3. Seek a third-party cost-benefit analysis regarding compliance with regulations of the San Diego Water Board, with a specific focus on the infeasibility of meeting wet-weather TMDL water quality objectives.

Actions Taken to Meet 2014 Triennial Review Commitments

The following section outlines the most significant actions taken and technical information considered by the San Diego Water Board in the development of recommendations for achieving the goal of protecting the REC-1 beneficial use in the most efficient manner practicable.

External TMDL Stakeholder Workgroup

San Diego Water Board staff formed, and actively participated in, monthly stakeholder workgroup meetings to examine issues related to the REC-1 bacteria water quality objectives for surface waters and to discuss various technical studies. Potential changes and/or updates to existing TMDLs were also discussed during the meetings; a list of stakeholder requested changes and/or updates and San Diego Water Board staff responses are included in Attachment A. These meetings were also essential in bridging the communication gap between staff and external stakeholders. Meetings extended from August 2015 through December 2017. The stakeholder group included representatives from the City of San Diego's Transportation and Storm Water Department, County of Orange South Watershed Management Area, and the County of San Diego Watershed Protection Program. Meeting minutes are available at the following location:
https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/issue3.html

Internal Stakeholder Workgroup

An internal team was established to maximize collaboration and communication across the various implementing programs within the San Diego Water Board. The internal workgroup consisted of staff from the following programs: Groundwater Protection, Monitoring Assessment and Research, Restoration and Protection Planning, Source Control Regulation, and Storm Water Management. Having staff from the various programs allowed the project team to listen to and consider various perspectives, identify potential challenges and barriers, and identify the best solutions to move forward. The internal workgroup consisted of line staff, senior staff, and executive management.

Surfer Health Study

In the winters of 2013/2014 and 2014/2015, the Southern California Coastal Water Research Project (SCCWRP) conducted a Surfer Health Study (SHS). The study focused enrollment and water quality monitoring at two beaches within San Diego city limits - Ocean Beach (located at the mouth of the San Diego River) and Tourmaline Beach, to determine whether or not the REC-1 beneficial use was supported in wet weather by measuring illness rates of surfers after their ocean exposure. The study was funded by the City and County of San Diego. The San Diego Water Board was an active member of the study's Water Quality Advisory Committee. Results indicated gastrointestinal illness (GI) increased following periods of ocean exposure and increased even further following wet weather. Among the study population (i.e. adult and predominantly male surfers), the SHS results did not exceed the most recent USEPA guidance for recreational beaches from 2012, which recommends no more than an average 32 to 36 gastrointestinal illnesses per 1,000 swimmers. The full report is available at: http://www.sccwrp.org/shs/

Based on the SHS results, SCCWRP conducted an upstream microbial source tracking study during two rain events in January-February of 2016 and February 2017 to evaluate the presence of pathogens and human fecal marker (HF183) at five main stem stations and seven tributary stations in the San Diego River watershed. Norovirus was detected at four stations in 2016 and three stations in 2017, and in both years, HF183 was detected in 100 percent of samples at all 12 stations in the San Diego River watershed (Table 1). The high frequencies of pathogen and HF183 detections, together with their relatively high concentrations, point towards broadly distributed human fecal contamination in the San Diego River watershed, with wet weather discharges presenting an ongoing risk to the health of surfers at Ocean Beach following storm events.

Table 1. Pathogen and Human Marker Results of Surfer Health Study and Upstream Microbial Source Tracking Study

Category		Surfer Health Study		Upstream Source Tracking			
				2016		2017	
		Detection Frequency (%, n= 23 samples from one station)[a]	Maximum Concentrations (gene copies/100 ml)	Detection Frequency (%, n = 12 stations)[a]	Maximum Concentrations (gene copies/100 ml)[b]	Detection Frequency (%, n = 12 stations)[a]	Maximum Concentrations (gene copies/100 ml)[c]
Pathogen	Norovirus	96	495	33	280	25	168
	Adenovirus	22	42	Not analyzed	Not available	Not analyzed	Not available
	Campylobacter sp.	100	1136	Not analyzed	Not available	Not analyzed	Not available
	Salmonella	25	14	Not analyzed	Not available	Not analyzed	Not available
	Enterovirus	0	Not available	16	470	Not analyzed	Not available
Human Marker	HF183	100	3363	100	16, 240	100	5,971

a Method Detection Limits are 3 copies/100 ml.
b Maximum concentrations were observed at the Morena Boulevard outfall.
c Maximum concentrations were observed at the Morena Boulevard outfall for Norovirus and the Los Coches tributary for HF183.

Tecolote Creek Quantitative Microbial Risk Assessment (QMRA) Study

In 2013/2014, the San Diego Water Board participated in the Regulatory Advisory Committee for a QMRA Study in the Tecolote Creek Watershed (sponsored by the City of San Diego) to evaluate the human health risk associated with recreating in the creek water. The San Diego Water Board actively provided regulatory guidance and technical comments, which helped the project team successfully complete the first phase of sampling and analysis. The study has not been completed and is currently on hold for several reasons, including the detection of markers of raw human waste in the receiving water.

Comparability Study to Evaluate the Performance of New Sampling and Analysis Technology for Bacterial Monitoring

In the summer of 2017, the San Diego Water Board completed a Comparability Study to evaluate the feasibility of using an in-situ sampling and analysis device - the ALERT system by Fluidion Inc., for *E. coli* and total coliform measurements at the Tijuana River Valley. In the study, the ALERT system was tested over different water matrices and the test results by ALERT were compared with parallel sampling and analysis results with the USEPA approved method. Primary results show that the ALERT system and USEPA approved method results are in good agreement over a broad range of *E. coli* concentrations, and the ALERT system holds great potential to serve as an early warning system of cross-border sewage flows.

Cost Benefit Analysis

In August 2015, the San Diego Water Board along with representatives from the City of San Diego, Counties of San Diego and Orange, the San Diego River Park Foundation, and the San Diego County Taxpayers Association formed a Steering Committee to oversee the development of a Cost Benefit Analysis (CBA). Monthly meetings were held between August 2015 and October 2017. The specific focus of the CBA was to evaluate the infeasibility of meeting wet weather TMDL water quality objectives for bacteria indicators. The County of San Diego, County of Orange, and the City of San Diego provided the funding for the CBA. The CBA found the most effective way to meet the TMDL was to abate sources of human waste. The findings of the CBA are helping to support the San Diego Water Board, Copermittees,[2] sewage collection system[3] owners or operators and other entities focus efforts and resources on identifying and remediating sources of human fecal contamination. The meeting minutes and full CBA report are available at:
https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/issue3.html

Public Outreach

The San Diego Water Board held a series of informational Board items and workshops on the state of the science and the CBA.

September 2015 – The San Diego Water Board held a public meeting to discuss the development of cost benefit analysis of complying with the San Diego Water Board's bacteria water quality objectives. The purpose of the meeting was to consult with the public on issues that should be considered in the analysis, including relevant costs, consequences, and alternatives. The staff presentation and meeting summary are available at:
https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/issue3.html

December 2015 – A representative from the Southern California Coastal Water Research Project (SCCWRP) provided San Diego Water Board Members and the public with information about ongoing research, including rapid testing methods for existing indicators and investigation into alternate indicators and/or direct pathogen measurements. Additional information, including SCCWRP's presentation, can be found at:
https://www.waterboards.ca.gov/sandiego/board_info/agendas/2017/Apr/Apr12.html

[2] Copermittees refers to municipal, county government, and special district entities (referred to jointly as Copermittees) who own and operate large MS4s which discharge storm water (wet weather) runoff and non-storm water (dry weather) runoff to surface waters throughout the San Diego Region.

[3] A generic term describing any system of pipes, pump stations, sewer lines, or other conveyances, upstream of a wastewater treatment plant headworks.

August 2016 – The San Diego Water Board held a public meeting to provide an overview of the draft work plan for the CBA. The intent of the meeting was to provide an introduction and overview of the approach and to review scenarios being considered in the analysis. Additional information, including staff presentation, meeting summary, and comment letter received, is available at:
https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/issue3.html

April 2017 – The San Diego Water Board held an informational workshop to provide the Board, staff, dischargers, and the public with information on several state-of-the-art monitoring and surveillance technologies not commonly used by Board staff or dischargers for compliance, monitoring, and enforcement work. Some of the technologies presented specifically addressed sampling and analysis of indicator bacteria. Additional information, including presentations on the technologies discussed, is available at:
https://www.waterboards.ca.gov/sandiego/board_info/agendas/2017/Apr/Apr12.html

August 2017 – The San Diego Water Board participated in a public meeting regarding the CBA; the meeting was hosted by the County of San Diego. The purpose of this meeting was to provide an overview of the approach and scenarios considered and to inform and consult the public on preliminary results of the CBA. Additional information, including consultant presentation, meeting summary, and comment letters received, is available at:
https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/issue3.html

State Water Board Bacterial Objectives

The State Water Board began an effort in July 2014 to revise bacteria REC-1 standards statewide. The project team provided comments to the State Water Board reflecting the lessons learned from the REC-1 Triennial Review project and intending to ensure the statewide action would be compatible with ultimate project team recommendations. Information on the State Water Board's proposed project is available at:
https://www.waterboards.ca.gov/bacterialobjectives/

The State Water Board plans to hold a public meeting on August 7, 2018 to consider revisions to bacteria standards in statewide Plans. The Bacteria Provisions, if adopted, would apply to fresh, estuarine, and ocean waters and establish updated bacteria water quality objectives for the protection of the REC-1 beneficial use based on a risk protection level of 32 illnesses per 1,000 recreators. The Bacteria Provisions would establish: *Escherichia coli* (*E. coli*) as the sole indicator of pathogens in freshwater; enterococci as the sole indicator for saline inland surface waters, enclosed bays, and estuaries; and enterococci as an indicator in ocean waters. Unlike the previously distributed documents, the Ocean Plan Amendment would retain the fecal coliform objective contained in the existing Water Quality Control Plan for Ocean Waters of California because California-specific epidemiological studies provide data that suggest fecal coliform may be a better indicator of gastrointestinal illness than enterococci during certain types of exposure and environmental conditions. The State Water Board will consider evaluating the fecal coliform water quality objective at a later date. The Bacteria Provisions would supersede numeric, but not narrative, water quality objectives for bacteria for the REC-1 beneficial use in the water quality control plans established by the Regional Water Quality Control Boards prior to the effective date of the Bacteria Provisions.

Staff Recommendations

The San Diego Water Board staff prepared the following recommendations for moving forward on the REC-1 Triennial Review project. In developing these recommendations, staff considered issues and perspectives from the external and internal workgroups, the public, local and regional studies and data, and available resources. Consistent with the San Diego Water Board Practical Vision, recommendations are prioritized so that the Board can align its effort to its priorities. Recommendations are also separated by program and, where appropriate, into short-term and long-term projects and/or actions. Short-term projects and/or actions are those that can be completed within the next three years.

Although the goal of the Triennial Review project focused on evaluation of Basin Plan bacteria water quality objectives (for protection of the REC-1 beneficial use) and the bacteria TMDLs, recommendations extend beyond these. TMDLs are not self-implementing and must, therefore, be implemented through the regulatory programs or authorities of the San Diego Water Board. Therefore, recommendations are presented as actions to be implemented within specific programs. The available regulatory authorities include:

- Incorporating discharge prohibitions into the Basin Plan;
- Issuing individual or general National Pollutant Discharge Elimination System Permit (NPDES) or Waste Discharge Requirements (WDRs);
- Issuing individual or general conditional waivers of WDRs;
- Issuing investigative orders;
- Issuing formal enforcement actions to compel compliance with NPDES Permits, WDRs, and Basin Plan prohibitions (e.g., time schedule orders, cleanup and abatement orders, cease and desist orders, administrative civil liabilities); and
- Conduct compliance audits of existing permit requirements related to the regulation of human waste.

The recommendations are intended to ensure judicious use of authorities and resources of the San Diego Water Board while also facilitating effective use of resources by regulated parties in protecting the REC-1 beneficial use.

Storm Water Management

The bacteria TMDLs are currently implemented primarily through the Regional NPDES Permit for Discharges from Municipal Separate Storm Sewer Systems (MS4s). The Regional MS4 Permit contains water quality based effluent limitations (WQBELs) which are based on the wasteload allocations (WLAs) specified in the bacteria TMDL. Although NPDES requirements must contain WQBELs that are consistent with the assumptions and requirements of WLAs in the TMDL, the federal regulations do not specifically require the WQBELs to be identical to the WLAs. The regulations leave open the possibility that the San Diego Water Board could determine that fact-specific circumstances render something other than literal incorporation of the WLAs to be consistent with the TMDL assumptions and requirements. Considering the amount of time and resources necessary to amend a TMDL, it is prudent to first focus resources on changes within the Regional MS4 Permit that can be done in the short-term and achieve the desired outcome.

Recommendations within this program have been separated into two categories: changes to the Regional MS4 Permit and other program actions – both of which are considered short-term actions. Recommended changes to the Regional MS4 Permit are timely given that it is up for reissuance in Fiscal Year 2018.

Recommended MS4 Permit Changes

- Findings (Section I.) – add a finding that clearly specifies responsibility of compliance is with the municipality, not a storm water division within the municipality – this is particularly important for agencies that have multiple authorities that need to come together to develop a comprehensive solution. A city or county is the Copermittee. As such, they should rely upon the totality of their authorities and departments to comply with the permit.

- Water Quality Improvement Plans (Section II.B) – specify that for areas in which bacteria is identified as the highest priority water quality condition, reduction of human sources of bacteria should be the priority.

- Monitoring and Assessment Program Requirements (Section II.D) - evaluate and adjust receiving water monitoring as needed to ensure information is being collected to fill data gaps; the San Diego Water Board needs to more clearly identify specific questions that should be answered (e.g. is it safe to swim? What is the source(s) of the unsafe bacteria levels?).

- Illicit Discharge Detection and Elimination (IDDE) (Section II.E.2) - clarify expectations for human sources of fecal indicator bacteria (FIB) that are conveyed by the MS4 to surface waters and to identify what constitutes an adequate IDDE Program.

- Attachment E (Specific Provisions For Total Maximum Daily Loads) Section 5, TMDLs of Indicator Bacteria, Baby Beach in Dana Point Harbor and Shelter Island Shoreline Park in San Diego Bay and Section 6, Revised TMDLs for Indicator Bacteria, Twenty Beaches and Creeks in the San Diego Region

    - Update indicators to be consistent with the statewide bacteria water quality objectives (or USEPA 2012 guidance if statewide objectives are not yet updated). This update would remove total coliform from the permit and would: use *E. coli* as the sole indicator of pathogens in freshwater; enterococci as the sole indicator for saline inland surface waters, enclosed bays, and estuaries; and Enterococci and fecal coliform in ocean waters. Scientific advancements in microbiological, statistical, and epidemiological methods have demonstrated that culturable Enterococci and *E. coli* are better indicators of fecal contamination than the previously used general indicator, total coliforms (2012 USEPA Criteria). In addition, California-specific epidemiological studies provide data that suggest fecal coliform may be a better indicator of gastrointestinal illness than enterococci during certain types of exposure and environmental conditions

    - Develop language that specifically acknowledges the allowable risk level associated with the revised objectives; this will ensure that permit requirements meet the intent of the TMDLs. Indicator bacteria water quality objectives are based upon an observed correlation between detectable additional illnesses among those participating in REC-1 activities and the water quality concentrations of the indicator bacteria. Current values in the TMDL correspond to an illness rate of 36 illnesses per 1,000 recreators, the revised objectives would require a more stringent threshold for fecal indicator bacteria corresponding to an illness rate of 32 illnesses per 1,000 recreators.

    - Update compliance determination to allow for use of alternative compliance pathways using human-specific fecal indicators in conjunction with existing Basin Plan indicators.

    - Add a requirement to submit an annual summary for human source illicit discharge detection and elimination efforts conducted by the Copermittees. In addition, the permit should specify the format of the data submission (i.e. shape files).

Recommended Storm Water Management Program Actions

- Conduct audits of Illicit Discharge Detection and Elimination Programs (IDDE) relative to human fecal sources and of compliance with section II.E.5.b.(1).(c).iv, which requires Copermittees to implement controls to prevent infiltration of sewage into the MS4 from leaking sanitary sewers.

- Require revisions of the Water Quality Improvements Plans (WQIPs) to make them more comprehensive (i.e. identify the strategies that will be implemented in coordination with or with the cooperation of other agencies and/or entities within the respective watershed). In addition, the focus of the WQIPs needs to shift from broad sources of fecal indicator bacteria towards honing in on human sources of pathogens, which will require modification of compliance strategies. Controlling high-risk sources of human waste will be more effective than trying to reduce all FIB through structural BMPs.

Source Control Regulation

The TMDLs appropriately do not assign WLAs for publicly owned treatment works (POTWs) or sanitary sewer collection systems because discharges of bacteria from POTWs and sanitary sewer collection systems to any waters addressed by the bacteria TMDLs were not expected or permitted. The only exception is Padre Dam Municipal Water District, whose discharge to the San Diego River is regulated by the San Diego Water Board through an NPDES permit.

The TMDL is implemented by requiring compliance with any existing individual and/or general WDRs and NPDES requirements. Information collected to date indicates the sanitary sewer collection system may be contributing to the bacteria impairment in receiving waters, suggesting the need for improved compliance with the regulations.

The sanitary sewer collection system is a critical element of wastewater infrastructure and failures of the system can result in significant threats to human health (from releases of raw sewage). It is therefore imperative for the sanitary sewer collection system agencies to remain engaged and to work collaboratively with all stakeholders to ensure management measures are protecting public health and the environment.

Discharges from the sanitary sewer collection system can pose a significant threat to public health due to the high concentrations of pathogenic organisms. Sanitary sewer collection systems are regulated by Order No. R9-2007-0005, *Waste Discharge Requirements for Sewage Collection Agencies in the San Diego Region*, and by Order No. 2006-0003-DWQ, *Statewide General Waste Discharge Requirements for Sanitary Sewer Systems* (Statewide General Order). The TMDL specifies that, if necessary, individual WDRs for POTWs and/or the San Diego Water Board WDRs for sanitary sewer collection systems can be revised to require more aggressive monitoring, maintenance, and repair schedules to ensure discharges of bacteria wasteloads to surface waters are minimized and/or eliminated.

Recommendations within this program have been separated into two categories: changes to the WDRs for Sewage Collection Agencies in the San Diego Region and other program actions – both of which are considered to be short-term actions. Recommended changes to the WDRs for Sewage Collection Systems are timely given that it is being reviewed pursuant to CWC section 13262(e) in calendar year 2018. The State Water Board may initiate the process of identifying updates to the Statewide General Order soon. The recommended updates presented below are intended to supplement (rather than replace) the requirements in the Statewide General Order.

Recommended Changes for the WDRs for Sewage Collection Agencies in the San Diego Region

- Add a requirement to conduct a condition assessment of the sanitary sewer system to identify areas that pose a risk of failure that could result in an unauthorized discharge of waste to receiving waters; these include, but are not limited to: sanitary sewer overflow, pipe leakage (exfiltration), and other critical defects.

- Add receiving water monitoring which should be coordinated with the MS4's (since MS4 may provide conveyance of raw sewage to receiving water) and that includes thresholds to trigger investigations of potential collection system leaks or spills. For beaches, SCCWRP has developed a source investigation protocol for the Clean Beaches initiative. https://www.waterboards.ca.gov/water_issues/programs/beaches/cbi_projects/docs/sipp_revised.pdf

- Add a requirement to assess fate and transport of illicit discharges; this could include modifying post-spill monitoring to ensure there are no long-term receiving water impacts.

- Add a requirement to have a map of the entire system and to submit GIS files.

- Add a requirement for an annual report. The annual report should, at a minimum, summarize spills (by waterbody), identify impacts to beneficial uses, and causal assessments.

Recommended Source Control Regulation Program Actions

- Review Sanitary Sewer Management Plans that were prepared under the Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (Order No. 2006-0003-DWQ) and require modification as necessary to include requirements for addressing exfiltration, infiltration and inflow (at a minimum), and prioritization of replacements/upgrades based on impacts to beneficial uses. The prioritization should consider distance to a receiving water or MS4 system and impacts to key uses and key areas within the San Diego Region.

Monitoring Assessment and Research

As discussed in the Practical Vision, the Water Board can only succeed through continuous learning, innovation, and the application of sound science in decision-making. It is therefore essential to collaborate and remain engaged with governmental agencies, nongovernmental organizations, and the scientific community to learn from experts in the field and to ensure that the San Diego Water Board is relying on the latest science. The Water Board's Monitoring Assessment and Research Unit plays a critical role in reviewing the latest scientific advancements and providing recommendations to program staff, coordinating and collaborating with the scientific community, and field testing modern monitoring techniques. Recommendations for this program are as follows:

- Continue to investigate and participate in research that advances rapid methods for existing indicators.
- Continue to investigate and participate in research that advances the science towards better indicators, human specific markers, and/or direct pathogen measurements.
- Continue to work collaboratively with other parties (internally and externally) to develop and implement monitoring and assessment programs by watershed management areas.

Restoration and Protection Planning

The Basin Plan is the blueprint for water quality management and control in the San Diego Region. It designates beneficial uses, and establishes water quality objectives and implementation plans to protect those beneficial uses. The Basin Plan is used as a regulatory tool by the Regional Water Board's technical staff; under the Porter-Cologne Water Quality Control Act, WDRs and other regulatory orders must implement the Basin Plan water quality standards and prohibitions applicable to a particular discharge. The Basin Plan is also used by other agencies in their permitting and resource management activities and serves as an educational and reference document for dischargers and members of the public.

The Basin Plan is a dynamic, rather than fixed, document. It requires periodic updates to maintain and ensure that the information is up-to-date. Updates and/or changes to the Basin Plan must follow an amendment process, which can be resource and time intensive. The time needed to go through the amendment process varies depending on the level of complexity (e.g., regulatory vs. non-regulatory), the status of supporting science, and public interest in the proposed changes. Recommendations in this section contain both short-term and long-term projects.

Short-term project – Recommended Basin Plan Updates

The Basin Plan should be amended to make editorial non-regulatory changes that clarify language, update tables, figures, and references to outdated Policies, or eliminate outdated paragraphs, and to correct other minor errors. Specifically, the following changes/updates should be considered during the 2018 Triennial Review:

Basin Plan	Section	Page	Recommended Change/Update
Chapter 3	Ocean Waters	3-5	Update shoreline segments that are listed as impaired
Chapter 3	Ocean Waters	3-5	Update indicators described in the paragraph for Total Maximum Daily Load (TMDL) Implementation Provisions to be consistent with statewide criteria*
Chapter 3	Inland Surface Waters, Enclosed Bays and Estuaries, Coastal Lagoons and Ground Waters	3-6	Bacteria - Total Coliform, Fecal Coliform, *E. coli*, and Enterococci subsection - Update indicators described to be consistent with statewide criteria*

* Assuming adoption of statewide criteria by the State Water Board

Long-term project – Recommended Basin Plan Updates

The following changes will require additional time because they are dependent on other actions being completed (i.e. additional studies, data collection, etc.).

- Chapter 4 – Implementation Provisions for Indicator Bacteria Water Quality Objectives in the Context of the TMDL: Evaluate "Natural Source Exclusion and Reference System Approach" to determine how to account/consider for source variability within urban environments.

  Fecal Indicator Bacteria (FIB) in a natural system is not likely from a human source however, studies are demonstrating that elevated FIB in an area with a high density of people is likely to originate from humans. Since FIB serve as an indicator of human pathogens, protecting the REC-1 beneficial use is concerned with the portion of FIB originating from humans. Any reference system that allows a FIB concentration from a natural system to apply to a more developed setting is therefore likely falsely attributing the source of FIB to non-human sources. The two FIB populations are not the same: the natural system probably does not contain pathogens, while the more urban setting has FIB almost certainly associated with human pathogens. It is important for the Reference System Approach to clarify that while exceedances may be allowed, human fecal discharges that pose excess risk are prohibited (not allowable).

- Chapter 7 – Revise Total Maximum Daily Load for Indicator Bacteria, Project I – Twenty Beaches and Creeks in the San Diego Region (including Tecolote Creek):

  - Update the problem statement to acknowledge the goal of the TMDL is reduction of bacteria/pathogens from human sources. Add a brief discussion on limitations of current indicators.

  - Update the numeric targets to match statewide bacteria objectives – use *E. coli* for freshwater and Enterococci for marine waters.

  - Update the source analysis to include other sources currently not accounted for; these include, but may not necessarily be limited to: homeless encampments, collection systems contributions, private lateral contributions, septic system contributions, and other illicit discharges. In addition, a discussion on risks associated with human vs non-human sources should be added to this section.

  - Update the allocations and allowable loads using new indicators and updated information on additional sources. This would include expressing the loads as concentration rather than mass loads.

- Review and revise, as necessary, the implementation provisions to reflect updated implementation approaches.

- Add language that encourages the investigation of alternative indicators and/or direct pathogen measurements.

General Recommendations for Additional Coordination and Collaboration

- In response to the SHS and follow-up studies, responsible parties should identify and quantify the sources and transport pathways of human fecal materials to the San Diego River watershed. If data suggests human sources are entering the River as a result of permit violations, then the San Diego Water Board and responsible parties should take steps to achieve compliance. This may entail filling data gaps in order to determine status of compliance and noncompliance. An Investigate Order may be necessary to achieve this goal.

- Receiving water monitoring requirements within San Diego Water Board permits should be coordinated on a watershed basis. This will enable the development of a comprehensive monitoring program that accounts for cumulative and synergistic effects of all discharges within the respective receiving water or watershed.

- San Diego Water Board staff should take advantage of opportunities to educate the public and regulated entities on impacts to the REC-1 beneficial use as a result of human fecal contamination and measures being taken to address the problem. This can be achieved through participation in conferences and meetings such as those held by non-governmental community groups.

- Financial resources should be directed at efforts to identify human sources, improve indicators, and restore in-stream habitats. For example, supplemental environmental projects could be focused on Key Areas for the REC-1 beneficial use. In addition, the San Diego Water Board should partner with local academia and environmental research institutions and fund (whenever possible) special studies that fill data gaps.

Lessons Learned

A significant amount of information and data has been collected and reviewed during the past three years and the San Diego Water Board staff has gained a better understanding of the link between illness rates and fecal contamination in recreational waters. Most notably, however, were the partnerships built throughout the process. The collaborative relationship between the various stakeholders involved allowed all parties to gain an understanding of each other's perspective, organizational framework, and culture; this was an essential step because it highlighted strengths and weaknesses within the respective organizations and helped to (better) identify solutions for moving forward. For example:

- There are limitations to existing indicators that make dealing with fecal indicator bacteria (as it relates to protecting the REC-1 beneficial use) complicated and complex. The San Diego Water Board should specifically acknowledge the allowable risk level associated with compliance with the REC-1 criteria and explore how new water quality criteria or targets could be used for compliance that achieves the same level of protection. This will ensure judicious use of authorities and resources of the San Diego Water Board while also facilitating effective use of resources by regulated parties in protecting the REC-1 beneficial use.

- The San Diego Water Board and regulated entities need to continue to evolve regulatory and management actions based on the latest information. Regulated entities should continue to explore innovative and creative solutions (rather than relying solely on traditional BMPs for example). In addition, regulated entities should use the latest information to implement short-term immediate measures while continuing long term planning. The San Diego Water Board should be willing to take and allow calculated risks that embrace new scientifically sound ideas; this would involve challenging the status quo and accepting short-term failures leading to long-term success.

- Policies and permits that allow regulated entities opportunities to develop creative solutions suffer when Water Board staff are not able to actively participate or fail to be specific about the most important things. For instance, recent efforts to allow Storm Water permittees maximum flexibility to establish strategies and actions for addressing REC-1 impairments suffered because Water Board staff were not able to advise on cross-program issues that ultimately are necessary for success.

- The prior lesson learned must be kept in balance with timely and effective regulatory oversight of existing permit conditions. While staffing resources simply do not allow in-depth review of every monitoring and annual report, those report elements and permit requirements related to high-priority efforts (such as restoring the Rec-1 Beneficial Use) must be closely examined.

- Collaboration and communication are essential to establishing long-term and sustainable solutions. Regulated entities need to work collaboratively to identify strategies that will be implemented in coordination with or with the cooperation of other agencies and/or entities within its jurisdiction. In addition, agencies that have multiple authorities need to rely upon the totality of their authorities and departments to develop comprehensive solutions. The San Diego Water Board needs to proactively seek partnerships, remain engaged with external parties, and clearly articulate how success will be measured. Maintaining good communication can help identify innovative solutions, maximize use of limited resources, and can help inform actions to better protect and restore the REC-1 beneficial use. Building partnerships requires additional time that must be taken

into consideration into project planning.

- The San Diego Water Board workload far exceeds its staff resources; therefore, it needs to strategically sort its priorities. Given that the resources of the San Diego Water Board are unlikely to change in the near future, it needs to implement measures to help its staff maximize efficiency. For example, implementation of a system to simplify data management (such as ArcGIS) would allow staff to identify and respond to potential issues and/or problem areas in a timelier manner, identify data gaps, and identify high quality waters in the region. Data can also inform changes to monitoring requirements within permits and/or when issuing investigative orders.

- The San Diego Water Board should coordinate among and across its various programs; this will ensure limited resources are put to the best use in the most efficient manner practicable. The Priority Setting Team outlined in Chapter 1 of the Practical Vision is positioned to lead this effort.

- The San Diego Water Board must wisely choose which water bodies and impairments to assign resources. This must involve the Key Use and Key Area concept. Initial steps should include thorough source analysis and review of all permits in the watershed that regulate constituents related to the impairment. Compliance audits and enforcement should be pursued when permittees are suspected of non-compliance with permit elements related to the impairment. This will be a faster and more judicious path toward the goal of restoring water quality.

Conclusions

- Efforts to achieve REC-1 WQOs and the TMDL targets should focus on human sources of FIB and pathogens. To date, storm water permittees have invested disproportionally in general FIB reductions, rather than human source reductions. San Diego Water Board staff should guide performance toward controlling human sources instead of achieving general FIB wasteload reductions.

- REC-1 WQOs should be revised to reflect the 2012 USEPA guidance, and the State Water Board intends to do so statewide.

- The TMDLs do not need to be updated at this time in order to align the effort of the San Diego Water Board and regulated parties to control human sources.

- Implementing permits, specifically the Regional MS4 Permit and the regional WDRs for Collection Systems, should be revised to ensure regulatory effort to restore and protect the REC-1 beneficial use is focused appropriately on controlling human sources.

- Monitoring and assessment activities of the San Diego Water Board and regulated parties should include efforts to identify human sources of FIB.

- The San Diego Water Board should advocate and support development of improved indicators of human health risk.

Appendix A - City of San Diego, County of Orange and County of San Diego Copermittee Requested Changes to the 20 Beaches and Creeks Bacteria TMDL

The Bacteria TMDL specifies that the San Diego Water Board will initiate a Basin Plan Amendment project to revise the requirements and/or provisions for implementing the TMDLs by April 2016, provided sufficient data exist to support the initiation of a Basin Plan Amendment. The City of San Diego, County of Orange, and County of San Diego have submitted a request for changes to the Bacteria TMDLs. This section includes a summary of the requested TMDL changes and the San Diego Water Board staff responses.

Request: Prioritize reduction of sources of human fecal contamination.

Detailed Description of Request:

1. The TMDL should include a discussion of health risks associated with exposure to human and non-human fecal sources; this provides a health risk perspective for prioritizing reduction of human fecal contamination sources. Human sources are high-risk sources, whereas non-human sources generally pose a lower risk.
2. Reduction of human fecal sources is a more cost-effective approach for reducing risk to human health based on CBA results, the SCCWRP Surfer Health Risk Study and other relevant information. TMDL compliance efforts should focus on reducing human fecal sources and shared responsibility. Shared responsibility includes bringing in other contributing sources/agencies outside of MS4 agencies, to help collaboratively reduce human fecal sources.

San Diego Water Board Response:

1. Staff agrees that TMDL compliance efforts must focus on controlling and reducing human fecal sources. A discussion supporting this concept will be included in the TMDL if the San Diego Water Board amends the TMDL in the future. Staff has also recommended adding clarifying language to the MS4 permit to specify that for areas in which bacteria is identified as the highest priority water quality condition, reduction of human sources of bacteria should be the priority.

2. Staff agrees that resources and efforts should be focused on controlling and reducing human sources of pathogens and pathogenic bacteria rather than broad sources of fecal indicator bacteria. The TMDL assigns wasteload allocations (WLA) to the MS4's and Caltrans and all other point sources, including but not limited to publicly owned treatment works (POTWs) and sanitary sewer collection systems which have a zero WLA. POTW discharges must be in compliance with waste discharge requirements and sewage collection agencies are prohibited from discharging sewage wastewater at any point upstream of the POTW headworks. Copermittee storm water agencies must implement controls and measures required under the MS4 Permit to prevent and eliminate seeping sewage from infiltrating the MS4. All parties have a collective responsibility to reduce, eliminate, and prevent the reoccurrence of unauthorized waste discharges.

Request: Improve TMDL implementation structure

Detailed Description of Request: The TMDL implementation structure should address human source reduction, monitoring, and adaptive management programs (to be developed). Adaptive management would include bringing in other sources/agencies outside of MS4s, to help collaboratively reduce human sources.

San Diego Water Board Response: The TMDL identifies more than MS4s in the implementation section. However, staff recognizes the TMDL may have taken for granted that existing regulations and prohibitions on sanitary sewer collection systems and septic systems were adequate and did not require changes. In addition, the TMDL discounted unknown data and contributions from private laterals and homeless encampments. Lastly, staff recognizes the TMDL gives little direction, if any, or incentives for collaboration or focusing on human sources.

The San Diego Water Board will make a reasonable effort to identify sources of human fecal contamination in discharges. It is not necessary to identify all dischargers for the San Diego Water Board to proceed with requirements to investigate and take necessary steps to reduce human sources. Where necessary to protect water quality, the San Diego Water may name other persons as dischargers, to the extent permitted by law.

The MS4 Permit supports adaptive management. The MS4 permit specifies that the goals of the Water Quality Improvement Plans can only be accomplished through an 'adaptive planning and management process'; furthermore, the MS4 permit directs copermittees to identify strategies that will be implemented in coordination with or with the cooperation of other agencies and/or entities within its jurisdiction. Copermittees that operate both a municipal sanitary sewer system and a MS4 must implement controls and measures to prevent and eliminate seeping sewage from infiltrating the MS4. Copermittees that do not operate both a municipal sanitary sewer system and a MS4 must coordinate with sewering agencies to keep themselves informed of relevant and appropriate maintenance activities and sanitary sewage projects in their jurisdiction that may cause or contribute to seepage of sewage into the MS4.

With regards to private property, staff recognizes the responsibility for the maintenance, repair, and replacement of a private sewer lateral falls on the property owner. However, private laterals present an opportunity for municipalities to update (or develop) Municipal Code requirements for property owners to inspect, maintain, repair and/or replace sewer laterals that are connected to their infrastructure if private lateral releases, either individually or collectively, represent a public nuisance and a threat to the best interests of the health and welfare of the public.

Request: Revise monitoring approach

Detailed Description of Request: The TMDL should incorporate a 4-Tiered Monitoring Framework and include discussion of monitoring requirements, identification of compliance locations, and triggers for additional upstream source identification investigations. It should focus on assessing and eliminating high-risk human sources of bacteria and shared responsibility.

The 4-tiered monitoring framework should identify specific parties responsible for reducing bacteria sources. Compliance pathways and monitoring requirements should be discussed in context of the tiered framework.

San Diego Water Board Response: The request is consistent with the requirements of the TMDL, which specifies the minimum monitoring locations and source identification investigations when exceedances are detected in the receiving water.

Request: Incorporate risk-based approach

Detailed Description of Request: The TMDL should include a detailed discussion relating the TMDL to the acceptable risk level used in USEPA's 2012 Recreational Water Quality Criteria (RWQC) and proposed use of alternative compliance pathways. The discussion is important to lay the foundation for a move to true risk-based objectives in the future, which seems to be goal of all parties. As re-written, the TMDL would allow future scientific studies to inform updates to numeric targets (e.g. site-specific objectives), corresponding to an acceptable risk level.

San Diego Water Board Response: The RWQC identifies acceptable estimated gastrointestinal illness rates due to pathogens that are protective of REC-1 uses. Staff agrees that a discussion clearly relating the TMDL to the RWQC acceptable level of risk is important to clarify public policy. Risk is already built-in to existing REC-1 critieria, but is not explicity explained in the Basin Plan. Additionally, staff is receptive to the concept of alternative compliance pathways; however, additional discussions will be needed to further refine specifics (such as the appropriate HF-183 method and threshold).

Request: Surfer Health Study (SHS) and human marker use to support compliance assessment

Detailed Description of Request: Provide justification for use of the SHS results to help form the basis of the proposed compliance pathways and implementation approach. The TMDL should document the SHS results reflect water quality conditions that are protective of the primary contact recreation use as defined by USEPA's 2012 RWQC. In addition, the TMDL should include a detailed discussion comparing similarities and differences in SHS and USEPA NEEAR studies and additional analysis to quantify the uncertainties inherent in the SHS (such as using children-specific ingestion rate).

San Diego Water Board Response: Staff agrees that the SHS and subsequent Upstream Microbial Source Tracking Studies in the San Diego River Watershed (MST) provide valuable information that may be used to form the basis of future compliance pathways and implementation approaches, especially for specific TMDL watersheds investigated in the SHS.

Staff does not believe the statement that "SHS results reflect water quality conditions that are protective of the primary contact recreation use as defined by USEPA's 2012 RWQC" is accurate, especially for the water quality conditions on "0-1 days" following rain events. Staff acknowledges the significant effort invested in quantifying the uncertainties in SHS [with Quantitative Microbial Risk Assessment (QMRA) analysis] to compare SHS study design and results to those in the US EPA NEEAR study. Staff agrees with the recommendation in the SHS report (Page 30, end of 1st paragraph) that states "(we recommend) caution in the direct comparison of risk estimates from this (SHS) with USEPA guidelines", based on the following considerations:

- Different sensitivities to pathogenic infection between children and adult
- Relatively limited number and uniform characteristics of surfers enrolled in the study
- Temporal and spatial variations of pathogen profiles in discharges (at river mouths)
- Different FIB (and pathogen) concentrations between near shore and surf zone

- Different probabilities that surfers enter ocean on Days 0 and 1 compared to on Days 2 and 3 following rain events

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Request: Revise monitoring/compliance framework

Detailed Description of Request: The TMDL should allow for alternative compliance pathways; the copermittees have developed three new pathways for demonstrating compliance with TMDL numeric targets and allocations. Under all pathways, compliance points are moved to the beach, where the CBA quantified the vast majority of recreation to occur. The TMDL would need to discuss options for creeks that do not have a REC-1 beach (e.g. Chollas Creek).

San Diego Water Board Response: Staff has reviewed the proposed compliance pathways and generally agrees with the concept. Staff is receptive to moving compliance points to areas with the highest recreational use for the purposes of assessing whether TMDL targets are met. This, however, would not relieve copermittees from meeting applicable freshwater water quality objectives. Furthermore, in instances where there are exceedances of water quality objectives in the creeks, copermittees will need to initiate source identification studies to investigate and abate sources causing and/or contributing to the exceedances.

Request: Human marker (HF183) based compliance

Detailed Description of Request: Compliance demonstration via Pathway 2 includes paired FIB/HF183 compliance assessment. The HF183 threshold for wet weather was derived from the SHS. The copermittees would like to include a placeholder for a discussion on future development of dry weather threshold; potential thresholds being developed by SCCWRP/ Stanford could be used when ready.

San Diego Water Board Response: Fecal indicator bacteria (FIB) have been used as an indicator of fecal contamination and the potential presence of pathogens capable of causing gastrointestinal (GI) illnesses because they are easy to measure and test relatively inexpensively. Staff recognizes FIB sources can vary significantly and current FIB objectives do not distinguish between human and non-human fecal sources, which pose different risks to human health. It is not the intent of the bacteria TMDLs to require treatment or diversion of natural waterbodies or to require treatment of natural sources of indicator bacteria, and therefore the staff supports further investigation and (ultimate) use of a human-specific indicator and/or direct pathogen measurement, as feasible and appropriate. As discussed in its Practical Vision, the San Diego Water Board recognizes that it can only succeed through continual learning and innovation and the application of sound science in decision-making. The state of science concerning fecal material indicators continues to evolve; however, data collected to date indicates HF-183 may improve the identification of human fecal contamination in receiving waters. The use of HF-183, in conjunction with existing FIBs, would allow responsible parties to collaborate and better allocate resources by focusing on source abatement in areas that pose the greatest threat to public health. Although staff is open to consideration of using HF-183 as part of a compliance pathway, there will need to be additional discussion on the appropriate compliance threshold and method.

Request: Incorporation of reference watershed studies

Detailed Description of Request: Copermittees are not proposing change to wet weather allowable exceedance frequency (AEF), based on the results of recent reference studies. The copermittees would like to include a discussion of possible future development of a dry weather AEF (depending on available data and justification).

San Diego Water Board Response: Given that we want to shift focus towards human specific sources, it seems more prudent to prioritize the development of HF183 (or other human specific indicator) as a compliance threshold than to justify an allowable exceedance frequency of human wastewater in receiving waters during dry weather.

Request: Revise TMDLs and allocations (flexible options)

Detailed Description of Request: The TMDL should allow copermittees to prioritize areas and time periods with high REC use. Examples include moving compliance points to the beach (where appropriate), incorporation of High Flow Suspension / Low Flow Suspension / Limited REC-1, etc.

San Diego Water Board Response: The prioritization of regulatory effort in areas with a high intensity of recreational use is consistent with the San Diego Water Board's Key Beneficial Uses and Key Areas concept. The San Diego Water Board understands and recognizes limited resources must be put to the best use possible to meet the goals of the TMDL. The San Diego Water Board has identified Ocean waters and San Diego Bay, which are included in the TMDLs, as key areas for the key beneficial use of recreation. Staff is receptive to moving compliance points to areas with the highest recreational use for the purposes of assessing whether TMDL targets are met. This, however, would not relieve copermittees from meeting freshwater water quality objectives; furthermore, in instances where there are exceedances of water quality objectives in the creeks, copermittees will need to initiate source identification studies to abate sources causing and/or contributing to the exceedances.

Staff will not recommend the Board consider incorporating high flow suspensions, low flow suspensions, or designation of the limited REC-1 beneficial use in any areas currently designated with REC-1 as an existing or potential beneficial use.

Request: Align with Regional Monitoring Framework

Detailed Description of Request: The Regional Monitoring Framework and modifications to the TMDL should focus on evaluating and reducing human health risk rather than simply quantifying bacteria loads in discharges.

San Diego Water Board Response: Staff agrees that monitoring should be aligned with the Framework for Monitoring and Assessment in the San Diego Region (Dec 2012).

Request: Revise compliance schedule

Detailed Description of Request: An extended compliance schedule (dates to be determined) is needed because additional time is required to engage responsible parties to address human sources and other factors, including the screening level FCA results (from the CBA) which showed residential costs in the "High" range.

San Diego Water Board Response: Staff recognizes there must be a shift in how municipalities approach efforts to achieve REC-1 water quality objectives and in how to assess whether TMDL targets are met and furthermore, that this shift may require additional time. However, given that the MS4 permit (already) encourages collaboration and adaptive planning to meet the goals of the Water Quality Improvement Plans, and further directs the copermittees to identify strategies that will be implemented in coordination with or with the cooperation of other agencies and/or entities within its jurisdiction, the results of such efforts explored to date would be needed to properly evaluate the reasonableness of this request. Furthermore, Section II.E.5.b. of the MS4 permit already directs the Copermittees to 'implement controls to prevent infiltration of sewage into the MS4…'. Finally, the MS4 permit is issued to a city or a county, and not solely to a storm water department. Copermittees have been implementing their current strategies to achieve REC-1 water quality objectives and to assess whether TMDL targets are met for at least five years, and presumably, they have made progress, in accordance with their own schedule, towards reducing sources of bacteria in their watersheds.

Prior to consideration of an extension to the schedule, staff would need to understand what specific barriers and/or regulatory hurdles have prevented the copermittees from achieving their goals. An extension based on collaboration would be difficult to justify without a detailed schedule of actions and demonstrated willingness of other responsible parties to participate in a MS4 copermittee process.

Request: Revise implementation milestones

Detailed Description of Request: The compliance schedule was developed based on a phased TMDL approach and includes a detailed list of major milestones, responsible parties, and dates (to be filled in). Revising implementation milestones would align schedule with other proposed changes.

San Diego Water Board Response: The San Diego Water Board can consider, in implementing permits, revising milestones that reflect updated action plans focused on human sources. Insufficient information exists for the San Diego Water Board to consider revising the final wet weather compliance date of 2031 at this time.

Request: Update waterbodies addressed by TMDL

Detailed Description of Request: The San Diego Water Board should update the TMDL to the 2010 303(d) list versus the 2002 list, which was the basis of the original TMDL. In addition, they should also develop an appendix showing the progression of 303(d) listings from 2002 through the proposed 2014 list.

San Diego Water Board Response: Implementation requirements and actions can reflect the latest 305(b) report. For example, these requirements and actions can focus restoration efforts on water bodies still impaired, while maintaining performance conformation (M4) monitoring at water bodies now meeting WQOs.

Request: Use USEPA 2012 RWQC as basis for WQOs

Detailed Description of Request:

1. WQOs include Statistical Threshold Value (STV) and Geometric Mean (GM) expressions. STV only will be used for wet weather annual assessments (i.e., all wet weather results collected over a one-year period). GM will be used for dry weather assessment (separate wet and dry season assessments). Default to use of STV for dry weather assessment only if sample size is insufficient for assessing GM.
2. Sets TMDL WQOs based on USEPA's 2012 RWQC and proposed SWRCB criteria: Enterococci for marine waterbodies, and *E. coli* for freshwater waterbodies. Removes WQOs for total and fecal coliform.

San Diego Water Board Response:

1. Staff support using the USEPA criteria and recognize that the State Water Board proposes to update the REC-1 WQOs applicable in the San Diego Region. However, staff will recommend a Basin Plan amendment if the State Water Board efforts stall.

   For dry and wet weather, both GM and STV, calculated over the same evaluation periods, should be used to gauge water quality for the best protection of the REC-1 beneficial use. For dry weather, the evaluation periods can be a month or six weeks. For wet weather, the evaluation periods can be six months or a year.

   The USEPA 2012 RWQC recommendations, clearly state that "EPA's criteria recommendations are <u>both</u> for a GM and STV (<u>rather than just a GM or just an STV</u>) because used together they would indicate whether the water quality is protective of the designated use of primary contact recreation" and that "For dry weather, using the GM alone would not reflect spikes in water quality because the GM alone is not sensitive to them."

2. Rather than updating the TMDLs at this time, staff is proposing to update permits to be consistent with the statewide bacteria water quality objectives which is based on a risk protection level of 32 illnesses per 1,000 recreators (vs 36 illnesses per 1,000 recreators in the TMDL). This update would remove total coliform and would: only use *E. coli* as the sole indicator of pathogens in freshwater; enterococci as the sole indicator for saline inland surface waters, enclosed bays, and estuaries; and enterococci and fecal coliform in ocean waters.

Request: Revise TMDLs and allocations (flexible options)

Detailed Description of Request: The TMDL should provide flexible options to support implementation planning/compliance determination. This would include having concentration-based TMDLs/allocations that align with the three compliance pathways. Improve organization and discussion of implementation planning options (alternative expressions of the TMDLs and allocations).

San Diego Water Board Response: Staff is receptive to moving away from mass-load based allocations towards concentration-based allocations in permits that implement the TMDL. Expressing the bacteria TMDL in terms of concentration provides a better link between existing water quality and numeric water quality criteria (and associated acceptable level of illness). In addition, using concentration is consistent with water quality standards, which apply for a range of flow and environmental conditions.

Request: San Diego Water Board actions

Detailed Description of Request: Include recommended actions the San Diego Water Board may take to encourage collaboration among all responsible parties to participate in monitoring and human source reduction efforts. Action include incorporating discharge prohibitions into the Basin Plan, issuing WDRs, or issuing conditional waivers of WDRs.

San Diego Water Board Response: These actions are currently identified in the TMDL; however, staff will evaluate actions and make modifications as needed.