county of ventura

PUBLIC WORKS AGENCY
JEFF PRATT
Agency Director

Watershed Protection District
Interim Director

Transportation Department
David Fleisch, Director

Engineering Services Department
Phil Nelson, Director

Water & Sanitation Department
R. Reddy Pakala, Director

Central Services Department
Janice Turner, Director

May 7, 2012

L.B. Nye, Ph. D., Chief, TMDLs and Standards
California Regional Water Quality Control Board
Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, CA 90013

Subject: **COMMENTS ON PROPOSED AMENDMENT FOR THE TOTAL MAXIMUM DAILY LOAD FOR INDICATOR BACTERIA IN THE MALIBU CREEK AND LAGOON**

Dear Dr. Nye:

The County of Ventura Public Works Agency (VCPWA) appreciates the opportunity to provide comments on the proposed amendment to the Water Quality Control Plan for the Los Angeles Regional (Basin Plan) to revise Total Maximum Daily Load (TMDL) for Indicator Bacteria in Malibu Creek and Lagoon. Additionally, we appreciate the Los Angeles Regional Water Quality Control Board (LARWQCB) staff's participation in discussing concerns we have on the TMDL under consideration.

Approximately 21,000 acres, or 30% of the entire Malibu Creek Watershed (MCW), is within Ventura County unincorporated areas. The unincorporated Ventura County portions of the watershed consist of open space (80%), urban and developed lands (10%), and agricultural areas (10%). A majority of the open space lands are managed by other public agencies (National Parks Service, California State Parks, Santa Monica Mountains Conservancy, Rancho Simi Parks & Recreation District, etc.). Six compliance monitoring stations are located downstream of County unincorporated areas. Further description of the County unincorporated area, along with the identification of new proposed bacteria BMPs, is summarized in the County of Ventura MCW Bacteria Total Maximum Daily Load (TMDL) Implementation Plan Addendum, which is currently under development.

As you are aware, we met with LARWQCB staff on January 20, 2012 to discuss the MCW Bacteria TMDL Reopener and appreciate the Board's efforts to revise the TMDLs as new data become available. We are providing the following comments and requested actions on the Draft MCW Bacteria TMDL Reopener, addressing a range of critical items to us, as well as supporting studies, references, and data as appropriate.

COMMENTS

1. Reopener Schedule

LARWQCB staff are proposing that comments are due on May 7, 2012 and the TMDL reopener hearing is scheduled for June 1, 2012. We request that the MCW Bacteria TMDL reopener be delayed until the Southern California Coastal Water Research

Project (SCCWRP) epidemiological study final results from Surfrider Beach, located at the outlet of MCW, become available, so these results can be considered in setting any revised WLAs. This is a very relevant and important study since it's the only recent local study that tells us: (a) whether swimmers are getting sick at rates above U.S. EPA tolerable levels (and whether this might be due to bather shedding or other uncontrollable pathogen sources), and (b) whether fecal indicator bacteria (FIB) are reliable metrics for protecting REC illness rates at a local Santa Monica Bay (SMB) Beach. Preliminary results at Surfrider Beach have found no correlation between illness rates and indicator bacteria concentrations (Griffith 2011). Other recent Southern California beach epidemiological studies have also questioned the correlation between traditional bacterial indicators and human health risks (Colford et al 2005). Furthermore, various freshwater stream studies have found that E. coli in particular originates and grows in soils (Ishii et al 2006, Goto and Yan 2011, Hardin and Fujioka 1991, and Fujioka et al 1998), thereby further questioning this presumed human health linkage for urban runoff impacted receiving waters. Therefore the results of this important SCCWRP epidemiological study at the mouth of the MCW should most certainly affect how REC beneficial use compliance is measured and assessed within a watershed, since the setting of compliance limits is a fundamental component of this TMDL reopener.

Requested Action: Postpone MCW Bacteria TMDL reopener until final results of the SCCWRP epidemiological study at the Surfrider Beach are available and published (scheduled for spring/summer of 2013).

2. Reconsideration Items

The proposed amendment includes items beyond those specifically listed as reconsideration items in the MCW Bacteria TMDL and 2004 Basin Plan Amendment (BPA). The currently approved MCW Bacteria TMDL text detailing the technical re-opener topics includes reconsideration of a possible Natural Source Exclusion (NSE), reassessment of dry/wet exceedance days, re-evaluation of reference year, and re-evaluation of geometric mean implementation. This TMDL re-opener text does not include reconsideration of new proposed items which require significant planning and funding on the part of the responsible agencies, or (1) revising and resubmitting previously approved Compliance Monitoring Plans, (2) the addition of outfall monitoring requirements, and (3) daily receiving water sampling, triggered by a waste load allocation (WLA) exceedance, and implemented within 24 hours after receiving lab results. The TMDL reopener should be limited to the technical details that the TMDL specifically identifies for reconsideration, in addition to other important items that do not require significant lead time for planning and funding, such as the three new monitoring-related items identified above.

Requested Action: Limit the MCW Bacteria TMDL reopener to consider technical details that the TMDL specifically identified for reconsideration, and only additional important items that do not require significant lead time for planning and funding such as the proposed outfall monitoring or daily monitoring following exceedances.

3. Proposed Daily Sampling Investigation

If the number of reported single sample exceedance days is greater than the allowable number of exceedance days, the water body is considered out-of-compliance. The proposed amendment requires when a water body is out-of-compliance, the responsible agencies must implement, within 24-hours of receiving analytical results, an investigation including daily sampling until all single sample events meet the objectives. As described in Comment #2, we request daily monitoring not be triggered within 24-hours. This was not a scheduled reconsideration item and this effort would require long-term planning that would be a significant burden on staff and fiscal resources not available for this purpose. We therefore request that instead of daily sampling, that a one-time source identification study be conducted, which would ultimately serve as a more valuable tool in identifying and eliminating sources of bacteria to the creeks. If the LARWQCB insists on keeping the daily sampling requirement, we request that the purpose and intent of daily sampling be clarified. Also, rather than implementing daily sampling immediately, exceedances beyond allowable should first trigger an investigation plan, laying out the approach for identifying and addressing sources, which will be much more valuable than immediate daily instream sampling. Mobilizing a team to begin daily sampling within 24 hours for an undetermined length of time is anticipated to be an extreme burden on resources. Furthermore, the end point for daily sampling should be better clarified, as is currently unclear as to when "all single sample events [would] meet the objectives." We also request clarification that, if LARWQCB insists on daily sampling requirement, then weekends, holidays, and days with unsafe conditions will be excluded.

Requested Action: Remove proposed requirement for the daily monitoring as a follow-up to exceeding the WLAs, with a source identification study to be conducted in its place.

4. Proposed Outfall Monitoring

The proposed amendment requires the responsible parties to submit an outfall monitoring plan within 6 months of the effective date of the revised TMDL (pages 8-9 of revised BPA). As described in Comment #2, we request that outfall monitoring not be required. This was not a scheduled reconsideration item and would require long-term planning that would be a significant burden on resources which have not been allocated for this purpose. Furthermore, periodic sampling at Municipal Separate Storm Sewer System (MS4) outfalls is not expected to provide any meaningful new information, such as that which would inform source identification. However, if the LARWQCB insists on requiring outfall monitoring, we request that the distinct goal or purpose of outfall monitoring be clarified to justify this additional significant cost. We also request that LARWQCB staff clarify that compliance determination will be based on the lower of the outfall and instream bacteria concentrations since, 1) If outfalls are lower, then MS4 discharges are not "causing or contributing to" receiving water violations, and 2) if receiving water is lower, then water body would be attaining REC beneficial uses. Lastly, we request that "enhanced outfall monitoring" (BPA page 9) only be triggered when both instream allowable exceedance days and past outfall monitoring data suggest that MS4 outfall concentrations are greater than instream concentrations.

Requested Action: Remove proposed outfall monitoring requirement from the draft MCW Bacteria TMDL Reopener.

5. Reference System Selection

Page 14 of the draft TMDL staff report says, "The reference system was selected based on all of the freshwater sites in the three SCCWRP studies (except the three minimally impacted sites) because this results in the most robust dataset." This data is included in Appendix C to the draft TMDL staff report. A review of the three SCCWRP studies, in comparison to the raw data provided in Appendix C, has shown that several reference sites were not included in the analysis that was used to determine the allowable exceedance rates. This is the case for both wet and dry weather. We request that the LARWQCB either include all reference sites in the reference system, or clarify which specific sites were selected and why the others were excluded. It is also requested that the "three minimally impacted sites" be listed, along with an explanation of how "minimally impacted" is defined.

Requested Action: Provide additional transparency as to the selection of the reference stream datasets, as well as a clear definition of "minimally impacted".

6. Removal of Fecal Coliform Limits for Fresh Waters

Fecal coliform limits have been removed as numeric targets to maintain consistency with U.S. EPA's recommended criteria. We support the removal of fecal coliform limits for fresh waters.

7. Removal of Clean Compliance Monitoring Locations

The proposed draft revised TMDL does not include a metric by which compliance monitoring can be discontinued and WLAs removed at compliance locations (e.g., land-use basis, consistently better water quality than reference system, etc.). We request that compliance monitoring be discontinued and WLAs be removed from the Compliance Monitoring Plan, at a minimum, for the following four clean upper watershed compliance monitoring locations: Cheeseboro/Palo Comado (MCW-9), Upper Las Virgenes (MCW-8b), Potrero Creek (MCW-17), and Hidden Valley (MCW-18). Compared to the Arroyo Sequit reference watershed, which is 98% undeveloped open space, the Cheeseboro and Upper Las Virgenes watersheds are 95% and 99% undeveloped open space, respectively. By comparison, the draft TMDL staff report (page 14) states that one of SCCWRP's selection criteria for reference watersheds is >=95% undeveloped. Furthermore and most importantly, since monitoring began in March 2008 (so based on three continuous years of compliance monitoring results), the Cheeseboro and Hidden Valley compliance monitoring locations have met the existing wet, summer dry, and winter dry weather allowable exceedance days, and the Upper Las Virgenes compliance monitoring location has met the existing wet weather allowable exceedance days. The

Potrero Creek compliance monitoring location has also demonstrated consistently excellent water quality, meeting the existing wet and winter-dry allowable exceedance days for three straight years, and meeting the proposed dry (summer plus winter) allowable exceedances days (see Comment #13) with no more than 3 weekly dry samples exceeding in a year.

In addition, discharges from Hidden Valley (MCW-18) and Potrero Creek (MCW-17) flow into Westlake Lake, which acts as a hydrologic break between the Hidden Valley and Potrero Creek subwatersheds and any downstream water bodies. Per the 2008 303(d) list, Westlake Lake is not impaired for bacteria. The Source Assessment section of the Staff Report did not identify Westlake Lake as source of bacteria and the model (HSPF) used under the Linkage Analysis section to predict bacteria concentrations in the 303(d) listed water bodies did not include this lake because it was not considered a source of bacteria (Staff Report, page 29). Since the Westlake Lake historically has not been source of bacteria and continue to not be source of bacteria, and it acts as hydrologic break between the Hidden Valley and Potrero Creek subwatersheds and downstream water bodies, monitoring as well as the other Bacteria TMDL elements for the Hidden Valley and Potrero Creek subwatersheds should be discontinued.

Requested Action: Remove MCW-9 (Cheeseboro/Palo Comado), MCW-8b (Upper Las Virgenes), Potrero Creek (MCW-17), and Hidden Valley (MCW-18) from the Compliance Monitoring Plan and discontinue monitoring at these locations.

8. Compliance Dates

Original dry weather deadlines were January 24, 2009 for summer-dry and January 24, 2012 for winter-dry. These seasons have now been combined into one single dry-weather period with a deadline of January 24, 2012 (page 14 of the BPA). Page 7 of the BPA incorrectly lists January 24, 2009 as the dry-weather compliance date. In addition, the amendment proposed to extend wet-weather compliance deadline from January 24, 2016 to July 15, 2021. We request that the error on page 7 of the BPA be revised to reflect the January 24, 2012 dry-weather compliance date. We support deadline extensions, and recommend further dry weather extension since, as discussed with the LARWQCB staff in January 2012, the Ventura County Implementation Plan Addendum has been in the development process based on most recent compliance monitoring data (monitoring began in March 2008 and data were needed to assess existing water quality of subwatersheds), and time is necessary to implement the plan before compliance can be expected to be achieved. New dry-weather BMPs and studies have been added including residential fertilizer use education, golf course outreach and inspection programs, Phase I media filter retrofits in the Upper Medea subwatershed, and dry-weather source investigations in subwatersheds exceeding bacteria WLAs. At least two years will be required to implement these BMPs and studies, and therefore we request that the dry-weather compliance date be extended to January 24, 2014.

Requested Action: We support extension of wet-weather compliance deadline to July 15, 2021, and request additional extension of the dry-weather compliance deadline to January 24, 2014.

9. TMDL Critical Year

The number of wet and dry days per year, to which the allowable percentage is applied to get the allowable number of both wet and dry weather exceedance days per year, is based on the 90th percentile year (1993) in terms of the number of wet weather days. The use of a conservative year to approximate the number of wet weather days should similarly be applied to dry weather days. The use of 1993, a wet year, to approximate the number of dry weather days results in an unfair underestimate of the number of allowable dry weather exceedance days. We request that similar to the wet weather approach, the 90th percentile "dry year" should be used to approximate the number of dry days used in the calculation of the number of allowable dry weather exceedance days. If the LAX rain gage is used (see Comment #11 below requesting alternate rain gage), the 90th percentile critical year, based on the number of dry days, should be 1948 and the number of dry days should be 330.

Requested Action: Use the 90th percentile "dry year" to approximate the number of dry days used in the calculation of the number of allowable dry weather exceedance days.

10. TMDL Rain Gage

Data from the LAX rain gage is used to determine the number of wet and dry days for MCW, and ultimately the number of allowable exceedance days. MCW is located in a relatively mountainous area, with elevations ranging from sea level at the outlet to approximately 3,000 feet in the upper watershed. The LAX rain gage is located at an elevation of approximately 97 feet. Furthermore, the LAX gauge is orographically separated from the MCW by the Santa Monica Mountains, therefore weather patterns there differ. The number of wet and dry days derived at the LAX gage does not take into account the orographic effect on rainfall patterns in MCW, and therefore underestimates the number of wet days per year. The Zuma Beach rain gage, which is discussed in the staff report as an alternate gage, is also located near sea level and would similarly underestimate the number of rain days. We recommend instead using the Lechuza Patrol Station (NCDC gage No. 44867) to determine the number of wet days used in the WLA calculations. This site is located at elevation 1600 feet and is located nearer the MCW, in the Santa Monica Mountains. We request that the number of wet days and dry days used in the allowable exceedance days calculations be based on the 90th percentile year (see Comment #10 above) at the Lechuza gage, rather than the LAX gage. At the Lechuza gage, the 90th percentile wet year is 1973 with 89 wet days, and the 90th percentile dry year is 1959 with 331 dry days.

Requested Action: We request that the number of wet days and dry days used in the allowable exceedance days calculations be based on the 90th percentile wet and dry years, respectively, at the Lechuza gage (elevation 1600 feet) instead of the LAX gage (elevation 97 feet). Alternatively, if the LARWQCB does not agree, we request that the record at the Agoura gage (elevation 800 feet), which is used in wet/dry day determination per our approved Compliance Monitoring Plan, be analyzed in place of the LAX record to determine the 90th percentile number of wet and dry days.

11. Remove Single Sample WLAs

The single sample limits are derived from the single sample maximum for REC-1 beneficial use based on the reference system and anti-degradation approach. We request that single sample WLAs be removed from the MCW Bacteria TMDL Reopener as compliance limits. Boehm (2007) found indicator bacteria concentrations to vary over short time scales; in some cases, changes between consecutive samples collected one to ten minutes apart were found to be greater than the single sample limit. The study recommends that multiple, rather than single, samples be used to form an accurate snapshot of water quality. The removal of single sample limits is also consistent with the recent draft Santa Ana Regional Water Quality Control Board (SARWQCB, 2012) Basin Plan Amendment which removes single sample limits and only keeps the geometric mean limits (SARWQCB, 2012). The U.S. EPA report further states because fecal indicator bacteria are highly variable in environmental waters, distributional estimates are more robust than single point estimates. Page 19 of the staff report also acknowledges, "The geometric mean is a more reliable measure of long term water quality than single sample criteria. It is also directly linked to the underlying epidemiological studies upon which the bacteria water quality objectives were based." In general, single sample exceedances – especially based on wet weather grab sample data, and especially for bacteria which concentrations known to vary over orders of magnitude – are unreliable means of assessing whether water quality at a compliance monitoring location is statistically different than a reference site, at an acceptable level of confidence.

Requested Action: We request that single sample WLAs be removed from the MCW Bacteria TMDL Reopener as compliance limits, leaving the geometric mean E. coli limit in place as a compliance limit as this is most protective of public health and consistent with U.S. EPA REC criteria guidance.

12. Revise Single Sample WLAs using Reference System Approach

While the current MCW TMDL relied on the Leo Carrillo reference beach to set allowable single sample exceedance rates (0% for summer-dry, 3% for winter-dry, and 22% for wet), the proposed draft reopener now utilizes the average exceedance rate across SCCWRP reference streams (1.6% for dry and 19% for wet). Based on the data provided in Appendix C of the staff report, four of the 23 dry weather reference streams exceed more frequently than the 1.6% average in dry weather (ranging from 0-23% exceedance rates among the 23 sites sampled), and six of the 12 wet weather reference streams exceed more than the 19% average in wet weather (ranging from 0-100% exceedance rates among the 12 sites sampled). Five of the 12 sites sampled during wet weather only had one sample collected, with exceedance rates of either 0% or 100%. If LARWQCB staff decide to keep the single sample based WLAs (see Comment #12), we request the WLAs be revised to account for natural *water quality* variability. This is accomplished by setting the allowed rate to the 90th percentile stream (similar to how the LARWQCB set the number of wet days to account for *hydrologic* variability), rather than the average of all stream data combined, and only evaluate reference systems with at least 3 samples. As shown in Attachment 1, due to the removal of sites with fewer than 3

samples, the number of wet weather reference sites would decrease from 12 to 6 and the number of dry weather reference sites would decrease from 23 to 19. The 90th percentile allowable exceedance rates would then be 64% during wet weather and 9% during dry weather. We therefore request these allowable exceedance rates.

Requested Action: We request the WLAs be revised to account for natural water quality variability by setting the allowed rate to the 90th percentile stream instead of the average of all stream data combined, and only evaluate reference systems with at least 3 samples. This methodology results in allowable exceedance rates of 64% during wet weather and 9% during dry weather.

13. Revise Single Sample WLAs using Statistical Threshold Value

The single sample limits are derived from the single sample maximum for REC-1 beneficial use based on the reference system. If LARWQCB staff do not agree with Comments #12 or 13, alternatively, we request that instead of using the single sample maximum to derive the WLA, use the U.S. EPA Draft Recreational Water Quality Criteria (2011) 75th percentile statistical threshold value (STV) which was computed based on the water quality variance observed during U.S. EPA's epidemiological studies and allows a 25% exceedance rate.

Requested Action: We request that instead of using the single sample maximum to derive the WLA, use the U.S. EPA Draft Recreational Water Quality Criteria (2011) 75th percentile statistical threshold value (STV), which allows a 25% exceedance rate.

14. Reference System Approach – Weekly Sampling Allowable Exceedance Days

During wet weather, the number of annual allowable exceedance days at all stations is 15 for daily sampling. The weekly sampling analog is 2 days. The number of annual allowable exceedance days under daily sampling should be 3, not 2. 15 days divided by 7 days per week equals 2.14 days under weekly sampling. Based on the rounding methodology used in the staff report, 2.14 should be rounded up to the next whole number because the fractional remainder exceeds 1/10th. Therefore, we request that the number of allowable exceedance days for weekly sampling be increased from 2 to 3 at all Ventura County compliance monitoring sites, consistent with the original TMDL.

Requested Action: We request the number of dry weather allowable exceedance days for weekly sampling be increased from 2 to 3 at all Ventura County compliance monitoring sites, consistent with the currently effective MCW Bacteria TMDL.

15. Geometric Mean Methodology

Similar to the currently effective MCW Bacteria TMDL, no exceedances are allowed for the geometric mean limits. The draft TMDL geometric mean calculation does not distinguish between wet and dry weather days. We request the geometric mean calculation be applied to dry weather days only. This is consistent with the bacteria TMDL geometric mean limits expressed in the Draft San Diego County MS4 Permit (SDRWQCB, 2012). This approach is further supported by our own analysis of the reference stream data contained in Appendix C of the draft staff report, which found that of the 12 wet weather reference streams cited in the draft staff report (Stein and Yoon, 2007, Tiefenthaler et al, 2008, and Schiff et al, 2005), the geometric mean of the consolidated E. coli data at both Leo Carrillo and San Onofre sites exceed the 126 MPN/100mL limit. This is also supported by the fact the geometric mean statistic is inherently intended to characterize chronic conditions, rather than episodic acute periods of excursion as would be expected during wet weather. Finally, recreational uses and public exposure to creek waters would be expected to be greatest during dry weather when creek flow and accessibility conditions are safest; therefore this clarification is expected to continue to be protective of public health and beneficial uses.

Requested Action: We request the TMDL clarify that the geometric mean is to be calculated based on dry weather compliance monitoring data only.

16. Geometric Mean Calculation Periods

Rolling geometric mean changed from daily to weekly calculation (5 or more samples, all calculations begin on Sunday), over a six week period, rather than a 30-day period. The draft TMDL staff report (beginning on page 19) uses Enterococcus results at the Leo Carrillo reference beach to support this change in methodology.

We support changing the rolling 30-day geometric mean approach, but suggest the following improvements:

I. If LARWQCB is opposed to setting an allowed geometric mean exceedance rate (per Comment #16), we suggest an alternative that meets the need of minimizing exceedances at the reference beach, while still being consistent with U.S. EPA's draft recommended REC criteria (which allow up to 90 day geometric mean averaging periods). For consistency with the draft TMDL staff report, our geometric mean averaging period recommendations are based on Enterococcus data from the Leo Carrillo reference beach, rather than E. coli data for reference streams. The LARWQCB's current proposed 6-week rolling average geometric mean calculation approach results in substantial exceedance at the Leo Carrillo reference beach (up to exceedance rates of 47% in a year), as shown in Attachment 2. We alternatively suggest a "hybrid" approach, consisting of monthly (calendar, not rolling) geometric mean during the AB411 period (Apr – Sept) and two 75 day geometric means during November through March. This would help to avoid confusion for reporting, compliance assessment, and enforcement penalty determination purposes. This is also generally consistent with the approach presented to us by LARWQCB staff

during our January meeting on the MCW TMDL reopener at your office. Based on 2003-2011 monitoring data at Leo Carrillo (Attachment 2), this would result in fewer geometric mean exceedances at the reference beach. This change would still be protective of human health since it is specifically the geometric mean limit that is linked to human health in the USEPA REC criteria guidance, primarily based on epidemiology data from wastewater impacted beaches. However, applying this geometric mean limit at non-wastewater impacted beaches is an unnecessarily stringent approach since recent peer-reviewed quantitative microbial risk assessment (QMRA) work by U.S. EPA's contractor (Soller et al 2010), and U.S. EPA (Schoen 2010) shows that the geometric mean limit can be greatly increased at beaches where bacteria sources are primarily non-human, while still being protective of the U.S. EPA's tolerable illness rates (8 per thousand swimmers), as shown in Figure 1 from Schoen (2010).

Requested Action: We request a "hybrid" approach, consisting of monthly (calendar, not rolling) geometric mean during the AB411 period (April through September), and two 75 day geometric means during November through March.

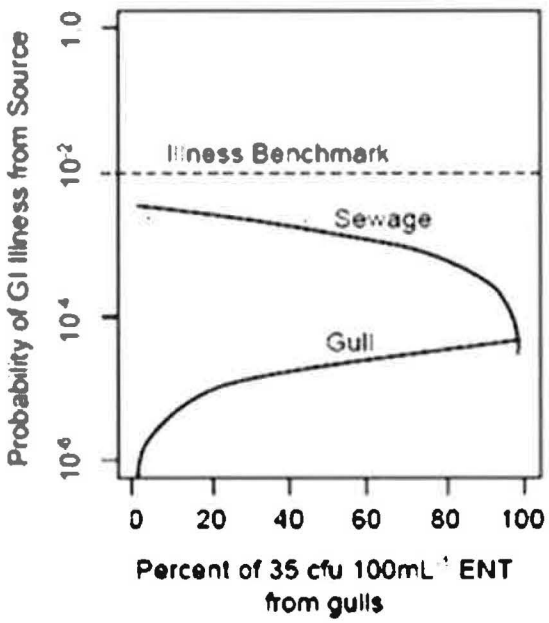


Figure 1. Comparison of median illness risk for adults when total ENT concentration (at 35 cfu /100mL) is attributed to a mixture of primary POTW effluent (sewage) and seagull feces (gulls).

II. Clarification is needed on how a rolling geometric mean should be computed for locations that don't have weekly data (e.g., many subwatersheds that don't flow during dry weather). We recommend excluding no-flow days from geometric mean calculation, however it should be noted there may be instances when, due to no-flow conditions, there are less than 5 samples in any 6-week geometric

mean period. In these instances no violation should be recorded, as the geometric mean cannot be computed or reported.

Requested Action: We request excluding no-flow days from geometric mean calculation and if geometric mean cannot be computed or reported, do not consider a violation.

III. "Compliance Monitoring" section of the Draft MCW Bacteria TMDL Reopener does not explicitly state how water body compliance (e.g., number of days in violation) will be determined with respect to the geometric mean, and whether this would be counted in addition to (versus redundant with) single sample based exceedances. Clarification is requested, particularly if any exceedance of the geometric mean limit causes a water body to be out-of-compliance.

Requested Action: We request clarification how compliance will be assessed and violation days computed based on the geometric mean results.

17. Non-Detect Value Substitution for Geometric Mean Calculation

As discussed in the staff report, the substitution of any value for a non-detect (ND) result must be supported and submitted to the Board in a revised Monitoring Plan. At this time all ND results are required to substitute the detection limit (DL) in geometric mean calculations, which will overestimate the geometric mean, particularly where exceedance frequencies are low. As described in the staff report (page 29) for marine sites, the Jurisdictional Groups 5 and 6 (J56 cities) for the SMB Beaches Bacteria TMDL have suggested a ND substitution value of 3.7 MPN/100mL be used as the Enterococcus value in the geometric mean calculations when the Enterolert result is less than the detection limit of 10 MPN/100mL. For Malibu Lagoon, it is recommended 3.7 MPN/100mL be written into the MCW TMDL as an allowable ND result substitution for Enterococcus. For freshwater, it is requested that an option be written into the TMDL for the responsible parties to submit a request for an alternate E. coli ND substitution value. In the interim, half of the detection limit for E. coli is requested as an ND substitution value until another value, proposed to and approved by the LARWQCB, can be substituted. Looking at Enterococcus, using half of the detection limit (10 MPN/100mL) would be a conservative approach given that 5 MPN/100mL is greater than the recommended 3.7 MPN/100mL.

Requested Action: We request an option for responsible parties to submit data supporting a ND substitution be written into the TMDL. We also request using half of the detection limit for E. coli until a special study-based site specific value can be proposed to and approved by the LARWQCB.

18. Compliance Monitoring Completion Trigger at Clean Subwatersheds

The staff report has no discussion of how the responsible party would go about the process of eventual removal of compliance monitoring locations in compliant

subwatersheds. We request to include an end point for monitoring at locations that are in compliance for three consecutive years. If dry and/or wet weather results meet allowable exceedance days for three straight years at a monitoring location, jurisdictions should be allowed to discontinue dry and/or weather monitoring at that location, with LARWQCB review and approval of a revised Compliance Monitoring Plan indicating such changes.

Requested Action: Include a monitoring discontinuation provision for locations that are in compliance for three consecutive years in the MCW Bacteria TMDL reopener.

19. Items for Future Reconsideration

A future reopener date is not included and no specific items for future reconsideration are listed. A reopener should be included three years from the effective date of the revised TMDL, for reconsideration of the following:

- Low and/or high flow REC suspensions or usage frequency adjustments based on Use Attainability Analysis (UAA) study of existing REC uses or safety considerations;
- Site specific REC objectives based on quantitative microbial risk assessment (QMRA) or epidemiological study results;
- NSE WLAs based on microbial source tracking (MST) results, showing no or minimal human or anthropogenic sources present;
- Revised exceedance rates based on new reference stream results; and
- Other items, including items requested in this comment letter, if requests are not granted.

Requested Action: We request inclusion of another reopener three years from the effective date of the revised TMDL.

20. Reasonable Assurance Plan based Compliance Option

There is no alternative to the numeric based compliance pathway, however page 9 of the reopener staff report cites the potential for a responsible party to pursue action-based interim limits in the MS4 Permit, beginning with the submittal of a Reasonable Assurance Plan (RAP). The Draft Los Angeles County MS4 Permit, and Washington State Department of Ecology's Draft Industrial Stormwater General Permit and MS4 General Permit all include action-based pathways as alternatives to the numeric-based compliance pathway for bacteria. The draft Los Angeles County MS4 Permit currently includes a compliance option for a reasonable assurance program, which would provide the Board reasonable assurance that the alternative requirements would provide equal or greater reduction in storm water discharge pollutant loading as would have been obtained through compliance with certain control criteria. The recently proposed modifications to Washington State's Industrial Stormwater General Permit (Department of Ecology, 2012) would similarly revise the draft effluent limits for fecal coliform by

replacing the draft numeric standard with BMP-based requirements. The permittees may be required to implement a new set of BMPs including methods to prevent wildlife from feeding, nesting, or roosting at the facility, annual dry weather inspections to address potential sewer cross-connections, and structural control of any on-site bacterial sources. Washington State's MS4 General Permit also includes action-based limits for compliance with bacteria TMDLs. We therefore request that the revised MCW Bacteria TMDL state that MS4 Co-Permittees may choose an action-based compliance pathway as an alternative to the numeric based compliance pathway

Requested Action: We request that the revised MCW Bacteria TMDL provides an action-based compliance option as an alternative to the numeric based compliance for the MS4 Co-Permittees.

21. Ventura County Watershed Protection District (VCWPD)

The current MCW Bacteria TMDL does not list VCWPD as a stand-alone responsible party, however this agency is added to the Draft MCW Bacteria TMDL Reopener (pages 5 and 9). VCWPD is not listed in the currently approved and effective MCW Bacteria TMDL, which lists the County of Ventura but not VCWPD as a responsible party. The County of Ventura includes all divisions, districts, and agencies, so it is redundant to also list the VCWPD or any of these other groups as responsible agencies. Additionally, as shown in Attachment 3, VCWPD facilities within the MCW are limited to four stretches of improved channel within the City of Thousand Oaks. These small and disconnected facilities, which correspond to monitoring site MCW-17, represent flow from a small portion of the subwatershed, and are *de minimis* in any FIB loads. Additionally, all VCWPD open channels are improved (concrete or rip-rap) and are not themselves a source of bacteria. For the many reasons above, we believe it is inappropriate to include the VCWPD. We request it be deleted as a responsible party.

Requested Action: Do not include VCWPD as a stand-alone responsible party in the MCW Bacteria TMDL Reopener.

We would like to offer our time and resources to further discuss this matter. As always, Ventura County staff is willing to work cooperatively to clarify the items discussed in this letter.

Thank you for your time to consider this matter. If you have any additional questions or require further clarification, please contact Ewelina Mutkowska at (805) 645-1382.

Sincerely,

Gerhardt Hubner
Deputy Director

Attachments:

1 Malibu Creek Watershed Bacteria TMDL Dry-Weather Reference System Exceedances, 2005 – 2007.
2 Leo Carrillo (SMB 1-1) Monitoring Data Analysis.
3 Channels Owned/Maintained/Operated by VCWPD.
4 References

cc: Sam Unger, LARWQCB Executive Officer
Jeff Pratt, County of Ventura Public Works Agency Director
Peter Sheydayi, VCWPD Interim Director
Ewelina Mutkowska, Stormwater Program Manager

Table 1. Malibu Creek Watershed Bacteria TMDL Dry Weather Reference System Exceedances, 2005 - 2007.

Reference System	All Sites			Sites with n>=3		
	# samples >235 SSM FW obj	Samples (n)	% Exceedance	# samples >235 SSM FW obj	Samples (n)	% Exceedance
Arroyo Seco	0	49	0%	0	49	0%
Bear Creek Matilija	0	3	0%	0	3	0%
Bear Creek WFSGR	0	3	0%	0	3	0%
Bell Canyon Creek	3	13	23%	3	13	23%
Boden Canyon Creek	2	20	10%	2	20	10%
Cattle Creek EFSGR	0	3	0%	0	3	0%
Cold Creek	0	50	0%	0	50	0%
Coldbrook NFSGR	0	3	0%	0	3	0%
Cristianitos Creek	0	1	0%	n<3		
Cucamonga Creek	0	45	0%	0	45	0%
Day Creek Canyon	0	52	0%	0	52	0%
Fry Creek	0	2	0%	n<3		
Hurkey Creek	1	21	5%	1	21	5%
Lachusa Canyon	0	48	0%	0	48	0%
Mill Creek	0	52	0%	0	52	0%
Piru Creek	0	3	0%	0	3	0%
San Juan Creek	1	12	8%	1	12	8%
Santiago Creek	0	12	0%	0	12	0%
Sespe Creek	0	3	0%	0	3	0%
Seven Oaks Dam	0	2	0%	n<3		
Silverado Creek	0	3	0%	0	3	0%
Solstice Canyon	0	48	0%	0	48	0%
Tenaja Creek	0	2	0%	n<3		
Total	7	450	1.6%	7	443	2%
	90th Percentile		8%	90th Percentile		9%
	Maximum		23%	Maximum		23%

Table 2. Malibu Creek Watershed Bacteria TMDL Wet Weather Reference System Exceedances, 2004 - 2006.

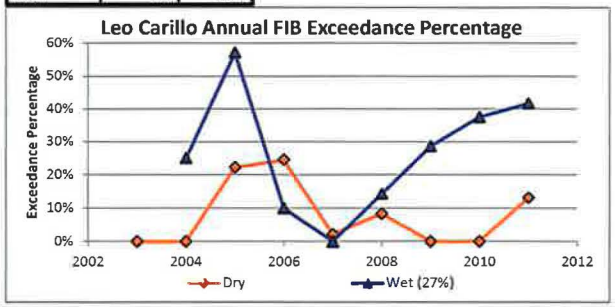
Reference Systems	All Sites			Sites with n>=3		
	# Samples >235 SSM FW obj	Samples (n)	% Exceedance	# Samples >235 SSM FW obj	Samples (n)	% Exceedance
Arroyo Sequit	3	3	100%	3	3	100%
Bear Creek Matilija	0	1	0%	n<3		
Bell Canyon Creek	0	1	0%	n<3		
Bell Creek	0	1	0%	n<3		
Cristianitos Creek	1	1	100%	n<3		
Deer Creek	0	16	0%	0	16	0%
Fry Creek	1	2	50%	n<3		
Leo Carrillo	2	8	25%	2	8	25%
San Mateo	0	6	0%	0	6	0%
San Onofre	4	14	29%	4	14	29%
Sespe Creek	0	1	0%	n<3		
Solstice Creek	2	16	13%	2	16	13%
Total	13	70	19%	11	63	17%
	90th Percentile		**95%**	**90th Percentile**		**64%**
	Maximum		100%	Maximum		100%

Leo Carrillo (SMB 1-1)

			SSM Exceedances					SSM Exceedance Percentage				
TMDL Year	Season	No. of Samples	Total Coliform	Fecal Coliform	Entero	FC/TC Ratio	Total	Total Coliform	Fecal Coliform	Entero	FC/TC Ratio	Total
2003	Dry	16	0	0	0	0	0	0%	0%	0%	0%	0%
2003	Wet	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
2004	Dry	44	0	0	0	0	0	0%	0%	0%	0%	0%
2004	Wet	8	0	0	2	0	2	0%	0%	25%	0%	25%
2005	Dry	54	0	3	9	3	12	0%	6%	17%	6%	22%
2005	Wet	7	2	0	3	0	4	29%	0%	43%	0%	57%
2006	Dry	49	2	3	10	1	12	4%	6%	20%	2%	24%
2006	Wet	10	0	0	1	0	1	0%	0%	10%	0%	10%
2007	Dry	46	0	0	1	0	1	0%	0%	2%	0%	2%
2007	Wet	8	0	0	0	0	0	0%	0%	0%	0%	0%
2008	Dry	48	2	0	2	0	4	4%	0%	4%	0%	8%
2008	Wet	7	1	0	0	0	1	14%	0%	0%	0%	14%
2009	Dry	45	0	0	0	0	0	0%	0%	0%	0%	0%
2009	Wet	7	0	0	2	0	2	0%	0%	29%	0%	29%
2010	Dry	43	0	0	0	0	0	0%	0%	0%	0%	0%
2010	Wet	8	1	0	2	0	3	13%	0%	25%	0%	38%
2011	Dry	46	0	1	6	2	6	0%	2%	13%	4%	13%
2011	Wet	12	0	3	5	3	5	0%	25%	42%	25%	42%
Total	**Dry**	391	4	7	28	6	35	1%	2%	7%	2%	9%
	Wet	67	4	3	15	3	18	6%	4%	22%	4%	27%
90th Percentile	**Dry**		2	3	9	2	12	4%	6%	17%	5%	23%
	Wet		1	0	3	0	4	19%	8%	42%	8%	46%

SSM Exceedance Percentage

	Dry	Wet
2003	0%	
2004	0%	25%
2005	22%	57%
2006	24%	10%
2007	2%	0%
2008	8%	14%
2009	0%	29%
2010	0%	38%
2011	13%	42%
Total	9%	27%

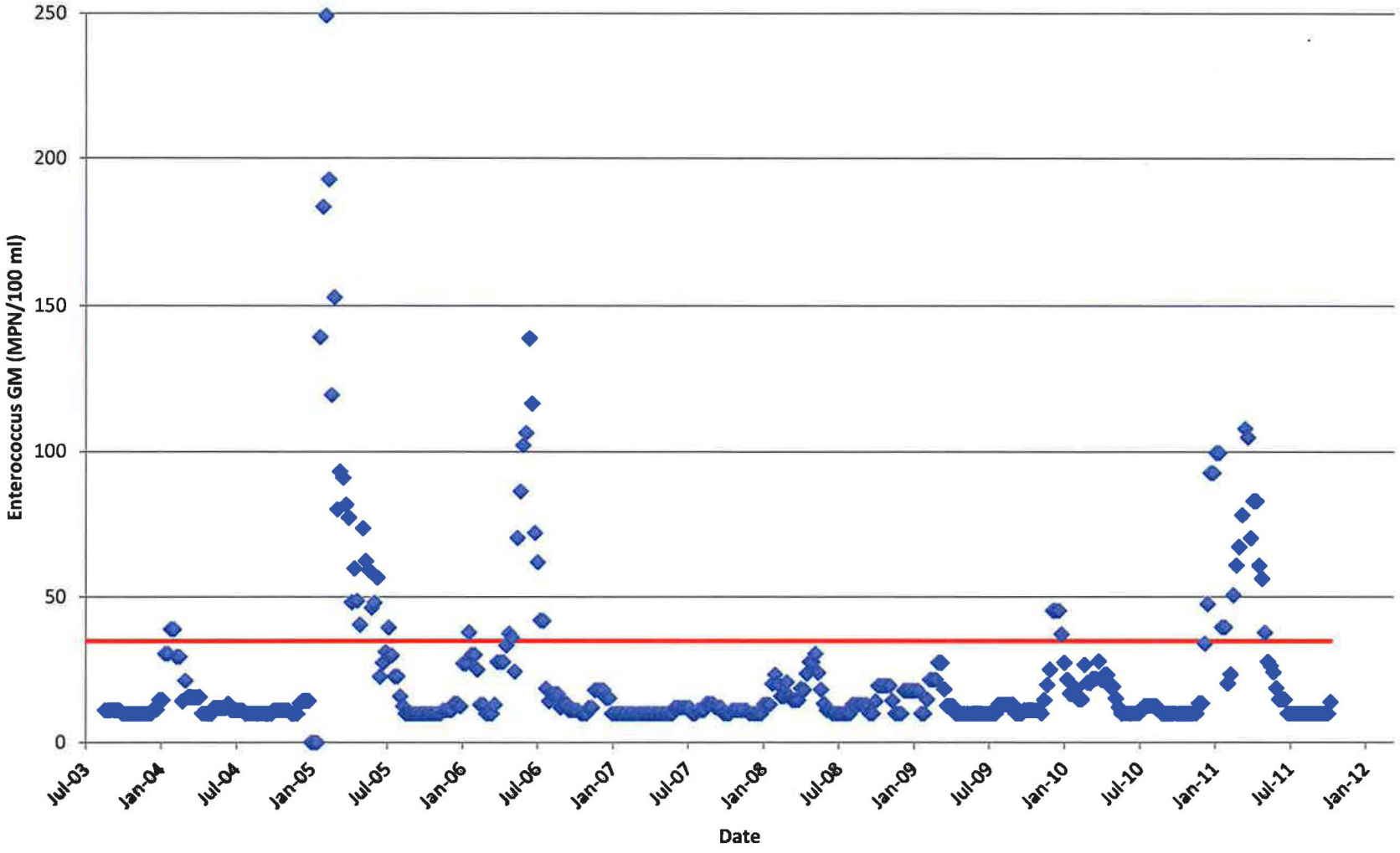


		6 Week Rolling GM[1]				6 Week Rolling GM[1] %				Monthly GM[2]				3-Month GM[3]				Hybrid GM[4]			
TMDL Year	Calculation days	Total Coliform	Fecal Coliform	Entero	Total	Total Coliform	Fecal Coliform	Entero	Total	Total Coliform	Fecal Coliform	Entero	Total	Total Coliform	Fecal Coliform	Entero	Total	Total Coliform	Fecal Coliform	Entero	Total
2003	11	0	0	0	0	0%	0%	0%	0%	0	0	0	0	0	0	0	0	0	0	0	0
2004	53	0	0	2	2	0%	0%	4%	4%	0	0	1	1	0	0	0	0	0	0	0	0
2005	49	15	0	22	23	31%	0%	45%	47%	3	0	6	6	1	0	2	2	2	0	4	4
2006	52	7	0	13	13	13%	0%	25%	25%	1	1	3	3	1	0	1	1	1	1	2	2
2007	52	0	0	0	0	0%	0%	0%	0%	0	0	0	0	0	0	0	0	0	0	0	0
2008	52	9	0	0	9	17%	0%	0%	17%	2	0	1	2	1	0	0	1	2	0	1	2
2009	52	0	0	0	0	0%	0%	0%	0%	0	0	0	0	0	0	0	0	0	0	0	0
2010	53	0	0	4	4	0%	0%	8%	8%	0	0	0	0	0	0	0	0	0	0	0	0
2011	52	5	0	19	19	10%	0%	37%	37%	1	0	5	5	0	0	1	1	1	0	2	2
Total	426	36	0	60	70	8%	0%	14%	16%	7	1	16	17	3	0	4	5	6	1	9	10
90th Percentile		10	0	19	19	20%	0%	38%	39%	2	0	5	5	1	0	1	1	2	0	2	2

When sampling results were not detected, the following detection limits (DL) were used:
Total Coliform DL: County of LA DHS - 10 MPN/100ML; City of LA EMD - 67 MPN/100ML
FecalColiform DL: County of LA DHS - 10 MPN/100ML; City of LA EMD - 67 MPN/100ML
Enterococcus DL: County of LA DHS - 10 MPN/100ML; City of LA EMD - 10 MPN/100ML

1. 6 Week Rolling GM - Geometric mean calculation performed every week, on the samples within the previous 6 week period, if 5 or more samples have been taken in the 6 week period
2. Monthly GM - Geometric mean calculation performed every month, on the samples within the previous month (not rolling)
3. 3-Month GM - Geometric mean calculation performed every 3 months, on the samples within the previous 3 month period (not rolling)
4. Hybrid GM - Geometric mean calculation preformed (1) every month during AB411 period (April 1 to October 31), on the samples within the previous month (not rolling), and (2) at two equally spaced intervals between November 1 to March 31 (about 75 days each), on the samples within each interval period (not rolling)

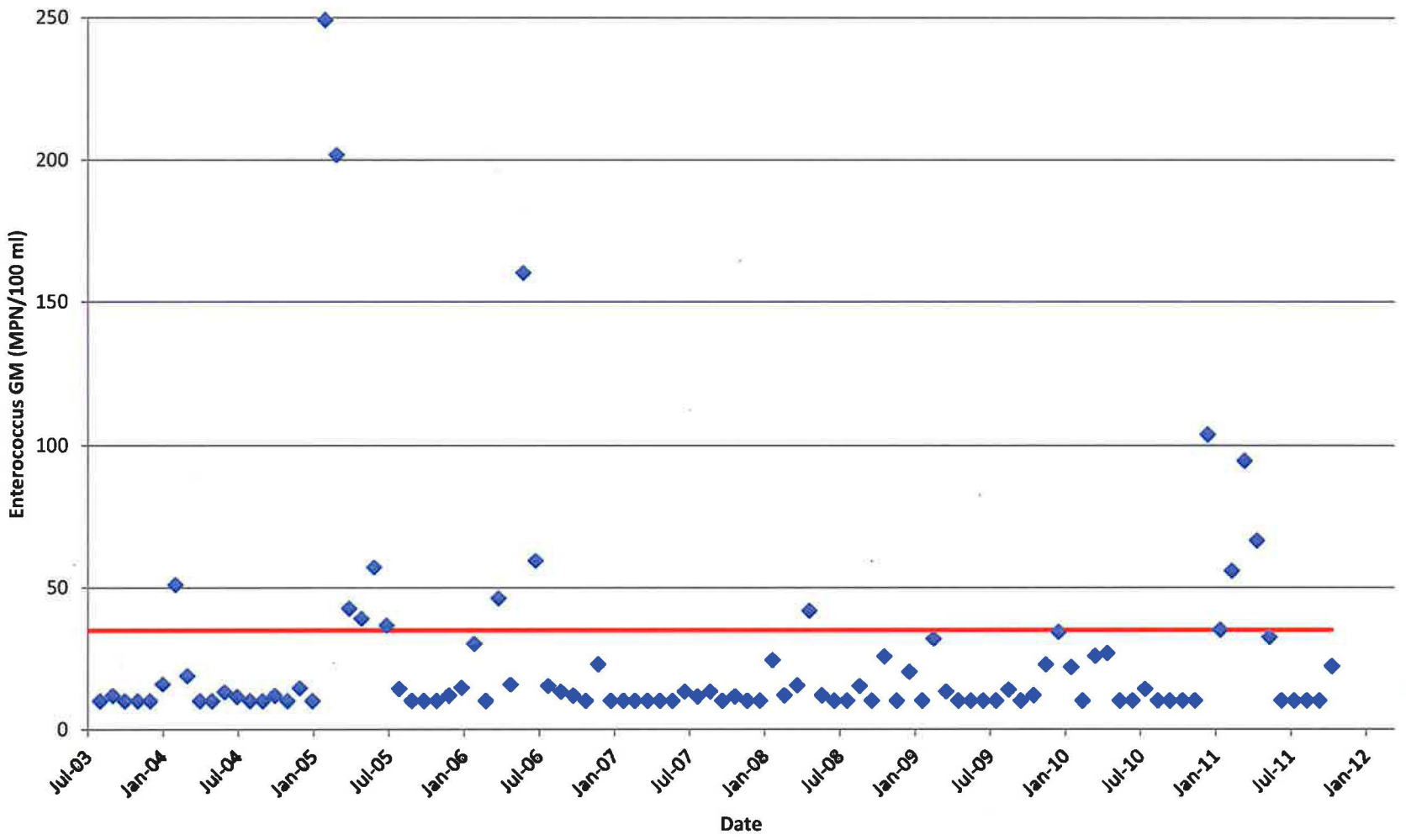
Leo Carrillo Enterococcus Geometric Mean (6 Week Rolling[1] Calculation)



When sampling results were not detected, the following detection limits (DL) were used:
Enterococcus DL: County of LA DHS - 10 MPN/100ML; City of LA EMD - 10 MPN/100ML

1. 6 Week Rolling GM - Geometric mean calculation performed every week, on the samples within the previous 6 week period, if 5 or more samples have been taken in the 6 week period

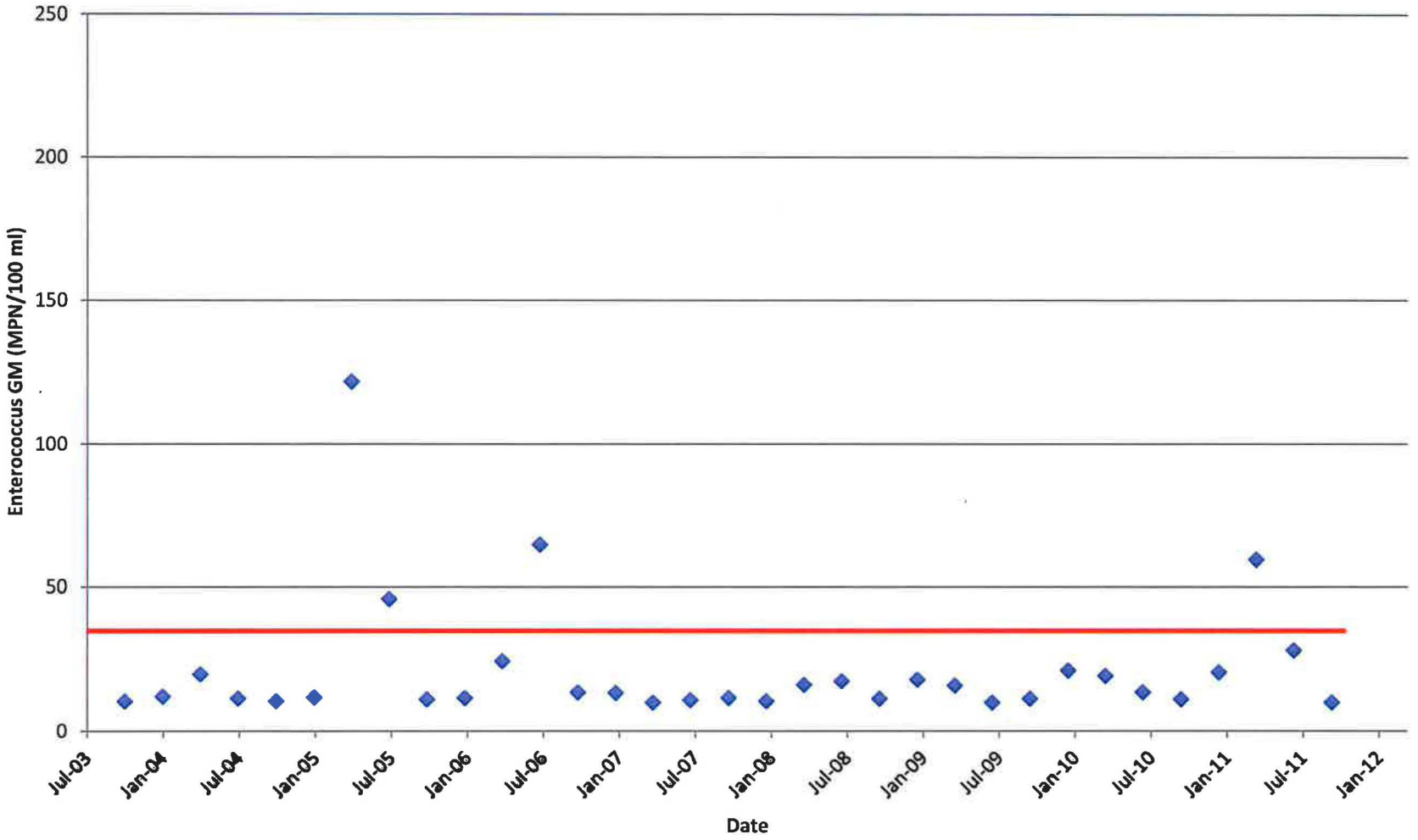
Leo Carrillo Enterococcus Geometric Mean (Monthly[2] Calculation)



When sampling results were not detected, the following detection limits (DL) were used:
Enterococcus DL: County of LA DHS - 10 MPN/100ML; City of LA EMD - 10 MPN/100ML

2. Monthly GM - Geometric mean calculation performed every month, on the samples within the previous month (not rolling)

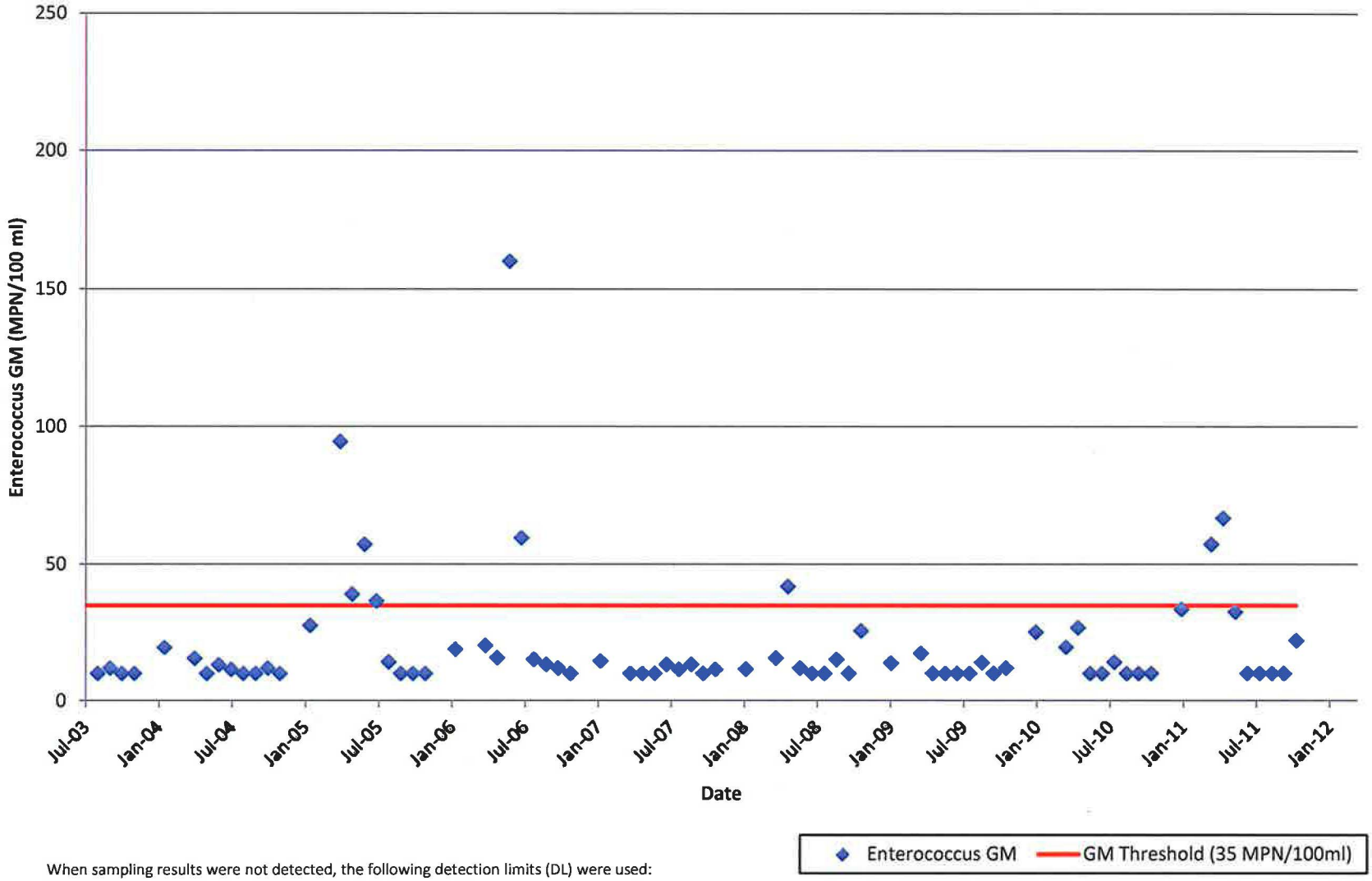
Leo Carrillo Enterococcus Geometric Mean (Quarterly[3] Calculation)



When sampling results were not detected, the following detection limits (DL) were used:
Enterococcus DL: County of LA DHS - 10 MPN/100ML; City of LA EMD - 10 MPN/100ML

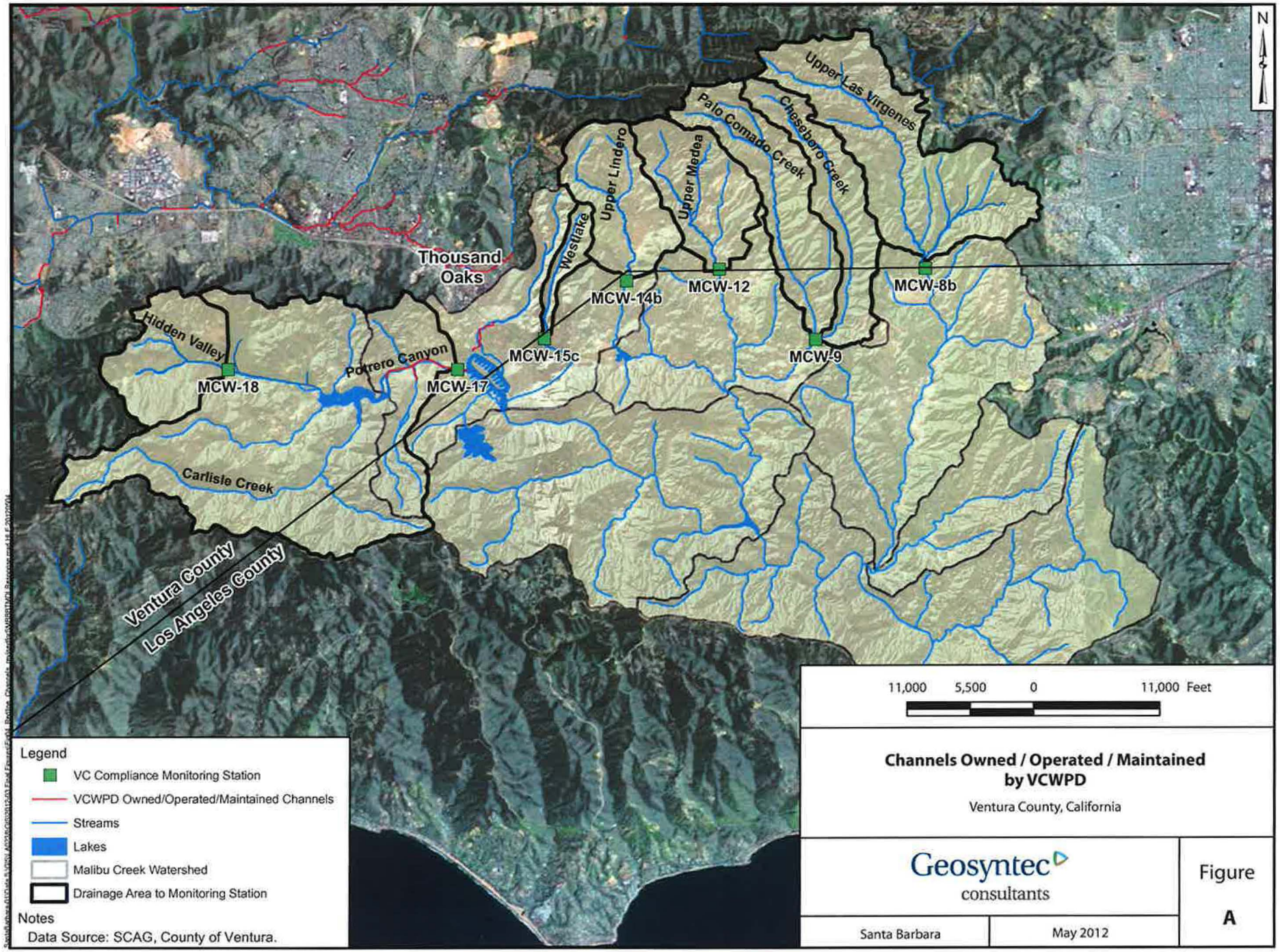
3. 3-Month GM - Geometric mean calculation performed every 3 months, on the samples within the previous 3 month period (not rolling)

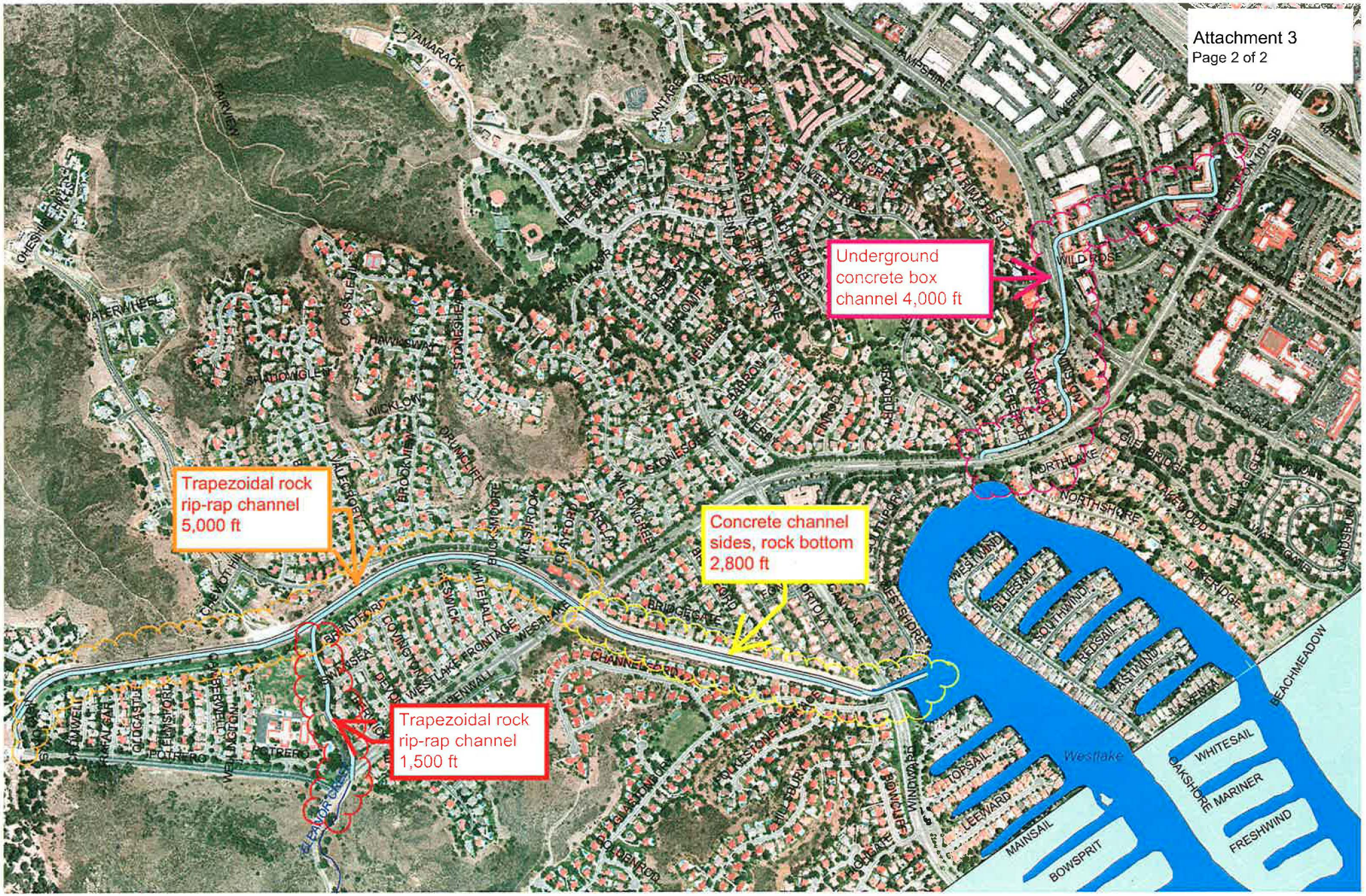
Leo Carrillo Enterococcus Geometric Mean (Hybrid[4] Calculation)



When sampling results were not detected, the following detection limits (DL) were used:
Enterococcus DL: County of LA DHS - 10 MPN/100ML; City of LA EMD - 10 MPN/100ML

4. Hybrid GM - Geometric mean calculation performed (1) every month during the AB411 period (April 1 to October 31) on the samples within the previous month (not rolling), and (2) at two equally spaced intervals between November 1 to March 31 (about 75 days each), on the samples within each interval period (not rolling)


N
Upper Las Virgenes
Palo Comado Creek
Chesebero Creek
Upper Lindero
Upper Medea
Westlake
Thousand Oaks
MCW-14b
MCW-12
MCW-8b
MCW-15c
MCW-9
Hidden Valley
MCW-18
Potrero Canyon
MCW-17
Carlisle Creek
Ventura County
Los Angeles County
11,000 5,500 0 11,000 Feet
Legend
VC Compliance Monitoring Station
VCWPD Owned/Operated/Maintained Channels
Streams
Lakes
Malibu Creek Watershed
Drainage Area to Monitoring Station
Notes
Data Source: SCAG, County of Ventura.
Channels Owned / Operated / Maintained by VCWPD
Ventura County, California
Geosyntec consultants
Santa Barbara
May 2012
Figure
A


Underground concrete box channel 4,000 ft
Trapezoidal rock rip-rap channel 5,000 ft
Concrete channel sides, rock bottom 2,800 ft
Trapezoidal rock rip-rap channel 1,500 ft
Westlake
TOPSAIL
LEEWARD
MAINSAIL
BOWSPRIT
WHITESAIL
OAKSHORE MARINER
FRESHWIND
BEACHMEADOW
NORTHSHORE
NORTHLAKE
WILD ROSE
TAMARACK
FAIRVIEW
WATERVIEW
WICKLOW
DRUMCLIFF
BRENTFORD
BRIDGEGATE
CHANNEL RD
WESTLAKE FRONTAGE
ELEANOR CREEK

REFERENCES

Boehm, A.B., 2007. "Enterococci Concentrations in Diverse Coastal Environments Exhibit Extreme Variability." Environmental Science and Technology 41(24).

Colford, J.M., Wade, T.J., Schiff, K.C., Wright, C., Griffith, J.F., Sandhu, S.K., and S.B. Weisberg, 2005. "Recreational water contact and illness in Mission Bay, California." Technical Report 449, Southern California Coastal Water Research Project.

Department of Ecology, State of Washington, 2012. "Draft Industrial General Stormwater General Permit." http://www.ecy.wa.gov/programs/wq/stormwater/industrial/permitdocs/iswgpdraft020112.pdf

Ferguson, D.M., Moore, D.F., Getrich, M.A., and M.H. Zhowandai, 2005. "Enumeration and speciation of enterococci found in marine and intertidal sediments and coastal water in southern California." Journal of Applied Microbiology 99(3).

Fujioka, R., Sian-Denton, C., Borja, M., Castro, J., and K. Morphew, 1998. "Soil: The environmental source of Escherichia coli and Enterococci in Guam's streams." Journal of Applied Microbiology. 85(1) 83S-89S.

Geosyntec, 2012. Draft Bacteria and Nutrient Total maximum Daily Load Implementation Plan for Unincorporated Ventura County and Watershed Protection District. March.

Goto, D.K. and T. Yan, 2011. "Genotypic diversity of Escherichia coli in the water and soil of tropical watersheds in Hawaii." Applied Environemtnal Microbiology. 77(12) 3988-3997.

Grant, S.B., Sanders, B.F., Boehm, A.B., Redman, J.A., Kim, J.H., Mrse, R.D., Chu, A.K., Gouldin, M., McGee, C.D., Gardiner, N.A., Jones, B.H., Svejkovsky, J., Leipzig, G.V., and A. Brown, 2001. "Generation of Enterococci Bacteria in a Coastal Saltwater Marsh and its Impact on Surf Zone Water Quality." Environmental Science and Technology 35(12).

Griffith, J.F., 2011. "Preliminary Findings: Doheny State Beach Epidemiology Study." SCCWRP Symposium. January 25.

Griffith, J.F., Schiff, K.C., and G.S. Lyon, 2006. "Microbiological water quality at non-human impacted reference beaches in southern California during wet weather." SCCWRP Technical Report #495.

Hardina, C.M. and R.S. Fujioka, 1991. "Soil: The environmental source of Escherichia coli and Enterococci in Hawaii's streams." Environmental Toxicology and Water Quality. 6(2) 185-195.

Ishii, S., Ksoll, W.B., Hicks, R.E., and M.J. Sadowsky, 2006. "Presence and growth of naturalized Escherichia coli in temperate soils from Lake Superior watersheds." Applied Environmental Microbiology 72(1) 612 – 621.

Imamura, G.J., Thompson, R.S., Boehm, A.B., and J.A. Jay, 2011. "Wrack promotes the persistence of fecal indicator bacteria in marine sands and seawater." FEMS Microbiology Ecology 77(1).

Izbicki, J., Swarzenski, P., Burton, C., and L.C. Van DeWerfhorst, 2012. "Sources of fecal indicator bacteria to groundwater, Malibu Lagoon, and the near-shore ocean, Malibu, California." Submitted 2012

Jay, J.A., Ambrose, R.F., Thulsiraj, V., and S. Estes, 2011. "2009 Investigation of Spatial and Temporal Distribution of Human-specific *Bacteroidales* marker in Malibu Creek, Lagoon and Surfrider Beach." DRAFT.

Lee, C.M., Lin, T.Y., Lin, C.C., Kohbodi, G.A., Bhatt, A., Lee, R., and J.A. Jay, 2006. "Persistence of fecal indicator bacteria in Santa Monica Bay beach sediments." Water Research 40(14).

Litton, R.M., Ahn, J.H., Sercu, B., Holden, P.A., Sedlak, D.L., and S.B. Grant, 2010. "Evaluation of Chemical, Molecular, and Traditional Markers of Fecal Contamination in an Effluent Dominated Urban Stream." Environmental Science and Technology 44(19).

Los Angeles Regional Water Quality Control Board (Regional Board), 2012. "Reconsideration of Certain Technical Matters of the Malibu Creek and Lagoon Bacteria TMDL." Staff Report. March.

Los Angeles Regional Water Quality Control Board (Regional Board), 2010. "Santa Clara River Bacteria TMDL." Basin Plan Amendment, Resolution R10-006.

Moore, D., Guzman, J., Hannah, P., Getrich, M., and C. McGee, 2007. "Does Enterococcus indicate fecal contamination? The presence of plant-associated Enterococcus in Southern California recreational waters." Coastal Conference Presentation. County of Orange County.

Noble, R.T., Griffith, J.F., Blackwood, A.D., Fuhrman, J.A., Gregory, J.B., Hernandez, X., Liang, X., Bera, A.A., and K. Schiff, 2005. "Multi-Tiered Approach Using Quantitative Polymerase Chain Reaction for Tracking Sources of Fecal Pollution to Santa Monica Bay, California." SCCWRP Technical Report #446.

Phillips, M.C., Solo-Gabriele, H.M., Piggot, A.M., Klaus, J.S., and Y. Zhang, 2011. "Relationships between Sand and Water Quality at Recreational Beaches", Water Resources 45(20).

San Diego Regional Water Quality Control Board (SDRWQCB), 2012. Draft NPDES Permit and WDR for Discharges form the Municipal Separate Storm Sewer Systems (MS4s) draining the Watersheds within the San Diego Region. http://www.waterboards.ca.gov/sandiego/water_issues/programs/stormwater/docs/admDraft2012-0406tentativeorder.PDF

SDRWQCB, 2008. "San Diego RWQCB NSE Basin Plan Amendment and Tech Report." http://www.waterboards.ca.gov/sandiego/ water_issues/programs/basin_plan/issue_7.shtml

Santa Ana Regional Water Quality Control Board (SARWQCB), 2012. "Basin Plan Amendments – Draft Revisions to Recreational Standards for Inland Surface Fresh Waters in the Santa Ana Region."

Schoen, M.E. and N.J. Ashbolt, 2010. "Assessing Pathogen Risk to Swimmers at Non-Sewage Impacted Recreational Beaches." Environmental Science and Technology 44 (7).

Soller J.A., Schoen, M.E., Bartrand, T., Ravenscroft, J.E., and N.J. Ashbolt, 2010. "Estimated Human Health Risks from Exposure to Recreational Waters Impacted by Human and Non-Human Sources of Faecal Contamination." Water Research 44 (16).

Surbeck, C.Q., Jiang, S.C, and S.B. Grant, 2010. "Ecological Control of Fecal Indicator Bacteria in an Urban Stream." Environmental Science and Technology 44 (2).

Sutula, M., Kamer, K., and J. Cable, 2004. "Sediments as a Non-Point Source of Nutrients to Malibu Lagoon, California (USA)." SCCWRP Technical Report #441.

Tiefenthaler, L.L., Stein, E.D., and G.S. Lyon, 2008. "Fecal Indicator Bacteria (FIB) Levels During Dry Weather from Southern California Reference Streams." SCCWRP Technical Report #542.

United States Environmental Protection Agency (USEPA), 2011. "DRAFT Recreational Water Quality Criteria." Office of Water 820-D-11-002. http://water.epa.gov/scitech/swguidance/standards/criteria/health/recreation/upload/recreation_document_draft.pdf

Weisberg, S.B., and D.M. Ferguson, 2009. "North Santa Monica Bay Source Investigation Study, Ramirez Creek and Escondido Creek, Malibu, 2009 Summary and Recommended Studies." Southern California Coastal Water Research Project (SCCWRP).

Weston Solutions, 2010. "Tecolote Creek Microbial Source Tracking Summary – Phases I, II, and III."