References and Resources for PCBs and Mercury-related Activities by the Regional Monitoring Program and BASMAA[1]

Appendix A to Small Tributaries Loading Strategy Multi-Year Plan

Version 2011

RMP Master Planning

The RMP Master Planning process centers on guidance from the Steering Committee in the form of priority information needs and budget commitments. As part of the planning discussion among stakeholders comprising the Steering Committee, Regional Water Board staff listed priority information needs for existing and planned regulatory projects, shown in Table A-1.

Table A-1: Current and anticipated Water Board management decisions, policies and actions influencing priority information needs[2]

Decisions, Policies, and Actions	Timing
Determination of Permit Limits	Ongoing
Biennial 303(d) List and 305(b) Report	2010-11 2012-13 2014-15
Mercury Review the existing TMDL and establish plan to revise it Revised mercury TMDL	 2011-13 2016-18
PCBs Review the existing TMDL and establish plan to revise it Revised PCBs TMDL	 2014-15 2019-20
Copper Compare levels to site specific objectives triggers Reevaluation of the site-specific objectives	 Annual Triennial (2012)
Cyanide Antidegradation policy Ambient levels below CTR threshold	 Triennial (2012)
Selenium North Bay Selenium TMDL South Bay Selenium TMDL	 2012-14 > 2015
Legacy Pesticides (DDT, Dieldrin, Chlordane) Development of "Simple" TMDL	 2012-13
Dioxins Review/reissue permit requirements TMDL project plan TMDL	 2013-14 2017-19

Decisions, Policies, and Actions	Timing
Sediment Quality Objectives 303(d) listings Determination of reasonable potential and permit requirements	 2010-11 2010-11
Nutrients New estuarine numerical endpoints Assessment of ammonia toxicity	 2012-15
Municipal Regional Stormwater Permit (MRP)	2010 and beyond
Pathogens *XX*	 XX
Pyrethroids *XX*	 XX
PBDEs *XX*	 XX
LTMS-DMMP-Regional Sediment Management	2010 and beyond
Dredging Permits	2010 and beyond
Chemicals of Emerging Concern Regional Water Board considering a policy	 XX

The RMP contributes to effective management by providing scientific support for current policies and by anticipating and addressing information needs related to future policies and actions.

[1] The Bay Area Stormwater Management Agencies Association is a 501(c)(3) non-profit organization representing 96 city, county and special district agencies comprising municipal stormwater programs in the San Francisco Bay Area.

[2] Presentation to the RMP Steering Committee Planning Workshop, February 7, 2011

Coordination of the Master Plan is achieved through the participation of stakeholders and scientists in four primary workgroups that report to the TRC and address the main technical subject areas covered by the RMP, and more recently through "strategy teams" in which stakeholders meet as needed to develop long-term RMP study plans addressing high priority topics. RMP strategy teams established by 2011 include mercury, PCBs, dioxins, small tributary loads, and forecasting/modeling.

Communication between the groups occurs via the participating stakeholder agencies, each of which has representatives on the TRC and the SC, as well as by RMP staff. While individual work groups such as SPLWG still have a role of identifying potential additional or alternative priorities, the new master planning process imposes a stronger "top down" framework for determining RMP funded activities.

Regional POC Conceptual Models and TMDLs

PCBs and mercury are the highest priority Pollutants of Concern (POCs), with TMDL and associated implementation plans already adopted and incorporated in the Basin Plan. Because the TMDLs were based on limited available data, several supporting documents were developed through the Clean Estuary Partnership, a regional stakeholder group. Conceptual model reports summarized and synthesized available knowledge for each POC on:

- sources, pathways, and loadings to the Bay
- the present rate of decline due to attenuation and removal
- fate processes and recovery forecasts.

Figure A 1 illustrates the main components of the conceptual model for PCBs. The conceptual model for mercury (Tetra Tech, 2006) is similar in its broad outlines, but contains additional components related to mercury speciation and transformation processes that facilitate production of methylmercury, the chemical form of mercury that accumulates in fish. These transformation processes in water, sediments, wetlands, and biota are complex and their interactions vary in the different Bay segments.

An important function of these conceptual model reports was to present this information in graphs, charts and other easily accessible formats along with assessment of uncertainties and data gaps that limit the ability to evaluate management alternatives and estimate recovery rates. The conceptual models provide a framework for evaluating potential management actions to reduce POC loadings and designing studies or projects that would best improve our understanding of the effectiveness and feasibility of those actions.

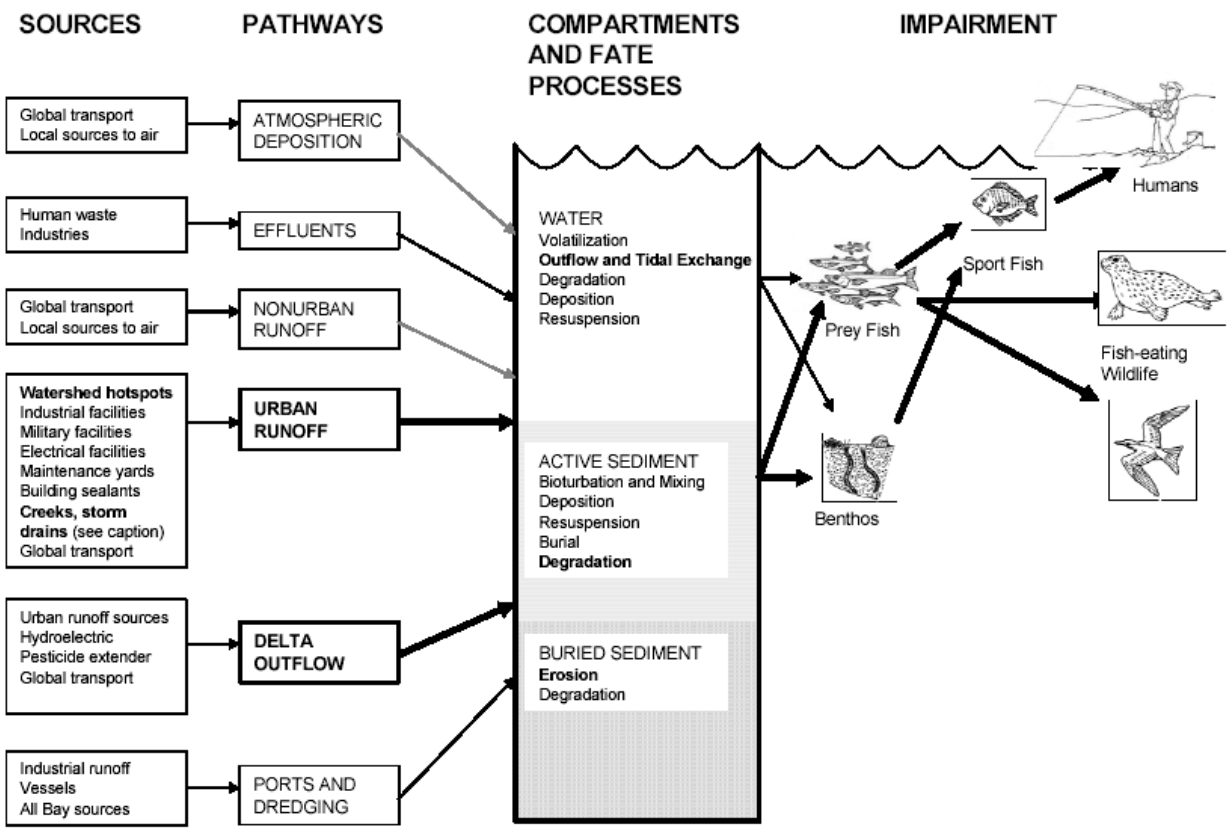

Figure A-1. Conceptual model of PCBs in San Francisco Bay (Davis et. al 2006).

The CEP also produced studies modeling Bioaccumulation in bay biota and evaluating options for discharger actions to achieve the load reductions set by the TMDLs. (Table A-2). Since stormwater runoff is the primary conveyance pathway involved in small tributary loading to the bay, another CEP study examined potential implementation options for municipalities to reduce PCB loads and recommended next steps for clarifying the effectiveness and feasibility of potential management actions, summarized in Table A-3. This report formed the framework for further investigations and later permit requirements in the Municipal Regional Stormwater Permit (MRP).

Table A-2. TMDL estimates of current loads and load reductions for urban runoff, (SFRWQCB 2006, 2008)

TMDL Loads or targets	Mercury	PCB
Total Annual Load (all sources), kg/year	1222	33
TMDL (all sources), kg/year	698	10
Urban runoff load, kg/year	160	20
Urban runoff TMDL Waste Load Allocation, kg/year	82	2
Final (20 year) Urban runoff reduction	49%	90%

1

2 **Table A-3. PCB Implementation Options for Municipalities (adapted from Larry Walker**
3 **Associates et. al, 2006)**

Action	Tools / Sub-tasks	Suggested lead
Source Identification & prioritization		
Identify PCB contaminated sites in service area	Online databases, DTSC & Water Board records, site investigations	Individual municipalities
Research types and age of structures that would most likely contain PCB-containing materials	Define procedures to identify which structures are most likely to contain these materials.	One-time regional study
Identify unenclosed PCB sources in service area	Use procedures identified above to identify structures. Review building & planning department records, Sanborn maps, other local agency records, site investigations	Individual municipalities
Identify areas likely to have elevated levels of PCBs in sediments	Evaluate based on information obtained for contaminated sites and unenclosed sources	Individual municipalities
Evaluate accumulated sediments in conveyance systems	Conduct sediment monitoring, upstream investigations in identified areas	Individual municipalities
Prioritize identified sources for further action	Prioritization conducted periodically as information on sources is developed. Tools include: • Screening level load estimate • Concentration evaluation • Ease of implementation/ cost • Potential for runoff • Other factors	Individual municipalities
Remediation options/ control strategies		
Conduct demonstration project to address on-land sites	• Identify 6-10 sites split between redevelopment candidates and sites that are not targeted for redevelopment • Determine most effective approach for municipalities to mitigate runoff from on-land sites	Regional effort
Develop individual municipal plan for on-land sites	• Use approaches identified in demonstration projects to address candidates for redevelopment and sites not targeted for redevelopment	Individual municipalities
Unenclosed sources BMP development	• Develop BMPs for dealing with disposal during remodeling and demolition • Develop education materials and procedures	Regional effort
Unenclosed sources regulatory strategies	• Evaluate existing regulatory authorities and programs to determine approaches to enforcing requirements as necessary	Regional effort
Unenclosed sources	• Work with building departments to create	Individual municipalities

Action	Tools / Sub-tasks	Suggested lead
education and outreach program	protocols for identifying sources • Conducting outreach regarding BMPs	or regional effort as appropriate
Unenclosed sources regulatory approaches	• Implement programs to require measures to prevent runoff from unenclosed sources	Individual municipalities or regional effort as appropriate
Develop plan for addressing accumulated sediments in conveyance systems based on source evaluation	• Revise maintenance programs to increase sediment removal • Conduct upstream investigations to identify ultimate PCB sources to sediments.	Individual municipalities
Periodic review of effectiveness of implemented strategies to determine future directions	• Monitoring • BMP implementation review • Other effectiveness measures	Individual municipalities or regional effort as appropriate

The report noted that further analysis was needed of the feasibility of these implementation options, including quantitative evaluation of costs and benefits. It also noted the need to take into account other factors that could be important in assessing feasibility, including:

- The likelihood of identifying responsible parties or obtaining state or federal funding for identification and cleanup of on-land PCBs sites.
- The cumulative benefits of implementing strategies that address multiple sediment-bound pollutants.

Source Identification and Stormwater Load Reduction Measures

During preparation of the mercury and PCB TMDLs, BASMAA programs[3] conducted field surveys of bedded sediments in creeks and storm drain conveyances (e.g. Gunther et. al, 2001, KLI, 2001) which revealed some urban areas with relatively elevated levels of PCBs and mercury in storm drain sediments[4] In 2001 stormwater agencies began performing case studies in some of these areas, employing additional sampling, property database searches and site visits to attempt to identify PCB sources. Lessons and potential control strategies developed as a result of these case studies were summarized in a review by EOA (2004). Several programs also

[3] BASMAA members from four urbanized counties are organized into countywide programs (Alameda Countywide Clean Water Program, Contra Costa Clean Water Program, San Mateo Countywide Water Pollution Prevention Program and Santa Clara Valley Urban Runoff Pollution Prevention Program) which, along with Solano County member programs (City of Vallejo, Vallejo Sanitation and Flood Control District and Fairfield-Suisun Urban Runoff Management Program):comprise all Bay Area Phase 1 municipal stormwater permittees. (San Francisco operates a combined sewer system and is not subject to the MRP).

[4] relative to TMDL targets, though often below regulatory action levels for direct human exposure

conducted studies to assess the removal of PCBs and mercury by existing sediment management, e.g. street sweeping and cleanouts of storm drain inlets and other conveyances.

With advisers and partnership from the Water Board and BASMAA, SFEI obtained a grant in 2004 from the Proposition 13 Coastal Non-point Source Pollution Control Grant Program: (Proposition 13) for a Regional Stormwater Monitoring and Urban BMP Evaluation Project intended to build on the preceding studies to further assist stormwater programs in implementing the mercury and PCB TMDLs. The project's conceptual model for stormwater sources and potential reductions is shown in Figure A-2, and a list of its products with the main information needs that were addressed is shown in Table A-4. Additional project information and copies of reports are available at the project web page at http://www.sfei.org/urbanstormwaterbmps

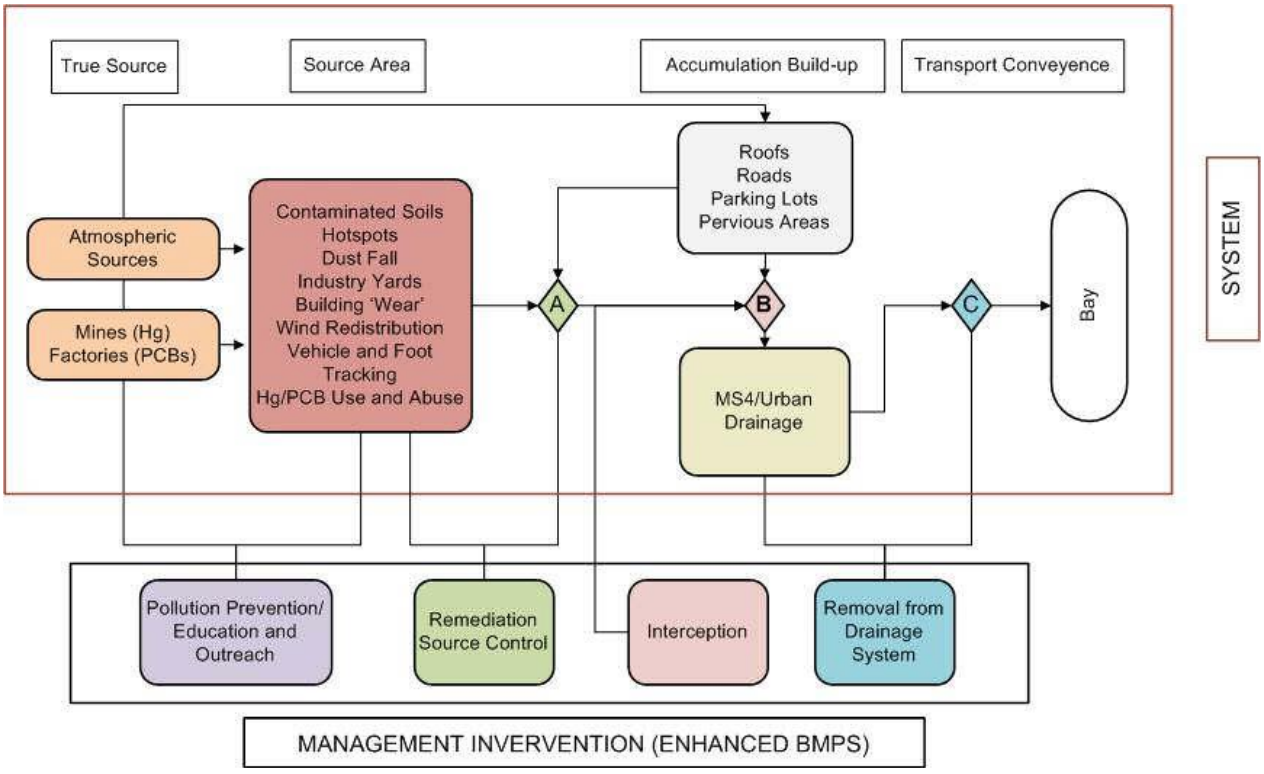

Figure A-2. Conceptual model of implementation points for reducing Hg and PCB loads to San Francisco Bay from local tributaries. (from SFEI 2010).

Table A-4. Main products of the Proposition 13 Urban BMP Evaluation Project

Deliverable	Key information provided
Storm drainage maps	Regional spatial dataset of urban storm drainage network and local watershed drainage areas
Report: (McKee et. al 2006) "White Paper" review of methods use to reduce urban stormwater loads	• Review of regulatory issues and history of use in relation to PCBs and mercury in the Bay Area • Preliminary mass balance analyses for Hg and PCBs in Bay Area local watersheds for the highest use (1950 -1990) and recent (1990 - 2005) periods. • Literature review of concentrations and particle characteristics of Hg and PCBs in soils, road surfaces, roof tops, catch basins, and storm drains, including previous BASMAA studies. • Initial hypotheses on effectiveness of BMPs particularly treatment control options.
Report: (SFEI 2010) BMP Toolbox for Reducing PCBs and Mercury	• Conceptual model of sources and pathways of PCBs and Hg in urban areas with best estimates of relative mass distribution in the Bay Area, • Review of different categories of institutional and treatment control BMPs for reducing PCB and Hg stormwater loads. • Discussion of BMP benefits for other pollutants and options for measuring programmatic effectiveness • Fact sheets and technical information for individual BMPs in relation to reducing loads of PCBs and Hg.
Report: (Mangarella et. al 2010) Desktop Evaluation of Controls for PCBs and Mercury Load Reduction Accompanied by spreadsheet templates for use in future updates	Evaluated different scenarios of implementing BMP types, • Institutional - Pollution Prevention: Fluorescent Bulb and Thermostat Recycling(Hg only); Building Demolition and Remodeling (PCB only); Atmospheric Deposition (Hg only) • Institutional – Operational: Street Sweeping; Street Washing; Drain Inlet Cleaning • Treatment and Site Stabilization: Redevelopment BMPs (retrofit of structural treatment); Cleanup/stabilization of "Elevated Industrial Areas"; Diversion (from pump stations to sanitary treatment)
Report: (Yee and McKee 2010) Concentrations of PCBs and Hg in soils, sediments and water	• Sediment samples were collected from street sides and storm water collection facilities at over 360 locations within the Bay Area, focusing on historically industrial areas more likely to contain elevated levels of PCBs. • Settling experiments were conducted with collected stormwater and sediment samples to examine pollutant portioning in various aqueous (suspended, dissolved) or solid (bed sediment) fractions.

Figures A-3 and A-4 from Yee and McKee (2010) summarize the spatial distribution and concentrations of total mercury and PCBs measured in samples collected during the Proposition 13 study, combined with results compiled from previous studies in the region (e.g. Gunther et. al, 2001, KLI 2001). On a regional scale, the general areas of highest concentrations are often clustered in different areas for mercury and PCBs. This lack of similarity in Hg and PCB distributions could also be demonstrated statistically.

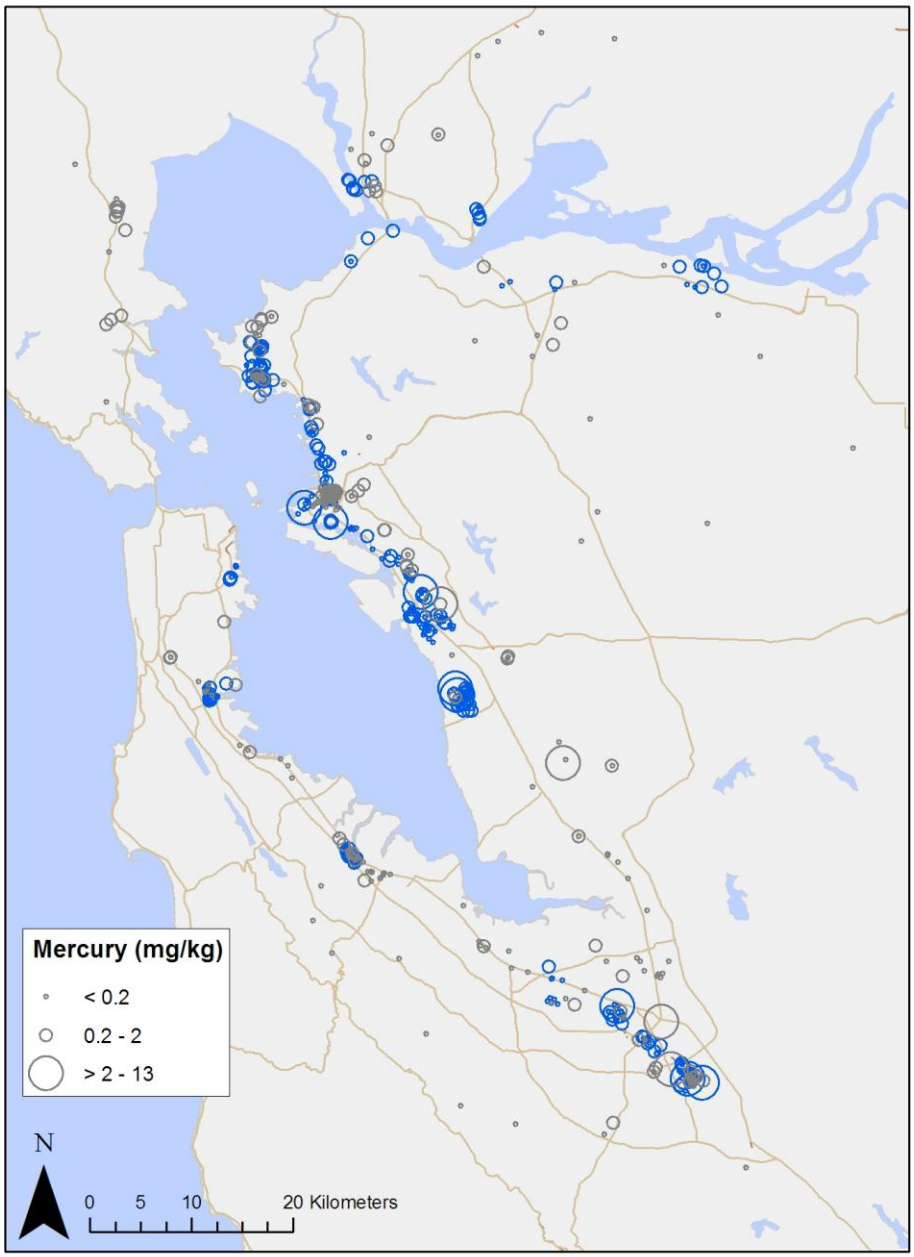

Figure A-3. Particulate Hg concentrations sampled in storm collection facilities and street side soils in the Bay Area in the Proposition 13 study (blue symbols) and others (grey).

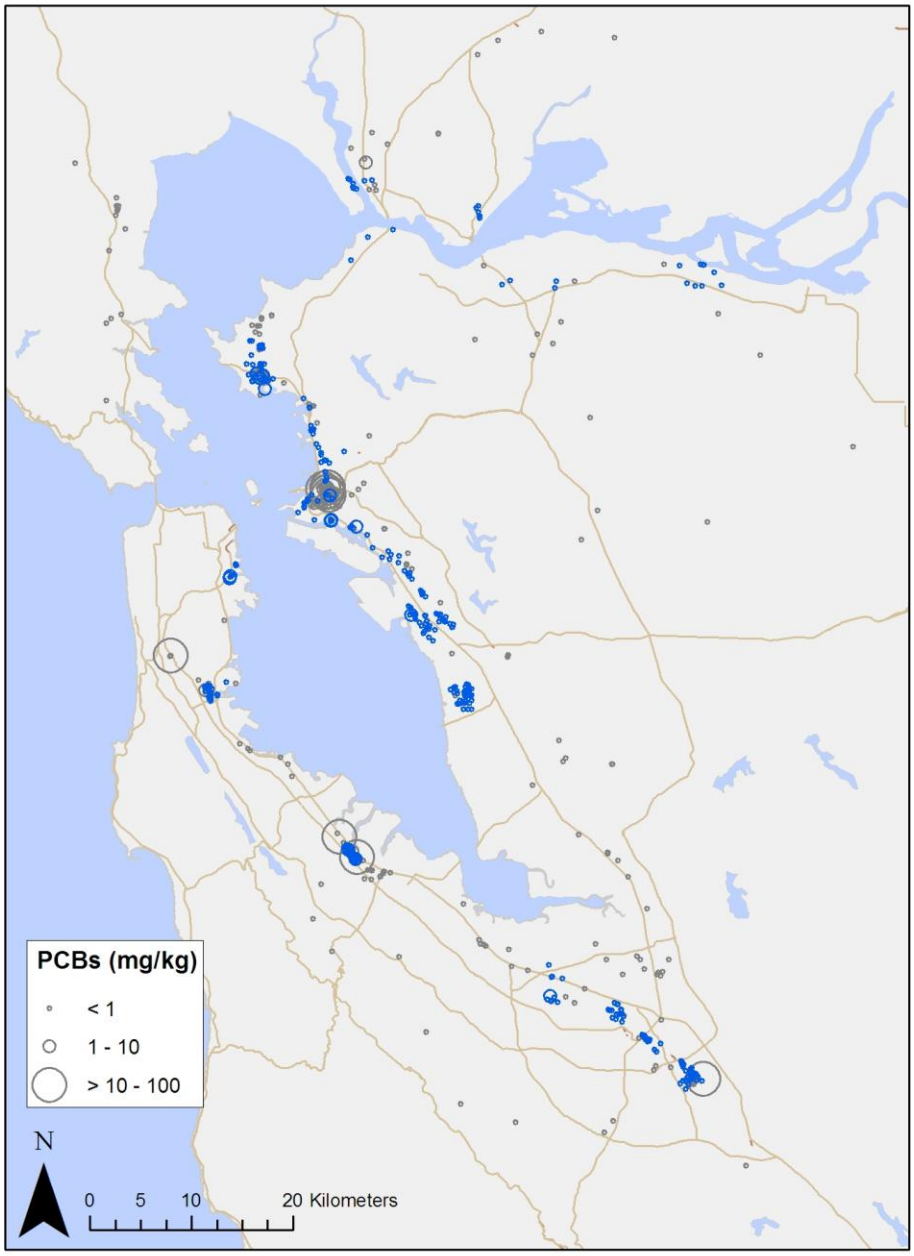

Figure A-4. Particulate PCB concentrations sampled in storm collection facilities and street side soils in the Bay Area in the Proposition 13 study (blue symbols) and others (grey).

Mangarella et al (2010) developed preliminary estimates of potential load reductions from various BMP implementation scenarios with somewhat differing results for mercury and PCBs. For each scenario they also identified the key assumptions and sources of uncertainty, and in many of the scenarios provided a range of projections based on different assumptions. The major sources of uncertainty consisted of:

- Projecting current regulatory or usage conditions into the future
- Projecting local study results developed by one or more municipal to other portions of the Bay Area or to the Bay Area as a whole.
- Inability to accurately incorporate land use in scenario development, for example where existing land use data did not capture characteristics thought to be related to PCB use.
- Potential for overlap amongst scenarios.

The report concluded that most effective scenarios are those that address source control and maintenance, namely air emissions, recycling, street sweeping, and drop inlet cleaning. The underlying message from the scenario analysis is that effectiveness improves as measures move up the continuum from San Francisco Bay to source. Controls like recycling that address the product at its point of usage are generally shown to be superior in effectiveness. Controls like sweeping or drop inlet cleaning, which address accumulation of pollutants in depositional sediments, can also be relatively effective if the depositional areas contain elevated concentrations of the constituent. Concentrations of suspended sediment and mercury associated with suspended sediment in urban runoff are sufficiently low to illustrate that treatment of urban runoff is projected to be less effective.

With understanding of the information gaps and uncertainties associated with the various management strategies, the Water Board developed MRP provisions C11 (mercury) and C12 (PCB) within a framework of four implementation modes, shown in Table A-5. Under the logic of this categorization, as actions are tested and confidence is gained regarding level of experience and confidence in a control measure's effectiveness, that control measure may be implemented with a greater scope in the next permit term.

Provisions C.11.c through Provision C.11.g for mercury are written identically to C.12.c through Provision C.12.g for PCBs, reflecting similarities between the respective TMDLs for these pollutants, based on the legacy and sediment-associated nature of their occurrence. For Provisions C.11/12.c through Provision C.11/12.f, the permit requirements focus on pilot studies; the MRP prioritizes selection of pilot sites primarily on the basis of the potential for reducing PCB loads, although consideration will be given to mercury removal in the final design and implementation of the studies. Provisions C.11.i and C.12.i are also written identically, since the primary San Francisco Bay beneficial use impairment for both mercury and PCBs is associated with consumption of fish containing these pollutants.

Table A-5. Modes of application for PCBs, mercury or other sediment-bound pollutants (from Fact Sheet portions of SFRWQCB 2009).

Mode of Implementation	MRP Provisions for mercury and PCBs
1. Full-scale implementation throughout the region.	C.11.a. Mercury Collection and Recycling: promote, facilitate, and/or participate in collection and recycling of mercury containing devices and equipment at the consumer level (e.g., thermometers, thermostats, switches, bulbs).
	C.12.a. Incorporate PCBs and PCB-Containing Equipment Identification into Existing Industrial Inspections
2. Focused implementation in areas where benefits are most likely to accrue.	C.11/12.i. Development of a Risk Reduction Program Implemented throughout the Region (addressing those people and communities most likely to be affected by mercury/PCBs in San Francisco Bay-caught fish)
3. Pilot-testing in a few specific locations.	C.12.b. Evaluate Managing PCB-Containing Materials and Wastes during Building Demolition and Renovation (e.g., Window Replacement) Activities C.11/12.c. Investigate and Abate On-land Locations with Elevated PCB Concentrations, Including Public Rights-of-way, and Stormwater Conveyances with Accumulated Sediments with Elevated PCBs Concentrations. C.11/12.d. Pilot Projects to Evaluate and Enhance Municipal Sediment Removal and Management Practices C.11/12.e. Evaluate On-Site Stormwater Treatment via Retrofit C.11/12.f. Diversion of Dry Weather and First Flush Flows to POTWs
4. Other: e.g. experimental control measures, Research and Development, desktop analysis, laboratory studies, and/or literature review.	C.11.j. Develop Allocation Sharing Scheme with Caltrans.
	C.11/12.g. Monitor Stormwater mercury/PCB Pollutant Loads and Loads Reduced
	Portions of C.12.b, C.11/12.c, C.11/12.d, C.11/12.e.
	C.11/12.h. Fate and Transport Study of mercury/PCBs in Urban Runoff

In 2010, BASMAA was awarded a $5 million grant from USEPA's San Francisco Bay Water Quality Improvement Fund for the Clean Watersheds For a Clean Bay (CW4CB) Project, which in anticipated to address most of the MRP pilot project requirements in C11 and C12 (table A-6). The total CW4CB project cost is $7.04 million including $2.04M matching funds from Bay Area municipal stormwater agencies, municipal wastewater treatment agencies and industrial dischargers. The planned project period is four years (July 2010 through June 2014) to synchronize with the implementation and reporting requirements of the MRP.

Table A-6. Summary of Key CW4CB Tasks and Associated Outputs and Outcomes.

TASK	MRP Provision	OUTPUTS/OUTCOMES
1. Management, oversight, and reporting.	N/A	▪ QAPP, quarterly progress reports, draft/final project report.
2. Select project watersheds.	C.11/12.c	▪ Five priority subwatersheds identified.
3. Identify locations with elevated PCBs/Hg, refer sites to regulatory agencies, and establish cleanup fund.	C.11/12.c	▪ Locations referred for cleanup. ▪ $100K fund to facilitate cleanups established. ▪ PCB and other pollutant loadings to the Bay reduced.
4. Enhance municipal sediment removal and management practices.	C.11/12.d	▪ Enhanced municipal removal and management of sediment with pollutants. ▪ PCB and other pollutant loadings to the Bay reduced.
5A. Urban runoff treatment retrofits - planning and design.	C.11/12.e	▪ Conceptual/engineering design, planning and permitting of eight to ten urban runoff treatment retrofits.
5B. Urban runoff treatment retrofits - construction, operation and monitoring.	C.11/12.e	▪ Eight to ten urban runoff treatment retrofits installed and evaluated. ▪ An estimated 2 to 12 square miles treated by retrofits to reduce potential hydrologic impacts on downstream receiving waters. ▪ PCB and other pollutant loadings to the Bay reduced.
6. Regional risk reduction program.	C.11/12.i	▪ Public education/outreach materials. ▪ Impacted populations will have a greater awareness and understanding of fish contamination issues and options for reducing exposures to pollutants in Bay fish.
7. Outreach and technology transfer.	N/A	▪ Project web portal. ▪ Guidance manual. ▪ Written outreach materials. ▪ Technical workshops.

To evaluate effectiveness of the pilot studies, field monitoring will be conducted to inform a quantitative estimation of the degree to which each type of control measure reduces loads of PCBs and other pollutants to the Bay. During preparation of the Integrated Monitoring Report due March 2014, the pilot study results will be evaluated based on the following general criteria:

1. **Feasibility** – is a control measure technically and economically feasible?
2. **Efficiency** – what is the cost-effectiveness of the control measure (e.g., $/kg pollutant load avoided).

3. **Opportunity** – what mass of pollutant can reasonably be avoided over a given time period via the control measure? For example, enhanced inlet cleaning is potentially feasible and cost-effective but it is possible that only a relatively limited mass of sediment and associated pollutants could be captured each year using this method due to the small amount of sediment usually found in Bay Area inlets.

BASMAA also is an active partner in the PCBs in Caulk Project managed by the San Francisco Estuary Partnership[5], which is intended to address the requirements in MRP provision C12 b. PCBs can be found in caulking and sealants installed in structures that were built or remodeled prior to 1980, especially during the 1950's through 1970's. The PCBs in Caulk Project is one portion of a larger SFEP program called Taking Action for Clean Water, originally funded through the State Water Resources Control Board Proposition 50 Coastal Nonpoint Source Pollution program and later with federal stimulus funds. The PCBs in Caulk Project will be completed in late 2011; more information and the following available draft products are posted on the SFEP website at http://www.sfestuary.org/projects/detail.php?projectID=29:

- **Best Management Practices** for managing contaminated caulk at a building site have already been developed for abatement of asbestos, which was often used in caulk during the same period as PCBs. Although methods and technology for testing for PCBs also are known, existing regulations do not require testing for PCBs
- **Model Implementation Process** is a proposed series of checklists and procedures that municipalities could use to educate proponents of renovation/demolition projects about the available BMPs, track progress and obtain certification that BMPs were correctly applied at a site.
- **Technical Memorandum** on existing regulatory controls and policies related to managing wastes and hazardous materials during building demolition and/or remodeling programs

Additional products of the PCBs in Caulk Project will include results of sampling from Bay Area structures and an outline for training inspectors. However review of existing regulations showed there are gaps in the regulatory structure concerning PCBs at the national and state level that would need to be addressed before municipalities could effectively implement procedures similar to the Model Implementation Process.

MRP Provisions C.11.g and C.12.g require stormwater programs to develop and implement a monitoring program to quantify mercury and PCB loads and loads reduced through source control, treatment and other management measures implemented by Permittees. Refinement of PCB and mercury loading estimates through the STLS will provide a baseline against which compliance with TMDL Waste Load Allocations (WLAs) issued to Bay Area stormwater agencies (see Table A-2 above) can be tracked.

BASMAA developed draft methods to assess Permittee progress towards TMDL milestones and attainment of WLAs through a regional project that reviewed the estimation methods developed through the Proposition 13 Project and drafted formulas for Permittee tracking of load reductions

[5] SFEP is a project of the Association of Bay Area Governments.

via specific stormwater management measures. The formulas included in BASMAA's final the technical memorandum (in prep) may be updated as additional information on the effectiveness of management measures becomes available via the CW4CB project or other MRP-required pilot studies.

Modeling and other information needs

MRP provisions C11.h. and C12.h. require stormwater programs to conduct or cause to be conducted studies aimed at better understanding the fate, transport, and biological uptake of mercury and PCBs discharged in urban runoff to San Francisco Bay and tidal areas. These requirements will be met through BASMAA participation in the RMP and in particular through support of the RMP's mercury and PCB strategies. In 2011 the RMP is developing synthesis documents for each of these POCs which will review the results of recent special studies and present recommendations for future studies that fit within the Master Planning framework. Some of these studies will also support the Forecasting or Modeling Strategy in which improved quantitative modeling of the Bay should address the following topic areas and Management Questions:

1. Bay Margins: What are the projected impacts of management actions on impairment at contaminated sites on the Bay margin?

2. Recovery of the Bay: What patterns of exposure are forecast for major segments of the Bay under various management scenarios?

3. Small Tributary Loads: What are the projected impacts of management actions on loads or concentrations of pollutants of concern from the high-leverage small tributaries? Where should management actions be implemented in the region to have the greatest impact?

Previous RMP Modeling work overseen by the Contaminant Fate Work Group included development of a "multi-box" mass budget model (Oram et al. 2008) that was more spatially explicit than the "one-box" model used to develop the mercury and PCB TMDLs. The multi-box model added contaminant modeling functions to an existing tidally averaged sediment transport model that represents the Bay's five main segments by 50 laterally-averaged segments, each divided into two layers (main channel and shallow-water) for a total of 100 boxes. Other improvements incorporated in the multi-box model include a more realistic treatment of mixing at the sediment-water interface, sediment erosion and deposition, and a quantification of the aggregate uncertainty of the model estimates. The initial version of the multi-box model was developed and calibrated for PCBs and was found to reasonably simulate observed patterns of PCB impairment. Forecast recovery scenarios using load reductions in the TMDL also were plausible, but were sensitive to uncertainties in assumptions about natural degradation and attenuation rates. A companion study sponsored by the CEP described PCB movement from water and sediment through the Bay food web (Gobas and Arnot 2005).

Another RMP-sponsored study developed an initial mass balance model of methylmercury in

San Francisco Bay (Yee et al. 2011). Other reports recently drafted for the CFWG present conceptual models for pollutant fate and transport in the marginal areas of the Bay (Jones et.al. in prep) and bioaccumulation in the food web (Melwani et al., in prep) that summarize available information about key biotic and abiotic processes that will need to be considered in future Bay modeling developments. These studies lay the groundwork for further development of a Modeling Strategy; future versions of this Appendix will provide updates on efforts to integrate the various recommendations and develop cost effective modeling tools operating at the appropriate temporal and spatial scales to support water quality management decisions.

Other pollutants or constituents

While initial Bay Modeling strategy development focuses on mercury and PCBs, the abiotic hydrodynamic and sediment transport components of future models can be parameterized for other POCs. The bioaccumulation conceptual model report also includes information on selenium, polybrominated diphenyl ethers (PBDEs), dioxins and organochlorine pesticides (DDTs, chlordane and dieldrin) for a variety of vertebrate and invertebrate target species. The Emerging Contaminants Work Group is evaluating other pollutants that may be given increasing priority in future RMP studies. These additional POCs or categories of pollutants overlap with MRP Provision C.8.e.vii which requires a work plan and schedule for future development of initial loading estimates and source analyses for:

- Endocrine disrupting compounds,
- Perfluorooctane Sulfonates (PFOS)/Perfluoroalkyl sulfonates (PFAS)
- Nonylphenols (NP) /nonylphenol esters (NPEs)

Nutrients have recently been identified as an area of concern in the Bay Delta system and the RMP is developing a Nutrient Strategy to coordinate RMP sponsored studies with the Numeric Nutrient Endpoints (NNE) regulatory development process for the San Francisco Estuary, sponsored by the State Water Resources Control Board. The RMP steering committee has projected increasing RMP funding for such studies in 2012 through 2014.

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