



Memorandum

To: SAWPA

From: CDM

Date: September 14, 2011

Subject: Source Evaluation Task 2.5 - Site-Specific Log Standard Deviation at Middle Santa Ana River Watershed Monitoring Sites

Task Overview

Antidegradation policy in the Clean Water Act requires that existing beneficial uses in all Waters of the US be protected by ensuring that water quality is maintained at levels sufficient to support such uses. Two methods for evaluating water quality monitoring data to assess whether antidegradation policy is achieved for bacterial water quality in the MSAR watershed were implemented as described in the following sections.

Single Sample Maximum Criteria

The EPA uses a default log standard deviation (LSD) of 0.4 for *E. coli* when calculating single sample maximum criteria. A local log standard deviation may be substituted for the default value where such data exist, which would result in different single sample maximum criteria. The potential to use a site-specific log standard deviation to establish site-specific single sample criteria has been incorporated into the Basin Plan amendment under development by the Stormwater Quality Standards Task Force. The purpose of this task is to calculate site-specific criteria for antidegradation objectives for waterbodies in the MSAR watershed. Sites included in this analysis include the five watershed-wide TMDL compliance monitoring sites (sampled regularly since 2007), major tributaries sampled in the 2007-2008 Urban Source Evaluation Plan (USEP) Monitoring Program¹, and one new urban source evaluation monitoring site sampled during the 2011 dry season (see Source Evaluation Task 2.2 Preliminary Characterization of Bacteria Loading in Pomona and Claremont).

Table 1 shows the geometric mean, 95th percentile, and potential antidegradation objectives based on the default LSD of 0.4 and site specific LSD for dry season *E. coli* for each site.

¹ SAWPA. 2008. *Middle Santa Ana River Water Quality Monitoring Plan*. Prepared by CDM on behalf of SAWPA and the Middle Santa Ana River Watershed TMDL Task Force. April, 2008.

The EPA Procedure for Estimating the Maximum Expected Concentration² estimates site-specific alternative single sample maximums for each site. This method assigns the 95th or 99th percentile of the fitted lognormal distribution as the single sample maximum. As shown in Figure 1, for sites with robust datasets (n > 100 for the five watershed-wide TMDL compliance sites), the 95th percentile of the data is similar to the 95th percentile of the lognormal distribution, because the data fit a lognormal distribution.

Table 1. Single Sample Maximum Criteria for *E. coli* at USEP and Watershed-Wide Monitoring Sites

Site Name	Number of Samples ¹	95th Percentile of Dry Weather <i>E. coli</i> Samples (cfu/100 mL)	95th Percentile of Lognormal Dist. With LSD of 0.4 (cfu/100 mL)	95th Percentile of Lognormal Dist. with Site Specific LSD (cfu/100 mL)
Urban Source Evaluation Sites				
US-ANZA	18	5,565	663	2,790
US-BXSP	23	5,910	2,487	19,056
US-CCCH	19	590	190	854
US-CHINOCRK	10	1,411	1,034	2,526
US-CHRIS	18	4,600	2,087	7,415
US-CLCH	7	8,170	1,498	43,612
US-CUC	19	3,930	367	6,264
US-CYP	12	32,625	5,204	17,699
US-DAY	13	6,200	902	3,977
US-SACH	18	4,205	739	8,838
US-SAR	5	6,360	1,792	21,725
US-SNCH	19	1,546	284	1,481
US-SSCH	14	4,090	704	6,086
US-TEM ¹	18	1,180	691	1,644
Watershed-wide TMDL Compliance Monitoring Sites				
WW-C3	131	740	230	688
WW-C7	128	1,929	624	1,563
WW-M5	127	3,380	1,180	3,537
WW-S1	125	400	263	510
WW-S4	123	489	263	474

¹ Outlier sample collected from Temescal Creek on 9/8/2007 was removed

² EPA, 1991. Technical Support Document for Water Quality Based Toxics Control. Report EPA/505/2-90-001

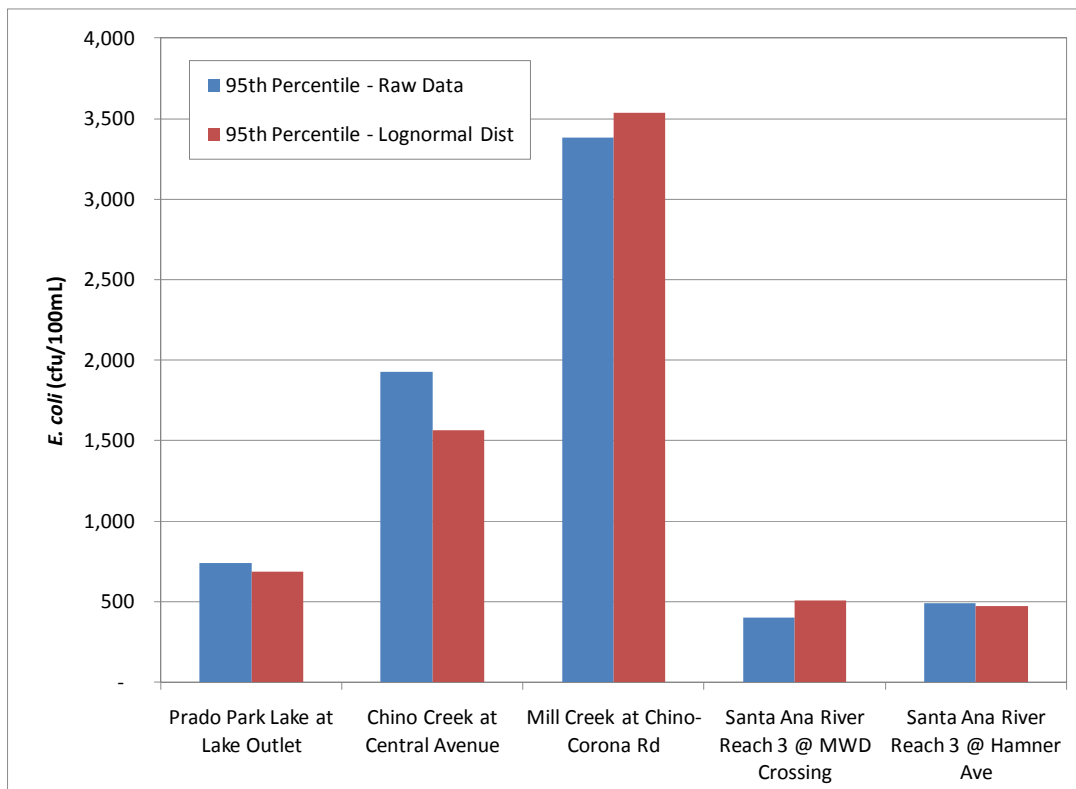


Figure 1. Comparison of 95th Percentile of *E. coli* Data with 95th Percentile of Lognormal Distribution (Site Specific Single Sample Maximum Criteria)

Maximum Expected Geometric Mean

Single sample criteria provide limited benefit for evaluation of potential degradation, because of the inherent sample-to-sample variability in bacterial indicators concentration. One alternative to using a single sample maximum objective is to use a maximum expected geometric mean. Land's Method³ was applied to estimate the 95th percentile upper confidence limit for the geometric mean). When calculating geometric means based on new data, it is improbable that they would exceed the 95th percentile upper confidence limit, unless bacterial indicator quality was degraded. Table 2 summarizes the results of this analysis for all dry weather *E. coli* samples from USEP and watershed-wide TMDL compliance monitoring sites. The difference between the geometric mean of historical data and the maximum expected geometric mean is a function of the number of samples and variability of the original dataset. EPA's guidance document recommends that caution be used when applying this method because it is sensitive to potential outliers. Results shown for the USEP Study monitoring sites show that this method does not produce valuable results given the small dataset ($n < 20$) and higher variability ($LSD > 3.0$), therefore it is only recommended that this antidegradation objective be considered for the watershed-wide TMDL compliance monitoring sites. Figure 2 compares geometric means and

³ EPA, 1991. Technical Support Document for Water Quality Based Toxics Control. Report EPA/505/2-90-001

95th percentile upper confidence limits for geometric means for each watershed-wide monitoring site. The site with the greatest variability, Mill-Cucamonga Creek at Chino-Corona Road, has the greatest relative difference between the historical geometric mean and the 95th percentile upper confidence limit.

Table 2. Maximum Geometric Mean Criteria for *E. coli* at USEP Study and Watershed-Wide TMDL Compliance Monitoring Sites

Site Name	Number of Samples ¹	Geometric Mean (cfu/100 mL)	95th Percentile Upper Confidence Limit for Geometric Mean (cfu/100 mL)
US-ANZA	18	343	1,952
US-BXSP	23	1,302	16,720
US-CCCH	19	99	590
US-CHINOCRK	10	613	2,145
US-CHRIS	18	1,081	5,027
US-CLCH	7	776	65,180,370
US-CUC	19	190	16,467
US-CYP	12	2,695	15,640
US-DAY	13	467	3,769
US-SACH	18	382	17,315
US-SAR	5	928	47,647,003
US-SNCH	19	147	1,255
US-SSCH	14	364	11,038
US-TEM ¹	18	358	1,952
WW-C3	131	119	272
WW-C7	128	323	1,383
WW-M5	127	611	2,268
WW-S1	125	136	415
WW-S4	123	136	461

¹ Outlier sample collected from Temescal Creek on 9/8/2007 were removed

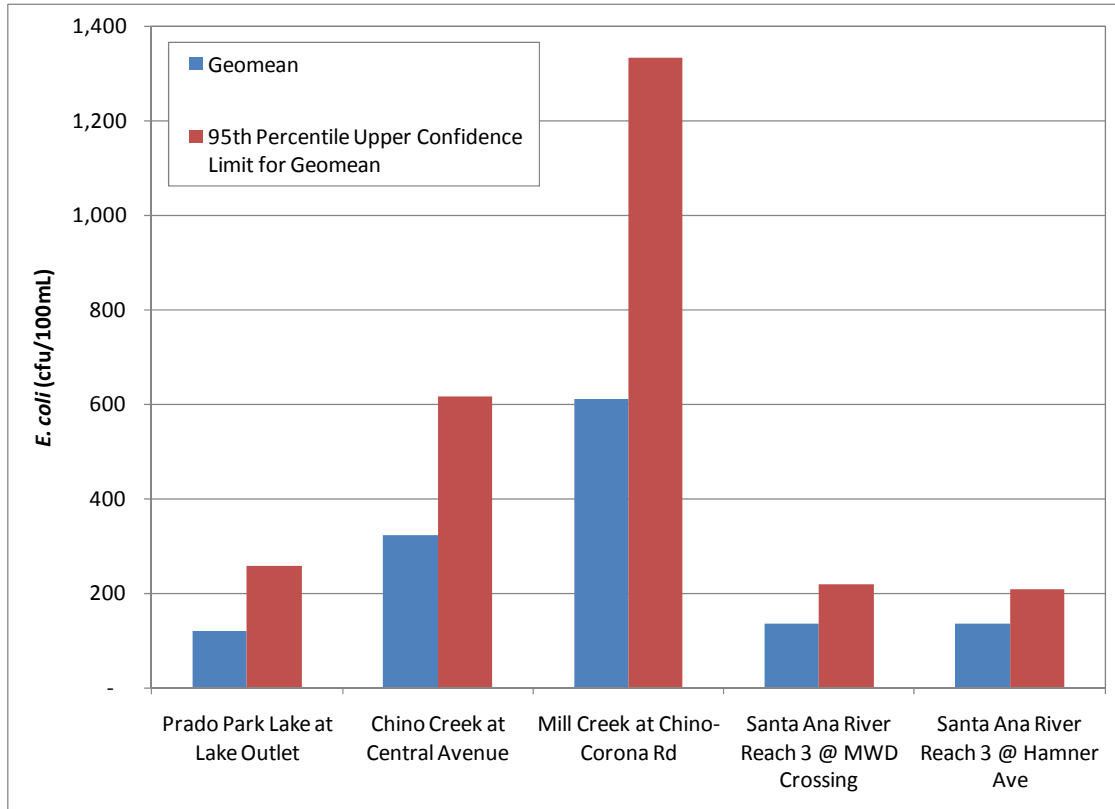


Figure 2. Comparison of Geometric Mean of Historical *E. coli* Data with 95th Percentile Upper Confidence Limit for Geometric Mean