RMP
REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY

sfei.org/rmp

MULTI-YEAR PLAN

2018 ANNUAL UPDATE

FINAL: January 2018

Contribution Number 860

RMP ORIGIN AND PURPOSE

In 1992 the San Francisco Bay Regional Water Board passed Resolution No. 92-043 directing the Executive Officer to send a letter to regulated dischargers requiring them to implement a regional multi-media pollutant monitoring program for water quality (RMP) in San Francisco Bay. The Water Board's regulatory authority to require such a program comes from California Water Code Sections 13267, 13383, 13268 and 13385. The Water Board offered to suspend some effluent and local receiving water monitoring requirements for individual discharges to provide cost savings to implement baseline portions of the RMP, although they recognized that additional resources would be necessary. The Resolution also included a provision that the requirement for a RMP be included in discharger permits. The RMP began in 1993, and over ensuing years has been a successful and effective partnership of regulatory agencies and the regulated community.

The goal of the RMP is to collect data and communicate information about water quality in San Francisco Bay in support of management decisions.

This goal is achieved through a cooperative effort of a wide range of regulators, dischargers, scientists, and environmental advocates. This collaboration has fostered the development of a multifaceted, sophisticated, and efficient program that has demonstrated the capacity for considerable adaptation in response to changing management priorities and advances in scientific understanding.

RMP PLANNING

This collaboration and adaptation is achieved through the participation of stakeholders and scientists in frequent committee and workgroup meetings (Figure 1).

The annual planning cycle begins with a workshop in October in which the Steering Committee articulates general priorities among the information needs on water quality topics of concern. In the second quarter of the following year the workgroups and strategy teams forward recommendations for study plans to the TRC. At their June meeting, the TRC combines all of this input into a study plan for the following year that is submitted to the Steering Committee. The Steering Committee then considers this recommendation and makes the final decision on the annual workplan.

In order to fulfill the overarching goal of the RMP, the Program has to be forward-thinking and anticipate what decisions are on the horizon, so that when their time comes, the scientific knowledge needed to inform the decisions is at hand. Consequently, each of the workgroups and teams develops five-year plans for studies to address the highest priority management questions for their subject area. Collectively, the efforts of all these groups represent a substantial body of deliberation and planning.

PURPOSE AND ORGANIZATION OF THIS DOCUMENT

The purpose of this document is to guide efforts and summarize plans developed within the RMP. The intended audience includes representatives of the many organizations who directly participate in the Program. This document will also be useful for individuals who are not directly involved with the RMP but are interested in an overview of the Program and where it is heading.

The organization of this Multi-Year Plan parallels the RMP planning process (Figure 2). Section 1 presents the long-term management plans of the agencies responsible for managing water quality in the Bay and the overarching management questions that guide the Program. The agencies' long-term management plans provide the foundation for RMP planning (page 6). The first step the RMP takes to support these plans, is to distill prioritized lists of management questions that need to be answered in order to turn the plans into effective actions (page 7). The prioritized management questions then serve as a roadmap for scientists on the Technical Review Committee, the workgroups, and the strategy teams to plan and implement scientific studies to address the most urgent information needs. This information sharpens the focus on management actions that will most effectively and efficiently improve water quality in the Bay.

Figure 1. Collaboration and adaptation in the RMP are achieved through the engagement of stakeholders and scientists in frequent committee and workgroup meetings.

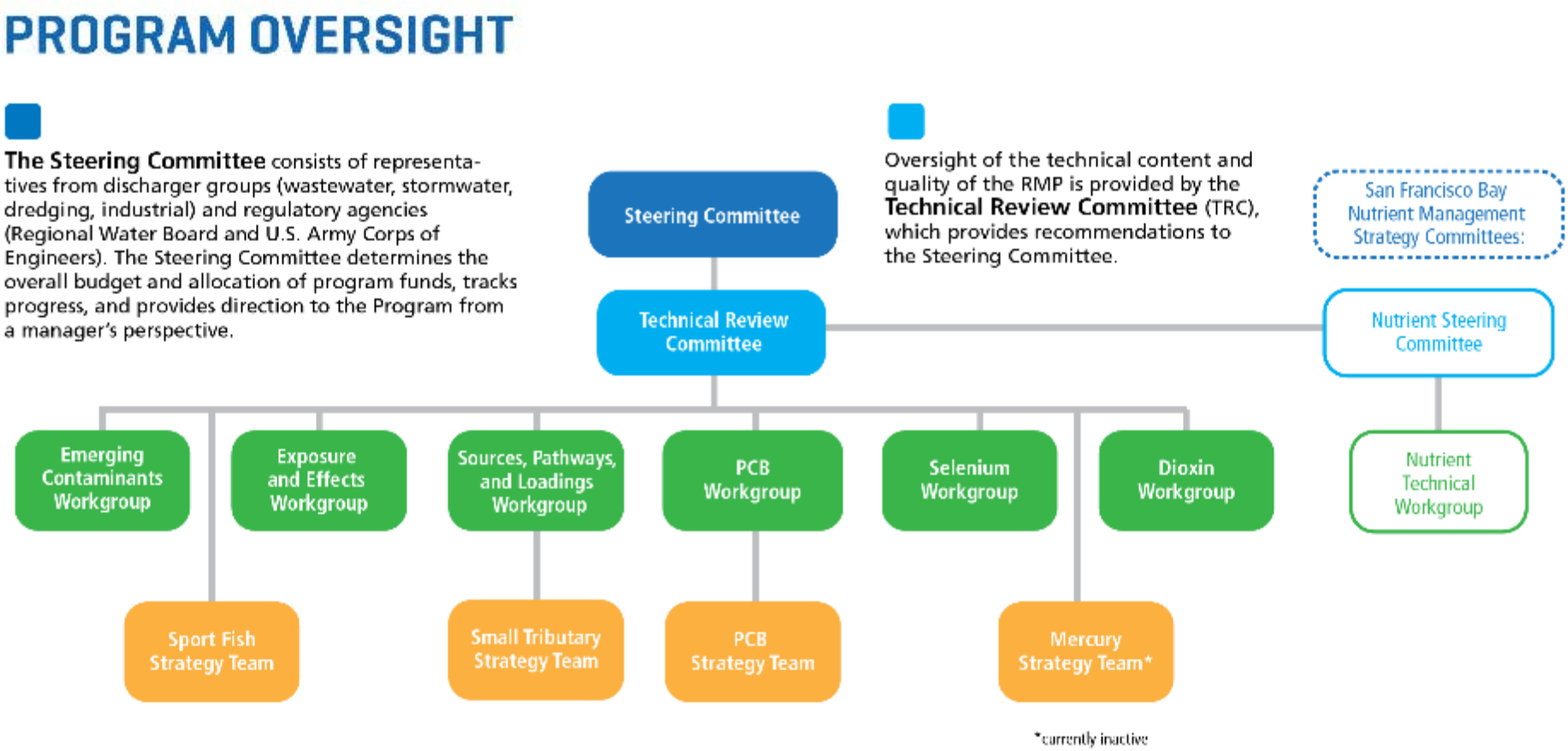
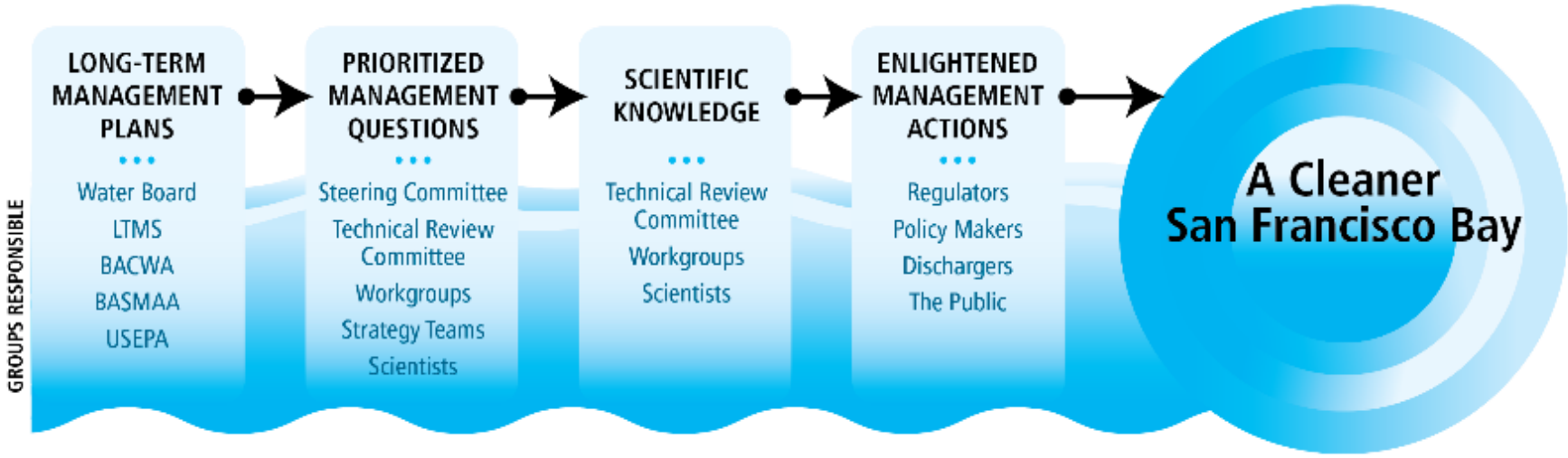


Figure 2. Science in support of water quality management.



Section 2 provides an overview of the budget of the RMP, including where the funding comes from and how it is allocated among different elements of the Program. This section provides a summary of the priority topics to be addressed by the Program over the next five years.

Section 3 presents the five-year plans developed by the workgroups and strategy teams for the current focus areas: PCBs, dioxins, selenium, emerging contaminants, small tributary loads, exposure and effects, and nutrients. Led by the stakeholder representatives that participate in these groups, each workgroup and strategy team has developed a specific list of management questions for each topic that the RMP will strive to answer over the next five years. With guidance from the science advisors on the workgroups, plans have been developed to address these questions. These plans include proposed projects and tasks and projected annual budgets. Information synthesis efforts are often conducted to yield recommendations for a next phase of studies. For now, study plans and budget allocations for these strategies are largely labelled as "to be determined". Other pieces of information are also included to provide context for the multi-year plans. First, for each high priority topic, specific management policies or decisions that are anticipated to occur in the next few years are listed. Second, the latest advances in understanding achieved through the RMP and other programs on Bay water quality topics of greatest concern are summarized. Lastly, additional context is provided by listing studies performed within the last two years and studies that are currently underway.

Section 4 describes five-year plans for other elements that are essential to the mission of the RMP: Status and Trends Monitoring, Program Management, Communications, Data Management, and Quality Assurance.

Section 5 contains lists of RMP studies that are relevant to specific permit conditions for dredging, wastewater discharges, and stormwater discharges.

A Living Document

The RMP Multi-Year Plan is updated annually to provide an up-to-date description of the priorities and directions of the Program. An annual Planning Workshop is held in conjunction with the October Steering Committee meeting. A draft Multi-Year Plan is prepared before the workshop, and approved by the Steering Committee at the January meeting.

More detailed descriptions of the elements of the RMP are provided in the annual Detailed Workplan (available at www.sfei.org/rmp).

Figure 3. Annual planning calendar for the Regional Monitoring Program.

Annual Steering Committee Calendar

- January
  - Approve Multi-Year Plan
  - Review of incomplete projects from the previous year
  - Approve annual report outline
  - Pick date for Annual Meeting
- April
  - Plan for Annual Meeting
  - Provide additional planning guidance to workgroups
- July
  - Multi-year Plan: mid-year check-in, workshop planning
  - Approve special studies recommended by the TRC for the next year and update projects list for SEP funding
  - Plan for Annual Meeting
  - Report on SFEI financial audit
  - Briefly discuss fees for year after next
  - Select annual report theme for next year
- October
  - Confirm chair(s) and Charter
  - Planning Workshop
  - Decision on fees for the year after next
  - Approve workplan and budget for next year
  - Approve general Pulse outline for next year
  - Decision on workshops to be held next year

Each meeting (except October) includes a Science Program Update from a workgroup or strategy team focus area.

Annual Technical Review Committee Calendar

- March
  - Confirm chair(s)
  - Provide additional planning guidance to workgroups
- June
  - Recommend special studies for funding
  - Review S&T target analyte list, CEC tiers
  - Review plans for Annual Meeting and annual report
- September
  - Prepare for Annual Meeting
  - Review Status and Trends Monitoring Design
- December
  - Review Pulse outline for next year
  - Informatics update
  - Present workplan for next year and outcome of Multi-Year Planning Workshop

Each meeting includes a Science Program Update from a workgroup or strategy team focus area, and feedback on current and proposed studies.

Annual Workgroup Calendar

Workgroups meet annually in April-June to discuss results from prior studies and select proposals to recommend to the TRC and SC for funding for the next year.

Agendas and meeting summaries available at https://sites.google.com/a/sfei.org/rmp-operations/home/workgroup-notes

CURRENT AND ANTICIPATED MANAGEMENT DECISIONS, POLICIES, AND ACTIONS BY THE REGULATORY AGENCIES THAT MANAGE BAY WATER QUALITY

Decisions, Policies, and Actions	Timing
BAY WATERSHED PERMITS (CURRENT & NEXT RENEWAL)	
Municipal Regional Stormwater Permit	2015, 2020*
Mercury and PCBs Watershed Permit for Municipal and Industrial Wastewater	2017, 2022
Nutrient Watershed Permit for Municipal Wastewater	2019, 2024
CURRENT DRIVERS BY TOPIC	
Determination of Wastewater Permit Limits	Ongoing
303(d) List and 305(b) Report Current listings and next cycle	2017, 2022
Dredging Permits Bioaccumulation testing triggers and in-Bay disposal thresholds+	2019
Copper Site specific objectives triggers+	2018
Cyanide Site specific objectives triggers+	2018
PCBs Review existing TMDL and establish plan to revise*	2020
Mercury Review existing TMDL and establish plan to revise*	2020
Selenium North Bay Selenium TMDL EPA Water Quality Criteria South Bay Selenium TMDL	 2016 ~2018? ~2019?
Nutrients Nutrient Management Strategy Nutrient Monitoring Program Nutrient Water Quality Objective	 Ongoing 2019 2024
Chemicals of Emerging Concern Updates to CEC Tiered Risk Framework Opportunities to inform regional actions and state and federal regulations	 Annual Ongoing

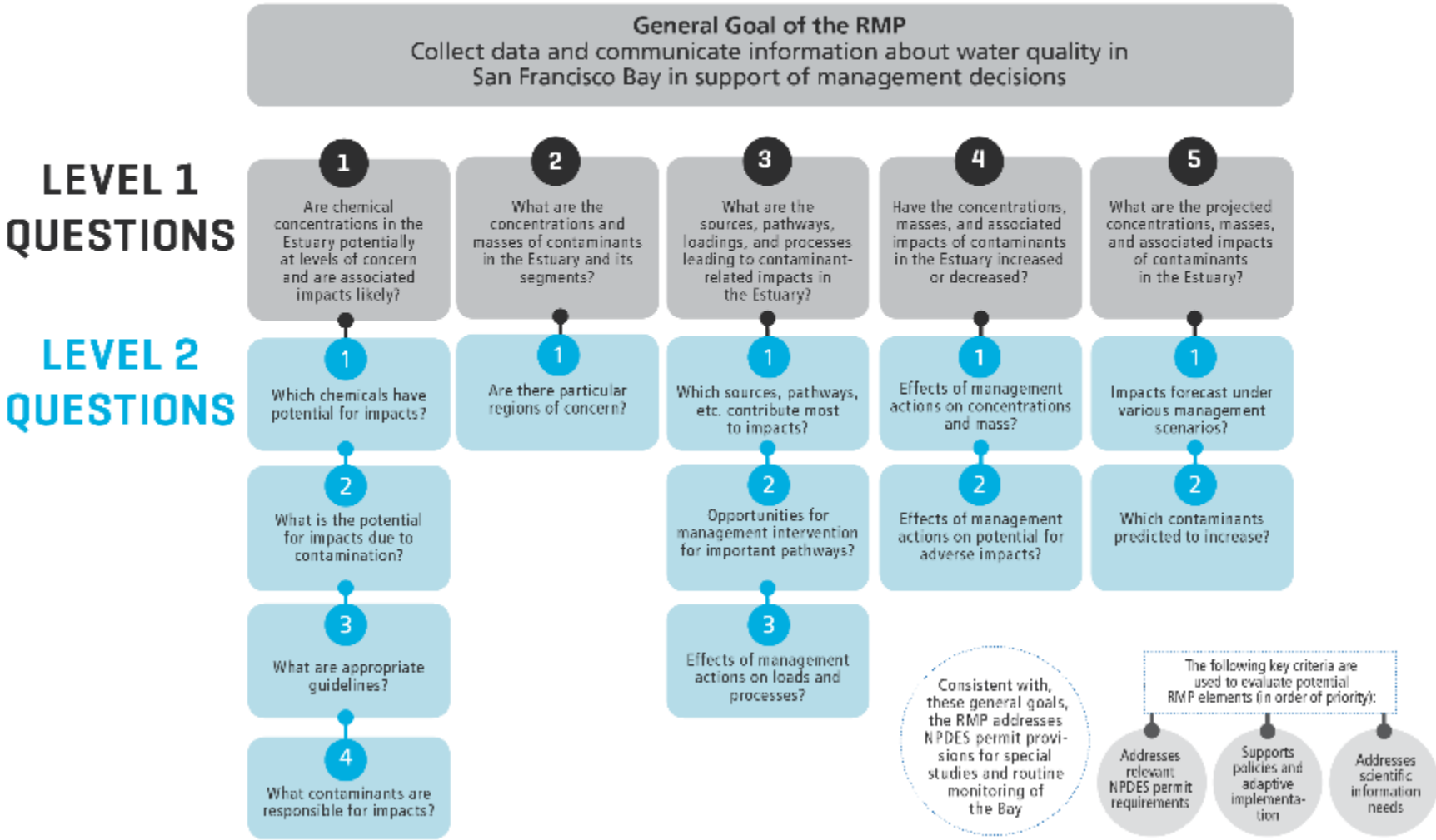
Decisions, Policies, and Actions	Timing
Current Use Pesticides EPA Registration Review of fipronil and imidacloprid DPR fipronil mitigation measures	Ongoing
Legacy Pesticides (DDT, Dieldrin, Chlordane) Monitoring recovery	Ongoing
Dioxins Review 303(d) listings and establish TMDL development plan or alternative	2018
Toxicity New state plan on effluent and receiving water toxicity (schedule depends on State Water Board)	~2018?
Sediment Hot Spots Review 303(d) listings and establish TMDL development plan or alternative Phase 2 Sediment Quality Objectives (Human Health)	2018, 2022 2018
Long-Term Management Strategy for Placement of Dredged Material Regional Sediment Management Strategy	Ongoing
Pathogens Bay Beaches Bacteria TMDL TMDL modifications to add new listings State Board Bacteria Objectives	 2016 2019 2018
Suisun Marsh Establish TMDL for DO, mercury, nutrients, salinity	2018
POTENTIAL FUTURE DRIVERS	
Wetland Restoration Permits Regional wetland monitoring (under development)	TBD
Trash	TBD

+ Comparisons to triggers will be updated on the RMP sampling frequency (every 4 years for sediment, every 2 years for water)

* The dates for reviewing the Mercury and PCB TMDLs coincide with the schedule for reissuing the Municipal Regional Stormwater Permit.

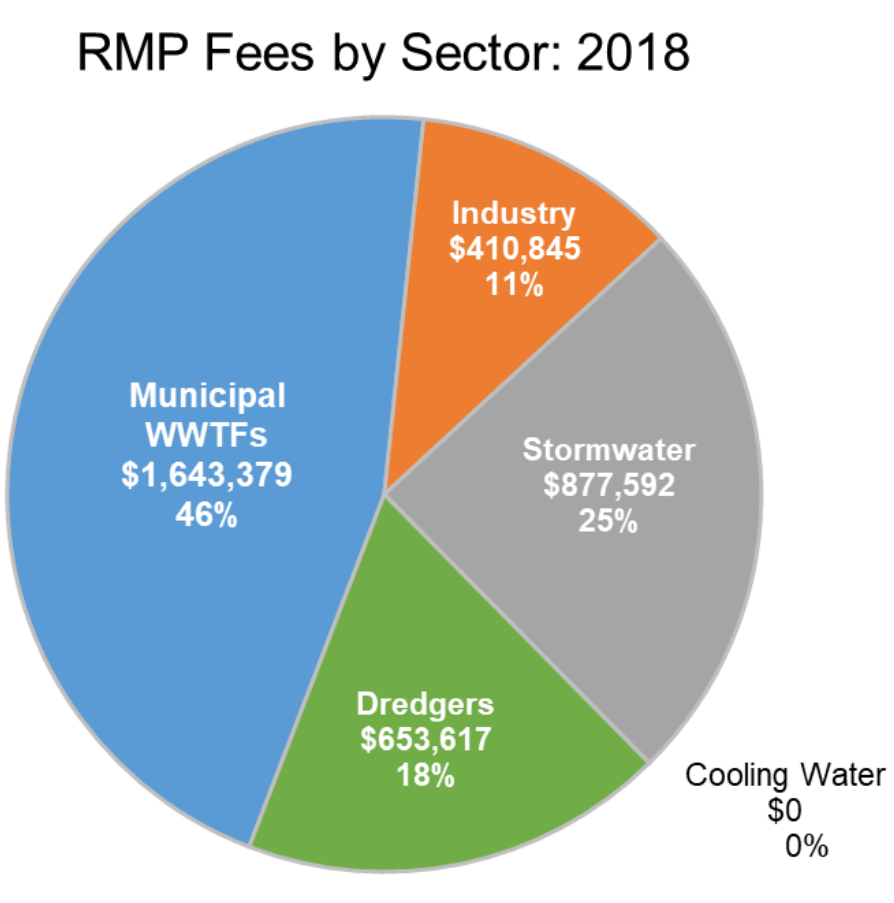
RMP GOAL AND MANAGEMENT QUESTIONS

RMP stakeholders have articulated an overarching goal and a tiered framework of management questions that organize and guide RMP studies. The management questions are closely linked to existing and planned regulations.



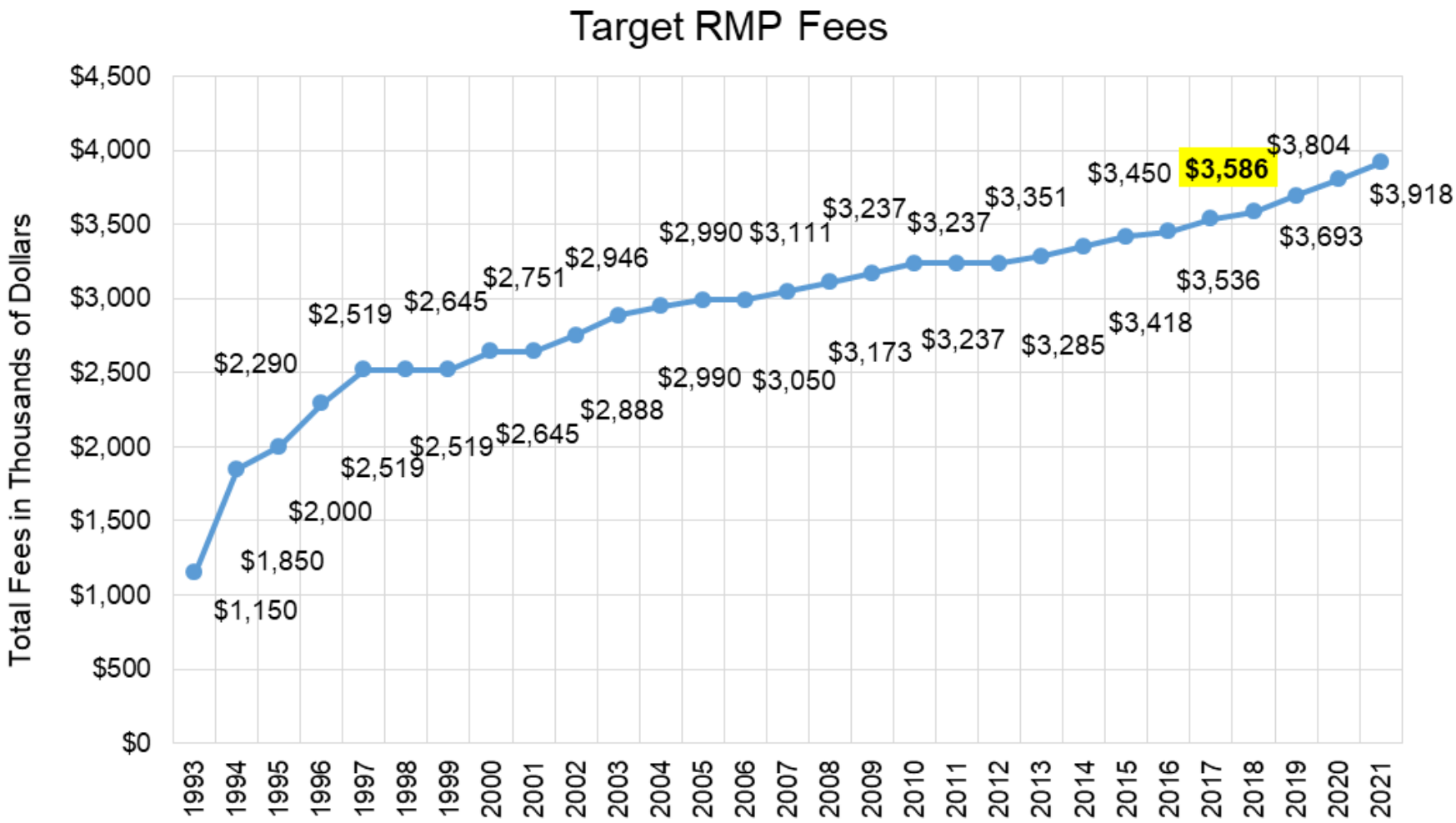
BUDGET: Revenue by Sector

RMP fees are divided among four major discharger groups. Total fees in 2018 will be $3.586 million. Municipal wastewater treatment agencies are the largest contributor, and stormwater agencies are the second largest contributor. The contribution from dredgers includes $250,000 from the U.S. Army Corps of Engineers. Refineries constitute the majority of the industrial sector, and also contribute to the Program due to dredging activities at their facilities. The last cooling water discharge recently phased out of operation - discharges to the Bay and payments to the RMP ceased. The fees formerly paid for cooling water discharges will not be passed on to the other participants. In addition to fees, the RMP also receives penalty funds for Supplemental Environmental Projects and Alternative Monitoring Requirement funds from municipal wastewater agencies (see page 12 for more information).



BUDGET: Revenue by Year

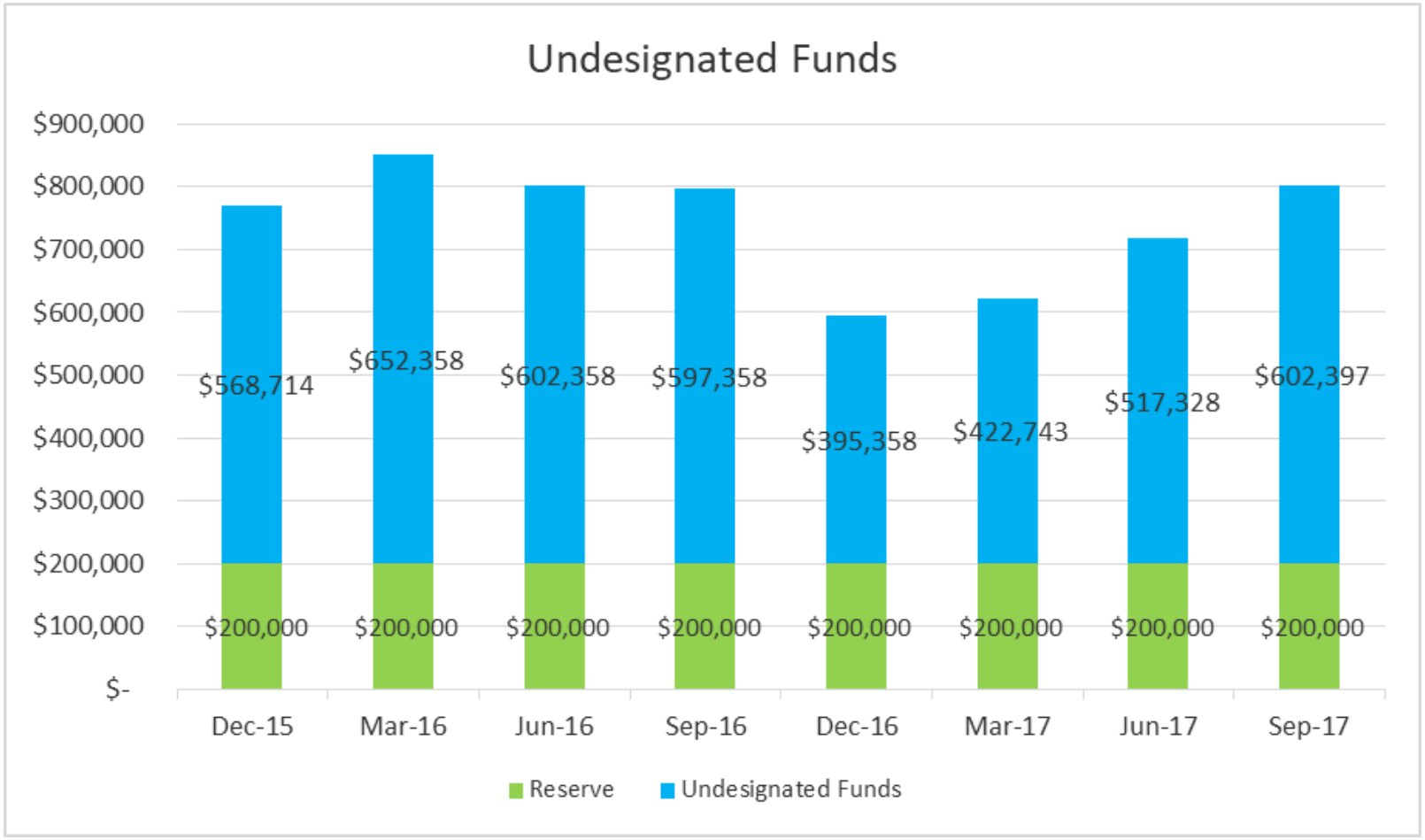
Target RMP fees in 2018 are $3.586 million. For 2019-2021, the Steering Committee is planning for 3%/year increases in fees. Over the past 20 years, RMP fee growth has not kept up with inflation.



BUDGET: Reserve Funds

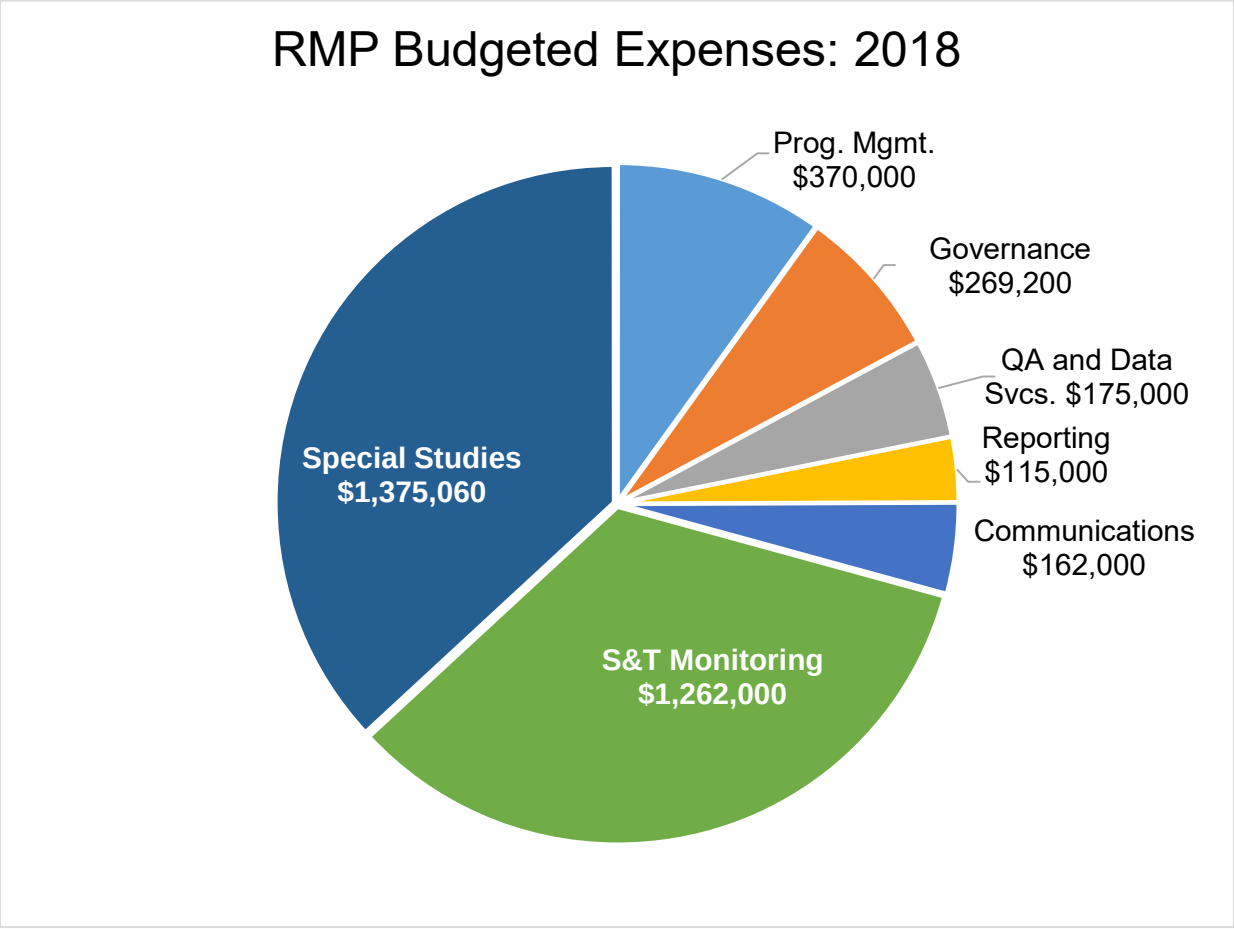
The RMP maintains a balance of Undesignated Funds for contingencies. Higher than anticipated revenues and elimination or reduction of lower priority elements sometimes leads to accumulation of funds that can be used for high priority topics at the discretion of the Steering Committee.

The Bay RMP Undesignated Funds balance over the past two budget years is shown below. The height of the bar shows the total balance of the Undesignated Funds. The bars are color coded to indicate the RMP policy that $200,000 of the Undesignated Funds should be held in reserve.



BUDGET: Expenses

Each year, approximately 71% of the budget is spent on monitoring and special studies. Quality assurance and data systems, reporting, and communications are each 5% of the budget. Governance meetings (8%) are critical to ensure that RMP is addressing stakeholder needs and conducting studies that include peer-review from project planning through report preparation. Finally, 12% of the budget is needed for program management, including fiduciary oversight of contracts and expenditures.



BUDGET: Special Studies 2015-2021

RMP actual and planned expenditures on special study topics. Costs for 2015-2017 are actual amounts. Costs for 2018 are from the approved budget. Costs for 2019 and beyond are estimates for planning based on the most recent input from the Workgroups and Strategy Teams. The funds available for 2019-2021 were estimated by assuming RMP revenue will increase by 3% per year, subtracting ~40% for programmatic expenses (see page 11), and subtracting estimated Status and Trends monitoring costs for each year (see page 38).

FOCUS AREA	2015	2016	2017	2018	2019	2020	2021
	Actual	*Actual*	*Actual*	*Budget*	*Forecast*	*Forecast*	*Forecast*
Mercury	$0	$0	$0	$0	$0	$0	$0
PCBs	$85,000	$40,000	$70,000	$61,000	$190,000	$192,000	$160,000
Dioxins	$0	$0	$52,000	$0	$0	$0	$0
Emerging Contaminants	$75,000	$130,000	$284,835	$330,000	$555,000	$705,000	$630,000
Small Tributaries	$470,000	$311,000	$370,000	$302,000	$555,000	$643,000	$620,000
Exposure and Effects	$0	$35,000	$55,000	$61,000	$124,000	$155,000	$50,000
Forecasting	$0	$0	$0	$0	$0	$0	$0
Selenium	$84,000	$47,000	$106,000	$10,000	$246,000	$166,000	$196,000
Nutrients	$470,000	$300,000	$373,000	$350,000	$500,000	$500,000	$500,000
Microplastic	$9,000	$25,000	$75,000	$50,000	$120,000	$60,000	$310,000
Sediment	$0	$33,000	$90,000	$215,000	$325,000	$150,000	$225,000
SPECIAL STUDIES TOTAL	**$1,193,000**	**$921,000**	**$1,475,835**	**$1,379,000**	**$2,615,000**	**$2,571,000**	**$2,191,000**
PREDICTED SPECIAL STUDIES BUDGET TOTAL			**$1,678,408**	**$1,569,999**	**$1,431,529**	**$1,536,545**	**$1,591,721**
Predicted RMP Core Budget for Special Studies			$1,071,308	$973,230	$861,529	$966,545	$1,021,721
Predicted AMR Funds			$235,000	$296,769	$270,000	$270,000	$270,000
Predicted SEP Funds			$372,100	$300,000	$300,000	$300,000	$300,000

*The estimated RMP budgets on this table do not cover all of the funding needs for the Nutrients Management Strategy and Small Tributary Loading Strategy. Funding for these strategies is partially provided from other sources.

In 2016, the RMP became eligible to receive penalty funds for Supplemental Environmental Projects. Wastewater agencies also began to provide the RMP with Alternative Monitoring Requirement (AMR) funds for additional emerging contaminants studies. These new funding streams will augment the core RMP budget for special studies.

Fishing on the Bay. Photograph by Shira Bezalel.

SMALL TRIBUTARY LOADING

Relevant Management Policies and Decisions

Refining pollutant loading estimates for future TMDL updates.

Informing provisions of the current and future versions of the Municipal Regional Stormwater Permit (MRP).

Identifying small tributaries to prioritize for management actions.

Informing decisions on the best management practices for reducing concentrations and loads.

Stormwater sampling. Photograph by Jennifer Sun.

Recent Noteworthy Findings

Based on particle ratio information collected by the RMP in stormwater to-date, the samples with the highest concentrations for PCBs have been collected from watersheds draining to Pulgas Creek Pump Station, a ditch on Industrial Rd. in San Carlos, Santa Fe Channel, a storm drain on Gull Dr. in South San Francisco, and an outfall at Gilman Street. The outfall at Gilman Street, and the Santa Fe Channel sites also appear to be relatively polluted for mercury.

A pilot study of unmanned suspended sediment samplers is underway. These samplers show promise as a lower-cost stormwater characterization tool, especially for PCBs.

Using a statistical model developed for PCB loads in the Guadalupe River, 80% of the variability in loads is accounted for by rainfall characteristics and seasonality, providing insight into monitoring design to detect trends in PCB loads for this watershed.

A rare five-year storm event was sampled in Guadalupe River in January 2017. The load measured during the five-day storm event was 70 kg, far more than the total wet season loads for every year since 2003.

Using the Regional Watershed Spreadsheet Model (RWSM), the most recent estimate of regional loads for PCBs are similar to those in the TMDL (20 kg), whereas estimates for mercury are 92 kg, which is lower than that of the TMDL (160 kg).

Note: “Small tributary” refers to the rivers, creeks, and storm drains that enter the Bay from the nine counties that surround the Bay.

Special studies for this focus area assess contaminant loading to the Bay from these small tributaries.

Priority Questions for the Next Five Years

1. What are the loads or concentrations of pollutants of concern from small tributaries to the Bay?
2. Which are the “high-leverage” small tributaries that contribute or potentially contribute most to Bay impairment by pollutants of concern?
3. How are loads or concentrations of pollutants of concern from small tributaries changing on a decadal scale?
4. Which sources or watershed source areas provide the greatest opportunities for reductions of pollutants of concern in urban stormwater runoff?
5. What are the measured and projected impacts of management action(s) on loads or concentrations of pollutants of concern from the small tributaries, and what management action(s) should be implemented in the region to have the greatest impact?

MULTI-YEAR PLAN FOR SMALL TRIBUTARY LOADING STRATEGY

Small tributaries loading studies in the RMP from 2014 to 2021. Numbers indicate budget allocations in $1000s.

Element	Funder	Questions addressed	2014	2015	2016	2017	2018	2019	2020	2021
Coordination and management	RMP		25	26	26	30	32	40	43	45
Source Area Monitoring/EMC development	RMP	1,2,3,4	80							
Source Area Monitoring/EMC development	BASMAA	1,2,3,4		450	350	450	TBD			
Regional Watershed Spreadsheet Model: Water, Sediment, PCBs and Mercury	RMP	1,2,4	30	35	35	40	7			
Regional Watershed Spreadsheet Model: Sediment, PBDEs, DDT, chlordane, dieldrin	BASMAA	1,2,4	52							
POC Loads Monitoring - 2 stations	RMP	1	352							
POC Loads Monitoring - 4 stations; lab analyses, QA, Data Management	BASMAA	1	800							
POC Reconnaissance Monitoring	RMP	1,2,3,4		374	150	200	88*	200	200	200
POC Reconnaissance Monitoring	BASMAA	1,2,3,4		200	200	200	TBD			
Advanced Data Analysis	RMP	1,2,3,4					100	25	100	25
Trends Strategy	RMP	3,5		35	100	100	62	100	150	200
AFR conceptual model development	RMP	1,4					13	40		
Emerging Contaminants coordination	RMP	1,4								
BMP effectiveness monitoring (potential SEP)+	RMP	5						150	150	150
Innovative monitoring methods	RMP	1,2,3,4								
		RMP Total	**487**	**470**	**311**	**370**	**302**	**555**	**643**	**620**
		Non-RMP Total	**852**	**650**	**550**	**650**	**TBD**	**TBD**	**TBD**	**TBD**
		Overall Total	**1339**	**1120**	**861**	**1020**	**TBD**	**TBD**	**TBD**	**TBD**

* Approximately $55,000 in carryover funding from 2017 will be added to this amount. + Projects for measuring BMP effectiveness are about regional scale studies and/or aggregating results from across the region to answer questions about regional loads, not monitoring of individual BMPs installed in the landscape.

Screening and characterization to identify high-leverage watersheds will be the major emphasis for the next several years, along with an increasing focus on data analysis and detecting trends in loads or concentrations of pollutants of concern from small tributaries.

NUTRIENTS

Relevant Management Policies and Decisions

Development of nutrient numeric endpoints and assessment framework

Evaluating need for revised objectives for dissolved oxygen and other parameters

Assessment of water quality impairment status

Implementation of NPDES permits for wastewater and stormwater

Recent Noteworthy Findings

The Nutrient Management Strategy (NMS), a major collaborative regional science program that works in close collaboration with the RMP, has developed a 10-year Science Plan for addressing monitoring and research needs for the complicated issue of nutrients in the Bay. Below are highlights of recent progress for focus areas.

High-frequency sensors are providing new data for identifying the mechanisms that drive dissolved oxygen concentrations in the Bay, such as algae blooms, tidal currents, suspended sediment, and stratification of the water column that limits transfer of oxygen to the bottom waters.

Studies conducted to date indicate that algae growth is most often limited by factors other than nutrients, such as high turbidity and strong tidal mixing, but the role of nutrients in fueling algae blooms at certain times and locations still needs to be resolved.

Algae that produce potent toxins have been detected in the Bay and these toxins are regularly detected in water and shellfish at levels that justify continued investigation.

Major progress on numerical models has been made in the first two years of the program; ongoing efforts are adding algae growth calculations and expanding the range of the models into the Delta and the sloughs of Lower South Bay.

Priority Questions for the Next Five Years

1. What conditions in different Bay habitats would indicate that beneficial uses are being protected versus experiencing nutrient-related impairment?

2. In which subembayments or habitats are beneficial uses being supported? Which subembayments or habitats are experiencing nutrient-related impairment?

3. A. To what extent is nutrient over-enrichment, versus other factors, responsible for current impairments? B. What management actions would be required to mitigate those impairments and protect beneficial uses?

4. A. Under what future scenarios could nutrient-related impairments occur, and which of these scenarios warrant pre-emptive management actions? B. What management actions would be required to protect beneficial uses under those scenarios?

5. What nutrient sources contribute to elevated nutrient concentrations in subembayments or habitats that are currently impaired, or would be impaired in the future, by nutrients?

6. When nutrients exit the Bay through the Golden Gate, where are they transported and how do they influence water quality in the Gulf of Farallones or other coastal areas?

7. What specific management actions, including load reductions, are needed to mitigate or prevent current or future impairment?

Right, page 17 – Water quality sensor.
Bottom, page 17 – The *R/V Questuary* .
Page 17 – SFEI and collaborators at USGS servicing moored sensor monitoring equipment installed at Dumbarton Bridge.
Photographs by Phil Breshnahan.

MULTI-YEAR PLAN FOR NUTRIENTS

Special studies and monitoring in the RMP from 2013 to 2021. Numbers indicate budget allocations in $1000s. The exact distribution of projects between RMP and Nutrient Permit funds past 2019 is not yet defined; only general allocations are indicated.

Tasks	Funding Agency	Questions Addressed	2013	2014	2015	2016	2017	2018	2019	2020	2021
RMP funding											
Program coordination	RMP	1-5	20	20							
Monitoring/special studies: moored sensors	RMP	1	200	215	190	39.3	220	230			
Monitoring/special studies: ship-based channel monitoring							153	120			
Monitoring/special studies: algal biotoxins	RMP	1	65								
Monitoring/special studies: stormwater loads	RMP	3	40	35							
Monitoring/special studies: monitoring program development	RMP	1,3		50		20					
Monitoring/special studies: dissolved oxygen						200					
Monitoring/special studies: HF mapping					115						
Monitoring/special studies: Chl a analysis						15.7					
Modeling[1]	RMP	4,5	100	200	165						
Monitoring/special studies: data management						25					
Synthesis: conceptual model report	RMP	1-5	50								
Synthesis: nutrient loads and data gaps	RMP	3	30								
General allocation (exact projects TBD)	RMP										
SUBTOTALS	**RMP Nutrients Studies**		**505**	**520**	**470**	**300**	**373**	**350**	**500**	**500**	**500**
RMP S&T ship-based monitoring (USGS, Cloern)	RMP S&T	1,3	110	172	172	223	229	235	242	248	248
SUBTOTALS	**RMP S&T Monitoring**		**110**	**172**	**172**	**192**	**229**	**235**	**242**	**248**	**248**
Nutrient Management Strategy funding											
Program coordination and management	Permit	1-5	(135)	(75)	(150)	(270)	(325)	(337)			
Science plan development	Permit	1-5	(15)	(15)			(58)				
Monitoring/special studies: ship-based sampling	Permit	1			(75)	(95)		(28)			
Monitoring/special studies: moored sensor	Permit	1	(75)	(75)	(150)		(123)	(28)			
Monitoring/special studies: POTW and refinery effluent characterization[3]	Dischargers, Permit	3	(315)	(200)							

Tasks	Funding Agency	Questions Addressed	2013	2014	2015	2016	2017	2018	2019	2020	2021
Monitoring/special studies: algal toxins	Permit	1			(175)	(125)	(63)				
Monitoring/special studies: phytoplankton composition	Permit	1	(60)	(60)							
Monitoring/special studies: monitoring program development	Permit/SWRB	1,3	(55)	(60)	(80)		(58)				
Monitoring/special studies: research vessel	Permit	1,3				(200)					
Delta Loads to Suisun	DWR-EMP	3	(90)	(90)							
Synthesis: Suisun Bay, Lower South Bay, other	Permit	*1,3*	(100)	(150)							
Biological endpoints (DO, toxins)	Permit						(126)	(229)			
Science plan development	SFBRWQCB	1-5			(100)						
Biogeochemical modeling and application[1]	Permit/ CCCSD/DSP/ Palo Alto/ Sunnyvale/ State Board/ SEP/Sac Regional						(355)	(945)			
Data management, plan development and implementation	Permit						(11)	(9)			
Data Analysis/Synthesis	Permit						(33)	(176)			
Permit funds, reserves, and additional support (exact projects TBD)	Permit				(280)	(190)	(285)	(1080)	(880)	(880)	(2,220)
SUBTOTALS	***NMS Total***		**(845)**	**(725)**	**(1,010)[2]**	**(880)[2]**	**(1,437)[2]**	**(1,952)[2]**	**(880)[2]**	**(880)[2]**	**(2,220)**
GRAND TOTAL - RMP, BACWA and other funding sources[3]			**1,460**	**1,417**	**1,652**	**1,372**	**2,022**	**2,537**	**1,622+ ?**	**1,622+ ?**	**2,968**

[1] Suisun modeling funded by CCCSD, DSP, & Sac Regional; Lower South Bay modeling funded by City of Palo Alto & City of Sunnyvale; Modeling scenarios funded by the State Water Board; Biogeochemcial modeling funded by BACWA and SEP funds

[2]Indicates fiscal year

[3]This table only lists contributions from other funding sources for projects that SFEI is directly involved in. There are additional efforts by numerous agencies (USGS, DWR-EMP, SFCWA, SFBRWQCB, SWRCB) that directly or indirectly support the Nutrient Management Strategy, but are not included here for simplicity

TBD = To be determined.

EMERGING CONTAMINANTS

Relevant Management Policies and Decisions

Regional Action Plans for emerging contaminants

Early management intervention, including green chemistry and pollution prevention

State and federal pesticide regulatory programs

Recent Noteworthy Findings

The RMP completed the first major revision of its CEC Strategy document. The review affirmed the value of the RMP's three-element strategy: 1) CEC monitoring and risk evaluation; 2) reviewing literature and other programs to identify new analytes; and 3) using non-targeted techniques to scan for additional concerns. New management questions were added. Information regarding temporal trends was added to the tiered prioritization framework used to classify the level of concern associated with emerging contaminant compounds or classes. A revised multi-year plan and recommendations for Status and Trends monitoring were also provided.

PBDEs were downgraded from Moderate to Low Concern for the Bay. Status & Trends monitoring of key matrices will continue for at least two cycles.

Synthesis of extensive RMP monitoring data on poly- and perfluoroalkyl substances (PFASs) and consultation with international experts resulted in the recommendation that perfluorooctanoic acid (PFOA) and similar long-chain carboxylates be considered Moderate Concerns for San Francisco Bay. The strategy for future studies includes continued Status & Trends monitoring of sport fish and bird eggs, and Special Studies on sediment, harbor seals, and stormwater using advanced analytical techniques.

Preliminary results from non-targeted analysis of Bay water samples suggests stormwater-influenced sites may have a number of diverse, unique contaminants at relatively high abundances. Follow-up studies that target compounds linked to pollution from vehicles, roadways, and other outdoor urban sources are recommended.

Priority Question for the Next Five Years

1. Which CECs have the potential to adversely impact beneficial uses in San Francisco Bay?
2. What are the sources, pathways and loadings leading to the presence of individual CECs or groups of CECs in the Bay?
3. What are the physical, chemical, and biological processes that may affect the transport and fate of individual CECs or groups of CECs in the Bay?
4. Have the concentrations of individual CECs or groups of CECs increased or decreased in the Bay?
5. Are the concentrations of individual CECs or groups of CECs predicted to increase or decrease in the future?
6. What are the effects of management actions?

MULTI-YEAR PLAN FOR EMERGING CONTAMINANTS

Emerging contaminant studies and monitoring in the RMP from 2013 to 2021. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external partners. Budgets that are starred represent funding that has been allocated for the given study within other workgroups.

Element	Study	Funder	Questions addressed	2013	2014	2015	2016	2017	2018	2019	2020	2021
CEC Strategy				20	20	20	48	50	65	65	65	80
MODERATE CONCERN CECs												
PFOS/PFASs	Perfluorinated Compounds in Harbor Seals	RMP	1,4,6		26							
	Sediment, Effluent Precursor Monitoring	AXYS	1,2		(30)							
	CECs in Municipal Wastewater[1]	RMP	1,2,4			27.5						
	Effluent TOF analysis	DTSC	1,2,4,6			(50)						
	Perfluorinated and Polyfluorinated Compounds in San Francisco Bay: Synthesis and Strategy	RMP	1-6					56				
	Margin Sediment Archiving	RMP	1						2.5			
	Stormwater PFASs[2]	RMP	1,2							147.5		
	Sediment and Seal PFASs	RMP	1,2,4,6								80	
	Air Deposition PFASs		1,2									100
	RMP Status and Trends[3]	RMP S&T	1,4		F		E		E	F		E
NP/NPEs	Margin Sediment Archiving, Analysis	RMP	1,4						2.5		50	
	Archived Tissue	RMP	1,4									100
Fipronil	CECs in Municipal Wastewater[1]	RMP	1,2,3			27.5						
	Fipronil, Fipronil Degradates, and Imidacloprid in Municipal Wastewater	RMP	1,2,3				30					
	Fipronil, Fipronil Degradates, and Imidacloprid in Biosolids	ASU	1,2,3				(8)					
	Sport and Prey Fish	RMP	1							70		
	RMP Status and Trends[3,4]	RMP	1,3,4		S				S			
LOW or POSSIBLE CONCERN CECs												
PBDEs	PBDE Summary Report	RMP	1-6	36								
	RMP Status and Trends[3]	RMP S&T	1,3,4		S, B, F		B, E		S, E	F		E

Element	Study	Funder	Questions addressed	2013	2014	2015	2016	2017	2018	2019	2020	2021
Alt. Flame Retardants	Monitoring Alternative Flame Retardants in SF Bay Water, Effluent, Stormwater, Sediment and Biota	RMP	1,2,4		104							
	Phosphate Flame Retardants in Ambient Bay Water	RMP / ECCC	1,4		(2)			47				60
	Conceptual Model[6]	RMP	1,2,3,6							40		
Pharmaceut-icals	Pharmaceuticals in Wastewater	RMP / POTWs	1,2,4				(68)		30			
	Pharmaceuticals in Water & (Archived) Sediment – coordinated with EEWG glucocorticoid bioanalytical tools	RMP	1,2,4								180	
	Antibiotics in Sediment Cores	U Minn	1,3,4						(8)			
Plastic Additives	Bisphenol Compounds in Ambient Bay Water	RMP / SIU	1			(25)		50				
	Bisphenol Compounds in Archived Sediment	RMP	1							50		
	Phthalates in Bay Matrices		1,4									70
Personal Care/Cleaning	Triclosan in Small Fish	RMP	1					41				
	Musks in Water & Sediment[5]	RMP	1						64.5			
	Sunscreen Chemicals in Water & Fish	RMP	1							100		
	Quats in (Archived) Sediment	RMP	1								50	
	Siloxanes in Bivalves	ECCC	1		(5)							
Pesticides	Current Use Pesticides in Ambient Bay Water	RMP	1,2	15								
	Imidacloprid, Imidacloprid Degradates and other Neonicotinoids in Ambient Bay Water	RMP	1					40				
	DPR Priorities in Water & Sediment[5]	RMP / USGS	1,2,3						64.5 (6.8)			
	Agricultural Pesticides in Water & Sediment – coordinated with North Bay Margins	RMP	1,2								100	
SDPAs/BZTs	Water, Sediment	ECCC	1		(3)							
OH-BDEs / Triclosan	Water, Sediment Cores	U Minn	1,3,4		(125)							
PHCZs	Sediment, Tissue	SIU	1			(15)	(20)	(40)				
Brominated Azo Dyes	Archived Sediment, Tissue	RMP	1								60	

Element	Study	Funder	Questions addressed	2013	2014	2015	2016	2017	2018	2019	2020	2021
NON-TARGETED & OTHER STUDIES												
Non-targeted	Non-targeted Analysis of Water-soluble CECs	RMP / Duke / AXYS	1,2				52 (10) (6)					
	Non-targeted Analysis of Sediment	RMP	1,2						101			
	Follow-up Targeted Study[2]	RMP	1,2							82.5		
	Tissue (Polar and Nonpolar Compounds)	RMP	1								120	
	Follow-up Targeted Study (2018 results)	RMP	1									100
	Trash Hot Spots Study	RMP	1									120
RELEVANT STUDIES IN OTHER WORKGROUPS												
Bioassay (EEWG)	Linkage of In Vitro Estrogenic Assays with In Vivo End Points	RMP / SCCWRP / UF	1,2	70	56 (125)			45				
	Development of Glucocorticoid Bioanalytical Screens	RMP / SCCWRP / UF	1							25 (50)	75 (100)	50 (50)
RMP-funded Special Studies Subtotal - ECWG				**71**	**150**	**75**	**130**	**284**	**330**	**555**	**705**	**630**
RMP-funded Special Studies Subtotal – Other Workgroups				**70**	**56**	**0**	**0**	**45**	**0**	**25**	**75**	**50**
Pro-Bono & Externally Funded Studies Subtotal				**0**	**165**	**90**	**112**	**40**	**14.8**	**50+**	**100+**	**50+**
OVERALL TOTAL				**141**	**371**	**165**	**242**	**369**	**344.8**	**630+**	**880+**	**730+**

1 – The 2015 CECs in Municipal Wastewater study was a $55k study that included analyses of PFOS/PFAS and fipronil; in this table the budget for this study has been split between these two contaminant groups.

2 – The proposed 2019 stormwater studies include $55k in estimated field work costs; the budget for this field work is split between the two proposed studies.

3 – When a CEC is proposed for inclusion in the the RMP Status and Trends monitoring, there is a letter in the cell denoting the matrix for which monitoring is proposed: W = water; S = sediment; B = bivalve; E = eggs; F = fish.

4 – Analysis of fipronil and fipronil degradates is a proposed recommendation for inclusion in the RMP Status and Trends monitoring effort. The current Status and Trends monitoring budget does not include these analyses.

5 – The 2018 CECs in Municipal Wastewater study was a $129k study that included analyses of pesticides and fragrance ingredients; in this table the budget for this study has been split between these two contaminant groups.

6 – The Alternative Flame Retardants Conceptual Model will be co-funded by ECWG and STLS, with each group allocating $40k toward the study.

MICROPLASTIC

Relevant Management Policies and Decisions

Regional bans on plastic bags and foam packaging materials

State and Federal bans on microbeads

Trash TMDL

Potential for public outreach and education regarding pollution prevention for microplastic and macroplastic that can disintegrate to microplastic

Recent Noteworthy Findings

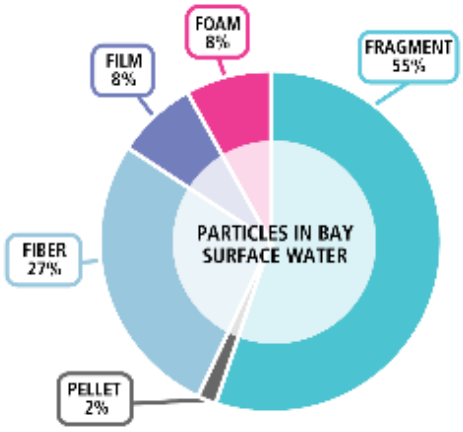
In 2015, the RMP conducted a small study to monitor microplastic in treated effluent and Bay surface water. Bay surface water appeared to have higher microplastic levels than other urban water bodies sampled in North America, such as the Great Lakes and Chesapeake Bay. Microbeads derived from personal care products and tiny fibers, a portion of which were likely derived from synthetic textiles and carpets, were recovered from all nine Bay sites. Tiny particles, primarily fibers, were also detected in treated effluent from Bay Area facilities; not all of these particles are known to be plastic.

While conducting the surface water trawls of San Francisco Bay, nine small prey fish were inadvertently caught at one site. These fish were found to contain 52 particles. This average of nearly six particles per fish is higher than one to three particles typically found in Great Lakes fish. 50% of the particles were classified as fragments, while 33% were classified as fibers.

In 2016, the RMP convened a Microplastic workgroup to develop a strategy for the monitoring micproplastic in San Francisco Bay. The workgroup consisted of national experts on the topic and a wide range of stakeholders. Following the meeting, RMP staff produced a strategy document. The proposed studies listed on the next page are from the strategy document. SFEI was awarded a $880K external grant from the Gordon and Betty Moore Foundation to complete many of these tasks. Additional funds have been obtained from the RMP, Patagonia, and EBMUD.

Priority Questions for the Next Five Years

1. How much microplastic pollution is there in the Bay?
2. What are the health risks?
3. What are the sources, pathways, loadings, and processes leading to microplastic pollution in the Bay?
4. Have the concentrations of microplastic in the Bay increased or decreased?
5. What management actions may be effective in reducing microplastic pollution?



Right: Percent contribution by particle type for Bay surface water (Sutton et al. 2016).

Microplastic, commonly defined as plastic particles smaller than 5 mm, come in a broad range of shapes and sizes. Commonly observed particles include: fragments, fibers or lines, pellets, films, or foam bits. Differences in size and shape can affect the way particles move through the environment, and may modify their potential for toxicity.

MULTI-YEAR PLAN FOR MICROPLASTIC

Microplastic studies and monitoring in the RMP from 2011 to 2020. Numbers indicate budget allocations in $1000s. Text in purple font indicates funding from the Gordon and Betty Moore Foundation ($880k) and related RMP funds. Text in blue font indicates externally projects that will be used to inform work conducted as part of this strategy. Budgets in parentheses represent funding or in-kind services from external partners.

Element	Study	Funder	Questions Addressed	2015	2016	2017	2018	2019	2020	Beyond
Pilot Study	Microplastic in Ambient Bay Water	RMP	1	9						
Strategy	Microplastic Strategy	RMP	1,2,3,4,5		25			10	10	10
	Private Foundation Grant Match	RMP*	1,2,3,4,5			75[1]				
Method Development	New methods for collection, extraction, analysis, and intercomparison – USEPA, NOAA	External	1,3				(x)	(x)		
	Follow-up method development	External								150[2]
	Laboratory intercomparison	External								100
Monitoring biota	Bivalves	RMP	1,2,4				50			
	Sport fish	RMP						110[2]		
	Benthic organisms	RMP								50
	Prey fish	External*				(130)				
Monitoring water and sediment	Archived ambient & margins sediment	External*	1,3,4			(100)				
	Sediment cores	RMP								50
	Surface water: Bay / Sanctuaries	External*				(220)				
Characterizing sources, pathways, loadings, processes	Refine conceptual model	RMP	1,3						50	
	Stormwater and wastewater effluent	External*					(90)			
	Model transport in Bay and ocean	External*					(80)			
Evaluating control options	Options for source control / Efficacy of microbead ban, foam bans	RMP / External*	5				(40)			100
	Characterize microplastic additives to assess exposure	RMP								100
Synthesis	Synthesize findings (e.g. report, factsheet, video), hold symposium	External*	1,3					(220)		
			RMP Subtotal	**9**	**25**	**75**	**50**	**120**	**60**	**310**
			External Subtotal	**0**	**0**	**450**	**210**	**220**	**0**	**0**
			Overall Total	**0**	**25**	**525**	**260**	**340**	**60**	**310**

1 -- The RMP Steering Committee has approved $75k of RMP funds in 2017 to match the private foundation funding.
2 -- Assumes that this project would be an added on to existing RMP S&T sampling.

EXPOSURE AND EFFECTS

Relevant Management Policies and Decisions

Implementation of narrative water quality objectives for toxicity, bioaccumulation, and aquatic species populations and community ecology

Implementation of sediment quality objectives

Permitting decisions regarding dredging projects

Contaminated sediment 303(d) listing and delisting decisions

Recent Noteworthy Findings

Laboratory studies showed that clay has size-specific mortality effects on the amphipod species used in RMP sediment toxicity testing. Larger amphipods appear to be more sensitive to clay particles. In 2016, additional studies using sediment samples from the Bay confirmed these findings. Future RMP sediment toxicity testing will focus on smaller amphipods to minimize this effect.

A project funded by the RMP in 2013 and 2014 evaluated linkages between in vitro assays and in vivo endpoints that point to population level effects in estuarine fish. The study succeeded in establishing a linkage between in vitro estrogen assays and in vivo feminization of juvenile fish. A follow-up study is underway to better quantify the relationship.

In 2018, the Exposure and Effects Workgroup will develop a strategic plan for the future direction of this workgroup. The planning process will be guided by the mission of the EEWG to: Provide technical oversight and stakeholder guidance on RMP studies addressing questions about biological impacts related to contaminant exposure.

Priority Questions for the Next Five Years

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

2. Is chemical contamination the cause of observed sediment toxicity in the Bay?

3. What are the best tools to predict ecological effects from chemical contamination of sediments in the Bay?

4. Should any sediment contamination hotspots on the 303d list be de-listed?

5. Do spatial patterns in bioaccumulation in birds indicate particular regions of concern?

6. Are there any indications of ecological effects caused by exposure to specific chemicals or mixtures of contaminants in the Bay? (Overlap with ECWG)

7. What are acceptable levels of chemicals in dredged material for placement in the Bay, baylands, or restoration projects? (Overlap with Sediment WG)

8. Are there effects on fish, benthic species, and submerged habitats from dredging or placement of dredged material? (Overlap with Sediment WG)

MULTI-YEAR PLAN FOR EXPOSURE AND EFFECTS

Special studies and monitoring in the RMP from 2012 to 2021. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources. Blue shading indicates overlap with the Sediment Workgroup.

Category	Study	Funder	Questions addressed	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Strategy	Strategy/Workgroup Support	RMP	All						10	10			
	Acidification Workshop	RMP Others*	None					5 (20)					
Benthos	Benthic Assessment Tools	RMP	3	50	76					21	29		
	Causes of Sediment Toxicity: TIEs and LC50 Work	RMP	2,3										
	Causes of Sediment Toxicity: Molecular TIEs	RMP	2,3										
	Causes of Sediment Toxicity: Moderate Toxicity Strategy	RMP	2,3	50		30		30					
	Nat'l Coastal Assess. Synthesis	USEPA	1,2,3	(50)									
	Hotspot Follow-up Study	RMP	3,4	30							TBD	TBD	
Fish	Effects of Copper on Salmon	RMP NOAA	6		38								
	Sed. Bioaccumulation Guidance	RMP	7							30	30		
	Synthesis of PCB Bioaccumulation Test Results		7								40		
	Participate in LTMS Studies of Essential Fish Habitat	RMP LTMS	8			50 (100)						TBD	TBD
	Synthesis of Light Attenuation Data Near Dredging Projects		7,8									40	
Bioassays	Estrogenic Assay Development and Screening+	RMP SCCWRP U. Florida	6		70	56 (125)			45			40	
	Glucocorticoid Assay Development and Screening+	RMP SCCWRP U. Florida	6								25 (50)	75 (100)	50 (50)
	Total for RMP Funding			130	184	136	0	35	55	61	124	155	50
	Total for Non-RMP Funding			50	0	225	0	20	0	0	50	100	50

* Funding for Acidification Workshop from RMP, SFEP, EPA, OST, and Cal SeaGrant. + Bioassay projects will be integrated with the Emerging Contaminants Workgroup.

PCBs

Relevant Management Policies and Decisions

- PCBs TMDL and potential update
- Implementation of NPDES permits
- Selecting management actions for reducing PCB impairment
- Municipal Regional Permit

Recent Noteworthy Findings

Shiner surfperch have a Bay-wide average concentration 9 times higher than the TMDL target, and these concentrations have resulted in an advisory from the Office of Environmental Health Hazards Assessment (OEHHA) recommending no consumption for all surfperch in the Bay. Concentrations in shiner surfperch and white croaker show no clear sign of decline. For birds, seals and fish there is evidence of PCB exposures in certain locations that may be reducing health and survival. Average concentrations in Suisun Bay sediments are lower than in the other Bay segments, indicating a lower degree of impairment in this region.

Urban stormwater is the largest pathway of PCB loads to the Bay, and the pathway with the greatest load reduction goals. Concentrations of PCBs and mercury on suspended sediment particles from a wide range of watersheds are being measured as an index of the degree of watershed contamination and potential for effective management action. Stormwater samples from Pulgas Creek Pump Station North and South, Industrial Road Ditch, and Gull Drive Storm Drain in San Mateo County; Santa Fe Channel in Contra Costa County; Outfall at Gilman Street and Ettie Street Pump Station in Alameda County; and Outfall to Lower Silver Creek in Santa Clara County had the highest concentrations of PCBs on suspended sediment particles measured to date.

An assessment of Emeryville Crescent established a conceptual model as a foundation for monitoring response to load reductions and for planning management actions. The key finding was that PCB concentrations in sediment and the food web could potentially decline fairly quickly (within 10 years) in response to load reductions from the watershed.

Priority Questions for the Next Five Years

1. What are the rates of recovery of the Bay, its segments, and in-Bay contaminated sites from PCB contamination?
2. What are the present loads and long-term trends in loading from each of the major pathways?
3. What role do in-Bay contaminated sites play in segment-scale recovery rates?
4. Which small tributaries and contaminated margin sites are the highest priorities for cleanup?
5. What management actions have the greatest potential for accelerating recovery or reducing exposure?
6. What are the near-term effects of management actions on the potential for adverse impacts on humans and aquatic life due to Bay contamination?

MULTI-YEAR PLAN FOR PCBs

Special studies and monitoring in the RMP from 2015 to 2021. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources. Budgets that are starred represent funding that has been allocated for the given study within other workgroups.

Category	Study	Funder	Questions addressed	2015	2016	2017	2018	2019	2020	2021
General	Development and updating of multi-year workplan and continued support of PCB Workgroup meetings	RMP		10	10	10	10	10	10	10
PMU	Prioritize Margin Units	RMP	1, 4, 5, 6	30						
PMU	Develop Conceptual Site Models and Mass Balances for PMUs (4 PMUs)	RMP	1, 4, 5, 6	45	30 (30)	60	30	30		
PMU	PMU Field Studies to Support Development of Conceptual Site Models and Monitoring Plans	RMP	1, 4, 5, 6		(202)		21	150	150	150
PMU	PMU Trend Monitoring (5 PMUs)	RMP	1, 4, 5, 6					TBD	TBD	TBD
DMMO	Synthesis of DMMO data for PCB hot spots and mass removed	RMP	1						32	
	RMP Total			**85**	**40**	**70**	**61**	**190**	**192**	**160**
	SEP Funding				**232**					
	Overall Total			**85**	**272**	**70**	**61**	**190**	**192**	**160**

SELENIUM

Relevant Management Policies and Decisions

- North Bay Selenium TMDL
- USEPA Selenium Criteria for the Bay-Delta
- South Bay Selenium TMDL (under consideration)

Recent Noteworthy Findings

White sturgeon, a benthic species, is recognized as a key indicator of selenium impairment in the North Bay due to its susceptibility to selenium bioaccumulation. In general, white sturgeon muscle selenium concentrations measured over the past 30 years have exceeded the North Bay TMDL target in some individual sturgeon, but annual average concentrations have remained below the target and no long-term trend has been apparent since 1987. The highest tissue selenium concentrations were measured in in Suisun Bay; the lowest were in Central Bay. Sturgeon muscle plug sampling provides a non-lethal means of obtaining a larger sample size of concentrations in the North Bay. Selenium concentrations measured in sturgeon muscle plugs and muscle fillets are well-correlated. Muscle plug sampling in 2015 found concentrations that were higher than those observed in the recent past, due to 2015 being the fourth year of a drought (long-term clam monitoring shows that this important component of the sturgeon diet has higher concentrations in dry years) and the fish being collected exclusively in Suisun Bay.

The Lower South Bay has much higher average selenium concentrations in water than the other Bay segments, but white sturgeon collected in South Bay have had lower concentrations than North Bay sturgeon. This difference from the North Bay may be due to the low abundance of *Potamocorbula* in the South Bay.

The RMP Selenium Workgroup is developing a monitoring plan for sturgeon, water, and clams to track trends, with a special emphasis on early detection of change. The goal is to have an integrated, long-term design for all three indicators based on a solid statistical framework that is explicitly linked to management decision-making. Funding from a North Bay Supplemental Environmental Project supported the data analysis and statistical evaluation conducted in 2017. Additional development of the design and framework in 2018 will take the form of a synthesis of information for North Bay selenium indicators that will support an integrated and strategic approach to monitoring in support of the TMDL.

Priority Questions for the Next Five Years: General

1. What are appropriate thresholds?
2. Are the beneficial uses of San Francisco Bay impaired by selenium?
3. What is the spatial pattern of selenium impairment?
4. How do selenium concentrations and loadings change over time?
5. What is the relative importance of each pathway of selenium loading in the Bay?

Priority Questions for the Next Five Years: North Bay

6. Are the beneficial uses of north San Francisco Bay impaired by selenium?
7. Are changes occurring in selenium concentrations that warrant changes in management actions?
8. Will proposed changes in water flows and/or selenium loads in the Bay or upstream cause impairment in the North Bay?

MULTI-YEAR PLAN FOR SELENIUM

Special studies and monitoring in the RMP from 2014 to 2021. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources. Budgets that are starred represent funding that has been allocated for the given study within other workgroups.

Category	Study	Funder	Questions addressed	2014	2015	2016	2017	2018	2019	2020	2021
General	Selenium Strategy Coordination	RMP	1,2,3,4,5, 6,7,8	10	10	10	25 (10) SEP #1	10	10	10	10
General	Selenium Information Synthesis	RMP	1,2,3,4,5		10						
North Bay	Selenium Information Synthesis	RMP	1,2,3,4,5, 6,7,8				(50) SEP #2				
North Bay	Selenium Sturgeon Plugs	RMP	1,2,3,4,6, 7,8	23	35		(57) 29.5 SEP #1 27.5 MMP		30		30
North Bay	Selenium Sturgeon Derby	RMP	1,2,3,4		29	37	42				
North Bay	Selenium in North Bay Clams: Monitoring	RMP	3,4,7				39		156	156	156
North Bay	Selenium in North Bay Water: Synthesis	RMP	3,4,5,7,8				(50) SEP #1				
North Bay	Selenium in North Bay Water: Monitoring	RMP	3,4,5,7,8						0*	0*	0*
South Bay	Selenium South Bay Synthesis	RMP	1,2,3,4,5						50		
South Bay	Selenium South Bay Food Web Sampling	RMP	1,2,3,4							TBD	TBD
South Bay	Selenium South Bay Model	RMP	5								TBD
	RMP Total			33	84	47	106	10	246	166	196
	Other Funding						167				
	Overall Total			33	84	47	273	10	TBD	TBD	TBD

* Cost of water monitoring is included with cost of clam monitoring presuming that USGS will do both.

DIOXINS

Relevant Management Policies and Decisions

- Review 303(d) listings and establish TMDL development plan or alternative

Recent Noteworthy Findings

The key sport fish indicator species (shiner surfperch and white croaker) have higher tissue levels than the Water Board screening value of 0.14 ppt and show no sign of decline, but there is a great deal of uncertainty regarding the human health risk associated with dioxins in sport fish.

Dioxin toxic equivalents in Least Tern, Caspian Tern, and Forster's Tern eggs are at or above estimated thresholds for adverse effects; risks are especially significant in combination with dioxin-like PCBs.

Wetland sediment cores suggest rapidly declining inputs from local watersheds during recent decades, although additional coring data are needed to support this hypothesis.

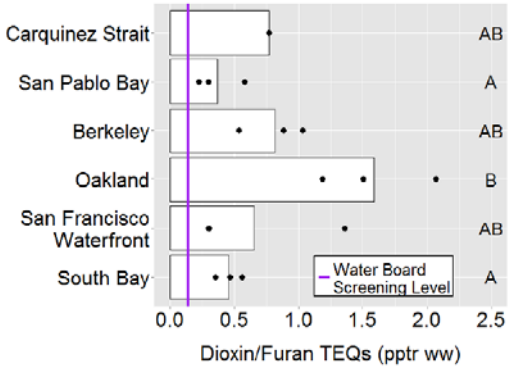
Recent monitoring of open Bay water and sediment did not show patterns suggesting large localized sources of dioxins in different areas of the Bay, although it is unknown whether some margin areas may be disproportionately affected.

Few data on dioxins are available on other priority questions - the Dioxin Strategy was developed to address this need.

Work is underway in 2017 to summarize and synthesize results of monitoring conducted between 2008 and 2014 in response to information needs identified in the 2004 Dioxin Conceptual Model and Impairment Assessment report, and prioritized by the RMP Dioxin Workgroup.

Priority Questions for the Next Five Years

1. What is the dioxin reservoir in Bay sediment and water?
2. Have dioxin loadings or concentrations changed over time?
3. What is the relative contribution of each loading pathway as a cause of dioxin impairment in the Bay?



$TEQ_{SPCDD/PCDF}$ (pptr ww) in shiner surfperch in San Francisco Bay, 2014.

MULTI-YEAR PLAN FOR DIOXINS

Special studies and monitoring in the RMP from 2009 to 2017. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources. Budgets that are starred represent funding that has been allocated for the given study within other workgroups.

Category	Study	Funder	Questions addressed	2009	2010	2011	2012	2013	2014	2015	2016	2017
General	Quality Assurance	RMP	1,2,3,4,5,6	14								
S&T	Sport Fish	RMP	1,2,4	22					24			
S&T	Avian Eggs	RMP	1,2,4				13					
S&T	Surface Sediment	RMP	2,3	58	58							
S&T	Water	RMP	2,3	26		26						
Loading	Small Tributary Loading	RMP	4,5,6		65		52					
Loading	River Loading (THg)	RMP	4,5,6		34							
Loading	Sediment Cores	RMP	3,4,6		57							
Loading	Atmospheric Deposition	RMP	5,6		20							
Forecast	Synthesis: RMP and DMMO	RMP	1,2,3,4,5,6									52
	RMP Total			120	234	26	65		24			52
	Other Funding											
	Overall Total			120	234	26	65		24			52

SEDIMENT

Relevant Management Policies and Decisions

1. NOAA 2011 Programmatic Essential Fish Habitat Agreement & 2015 LTMS Amended Programmatic Biological Opinion

2. PCB TMDL

3. Mercury TMDL

4. Long-Term Management Strategy for Dredged Material in SF Bay (LTMS) to comply with the Basin Plan

5. Regional Restoration Plans[1]

Recent Noteworthy Findings

In Water Year (WY) 2016 and 2017, the USGS monitored the sediment flux through the Golden Gate. This flux is the largest unknown in the sediment budget for the Bay. Preliminary results from WY2016 indicated that sediment loads from the Delta during winter storms were at least partially retained in the Bay. The results during bigger floods in WY2017 are still being analyzed.

USGS monitoring of suspended sediments at the Dumbarton Bridge in WY2016 indicated that particle flocculation is an important factor for accurately calculating the sediment flux into Lower South Bay. The RMP has allocated funds for a special study in 2018-2019 to follow-up on this finding.

A draft synthesis report estimated that net average annual sediment supply to San Francisco Bay from terrestrial sources during the most recent 22-year period (WY1995-2016) was 1.95 billion kilograms. Approximately 63% of the sediment supply was estimated to be from small tributaries that drain directly to the Bay. Net supply from the Central Valley (measured at Mallard Island) was approximately 37% of the total supply. Bedload supply, after accounting for dredging, removals, and storage in flood control channels, was approximately 3% of the total. Recent data do not indicate any trends besides the step decrease in supply from the Delta in 1999. The report contains initial recommendations for improvements in sediment supply monitoring.

Priority Questions for the Next Five Years

1. What are acceptable levels of chemicals in dredged material for placement in the Bay, baylands, or restoration projects?

2. Are there effects on fish, benthic species, and submerged habitats from dredging or placement of dredged material?

3. What are the sources, sinks, pathways and loadings of sediment and sediment-bound contaminants to the Bay and subembayments?

4. How much sediment is passively reaching tidal marshes and restoration projects and how could the amounts be increased by management actions?

[1] San Francisco Bay Restoration Authority Goals, Baylands Goals Update for Climate Change, Subtidal Habitat Goals Project, and Action 13 “Manage sediment on a regional scale and advance beneficial reuse” from the Comprehensive Conservation and Management Plan.

MULTI-YEAR PLAN FOR SEDIMENT

Special studies and monitoring in the RMP from 2014 to 2021. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources. Budgets that are starred represent funding that has been allocated for the given study within other workgroups. Blue shading indicates overlap with the Exposure and Effects Workgroup. This table does not show suspended sediment monitoring done for Status & Trends.

Category	Study	Funder	Questions addressed	2014	2015	2016	2017	2018	2019	2020	2021
Strategy	Sediment Monitoring Strategy Chapter in Healthy Watersheds Project	RMP WQIF	1,3,4				50 (238)		TBD		
	Strategy/Workgroup Support		1,2,3,4					10	10	10	10
	Sediment Modeling Strategy		1,2,3,4					TBD	TBD		
Screening Values	Sed. Bioaccumulation Guidance	RMP	1					30*	30*		
	Synthesis of PCB Bioaccumulation Results		1						40*		
Impact Studies	Participate in Essential Fish Habitat Studies	RMP LTMS	2	50* (100)						TBD	TBD
	Synthesis of Light Attenuation Data Near Dredging Projects		1,2							40*	
Data Mining	DMMO Database and Online Tools	RMP	1					55	50	15	15
	Synthesis of DMMO Dioxin Data	RMP	1,2				12*				
	Synthesis of DMMO PCB Data		1,2							32*	
Beneficial Reuse	Regional Monitoring of Reuse and SLR Adaptation Projects, incl. Reference Sites		1,2								TBD
	Measure Bulk Density of Sediment Types		4						TBD		
Sediment Budgets	Sediment Supply Synthesis	RMP USGS	3,4				40 (40)		TBD		TBD
	Golden Gate Sediment Flux Study	RMP SFEP/SEP	3,4			33 (98)	(69)				
	Lower South Bay Sediment Flux Study	RMP SFEP	3,4			(98)		120	100-180	75	
	Mallard Island Sediment Flux Study	RMP	3,4					30	35		
	Additional Sediment Flux Studies	RMP	3,4					TBD	TBD	TBD	TBD
	Maintain Streamgages and Add New Ones							TBD	TBD	TBD	TBD
General	General Allocation for Special Studies							TBD	50	50	200
	Total for RMP Funding – Sediment			0	0	33	90	215	245-325	150	225
	Total for RMP Funding – Other Workgroups			50	0	0	12	30	70	72	TBD
	Total for Non-RMP Funding			100	0	196	347	0	0	0	0

STATUS AND TRENDS MONITORING

Relevant Management Policies and Decisions

Defining ambient conditions in the Bay

Water Quality Assessment – 303(d) impairment listings or de-listings

Determination of whether there is reasonable potential that a NPDES-permitted discharge may cause violation of a water quality standard

Evaluation of water and sediment quality objectives

Dredged material management

Development and implementation of TMDLs for mercury, PCBs, and selenium

Site-specific objectives and anti-degradation policies for copper and cyanide

Development and evaluation of a Nutrient Assessment Framework

When recommending addition of any analyte to S&T the following details need to be specified: relevance of the analyte to a management question, the matrix to be monitored, the frequency of monitoring, the minimum duration of the monitoring, and the spatial extent (e.g., all sites or a subset).

Recent Noteworthy Findings

In 2015, the RMP monitored sediments in the margin areas of Central Bay. The study determined the ambient concentrations of PCBs, mercury, and other contaminants in these areas. On average, PCB concentrations were 4-5 times higher in the margins than in the open Bay. The study also detected a number of “warm spots” where the concentrations of contaminants were significantly elevated and one previously unknown “hot spot”. In 2017, another study will repeat this assessment in South Bay and Lower South Bay.

In 2017, the RMP published the latest information on contaminant concentrations in sport fish tissue. The most recent data show that there is no long-term trend for mercury and little evidence of PCB declines in important sport fish species.

Copper concentrations in water, last monitored in 2015, remain below trigger levels.

A sudden Bay-wide shift in suspended sediment occurred in the late 1990s, and concentrations remained low for the next 10 years. Levels were higher at the Dumbarton Bridge in 2014-2016, possibly reflecting a change due to drought conditions.

Over the subsequent 10 years, data on chlorophyll-a concentrations in South Bay and Lower South Bay suggest that phytoplankton biomass has stopped increasing and reached a new plateau, but at a higher level than the concentrations that prevailed from 1980 to 1995.

Priority Questions for the Next Five Years

1. Are contaminants at levels of concern?

2. What are concentrations and masses of priority contaminants in the Bay, its compartments, and its segments?

3. Are there particular regions of concern?

4. Have concentrations and masses increased or decreased?

MULTI-YEAR PLAN FOR STATUS AND TRENDS MONITORING

Status and Trends Monitoring in the RMP from 2014 to 2027. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources. Budgets that are starred represent funding that has been allocated for the given study within other workgroups.

Monitoring Type	'14	'15	'16	'17	'18	'19	'20	'21	'22	'23	'24	'25	'26	'27
	Actl	Actl	Actl	Bdgt	Bdgt	Fcst	Fcst	Fcst	Fcst	Fcst	Fcst	Fcst	Fcst	Fcst
USGS Moored Sensor Network for Suspended Sediment	250	250	250	250	250	250	250	250	250	250	250	250	250	250
USGS Monthly Cruises for Nutrients and Phytoplankton	173	173	223	229	235	242	248	255	262	269	276	283	291	299
S&T Water		179		215		228		240		253		267		282
Water-Organics								124						
Water-CTR		40										53		
S&T Bivalves	136		144		132		153		161		170		179	
Bivalves-PCBs									21					
S&T Bird Eggs			198		238			264			286			309
Bird Egg Report											54			
S&T Margins Sediment		233		240			255		268		283		299	
Margins Reporting		42		50			49							
S&T Sediment	251				325				340				379	
Tox/Benthos									137				153	
S&T Sport Fish	311					339					387			
Sport Fish Report	41					42					48			
Archives	20	48	22	51	47	49	50	51	53	54	55	57	58	60
Reporting	19	18	19	25	10	21	22	22	23	23	24	25	25	26
Lab Intercomp Studies				10	50	70	55	69	102	28	158	30	113	81
Grand Total	**1,202**	**983**	**856**	**1,070**	**1,287**	**1,239**	**1,081**	**1,275**	**1,616**	**878**	**1,991**	**965**	**1,747**	**1,308**
Set-Aside Funds Used	417	79	0	0	0	0	0	0	300	0	600	0	400	0
Set-Aside Funds Saved	161	0	250	125	0	0	225	0	0	400	0	300	0	0
Set-Aside Funds Balance	297	218	468	593	593	593	818	818	518	918	318	618	218	218
Net S&T Funding Needed	946	904	1,106	1,195	1,287	1,239	1,306	1,275	1,316	1,278	1,391	1,265	1,347	1,308

Regional Monitoring Program for Water Quality in San Francisco Bay

Monitoring Design for the Status and Trends Monitoring Program (2014-2027)

Program	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
USGS Moored Sensor Network for Suspended Sediment (5 targeted sites) [a]														
Parameters: SSC, Water temperature, Salinity	X	X	X	X	X	X	X	X	X	X	X	X	X	X
USGS Monthly Cruises for Nutrients and Phytoplankton in Deep Channel (38 targeted sites)														
Parameters: CTD profiles, light attenuation, SSC, DO, Chl-a, Phytoplankton speciation, Nutrients (NO_2, NO_3, NH_4, PO_4, Si) [b]	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Every 2 Years: Toxic Contaminants in Water (5 targeted sites and 17 random sites)														
MeHg, Cu, Se (dissolved & particulate fractions in 2017 and onwards, dissolved & total fractions measured in 2015)		X		X		X		X		X		X		X
CN, Hardness, SSC, DOC, POC		X		X		X		X		X		X		X
Aquatic Toxicity (9 stations) [c]		X		X		X		X		X		X		X
Chl-a and Nutrients (NH4, NO3, NO2, TN, PO4, TP, Si) (at GG site only).				X		X		X		X		X		X
PCBs, PAHs, Pesticides								X						
CTR parameters (10 samples at 3 targeted stations) [d]		X										X		
Every 2 years: Toxic Contaminants in Bivalve Tissue (7 targeted sites) [e]														
Se, PAHs	X		X		X		X		X		X		X	
PBDEs	X		X											
PCBs	X								X					

Program	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Every 3 Years: Toxic Contaminants in Bird Egg Tissue														
Cormorant Eggs: Hg, Se, PCBs, PBDEs, PFCs (3 targeted sites) [f]			X		X			X			X			X
Tern Eggs: Hg, Se, PBDEs (variable fixed sites) [g]			X		X			X			X			X
Every 2 Years: Toxic Contaminants in Bay Margin Sediments (~40 random sites)														
Ag, Al, As, Cd, Cu, Fe, Hg, MeHg, Mn, Ni, Pb, Se, Zn, PCBs, TOC, N, % Solids, Grain Size		X		X			X		?		?		?	
Every 4 Years: Toxic Contaminants in Sediment (7 targeted sites and 20 random sites) [h]														
Ag, Al, As, Cd, Cu, Fe, Hg, MeHg, Mn, Ni, Pb, Se, Zn, PAHs, PCBs, TOC, N, % Solids, Grain Size	X				X				X				X	
PBDEs	X				X				X					
Legacy Pesticides and Fipronil (reconsider whether to include before the 2018 cruise)	X				?				?				?	
Sediment Toxicity [i]									?				?	
Benthic Macroinvertebrates [j]									?				?	
Every 5 Years: Toxic Contaminants in Sport Fish Tissue (7 targeted sites)														
Hg, Se, PCBs, PBDEs, PFCs, Dioxins	X					X					X			

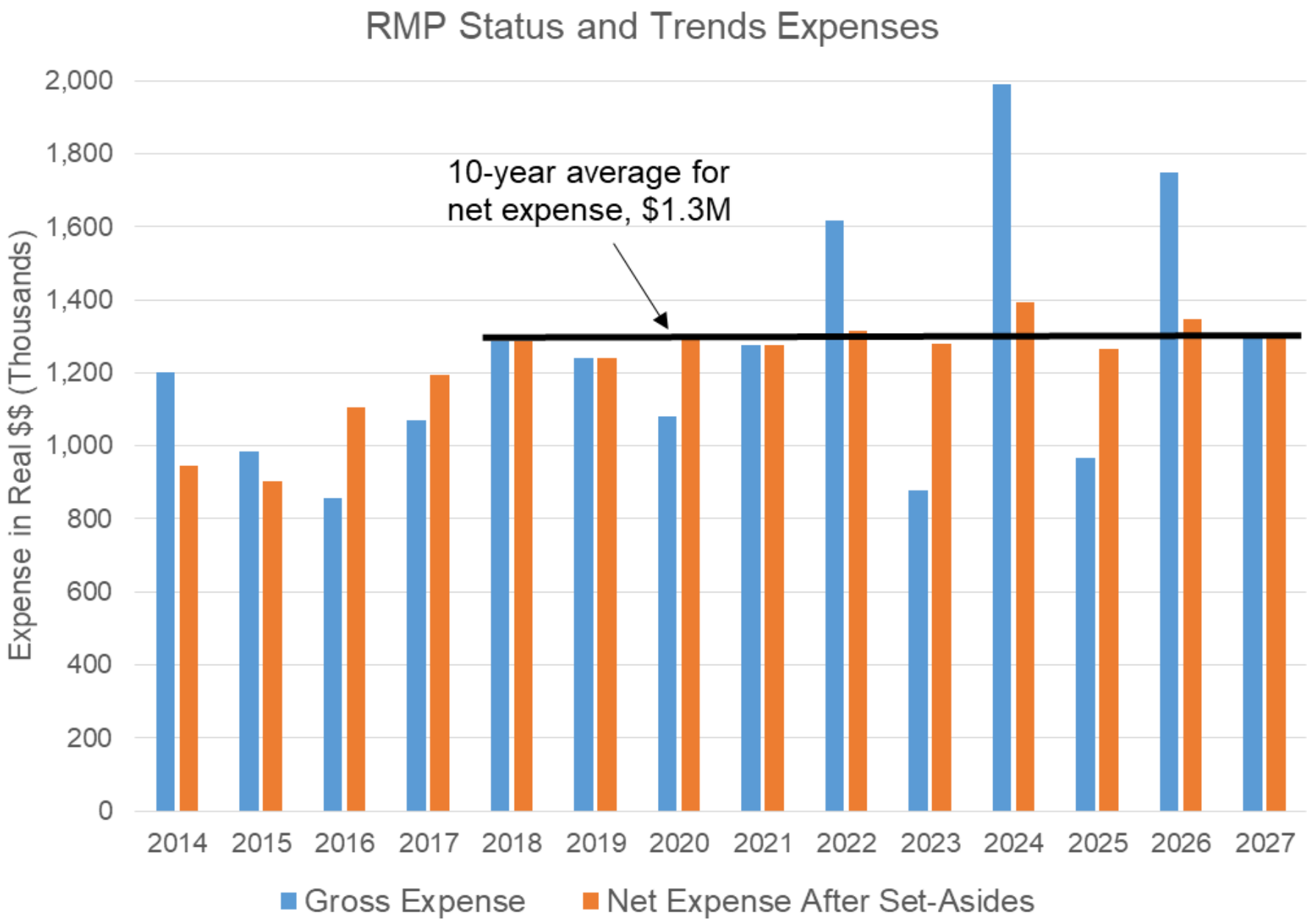
Notes:

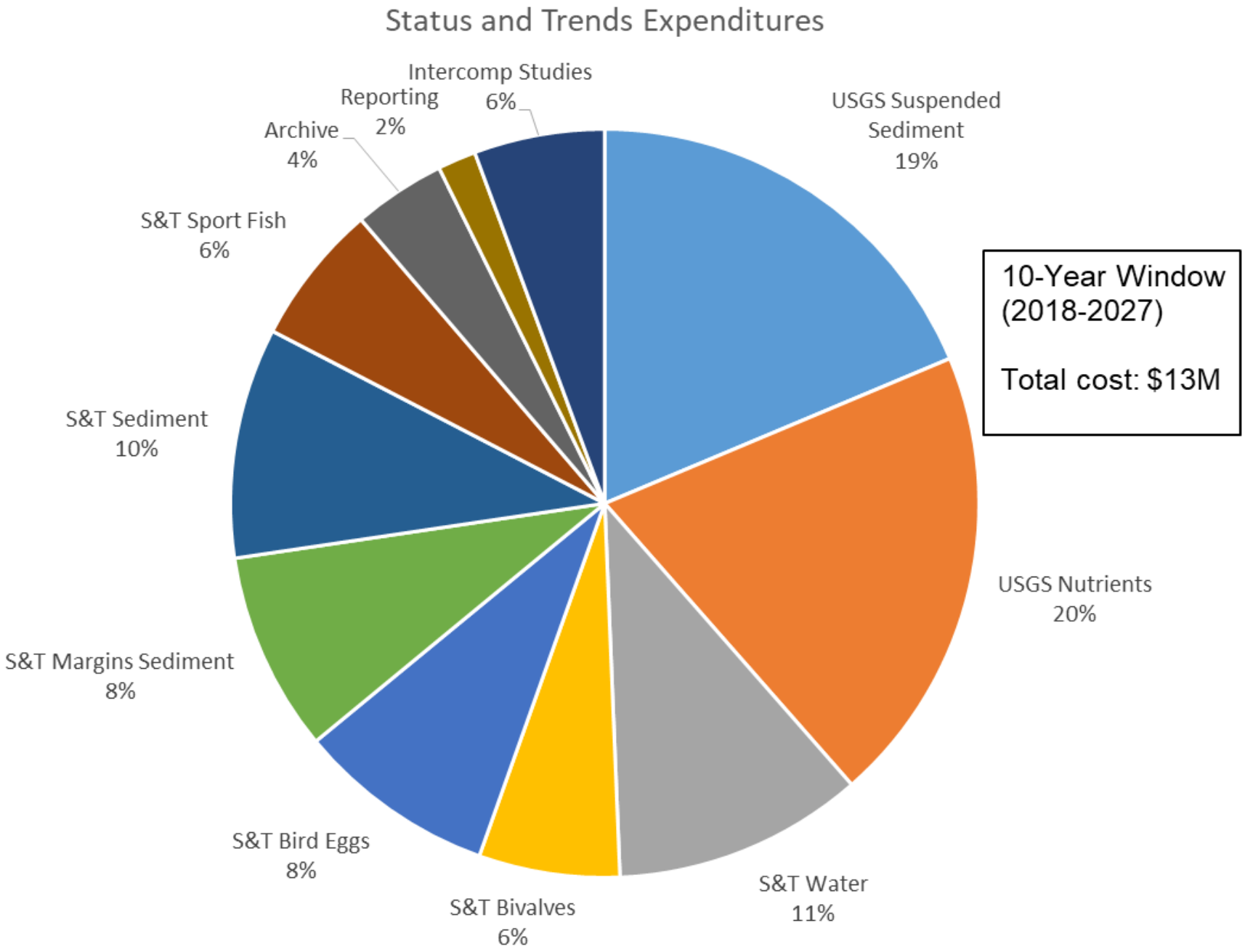
"X" = Planned sampling event. "?" = Event that is planned but must be approved by the RMP Steering Committee before implementation. Additional parameters can be added to sampling events to support RMP Special Studies.

a. The RMP Status and Trend Program provides direct support to the U.S. Geological Survey (PI: Dave Schoellhamer) for 5 SSC stations. However, this contribution leverages SSC data at 2 more stations and salinity at 8 stations funded by other partners. In addition, since 2012, the RMP has used Special Studies funds to add DO sensors at 6 stations and nutrient-related sensors to 3 stations.
b. Monthly cruises are completed by the U.S. Geological Survey (PI: Jim Cloern). Phytoplankton speciation and nutrient sampling only occurs at 14 of stations.
c. Aquatic Toxicity is measured following EPA Method 1007.0 (*Americamysis bahia*).
d. CTR sampling occurs at the Sacramento River, Yerba Buena Island, and Dumbarton Bridge sites.
e. Mussels (*Mytilus californianus*) are collected from Bodega Head State Marine Reserve, an uncontaminated "background" site of known chemistry, and are transplanted to 7 targeted locations in the Bay. After ~100 days, mussels from the transplanted sites and a sample from Bodega Head are collected for analysis. Three of the 7 transplant sites serve as back-ups in case something goes wrong with the transplants at the 4 primary sites. At the same time, resident clams (*Corbicula fluminea*) are collected from 2 sites in the Sacramento River and San Joaquin River.
f. Double-crested Cormorants (*Phalacrocorax auritus*). Cormorant eggs are collected at three sites: Don Edwards National Wildlife Refuge, the Richmond-San Rafael Bridge, and Wheeler Island.
g. Forster's Tern (*Sterna forsteri*). Tern eggs are typically collected from multiple sites in the Don Edwards National Wildlife Refuge and the Hayward Shoreline Regional Park.
h. Sediment samples are collected in the dry season (summer).
i. Sediment toxicity is measured using the following methods: EPA 600/R-94-025 (*Eohaustorius estuaries*), EPA 821/R-02-012M (*Ceriodaphnia dubia*), EPA 600/R-99-064 (*Hyalella azteca*), and EPA 600/R-95-136M (*Mytilus galloprovincialis*)
j. Benthic macroinvertebrates are measured during dry-season sediment sampling events (2014, 2022). Sediment samples are sieved through nested 1.0 and 0.5 mm sieves Organisms are sorted into major taxonomic categories and taxonomy and abundance are determined to the lowest practical taxonomic level.

Acronyms:

SSC: Suspended Sediment Concentration
Chl-a: Chlorophyll-a
CTD: Conductivity, Temperature, and Depth
CTR: California Toxics Rule,
see http://water.epa.gov/lawsregs/rulesregs/ctr/
DO: Dissolved Oxygen
DOC: Dissolved Organic Carbon
MeHg: Methylmercury
NH_4: Ammonia (dissolved)
NO_2: Nitrite (dissolved)
NO_3: Nitrate (dissolved)
PAHs: Polynuclear Aromatic Hydrocarbons
PCBs: Polychlorinated Biphenyls
PBDEs: Polybrominated Diphenyl Ethers
"Pesticides": The suite of legacy pesticides that has been routinely measured by the RMP: Chlordanes (Chlordane, cis-; Chlordane, trans-; Heptachlor; Heptachlor Epoxide; Nonachlor, cis-; Nonachlor, trans-; Oxychlordane); Cyclopentadienes (Aldrin; Dieldrin; Endrin); DDTs (DDD(o,p'); DDD(p,p'); DDE(o,p'); DDE(p,p'); DDT(o,p'); DDT(p,p')); HCHs (HCH, alpha-; HCH, beta-; HCH, delta-; HCH, gamma-); Organochlorines (Hexachlorobenzene; Mirex).
PFCs: Perfluorinated Compounds
PO_4: Phosphate (dissolved)
POC: Particulate Organic Carbon
Si: Silica (dissolved)
TN: Total Nitrogen
TOC: Total Organic Carbon
TP: Total Phosphorus


RMP Status and Trends Expenses
Expense in Real $$ (Thousands)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
10-year average for
net expense, $1.3M
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Gross Expense
Net Expense After Set-Asides


Status and Trends Expenditures
Intercomp Studies 6%
Reporting 2%
Archive 4%
S&T Sport Fish 6%
S&T Sediment 10%
S&T Margins Sediment 8%
S&T Bird Eggs 8%
S&T Bivalves 6%
S&T Water 11%
USGS Nutrients 20%
USGS Suspended Sediment 19%
10-Year Window (2018-2027)
Total cost: $13M

PROGRAM MANAGEMENT

Average: 12% of the total budget

Program management includes the following activities:

Program planning
- Preparing the Detailed Workplan and Multi-Year Plan

Contract and financial management
- Tracking expenditures versus budgets
- Developing and overseeing contracts, invoicing
- Providing financial updates to the RMP Steering Committee

Technical oversight
- Internal review by senior staff of reports, presentations, posters, workplans, memos, and other communications

Internal coordination
- Workflow planning
- Tracking deliverables and preparing RMP Deliverables Stoplight and Action items reports
- Staff meetings

External coordination
- 20 meetings with external partners (SCCWRP, Delta RMP, SWAMP, and others) to coordinate programs and leverage RMP funds

Administration
- Office management assistance

Program Review
Periodically, the RMP conducts an overall peer review of the Program as a whole. Two external Program Reviews have been conducted to date, in 1997 and in 2003. The RMP has evolved considerably since the 2003 Review, with greatly enhanced planning processes that have made the Program much more forward-looking and thoroughly peer-reviewed.

A review of RMP governance was conducted in 2014 and a charter for the Program was adopted in 2015. An internal program review was conducted in 2016, focused on identifying new high priority technical areas and issues for the program to address. New science advisors, program partners, and technical focus areas were identified and will be further developed with the Technical Review Committee and Steering Committee.

The timing and scope of Program Reviews are determined by the Steering Committee. The Steering Committee does not consider a further External Program Review necessary at this time, as ongoing review of critical elements is well established.

Peer Review
Extensive peer review is a key to the cost-effective production of reliable information in the RMP. This peer review is accomplished through the following mechanisms.
- **Workgroups** include leading external scientists that work with stakeholders to develop workplans and provide feedback on project planning, implementation, and reporting
- The **Technical Review Committee** provides general technical oversight of the Program.
- **Peer-reviewed publications** provide another layer of peer review for most significant RMP studies.

GOVERNANCE

Average: 8% of the total budget

RMP meetings provide a collaborative forum for communication among regulators, regulated entities, and scientists. This forum is provided by regular meetings of organizational and technical committees to track progress and guide future work. Additional information about the function and activities of each governance group can be found in Figure 1 and 3 in this booklet.

- **Steering Committee** – quarterly meetings to track progress, provide management direction, and track financials
- **Technical Review Committee** – quarterly meetings to provide technical oversight
- **Workgroups** – annual meetings to develop multi-year work plans, guide planning and implementation of special studies and Status and Trends monitoring, and provide peer-review of study plans and reports.
- **Strategy Teams** - stakeholder groups that meet as needed to provide frequent feedback on areas of emerging importance, and develop long-term RMP study plans for addressing these high priority topics. The RMP currently has active strategy teams for sport fish monitoring, small tributary loadings, and PCBs.

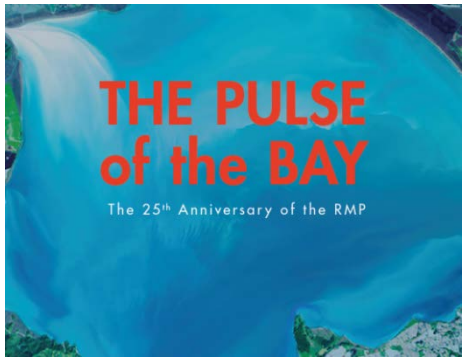
ANNUAL REPORTING & COMMUNICATIONS

Average: 10% of the total budget (+$50,000 in years when a full Pulse report is produced)

Includes the Pulse of the Bay, Annual Meeting, RMP Update, Multi-Year Plan, State of the Estuary report, RMP web site, Annual Monitoring Report, technical reports, journal publications, Estuary News, oral presentations and posters, and media outreach.

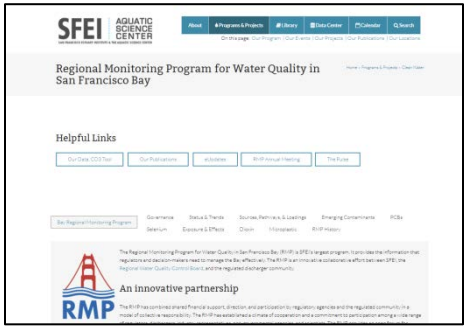
These platforms are used to make information from the RMP available to the following target audiences:

- Primary Audience
  - **RMP Participants**. Need information to encourage support for the RMP and water quality programs in the Bay. The Pulse, Annual Meeting, Multi-Year Plan, State of the Estuary report card, RMP web site, newsletter, fact sheets, oral presentations, media outreach.
- Secondary Audiences
  - **Other regional managers**. Need information to inform their decisions and evaluate effectiveness of their actions. A target audience for all communication products.
  - **Regional law and policy makers**. Need information to encourage support for water quality programs in the Bay. The Pulse, State of the Estuary report card, media outreach.
  - **Regional Scientists**. Need to share information to increase understanding of water quality and maintain technical quality of the science. A target audience for all communication products.
  - **Media, public outreach specialists, educators**. Need information to encourage support for the RMP and water quality programs in the Bay, and to protect their health. A target audience for the Pulse, Multi-Year Plan, State of the Estuary report card, RMP web site, newsletter, fact sheets, media outreach.
  - **Managers and scientists from other regions**.



Highlights for the Next Five Years

- RMP Update (2018)
- Pulse of the Bay (2019)
- Continued partnership with SFEP's "Estuary News" to reach broader audience
- Continued website improvement



www.sfei.org/rmp

QUALITY ASSURANCE AND DATA SERVICES

Average: 5% of the total budget for general support plus funding in Status and Trends for handling S&T datasets

Data Services

Data management includes formatting, uploading, and reporting each year's Status and Trends data; managing, maintaining, and improving the RMP dataset to enable easy access to RMP data through CD3; coordinating with statewide data management initiatives (e.g., SWAMP and CEDEN); supporting quality assurance evaluation, data analysis, and RMP report production.

Quality Assurance

Quality assurance includes the QA review of data submitted by the analytical laboratories; development and application of the QAPP; review of data in comparison to data quality objectives and prior results; review of congener ratios; and troubleshooting problems with the chemical analyses. Occasional special studies to assess sampling methods, analytical methods, or lab performance are conducted.

CD3 makes the RMP data available to water quality managers, stakeholders, scientists, and the public.

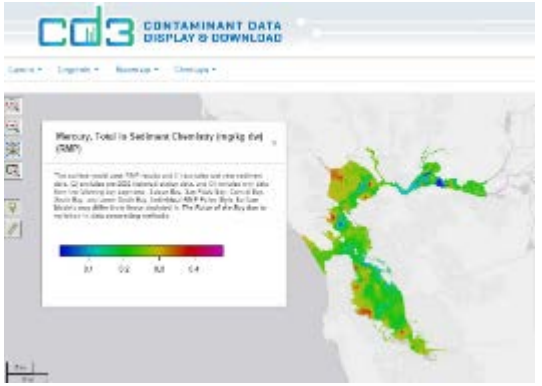
Recent Noteworthy Findings

The RMP's 25-year dataset contains approximately 1.4 million records. All data are stored in SFEI's Regional Data Center database and are comparable to CEDEN's statewide standards.

CD3 (cd3.sfei.org) is a web-based tool for accessing and visualizing RMP data along with other relevant datasets. Through the user-defined query tool, results can be downloaded in multiple formats as a tabular or spatial (KML or shapefile) file. Dynamic mapping of concentrations allows users to view spatial distributions across the Estuary, and statistical functions, such as cumulative distribution function plots, provide aggregated summaries that can be customized and downloaded for use in reports and presentations.

Priority Initiatives for the Next Five Years

- Efficiencies in Data Uploading and Formatting
- Enhancement of Data Access and Visualization Tools
- Coordination with the Estuary Portal
- Coordination with SFEI's Environmental Informatics Program
- Providing access to DMMO data



RMP STUDIES ASSISTING PERMITTEES WITH ADDRESSING SPECIFIC PERMIT CONDITIONS

Dredgers

Policy	Provision	Study
2011 Programmatic Essential Fish Habitat Agreement, Measure 1	Conduct benthic recovery study in dredged areas	Benthos Recovery After Dredging, Benthic Assessment Tools
2011 Programmatic Essential Fish Habitat Agreement, Measure 7	Conduct bioaccumulation testing evaluations for in-Bay sediment disposal. Clearly define bioaccumulation triggers for testing and subsequent permitting decisions.	S&T Sediment Monitoring– determine ambient bay sediment concentrations for bioaccumulation testing thresholds
PCBs TMDL	Monitor PCB loads in dredged materials disposed in-Bay relative to TMDL allocation	S&T Sediment Monitoring – determine ambient bay sediment concentrations for in-Bay disposal limits
Mercury TMDL	Monitor mercury loads in dredged materials disposed in-Bay relative to TMDL allocation	S&T Sediment Monitoring– determine ambient bay sediment concentrations for in-Bay disposal limits
Long-Term Management Strategy	Establish how much dredged material can be disposed of in-Bay, and where	USGS Suspended Sediment Monitoring, Bay sediment budgets

RMP STUDIES ASSISTING PERMITTEES WITH ADDRESSING SPECIFIC PERMIT CONDITIONS

Industrial Wastewater Treatment Plants

Policy	Provision	Study
Mercury Watershed Permit	Better understand mercury fate, transport, the conditions under which methylation occurs, and biological uptake	Mercury Strategy Studies: Food Web Uptake (small fish), DGTs, Isotopes
Copper Action Plan	Investigate possible copper sediment toxicity	S&T Sediment Toxicity
Copper Action Plan	Investigate sublethal effects on salmonids	Effects of Copper on Salmon (NOAA)

RMP STUDIES ASSISTING PERMITTEES WITH ADDRESSING SPECIFIC PERMIT CONDITIONS

Municipal Wastewater Treatment Plants

Policy	Provision	Study
Mercury Watershed Permit	Better understand mercury fate, transport, the conditions under which methylation occurs, and biological uptake	Mercury Strategy Studies: Food Web Uptake (small fish), DGTs, Isotopes
Copper Action Plan	Investigate possible copper sediment toxicity	S&T Sediment Toxicity
Copper Action Plan	Investigate sublethal effects on salmonids	Effects of Copper on Salmon (NOAA)
Nutrient Watershed Permit	Characterize nutrients and nutrient-related parameters in the Bay	Contributions to Nutrient Management Strategy studies

RMP STUDIES RELATED TO SPECIFIC PERMIT CONDITIONS

Urban Stormwater

MRP link: http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/Municipal/R2-2015-0049.pdf

Policy	Provision	Study or linkage
Municipal Regional Stormwater Permit (MRP)	C.8.f Pollutants of Concern Monitoring	Sources, Pathways, and Loadings Workgroup (SPLWG) / Small Tributary Loading Strategy (STLS) studies on PCBs and Hg and other POCs can fulfill a portion of requirement in conjunction with BASMAA efforts.
		ECWG in collaboration with SPLWG to conduct the required special study for emerging contaminants in stormwater to include at least PFOS, PFOA and alternative flame retardants.
MRP	C.8.g. iii Wet Weather Pesticides and Toxicity Monitoring	Possible linkage to STLS/ SPLWG studies but the details are still to be determined.
MRP	C.11/12.a Implement Control Measures to Achieve Mercury/ PCB Load Reductions	STLS/ SPLWG monitoring efforts will help identify priority watersheds / management areas where coordinated with stormwater program planning.
MRP	C.11/12.b. Assess Mercury/ PCB Load Reductions from Stormwater	STLS/ SPLWG information could be used by stormwater programs to help with refinements and documentation for methodology assessing load reductions
MRP	C.11/12.c. Plan and Implement Green Infrastructure to reduce mercury / PCB loads	STLS/ SPLWG information and the RWSM outputs can help stormwater permittees with quantifying relationships between areal extent of green infrastructure and load reductions.
MRP	C.11/12.d. Prepare Implementation Plan and Schedule to Achieve TMDL Allocations	STLS/ SPLWG information and the RWSM outputs can help stormwater permittees with the development of a reasonable assurance analysis.
MRP	C.12.g. Fate and Transport Study of PCBs: Urban Runoff Impact on San Francisco Bay Margins	PCB Strategy Team will implement required study via the multi-year Bay Margins project to develop Conceptual Models of Priority Margin Units
		STLS/ SPLWG concentrations and loads information is helping to complete the Bay margins mass balance pilot projects that aims to provide information on the fate of PCBs in Urban Runoff and impact on San Francisco Bay margins.