Reconsideration of Certain Technical Matters of the TMDL for Bacteria Indicator Densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel

STAFF REPORT

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1. Overview and Current Status of the Ballona Creek Bacterial Indicator Densities TMDL

This staff report presents technical analysis in support of recommendations to reconsider aspects of the Total Maximum Daily Load (TMDL) for bacterial indicator densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel (hereinafter BC Bacteria TMDL). Fecal indicator bacteria (including total coliform, *E. coli*, fecal coliform, and *enterococci*) are used to monitor the water quality of freshwater and marine and estuary waters designated for water contact recreation because local and national epidemiological studies have documented a linkage between elevated bacterial densities and adverse human health effects.

The goal of the BC Bacteria TMDL is to establish water quality targets and waste load and load allocations for sources of bacteria within the watershed that are protective of the designated water contact recreation use, and specify a program of implementation to address impairment of water quality due to elevated bacteria densities. The BC Bacteria TMDL covers Ballona Creek, Ballona Estuary, and their tributaries. Tributaries of the Ballona Creek and Estuary include Centinela Creek, Sepulveda Canyon Channel, and Benedict Canyon Channel.

The Los Angeles Water Board adopted the BC Bacteria TMDL on June 8, 2006 (Resolution No. R06-011). The BC Bacteria TMDL was approved by the State Water Resources Control Board (State Water Board) on November 15, 2006, the Office of Administrative Law on February 20, 2007, and the United States Environmental Protection Agency (USEPA) on March 26, 2007. This TMDL became effective on April 27, 2007, when the Certificate of Fee Exemption was filed with the Department of Fish and Game. The regulatory background, beneficial uses to be protected, geographical setting, and required TMDL elements along with supporting analysis were described in the 2006 staff report and amendment to the Water Quality Control Plan for the Los Angeles Region (Basin Plan). These documents are available on the Los Angeles Water Board website at:
http://www.waterboards.ca.gov/losangeles/water_issues/programs/tmdl/tmdl_list.shtml

The first bacteria TMDL adopted by the Los Angeles Water Board was the Santa Monica Bay Beaches Bacteria TMDL, adopted first for dry weather on January 24, 2002 (Resolution No. R02-004) and then for wet weather on December 12, 2002 (Resolution No. R02-022). Both Santa Monica Bay Beaches Bacteria TMDLs became effective on July 15, 2003. Ballona Estuary flows into the Santa Monica Bay, and its water quality affects the adjacent shoreline of Dockweiler Beach. Since the Ballona Creek watershed is a subwatershed of the Santa Monica Bay watershed management area, the technical approaches and implementation schedule proposed in this reconsideration of the BC Bacteria TMDL are consistent with the approaches and schedule being proposed in the reconsideration of the Santa Monica Bay Beaches Bacteria TMDL.

1.1 Implementation Tasks Specified in the Basin Plan

The BC Bacteria TMDL requires responsible jurisdictions and responsible agencies to implement tasks adhering to the schedule provided in Table 7-21.3 of the Basin Plan. These tasks are summarized in the following paragraphs:

12 months after the effective date of the TMDL (i.e., April 27, 2008)
Responsible jurisdictions and responsible agencies must submit, for Regional Board approval, a comprehensive bacteria water quality monitoring plan for the Ballona Creek Watershed.

Responsible agencies must submit, for Regional Board approval, separate comprehensive bacteria water quality monitoring plans for inputs from Del Rey Lagoon and the Ballona Wetlands to the Ballona Estuary.

2 ½ years after the effective date of the TMDL (i.e., October 27, 2009)
Responsible jurisdictions and agencies must provide a draft Implementation Plan to the Regional Board outlining how each intends to cooperatively achieve compliance with the dry-weather and wet-weather TMDL Waste Load Allocations.

Three months after receipt of Regional Board comments on the draft plan, responsible jurisdictions and agencies submit a Final Implementation Plan to the Regional Board.

3 years after the effective date of the TMDL (i.e., April 27, 2010)
If the responsible agency for the Del Rey Lagoon intends to pursue a natural source exclusion, it shall submit the results of separate natural source study for the Lagoon to the Executive Officer of the Regional Board. The study shall include a comprehensive assessment of all sources of bacteria loads to the Lagoon and estimates of their individual contributions. In addition, a determination of the number of exceedance days caused by these sources should be made.

1.2 Compliance with Implementation Tasks

The implementation tasks, which have been fulfilled by responsible jurisdictions and responsible agencies, are summarized below:

Coordinated Monitoring Plans

On April 23, 2008, the Regional Board received the Ballona Creek, Ballona Estuary, and Sepulveda Channel Bacteria TMDL Coordinated Monitoring Plan (Ballona CMP) and the Coordinated Monitoring Plan for Del Rey Lagoon (Del Rey Lagoon CMP). The Ballona CMP was prepared by the Monitoring Plan Sub-committee chaired by the City of Los Angeles. The Sub-committee consists of the County of Los Angeles, the Cities of Los Angeles, Culver City, Inglewood, Beverly Hills, West Hollywood, and Santa Monica, and the California Department of Transportation (hereinafter Ballona Creek Jurisdictional Group).

The Del Rey Lagoon CMP was submitted by the City of Los Angeles as the sole responsible agency for Del Rey Lagoon. The Ballona CMP and the Del Rey Lagoon CMP were submitted to comply with the 12-month requirements contained in the BC Bacteria TMDL to submit water quality monitoring plans for the Ballona Creek watershed and for Del Rey Lagoon.

On May 8, 2008, both CMPs were distributed for public comment, and stakeholder comments were received from Heal the Bay and Santa Monica BayKeeper. These CMPs were conditionally approved by the Regional Board Executive Officer on December 16, 2008, and resubmitted to the Regional Board on January 29, 2009 with the incorporated conditions. Based on this approval, the Ballona Creek Jurisdictional Group and the City of Los Angeles began weekly compliance sampling on June 25, 2009 for the Ballona CMP and Del Ray Lagoon CMP, respectively. The City of Los Angeles' Environmental Monitoring Division is responsible for monitoring and reporting data for both CMPs.

This staff report reviews the recent bacteria monitoring data collected under the CMPs and summarizes the number of days that the applicable single sample objective(s) is exceeded for three time periods in order to assess current conditions. These three periods are (1) summer dry-weather (April 1 to October 31), (2) winter dry-weather (November 1 to March 31), and (3) wet-weather (defined as days of 0.1 inch of rain or more plus three days following the rain event). A 1:1 *E. coli* to fecal coliform ratio was used to translate *E. coli* results to fecal coliform equivalents for comparison with REC-1 objectives for marine waters. Table 1 shows the results of this analysis.

Table 1. Compliance monitoring data (from June, 2009 through September, 2011)

		Single Sample Exceedances		
Sample Station	**Monitoring Location**	**Summer Dry Weather**	**Winter Dry Weather**	**Wet Weather**
BCB-1	Washington Blvd (Ballona Creek Reach 1)	16% (11/70)	3.6% (1/28)	24% (5/21)
BCB-2	Duquesne Ave (Ballona Creek Reach 2)	61% (43/70)	39% (11/28)	86% (18/21)
BCB-3	Duquesne Ave at confluence of Ballona Creek and Benedict Canyon (Benedict Canyon)	64% (45/70)	43% (12/28)	62% (13/21)
BCB-4	Culver Blvd (Sepulveda Channel)	91% (64/70)	93% (26/28)	100% (21/21)
BCB-5	Inglewood Blvd (Ballona Creek Reach 2)	60% (42/70)	54% (15/28)	86% (18/21)
BCB-6	McConnell Ave (Upper Ballona Creek Estuary)	91% (64/70)	93% (26/28)	100% (21/21)
BCB-7	Inglewood Blvd (Centinela Creek)	99% (69/70)	93% (26/28)	90% (19/21)

Sample Station	Monitoring Location	Single Sample Exceedances		
		Summer Dry Weather	Winter Dry Weather	Wet Weather
BCB-8	Pacific Ave (Lower Ballona Creek Estuary)	17% (12/70)	29% (8/28)	86% (18/21)
BCB-9	Tide gate (Del Rey Lagoon)	14% (10/70)	43% (12/28)	50% (10/20)

The allowable number of exceedance days specified in the BC Bacteria TMDL assumes that daily sampling is conducted. To determine the number of allowable exceedances for less frequent sampling, a ratio is used. Weekly samples were collected as part of the CMPs. From June 2009 to September 2011, samples were collected during three summer dry-weather periods, two winter dry-weather periods, and 21 wet-weather days. For the purposes of assessing current conditions in this reconsideration, the calculated exceedance frequencies for the three time periods were compared with the allowable exceedance frequencies in the existing TMDL. The TMDL adopted by Resolution R06-011 allows a zero (0) percent exceedance frequency in summer dry weather, a three (3) percent exceedance frequency in winter dry weather, and a 22 percent exceedance frequency in wet weather. For example, in Table 1 the single sample exceedance frequency for the summer dry-weather period at BCB-1 is determined as follows:

(11 days exceedance during the summer dry-weather period) / (70 sampling days during summer dry-weather period) = 16% exceedance frequency during summer dry-weather period at the BCB-1 station

According to the requirements in Table 7-21.3 of the Basin Plan, six years after the effective date of the TMDL (i.e., April 27, 2013), the responsible jurisdictions and responsible agencies shall achieve compliance with the allowable exceedance days for summer and winter dry-weather as set forth in the Basin Plan. Ten years after the effective date of the TMDL (i.e., April 27, 2017) or, at the discretion of the Regional Board if an Integrated Water Resources Approach is implemented, up to 15 years after the effective date (i.e., July 15, 2021), the responsible jurisdictions and responsible agencies shall achieve compliance with the allowable exceedance days during wet weather as set forth in the Basin Plan.

Implementation Plan

The County of Los Angeles, individually, and the City of Los Angeles, on behalf of the Ballona Creek Jurisdictional Group (excluding the County of Los Angeles), submitted draft coordinated implementation plans (IPs) to the Regional Board on October 26, 2009 and November 30, 2009, respectively (included as Appendix A to this report). The Regional Board released both draft IPs for public comment on February 24, 2010. Regional Board staff has not yet formally commented on the draft IPs; however, staff has reviewed the IPs and has determined that they meet the requirements of an Integrated

Water Resources Approach. Therefore, staff recommends that the deadline for achieving the final wet weather WLA (expressed as allowable exceedance days) is set at July 15, 2021. The final IPs will be submitted to the Executive Officer of the Regional Board after staff's review and comment on the draft IPs.

Since submittal of the implementation plans, responsible jurisdictions and agencies have pursued integrated approaches. In addition, through implementation of the Los Angeles County MS4 permit, the Regional Board can ensure that responsible parties are implementing the integrated approaches that they have outlined in their implementation plans. For example, if a responsible party intends to pursue action-based interim limits in the MS4 permit, they must submit and obtain approval of a reasonable assurance plan, and then they must implement that plan, subject to enforcement and/or numeric effluent limits. Through this process, the Regional Board can ensure that responsible parties are making timely progress towards achieving TMDLs.

Based on the fact that responsible parties submitted implementation plans outlining integrated approaches, that they are continuing to pursue integrated approaches, and that the Regional Board can ensure the integrated approaches are implemented through the MS4 permitting process, an extended wet-weather schedule is justified. Staff finds that all responsible parties should receive the same extended schedule because the TMDLs were developed with the understanding that it would take a collective effort to achieve waste load allocations. This is evident in the fact that the waste load allocations are expressed as receiving water limits. By assigning all responsible jurisdictions the same implementation schedule, continued collaborative implementation efforts are encouraged.

Implementation Actions done by Responsible Agencies

As part of this reconsideration, staff conducted a brief review of implementation actions conducted to date by responsible agencies.

The City of Los Angeles has completed the Mar Vista Recreation Center Stormwater Best Management Practices (BMPs) project funded by Proposition O. The BMPs include the installation of a flow diversion facility, a hydrodynamic separator, an underground detention tank, bioretention system, and chlorination contact tank for disinfection, which treats bacteria and other pollutants. The Westside Park Rainwater Irrigation Project funded by Prop O has completed in July 2011. This project is targeted to reuse rainwater to irrigate Westside Park and to reduce storm water pollution that currently flows to Ballona Creek and Santa Monica Bay. The city has also completed a downspout disconnection pilot program for 600 homes. The goal of this project is to significantly reduce the amount of precipitation that becomes runoff from the targeted residential areas.

The County of Los Angeles and City of Los Angeles adopted the Low Impact Development (LID) Ordinance in 2009 and 2011, respectively, to control storm water runoff from properties. The LID ordinances require new developments to implement practices that improve water quality and water conservation.

Optional Special Study for the Del Rey Lagoon

Based on the BC Bacteria TMDL, if the responsible agency for the Del Rey Lagoon and the Ballona Wetlands intends to pursue a natural source exclusion, it shall submit the results of a separate natural source study for the Lagoon to the Executive Officer of the Regional Board. The Regional Board has not received the source identification study. Therefore, consideration of a natural source exclusion for bacteria loading from Del Rey Lagoon and the Ballona Wetlands is not part of this BC Bacteria TMDL reconsideration.

1.3 Other Technical Studies

In addition to the required tasks in the Basin Plan, at the time the BC Bacteria TMDL was adopted and approved, there were certain on-going technical studies regarding the reference watershed, rainfall conditions, and reference year used in the calculation of allowable exceedance days. The Regional Board has incorporated findings from these studies to re-evaluate the allowable dry-weather and wet-weather exceedance days based on additional data.

2. Purpose of this Reconsideration

While the Regional Board can amend the Basin Plan to adjust a TMDL at any time, implementation schedules for TMDLs in the Los Angeles Region have often included scheduled "reconsiderations" by the Regional Board at a specific point during implementation. Specific reconsiderations have been included so that aspects of the TMDL, or the TMDL implementation schedule, could be adjusted based on anticipated new information or methods. This approach has allowed the Regional Board to establish TMDLs with all the required elements, including numeric targets, allocations, and implementation schedules, so that responsible parties could begin implementing the TMDL to improve water quality, while acknowledging the potential benefit to refining certain technical elements of the TMDL or the implementation schedule after additional study and data collection were completed.

This reconsideration is not a general reconsideration of all the elements of the BC Bacteria TMDL, but a re-examination of certain technical issues which, as recognized at the time of TMDL adoption, might need revision upon further data collection and analysis, study or experience. Table 2 outlines the technical matters to be reconsidered as specified in the BC Bacteria TMDL. The geographical extent, principal structure and approach of this TMDL are not being reconsidered in this action. The technical basis of the BC Bacteria TMDL adopted by Resolution R06-011 is contained in the report entitled "Total Maximum Daily Load for Bacterial Indicator Densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel", and is included as Appendix B to this report.

Table 2. Summary of Reconsideration Elements specified in the BC Bacteria TMDL

Date	Action
4 years after effective date of the TMDL (i.e., April 27, 2011)	The Regional Board shall reconsider this TMDL to: (1) Re-assess the allowable winter dry-weather and wet-weather exceedance days based on a re-evaluation of the selected reference watershed and consideration of other reference watersheds that may better represent reaches of Ballona Creek and Estuary, (2) Consider whether the allowable winter dry-weather and wet-weather exceedance days should be adjusted annually dependent on the rainfall conditions and an evaluation of natural variability in exceedance levels in the reference system(s), (3) Re-evaluate the reference year used in the calculation of allowable exceedance days, and (4) Re-evaluate whether there is a need for further clarification or revision of the geometric mean implementation provision. (5) Consider natural source exclusions for bacteria loading from Del Rey Lagoon and the Ballona Wetlands based on results of the source identification study. (6) Re-assess WLAs for Benedict Canyon Channel, Sepulveda Channel, and Centinela Creek based on results of the required compliance monitoring, and/or any voluntary beneficial use investigations.

3. Technical Matters to be Reconsidered as Specified in the BC Bacteria TMDL

This section discusses the Regional Board's evaluation of each of the technical matters specified in Table 2.

3.1 Reference Watershed and Allowable Dry-Weather and Wet-Weather Exceedance Days

Reference Watershed

The reference watershed approach is based on a statistical analysis of the historical exceedance frequency observed at a reference system. The allowable number of exceedance days is based on the historical exceedance frequency in the reference system (expressed as a percentage) multiplied by the number of dry- and wet-weather days in the 90th percentile year (in terms of wet-weather days).

When the BC Bacteria TMDL was originally adopted in 2006, Leo Carrillo Beach was selected as the reference system to determine the allowable number of exceedance days for the Ballona Creek watershed due to the lack of bacteria data from a freshwater reference system in the Los Angeles region at that time. Arroyo Sequit Canyon, which drains to Leo Carrillo Beach, is approximately 12 square miles in size and is almost entirely undeveloped open space (98% of land use). This beach and corresponding drainage system was selected for three reasons: (1) Arroyo Sequit is the most undeveloped subwatershed in the Santa Monica Bay watershed management area, (2) there is a freshwater outlet (creek), which drains to the beach, and (3) a sufficient historical shoreline monitoring dataset for this system was available.

However, it was recognized that Leo Carrillo Beach was not the most representative reference site for freshwater systems in the Los Angeles region. In this reconsideration, Regional Board staff proposes to use data from freshwater reference systems that is now available for southern California.

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

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

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

Table 3. Estimated Exceedance Probabilities for the Freshwater Reference System for the Ballona Creek and its Tributaries

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

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

Allowable Dry-Weather and Wet-Weather Exceedance Days

This BC Bacteria TMDL sets the number of allowable exceedance days for each reach or tributary to ensure that two criteria are met: (1) bacteriological water quality at any site is at least as good as at a designated reference site, and (2) there is no degradation of existing bacteriological water quality.

As in previous bacterial TMDLs in the Los Angeles Region, allowable exceedance days were calculated with the smaller of the two exceedance probabilities, that of the targeted site or the reference site. In the case of this BC Bacteria TMDL, the smaller of the exceedance probabilities for all sites (Table 1) was that of the reference site and that value was used in subsequent calculations.

To translate the exceedance probabilities into allowable exceedance days, the number of wet-weather days and the number of dry-weather days in the 90th percentile storm year, based on historical rainfall data from the Los Angeles International Airport (LAX) meteorological station, were used. The wet-weather days are defined as days of 0.1 inch of rain or more plus three days following the rain event. The storm year is defined as November 1 to October 31.

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

Allowable Exceedance Days

= Exceedance Probability in a Reference System × Number of Days in a Reference Year (Equation 3.1)

The site-specific exceedance probability is taken directly from the data analysis presented in Table 1. Based on rainfall data from the LAX meteorological station, 1993 is the reference year. As described in previous documents, the exceedance probability is appropriate, since the weekly sampling is systematic and the rain events are randomly distributed; therefore, sampling will be evenly spread over the dry- and wet-weather events (i.e., the rain day, day after, 2nd day after, 3rd day after) (Schiff et al., 2002).

Using Equation 3.1, the exceedance probability of the freshwater reference system is translated to exceedance days as follows. The exceedance probability of 0.016 for dry weather is multiplied by 290 days, the number of dry weather days in the 1993 storm year, resulting in five (5) exceedance days (4.64 rounded to the next whole integer) when daily sampling is conducted. The exceedance probability of 0.19 for wet weather is multiplied by 75 days, the number of wet weather days in the 1993 storm year, resulting in 15 exceedance days (14.3 rounded to the next whole integer) when daily sampling is conducted.

To estimate the number of exceedance days at the freshwater reference system in the reference year under a weekly sampling regime for dry weather and wet weather, the number of days was adjusted by solving for x and y in Equation 3.2 and 3.3, respectively, as follows:

$$\frac{290\ days}{365\ days} = \frac{x}{52\ weeks}$$ (Equation 3.2 for dry weather)

$$\frac{75\ days}{365\ days} = \frac{y}{52\ weeks}$$ (Equation 3.3 for wet weather)

For dry weather, solving for x equals 41.3, which is then multiplied by 0.016, resulting in one (1) exceedance day (0.661 rounded to the next whole integer) during dry weather when weekly sampling is conducted. For wet weather, y equals 10.7 multiplied by 0.19, resulting in two (2) exceedance days (2.03 rounded to the previous whole integer) during wet weather when weekly sampling is conducted. Consistent with the Santa Monica Bay Beaches Bacteria TMDL, where the fractional remainder for the calculated allowable exceedance days equals or exceeds $1/10^{th}$, then the number of days are rounded up (e.g., 14.3 is rounded up to 15). In instances where the tenths decimal place for the allowable exceedance days (or weeks or months) is lower than $1/10^{th}$, then the number of days are rounded down (e.g., 2.03 is rounded down to 2). The dry- and wet-weather allocations for the Ballona Creek and its tributaries for the single sample targets are listed in Table 4(a).

To estimate the number of allowable exceedance days in the Ballona Estuary, the exceedance probability of 0.104 for winter dry-weather is multiplied by 80 days, the number of winter dry-weather days in the 1993 storm year, resulting in nine (9) exceedance days (8.32 rounded to the next whole integer) when daily sampling is conducted. The exceedance probability of 0.22 for wet weather is multiplied by 75 days, the number of wet-weather days in the 1993 storm year, resulting in 17 exceedance days (16.5 rounded to the next whole integer) when daily sampling is conducted. The summer dry-, winter dry-, and wet-weather allocations for the Ballona Estuary for the single sample targets are listed in Table 4 (b).

Table 4. Allowable Exceedance Days for Daily and Weekly Sampling based on the Reference Year

(a) Ballona Creek and its Tributaries

Allowable Number of Exceedance Days	Daily Sampling	Weekly Sampling
Dry weather	**5**	**1**
Wet Weather	**15**	**2**

(b) Ballona Estuary

Allowable Number of Exceedance Days	Daily Sampling	Weekly Sampling
Summer Dry-Weather	**0**	**0**
Winter Dry-Weather	**9**	**2**
Wet Weather	**17**	**3**

Recommendation

It is recommended that the exceedance probabilities for freshwater reference systems in Table 3 are used to determine the allowable exceedance days for Ballona Creek and its tributaries in this TMDL reconsideration. Based on these exceedance probabilities, the recommended allowable dry- and wet-weather exceedance days for the single sample targets, shown in Table 4(a), are applied to this TMDL reconsideration.

For the Ballona Estuary, it is recommended that the exceedance probabilities at the Leo Carillo reference beach are used to determine the allowable exceedance days in this TMDL reconsideration. Based on these exceedance probabilities, the recommended allowable summer dry-weather, winter dry-weather, and wet-weather exceedance days for the single sample targets, shown in Table 4(b), are applied to this TMDL reconsideration.

3.2 Exceedance Days Adjusted Annually Dependent on the Rainfall Conditions

Regional Board staff recognizes that the number of dry-weather and wet-weather days will change from year-to-year and, therefore, the exceedance probability of 0.016 for dry weather and 0.19 for wet weather will not always equate to the same number of exceedance days.

Allowable exceedance days were set using the exceedance rates for dry and wet weather at the reference system and the number of days of dry and wet weather in the reference year. An alternative method that could be used to set allowable exceedance days is to use the actual number of wet and dry days from the current year and not a reference year.

This approach could use the actual number of wet and dry days or a rolling average of wet and dry days over several years. This approach would be more tailored to the unique conditions during each year, but would not provide as much certainty with regard to addressing the critical wet-weather condition.

This approach may be considered more protective during wet weather as it would allow fewer wet weather exceedances in years with less precipitation (most years would have fewer wet weather days than the 90th percentile year.) On the other hand, under drier conditions, the approach would allow a greater number of exceedances during dry weather. Generally, it is expected that the reference year conditions will be used for implementation planning, therefore, while fewer wet weather exceedances might be allowed under this approach, measures to address the 90th percentile reference year conditions should be adequate to address wet weather in drier years, too.

Recommendation

Staff does not recommend adjusting the allowable number of exceedance days annually based on the number of dry- and wet-weather days in a particular year. This is because it would be difficult to design BMPs and diversion or treatment facilities to address such variability from year to year. Staff expects that by designing facilities for the 90th percentile year, during drier years there will most likely be fewer exceedance days than the maximum allowable. Therefore, staff proposes no change to the approach of setting the allowable number of exceedance days based on the 90th percentile year.

3.3 Reference Year (Critical Condition)

The BC Bacteria TMDL identified the critical condition generally as wet weather and further defined a critical condition within wet weather in order to set the allowable number of exceedance days of the single sample limit. The 90th percentile storm year in terms of wet days was defined as the specific wet weather critical condition, and is referred to as the 'reference year'.

Based on an examination of historical rainfall data from the LAX meteorological station, 1993 was chosen as the reference year because it is the 90th percentile year in terms of wet weather days, based on 54 storm years (1948-2001) of rainfall data from LAX. In the 1993 storm year, there were 75 wet-weather days and 290 dry days.

For this reconsideration, staff evaluated additional rain data, from 1948 to 2008 (Appendix D), and determined that the 90th percentile year in this expanded dataset is 1958. The year 1958 storm year had 74 wet days in comparison to the 75 wet days of 1993.

Staff finds that the number of allowable exceedance days during wet weather, as calculated using the exceedance probability for the freshwater reference system, would not change using 74 wet days instead of 75 wet days in the calculation. Data from the freshwater reference system show that the wet-weather exceedance probability is 0.19. This exceedance probability multiplied by 75 wet days results in 15 allowable exceedance days (14.3 rounded to the next whole integer). This exceedance probability multiplied by 74 wet days results in 15 exceedance days (14.1 rounded to the next whole integer).

Recommendation

Due to the value of continuity for planning and design of BMPs, and the lack of impact on allowable exceedance days, staff does not recommend changing the reference year of 1993 as the critical condition.

The critical condition and number of wet days (or dry days) to be used in calculations of allowable exceedances will stay the same.

3.4 Revision of the Geometric Mean Calculation

The geometric mean, or geomean, is a method of calculating a mean which uses the log-transformation of the bacteria concentration data. A geometric mean, unlike an arithmetic mean, tends to dampen the effect of very high or low values. Because bacterial concentrations can often vary by orders of magnitude, this calculation returns a parameter which is a better representation of the central tendency of the data and more meaningful in statistical evaluations than an arithmetic mean.

The geometric mean objective for bacteria is usually a more reliable measure of long term water quality than single sample criteria. It is also directly linked to the underlying epidemiological studies upon which the bacteria water quality objectives were based.

The Basin Plan geometric mean objectives for marine waters designated for Water Contact Recreation (REC-1) are as follows:

a. Total coliform density shall not exceed 1,000/100 ml.
b. Fecal coliform density shall not exceed 200/100 ml.
c. *Enterococcus* density shall not exceed 35/100 ml.

The Basin Plan geometric mean objective for fresh waters designated for either Water Contact Recreation (REC-1) or Limited Water Contact Recreation (LREC-1) is:

E. coli density shall not exceed 126/100 ml,

The Basin Plan geometric mean objective for Non-Contact Water Recreation (REC-2) is:

Fecal coliform density shall not exceed 2000/100 ml.

In addition, the Basin Plan includes an implementation provision for the geometric mean objectives: *"The geometric mean values should be calculated based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period)."*

USEPA's 1986 Ambient Water Quality Criteria for Bacteria (USEPA, 1986) also specifies "...a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period)...." USEPA's draft Recreational Water Quality Criteria (USEPA, 2011) does not specify the number of samples but recommends periods of 30 to 90 days.

The following is a discussion of the analysis regarding number of samples required and rolling calculations versus discrete calculations to provide further clarification or revision of the geometric mean implementation provision.

Calculation of Rolling Geometric Means

The current standard method used in the BC Bacteria TMDL is:

The rolling 30-day geometric mean is calculated on a daily basis. All data including wet-weather, data are included in the geometric mean calculations. The calculation is rolled forward on a daily basis and a geometric mean value is computed given 5 samples or more within that 30-day time frame.

Sampling data as analyzed in the laboratory may typically include both an upper and lower bound sample detection limit depending on the testing method used or the limitations of the testing laboratory. Where the sample result exceeded the method upper limit, that data point is taken as the method upper limit; where the sample result fell below the method lower detection limit, that data point is taken as the lower detection limit. (Other alternative values to the lower detection limit are discussed in the next section.)

In some cases, geometric means have been calculated just for the summer or winter weather period for comparison. In that case, the first geometric mean value has been calculated on April 30th for the summer period in order to include only data collected during the defined summer period, which begins April 1.

In this re-consideration, six alternative methods of calculating geometric mean were evaluated and are presented in detail in Appendix E. Four alternative methods are contrasted in the following discussion.

Method (1): Calendar month (30-day periods, any number of samples per period, one calculation every month). In this calculation method, a discrete calendar month is used for the time period and 4 or 5 samples are used to calculate one geometric mean result for the month. Geometric means do not roll forward and each calculated geometric mean is independent of others. However, information regarding increases or decreases during the month is lost. This method is the same as is usually applied for 303(d) listing purposes under the Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) list (SWRCB, 2004).

Method (2): Standard method (rolling 30-day period, 5 or more samples per 30 days, a calculation every day). This is the method used in the development of this TMDL and that is in use, currently, for compliance.

Method (3): Calculation only on sampled days (rolling 30-day period, 5 or more samples per 30 days, a calculation every *sampled* day).

Method (4): Four samples/calculation only on sampled days (rolling 30-day period, 4 or more samples per 30 days, a calculation every *sampled* day).

Data from the Santa Monica Bay Beaches reconsideration were used to determine the appropriate method for calculating the geometric mean in the BC Bacteria TMDL (Table 5). Data from five different shoreline sites in the Los Angeles Region were used in the analysis. In addition, data from Dockweiler Beach were compiled in two different ways:

CL) County Line Beach, one day per week sampled, 54 months
SP) Surfers Point, one day per week sampled, 54 months

SK) Surfers Knoll, one day per week sampled, 54 months
LB) Long Beach-Mothers Beach, one day per week sampled, 30 months
D5) Dockweiler, 5 days a week sampled, 49 months
DW) Dockweiler, one day of sampling per week analyzed, i.e. Wednesdays only, 49 months

Table 5. Percent of Exceedances of Geometric Mean, at Selected Shoreline Monitoring Sites

	Method:			
Site:	1	2	3	4
CL	**1.9**	0.0	0.0	0.0
SP	39.6	**45.3**	30.5	30.3
SK	18.9	**28.2**	15.1	15.8
LB	63.3	69.6	**70.3**	66.2
D5	59.2	61.1	**63.1**	63.0
DW	57.1	58.7	58.7	**59.6**

The highest percent geometric mean exceedance per site is in bold

The calculation method does not result in largely different estimations of exceedances percentages. While Surfers Knoll differs by 13.1% (15.1% to 28.2%) depending on the method of geometric mean calculation, Dockweiler Beach has very similar exceedance percentages for each method (57.1% to 59.6%). Additionally, the discrete, calendar month method, resulted in similar exceedance percentages as the rolling methods. This conclusion is in keeping with the comparison of rolling averages or calendar month averages for compliance determination conducted by the State Water Resources Control Board for several contaminants other than bacteria (Saiz, 2005).

Any of these calculation methods could be used to measure long term water quality.

The standard method is conservative. The Regional Board standard method often results in the highest or second highest exceedance percentage.

As observed before, the number and percentage of single sample exceedances are fewer and less than the number and percentage of geometric mean exceedances (data not shown in this summary, see Appendix E).

Any method that curtails the frequency with which the geometric mean is calculated such as a method where the geometric mean is calculated on sampled days only (Method 3), lowers the total number of exceedances in comparison to methods where the geometric mean is calculated everyday (Method 2) even where the exceedance *rate* of the different methods is virtually the same (data not shown in this summary, see Appendix E). Therefore, if the method of calculation of geomeans includes calculating geomeans only on sampled days, the method may disincentivize more frequent sampling, especially on beaches with a high geometric mean exceedance rate where the high exceedance rate ensures that more calculations means more exceedances/violations.

One way to reduce the disincentive for more frequent sampling when using a calculation method which calculates on only sampled days would be to calculate at the same frequency as regular sampling without adding additional calculations for additional or accelerated samples. For example, Method 3 (calculation only on sampled days (rolling 30 day period, 5 or more samples per 30 days, a calculation every *sampled* day), would be instead **Method 3a**, calculation weekly (rolling 30 day period, 5 or more samples per 30 days, a calculation every *week*). Additional samples would be included in the geometric mean calculations, but no additional calculations would be made. A weekly calculation is many fewer calculations than a daily calculation, but there is no disincentive for accelerated samples or disadvantage to beaches which conduct daily samples routinely.

It is common when examining beach bacteria data in Southern California to divide the data into summer dry-, winter dry- and wet-weather data. Heal the Bay uses these 'seasons' to calculate and present beach grades in their Beach Report Card. In addition, these seasons are used in a regulatory fashion by this Regional Board to determine compliance with allowable exceedance days of the bacteria single sample objectives.

For the single sample objectives, there are different allowable exceedance rates in summer dry, winter dry and wet weather. However, unlike the single sample objectives, there is no allowable exceedance rate for the geometric mean objectives and therefore, no difference between seasons. The rolling geometric mean rolls through the calendar or seasonal boundaries and is held to the same standard (zero exceedances) in all seasons. In addition, as the geometric means expresses the overall risk of exposure during a 30-day period including dry and wet weather, if any, a dry weather-only calculation is artificial. USEPA's draft Recreational Water Quality Criteria (USEPA, 2011) recommends use of both wet and dry weather, stating, "Sampling of waterbodies should be representative of meteorological conditions (e.g., wet and dry weather)."

While the rate of exceedance of the geometric mean standards does not change very much depending on method, the number of exceedances, and, potentially, violations of a permit requirement, may differ greatly depending on the geometric mean calculation method. For example, in this 2.5 year data set, at Dockweiler Beach, a beach which has a high exceedance rate of the geometric mean, the standard method (Method 2) resulted in 252 exceedances of the geometric mean objective for the three bacterial indicators; the sample days only method (Method 3) resulted in 126 exceedances; and the non-rolling calendar month method (Method 1) resulted in 49 exceedances. See Appendix E.

The Basin Plan Chapter 3, Implementation Provisions for Water Contact Recreation Bacteria Objectives specifies "*generally not less than 5 samples equally spaced over a 30 day period*..." The standard method used by his Regional Board has explicitly required at least 5 samples. When 5 samples are required under a weekly sampling regime, the occasional missed sampling day or sample lost during analysis may mean that a geometric mean cannot be calculated at all for that 30-day period because there are fewer than 5 samples to include in the calculation. Requiring only 4 samples increases the ability to consistently calculate geometric means, but, also, results in some loss of the accuracy of the calculation. Alternatively, using a longer than 30 day period for the calculation of the geometric mean can also ensure sufficient samples for a minimum 5 sample geometric mean under a weekly sampling regime.

It is important to note that some beaches do not exceed the geometric mean criteria. County Line beach, for example, had zero exceedances of the geometric mean criteria by the standard method.

Dockweiler Beach data was compiled two different ways before analysis; the full data set with 49 months of five-day-a-week data was analyzed, and also a data set of one-day-a-week data (just Wednesday data) was analyzed. Little difference was found, suggesting that with sufficient data, weekly sampling is sufficient to characterize the exceedance rates and variability in water quality at a beach.

Recommendation

To calculate *rolling* geometric means, calculate a geometric mean weekly using 5 or more samples (Method 3a) for rolling six week periods. For consistency, start all calculation weeks on Sunday.

Calculation of Non-Rolling Geometric Means

Previously the Regional Board has required the use of rolling 30-day geometric means. This was due in part to USEPA's stated expectation that most states will calculate the geometric mean as a rolling average. However, USEPA has given states discretion to consider discrete calendar or seasonal geometric means. USEPA's draft Recreational Water Quality Criteria (USEPA, 2011) does not specify rolling or discrete geomentric means. In addition, USEPA, through their current re-evaluation of the Recreational Waterbody standards, has explored the application of non-rolling, seasonal geometric means.

Non-rolling or discrete calculations such as a monthly or seasonal calculation are temporally independent of each other. With a rolling calculation, one calculation will use much the same data as the previous calculation which used much the same data as the calculation previous to that. The State Water Resources Control Board's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (Listing Policy) (SWRCB, 2004) requires that data used for listing decisions be temporally independent.

Staff considered assessing the geometric mean objectives on a purely seasonal basis (winter and summer for southern California), but found that given the length of the southern California summer season (April through October) and the differences in precipitation and flow patterns between months within the seven-month summer season in particular, it was justifiable to assessing geometric means on a more frequent, sub-season, basis. Since the exceedances are largely driven by precipitation and/or flow from streams or storm drains, staff considered several sub-seasonal alternatives, which group the months of the year into sub-seasons on the basis of precipitation.

Data from the Santa Monica Bay Beaches reconsideration were used to assess the use of seasonal and monthly geometric means for the BC Bacteria TMDL. Tables 6, 7, and 8 show the number of exceedances of geometric means at Leo Carrillo Beach based on different seasonal and monthly periods.

These alternatives split the seasons differently. These values were also compared to the number of monthly precipitation days at the LAX rain gage. The monthly precipitation day charts and tables for the LAX rain gauge are included the Appendix F.

This analysis used 6 years of data in discrete (i.e. non-rolling) calculations; therefore for each period considered, there were 6 calculations for each objective, total coliform, fecal coliform and *enterococcus*. For example, in Alternative 1, Table 6, there were 6 April-May periods in the 6 years of data, so the geometric means for total coliform, fecal coliform and *enterococcus* were calculated 6 times each revealing two exceedances of the *enterococcus* geometric mean standard.

Alternative One includes two summer "shoulder" sub-seasons of early summer: April - May and late summer: September - October, a midsummer sub-season of June through August, and one winter season.

Table 6. Seasonal Geometric Means at Leo Carrillo Beach, Alternative 1

Leo Carrillo Beach Seasonal Geometric Mean November 2004 to October 2010					
Month	**Total Coliform**	**Fecal Coliform**	***enterococcus* MDL10[1]**	***enterococcus* MDL3.7[2]**	**Sum of Number of Precipitation days[3]**
April – May	0	0	2	2	15
June-August	0	0	0	0	1
September - October	0	0	0	0	14
November – March	0	0	1	1	101

[1]MDL 10 refers *enterococcus* calculated with a method detection limit of 10 Most Probable Number per 100 milliliters
[2]MDL 3.7 refers *enterococcus* calculated assuming a method detection limit of 3.7 Most Probable Number per 100 milliliters
[3]Precipitation day refers to any day with 0.1 inch of rain or greater

Alternative Two includes two summer "shoulder" sub-seasons of early summer; April - May and late summer: September - October, includes a separate geometric mean for the mid-summer months of June, July and August and two winter seasons.

Table 7. Seasonal Geometric Means at Leo Carrillo Beach, Alternative 2

Leo Carrillo Beach Seasonal Geometric Mean November 2004 to October 2010					
Month	**Total Coliform**	**Fecal Coliform**	***enterococcus* MDL10[1]**	***enterococcus* MDL3.7[2]**	**Sum of Number of Precipitation days[3]**
April - May	0	0	2	2	15
June	1	1	2	1	0
July	0	0	0	0	1
August	0	0	0	0	0
September - October	0	0	0	0	14
November – December	0	0	0	0	30
January - March	2	0	1	1	71

[1]MDL 10 refers *enterococcus* calculated with a method detection limit of 10 Most Probable Number per 100 milliliters
[2]MDL 3.7 refers *enterococcus* calculated assuming a method detection limit of 3.7 Most Probable Number per 100 milliliters
[3]Precipitation day refers to any day with 0.1 inch of rain or greater

Alternative Three includes a separate geometric mean for all-summer months and three winter sub-seasons. In this alternative, April is treated as a winter month.

Table 8. Seasonal Geometric Means at Leo Carrillo Beach, Alternative 3

Leo Carrillo Beach Seasonal Geometric Mean November 2004 to October 2010					
Month	**Total Coliform**	**Fecal Coliform**	***enterococcus* MDL10[1]**	***enterococcus* MDL3.7[2]**	**Number of Precipitation days**
May	1	0	2	2	5
June	1	1	2	1	0
July	0	0	0	0	1
August	0	0	0	0	0
September	0	0	0	0	3
October	0	0	0	0	11
November – December	0	0	0	0	30
January – February	1	0	1	1	65
March – April	1	0	1	0	16

[1]MDL 10 refers *enterococcus* calculated with a method detection limit of 10 Most Probable Number per 100 milliters
[2]MDL 3.7 refers *enterococcus* calculated assuming a method detection limit of 3.7 Most Probable Number per 100 milliters

Seasonal geometric means are consistent with the intent of the reference system/antidegradation approach and USEPA's current thinking on the expression of the recreational water quality criteria. USEPA's draft Recreational Water Quality Criteria (USEPA, 2011) recommends geometric mean calculation periods of 30 to 90 days. Both alternatives Two and Three include periods between 30 and 90 days and no greater than 90 days.

Higher concentrations of bacteria are associated with wet weather and winter months experience wet weather more frequently. In many cases, the higher levels of bacteria experienced in wet weather are *much* higher than typical dry-weather concentrations (e.g. 100 times more or 1,000 times more). For that reason, calculating the geometric mean over the longer periods (i.e. the 60 day or 90 day periods) during winter will express the overall risk of exposure during the period more accurately and will be a more appropriate calculation for geometric mean compliance.

This Region's reference system approach allows more frequent exceedances of the single sample objective during winter and during wet weather (principally in winter). Using a longer period for geometric mean calculation during the times when more excursions above the single sample objective are allowed, corresponds, then, to the approach taken for compliance with the single sample objectives.

Alternative Three differs from Alternative Two in that no period of calculation is longer than 60 days and that April, a summer month for single sample exceedance day allowances, is grouped with March, a winter month. Staff has included April with the winter periods in Alternative Three because of the frequent wet- weather events and resulting higher exceedance day frequency in April.

This comparison of calculation methods used data from Leo Carillo, so it was expected that the geometric mean exceedance rate would be low and exceedances infrequent. Depending on the method, the exceedance rate of the geometric mean (including potential exceedances of total coliform, fecal coliform and *enterococcus*) varied between 4 and 6 percent.

Staff continues to recommend allowing no exceedances of the geometric mean objectives as calculated for these seasons/sub-seasons.

Use of seasonal geometric means would not change any target, allowed exceedance rate or allocation and would not represent a need for significantly greater or smaller reductions in bacterial densities and would not require greater or lesser implementation actions on the part of responsible parties.

Recommendation

Include the option of assessing geometric means on a seasonal/sub-seasonal basis in the Basin Plan, Chapter 3 “Water Quality Objectives.”

To calculate discrete geometric means, calculate a seasonal geometric mean such that a separate geometric mean is calculated for all summer months and for three winter sub-seasons where April is included as a winter month consistent with Alternative Three.

Staff continues to recommend allowing no exceedances of the geometric mean objectives as calculated for these seasons/sub-seasons.

Application of Rolling Geometric Mean Calculation or Discrete Geometric Mean Calculation

Two principal types of error are possible when determining whether a waterbody is meeting the geometric mean standard: 1) determining the waterbody *does not* meet water quality standards when it *does* and 2) determining the beach *does* meet water quality standards when it *does not*.

A rolling geometric mean may in some cases determine a waterbody does not meet standards when it does. For example, a single very high sample can influence the geometric mean calculation week after week into a period where the water quality is, in fact, meeting standards.

Alternatively, a discrete geometric mean can in some cases, arbitrarily split a period of low water quality such that the geometric mean calculation determines the waterbody does meet water quality standards when there was a period when it did not. While a discrete geometric mean calculation may adjust the periods of calculation according to seasons and weather or rainfall patterns in an appropriate manner, the exact boundaries between seasons may be arbitrary. Using seasonal Alternative Three, above, as an example, low water quality results from the last week in October, would be separated from low water quality results in the beginning of November and since the late October-early November time period is never assessed on its own, the period of low water quality is not identified.

In the superior interest of not failing to identify water quality impairment, the rolling geometric mean calculation is preferred. This is consistent with the discussion of listing and delisting decisions in the Functional Equivalent Document for the Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) list (SWRCB, 2004).

Recommendation

For the BC Bacteria TMDL, calculate *rolling* geometric means; calculate a geometric mean weekly using 5 or more samples (calculation Method 3a, above) for rolling six week periods. For consistency, start all calculation weeks on Sunday.

The revised method for assessing compliance with the geometric means should be reflected in updated monitoring plans, which should be submitted for Executive Officer consideration.

Geometric Means Calculated with the *Enterococcus* Detection Limits

There are several USEPA-approved methods to measure the number of *enterococcus* bacteria in a water sample including membrane filtration and the chromogenic method, Enterolert by IDEXX. Enterolert is usually preferred because it is faster and less expensive. However, the Enterolert method has a higher method detection limit than the membrane filtration method.

The calculation method for the geometric mean requires the use of the detection limit as a substitute for the sample result when the sample result shows that the sample is at, or below, the detection limit (a non-detect result). The resulting geometric mean is higher than it might be if the actual sample result was known. This is the conservative calculation method. However, because the *enterococcus* geometric mean objective of 35 mpn/100ml is close to the Enterolert detection limit of 10 mpn/100ml and because the results of many water samples are at, or below, the detection limit, the difference between calculating the geometric mean using the detection limit for non-detect samples and using another substitute, such as zero or half the detection limit, may be meaningful.

The City of Los Angeles Environmental Monitoring Division evaluated data from seven beach monitoring sites of Jurisdictional Groups 5 and 6 (the northern border of Manhattan Beach to southern border of Torrance). The data, collected between January 1, 1996 and October 31, 2004, was analyzed by membrane filtration (detection limit: 1 mpn/100ml), and included 3179 samples of which 2135 had a concentration between 1 and 9 mpn/100ml. Assuming a normal distribution of the log results, 90% of results reported as less than 10 would be less than 3.7. Therefore, the Jurisdictional Groups for the Santa Monica Bay Beaches Bacteria TMDLs have suggested using 3.7 mpn/100ml as the result in geometric mean calculations when the Enterolert result is less than the detection limit of 10mpn/100ml (Jurisdictional Groups, 2009).

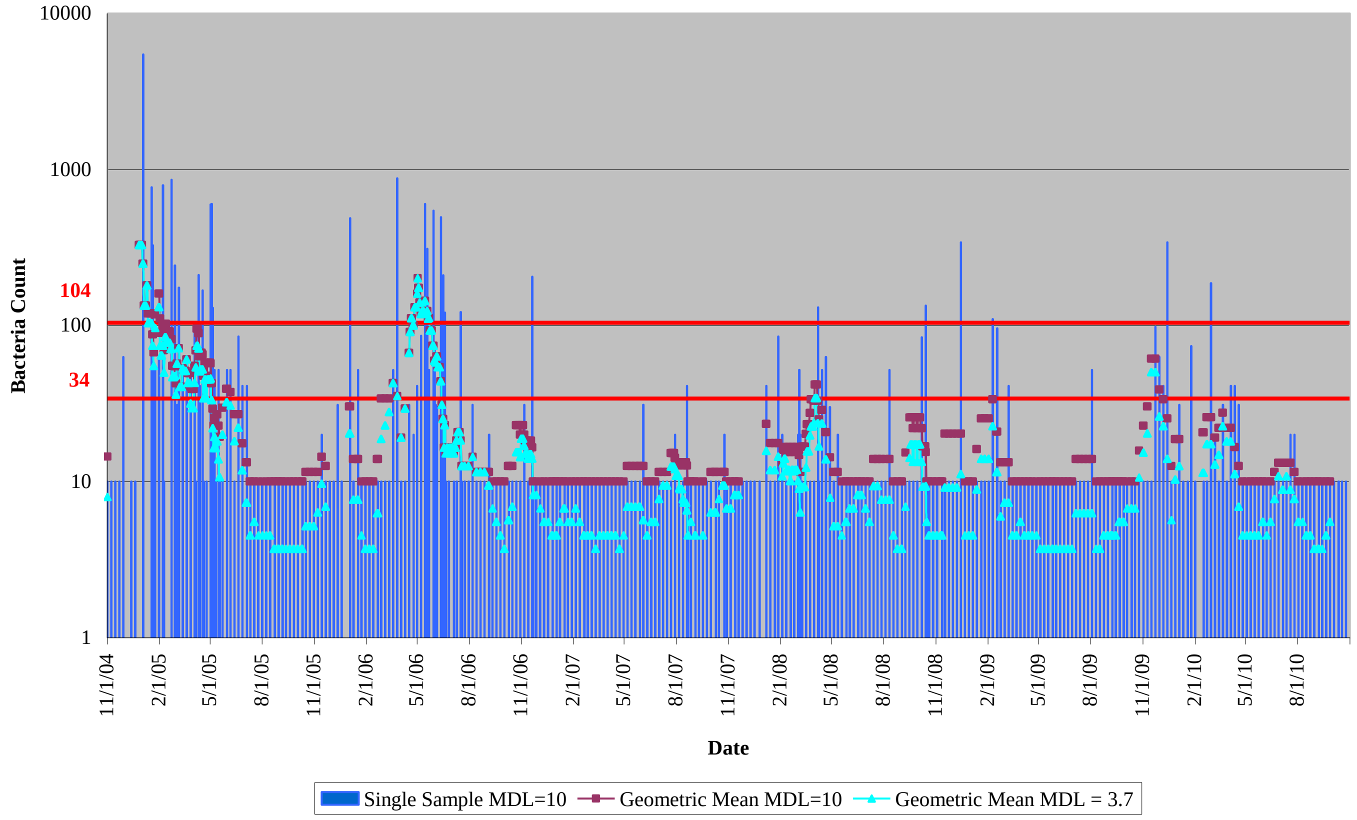
Table 9 and Figure 1 show the difference between calculating the rolling geometric mean using the method detection limit of 10 mpn/100 ml in calculations when the actual result is below the detection limit and using 3.7 mpn/100 ml as a substitute for 10 in the calculation. The percent of exceedances of the rolling geometric mean at Leo Carrillo Beach decreased from 23.47% to 20.64%. Because no exceedance of the geometric mean is allowed, the recalculation of the geometric mean does not affect any allowable exceedance rate.

Table 9. Geometric Means Calculated with New Point Zero Data at Leo Carrillo Beach

Leo Carrillo Beach November 2004 - October 2010 Exceed % (Exceed Count/Sample Count)			
Total Coliform	**Fecal Coliform**	***enterococcus* MDL10[1]**	***enterococcus* MDL3.7[2]**
21.93% (186/848)	1.18% (10/848)	23.47% (199/848)	20.64% (175/848)

*Geometric Means were calculated based on a rolling 30-day with 5 or more samples
[1]MDL 10 refers *enterococcus* calculated with a method detection limit of 10
[2]MDL 3.7 refers *enterococcus* calculated assuming a method detection limit of 3.7

Figure 1. Leo Carrillo Beach, *enterococcus*, single sample and geometric means calculated with different substitutes for detection limit data (November 2004 - October 2010)



The City of Los Angeles also examined the consequences of using 3.7 mpn/day as a substitute for 10 mpn/day with data from a number of beaches. Similar to staff's finding with the data from Leo Carrillo Beach, very few beaches showed a meaningful difference.

Although this change in how the *enterococcus* geometric mean is calculated could allow for a small reduction in the number of exceedances of the geometric mean, it does not change any target, allowed exceedance rate or allocation. Therefore, it does not represent a need for significantly greater or smaller reductions in bacterial densities and will not require greater or lesser implementation actions on the part of responsible parties.

Recommendation

No additions or modifications to the TMDL. Responsible jurisdictions and agencies subject to the TMDL may conduct special studies for the Ballona Estuary to determine the appropriate value for usage when samples results are below the detection limit. These studies should then be included in an updated monitoring plan for Executive Officer consideration. Detection limit substitutes will be subject to change if a different testing method with a different method detection limit is used.

3.5 Natural Source Exclusion

Del Rey Lagoon is a nonpoint source to Ballona Estuary that potentially receives its bacteria loading from natural sources. This makes the lagoon a potential candidate waterbody for the natural sources exclusion implementation provision provided for by the bacteria objectives in Chapter 3 of the Basin Plan.

Under the natural sources exclusion implementation provision, after all anthropogenic sources of bacteria have been controlled such that they do not cause an exceedance of the single sample objectives, a certain frequency of exceedance of the single sample objectives shall be permitted based on the residual exceedance frequency in the specific waterbody.

According to the BC Bacteria TMDL, if the responsible agency for the Del Rey Lagoon intended to pursue a natural source exclusion, it was required to conduct a natural sources study by April 27, 2010 in order to determine its eligibility for such an exclusion. The Regional Board has not received a source identification study, nor has it received documentation that all anthropogenic sources of bacteria been controlled.

Recommendation

Staff does not recommend the application of the natural source exclusion approach to set the allowable exceedance frequencies for bacteria loading from Del Rey Lagoon and the Ballona Wetlands at this time. It is recommended that the allowable exceedance frequency continue to be based on the reference system / anti-degradation approach provided for the implementation of the bacteria objectives in Chapter 3 of the Basin Plan.

3.6 Re-assess WLAs for Benedict Canyon Channel, Sepulveda Channel, and Centinela Creek

Based on the compliance monitoring data in Table 1, the high frequencies of exceedances of the applicable bacteria objectives in Benedict Canyon Channel, Sepulveda Channel, and Centinela Creek demonstrate that these tributaries are potential sources of bacteria to their downstream reaches and are still themselves impaired. Further, no investigations of recreational beneficial uses have been undertaken for these tributaries. Therefore, the WLAs remain unchanged in order to protect the designated beneficial uses of these tributaries as well as to protect downstream uses.

Recommendation

No change to WLAs for Benedict Canyon Channel, Sepulveda Channel, and Centinela Creek given that no beneficial use investigations have been conducted and these tributaries remain impaired as evidenced by recent monitoring data.

4. Other Considerations not Specified for Reconsideration in the BC Bacteria TMDL

In addition to the technical considerations specified in the BC Bacteria TMDL, this reconsideration examines other issues that have been brought to the Regional Board's attention since the BC Bacteria TMDL was adopted and approved. This section discusses these additional issues.

4.1 Numeric Targets

The BC Bacteria TMDL has a multi-part numeric target based on the bacteriological water quality objectives for marine and fresh waters to protect the REC-1, LREC-1, and REC-2 beneficial uses.

The Regional Board has updated the bacteria objectives for freshwaters designated as REC-1 and LREC-1 to remove redundancy and maintain consistency with US EPA's recommended criteria. The Regional Board adopted the revised objectives on July 8, 2010 in Resolution R10-005, the State Water Board approved the revised objectives on July 19, 2011 in Resolution 2011-0031 and OAL approved them on November 1, 2011. The revised objectives became final after USEPA approval on December 5, 2011.

The update of bacteria objectives removes the fecal coliform objectives and uses *E. coli* objectives as the sole objective for freshwaters designated with the REC-1 or LREC-1 beneficial use. To be consistent with the update of the bacteria objectives, staff proposes that numeric targets in the revised BC Bacteria TMDL only include the Basin Plan objectives for *E. coli* for REC-1 and LREC-1 in freshwaters.

The revised numeric targets for single sample limits are:

In Fresh Waters Designated for Water Contact Recreation (REC-1):
1. Geometric Mean Limits
a. *E. coli* density shall not exceed 126/100 ml.

2. Single Sample Limits
a. *E. coli* density shall not exceed 235/100 ml.

In Fresh Waters Designated for Limited Water Contact Recreation (LREC-1):
1. Geometric Mean Limits
a. *E. coli* density shall not exceed 126/100 ml.

2. Single Sample Limits
a. *E. coli* density shall not exceed 576/100 ml.

4.2 Time Periods for Allowable Exccedance Days

In the studies of reference systems for freshwaters, allowable exceedance days are set on an annual basis based on rainfall conditions, namely dry-weather days and wet-weather days. Wet weather is defined as days of 0.1 inch of rain or more plus three days following the rain event. Therefore, this TMDL has been modified from three time periods (i.e. summer dry weather, winter dry weather, wet weather) to two time periods (i.e., dry weather and wet weather irrespective of season) for the allocations to be consistent with the data from the freshwater reference systems.

4.3 Implementation

Additional language is proposed for the TMDL implementation that clarifies the requirements for Phase II Municipal Separate Storm Sewer System (MS4) permits. The existing TMDL assigns waste load allocations (WLAs) to MS4 permits. Staff proposes to clarify these WLAs apply to Phase II MS4 permits as well as Phase I MS4 permits.

4.4 Monitoring

Staff proposes to require responsible jurisdictions and agencies for the waste load allocations to conduct outfall monitoring for the purpose of demonstrating compliance. Responsible jurisdictions and agencies would be required to submit a revision to the comprehensive bacteria water quality monitoring plan to include an outfall monitoring plan with an adequate number of proposed outfalls and a frequency of sampling. This outfall monitoring is consistent with the recently adopted Santa Clara River and Los Angeles River Bacteria TMDLs.

Staff proposes that follow up monitoring requirements when there is an in-stream exceedance in the current TMDL be replaced with the outfall monitoring. Staff believes that the outfall monitoring is more useful to identify the sources of bacteria, as well as to demonstrate MS4 compliance with waste load allocations and exclude any potential contributions from other sources outside the MS4 system. Staff proposes to strike the 4th paragraph in the Monitoring section on page 8. (Paragraph starts with "If an in-stream location …" and ends with "… meet bacteria water quality objectives"). Staff proposes to modify the 3rd paragraph, to clarify how outfall monitoring will be used to determine whether or not bacterial sources originating within the jurisdiction of the responsible agency have caused or contributed to the in-stream exceedance. The proposed revisions are as follows:

In paragraph 3: "…Responsible jurisdictions or agencies shall not be ~~required to initiate an investigation detailed in the next paragraph if a demonstration is made~~ *deemed non-attaining if the outfall monitoring described in the paragraph above demonstrates* that bacterial sources originating within the jurisdiction of the responsible agency have not caused or contributed to the exceedance." This change makes the Ballona Creek TMDL consistent with the Malibu Creek, Los Angeles River and Santa Clara River Bacteria TMDL monitoring requirements.

During implementation of the BC Bacteria TMDL as well as the Santa Monica Bay Beaches Bacteria TMDLs, responsible agencies requested permission to use *E. coli* sampling in lieu of fecal coliform sampling and to apply a ratio to convert the *E. coli* data to fecal coliform equivalents in order to compare with the fecal coliform objective for marine waters. Staff proposes to allow this approach and recommend that if responsible agencies wish to follow this approach that they resubmit their monitoring plan for Executive Officer approval and include a proposed ratio to convert *E. coli* data to fecal coliform equivalents.

5. CEQA Analysis

Pursuant to Public Resources Code section 21080.5, the Resources Agency has approved the Regional Water Boards' basin planning process as a "certified regulatory program" that adequately satisfies the California Environmental Quality Act (CEQA) (Public Resources Code section 21000 et seq.) requirements for preparing environmental documents. (14 Cal. Code Regs. § 15251(g); 23 Cal. Code Regs. § 3782.) The Regional Board previously prepared "substitute environmental documents" for the establishment of the BC Bacteria TMDL adopted by Resolution No. R06-011, which was filed with the Resources Agency on April 27, 2007. Those documents contained the required environmental documentation under the State Water Board's CEQA regulations (23 Cal. Code Regs § 3777.) The project itself was the establishment of the BC Bacteria TMDL. In preparing the previous substitute environmental documents, the Regional Board considered the requirements of Public Resources Code section 21159 and California Code of Regulations, Title 14, section 15187, and intended those documents to serve as a tier 1 environmental review. The previous substitute environmental documents contained environmental analysis and findings related to the reasonably foreseeable methods of compliance, the impacts of the methods of compliance, feasible mitigation measures, and alternative means of compliance.

Staff has determined that this TMDL revision does not alter the environmental analysis that was previously prepared for the establishment of the BC Bacteria TMDL because the TMDL revisions will not result in different implementation actions than those previously analyzed for the BC Bacteria TMDL, or different effects upon the environment. Moreover, no additional reasonably foreseeable methods of compliance warrant environmental analysis pursuant to Public Resources Code section 21159 and California Code of Regulations, Title 14, section 15187. As such, this amendment is consistent with the prior CEQA documentation.

Further, consistent with California Code of Regulations, title 14, section 15162, the Regional Board has determined that no subsequent environmental documents shall be prepared because this TMDL revision does not involve new significant environmental effects, a substantial increase in the severity of previously identified significant effects, or mitigation measures or alternatives that are considerably different from those analyzed in the previous substitute environmental documentation.

6. References

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Los Angeles Regional Water Quality Control Board. 2002. Amendment to the Water Quality Control Plan - Los Angeles Region to incorporate the Santa Monica Bay Beaches Bacteria TMDL. Regional Board Resolution No. R02-004. January 14, 2002.

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