



## Sediment Quality Assessment of Targeted Toxic Hot Spots Previously Identified in San Francisco Bay by the Bay Protection and Toxic Cleanup Program or Other Sites on the 303(d) List.

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Estimated Cost: \$90,000  
Oversight Group: RMP Exposure and Effects Workgroup (EEWG)  
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### Proposed Deliverables and Time Line

Deliverable	Due Date
Task 1: Convene focus group and develop final plan	Summary report on BPTCP site status - March 15 <sup>th</sup> , 2011. Focus group meeting - April/May 2011.
Task 2: Sample collection and data analysis	July/August 2011 - coordinated with the RMP S&T sediment sampling.
Task 3: Reporting	Draft - August, 2012 Final - October, 2012

### Background and Justification

In August 2009 the State Water Resources Control Board (State Water Board) adopted the Sediment Quality Objectives for Enclosed Bays and Estuaries. These sediment assessment methods use the sediment triad approach to evaluate the ecological condition of sediments from a site, using measurements of sediment chemistry, toxicity tests, and benthic community condition (Bay *et al.*, 2009). The San Francisco Bay Regional Water Quality Control Board (Water Board) is interested in employing these SQO assessment methods to evaluate sediment condition at toxic hotspots and other sites that are on the 303(d) list<sup>1</sup> in support of management decisions.

The sites of current interest to the Water Board that will be considered for this study because they have not had cleanup orders or implementation plans developed for them include sites identified as impaired by the Bay Protection and Toxic Cleanup Program (BPTCP) in the late 1990s (Hunt *et al.*, 1998) or sites listed on the current 303(d) list. They include: Central Basin, Islais Creek, Mission Creek, San Leandro Bay and two sites in the Oakland Inner Harbor - Pacific Dry Dock and Fruitvale.

The proposed study will conduct Sediment Quality Objectives assessments (SQOs) at up to six sediment stations to support the Water Board's management decisions. Sites will be located within the general geographic region of the Estuary currently defined as the

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<sup>1</sup> [http://www.waterboards.ca.gov/water\\_issues/programs/tmdl/2010state\\_ir\\_reports/category5\\_report.shtml](http://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/category5_report.shtml)

polyhaline benthic assemblage by the current SQO guidance documentation – between the Dumbarton Bridge in the south and the Richmond Bridge in the north (Bay *et al.* 2009).

The first objective of the proposed study is to conduct an assessment of sediment condition at sites of concern to the Water Board using the recently approved SQO assessment methods. If this study is funded, a focus group will be convened to consider management priorities and finalize the study design. A secondary objective of the study is to continue the RMP's ongoing effort to investigate potential causes of toxicity and develop stressor identification methods. If sediments prove to be sufficiently toxic to either the amphipod or bivalve laboratory test species, a toxicity identification evaluation (TIE) will be conducted to investigate possible causes of the observed toxicity (see below for more detail).

This study will address RMP management questions (listed below) related to pollutant effects on benthic organisms including: evaluating the long-term persistence of benthic impacts at hotspots, which pollutants are responsible for potential impacts, and the utility of the SQO approach in evaluating sediment condition. This study will provide the Water Board with SQO assessments of important estuary margin sites of concern in the Central and South Bay regions of the San Francisco Estuary in support of managing contaminated sites and 303(d) listing decisions.

## Study Plan

This study will limit its focus to sites that fall within the polyhaline benthic assemblage as defined by the current SQO guidance (Bay *et al.*, 2009). Benthos samples will be further evaluated to confirm they are placed in the right benthic assemblage using salinity measures and indicator taxa defined in the SQO guidance documentation. If samples do not fall within the expected polyhaline assemblage, alternative benthic assessments may be used to provide a basis for comparison of condition. The RMP and SCCWRP are currently working on revising and formalizing the mesohaline SQO benthic assessment methods and these new methods may be used to evaluate benthic community condition in samples if the resulting samples are determined to belong to the mesohaline assemblage.

This study will consist of three tasks:

### **1. Convene a focus group to finalize study design:**

Because a summary of the current status of the sites of interest must be compiled and considered before selecting the sites to sample, a focus group will be convened after the start of the project to develop the final study plan. After reviewing the summary of site-conditions the group will decide which sites, the number of samples to be collected per site, and the measurements to be analyzed (beyond the core SQO assessment measures) based largely on Water Board priorities and the project budget. Up to six samples will be collected under the current budget and, depending on the study design (number of sites and replicates), the full suite of RMP Status and Trends triad measures will be analyzed.

If the focus group chooses to study a site previously visited by the BPTCP, it may be possible compare SQO assessment scores from results from the earlier study. Many of the BPTCP sites were sampled in 1997 for a similar suite of sediment triad parameters as employed by the current SQO methods (Figure 1).

Some of those sites were determined to be toxic hot-spots, and remediation efforts were implemented. The focus group may decide to re-assess some of those sites to see if sediment conditions have improved.

The review document of site-condition for the candidate sites to be considered will summarize information about sediment conditions and/or rationale for a site being listed on the 303(d) list, and outline any remediation efforts that may have taken place to-date.

## 2. Sample collection and analyses:

This study will coordinate with the RMP Status and Trends sediment monitoring effort scheduled in the summer of 2011 to sample during the same season as the long-term monitoring program and to leverage logistics, analytical, and information-management costs. The same analytical laboratories and core analyte list as monitored by the RMP Status and Trends sediment monitoring effort will be used in this study in order to maximize the use of the data in other RMP studies.

Surface sediment will be sampled and analyzed for the full suite of RMP Status and Trends measures including:

- Sediment and water quality - grain-size, TOC, TN, and a CTD cast will be taken to record water quality conditions near the bottom.
- Trace metals
- Trace organics
- Toxicity to two test species (*Eohaustorius estuarius* and *Mytilus galloprovincialis*)
- Benthic macrofauna

## 3. Reporting:

Sediment assessment scores will be compared among sites and to the RMP Status and Trends program scores. The Status and Trends program began conducting SQO assessments in 2008 at a subset of the long-term sediment monitoring sites (sampled annually on an alternating wet and dry season sampling period). Those sites are located throughout the Estuary and represent ambient conditions as they are not located near known sources of pollution. Comparing the study sites to those in the Estuary will provide perspective about the respective ecological condition of sediments in the Estuary as a whole and in the Estuary margins - near pollution sources.

If previously sampled BPTCP study sites are selected for this study, it may be possible to further evaluate if sediment quality conditions have improved by using the SQO assessment scores to compare historic condition to this new study.



**Figure 1.** Map of the BPTCP triad stations sampled 1994 - 1997.

### **Contingency TIE Study for Stressor Identification**

A conditional task is included in this proposal to address stressor identification at sites that are highly toxic. If <55 % mean survival or mean normal-development is observed in either the amphipod or bivalve tests respectively, a phased TIE study will be authorized through written agreement from the RMP program manager, via the use of additional funds from the 'RMP contingency fund'. This conditional add-on is consistent with the RMP's current standard that authorizes TIE studies to be conducted in the RMP S&T program whenever sediment samples are considered toxic enough to warrant a TIE to investigate possible causes of the observed toxicity.

This study will be conducted by the RMP's S&T toxicity laboratory (UCD-MPSL) and may include techniques developed through the RMP in the past for bivalve TIEs and through methods being developed for amphipods through the current RMP special study - Sediment TIEs (2009-2010) with oversight by the EEWG.

### **Applicable RMP Management Questions**

EEWG benthic effects management questions:

1. What are the spatial and temporal patterns of impacts of sediment contamination on benthic biota?

*The proposed study will employ the SQO methods for Enclosed Bays and Estuaries to assess ecological condition, and if there is a potential concern of degraded conditions due to pollution. This Study will focus on impaired sites located in the Estuary margins and SQO assessment scores will be compared to the RMP Status and Trends scores from the ambient survey design. To evaluate temporal patterns, BPTCP sites that were sampled in 1997 may be re-assessed to investigate to what extent sediment conditions have improved.*

2. Which pollutants are responsible for observed impacts on benthic biota?

*If the TIE study is authorized, due to significant toxicity observed in one or both toxicity tests, this study will address this specific benthic effects management question from the EEWG Five Year Work Plan (2008). TIE methods are currently being developed by the RMP and SCCWRP for both SQO test species. Employing these new developing TIE procedures on highly toxic ambient sediments begins to inform managers of the environmental stressors that may be causing the observed toxicity and provides an opportunity to improve TIE procedures.*

3. Are the toxicity tests, benthic community assessment approaches, and the overall SQO assessment framework we are using reliable indicators of impacts on benthic biota?

*The SQO methods for Enclosed Bays and Estuaries will be implemented to investigate sediment conditions at sites that are the most impaired in the Estuary which will help to inform us on how sensitive these tools are and if they can detect changes in sediment conditions over time or after remediation efforts have been completed.*

## Budget Estimate

<b>Description</b>	<b>Cost per Sample (\$)</b>	<b>Cost Estimate (\$)</b>
<b>Sediment Chemistry</b>	3,548	<b>21,290</b>
<b>Sediment Toxicity</b> (Eohaustorius & Mytilus)	1,975	<b>11,850</b>
<b>Benthos</b>	2,200	<b>13,200</b>
<b>Management, Sampling and Reporting</b>		<b>28,776</b>
<b>Other Expenses</b>		<b>14,884</b>
Logistics contract, vessels, shipping, travel, etc.		
<b>Total Cost Estimate</b>		<b>\$ 90,000</b>

## References

Bay S., D.J. Greenstein, J.A. Ranashinghe, D.W. Diehl, A.E. Fetscher. 2009. Sediment Quality Assessment Draft Technical Support Manual. Technical Report 582. May, 2009. Southern California Coastal Water Research Project. Costa Mesa, CA

Hunt JW, Anderson BS, Phillips BM, Newman J, Tjeerdema RS, Taberski KM, Wilson CJ, Stephenson M, Puckett HM, Fairey R, Oakden J. 1998. Sediment Quality and Biological Effects in San Francisco Bay. Final Report for the Bay Protection and Toxic Cleanup Program. California State Water Resources Control Board.