

Sediment Toxicity Monitoring Plan for the South Bay Ocean Outfall and Point Loma Ocean Outfall Monitoring Regions, San Diego, California

Submitted by

**City of San Diego Public Utilities Department
Environmental Monitoring & Technical Services Division**

AUGUST 28, 2015

City of San Diego South Bay Water Reclamation Plant
(Order R9-2013-0006 as amended by Order R9-2014-0071, NPDES CA0109045)

U.S. IBWC South Bay International Wastewater Treatment Plant
(Order R9-2014-0009 as amended by Order R9-2014-0094, NPDES CA0108928)

City of San Diego Point Loma Wastewater Treatment Plant
(Order R9-2000-0001, NPDES CA0107409)

INTRODUCTION

This Sediment Toxicity Monitoring Plan (STMP) is submitted pursuant to: (a) Order No. R9-2013-0006 (NPDES Permit No. CA0109045) for the City of San Diego (City) South Bay Water Reclamation Plant, and Order No. R9-2014-0009 (NPDES Permit No. CA0108928) for the U.S. Section of the International Boundary and Water Commission (USIBWC), South Bay International Wastewater Treatment Plant (SBIWTP), discharges to the Pacific Ocean through the South Bay Ocean Outfall (SBOO), and (b) to changes to be incorporated with renewal of Order No. R9-2009-0001 (NPDES Permit No. CA0107409) for the City's Point Loma Wastewater Treatment Plant discharge via the Point Loma Ocean Outfall (PLOO). These ocean discharges fall under the jurisdiction of the San Diego Regional Water Quality Control Board (SDRWQCB). Accordingly, the STMP summarizes steps the City, USIBWC and SDRWQCB intend to implement to address the Aquatic Life Toxicity monitoring requirements for Point Sources specified in the 2012 California Ocean Plan (SWRCB, 2013: Appendix III, Section 7.1).

The STMP for the San Diego ocean outfall (SBOO and PLOO) monitoring region off San Diego is designed to answer the following primary questions:

1. What is the extent and magnitude of sediment toxicity in the San Diego outfall region?
2. How does the extent and magnitude of sediment toxicity in the region compare among different coastal shelf depth strata (e.g., inner, mid, and outer shelf)?
3. How does the extent and magnitude of sediment toxicity in the region compare to results from the Southern California Bight regional monitoring surveys?

QUALITY ASSURANCE PROJECT PLAN (QAPP)

Project Organization and Responsibilities

The San Diego Ocean Outfall Sediment Toxicity Monitoring Project (Project) for the Point Loma and South Bay outfall regions will be managed and overseen by the Senior Biologist or Senior Marine Biologist for the City's Public Utilities Department (PUD), Environmental Monitoring and Technical Services Division (EMTS). Toxicology testing operations (e.g., bioassays) and laboratory equipment maintenance will be supervised by the Supervising Toxicologist in charge of the PUD/EMTS Toxicology Lab or designated external contract laboratory management. Field sampling operations and equipment maintenance will be supervised by the Ocean Operations supervisor for PUD/EMTS. Analytical chemistry operations will be supervised by the City's Senior Chemist in charge of the PUD/EMTS Environmental Chemistry Services section. Review and analysis of the laboratory reports and internal QA/QC program will be supervised by the Project QA Officer (i.e., Supervising Toxicologist). All analyses will be provided by laboratories certified by the California State Water Resources Control Board's Environmental Laboratory Accreditation Program (ELAP) and the QA Officer will review and assess all Project procedures, report all findings to the Program Manager, and request corrective actions if there are significant deviations from required practices or if there is evidence of a systemic failure. The organization chart of the Project is shown below in **Figure 1**.

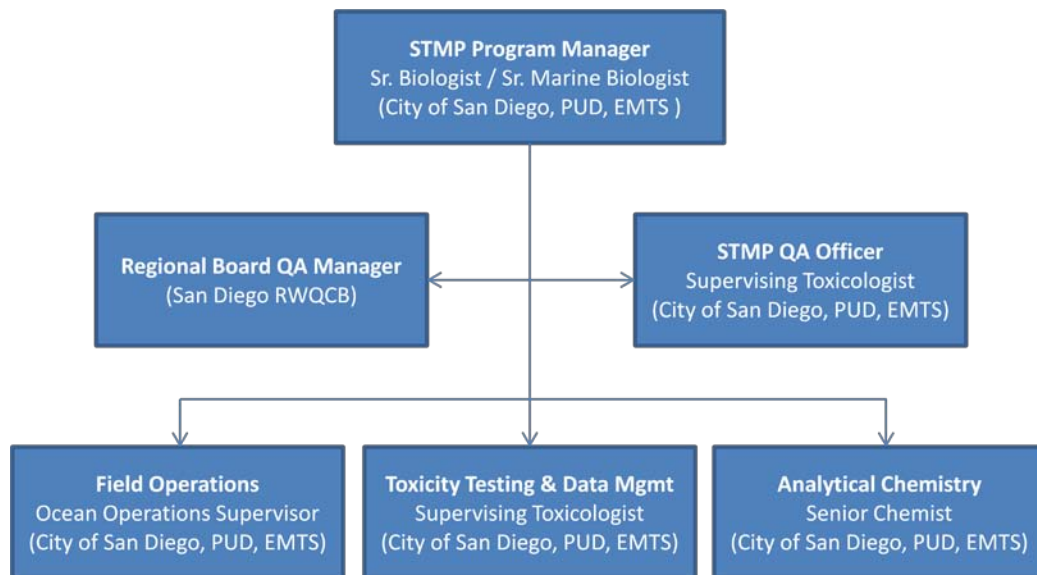


Figure 1

Organization Chart for the Sediment Toxicity Monitoring Plan for the South Bay and Point Loma Ocean Outfall monitoring regions. STMP officers for the City are members of the Public Utilities Department, Environmental Monitoring and Technical Services Division (PUD, EMTS).

Issue Definition and Objectives

The overall goal of the Project is to characterize the risk to aquatic life as indicated by acute toxicity and to meet the requirements specified in the Monitoring and Reporting Programs specified in Appendices E of Order No. R9-2013-0006 for the SBWRP and Order No. R9-2014-0009 for the SBIWTP, as well as similar requirements to be incorporated with renewal of Order No. R9-2009-0001 for the PLWTP.

For the purpose of the Project, the City and USIBWC are required to perform acute sediment toxicity testing using an alternative amphipod species (*Eohaustorius estuarius*, *Leptocheirus plumulosus*, or *Rhepoxynius abronius*).

The intended role of the QAPP is to ensure the consistent collection of accurate, precise, and representative sediment toxicity information that will be used to satisfy the objectives of the STMP for the SBOO and PLOO regions.

In accordance with U.S. Environmental Protection Agency's QAPP guidance documents and ELAP's specifications on quality systems, the City's Toxicology Laboratory Quality Assurance Manual (QAM) was updated in 2014 to encompass sediment toxicity QAPP elements and approved by ELAP (see City of San Diego, 2014). These include:

- Project Management *QAM Section 1, pp. 5-23 (also see previous section)*
- Data Generation and Acquisition *QAM Section 5, pp. 55-64*
- Assessment and Oversight *QAM Sections 6-8, pp. 65-140*
- Data Validation and Usability *QAM Sections 9-11, pp. 141-157*

The QAM is revised with as-needed amendments on an ongoing basis, and an updated edition is issued every two years.

TOXICITY TESTING PROTOCOLS

The amphipod marine sediment toxicity tests are conducted in accordance with EPA 600/R-94/0925 (USEPA, 1994), "*Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods*," and the Southern California Bight Project sediment toxicity testing guidelines (Bight'13 Toxicology Committee, 2013). Juvenile amphipods are exposed for 10 days to test and control sediment. Response criteria include mortality, emergence from sediment during exposure, and ability to rebury in clean sediment at the end of the exposure period.

Amphipods for toxicity testing will be collected from uncontaminated sites with large endemic populations and/or purchased through appropriate biological supply vendors. Substrate consists of 'home sediment' from the site where animals are collected that is sieved through a 500 micron screen. Amphipods are held in aquaria at 15°C and left undisturbed in the home sediment

submerged within an overlying layer of 25% filtered seawater. Animals are acclimated for no less than two days prior to test initiation.

Test and control sediments are held at 4°C for no longer than 14 days before test initiation. Control (home) sediment is collected at the same site as the test organisms. The sediment sample for water quality is centrifuged at an RCF of 3000 x g for 30 minutes to separate sediment particles from the water. A reference toxicant test is conducted simultaneously with each bioassay. Reference toxicant samples are made using reagent grade ammonium chloride. Serial dilutions are made using volumetric pipettes and volumetric flasks. Reference toxicant test concentrations are 0, 15.6, 31.2, 62.5, 125, and 250 mg/L total ammonia.

Water quality measurements are made from a surrogate replicate. Temperature, dissolved oxygen, salinity, and pH are measured at Days 0, 2, 4, 6, 8, and 10. Pore water ammonia is measured within 48 hours of sample receipt and again at test initiation if the sample is held for less than 48 hours. Ammonia in the overlying water is measured at test initiation and test termination.

The test chambers consist of standard 1-L glass jars, and there are five test replicates per sediment sample plus a sixth blank replicate that is used for pore water extraction and initial water quality measurement on Day 0. On the day before test initiation, pre-sieved (1.0 mm) test sediment (175 mL) is added to the bottom of each replicate jar to create a 2 cm deep layer and then filled with seawater, covered, and placed in a 15°C temperature controlled room or water bath. Water in the containers is gently aerated to promote constant circulation without disturbing the sediment surface. On the following day (Day 0), amphipods are sieved (0.5 mm) from the holding sediment and transferred with large bore plastic pipettes to transfer dishes (plastic weigh boats or condiment cups work well) containing approximately 50 mL of seawater until each container has 20 amphipods for the sediment test and 10 amphipods for the reference toxicant test. The number of amphipods in each dish shall be recounted before adding to the test chambers.

The test amphipods are distributed into the test chambers in a randomized manner and with minimal disturbance to the test sediment. Animals remaining in the transfer dish are gently washed into the test chamber with test seawater. Aeration is temporarily discontinued while the animals are being added. The amphipods are given 5 to 10 minutes to bury into the test sediments. Injured or stressed animals that remain emerged (not buried) are removed and replaced with healthy amphipods from the same sieved population.

Reference toxicant tests are conducted in plastic or glass containers in the dark (the entire test is covered after the addition of the amphipods). Four 800-mL replicates of each concentration are tested for 96 hours at $15 \pm 2^\circ\text{C}$.

A photoperiod of 16h light:8h dark is used for the *Eohaustorius* sediment tests. Light intensity is maintained between 50-100 ft candles in all areas of the environmental chamber throughout the test period.

The number of emergent (swimming) and surface-trapped amphipods are counted and recorded daily. Any amphipods trapped at the air-water interface are gently pushed down into the water with a wide-bore plastic pipette.

The acute sediment toxicity test is terminated after 10 days of exposure. The reference toxicant test is terminated after 96 hours of exposure unless the un-ionized pore water ammonia concentration in any of the sediment samples is ≥ 0.8 mg/L, in which case the ammonia reference toxicant test will be extended from 4 days to 10 days for better comparison to the 10-day test sample results.

The test sediment is sieved through a 0.5 mm screen, and the number of live, missing, and dead amphipods are counted and recorded. Missing animals are assumed to have died and decomposed during the test; these missing animals are counted as dead when calculating percent survival for the replicate. A dead amphipod is considered one that does not exhibit movement (e.g., neuromuscular twitch of pleopods or antennae) upon gentle prodding with a probe.

If reburial is a measurement of interest, then the surviving amphipods from the above test are placed in beakers containing control sediment and filtered seawater for a period of one hour, after which the number of animals that are unable to rebury is recorded.

The data are analyzed in accordance with procedures outlined in Sections 12 and 13 of EPA 600/R-94/0925. The test acceptability criterion is $\geq 90\%$ mean control survival at test termination.

Additional information and the standard operation procedures for sediment toxicity testing are provided in Section 15 of the QAM (City of San Diego, 2014: pp. 471-490).

SPATIAL REPRESENTATION, MONITORING FREQUENCY, AND ANALYSIS

The STMP is designed to ensure that the benthic sampling stations are spatially representative of the sediments within the region of interest. For the area surrounding the Point Loma and South Bay ocean outfalls, the stations selected for sediment toxicity testing shall be drawn from a combination of the “core” (permanent, fixed location) and “random array” monitoring stations for sediment condition (chemistry, grain size distribution) and benthic community structure that are presently required. Details of the core PLOO and SBOO stations (e.g., coordinates, depth) that are monitored on a semiannual basis (Winter, Summer), as well as the requirements for sampling an additional array of 40 randomly selected stations each year that span both regions from offshore of Del Mar in northern San Diego County southward to the USA/Mexico border are available in the above orders and most recent annual monitoring and assessment reports (see City of San Diego, 2015a, b).

Upon implementation of the STMP, the City will test sediment samples using a hybrid sampling design of both permanent (fixed) and random stations as described below for three years (2016-2018). Sampling will be targeted for the third quarter (July – September) of each year beginning in calendar year 2016 and shall correspond as closely as possible to the regular sampling for sediment chemistry and benthic community condition at these sites. If successful sample collection for sediment toxicity testing cannot be accomplished during this quarter, sampling may be rescheduled for the first quarter (January – March) of the following year if necessary and upon notification of the San Diego Regional Water Board.

1. YEAR 1 (Summer 2016)

The first year sample design will include about 28 stations as follows:

- a. Permanent/fixed location sites ($n = 8$): The four closest near-ZID stations located within 1,000 m of the discharge site for each outfall will be sampled for sediment toxicity since these are the most likely sites to be affected by wastewater discharge. These include stations E11, E14, E17 and E15 near the PLOO discharge site and stations I12, I14, I15 and I16 near the SBOO discharge site (see **Figure 2**).
- b. Randomly selected sites ($n = 16-20$): Twenty of the 40 random benthic stations to be designated for the summer 2016 survey will also be targeted for sediment toxicity testing. Final selection of these 20 sites will be approved in consultation between the City, USIBWC, SDRWQCB, and USEPA. A maximum of four stations (20%) may be abandoned without replacement if sampling cannot be completed successfully due to unsuitable substrate or other logistical difficulties. If sampling cannot be conducted at >4 stations, replacement sites will be selected to ensure that 16 stations are sampled successfully. A map of the summer 2015 survey stations is shown in **Figure 3** as an example of the expected spatial coverage; station selection for the 2016 summer survey is expected to occur during spring 2016.

2. YEAR 2 (Summer 2017)

The second year design will include sampling at eight or more stations as follows:

- a. Permanent/fixed location sites ($n = 8$): Repeat sampling and testing will be conducted at all eight of the permanent near-ZID stations described above regardless of whether any toxicity was observed in Year 1.
- b. Randomly selected sites ($n = TBD$): Repeat sampling will be conducted at any of the randomly-selected stations in Year 1 that showed toxicity.

3. YEAR 3 (Summer 2018)

The third year survey will repeat the Year 1 design, but with new “random” stations.

- a. Permanent/fixed location sites ($n = 8$): Repeat sampling and testing will be conducted at all eight of the permanent near-ZID stations described above.
- b. Randomly selected sites ($n = 16-20$): See description above for Year 1.

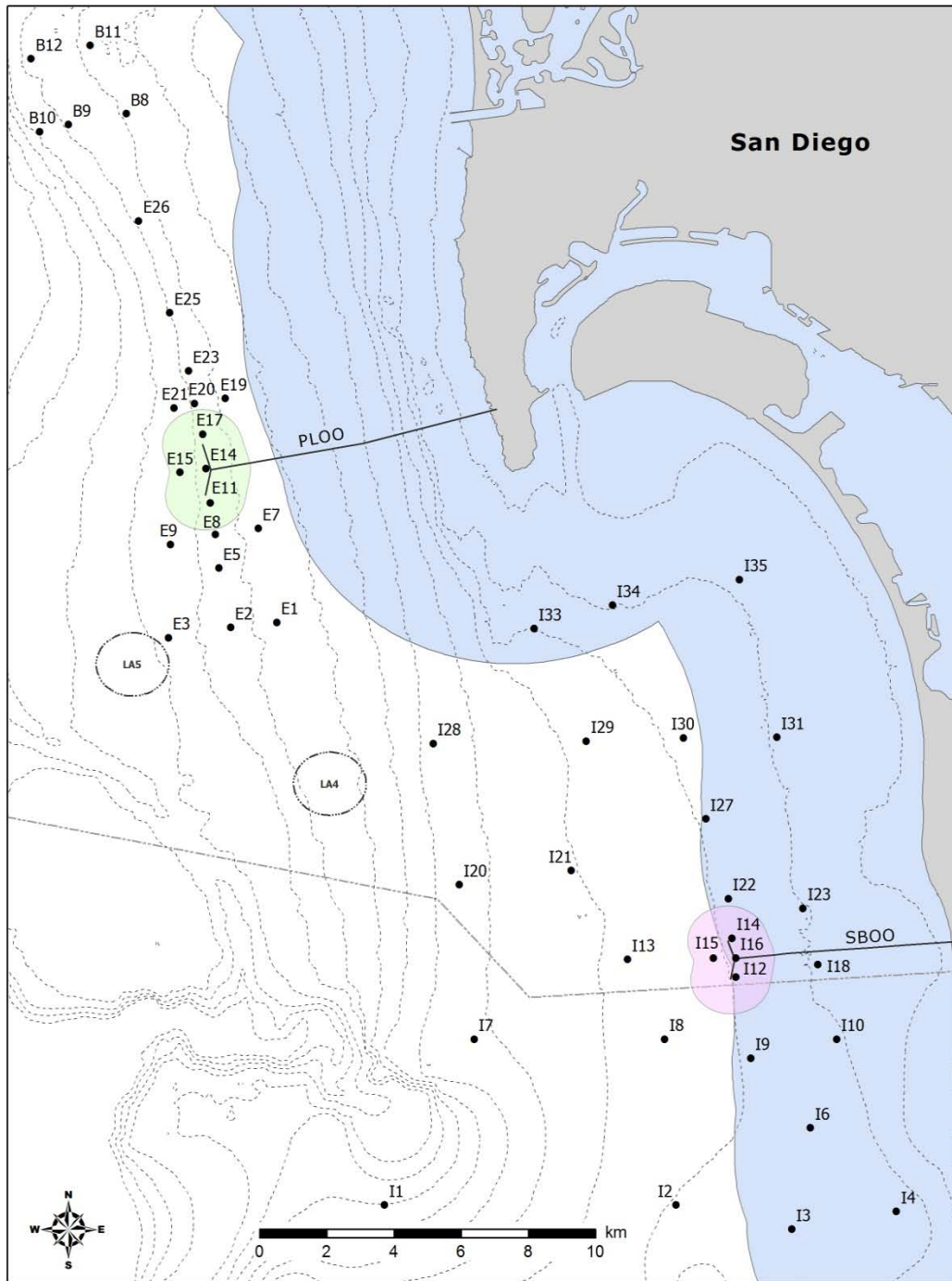


Figure 2

Core benthic station locations surround the Point Loma Ocean Outfall (PLOO) and South Bay Ocean Outfall (SBOO) as part of the City of San Diego’s Ocean Monitoring Program. Near-ZID stations within 1,000 m of the discharge sites are shaded in green for the PLOO and pink for the SBOO.

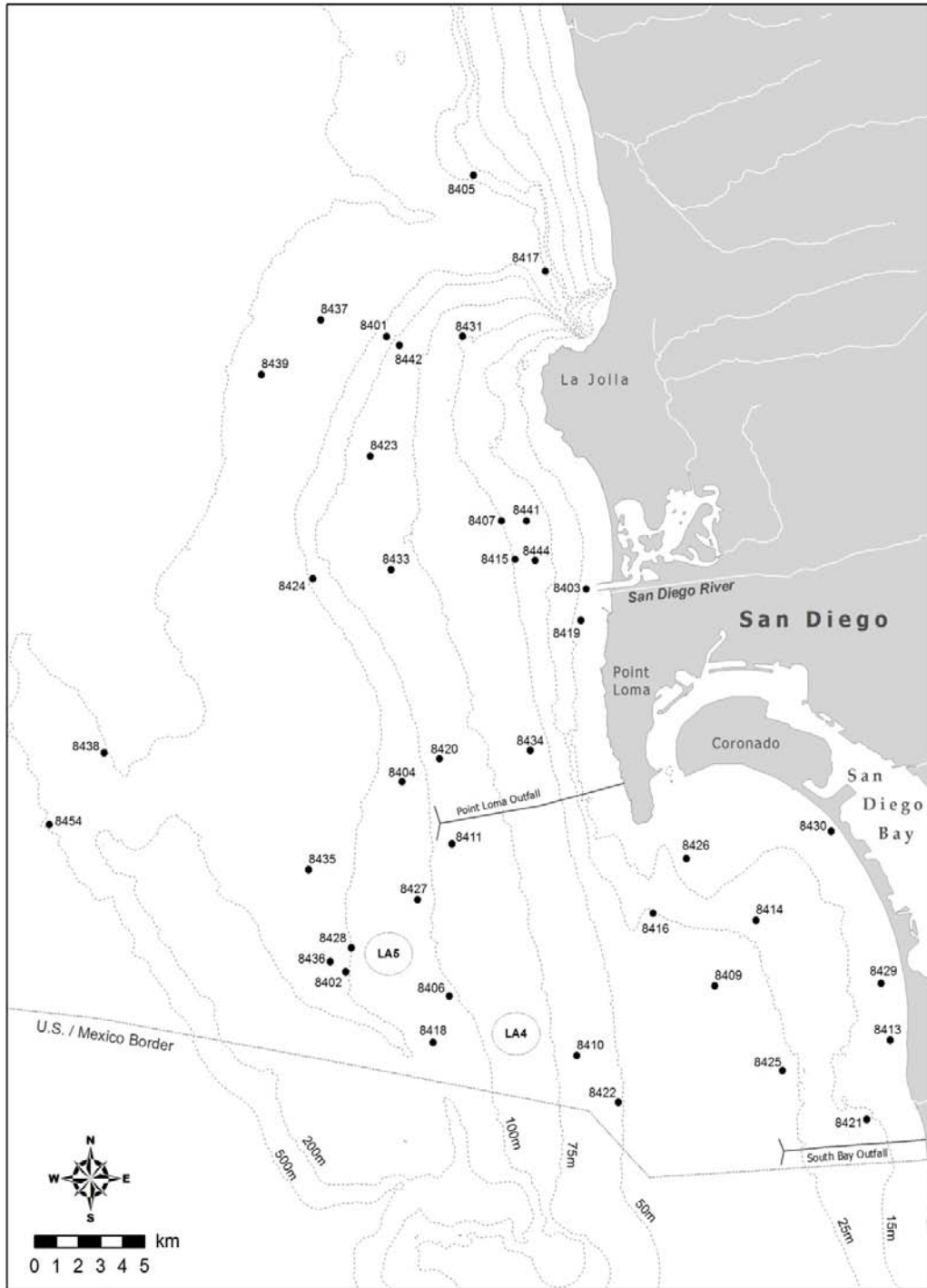


Figure 3

Randomly selected regional benthic stations sampled during July 2015 as part of the City of San Diego’s Ocean Monitoring Program. Note: New stations will be selected for the 2016-2018 regional surveys (see text).

If persistent toxicity based on the results of repeat testing between years is found to occur at any site, the results will be discussed with the Regional Water Board and further compared to the findings from the corresponding sediment chemistry and benthic community condition assessments, if available, following the Sediment Quality Objectives triad approach. If determined to be warranted by the Regional Water Board, additional sampling at neighboring core stations or other sites to be later defined may be collected and tested to assess the spatial extent of such persistent toxicity. Finally, a sediment toxicity identification evaluation (TIE) may also be initiated to investigate the source(s) of any observed toxicity.

Finally, the results of the sediment toxicity data gathered during this Project will be compared to the Receiving Water Limitations (RWLs) specified in the above orders for the SBWRP, SBIWTP and PLWTP, tabulated, evaluated and interpreted to determine whether the applicable RWLs have been attained. The results will be summarized in a final narrative project report due within six months of completion of the Year 3 survey (e.g., ~July 1, 2018).

EXISTING DATA AND INFORMATION

The above STMP test design takes into consideration available data and information from the Southern California Bight Regional Monitoring Program (Bight Project). The City has participated in and conducted sediment toxicity testing in support of multiple iterations of the Bight Project (e.g., Bay et al., 2000, 2005, 2011, 2015).

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