Santa Monica Bay Beaches
Bacteria Total Maximum Daily Load
Implementation Plan for Jurisdictional Groups 2 and 3

A Cooperative Effort by:
City of Los Angeles
City of Santa Monica
City of El Segundo
County of Los Angeles
California Department of Transportation

JUNE 2005
FINAL REPORT

LAC/IRPSMBB-CVR_FINAL.PSD

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Acronyms and Abbreviations

ARA	Antibiotic Resistance Analysis
ASCE	American Society of Civil Engineers
BID	Business Improvement District
BMP	best management practice
BOS	Bureau of Sanitation, City of Los Angeles
Caltrans	California Department of Transportation
CASQA	California Association of Stormwater Quality Agencies
CDS	continuous deflection separation
CEQA	California Environmental Quality Act
CH:CDM	A Joint Venture of CH2M HILL and CDM
CIS	Coastal Interceptor Sewer
COS	Central Outfall Sewer
CRC	Cooperative Research Centre
DAF	dissolved air flotation
DPW	Department of Public Works, City of Los Angeles
ft^2	square foot/feet
GIS	geographic information system
gpd	gallons per day
gpm	gallons per minute
HTP	Hyperion Treatment Plant
IRP	Integrated Resources Plan
IWR	integrated water resources
JG 2/3	Jurisdictional Groups 2 and 3
JG	jurisdictional group
LAUSD	Los Angeles Unified School District
LAX	Los Angeles International Airport
MAR	multiple antibiotic resistance

MG	million gallons
mgd	million gallons per day
mL	milliliter(s)
MPN	most probable number
NOS	North Outfall Sewer
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
RCDSMM	Resource Conservation District of the Santa Monica Mountains
Regional Board	California Regional Water Quality Control Board, Los Angeles Region
SCCWRP	Southern California Coastal Water Research Project
SMBB	Santa Monica Bay Beaches
SMBRC	Santa Monica Bay Restoration Commission
SMURRF	Santa Monica Urban Runoff Recycling Facility
SWEEP	Stormwater Environmental Educational Partnership
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	California State Water Resources Control Board
TDS	total dissolved solids
TMDL	total maximum daily load
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UV	ultraviolet
UWRRC	Urban Water Resources Research Council
WPD	Watershed Protection Division, Bureau of Sanitation, City of Los Angeles

Executive Summary

This Implementation Plan has been developed to address the requirements of both the Santa Monica Bay Beaches (SMBB) Dry Weather and Wet Weather Bacteria Total Maximum Daily Loads (TMDLs). These TMDLs set limits on annual allowable water quality exceedance days based on bacterial indicator monitoring at the Santa Monica Bay shoreline during summer dry weather, winter dry weather, and wet weather conditions.

There are 27 subwatersheds defined in the Santa Monica Bay Watershed Management Area, with multiple jurisdictions that are responsible for compliance with the SMBB Bacteria TMDLs. A primary jurisdiction for each subwatershed was identified; these are defined in the TMDL as the jurisdiction comprising greater than 50 percent of the subwatershed land area. There are seven primary jurisdictions within the Santa Monica Bay Watershed, each with a group of associated subwatersheds, beach monitoring locations, and other jurisdictions and agencies responsible for these subwatersheds.

Of these seven jurisdictional groups, the City of Los Angeles was designated the lead agency for Jurisdictional Group (JG) 2 and is a participant in three other JGs (1, 3, and 7). The City of Santa Monica was designated the lead in JG 3 and is a participant in JGs 2 and 8. Other responsible agencies within Jurisdictional Groups 2 and 3 (JG 2/3) include El Segundo, the County of Los Angeles, and the California Department of Transportation (Caltrans). This Implementation Plan pertains to the joint implementation planning effort for JG 2/3. JG 2 is responsible for six subwatersheds and JG 3 is responsible for one subwatershed.

ES-1 Introduction

In 1988, the California State Water Resources Control Board (SWRCB) identified and approved Section 303(d) of the Clean Water Act for the list of impaired water bodies within California. Of these, many of the beaches along Santa Monica Bay were included as impaired due to high coliform counts or because of beach closures generally associated with high bacteria levels. The beaches appeared on the Section 303(d) lists because the elevated bacteria levels and beach closures prevented full support of the beaches designated beneficial use for water contact recreation.

A TMDL allocates the amount of a specific pollutant load that a water body can receive and still meet water quality objectives established to protect designated uses of the water body. The TMDL consists of the acceptable pollutant load from point and nonpoint sources (waste load and load allocations, respectively), plus a margin of safety to account for uncertainty in the analysis. For these Bacteria TMDLs, the numeric target is based on adopted bacterial densities that meet the public health levels of acceptable risk. The allocation is then expressed in terms of the maximum number of days per year in which the target may be exceeded at the beaches.

These TMDLs establish numeric criteria for compliance with bacterial water quality objectives.[1] Compliance targets are established in terms of "allowable exceedance-days," which are set such that:

(1) The number of days per year in which bacteriological water quality exceeds the water quality objectives at any site is no greater than at the designated reference site, or

(2) There is no increase in the historical number of exceedance days at any site.

These TMDLs were developed using a reference system/antidegradation approach. This approach recognizes that there are natural sources of bacteria and that water quality at each subwatershed should be at least as good as that of a reference subwatershed site, or that there is no further degradation of bacteriological water quality for those subwatersheds where the water quality is better than the reference site. This indicates that the intent of the Regional Board for this TMDL is to control only anthropogenic (human-caused) sources of bacteria, since natural sources of bacteria from undeveloped areas that may also contribute indicator bacteria to the receiving waters and cause measurable exceedances that cannot be directly controlled through more traditional mechanisms.

The TMDL allocations for the SMBB Dry Weather and Wet Weather Bacteria TMDLs are summarized in Table ES-1.

TABLE ES-1
TMDL Load Allocations
SMBB Bacteria TMDL Implementation Plan

Weather Condition	Season	Allowable Exceedance Days	
		Daily Sampling	Weekly Sampling
Dry Weather	Winter[1]	3[2]	1
	Summer[3]	0	0
Wet Weather	Storm Year[4]	17[5]	3[6]

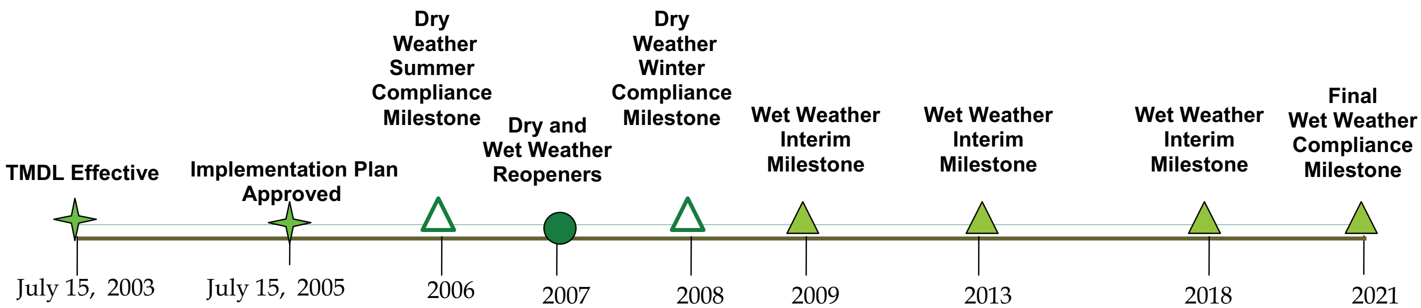
Notes:
[1] Winter season: November 1 to March 31
[2] Two allowable exceedance days for Venice City Beach and Imperial Highway storm drain
[3] Summer season: April 1 to October 31
[4] Storm Year: November 1 to October 31
[5] 13 allowable exceedance days for Venice City Beach based on daily sampling
[6] Two allowable exceedance days for Venice City Beach based on weekly sampling

The SMBB Dry Weather Bacteria TMDL was adopted by the Regional Board on January 24, 2002. The SMBB Wet Weather Bacteria TMDL was adopted by the Regional Board on December 12, 2002. The associated Basin Plan Amendments were then approved by the U.S. Environmental Protection Agency (USEPA) on June 19, 2003, and the effective date of both

[1] A water quality objective exceedance occurs when the rolling geometric mean of samples taken during the past 30 days exceeds the geometric mean limits or when any single sample exceeds the single sample limits.

TMDLs was July 15, 2003, when the Regional Board filed the Notice of Decision. The compliance time frames for these TMDLs are shown below in Figure ES-1.

FIGURE ES-1
Santa Monica Bay Beaches Bacterial TMDL Compliance Schedule



ES-2 Proposed Dry Weather Implementation Plan

A Dry Weather Implementation Plan for JG 2/3 is proposed in this draft report in Appendix A. The plan consists of diverting dry weather urban runoff from the coastal watershed through low-flow diversions from the storm drain system to the sanitary sewer system via the Coastal Interceptor Sewer for treatment at the Hyperion Treatment Plant during dry weather. The low-flow diversions will be temporarily closed during wet weather conditions. A schedule for diversion of priority drains along the SMBB is included with the plan. Within JG 2/3, 19 priority storm drains identified in the TMDL will be diverted. Of these, ten storm drains have already been diverted, seven are in progress (under design or construction), and two storm drains to be diverted are being planned.

ES-3 Proposed Wet Weather Implementation Plan

The SMBB Wet Weather Bacteria TMDL establishes the critical condition for compliance as the 90th percentile "storm year" in terms of wet days. For beach sites within JG 2/3, when the sites are sampled daily, the final allowance of wet weather exceedance days on which an exceedance of either limit is detected is 17 days per storm year, except at Venice City Beach at Windward Avenue, which is 13 days. Equivalently, when the sites are sampled on a weekly basis, the number of allowable violation days will be scaled to 3 exceedance days and 2 exceedance days, respectively. There are also interim milestones established in the TMDL to assure progress toward these goals.

The TMDL acknowledges that there are two broad approaches to implementation:

- **Integrated Water Resources Approach (preferred approach):** This approach takes a holistic view of regional water resources by integrating planning focused on beneficial reuse of stormwater and integrates multiple pollutant solutions.
- **Nonintegrated Water Resources Approach:** This approach looks at the specific watershed in isolation and points toward structural, end-of-pipe solutions.

The members of JG 2/3 and the watershed stakeholders agree that an integrated water resources approach is preferable, as it would represent the most cost-effective and efficient use of resources to address this problem. The integrated water resources approach described in this report has the following characteristics:

- Integrates urban runoff planning with planning for other water system needs, such as recycled water and potable water.
- Focuses on beneficial reuse of urban runoff, including groundwater infiltration at multiple points throughout a watershed.
- Addresses multiple pollutants with which the SMBB is impaired (metals, pesticides, suspended solids, polycyclic aromatic hydrocarbons [PAHs] and polychlorinated biphenyls [PCBs] as listed on the USEPA Section 303[d] list).
- Incorporates enhancement of other public goals, such as water supply, recycling and storage, environmental justice, parks, greenways, open space, and active and passive recreational and environmental education opportunities.

ES-3.1 Wet Weather Implementation Plan Approach

The approach to implementation for compliance with the SMBB Wet Weather Bacteria TMDL was based in large part on stakeholder input from representatives from JG 2/3, local communities within JG 2/3 watersheds, the Regional Board and environmental organizations. Input from the stakeholders clearly indicated support for an approach to avoid large structural, end-of-pipe solutions that would be expensive and could result in significant negative impacts to the communities along the SMBB. Instead, the stakeholders preferred an approach emphasizing nonstructural, institutional solutions along with small, decentralized structural projects, i.e., wet weather best management practices (BMPs). These BMPs would be sited in selective locations within the watershed and offer multiple benefits for the community and environment.

As a result, this Wet Weather Implementation Plan is based on a phased, iterative approach to TMDL compliance due to the unique developmental nature of the project. It is widely accepted that there are insufficient data and understanding within the scientific community for quantifying the performance of wet weather BMPs for bacteria removal. This TMDL Implementation Plan will be the first of its kind for a large urban region in a semiarid environment. Therefore, a phased, iterative approach employing adaptive management principles is the most reasonable strategy to meet the objectives of this TMDL.

ES-3.1.1 TMDL Compliance using Recommended Implementation Approach

The JG 2/3 stakeholder community selected the recommended iterative, adaptive integrated water resources approach described above because it offers the potential to achieve compliance at a reasonable cost with limited negative impacts to the SMBB communities. This approach is unique in that no other large urban community in a semiarid environment has employed an implementation approach to control bacteria from wet weather urban runoff. However, this approach has been proven to effectively control wet weather urban runoff in other urban areas such as Portland, Oregon. Since the sources of bacterial pollution in runoff are widespread, controlling urban runoff using nonstructural and selected small, structural BMPs is currently the most effective way to assure reduction of bacterial pollution of the beaches.

Employing the recommended iterative phased approach, which incorporates adaptive management principles, allows substantial progress toward reducing bacterial runoff pollution while regularly improving and optimizing the program to achieve TMDL compliance within desired timeframes. As data comes in from ongoing monitoring of runoff water quality (i.e., identification of "hot spots" within the subwatersheds) and BMP performance effectiveness, the implementation program will be refined and optimized to prioritize the selection and siting of institutional and subregional solutions that offer the most potential to reduce bacterial concentrations at the beach drains. This integrated water resources approach also helps control other pollutants beyond bacteria and offers benefits to the community beyond pollution control.

ES-3.1.2 Compliance through Local Runoff Reductions and Water Quality Improvements

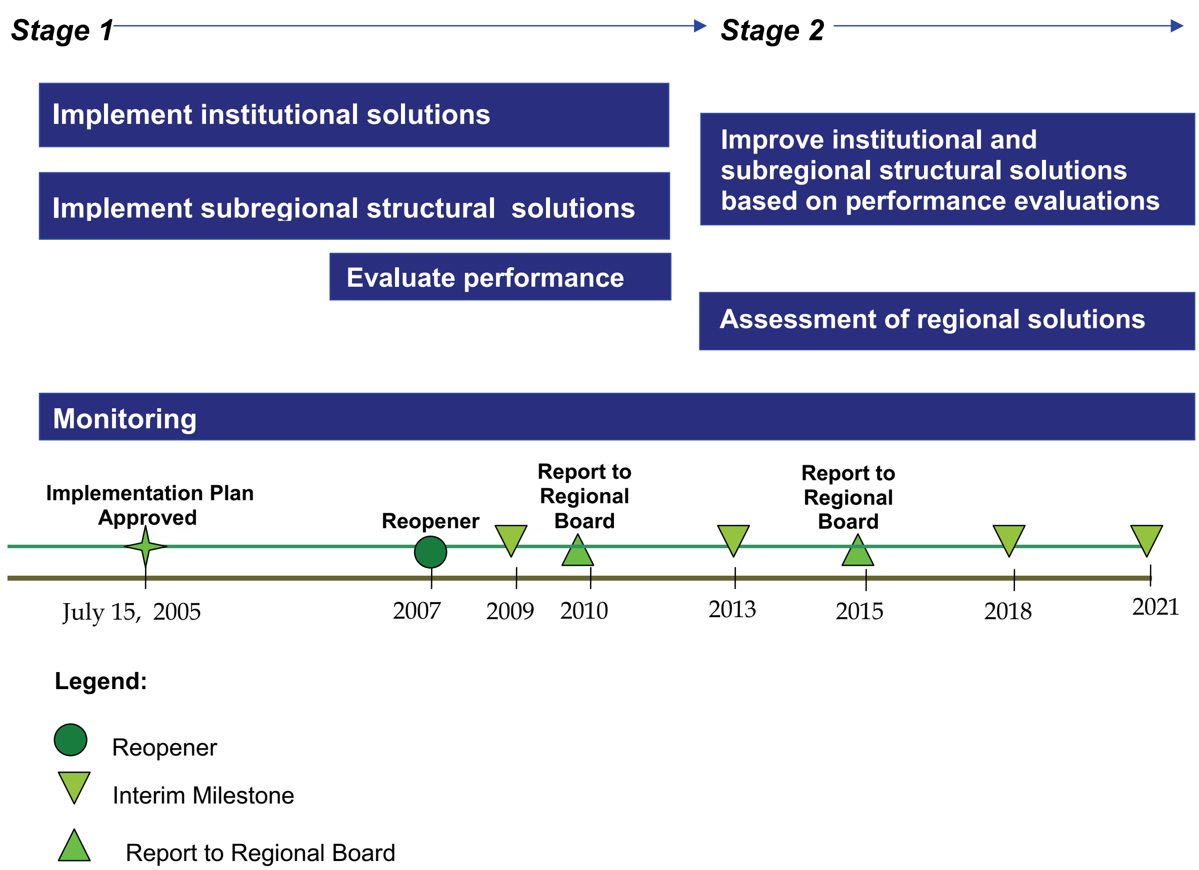
An analysis of wet weather runoff events and bacterial exceedances indicates that if wet weather flow reaches the beach, then health standard bacterial exceedances are highly likely under current conditions. Therefore, the initial strategy for reducing exceedances is tied to a combination of reducing bacteria at the source through institutional (nonstructural) and local (or subregional) structural measures, and reducing the amount of runoff that reaches the receiving water, rather than focusing on treating a specific volume of runoff collected in the storm drain system for bacterial reduction. This strategy emphasizes the beneficial use of wet weather runoff and the installation of subregional structural solutions to reduce downstream flows from areas that are associated with high levels of bacteria. It also focuses on local source control to reduce the level of bacteria and other pollutants discharged into the storm drains. Water quality improvements in the receiving waters will be realized from water quantity (flow) management practices, including an array of small, decentralized structural BMPs, as well as from source control resulting from institutional solutions.

Whereas employing large-scale, end-of-pipe, regional solutions minimizes the risk of noncompliance, it also carries with it large costs and severe impacts to the local, densely urbanized beach communities. Therefore, regional solutions are proposed to be deferred from further consideration until the institutional and subregional structural solutions can be implemented and their effectiveness at improving beach water quality assessed.

ES-3.2 Phased Iterative Approach to TMDL Compliance

As shown in Figure ES-2, institutional and subregional structural solutions will be implemented initially (during Stage 1) and the results of these efforts monitored to determine the subsequent course of action. In parallel, shoreline monitoring at the point of discharge from the storm drain to the surf zone ("point zero") as well as continued research on BMP effectiveness and pathogen indicators will be ongoing.

FIGURE ES-2
Phased Iterative Approach to Implementation



ES-3.2.1 Stage 1 of Implementation

The first stage of this program (Stage 1) will emphasize institutional (nonstructural) and subregional structural runoff management solutions that can be quickly implemented and monitored for effectiveness to reduce the contribution of bacteria and other pollutants from wet weather runoff. Institutional solutions include expansion of current stormwater quality improvement programs as well as additional programmatic measures.

Subregional structural runoff management solutions to reduce the volume of wet weather runoff that reaches the receiving waters include the installation of decentralized, small-scale, local storage and reuse or infiltration projects at public facilities, as well as consideration of residential options, such as cisterns/rain barrels and redirected downspouts. These types of BMPs offer the advantages of addressing multiple goals (water quality improvement, water conservation, habitat enhancement, aesthetics, and recreation) while preventing multiple pollutants from reaching the beaches.

These Stage 1 programs and projects will be focused initially on watersheds that drain into the highest priority storm drains, i.e., those with greatest risk of bacterial standard exeedances. These are, in order of priority, the Venice Beach, Santa Monica, Dockweiler, Pulga Canyon, and Santa Monica Canyon subwatersheds. The higher priority watersheds generally have greater concentrations of high density and commercial areas.

Monitoring the effectiveness of these nonstructural and structural BMPs will occur through both onsite and inland runoff water quality monitoring as well as through the Coordinated Shoreline Monitoring Plan associated with this TMDL to determine whether the BMPs improve stormwater quality in terms of loads and/or concentrations of pollutants. Additional monitoring for source identification and baseline upstream monitoring will provide information to determine the most effective pollutant control methodologies. The results of these monitoring efforts, as well as parallel research on BMP effectiveness and alternative pathogen indicators, will be factored in through a phased, iterative compliance plan for this TMDL. By employing adaptive management principles, there will be opportunities to consider these new data and reflect new findings within this integrated and holistic approach to watershed management.

ES-3.2.2 Stage 2 of Implementation

Consideration of the need to implement regional, end-of-pipe solutions, such as diversion of wet weather runoff to the wastewater treatment system or the construction of operational storage and runoff treatment plants, will be considered in the second stage of this compliance program (Stage 2). These are generally single-purpose facilities that offer little benefit beyond pollution reduction and represent a less holistic approach to runoff management. For this reason, the need to pursue these options is deferred until the effectiveness of a concerted effort to implement institutional and subregional structural solutions can be evaluated.

ES-3.2.3 Interim Compliance Milestones

At the TMDL reopener scheduled for July 2007, the effectiveness of these measures for achieving water quality improvements in the SMBB will likely not yet be fully realized, as only 2 years will have elapsed since the initiation of these measures (corresponding to approval of this Implementation Plan). This is not enough time to plan, fund, implement, achieve and demonstrate water quality improvements with these measures. In addition, the numeric target, load allocation, and pathogen indicators for this TMDL may be revisited at this reopener. The basis for compliance may be reconsidered if sufficient research has been conducted, and results have been evaluated for applicability to this TMDL by this time. If this information is not available by this date, then it may be presented to the Regional Board through future requests or resolutions, as appropriate.

The first interim compliance milestone is scheduled for July 2009. Achieving the compliance target of a 10 percent reduction of exceedance days is contingent on the effectiveness of these initial activities as well as precipitation patterns during the intervening years.

The effectiveness of the Stage 1 activities will be evaluated based on results from shoreline monitoring, upstream monitoring, and BMP effectiveness monitoring of both structural and nonstructural solutions implemented thus far, as well as consideration of relevant, parallel research on BMPs. The analysis of these results will help focus and refine Stage 2 activities. As new data (i.e., BMP performance, indicator research) are generated and the results evaluated, they will be brought to the Board for direction. If warranted, resolutions to modify the TMDL(s) may be proposed for adoption by the Board. Anticipated dates in which such data may be available for reporting to the Board are shown in Figure ES-2. These scheduled reports provide a forum for communicating to the Board the level of achievement of the Stage 1 activities, the effectiveness of these measures, and the potential implications of these results for the TMDL(s).

The beginning of Stage 2 is shown to coincide with the second interim milestone, scheduled for July 2013. By this time, the extent of implementation and effectiveness evaluation of institutional and subregional structural solutions should be adequate to ascertain the feasibility of meeting the TMDL numeric criteria. These criteria might be the same as those contained in the current TMDL, or, through additional research and analysis, and might reflect modified numeric targets or load allocations.

By that time, there should be enough information to gauge whether the large regional structural solutions will be necessary. The need for regional solutions may vary considerably by subwatershed. For example, less developed subwatersheds might be less likely to need to employ regional solutions than more developed subwatersheds. The determination of the necessary path forward to meet subsequent milestones and compliance deadlines can then be initiated with Stage 2.

ES-3.3 Project Implementation

Institutional solutions are program-level activities that provide source control measures intended to prevent or reduce levels of bacteria, or bacteria sources (e.g., garbage, trash, pet waste) from initially being picked up by runoff whether onsite, in the curb/street, or in the storm drain system. The current programs that are in place by the agencies of JG 2/3 to implement these BMPs as well as additional source control measures were identified. These additional programs include increased litter reduction, improved restaurant and grocery store trash management, Business Improvement District outreach, incentives, exploring methods to reduce bacteria contribution from the homeless population, pre-wet weather storm drain flushing, redirecting downspouts, and modifying/enhancing public education programs.

Potential sites for the implementation of subregional structural solutions projects were identified through a survey of public parks, public buildings, vacant lots, and schools in the JG 2/3 watershed area. While this list is not inclusive of all possible sites for BMP implementation, it is a starting point from which initial subregional structural solutions can be identified.

From the list of potential projects, each agency selected projects within their jurisdiction and assigned a level of commitment. For the projects listed as “Committed,” this indicates that the agency is either already implementing the projects or is committed to pursue the implementation of the programs or projects. This commitment is made by the agency to execute those programs and projects, to the best of their ability, within their realm of authority and control. If a Committed project or program is determined to be infeasible or less effective than a substitute approach, then the agency will implement the substitute program or project to achieve the same objective.

When a project is categorized as a “Pilot” project, this indicates that the agency intends to perform a Pilot study or similar activity prior to considering full implementation. Piloting may involve a focused study or a single pilot scale project that will help determine the effectiveness and feasibility of the intended program or project.

Where “Consider” is selected, this indicates that the agency will evaluate the program’s or project’s feasibility. Programs and projects that are listed under this category require further discussions to determine technical viability and implementability.

Coordination will be needed both within and among agencies to successfully execute these projects. For example, local codes that require diversion of stormwater from properties to street drainage systems will need to be modified so that projects are not handled with variances but rather are built into the codes with necessary protections from local flooding and for building structural integrity. Some time will be needed to systematize these procedures as code and practice modifications.

ES-3.3.1 Schedule of Institutional Solutions Implementation

Initial institutional solutions that are identified in this report as “Committed” projects will be implemented by each jurisdiction within the first 4 years following approval of this Implementation Plan, enabling these strategies to be fully in effect by the first interim compliance milestone of 2009.

The JG 2/3 agencies will implement a minimum of two initial Pilot programs within the first 4 years (by 2009). Two additional Pilot programs will be implemented subsequently by year 8 (2013). Those programs identified as “Consider” programs will be studied within the first 8 years (by year 2013) and, if found to feasible, implemented by year 2021.This schedule for implementation of institutional solutions is summarized below in Table 25. Refinements to these institutional solutions will be conducted in Stage 2 of the Implementation Plan to incorporate findings.

Institutional solutions programs will generally go through planning, preparation of as implementation plan, development of a Pilot program and implementation phases. Each of these project phases is expected to take approximately one year. These programs will be prioritized to target the higher priority subwatersheds, i.e., those that drain to the more contaminated storm drains that are generally associated with high density land uses. The Implementation Plan that will be developed for each program will focus on what each specific agency is currently doing, how resources could be shifted to target these high priority drains initially, and what can be done to enhance activities in these subwatersheds.

As these programs become better defined through the iterative, adaptive approach, specific, quantifiable performance measures will be identified and included in the respective program implementation plans. In addition, as baseline water quality monitoring results are obtained upstream in the watershed, institutional solutions can be honed to target specific locations where high bacterial contributions are found, and the implementation plan for the affected programs modified accordingly. These will be living documents that will be revisited by the JG 2/3 agencies annually.

The implementation schedule for institutional solutions is summarized in Table ES-2. The agencies implementing the specific program will monitor the achievement of these timeline milestones, and report progress to the Regional Board through the MS4 annual permit report. Issues adversely impacting the schedule will be closely monitored and diligent efforts will be made to meet the committed plan.

ES-3.3.2 Schedule of Subregional Structural Solutions Implementation

Implementation of the smaller, decentralized, structural BMPs consists of several steps: planning and coordination, design, permitting/environmental documentation, advertisements/bid/award/construction and operations and matinenance (O&M). The effectiveness of the system can then be determined from a combination of baseline and influent/effluent monitoring over the course of approximately one year. Depending on magnitude and complexity of these projects, the overall duration from developing the concept to assessing the project's effectiveness can range from 2 to 5 years from inception.

Of the 17 initial Committed subregional structural solutions projects, the agencies in JG 2/3 will implement up to three projects per year, until they are completed in 8 years (by year 2013). Of the eight Pilot projects identified, four will be completed in the first 4 years (by year 2009) and the other four by year 2013. The 45 subregional structural solutions projects that are listed as "Consider" will be studied for implementation by year 8 (by year 2013). Those that are found to be feasible will be implemented by year 2021. Refinements to these subregional structural solutions will be conducted in Stage 2 of the Implementation Plan to incorporate findings.

The priorities defined for the projects are set to initially target the watersheds that drain into the highest priority storm drains. These are in the following order of priority: Venice Beach, Santa Monica, Dockweiler, Pulga Canyon, and Santa Monica Canyon subwatersheds. Two projects, Del Rey Lagoon Park and Rustic Canyon Recreation Center, begin earlier than their priority watershed might indicate because there are coordination complexities that will take longer to sort through during the planning process.

All of the 17 Committed projects are scheduled to be completed by year 2013. The eight Pilot projects identified will proceed through the same planning, design, permitting/environmental documentation, and construction phases and will be completed by year 2013. After completion of each of these projects, the O&M phase begins, as early as fiscal year 2006/2007 for the projects completed in fiscal year 2005/2006. However, there will be a data gap as monitoring results from the new projects identified under this Plan will not be available until 2010. It is during this O&M phase that the water quality impacts can be evaluated, and adjustments made to Implementation Plan.

The iterative, adaptive process inherent in this Implementation Plan allows for consideration of the effectiveness of the institutional and subregional structural solutions implemented in Stage 1 for the formulation of the Stage 2 projects. In addition, the results of baseline water quality data collected during Stage 1 can also be taken into account as Stage 2 plans are made. Because of the uncertainties of rainfall patterns, there needs to be sufficient time (7 years for Stage 1) to allow for adequate assessment of the performance of these projects and programs. In addition, the data that served as the bases for the water quality analyses for these SMBB Bacteria TMDLs spanned from 1995-2000. Since then, there have been several programs and projects implemented by the participating JG 2/3 agencies, including the Santa Monica Runoff Recycling Facility (SMURRF), several low-flow diversions, increased public outreach and other MS4 permit-related institutional programs, and some small structural solutions. These may be contributing to improving wet weather water quality, but the effects on the downstream SMBB Bacteria TMDL exceedance-day criteria are unknown at this time.

By the time Stage 2 planning begins (2013), there will be much more information about the effectiveness of the projects and programs implemented thus far and "hot spots" will be identified upstream in the watersheds. Balancing the increased certainty from this information and increased efficiency from the experience of Stage 1 implementation with limitations of agency resources (funding, staff) and increased stakeholder involvement in generating and implementing projects that align with this compliance strategy, the rate of potential project implementation of subregional structural solutions is planned to double from a rate of two to three projects per year to a rate of five to six projects per year. Although this is an ambitious agenda, and one that is subject to the vagaries of stakeholder participation and intra-/interagency coordination, the JG 2/3 agencies are committed to investigating these "Consider" projects slated for Stage 2, and believe that, if found to be feasible, can be implemented by year 2021. If specific projects are not found to be feasible, alternate projects will be explored and adjustments to the Plan can be made as needed to optimize the selection of the types and locations of these projects. The 16 years ahead of us (from 2005 to 2021) provide sufficient time to plan resource allocations, obtain funding and develop and construct projects to ensure the successful completion of this Implementation Plan to meet the TMDL objectives.

This schedule for implementation of subregional structural solutions is summarized in Table ES-2. A schedule for coordination with local school districts is also shown in Table ES-2. School districts are not subject to the requirements of this TMDL, but own public facilities that could offer opportunities for local solution implementation.

TABLE ES-2
Project Commitments
SMBB Bacteria TMDL Implementation Plan

Project Type	Commit	Pilot	Consider
Institutional	6 programs identified Implement all programs by 2009	4 programs identified Implement 2 programs by 2009 Implement remaining 2 programs by year 2013	3 programs identified Study all programs by 2009 Implement feasible programs by year 2021
Subregional Structural Solutions	17 projects identified Implement 2 to 3 projects per year by year 2013	8 projects identified Implement 4 projects by 2009 Implement remaining 4 projects by year 2013	46 projects identified Study project for feasibility by 2013 Implement feasible projects by year 2021
Schools	N/A	N/A	42 schools identified Study/coordinate with school districts and develop schedule for implementation by year 2009

Section 1 Introduction

This Implementation Plan has been developed to address the requirements of both the Santa Monica Bay Beaches (SMBB) dry weather and Wet Weather Bacteria Total Maximum Daily Loads (TMDLs). These TMDLs set limits on annual allowable water quality exceedance days based on bacterial indicator monitoring at the Santa Monica Bay shoreline during summer dry weather, winter dry weather, and wet weather conditions.

1.1 SMBB Bacteria TMDL Development History

1.1.1 General Objectives of a TMDL

A TMDL is a maximum allotted pollutant budget for a water body. A TMDL is prepared for a specific water body or segment of a water body when a pollutant or stressor is impairing the designated uses of that water body or causing it to exceed water quality objectives. If a water body is impaired for a specific pollutant or stressor, it is then listed on an *impaired waters list*. The impaired waters list, also known as a Section 303(d) list of the Clean Water Act, is developed by the state and accepted by the U.S. Environmental Protection Agency (USEPA). The Section 303(d) list includes the waters, the impairing pollutants or stressors, and the probable sources of these pollutants.

A TMDL, in its most basic sense, allocates the amount of a specific pollutant load that a water body can receive and still meet water quality objectives established to protect designated uses of the water body. The TMDL consists of the acceptable pollutant load from point and nonpoint sources (waste load and load allocations respectively) plus a margin of safety to account for uncertainty in the analysis.

The TMDL allocation does not have to be a daily load, but is often a mass load or total concentration of pollutants allowed in the water body. In the case of the Santa Monica Bay Bacteria TMDLs, the numeric targets are based on adopted bacterial densities that meet the public health levels of acceptable risk. The allocation is then expressed in terms of the maximum number of days per year in which the target may be exceeded in the receiving waters at beaches.

1.1.1.1 SMBB Bacteria TMDL Development History

On November 9, 2001, the California State Regional Water Quality Control Board (SWRCB), Los Angeles Region (Regional Board) issued a draft TMDL to reduce bacterial indicator densities at SMBB, which addressed both Dry and Wet Weather Bacteria TMDLs. After receiving and considering public review input on the wet weather components of the draft TMDL, it was bifurcated into two TMDLs: (1) addressing bacterial indicator water quality exceedances during dry weather, with distinct requirements for summer dry weather and winter dry weather, and (2) a TMDL for bacterial indicator water quality exceedances during wet weather.

Wet weather is defined as those days with 0.1 inch of rain or more and the 3 days following the rain event. This is the definition used by the Los Angeles County Department of Health

Services for rain-related beach postings. The other days are considered dry weather. Winter is defined as the period from November 1 to March 31, and summer from April 1 to October 31.

The SMBB Dry Weather Bacteria TMDL was prepared by the Regional Board staff and adopted by the Regional Board on January 24, 2002. The associated Board Resolution and Basin Plan Amendment are provided in Appendix A.

A preliminary draft of the Wet Weather Bacteria TMDL was then developed and shared with stakeholders for input on June 21, 2002. It was issued as a draft TMDL on August 5, 2002, and a public hearing was held on September 26, 2002. The Regional Board continued the item from this Board meeting to the next scheduled meeting. This allowed the Regional Board staff to revise the TMDL based upon comments received at the September 26, 2002, Board meeting. It also allowed stakeholders to consider the revised versions of the tentative TMDL resolution and Basin Plan Amendment (posted on October 25, 2002) and Staff Report (posted on November 7, 2002) prior to Board adoption on December 12, 2002, which was then approved by USEPA on June 19, 2003.

The Regional Board filed its Notice of Decision on July 15, 2003, the effective date of both TMDLs. The final Board Resolution and Basin Plan Amendments for both the Wet Weather and Dry Weather Bacteria TMDLs are provided in Appendix B. This version of the Dry Weather TMDL Basin Plan Amendment reflects modification to the reopener date to coincide with that of the Wet Weather TMDL reopener.

This process demonstrated the willingness of the Regional Board to work closely with stakeholders to craft a TMDL that was reasonable and that took into account stakeholder feedback. This cooperative approach to TMDL development was demonstrated in the inclusion of an extended timeframe for an integrated water resources (IWR) approach to TMDL compliance, and by applying a reference system/antidegradation approach. This approach is discussed further below.

1.1.1.2 Objectives of the SMBB Bacteria TMDL

The goal of the SMBB Wet Weather Bacteria TMDL is to reduce the risk of human illness associated with recreation in marine waters contaminated with bacteria. Currently, more than 55 million beachgoers visit the SMBB annually. An epidemiological study (Haile et al., 1996) by the Santa Monica Bay Restoration Project established a causal relationship between adverse health effects and poor recreational water quality. In 1988 and in 2002, the Section 303(d) list showed that beaches were impaired by bacterial indicators and, therefore, the Regional Board adopted this Bacteria TMDL. This TMDL is intended to specifically control (i.e., reduce) bacteria that reach the beaches during, or as a result of, wet weather runoff events.

A reference system/antidegradation approach was incorporated into the allocations and will continue to apply through the implementation period, subject to review at the TMDL reopener. The application of a reference system/antidegradation approach recognizes that there are natural sources of bacteria and that water quality at each of the subwatersheds should be at least as good as that of a reference subwatershed site, or that there is no further degradation of bacteriological water quality for those subwatersheds where the water quality is better than the reference site. This indicates that the intent of the Regional Board for this TMDL is to control only anthropogenic (human-caused) sources of bacteria since natural sources of bacteria from undeveloped areas that may also contribute indicator bacteria to the receiving waters and cause measurable exceedances cannot be directly controlled through more traditional mechanisms. The Regional Board recognized that "while treatment and diversion of natural sources may fully address the impairment of the water contact recreation beneficial use, such an approach may adversely affect aquatic life and wildlife beneficial uses" (Regional Board, 2002).

The reference site, Leo Carrillo Beach and its associated drainage area (Arroyo Sequit Canyon), is representative of an undeveloped natural watershed with minimal anthropogenic impacts. This approach is intended to ensure that the bacteriological water quality of the SMBB is at least as good as that of the reference sites and that no degradation of existing bacteriological water quality is permitted. Currently, runoff conveyed from developed areas by storm drains and creeks is identified as the primary source of elevated bacterial levels.

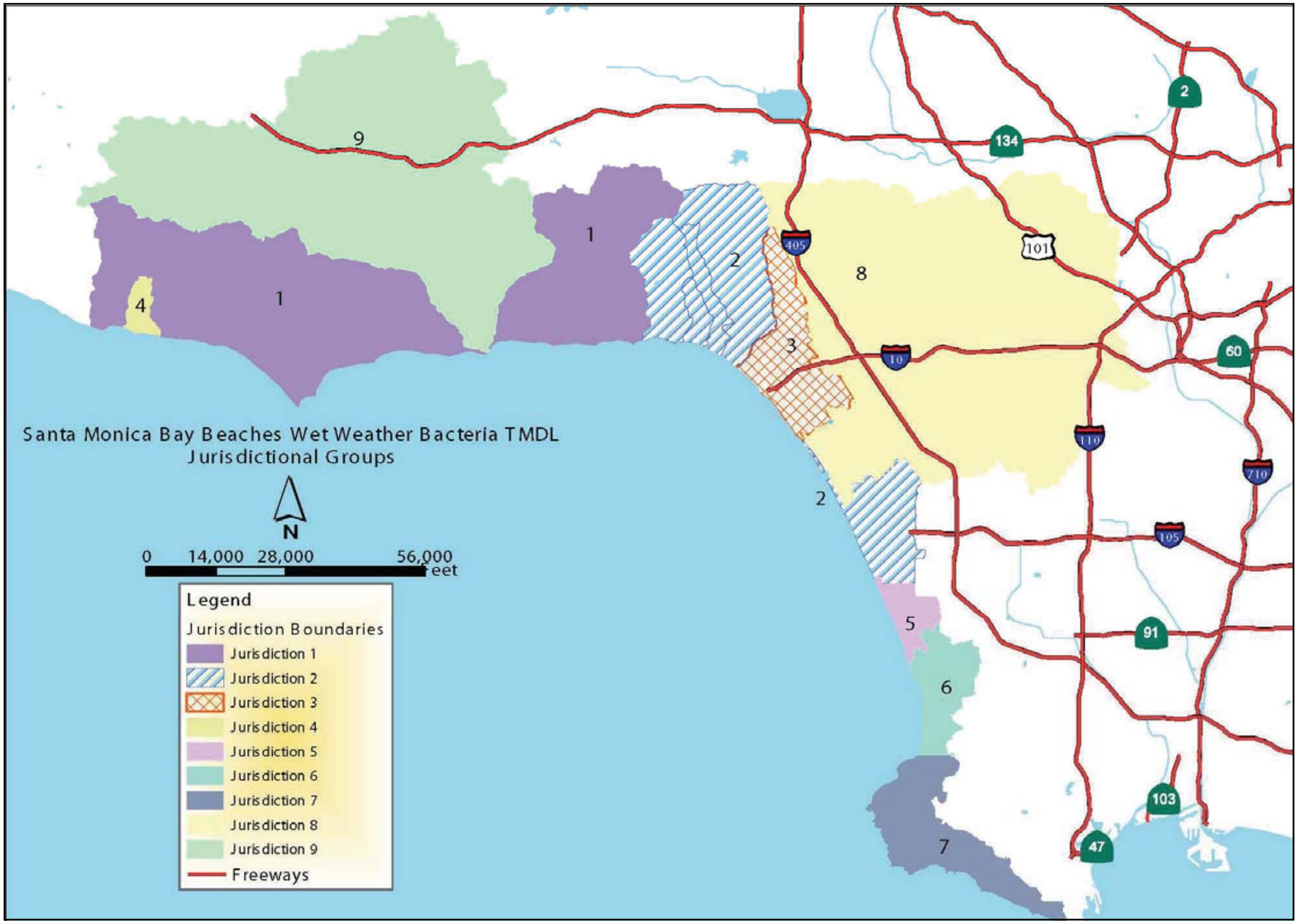
The TMDL requires that the near-shore waters of the SMBB reach water quality targets that will ensure that the risk of bacteriological illness is no greater than the USEPA "acceptable health risk" of 19 illnesses per 1,000 swimmers, or less than 2 percent risk of illness.

There are 27 subwatersheds defined in the Santa Monica Bay Watershed Management Area, with multiple jurisdictions that are responsible for compliance with the SMBB Bacteria TMDLs. A primary jurisdiction for each subwatershed was identified; these are defined in the TMDL as the jurisdiction comprising greater than 50 percent of the subwatershed land area.

As shown in Figure 1, there are nine primary jurisdictions within the Santa Monica Bay Watershed, each with a group of associated subwatersheds, beach monitoring locations, and other jurisdictions and agencies responsible for these subwatersheds. Seven of these jurisdictional groups are affected by these TMDLs; the other two, Ballona Creek and Malibu Creek, will have separate bacteria TMDLs developed. Although the implementation plans for these two watersheds are being developed under separate TMDLs, the jurisdictions within these watersheds remain responsible agencies under the SMBB Bacteria TMDLs as well. The implementation plans developed under the individual bacteria TMDLs for Ballona Creek and Malibu Creek will be required to achieve the downstream waste load allocations (exceedance day requirements) at the beach locations under the Beaches TMDLs.

The City of Los Angeles was designated the lead agency for Jurisdictional Group (JG) 2 and is a significant participant in three other JGs (1, 3, and 7). The City of Santa Monica was designated the lead in JG 3 and is a participant in JGs 2 and 8. Other responsible agencies within Jurisdictional Groups 2 and 3 (JG 2/3) include El Segundo, the County of Los Angeles, and the California Department of Transportation (Caltrans).

FIGURE 1
Santa Monica Bay Wet Weather Bacteria TMDL Jurisdictional Groups



This Implementation Plan pertains to the joint implementation planning effort for JG 2/3. JG 2 is responsible for six subwatersheds and JG 3 is responsible for one subwatershed. The primary jurisdictions are responsible for submitting this Implementation Plan to the Regional Board. Although the California State Department of Parks and Recreation is also included in JG 2/3, it has elected to develop its own implementation plan for complying with these Bacteria TMDLs.

The health of the Bay is also impacted by neighboring watersheds not regulated by the SMBB Bacteria TMDL, specifically the Malibu Creek, Ballona Creek, and Marina Del Rey watersheds. Ballona Creek and Malibu Creek watersheds are regulated by the beaches TMDLs in that they must achieve the downstream (beach) waste load allocations set in the Beaches TMDLs. However, implementation plans will be developed under the individual TMDLs rather than under the beaches TMDLs.

A proposed Dry Weather Implementation Plan for JG 2/3 is contained in Appendix C. The plan consists of diverting dry weather urban runoff from the coastal watershed through low-flow diversions from the storm drain system to the sanitary sewer system via the Coastal Interceptor Sewer (CIS) for treatment at the Hyperion Treatment Plant (HTP) during dry weather. The total flow planned for dry weather diversion to HTP via the CIS by the end of 2005 is 9.33 million gallons a day (mgd). Low-flow diversions will be temporarily closed during wet weather conditions. A proposed Wet Weather Implementation Plan is described in this report.

1.1.2 Consultant Team Scope of Work

In support of efforts by the City of Los Angeles to prepare the Implementation Plan, the consultant team, which includes the joint venture of CH2M HILL and CDM (CH:CDM), Psomas, E2 Consultants, MapVision, and Harris and Company, was contracted by the City of Los Angeles to conduct the following work:

- Task 1: Assist with TMDL Development Planning
- Task 2: Provide Staff Support for the Development of an Integrated Implementation Plan
- Task 3: Determine Regulatory Requirements
- Task 4: Conduct a Detailed Hydrologic Study
- Task 5: Conduct a Beneficial Use Evaluation
- Task 6: Conduct a Treatment and Management Options Evaluation
- Task 7: Develop Coastal Collection System Evaluation and Conceptual Alternatives
- Task 8: Research Potential Sites for Collection, Treatment, and Diversion Facilities
- Task 9: Conduct an Analysis of Implementation Alternatives
- Task 10: Prepare TMDL Implementation Plan
- Task 11: Perform Task Management

This Implementation Plan contains a summary of the results of these efforts.

1.1.3 Wet Weather Implementation Plan Approach

The approach to implementation for compliance with the SMBB Wet Weather Bacteria TMDL was based in large part on stakeholder input from representatives from: JG 2/3; local communities within JG 2/3; the Regional Board; and environmental organizations, i.e., Heal the Bay and Santa Monica BayKeeper. Input from the stakeholders indicated support for an approach to avoid large structural, end-of-pipe solutions that would be expensive and result in significant negative impacts (construction, land use) to the communities along the SMBB. Instead, the stakeholders preferred an approach emphasizing nonstructural, institutional solutions along with small, decentralized structural projects, i.e., wet weather best management practices (BMPs). These BMPs would be sited in selective locations within the watershed and offer multiple benefits for the community and environment.

As a result, this Wet Weather Implementation Plan is based on a phased, iterative approach to TMDL compliance due to the unique developmental nature of the project. It is widely accepted that there are insufficient data and understanding within the scientific community quantifying the performance of wet weather BMPs for bacteria removal. This TMDL Implementation Plan will be the first of its kind for a large urban a region in a semiarid environment. Therefore, a phased, iterative approach employing adaptive management principles is the most reasonable strategy to meet the objectives of this TMDL.

1.1.3.1 Stage 1 of Implementation

The first stage of this program (Stage 1) will emphasize institutional (nonstructural) and local runoff management solutions (structural) to reduce the contribution of bacteria and other pollutants of concern from wet weather runoff that can be quickly implemented and monitored for effectiveness. Institutional solutions include expansion of current stormwater quality improvement programs as well as additional programmatic measures.

Local runoff management solutions to reduce the volume of wet weather runoff that reaches the receiving waters include the installation of decentralized, small-scale, local storage and reuse or infiltration projects at public facilities, as well as consideration of residential options, such as cisterns/rain barrels and redirecting downspouts. These types of BMPs offer advantages of addressing multiple objectives (water quality improvement, water conservation, habitat enhancement, aesthetics, and recreation) while preventing multiple pollutants from reaching the beaches.

These Stage 1 programs and projects will focus initially on watersheds that drain into the highest priority storm drains, that is, those with greatest risk of bacterial standard exeedances. These are, in order of priority, the Venice Beach, Santa Monica, Dockweiler, Pulga Canyon, and Santa Monica Canyon subwatersheds. The higher priority watersheds generally have greater concentrations of high density and commercial areas.

Monitoring the effectiveness of these nonstructural and structural BMPs will occur through both onsite and inland receiving water monitoring as well as through the Coordinated Shoreline Monitoring Plan associated with this TMDL to determine whether the BMPs improve stormwater quality in terms of loads and/or concentrations of pollutants. Additional monitoring for source identification and baseline upstream monitoring will provide information to determine the most effective pollutant control methodologies. The results of these monitoring efforts, as well as parallel research on BMP effectiveness and alternative pathogen indicators, will be factored in through a phased, iterative compliance plan for this TMDL. By employing adaptive management principles, there will be opportunities to consider these new data and to reflect new findings within this integrated and holistic approach to watershed management.

1.1.3.2 Stage 2 of Implementation

Consideration of the need to implement regional, end-of-pipe solutions, such as diversion of wet weather runoff to the wastewater treatment system or the construction of operational storage and runoff treatment plants, will be considered in the second stage of this compliance program (Stage 2). These solutions are generally single-purpose facilities that offer little benefit beyond pollution reduction and represent a less holistic approach to runoff management. For this reason, the need to pursue these options is deferred until the effectiveness of a concerted effort to implement nonstructural and subregional structural solutions can be evaluated.

1.1.3.3 TMDL Compliance using Recommended Implementation Approach

The JG 2/3 stakeholder community selected the recommended iterative adaptive IWR approach because it offers the potential to achieve compliance at a reasonable cost and with limited negative impacts to the SMBB communities. This approach is unique in that no other large urban community in a semiarid environment has employed an implementation approach to control bacteria from wet weather urban runoff. However, this approach has been proven to effectively control wet weather urban runoff in other urban areas, such as Portland, Oregon (Lipton, 2004). Since the sources of bacterial pollution in runoff are widespread, controlling urban runoff using nonstructural source control solutions and selected decentralized structural BMPs is currently the most effective way to assure reduction of bacterial pollution at the beaches. Employing the recommended iterative phased approach, which incorporates adaptive management principles, allows substantial progress toward reducing bacterial runoff pollution while improving and optimizing the program to achieve TMDL compliance within desired timeframes. This IWR approach also helps control other pollutants beyond bacteria and offers benefits to the community beyond pollution control.

As noted above, the state of the science is such that the projected effectiveness of these institutional and subregional structural solutions for bacteria reduction is uncertain. The programs and projects identified in this Implementation Plan have been prioritized based on a qualitative evaluation of their potential impacts on bacterial loading reduction. Although employing regional solutions would allow a more certain prediction of bacterial reduction, it was widely agreed after the second stakeholder workshop that this was not the preferred approach. Therefore the iterative, adaptive process that underlied this Implementation Plan was employed instead to provide an IWR approach using institutional and subregional structural solutions.

While the institutional solutions focus on source control, many of the subregional structural solutions will contribute to bacterial loading reduction by eliminating or reducing the transport mechanism, i.e., runoff, at the site. However, the precise relationship between runoff reduction and exceedance-day reduction is unknown at this time.

Sites for the development of subregional structural solutions were evaluated based most prominently on factors including their subwatershed, ownership, and soil infiltration capacities. Sites located in subwatersheds with the highest amount of beach exceedance days at their downstream beach drains are more likely to contain high concentrations of indicator bacteria; reducing bacterial loading in these subwatersheds will more likely reduce the number of exceedance days. For example, the site of the new Santa Monica Library is in a dense urban area and is part of the Santa Monica subwatershed, a high priority area. Ownership had a large impact on initial site selection to reduce costs and ensure early commitment resulting in sites owned by the JG 2/3 agencies having a higher initial priority for listing in this Implementation Plan. In the future there may be opportunity to apply these same strategies with other agencies and private entities.

Although the tools are not currently in place to accurately estimate the bacterial reductions that will be achieved with this proposed iterative adaptive IWR approach, the JG 2/3 agencies believe that through the two-pronged approach of reducing the bacterial loading through both source control and runoff reduction from the more highly contaminated subwatersheds and corresponding land uses, it is expected that the TMDL milestones that occur during Stage 1 will be met.

Section 2 Background

2.1 Wet Weather Bacteria TMDL Summary

2.1.1 Numeric Targets

Compliance with the SMBB Wet Weather Bacteria TMDL load allocation is based on beach water quality monitoring results relative to the following water quality numeric targets:

Rolling 30-day Geometric Mean Limits:

- Total coliform density shall not exceed 1,000/100 milliliters (mL)
- Fecal coliform density shall not exceed 200/100 mL
- Enterococcus density shall not exceed 35/100 mL
- Geometric mean targets may not be exceeded at any time

Single Sample Limits:

- Total coliform density shall not exceed 10,000/100 mL
- Fecal coliform density shall not exceed 400/100 mL
- Enterococcus density shall not exceed 104/100 mL
- Total coliform density shall not exceed 1,000/100 mL if the ratio of fecal-to-total exceeds 0.1

An exceedance day occurs when the average of samples taken within the past 30 days exceeds the geometric mean limit or when any single sample exceeds the single sample limit.

The TMDL establishes the critical condition as the 90th percentile "storm year" in terms of wet days. For beach sites within JG 2/3, when the sites are sampled daily, the final allowance of wet weather exceedance days on which an exceedance of either limit is detected is 17 days per storm year[2], except at Venice City Beach at Windward Avenue, which is 13 days. Equivalently, when the sites are sampled on a weekly basis, the number of allowable violation days will be scaled to 3 exceedance days and 2 exceedance days, respectively.

2.1.2 Implementation Options

The TMDL acknowledges that there are two broad approaches to implementation:

- **IWR Approach (preferred approach):** This approach takes a holistic view of regional water resources by integrating planning focused on beneficial reuses of stormwater and integrates multiple pollutant solutions.

- **Nonintegrated Water Resources Approach:** This approach looks at the specific watershed in isolation and points toward structural, end-of-pipe solutions.

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[2] A 'storm year' is defined to extend from November 1 to October 31.

The members of JG 2/3, and the watershed stakeholders agree that an IWR approach is preferable, as it would represent the most cost-effective and efficient use of resources to address this problem. The IWR approach described in this report has the following characteristics:

- Integrates urban runoff planning with planning for other water system needs, such as recycled water and potable water.
- Focuses on beneficial reuse of urban runoff, including groundwater infiltration at multiple points throughout a watershed.
- Addresses multiple pollutants with which the SMBB is impaired (metals, pesticides, suspended solids, polycyclic aromatic hydrocarbons [PAHs] and polychlorinated biphenyls [PCBs] as listed on the USEPA Section 303[d] list).
- Incorporates enhancement of other public goals, such as water supply, recycling and storage, environmental justice, parks, greenways, open space, and active and passive recreational and environmental education opportunities.

2.1.3 Compliance Schedule

Using an IWR approach, the watershed must achieve a cumulative 10 percent reduction from the total exceedance-day reduction within 6 years of the effective date of the TMDL, a 25 percent reduction within 10 years, and a 50 percent reduction within 15 years of the effective date of the TMDL. Final implementation targets must be achieved in 18 years. Table 2-1 summarizes these dates relative to the effective date of July 15, 2003.

TABLE 1
Compliance Milestones for Integrated Water Resources Approach to Implementation
SMBB Bacteria TMDL Implementation Plan

Milestone	Date
Effective date	July 15, 2003
Submit coordinated shoreline monitoring plan	November 15, 2003
Submit draft Implementation Plan report	March 15, 2005
Submit final Implementation Plan report	July 15, 2005
TMDL Reopener	July 15, 2007
Achieve 10% cumulative reduction from the total exceedance-day reductions required for that jurisdictional group	July 15, 2009
Achieve 25% cumulative reduction from the total exceedance-day reductions required for that jurisdictional group	July 15, 2013
Achieve 50% cumulative reduction from the total exceedance-day reductions required for that jurisdictional group	July 15, 2018
Achieve 100% cumulative reduction from the total exceedance-day reductions required for that jurisdictional group	July 15, 2021

2.1.4 Compliance Monitoring

Achievement of the designated exceedance-day reductions will be measured by shoreline compliance monitoring. For JG 2/3, the City of Los Angeles will conduct daily or systematic weekly bacterial sampling in the wave wash at all major drains and creeks or at existing monitoring stations at beaches to determine compliance. The specific plan for conducting this shoreline monitoring is contained in the Coordinated Shoreline Monitoring Plan, initially submitted by all seven jurisdictional groups affected by the SMBB Bacteria TMDLs on November 12, 2003, and, after two subsequent revisions, was approved by the Regional Board on April 28, 2004. Monitoring in accordance with this plan began on November 1, 2004.

2.2 Summary of Land Use Distribution by Subwatershed

As seen in Figure 2, Castle Rock, Pulga Canyon, and Santa Monica Canyon subwatersheds are mostly natural open space, some parts of which are undeveloped rocky mountainous areas. Therefore, runoff from these subwatersheds is expected to have generally lower relative contribution from urban sources of bacteria when compared to the other watersheds.

In contrast, Dockweiler and Santa Monica subwatersheds are more urbanized with large percentages of transportation, residential and commercial land uses. The runoff from these subwatersheds is predominantly from urban sources. Santa Ynez Canyon subwatershed consists of relatively equal proportions of urban and non-urban land use areas, and Venice Beach subwatershed consists mainly of beach park land use.

Table 2 contains the areas of each subwatershed land use.

FIGURE 2
Subwatersheds and Land Use Distribution in Jurisdictional Groups 2 and 3

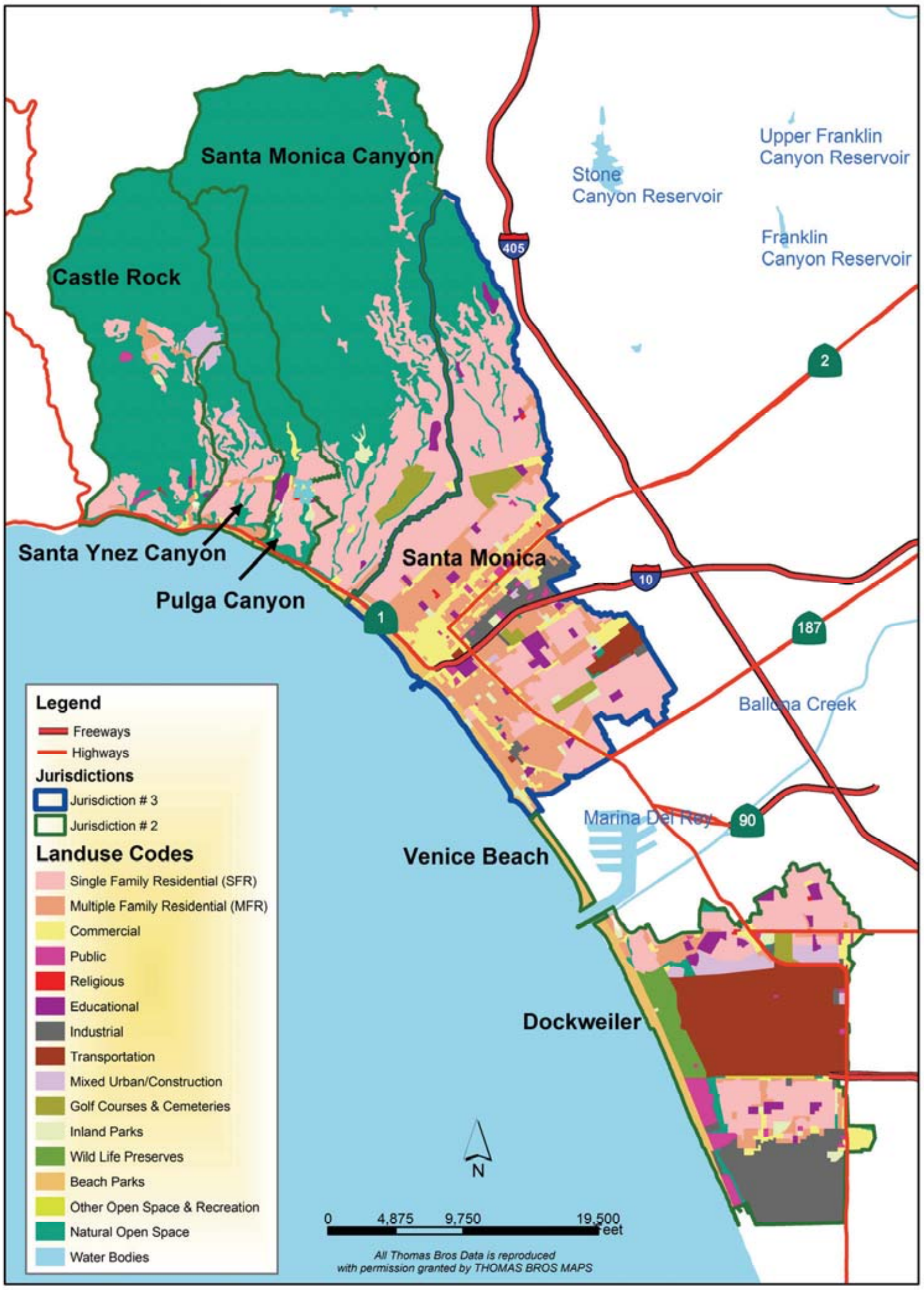


TABLE 2
Land Use Area Per Subwatershed in Jurisdictional Groups 2 and 3
SMBB Bacteria TMDL Implementation Plan

Land Use Category	Castle Rock	Dockweiler	Pulga Canyon	Santa Monica Canyon	Santa Ynez Canyon	Venice Beach	JG 2 Total	Santa Monica/ JG 3 Total	JG 2 and JG 3 Total
	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)
Single Family Residential	572	1,401	334	1,983	557	0	4,848	3,631	8,479
Multi-Family Residential	114	376	18	45	66	9	629	1,983	2,612
Commercial	21	271	54	38	18	0	402	1,006	1,408
Government Only	0	2	2	0	0	0	4	22	26
Public (w/o Government)	26	227	1	5	0	0	259	48	307
Religious	2	6	2	0	0	0	10	9	19
Educational	10	184	38	35	7	0	274	265	539
Industrial	3	1,118	7	0	0	0	1,127	315	1,442
Transportation	0	2,049	0	0	0	0	2,049	231	2,280
Mixed Urban/Construction	95	270	0	10	55	0	430	25	455
Golf Courses & Cemeteries	0	73	0	156	0	0	230	232	461
Inland Parks	14	81	27	38	0	0	160	149	308
Wild Life Preserves	0	317	0	0	0	0	317	0	317
Beach Parks	30	313	28	38	26	99	533	253	786
Open Space & Recreation	5	25	0	0	0	0	30	0	30
Natural Open Space	4,090	153	1,473	7,777	496	0	13,989	983	14,972
Water	1	14	0	0	0	0	15	0	15
Total	**4,982**	**6,879**	**1,984**	**10,125**	**1,226**	**109**	**25,305**	**9,152**	**34,457**

2.3 Stakeholder Process

This TMDL Implementation Plan is the product of coordination between the affected agencies comprising JG 2/3, as well as interested stakeholders, the Regional Board, and USEPA. Monthly meetings among the regulators and agencies were held to direct the course of the Implementation Plan development and coordinate information needs and decision making.

Four workshops were held for interested stakeholders. Stakeholders included a broad range of elected and appointed officials of the Cities of Los Angeles, Santa Monica, and El Segundo; the County of Los Angeles, Caltrans and other state representatives. Managers of these and other agencies, representatives of the Regional Board, several environmental organizations, and local interests also were included. Stakeholder workshops held at the HTP were usually attended by 40 to 60 people. The dates for each workshop are shown below in Table 2-3; agendas and presentations from these workshops are included in Appendix D.

TABLE 3
Jurisdictional Groups 2 and 3 Stakeholder Workshops
SMBB Bacteria TMDL Implementation Plan

Workshop Number	Workshop Date	Highlights of Workshop Agenda
1	May 29, 2003	Introduce Stakeholder Process in TMDL Implementation Plan Development.
2	February 6, 2004	Review of SMBB Wet Weather Bacteria TMDL compliance requirements. Initial findings. Stakeholder feedback.
3	August 12, 2004	Compliance requirements and implementation methodology. Task update. Preliminary alternatives. Stakeholder feedback.
4	November 9, 2004	TMDL Compliance: goal, schedule, and approach. Preferred alternative. Process of selecting sites. Stakeholder feedback. Draft TMDL Implementation Plan and discussion.

Stakeholders provided feedback and recommendations for the Implementation Plan that were addressed and/or incorporated into the Implementation Plan approach.

Section 3 Summary of Technical Analyses

A series of technical analyses were conducted to lay the groundwork for identifying compliance options for the subwatersheds of JG 2/3. The analyses were documented in technical memoranda and are summarized below.

3.1 Hydrological Analysis

A hydrological analysis of the JG 2/3 SMBB subwatersheds was performed to estimate the capture volumes of wet weather runoff that must be managed to meet the TMDL numeric limits. The study determined target runoff volumes and design hydrographic relationships for use in sizing operational storage, diversion, and treatment facilities. The technical memorandum documenting this work is provided in Appendix E. Note that the hydrologic method applied in this concept hydrology study may not apply to other TMDL implementation analyses.

For this study, it was assumed that any discharge of untreated runoff will result in an exceedance. Therefore, violations would occur when runoff volume exceeds the capacity of the storage system (and subsequent treatment, diversion or beneficial use systems) more than 17 times in 1 year for most of the beaches within JG 2/3 (13 times for Venice Beach).

The risk of beach discharges (and, presumably, exceedance days) over a range of different volumes of managed wet weather runoff was estimated. By increasing the target runoff volume to manage less runoff "spills over" the captured volume, less runoff is discharged at the beach and the risk of violating the TMDL decreases. Conversely, if smaller runoff volumes are managed, more runoff is discharged at the beach and the risk of violating the TMDL increases.

The TMDL allows for 17 exceedance days in a given wet season (13 for Venice Beach). Table 4 summarizes analytical results and the relationship between required storage volume and number of hypothetical violation days generated from the application of a continuous simulation rainfall-runoff model (XP-SWMM) based on historical rainfall data. If an end-of-pipe treatment approach were to be used, these volumes represent the potential risk of violations. However, due to the magnitude of these volumes, alternative approaches will be considered, as discussed in Section 4.1.

TABLE 4
Estimated Required Volume (million gallons) for Hypothetical Violation Days within a 50-year Period
SMBB Bacteria TMDL Implementation Plan

Subwatershed	1 Violation in 50 yrs	2 Violations in 50 yrs	5 Violations in 50 yrs
Castle Rock	2.0	1.7	1.0
Santa Ynez	5.7	4.8	2.6
Pulga Canyon	2.8	0.9	0.5
Santa Monica Canyon	29.2	25.1	7.3
Santa Monica	76.0	75.2	72.7
Venice Beach	<0.1	<0.1	<0.1
Dockweiler	53.6	53.1	51.9
TOTAL	**169.3**	**160.8**	**135.9**

Note: The hydrological analysis performed in this study is a conceptual level estimate of runoff values. More detailed hydrologic studies should be conducted for design of local BMPs and for design of regional solutions, if they become necessary.

3.2 Beneficial Use Opportunities

An evaluation was conducted to identify opportunities to beneficially use treated wet weather runoff within the JG 2/3 SMBB subwatersheds via landscape irrigation or groundwater recharge. Both localized and regional beneficial reuse opportunities were considered to reduce or eliminate wet weather discharge to the beaches. The technical memorandum documenting this work is provided in Appendix F.

3.2.1 Subregional Structural Options

Localized beneficial use opportunities such as cisterns/rain barrels, local storage and reuse, and ground infiltration projects, were evaluated for both residential and public buildings.

Cisterns/rain barrels involve diverting runoff from impervious roof areas on residential and commercial properties and storing it in 1,000- to 100,000-gallon tanks. This stored runoff provides a source of chemically untreated water for gardens, free of most sediment and dissolved salts. Installing cisterns/rain barrels at residences will beneficially reuse runoff, but the quantifiable gains will be slight. If cisterns/rain barrels are installed at 5 to 10 percent of the potential lots/parcels in the study area, it was estimated that approximately 0.6 to 1.2 percent of the estimated total average annual wet weather runoff could be managed via cisterns/rain barrels.

Local storage and reuse involves capturing runoff from areas in addition to rooftops and storing it for subsequent reuse onsite. These other areas include driveways, parking lots, and paved sports areas. This option could include some treatment (e.g., chlorination) and would require careful management and consideration of appropriate water distribution systems.

The potential sites for this type of system would be public parks, government facilities, or schools at which the runoff could be reused for irrigation without meeting full Title 22 treatment standards (requiring filtration and disinfection). They would be installed underground since they would need to be big enough to store large volumes of runoff. The landscape maintenance could involve a controlled subsurface distribution system (i.e., no sprinkler system) so that direct public contact is essentially eliminated. The opportunities for these types of projects would have to be identified and developed on a case-by-case basis. The Open Charter School Demonstration Project in the Ballona Creek Watershed, a cooperative effort between the City of Los Angeles, Los Angeles Unified School District (LAUSD), and TreePeople, is an example of this option.

Opportunities for local infiltration projects to manage runoff also were investigated involving capturing runoff at the site where it is generated and using options, such as porous pavement, retention grading, infiltration basins and trenches, bioretention, and infiltration culverts, to infiltrate runoff toward the local groundwater. Infiltration requires that the soils be permeable enough to allow percolation over time into the underlying groundwater basin in a reasonable time and without excessive mounding or surfacing.

Areas with soils that have sufficient infiltration capacity are very limited within the JG 2/3 subwatersheds. Some areas of coastal sands, however, may provide opportunities for localized infiltration, and may provide some incremental savings in total runoff volume to be managed.

Overall, implementing these local opportunities alone will not be sufficient to manage the target runoff volumes. Local storage and reuse projects would be relatively small and would be constructed on a project by project basis. Opportunities for local infiltration are restricted to areas that have porous soils, which were not found on a large scale within the study area.

3.2.2 Regional Options

Beneficial reuse opportunities on a regional level within the study area were also evaluated. The options considered were groundwater injection and landscape irrigation of treated runoff.

Existing and planned groundwater injection projects were evaluated to determine if treated runoff could supplement the existing water supply. It was found that wet weather runoff may have value as a supplemental, low total dissolved solids (TDS) source water that could, under the right conditions, be blended with HTP effluent as a feed to the West Basin Municipal Water District recycled water facilities. This would require careful review of the water quality issues, as well as contractual agreements in place between all parties. However, dedicated injection systems using runoff were found to be infeasible in the JG 2/3 subwatersheds.

Using treated runoff to supplement the irrigation water supply was also evaluated, particularly in areas where there are no current plans to supply treated wastewater as recycled water. Irrigation demands for the JG 2/3 areas were estimated. From a theoretical point of view, if it were possible to capture, store, treat, and distribute wet weather runoff to meet all of these demands, 72 percent of the total target runoff volumes could be beneficially used.

Recommendations regarding employing these regional beneficial use options vary throughout the study area. In the Dockweiler subwatershed area, there are already systems in place to recycle treated wastewater via landscape irrigation. It would not be practical to duplicate the existing treatment, distribution, and delivery systems to the same customers.

The City of Santa Monica already provides recycled water to a few local customers from the Santa Monica Urban Runoff Recycling Facility (SMURRF). The facility treats dry weather urban runoff water that previously was discharged into the Santa Monica Bay through storm drains.

There are no current plans to use treated wastewater to meet irrigation demands north of Santa Monica; therefore, treated runoff may be a viable option to meet some or all of these demands. This can be accomplished by collecting, seasonally storing, and treating runoff for irrigation use. In addition, there may be more localized opportunities to meet smaller irrigation demands through local storage and reuse at end uses that may not require the same high level of treatment.

In summary, there is some opportunity to beneficially reuse wet weather runoff through local and regional solutions. Full implementation of these options, however, would not eliminate the need for other management options.

3.3 Runoff Management Options

An evaluation of the potential management options for runoff was conducted and is summarized in this section. These options included institutional, local and regional options. Final recommendations were based not only on technology, but on feasibility, cost, siting, permitting, reliability, and maintenance. The technical memorandum documenting this work is provided in Appendix G.

3.3.1 Institutional (Nonstructural Source Control) Options

Institutional options are intended to prevent/reduce levels of bacteria, or bacterial sources (e.g., trash) from initially being picked up by runoff. These options include good housekeeping practices programs, education and outreach programs, street maintenance, storm drain maintenance, land use planning and management, ordinances and codes, and enforcement activities.

If used by themselves, institutional options would likely help the most with dry weather runoff and would be minimally effective in reducing bacterial exceedance at the beach. Institutional options should, however, be part of an integrated solution during the early implementation steps.

3.3.2 Subregional, Structural (Small, Decentralized Source Control) Options

Subregional structural options include cisterns/rain barrels, local storage/reuse, onsite capture, and infiltration as previously discussed in Section 3.2. These options are intended to reduce the total volume and flow rate of runoff leaving properties and entering the storm drain system, including any bacteria that might be picked up in runoff from the site, and in some cases, from offsite runoff as well. Local options involve no or minimal treatment because they involve direct reuse of the collected runoff for landscape irrigation or groundwater infiltration at the site.

3.3.3 Regional (Large, End-of-Pipe, Structural) Options

Regional options involve capturing runoff from the storm drain systems, generally immediately upstream of the beach discharge location. Operational storage is necessary to buffer large flows associated with rain events; holding times of 24 to 48 hours are typically necessary. The following regional options for managing the stored runoff were found to be potentially feasible in the study area:

- Divert to the wastewater collection system for treatment at the HTP
- Traditional treatment for discharge to the ocean
- Subsurface constructed wetlands treatment for discharge to the ocean
- Treatment for beneficial reuse – landscape irrigation or groundwater injection
- Discharge to the ocean untreated through an extended outfall

The HTP can treat diverted wet weather runoff and discharge it through the 5-mile outfall, but only when excess capacity exists in the wastewater collection system and at HTP. Due to hydraulic capacity constraints, this option is therefore limited to subwatersheds closest to the treatment plant. This option is discussed in more detail in Section 3.4.

The concept of stormwater treatment requires construction of treatment facilities to remove contaminants. For this TMDL, bacteria, and therefore pathogens, would require disinfection plus appropriate ancillary and pre-treatment to discharge treated runoff to the ocean. It would also be a first step in providing water for beneficial reuse opportunities. A typical treatment train would likely consist of influent pumping, bar screens to remove trash, possibly sedimentation and/or filtration, and disinfection. Based on a survey of similar plants, it was estimated that the footprint area for these facilities would need to be approximately 700 square feet (ft^2) for each million gallons per day of treatment.

As an alternative, in a subsurface-flow constructed wetland, collected runoff flows beneath the surface through a gravel matrix from which wetland plants grow. A typical system configuration would be a cell that is 3.5 feet deep by 100 feet wide by 162 feet long. With an estimated porosity of 0.45, this cell would accommodate a flow of up to 121,000 gallons per day (gpd). This corresponds to an area of approximately 3 acres per mgd.

Treatment to provide water for beneficial reuse opportunities, such as landscape irrigation or groundwater injection, would include traditional pre-treatment and diversion to treatment facilities designed to Title 22 standards (possibly coagulation, flocculation, filtration, and disinfection to meet a 2.2 most probable number [MPN] coliform standard). Membrane filtration could be a practical alternative to conventional coagulation/granular filtration.

For this analysis, it was assumed that a plant to treat runoff to these standards would be similar to the SMURRF. The SMURRF has an average capacity of 500,000 gpd and a peak capacity of 750,000 gpd. It employs a rotating drum screen and cyclone-type grit chamber to remove grit, small particles and debris, a dissolved air flotation (DAF) system to remove oil and grease, microfiltration, and ultraviolet (UV) disinfection. The footprint area for this plant is about 19,000 ft^2 with the usable portion at 12,000 ft^2 because of setback requirements. It was assumed that a new plant would require 12,000 ft^2 for each 0.5 mgd, plus a 10 percent factor for setbacks. This corresponds to a footprint area of 0.6 acre per mgd.

In addition to treating and discharging a blend of treated wastewater and runoff, the existing ocean outfalls could potentially be used to discharge wet weather runoff directly. The HTP uses a 5-mile outfall and maintains a 1-mile outfall for emergency discharges during periods of high wastewater flows. Discharging untreated runoff would eliminate the expense of increasing the wastewater treatment volume and is a potential means of diverting contaminated water from the beaches.

While discharging untreated urban runoff through the HTP outfalls, or any other potential outfall, is an option, it does not fit within the desired integrated water resources approach framework of this TMDL Implementation Plan; that is, outfall discharge would not provide for beneficial reuse or other community benefits.

3.4 Options for Diversion to Wastewater Collection System

The capacity of the coastal wastewater collection system to convey runoff to HTP during off-peak periods was assessed. The technical memorandum documenting this work is provided in Appendix H.

The runoff would be stored in operational storage facilities for 24 to 48 hours. It would then be pumped into either the CIS or, for the Dockweiler subwatershed, into the Central Outfall Sewer (COS) or North Outfall Sewer (NOS) for treatment at HTP.

The scope of this study included hydrodynamic modeling (using the MOUSE program by DHI, Inc.) to assess the capacity of the CIS using a hydraulic model that includes inputs of the wastewater inflow during a rain event. These analyses determined how much of the stored runoff could be diverted into HTP during off-peak periods.

Each subwatershed was considered in isolation. Simultaneous contributions to CIS from all subwatersheds were not analyzed and will decrease the available capacity to upstream subwatersheds. Dockweiler subwatershed contributions to HTP are independent of others because they would utilize a separate conveyance system, either the COS or NOS. Table 5 summarizes conveyance capacity for each subwatershed as an independent source.

TABLE 5
Conveyance Capacity to Hyperion Treatment Plant for Independent Subwatersheds
SMBB Bacteria TMDL Implementation Plan

Subwatershed	Average Post-Wet Peak Flow Capacity (gpm)	Total 24-Hour Divertible Volume (MG)	Estimated Required Volume for 1 Hypothetical Violation Year within a 50-year Period (MG)
Castle Rock	2,195	3.1	2.0
Santa Ynez Canyon	4,041	5.8	5.7
Pulga Canyon	7,420	11.8	2.8
Santa Monica Canyon	7,740	10.7	29.2
Santa Monica	7,740	10.7	76.0
Venice Beach	13,146	17.3	<0.1
Dockweiler	31,546	60.4	53.6

Notes:
MG – million gallons
gpm – gallons per minute

Diverting stored runoff into the wastewater collection system would need to be combined with other options. While the local wastewater collection system may be adequate to convey the estimated stored runoff volumes from Castle Rock, Santa Ynez Canyon, and Pulga Canyon, capacity constraints further downstream in the CIS would limit the diversion from the Santa Monica Canyon and Santa Monica subwatersheds. The Venice Beach and Dockweiler subwatersheds have the potential to be effectively served by the diversion option.

3.5 Siting Study

Potential sites and evaluative criteria were discussed for the following facilities:

- Local storage and reuse projects
- Operational storage near major storm drain outlets
- Transmission pipelines to HTP or new treatment plants
- Treatment facilities
- Beneficial reuse sites

The technical memorandum documenting this work is provided in Appendix I.

Public parks, government facilities, schools, and urban vacant lots were identified as possible sites at which to implement local storage and reuse projects to manage runoff before it enters the storm drain system. The 10 largest parks considered were Will Rogers Park, Rustic Canyon Recreation Center, Palisades Park, Memorial Park, Clover Park, Penmar Recreational Park and Playground, South Beach Park, Westchester Golf and Recreation Center, Recreation Park, and The Lakes at El Segundo. A total of 28 government facilities were identified within JG 2/3, totaling 90.1 acres. Local storage and reuse projects have been successfully implemented at several schools within Southern California. There are approximately 40 public school facilities within JG 2/3 that may be candidates for similar projects. A total of 11 urban vacant lots identified within JG 2/3 were identified with a total area of 61.9 acres.

To manage runoff regionally, it must be diverted from major storm drains at the beach discharge point and temporarily stored (facilities were sized to store the target volume for a 24-hour period). Beach parking areas along the coast were found to be feasible locations for underground operational storage facilities because they are close to the drains, are in open areas, and have easy access to local roads.

Possible sites for treatment facilities were identified. Temescal Canyon Park in Pulga Canyon is a potential site in the area north of Santa Monica. South Beach Park was identified as a potential site in Santa Monica. Vacant land in the vicinity north of the Los Angeles International Airport (LAX) was identified as a potential site for a southern treatment plant or for subsurface constructed wetlands.

3.6 Regulatory and Permitting Requirements

Regulatory issues that need to be considered in developing the management options were summarized. Much of this information was discussed in Section 2.1. The technical memorandum documenting this work is provided in Appendix J. This memorandum also includes information about specific local applicable regulations including planning, public works, and zoning codes that should be considered, and state and federal regulations that cover the planning, siting, and development of facilities that are under consideration in order to comply with this TMDL.

In general, the project proponents should approach permit and regulatory agencies as soon as they have a specific project in mind. Beginning to work early with permit agencies is critical, so that California Environmental Quality Act (CEQA) or project description documentation can take into account the concerns of the specific regulator, and can address issues related to codes, ordinances, regulations, and laws. Obtaining a permit can take between 3 and 12 months, not including time to plan, provide CEQA documentation, and design the facility. Therefore, to shorten the process, it is important to have early and frequent communication with regulators, depending on the project's degree of complexity.

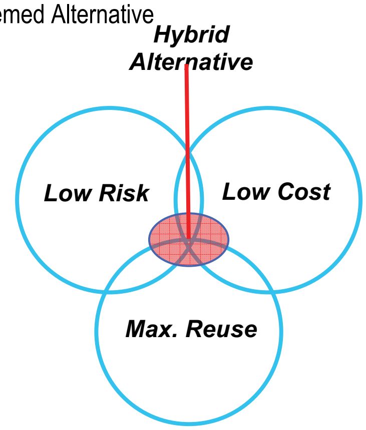
3.7 Alternatives Development and Evaluation

Technical and regulatory information from Tasks 3 through 8 were compiled to develop alternatives that could be implemented to meet the load allocations in the TMDL. The technical memorandum documenting this work is provided in Appendix K. Three alternative themes were developed and evaluated for the Implementation Plan:

- Low risk
- Low cost
- Maximum beneficial reuse

The low cost alternative is configured to have the lowest capital and O&M costs. The low risk alternative is configured to manage the highest theoretical target runoff goal and will include options that will minimize the compliance risk with the TMDL without regard to cost or optimizing the beneficial use of runoff. The maximum beneficial reuse alternative is configured to manage the highest target runoff goal and will include options that maximize the amount of runoff that can be beneficially reused.

FIGURE 3
Themed Alternative



As a result of this evaluation, a hybrid alternative was developed. As shown in Figure 3, this alternative represents an optimal combination of elements from the other three alternatives. This alternative balances the cost of implementation with the risk of compliance and the amount of beneficial use of runoff.

3.7.1 Hydrology

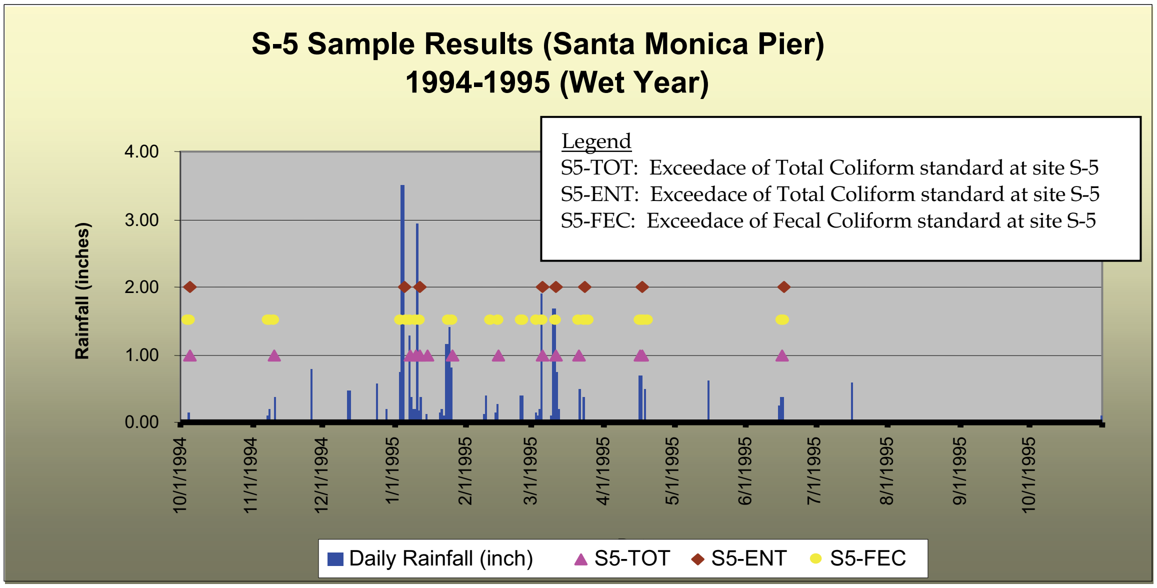
Table 4 in Section 3.1 shows a range of theoretical target volumes that provides a basis for making decisions when forming different alternatives. For example, the low cost alternative was formed to potentially manage smaller runoff volumes; however, the theoretical risk of violating the TMDL is higher. On the other hand, the low risk alternative was formed to potentially manage larger runoff volumes, and the risk of TMDL violation is reduced.

These volumes represent upper limits, or theoretical goals. In actuality, JG 2/3 agencies recognize that achieving full management of these theoretical target runoff volumes would require aggressive implementation of large, regional, structural, end-of-pipe solutions, which face major challenges and multiple significant constraints. Moreover, implementation of institutional and subregional structural solutions in an iterative, adaptive fashion that may contribute to a higher percentage of success in reducing bacterial exceedances and may reduce or minimize the need for regional options or, in some areas, eliminate their necessity altogether.

An examination of several typical years of rainfall and exceedance data at historical monitoring locations shows support for the approach of first focusing on managing smaller storms through implementation of institutional and subregional structural solutions, and monitoring their effectiveness before considering implementation of regional solutions.

The graph in Figure 4 shows rainfall, in inches, recorded for the 1994-1995 rain year at sample location S-5 (Santa Monica Pier). It also plots the instances of bacterial exceedances for each of the indicators (total coliform, enterococcus, and fecal coliform) on the dates they occurred. The graph illustrates that exceedances at this location occurred regardless of storm size, which was found to be typical for varied locations and rain years. This supports the preferred approach to implementation, which is to first manage the more frequent, smaller storms through source control (institutional solutions) and subregional structural solutions. Thus, the alternatives focus on implementation of institutional and subregional structural solutions, with the potential for consideration of regional solutions only if compliance goals cannot be accomplished without them.

FIGURE 4
Historical Rainfall and Bacterial Exceedances



3.7.2 Runoff Management Options

The component options that comprise the three themed alternatives were selected because they not only manage runoff volume, but also specifically help to reduce bacterial concentrations in the runoff. Many of these options help to reduce concentrations of other pollutants as well. The following three categories of runoff management options were considered for inclusion in the alternatives:

Institutional (Nonstructural, Source Control) Options

a. Current programs
   - Stormwater BMP programs
   - Education and outreach programs
   - Street and storm drain maintenance
   - Land use planning and management
   - Ordinances, codes, and enforcement

b. Additional measures for consideration
   - Public trash receptacles
   - Improved restaurant and grocery store trash management
   - Business improvement district expansion
   - Expanded public education
   - Incentive programs
   - Portable bathrooms
   - Pre-wet-weather storm drain flushing

Subregional (Small-scale, Decentralized, Structural Source Control) Options

a. Cisterns/rain barrels (residential rooftop capture and direct reuse without treatment)
b. Local storage and reuse (capture and reuse, limited treatment necessary)
c. Small-scale capture and infiltration (sunken street medians and sidewalk planters, tree wells, dry wells, pervious pavement, and perforated culvert under Venice Beach Boardwalk)
d. Redirecting downspouts into planters or other pervious surfaces

Regional (Large, End-of-Pipe Structural) Options

a. Divert to wastewater treatment
b. Capture, store, treat, and discharge
c. Capture, store, treat, and reuse as irrigation supply
d. Large-scale infiltration projects
e. Capture, store, treat, and inject
f. Ocean outfall discharge

3.7.3 Alternatives

Runoff management options were combined to form alternatives, each with a different theme. The following alternatives are described below: (1) low cost, (2) low risk, (3) maximum beneficial reuse, and (4) hybrid alternative.

3.7.3.1 Low Cost Alternative

The low cost alternative, as defined, is the alternative configured to have the lowest capital and O&M costs. This alternative assumes a higher level of risk of compliance with TMDL than the other alternatives by managing a reduced target volume of runoff, as explained in the previous section. It also includes minimal subregional structural solutions. Regional solutions to meet the TMDL requirements are not currently identified for this alternative; the need to plan and construct these will be assessed in Stage 2 of implementation. The total target runoff management volume for the low cost alternative is 136 million gallons (MG), which corresponds to a predicted occurrence rate of 5 years in which violations occur for all subwatersheds in JG 2/3 over a 50-year period. Table 6 summarizes the runoff management options used in the low cost alternative.

TABLE 6
Low Cost Alternative
SMBB Bacteria TMDL Implementation Plan

Institutional Solutions - Reduce contaminants from the source, applicable to all subwatersheds.
Increase litter reduction.
Improve restaurant and grocery store trash management through education.
Install more portable restrooms in areas with high homeless populations.
Expand Business Improvement District.
Modify/enhance public education programs.
Create incentives for private implementation of cisterns/rain barrels, porous pavement, and similar practices.
Subregional Structural Solutions
Capture and infiltrate 0.1 MG from the Venice Beach subwatershed.
Fund program to reroute rooftop drains to permeable surfaces on residential and public buildings.
Regional Solutions
To be assessed in Stage 2.

3.7.3.2 Low Risk Alternative

The low risk alternative is configured to manage the highest target runoff volumes and will include options that will minimize the risk of not being in compliance with the TMDL without regard to cost or optimizing the beneficial use of runoff. From the hydrologic analysis, the target runoff management volume for the low risk alternative is 169 MG, which corresponds to a predicted occurrence rate of 1 year in which a violation will occur for all subwatersheds in JG 2/3 over a 50-year period.

The low risk alternative includes the same runoff management options as the low cost alternative. It does not include any subregional structural solutions that are somewhat challenging to coordinate implementation and operation among multiple agencies and are therefore more risky than dedicated treatment facilities. Regional solutions to meet the TMDL requirements are not currently identified for this alternative; the need to plan and construct these will be assessed in Stage 2 of implementation. However, the low risk alternative is designed to manage an additional 33 MG of runoff volume compared to the low cost alternative. Table 7 summarizes the runoff management options included in the low risk alternative.

TABLE 7 Low Risk Alternative *SMBB Bacteria TMDL Implementation Plan*
Institutional Solutions - Reduce contaminants from the source, applicable to all subwatersheds.
Increase litter reduction. Improve restaurant and grocery store trash management through education. Install more portable restrooms in areas with high homeless populations. Expand Business Improvement District. Modify/enhance public education programs. Create incentives for private implementation of cisterns/rain barrels, porous pavement, and similar practices.
Subregional Structural Solutions
None.
Regional Solutions
Divert to wastewater treatment; Capture, store, treat and discharge.

3.7.3.3 Maximum Beneficial Reuse Alternative

The maximum beneficial reuse alternative is configured to manage the highest target runoff volumes, and includes options that will maximize the amount of runoff that can be beneficially used. The target runoff management volume for the maximum beneficial reuse alternative, which is the same as the low risk alternative, is 169 MG, which corresponds to a predicted occurrence rate of 1 year in which a violation will occur for all subwatersheds in JG 2/3 over a 50-year period. The maximum beneficial reuse alternative shares the same runoff management options as the low risk alternative, but includes additional options to beneficially reuse a portion of the runoff through expanded implementation of subregional structural solutions and beneficial use of runoff. Table 8 summarizes the management options included in the maximum beneficial reuse alternative.

TABLE 8 Maximum Beneficial Reuse Alternative *SMBB Bacteria TMDL Implementation Plan*
Institutional Solutions - Reduce contaminants from the source, applicable to all subwatersheds.
Increase litter reduction. Improve restaurant and grocery store trash management through education. Install more portable restrooms in areas with high homeless populations. Expand Business Improvement District. Increase funding to public education programs. Create incentives for private implementation of cisterns/rain barrels, porous pavement, and similar practices.
Subregional Structural Solutions
Capture and infiltrate 0.1 MG from the Venice Beach subwatershed. Residential cisterns/rain barrels, goal of 5 to 10 percent of residential homes. Public local storage and reuse projects. Small-scale capture and infiltration projects. Redirecting rooftop drainage systems to discharge on grassy areas.
Regional Solutions To be assessed in Stage 2.

3.7.3.4 Hybrid Alternative

The hybrid alternative balances the cost of implementation with the risk of compliance, as well as provides some beneficial reuse of runoff. Similar to the low cost alternative, the hybrid alternative would use a phased, iterative approach by implementing institutional solutions and subregional structural solutions.

The hybrid alternative, similar to the low cost alternative, would manage a lower target runoff volume of 136 MG, which corresponds to a predicted occurrence rate of 5 years in which violations occur for all subwatersheds in JG 2/3 over a 50-year period. Like the maximum beneficial reuse alternative, the hybrid alternative also includes implementation of the maximum amount of local options that provide beneficial reuse of the runoff and are compatible with a phased implementation approach.

3.7.3.4.1 Institutional Options

Similar to the other alternatives, the hybrid alternative would include the same recommended institutional options, which consist of new and expanded programs as outlined in Tables 6, 7, and 8.

3.7.3.4.2 Local Options

The hybrid alternative includes the same levels of local options as the maximum beneficial reuse alternative. This includes: (1) residential cisterns/rain barrels, (2) public local storage and reuse projects, (3) small-scale capture and infiltration projects, and (4) redirecting rooftop downspouts to discharge on permeable areas.

3.7.3.4.3 Regional Options

The hybrid alternative does not include any regional solutions in Stage 1. However, regional solutions will be considered for assessment during Stage 2. Table 9 summarizes the management options included in the maximum beneficial reuse alternative.

TABLE 9
Hybrid Alternative
SMBB Bacteria TMDL Implementation Plan

Institutional Solutions - Reduce contaminants from the source, applicable to all subwatersheds.
Increase litter reduction. Improve restaurant and grocery store trash management through education. Install more portable restrooms in areas with high homeless populations. Expand Business Improvement District. Modify/enhance public education programs. Create incentives for private implementation of cisterns/rain barrels, porous pavement, and similar practices.
Subregional Structural Solutions
Capture and infiltrate 0.1 MG from the Venice Beach subwatershed. Residential cisterns/rain barrels, goal of 5 to 10 percent of residential homes. Public local storage and reuse projects. Small-scale capture and infiltration projects. Redirecting rooftop drainage systems to discharge on permeable areas.
Regional Solutions
To be assessed in Stage 2.

3.7.4 Alternatives Evaluation

The themed alternatives were evaluated using criteria developed through the stakeholder process, interactions with the JG 2/3 agencies, and engineering experience. The criteria used for this evaluation were as follows:

- Amount of runoff beneficially used
- Regulatory issues
- Engineering/constructibility issues
- Facilities siting issues
- Reliability issues
- Compatibility with a phased approach

Table 10 summarizes the ranking of the four alternatives relative to these criteria.

TABLE 10
Evaluation of Alternatives
SMBB Bacteria TMDL Implementation Plan

	Low Cost Alternative		Low Risk Alternative		Max Reuse Alternative		Hybrid Alternative	
Criteria	**Amount**	**Rank[1]**	**Amount**	**Rank[1]**	**Amount**	**Rank[1]**	**Amount**	**Rank[1]**
Runoff Beneficially Reused (mgd)	Low	2	None	3	High	1	High	1
Regulatory Compliance	-	3	-	1	-	2	-	2
Design Complexity and Constructability	-	1	-	1	-	1	-	1
Facilities Siting Difficulty	-	2	-	2	-	3	-	2
Reliability	-	2	-	2	-	3	-	2
Compatibility with a Phased Approach	-	2	-	2	-	1	-	1
Total Ranking		**12**		**11**		**11**		**9**

Notes:
[1]A lower ranking represents a more favorable rating.

Rankings for each alternative were assigned on a scale of 1 to 3, with 1 being the most preferable and 3 being the least preferable. The amount of Runoff Beneficially Used (estimated as a flow rate) is assessed as high, medium, or low, and is also shown for each alternative.

A preferred alternative was then derived which combined the most favorable (highest ranking) elements of the four initial alternatives. The preferred alternative was similar to the low cost alternative, i.e., managed a lower theoretical goal volume of runoff. The preferred alternative also included implementation of the maximum amount of on-site options which provide beneficial reuse of the runoff and are compatible with a phased implementation approach. Table 11 provides a summary of the preferred alternative, alongside the themed alternatives. The table shows which options were included in each alternative.

TABLE 11
Alternatives Summary
SMBB Bacteria TMDL Implementation Plan

Runoff Management Options	Alternative			
	Low Cost	**Low Risk**	**Max. Beneficial Reuse**	**Hybrid**
Institutional Solutions	Included	Included	Included	Included
Subregional Structural Solutions Residential Cisterns/rain barrels[1]	---	---	Included (up to 3.4 MG)	Included
Public Local Storage and Reuse[2]	---	---	Included (up to 0.8 MG)	Included
Small-Scale Capture and Infiltration	Included (Venice Beach only)	---	Included	Included
Redirecting Rooftop Downspouts	Included	---	Included	Included
Regional Solutions	To be assessed in Stage 2	Included	To be assessed in Stage 2	To be assessed in Stage 2

Notes:
[1] Considered at single-family/multi-family residences—no treatment necessary.
[2] Considered at schools, public properties, golf courses—treatment necessary.

Section 4 Proposed Implementation Plan

Using the Hybrid Alternative developed in Section 3.7 as an overall framework, a detailed Implementation Plan was formulated, incorporating stakeholder input. This section describes the plan for implementation of activities, programs and projects proposed by the responsible jurisdictions in JG 2/3 to meet the requirements of the SMBB Wet Weather Bacteria TMDL. The plan includes a general compliance approach and activities that are common to the entire JG 2/3 area (described in Sections 4.1 through 4.7) as well as plans, programs and/or projects that are specific to each subwatershed (described in Sections 4.8 through 4.10).

4.1 General Compliance Approach

The general approach to achieving compliance with this TMDL within the subwatersheds of JG 2/3 is described in this section.

The approach to implementation for compliance with the SMBB Wet Weather Bacteria TMDL was based in large part on stakeholder input from representatives from JG 2/3, local communities within JG 2/3 watersheds, the Regional Board, and environmental organizations. Input from the stakeholders clearly indicated support for an approach to avoid large structural, end-of-pipe solutions that would be expensive and result in significant negative impacts to the communities along the SMBB. Instead, the stakeholders preferred an approach emphasizing nonstructural, institutional solutions along with small, decentralized structural projects, i.e., wet weather BMPs. These BMPs would be sited in selective locations within the watershed and offer multiple benefits for the community and environment. Subwatersheds that drain to priority storm drains would be the focus of initial efforts. As data comes in from ongoing monitoring of runoff water quality (i.e., identification of "hot spots" within the subwatersheds) and BMP performance effectiveness, the implementation program will be refined and optimized to prioritize the selection and siting of institutional and subregional solutions that offer the most potential to reduce bacterial concentrations at the beach drains.

As a result, this Wet Weather Implementation Plan is based on a phased, iterative approach to TMDL compliance due to the unique developmental nature of the project. It is widely accepted that there are insufficient data and understanding within the scientific community for quantifying the performance of wet weather BMPs for bacterial removal. This TMDL Implementation Plan will be the first of its kind for a large urban region in a semiarid environment. Therefore, a phased, iterative approach employing adaptive management principles is the most reasonable strategy to meet the objectives of this TMDL.

4.1.1 TMDL Compliance using Recommended Implementation Approach

The recommended implementation plan approach described above is preferred by the JG 2/3 stakeholder community because it offers the potential to achieve compliance at a reasonable cost and with limited negative impacts to the SMBB communities. This approach is unique in that no other large urban community in a semiarid environment has employed an implementation approach to control bacteria from wet weather urban runoff. However, this approach has been proven to effectively control wet weather urban runoff in other urban areas such as Portland, Oregon. Since the sources of bacterial pollution in runoff are widespread, controlling urban runoff using nonstructural and selected small structural BMPs is currently the most effective way to assure reduction of bacterial pollution of the beaches.

Employing the recommended iterative phased approach that incorporates adaptive management principles allows substantial progress toward reducing bacterial runoff pollution while regularly improving and optimizing the program to achieve TMDL compliance within desired time frames. This integrated water resources approach also helps control other pollutants beyond bacteria and offers benefits to the community beyond pollution control, including stormwater conservation and reuse, habitat enhancement, aesthetic improvements and recreational opportunities.

4.1.2 Compliance through Local Runoff Reductions and Water Quality Improvements

An analysis of wet weather runoff events and bacterial exceedances indicates that if wet weather flow reaches the beach, then health standard bacterial exceedances are highly likely under current conditions. Therefore, the initial strategy for reducing exceedances is tied to a combination of reducing bacteria at the source through institutional and local (or subregional) structural measures, and reducing the amount of runoff that reaches the receiving water, rather than focusing on treating the flow collected in the storm drain system for bacterial reduction. This strategy emphasizes the beneficial use of wet weather runoff and the installation of subregional structural solutions to reduce downstream flows from areas that are associated with high levels of bacteria. It also focuses on local source control to reduce the level of bacteria and other pollutants discharged into the storm drains.

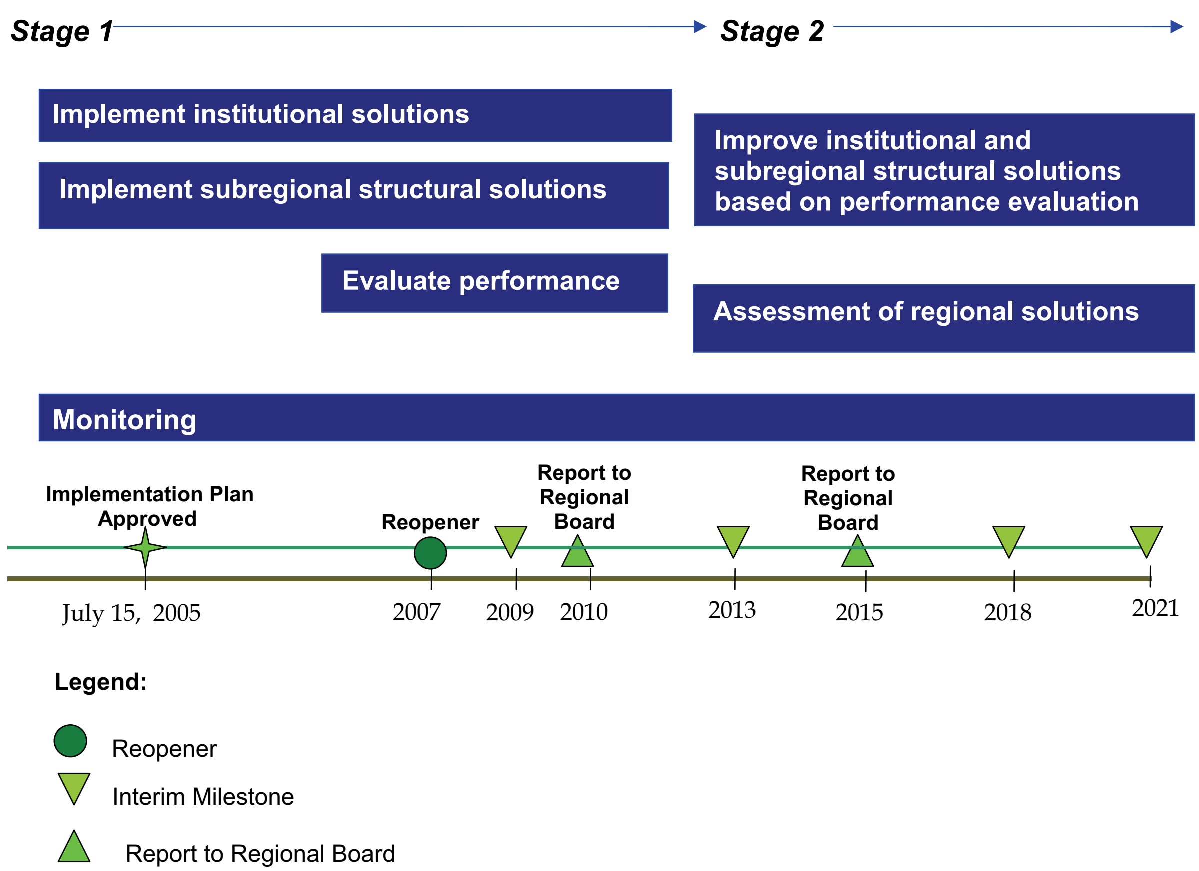
Water quality improvements in the receiving waters will be realized from water quantity (flow) management practices (i.e., small structural BMPs and nonstructrual source control solutions) that are focused on "hot spots" within the subwatersheds that are identified through ongoing runoff water quality monitoring.Whereas employing large-scale, end-of-pipe, regional solutions minimizes the risk of noncompliance, it also carries with it large costs and severe impacts to the local, densely urbanized beach communities. Therefore, regional solutions are proposed to be deferred from further consideration until the institutional and subregional structural solutions can be implemented and their effectiveness at improving beach water quality assessed.

Rather than targeting specific volumes of runoff to manage (as developed in the component studies of this TMDL report and documented in the associated technical memoranda) and then designing treatment systems for these volumes, the recommended implementation approach identifies specific actions to achieve water quality improvements in a more holistic manner. This plan is further detailed below.

4.2 Phased, Iterative Approach to TMDL Compliance

As shown in Figure 5, institutional and subregional structural solutions will be implemented initially (during Stage 1), and the results of these efforts monitored to determine the subsequent course of action. In parallel, shoreline monitoring at the point of discharge from the storm drain to the surf zone ("point zero") as well as continued research on BMP effectiveness and pathogen indicators will be ongoing.

FIGURE 5
Phased Iterative Approach to Implementation



4.2.1 Stage 1 of Implementation

The first stage of this program (Stage 1) will emphasize institutional (nonstructural) and subregional structural runoff management solutions that can be quickly implemented and monitored for effectiveness to reduce the contribution of bacteria and other pollutants from wet weather runoff. For example, the recommended institutional solutions will initially include expanded public education and code enforcement; increased street and storm drain cleanings; additional trash receptacles; and improved restaurant and grocery store trash management. Implementing additional nonstructural measures that may require further exploration will follow. These may include incentive programs to encourage private sector programs and projects, portable bathrooms, and pre-wet weather storm drain flushing.

Subregional structural solutions to reduce the volume of wet weather runoff that reaches the receiving waters include the installation of decentralized, small-scale, local storage and reuse or infiltration projects at public facilities, as well as consideration of residential options, such as cisterns/rain barrels and redirecting downspouts. These types of BMPs offer the advantages of addressing multiple objectives (water quality improvement, water conservation, habitat enhancement, aesthetics, and recreation) while preventing multiple pollutants from reaching the beaches.

These Stage 1 programs and projects will be focused initially on watersheds that drain into the highest priority storm drains, i.e., those with greatest risk of bacterial standard exeedances. These are, in order of priority, the Venice Beach, Santa Monica, Dockweiler, Pulga Canyon, and Santa Monica Canyon subwatersheds. The higher priority watersheds generally have greater concentrations of high density and commercial areas.Monitoring the effectiveness of these structural and nonstructural BMPs will occur through both onsite and inland receiving water monitoring, as well as through the Coordinated Shoreline Monitoring Plan associated with this TMDL, to determine whether the BMPs improve stormwater quality in terms of loads and/or concentrations of pollutants. Additional monitoring for source identification and baseline upstream monitoring will provide information to determine the most effective pollutant control methodologies. The results of these monitoring efforts, as well as parallel research on BMP effectiveness and alternative pathogen indicators, will be factored in through a phased, iterative compliance plan for this TMDL. By employing adaptive management principles, there will be opportunities to consider these new data and reflect new findings within this integrated and holistic approach to watershed management.

4.2.2 Stage 2 of Implementation

Consideration of the need to implement regional, end-of-pipe solutions, such as diversion of wet weather runoff to the wastewater treatment system or the construction of operational storage and runoff treatment plants will be considered in the Stage 2 of this compliance program. These solutions are generally single-purpose facilities that offer little benefit beyond pollution reduction and represent a less holistic approach to runoff management. For this reason, the need to pursue these options is deferred until the effectiveness of a concerted effort of institutional and subregional structural solutions can be implemented and evaluated.

4.2.3 Interim Compliance Milestones

The Implementation Plan assumes an iterative, phased approach to implementation. As shown in Figure 5, institutional and subregional structural solutions will be implemented initially (Stage 1), and the results of these efforts monitored to determine the subsequent course of action. In parallel, shoreline monitoring at the point of discharge from the storm drain to the surf zone ("point zero") as well as continued research on BMP effectiveness and pathogen indicators will be ongoing.

At the TMDL reopener scheduled for July 2007, the effectiveness of these measures for achieving water quality improvements in the SMBB will likely not yet be fully realized, as only 2 years will have elapsed since the initiation of these measures (corresponding to approval of this Implementation Plan). This is not enough time to plan, fund, implement, achieve and demonstrate water quality improvements with these measures. In addition, the numeric target, load allocation, and pathogen indicators for this TMDL may be revisited at this reopener. The basis for compliance may be reconsidered if sufficient research has been conducted, and results have been evaluated for applicability to this TMDL by this time. If this information is not available by this date, then it may be presented to the Regional Board through future requests or resolutions, as appropriate.

The first interim compliance milestone is scheduled for July 2009. Achieving the compliance target of a 10 percent reduction of exceedance days is contingent on the effectiveness of these initial activities as well as precipitation patterns during the intervening years.

The effectiveness of the Stage 1 activities will be evaluated based on results from shoreline monitoring, upstream monitoring, and BMP effectiveness monitoring of both structural and nonstructural solutions implemented thus far, as well as consideration of relevant, parallel research on BMPs. The analysis of these results will help focus and refine Stage 2 activities. As new data (i.e., BMP performance, indicators) are generated and the results evaluated, they will be brought to the Board for direction. If warranted, resolutions to modify the TMDL may be proposed for adoption by the Board. Anticipated dates in which such data may be available for reporting to the Board are shown in Figure 5. These scheduled reports provide a forum for assessing the performance of the initial stage activities with more complete and more comprehensive data from the monitoring activities and applying this information to the TMDL requirements.

The beginning of Stage 2 is shown to coincide with the second interim milestone, scheduled for July 2013. By this time, the extent of implementation and effectiveness evaluation of institutional and subregional structural solutions should be adequate to ascertain the feasibility of meeting the TMDL numeric criteria. These criteria might be the same as those contained in the current TMDL, or, through additional research and analysis, and might reflect modified numeric targets or load allocations.

By that time, there should be enough information to gauge whether regional solutions will be necessary. The need for regional solutions may vary considerably by subwatershed. For example, less developed subwatersheds might be less likely to need to employ regional solutions than more developed subwatersheds. The determination of the necessary path forward to meet subsequent milestones and compliance deadlines can then be initiated with Stage 2.

4.3 Compliance History at Drain Outlets

Stormwater discharges from the existing storm drainage system occur at several drains located along the SMBB within JG 2/3. A description of these facilities, the current program to divert the dry weather discharges from these drains, and a preliminary assessment of the relative contamination from them during rain events are presented in this section.

4.3.1 Storm Drains along the Santa Monica Bay

Twenty storm drains discharge into the Santa Monica Bay from JG 2/3 and are monitored. A summary of these drains and their associated drainage areas is presented in Table 12 and graphically shown in Figure 6.

TABLE 12
Stormwater System Drains
SMBB Bacteria TMDL Implementation Plan

Storm Drain (N to S)	Drainage Area (Acres)
Castlerock	74
Santa Ynez Canyon	4,387
Marquez Avenue	47
Bay Club Drive	148
Pulga Canyon	1,220
Temescal Canyon	1,660
Palisades Park	405
Santa Monica Canyon	10,147
Montana Avenue	824
Wilshire Blvd	926
Santa Monica Pier[2]	94
Pico-Kenter[2]	4,147
Ashland Avenue	264
Rose Avenue	2,117
Thornton Avenue	267
Brooks Avenue	304
Venice Pavilion	160
Playa Del Rey	403
North Westchester	2,416
Imperial Highway	1,958

Notes:
[1]Source: Santa Monica Bay Storm Drain Low-Flow Diversion Mater Plan – A Feasibility & Preliminary Engineering Report (City of Los Angeles, 1996).
[2]Diverted to SMURRF

4.3.2 Dry Weather Diversion Program

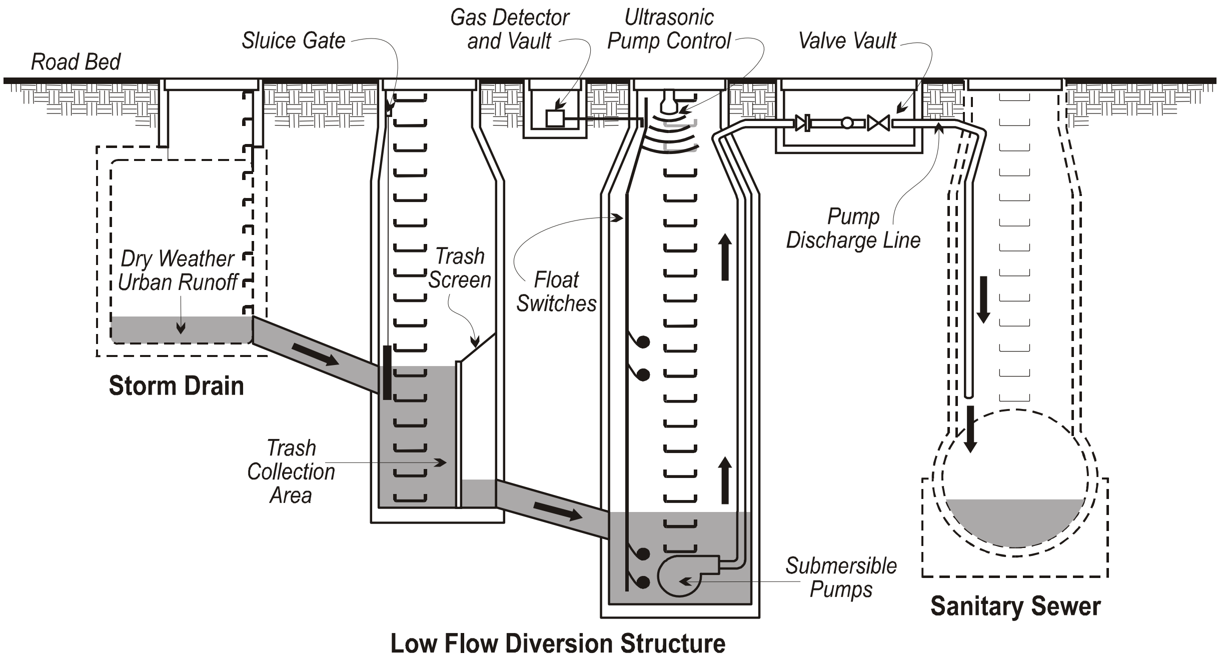
To protect human health, the City and County of Los Angeles initiated a program to divert dry weather urban runoff from these storm drains in the 1990s. These dry weather low flows can be the result of a combination of over-irrigation runoff, parking lot, sidewalks, alleys and street washing, groundwater seepage, illegal connections, hydrant flushing, construction runoff, and various other daily commercial activities. Studies conducted in the early 1990s revealed that urban runoff is a major source of contamination, causing water quality problems in the Santa Monica Bay.

FIGURE 6
Stormwater System Drains

4.3.3 Low-Flow Diversion Structures

Low-flow diversion structures collect dry weather urban runoff, screen out large debris and trash, and pump dry weather flows into the wastewater collection system. Figure 7 shows a cross-sectional view of a typical low-flow diversion structure similar to what is now being employed by the City of Los Angeles at the Thornton Avenue drain.

FIGURE 7
Low-Flow Diversion - Typical Cross Section



These structures discharge into the CIS. The CIS runs along the coast from Topanga State Beach in the north to Playa del Rey in the south. The ability of the CIS to convey these low flows without detriment to the wastewater design capacity of the CIS depends on the amount of flow being diverted and the diurnal pattern of the wastewater, i.e., peak dry weather flow.

A summary of the implementation schedule for diverting the dry weather urban runoff from these drains is provided in Table B-1 of the Dry Weather Bacteria TMDL Implementation Plan.

4.3.4 Compliance History during Dry Weather

The City of Los Angeles monitors storm drain discharges during dry and wet weather periods at 18 locations along the Santa Monica Bay. A summary of these sites is presented in Table 13. Of these sites, eight are representative of the JG 2/3 areas. The dry weather results at these sites and results presented by Heal the Bay are discussed in this section.

TABLE 13
Stormwater Drain Monitoring Sites
SMBB Bacteria TMDL Implementation Plan

CLA Mon Sites	Location[1]	Jurisdiction[2]	Subwatershed[2,3]
S1	Surfrider Beach	1	
S2	Topanga State Beach	1	Topanga Canyon
S3	Pulga Canyon SD, Will Rogers State Beach	2	Pulga Canyon
S4	Santa Monica Canyon, Will Rogers State Beach	2	Santa Monica Canyon
S5	Santa Monica Municipal Pier	3	Santa Monica
S6	Santa Monica Beach at Pico/Kenter SD	3	Santa Monica
S7	Ashland Avenue SD	3	Santa Monica
S8	Venice City Beach - Windward Ave, Venice Pavilion	2	Marina Del Rey[3]
S10	Ballona Creek Entrance[4]		
S11	Dockweiler State Beach at Culver Bl.	2	Dockweiler
S12	Imperial Highway SD	2	Dockweiler
S13	Manhattan State Beach at 40th Street	5	Hermosa
S14	Manhattan Beach Pier	5	Hermosa
S15	Hermosa Beach Pier	5	Hermosa
S16	Redondo Municipal Pier	6	Redondo
S17	Redondo State Beach at Avenue I	6	Redondo
S18	Malaga Cove, Palo Verde Estates	7	Palos Verde Peninsula

Notes:

[1]Location descriptions per Table 7-4.5 of Attachment A to TMDL.

[2]Data per Table 7-4.6 of Attachment A to TMDL.

[3]There were no sampling locations for the Castlerock Subwatershed until two new ones were added in December 2003. Two county sampling points (DHS101 and 102) cover the Santa Ynez Canyon Subwatershed. The Marina Del Rey area is not in the study area. It will be used to evaluate the Venice Beach Subwatershed.

[4]The Ballona Creek Sampling Point (S10) is a compliance point under the Beaches TMDLs, though not for Jurisdictional Groups 2 or 3. S10 is a compliance point for Jurisdictional Group 8 (Ballona Creek Watershed) under the Beaches TMDLs.

The number of reported exceedances during dry periods from 1994 to 2001 at the eight monitoring sites is presented in Table 14. As can be seen, the most exceedances were found at Santa Monica Municipal Pier. Note that this drain at this location was diverted in 1997. The second highest number of exceedances occurred at Santa Monica Canyon, Will Rogers State Beach. In this case, however, diverting the local drain had a significantly positive impact (based on review of the Heal the Bay data before and after the diversion). The lowest numbers of exceedances was observed at Venice City Beach at Windward Avenue, Venice Pavilion, and at Dockweiler State Beach at Culver Boulevard.

4.3.5 Compliance History during Wet Weather

The number of reported exceedances during wet periods from 1994 to 2001 at the eight monitoring sites is presented in Table 15. As can be seen, most exceedances were found at Santa Monica Beach at Pico/Kenter storm drain. Note that the drain at this location was diverted in 1997. The second highest number of exceedances occurred at Santa Monica Canyon, Will Rogers State Beach. The lowest numbers of exceedances was observed at

Venice City Beach at Windward Avenue, Venice Pavilion, and at Imperial Highway storm drain.

4.3.6 Observations Based on Compliance History

The following observations were made based on the data discussed above:

- The rankings are essentially the same for the two data sources - City of Los Angeles sampling results and Heal the Bay Report Cards.
- The dry and wet weather ranks are similar (see Table 16).
- The results before and after diversion during dry weather were impacted by diversion at the discharge points.
- Diversion had no impact on the wet weather results. These observations may indicate that contaminants that are entering the collection system during dry weather are a primary source of the contaminants observed during wet weather events. The contaminants could be swept to the discharge point due to the high flow.
- Based on these observations, it appears that aggressive source control in the drainage area for Pico Kenter (ranked 6 for dry weather and 8 for wet weather), Santa Monica Pier (ranked 8 for dry weather and 7 for wet weather), and Santa Monica Canyon (ranked 7 for dry weather and 5 for wet weather) could contribute significantly toward improving wet weather quality.
- Since the wet and dry weather rankings are similar, and because diversion during dry weather had little or no impact on exceedances during wet weather, an aggressive campaign to reduce contamination throughout the year could greatly reduce the exceedances during wet weather.
- The one exception to this pattern is at Dockweiler (ranked 2 for dry weather and 6 for wet weather) where the dry weather ranking is much higher than the wet weather ranking.

TABLE 14
Stormwater Drain Compliance History – Dry Weather Periods
SMBB Bacteria TMDL Implementation Plan

Location[1]	JG 2/3 Subwatershed[2,3]	CLA Mon Sites	All Exceedances - Dry periods 1994–1995	1995–1996	1996–1997	1997–1998	1998–1999	1999–2000	2000–2001	Total	Rank	Heal-the-Bay Report Cards[5] Dry Weather Periods A/B	C	D/F	Rank
Pulga Canyon SD, Will Rogers State Beach	Pulga Canyon	S3	9	11	6	24	14	3	2	69	4	91%	6%	3%	2
Santa Monica Canyon, Will Rogers State Beach	SM Canyon	S4	63	34	19	58	22	26	40	262	7	43%	9%	48%	8
Results before the dry weather diversion (12/02)												32%	11%	58%	
Results after the dry weather diversion (12/02)												70%	7%	24%	
Santa Monica Municipal Pier (diverted 12/97)	Santa Monica	S5	90	89	93	82	77	36	40	507	8	43%	16%	41%	7
Santa Monica Beach at Pico/Kenter SD (diverted 12/93)	Santa Monica	S6	37	26	43	37	24	22	13	202	6	60%	11%	29%	6
Ashland Avenue SD	Santa Monica	S7	45	18	41	19	33	16	1	173	5	82%	8%	10%	5
Results before the dry weather diversion (12/01)												74%	10%	16%	
Results after the dry weather diversion (12/01)												93%	4%	2%	
Venice City Beach at Windward Ave, Venice Pavilion	Marina Del Rey[4]	S8	4	6	5	7	6	4	2	34	1	94%	4%	2%	1
Results before the dry weather diversion (12/02)												94%	5%	1%	
Results after the dry weather diversion (12/02)												93%	1%	5%	
Dockweiller State Beach at Culver Bl.	Dockweiller	S11	4	9	6	11	10	4	1	45	2	85%	11%	4%	2
Results before the dry weather diversion (12/01)												77%	17%	6%	
Results after the dry weather diversion (12/01)												96%	4%	1%	
Imperial Highway SD	Dockweiller	S12	9	7	4	20	7	4	2	53	3	93%	3%	4%	3

Notes:
[1]Locations descriptions per Table 7-4.5 of Attachment A to TMDL.
[2]Data per Table 7-4.6 of Attachment A to TMDL.
[3]There was no sampling locations for the Castlerock Subwatershed until two new ones were added December 2003.
Two county sampling point (DHS101 and 102) cover the Santa Ynez Canyon Subwatershed.
The Mother's Beach (S-9) and Ballona Creek (S-10) Sampling Points do not reflect areas within the TMDL jurisdiction.
[4]The Marina Del Rey area is not in the study area. It will be used to evaluate the Venice Beach Subwatershed.
[5]The Heal-the Bay Report Card data was procured from the website (http://www.healthebay.org/brc/grademap.asp?map=3) and included samples taken from June 1998 to October 2004.

TABLE 15
Stormwater Drain Compliance History – Wet Weather Periods
SMBB Bacteria TMDL Implementation Plan

		CLA	Exceedances from Rain Events									Heal the Bay Report Cards[5]			
	JG 2/3	Mon	1994	1995	1996	1997	1998	1999	2000			After Rain Events			
Location[1]	Subwatershed[2,3]	Sites[7]	1995	1996	1997	1998	1999	2000	2001	Total	Rank	A/B	C	D/F	Rank[6]
Pulga Canyon SD, Will Rogers State Beach	Pulga Canyon	S3	21	12	17	39	10	15	8	122	4	41%	1%	58%	4
Santa Monica Canyon, Will Rogers State Beach	Santa Monica Canyon	S4	28	12	16	34	16	20	25	151	5	20%	11%	69%	6
Santa Monica Municipal Pier	Santa Monica	S5	28	22	25	46	38	18	21	198	7	23%	3%	74%	7
Santa Monica Beach at Pico/Kenter SD	Santa Monica	S6	39	27	25	53	32	27	17	220	8	8%	4%	88%	8
Ashland Avenue SD	Santa Monica	S7	24	16	11	26	15	15	11	118	3	24%	13%	64%	5
Venice City Beach at Windward Ave, Venice Pavilion	Marina Del Rey[4]	S8	12	11	8	15	8	4	5	63	1	54%	7%	39%	1
Dockweiller State Beach at Culver Bl.	Dockweiller	S11	34	22	15	33	17	23	12	156	6	39%	9%	52%	2
Imperial Highway SD	Dockweiller	S12	21	11	11	26	12	16	9	106	2	31%	11%	57%	3

Notes:
[1]Locations descriptions per Table 7-4.5 Attachment A to TMDL
[2]Data per Table 7-4.6 of Attachment A to TMDL
[3]There was no sampling locations for the Castlerock Subwatershed until two new ones were added December 2003
Two county sampling point (DHS101 and 102) cover the Santa Ynez Canyon Subwatershed.
The S-9 (Mother's Beach) and (S-10) Ballona Creek Sampling Points do not reflect areas within the TMDL jurisdiction.
[4]The S-8 Sampling Point is in Marina Del Rey and will be used to reflect the conditions for the Venice Beach Subwatershed.
[5]Data was procured from the website (http://www.healthebay.org/brc/gradem ap.asp?map=3) and included samples taken from June 1998 to October 2004.
[6]Ranking based on percentage of D/F grades.
[7]The S-9 location is not listed in the table or on the City's Monitoring Location Figure. This location was provided by the City of LA EMD.

TABLE 16
Dry and Wet Weather Rankings
SMBB Bacteria TMDL Implementation Plan

Storm Drain	Sample Site ID	Dry Rank	Wet Rank
Pulga Canyon SD, Will Rogers State Beach	S3	4	4
Santa Monica Canyon, Will Rogers State Beach	S4	7	5
Santa Monica Municipal Pier (diverted 12/97)	S5	8	7
Santa Monica Beach at Pico/Kenter SD (diverted 12/93)	S6	6	8
Ashland Avenue SD	S7	5	3
Venice City Beach at Windward Ave, Venice Pavilion	S8	1	1
Dockweiler State Beach at Culver Blvd.	S11	2	6
Imperial Highway SD	S12	3	2

4.4 Institutional (Nonstructural) Solutions

Institutional solutions are program-level activities that provide source control measures intended to prevent or reduce bacteria, or bacterial sources (e.g., garbage, trash and pet waste) from being picked up by runoff whether onsite, in the curb/street, or in the storm drain system. They generally do not substantially reduce the volume of wet weather runoff to be managed. Because of the ubiquitous presence of indicator bacteria, institutional options may be of limited effectiveness in reducing their concentrations at the beaches. However, human pathogen sources, such as human fecal material, have the potential to be more significantly reduced by these measures and therefore result in a reduction of the human health risk in beach waters.

4.4.1 Existing Institutional Programs

The JG 2/3 agencies have existing institutional programs in place through which they improve stormwater quality in accordance with their stormwater NPDES permit requirements. These include BMP programs, public education and outreach, street maintenance, storm drain maintenance, land use planning and management, ordinances and codes, and enforcement. A list of these programs and practices is presented in the Appendix L followed by a discussion of the current programs in place by the agencies of JG 2/3 to implement these BMPs and other source control measures.

4.4.2 Additional Institutional Measures to be Considered

The following measures have been identified for consideration in expanding the institutional solutions to prevent or reduce levels of bacteria, or bacterial sources (e.g., garbage and trash) from initially being picked up by runoff whether onsite, in the curb/street, or in the storm drain system. Each alternative, which is defined in Section 3, includes implementation of these measures.

- Increase litter reduction

- Improve restaurant and grocery store trash management
- Business Improvement District outreach
- Incentives
- Explore methods to reduce bacterial contributions from the homeless population
- Pre-wet weather storm drain flushing
- Redirect downspouts
- Modify/enhance public education programs

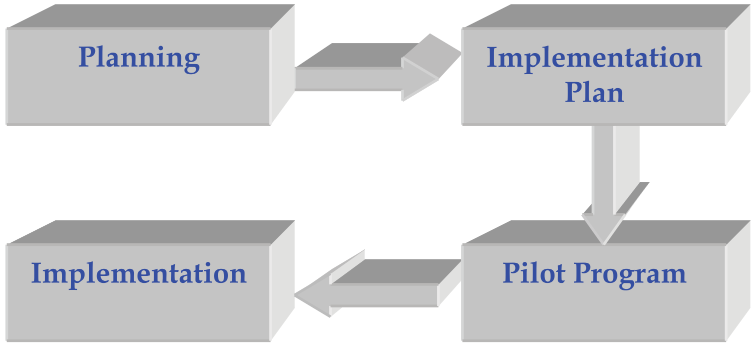
These measures have been identified as institutional options applicable to the SMBB watershed for reducing bacterial loading within the Bay waters. Priority should be given to those subwatersheds associated with the storm drains with greatest risk of noncompliance with the wet weather TMDL, based on historical bacteriological sampling data. The compliance rankings for the eight storm drains in JG 2/3 are summarized in Table 16. Of these, the top priority storm drain for both wet and dry weather is the Venice Pavilion storm drain at Venice City Beach in the Venice Beach subwatershed. Table 17 indicates the subwatershed within which each of these monitored storm drains are located, in general order of priority.

TABLE 17
Subwatershed Prioritization
SMBB Bacteria TMDL Implementation Plan

Subwatershed	Storm Drain	Priority Ranking
Venice Beach	Venice Pavilion	1
Santa Monica	Ashland Avenue	3
	Santa Monica Municipal Pier	7
	Santa Monica Beach at Pico/Kenter Storm Drain	8
Dockweiler	Imperial Highway	2
	Dockweiler State Beach at Culver Blvs.	6
Pulga Canyon	Pulga Canyon	4
Santa Monica Canyon	Santa Monica Canyon	5

4.4.3 General Steps for Implementation

Various institutional solutions described in the report will follow the general steps of planning, development of implementation plan, pilot program and implementation. The steps taken to implement a given option may vary depending on the specifics of the option, goals, implementing agency, and other criteria.



The planning stage will involve defining the characteristics and geographical extent of the measure being considered. The geographical grouping and analysis will help prioritize the study area. The possible solutions, available technological options and other applicable alternative will be defined. This step sets the stage for the overall implementation and helps gauge the effort required to implement the given solution.

Developing the Implementation Plan will involve defining the specific scope of the project including timeline, estimated cost, budget, resources, educational material and enforcement activities, if required. This stage will set the road map for the remainder of the implementation with more specific tasks and activities.

Some institutional options may require a pilot program prior to full implementation. The pilot program will provide proof of concept and also help to refine the implementation based on experience gained during the pilot program.

Implementation will follow based on planned activities during the earlier stages of the program. It will include physical upgrades to structures, implementation of BMPs, distribution of educational materials, training programs, seminars and other awareness activities.

4.4.3.1 Increased Litter Reduction

Litter can be a source of bacteria in urban runoff. Trash receptacle programs, such as those in Santa Monica and the City of Los Angeles, maintain trash cans in public areas in an effort to reduce litter. Studies show that providing trash cans is not enough. Public education programs in the form of signs, public service messages, and community clean-up events may help change the attitudes of people who litter (Missouri Department of Conservation, www.mdc.state.mo.us).

This measure involves identifying additional opportunities for educating the public regarding litter, increasing enforcement of existing ordinances about littering, and providing additional public trash receptacles or increasing the frequency of trash pickup, where appropriate. Reducing the amount of litter will reduce the bacterial load within the stormwater discharges. Convenient access to trash receptacles along with increased education and enforcement should further reduce the litter in public areas.

General Steps for Implementation

1. Planning
   a) Define service area
      i. Identify drainage areas collecting high trash volumes in storm drains
      ii. Identify source, e.g., high foot traffic areas
   b) Study effectiveness of existing receptacle locations/collections
      i. Identify number of locations
      ii. Describe visibility/convenient access
      iii. Determine frequency of collection
      iv. Monitor of overflow situations
   c) Determine corrective measures
      i. Change collection frequency
      ii. Provide larger trash collection bins
      iii. Select additional locations
   d) Estimate potential increased collection and reduction of overflow
   e) Prioritize site locations
2. Implementation Plan
   a) Develop Implementation Plan
      i. Estimate initial implementation and ongoing maintenance/ operations cost
      ii. Identify revenue source (if applicable) and budget requirements
      iii. Develop resource availability and allocations
      iv. Obtain approvals from applicable internal and external departments/agencies
   b) Conduct public awareness and educational programs
      i. Define educational materials
      ii. Identify targeted audience
      iii. Develop an action plan
   c) Enforcement
      i. Review existing enforcement program
      ii. Update/enhance enforcement activities if applicable
3. Pilot Program: Develop pilot program and measure effectiveness over defined period of time
4. Implementation: Update initial Implementation Plan based on results of pilot program and follow through Implementation Plan

4.4.3.2 Improved Restaurant and Grocery Store Trash Management

Uncontained restaurant and grocery store wastes can become a pathway for bacteria to enter the stormwater system. This measure involves an expanded program to increase restaurant and store operator awareness of this issue and to provide solutions to trash management problems.

General Steps for Implementation

1. Planning
   a) Define service area
      i. Identify drainage areas with high number of restaurants and grocery stores
      ii. Inventory restaurant and grocery stores in drainage areas.
   b) Study effectiveness of existing programs
      i. Check frequency of collection/pickup schedules
      ii. Monitor overflow situations
      iii. Verify receptacle size and physical conditions
   c) Implement corrective measures
      i. Improve collection frequency and pickup schedule
      ii. Use larger trash collection bins
   d) Estimate potential increased collection and reduction of overflow
   e) Prioritize site locations
2. Implementation Plan
   a) Develop Implementation Plan
      i. Estimate initial implementation and ongoing maintenance/ operations cost
      ii. Identify revenue source (if applicable) and budget requirements
      iii. Develop resource availability and allocations
      iv. Obtain approvals from applicable internal and external departments/agencies
   b) Conduct public awareness and educational programs
      i. Prepare educational materials
      ii. Provide training/education to operators/owners
   c) Enforcement
      i. Review existing enforcement program
      ii. Update/enhance enforcement activities if applicable
3. Pilot Program: Develop pilot program and measure effectiveness over defined period of time
4. Implementation: Update initial Implementation Plan based on results of pilot program and follow through Implementation Plan

4.4.3.3 Business Improvement District Outreach

Business Improvement Districts (BIDs) provide services, activities and programs to businesses in a defined area. Funding is provided by businesses in the district. Services include advertising, maintenance and holiday decorations. This program targets businesses with outreach programs through the BIDs and encourages businesses to form BIDs. Businesses will be provided with information about trash management, bacteria-reducing BMPs, and runoff reduction techniques, such as reducing paved (impervious) areas, improving landscaping, and using porous pavement. Additionally, this can be done in conjunction with incentive programs.

Table 18 illustrates the BIDs in Santa Monica with associated locations, average budgets, and objectives.

TABLE 18
Santa Monica Business Improvements District
SMBB Bacteria TMDL Implementation Plan

Business Improvement District	Coverage Area	Average Budget	Expenses
Third Street Promenade & Downtown District Maintenance	The District covers 2nd, 3rd, and 4th streets between Wilshire and Broadway	$770,000 per year	Supplemental operations and maintenance, including Bayside District Corp. budget
Downtown Parking & Business Improvement Area: Retail Only	The centerline of Ocean Avenue to the centerline of 7th Street, and the centerline of the Santa Monica Freeway to 200 feet northwesterly of the centerline of Wilshire Blvd	$170,000 per year	General promotion of retail activity in the area, including holiday decorations.
Main Street Parking & Business Improvement Area	Main Street from Pico Boulevard on the North to Southern City Limits	$84,500 per year	Parking improvements, promotion and advertising for Main Street business area, Summer Solstice and other promotional events
Montana Parking & Business Improvement Area	Montana Avenue from the centerline of 6th Court to the centerline of 17th Street	$69,000 per year	Advertising and promotion of Montana Avenue merchants and businesses
Pico Boulevard Business Improvement District	Properties bordering Pico Boulevard from the Pacific Ocean to the easternmost City limits at Centinela Blvd.	$63,000 per year	Solving business problems along Pico, particularly parking, neighbor relations, and promotion and advertising of Pico Boulevard businesses. Initiating a Storefront Renovation Program in 2005 using grants and low-cost loans.

As another example, the City of Los Angeles' stormwater program currently has a partnership with four BIDs in the downtown Los Angeles area. The BIDs included in this partnership include the Downtown Center BID, the Downtown Industrial BID, the Fashion District BID and the Historic Core BID. According to the City, the partnership was established to (1) establish a relationship with local businesses, (2) provide an information loop for businesses, and (3) disseminate educational information to local businesses.

The City of Los Angeles distributed an educational letter to the four above-mentioned BIDs for further distribution to downtown businesses. The letter included educational BMPs for businesses located in the four BIDs. More than 1,000 letters were distributed to downtown business owners.

Future efforts with the Downtown BIDs include the production and distribution of an educational poster, including BMPs in four languages (English, Spanish, Chinese and

Korean), the creation and distribution of a newsletter insert article and the creation and service of enforcement letters, as necessary.

Upon request, the City's Stormwater Program also offers a speaker to BID groups.

General Steps for Implementation

1. Planning
   a) Identify business improvement districts
      i. Inspect business districts within drainage areas
      ii. Analyze pavement areas, landscape areas, porous pavement opportunities and related runoff criteria
      iii. Identify and prioritize candidate site/business improvement districts
   b) Define alternatives
      i. Develop pavement and landscaping options
      ii. Study cost benefit of replacement/improvements
      iii. Develop portfolio of design alternatives, building/landscaping materials, vendor/contractors and other related supporting needs
      iv. Build showcase projects and provide proof of concepts
   c) Develop incentive programs
      i. Develop financing solutions
      ii. Offer preferred vendor programs
      iii. Provide planning/design assistance
      iv. Investigate other available programs
2. Implementation Plan
   a) Develop Implementation Plan
      i. Define timeline and implementation approach
      ii. Identify revenue source (if applicable) and budget requirements
      iii. Develop resource availability and allocations
      iv. Obtain approvals from applicable internal and external departments/agencies
   b) Educational programs
      i. Prepare educational materials
      ii. Conduct training/seminars for business districts
3. Implementation: Implement defined activities, monitor progress and modify plan as required.

4.4.3.4 Incentives

Incentives are a method to increase the cooperation of residents and businesses in measures designed to reduce urban runoff and bacterial sources. Incentives should be considered for new programs where some installation by individual owners is involved. For example, incentives could include providing funding or tax credits to assist in the installation of residential rooftop drain diversions and cisterns/rain barrels as well as funding to use porous pavement in driveways where the soil conditions are appropriate. Youth organizations or other community-based organizations could be used to direct these funding programs and could provide some or all of the labor to install them as a source of income.

Within JG 2/3, the City of Santa Monica offers free or reduced priced cisterns/rain barrels; this program is similar to previously developed programs for compost bins for residents and businesses. The City of Santa Monica also has a Water Efficiency Competitive Grant Program where the City has set aside funds for grants up to $20,000 to property owners in the City to implement various landscape water efficiency strategies to reduce water consumption but also reduce rain and sprinkler runoff, which is often a component of inefficient sprinkler systems. The program has two cycles per year, and is expected to last about 5 years. Through these projects, people of the City can visit the sites and see what strategies can be used to use water more efficiently and reduce runoff.

General Steps for Implementation

1. Planning
   a) Define alternatives
      i. Identify bacteria-reducing BMPs, such as residential cisterns/rain barrels, that may be encouraged by offering residents cost-saving incentives
      ii. Evaluate and rank BMPs based on reduction of bacteria entering the bay, cost of implementation, and impact on property function and aesthetics
   b) Develop incentive programs
      i. Develop financing options: develop subsidized projects, tax credits programs, strategic partnerships with financial institutions/lenders, cost sharing options, etc.
      ii. Provide creative assistance: expedited design/permitting process, cost effective labor through youth organizations and community-based organizations
      iii. Provide free Do-It-Yourself clinic and startup tool kit
      iv. Provide rebate programs upon successful implementation
   c) Project costing
      i. Identify scope and budget of projects, prioritizing areas in priority subwatersheds
      ii. Estimate costs of administering the program, including field inspectors, telephone support, and Web site administration, if necessary.
      iii. Estimate hardware and installation costs
      iv. Estimate the demand for the project, i.e., how many people will be expected to take advantage of the program
2. Implementation Plan
   a) Develop Implementation Plan
      i. Decide how to best distribute the incentives based on budget and demand; for example X% of cistern installation costs can be reimbursed with a maximum of $Y
      ii. Optimize benefits to encourage participation and reduce costs
      iii. Identify revenue source (if applicable) and budget requirements

   iv. Develop resource availability and allocations
   v. Obtain approvals from applicable internal and external departments/agencies
b) Educational programs
   i. Compile literature on the program to provide residents with the information they need to decide if the BMP is right for their property and serve as an "installation guide" for the selected BMP (this may also include recommended sources of hardware)
   ii. Identify methods of advertising incentives to residents in the target areas such as flyers or newspaper articles
   iii. Provide internet and telephone support for residents to request literature and ask questions

3. Implementation: Implement defined activities, monitor progress and modify plan as required

4.4.3.5 Exploring Methods to Reduce Bacterial Contributions from the Homeless Population

Each person generates an average of 160 grams of solid feces per day containing bacteria and viruses pathogenic to other humans (Pitt, 2001). These materials are much more of a health hazard than fecal material from wild or domestic animals. Homeless people often defecate in public areas when toilet facilities are not available, which then may be washed into the storm drain systems during irrigation or rainfall. This is a preventable problem that can be improved by installing portable or permanent toilet facilities in places where homeless typically camp and educating them on the health hazards associated with human feces. Education may consist of brochures or signs posted near public restrooms. Care must be taken in implementing this measure, however, to ensure that these units do not increase the opportunities for illegal activities, such as drug sales, drug use, and prostitution.

Self-cleaning toilet facilities are being placed in cities, such as San Francisco and Philadelphia, to cope with sanitary and maintenance issues associated with pubic restrooms. After about 20 minutes of occupancy, these restrooms wash and sanitize themselves and require little maintenance. They are often equipped with security equipment to prevent illegal activities. They cost about $250,000 and can be paid for through poster advertisements or pay-per-use features.

General Steps for Implementation

1. Planning
   a) Define target areas
      i. Study and define areas with high concentration of homeless counts
      ii. Identify and prioritize areas needing public bathroom facilities
      iii. Identify suitable locations
   b) Define alternatives
      i. Evaluate self-cleaning toilets
      ii. Compare portable vs. permanent
      iii. Compare pay-per-use vs. free
      iv. Compare public funding vs. private investments
2. Implementation Plan
   a) Develop Implementation Plan
      i. Define timeline and implementation approach
      ii. Identify revenue source for initial installation and cost recovery thru advertisement revenues
      iii. Develop resource availability and allocations
      iv. Obtain approvals from applicable internal and external departments/agencies
   b) Educational materials
      i. Use highly visible posters, signs, brochures
      ii. Implement ongoing awareness activities
   c) Monitoring activities
      i. Schedule regular maintenance and inspections of facilities
      ii. Implement required policing to avoid illegal activities such as drug sales, drug use, and prostitution
3. Implementation: Implement defined activities, monitor progress and modify plan as required

4.4.3.6 Pre-Wet Weather Storm Drain Flushing

Storm drain flushing removes trash, sediment, and debris from storm drains, prior to the rainy season to reduce bacterial sources and also reduce trash entering the ocean.

Flushing techniques typically utilize an inflatable plug downstream where water is collected using a vacuum truck. Storm drains that are engineered for dry-weather diversions to the sanitary sewer system provide a good opportunity to flush without the costs associated with water collection and disposal.

General Steps for Implementation

1. Pilot Program: Develop pilot program and validate concept and cost feasibility.
2. Planning: Prioritize service areas and develop flushing schedule
   a) Define service area
      i. Identify drainage areas collecting high trash volumes in storm drains
      ii. Identify tributary storm drains and catch basins

iii. Develop inventory; length of storm drains, number of catch basins, etc.
iv. Prioritize service areas

b) Develop storm drain flushing schedules
i. Develop activity schedules and frequency for storm drain flushing
ii. Develop resource availability and allocations
iii. Obtain approvals from applicable internal and external departments/agencies

3. Implementation: Update initial implementation plan based on results of pilot program and follow through Implementation Plan

4.4.3.7 Redirecting Downspouts

Roof drainage systems sometimes discharge to impervious surfaces, such as driveways, or are routed directly to the stormdrain system. Downspouts can usually be redirected to pervious landscaped areas, drywells, or trenches with minimal expense and effort. Redirecting downspouts reduces stormwater volume and reduces transport mechanisms for indicator bacteria.

Encouraging residents to redirect their downspouts can be accomplished through educational material, how-to guides, and cost-saving incentives.

General Steps for Implementation

1. Planning
   a) Define service area
      i. Identify drainage areas with high runoff volumes; primarily areas with high paved surface and low permeable surface areas
      ii. Prioritize service areas
   b) Develop program guidelines
      i. Develop educational material defining benefits to redirecting downspouts
      ii. Create how-to guidelines describing concept of redirecting downspouts
      iii. Provide landscaping ideas offering beneficial use of stormwater improving esthetic of property
      iv. Develop program guidelines
   c) Incentive programs
      i. Provide free Do-it-Yourself clinic and startup tool kit
      ii. Offer rebate programs upon successful implementations
   d) Public awareness and program campaign
      i. Implement direct mailing to residences and businesses
      ii. Use advertisements and media campaign
      iii. Incorporate the Internet – web-based information distribution
2. Implementation: Update initial Implementation Plan based on results of pilot program and follow through Implementation Plan

4.4.3.8 Modifying/Enhancing Public Education Programs
There are many public outreach programs in the JG 2/3 area. The following recommendations can be used to enhance or expand current programs to include material about the Bacteria TMDL.

4.4.3.8.1 Modifying Existing Educational Programs to Address TMDLs, specifically Bacteria – The goal of this recommendation is to inform the public of bacteria TMDL regulations through existing educational programs. Establishing a link between beach closures, human health risk, bacterial sources, and runoff as a means to transport bacteria is an important step in public awareness. Some highlights of the programs could be:

- Illnesses typically caused by pathogens from stormwater
- Bacteria and virus properties: relative size, ability to go dormant
- Common bacterial sources such as food waste and animal waste
- Transport of bacteria by rainwater to the ocean leading to TMDL exceedances
- Incorporating microscope sessions or photos so students can establish a visual conception of bacteria

4.4.3.8.2 Outreach to Pet Owners about Animal Wastes and Health – Environmental literature currently does not draw the connection between pet waste and bacterial contamination at the beaches. Dog owners would be more likely to pick up after their pets both at home and in public areas if they were aware of facts, such as:

- Dog feces contain fecal coliform and enterococci bacteria, which determine beach closings and may contain pathogens (e.g., *Giardia* and *Salmonella*) that can make swimmers ill.
- Animal feces can be washed into the Bay through grass, landscaping, streets, and sidewalks, which eventually lead to a storm drain, even if the source is miles from the coast.
- Picking up after pets will reduce bacterial contamination in the Bay and may reduce the health risk to swimmers.

Three dog waste collection surveys were summarized in *Residential Nutrient Behavior in the Chesapeake Bay,* published by the Center for Watershed Protection. The results suggest that many people (15 percent in Washington and 37 percent in Chesapeake Bay) do not know that pet wastes contribute to water quality problems. Furthermore, in the Chesapeake Bay Study, 41 percent said they rarely or never clean up after their dogs; and of those people, 44 percent would still not clean up even with fines, complaints, or improved sanitary collection or disposal methods.

Los Angeles County has also conducted a marketing survey and a pilot program study in County-unincorporated areas about behavior of pet waste collection.

4.4.3.8.3 Modifying Existing Handouts to Establish Runoff as a Means for Conveying Bacteria to Storm Drains – Many existing BMPs will reduce runoff, thus reducing the conveyance mechanism of bacteria; however, those reading the handouts may be unaware of this. The objective of this program is to increase the public's awareness of why runoff is a problem in terms of bacterial contamination at the beaches. This may lead to better runoff management practices in residential areas.

Homeowners may not understand the benefits gained from runoff management. Private implementation of BMPs, such as roof cisterns/rain barrels, not only conserves water, but reduces runoff and, as a result, may reduce the amount of pollutants entering the stormwater system. Another benefit is the protection of property value. Property values are negatively influence by poor water quality and litter proliferation.

4.4.3.8.4 Including Pet Waste Brochures with Animal Licensing Renewals - The objective of this recommendation is to target pet owners with information about pet waste and its impact on the beaches. Dog owners would be more likely to pick up after their pets both at home and in public areas if they were aware of such facts.

4.4.3.8.5 Outreach at Trailheads Designated for Equestrian Use – Signs should be posted at trailheads designated for equestrian use instructing horse owners not to clean out their horse trailers in the parking lots**.** Parking areas at trailheads tend to be graded dirt lots that increase runoff volumes as opposed to trails. Horse waste on trails is also filtered by vegetation before entering waterways, which may or may not be the case within trailhead parking lots.

4.4.3.8.6 Increase Coordination between Agencies and Organizations - An effort should be made to increase coordination between agencies and organizations in preparing outreach materials, and meetings should be held to ensure consistency. Multiple efforts are being made to produce outreach materials, but production is not always coordinated between organizations and agencies, resulting in the preparation of similar or duplicate materials. This would include JG 2/3 member agencies as well as organizations, such as the Santa Monica Bay Restoration Commission (SMBRC) and the Resource Conservation District of the Santa Monica Mountains (RCDSMM).

The following list includes ideas that may help to increase communication between agencies:

- Compile and distribute contact information from all the agencies and organizations in the JG 2/3 areas.
- Encourage organizations and agencies to post outreach materials on their Web sites so they can be easily reviewed and downloaded.
- Implement an e-mail list or public listserv to discuss outreach materials and post new material before it is produced.
- Fund a Web site that provides links to all agencies and organizations in the JG 2/3 areas and their outreach materials.

4.4.3.8.7 Locate Areas with Corralled Animals and Educate Property Owners on Bacteria TMDLs – Horse stables and other animal corrals are a large, preventable source of indicator bacteria. This program will educate the owners about bacteria TMDLs and steps they can take to decrease negative impacts on the environment. A network of volunteers from environmental organizations could be trained in this area. Some highlights of the program should include:

- Indicator organisms and their presence in farm animal manure.

- Beach closures and human health risks are correlated with indicator organism concentrations.
- The ability of rainwater to wash bacteria into the beaches through storm drain systems.
- Example BMPs that control runoff and, as a result, reduce bacteria reaching the beaches.
- Point of purchase/service collateral that demonstrates BMPs.

Public Education Programs' General Steps

1. Generate inventory of required updates to public education
   a) Modify existing educational programs to specifically address TMDLs and bacteria.
   b) Modify existing handouts to establish direct links between animal wastes and health issues.
   c) Modify existing handouts to establish runoff as a means for conveying bacteria to storm drains.
   d) Include pet waste brochures with animal licensing renewals.
   e) Post signs at trailheads encouraging people to use restroom facilities (assuming facilities already exist at the trailhead) before hiking.
   f) Post signs at trailheads designated for equestrian uses to not clean out horse trailers in parking lots and to clean up horse waste in parking lots.
   g) Increase coordination between agencies and organizations in preparing outreach materials, and meet with them to ensure consistency in programs and materials.
   h) Locate areas with corralled animals and educate property owners on bacteria TMDLs
   i) Address virus issues in addition to bacteria in campaigns and source control.
2. Define an approach to disseminate updated educational material.
3. Implement planned activities supporting expanded public education.

4.5 Subregional Structural Solutions

Subregional structural solutions that consist of decentralized, structural BMPs that may provide for management of both onsite and offsite flow include the following:

- **Install residential and commercial cisterns/rain barrels:** An implementation goal of 5 to 10 percent of single-family and multi-family residential homes (1,000- and 10,000-gallon sizes, respectively) was applied in the Hybrid Alternative. Also included here are similarly sized cisterns or rain barrels at commercial facilities.
- **Install storage and reuse projects at publicly owned facilities:** An implementation goal of 10 percent of the potential sites identified in JG 2/3, including schools, government and public facilities, vacant lots, golf courses, and public parks, was applied.
- **Install small-scale capture and infiltration projects:** These projects, which include the installation of porous pavement, retention grading, dry wells, and bioretention as well as sunken street medians/sidewalk planters and permeable catch basin bottoms, can be

installed at public parks, as well as commercial and residential communities. The ability of these types of projects to effectively manage runoff will be determined on a case-by-case basis and, therefore, an estimate of the potential volume of runoff that will be managed is unknown at this point.

In addition, an infiltration project in Venice Beach was identified in the development of this Implementation Plan, wherein runoff from the boardwalk and street areas near the beach could be routed to a treatment system to remove grit and oil, and then routed to an infiltration system located in the sandy (highly permeable soil) area. The infiltration system would consist of a perforated culvert that could store the runoff until it is infiltrated. A 48-inch perforated culvert, located parallel to the coast, would have a storage capacity of 94 gallons per foot of culvert. In some cases, this volume may be infiltrated in a 24-hour period. A small-scale infiltration project consisting of 1,000 feet of culvert could be implemented, for example, in the southern area of Venice Beach where the historical bacterial exceedances are of more concern than in the northern section of Venice Beach. Subsurface monitoring of the saturated zone (groundwater) would be recommended to watch for potential migration of bacteria from the infiltration project through the beach sands that might exfiltrate into the surf zone.

- **Redirect rooftop downspouts to discharge on permeable areas:** Rooftop drain downspouts can be redirected to discharge onto permeable areas instead of hardscapes. This strategy can be implemented at single-family and multi-family residences, as well as at public and commercial buildings and is a runoff conservation measure that will assist with source control quality and quantity. Efforts to implement this option could be combined with public education or consumer water use audits.

4.6 Initiating CEQA and Permitting

The implementation of the first phase of this Implementation Plan would focus on nonstructural solutions that are actually changes in institutional behavior. Possible activities include expanded public education, code enforcement, increased street and storm drain cleaning frequency, increased number and maintenance of trash receptacles, and improved restaurant and grocery store trash management. subregional structural solutions for runoff management (structural source control projects), such as the installation of small-scale storage and reuse or infiltration projects at public facilities, as well as consideration of residential options, such as cisterns/rain barrels, dry wells, and redirecting downspouts, also will be implemented. In general, the institutional types of activities are not subject to the requirements of CEQA. Some of these activities would require additional support features that have the potential to result in physical changes to the environment, including the structural source control solutions; however, such projects would likely be relatively minor given the institutional or minor structural focus of this phase. These types of support features or projects would, in all likelihood, qualify for Categorical Exemptions under CEQA on an individual basis.

Higher-level CEQA documents, such as a Negative Declarations or Mitigated Negative Declarations, may be necessary for medium-sized or larger subregional structural solutions projects. These would include projects such as capture and retention projects designed to manage wet-weather runoff from larger subareas (i.e., multiple neighborhoods). These would also include projects that could affect public use areas such as parks or recreational areas. Again, CEQA documentation for these types of projects would occur on a project-specific basis.

Regional, end-of-pipe facilities might be implemented in Stage 2, in the event that the nonstructural and small-scale, local, structural TMDL compliance measures need to be supplemented. These large facilities include relatively standard projects, such as diversions into the wastewater system, or other end-of-pipe solutions with a larger regional emphasis, such as runoff treatment plants or constructed wetlands. The smaller projects like diversions to the wastewater system are likely to be individually cleared with Categorical Exemptions or Negative Declarations under CEQA. The larger facilities that could result in potential siting issues or stakeholder concerns would likely be subject to higher level CEQA documents, such as a Mitigated Negative Declaration or Environmental Impact Report, which would be prepared on a project–by-project basis.

4.7 Parallel Studies

Research is currently underway by local agencies to (1) improve human-health risk indicator methods and methods for source tracking, and (2) evaluate BMPs in Southern California. Results from these projects will be used to efficiently trace sources of pollution in the watershed and prioritize BMP projects.

Development of new chemical and biological detection methods may lead to a faster, more accurate assessment of human health risk in the Bay and can be used to trace the sources of contaminants in storm drain systems. This effort will speed the process of posting beach advisories, aid in the detection of illicit discharges, and may provide a means to prioritize areas for source reduction.

The effectiveness of stormwater BMPs applicable to Southern California is being evaluated. Information gained from these studies will be useful in prioritizing BMP projects based on their cost and potential for reducing pollutants entering the storm drain system.

4.7.1 Human-Health Risk Indicators

Human-health risk due to pathogens is gauged by the concentration of indicator bacteria in ocean water. Ongoing research is exploring other methods for detection of pathogens in recreational waters. Because the future of pathogen monitoring is uncertain, the water quality objectives for this TMDL may change in the future. Since potential changes will have a dramatic impact on implementation of this TMDL, current and emerging indicator methods were reviewed. Indicator methods will play a large role in determining the success of implementation methods, and will effect decisions about TMDL compliance in the future.

Bacterial indicators used to monitor beach water quality have been the focus of many epidemiological studies. The correlation between indicators and human-health risk was found to be variable, in part because indicators are not specific to pathogen sources. Currently, they are the basis for evaluating water quality for the purposes of beach advisories and regulatory control. There is general agreement in the scientific community that they should not be used as the sole objective in the remediation efforts to protect human health and receiving waters.

Because it is impractical to monitor all human-disease-causing agents, microbial indicators are used to estimate the concentration of pathogens in ocean water. Three groups of bacteria—total coliform, fecal coliform, and enterococci—are measured and compared to standards developed by USEPA. Indicator organisms are easily measured and have been found to correlate with human-health risk and poor water quality. They are not necessarily pathogenic, but their concentrations are assumed to be proportional to levels of fecal contamination, a major source of pathogens.

Fecal material is washed into storm drain systems during heavy rain, or through cross contamination from sanitary sewer infrastructure. Several studies conducted in urban environments have shown runoff from streets, parking lots, and sidewalks are major sources of indicator bacteria (Pitt, 2001). Residential and light commercial areas have had high levels of indicator bacteria in stormwater, primarily from fecal contaminated soils and drainage areas (Pitt, 2001). In both cases, domestic animals and wildlife were the primary sources, especially dogs in areas where they are frequently walked.

Indicator bacteria are not necessarily specific to the pathogen source. Coliform bacteria are ubiquitous, found on plant surfaces, in soils, and in the digestive systems of mammals and birds. Enterococci bacteria and fecal coliform, a subset of total coliform, thrive in the digestive systems of warm-blooded animals. Concentrations of these indicators above the set criteria indicate the water has been contaminated with fecal material. The actual pathogen concentration, however, depends on how much of the fecal contamination is from human sources.

Local and national epidemiological studies reveal that the correlations between adverse health effects, fecal coliform, total coliform, and enterococci are variable (SWRCB, 2004). Both enterococci and the ratio between total coliform and fecal coliform were found to be indicators of human-health risk in a series of studies conducted by the University of California at Berkeley. The results of this study and others conducted by USEPA, however, do not state which indicator is superior, especially when applied over broad environmental conditions. A recent epidemiological study (Rodgers, 2004) on Mission Bay in Southern California found no link between indicator bacteria and illnesses caused by water contact. A bacterial source identification study found that bird droppings contributed significantly to elevated indicator concentrations in that area. Beaches were found to be safe even when state standards were exceeded.

4.7.2 Alternative Indicators

USEPA has identified two alternative indicators, *Clostridium prefringens* and bacteriophages, which are currently not utilized in traditional beach monitoring. *C. prefringens* is a disinfection-resistant spore-forming bacterium that has potential use as an indicator of pathogenic bacteria, viruses, and protozoa. It has been found to correlate with *Salmonella spp*. and *Giardia* and *Aeromonas* densities in marine waters. Research by Kueh et al. (1995) demonstrated correlations between gastrointestinal symptoms and concentrations of *C. prefringens*. It has desirable characteristics, such as its presence in human feces but not bird droppings, and has superior spore survival. It can be readily enumerated using traditional membrane filtration methods.

Bacteriophages, viruses that infect bacteria, also show promise as water quality indicators. Studies have found specific bacteriophages to be correlated with microbiological parameters in coastal waters.

Emerging technology in the field of microbial source tracking may unveil a more efficient means to reduce human-health risk associated with stormwater discharge. Methods have been developed to differentiate between human and animal fecal material in stormwater, and even between different animals. These methods can be used to trace and eliminate inappropriate discharges to the storm drain systems and target areas with high concentrations of preventable fecal contamination. In addition, research in this field may lead to better indicator standards for use in beach monitoring.

Research is being conducted to improve source tracking by finding indicators that quickly and cost-effectively differentiate between human bacterial sources and natural sources. The Southern California Coastal Water Research Project (SCCWRP) currently has projects underway to develop microbial source tracking methods and develop rapid methods for measuring indicator bacteria. Current methods take 18 to 24 hours and are not adequate for tracking sources during short rain events or posting beach advisories in time to protect public health. They hope to substantially enhance our ability to correctly and rapidly identify when recreational waters are contaminated with microorganisms pathogenic to humans within the next decade.

Bacterial source tracking methods use indicators that distinguish between human and animal fecal material. Methods currently in use include the following:

Antibiotic Resistance Analysis (ARA) – ARA takes advantage of the exposure of bacterial sources to different antibiotics and the resulting patterns of resistance that develop. Samples are exposed to a variety of antibiotics; the results determine the multiple antibiotic resistance (MAR) profile of the sample. This MAR profile is compared to a database and the probable source can then be determined.

Molecular Methods – Genetic markers can be used to aid source identification. These methods are not yet ready for routine use, but have been used in research studies and found to be successful. One recent example is a study conducted on the Lower Boise River, Illinois (CH2M HILL, 2002). Coliform bacterial DNA testing (ribotyping) was used to determine the sources of coliform bacteria in the river.

Chemical Analysis – Chemicals unique to human sewage such as aspirin, Ibuprofen, and caffeine can be used to identify illicit discharges to stormwater systems. Caffeine has been successfully used in storm drain source tracking studies (Pitt, 2001).

SCCWRP is investigating a method using "real-time polymerase chain reaction" (rt-qPCR), a relatively new nucleic-acid-based technology. The use of DNA (or RNA) sequencing will allow development of quantitative probes that rapidly discriminate between enterococcus strains originating from humans, pets, livestock, and other wildlife.

4.7.3 BMP Studies

Stormwater BMPs are implemented to reduce trash, sediment, and toxins from entering water bodies. Information on stormwater BMP effectiveness is not abundant, especially for the removal of bacteria under wet weather conditions. The International Stormwater Best Management Practices Database (USEPA, 2004) contains the results of approximately 200 historical BMP studies. The database, developed by the Urban Water Resources Research Council (UWRRC) of the American Society of Civil Engineers (ASCE) under a cooperative agreement with USEPA, serves two key purposes: (1) to define a standard set of data-reporting protocols for use with BMP monitoring efforts, and (2) to summarize historical BMP study data in a standardized format. While this database is a step in the right direction, much more data are needed for many BMP types.

Evaluation of urban runoff BMP effectiveness is being conducted by SCCWRP to assess the effectiveness of BMPs for reducing the concentration of toxics in dry and wet weather runoff. Many BMPs implemented in the Southern California coastal area are being monitored both upstream and downstream for selected chemicals toxic to marine life. The types of BMPs being considered in this study include continuous deflection separation (CDS) units (with and without additional treatment modules), storm drain inserts, UV light disinfection systems, wetlands, and detention ponds, all of which are applicable to the Southern California coastal region. This 3-year project is currently in its second year; results may be available for consideration in this TMDL within the next two years.

The SMBRC is part of the county-led BMP Task Force. Its mission is to address BMP requirements called for in NPDES permits and to explore viable solutions for BMP implementation. Priorities of the Task Force include:

- Prepare guidelines for evaluating BMPs.
- Develop an objective book of standard plans and specifications for BMP selection and implementation.
- Develop guidelines for coordinating regional solutions and broad BMPs.
- Develop a website/list serve to disseminate information.
- Create a forum for exploring financing mechanisms.

The evaluation of stormwater BMP effectiveness can be applied to the subregional structural solutions recommended in this Implementation Plan. Results will be useful in developing and refining this integrated approach to reducing coastal water pollution.

4.8 Baseline and Performance Monitoring

4.8.1 Upstream Baseline Monitoring

As noted in Section 1.1.3, the overall baseline and performance monitoring at the beaches will be conducted in accordance with the Coordinated Shoreline Monitoring Plan, submitted under a requirement of this TMDL. While these data will provide an indication of the current and future patterns of bacterial indicators (total coliform, fecal coliform, and enterococcus) regulated under this TMDL, additional monitoring upstream in the subwatersheds would provide additional information about patterns of bacterial contamination. Upstream sampling of the regulated bacterial indicators can be used to first identify "hot spots" that show consistent patterns of high bacterial densities that would represent candidates for additional local structural solutions.

Upstream sampling can also be conducted to investigate more specifically where the source of the bacterial contamination identified at these "hot spots" might be coming from by tracking bacterial concentrations through the storm drain system. This would provide further information with which to select and implement pollution control measures (structural or nonstructural) that target these particular contamination sources.

Baseline and performance monitoring should be conducted using established protocols such as those established by USEPA and ASCE for the International Stormwater BMP Database.

In addition, additional sampling could be expanded to include some of the more promising alternative indicators (see Sections 4.5.1 through 4.5.4 for a discussion of other sampling parameters and techniques).

4.8.2 Performance Assessment of Non-structural Programs

Nonstructural solutions have been a cornerstone of many stormwater management programs. These are widely regarded within the engineering and scientific communities as essential components of integrated nonpoint source management programs. However, as noted by the Australia-based Cooperative Research Centre (CRC) for Catchment Hydrology, there have been few attempts to evaluate the effects of nonstructural BMPs on stormwater quality. The CRC developed a set of guidelines (Taylor and Wong, 2003) that include a conceptual framework for assessing the value (benefits) and life-cycle costs of nonstructural BMPs for stormwater quality improvement, a set of monitoring and evaluation protocols, and example monitoring tools.

USEPA also has provided guidance in its *Monitoring Guidance for Determining the Effectiveness of Nonpoint Source Controls* (USEPA, 1997). Nevertheless, monitoring BMPs that seek to change the behavior of people is inherently difficult. It is also difficult to isolate the measured impacts from nonstructural programs where structural control measures are also implemented, and there could be synergistic effects between multiple nonstructural controls (e.g., between education and enforcement).

The CRC suggested conceptual model of how nonstructural BMPs operate and the outcomes they might produce is shown in Figure 8. This model indicates the relationship between nonstructural BMPs and the resulting changes in awareness, attitudes, behavior, stormwater quality, and, ultimately, waterway health. The degree to which each of these elements is met determines the effectiveness of these measures. It highlights the need to be able to measure the effectiveness of these BMPs in each of these elements.

3. **Changes in people's attitude (self-reported) –** Evaluate whether the BMP has changed people's attitudes, as indicated through self-reporting.
4. **Changes in people's behavior (self-reported) –** Evaluate whether the BMP has changed people's behaviors, as indicated through self-reporting.
5. **Changes in people's behavior (actual) –** Evaluate whether the BMP has changed people's behaviors, as indicated through direct measurement (e.g., the "observational approach").
6. **Changes in stormwater quality –** Evaluate whether the BMP has improved stormwater quality in terms of loads and/or concentrations of pollutants.
7. **Changes in waterway health –** Evaluate whether the BMP has improved the health of receiving waters.

The monitoring tools that would be best suited to each of these evaluation styles could range from checklists and surveys to water quality monitoring and modeling.

The selection of the appropriate evaluation style is dependent on the primary objective of the specific BMP (e.g., raise awareness or improve water quality), the resources available to conduct the evaluation, the timeframe over which the monitoring will occur, and the purpose of the evaluation. Monitoring and evaluation protocols relevant to each select evaluation style are provided and can be used to develop a Monitoring and Evaluation Plan for each BMP.

In addition, the California Association of Stormwater Quality Agencies (CASQA) has an Effectiveness Assessment Subcommittee. They have nearly completed the initial draft effectiveness assessment concepts white paper, and will be developing an Effectiveness Assessment Guidance Manual. The JG 2/3 agencies will monitor these developments to ensure alignment. Similarly, these efforts will be coordinated with related County MS4 Permit activities to assess whether the outreach campaigns associated with the Public Information and Participation Program have resulted in changes to polluting behaviors.

4.8.3 Performance Assessment of Subregional Structural Solutions

Sites at which specific subregional structural BMPs will be installed should be monitored prior to installation to establish baseline water quality conditions (see Section 4.6.1). The parameters for which the BMPs will be evaluated will include the regulated bacterial indicators, other constituents for which the Santa Monica Bay beaches are impaired that could be addressed by the same BMP, other water quality parameters, that could impact treatment performance (e.g., pH, temperature), and hydraulic parameters such as influent and effluent flow rates and water volumes.

A Monitoring and Evaluation Plan should be developed for each BMP, and the data configured to feed into the International Stormwater BMP Database. The requirements for conducting this performance monitoring are specified in the associated guidance manual (USEPA and ASCE, 2002). This document reflects standards of practice for the industry, and the application of the requirements for the database would provide much of the needed data for the JG 2/3 assessments of the effectiveness of their installed BMP, while also benefiting the stormwater technical community at large.

4.9 Subregional Structural Solutions Projects Development

4.9.1 Identify and Prioritizing Sites

Potential sites for the implementation of subregional structural BMPs were identified through a survey of public parks, public buildings, vacant lots, and schools in the JG 2/3 watershed area. While this list is not inclusive of all possible sites for BMP implementation, it is a starting point from which subregional structural solutions can be identified.

Field visits were conducted at public parks, public buildings, and vacant land to estimate land use, proximity to dense urban areas, topography, and other features relevant to BMP siting. Aerial photographs from the United States Geological Survey (USGS) were used to estimate roof areas, paved areas, and landscaped areas to calculate potential runoff and beneficial use opportunities. Parcel numbers were identified to obtain surface area, soil data, and proximity to storm drains from the City of Los Angeles' geographic information system (GIS) database.

School sites in the JG 2/3 area were identified using land use data, information from LAUSD, and information from the Santa Monica-Malibu Unified School District. The list contains both public and private schools. School districts were not included in the jurisdictions listed in the TMDL, and therefore, have not been consulted on the development of this Implementation Plan. School district staff will be heavily involved in the site selection process; therefore, sites were not yet analyzed in detail since district staff has not yet been fully engaged in the development of this Implementation Plan. As part of the City of Los Angeles' Integrated Resources Plan (IRP) effort, the Bureau of Sanitation, City of Los Angeles (BOS) meets regularly with LAUSD to discuss joint efforts between the agencies to promote water management and water quality improvements, including urban runoff pollution control. However, a preliminary selection of suitable BMPs has been identified and is shown in Table 19.

Public schools are ideal locations to implement bacterial control measures because they typically consist of large tracts of land, are heavily used, and can sometimes beneficially reuse stormwater for irrigation. Runoff can be significantly reduced or eliminated by coupling structural BMPs such as cisterns and green roofs with landscape design features to reduce paved areas and promote infiltration. Institutional solutions can easily be implemented through the current grounds management and by providing supplemental education for the students. Not only does this improve the school site, but also sends a message home with the next generation of Los Angeles area residents.

The idea of stormwater management in schools is not an entirely new idea in Los Angeles. The Open Charter Elementary School, part of LAUSD, was retrofitted with stormwater management BMPs in 2004. The project consists of three components: a water treatment device; a 110,000-gallon cistern that stores rainwater and feeds the irrigation system; and a system of trees, vegetation and mulched swales that slows, filters and safely channels rainwater through the campus.

The Open Charter Stormwater Project is a collaborative effort among TreePeople, the City of Los Angeles' Bureau of Sanitation, LAUSD and the County Regional Park and Open Space District. Open Charter students, parent, administration, faculty and school board also participated in the implementation of the Project.

A preliminary evaluation of school sites was conducted based on USGS aerial photographs and GIS soil data. Roofs, pavement, and landscaped terrain were estimated and used to identify applicable BMPs for each site. Evaluations are discussed below in Section 4.2.9.

Public parks, buildings, and vacant land were initially prioritized based on three criteria: (1) surface area, (2) proximity to dense urban areas, and (3) proximity to major storm drains. Sites with large surface areas have more room for BMPs, have more runoff to manage, and have the potential to use more water for irrigation. The proximity of the site to densely developed urban areas was estimated because those areas are generally found to have the higher concentrations of indicator bacteria in the stormwater. Some sites can be used to treat water generated offsite if they are near a storm drain from which water can be pulled, or significant flows in the gutter adjacent to these sites can be diverted onsite for treatment and resuse, particularly larger sites with a small percentage of impervious area. Evaluations were conducted to select applicable BMPs; these are described in Section 4.9.2.

TABLE 19
Select BMPs for School Sites
SMBB Bacteria TMDL Implementation Plan

Seq. No.	Site Name	School District*	Area	Topography	% Landscaped	% Paved / Buildings	Rooftop Area (ft^2)	% Native	Infiltration Capacity	Applicable BMP(s)**	Notes
S1	Kentwood Elementary School	LAUSD	6.21	Flat	14.3%	85.7%	48,050	0%	Poor	1,3,8,9	1,2,3,4
S2	Westchester Lutheran Church School	Private	3.18	Flat	18.6%	81.4%	46,271	0%	Poor	1,3,8,9	1,2,3,4
S3	Orville Wright Middle School	LAUSD	19.88	Flat	31.3%	68.7%	221,979	0%	Poor	1,3,8,9	1,2,3
S4	Paseo Del Rey Elementary	LAUSD	6.16	Flat	5.8%	94.2%	53,807	0%	Poor	1,3,8,9	1,2,3,4
S5	St. Bernard High School	Private	11.97	Flat	41.3%	58.7%	75,595	0%	Poor	1,3,6,8,9	1,3,4
S6	Westchester High School	LAUSD	35.44	Flat	26.5%	73.5%	324,855	0%	Poor	1,3,8,9	1,3,4
S7	Del Rey Senior High School	LAUSD	3.65	Flat	20.3%	79.7%	26,483	0%	Poor	1,3,6,8,9	1,3,4
S8	Loyola Village Elementary School	LAUSD	6.95	Flat	2.5%	97.5%	61,354	0%	Poor	1,3,8,9	1,2,3,4
S9	Emerson Adult Learning Ctr	Private	2.97	Flat	6.4%	93.6%	35,257	0%	Poor	1,3,8,9	1,2,3,4
S10	El Segundo High School	ESUSD	21.81	Flat	46.6%	53.4%	143,574	0%	Poor	1,3,6,8,9	1,3,4
S11	St. Anthony Catholic School	Private	3.55	Flat	15.8%	84.2%	51,227	0%	Poor	1,3,6,8,9	1,2,3,4
S12	Richmond Street Elementary	ESUSD	7.61	Flat	40.0%	60.0%	54,956	0%	Poor	1,3,6,8,9	1,3,4
S13	Center Street Elementary	ESUSD	12.31	Flat	42.5%	57.5%	102,970	0%	Poor	1,3,6,8,9	1,3,4
S14	El Segundo Middle School	ESUSD	9.22	Flat	48.8%	51.2%	70,964	0%	Poor	1,3,6,8,9	1,3,4
S15	Westminster Elementary	LAUSD	8.65	Flat	4.6%	95.4%	68,450	0%	Poor	1,3,8,9	1,2,3,4
S16	Broadway Elementary School	LAUSD	6.09	Flat	2.2%	97.8%	50,189	0%	Poor	1,3,8,9	1,2,3,4
S17	Walgrove Avenue Elementary	LAUSD	10.84	Flat	3.3%	96.7%	46,810	0%	Poor	1,3,8,9	1,2,3,4
S18	Brockton Avenue Elementary School	LAUSD	2.92	Flat	9.1%	90.9%	36,811	0%	Poor	1,3,8,9	1,2,3,4
S19	Brentwood Science Magnet School	LAUSD	8.12	Flat	11.7%	88.3%	111,415	0%	Poor	1,3,8,9	1,3,4
S20	Santa Monica College	COUNTY	37.20	Flat	25.0%	75.0%	810,221	0%	Poor	1,3,8,9	1,3,4
S20	John Adams Jr High	SMMUSD	20.96	Flat	40.0%	60.0%	365,284	0%	Poor	1,3,6,8,9	1,3,4

TABLE 19
Select BMPs for School Sites
SMBB Bacteria TMDL Implementation Plan

Seq. No.	Site Name	School District*	Area	Topography	% Landscaped	% Paved / Buildings	Rooftop Area (ft^2)	% Native	Infiltration Capacity	Applicable BMP(s)**	Notes
S20	Will Rogers School	SMMUSD	6.12	Flat	25.0%	75.0%	133,214	0%	Poor	1,3,6,8,9	1,3,4
S21	Grant Elementary School	SMMUSD	6.42	Flat	19.3%	80.7%	73,598	0%	Poor	1,3,6,8,9	1,2,3,4
S22	Santa Monica School District	SMMUSD	19.56	Flat	35.4%	64.6%	159,796	0%	Poor	1,3,6,8,9	1,3,4
S23	Crossroads School	Private	0.70	Flat	3.7%	96.3%	14,370	0%	Poor	1,3,8,9	1,2,3,4
S24	Mc Kinley Elementary School	LAUSD	6.73	Flat	21.4%	78.6%	47,572	0%	Poor	1,3,6,8,9	1,3,4
S25	Franklin Elementary School	LAUSD	5.38	Flat	24.9%	75.1%	83,186	0%	Poor	1,3,6,8,9	1,3,4
S26	Roosevelt Elementary School	SMMUSD	6.25	Flat	26.3%	73.7%	90,611	0%	Poor	1,3,6,8,9	1,3,4
S27	Lincoln Middle School	SMMUSD	10.37	Flat	25.6%	74.4%	124,323	0%	Poor	1,3,6,8,9	1,3,4
S28	Will Rogers Elementary School	SMMUSD	6.47	Flat	17.7%	82.3%	86,880	0%	Poor	1,3,6,8,9	1,2,3,4
S29	Santa Monica Malibu USD Adlt	SMMUSD	4.47	Flat	12.9%	87.1%	48,092	0%	Poor	1,3,8,9	1,2,3,4
S30	Santa Monica Alt High School	SMMUSD	5.63	Flat	33.1%	66.9%	42,135	0%	Poor	1,3,6,8,9	1,3,4
S31	Santa Monica High School	SMMUSD	27.58	Flat	38.2%	61.8%	297,687	0%	Poor	1,3,6,8,9	1,3,4
S32	St Monica's School	Private	9.38	Flat	15.5%	84.5%	90,368	0%	Poor	1,3,8,9	1,2,3,4
S33	Carl Thorp School	Private	1.04	Flat	23.6%	76.4%	21,222	0%	Poor	1,3,6,8,9	1,2,3,4
S34	Brentwood School	Private	7.10	Flat	56.7%	43.3%	48,849	0%	Poor	1,3,6,8,9	1,3,4
S35	Brentwood Lower School	Private	3.40	Flat	40.6%	59.4%	25,408	0%	Poor	1,3,6,8,9	1,3,4
S36	Paul Revere Middle School	LAUSD Charter	22.24	Flat	19.7%	80.3%	204,945	0%	Fair	1,3,7,8,9	1,3,4
S37	Canyon Elementary School	LAUSD Charter	2.97	Flat	19.1%	80.9%	34,234	0%	Fair	1,3,6,7,8,9	1,2,3,4
S38	Corpus Christi School	Private	1.77	Flat	5.0%	95.0%	29,934	0%	Fair	1,3,7,8,9	1,2,3,4
S39	Pacific Palisades Elementary	LAUSD Charter	4.70	Flat	12.5%	87.5%	45,241	0%	Fair	1,3,7,8,9	1,2,3,4
S40	Palisades High School	LAUSD Charter	5.87	Flat	41.0%	59.0%	62,097	0%	Fair	1,3,6,7,8,9	1,3,4
S41	Montessori School	Private	0.34	Flat	15.5%	84.5%	5,942	0%	Fair	1,3,6,7,8,9	1,2,3,4

TABLE 19
Select BMPs for School Sites
SMBB Bacteria TMDL Implementation Plan

Seq. No.	Site Name	School District*	Area	Topography	% Landscaped	% Paved / Buildings	Rooftop Area (ft^2)	% Native	Infiltration Capacity	Applicable BMP(s)**	Notes
S42	Kenter Canyon Elementary School	LAUSD Charter	6.75	Flat	17.4%	82.6%	40,542	0%	Fair	1,3,6,7,8,9	1,2,3,4

* School District Abbreviations:
LAUSD - Los Angeles Unified School District
ESUSD - El Segundo Unified School District
SMMUSD - Santa Monica-Malibu Unified School District
** See Table 20 for BMP type.

Notes:

[1]The soil infiltration capacity is fair or poor. Any BMP relying on infiltration may not be effective on this site as flooding could occur during some rain events.

[2]Most of the site is paved so there is little room available to install a BMP or landscaping to use the runoff other than BMP 3 (green roofs) and BMP 8 (pervious pavement).`

[3]A cistern or on-site storage and reuse system is preferable to wetlands where there is sufficient landscaping to utilize the runoff. However, if the existing irrigation system at the site is pressurized, the water is distributed by sprinklers, and public access cannot be restricted during irrigation, water that meets Title 22 treatment standards may be required. If so, a wetlands would be preferred.

[4]Bioretention Areas (1) are applicable to all sites, they can be implemented together with porous pavement (8) and the replacement of pavement (9) to reduce hardscape surfaces. Infiltration will vary with soil conditions, bioretention areas such as parking lot grass swales will also reduce runoff velocity.

4.9.2 Identifying BMPs to Reduce Indicated Bacteria in Runoff

The City of Los Angeles' BMP program is presented in its *Development BMPs Handbook* (DPW BOS, 2002). The BMP Handbook identifies 14 BMPs that provide control measures to reduce or eliminate pollutant levels at their source. This and other sources[3] were used to identify potential BMPs that could be applied as subregional structural solutions for bacterial reduction. The initial list of potential BMPs included:

- Vegetated buffer systems
- Bioretention
- Constructed wetlands
- Green roofs
- Infiltration trenches
- Infiltration basins
- Cisterns/Rain barrels
- Wet (retention) ponds
- Dry (extended detention) ponds
- Dry wells
- Pervious pavements
- Catch basin/storm drain inserts
- Vortex/Hydrodynamic systems
- Clarifiers
- Media filtration

While these practices are effective at removing many constituents of concern from runoff, they have not all been proven to be effective in reducing bacteria. For example, BMPs that filter runoff for a short period of time, such as vegetated buffer systems, are effective in removing sediment and other contaminants before runoff enters the collection system, but have not been shown to significantly remove bacteria. BMPs that provide mechanical removal such as catch basin inserts, clarifiers, and media filtration, are pretreatment steps that do not, by themselves, remove bacteria.

BMPs that retain runoff and use it for irrigation or infiltrate it to the groundwater effectively reduce bacteria from entering the storm drain system by (1) isolating bacteria on that site and (2) reducing the surface flow between that site and the storm drain, thus reducing the potential for bacteria to be washed out of soils and paved surfaces. Thus, cisterns/rain barrels, green roofs, and infiltration BMPs were selected for further study. Carefully designed and operated constructed wetlands also can be effective in removing bacteria before the runoff is discharged to the collection system. Based on these observations, the following BMPs were selected for use in potential projects at the identified sites:

1. Bioretention
2. Subsurface constructed wetland
3. Green roof
4. Infiltration trench

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[3] The other sources included New Development Handbook - BMP fact sheets: http://www.cabmphandbooks.com, the City of LA's "Reference Guide for Stormwater BMPs": http://www.lacity.org/san/wpd/index.htmhttp://www.lacity.org/san/wpd/index.htm, and "Start at the Source Manual" from BASMA (Bay Area Stormwater Management Agencies).

5. Infiltration basin
6. Cistern and local storage and reuse
7. Dry well
8. Pervious pavement
9. Pavement replacement
10. Street bioretention systems

The criteria for identifying the required site characteristics include the total site area, the ratio of hardscape to softscape, the slope of the site, and the infiltration capacity of the soils. A relatively large area is required to install a subsurface constructed wetlands (BMP 2), an infiltration trench (BMP 4), or an infiltration basin (BMP 5). A relatively large area of the site must be free of structures to accommodate a bioretention system (BMP 1), subsurface constructed wetlands (BMP 2) or a cistern system (BMP 6). A flat surface or lot is required for all of the BMPs. BMPs that rely on infiltration (1, 4, 5, 7, 8, 9 and 10) must be located on soils that are known to have good infiltration. A summary of the applicable BMPs is presented in Table 20.

TABLE 20
Summary of Best Management Practices
SMBB Bacteria TMDL Implementation Plan

BMP No.	BMP Name	Description	Required Area	Required Softscape	Required Soil Infiltration
1	**Bioretention**	Bioretention areas are landscaping features adapted to treat stormwater runoff on the development site. They are commonly located in parking lot islands or within small pockets in residential land uses. Surface runoff is directed into shallow, landscaped depressions. These depressions are designed to incorporate many of the pollutant removal mechanisms that operate in forested ecosystems.	Relatively large area	At least 50% of site	Good - Infiltration provides bacteria removal
2	**Subsurface Constructed Wetland**	A constructed wetland is a biological stormwater treatment technology designed to mimic processes found in natural wetland ecosystems. These wetland systems utilize wetland plants, soil and the associated microorganisms to remove contaminants. It is constructed of a gravel media, and is essentially operated as a large hydroponics system. Water must be available to keep the plants alive during dry periods.	Relatively large area	At least 50% of site	Any - bacteria removal through biological removal

TABLE 20
Summary of Best Management Practices
SMBB Bacteria TMDL Implementation Plan

BMP No.	BMP Name	Description	Required Area	Required Softscape	Required Soil Infiltration
3	**Green Roof**	Green roofs refer to rooftops that have been designed or retrofitted with a layer of soil and vegetation. Green roofs can be as elaborate as entire gardens that can be used for recreation, or as simple as a layer of low growing and shallow rooted plants. Structural properties of existing roofs must be taken into consideration. Green roof systems are not applicable to all roofs. Green roof systems vary in complexity and are essentially unique to every application. The mimimum weight of a green roof, according to www.greenroofs.com, is 17 psf. This is approximately the weight of traditional gravel ballast on the roofs of some buildings. Structures must be analyzed on a case-by-case basis to determine if their roofs can be retrofitted with green roof systems.	Any	None	Any - bacteria removal by capturing runoff
4	**Infiltration Trench**	An infiltration trench is a rock-filled trench with no outlet that receives stormwater runoff. Stormwater runoff passes through some combination of pretreatment measures, such as a swale or sediment basin, before entering the trench. Runoff is then stored in the voids of the stones, slowly infiltrated through the bottom and into the soil matrix over a few days. The primary pollutant removal mechanism of this practice is filtration through the soil.	Relatively large area	At least 50% of site	Good - Infiltration provides bacteria removal
5	**Infiltration Basin**	An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. By using plastic storage media or precast concrete boxes, infiltration basins can also be installed underground. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff.	Relatively large area	At least 50% of site	Good - Infiltration provides bacteria removal

TABLE 20
Summary of Best Management Practices
SMBB Bacteria TMDL Implementation Plan

BMP No.	BMP Name	Description	Required Area	Required Softscape	Required Soil Infiltration
6	**Cistern/Rain Barrel and Local Storage and Reuse**	A cistern or rain barrel is a tank for storing collected from a roof or other catchment area. Cisterns/rain barrels can be used for single homes (assumed to be 1,000-gallon units), multiple homes (assumed to be 10,000-gallon but could be larger), or businesses (assumed to be 10,000-gallon but could be larger). If there is sufficient landscaped area on the site, a unit with a volume up to 100,000 gallons could be used (local storage and reuse). The captured water is used to irrigate landscaped areas that are on the same site as the cistern, or could be used for indoor toilet flushing for dual-plumbed buildings. Chlorination will be considered where appropriate. No other treatment is assumed.	Any	At least 50% of site	Any - bacteria removal by capturing runoff
7	**Dry Well**	Dry wells are a common means of stormwater management in many areas of the United States. Driveway dry wells involve adding a drainage grate and an open bottom concrete structure at the end of the driveway. They are designed to capture and store stormwater until the water percolates into the subsurface soils.	Any	None	Good - Infiltration provides bacteria removal
8	**Pervious Pavement**	Pervious paving describes a system comprising a load-bearing, durable surface together with an underlying layered structure that temporarily stores water prior to infiltration or drainage to a controlled outlet. The surface can itself be porous, such that water infiltrates across the entire surface of the material (e.g., grass and gravel surfaces, porous concrete, and porous asphalt), or can be built up of impermeable blocks separated by spaces and joints, through which the water can drain. This latter system is termed “permeable” paving. The advantage of pervious pavement is that it reduces runoff volume and is unobtrusive, resulting in a high level of acceptability. Typical pervious pavements include Asphalt Porous Pavements, Modular Concrete Block Porous Pavements, Poured Concrete Porous Pavements, and Structural Soil.	Yes	No - Cannot route to location	Good - Infiltration provides bacteria removal

TABLE 20
Summary of Best Management Practices
SMBB Bacteria TMDL Implementation Plan

BMP No.	BMP Name	Description	Required Area	Required Softscape	Required Soil Infiltration
9	**Pavement Replacement**	Replacement of unnecessary paved surfaces with trees, lawns, and other pervious landscape.	Unused paved area	No	Good infiltration will improve capacity, but this can be implemented on all soil types
10	**Street Bioretention Systems**	Street bioretention systems include Tree Wells and Sunken Medians. They are landscaping features adapted to treat stormwater runoff from roadways and sidewalks.	Unused paved area, medians, or landscaped areas near roadways.	No	Good - Infiltration provides bacteria removal

4.9.3 Process for Identifying Applicable BMPs for Each Site

Several parameters were collected for each site to prepare a preliminary list of applicable BMPs. The total area of each site was determined based on City of Los Angeles' GIS data for each parcel. The topography and portion of the site devoted to landscaping, building and paving, and native plants were estimated based on information collected during site visits.

Infiltrating runoff requires that the soils be permeable enough to allow percolation into the underlying groundwater basin within a reasonable timeframe and without excessive mounding or surfacing. Sandy or sandy loam soils have the highest percolation rates (infiltration capacity). Clay and silty soils tend to have the lowest infiltration capacity.

As described in the technical memorandum for Task 5, *Beneficial Use Evaluation*, the types of soil within the JG 2/3 area were identified based on data provided by the Los Angeles County DPW hydrology GIS database. These data consist of charts of runoff coefficients (Cu) versus rainfall intensity for 172 soil types and the geographic distribution of these soil types throughout the county. Based on a visual inspection of the plots, a soil was classified as having good infiltration capacity, fair infiltration capacity, or poor infiltration capacity. It is assumed for this study that only soils with good infiltration capacity would support effective use of infiltration as a method of local control; that is, may achieve reductions in runoff volume. Areas with fair infiltration capacity may sustain infiltration source control measures without serious flooding under some, but not all, rainfall intensities; these areas would, however, be at risk for serious flooding under some rainfall conditions and are therefore not recommended. Areas with poor infiltration capacity would incur serious flooding under almost all rainfall conditions. The County GIS data were merged with jurisdiction boundaries to develop a geographic distribution of soil types within the study area. A plot of the JG 2/3 areas with each soil type is presented in Figure 9.

In addition, a site must be compatible with a specific BMP. For example, a wetland is primarily a gravel matrix that is essentially operated as a large hydroponics system. The plants must be kept alive during non-wet weather; thus potable water, recycled water, or dry weather urban runoff must be applied during dry weather periods. Also, the land will not be available for pedestrian traffic because the system relies on specific, and somewhat fragile, soil porosity.

For cistern systems, sufficient landscaped area must be available to utilize the captured runoff. In addition, if the existing irrigation system at the site is pressurized, i.e., the water is distributed by sprinklers and public access cannot be restricted during irrigation, water that meets Title 22 treatment standards may be required. If so, a wetland may be preferred on that site. A summary of the assumed characteristics and BMP assumed to be applicable for each site is presented in Appendix M.

4.9.4 Selected BMPs for Each Site

A summary of the selected BMPs for each site is also presented in the table provided in Appendix M. Below is a discussion of the sites and methodologies employed for selecting suitable BMPs. Some of the preliminary sites were found to not be suitable for BMPs that could potentially reduce the bacterial exceedances.

4.9.4.1 Sites with Good Infiltrating Soils

As can be seen, two sites were found to be located in areas that, according to the County hydrology GIS, have good infiltrating soils with (P-11: South Beach Park; and P-23: Vista del Mar Park). All of the identified BMPs are applicable for these sites since they also are relatively flat and have large landscaped areas. Based on these observations, bioretention (BMP 1), infiltration trenches (BMP 4) or infiltration basins (BMP 5), dry wells (BMP 7), and pervious pavement (BMP 8) were preliminary selections for these sites. Further analysis of each of these sites is required to finalize the selected BMP (and all of the selected BMPs described in this subsection). For the purposes of this study, it was assumed that bioretention systems (BMP 1) and porous paving systems (BMP 8) would be constructed on these sites. A summary of the estimated costs and assumptions used for each of these sites with good infiltration is presented in Appendix N.

FIGURE 9
Soil Infiltration Capabilities in Jurisdictions 2 and 3

4.9.4.2 Sites for Potential Subsurface Constructed Wetlands

Three sites were also selected as potential sites for subsurface constructed wetlands (P-20: Will Rogers State Historic Park; P-40: Santa Ynez Canyon Park; and V-10: E. Grand Avenue and Illinois Street). For this study, it was assumed that 50 percent of the landscaped areas at these sites would be available for a wetland system. The system for Grand Avenue and Illinois Street would be relatively small because the site is not as large as the other two. Dry weather runoff may be available to maintain the system at Santa Ynez Canyon Park since large storm drain pipes are located in the Palisades Drive roadway and were observed to have appreciable annual dry-weather flow. It was not part of this study to determine if similar water resources are available at Will Rogers State Historic Park since this site is owned by the State of California Department of Parks and Recreation who opted out of participating in JG 2/3. A summary of the estimated costs and assumptions used for each of these potential wetlands sites is presented in Appendix O.

4.9.4.3 Sites for Potential Cistern and Local Storage and Reuse Projects

A total of 39 sites were selected as potential cistern and local storage and reuse projects. It was assumed that only landscaping at the sites would receive captured runoff. For those sites that have relatively large hardscaped areas, it was assumed that only runoff collected from the site would be captured. For those sites without hardscaping, it was assumed that runoff would be imported from nearby stormwater collection facilities. Information regarding the proximity of such facilities, however, was not available at the time of this study. A summary of the estimated costs and other assumptions used for each of these potential cistern sites is presented in Appendix P.

As can be seen in Table P-1, most sites will accommodate an underground 100,000-gallon system at an estimated capital cost of approximately $1 million. The amount of wet weather runoff volume managed at each cistern system was also projected based on the following assumptions:

- The rainfall data at LAX from January 1990 to December 2001 are representative of future rainfall patterns.
- 90 percent of the runoff from hardscaped areas would be captured by cisterns/rain barrels (based on TreePeople's Cistern Model) if volume is available in the cistern.
- The captured runoff would be used for irrigation only. The cisterns/rain barrels would not be emptied other than to meet irrigation needs.
- Irrigation would be initiated 2 days after a rainfall event with total rainfall greater than 0.1 inch and stopped 1 day before a subsequent rainfall event.
- It is assumed that the cisterns/rain barrels are emptied at a typical daily rate of irrigation for turf, which was estimated to be 2,300 gpd. This is an average demand for turf in the Los Angeles area calculated from recommendations prepared by the University of California Division of Agriculture and Natural Resources Cooperative Extension.
- Irrigation would occur efficiently with negligible runoff.

Not all of the rainfall that is generated at the site can be used for irrigation. If the rainfall occurs when the cistern is full, it will be discharged to the local stormwater collection system. The effectiveness of a cistern is dependent on cistern size, hardscape area, landscape area, rainfall amount, and rainfall interval. The hardscape area and rainfall amount determines the rate at which the cistern fills, and the landscape area determines the rate at which the cistern empties. The duration between rainfall events reflects how full the cistern is before the rainfall event. The rainfall amount determines how full the cistern is after the rainfall event. The cistern size reflects how often the system reaches capacity and must route rainfall to the collection system.

Therefore, the effectiveness of a cistern can be estimated based on past rainfall history. The percent effectiveness of each cistern size, landscape area, and hardscape area, was estimated based on the TreePeople Cistern Model and the daily rainfall data from January 1990 to December 2001 at the LAX rainfall gauge. Using this continuous simulation approach, the cistern size to capture all of the runoff from a specific site was estimated. If the calculated cistern size was more than 100,000 gallons, it was assumed that at least a 100,000-gallon cistern would be installed. The estimated runoff captured with the smaller cistern was then calculated and compared to the total runoff to calculate a percent effectiveness. (In some cases, i.e., Sites P-22, P-33 and P-35, larger cistern sizes will be used, as noted on the corresponding fact sheets for each of these projects, included in Appendix R.)

As can be seen in Table P-1, the estimated effectiveness ranged from 22 to 100 percent. Sites with a relatively large area of hardscaping and small area of landscaping (such as Site G-8: County Courthouse) have low effectiveness. This does not, however, indicate that a project at this site would not be beneficial since the amount of runoff captured at this site would be relatively large compared with the other sites. Importing runoff greatly increases the annual runoff captured at a site (e.g., at Site P-29: The Lakes at El Segundo Golf Course). Importing runoff at all of the sites could be considered to increase the runoff that would be captured. Filling the cistern with imported runoff from each rain event, however, would reduce the probability that storage volume will be available to capture runoff generated from the next rain event at the site.

4.9.4.4 Sites for Potential Green Roof Projects

A total of 14 sites were identified as being candidates for green roofs (see Appendix Q). The roof area for each site was roughly estimated based on site visits and review of aerial photographs. A unit cost of $14[4] per square foot was used to estimate the cost for each project (Peck). The runoff from the roof during a 0.45-inch target storm was estimated based on an assumed capture rate of 90 percent (see Appendix M).

4.9.5 Subregional Structural Solutions Projects by Area

A summary of the potential BMP projects at public sites by subwatershed is presented in Table 21.

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[4] This unit cost accounts only for the cost of installing the green roof material and appurtenances; it does not reflect any additional structural reinforcement that might be needed to sustain the additional weight of the green roof system.

4.9.6 Subregional Structural Solutions Projects by Commitment Level

From the list of potential projects, each agency selected projects within its jurisdiction and assigned a level of commitment. These are shown in Table 22.

For the projects listed as “Committed,” this indicates that the agency is either already implementing the programs or projects or is committed to pursue the implementation of the programs or projects. This commitment is made by the agency to execute those programs and projects, to the best of their ability, within its realm of authority and control. If a Committed project or program is determined to be infeasible or less effective then a substitute approach, then the agency will implement the substitute program or project to achieve the same objective.

When a project is categorized as a “Pilot” project, this indicates that the agency intends to perform a pilot study or similar activity prior to considering full implementation. Piloting may involve a focused study or a single pilot scale project that will help determine the effectiveness and feasibility of the intended program or project. Where “Consider” is selected, this indicates that the agency will evaluate the program’s or project’s feasibility. Programs and projects that are listed under this category require further discussions to determine technical viability and implementability.

The Committed and Pilot projects are further along in definition and planning than the Consider projects. A map of and individual fact sheets for each Committed and Pilot project are provided in Appendix R.

4.10 Institutional Solutions by Agency

As detailed in Section 4.2, institutional solutions are program-level activities that provide source control measures intended to prevent or reduce levels of bacteria or bacterial sources (e.g., garbage, trash, pet waste) from initially being picked up by runoff whether onsite, in the curb/street, or in the storm drain system. The current programs that are in place by the agencies of JG 2/3 to implement these BMPs and other source control measures are included in Table 23. These programs include public education and outreach, street maintenance, storm drain maintenance, land use planning and management, ordinances and codes, and enforcement. Following the current programs, additional institutional solutions that are included in each alternative considered in this Implementation Plan are identified. Also shown in Table 23 for each of the institutional solutions identified, the level of commitment by each agency is indicated as either “Committed,” “Pilot,” or “Consider.”

4.11 Intra- and Interagency Coordination

Coordination will be needed both within and among agencies to successfully execute these programs and projects. Such coordination can create opportunities, increase efficiency and effectiveness, and avoid agencies working at cross-purposes. For example, local codes that require diversion of stormwater from properties to street drainage systems will need to be modified so that projects are not handled with variances but rather are built into the codes with necessary protections from local flooding and for building structural integrity. Some time will be needed to systematize these procedures as code and practice modifications. For example, close coordination with the City of Los Angeles' Department of Building and Safety will be critical to accomplishing this.

There are existing forums that may offer opportunity for local agencies to coordinate activities described in this Implementation Plan. In addition, the JG 2/3 agencies will continue to meet monthly to follow through with the commitments outlined in this Plan. It may also be necessary to establish new forums for coordination with the following departments and agencies:

- LAUSD and other school districts
- LAX to tie in institutional and subregional structural solutions into the airport expansion program
- Metropolitan Water District of Southern California and the Los Angeles Department of Water and Power to coordinate pre-wet weather storm drain flushing with their distribution system and operations flushing programs

TABLE 21
Summary of Potential BMP Projects at Public Sites by Subwatershed
SMBB Bacteria TMDL Implementation Plan

Site ID	Site Name	Subwatershed	Jurisdiction	Selected BMP(s)	Est Cost ($ Mil)
P-40	Santa Ynez Canyon Park	Castle Rock	City of Los Angeles	Subsurface Constructed Wetland	1.5
G-19	Post Office	Pulga Canyon	City of Los Angeles	Green Roof	0.07
P-35	Rustic Canyon Recreation Center	Pulga Canyon	City of Los Angeles	Cistern/Rain barrel and Local Storage and Reuse	3.0
P-36	Palisades Park (Below Temescal Canyon)	Pulga Canyon	City of Los Angeles	Bioswales	TBD[1]
P-37	Temescal Canyon Park	Pulga Canyon	City of Los Angeles	Cistern/Rain barrel and Local Storage and Reuse	1.0
P-51	Palisades Park \ Recreation Center & Library	Pulga Canyon	Los Angeles County	Cistern/Rain barrel	TBD[1]
P-20	Will Rogers State Historic Park	Pulga, Santa Monica Canyon, and Castlerock	City of Los Angeles	Subsurface Constructed Wetland	1.1
G-1	Santa Monica Fire Station #5	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, Infiltration	0.06
G-4	Santa Monica Fire Stations #3 and #4	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, Infiltration	0.08
G-7	Santa Monica City Hall	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, Infiltration	1.0
G-8	County Courthouse	Santa Monica	Los Angeles County	Cistern/Rain barrel and Local Storage and Reuse	1.0
G-10	Main Library	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse	0.15
G-11	Santa Monica Fire Headquarters Station #1	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, Infiltration	0.43
P-2	Clover Park	Santa Monica	Santa Monica	Infiltration	1.0
P-3	Virginia Avenue Park	Santa Monica	Santa Monica	Infiltration	1.0
P-4	Schader and/or Park Dr. Park	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	1.0
P-5	Park Dr. Park	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	1.0
P-6	Douglas Park	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	1.0
P-8	Marine Park	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	0.9

TABLE 21
Summary of Potential BMP Projects at Public Sites by Subwatershed
SMBB Bacteria TMDL Implementation Plan

Site ID	Site Name	Subwatershed	Jurisdiction	Selected BMP(s)	Est Cost ($ Mil)
P-9	Los Amigos Park	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	0.9
P-10	Ocean View Park	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	1.0
P-11	South Beach Park	Santa Monica	Santa Monica	Bioretention, Infiltration Trench or Basin, Dry Well, Pervious Pavement	1.5
P-14	Beach Park	Santa Monica	Santa Monica	Local Storage or Infiltration	TBD[1]
P-15	Joslyn Park	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	1.0
P-16	Mary Hotchkiss Park	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	1.0
P-17	Crescent Bay Park-Green Beach Parking Lot	Santa Monica	Santa Monica	Infiltration	1.0
P-18	Christine Emerson Reed Park	Santa Monica	Santa Monica	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	1.0
P-31	Westminster Park (dog park)	Santa Monica	City of Los Angeles	Cistern/Rain barrel and Local Storage and Reuse, Infiltration Trench	1.5
P-32	Oakwood Recreation Center	Santa Monica	City of Los Angeles	Cistern/Rain barrel and Local Storage and Reuse, Pervious Paving	2.0
P-33	Penmar Recreational Park	Santa Monica	City of Los Angeles	Cistern/Rain barrel and Local Storage and Reuse, Pervious Paving	2.5
P-34	Barrington Recreation Center	Santa Monica	City of Los Angeles	Cistern/Rain barrel and Local Storage and Reuse	1.0
P-42	Major street to be retrofitted – Grand Ave., Los Angeles	Santa Monica	City of Los Angeles	Tree Wells	TBD[1]
G-17	Big Blue Bus Phase II	Santa Monica	Santa Monica	Infiltration Pits	TBD[1]
G-19	Civic Center Parking Structure	Santa Monica	Santa Monica	Separation-Screening, Catch Basin Inserts	TBD[1]
P-44	Memorial Park Expansion	Santa Monica	Santa Monica	Bioretention, Infiltration Trench or Basin, Dry Well, Pervious Pavement	TBD[1]
G-20	Civic Center Village Housing Project	Santa Monica	Santa Monica	Infiltration, Storage/Reuse, or Permeable Pavers	TBD[1]
G-21	Fire Station #2	Santa Monica	Santa Monica	Infiltration Pit, Permeable Pavers	TBD[1]
G-31	Big Blue Bus Phase I	Santa Monica	Santa Monica	Infiltration Pit	TBD[1]
P-45	Club House	Santa Monica	Los Angeles County	Cistern/Rain barrel	TBD[1]

TABLE 21
Summary of Potential BMP Projects at Public Sites by Subwatershed
SMBB Bacteria TMDL Implementation Plan

Site ID	Site Name	Subwatershed	Jurisdiction	Selected BMP(s)	Est Cost ($ Mil)
P-47	Venice Skill Center	Santa Monica	Los Angeles County	Cistern/Rain barrel	TBD[1]
G-22	Fire Station (Venice Blvd)	Santa Monica	Los Angeles County	Cistern/Rain barrel	TBD[1]
G-23	Fire Station (Butler Ave)	Santa Monica	Los Angeles County	Cistern/Rain barrel	TBD[1]
G-24	Brentwood Library	Santa Monica	Los Angeles County	Cistern/Rain barrel	TBD[1]
G-25	Montana Library	Santa Monica	Los Angeles County	Cistern/Rain barrel	TBD[1]
G-26	Fire Station (Hollister Ave)	Santa Monica	Los Angeles County	Cistern/Rain barrel	TBD[1]
G-28	Fire Station (Sunset Blvd)	Santa Monica	Los Angeles County	Cistern/Rain barrel	TBD[1]
G-30	Fire Station (Carey/Embury)	Santa Monica	Los Angeles County	Cistern/Rain barrel	TBD[1]
G-8	Santa Monica Court House	Santa Monica	Los Angeles County	Cistern/Rain barrel	TBD[1]
P-41	Venice Beach Boardwalk	Venice Beach	City of Los Angeles	Perforated Culvert, Drywells, Bioswales, Bioretention, Pervious Paving	1.5
G-14	Loyola Village Branch Library	Dockweiler	City of Los Angeles	Cistern/Rain barrel and Local Storage and Reuse	1.0
G-16	Storm Water Station #16 at El Segundo City Hall	Dockweiler	El Segundo	Cistern/Rain barrel and Local Storage and Reuse	1.0
P-21	Del Rey Lagoon Park	Dockweiler	City of Los Angeles	Cistern/Rain barrel and Local Storage and Reuse	1.0
P-22	Westchester Golf and Recreation Center	Dockweiler	City of Los Angeles	Cistern/Rain barrel and Local Storage and Reuse, Bioretention, Pervious Paving	1.0
P-23	Vista del Mar Park/Imperial and Vista del Mar Lot	Dockweiler	City of Los Angeles	Bioretention, Infiltration Trench or Basin, Dry Well, Pervious Pavement	2.0
G-32	Storm Water Station #17	Dockweiler	El Segundo	Cistern/Rain barrel	TBD[1]
G-33	Storm Water Station #18	Dockweiler	El Segundo	Cistern/Rain barrel	TBD[1]
P-29	The Lakes at El Segundo Golf Course	Dockweiler	El Segundo	Cistern/Rain barrel and Local Storage and Reuse	TBD[1]
V-6	Lincoln Bl. & Tijera Bl (by Westchester Rec Center)	Dockweiler	City of Los Angeles	Bioswales	TBD[1]
P-43	Major street to be retrofitted – Imperial Hwy.	Dockweiler	City of Los Angeles	Sunken Median	TBD[1]
P-46	Westminster Park & Recreation Center		Los Angeles County	Bioretention /Infiltration	TBD[1]
P-48	Mahood Senior Center \ Library		Los Angeles County	Cistern/Rain barrel	TBD[1]
P-49	Ozone Park	Santa Monica	Santa Monica	Bioretention /Infiltration	0.6

TABLE 21
Summary of Potential BMP Projects at Public Sites by Subwatershed
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Site ID	Site Name	Subwatershed	Jurisdiction	Selected BMP(s)	Est Cost ($ Mil)
P-50	Westwood Park \ Recreation Center		Los Angeles County	Bioretention /Infiltration	TBD[1]
G-27	Fire Station (Veteran Ave)		Los Angeles County	Cistern/Rain barrel	TBD[1]
G-29	Fire Station (Sunset/Liones)		Los Angeles County	Cistern/Rain barrel	TBD[1]
P-52	Arena Drain Pump Plant		Los Angeles County		TBD[1]
V-7	Vacant Land?		Los Angeles County	Bioretention /Infiltration	TBD[1]
P-54	Electric Avenue - Pump Plant		Los Angeles County	Diversion	TBD[1]
V-8	Vacant Land?		Los Angeles County	Bioretention /Infiltration	TBD[1]
V-9	Vacant Land \ Open Space		Los Angeles County	Bioretention /Infiltration	TBD[1]
P-53	Topanga County Beach (East Lot)		Los Angeles County	Infiltration	TBD[1]
P-54	Topanga County Beach (West Lot)		Los Angeles County	Infiltration	TBD[1]

[1] Estimated cost for these projects will be developed as the project becomes better defined.

TABLE 22
Subregional Structural Solutions by Agency
SMBB Bacteria TMDL Implementation Plan

Jurisdiction	Site ID	Site Name	BMP	Site Type	Subwatershed	Address	Commitment Level	IWRA Criteria
City of Los Angeles	P-21	Del Rey Lagoon Park	Cistern/Rain barrel and Local Storage and Reuse	Public Park	Dockweiler	Pacific Ave & Convoy St, Marina Del Rey 90292	COMMITTED	1, 2, 3, 4
	P-22	Westchester Golf and Recreation Center	Cistern/Rain barrel and Local Storage and Reuse, Bioretention, Pervious Paving	Public Park	Dockweiler	Lincoln Blvd & W Manchester Ave, Los Angeles 90045	COMMITTED	1, 2, 3, 4
	P-33	Penmar Recreational Park & Golf Course	Cistern/Rain barrel and Local Storage and Reuse, Pervious Paving	Public Park	Santa Monica	Rose Ave & Penmar Ave, Los Angeles 90291	COMMITTED	1, 2, 3, 4
	P-31	Westminster Park (dog park)	Cistern/Rain barrel and Local Storage and Reuse, Infiltration Trench	Public Park	Santa Monica	Neilson Wy & Westminster Ave, Venice 90291	COMMITTED	1, 2, 3, 4
	P-32	Oakwood Recreation Center	Cistern/Rain barrel and Local Storage and Reuse, Pervious Paving	Public Park	Santa Monica	California Ave & 7th St, Venice 90291	COMMITTED	1, 2, 3, 4
	P-35	Rustic Canyon Recreation Center	Cistern/Rain barrel and Local Storage and Reuse,	Public Park	Pulga Canyon	Hightree Rd & Brooktree Rd, Santa Monica 90402	COMMITTED	1, 2, 3, 4
	P-41	Venice Beach Boardwalk	Perforated Culvert, Drywells, Bioswales, Bioretention, Pervious Paving	Public Park	Venice Beach	Ocean Front Walk, Venice, CA 90291	COMMITTED	3, 4
	P-42	Major street to be retrofitted – Grand Ave.	Tree Wells	Public RW	Pulga, SMC,& Castlerock	Grand Ave., Santa Monica	PILOT	1, 2, 3, 4
	P-43	Major street to be retrofitted – Imperial Hwy.	Sunken Median	Public RW	Pulga, SMC,& Castlerock	Imperial Hwy., El Segundo	PILOT	1, 2, 3, 4
	P-20	Will Rogers State Historic Park	Subsurface Constructed Wetland	Public Park	Pulga, SMC,& Castlerock	Will Rogers State Park Rd & Sunset Blvd, Pacific Palisades 90272	PILOT	1, 3, 4
	P-37	Temescal Canyon Park	Cistern/Rain barrel and Local Storage and Reuse	Public Park	Pulga Canyon	15600 block Sunset Blvd, Pacific Palisades 90272 and also along both sides of Temescal Canyon Rd	PILOT	1, 2, 3, 4
	P-40	Santa Ynez Canyon Park	Subsurface Constructed Wetland	Public Park	Castle Rock	Palisades Drive, Pacific Palisades 90272	PILOT	1, 3, 4
	G-14	Loyola Village Branch Library	Cistern/Rain barrel and Local Storage and Reuse	City Govt	Dockweiler	7144 W Manchester Ave, Los Angles 90045	CONSIDER	1, 2, 3, 4

TABLE 22
Subregional Structural Solutions by Agency
SMBB Bacteria TMDL Implementation Plan

Jurisdiction	Site ID	Site Name	BMP	Site Type	Subwatershed	Address	Commitment Level	IWRA Criteria
	P-23	Vista del Mar Park/ Imperial and Vista del Mar lot	Bioretention, Infiltration Trench or Basin, Dry Well, Pervious Pavement	Public Park	Dockweiler	8000 block of Vista Del Mar, Los Angeles 90293	CONSIDER	1, 3, 4
	P-34	Barrington Recreation Center	Cistern/Rain barrel and Local Storage and Reuse	Public Park	Santa Monica	200 block of Barrington Ave, Los Angeles 90073	CONSIDER	1, 2, 3, 4
	P-36	Palisades Park (Below Temescal Canyon)	Bioswales	Public Park	Pulga Canyon	SE Corner of Temescal Canyon Rd & Pacific Coast Highway, Pacific Palisades 90272	CONSIDER	3, 4
	V-6	Lincoln Bl. & Tijera Bl (by Westchester Rec Center)	Bioswales	Vacant Lot	Dockweiler	Lincoln Blvd & Tijera Blvd, Los Angeles 90045	CONSIDER	3,, 4
City of Santa Monica	G-10	Main Library	Cistern/Rain barrel and Local Storage and Reuse	City Govt	Santa Monica	7th Street and Santa Monica Blvd.	COMMITTED*	1, 2, 3, 4
	P-2	Clover Park	Infiltration	Public Park	Santa Monica	Ocean Park & 25th St, Santa Monica 90405	COMMITTED*	3, 4
	P-3	Virginia Avenue Park	Infiltration	Public Park	Santa Monica	Pico Blvd & 22nd St, Santa Monica 90404	COMMITTED*	3, 4
	G-17	Big Blue Bus Phase II	Infiltration Pits	City Govt	Santa Monica	1660 7th Street, Santa Monica 90404	COMMITTED	3
	G-19	Civic Center Parking Structure	Separation-Screening, Catch Basin Inserts	City Govt	Santa Monica	Pico Blvd & 4th street, Santa Monica 90404	COMMITTED	3
	P-44	Memorial Park Expansion	Bioretention, Infiltration Trench or Basin, Dry Well, Pervious Pavement	Public Park	Santa Monica	Colorado Ave & 14th Street, Santa Monica	COMMITTED	3, 4
	P-17	Crescent Bay Park-Green Beach Parking Lot	Infiltration	Public Park	Santa Monica	Bicknell Ave & Ocean Front Walk, Santa Monica	COMMITTED	3
	G-20	Civic Center Village Housing Project	Infiltration, Storage/Reuse, or Permeable Pavers	City Govt	Santa Monica	Pico Blvd & 4th street, Santa Monica 90404	COMMITTED	1, 2, 3, 4
	G-21	Fire Station #2	Inftiltration Pit, Permeable Pavers	City Govt	Santa Monica	222 Hollister Ave at 2nd Street, Santa Monica	COMMITTED*	3, 4
	G-31	Big Blue Bus Phase I	Inftiltration Pit	City Govt	Santa Monica	1660 7th Street, Santa Monica 90404	COMMITTED*	3
	G-1	Santa Monica Fire Station #5	Cistern/Rain barrel and Local Storage and Reuse, Infiltration	City Govt	Santa Monica	2450 Ashland Ave, Santa Monica	CONSIDER	1, 2, 3, 4
	G-4	Santa Monica Fire Stations #3 and #4	Cistern/Rain barrel and Local Storage and Reuse, Infiltration	City Govt	Santa Monica	1302 19th St, Santa Monica 90404	CONSIDER	1, 2, 3, 4

TABLE 22
Subregional Structural Solutions by Agency
SMBB Bacteria TMDL Implementation Plan

Jurisdiction	Site ID	Site Name	BMP	Site Type	Subwatershed	Address	Commitment Level	IWRA Criteria
	G-7	Santa Monica City Hall	Cistern/Rain barrel and Local Storage and Reuse, Infiltration	City Govt	Santa Monica	1685 Main St, Santa Monica, 90401	CONSIDER	1, 2, 3, 4
	G-11	Santa Monica Fire Headquarters Station #1	Cistern/Rain barrel and Local Storage and Reuse, Infiltration	City Govt	Santa Monica	1444 7th St, Santa Monica, 90401	CONSIDER	1, 2, 3, 4
	P-4	Schader Park	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	Public Park	Santa Monica	Cloverfield Bl at Schader Dr., Santa Monica 90404	CONSIDER	1, 2, 3, 4
	P-5	Park Dr. Park	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	Public Park	Santa Monica	Park Dr. at Broadway, Santa Monica 90404	CONSIDER	1, 2, 3, 4
	P-6	Douglas Park	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	Public Park	Santa Monica	Chelsea Ave & Wilshire Blvd, Santa Monica 90403	CONSIDER	1, 2, 3, 4
	P-8	Marine Park	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	Public Park	Santa Monica	Dewey St & Linda Ln, Santa Monica 90405	CONSIDER	1, 2, 3, 4
	P-9	Los Amigos Park	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	Public Park	Santa Monica	6th St & Hollister Av, Santa Monica 90405	CONSIDER	1, 2, 3, 4
	P-10	Ocean View Park	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	Public Park	Santa Monica	Bernard Wy, Santa Monica 90405	CONSIDER	1, 2, 3, 4
	P-11, 12,13	South Beach Park	Bioretention, Infiltration Trench or Basin, Dry Well, Pervious Pavement	Public Park	Santa Monica	Barnard Wy, Santa Monica 90405	CONSIDER	3, 4
	P-14	Beach Park	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	Public Park	Santa Monica	Ocean Park & Barnard Wy, Santa Monica 90405	CONSIDER	3
	P-15	Joslyn Park	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	Public Park	Santa Monica	7th St & Kensington Rd, Santa Monica 90405	CONSIDER	1, 2, 3, 4
	P-16	Mary Hotchkiss Park	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	Public Park	Santa Monica	3rd St & Strand St, Santa Monica 90405	CONSIDER	1, 2, 3, 4
	P-18	Christine Emerson Reed Park	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	Public Park	Santa Monica	Lincoln Blvd & Wilshire Blvd, Santa Monica 90403	CONSIDER	1, 2, 3, 4
	P-49	Ozone Park	Cistern/Rain barrel and Local Storage and Reuse, or Infiltration	Public Park	Santa Monica	730 Ozone St., Santa Monica	CONSIDER	1, 2, 3, 4

TABLE 22
Subregional Structural Solutions by Agency
SMBB Bacteria TMDL Implementation Plan

Jurisdiction	Site ID	Site Name	BMP	Site Type	Subwatershed	Address	Commitment Level	IWRA Criteria
City of El Segundo	P-29	The Lakes at El Segundo Golf Course	Cistern/Rain barrel and Local Storage and Reuse	Public Park	Dockweiler	S Sepulveda Blvd., El Segundo 90245	PILOT	1, 2, 3, 4
	G-32	Storm Water Station #17	Cistern/Rain barrel	City Govt	Dockweiler	1015 E. Imperial Ave., El Segundo 90245	PILOT	1, 2, 3, 4
	G-33	Storm Water Station #18	Cistern/Rain barrel	City Govt	Dockweiler	600 S Sepulveda Blvd., El Segundo 90245	PILOT	1, 2, 3, 4
	G-16	Storm Water Station #16 at El Segundo City Hall	Cistern/Rain barrel and Local Storage and Reuse	City Govt	Dockweiler	350 Main St., El Segundo 90245	CONSIDER	1, 2, 3, 4
Los Angeles County	P-45	Club House	Cistern/Rain barrel	Public Facility	Santa Monica	Pacific Avenue & Westminster Avenue	CONSIDER	1, 2, 3, 4
	P-46	Westminster Park & Recreation Center	Bioretention, Infiltration	Public Facility		W. 9th Street & Bluegrass Place, Pomona CA. 91766	CONSIDER	3, 4
	P-47	Venice Skill Center	Cistern/Rain barrel	Public Facility	Santa Monica	Vernon Avenue & 4th Avenue, Venice CA. 90291	CONSIDER	1, 2, 3, 4
	G-22	Fire Station (Venice Blvd)	Cistern/Rain barrel	City Govt	Santa Monica	Shell Court & Venice Boulevard	CONSIDER	1, 2, 3, 4
	G-23	Fire Station (Butler Ave)	Cistern/Rain barrel	City Govt	Santa Monica	11500 Olympic Boulevard (cross st. - Butler Avenue)	CONSIDER	1, 2, 3, 4
	P-48	Mahood Senior Center \ Library	Cistern/Rain barrel	Public Facility		Santa Monica Boulevard & Purdue Avenue, West L.A. CA. 90025	CONSIDER	1, 2, 3, 4
	G-24	Brentwood Library	Cistern/Rain barrel	City Govt	Santa Monica	11820 San Vicente Boulevard, Brentwood CA. 90402	CONSIDER	1, 2, 3, 4
	G-25	Montana Library	Cistern/Rain barrel	City Govt	Santa Monica	1704 Montana Avenue, Santa Monica CA. 90403	CONSIDER	1, 2, 3, 4
	G-26	Fire Station (Hollister Ave)	Cistern/Rain barrel	City Govt	Santa Monica	222 Hollister Avenue (cross st.- 2nd Street)	CONSIDER	1, 2, 3, 4
	P-49	Ozone Park	Bioretention /Infiltration	Public Facility		720 Ozone Street, Santa Monica CA. 90405	CONSIDER	3, 4
	P-50	Westwood Park \ Recreation Center	Bioretention /Infiltration	Public Facility		1350 S. Sepulveda Boulevard, Westwood CA. 90024	CONSIDER	3, 4
	G-27	Fire Station (Veteran Ave)	Cistern/Rain barrel	City Govt		Veteran Avenue & Weyburn Avenue	CONSIDER	1, 2, 3, 4
	G-28	Fire Station (Sunset Blvd)	Cistern/Rain barrel	City Govt	Santa Monica	12200 Sunset Blvd. (cross st.- Gretna Way)	CONSIDER	1, 2, 3, 4

TABLE 22
Subregional Structural Solutions by Agency
SMBB Bacteria TMDL Implementation Plan

Jurisdiction	Site ID	Site Name	BMP	Site Type	Subwatershed	Address	Commitment Level	IWRA Criteria
	P-51	Palisades Park \ Recreation Center & Library	Cistern/Rain barrel	Public Facility	Pulga Canyon	861 & 851 Alma Real Drive, Pacific Palisades, CA. 90272	CONSIDER	1, 2, 3, 4
	G-29	Fire Station (Sunset/Liones)	Cistern/Rain barrel	City Govt		Sunset Boulevard & Liones Drive	CONSIDER	1, 2, 3, 4
	G-30	Fire Station (Carey/Embury)	Cistern/Rain barrel	City Govt	Santa Monica	Carey Street & Embury Street	CONSIDER	1, 2, 3, 4
	P-52	Arena Drain Pump Plant		Public Facility			CONSIDER	3
	V-7	Vacant Land?	Bioretention /Infiltration	Public Land			CONSIDER	3, 4
	P-54	Electric Avenue - Pump Plant	Diversion	Public Facility			CONSIDER	3
	V-8	Vacant Land?	Bioretention /Infiltration	Public Land			CONSIDER	3, 4
	G-8	Santa Monica Court House	Cistern/Rain barrel	City Govt	Santa Monica	1725 Main Street, Santa Monica , CA 90401	CONSIDER	1, 2, 3, 4
	V-9	Vacant Land \ Open Space	Bioretention /Infiltration	Public Land			CONSIDER	3, 4
	P-53	Topanga County Beach (East Lot)	Infiltration	Public Parking Lot		18700 PCH, Malibu	CONSIDER	3
	P-54	Topanga County Beach (West Lot)	Infiltration	Public Parking Lot		18700 PCH, Malibu	CONSIDER	3
Caltrans		Possible Treatment BMPs in State Route rights-of-way					CONSIDER	1, 2, 3, 4

Notes:
- Project is completed or will be completed by mid-2005.

Integrated Water Resources Approach (IWRA) Criteria:
1 Integrating planning for future wastewater, storm water, recycled water, and potable water needs and systems
2 Focuses on beneficial re-use of storm water, including groundwater infiltration, at multiple points throughout the watershed
3 Addresses multiple pollutants
4 May incorporate and enhance other public goals

TABLE 23
Institutional Solutions by Agency
SMBB Bacteria TMDL Implementation Plan

Agency/ Level of Commitment	Institutional BMP[1]: Stormwater BMP programs*	Education & Outreach Programs	Street & Storm Drain Maintenance	Land Use Planning & Management	Ordinances, Codes, & Enforcement	Increase Litter Reduction	Improve Restaurant & Grocery Store Trash Management	Expand Business Improve-ment District Outreach	Create Incentives	Explore Methods to Reduce Bacteria Contributions from the Homeless Population	Pre-wet weather storm drain flushing	Redirect Downspouts	Modify/Enhance Public Education Programs
City of Los Angeles													
Committed	X	X	X	X	X								X
Pilot							X			X	X	X	
Consider						X		X	X				
City of Santa Monica													
Committed	X	X	X	X	X								
Pilot													
Consider						X	X	X	X	X	X	X	
City of El Segundo													
Committed	X	X	X	X	X								
Pilot							X			X	X	X	
Consider						X		X	X				X
County of Los Angeles													
Committed	X	X	X	X	X								
Pilot							X			X	X	X	
Consider						X		X	X				X
Caltrans[2]													
Committed	X	X	X										
Pilot													
Consider													X

NOTES: [1] Institutional solutions may be existing activities or additional proposed activities. The extent to which a program is existing or proposed varies by agency.
[2] Caltrans can only consider additional efforts if they are in accordance with their Statewide Program and depends on funding availability.

4.12 Summary of Institutional and Subregional Structural Solutions Projects by Agency

Table 24 summarizes the commitments of each agency in JG 2/3 to institutional and subregional structural solutions for bacterial reduction in the Santa Monica Bay beaches. Caltrans' intent is to participate jointly with other permittees in developing a basin-wide approach for addressing bacteria as well as other listed pollutants. Caltrans, however reserves the right to proceed independently to address the TMDL goals depending on the specific costs and implementation measures identified during the implementation process.

4.12.1 Schedule of Institutional Solutions Implementation

Initial institutional solutions that are identified in this report as Committed projects will be implemented by each jurisdiction within the first 4 years following approval of this Implementation Plan, enabling these strategies to be fully in effect by the first interim compliance milestone of 2009.

The JG 2/3 agencies will implement a minimum of two initial Pilot programs within the first 4 years (by 2009). Two additional Pilot programs will be implemented subsequently by year 8 (2013). Those programs identified as Consider programs will be studied within the first 8 years (by year 2013) and, if found to feasible, implemented by year 2021.This schedule for implementation of institutional solutions is summarized below in Table 25. Refinements to these institutional solutions will be conducted in Stage 2 of the Implementation Plan to incorporate findings.

Institutional solutions programs will generally follow the project cycle described above in Section 4.4.3 and go through planning, preparation of as implementation plan, development of a pilot program and implementation phases. Each of these project phases is expected to take approximately one year. These programs will be prioritized to target the higher priority subwatersheds, i.e., those that drain to the more contaminated storm drains that are generally associated with high density land uses. The Implementation Plan that will be developed for each program will focus on what each specific agency is currently doing, how resources could be shifted to target these high priority drains initially, and what can be done to enhance activities in these subwatersheds.

As these programs become better defined through the iterative, adaptive approach, specific, quantifiable performance measures will be identified and included in the respective program implementation plans. In addition, as baseline water quality monitoring results are obtained upstream in the watershed, institutional solutions can be honed to target specific locations where high bacterial contributions are found, and the implementation plan for the affected programs modified accordingly. These will be living documents that will be revisited by the JG 2/3 agencies annually.

Figure 10 shows the schedule for each phase of each institutional solutions program. The agencies implementing the specific program will monitor the achievement of these timeline milestones, and report progress to the Regional Board through the MS4 annual permit report. Issues adversely impacting the schedule will be closely monitored and diligent efforts will be made to meet the committed plan.

TABLE 24
Project Commitments by Agency
SMBB Bacteria TMDL Implementation Plan

Jurisdiction	Committed		Pilot		Consider	
City of Los Angeles						
Local Solutions:	P-21	Del Rey Lagoon Park	**P-42**	Major Street to be retrofitted with tree wells – Grand Ave.	G-14	Loyola Village Branch Library
	P-22	Westchester Golf and Recreation Center	P-43	Major Street to be retrofitted with sunken median – Imperial Hwy.	P-23	Vista del Mar Park/ Imperial and Vista del Mar lot
	P-33	Penmar Recreational Park & Golf Course	P-20	Will Rogers State Historic Park	P-34	Barrington Recreation Center
	P-31	Westminster Park (dog park)	P-38	Temescal Canyon Park	P-36	Palisades Park (Below Temescal Canyon)
	P-32	Oakwood Recreation Center	P-40	Santa Ynez Canyon Park	V-6	Lincoln Bl. & Tijera Bl (by Westchester Rec Center)
	P-35	Rustic Canyon Recreation Center				
	P-41	Venice Beach City Boardwald				
Institutional Solutions[1]*:*		Stormwater BMP programs		Improve restaurant & grocery store trash management		Increase litter reduction
		Education & Outreach Programs		Explore methods to reduce bacteria contributions from the homeless population		Expand Business Improvement District outreach
		Street & Storm Drain Maintenance		Pre-wet weather storm drain flushing		Create incentives
		Land Use Planning & Management				
		Ordinances, Codes, & Enforcement				
		Reduce contaminants from the source				
		Modify/enhance Public Education Programs				
		Redirect downspouts				
City of Santa Monica						
Local Solutions:	G-10	Main Library			G-1	Santa Monica Fire Station #5
	P-2	Clover Park			G-4	Santa Monica Fire Stations #3 and #4
	P-3	Virginia Avenue Park			G-7	Santa Monica City Hall
	G-17	Big Blue Bus Phase II			G-11	Santa Monica Fire Headquarters Station #1
	G-19	Civic Center Parking Structure			P-5	Park Dr. Park
	P-44	Memorial Park Expansion			P-6	Douglas Park
	P-17	Crescent Bay Park-Green Beach Parking Lot			P-8	Marine Park
	G-20	Civic Center Village Housing Project			P-9	Los Amigos Park
	G-21	Fire Station #2			P-10	Ocean View Park
	G-31	Big Blue Bus Phase I			P-11,12,13	South Beach Park
					P-14	Beach Park

TABLE 24
Project Commitments by Agency
SMBB Bacteria TMDL Implementation Plan

Jurisdiction	Committed		Pilot		Consider	
					P-15	Joslyn Park
					P-16	Mary Hotchkiss Park
					P-18	Christine Emerson Reed Park
					P-49	Ozone Park
Institutional Solutions[1]:		Stormwater BMP programs		Improve restaurant & grocery store trash management		Increase litter reduction
		Education & Outreach Programs				Expand Business Improvement District outreach
		Street & Storm Drain Maintenance				Create incentives
		Land Use Planning & Management				Explore methods to reduce bacteria contributions from the homeless population
		Ordinances, Codes, & Enforcement				Pre-wet weather storm drain flushing
						Redirect downspouts
City of El Segundo						
Local Solutions:			P-29	The Lakes at El Segundo Golf Course	G-16	Storm Water Station #16 at El Segundo City Hall
			G-32	Storm Water Station #17		
			G-33	Storm Water Station #18		
Institutional Solutions[1]:		Stormwater BMP programs		Improve restaurant & grocery store trash management		Increase litter reduction
		Education & Outreach Programs		Explore methods to reduce bacteria contributions from the homeless population		Expand Business Improvement District outreach
		Street & Storm Drain Maintenance		Pre-wet weather storm drain flushing		Create incentives
		Land Use Planning & Management		Redirect downspouts		Modify/enhance Public Education Programs
		Ordinances, Codes, & Enforcement				
		Reduce contaminants from the source				
Los Angeles County						
Local Solutions					P-45	Club House
					P-46	Westminster Park & Recreation Center
					P-47	Venice Skill Center
					G-22	Fire Station (Venice Blvd.)
					G-23	Fire Station (Butler Ave.)
					P-48	Mahood Senior Center \ Library
					G-24	Brentwood Library

TABLE 24
Project Commitments by Agency
SMBB Bacteria TMDL Implementation Plan

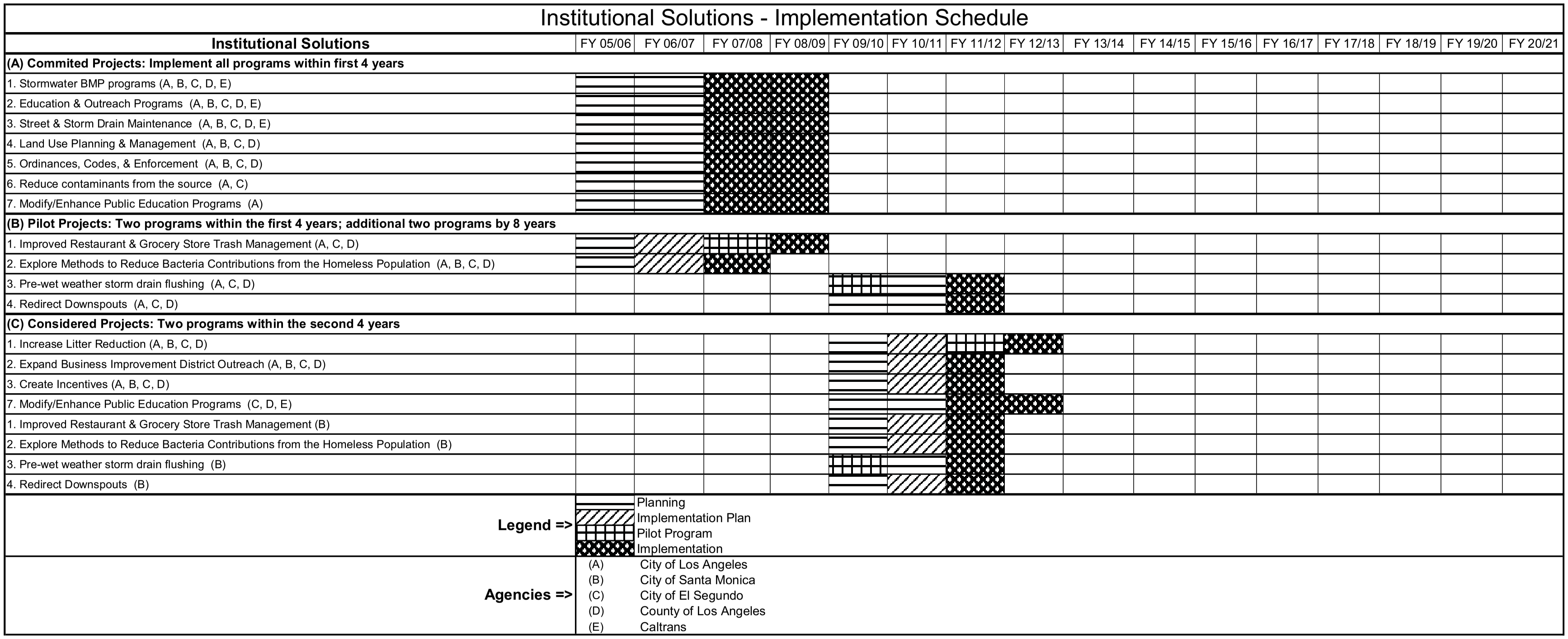
Jurisdiction	Committed		Pilot		Consider	
					G-25	Montana Library
					G-26	Fire Station – (Hollister Ave.)
					P-49	Ozone Park
					P-50	Westwood Park \ Recreation Center
					G-27	Fire Station (Veteran Ave.)
					G-28	Fire Station (Sunset Blvd.)
					P-51	Palisades Park \ Recreation Center & Library
					G-29	Fire Station (Sunset/Liones)
					G-30	Fire Station (Carey/Embury)
					P-52	Arena Drain Pump Plant
					V-7	Vacant Land?
					P-54	Electric Avenue - Pump Plant
					V-8	Vacant Land?
					G-8	Santa Monica Court House
					V-9	Vacant Land \ Open Space
					P-53	Topanga County Beach (East Lot)
					P-54	Topanga County Beach (West Lot)
Institutional Solutions[1]:		Stormwater BMP programs		Improve restaurant & grocery store trash management		Increase litter reduction
		Education & Outreach Programs		Explore methods to reduce bacteria contributions from the homeless population		Expand Business Improvement District outreach
		Street & Storm Drain Maintenance		Pre-wet weather storm drain flushing		Create incentives
		Land Use Planning & Management		Redirect downspouts		Modify/enhance Public Education Programs
		Ordinances, Codes, & Enforcement				
Caltrans[2]						
Local Solutions:						Possible Treatment BMPs in State Route rights-of-way
Institutional Solutions[1]:		Stormwater BMP programs				Modify/enhance Public Education Programs
		Education & Outreach Programs				
		Street & Storm Drain Maintenance				

TABLE 24
Project Commitments by Agency
SMBB Bacteria TMDL Implementation Plan

Jurisdiction	Committed	Pilot	Consider

NOTES:
[1] **Institutional solutions may be existing activities or additional proposed activities. The extent to which a program is existing or proposed varies by agency.**
[2] **Caltrans can only consider additional efforts if they are in accordance their Statewide Program and depends on funding availability.**

FIGURE 10
Institutional Solutions – Implementation Schedule



4.12.2 Schedule of Subregional Structural Solutions Implementation

Implementation of decentralized, structural BMPs consists of several steps: planning and coordination, design, permitting/environmental documentation, advertisement/bid/award/construction and O&M. The effectiveness of the system can then be determined from a combination of baseline and influent/effluent monitoring over the course of approximately 1 year. Depending on magnitude and complexity of these projects, the overall duration from developing the concept to assessing the project's effectiveness can range from 2 to 5 years from inception.

Of the 17 initial Committed subregional structural solutions projects, the agencies in JG 2/3 will implement up to three projects per year, until they are completed in 8 years (by year 2013). Of the eight Pilot projects identified, four will be completed in the first 4 years (by year 2009) and the other four by year 2013. The 45 subregional structural solutions projects that are listed as Consider will be studied for implementation by year 8 (by year 2013). Those that are found to be feasible will be implemented by year 2021. Refinements to these subregional structural solutions will be conducted in Stage 2 of the Implementation Plan to incorporate findings.

In Figure 11, the implementation schedule indicates priority and timeline for Committed and Pilot projects for subregional structural solutions. Five of the 17 Committed projects are currently in the implementation phase and will be completed in fiscal year 2005/2006. Each planned project will go through planning, design, permitting/environmental documentation, and construction phases. It is estimated that each of these phases will take approximately 6 to 12 months, assuming the required staffing, funding, public approval, and permitting-related issues are resolved expeditiously. Any issues and unexpected conditions during these processes may ultimately impact the scheduled timeline and agencies may need to adjust timeframes as these arise. The Regional Board will be apprised of any significant impacts to the schedule, as well as project accomplishments, through the annual MS4 permit report.

The priorities defined for the projects are set to initially target the watersheds that drain into the highest priority storm drains. As described in Section 4.4.2, these are in the following order of priority: Venice Beach, Santa Monica, Dockweiler, Pulga Canyon, and Santa Monica Canyon subwatersheds. Two projects, Del Rey Lagoon Park and Rustic Canyon Recreation Center, begin earlier than their priority watershed might indicate because there are coordination complexities that will take longer to sort through during the planning process.

All of the 17 Committed projects are scheduled to be completed by 2013. The eight Pilot projects identified will proceed through the same planning, design, permitting/environmental documentation, and construction phases and will be completed by 2013. After completion of each of these projects, the O&M phase begins, as early as fiscal year 2006/2007 for the projects completed in fiscal year 2005/2006. However, there will be a data gap as monitoring results from the new projects identified under this Plan will not be available until 2010. It is during this O&M phase that the water quality impacts can be evaluated, and adjustments made to Implementation Plan.

The iterative, adaptive process inherent in this Implementation Plan allows for consideration of the effectiveness of the institutional and subregional structural solutions implemented in Stage 1 for the formulation of the Stage 2 projects. In addition, the results of baseline water quality data collected during Stage 1 can also be taken into account as Stage 2 plans are made. Because of the uncertainties of rainfall patterns, there needs to be sufficient time (7 years for Stage 1) to allow for adequate assessment of the performance of these projects and programs. In addition, the data that served as the bases for the water quality analyses for these SMBB Bacteria TMDLs spanned from 1995-2000. Since then, there have been several programs and projects implemented by the participating JG 2/3 agencies, including SMURRF, several low flow diversions, increased public outreach and other MS4 permit-related institutional programs, and some small structural solutions. These may be contributing to improving wet weather water quality, but the effects on the downstream SMBB Bacteria TMDL exceedance-day criteria are unknown at this time.

By the time Stage 2 planning begins (2013), there will be much more information about the effectiveness of the projects and programs implemented thus far and "hot spots" will be identified upstream in the watersheds. Balancing the increased certainty from this information and increased efficiency from the experience of Stage 1 implementation with limitations of agency resources (funding, staff) and increased stakeholder involvement in generating and implementing projects that align with this compliance strategy, the rate of potential project implementation of subregional structural solutions is planned to double from a rate of two to three projects per year to a rate of five to six projects per year. Although this is an ambitious agenda, and one that is subject to the vagaries of stakeholder participation and intra-/interagency coordination, the JG 2/3 agencies are committed to investigating these Consider projects slated for Stage 2, and believe that, if found to be feasible, can be implemented by year 2021. If specific projects are not found to be feasible, alternate projects will be explored and adjustments to the Plan can be made as needed to optimize the selection of the types and locations of these projects. The 16 years ahead of us (from 2005 to 2021) provides sufficient time to plan resource allocations, obtain funding and develop and construct projects to ensure the successful completion of this Implementation Plan to meet the TMDL objectives.

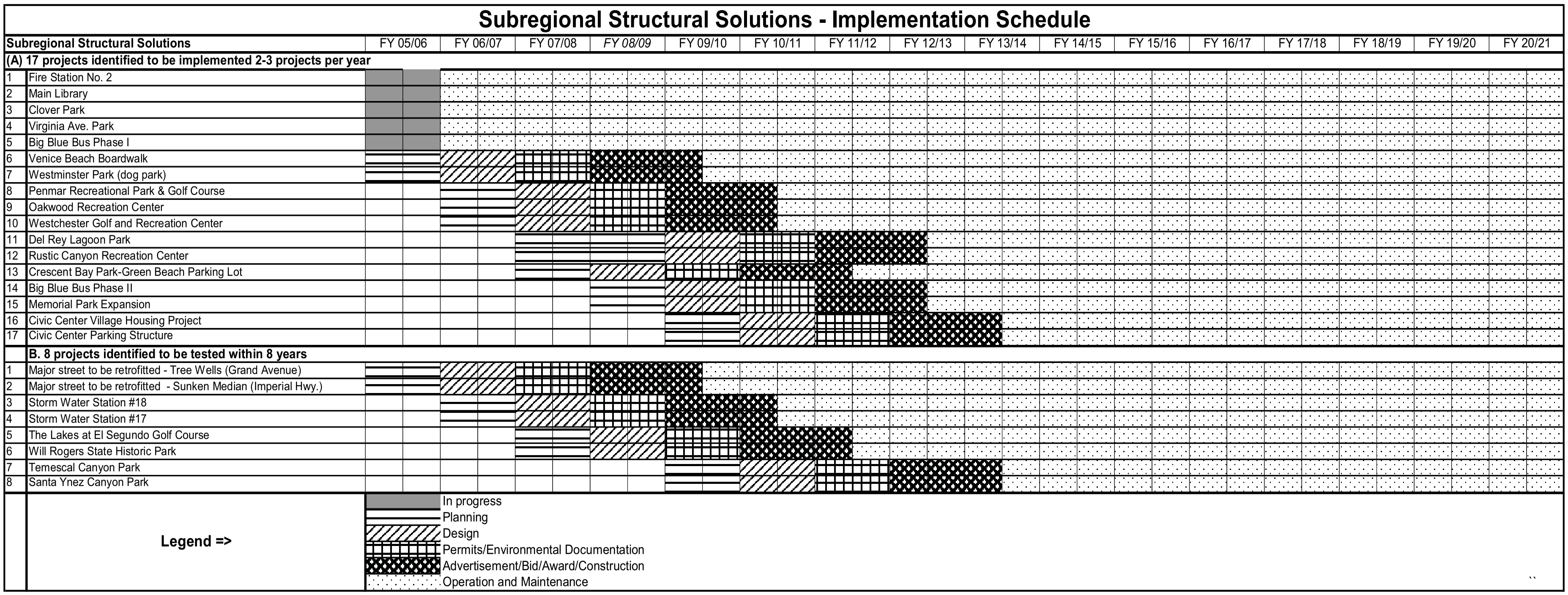
This schedule for implementation of institutional and subregional structural solutions is summarized in Table 25.

A schedule for coordination with local school districts is also shown in Table 25. School districts are not subject to the requirements of this TMDL, but own public facilities that could offer opportunities for local solution implementation.

TABLE 25
Project Commitments
SMBB Bacteria TMDL Implementation Plan

Project Type	Commit	Pilot	Consider
Institutional	6 programs identified Implement all programs by 2009	4 programs identified Implement 2 programs by 2009 Implement remaining 2 programs by year 2013	3 programs identified Study all programs by 2009 Implement feasible programs by year 2021
Subregional Structural Solutions	17 projects identified Implement 2 to 3 projects per year by year 2013	8 projects identified Implement 4 projects by 2009 Implement remaining 4 projects by year 2013	46 projects identified Study project for feasibility by 2013 Implement feasible projects by year 2021
Schools	N/A	N/A	42 schools identified Study/coordinate with School Districts and develop schedule for implementation by year 2009

FIGURE 11
Subregional Structural Solutions – Implementation Schedule



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