

Regional Monitoring Program for Water Quality in San Francisco Bay

2015 Program Plan

HIGHLIGHTS OF THE 2015 PROGRAM

In 2015 the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) is entering its 23rd year of collecting data and communicating information to support water quality management decisions.

Status and Trends Monitoring

A continuing goal is to make optimal use of the funds that participants provide to the Program. High priority topics continue to emerge (e.g., nutrients and selenium), and information needs continue to grow. Status and trends monitoring of open Bay waters is a cornerstone of the Program, but after 20 years of repeated sampling the information yield has gradually diminished.

In 2014, the Steering Committee and Technical Review Committee continued a process of seeking efficiencies in status and trends monitoring. The committees reduced the frequency of sediment sampling from a two-year cycle to a four-year cycle. Water will continue to be sampled on a two-year cycle, but many of the more expensive parameters will be measured a greatly reduced frequency. As one example, PCBs in water will now be analyzed once every 10 years - commensurate with the value of additional water PCB data in promoting understanding and supporting decision-making. Other matrices that are more crucial for PCBs, such as sport fish, bird eggs, and sediment, will continue to be monitored at a higher frequency. This belt-tightening has freed up resources that can be applied to higher priority information needs, such as sampling of sediment on the shallow margins of the Bay, which have historically not been included in status and trends monitoring.

The revised schedule for status and trends monitoring is as follows:

- continuous monitoring of suspended sediment,
- monthly monitoring of basic water quality parameters (salinity, temperature and dissolved oxygen; suspended sediments; and phytoplankton biomass),
- biennial water and bivalve monitoring,
- triennial bird egg monitoring, and
- sediment monitoring on a four-year cycle, and
- sport fish monitoring on a five-year cycle.

In 2015, the schedule calls for sampling of water and bird eggs. Water analytes will include copper, cyanide, selenium, methylmercury, ancillary parameters, and aquatic toxicity. Eggs of double-crested cormorants and Forster's Terns will be collected. Cormorant eggs will be analyzed for PCBs, PBDEs, Hg, PFCs, and Se. Tern eggs will be analyzed for Hg, PBDEs, and Se.

Discussions are in progress regarding using the funds freed up by the reductions in water and open-Bay sediment monitoring to sample sediment on the Bay margins. Due to the type of sampling vessel used in open Bay monitoring, sediment sampling to date has not included areas on the margin of the Bay where the water is less than 1 ft deep at mean lower low water. In parts of the Bay, especially Lower South Bay, this encompasses an extensive area of important habitat.

Special Studies

Special study funds in 2015 will primarily go to work on nutrients and small tributary loading. Smaller amounts will go to studies on emerging contaminants, PCBs, and selenium.

Nutrients

RMP funds will provide support for the Nutrient Science Strategy, augmenting major funding from BACWA, USGS, and other sources. RMP funds will primarily be used for moored sensor work. RMP moored sensor monitoring began in 2013 to better assess the Bay's condition, and to collect high frequency data to calibrate water quality models. The sensors gather data on chlorophyll, dissolved oxygen, turbidity, temperature, and other parameters were deployed at three stations in Lower South Bay and South Bay. RMP funds are also supporting development of models that will allow forecasting the response of the Bay to changes in nutrient loads and other factors that drive potential impairment related to nutrients.

Small Tributaries

RMP work on small tributary load monitoring is being conducted in close coordination with monitoring being performed by members of the Bay Area Stormwater Management Agencies Association. Work elements to be performed with funds from 2015 will include:

- a characterization study to support identification of additional watersheds for management consideration through analysis of contaminant concentrations on suspended sediment particles, with a design that includes sampling of fine sediments using settling chambers,
- ongoing regional-scale stormwater load estimation using the regional watershed spreadsheet model, and
- development of a trend monitoring strategy.

Chemicals of Emerging Concern

Monitoring of chemicals of emerging concern continues to be a priority for the Program. Activities in 2015 will include:

- a study of perfluorochemicals (PFCs or Teflon chemicals) and the pesticide fipronil in treated wastewater discharged to the Bay, and
- analysis of microplastic pollution in Bay water and sediment.

PCBs

A synthesis and conceptual model update published in 2014 shifted focus from the open Bay to the contaminated areas on the margins where impairment is greatest, where load reductions are being pursued, and where reductions in impairment, in response to load reductions, will be most apparent. The Synthesis was the foundation for a 2014 update of the PCB Strategy that calls for a multi-year effort to identify margin areas that are high priorities for management and monitoring, develop site-specific conceptual models and sediment mass balances for margin areas downstream of watersheds where management actions will occur, and perform monitoring in these areas as a performance measure. Work in 2015 will include selection of priority margin areas for evaluation and development of conceptual models and mass balances for one or two of these areas.

Selenium

In April 2014 the RMP formed a Selenium Strategy Team to evaluate low-cost, near-term information needs that can be addressed by the Program in the next several years. The Team recommended exploring an opportunity to obtain a larger number of sturgeon muscle samples, non-lethally and inexpensively, through collection of small plugs of sturgeon muscle in a collaboration with a California Department of Fish and Wildlife annual tagging program. A pilot effort using this technique was conducted in 2014, and the approach will be applied again in 2015. Another small study of selenium in sturgeon will be performed in collaboration with a fishing derby in the Delta. Tissues will be obtained from fish caught for the derby that will allow a comparison of muscle plugs, which are easy to obtain, with concentrations in eggs or ovaries, which is the exposure of interest toxicologically.

Communications

A Pulse of the Bay will be produced in 2015, to be released at the Annual Meeting which will once again be held jointly with the State of the Estuary Conference in September. This edition of the *Pulse* will be a companion to the *State of the Estuary Report*, which will also be released in September. The 2015 *Pulse* will provide profiles of the contaminants of concern in the Bay, similar to the profiles provided for CECs in the 2013 *Pulse*.

This Program Plan is a brief summary of activities planned for 2015. A Detailed Workplan and budget are prepared separately and are reviewed and approved by the Technical Review Committee and Steering Committee. A budget summary of the total cost for each program element is included in Table 1. Detailed scopes of work and budgets will be presented in the 2015 Detailed Workplan.

TASK DESCRIPTIONS

1. Program Management

The administration and management of the RMP requires a substantial effort from SFEI staff. Program management tasks include:

- program planning
- contract and financial management
- technical oversight
- internal coordination
- external coordination
- safety training
- administration

Approximately half of the cost for this category is fiduciary oversight, project-specific safety training, and office administrative costs. Deliverables associated with this line item include documents describing the budget, the Multi-Year Plan, the Detailed Workplan, and the Program Plan. The funds for technical oversight allow for internal review by senior staff of the many reports, presentations, posters, workplans, memos, and other communications coming out of the RMP. The funds for external coordination cover participation in meetings with external partners to coordinate programs and leverage RMP funds (e.g., coordinating work on the Pulse Report with the State of the Estuary Report, coordination with SCCWRP, and serving as liaison to the Delta RMP and other RMPs).

The total cost for these tasks in 2015 will be \$432k.

2. Governance

Governance tasks include convening, coordinating, and facilitating Steering Committee, Technical Review Committee, and Workgroup meetings. Tasks include preparing agendas, agenda packages, participating in meetings, writing meeting summaries, action item follow-up, reviewing minutes from past meetings, coordination with committee chairs, and honoraria and travel for external advisors.

The total budget for governance is \$280k.

3. Data Management

Data management tasks include processing of new data, maintaining the RMP database and providing online access, and providing quality assurance.

Results from the large number of samples collected in 2014 will be processed and quality assured in 2015. Processing of new data includes formatting, performing QA/QC review, and uploading RMP field and analytical results from laboratories to SFEI's Regional Data Center database and replicating to CEDEN, maintaining the database of archived RMP samples and

coordinating with archive facilities, coordinating our team, collection agencies, and laboratories, and tracking data deliverables and pending issues.

The RMP database currently includes approximately 1.1 million records generated since the Program began in 1993. Database maintenance includes incorporating updates and corrections to data as needed, including re-analyzed results and updates implemented by CEDEN/SWAMP; and adding enhancements and updates to web-based data access tools such as CD3. Web-based data access tools provided by CD3 include user-defined queries, data download and printing functionality, maps of sampling locations, and visualization tools.

Quality assurance tasks include updating the Quality Assurance Project Plan, writing QA memos for datasets, conducting interlaboratory comparison tests, researching analytical methods, and maintaining our laboratory SOP file system.

The total cost for these tasks in 2015 will be \$355k.

4. Annual Reporting

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Tasks related to production of the *Pulse* include preparation of technical content (text, analyses, graphics), graphic design, and web presence. Subcontractors assist with editing and preparing content.

Tasks related to the Annual Meeting include developing the meeting agenda, managing logistics, advertising about the meeting, managing attendee registration, preparing presentations, and staffing the meeting.

In 2015 the report formerly titled “Annual Monitoring Results” will be scaled back and renamed the “Annual Monitoring Report.” The report will now only provide summary information on data collection.

The total cost for these tasks in 2015 will be \$254k.

5. Communications

Communications tasks will implement the plans included in the RMP Communications Strategy, approved by the Steering Committee in July 2014. Tasks will include the distribution of RMP information to stakeholders, natural resource managers, and the public through multiple media channels (e.g., website, publications, email newsletters, fact sheets, social media, etc.).

Stakeholder engagement is critically important to addressing the information needs of

RMP participants. Tasks include preparing for and attending RMP stakeholder meetings (e.g., BACWA, BASMAA, LTMS, WSPA) as well as communicating directly with stakeholder representatives.

Other communications tasks include responding to inquiries for RMP data and reports, including press calls, producing summary information on important topics in convenient formats, and planning and reviewing content for *Estuary News*. Participation in workshops and conferences for SWAMP, SETAC, ACS, and other professional organizations allows sharing of RMP information, gathering of information from other investigators on the latest advances in monitoring and understanding, and identification of opportunities for collaboration with other organizations. Presentations at local meetings and to local audiences are also important for collaboration and information dissemination to scientific partners. Keeping the website up to date is another important component of communication.

The total cost for these tasks in 2015 will be \$166k.

6. Status and Trends Monitoring

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The total costs for these tasks in 2015 will be \$966k. Brief summaries of each of the Status and Trends elements for 2015 are provided below.

Continuous Monitoring of Suspended Sediment (\$250k)

Tides and wind waves are constantly moving water and altering the water quality of San Francisco Bay. The USGS California Water Science Center provides the RMP water quality measurements at the tidal time scale through continuous monitoring of suspended-sediment concentration and dissolved oxygen at multiple locations in the Bay. At each station, turbidity and dissolved oxygen sensors are deployed in the water column and automatically collect measurements every 15 minutes. Approximately every 3 weeks technicians visit the stations to clean the sensors, check their calibrations, and download data. Data are processed and edited to remove values that are corrupted by biofouling. Data are available at <http://waterdata.usgs.gov/ca/nwis/sw/>. Data are analyzed and the resulting reports are available at <http://ca.water.usgs.gov/projects/baydelta/publications.html>.

This monitoring has been conducted since the Program began in 1993, and revealed that suspended sediment concentrations in the Bay declined sharply beginning in 1999. This work is led by Dr. David Schoellhamer of the USGS in Sacramento.

USGS maintains five suspended sediment stations in the Estuary (i.e., Mallard Island, Benicia, Richmond Bridge, Alcatraz, and Dumbarton Bridge) and funding for a temporary site. The USGS used the temporary site funding for 2013 for better understanding the sediment flux at the Golden Gate. In 2014, the temporary site funding was used to install a suspended sediment station at the Exploratorium (Pier 15). Discussions are underway to determine how to maintain the existing monitoring scheme in light of increasing costs and the available budget, which has been fixed at \$250k since 1993.

Hydrography and Phytoplankton (\$173k)

This work is led by Dr. Jim Cloern of the USGS in Menlo Park. The study performs monthly water sampling to map the spatial distributions and temporal trends of basic water quality parameters along the entire Bay-Delta system. Measurements include salinity, temperature, dissolved oxygen, suspended sediments, and phytoplankton biomass. This basic information is required to follow the seasonal changes in water quality and estuarine habitat as they influence biological communities and the distribution and reactivity of trace contaminants.

This monitoring has played a crucial role in documenting changes in the Bay that have raised concern for the possible impacts of nutrients and provided an impetus for the Nutrient Science Strategy.

USGS also provides funding for this monitoring. This funding decreased in 2014, and the contribution from the RMP increased from the \$110k that had been in place for many years to \$173k.

Water Chemistry (\$45k)

Monitoring for trace elements and water quality parameters will occur at 22 sites in 2015. Water analytes will include copper, cyanide, selenium, methylmercury, ancillary parameters, and aquatic toxicity. As in prior years, SFEI staff will assist in the collection of water samples. Subcontractors conducting the water chemistry analyses will include EBMUD for ancillary, ALS Laboratory Group for nutrients, Brooks Rand for inorganics, City and County of San Francisco for cyanide, and City of San Jose for splits of copper and nickel. We may also work with a specialty lab to be determined for lower selenium detection limits. Applied Marine Sciences has will continue to serve as our logistics coordinator.

Bird Eggs (\$150k)

Avian egg monitoring is a tool that was piloted in the Exposure and Effects Pilot Study and retained as an element of RMP Status and Trends monitoring (Davis et al., 2006). Avian egg monitoring in other aquatic ecosystems has proven to be a highly effective tool for assessment of long-term trends in persistent, bioaccumulative contaminants. Egg monitoring is now conducted in the RMP once every three years.

Double-crested Cormorants (*Phalacrocorax auritus*) are now routinely monitored by the RMP as a sentinel species for the open waters of the Bay. Cormorant eggs are sampled Bay-wide every three years and analyzed for mercury, selenium, PBDEs, PCBs, legacy pesticides, and, starting in 2009, perfluorinated compounds (PFCs). Sampling locations include Wheeler Island in Suisun Bay, the Richmond Bridge, and Don Edwards Wildlife Refuge in the Lower South Bay.

Forster's Tern eggs were selected as another avian indicator because this species feeds primarily on small fish in shallow water habitats on the Bay margins, including managed ponds. The spatial and habitat coverage of this species (Bay margins and managed ponds) therefore complements that of Double-crested Cormorants (open waters and large sloughs). Studies by the U.S. Geological Survey (USGS) have resulted in the establishment of Forster's Tern eggs as a primary biosentinel tool for monitoring of mercury risk to Bay wildlife. Tern eggs are also sampled every three years and analyzed for mercury, PBDEs, and selenium. Forster's Tern nesting locations vary from year to year. Past sampling locations have included Knight Island and Napa Marsh near the Napa River (San Pablo Bay segment); salt ponds near Hayward (South Bay segment); and salt ponds in Lower South Bay.

Field Work and Logistics (\$175k)

This task includes work by SFEI to assist with sampling and coordination (\$45k); a subcontractor (Applied Marine Sciences) to plan cruise logistics, collect samples, ship samples to laboratories, and manage the sample archive (\$95k); funds for renting the research vessel (the USGS R/V Turning Tide) (\$25k); and funds for other miscellaneous items.

Margin Sediment Sampling: Planning (\$20k) and Sampling (\$120k)

As mentioned above, discussions are in progress regarding using the funds freed up by the reductions in water and open-Bay sediment monitoring to sample sediment on the Bay margins. In parts of the Bay, especially Lower South Bay, this encompasses an extensive area of important habitat. The 2014 workplan included \$20k for development of a draft probabilistic sampling design. An additional \$20k is needed to support continued discussion and sampling design development. The reductions in the water and open-Bay sediment elements of RMP status and trends monitoring have made \$120k available for margin sediment sampling.

Sample Archive (\$18k)

This item covers storage costs for the long-term archive of sediment, bivalve, bird egg, and sport fish samples at NIST. Selected RMP samples are stored at ultra-low temperatures. Payments are made in odd numbered years. An archiving protocol documents the procedures: <http://www.sfei.org/sites/default/files/Report%20628%20Archive%20Protocol.pdf>

Data Analysis (\$15k)

The RMP has been invited to submit a paper for a special issue of the new journal *Regional Studies in Marine Science*. The special issue will focus on successful regional monitoring programs around the US. These funds will allow for an article documenting the evolution of and lessons learned from RMP monitoring, including data analysis.

7. Special Studies

The following studies were reviewed by the TRC and SC and approved for incorporation into the 2014 Program Plan. The total costs for special studies in 2015 will be \$1,172k.

Nutrients (\$470k)

San Francisco Bay has long been recognized as a nutrient-enriched estuary, but one that has historically proven resilient to the harmful effects of nutrient enrichment, such as excessive phytoplankton blooms and hypoxia. Available information suggests that the accumulation of phytoplankton biomass in the Bay is strongly limited by tidal mixing, grazing pressure by invasive clams, light limitation from high turbidity, and potentially, in the North Bay, ammonium inhibition of diatom uptake of nitrate. However, evidence is building that, since the late 1990s, the historic resilience of the Bay to the harmful effects of nutrient enrichment is

weakening. In response to these apparent changes in the Bay's resilience to nutrient loading, a Nutrient Science Strategy has been developed.

Bay-wide Nutrient Permit funds from BACWA (\$880k/yr) are being directed toward nutrient science studies in the Bay. The intent is for these funds to be combined with funds from the RMP (\$470k in 2015) and other entities, and that the Nutrient Management Strategy Steering Committee will make decisions about how to allocate funds, based on recommendations in a Science Plan, which is under development. Tentative plans for the use of the funds from the RMP are presented here.

Moored Sensor Monitoring (\$190k)

While monitoring has occurred regularly in the Bay over the past 40 years, most of the data have been collected at weekly or monthly time intervals. Phytoplankton, nutrients, dissolved oxygen, and other parameters such as suspended sediment (which dictates the light available for phytoplankton growth) vary strongly over much shorter time scales (e.g., on an hourly basis) due to the daily cycle of photosynthesis and respiration in phytoplankton, mixing, biogeochemical processes, and tides. To better assess the Bay's condition, and to collect high-frequency data to calibrate water quality models, the RMP is funding a moored sensor network. Beginning in summer 2013, sensors for chlorophyll, dissolved oxygen, turbidity, temperature, and other parameters were deployed at three stations in Lower South Bay and South Bay. In 2015, plans include addition of one more permanent deployment in a slough or margin habitat in South Bay, and performing a number of shorter-term deployments at a network of margin sites, with a specific focus on characterizing dissolved oxygen in the system. Telemetry will be added to new and existing sites. Experiments will also be conducted to improve our ability to accurately infer chlorophyll-a concentration from fluorescence measurements.

Modeling (\$165k)

RMP funds are also supporting development of models that will allow forecasting the response of the Bay to changes in nutrient loads and other factors that drive potential impairment related to nutrients. Among its recommendations, the Nutrient Strategy calls for developing models to quantitatively characterize the Bay's response to nutrient loads; explore ecosystem response under future environmental conditions; and test the effectiveness of load reduction scenarios and other scenarios that mitigate or prevent impairment. A draft modeling workplan for 2015-2021 is currently in review.

The draft workplan calls for a phased approach, quality assurance protocols, and an open-source modeling platform to promote efficiency, produce quality results, and maximize the value of the modeling investment. In Phase 1 of model development, models will be simplified-domain (several boxes, with "real" hydrodynamics through grid aggregation of an existing hydrodynamic model), and focused on South Bay/Lower South Bay and Suisun Bay. The simplified domain models will allow effort to be directed toward parameter sensitivity analysis, subembayment scale calibration, exploration of underlying causes of observed changes in ecosystem response, and identification of key data needs to prioritize among other research and monitoring activities in subsequent years. Phase 1 will begin in 2015 and conclude in 2017.

For Phase 2, beginning in 2017, work will gradually move toward higher degrees of spatial resolution, building toward a whole bay model and will provide preliminary answers to key management questions about the role of nutrients in the Bay. Phase 3 modeling, planned to begin in 2021, will involve more complicated and/or multi-year scenarios to answer management questions with a higher degree of certainty.

Small Tributary Loadings

RMP work on small tributary load monitoring is being conducted in close coordination with monitoring being performed by members of the Bay Area Stormwater Management Agencies Association as required by the Municipal Regional Permit.

Wet Weather Characterization (\$374k)

Most of the budget for small tributary load monitoring in 2015 will support a characterization study in the winter of 2014-15 to identify additional watersheds with high-concentration sources areas for potential actions to reduce loads of PCBs and mercury. The basic design of this effort will be to collect one composite in the tidal reaches of up to 25 selected tributaries. Concentrations of PCBs, mercury, and other metals will be analyzed on suspended sediment particles. In addition, a pilot study will be conducted to collect fine sediments using special settling chambers. If this approach works, it will provide a highly cost-effective means of evaluating concentrations on particles for future monitoring.

Regional Watershed Spreadsheet Model (\$35k)

To accurately assess total contaminant loads entering San Francisco Bay, it is necessary to estimate loads from local watersheds. "Spreadsheet models" of stormwater quality provide a useful and relatively cheap tool for estimating regional scale watershed loads. Spreadsheet models have advantages over mechanistic models because the data for many of the input parameters required by those models do not currently exist, and also require large calibration datasets which take money and time to collect. Development of a spreadsheet model for the Bay has been underway since 2010.

Tasks for 2015 depend upon the outcomes of the work for 2014 which is still underway. Possible uses of the 2015 funds include improving the basis of the model by shifting the model to a water-based starting point or completing further structural improvements to the sediment-based model, or incorporation of additional calibration watersheds and BASMAA studies.

Trends Strategy (\$35k)

The Sources, Pathways, and Loadings Workgroup recommended an effort to define where and how trends may be most effectively measured in relation to management effort so that data collection methods deployed over the next several years support this future need. A trends strategy white paper will be developed in 2015 addressing where trends should be measured, appropriate media and metrics, numerical methods for assessing trends, and sampling design.

Small Tributary Loading Strategy Coordination (\$26k)

The RMP Small Tributaries Loading Strategy Team provides the forum for planning and coordinating projects for the improvement of information on small tributary loads to the Bay. This task will include quarterly STLS meetings to coordinate monitoring, and provide updates and solicit input on spreadsheet model and trends strategy development. Monthly phone conferences calls will be convened to provide brief updates and information sharing.

Chemicals of Emerging Concern (CECs)

CECs in Municipal Wastewater (\$55k)

The State Water Resources Control Board's Chemicals of Emerging Concern (CECs) Science Advisory Panel has recommended that programs include sampling wastewater treatment plant (WWTP) effluent and stormwater when screening for emerging contaminants. The follow-up state pilot study, now under development, similarly emphasizes examination of these contamination pathways as an important means of providing managers with the data they need to make sound decisions regarding CECs. A study in 2015 will expand our knowledge of the role of WWTP effluent in contaminating the Bay environment by monitoring high priority and newly-identified CECs in this matrix. This study will expand on previously-approved plans to sample WWTP effluent monitoring for alternative flame retardants and estrogenic contaminants. The 2015 funds will be used to screen for perfluorinated compounds (including PFOS) and fipronil in effluent from eight WWTPs. Both PFOS and fipronil are Tier 3 (moderate concern) CECs according to the RMP prioritization scheme.

Microplastics in the Bay and Municipal Wastewater (\$9k)

Microplastic is a term used to describe fragments of plastic that are less than 5 mm. Microplastics can be pellets that are used as precursors for industrial products, microbeads used in consumer products (e.g. exfoliants), or fragments/fibers of plastics that are the breakdown products of larger plastic materials. Microplastics can enter the aquatic environment through wind, stormwater runoff, or illegal dumping of plastic materials. Additionally, both microbeads from cosmetic products and plastic fibers (e.g., polyester and acrylic) from clothing can be washed down the drain and enter wastewater treatment plants. Microplastics are not captured by wastewater treatment plants because they are buoyant and do not flocculate; therefore, they are released in wastewater. California and New York have proposed bans on microplastics found in cosmetics. Additionally, Johnson & Johnson, L'Oréal, Colgate-Palmolive, and Procter & Gamble have pledged to phase out the use of microbeads in their skin cleansers. Therefore, the concentrations entering wastewater may decrease in the future.

Microplastics are found in surface waters, the water column, and sediment. They can also be found in the gut and circulatory system of aquatic organisms that ingest the particles. Ingestion of microplastics can block the digestive tract, reduce growth rates, block enzyme production, lower steroid hormone levels, affect reproduction, and cause the adsorption of contaminants.

Samples of ambient Bay water and sediment from 10 sites will be analyzed for microplastics in two size classes: >0.355-mm and 0.125-0.355-mm (the size fraction that is characteristic of personal care product microbeads). Effluent from six WWTPs will also be analyzed.

CEC Information Synthesis (\$20k)

Information on CECs is rapidly evolving. The RMP CEC Strategy (<http://www.sfei.org/sites/default/files/SFEI%20CEC%20strategy%20FINAL.pdf>) calls for routine review of work done by others to identify new chemicals, new methods, and new collaborators. RMP staff actively read the latest literature, attend scientific conferences, and confer with leading CEC scientists to obtain feedback on existing RMP studies, to identify new CECs, and to forge new partnerships. This information feeds into annual study plans and refinement of the CEC Strategy.

PCBs (\$85k)

A synthesis and conceptual model update published in 2014 shifted focus from the open Bay to the contaminated areas on the margins where impairment is greatest, where load reductions are being pursued, and where reductions in impairment, in response to load reductions, will be most apparent. The Synthesis was the foundation for a 2014 update of the PCB Strategy that calls for a multi-year effort to identify margin areas that are high priorities for management and monitoring, develop site-specific conceptual models and sediment mass balances for margin areas downstream of watersheds where management actions will occur, and perform monitoring in these areas as a performance measure.

Tasks in 2015 will include 1) selection of priority margin areas for evaluation and 2) development of conceptual models and mass balances for one or two of these areas.

Task 1 will be performed by the PCB Strategy Team with staff support from SFEI. An initial survey and prioritization of all the margin units will be conducted. Properties of the margin units to be evaluated will be determined through Team discussion. Data gathering and analysis will be needed to support the prioritization effort, including evaluation of data on contamination in the watersheds and in the Bay, mapping information to link watersheds with margin units, and mapping to delineate boundaries of margin units. All margin units will be considered in this prioritization phase, not just those for which data are already available.

For task 2, the one or two highest priority margin units (PMUs) will be evaluated in detail in 2015. The following approach will be applied to each PMU. A relatively large Conceptual Site Model Workgroup (CSMW) will be assembled that includes members of the PCB Strategy Team, along with experts on potential biotic indicators, sediment movement from watersheds to margins to the open Bay, and local conditions. This CSMW will meet two to three times to develop and document conceptual understanding and a monitoring plan for the PMU.

Selenium

In April 2014 the RMP formed a Selenium Strategy Team to evaluate low-cost, near-term information needs that can be addressed by the Program in the next several years.

Sturgeon Tissue Plug Monitoring (\$23k)

The Team recommended exploring an opportunity to obtain a larger number of sturgeon muscle samples, non-lethally and inexpensively, through collection of small plugs of sturgeon muscle in a collaboration with a California Department of Fish and Wildlife annual tagging program. A pilot effort using this technique was conducted in 2014, and the approach will be applied again in 2015. This task will be performed in collaboration with CDFW and USGS. SFEI staff would plan the study, train CDFW staff and perform sampling, manage the data, and write a brief technical report. USGS (Robin Stewart and her team) will perform analysis of selenium and stable isotopes of C, N, and S in the plugs. The stable isotopes provide information on diet and habitat use by the sturgeon. The sampling will occur during the course of the CDFW survey in August through October. Thirty white sturgeon plugs will be collected and analyzed. Another 30 will be collected and archived in case additional samples are needed.

Sturgeon Derby Study (\$20k)

Another small study of selenium in sturgeon will be performed in collaboration with an annual sturgeon fishing derby in the Delta. Tissues will be obtained from fish caught for the derby that will allow a comparison of muscle plugs, which are easy to obtain, with concentrations in eggs or ovaries, which is the exposure of interest toxicologically. This study will be performed in collaboration with USFWS and USGS. SFEI staff will plan the study, perform sampling, manage the data, and write a brief technical report. USGS (Robin Stewart and her team) will analyze of selenium and stable isotopes of C, N, and S in the plugs, and of selenium on the eggs or ovaries. The stable isotopes provide information on diet and habitat use by the sturgeon. The sampling would occur on Super Bowl weekend in 2015.

Fifteen white sturgeon muscle plugs will be collected and analyzed. Fifteen splits of their egg or ovary samples will also be obtained from USFWS for analysis by USGS.

Selenium Information Synthesis (\$10k)

The Selenium Strategy Team recommended the allocation of \$10k per year to support compilation of data and information, review of literature, and continuing Strategy development.

Selenium Strategy Team (\$10k)

The Selenium Strategy Team provides the forum for planning and coordinating projects for the improvement of information on selenium in the Bay. This task will include one or two meetings in 2015 to coordinate monitoring, provide updates and solicit input on current projects, and plan projects for 2016 and beyond.

Table 1: RMP 2015 Expenses

Row Labels	2015 Budget Proposed
Expense	\$3,624,700
1. Program Management	\$431,800
A. Program Planning	\$50,000
B. Contract and Financial Management	\$187,100
C. Technical Oversight	\$50,000
D. Internal Coordination	\$90,000
E. External Coordination	\$30,000
F. Safety Training	\$5,000
G. Administration	\$19,700
2. Governance	\$279,500
A. SC meetings	\$66,500
B. TRC meetings	\$81,500
C. WG meetings	\$81,500
D. External Science Advisors	\$50,000
3. Data Management	\$355,000
A. Data Processing, Quality Assurance, and Upload to CEDEN	\$160,000
B. Database Maintenance and Online Data Access	\$140,000
C. Quality Assurance System	\$25,000
D. Updates to SOPs and Templates	\$30,000
4. Annual Reporting	\$254,400
A. Pulse or Pulse Lite Report	\$165,500
B. Annual Meeting	\$73,900
C. Annual Monitoring Results Report	\$10,000
D. Updates to Copper SSO and Dredged Material Thresholds	\$5,000
5. Communications	\$166,000
A. Communications Plan Implementation	\$22,000
B. Stakeholder Engagement	\$42,000
C. Responses to Information Requests	\$10,000
D. Fact Sheets and Outreach Products	\$10,500
E. Support for "Estuary News"	\$18,500
F. Presentations at Conferences and Meetings	\$48,000
G. RMP Website Maintenance	\$15,000
H. RMP Website Redesign	\$0
I. Products for New Media	\$0
6. S&T Monitoring	\$966,000
A. Field Work and Logistics	\$175,000
B. USGS Sacramento Support	\$250,000
C. USGS Menlo Park Support	\$173,000
D. Water Chemistry Monitoring	\$45,000
E. Water Chemistry CTR Monitoring	\$0
F. Bird Egg Monitoring	\$150,000
G. Sample Archive	\$18,000
H. Planning for Bay Margins Sediment Study	\$20,000
I. Bay Margins Sediment Study	\$120,000
J. Analysis of S&T Impacts, Changes, and Data	\$15,000
7. Special Studies	\$1,172,000
EC Microplastics Monitoring	\$9,000
EC Strategy Support	\$20,000
EC Wastewater Monitoring	\$55,000
Nutrient Modeling Program Development	\$165,000
Nutrient Moored Sensor Program Development	\$190,000
Nutrient Research TBD	\$115,000
PCB: PMU Conceptual Model	\$85,000
Selenium Delta Fish Derby Monitoring	\$20,000
Selenium Information Synthesis	\$10,000
Selenium Sturgeon Tissue Plug Monitoring	\$23,000
Selenium Strategy Team Meeting	\$10,000
STLS Regional Watershed Model	\$35,000
STLS Strategy Coordination	\$26,000
STLS Trends strategy	\$35,000
STLS Wet Weather Characterization	\$374,000
Grand Total	\$3,624,700