
Cucamonga Creek	=	10	09/26/2006	Summer	FIB
Cucamonga Creek	<	10	10/03/2006	Summer	FIB
Cucamonga Creek	<	10	10/10/2006	Summer	FIB
Cucamonga Creek	<	10	10/17/2006	Summer	FIB
Cucamonga Creek	=	10	10/24/2006	Summer	FIB
Cucamonga Creek	<	10	10/31/2006	Summer	FIB
Cucamonga Creek	=	10	11/07/2006	Winter	FIB
Cucamonga Creek	<	10	11/21/2006	Winter	FIB
Cucamonga Creek	<	10	11/28/2006	Winter	FIB
Cucamonga Creek	<	10	12/05/2006	Winter	FIB
Cucamonga Creek	=	180	12/12/2006	Winter	FIB
Cucamonga Creek	<	10	12/20/2006	Winter	FIB
Cucamonga Creek	<	10	12/27/2006	Winter	FIB
Cucamonga Creek	<	10	01/03/2007	Winter	FIB
Cucamonga Creek	<	10	01/16/2007	Winter	FIB
Cucamonga Creek	<	10	01/23/2007	Winter	FIB
Cucamonga Creek	<	10	01/30/2007	Winter	FIB
Cucamonga Creek	<	10	02/06/2007	Winter	FIB
Cucamonga Creek	=	30	02/13/2007	Winter	FIB
Cucamonga Creek	<	10	02/20/2007	Winter	FIB
Cucamonga Creek	<	10	02/28/2007	Winter	FIB
Cucamonga Creek	<	10	03/06/2007	Winter	FIB
Cucamonga Creek	<	10	03/20/2007	Winter	FIB
Cucamonga Creek	=	10	03/27/2007	Winter	FIB
Cucamonga Creek	<	10	04/03/2007	Summer	FIB
Cucamonga Creek	<	10	04/17/2007	Summer	FIB
Cucamonga Creek	<	10	04/24/2007	Summer	FIB
Cucamonga Creek	<	10	05/01/2007	Summer	FIB
Day Creek Canyon	<	10	05/17/2006	Summer	FIB

Waterbody	NumQual	Result	SampleDate	Season	Study*
Day Creek Canyon	<	10	05/26/2006	Summer	FIB
Day Creek Canyon	=	10	05/31/2006	Summer	FIB
Day Creek Canyon	=	160	06/07/2006	Summer	FIB
Day Creek Canyon	=	10	06/14/2006	Summer	FIB
Day Creek Canyon	<	10	06/21/2006	Summer	FIB
Day Creek Canyon	=	10	06/28/2006	Summer	FIB
Day Creek Canyon	=	10	07/05/2006	Summer	FIB
Day Creek Canyon	=	10	07/12/2006	Summer	FIB
Day Creek Canyon	=	10	07/19/2006	Summer	FIB
Day Creek Canyon	<	10	07/26/2006	Summer	FIB
Day Creek Canyon	=	20	08/02/2006	Summer	FIB
Day Creek Canyon	=	20	08/09/2006	Summer	FIB
Day Creek Canyon	=	4	08/16/2006	Summer	FIB
Day Creek Canyon	<	10	08/23/2006	Summer	FIB
Day Creek Canyon	<	10	08/30/2006	Summer	FIB
Day Creek Canyon	=	10	09/06/2006	Summer	FIB
Day Creek Canyon	<	10	09/13/2006	Summer	FIB
Day Creek Canyon	<	10	09/20/2006	Summer	FIB
Day Creek Canyon	<	10	09/27/2006	Summer	FIB
Day Creek Canyon	<	10	10/04/2006	Summer	FIB
Day Creek Canyon	<	10	10/11/2006	Summer	FIB
Day Creek Canyon	<	10	10/18/2006	Summer	FIB
Day Creek Canyon	=	30	10/25/2006	Summer	FIB
Day Creek Canyon	<	10	11/01/2006	Winter	FIB
Day Creek Canyon	<	10	11/08/2006	Winter	FIB
Day Creek Canyon	<	10	11/15/2006	Winter	FIB
Day Creek Canyon	<	10	11/22/2006	Winter	FIB
Day Creek Canyon	<	10	11/29/2006	Winter	FIB
Day Creek Canyon	<	10	12/06/2006	Winter	FIB
Day Creek Canyon	<	10	12/13/2006	Winter	FIB
Day Creek Canyon	<	10	12/19/2006	Winter	FIB
Day Creek Canyon	<	10	12/27/2006	Winter	FIB
Day Creek Canyon	<	10	01/03/2007	Winter	FIB
Day Creek Canyon	<	10	01/10/2007	Winter	FIB
Day Creek Canyon	<	10	01/17/2007	Winter	FIB
Day Creek Canyon	=	10	01/24/2007	Winter	FIB
Day Creek Canyon	<	10	01/31/2007	Winter	FIB
Day Creek Canyon	<	10	02/07/2007	Winter	FIB
Day Creek Canyon	<	10	02/14/2007	Winter	FIB
Day Creek Canyon	=	10	02/21/2007	Winter	FIB

Waterbody	NumQual	Result	SampleDate	Season	Study*
Day Creek Canyon	=	20	02/27/2007	Winter	FIB
Day Creek Canyon	=	10	03/07/2007	Winter	FIB
Day Creek Canyon	<	10	03/14/2007	Winter	FIB
Day Creek Canyon	<	10	03/21/2007	Winter	FIB
Day Creek Canyon	<	10	03/28/2007	Winter	FIB
Day Creek Canyon	<	10	04/04/2007	Summer	FIB
Day Creek Canyon	<	10	04/11/2007	Summer	FIB
Day Creek Canyon	<	10	04/18/2007	Summer	FIB
Day Creek Canyon	<	10	04/25/2007	Summer	FIB
Day Creek Canyon	<	10	05/02/2007	Summer	FIB
Day Creek Canyon	=	10	05/09/2007	Summer	FIB
Fry Creek	=	10	6/13/05	Summer	NL
Fry Creek	=	10	5/18/06	Summer	NL
Hurkey Creek	=	5500	05/31/2006	Summer	FIB
Hurkey Creek	=	10	06/07/2006	Summer	FIB
Hurkey Creek	=	31	06/14/2006	Summer	FIB
Hurkey Creek	<	10	06/21/2006	Summer	FIB
Hurkey Creek	=	41	06/28/2006	Summer	FIB
Hurkey Creek	=	20	07/05/2006	Summer	FIB
Hurkey Creek	<	10	07/12/2006	Summer	FIB
Hurkey Creek	=	10	01/03/2007	Winter	FIB
Hurkey Creek	<	10	01/10/2007	Winter	FIB
Hurkey Creek	=	10	01/17/2007	Winter	FIB
Hurkey Creek	=	150	01/24/2007	Winter	FIB
Hurkey Creek	=	30	01/31/2007	Winter	FIB
Hurkey Creek	=	10	02/07/2007	Winter	FIB
Hurkey Creek	<	10	02/21/2007	Winter	FIB
Hurkey Creek	=	10	03/07/2007	Winter	FIB
Hurkey Creek	<	10	03/14/2007	Winter	FIB
Hurkey Creek	<	10	03/23/2007	Winter	FIB
Hurkey Creek	<	10	03/28/2007	Winter	FIB
Hurkey Creek	<	10	04/04/2007	Summer	FIB
Hurkey Creek	<	10	04/11/2007	Summer	FIB
Hurkey Creek	<	10	04/18/2007	Summer	FIB
Lachusa Canyon	=	132	05/15/2006	Summer	FIB
Lachusa Canyon	=	52	05/26/2006	Summer	FIB
Lachusa Canyon	=	20	06/02/2006	Summer	FIB
Lachusa Canyon	=	108	06/06/2006	Summer	FIB
Lachusa Canyon	=	10	06/13/2006	Summer	FIB
Lachusa Canyon	=	63	06/20/2006	Summer	FIB

Waterbody	NumQual	Result	SampleDate	Season	Study*
Lachusa Canyon	=	20	06/27/2006	Summer	FIB
Lachusa Canyon	<	10	07/06/2006	Summer	FIB
Lachusa Canyon	=	52	07/12/2006	Summer	FIB
Lachusa Canyon	=	31	07/19/2006	Summer	FIB
Lachusa Canyon	<	10	07/26/2006	Summer	FIB
Lachusa Canyon	=	10	08/02/2006	Summer	FIB
Lachusa Canyon	=	31	08/09/2006	Summer	FIB
Lachusa Canyon	<	10	08/16/2006	Summer	FIB
Lachusa Canyon	=	10	08/23/2006	Summer	FIB
Lachusa Canyon	<	10	08/30/2006	Summer	FIB
Lachusa Canyon	<	10	09/06/2006	Summer	FIB
Lachusa Canyon	=	41	09/13/2006	Summer	FIB
Lachusa Canyon	<	10	09/20/2006	Summer	FIB
Lachusa Canyon	=	161	09/27/2006	Summer	FIB
Lachusa Canyon	<	10	10/04/2006	Summer	FIB
Lachusa Canyon	<	10	10/11/2006	Summer	FIB
Lachusa Canyon	=	10	10/18/2006	Summer	FIB
Lachusa Canyon	<	10	10/25/2006	Summer	FIB
Lachusa Canyon	=	10	11/01/2006	Winter	FIB
Lachusa Canyon	=	10	11/08/2006	Winter	FIB
Lachusa Canyon	=	10	11/15/2006	Winter	FIB
Lachusa Canyon	<	10	11/20/2006	Winter	FIB
Lachusa Canyon	=	10	11/29/2006	Winter	FIB
Lachusa Canyon	=	20	12/06/2006	Winter	FIB
Lachusa Canyon	=	10	12/20/2006	Winter	FIB
Lachusa Canyon	<	10	01/03/2007	Winter	FIB
Lachusa Canyon	<	10	01/10/2007	Winter	FIB
Lachusa Canyon	=	10	01/24/2007	Winter	FIB
Lachusa Canyon	<	10	02/07/2007	Winter	FIB
Lachusa Canyon	=	10	02/14/2007	Winter	FIB
Lachusa Canyon	<	10	02/21/2007	Winter	FIB
Lachusa Canyon	<	10	03/01/2007	Winter	FIB
Lachusa Canyon	=	52	03/07/2007	Winter	FIB
Lachusa Canyon	<	10	03/14/2007	Winter	FIB
Lachusa Canyon	=	20	03/21/2007	Winter	FIB
Lachusa Canyon	=	10	03/28/2007	Winter	FIB
Lachusa Canyon	<	10	04/05/2007	Summer	FIB
Lachusa Canyon	<	10	04/11/2007	Summer	FIB
Lachusa Canyon	=	10	04/18/2007	Summer	FIB
Lachusa Canyon	=	10	04/27/2007	Summer	FIB

Waterbody	NumQual	Result	SampleDate	Season	Study*
Lachusa Canyon	=	63	05/02/2007	Summer	FIB
Lachusa Canyon	=	10	05/09/2007	Summer	FIB
Mill Creek	=	10	6/20/05	Summer	NL
Mill Creek	=	5	9/12/05	Summer	NL
Mill Creek	<	10	05/16/2006	Summer	FIB
Mill Creek	<	10	05/26/2006	Summer	FIB
Mill Creek	<	10	05/30/2006	Summer	FIB
Mill Creek	<	10	06/06/2006	Summer	FIB
Mill Creek	<	10	06/14/2006	Summer	FIB
Mill Creek	<	10	06/21/2006	Summer	FIB
Mill Creek	<	10	06/27/2006	Summer	FIB
Mill Creek	<	10	07/03/2006	Summer	FIB
Mill Creek	=	10	07/12/2006	Summer	FIB
Mill Creek	=	2	07/19/2006	Summer	FIB
Mill Creek	=	3.1	07/25/2006	Summer	FIB
Mill Creek	=	5.1	08/02/2006	Summer	FIB
Mill Creek	=	1	08/08/2006	Summer	FIB
Mill Creek	=	2	08/16/2006	Summer	FIB
Mill Creek	=	2	08/22/2006	Summer	FIB
Mill Creek	=	6.3	08/29/2006	Summer	FIB
Mill Creek	=	20.9	09/05/2006	Summer	FIB
Mill Creek	=	1	09/13/2006	Summer	FIB
Mill Creek	=	3.1	09/19/2006	Summer	FIB
Mill Creek	=	1	09/26/2006	Summer	FIB
Mill Creek	=	1	10/03/2006	Summer	FIB
Mill Creek	=	1	10/10/2006	Summer	FIB
Mill Creek	=	2	10/17/2006	Summer	FIB
Mill Creek	=	3.1	10/24/2006	Summer	FIB
Mill Creek	=	1	10/31/2006	Summer	FIB
Mill Creek	<	1	11/07/2006	Winter	FIB
Mill Creek	<	1	11/15/2006	Winter	FIB
Mill Creek	<	1	11/22/2006	Winter	FIB
Mill Creek	<	1	12/05/2006	Winter	FIB
Mill Creek	=	1	12/12/2006	Winter	FIB
Mill Creek	=	1	12/19/2006	Winter	FIB
Mill Creek	<	1	01/02/2007	Winter	FIB
Mill Creek	<	1	01/11/2007	Winter	FIB
Mill Creek	<	1	01/17/2007	Winter	FIB
Mill Creek	<	1	01/23/2007	Winter	FIB
Mill Creek	=	2	01/30/2007	Winter	FIB

Waterbody	NumQual	Result	SampleDate	Season	Study*
Mill Creek	=	8.5	02/06/2007	Winter	FIB
Mill Creek	=	1	02/13/2007	Winter	FIB
Mill Creek	<	1	02/21/2007	Winter	FIB
Mill Creek	<	1	03/06/2007	Winter	FIB
Mill Creek	<	1	03/13/2007	Winter	FIB
Mill Creek	<	1	03/21/2007	Winter	FIB
Mill Creek	<	1	04/03/2007	Summer	FIB
Mill Creek	<	1	04/10/2007	Summer	FIB
Mill Creek	<	1	04/18/2007	Summer	FIB
Mill Creek	<	1	05/01/2007	Summer	FIB
Mill Creek	<	1	05/08/2007	Summer	FIB
Mill Creek	=	1	05/15/2007	Summer	FIB
Mill Creek	=	1	05/22/2007	Summer	FIB
Mill Creek	<	1	05/29/2007	Summer	FIB
Piru Creek	=	10	6/22/05	Summer	NL
Piru Creek	=	5	9/16/05	Summer	NL
Piru Creek	=	41	6/2/06	Summer	NL
San Juan Creek	=	25	5/23/05	Summer	NL
San Juan Creek	=	52	9/1/05	Summer	NL
San Juan Creek	=	20	05/17/2006	Summer	FIB
San Juan Creek	=	30.5	5/18/06	Summer	NL
San Juan Creek	=	75	05/25/2006	Summer	FIB
San Juan Creek	=	31	05/31/2006	Summer	FIB
San Juan Creek	=	187	06/09/2006	Summer	FIB
San Juan Creek	=	259	06/15/2006	Summer	FIB
San Juan Creek	=	110	06/21/2006	Summer	FIB
San Juan Creek	=	41	06/30/2006	Summer	FIB
San Juan Creek	=	173	07/07/2006	Summer	FIB
San Juan Creek	=	41	07/12/2006	Summer	FIB
Santiago Creek	=	10	6/7/05	Summer	NL
Santiago Creek	=	15	9/2/05	Summer	NL
Santiago Creek	=	10	05/17/2006	Summer	FIB
Santiago Creek	<	10	05/25/2006	Summer	FIB
Santiago Creek	<	10	05/31/2006	Summer	FIB
Santiago Creek	=	10	06/09/2006	Summer	FIB
Santiago Creek	=	134	06/15/2006	Summer	FIB
Santiago Creek	=	10	06/21/2006	Summer	FIB
Santiago Creek	=	20	06/30/2006	Summer	FIB
Santiago Creek	=	41	07/07/2006	Summer	FIB
Santiago Creek	=	31	07/12/2006	Summer	FIB

Waterbody	NumQual	Result	SampleDate	Season	Study*
Santiago Creek	=	121	07/18/2006	Summer	FIB
Sespe Creek	=	10	6/22/05	Summer	NL
Sespe Creek	=	5	9/15/05	Summer	NL
Sespe Creek	=	52	6/2/06	Summer	NL
Seven Oaks Dam	=	10	6/20/05	Summer	NL
Seven Oaks Dam	=	5	9/12/05	Summer	NL
Silverado Creek	=	46.5	5/25/05	Summer	NL
Silverado Creek	=	12.5	9/1/05	Summer	NL
Silverado Creek	=	10	5/17/06	Summer	NL
Solstice Canyon	=	20	05/15/2006	Summer	FIB
Solstice Canyon	=	52	05/26/2006	Summer	FIB
Solstice Canyon	=	41	06/02/2006	Summer	FIB
Solstice Canyon	=	135	06/06/2006	Summer	FIB
Solstice Canyon	=	20	06/13/2006	Summer	FIB
Solstice Canyon	=	131	06/20/2006	Summer	FIB
Solstice Canyon	=	52	06/27/2006	Summer	FIB
Solstice Canyon	<	10	07/06/2006	Summer	FIB
Solstice Canyon	<	10	07/12/2006	Summer	FIB
Solstice Canyon	=	10	07/21/2006	Summer	FIB
Solstice Canyon	=	20	07/26/2006	Summer	FIB
Solstice Canyon	=	20	08/02/2006	Summer	FIB
Solstice Canyon	=	10	08/09/2006	Summer	FIB
Solstice Canyon	=	10	08/16/2006	Summer	FIB
Solstice Canyon	=	20	08/23/2006	Summer	FIB
Solstice Canyon	=	20	08/30/2006	Summer	FIB
Solstice Canyon	=	20	09/06/2006	Summer	FIB
Solstice Canyon	=	200	09/13/2006	Summer	FIB
Solstice Canyon	=	20	09/20/2006	Summer	FIB
Solstice Canyon	<	10	09/27/2006	Summer	FIB
Solstice Canyon	<	10	10/04/2006	Summer	FIB
Solstice Canyon	<	10	10/11/2006	Summer	FIB
Solstice Canyon	=	10	10/18/2006	Summer	FIB
Solstice Canyon	<	10	10/25/2006	Summer	FIB
Solstice Canyon	<	10	11/01/2006	Winter	FIB
Solstice Canyon	<	10	11/08/2006	Winter	FIB
Solstice Canyon	=	10	11/15/2006	Winter	FIB
Solstice Canyon	<	10	11/20/2006	Winter	FIB
Solstice Canyon	<	10	11/29/2006	Winter	FIB
Solstice Canyon	=	160	12/06/2006	Winter	FIB
Solstice Canyon	<	10	12/20/2006	Winter	FIB

Waterbody	NumQual	Result	SampleDate	Season	Study*
Solstice Canyon	<	10	01/03/2007	Winter	FIB
Solstice Canyon	=	20	01/10/2007	Winter	FIB
Solstice Canyon	<	10	01/24/2007	Winter	FIB
Solstice Canyon	<	10	02/07/2007	Winter	FIB
Solstice Canyon	<	10	02/14/2007	Winter	FIB
Solstice Canyon	<	10	02/21/2007	Winter	FIB
Solstice Canyon	<	10	03/01/2007	Winter	FIB
Solstice Canyon	=	41	03/07/2007	Winter	FIB
Solstice Canyon	=	10	03/14/2007	Winter	FIB
Solstice Canyon	=	10	03/21/2007	Winter	FIB
Solstice Canyon	=	20	03/28/2007	Winter	FIB
Solstice Canyon	<	10	04/05/2007	Summer	FIB
Solstice Canyon	<	10	04/11/2007	Summer	FIB
Solstice Canyon	<	10	04/18/2007	Summer	FIB
Solstice Canyon	<	10	04/27/2007	Summer	FIB
Solstice Canyon	=	20	05/02/2007	Summer	FIB
Solstice Canyon	=	20	05/09/2007	Summer	FIB
Tenaja Creek	=	20.5	6/15/05	Summer	NL
Tenaja Creek	=	10	5/18/06	Summer	NL

* NL: Assessment of Water Quality Concentrations and Loads from Natural Landscapes (SCCWRP Technical Report 500)
FIB: Fecal Indicator Bacteria (FIB) Levels During Dry Weather from Southern California Reference Streams (SCCWRP Technical Report 542)