Reconsideration of Certain Technical Matters of the Santa Monica Bay Beaches Bacteria TMDLs; the Marina del Rey Harbor Mothers' Beach and Back Basins Bacteria TMDL; and the Los Angeles Harbor Inner Cabrillo Beach and Main Ship Channel Bacteria TMDL

STAFF REPORT

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Acronyms

303(d) list	State of California Clean Water Act Section 303(d) List of Water Quality Limited Segments
AB411	State Assembly Bill No. 411 (1997)
CEQA	California Environmental Quality Act
CWA	Clean Water Act
LA	Load Allocation
ml	Milliliter
mpn	Most probable number
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollution Discharge Elimination System
OAL	Office of Administrative Law
REC-1	Water Contact Recreation
REC-2	Non-contact Water Recreation
SCCWRP	Southern California Water Research Project
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
WLA	Waste Load Allocation

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1. Overview and current status of bacterial indicator TMDLs

This staff report presents technical analyses in support of recommendations to reconsider aspects of three bacterial indicator TMDLs established by the Los Angeles Regional Water Quality Control Board (Regional Board). All three of these TMDLs include swimming beaches so the health of swimmers and surfers and sizeable revenues to the local economy are at stake. Fecal indicator bacteria (including total coliform, fecal coliform, and *enterococci*) are used to monitor the water quality of beaches 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 three TMDLs to be re-considered in this action are the Santa Monica Bay Beaches bacteria TMDL, both wet and dry weather elements (SMBB TMDL); the Marina del Rey Harbor Mothers' Beach and Back Basins bacterial TMDL (MdR TMDL); and the Los Angeles Harbor Inner Cabrillo Beach and Main Ship Channel bacteria TMDL (ICB TMDL). The regulatory background, beneficial uses to be protected, geographical extent and complete TMDL elements along with supporting analysis are described in the respective staff reports and amendments to the Los Angeles Region Water Quality Control Plan (Basin Plan) (LARWQCB, 2002a, 2002b, 2003 and 2004) at (http://www.waterboards.ca.gov/losangeles/water_issues/programs/tmdl/tmdl_list.shtml) and are not repeated, herein.

The first bacteria TMDL adopted by the Los Angeles Water Board (and only the third TMDL for any pollutant) was the Santa Monica Bay Beaches bacteria TMDL, adopted first for dry weather on January 24, 2002 and then for wet weather December 12, 2002 (both in effect on July 15, 2003). This TMDL was also the first bacteria TMDL in California.

Since this was the first bacteria TMDL, several new approaches for regulating bacteria were developed. A 2-year work plan was conducted to support the TMDL, including an intensive wet weather monitoring effort, watershed modeling, and various special studies (e.g., a bacteria degradation study and bacteria dispersion study). Based on these studies, new implementation provisions for bacteria were incorporated into Chapter 3 of the Basin Plan. The SMBB TMDL used these new approaches, including the reference beach/antidegradation approach and the corresponding exceedance day approach to expressing TMDL allocations. These approaches have been used in bacteria TMDLs in the region since then.

The Marina del Rey bacteria TMDL, building on work of the Santa Monica Bay bacteria TMDL, was adopted August 7, 2003 (in effect on March 18, 2004).

The Inner Cabrillo Beach and Main Ship Channel bacteria TMDL was adopted July 1, 2004 (in effect on March 10, 2005).

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 TMDLs 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 1 outlines the technical matters to be reconsidered as specified in the beach TMDLs.

Table 1 Summary of Reconsideration Elements Specified in the Beach TMDLs

Santa Monica Bay Beaches Dry-Weather TMDL **4 years after effective date of July 15, 2003**	Re-consider TMDL to re-evaluate allowable winter dry weather exceedance days based on additional data on bacterial indicator densities in the wave wash, a reevaluation of the reference system selected to set allowable exceedance levels, and a re-evaluation of the reference year used in the calculation of allowable exceedance days.		
Santa Monica Bay Beaches Wet-Weather TMDL **4 years after effective date of July 15, 2003**	Refine allowable wet weather exceedance days based on additional data on bacterial indicator densities in the wave wash and an evaluation of site-specific variability in exceedance levels,		
	Re-evaluate the reference system selected to set allowable exceedance levels, including a reconsideration of whether the allowable number of 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),		
	Re-evaluate the reference year used in the calculation of		

	allowable exceedance days, and		
	Re-evaluate whether there is a need for further clarification or revision of the geometric mean implementation provision.		
Marina del Rey Back Basins 4 years after effective date of March 18, 2004	Refine allowable winter dry-weather and wet-weather exceedance days based on additional data on bacterial indicator densities, an evaluation of site-specific variability in exceedance levels, and the results of the study of relative bacterial loading from sources including but not limited to storm drains, boats, birds, and other nonpoint sources,		
	Re-evaluate the reference system selected to set allowable exceedance levels, including a reconsideration of whether the allowable number of 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), and if an appropriate reference system cannot be identified for this enclosed harbor, evaluate using the 'natural sources exclusion approach subject to antidegradation policies' rather than the 'reference system/antidegradation' approach ,		
	Re-evaluate the reference year used in the calculation of allowable exceedance days, and		
	Re-evaluate whether there is a need for further clarification or revision of the geometric mean implementation provision.		
Inner Cabrillo Beach and Main Ship Channel 4 years after effective date of March 10, 2005 or at the time of Santa Monica Bay Beaches Reopener 7	Refine allowable wet weather exceedance days based on additional data on bacterial indicator densities in the wave wash and an evaluation of site-specific variability in exceedance levels,		
	Re-evaluate the reference system selected to set allowable exceedance levels, including a reconsideration of whether the allowable number of 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), and if an appropriate reference system cannot be identified for this enclosed harbor, evaluate using the 'natural sources exclusion approach subject to antidegradation policies' rather than the 'reference system/antidegradation' approach ,		
	Re-evaluate the reference year used in the calculation of allowable exceedance days, and		

	Re-evaluate whether there is a need for further clarification or revision of the geometric mean implementation provision.		
	Evaluate the feasibility of a natural sources exclusion for the non-swimming portion of ICB		
	Re-evaluate the implementation schedule.		

The geographical extent, principal structure and approach of the three TMDLs are not being reconsidered in this action. The principal structure and approach includes:

<u>Use of the Reference beach/antidegradation approach</u>: The three TMDLs being reconsidered in this action use a reference beach/anti degradation approach to establish allocations. The number of allowable exceedance days is based on two criteria: (1) bacteriological water quality at any site is required to be at least as good as at a designated reference site, and (2) there is no degradation of existing bacteriological water quality allowed, if historical water quality at a particular site is better than the designated reference site. This approach is not being considered for change in this reconsideration.

The alternative to the reference system/antidegradation approach is the natural sources exclusion approach, which provides that 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. Documentation has not been provided for either the MdR TMDL or the ICB TMDL indicating that all anthropogenic sources of bacteria have been controlled; therefore, it is premature to consider the application of the natural sources exclusion approach in these two TMDLs.

<u>Exceedance Days</u>: The WLAs and LAs for the three TMDLs being reconsidered in this action are expressed as allowable exceedance days, that is, the number of days when any one or more of the single sample bacteria objectives may be exceeded. The frequency of exceedances of the bacteria indicator objectives is most relevant to public health. This approach is not being considered for change in this reconsideration.

<u>Allocations for summer dry, winter dry and wet weather</u>: Each of these TMDLs established allocations for three time periods. These three periods are (1) winter dry weather (November 1 to March 31), (2) summer dry weather (April 1 to October 31) and (2) wet weather (defined as days of 0.1 inch of rain or more plus three days following the rain event). This approach is not being considered for change in this reconsideration.

3. Technical Matters to be Re-considered

3.1 Reference: single sample exceedance rates

These TMDLs use a reference/antidegradation approach and calculate an allowable number of exceedance days for each beach. The number of exceedance days is the number of days on which any of the single sample objectives are exceeded and the corresponding exceedance rate is the percentage of days that exceed.

Exceedances of single sample objectives are allowed in these TMDLs, not because there is no risk associated with exceedances of the objectives, but because it was not the Regional Board's intention to hold a non-reference beach to a higher standard than a reference beach.

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

a. Total coliform density shall not exceed 10,000/100 ml.
b. Fecal coliform density shall not exceed 400/100 ml.
c. Enterococcus density shall not exceed 104/100 ml.
d. Total coliform density shall not exceed 1,000/100 ml, if the ratio of fecal-to-total coliform exceeds 0.1.

3.1.1 Additional reference beaches

Each of these TMDLs used Leo Carrillo Beach as the reference beach to set the allowable number of exceedance days. 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 might not be the most representative reference site for all beaches in the Region. A study to examine other reference systems throughout Southern California coastal beaches, conducted by the Southern California Water Research Project (SCCWRP), "Microbiological water quality at non-human impacted reference beaches in southern California during wet weather" (SCCWRP, 2006) examined reference beaches in regards to the size of the watershed among other factors. This study focused on wet weather, the critical condition.

The SCCWRP 2006 study found that exceedances of water quality objectives for bacterial indicators in wet weather occurred more frequently in large (> 100 km^2) watersheds (~30%) than in medium (28-56 km^2) watersheds (~12%) or small (3-12 km^2) watersheds (~7%).

Staff examined the study data for the large reference watersheds, which were higher than the Leo Carrillo beach data. Staff also examined the study data available for the small and medium reference watersheds. In the Santa Monica Bay watershed, only two beaches at mouth of the Ballona Creek and Malibu Creek watersheds meet the SCCWRP definition of a large watershed. These two beaches are Surfrider Beach and Dockweiler Beach. With the exception of Surfrider and Dockweiler beaches, the beaches under consideration in this reconsideration are all within the size of medium or small watersheds. In the SCCWRP 2006 study, there was not a great difference in the exceedance rates from the medium and small watershed beaches and the Leo Carrillo Beach.

3.1.1 RECOMMENDATION

Continued use of Leo Carrillo Beach as the reference beach for these bacteria TMDLs. Staff finds that it is most appropriate to continue to use Leo Carrillo Beach as the reference beach for all Santa Monica Bay beaches given that it is within the Santa Monica Bay watershed management area; it provides a much larger and longer, database than the data considered in the SCCWRP 2006 study; and ensures equal protection across Santa Monica Bay beaches.

3.1.2 Reference: new exceedance levels at point zero sampling locations

The TMDL targets and allocations in these TMDLs apply in the "mixing zone" or "point zero." The mixing zone is the volume of water into which the storm drain or creek empties and where the effluent from the storm drain initially mixes with the receiving water. In these TMDLs, the mixing zone is the same as the "wave wash" or "point zero."

At the time of the development of the Santa Monica Bay bacteria TMDL, most beach data had been collected not at point zero from the storm drains or streams, but at a distance up to 50 yards above or below the mixing zone of the discharge. Since it was the intention of the TMDL to require compliance with the TMDL at point zero, it was necessary to collect some years of data at the reference beach point zero to set appropriate exceedance rates to apply to the subject beaches at their point zero compliance locations. In addition, it was necessary to calculate the exceedance rates at the subject beaches again to determine if the beach should be subject to the reference beach exceedance rates or, if the beach has fewer exceedances than the reference beach, be subject to "antidegradation" and required to not exceed its current rate of exceedance at the new location.

3.2.2.1 Wet weather reference exceedance rates

An examination of the data collected at Leo Carrillo Beach from the years data was collected at point zero, 2004 to 2010, shows the wet weather rates to be about the same as the non point zero exceedance rates, pre-2004. See Table 2.

3.2.2.2 Winter dry reference exceedance rates

An examination of the data collected at Leo Carrillo Beach from point zero during the years 2004 to 2010 shows the winter dry weather exceedance rates to be higher than the pre-2004, non point zero, exceedance rates. See Table 2. Options for adjusting reference exceedance rates to be required at other beaches include:

1) Retain previous allowable exceedance rate for winter dry weather.
2) Allow exceedances of the single sample objectives at the same rate as the reference beach as reflected in the post-2004 data set.

3.2.2.3 Summer dry reference exceedance rates

An examination of the data collected at Leo Carrillo Beach from point zero during the years 2004 to 2010 shows the summer dry weather exceedance rates to be higher than the pre-2004 non point zero exceedance rates. See Table 2. Options for adjusting reference exceedance rates to be required at other beaches include:

1) Do not allow exceedances of the single sample objectives in summer dry weather.
2) Allow exceedances of the single sample objectives at the same rate as the reference beach.

An examination of the summer dry weather data reveals that the ~~few~~ exceedances, which brought the exceedance rate to 10%, happened ~~early~~ primarily in the summer season during a single year (2006), as well as some exceedances in 2005 and 2008. The rest of the years of data showed no exceedances in summer dry weather. In addition, the summer period in the Los Angeles Region typically experiences the highest usage rate for beaches. The County of Los Angeles estimated the total number of beach visitors in 2011 to the county (~71 miles of shoreline) to be just over 61 million (County of Los Angeles, 2012). Of the estimated 61 million visitors, more than 52 million visited during the summer months (April – October), and especially during the peak months of June to August (~37 million).

Table 2 Comparison of Exceedance Rates at Leo Carrillo Beach (pre 2004 and 2004-2010 beach data)

Sampling Location	Summer Dry	Winter Dry	Wet
pre 2004	0%	3%	22%
2004-2010 (Point zero)	10%	10%	22%

3.1.2 RECOMMENDATION

Continued use of the current wet weather exceedance rate of **22%** (unchanged in the new data analysis) and adjustment of the winter dry weather exceedance rate to mirror the current point zero exceedance rate at Leo Carrillo Beach, **10%**, consistent with the Regional Board's intention in applying a reference system approach in the TMDL. No change in the summer dry weather exceedance rate, **0%**, consistent with the Regional Board's recognition that summer dry weather is the period of highest recreational use and staff's evaluation of data from 2004-2010, indicating that in five out of the six years there were no exceedances at Leo Carrillo Beach during summer dry weather.

3.2 New beach calculations

3.2.1 New calculations: point zero and "anti-degradation" beaches

New bacteria exceedance rates were calculated for those Santa Monica Bay beaches where the point of compliance was changed to point zero, for one beach which represented a new sampling station, and for beaches which were previously identified as anti-degradation beaches. New calculations were made using data collected from 2004 to 2010. See Table 3, below. Data for beach sites which did not move to point zero or which were not anti-degradation sites were not re-analyzed.

Data shown in Table 3 was collected by the City of Los Angeles, Bureau of Sanitation and the City of Redondo Beach. For sites that were sampled by both municipalities, the overlapping data sets were combined. Samples taken on the same day at the same sampling location by both municipalities were not temporally independent and the arithmetic mean was use for those samples.

Staff notes that at some locations, exceedance rates increased due to higher bacteria counts at point zero but others, decreased, presumably due to implementation actions taken by municipalities.

Table 3 New beach data: point zero, open, and "anti-degradation" beaches

Sample Station	Type (M=Moved N=New E=Existing)	Location	Single Sample November 2004 to October 2010 Exceedance % (Exceed Count/Sample Count)		
			Summer Dry Weather Exceedance Day	Winter Dry Weather Exceedance Day	Wet Weather Exceedance Day
SMB 1-1	Point Zero (M)~~Point Zero (M)~~	Leo Carrillo Beach, at 35000 PCH	10% (19/187)	10% (10/96)	22% (11/49)
SMB 1-2	Point Zero (N)~~Point Zero (N)~~	El Pescador State Beach~~Las Flores State Beach at Las Flores Creek~~	0% (0/169)	1% (1/92)	6% (3/52)
SMB 1-3	Point Zero (N)~~Point Zero (N)~~	El Matador State Beach~~Las Tunas County Beach at Pena Creek~~	0% (0/169)	1% (1/91)	4% (2/52)

Sample Station	Type (M=Moved N=New E=Existing)	Location	Single Sample November 2004 to October 2010 Exceedance % (Exceed Count/Sample Count)		
			Summer Dry Weather Exceedance Day	Winter Dry Weather Exceedance Day	Wet Weather Exceedance Day
SMB 1-4	Point Zero (M)~~Point Zero (N)~~	Trancas Creek at Broad Beach~~Las Tunas County Beach at Tuna Canyon~~	3% (5/177)	22% (22/102)	43% (20/47)
SMB 1-5	Point Zero (M)~~Point Zero (N)~~	Zuma Creek at Zuma Beach~~Topanga County Beach at Castlerock Storm Drain~~	4% (8/179)	17% (17/99)	26% (13/50)
SMB 1-6	Point Zero (N)~~Point Zero (N)~~	Walnut Creek in Paradise Cove~~Will Rogers State Beach at Santa Ynez Storm Drain~~	3% (6/173)	12% (12/98)	27% (14/52)
SMB O-1#	Point Zero (N)	Paradise Cove	2% (1/62)	13% (2/16)	20% (3/15)
SMB 1-7	Point Zero (M)~~Point Zero (N)~~	Ramirez Creek at Paradise Cove Pier~~Dockweiler State Beach at North Westchester Storm Drain~~	21% (44/214)	39% (46/118)	56% (32/57)
SMB 1-8	Point Zero (N)~~Point Zero (M)~~	Escondido Creek, just east of Escondido State Beach~~Dockweiler State Beach at Imperial Hwy. Storm Drain~~	37% (88/237)	40% (50/126)	48% (31/64)
SMB 1-9	Point Zero (M)~~Point Zero (N)~~	Latigo Canyon Creek, adjacent the Trivoli Bay Villa Treatment Plant~~Venice Beach at Rose Ave. Storm Drain~~	15% (30/195)	19% (20/105)	42% (22/52)
SMB 1-10	Point Zero (N)~~Point Zero (N)~~	Solstice Creek at Dan Blocker County Beach~~El Pescador State Beach~~	19% (40/208)	6% (6/95)	33% (18/54)
SMB O-2#	Point Zero (N)	Puerco Canyon storm drain	3% (2/59)	0% (0/13)	7% (1/14)
SMB 1-11	Point Zero (M)~~Point Zero (N)~~	Wave wash of unnamed creek on Puerco Beach~~El Matador State Beach~~	8% (15/183)	9% (8/94)	37% (18/49)
SMB 1-12	Point Zero (N)~~Point Zero (M)~~	Marie Canyon Storm Drain at Puerco Beach~~Trancas Creek at Broad Beach~~	50% (139/278)	44% (58/133)	58% (36/62)
SMB 1-13	Point Zero (N)~~Point Zero (M)~~	Sweetwater Creek on Carbon Beach~~Zuma Creek at Zuma Beach~~	12% (23/187)	10% (10/98)	44% (23/52)
SMB 1-14	Point Zero (N)~~Point Zero (N)~~	Las Flores Creek at Las Flores State Beach~~Paradise Cove at Walnut Creek~~	8% (15/181)	7% (6/91)	38% (21/55)
SMB 1-15	Open Beach~~Point Zero (N)~~	Big Rock Beach at 19948 Pacific Coast Hwy~~East of Escondido State Beach at Escondido Creek~~	11% (21/190)	24% (26/107)	30% (16/53)
SMB 1-16	Point Zero (N)~~Point Zero (N)~~	Pena Creek at Las Tunas County Beach~~Dan Blocker County Beach at Solstice Creek~~	2% (3/173)	3% (3/91)	18% (10/55)
SMB 1-17	Point Zero (N)~~Point Zero (N)~~	Tuna Canyon Creek at Las Tunas County Beach~~Puerco Beach at Marie Canyon Storm Drain~~	7% (7/94)	8% (5/60)	15% (4/26)
SMB 1-18	Point Zero (M)~~Point Zero (N)~~	Topanga Creek at Topanga County Beach~~Carbon Beach at Sweetwater Canyon Storm Drain~~	24% (203/859)	28% (134/480)	60% (152/252)
SMB 2-1	Point Zero (N)~~Point Zero~~	Castlerock (Parker Mesa) Storm Drain Topanga County	50% (124/248)	64% (87/135)	65% (40/62)

Sample Station	Type (M=Moved N=New E=Existing)	Location	Single Sample November 2004 to October 2010 Exceedance % (Exceed Count/Sample Count)		
			Summer Dry Weather Exceedance Day	Winter Dry Weather Exceedance Day	Wet Weather Exceedance Day
	~~(M)~~	Beach~~Venice City Beach at Windward Ave Storm Drain~~			
SMB 2-2	Point Zero (N)~~Point Zero (M)~~	Santa Ynez Storm Drain at Will Rodgers State Beach~~Redondo Beach at Herondo Street Storm Drain~~	32% (45/140)	46% (48/105)	59% (29/49)
SMB 2-3	Open Beach~~Open Beach~~	Will Rogers State Beach at 17200 Pacific Coast Hwy.~~Redondo Municipal Pier - 50 yards south~~	4% (8/178)	1% (1/90)	33% (17/51)
SMB 2-4	Point Zero (M)~~Point Zero (N)~~	Pulga Canyon storm drain at Will Rodgers State Beach~~Redondo State Beach at Sapphire St. Storm Drain~~	13% (30/236)	17% (30/172)	48% (44/91)
SMB 2-5	Point Zero (M)~~Open Beach~~	Bay Club Storm Drain~~Redondo State Beach at Topaz St. - north of jetty~~	10% (18/185)	13% (13/99)	40% (21/53)
SMB 2-6	Point Zero (M)~~Point Zero (M)~~	Temescal Storm Drain~~Redondo State Beach at Avenue I~~	7% (13/185)	34% (40/116)	46% (26/56)
SMB 2-7	Point Zero (M)~~Open Beach~~	Santa Monica Canyon, Will Rogers State Beach~~Malaga Cove, Palos Verdes Estates-daily~~	17% (147/860)	66% (316/481)	80% (202/252)
SMB 2-8	Open Beach~~Open Beach~~	Venice Pier, Venice~~Malaga Cove, Palos Verdes Estates-weekly~~	4% (7/178)	3% (3/91)	36% (18/50)
SMB 2-9	Open Beach~~Open Beach~~	Topsail Street extended at Venice Beach~~Palos Verdes (Bluff) Cove, Palos Verdes Estates~~	9% (16/185)	4% (4/91)	39% (20/51)
SMB 2-10	Point Zero (M)~~Point Zero (M)~~	Culver Bl. Storm Drain at Dockweiler State Beach~~Nicholas Beach at Nicholas Canyon Creek~~	2% (5/230)	4% (6/166)	37% (34/91)
SMB 2-11	Point Zero (N)~~Open Beach~~	North Westchester Storm Drain at Dockweiler State Beach~~Manhattan State Beach at 40th Street~~	1% (1/170)	0% (0/90)	26% (14/53)
SMB 2-12	Open Beach~~Point Zero (M)~~	World Way extended at Dockweiler State Beach~~Manhattan Beach at 28th Street Storm Drain~~	2% (4/173)	5% (5/92)	28% (14/50)
SMB 2-13	Point Zero (M)~~Point Zero (M)~~	Imperial Highway storm drain at Dockweiler State Beach~~Manhattan Beach Pier- 50 yards south~~	7% (16/230)	5% (8/167)	34% (31/90)
SMB 2-14	Open Beach~~Open Beach~~	Opposite Hyperion Plant at Dockweiler State Beach~~Hermosa City Beach at 26th St.~~	2% (3/173)	3% (3/91)	22% (11/49)
SMB 2-15	Point Zero (E)~~Open Beach~~	Grand Avenue Storm Drain at Dockweiler State Beach~~Hermosa Beach Pier- 50 yards south~~	3% (6/175)	5% (5/91)	26% (13/50)
SMB 3-1	Point Zero (M)~~Open Beach~~	Montana Storm Drain at Santa Monica State Beach~~Long Point, Rancho Palos Verdes~~	13% (25/192)	12% (12/98)	37% (19/51)
SMB 3-2	Point Zero (M)~~Open~~	Wilshire Storm Drain at Santa Monica State Beach~~Abalone~~	10% (20/191)	18% (19/103)	47% (25/53)

Sample Station	Type (M=Moved N=New E=Existing)	Location	Single Sample November 2004 to October 2010 Exceedance % (Exceed Count/Sample Count)		
			Summer Dry Weather Exceedance Day	Winter Dry Weather Exceedance Day	Wet Weather Exceedance Day
	~~Beach~~	~~Cove Shoreline Park~~			
SMB 3-3	Point Zero (M)~~Open Beach~~	Santa Monica Pier Storm Drain at Santa Monica State Beach~~Portuguese Bend Cove, Rancho Palos Verdes~~	41% (352/860)	45% (215/481)	57% (145/253)
SMB 3-4	Point Zero (M)~~Open Beach~~	Pico-Kenter Storm Drain at Santa Monica State Beach~~Royal Palms State Beach~~	9% (73/856)	22% (105/481)	64% (163/253)
SMB 3-5	Point Zero (M)~~Point Zero (N)~~	Ashland Storm Drain at Venice Beach~~Midway between White Point County Beach and Wilder Annex~~	1% (10/859)	6% (30/481)	37% (93/253)
SMB 3-6	Point Zero (N)~~Open Beach~~	Rose Ave. Storm Drain at Venice Beach~~Wilder Annex, San Pedro~~	5% (8/175)	7% (7/96)	44% (25/57)
SMB 3-7	Point Zero (M)~~Open Beach~~	Brooks Storm Drain at Venice City Beach~~Cabrillo Beach, oceanside~~	3% (6/178)	11% (10/95)	42% (22/52)
SMB 3-8	Point Zero (M)~~Point Zero (M)~~	Windward Storm Drain at Venice City Beach~~Ramirez Canyon at Paradise Cove Pier~~	6% (15/236)	10% (17/163)	30% (27/89)
SMB 3-9	Open Beach~~Point Zero (M)~~	Strand Street extended at Santa Monica Beach~~Latigo Canyon, adjacent from Tivoli Bay Villa Treatment Plant~~	3% (5/176)	8% (8/95)	38% (19/50)
SMB 4-1	Point Zero (M)~~Point Zero (M)~~	San Nicholas Canyon Creek at Nicholas Beach~~Puerco Beach at an un-named creek~~	2% (3/173)	4% (4/93)	13% (6/48)
SMB 5-1*	Open Beach~~Open Beach~~	Manhattan State Beach at 40th Street~~Big Rock Beach~~	2% (4/234)	2% (2/124)	11% (7/65)
SMB 5-2	Point Zero (M)~~Point Zero (M)~~	28th Street Drain at Manhattan State Beach~~Topanga Canyon at Topanga State Beach~~	7% (56/811)	14% (57/402)	44% (96/216)
SMB 5-3*	Point Zero (M)~~Open Beach~~	Manhattan Beach Pier at Manhattan State Beach~~Will Rogers State Beach at 17200 Pacific Coast Hwy.~~	2% (5/256)	3% (4/138)	8% (6/75)
SMB 5-4	Open Beach~~Point Zero (M)~~	Hermosa Beach at 26th Street~~Will Rogers State Beach at Pulga Canyon stormdrain~~	1% (1/187)	1% (1/87)	21% (10/48)
SMB 5-5*	Open Beach~~Point Zero (M)~~	Hermosa Beach Pier at Hermosa Beach ~~Will Rogers State Beach at Bay Club Storm drain~~	11% (29/273)	5% (5/110)	22% (15/67)
SMB 6-1	Point Zero (M)~~Point Zero (M)~~	Herondo Storm Drain at Redondo Beach~~Temescal Canyon storm drain~~	3% (26/807)	9% (35/384)	46% (99/213)
SMB 6-2*	Open Beach~~Point Zero (M)~~	Redondo Municipal Pier - 100 yards south at Redondo Beach~~Santa Monica State Beach at Santa Monica Canyon~~	12% (35/303)	18% (30/169)	32% (35/108)
SMB 6-3	Point Zero (N)~~Open Beach~~	Sapphire Street Drain at Redondo Beach~~Venice Beach, 50 yards south of the pier~~	6% (10/178)	6% (6/97)	22% (11/51)

Sample Station	Type (M=Moved N=New E=Existing)	Location	Single Sample November 2004 to October 2010 Exceedance % (Exceed Count/Sample Count)		
			Summer Dry Weather Exceedance Day	Winter Dry Weather Exceedance Day	Wet Weather Exceedance Day
SMB 6-4	Open Beach~~Open Beach~~	120' north of Topaz groin at Redondo Beach~~Venice Beach at Topsail Street~~	5% (9/181)	14% (13/94)	24% (12/51)
SMB 6-5*	Point Zero (M)~~Point Zero (M)~~	Avenue I Storm Drain at Redondo Beach~~Dockweiler State Beach at Culver stormdrain~~	6% (15/261)	5% (7/139)	14% (10/74)
SMB 6-6*	Open Beach~~Open Beach~~	Malaga Cove, Palos Verdes Estates~~Dockweiler Beach at World Way~~	2% (4/196)	5% (5/110)	11% (7/64)
SMB 7-1	Open Beach~~Open Beach~~	Malaga Cove~~Dockweiler Beach opposite the Hyperion Treatment Plant~~	0% (0/175)	0% (0/96)	15% (8/55)
SMB 7-2	Open Beach~~Point Zero (E)~~	Bluff Cove~~Dockweiler Beach at Grand Avenue stormdrain~~	0% (0/176)	1% (1/97)	4% (2/52)
SMB 7-3	Open Beach~~Point Zero (M)~~	Long Point~~Santa Monica State Beach at Montana Ave. stormdrain~~	0% (0/374)	0% (0/273)	9% (14/160)
SMB 7-4	Open Beach~~Point Zero (M)~~	Abalone Cove~~Santa Monica State Beach at Wilshire Blvd. stormdrain~~	0% (1/374)	0% (1/273)	4% (7/160)
SMB 7-5	Open Beach~~Point Zero (M)~~	Portuguese Bend Cove~~Santa Monica State Beach at Santa Monica Pier stormdrain~~	0% (1/375)	1% (4/275)	4% (7/160)
SMB 7-6	Open Beach~~Point Zero (M)~~	Royal Palms~~Santa Monica State Beach at Pico Kenter stormdrain~~	0% (0/374)	0% (0/273)	9% (14/160)
SMB 7-7	Point Zero (N)~~Point Zero (M)~~	At storm drain between White Point and Wilder Annex~~Santa Monica State Beach at Ashland stormdrain~~	5% (7/152)	3% (3/93)	33% (16/48)
SMB 7-8	Open Beach~~Point Zero (M)~~	Wilder Annex~~Venice Beach at Brooks Ave. stormdrain~~	0% (0/374)	1% (4/275)	8% (13/159)
SMB 7-9	Open Beach~~Open Beach~~	Outer Cabrillo Beach~~Santa Monica State Beach at Strand St~~	1% (4/378)	1% (3/277)	7% (11/160)
SMB BC-1	Point Zero (M)~~Open Beach~~	Ballona Creek at Dockweiler State Beach~~Dockweiler State Beach at Ballona Creek~~	21% (180/857)	17% (80/481)	62% (155/251)
SMB MC-1	Open Beach~~Open Beach~~	Malibu Point, Malibu State Beach~~Malibu State Beach on Malibu Point~~	11% (21/187)	14% (14/102)	25% (12/48)
SMB MC-2	Point Zero (M)~~Point Zero (M)~~	Surfrider Beach (breach point of Malibu Lagoon)~~Malibu State Beach at Malibu Lagoon~~	29% (246/857)	46% (222/481)	68% (171/250)
SMB MC-3	Open Beach~~Open Beach~~	Malibu Pier at Carbon Beach~~Carbon Beach at Malibu pier~~	15% (29/196)	19% (20/104)	52% (27/52)

Monitoring began in 2010 and data was examine from April 2010 to November 2011

* Two different data were available for the sampling site and subsequently combined

Data in Table 4 compares the allowable exceedances as established in the TMDL in 2002 to the observed numbers of exceedances for the period 2004-2010.

Table 4 Allowable (pre 2004) vs. Observed (2004-2010) Exceedance Days

		Winter Dry Weather				Wet Weather			
		Allowable Number of Exceedance Days		Observed Number of Exceedance Days		Allowable Number of Exceedance Days		Observed Number of Exceedance Days	
Station	Beach Monitoring Location	Daily Sampling	Weekly Sampling	Daily Sampling**	Weekly Sampling	Daily Sampling	Weekly Sampling	Daily Sampling**	Weekly Sampling
SMB 1-1	**Leo Carrillo Beach, at 35000 PCH**	**3**	**1**	**9**	**2**	**17**	**3**	**17**	**3**
SMB 1-4	Trancas Creek at Broad Beach	0	0	18	3	17	3	32	5
SMB 1-5	Zuma Creek at Zuma Beach	0	0	14	2	17	3	20	3
SMB 2-13	Imperial storm drain	2	1	4	1	17	3	26	4
SMB 3-8	Venice City Beach at Windward Av.- 50 yards north	2	1	9	2	13	2	23	4
SMB 4-1	Nicholas Beach- 100 feet west of lifeguard tower	0	0	4	1	14	2	10	2
SMB 5-1*	Manhattan State Beach at 40th Street	1	1	2	1	4	1	8	2
SMB 5-2	28th Street storm drain at Manhattan Beach	0	0	12	2	17	3	34	5
SMB 5-3*	Manhattan Beach Pier- 50 yards south	1	1	3	1	5	1	6	1
SMB 5-4	Hermosa City Beach at 26th St.	3	1	1	1	12	2	16	3
SMB 5-5*	Hermosa Beach Pier- 50 yards south	2	1	4	1	8	2	17	3
SMB 6-2*	Redondo Municipal Pier- 50 yards south	3	1	15	3	14	2	25	4
SMB 6-5*	Redondo State Beach at Avenue I	3	1	4	1	6	1	11	2
SMB 6-6*	Malaga Cove, Palos Verdes Estates-daily	1	1	4	1	3	1	9	2
SMB 7-1	Malaga Cove, Palos Verdes Estates-weekly	1	1	0	0	14	2	11	2
SMB 7-2	Palos Verdes (Bluff) Cove, Palos Verdes Estates	1	1	1	1	0	0	3	1
SMB 7-3	Long Point, Rancho Palos Verdes	1	1	0	0	5	1	7	1
SMB 7-4	Abalone Cove Shoreline Park	0	0	1	1	1	1	4	1
SMB 7-5	Portuguese Bend Cove, Rancho Palos Verdes	1	1	2	1	2	1	4	1
SMB 7-6	Royal Palms State Beach	1	1	7	1	6	1	15	3
SMB 7-8	Wilder Annex, San Pedro	1	1	2	1	2	1	7	1
SMB 7-9	Cabrillo Beach, oceanside	1	1	1	1	3	1	6	1

Notes: The allowable number of exceedance days was based on existing shoreline monitoring data and was calculated for both daily sampling and weekly sampling.

* Two different data sets were available for the sampling site and subsequently combined

** Observed number of daily exceedances days were calculated based on the observed exceedance rate per sampling station and the number wet and or dry days observed in the critical year.

Table 4 includes the allowable and observed exceedances for sampling locations that have moved to point zero or were listed as antidegradation sites in the Santa Monica Bay Bacteria TMDL. Certain sites that were previously listed as antidegradation sites have been observed to exceed bacteria objectives in excess of their previous rate due to more elevated bacteria levels due to point zero monitoring in both winter dry and wet weather.

3.2.1 RECOMMENDATION

The final allowable exceedance days shall be updated for the Santa Monica Bay beaches TMDL according to the new calculations (see Table 5 which includes all beach sites).

Table 5: **Santa Monica Bay Beaches Bacteria TMDL Implementation Schedule:**
Allowable Number of Days that May Exceed Any Single Sample Bacterial Indicator Target for Existing Shoreline Monitoring Stations

Compliance Deadline			**15-Jul-06**		**1-Nov-09**		**15-Jul-21**	
			Summer Dry Weather^ Apr. 1-Oct. 31		Winter Dry Weather^* Nov. 1-Mar. 31		Wet Weather Year-round	
Station ID	Location Name	Subwatershed	Daily sampling (No. days)	Weekly sampling (No. days)	Daily sampling (No. days)	Weekly sampling (No. days)	Daily sampling (No. days)	Weekly sampling (No. days)
SMB 1-1	**Leo Carillo Beach (REFERENCE BEACH)**	**Arroyo Sequit Canyon**	**0**	**0**	**9**	**2**	**17**	**3**
SMB 1-2	El Pescador State Beach	Los Alisos Canyon	0	0	1	1	5	1
SMB 1-3	El Matador State Beach	Encinal Canyon	0	0	1	1	3	1
SMB 1-4	Trancas Creek	Trancas Canyon	0	0	9	2	17	3
SMB 1-5	Zuma Creek	Zuma Canyon	0	0	9	2	17	3
SMB 1-6	Walnut Creek	Ramirez Canyon	0	0	9	2	17	3
SMB O-1#	Paradise Cove	Ramirez Canyon	0	0	9	2	15	3
SMB 1-7	Ramirez Creek	Ramirez Canyon	0	0	9	2	17	3
SMB 1-8	Escondido Creek	Escondido Canyon	0	0	9	2	17	3
SMB 1-9	Latigo Canyon Creek	Latigo Canyon	0	0	9	2	17	3
SMB 1-10	Solstice Creek	Solstice Canyon	0	0	5	2	17	3
SMB 1-11	Wave wash of unnamed creek on Puerco Beach	Corral Canyon	0	0	9	2	17	3
SMB 1-12	Marie Canyon Storm Drain on Puerco Beach	Corral Canyon	0	0	9	2	17	3
SMB O-2#	Puerco Canyon storm drain	Corral Canyon	0	0	0	0	6	1
SMB 1-13	Sweetwater Creek on Carbon Beach	Carbon Canyon	0	0	9	2	17	3
SMB 1-14	Las Flores Creek	Las Flores Canyon	0	0	6	1	17	3
SMB 1-15	Big Rock Beach at 19948 Pacific Coast Hwy	Piedra Gorda Canyon	0	0	9	2	17	3
SMB 1-16	Pena Creek	Pena Canyon	0	0	3	2	14	3
SMB 1-17	Tuna Canyon Creek	Tuna Canyon	0	0	7	1	12	2
SMB 1-18	Topanga Creek	Topanga Canyon	0	0	9	2	17	3
SMB 4-1	San Nicholas Canyon Creek	Nicholas Canyon	0	0	4	1	14	2
SMB 2-1	Castlerock (Parker Mesa) Storm Drain	Castlerock Canyon	0	0	9	2	17	3
SMB 2-2	Santa Ynez Storm Drain	Santa Ynez Canyon	0	0	9	2	17	3
SMB 2-3	Will Rogers State Beach at 17200 Pacific Coast Hwy.	Santa Ynez Canyon	0	0	9	2	17	3

Table 5: **Santa Monica Bay Beaches Bacteria TMDL Implementation Schedule: Allowable Number of Days that May Exceed Any Single Sample Bacterial Indicator Target for Existing Shoreline Monitoring Stations**								
Compliance Deadline			**15-Jul-06**		**1-Nov-09**		**15-Jul-21**	
			Summer Dry Weather^ Apr. 1-Oct. 31		Winter Dry Weather^* Nov. 1-Mar. 31		Wet Weather Year-round	
Station ID	Location Name	Subwatershed	Daily sampling (No. days)	Weekly sampling (No. days)	Daily sampling (No. days)	Weekly sampling (No. days)	Daily sampling (No. days)	Weekly sampling (No. days)
SMB 2-4	Pulga Canyon storm drain	Pulga Canyon	0	0	9	2	17	3
SMB 2-5	Temescal Storm Drain	Pulga Canyon	0	0	9	2	17	3
SMB 2-6	Bay Club Storm Drain	Santa Ynez Canyon	0	0	9	2	17	3
SMB 2-7	Santa Monica Canyon, Will Rogers State Beach	Santa Monica Canyon	0	0	9	2	17	3
SMB 2-8	Venice Pier, Venice	Ballona	0	0	9	2	17	3
SMB 2-9	Topsail Street extended	Ballona	0	0	9	2	17	3
SMB 2-10	Dockweiler State Beach at Culver Bl. Storm Drain	Dockweiler	0	0	9	2	17	3
SMB 2-11	North Westchester Storm Drain	Dockweiler	0	0	9	2	17	3
SMB 2-12	World Way extended	Dockweiler	0	0	9	2	17	3
SMB 2-13	Imperial Highway storm drain (Dockweiler)	Dockweiler	0	0	4	2	17	3
SMB 2-14	Opposite Hyperion Plant, 1 mile	Dockweiler	0	0	9	2	17	3
SMB 2-15	Grand Avenue Storm Drain	Dockweiler	0	0	9	2	17	3
SMB 3-1	Montana Ave. Storm Drain	Santa Monica	0	0	9	2	17	3
SMB 3-2	Wilshire Blvd., Santa Monica	Santa Monica	0	0	9	2	17	3
SMB 3-3	Santa Monica Municipal Pier at storm drain	Santa Monica	0	0	9	2	17	3
SMB 3-4	Santa Monica Beach at Pico/Kenter storm drain	Santa Monica	0	0	9	2	17	3
SMB 3-5	Ashland Av. storm drain (Venice)	Santa Monica	0	0	9	2	17	3
SMB 3-6	Rose Ave. Storm Drain on Venice Beach	Santa Monica	0	0	6	1	17	3
SMB 3-7	Venice City Beach at Brooks Storm Drain (projection of Brooks Ave.)	Ballona	0	0	9	2	17	3
SMB 3-8	Venice Pavilion at projection of Windward Av.	Ballona	0	0	9	2	17	3
SMB 3-9	Strand Street extended	Santa Monica	0	0	9	2	17	3
SMB 5-1	Manhattan State Beach at 40th Street (El Porto Beach)	Hermosa	0	0	1	1	4	1
SMB 5-2	Terminus of 28th Street Drain in Manhattan Beach	Hermosa	0	0	9	2	17	3
SMB 5-3	Manhattan Beach Pier	Hermosa	0	0	3	1	6	1

Table 5: **Santa Monica Bay Beaches Bacteria TMDL Implementation Schedule: Allowable Number of Days that May Exceed Any Single Sample Bacterial Indicator Target for Existing Shoreline Monitoring Stations**								
Compliance Deadline			**15-Jul-06**		**1-Nov-09**		**15-Jul-21**	
			Summer Dry Weather^ Apr. 1-Oct. 31		Winter Dry Weather^* Nov. 1-Mar. 31		Wet Weather Year-round	
Station ID	Location Name	Subwatershed	Daily sampling (No. days)	Weekly sampling (No. days)	Daily sampling (No. days)	Weekly sampling (No. days)	Daily sampling (No. days)	Weekly sampling (No. days)
SMB 5-4	Near 26th Street on Hermosa Beach	Hermosa	0	0	3	1	12	2
SMB 5-5	Hermosa Beach Pier	Hermosa	0	0	2	1	8	2
SMB 6-1	Herondo Storm Drain	Redondo	0	0	9	2	17	3
SMB 6-2	Redondo Municipal Pier - 100 yards south	Redondo	0	0	3	1	14	2
SMB 6-3	4' x 4' outlet at projection of Sapphire Street	Redondo	0	0	5	1	17	3
SMB 6-4	120' north of Topaz groin	Redondo	0	0	9	2	17	3
SMB 6-5	Storm Drain at Projection of Avenue I	Redondo	0	0	4	1	11	2
SMB 6-6	Malaga Cove, Palos Verdes Estates	Redondo~~Palos Verdes~~	0	0	1	1	3	1
SMB 7-1	Malaga Cove	Palos Verdes	0	0	1	1	14	2
SMB 7-2	Bluff Cove	Palos Verdes	0	0	1	1	0	0
SMB 7-3	Long Point	Palos Verdes	0	0	1	1	5	1
SMB 7-4	Abalone Cove	Palos Verdes	0	0	0	0	1	1
SMB 7-5	Portuguese Bend Cove	Palos Verdes	0	0	1	1	2	1
SMB 7-6	Royal Palms	Palos Verdes	0	0	1	1	6	1
~~SMB 7-7~~	~~At storm drain between White Point and Wilder Annex~~	~~Palos Verdes~~	~~0~~	~~0~~	~~3~~	~~1~~	~~17~~	~~3~~
SMB 7-8	Wilder Annex	Palos Verdes	0	0	1	1	2	1
SMB 7-9	Outer Cabrillo Beach	Palos Verdes	0	0	1	1	3	1
SMB BC-1	Ballona Creek entrance (Dockweiler)	Dockweiler	0	0	9	2	17	3
SMB MC-1	Malibu Point, Malibu Colony Dr.	Malibu Canyon	0	0	9	2	17	3
SMB MC-2	Surfrider Beach (breach point of Malibu Lagoon)	Malibu Canyon	0	0	9	2	17	3
SMB MC-3	Malibu Pier on Carbon Beach	Malibu Canyon	0	0	9	2	17	3

Notes: The allowable number of exceedance days during winter dry weather is calculated based on the 10th percentile year in terms of non-wet days at the LAX meteorological station. The number of allowable exceedances during winter dry weather is based on the lesser of (1) the reference system or (2) existing levels of exceedance based on historical shoreline data.

^Dry weather days are defined as those with <0.1 inch of rain and those days not less than 3 days after a rain day. Rain days are defined as those with >=0.1 inch of rain. Detailed descriptions of the sampling locations are provided in the Santa Monica Bay Beaches Bacterial TMDLs Coordinated Shoreline Monitoring Plan.

3.2.2 Interannual variability at the reference beach

An element of the reconsideration of the Santa Monica Bay Beaches and Marina del Rey bacteria TMDLs was also to examine the natural variability of the reference beach, itself, so that if some years have very different frequencies of exceedance from other years, the application of reference beach exceedance rates to other beaches subject to the TMDLs could be adjusted to account for the variability. Figure 1, shown in section 3.4.3, shows six years of data collected since 2004 and provides an illustration of the variability at Leo Carrillo Beach.

While the reference system does exhibit variability in exceedances, the six years of data collected since 2004 encompass a sufficient range of the variability to ensure the calculation of the reference exceedance rate is appropriate. This, in combination with the use of the 90th percentile year in terms of wet weather, adequately addresses the variability in the reference system in setting allocations. In addition, an allowable exceedance rate which varies year to year may make the design of stormwater and runoff controls more difficult.

3.2.2 RECOMMENDATION

No changes to the TMDLs based on the evaluation of interannual variability at the reference beach with the exception of updating the reference exceedance rates based on the more recent data (2004-2010) as previously discussed.

3.3 Reference year (critical condition)

The critical condition in these bacteria TMDLs was determined to be wet weather and the 90th percentile wet weather year (1993) was used to define the critical condition in calculating allocations (75 wet days in 1993). Allowable exceedance days at an impaired beach, therefore, are calculated with the exceedance probability at the reference beach *multiplied by* the number of wet or dry days during the critical year.

The critical year therefore has 75 wet days, and the remaining 290 dry days are split between summer dry and winter dry.

3.3.1 Updated critical year

Staff, in developing these TMDLs, determined the critical condition to be wet weather and determined that the 90th percentile wet year was an appropriate definition of the critical condition. Precipitation data from 1948 to 2000 at the LAX rain gage was evaluated for these TMDLs and the year 1993, with 75 wet days, was found to be the 90th percentile wet year. For this reconsideration, staff evaluated additional rain data, 1948 to 2008 (Appendix B) and found 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 rate from the reference Leo Carrillo Beach, would not change using 74 wet days instead of 75 wet days. Data for Leo Carrillo Beach show that the wet-weather exceedance probability is 0.22. This exceedance probability multiplied by 75 wet days results in 17 exceedance days (16.5 rounded to the next whole integer) and multiplied by 74 wet days results in 17 exceedance days (16.28 rounded to the next whole integer).

3.3.1 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) in calculations of allowable exceedances will stay the same.

3.3.2 Reference year or annually adjusted exceedance rates

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

Allowable exceedance days were set using the exceedance rates for summer and winter dry weather and wet weather at the reference beach and the number of days of summer and winter dry weather 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 would 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.

3.3.2 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.

In addition, responsible jurisdictions have expressed a preference for a fixed number of allowable exceedances for these reasons (Jurisdictional Groups, 2009).

3.4 Geometric means

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 criteria for bacteria is usually a more reliable measure of long term water quality than single sample criteria. It is also 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.

In addition, the Basin Plan includes an implementation provision for geometric means: *"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)."*

US EPA'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 Criteria

(USEPA, 2011) does not specify the number of samples but recommends periods of 30 to 90 days.

Each of the TMDLs include the same re-consideration task for geometric means: “Re-evaluate whether there is a need for further clarification or revision of the geometric mean implementation provision.”

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.

3.4.1 Calculation of rolling geometric means

The standard method used in these TMDLs is:

The rolling 30-day geometric mean is calculated on a daily basis. All data including wet-weather data, is included in the geometric mean calculations. The calculation is rolled forward on a daily basis and 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 exceeded the method upper limit, that data point is be 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 means were evaluated and are presented in detail in Appendix B. Four alternative methods are contrasted in the following discussion.

Method 1) <u>Calendar month</u> (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 these TMDLs 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 five different sites 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 6 Percent of Exceedances of Geometric Mean, at Selected Shoreline Monitoring Sites

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 exceedance percentages. While Surfers Knoll differs by 13% (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 B).

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 B). 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, as discussed in Section 3.1 of this report.

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 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 B.

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 a beach.

3.4.1 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.

3.4.2 Geometric means calculated with dry weather data only (Santa Monica Bay Beaches TMDL)

The Santa Monica Bay Beaches bacteria TMDL and the Marina del Rey bacteria TMDL required that responsible jurisdictions and agencies attain geometric mean objectives, calculated using dry weather data, three years after the effective date of the TMDL.

Geometric means express the overall risk of exposure during a 30-day period including dry and wet weather, if any, and a dry weather-only calculation is artificial. USEPA's draft Recreational Water 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)."

Staff finds that the single sample maximums objective is a sufficient protective requirement for evaluation of dry weather only. Staff recommends that geometric means be calculated with all data in the 30 day period (wet weather and dry).

3.4.2 RECOMMENDATION

Delete reference to a dry weather-only geometric mean from the Santa Monica Bay Beaches bacteria TMDL and Marina del Rey Bacteria TMDL requirements.

3.4.3 Geometric means calculated with the *enterococcus* detection limit

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 much faster, allowing a beach to be posted as soon as the next day, if necessary. 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). 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 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 and was analyzed by membrane filtration (detection limit: 1 mpn/100ml), 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 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).

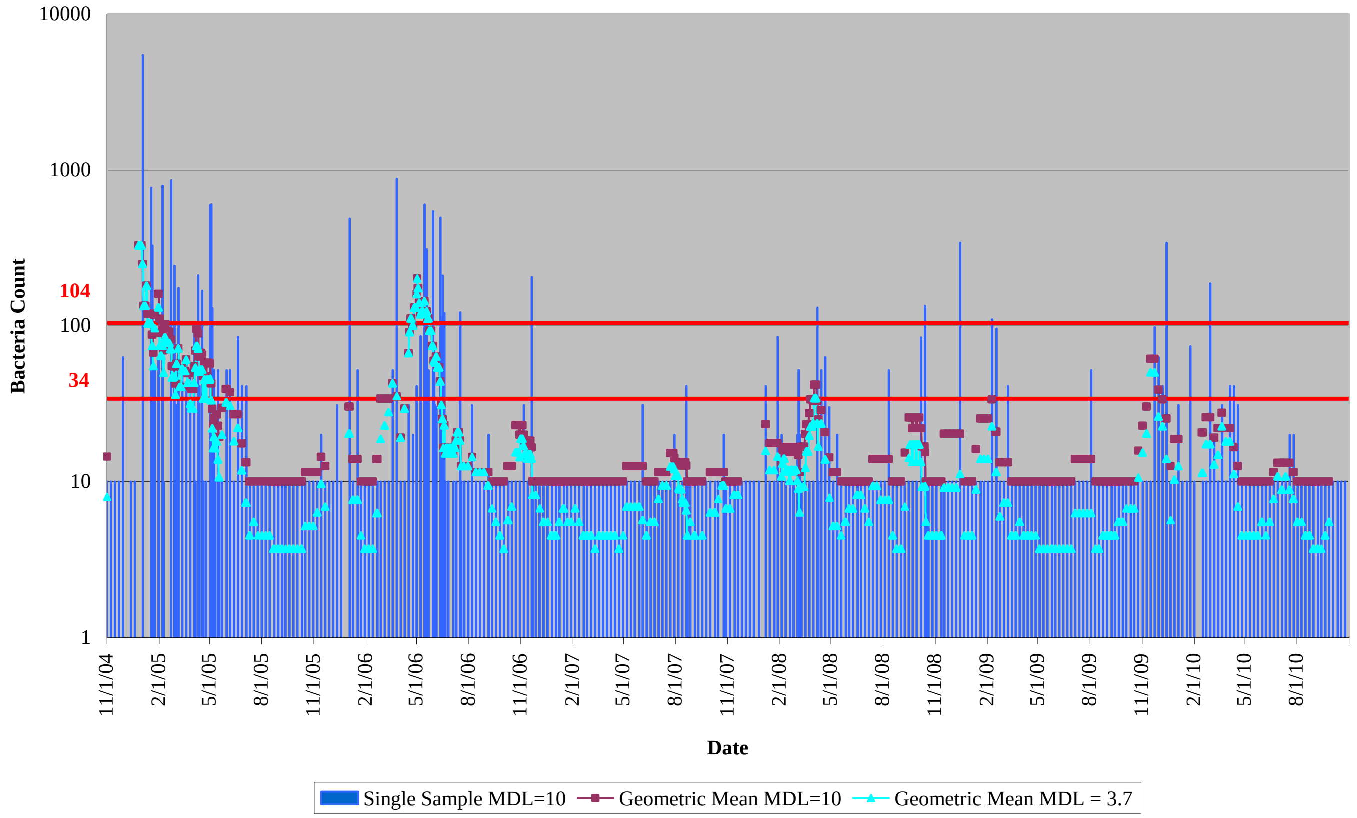
The Table 7 and Figure 1 show the difference between calculating the rolling geometric mean using the method detection limit of 10 mpn/100 ml in calculations when the actual result is below the detection limit and using 3.7 mpn/100 ml as a substitute for 10 in the calculation. The percent of exceedances of the rolling geometric mean at Leo Carillo 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 7 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 to *enterococcus* calculated with a method detection limit of 10
[2]MDL 3.7 refers to *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.

3.4.3 RECOMMENDATION

No additions or modifications to the TMDL. Responsible jurisdictions and agencies subject to the TMDL may conduct special studies for individual beaches 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.

3.4.4 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 Criteria (USEPA, 2011) does not specify rolling or discrete geometric 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. (SWQCB, 2004) (Listing Policy).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 difference 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 onto a beach, staff considered several sub-seasonal alternatives which group the months into subseasons on the basis of precipitation.

Tables 8, 9, and 10 below, 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 C.

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 *enterococcu*s. For example, in Alternative 1, Table 8, there were 6 April-May periods in the 6 years of data, so the geometric means for total coliform, fecal coliform and *enterococcu*s 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 8 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 9 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 subseasons. In this alternative, April is treated as a winter month.

Table 10 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 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 beach 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 the reference beach, 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 a greater or lesser implementation actions on the part of responsible parties.

3.4.4 RECOMMENDATION

Include consideration of seasonal and monthly geometric means 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 subseasons 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.

3.4.5 Application of Rolling geometric mean calculation or discrete geometric mean calculation.

Two principal types of error are possible when determining whether a beach is meeting the geometric mean standard: 1) determining the beach *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 beach 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 beach 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 of Section 3.4.4, 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 State Water Resources Control Board (SWRCB) 2004. Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) list. Sept. 30, 2004.

3.4.5 RECOMMENDATION

For these three beach TMDLs, calculate *rolling* geometric means; calculate a geometric mean weekly using 5 or more samples (calculation Method 3a from Section 3.4.1, 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.

3.5 Natural Sources Exclusion

The Natural Sources Exclusion approach is an alternative method for determining allowable exceedances days.

Chapter 3 of the Basin Plan, Water Quality Objectives, Bacteria, Coliform, includes implementation provisions for the bacterial objectives including a "Natural Sources Exclusion" approach:

> Under the natural sources exclusion implementation procedure, after all anthropogenic sources of bacteria have been controlled such that they do not cause or contribute to an exceedance of the single sample objectives and natural sources have been identified and quantified, a certain frequency of exceedance of the single sample objectives shall be permitted based on the residual exceedance frequency in the specific water body. The residual exceedance frequency shall define the background level of exceedance due to natural sources. The 'natural sources exclusion'

approach may be used if an appropriate reference system cannot be identified due to unique characteristics of the target water body. These approaches are consistent with the State Antidegradation Policy (State Board Resolution No. 68-16) and with federal antidegradation requirements (40 CFR 131.12).

TMDLs in this region have all used the reference system/antidegradation approach and none yet have used a natural sources exclusion approach. The natural sources exclusion approach requires that anthropogenic sources be controlled and natural contributions be quantified.

Both the Marina del Rey bacteria TMDL and the Inner Cabrillo Beach bacteria TMDL (for the Northern Beach at Inner Cabrillo Beach) specify that a natural sources exclusion approach may be developed for those beaches.

The alternative to the reference system/antidegradation approach is the natural sources exclusion approach, which provides that 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. Documentation has not been provided for either the MdR TMDL or the ICB TMDL indicating that all anthropogenic sources of bacteria have been controlled; therefore, it is premature to consider the application of the natural sources exclusion approach in these two TMDLs.

3.5 RECOMMENDATION

Continue with the reference system/antidegradation approach for these TMDLS.

3.6 Schedules

3.6.1 SMBB and MdR TMDLs Integrated Approach

The Santa Monica Bay beaches TMDL for wet weather allows for an extended wet-weather schedule if the Jurisdictional Groups pursue an Integrated Water Resources Approach. All Jurisdictional Groups have indicated that they would be pursuing an Integrated Water Resources Approach to implementation in their implementation plans submitted to the Regional Board in 2005. These plans have been accepted by the Regional Board by resolution.

Jurisdictional Group 1 and 4 Resolution No. 2006-005 (County of Los Angeles, 2005)
Jurisdictional Group 2 and 3 Resolution No. 2006-006 (City of Los Angeles, 2005)
Jurisdictional Group 5 and 6 Resolution No. 2006-007 (City of Manhattan Beach and Redondo Beach, 2005)

Jurisdictional Group 7 Resolution No. 2006-008 (City of Rancho Palos Verdes, 2005)

The Marina del Rey TMDL also allows for an extended wet-weather schedule if the responsible parties pursue an Integrated Water Resources Approach. The responsible parties have indicated that they would be pursuing an Integrated Water Resources Approach to implementation in their implementation plan submitted to the Regional Board in 2006. This plan was accepted by the Regional Board by Resolution No. 2006-009 (County of Los Angeles, 2005).

Since approval of the implementation plans, the Santa Monica Bay Beaches Jurisdictional Groups and the Marina del Rey Harbor TMDL responsible parties have continued to pursue 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 for the Santa Monica Bay and Marina del Rey Bacteria TMDLs 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 TMDLs combine responsible parties into Jurisdictional Groups for implementation planning and 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.

3.6.2 Inner Cabrillo Beach TMDL schedule

The Inner Cabrillo Beach, Main Ship Channel bacteria TMDL reconsideration includes a provision to “re-evaluate” the implementation schedule. While the TMDL targets have not yet been achieved at Inner Cabrillo Beach, and implementation deadlines have passed, failure to achieve targets per the original implementation schedule alone is insufficient to justify extending the schedule.

3.6 RECOMMENDATION

Confirm the Integrated Water Resources Approach for all Jurisdictional Groups in the Santa Monica bay Beaches TMDL and for the MdR Bacteria TMDL. No change to the schedule for the Inner Cabrillo Beach, Main Ship Channel bacteria TMDL.

3.7 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.

3.8 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.)
"Substitute environmental documents" were prepared for each of these TMDLs and the revision of the bacteria objectives and were adopted by the Regional Board by resolution:

SMBB dry weather	Resolution No. R02-004
SMBB wet weather	Resolution No. R02-022
MdR	Resolution No. R03-012
ICB	Resolution No. R04-011
Bacterial objectives	Resolution No. R01-018

Those documents contained the required environmental documentation under the State Water Board's CEQA regulations (23 Cal. Code Regs § 3777.) 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 these TMDL revisions do not alter the environmental analysis that was previously prepared for the establishment of the TMDLs because the TMDL revisions will not result in different implementation actions than those previously analyzed for the TMDLs, 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 these TMDL revisions do 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.

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APPENDIX A

Historical Rainfall Data at LAX Meterological Station from 1948 to 2008

Storm Year*	Rain Days	Percentile	Storm Year*	Wet Days**	Percentile	Storm Year*	Rain (in)	Percentile	Storm Year*	Dry Days***	Percentile
1983	70	100.0%	1983	118	100.0%	1998	30.79	100.0%	1968	341	100.0%
1998	58	98.3%	1998	110	98.3%	1983	28.75	98.3%	1959	340	98.3%
2005	54	96.6%	1978	80	96.6%	2005	26.71	96.6%	1961	338	95.0%
1978	49	95.0%	1995	78	95.0%	1978	26.51	95.0%	1970	338	95.0%
1957	47	91.6%	1979	77	93.3%	**1993**	**22.93**	**93.3%**	1972	336	93.3%
1958	**47**	**91.6%**	**1993**	**75**	**91.6%**	1995	22.73	91.6%	1964	333	91.6%
1979	44	86.6%	**1958**	**74**	**90.0%**	1980	20.67	90.0%	1948	330	90.0%
1982	44	86.6%	1952	73	85.0%	1986	19.68	88.3%	1991	327	88.3%
1995	44	86.6%	1969	73	85.0%	1952	18.65	86.6%	1955	326	85.0%
2006	43	85.0%	1982	73	85.0%	**1958**	**17.98**	**85.0%**	1987	326	85.0%
1969	42	81.6%	1986	67	81.6%	1962	17.7	83.3%	1960	325	81.6%
1992	42	81.6%	1992	67	81.6%	1973	15.57	81.6%	1990	325	81.6%
1952	41	75.0%	1999	66	80.0%	1969	15.5	80.0%	1977	324	80.0%
1965	41	75.0%	1985	65	76.6%	1992	15.29	78.3%	1976	323	78.3%
1980	41	75.0%	2005	65	76.6%	1979	14.91	76.6%	2008	322	76.6%
1993	**41**	**75.0%**	1973	64	73.3%	2001	14.42	75.0%	1951	320	73.3%
1949	39	71.6%	2006	64	73.3%	1982	13.69	73.3%	1954	320	73.3%
1999	39	71.6%	1980	62	71.6%	1967	13.26	71.6%	1956	319	68.3%
1985	38	70.0%	1989	61	70.0%	1966	12.63	70.0%	1981	319	68.3%
1973	37	65.0%	1949	60	66.6%	1954	12.22	68.3%	2007	319	68.3%
1974	37	65.0%	1996	60	66.6%	1997	11.86	66.6%	1988	318	63.3%
1986	37	65.0%	1957	59	63.3%	1996	11.66	65.0%	1997	318	63.3%
1966	35	63.3%	1965	59	63.3%	1977	11.54	63.3%	2001	318	63.3%
1975	34	58.3%	1984	58	61.6%	1974	11.37	61.6%	1967	317	61.6%
1976	34	58.3%	1950	57	58.3%	2000	11.28	60.0%	2003	316	60.0%
2000	34	58.3%	2000	57	58.3%	1975	10.98	58.3%	1962	315	58.3%
1962	33	55.0%	1975	56	56.6%	1963	10.78	56.6%	1963	314	55.0%
1971	33	55.0%	1953	55	51.6%	2006	10.75	55.0%	2004	314	55.0%
1951	32	46.6%	1971	55	51.6%	2003	10.32	53.3%	1966	312	50.0%
1954	32	46.6%	1994	55	51.6%	1957	10.22	51.6%	1974	312	50.0%
1963	32	46.6%	1966	53	48.3%	1965	10.2	50.0%	2002	312	50.0%
1967	32	46.6%	1974	53	48.3%	1971	10.18	48.3%	1953	310	45.0%
1989	32	46.6%	2002	52	45.0%	1985	9.58	45.0%	1971	310	45.0%
1950	31	40.0%	2004	52	45.0%	1950	9.4	43.3%	1994	310	45.0%
1953	31	40.0%	1963	51	43.3%	1956	9.22	41.6%	1975	309	41.6%
1994	31	40.0%	1962	50	41.6%	1999	9.09	40.0%	2000	309	41.6%
2001	31	40.0%	2003	49	40.0%	1968	8.88	38.3%	1950	308	38.3%
2008	30	38.3%	1967	48	36.6%	1960	8.87	36.6%	1984	308	38.3%
1996	29	36.6%	1988	48	36.6%	1981	8.81	35.0%	1957	306	33.3%
1948	28	31.6%	1956	47	31.6%	1953	8.51	33.3%	1965	306	33.3%
1987	28	31.6%	1997	47	31.6%	1991	8.32	31.6%	1996	306	33.3%
2002	28	31.6%	2001	47	31.6%	1994	8.26	30.0%	1949	305	31.6%
1956	27	23.3%	1981	46	28.3%	1972	8.03	28.3%	1980	304	28.3%
1984	27	23.3%	2007	46	28.3%	2004	7.79	26.6%	1989	304	28.3%
1988	27	23.3%	1951	45	25.0%	1949	7.71	25.0%	1973	301	25.0%
1997	27	23.3%	1954	45	25.0%	1976	7.53	23.3%	2006	301	25.0%
2003	27	23.3%	2008	44	23.3%	1984	7.21	21.6%	1985	300	21.6%
1977	26	20.0%	1976	43	21.6%	1988	7.1	20.0%	2005	300	21.6%
1991	26	20.0%	1960	41	18.3%	1989	7.06	18.3%	1992	299	18.3%
1981	25	18.3%	1977	41	18.3%	1951	6.67	16.6%	1999	299	18.3%
1964	24	15.0%	1990	40	16.6%	1987	6.28	15.0%	1986	298	16.6%
1970	24	15.0%	1955	39	13.3%	1964	6.25	13.3%	1952	293	15.0%
1990	23	11.6%	1987	39	13.3%	1970	5.53	11.6%	1969	292	11.6%
2007	23	11.6%	1991	38	11.6%	1990	5.49	10.0%	1982	292	11.6%
1955	22	6.6%	1948	36	10.0%	1955	5.45	8.3%	**1958**	**291**	**10.0%**
1960	22	6.6%	1964	33	8.3%	1948	5.1	6.6%	**1993**	**290**	**8.3%**
1972	22	6.6%	1972	30	6.6%	1959	5.04	5.0%	1979	288	6.6%
2004	20	5.0%	1961	27	3.3%	1961	4.83	3.3%	1995	287	5.0%
1959	18	1.6%	1970	27	3.3%	2002	4.24	1.6%	1978	285	3.3%
1961	18	1.6%	1959	25	0.0%	2007	3.02	0.0%	1998	255	1.6%
1968	16	0.0%	1968	25	0.0%	2008	9.74	46.6%	1983	247	0.0%

* A storm year is defined as November 1 to October 31 to be consistent with the periods specified in AB411.
** A wet day is defined as a day with a 0.1" of rain or more plus the 3 days following the rain event.
*** A dry day is defined as a non-wet day.

Appendix B

Table 1: Single Sample Analysis

	Time Period Analyzed	Constituent	Average	Median	Max	Min	Standard Deviation	Exceedance Count	Total Count	Exceed %
County Line Beach	January 2003 - July 2007	Total Coliform	283.45	20.00	17329.00	10.00	1667.39	2	223	0.90%
		Fecal Colifom	17.25	10.00	805.00	10.00	54.67	1	223	0.45%
		enterococcus	23.82	10.00	2005.00	10.00	134.99	5	223	2.24%
		Fecal to Coliform	0.58	0.50	1.00	0.00	0.40	1	223	0.45%
		Exceedance Day	N/A	N/A	N/A	N/A	N/A	5	223	2.24%
Dockweiler Beach Weekly (Wednesday) Sampling	January 2005 - July 2007	Total Coliform	283.45	20.00	17329.00	10.00	1667.39	2	223	0.90%
		Fecal Colifom	397.84	67.00	13000.00	67.00	1394.00	21	188	11.17%
		enterococcus	146.95	10.00	2000.00	9.00	423.67	28	188	14.89%
		Fecal to Coliform	0.29	0.12	1.00	0.01	0.35	14	188	7.45%
		Exceedance Day	N/A	N/A	N/A	N/A	N/A	51	188	27.13%
Dockweiler Beach 5 Day per Week Sampling	January 2005 - July 2007	Total Coliform	4058.79	1200.00	13000.00	67.00	4976.39	204	967	21.10%
		Fecal Colifom	504.11	67.00	13000.00	67.00	1733.26	139	967	14.37%
		enterococcus	172.40	20.00	13000.00	9.00	599.04	168	967	17.37%
		Fecal to Coliform	0.58	0.50	1.00	0.00	0.40	1	223	0.45%
		Exceedance Day	N/A	N/A	N/A	N/A	N/A	288	967	29.78%
Leo Carillo Beach	January 2005 - February 2009	Total Coliform	1102.66	36.00	24196.00	10.00	3396.73	5	208	2.40%
		Fecal Colifom	25.35	10.00	183.00	10.00	36.23	0	104	0.00%
		enterococcus	81.49	10.00	5475.00	10.00	399.83	23	208	11.06%
		Fecal to Coliform	0.63	1.00	1.00	0.00	0.42	0	104	0.00%
		Exceedance Day	N/A	N/A	N/A	N/A	N/A	27	208	12.98%
Long Beach - Mother's Beach	January 2005 - July 2007	Total Coliform	3444.50	458.50	24192.00	10.00	7243.03	19	156	12.18%
		Fecal Colifom	1381.97	111.00	24192.00	10.00	4353.07	41	156	26.28%
		enterococcus	196.51	20.00	2005.00	10.00	490.10	26	140	18.57%
		Fecal to Coliform	0.58	0.50	1.00	0.00	0.40	1	223	0.45%
		Exceedance Day	N/A	N/A	N/A	N/A	N/A	50	156	32.05%
Surfers Knoll	January 2003 - July 2007	Total Coliform	1454.96	120.00	24192.00	10.00	4128.06	9	229	3.93%
		Fecal Colifom	63.33	10.00	4541.00	10.00	368.98	4	229	1.75%
		enterococcus	42.80	10.00	2005.00	10.00	164.14	13	229	5.68%
		Fecal to Coliform	0.58	0.50	1.00	0.00	0.40	1	223	0.45%
		Exceedance Day	N/A	N/A	N/A	N/A	N/A	19	229	8.30%
Surfers Point	January 2005 - July 2007	Total Coliform	2317.92	605.00	24192.00	10.00	4921.47	13	227	5.73%
		Fecal Colifom	88.57	20.00	4352.00	10.00	349.03	8	227	3.52%
		enterococcus	54.34	10.00	2005.00	10.00	226.87	12	227	5.29%
		Fecal to Coliform	0.58	0.50	1.00	0.00	0.40	1	223	0.45%
		Exceedance Day	N/A	N/A	N/A	N/A	N/A	18	227	7.93%

Table 2: Calendar Month Geometric Mean (No Qualifier)

	Time Period Analyzed	Constituent	Average	Median	Max	Min	Standard Deviation	Exceedance Count	Total Count	Exceed %
County Line Beach	January 2003 - July 2007	Total Coliform	95.61	31.77	2675.23	10.00	360.50	1	54	1.85%
		Fecal Colifom	12.27	10.00	24.80	10.00	3.81	0	54	0.00%
		enterococcus	12.49	10.00	37.01	10.00	5.25	1	54	1.85%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	1	54	1.85%
Dockweiler Beach Weekly (Wednesday) Sampling	January 2005 - July 2007	Total Coliform	2040.10	735.51	9915.64	67.00	2465.12	20	49	40.82%
		Fecal Colifom	136.13	96.13	569.06	67.00	99.83	7	49	14.29%
		enterococcus	55.35	25.57	522.11	10.00	92.56	15	49	30.61%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	28	49	57.14%
Dockweiler Beach 5 Day per Week Sampling	January 2005 - July 2007	Total Coliform	1899.38	956.13	7915.38	67.00	1897.01	24	49	48.98%
		Fecal Colifom	145.35	101.71	513.47	67.00	105.82	6	49	12.24%
		enterococcus	48.29	23.75	396.35	10.00	68.69	14	49	28.57%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	29	49	59.18%
Leo Carillo Beach	January 2005 - February 2009	Total Coliform	355.43	31.44	3267.06	10.00	728.81	5	48	10.42%
		Fecal Colifom	17.49	13.27	45.21	10.00	9.72	0	25	0.00%
		enterococcus	33.54	13.27	517.60	10.00	76.09	9	48	18.75%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	10	48	20.83%
Long Beach - Mother's Beach	January 2005 - July 2007	Total Coliform	848.11	586.78	3342.85	83.06	827.51	9	30	30.00%
		Fecal Colifom	171.25	130.91	686.29	11.40	164.39	9	30	30.00%
		enterococcus	38.84	27.88	113.73	10.00	27.16	12	30	40.00%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	19	30	63.33%
Surfers Knoll	January 2003 - July 2007	Total Coliform	600.64	111.01	7342.82	17.46	1306.76	8	53	15.09%
		Fecal Colifom	21.83	14.23	114.28	10.00	21.69	0	53	0.00%
		enterococcus	18.95	12.54	68.87	10.00	13.68	5	53	9.43%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	10	53	18.87%
Surfers Point	January 2005 - July 2007	Total Coliform	1254.88	604.02	21920.90	69.74	2983.94	19	53	35.85%
		Fecal Colifom	37.69	20.85	330.10	10.00	48.43	1	53	1.89%
		enterococcus	26.24	14.40	445.53	10.00	59.81	5	53	9.43%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	21	53	39.62%

Table 3: Rolling 30-day Geometric Mean (5 Samples or Greater and Daily Calculation)

	Time Period Analyzed	Constituent	Average	Median	Max	Min	Standard Deviation	Exceedance Count	Total Count	Exceed %
County Line Beach	January 2003 - July 2007	Total Coliform	53.75	33.66	488.02	10.00	62.69	0	411	0.00%
		Fecal Colifom	13.19	11.49	49.91	10.00	5.55	0	411	0.00%
		enterococcus	13.04	10.00	32.27	10.00	5.48	0	411	0.00%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	0	411	0.00%
Dockweiler Beach Weekly (Wednesday) Sampling	January 2005 - July 2007	Total Coliform	2039.46	819.01	13000.00	181.72	2614.65	110	252	43.65%
		Fecal Colifom	127.18	96.13	633.35	67.00	86.90	30	252	11.90%
		enterococcus	30.74	19.25	237.28	9.79	30.27	72	252	28.57%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	148	252	58.73%
Dockweiler Beach 5 Day per Week Sampling	January 2005 - July 2007	Total Coliform	1873.17	1094.13	13000.00	76.50	1820.55	770	1469	52.42%
		Fecal Colifom	144.77	102.53	1011.26	67.00	118.32	216	1469	14.70%
		enterococcus	42.72	23.24	396.35	10.00	52.10	442	1469	30.09%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	904	1489	60.71%
Leo Carillo Beach	January 2005 - February 2009	Total Coliform	738.26	101.26	5575.39	10.00	1037.86	139	474	29.32%
		Fecal Colifom	18.56	16.63	49.89	10.00	7.91	0	215	0.00%
		enterococcus	34.29	16.80	339.68	10.00	38.35	141	474	29.75%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	332	1466	22.65%
Long Beach - Mother's Beach	January 2005 - July 2007	Total Coliform	1003.43	735.25	5397.05	72.51	840.92	155	428	36.21%
		Fecal Colifom	236.08	192.59	1320.74	11.11	197.19	210	428	49.07%
		enterococcus	43.57	33.90	126.19	10.00	26.96	168	342	49.12%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	483	875	55.20%
Surfers Knoll	January 2003 - July 2007	Total Coliform	999.18	208.99	8453.26	11.49	1825.27	133	529	25.14%
		Fecal Colifom	25.27	17.50	114.28	10.00	19.31	0	529	0.00%
		enterococcus	21.98	15.82	72.53	10.00	15.80	69	529	13.04%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	284	1570	18.09%
Surfers Point	January 2005 - July 2007	Total Coliform	1050.16	889.69	4983.75	64.11	847.63	217	492	44.11%
		Fecal Colifom	35.97	27.98	207.95	10.00	24.34	2	492	0.41%
		enterococcus	19.88	16.03	131.82	10.00	12.70	38	492	7.72%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	567	1577	35.95%

Table 4: Rolling 30-day Geometric Mean (No Qualifier)

	Time Period Analyzed	Constituent	Average	Median	Max	Min	Standard Deviation	Exceedance Count	Total Count	Exceed %
County Line Beach	January 2003 - July 2007	Total Coliform	145.74	30.87	17329.00	10.00	1155.25	21	1606	1.31%
		Fecal Colifom	12.22	10.00	49.91	10.00	4.07	0	1606	0.00%
		enterococcus	12.97	10.00	137.00	10.00	9.86	38	1606	2.37%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	38	1606	2.37%
Dockweiler Beach Weekly (Wednesday) Sampling	January 2005 - July 2007	Total Coliform	2121.87	870.76	13000.00	67.00	2818.75	678	1478	45.87%
		Fecal Colifom	155.99	93.33	3700.00	67.00	255.44	259	1478	17.52%
		enterococcus	64.47	21.46	2000.00	9.74	184.32	489	1478	33.09%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	859	1478	58.12%
Dockweiler Beach 5 Day per Week Sampling	January 2005 - July 2007	Total Coliform	1901.70	1085.54	13000.00	67.00	1948.06	776	1489	52.12%
		Fecal Colifom	146.85	102.27	1179.83	67.00	127.06	222	1489	14.91%
		enterococcus	42.40	23.12	379.75	10.00	51.68	445	1489	29.89%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	904	1489	60.71%
Leo Carillo Beach	January 2005 - February 2009	Total Coliform	338.06	30.45	5575.39	10.00	710.09	169	1466	11.53%
		Fecal Colifom	16.84	14.23	62.71	10.00	9.10	0	756	0.00%
		enterococcus	24.50	13.27	339.68	10.00	28.90	268	1466	18.28%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	332	1466	22.65%
Long Beach - Mother's Beach	January 2005 - July 2007	Total Coliform	854.11	542.21	5397.05	46.17	925.23	258	875	29.49%
		Fecal Colifom	179.02	103.17	1523.95	10.91	210.46	281	875	32.11%
		enterococcus	41.87	27.66	290.19	10.00	42.39	347	875	39.66%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	483	875	55.20%
Surfers Knoll	January 2003 - July 2007	Total Coliform	612.12	123.57	9679.65	11.49	1361.84	241	1570	15.35%
		Fecal Colifom	22.24	14.40	308.80	10.00	26.75	7	1570	0.45%
		enterococcus	19.98	13.27	325.98	10.00	24.71	130	1570	8.28%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	284	1570	18.09%
Surfers Point	January 2005 - July 2007	Total Coliform	1197.69	640.22	24192.00	42.98	2758.63	509	1577	32.28%
		Fecal Colifom	40.47	22.45	779.82	10.00	76.75	30	1577	1.90%
		enterococcus	32.87	14.32	2005.00	10.00	144.15	153	1577	9.70%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	567	1577	35.95%

Table 5: Rolling 30-day Geometric Mean (5 Samples or Greater and Sampled Day Calculation)

	Time Period Analyzed	Constituent	Average	Median	Max	Min	Standard Deviation	Exceedance Count	Total Count	Exceed %
County Line Beach	January 2003 - July 2007	Total Coliform	52.45	32.46	488.02	10.00	64.11	0	194	0.00%
		Fecal Colifom	12.25	10.00	38.18	10.00	3.78	0	194	0.00%
		enterococcus	12.23	10.00	32.27	10.00	4.34	0	194	0.00%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	0	194	0.00%
Dockweiler Beach Weekly (Wednesday) Sampling	January 2005 - July 2007	Total Coliform	2039.46	819.01	13000.00	181.72	2619.87	55	126	43.65%
		Fecal Colifom	127.18	96.13	633.35	67.00	87.08	15	126	11.90%
		enterococcus	30.74	19.25	237.28	9.79	30.33	36	126	28.57%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	74	126	58.73%
Dockweiler Beach 5 Day per Week Sampling	January 2005 - July 2007	Total Coliform	1980.41	1151.95	13000.00	76.50	1890.91	508	940	54.04%
		Fecal Colifom	150.53	105.19	1011.26	67.00	120.72	153	940	16.28%
		enterococcus	44.69	24.02	396.35	10.00	54.63	295	940	31.38%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	593	940	63.09%
Leo Carillo Beach	January 2005 - February 2009	Total Coliform	428.15	35.14	3591.92	10.00	747.08	27	160	16.88%
		Fecal Colifom	17.47	14.43	49.89	10.00	8.53	0	78	0.00%
		enterococcus	27.24	13.91	339.68	10.00	36.79	30	160	18.75%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	41	160	25.63%
Long Beach - Mother's Beach	January 2005 - July 2007	Total Coliform	914.62	809.72	3108.43	72.51	655.48	46	118	38.98%
		Fecal Colifom	218.09	192.89	686.29	11.11	155.02	57	118	48.31%
		enterococcus	44.66	37.25	116.15	10.00	27.58	49	94	52.13%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	83	118	70.34%
Surfers Knoll	January 2003 - July 2007	Total Coliform	540.75	128.58	8218.99	11.49	1211.77	27	199	13.57%
		Fecal Colifom	19.52	15.16	76.14	10.00	13.07	0	199	0.00%
		enterococcus	17.51	13.32	60.29	10.00	10.65	12	199	6.03%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	30	199	15.08%
Surfers Point	January 2005 - July 2007	Total Coliform	810.66	596.68	4983.75	64.11	698.49	55	190	28.95%
		Fecal Colifom	30.64	23.05	207.95	10.00	22.78	1	190	0.53%
		enterococcus	18.61	14.82	131.82	10.00	12.31	10	190	5.26%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	58	190	30.53%

Table 6: Rolling 30-day Geometric Mean (4 Samples or Greater and Daily Calculation)

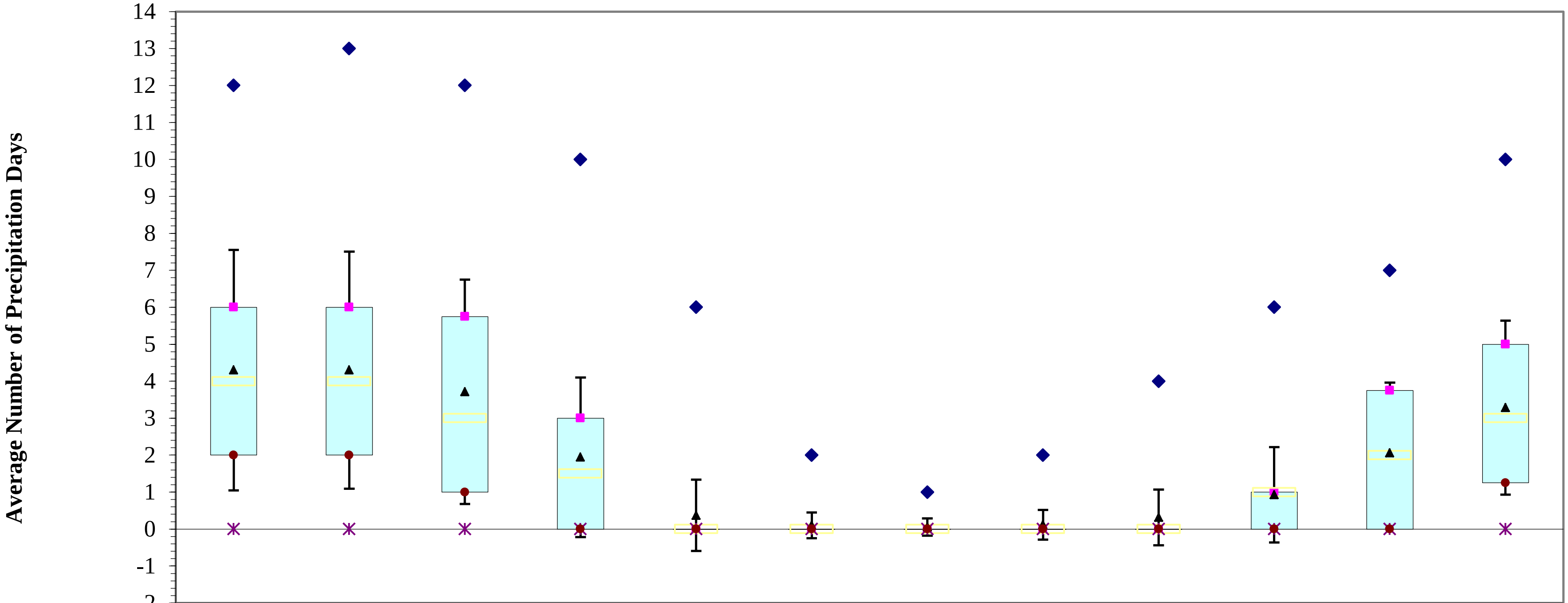
	Time Period Analyzed	Constituent	Average	Median	Max	Min	Standard Deviation	Exceedance Count	Total Count	Exceed %
County Line Beach	January 2003 - July 2007	Total Coliform	55.02	31.80	530.31	10.00	70.37	0	1442	0.00%
		Fecal Colifom	12.21	10.00	49.91	10.00	4.02	0	1442	0.00%
		enterococcus	12.28	10.00	37.63	10.00	4.90	17	1442	1.18%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	17	1442	1.18%
Dockweiler Beach Weekly (Wednesday) Sampling	January 2005 - July 2007	Total Coliform	2033.04	863.89	13000.00	93.33	2635.64	470	1028	45.72%
		Fecal Colifom	129.29	91.26	633.35	67.00	91.64	145	1028	14.11%
		enterococcus	33.73	19.00	271.73	9.74	38.98	294	1028	28.60%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	594	1028	57.78%
Dockweiler Beach 5 Day per Week Sampling	January 2005 - July 2007	Total Coliform	1876.37	1091.60	13000.00	76.50	1842.38	771	1474	52.31%
		Fecal Colifom	144.76	102.52	1011.26	67.00	118.45	217	1474	14.72%
		enterococcus	42.65	23.20	396.35	10.00	52.04	443	1474	30.05%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	899	1474	60.99%
Leo Carillo Beach	January 2005 - February 2009	Total Coliform	384.58	29.55	5575.39	10.00	770.99	155	1185	13.08%
		Fecal Colifom	17.50	14.40	62.71	10.00	9.56	0	607	0.00%
		enterococcus	25.44	13.27	339.68	10.00	30.54	218	1185	18.40%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	282	1185	23.80%
Long Beach - Mother's Beach	January 2005 - July 2007	Total Coliform	917.83	668.99	5397.05	56.34	887.11	222	669	33.18%
		Fecal Colifom	189.00	123.94	1320.74	11.11	183.19	244	669	36.47%
		enterococcus	40.28	29.85	141.97	10.00	30.31	271	631	42.95%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	411	669	61.43%
Surfers Knoll	January 2003 - July 2007	Total Coliform	528.34	124.29	8453.26	11.49	1201.19	184	1444	12.74%
		Fecal Colifom	20.62	14.23	158.35	10.00	18.16	0	1444	0.00%
		enterococcus	18.09	13.27	77.93	10.00	12.58	104	1444	7.20%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	222	1444	15.37%
Surfers Point	January 2005 - July 2007	Total Coliform	898.82	617.54	13377.58	57.96	1147.67	431	1422	30.31%
		Fecal Colifom	32.53	22.27	373.41	10.00	33.29	9	1422	0.63%
		enterococcus	19.52	14.66	251.17	10.00	19.83	127	1422	8.93%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	489	1422	34.39%

Table 7: Rolling 30-day Geometric Mean (4 Samples or Greater and Sampled Day Calculation)

	Time Period Analyzed	Constituent	Average	Median	Max	Min	Standard Deviation	Exceedance Count	Total Count	Exceed %
County Line Beach	January 2003 - July 2007	Total Coliform	52.82	30.79	488.02	10.00	66.59	0	217	0.00%
		Fecal Colifom	12.11	10.00	38.18	10.00	3.64	0	217	0.00%
		enterococcus	12.20	10.00	32.27	10.00	4.37	0	217	0.00%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	0	217	0.00%
Dockweiler Beach Weekly (Wednesday) Sampling	January 2005 - July 2007	Total Coliform	1941.94	857.62	13000.00	93.33	2431.91	74	161	45.96%
		Fecal Colifom	130.78	95.80	633.35	67.00	94.18	20	161	12.42%
		enterococcus	35.82	19.31	271.73	9.79	42.66	48	161	29.81%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	96	161	59.63%
Dockweiler Beach 5 Day per Week Sampling	January 2005 - July 2007	Total Coliform	1988.11	1151.81	13000.00	76.50	1923.68	509	943	53.98%
		Fecal Colifom	150.67	105.19	1011.26	67.00	120.98	154	943	16.33%
		enterococcus	44.63	24.01	396.35	10.00	54.56	296	943	31.39%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	594	943	62.99%
Leo Carillo Beach	January 2005 - February 2009	Total Coliform	397.31	39.29	3591.92	10.00	706.19	29	187	15.51%
		Fecal Colifom	17.53	14.43	49.89	10.00	8.51	0	92	0.00%
		enterococcus	26.51	13.91	339.68	10.00	35.04	36	187	19.25%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	47	187	25.13%
Long Beach - Mother's Beach	January 2005 - July 2007	Total Coliform	876.88	747.19	3108.43	72.51	648.68	52	139	37.41%
		Fecal Colifom	202.86	155.65	686.29	11.11	153.09	61	139	43.88%
		enterococcus	42.94	31.90	129.18	10.00	28.52	60	123	48.78%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	92	139	66.19%
Surfers Knoll	January 2003 - July 2007	Total Coliform	532.82	109.82	8218.99	11.49	1180.38	30	221	13.57%
		Fecal Colifom	19.91	14.80	96.33	10.00	14.29	0	221	0.00%
		enterococcus	17.41	12.70	60.29	10.00	10.75	14	221	6.33%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	35	221	15.84%
Surfers Point	January 2005 - July 2007	Total Coliform	863.33	601.04	13377.58	64.11	1092.50	63	218	28.90%
		Fecal Colifom	32.26	22.52	373.41	10.00	32.35	2	218	0.92%
		enterococcus	19.16	14.82	251.17	10.00	19.69	12	218	5.50%
		Any Indicator	N/A	N/A	N/A	N/A	N/A	66	218	30.28%

Appendix C

LAX Rain Gage Average Monthly Precipitation Day
November 1940 - October 2010



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
75th Percentile	6.00	6.00	5.75	3.00	0.00	0.00	0.00	0.00	0.00	1.00	3.75	5.00
median	4.00	4.00	3.00	1.50	0.00	0.00	0.00	0.00	0.00	1.00	2.00	3.00
Max	12.00	13.00	12.00	10.00	6.00	2.00	1.00	2.00	4.00	6.00	7.00	10.00
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
StDev	3.25	3.21	3.04	2.16	0.97	0.35	0.23	0.40	0.75	1.29	1.90	2.35
Average	4.30	4.30	3.71	1.94	0.37	0.10	0.06	0.11	0.31	0.93	2.06	3.29
25th Percentile	2.00	2.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25

Month

*Precipitation is measured as any day with 0.1 inch of rain or greater.

Appendix D

New beach data: point zero, open, and "anti-degradation" beaches 2004-2005

Sample Station	Type (M=Moved N=New E=Existing)	Location	Single Sample November 2004 to October 2010 Exceedance % (Exceed Count/Sample Count)		
			Summer Dry Weather Exceedance Day	Winter Dry Weather Exceedance Day	Wet Weather Exceedance Day
SMB 1-1	Point Zero (M)	Leo Carrillo Beach, at 35000 PCH	18% (6/34)	30% (6/20)	57% (4/7)
SMB 1-2	Point Zero (N)	El Pescador State Beach	0% (0/27)	6% (1/17)	30% (3/10)
SMB 1-3	Point Zero (N)	El Matador State Beach	0% (0/27)	0% (0/16)	22% (2/9)
SMB 1-4	Point Zero (M)	Trancas Creek at Broad Beach	6% (2/32)	65% (17/26)	60% (3/5)
SMB 1-5	Point Zero (M)	Zuma Creek at Zuma Beach	17% (6/35)	58% (14/24)	57% (4/7)
SMB 1-6	Point Zero (N)	Walnut Creek in Paradise Cove	0% (0/25)	18% (3/17)	38% (3/8)
SMB O-1#	Point Zero (N)	Paradise Cove	2% (1/62)	13% (2/16)	20% (3/15)
SMB 1-7	Point Zero (M)	Ramirez Creek at Paradise Cove Pier	32% (13/41)	70% (16/23)	80% (8/10)
SMB 1-8	Point Zero (N)	Escondido Creek, just east of Escondido State Beach	77% (47/61)	33% (7/21)	50% (6/12)
SMB 1-9	Point Zero (M)	Latigo Canyon Creek, adjacent the Trivoli Bay Villa Treatment Plant	40% (16/40)	38% (8/21)	50% (4/8)
SMB 1-10	Point Zero (N)	Solstice Creek at Dan Blocker County Beach	28% (10/36)	0% (0/15)	50% (5/10)
SMB O-2#	Point Zero (N)	Puerco Canyon storm drain	3% (2/59)	0% (0/13)	7% (1/14)
SMB 1-11	Point Zero (M)	Wave wash of unnamed creek on Puerco Beach	6% (2/31)	6% (1/16)	40% (2/5)
SMB 1-12	Point Zero (N)	Marie Canyon Storm Drain at Puerco Beach	74% (39/53)	65% (17/26)	69% (9/13)
SMB 1-13	Point Zero (N)	Sweetwater Creek on Carbon Beach	22% (7/32)	19% (4/21)	67% (6/9)
SMB 1-14	Point Zero (N)	Las Flores Creek at Las Flores State Beach	27% (9/33)	9% (1/11)	64% (7/11)
SMB 1-15	Open Beach	Big Rock Beach at 19948 Pacific Coast Hwy	12% (4/33)	6% (1/16)	50% (3/6)
SMB 1-16	Point Zero (N)	Pena Creek at Las Tunas County Beach	10% (3/30)	13% (2/16)	46% (6/13)
SMB 1-17	Point Zero (N)	Tuna Canyon Creek at Las Tunas County Beach	32% (7/22)	20% (3/15)	33% (2/6)
SMB 1-18	Point Zero (M)	Topanga Creek at Topanga County Beach	39% (57/148)	37% (33/90)	74% (40/54)
SMB 2-1	Point Zero (N)	Castlerock (Parker Mesa) Storm Drain Topanga County Beach	80% (49/61)	64% (18/28)	85% (11/13)

Appendix D

Sample Station	Type (M=Moved N=New E=Existing)	Location	Single Sample November 2004 to October 2010 Exceedance % (Exceed Count/Sample Count)		
			Summer Dry Weather Exceedance Day	Winter Dry Weather Exceedance Day	Wet Weather Exceedance Day
SMB 2-2	Point Zero (N)	Santa Ynez Storm Drain at Will Rodgers State Beach	63% (19/30)	52% (11/21)	64% (7/11)
SMB 2-3	Open Beach	Will Rogers State Beach at 17200 Pacific Coast Hwy.	3% (1/30)	6% (1/16)	63% (5/8)
SMB 2-4	Point Zero (M)	Pulga Canyon storm drain at Will Rodgers State Beach	28% (25/89)	27% (24/90)	75% (36/48)
SMB 2-5	Point Zero (M)	Bay Club Storm Drain	20% (7/35)	28% (5/18)	63% (5/8)
SMB 2-6	Point Zero (M)	Temescal Storm Drain	9% (3/33)	74% (20/27)	90% (9/10)
SMB 2-7	Point Zero (M)	Santa Monica Canyon, Will Rogers State Beach	71% (105/148)	77% (69/90)	96% (52/54)
SMB 2-8	Open Beach	Venice Pier, Venice	6% (2/31)	6% (1/16)	50% (3/6)
SMB 2-9	Open Beach	Topsail Street extended at Venice Beach	6% (2/31)	13% (2/15)	71% (5/7)
SMB 2-10	Point Zero (M)	Culver Bl. Storm Drain at Dockweiler State Beach	3% (3/87)	7% (6/90)	42% (20/48)
SMB 2-11	Point Zero (N)	North Westchester Storm Drain at Dockweiler State Beach	0% (0/27)	0% (0/15)	40% (4/10)
SMB 2-12	Open Beach	World Way extended at Dockweiler State Beach	3% (1/30)	18% (3/17)	33% (2/6)
SMB 2-13	Point Zero (M)	Imperial Highway storm drain at Dockweiler State Beach	14% (12/84)	7% (6/90)	44% (21/48)
SMB 2-14	Open Beach	Opposite Hyperion Plant at Dockweiler State Beach	0% (0/29)	7% (1/15)	33% (2/6)
SMB 2-15	Point Zero (E)	Grand Avenue Storm Drain at Dockweiler State Beach	6% (2/31)	20% (3/15)	50% (3/6)
SMB 3-1	Point Zero (M)	Montana Storm Drain at Santa Monica State Beach	6% (2/32)	26% (5/19)	50% (3/6)
SMB 3-2	Point Zero (M)	Wilshire Storm Drain at Santa Monica State Beach	6% (2/31)	13% (2/16)	71% (5/7)
SMB 3-3	Point Zero (M)	Santa Monica Pier Storm Drain at Santa Monica State Beach	41% (61/147)	49% (44/90)	69% (38/55)
SMB 3-4	Point Zero (M)	Pico-Kenter Storm Drain at Santa Monica State Beach	20% (30/147)	49% (44/90)	76% (42/55)
SMB 3-5	Point Zero (M)	Ashland Storm Drain at Venice Beach	1% (2/147)	17% (15/90)	55% (30/55)
SMB 3-6	Point Zero (N)	Rose Ave. Storm Drain at Venice Beach	10% (3/29)	12% (2/17)	55% (6/11)
SMB 3-7	Point Zero (M)	Brooks Storm Drain at Venice City Beach	3% (1/30)	7% (1/15)	50% (3/6)
SMB 3-8	Point Zero (M)	Windward Storm Drain at Venice City Beach	6% (5/85)	9% (6/70)	41% (17/41)
SMB 3-9	Open Beach	Strand Street extended at Santa Monica Beach	0% (0/29)	28% (5/18)	57% (4/7)
SMB 4-1	Point Zero (M)	San Nicholas Canyon Creek at Nicholas Beach	3% (1/30)	12% (2/17)	40% (2/5)

Appendix D

Sample Station	Type (M=Moved N=New E=Existing)	Location	Single Sample November 2004 to October 2010 Exceedance % (Exceed Count/Sample Count)		
			Summer Dry Weather Exceedance Day	Winter Dry Weather Exceedance Day	Wet Weather Exceedance Day
SMB 5-1*	Open Beach	Manhattan State Beach at 40th Street	0% (0/29)	6% (2/36)	11% (1/9)
SMB 5-2	Point Zero (M)	28th Street Drain at Manhattan State Beach	11% (11/97)	25% (4/16)	57% (8/14)
SMB 5-3*	Point Zero (M)	Manhattan Beach Pier at Manhattan State Beach	3% (1/29)	8% (3/36)	11% (1/9)
SMB 5-4	Open Beach	Hermosa Beach at 26th Street	0% (0/29)	0% (0/15)	50% (3/6)
SMB 5-5*	Open Beach	Hermosa Beach Pier at Hermosa Beach	0% (0/29)	7% (1/15)	22% (2/9)
SMB 6-1	Point Zero (M)	Herondo Storm Drain at Redondo Beach	4% (4/91)	24% (4/17)	71% (10/14)
SMB 6-2*	Open Beach	Redondo Municipal Pier - 100 yards south at Redondo Beach	13% (4/30)	0% (0/15)	22% (2/9)
SMB 6-3	Point Zero (N)	Sapphire Street Drain at Redondo Beach	10% (3/30)	0% (0/15)	22% (2/9)
SMB 6-4	Open Beach	120' north of Topaz groin at Redondo Beach	0% (0/29)	13% (2/15)	43% (3/7)
SMB 6-5*	Point Zero (M)	Avenue I Storm Drain at Redondo Beach	3% (1/30)	6% (2/36)	11% (1/9)
SMB 6-6*	Open Beach	Malaga Cove, Palos Verdes Estates	0% (0/29)	13% (2/16)	22% (2/9)
SMB 7-1	Open Beach	Malaga Cove	0% (0/32)	0% (0/18)	40% (4/10)
SMB 7-2	Open Beach	Bluff Cove	0% (0/32)	5% (1/19)	20% (2/10)
SMB 7-3	Open Beach	Long Point	0% (0/194)	0% (0/106)	15% (10/65)
SMB 7-4	Open Beach	Abalone Cove	1% (1/194)	0% (0/106)	9% (6/65)
SMB 7-5	Open Beach	Portuguese Bend Cove	0% (0/194)	3% (3/106)	6% (4/65)
SMB 7-6	Open Beach	Royal Palms	0% (0/194)	0% (0/106)	15% (10/65)
SMB 7-7	Point Zero (N)	At storm drain between White Point and Wilder Annex	0% (0/29)	0% (0/18)	60% (6/10)
SMB 7-8	Open Beach	Wilder Annex	0% (0/194)	3% (3/106)	18% (12/65)
SMB 7-9	Open Beach	Outer Cabrillo Beach	0% (0/194)	0% (0/106)	9% (6/65)
SMB BC-1	Point Zero (M)	Ballona Creek at Dockweiler State Beach	31% (45/147)	34% (31/90)	84% (46/55)
SMB MC-1	Open Beach	Malibu Point, Malibu State Beach	22% (8/36)	17% (3/18)	40% (2/5)
SMB MC-2	Point Zero (M)	Surfrider Beach (breach point of Malibu Lagoon)	58% (85/147)	37% (33/90)	71% (37/52)
SMB MC-3	Open Beach	Malibu Pier at Carbon Beach	12% (4/33)	41% (9/22)	57% (4/7)

Monitoring began in 2010 and data was examine from April 2010 to November 2011

* Two different data were available for the sampling site and subsequently combined