



**DESKTOP ANALYSIS TO INFORM PILOT TESTING OF
MUNICIPAL OPERATION AND MAINTENANCE ENHANCEMENTS FOR
PCB AND MERCURY LOAD REDUCTION**

WORK PLAN

1.0 INTRODUCTION

1.1 Background

Chemical analysis of tissue from fish caught in San Francisco Bay has revealed bioaccumulation of mercury, polychlorinated biphenyls (PCBs), and other pollutants at levels thought to pose a health risk to people consuming fish caught in the Bay. As a result of these findings, the California Office of Environmental Health Hazard Assessment issued an interim advisory on the consumption of fish from the Bay. The advisory led to the Bay being designated an impaired water body on the Clean Water Act "Section 303(d) list" due to mercury, PCBs, and other pollutants. In response, the California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board) has developed Total Maximum Daily Load (TMDL) water quality restoration programs targeting mercury and PCBs in the Bay. The general goals of the TMDLs are to identify sources of mercury and PCBs to the Bay and implement actions to control the sources and restore water quality. The TMDLs include requirements associated with municipal stormwater discharges that are implemented through the San Francisco Bay Area NPDES Municipal Regional Permit (MRP) adopted by the Regional Water Board (SFBRWQCB 2009).

MRP Provisions C.11 and C.12 prescribe mercury and PCBs requirements, respectively. Provisions C.11/12.c through C.11/12.f require pilot studies to test four types of potential mercury and PCB controls:

1. C.11/12.c - pollutant source property identification and referral to regulatory agencies for remediation.
2. C.11/12.d - municipal operation and maintenance (O&M) enhancements to remove additional sediments containing particle-bound pollutants such as mercury and PCBs.
3. C.11/12.e - stormwater treatment retrofitting.
4. C.11/12.f - diversion of stormwater to existing Publicly-Owned Treatment Works (POTWs).

Bay Area Stormwater Management Agency Association (BASMAA) member agencies (i.e., Bay Area municipal stormwater management programs) recently proposed a wide range of pilot projects in compliance with Provisions C.11/12.c through C.11/12.f (BASMAA 2011a). Many of these projects are being implemented through a BASMAA project called Clean Watersheds for a Clean Bay (CW4CB), which is funded by a USEPA grant and matching funds from BASMAA and BASMAA member agencies (BASMAA 2010). This suite of pilot projects proposed by BASMAA member agencies is consistent with the objectives of MRP Provisions C.11 and C.12, including evaluating the relative feasibility and cost-effectiveness of a range of potential



pollutant controls for reducing mercury and PCB loads to the Bay and gathering information to guide implementation of such controls during future permit terms.

BASMAA's proposed pilot studies include municipal O&M enhancement projects as required by MRP Provision C.11/12.d. The studies will be implemented in five Bay Area pilot investigation watersheds where previous studies have found relatively high levels of PCBs in sediments that were collected from roadways and stormwater drainage infrastructure. These watersheds are currently already under investigation through CW4CB. However, based upon recent discussions among BASMAA representatives, the CW4CB Technical Advisory Committee, and Regional Water Board staff, the conceptual planning of the municipal O&M pilot studies would benefit from further desktop analysis. This work plan provides a scope of work for such desktop analysis, focusing on the following five types of municipal O&M enhancement pilot studies:¹

1. Street sweeping.
2. Storm drain inlet cleaning.
3. Street flushing.
4. Stormwater conveyance pipeline flushing.
5. Pump station maintenance (e.g., vacuuming accumulated materials from pump station wet wells).

The latter three types of enhancement (above bullets 3, 4 and 5) may optionally be implemented as an "operational diversion" if captured wastewater is routed to a Publicly-Owned Treatment Plant (POTW) for treatment. It should be noted that in addition to contributing towards compliance with MRP Provision C.11/12.d, such operational diversion activities would also contribute towards compliance with MRP Provision C.11/12.f., consistent with Appendix I of the MRP (Fact Sheet), which states that efforts conducted per Provision C.12.f "*...can be conducted in conjunction with Provision C.12.d such that POTW diversion efforts conducted as part of C.12.d can be counted toward accomplishing C.12.f requirements.*"

1.2 Project Objectives

The objectives of the desktop analysis described in this work plan are to:

- inform the conceptual planning of municipal O&M enhancement pilot studies during the current permit term. The studies will be planned to yield maximum learning benefits in terms of furthering our understanding of how to optimize pollutant load reductions through O&M enhancements.
- develop tools that will assist future planning of O&M enhancements across a larger geographic scale. The desktop analysis will provide a conceptual framework to plan implementation of O&M enhancements that will maximize mercury and PCB load reduction and cost efficiency during future permit terms.

¹In addition to the enhanced municipal O&M enhancement pilot studies, BASMAA agencies have identified diversion pilot studies that entail piping of stormwater conveyance system flows to the sanitary sewer collection system. These diversion projects will contribute towards compliance with MRP Provision C.11/12.f and are currently under development by individual BASMAA agencies. These diversion projects will not be included in this desktop analysis.



2.0 SCOPE OF WORK

The desktop analysis will build upon previous efforts, including the following:

- A recent project funded by a State of California Proposition 13 grant and conducted by the San Francisco Estuary Institute (SFEI) that investigated options to better manage mercury and PCBs in urban stormwater (www.sfei.org/urbanstormwaterBMPS). The products of the SFEI project included a BMP toolbox for reducing mercury and PCBs in stormwater (SFEI 2010) and a desktop evaluation of potential pollutant load reductions under various mercury and PCB control scenarios (Mangarella et al. 2010).
- A review of existing literature on municipal O&M practices that remove sediments and associated particle-bound pollutants such as mercury and PCBs (referred to as “sediment management practices” by this literature review) conducted as part of CW4CB Task 4 (BASMAA 2011b).
- A description of preliminary calculation methods and formulas for quantifying mercury and PCB stormwater load reductions associated with practices such as street sweeping and inlet cleaning (BASMAA 2011c).

The desktop analysis will be a BASMAA Regional Project. The existing BASMAA Monitoring and Pollutants of Concern Committee (BASMAA MPC) will oversee implementation of the project. The CW4CB TAC will also assist the BASMAA MPC to oversee the project by providing technical guidance and feedback, including reviewing and commenting on the draft project report.

This desktop analysis will consist of the following five tasks:

1. Create GIS graphical representations of the spatial distribution of mercury and PCB concentrations in the portions of the Bay Area subject to MRP requirements, including the five pilot investigation watersheds where pilot O&M enhancement pilot studies will occur.
2. Develop a template for a conceptual model of pollutant sources/transport/storage and a preliminary O&M enhancement decision tree, including development of a questionnaire that identifies the information needed to populate the conceptual model and apply the decision tree.
3. For each pilot investigation watershed, collect the information needed to populate a conceptual model and apply the decision tree.
4. For each pilot investigation watershed, populate a conceptual model and apply the decision tree to inform the planning of optimal O&M enhancement pilot studies.
5. Perform pollutant load reduction opportunity analyses, cost estimating, conceptual planning of pilot O&M enhancement pilot studies, and project reporting.

The tools developed during the desktop analysis (graphic representation of pollutant distribution, conceptual model template, decision tree, and questionnaire) will inform both 1) the conceptual planning of municipal O&M enhancement pilot studies during the current permit term and 2) the planning of O&M enhancements across a larger geographic scale during future permit terms.

The following sections describe each of these tasks in greater detail. See Section 3.0 below



and Table 1 for information about anticipated schedules and estimated budgets.

Task 1 - Develop Mercury and PCB Concentration Spatial Distribution Maps

This task will develop GIS graphical representations of the spatial distribution of mercury and PCB concentrations in street and stormwater conveyance system sediments throughout the MRP footprint. Interpolation of spatial data (e.g., kriging) may be used, as appropriate, to create maps that illustrate the spatial distribution of pollutant sediment concentrations. Existing GIS layers of pollutant indicators (e.g., historic industrial land use, substations, pollutant release sites) can also be overlaid on the maps. The maps can then be used to identify geographic areas of concern that potentially have relatively high mercury and PCB concentrations. This information will be used to help identify potential locations within pilot investigation watersheds that may be appropriate for O&M enhancement pilot studies and additional areas throughout the MRP footprint where pollutant reduction activities should be considered during future permit terms. Data collected via numerous efforts during the last decade will be considered when developing the maps. These data were initially reviewed by BASMAA (2011b), including mercury and PCB concentration data for street sweeper materials, storm drain inlets, and street surface sediments collected at locations throughout the Bay Area.

Task 2 - Develop Conceptual Model Template, Decision Tree and Questionnaire

Task 2 will develop a conceptual framework that can be used to evaluate municipal O&M enhancements by creating a template for a pollutant source/transport/storage conceptual model and an O&M enhancement decision tree. The conceptual model template will present a framework for characterizing a typical old industrial watershed with regard to the locations of known or predicted mercury and PCB source areas, potential transport processes to the stormwater conveyance system, and locations and extent of potential pollutant-containing sediment deposits within the conveyance system. The decision tree will be designed to help identify both the type of O&M enhancement and the location where applying such an enhancement would likely provide the greatest pollutant reduction opportunity and cost-effectiveness. Examples of potentially relevant watershed characteristics include:

- Mercury and PCB concentrations in sediments collected from roadways and stormwater conveyance infrastructure.
- Historical and current land uses.
- Age of development.
- Known pollutant sources and transport processes.
- Sediment accumulation rates and/or sediment yields.
- Street sweeping frequency and sweeper type.
- Parking controls during street sweeping.
- Type and condition of roadway infrastructure.
- Type of stormwater conveyance infrastructure (e.g., drop inlets or catch basins).
- Extent of sediment accumulation in stormwater conveyance system.
- Stormwater conveyance system cleaning frequency.



- Other O&M activities.

The above characteristics will inform development of a questionnaire that is designed to identify the enhancement and location combinations with optimal pollutant reduction potential. For selected sites and/or enhancements that pass the first level of assessment, quantitative evaluation, including opportunity calculations and cost analysis, will be done during Task 5 to further assess the site/enhancement and identify candidate enhancements with the greatest opportunity and cost-effectiveness. The conceptual model template, decision tree and questionnaire developed through this task will serve as a model for assessing and identifying optimal O&M enhancements in other Bay area locations in the future.

Task 3 – Collect Information to Characterize Pilot Watersheds

Task 3 will apply the questionnaire to gather information on the characteristics identified in the previous section for each of the five pilot investigation watersheds. This task will collect baseline information required to populate conceptual models for each watershed and apply the decision tree (Task 4). The type, quantity and quality of information gathered will vary for each pilot watershed, but all relevant and readily available information will be gathered and compiled into a standardized spreadsheet or database format.

The individual stormwater management program and/or city with jurisdiction over each pilot investigation watershed will conduct the information gathering in that watershed. Potential sources of information include:

- Surveys of municipal staff.
- Site reconnaissance.
- NPDES permit compliance reports submitted annually by Bay Area stormwater programs to the Regional Water Board that include data on maintenance practices.
- Available pertinent data gathered during the ongoing CW4CB Task 3 effort to identify and refer source properties in the five pilot investigation watersheds. Such data would include identified suspect mercury or PCB source properties and information regarding sediment transport within the watersheds.

Task 4 - Populate Pilot Watershed Conceptual Models and Apply Decision Tree

Following completion of the pollutant maps (Task 1), conceptual model template, decision tree, and questionnaire (Task 2), and pilot watershed investigation characterization (Task 3), site-specific pollutant source/transport/storage conceptual models will be populated for each of the five pilot watersheds. The conceptual models will identify the locations of known or predicted pollutant source areas, potential transport processes to the stormwater conveyance system, and locations and extent of potential pollutant containing sediment deposits within the conveyance system. The conceptual models will be based upon existing knowledge and watershed characteristic information compiled through Task 3. The conceptual models will be presented in graphical format and their development may be assisted by GIS analysis. The decision tree will then be applied in each pilot investigation watershed to provide an initial qualitative screening of types and locations of O&M enhancement studies that would provide the greatest pollutant load reduction potential and learning benefits.



Task 5 – Perform Opportunity Analysis, Cost Estimating, Conceptual Planning of Studies, and Reporting

Pollutant reduction “opportunity” is defined as the hypothetical reduction in pollutant mass loading rate associated with implementing pollutant control scenarios such as municipal O&M enhancements. Following conceptual model development and decision tree application for the pilot investigation watersheds (Task 4), quantitative opportunity calculations will be conducted for those enhancement scenarios that appear most promising with regard to reducing pollutant loading and providing learning benefits. Calculations based on existing data will be performed to provide first-order estimates of mercury and PCB load reduction opportunities from proposed municipal O&M enhancements. For example, BASMAA (2011b) identified sources of data on increased sediment removal rates with increased sweeping frequency or with varying sweeper technologies. Further review will be conducted to identify data sources most useful for this analysis. All assumptions made during the calculations will be clearly stated and the uncertainty introduced with different types of input data will be discussed. Data gaps that limit the ability to perform calculations and/or limit the quality of the resultant calculation will also be identified and discussed.

In addition, preliminary cost estimates for implementing potential O&M enhancement pilot projects will be prepared based on available literature and a query of project managers, scientist and engineers who have previously conducted similar studies. This task will also document available funding to implement the municipal O&M enhancement pilot studies, including local, state and federal funding sources.

This task will then develop a conceptual plan for implementing the municipal O&M pilot studies. The planning process will include coordinating pilot study planning with municipal staff to find the intersection between proposed projects and the ability and willingness of a city to participate in the projects.

Finally, a project report will be prepared that describes in detail the methods and results of the desktop analysis and presents a conceptual plan for the municipal O&M enhancement pilot projects.² The project report will also document the products of the desktop analysis (graphic representation of pollutant distribution, conceptual model template, decision tree, and questionnaire) and discuss how these tools could be used to inform the planning and implementation of O&M enhancements across a larger geographic scale during future permit terms. A draft project report will be submitted to the project team and the CW4CB TAC for review and comment. After any comments are received the report will be revised as appropriate and finalized.

3.0 SCHEDULE AND BUDGET

Table 1 summarizes the tasks described in this work plan, anticipated completion dates, and estimated budgets for each task. The estimated budget assumes that the individual stormwater management programs and/or cities with jurisdiction over each pilot investigation watershed will

²It is anticipated that a regional contractor will be retained through CW4CB and provided with the conceptual plan. The contractor will work with project and municipal staff to prepare more detailed study designs and work plans, including monitoring plans, for conducting individual municipal O&M enhancement pilot projects.



conduct information gathering under Task 3, with facilitation and guidance provided by the BASMAA Regional Project team.

Table 1. Desktop Analysis Tasks, Anticipated Schedule, and Estimated Budget.

Task Number	Description	Anticipated Completion Date	Estimated Budget ¹
Task 1	Develop Mercury and PCB Concentration Spatial Distribution Maps	4/30/2012	\$5,400
Task 2	Develop Pollutant Source/Transport/Storage Conceptual Model Template, Decision Tree, and Questionnaire	4/13/2012	\$8,800
Task 3	Collect Information to Characterize Pilot Watersheds	4/30/2012	\$2,900 ²
Task 4	Populate Pilot Watershed Pollutant Source/Transport/Storage Conceptual Models and Apply Decision Tree	5/31/2012	\$18,800
Task 5	Perform Opportunity Analysis, Cost Estimating, Conceptual Planning of Pilot Municipal O&M Enhancement Studies, and Project Reporting	6/29/2012	\$19,900
Total Budget:			\$55,800

¹ The desktop analysis will be a BASMAA Regional Project.

² Individual stormwater management programs and/or cities with jurisdiction over each pilot investigation watershed will conduct information gathering under Task 3. The Task 3 estimated budget shown is only for the BASMAA Regional Project to provide facilitation and guidance in relation to the information gathering.

4.0 REFERENCES

BASMAA 2010. *Clean Watersheds for a Clean Bay*. San Francisco Bay Area Water Quality Improvement Fund proposal/workplan submitted by the Bay Area Stormwater Management Agencies Association on September 23, 2009. Revised April 19, 2010.

BASMAA 2011a. *Regional Pollutants of Concern Report for FY2010-2011 and Monitoring Status Report for January-June 2011*. September 12, 2011.

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BASMAA 2011c. *Methods for Quantifying Mercury and PCB Loads Reduced From Urban Stormwater Runoff*. Report prepared for the Bay Area Stormwater Management Agencies Association by EOA, Inc. Technical Memorandum. June 22, 2011 (Draft).

Mangarella, P., Havens, K., Lewis, W., and McKee, L.J., 2010. *Task 3.5.1: Desktop Evaluation of Controls for Polychlorinated Biphenyls and Mercury Load Reduction*. A Technical Report of the Regional Watershed Program: SFEI Contribution 613. San Francisco Estuary Institute, Oakland, CA. 41pp.

SFBRWQCB 2009. *Municipal Regional Stormwater NPDES Permit, Order R2-2009-0074. NPDES Permit No. CAS612008*. California Regional Water Quality Control Board, San Francisco Bay Region. October 14, 2009.

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