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Memorandum

January 14, 2019

To: Andrew Jirik, Port of Los Angeles, and James Vernon, Port of Long Beach

From: Steve Cappellino, Anchor QEA, LLC, and Shelly Anghera, PhD, Latitude Environmental, Inc.

Re: Sediment Quality Objectives for Benthic Health: Area-Impacted Analysis and Compliance Assessment

In accordance with monitoring requirements specified in the Coordinated Compliance Monitoring and Reporting Plan (CCMRP; Anchor QEA 2018), sediment quality from the Ports of Long Beach and Los Angeles (Ports) was assessed using California's Sediment Quality Objective (SQO) for aquatic life-benthic community (Benthic Community SQO). The assessment followed methods detailed in the Water Quality Control Plan for Enclosed Bays and Estuaries (SWRCB/CalEPA 2009), the Sediment Quality Assessment Draft Technical Support Manual (Bay et al. 2009), and the draft Amendments to the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality (Sediment Quality Provisions) (WQ Control Plan; SWRCB 2018). The SQO is based on a multiple line of evidence (MLOE) approach in which the individual lines of evidence are sediment chemistry, sediment toxicity, and benthic community condition. As permitted in the Final Basin Plan Amendment (RWQCB 2011) for the *Total Maximum Daily Load for Toxic Pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters* (Harbor Toxics TMDL), the Benthic Community SQO may be conducted to determine compliance with the sediment targets.

The amended WQ Control Plan includes a general description of how to use Benthic Community SQOs to evaluate attainment of beneficial uses for the benthic community by interpreting and integrating multiple lines of evidence. The qualitative sediment conditions of Unimpacted or Likely Unimpacted are protective of the benthic community. The Ports, together with the Los Angeles Regional Water Quality Control Board (RWQCB), developed a Total Maximum Daily Load (TMDL)-specific compliance framework for the Benthic Community SQOs to provide guidance for the assessment, evaluation, and documentation required to demonstrate compliance with the Harbor Toxics TMDL. The compliance framework is provided as Attachment A.

The Bight '13 program and the 2014/15 Annual Compliance Monitoring Report (Anchor QEA 2015) present the results of the Benthic Health SQO (i.e., designation of qualitative sediment condition such as Unimpacted, Likely Unimpacted, or Possibly Impacted) for each monitoring station (Figure 1). This memorandum summarizes the results of the Benthic Community SQO assessment using the area-impacted analysis approach described in the compliance framework (Attachment A). A detailed description of the methods applied to perform an area-impacted analysis is provided in Attachment A and summarized below.

Area-Impacted Analysis

Consistent with the amended WQ Control Plan, both the Bight program and TMDL-required monitoring program use randomized sampling designs. The Bight method for calculating the percent area impacted has been well established (Bight '13 CIA Committee 2013; Stevens and Olsen 2003); however, this method is only appropriate for Bight program-collected data within pre-identified Bight-related strata. An alternate sampling design was used for the required TMDL monitoring program. Consequently, a method for calculating the percent area impacted that can be applied to both data sets is needed. The percent area-impacted analysis is based on use of a commonly used spatial analysis method called the Thiessen polygon approach.

Area-Impacted Analysis Using Thiessen Polygon Approach

The SQO categorical value of each data point is assigned to the entire polygon and the percent area impacted is calculated using Equation 1.

Equation 1

$$\%\ \text{Area Impacted} = \frac{\Sigma\ \text{Area for each failing stations in assessment unit}}{\Sigma\ \text{Area for all of the stations within the assessment unit(km2)}} X\ 100$$

where:
A failing station = Possibly, Likely, and Clearly Impacted

The polygons were allowed to extend beyond assessment unit boundaries. The percent area that met the protective condition of Unimpacted or Likely Unimpacted in each assessment unit was calculated and compared to the threshold set in the amended WQ Quality Plan. Specifically, the WQ Control Plan defines the threshold for the percent area impacted (i.e., exceedance of a receiving waterbody to protect aquatic life) as the following, "The total percent area categorized as Possibly Impacted and/or Likely Impacted equals or exceeds 15 percent of the site area over the duration of a permit cycle."

Therefore, if 85% or more of the assessment unit is found to be Unimpacted or Likely Unimpacted and no sites are characterized as Clearly Impacted, then the unit meets the Benthic Community SQO protective condition.

Assessment Units

Assessment areas for the Greater Harbor Waters were established in consultation with the RWQCB and detailed in Attachment A. Nine assessment units incorporate one or more TMDL-defined waterbodies (Attachment A). These assessment units are shown in Figure 2and include the following:

- Dominguez Channel Estuary
- Consolidated Slip
- Fish Harbor
- Los Angeles Inner Harbor (including Cabrillo Marina)
- Los Angeles Outer Harbor (including Inner Cabrillo Beach)
- Long Beach Inner Harbor
- Long Beach Outer Harbor
- Eastern San Pedro Bay
- Los Angeles River Estuary (Queensway Bay)

Each assessment unit includes samples that were taken from randomly selected stations as part of the Bight '13 program and the TMDL-required monitoring program (Figure 1).

Results

Analysis of the Greater Harbor Waters included samples taken from 64 sampling stations. None of the sampled stations were characterized as Clearly Impacted. Table 1 provides a summary of each station, its SQO score, and the area (in acres) it represents. An assessment unit meets the protective condition when at least 85% of the area is Likely Unimpacted and Unimpacted as established in the amended WQ Control Plan and Attachment A. Los Angeles Inner Harbor, Los Angeles Outer Harbor, Long Beach Inner Harbor, Long Beach Outer Harbor, and Los Angeles River Estuary currently meet the 85% threshold. Fish Harbor, Consolidated Slip, and Eastern San Pedro Bay do not.

References

Anchor QEA, LLC, 2018. *Coordinated Compliance Monitoring and Reporting Plan*. Greater Los Angeles and Long Beach Harbor Water. June 2018.

Anchor QEA, 2015. *2014/15 Annual Compliance Monitoring Report*. Harbor Toxics TMDL Coordinated Compliance Monitoring And Reporting for the Greater Los Angeles and Long Beach Harbor Waters. December 2015.

Bay, SM, DJ Greenstein, JA Ranasinghe, DW Diehl, and AE Fetscher, 2009. *Sediment Quality Assessment Draft Technical Support Manual*. Technical Report 582. Southern California Coastal Water Research Project. May 2009.

Bight '13 CIA (Contaminant Impact Assessment) Committee, 2013. *Contaminant Impact Assessment Workplan*. Southern California Bight 2013 Regional Marine Monitoring Survey (Bight '13). Prepared for Commission of Southern California Coastal Water Research Project. July 2013.

RWQCB (Regional Water Quality Control Board), 2011. Final Basin Plan Amendment. Attachment A to Resolution No. R11-008. Amendment to the Water Quality Control Plan – Los Angeles Region to Incorporate the Total Maximum Daily Load for Toxic Pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters. Adopted by the California Regional Water Quality Control Board, Los Angeles Region on May 5, 2011. Available from: http://www.waterboards.ca.gov/losangeles/board_decisions/basin_plan_amendments/technical_documents/66_New/11_0630/02%20Final%20BPA%2005%2005%2011.pdf.

Stevens, DL and AR Olsen, 2003. Variance estimation for spatially balanced samples of environmental resources. *Environmetrics* 14: 593-610.

SWRCB, 2018. Staff Report Including Substitute Environmental Documentation for Amendments to the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality (Sediment Quality Provisions). July 5, 2018.

Attachments

Table 1	Area-Impacted Analysis
Figure 1	2013/Benthic Community SQO Assessment
Figure 2	Benthic Community SQO Assessment Using Thiessen Polygon Area-Weighted Assessment
Attachment A	Total Maximum Daily Load Compliance Approach for Greater Harbor Area Using the Sediment Quality Objectives

Table

Table 1
Area-Impacted Analysis

Assessment Unit	TMDL Waterbody	Station Identification	Acres	Integrated Score	Total Acres	SQO Area Meeting Protective Condition (acres)	% Area Meeting Protective Condition
Eastern San Pedro Bay	Eastern San Pedro Bay	SP-SS-20	249	Likely unimpacted	6048	4266	71%
	Eastern San Pedro Bay	B13-8315	153	Possibly impacted			
	Eastern San Pedro Bay	B13-8325	460	Possibly impacted			
	Eastern San Pedro Bay	B13-8350	426	Possibly impacted			
	Eastern San Pedro Bay	B13-8353	447	Possibly impacted			
	Eastern San Pedro Bay	B13-8358	297	Possibly impacted			
	Eastern San Pedro Bay	B13-8319	559	Unimpacted			
	Eastern San Pedro Bay	B13-8333	74	Unimpacted			
	Eastern San Pedro Bay	B13-8333	113	Unimpacted			
	Eastern San Pedro Bay	B13-8346	586	Unimpacted			
	Eastern San Pedro Bay	B13-8351	200	Unimpacted			
	Eastern San Pedro Bay	B13-8355	503	Unimpacted			
	Eastern San Pedro Bay	B13-8375	555	Unimpacted			
	Eastern San Pedro Bay	B13-8388	514	Unimpacted			
	Eastern San Pedro Bay	SP-SS-18	284	Unimpacted			
	Eastern San Pedro Bay	SP-SS-19	628	Unimpacted			
Long Beach Inner Harbor	LA/LB Inner Harbor	IB-SS-12	42	Likely impacted	1156	1080	93%
	LA/LB Inner Harbor	B13-8374	99	Likely unimpacted			
	LA/LB Inner Harbor	B13-8397	38	Likely unimpacted			
	LA/LB Inner Harbor	B13-8399	77	Likely unimpacted			
	LA/LB Inner Harbor	IB-SS-13	131	Likely unimpacted			
	LA/LB Inner Harbor	TMDL3-TB	84	Likely unimpacted			
	LA/LB Inner Harbor	B13-8401	35	Possibly impacted			
	LA/LB Inner Harbor	B13-8363	167	Unimpacted			
	LA/LB Inner Harbor	B13-8371	212	Unimpacted			
	LA/LB Inner Harbor	B13-8382	66	Unimpacted			
	LA/LB Inner Harbor	IB-SS-14	205	Unimpacted			

Table 1

Area-Impacted Analysis

Assessment Unit	TMDL Waterbody	Station Identification	Acres	Integrated Score	Total Acres	SQO Area Meeting Protective Condition (acres)	% Area Meeting Protective Condition
Los Angeles River Estuary (Queensway Bay)	Los Angeles River Estuary (Queensway Bay)	LE-SS-22	25	Likely impacted	246	221	90%
	Los Angeles River Estuary (Queensway Bay)	B13-8390	45	Likely unimpacted			
	Los Angeles River Estuary (Queensway Bay)	LE-SS-21	175	Likely unimpacted			
Long Beach Outer Harbor	LA/LB Outer Harbor	B13-8322	386	Likely unimpacted	2885	2632	91%
	LA/LB Outer Harbor	B13-8347	215	Likely unimpacted			
	LA/LB Outer Harbor	B13-8365	48	Likely unimpacted			
	LA/LB Outer Harbor	IB-SS-15	82	Likely unimpacted			
	LA/LB Outer Harbor	OB-SS-17	263	Likely unimpacted			
	LA/LB Outer Harbor	B13-8349	253	Possibly impacted			
	LA/LB Outer Harbor	B13-8310	131	Unimpacted			
	LA/LB Outer Harbor	B13-8318	350	Unimpacted			
	LA/LB Outer Harbor	B13-8326	300	Unimpacted			
	LA/LB Outer Harbor	B13-8333	378	Unimpacted			
	LA/LB Outer Harbor	B13-8356	123	Unimpacted			
	LA/LB Outer Harbor	B13-8360	52	Unimpacted			
	LA/LB Outer Harbor	OB-SS-16	305	Unimpacted			
Los Angeles Inner Harbor	Cabrillo Marina	CM-SS-10	42	Possibly impacted	1544	1312	85%
	Cabrillo Marina	TMDL1-CH	79	Possibly impacted			
	Inner Harbor	IA-SS-02	15	Likely impacted			
	Inner Harbor	B13-8340	96	Possibly impacted			
	Inner Harbor	B13-8384	87	Likely unimpacted			
	Inner Harbor	B13-8397	200	Likely unimpacted			
	Inner Harbor	IA-SS-03	53	Likely unimpacted			
	Inner Harbor	IA-SS-04	246	Likely unimpacted			
	Inner Harbor	B13-8316	69	Unimpacted			
	Inner Harbor	B13-8367	266	Unimpacted			
	Inner Harbor	B13-8396	54	Unimpacted			

Table 1

Area-Impacted Analysis

Assessment Unit	TMDL Waterbody	Station Identification	Acres	Integrated Score	Total Acres	SQO Area Meeting Protective Condition (acres)	% Area Meeting Protective Condition
Los Angeles Inner Harbor (continued)	Inner Harbor	IA-SS-05	141	Unimpacted	1544	1312	85%
	Inner Harbor	IA-SS-06	168	Unimpacted			
	Inner Harbor	OA-SS-09	5	Unimpacted			
	Inner Harbor	OA-SS-09	22	Unimpacted			
Los Angeles Outer Harbor	Outer Harbor	B13-8302	519	Likely unimpacted	1535	1535	100%
	Outer Harbor	B13-8306	57	Likely unimpacted			
	Outer Harbor	B13-8308	219	Likely unimpacted			
	Outer Harbor	B13-8304	99	Unimpacted			
	Outer Harbor	B13-8310	80	Unimpacted			
	Outer Harbor	B13-8326	42	Unimpacted			
	Outer Harbor	CB-SS-11	204	Unimpacted			
	Outer Harbor	OA-SS-08	86	Unimpacted			
	Outer Harbor	OA-SS-09	230	Unimpacted			
Consolidated Slip	Consolidated Slip	CS-SS-01	14	Likely impacted	38	0	0%
	Consolidated Slip	TMDL4-CS	24	Possibly impacted			
Fish Harbor	Fish Harbor	FH-SS-07	71	Likely unimpacted	133	71	54%
	Fish Harbor	TMDL2-FH	62	Possibly impacted			

Figures

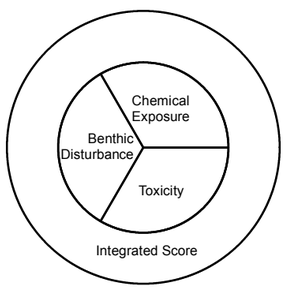
LEGEND:

Individual Category

- High
- Moderate
- Low
- Reference

Integrated Score

- Clearly Impacted
- Likely Impacted
- Possibly Impacted
- Likely Unimpacted
- Unimpacted



TMDL Waterbodies

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Feet

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Figure 1
2013/2016 Benthic Community SQO Assessment
Greater Los Angeles and Long Beach Harbor Waters

LEGEND:

- Likely Impacted
- Possibly Impacted
- Likely Unimpacted
- Unimpacted
- Consolidated Slip
- East San Pedro Bay, including Los Angeles River Estuary (Queensway Bay)
- Fish Harbor
- LA/LB Inner Harbor, including Cabrillo Marina
- LA/LB Outer harbor, including Inner Cabrillo Beach

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Figure 2
Benthic Community SQO Assessment Using Thiessen Polygon Area-Weighted Assessment
Greater Los Angeles and Long Beach Harbor Waters

Attachment A
Total Maximum Daily Load Compliance Approach for Greater Harbor Area Using the Sediment Quality Objectives