RMP
REGIONAL MONITORING
PROGRAM FOR WATER QUALITY
IN SAN FRANCISCO BAY

sfei.org/rmp

MULTI-YEAR PLAN

2022 ANNUAL UPDATE

March 2022

Contribution Number: 1058

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 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 from 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 put forward recommendations for special studies to the Technical Review Committee (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 who then considers this recommendation and makes the final decision on the annual workplan.

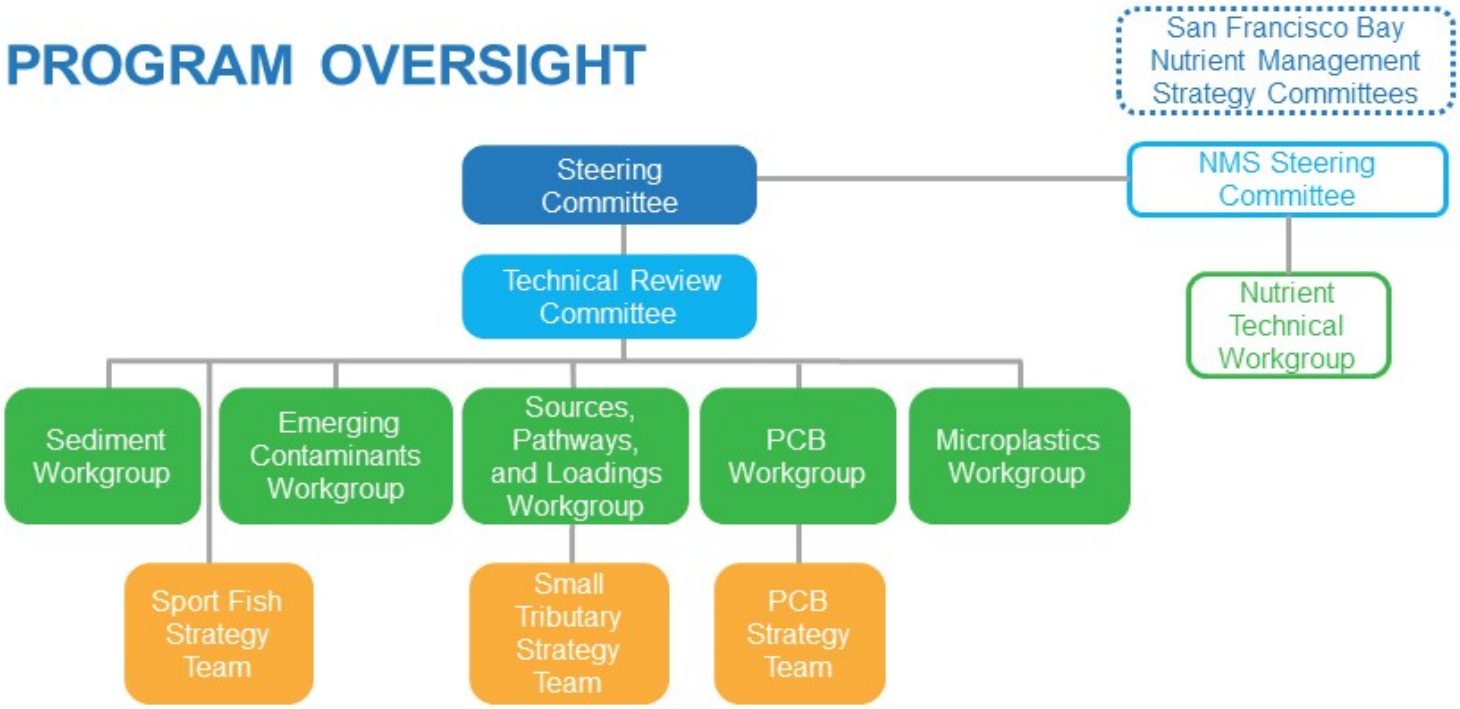
In order to fulfill the overarching goal of the RMP, the Program has to be forward-thinking and anticipate what decisions are on the horizon, so that when their time comes, the scientific knowledge needed to inform the decisions is at hand. Consequently, each of the workgroups and teams develops five-year 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 (Figure 2). In order to turn the plans into effective actions, the RMP distills prioritized lists of management questions that need to be answered (Page 8). The prioritized management questions then serve as a roadmap for scientists on the Technical Review Committee, workgroups, and 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 is achieved through the engagement of stakeholders and scientists in frequent committee and workgroup meetings.



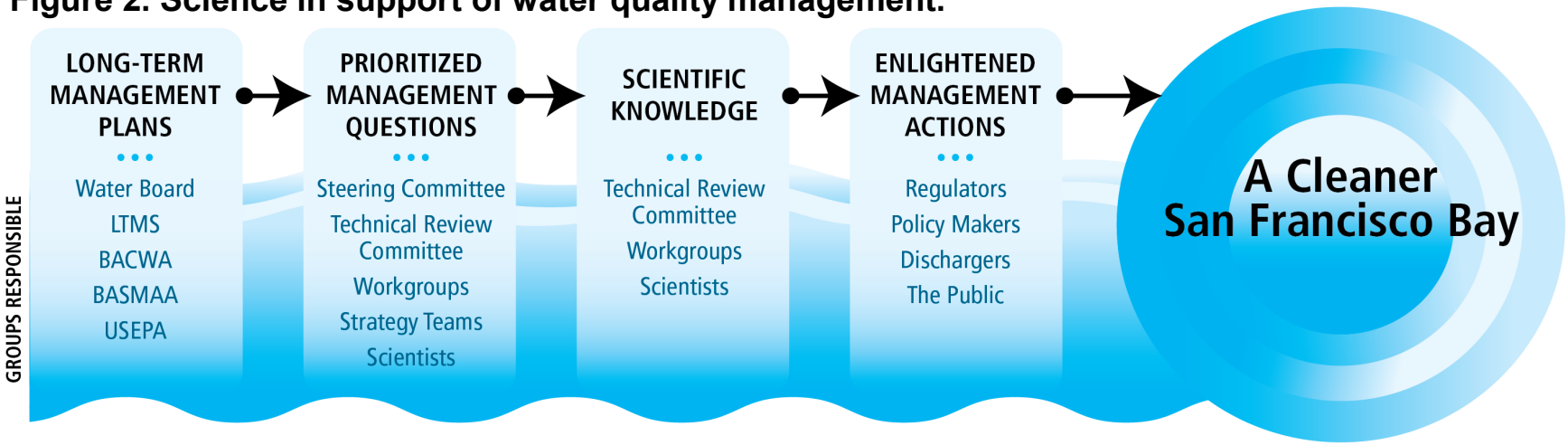
The Steering Committee consists of representatives from discharger groups (wastewater, stormwater, dredging, industrial) and regulatory agencies (Regional Water Board and U.S. Army Corps of Engineers). The Steering Committee determines the overall budget and allocation of program funds, tracks progress, and provides direction to the Program from a manager's perspective.

Workgroups report to the TRC and address the main technical subject areas covered by the RMP. The Nutrient Technical Workgroup was established as part of the committee structure of a separate effort—the Nutrient Management Strategy—and makes recommendations to the RMP committees on the use of the RMP funds that support nutrient studies. The workgroups consist of regional scientists and regulators and invited scientists recognized as authorities in the field. The workgroups directly guide planning and implementation of special studies.

Oversight of the technical content and quality of the RMP is provided by the **Technical Review Committee** (TRC), which provides recommendations to the Steering Committee.

RMP strategy teams constitute one more layer of planning activity. These stakeholder groups meet as needed to develop long-term RMP study plans for addressing high priority topics.

Figure 2. Science in support of water quality management.



Section 2 provides an overview of the RMP budget, 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: emerging contaminants, microplastics, nutrients, PCBs, sediment, selenium, and small tributary loads. Led by the stakeholder representatives that participate in these groups, each workgroup and strategy team develops 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 are 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 the 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 five 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, stormwater discharges, and municipal and industrial wastewater 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 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
  - Multi-Year Planning Workshop
  - Confirm chair(s) and Charter
  - Decision on fees for the year after next
  - Approve workplan and budget for next year
  - Decision on workgroups to be held next year
  - Discuss outcome of the Annual Meeting

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)
  - Review special studies to ensure coordination
  - Provide planning guidance to workgroups
- June
  - Recommend special studies for funding
  - Review SEP project list
  - 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
  - Discuss lab intercomparison studies
- December
  - Review annual report outline for next year
  - Informatics update
  - Present workplan for next year and outcome of Multi-Year Planning Workshop
  - Review intercalibration studies and plans

Each meeting includes feedback on proposed and ongoing studies.

Annual Workgroup Calendar

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

Multi-Year Calendar: RMP fees are approved in 3-year increments. The most recent approval was for 2023-2025. The dredger fee schedule is reviewed every 3 years. The most recent approval was for 2021. The MOU between SFEI and the Water Board for administering the RMP is amended every two years. The most recent amendment was for 2021-2022.

Current and anticipated management decisions, policies, and actions by the regulatory agencies that manage water quality in San Francisco Bay

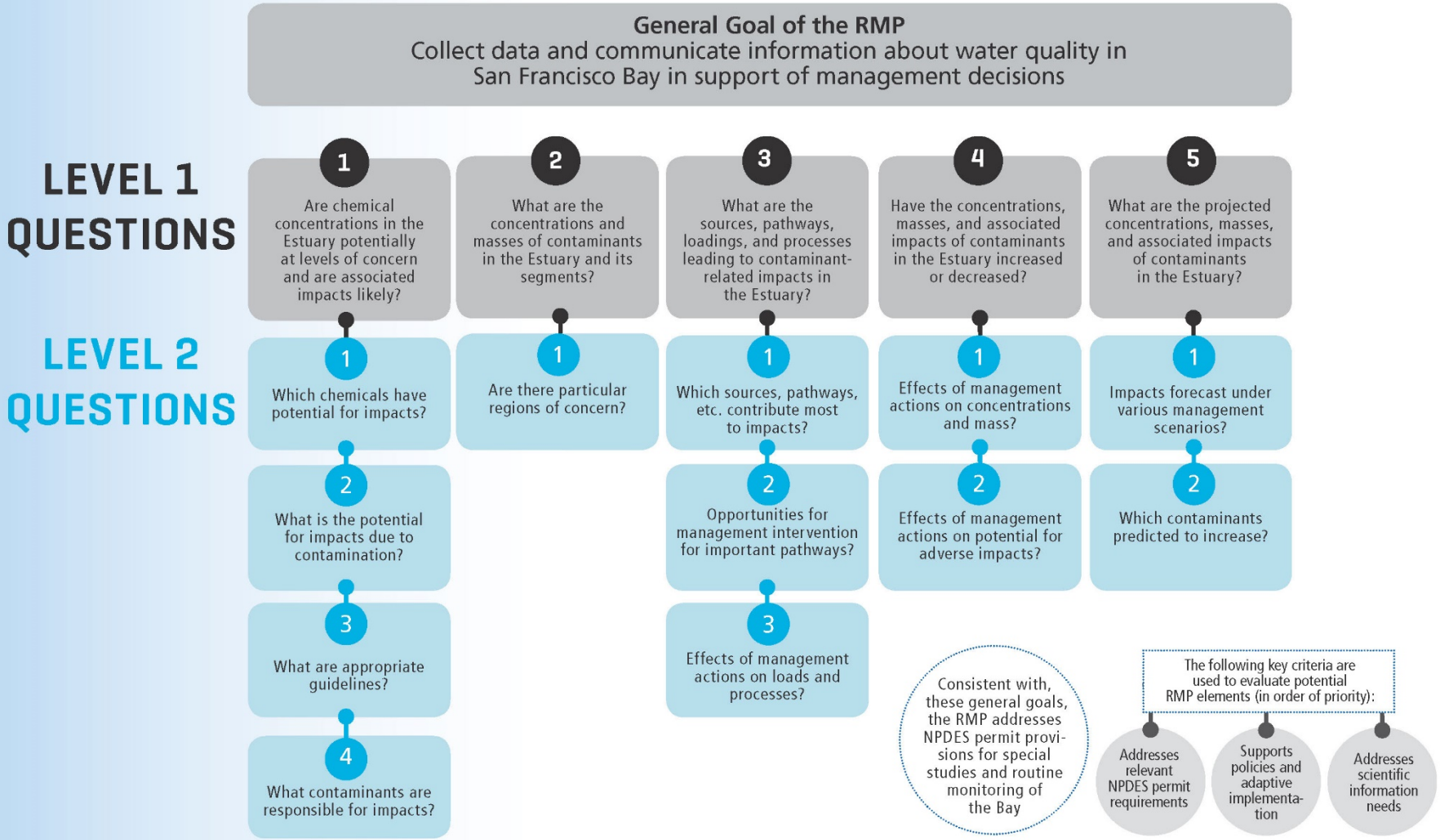
Decisions, Policies, and Actions	Timing
BAY WATERSHED PERMITS (CURRENT & NEXT RENEWAL)	
Municipal Regional Stormwater Permit	2022, 2027
Mercury and PCBs Watershed Permit for Municipal and Industrial Wastewater	2022, 2027
Nutrient Watershed Permit for Municipal Wastewater	2024, 2029
CURRENT HIGH PRIORITY DRIVERS BY TOPIC	
303(d) List and 305(b) Report Current listings and next cycle	2024
Beneficial Reuse of Dredged Sediment Review sediment guidelines+ and testing criteria Evaluate the effectiveness of strategic placement	Ongoing Ongoing
Chemicals of Emerging Concern Updates to CEC Tiered Risk-Based Framework Opportunities to inform regional actions and state and federal regulations	Annual Ongoing
Determination of Wastewater Permit Limits pH, temperature, salinity, hardness, California Toxics Rule	Ongoing
PCBs Review existing TMDL and inform revisions	Complete by 2028
Mercury Review existing TMDL and inform revisions	Complete by 2026
Nutrients Nutrient Management Strategy	Ongoing
OTHER DRIVERS BY TOPIC	
Beneficial uses Fish exposure (PCBs, Hg, and PFAS) and tribal uses	Ongoing
Copper Site specific objectives triggers+	Ongoing

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

Decisions, Policies, and Actions	Timing
OTHER DRIVERS BY TOPIC	
Current Use Pesticides EPA Registration Review of fipronil and imidacloprid DPR fipronil mitigation measures	Ongoing Ongoing
Cyanide Site specific objectives triggers+	Ongoing
Dioxins Review 303(d) listings and establish TMDL development plan or alternative	Ongoing
Dredging Permits Bioaccumulation testing triggers and in-Bay disposal thresholds+	Ongoing
Legacy Pesticides (DDT, Dieldrin, Chlordane) Monitoring recovery (biota)	Ongoing
Sediment Hot Spots Review 303(d) listings and establish TMDL development plan or alternative	2024
Toxicity New state plan on effluent and receiving water toxicity	Ongoing
POTENTIAL FUTURE DRIVERS	
Effects of reduced wastewater and stormwater inputs to the Bay	TBD
Effects of reverse osmosis concentrate discharge to the Bay	TBD
South Bay standards-related selenium assessment	TBD
Sea level rise adaptation and changes in salinity, temperature, pH, and dissolved oxygen due to climate change	TBD
Trash and Microplastics	2024
Wetland restoration permits Regional wetland monitoring (under development)	TBD

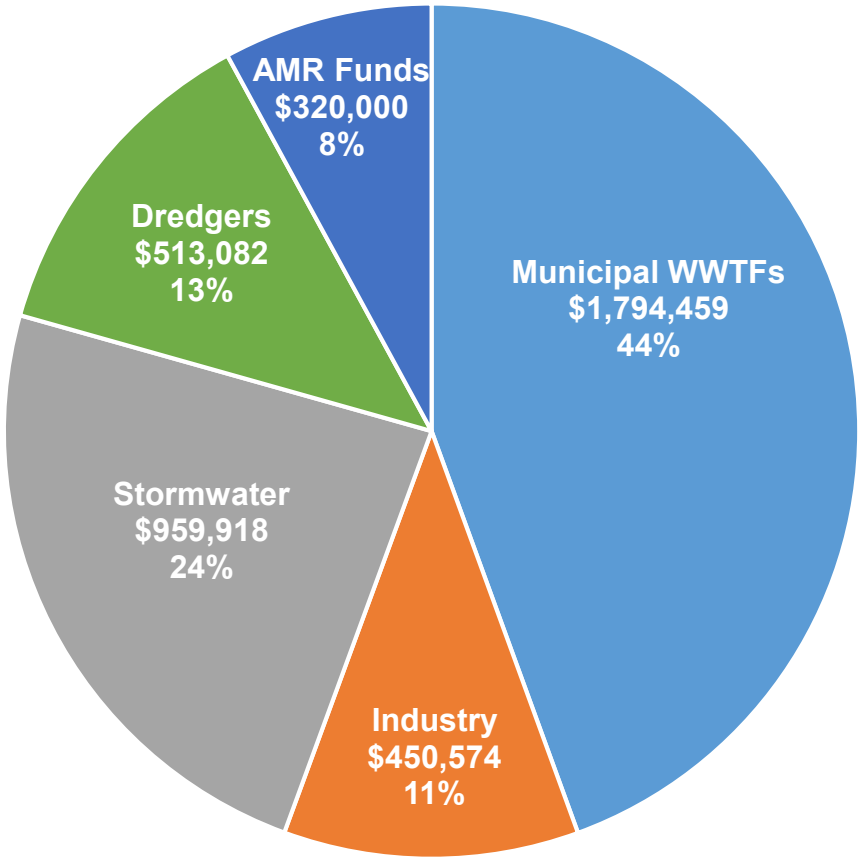
RMP GOAL AND MANAGEMENT QUESTIONS

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.



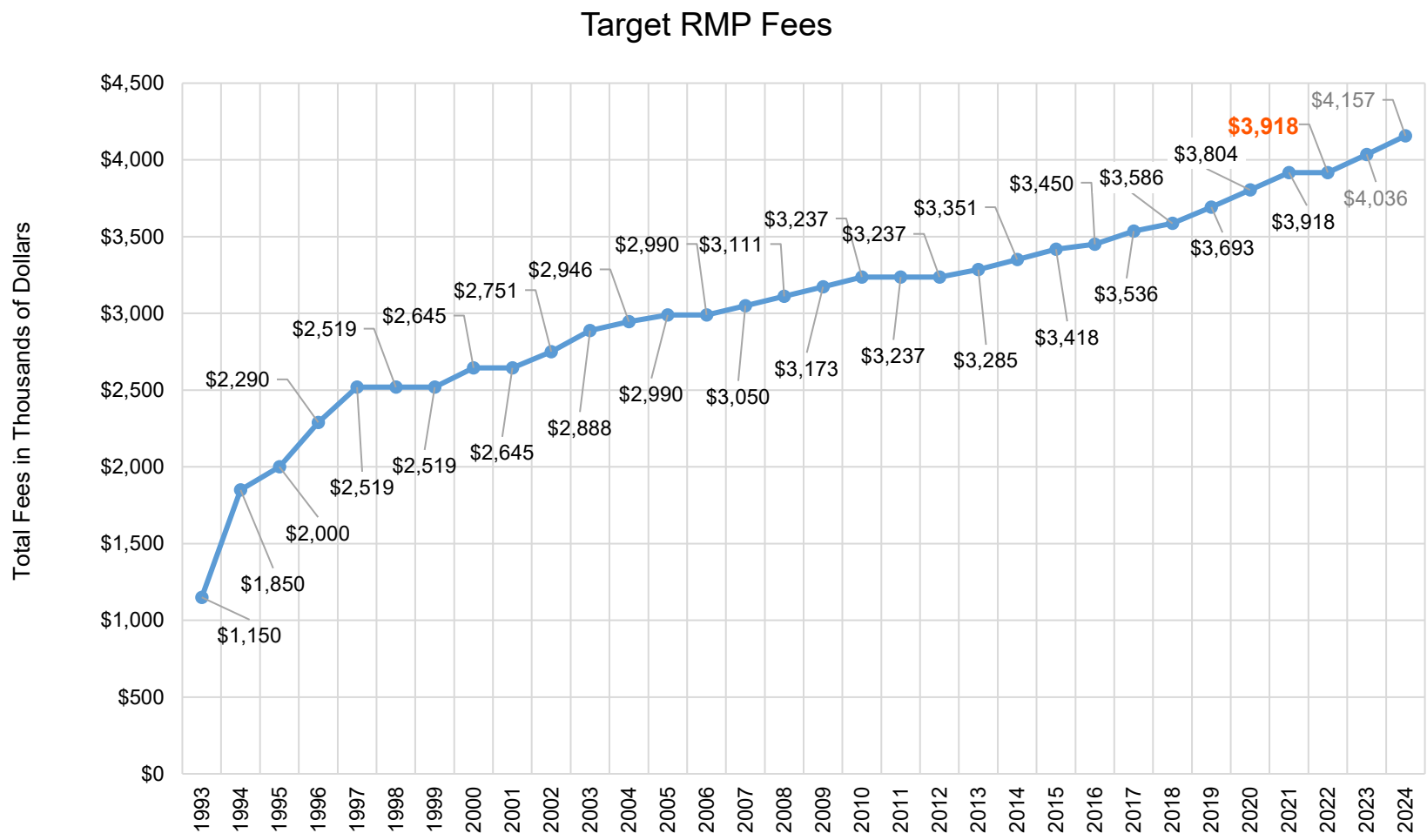
BUDGET: Revenue by Sector 2022

RMP fees are divided among four major discharger groups. Total fees in 2022 will be $3.918 million. Municipal wastewater treatment agencies are the largest contributor, and stormwater agencies are the second largest contributor. The contribution from dredgers includes $400,000 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. In addition to fees, the RMP also receives penalty funds for Supplemental Environmental Projects and Amended Monitoring and Reporting Order funds from municipal wastewater agencies.



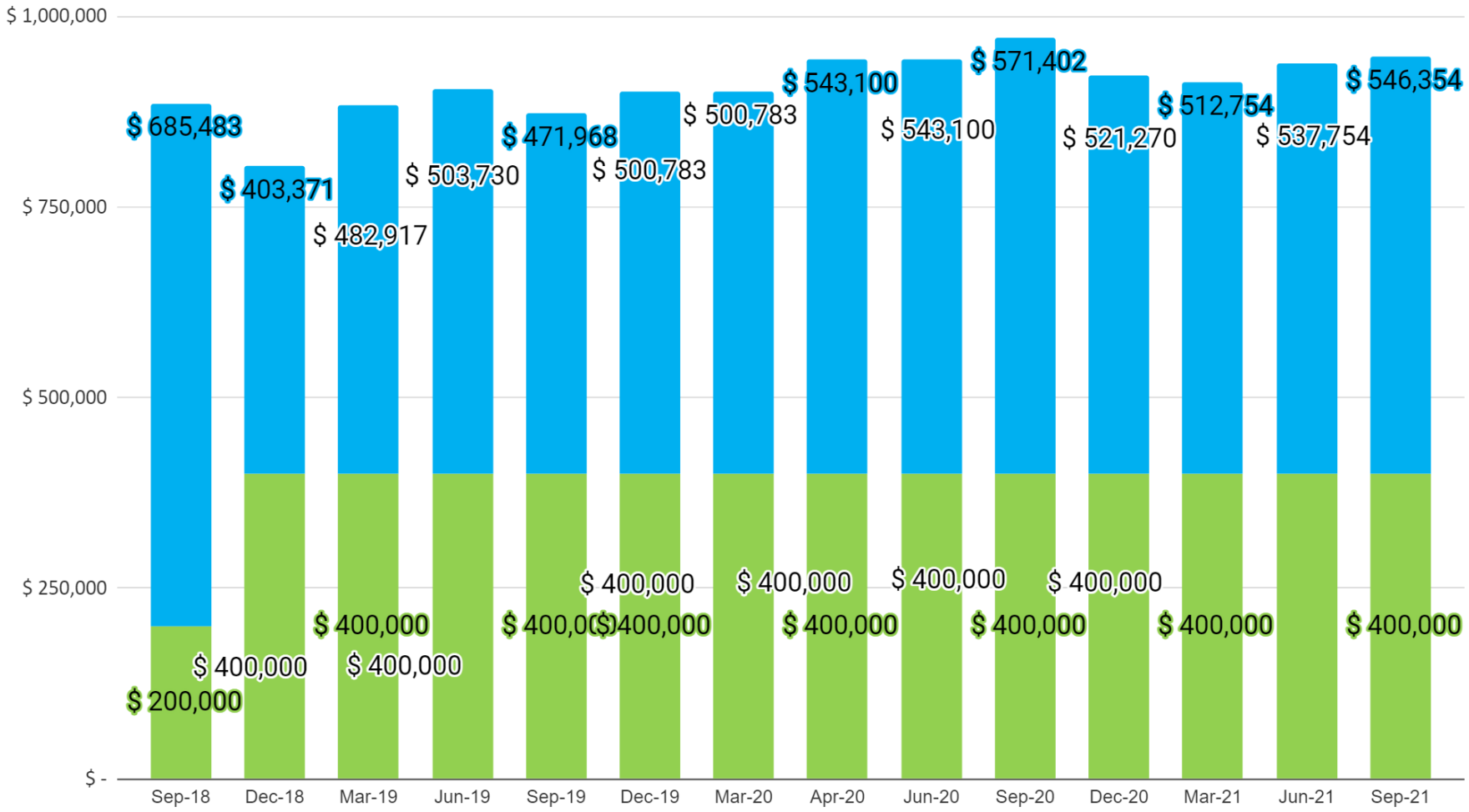
BUDGET: Revenue by Year

Target RMP fees in 2022 are $3.918 million, the same as they were in 2021. The usual fee increase was put on hold due to the economic downturn resulting from the Covid pandemic. For 2023-2025, the Steering Committee has approved a 3% increase in fees for each year. Over the past 20 years, RMP fee growth has not kept up with inflation.



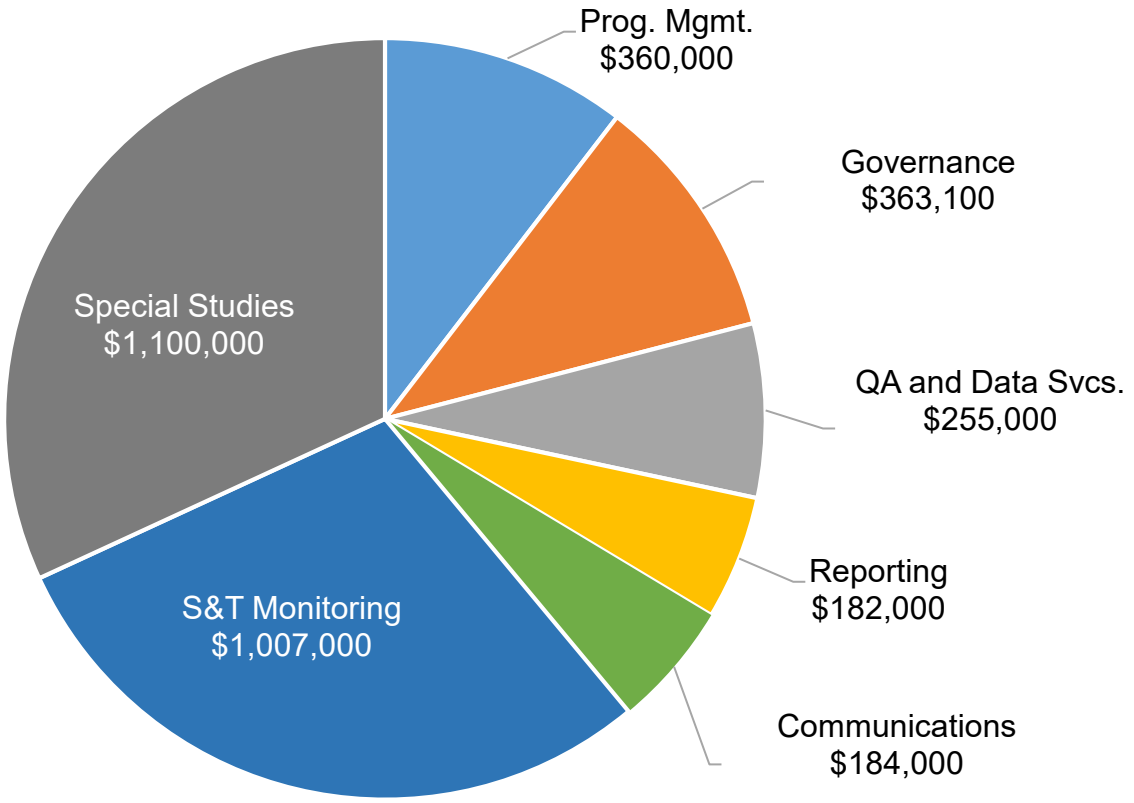
BUDGET: Reserve Funds

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 four 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 $400,000 of the Undesignated Funds should be held as a Reserve. The Steering Committee increased the Reserve amount from $200,000 to $400,000 in 2018 so that the reserve is now approximately 10% of the annual Program budget.



BUDGET: Expenses 2022

Each year, approximately 70% of the budget is spent on monitoring and special studies. Quality assurance and data systems, reporting, and communications are each approximately 5% of the budget. Governance meetings (8%) are critical to ensure that the RMP is addressing stakeholder needs and conducting studies that include peer-review from project planning through report preparation. Finally, 8% of the budget is needed for program management, including fiduciary oversight of contracts and expenditures.



ACTUAL AND FORECAST BUDGETS: Special Studies 2017-2025

RMP actual and planned expenditures on special study topics. Costs for 2016-2021 are the approved budgets. Costs for 2022 and beyond are estimates for planning based on the most recent input from the Workgroups and Strategy Teams. The funds available for 2023-2025 were estimated by assuming there will be a 3% RMP revenue increase each year, and subtracting estimated programmatic expenses (pages 47-50) and estimated Status and Trends monitoring costs (page 40).

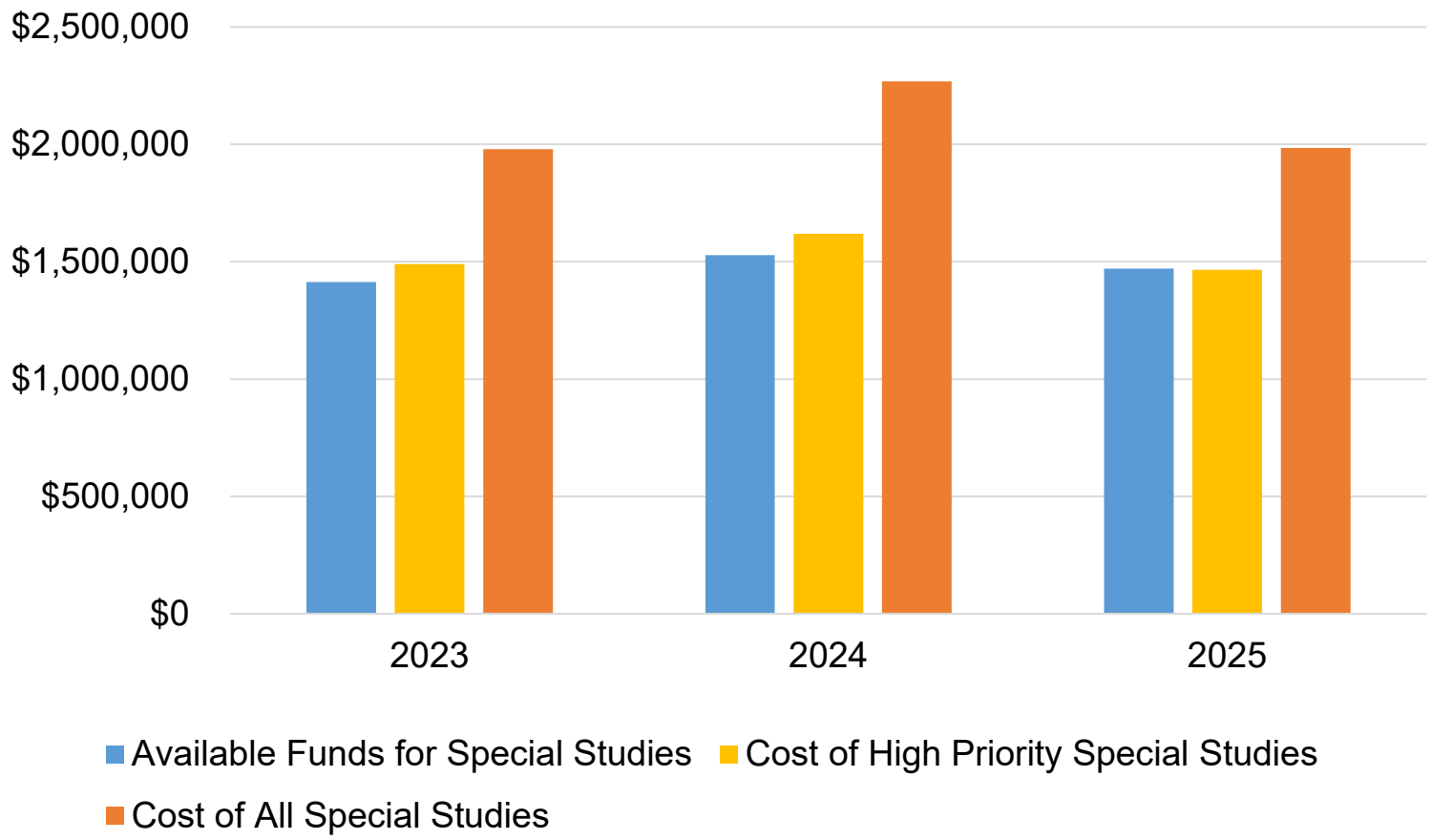
FOCUS AREA	2017	2018	2019	2020	2021	2022	2023	2024	2025
	Budget	*Budget*	*Budget*	*Budget*	*Budget*	*Budget*	*Forecast*	*Forecast*	*Forecast*
Emerging Contaminants	$284,835	$366,000	$325,000	$327,900	$338,000	$320,000	$460,000	$715,000	$705,000
Microplastic	$75,000	$46,000	$30,000	$50,000	$61,500	$35,500	$75,000	$95,000	$95,000
Nutrients*	$373,000	$350,000	$250,000	$250,000	$250,000	$250,000	$400,000	$400,000	$400,000
PCBs	$70,000	$31,000	$40,000	$101,000	$131,880	$108,000	$220,000	$189,000	$75,000
Sediment	$90,000	$215,000	$215,000	$180,500	$214,050	$185,000	$485,000	$515,000	$555,000
Selenium‡	$106,000	$10,000	$107,000	$84,000	$0	$0	$0	$0	$0
Small Tributaries*	$410,000	$302,000	$275,000	$287,000	$265,000	$193,000	$340,000	$355,000	$355,000
SPECIAL STUDIES TOTAL	**$1,515,835**	**$1,381,000**	**$1,242,000**	**$1,280,623**	**$1,260,430**	**$1,091,000**	**$1,980,000**	**$2,269,000**	**$1,785,000**
PREDICTED SPECIAL STUDIES BUDGET TOTAL						**$1,214,566**	**$1,413,186**	**$1,528,202**	**$1,470,580**
Predicted RMP Core Budget for Special Studies						$820,699	$1,083,586	$1,188,586	$1,120,907
Predicted AMR Funds						$320,000	$329,600	$339,488	$349,673

*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.
‡Funding for Selenium studies moved to the Status and Trends Program beginning in 2021.

In 2016, the RMP became eligible to receive penalty funds for Supplemental Environmental Projects. Wastewater agencies also began to provide the RMP funds through the Alternate Monitoring and Reporting (AMR) Program for additional emerging contaminants studies. These funding streams augment the core RMP budget for special studies. The AMR expired in 2021 but was replaced with a similar permit amendment for CEC monitoring starting in 2022. The SEP funds are not predictable. The AMR funds have been included in the predicted special studies budget total in the table above because these funds are predictable and are expected to increase at the same rate as the core RMP fees.

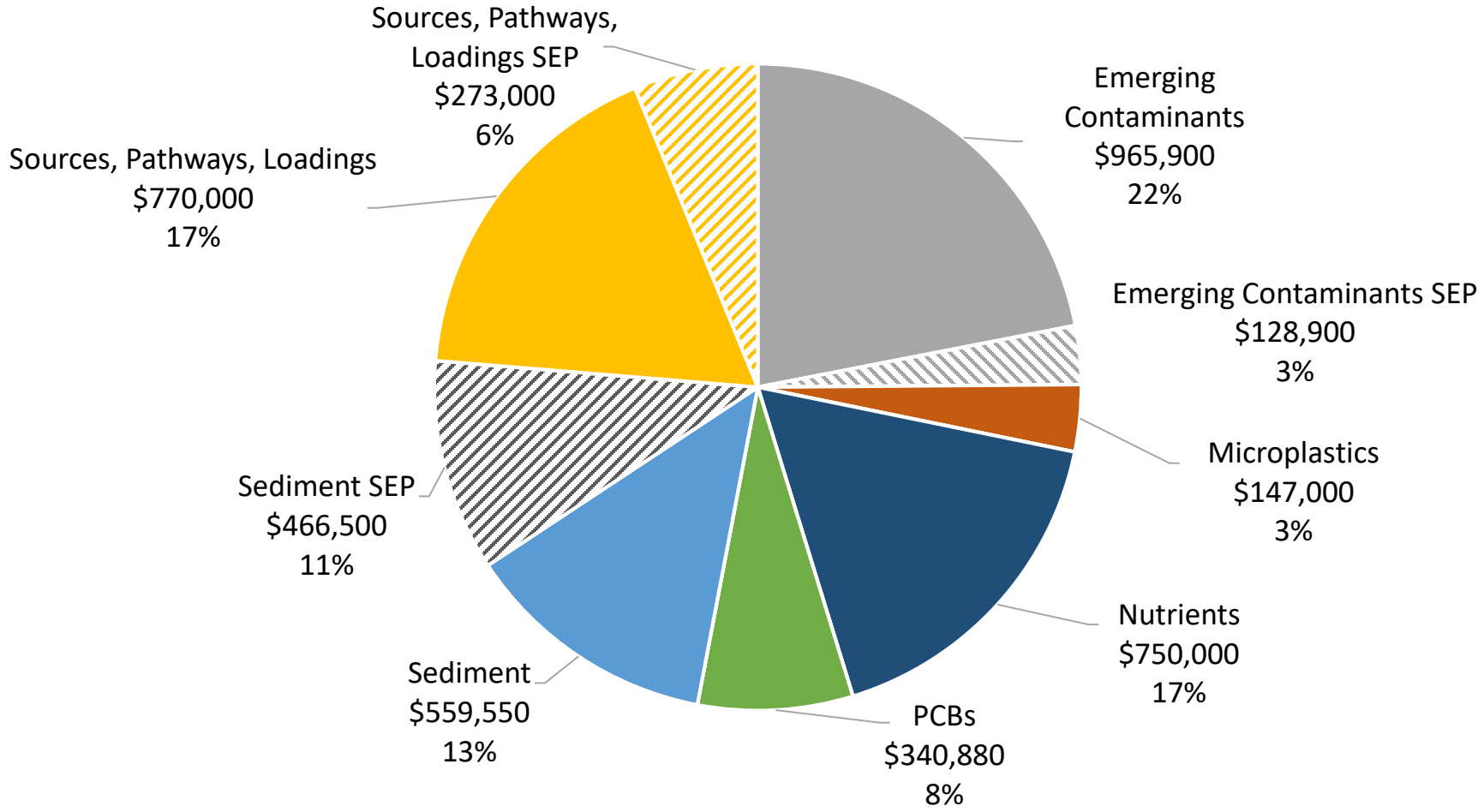
PROJECTED BUDGET: SPECIAL STUDIES 2023 to 2025

Projected funds available for special studies for 2023-2025 (blue), the cost of high priority studies (yellow), and the cost of all special studies based on the multi-year plans for each workgroup (orange). High priority studies for 2024 and 2025 should be viewed as estimates because the workgroups have not necessarily selected and prioritized studies for those years.



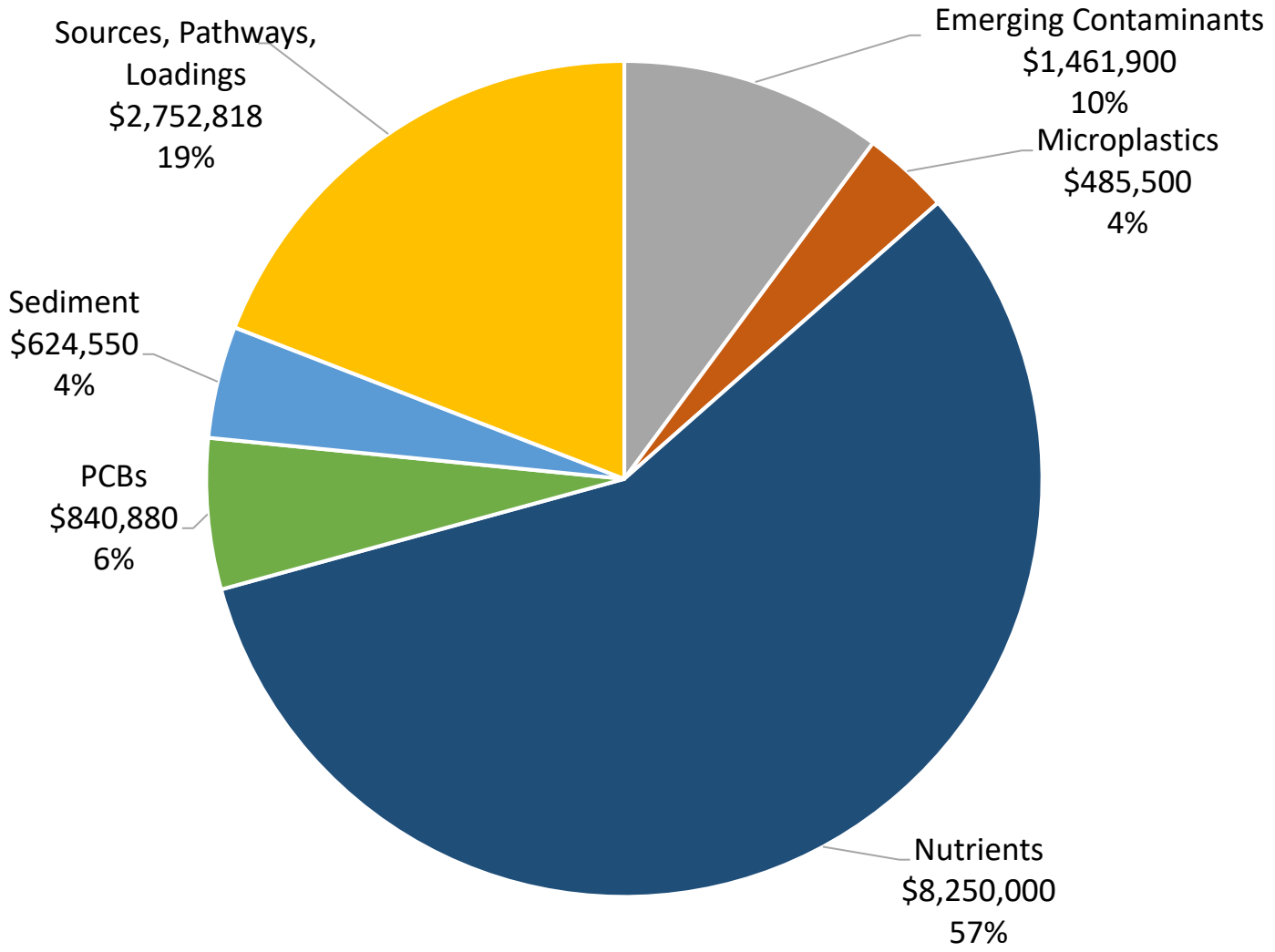
BUDGET: Special Studies and SEP funding 2020-2022

Special Studies (solid pies) and Supplemental Environmental Projects (hashed pies) funds over the past three years.
Total funds: $4,401,730



BUDGET: Total Workgroup Funding 2020-2022

Total funding for Special Studies over the past three years, including Supplemental Environmental Projects, Alternative Monitoring Requirements, RMP partner funding, and external funding. Total funds: $14,415,658



Fishing on the Bay. Photograph by Shira Bezalel.

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

State Water Board CEC Initiative

DTSC Safer Consumer Products program

Recent Noteworthy Findings

In December 2020, RMP collaborators in the State of Washington announced the findings of a decades-long search for the cause of coho salmon deaths in Puget Sound streams. The contaminant, 6PPDQ, is derived from a tire preservative (6PPD), and washes into streams with tire particles when it rains.

RMP scientists collected samples from nine Bay Area streams and storm drains during storm events as part of an ongoing multi-year study to screen urban stormwater runoff for CECs. Four samples contained levels of 6PPDQ above the concentration at which half the coho salmon die after a few hours of exposure in laboratory experiments. Coho salmon no longer reside in the Bay and its streams, but they are being restored to coastal streams from Santa Cruz to Sonoma County. They currently populate the Klamath, Smith, and Eel Rivers further north. Steelhead trout and Chinook salmon exhibit some sensitivity to tire chemicals, and studies on those species are underway.

In response to these important findings, as well as a petition from the state's stormwater leaders to act on zinc (another harmful chemical in tires), California's Department of Toxic Substances Control is considering taking action on motor vehicle tires containing zinc and 6PPD. A July 2021 public workshop on the chemicals in tires featured RMP science.

In addition, monitoring continues on CECs of moderate concern for the Bay. This spring, the RMP reviewed recent findings on alcohol and alkylphenol ethoxylated surfactants in stormwater runoff, wastewater effluent, and ambient Bay water. These ethoxylated surfactants are commonly used as detergents and emulsifiers in paints, cleaning products, personal care products, pesticides, and in the textile, paper, and metal industries. Ethoxylated surfactants were widely observed in wastewater and stormwater. While total concentrations were generally similar, a few effluent samples contained unusually high levels (up to 45 µg/L). Levels in Bay water were low, with significant detections at only two sites.

Priority Questions for the Next Five Years

1. Which CECs have the potential to adversely impact beneficial uses in San Francisco?
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

Special studies and monitoring in the RMP from 2016 to 2025. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources (e.g., SEP funds). Budgets that are starred represent funding that has been allocated for the given study within other workgroups. Bold boxes indicate multi-year studies. Items shaded in yellow are considered high priority for 2023 funding and beyond. Dollar signs indicate projected future priorities for RMP special studies funding.

Element	Study	Funder	Questions addressed	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Strategy	CEC Strategy[1] (not a Special Study after 2020)	RMP	1-6	48	50	65	70	75	*60*	*90*	*60*	*60*	*60*
	Stormwater Monitoring Strategy	RMP	1,2							50	55		
	Strategy-driven Stormwater CECs Monitoring	RMP	1,2								125	125	125
MODERATE CONCERN CECs													
PFAS	PFAS: Synthesis and Strategy	RMP	1-6		56								
	Margin Sediment Archiving	RMP	1			2.5							
	PFOS/PFOA Bay Model	Interwaste	1,2,3,5			(7)							
	Stormwater PFAS[2]	RMP	1,2				33	40	29.6	20			
	North Bay Margin Sediment PFAS ($40-$125k)	SEP proposal	1,2,4,6										
	PFAS in Ambient Bay Water	RMP	1,4,6						50				
	PFAS in Influent, Effluent, Biosolids; Study TBD, est. value	BACWA	1,2,4,6						(130)	(240)			
	Harbor Seal (PFAS and Nonpolar NTA; SEP proposal, ~$100k)[3]	SEP or RMP	1,4,6								50	50	
	PFAS Air Monitoring											60	
	RMP Status and Trends[4]	RMP S&T	1,4	E 4*		E 4*	F 9*			E, wet 15.5*	W, S, wet 55.5*	E, F, wet 28.7*	W 13*
Alkyl-phenols and Alkyl-phenol Ethoxylates	Margin Sediment Archiving	RMP	1,4			2.5							
	Stormwater Ethoxylated Surfactants[2]	RMP	1,2				33	40	29.6	20			
	Ethoxylated Surfactants in Water, Margin Sediment, and Wastewater	RMP	1,2,4				123						

Element	Study	Funder	Questions addressed	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
	Followup Study	RMP	1,2,4							30	30		
Bisphenols	Bisphenols in Bay Water	RMP SIU	1		50								
	Bisphenols in Stormwater	RMP	1,2					21	29.6	20			
	Bisphenols in Wastewater, Sediment	RMP	1,2					72					
	Bisphenols in Sport Fish, Bivalves	RMP	1									80	
	RMP Status and Trends[4]	RMP S&T	1,4						W 13*	wet 8.5*	W, S, wet 47.5*	wet 8.5*	W 13*
Organo-phosphate Esters	Organophosphate Ester Flame Retardants in Ambient Bay Water	RMP ECCC	1,4		47								
	Stormwater Organophosphate Ester Flame Retardants[2]	RMP	1,2				33	40	29.6	20			
	OPE Air Monitoring	RMP	1,2,3,6									50	
	RMP Status and Trends[5]	RMP S&T	1,4						W 17*	wet 11*	W, wet 28*	wet 11*	W 17*
Fipronil	Fipronil, Degradates, Imidacloprid in Wastewater and Biosolids	RMP ASU	1,2,3	30 (8)									
	RMP Status and Trends[4]	RMP	1,3,4			S 12*							
Imida-cloprid	Imidacloprid, Degradates, and other Neonicotinoids in Bay Water	RMP	1		40								
LOW or POSSIBLE CONCERN CECs													
PBDEs	RMP Status and Trends[4]	RMP S&T	1,3,4	B, E 24*		S, E 42*	F 24*			E 11.5*	S 20.5*	F 24*	
Pharma-ceuticals	Pharmaceuticals in Wastewater	RMP POTWs	1,2,4	(68)		30							
	Antibiotics and QACs in Surface Sediment and Cores	U Minn	1,3,4			(8)							
	Pharmaceuticals in Wastewater, Water & Archived Sediment	RMP	1,2,4										180
Plastic Additives	Phthalates and Replacements in Archived Sediment	RMP	1,4										70

Element	Study	Funder	Questions addressed	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Personal Care/ Cleaning	Triclosan in Small Fish	RMP	1		41								
	Musks in Water & Sediment[5]	RMP	1			64.5							
	Siloxanes in Sediment and Effluent	SWEAM DTSC	1,2			(15)							
	Sunscreens in Wastewater	MMP	1,2					(36.5)					
	QACs in Wastewater	MMP NSF	1,2,4						(58.2) (20)				
	QACs & New Concerns in Bay Water, Wastewater[6]											40	
Pesticides	DPR Priorities in Water & Sediment[5]	RMP USGS	1,2,3			64.5 (6.8)							
	Ag Pesticides in Water & Sediment of North Bay Margins (~$100k)	SEP proposal	1,2										
	Antimicrobials in Bay Water, Wastewater[6]	RMP	1,2									30	
PHCZs	Sediment, Tissue	SIU	1	(20)	(40)								
Brominated Azo Dyes	Archived Sediment (~$60k)	SEP proposal	1										
Building Materials	Isothiazolinone Biocides and Other Contaminants in Stormwater (~$50k)	U Iowa SEP Proposal	1,2				(2)						
	New concerns	RMP	1										50
Chlorinated Paraffins	Chlorinated Paraffins (medium-long) in Sediment (~$60k, 2022)	SEP proposal	1										
	Chlorinated Paraffins in Ambient Bay and Pathways	RMP	1										120
Vehicles, Roadways	Tire, Roadway Contaminants Follow-up from NTA, Stormwater[2]	RMP	1,2				33	40	29.6	20			
	Tire Contaminants Wet Season Water Screen	RMP	1,2							50			
	Tires Strategy Followup Study	RMP	1,2								50		
NON-TARGETED & OTHER STUDIES													
Non-targeted	Non-targeted Analysis of Water-soluble CECs	RMP / Duke / AXYS	1,2	52 (10) (6)									

Element	Study	Funder	Questions addressed	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
	Non-targeted Analysis of Sediment	RMP	1,2			101							
	Non-targeted Analysis of Runoff from North Bay Wildfires	RMP DTSC Water Brd Duke	1,2			36 (20) (27) (3)							
	Harbor Seal (PFAS and Nonpolar NTA; SEP proposal, ~$100k)[3]	SEP proposal	1,4,6								50	50	
	NTA Data Mining of Water & Sediment Findings	RMP	1,2								40		
	Follow-up Targeted Study (data mining results)	RMP	1									70	
	Non-targeted Analysis of Bay Fish	RMP	1									100	
	Microplastic Additives NTA Study[7]	RMP	1										100
Other	Toxicology	RMP	1				15		60		60	60	60
RELEVANT STUDIES IN OTHER WORKGROUPS													
Bioassay (EEWG)	Linkage of In Vitro Estrogenic Assays with In Vivo End Points	RMP SCCWRP UF	1,2		45								
Modeling (SPLWG)	Integrated Monitoring and Modeling Strategy - CEC Conceptual Model	RMP	1,2,4						50				
Modeling (SPLWG)	CEC Stormwater Load Modeling Exploration	RMP	2							25			
Strategy (MPWG)	Tires Strategy	RMP	1,23,6							25.5			
RMP-funded Special Studies Subtotal - ECWG				**130**	**284**	**366**	**325**	**328**	**258**	**230**	**460**	**715**	**705**
High Priority Special Studies for Future RMP Funding											**335**	**465**	**405**
RMP-funded CEC Strategy (not a Special Study after 2020)									**60**	**90**	**60**	**60**	**60**
RMP Status and Trends Analytical Costs for CECs				**28**	**0**	**58**	**33**	**0**	**30**	**46.5**	**151.5**	**72.2**	**43**
RMP-funded Special Studies Subtotal – Other Workgroups				**0**	**45**	**0**	**0**	**0**	**50**	**50.5**			
MMP & Supplemental Environmental Projects Subtotal				**0**	**0**	**0**	**0**	**36.5**	**58.2**				
Pro-Bono & Externally Funded Studies Subtotal				**112**	**90**	**37**	**2**	**0**	**150**	**240**			
OVERALL TOTAL				**270**	**419**	**461**	**360**	**364.5**	**606.2**	**657**	**671.5**	**847.2**	**808**

1 – The CEC Strategy funds preparation of RMP CEC Strategy Revisions, Updates, and Memos; it also funds literature review, scientific conference attendance, and responses to information requests from RMP stakeholders. A Revision to the CEC Strategy is planned for 2022, resulting in a higher funding request than in the prior years. While previously considered a Special Study, as of 2021 the CEC Strategy is considered part of program management.

2 – The multi-year (2019-2022) stormwater study includes five groups of analytes: PFAS, ethoxylated surfactants, organophosphate esters, bisphenols (added year 2), and targeted stormwater analytes identified via non-targeted analysis. The total projected cost ($586k) is spread across five groups and four years.
3 – The proposed non-targeted analysis of harbor seal tissues includes investigations of PFAS (targeted and suspect screening; $100k) and nonpolar compounds ($100k).
4 – When a CEC may be included in the the RMP Status and Trends monitoring, there is a code in the cell denoting the matrix for which monitoring is proposed: W = water; S = sediment; B = bivalve; E = eggs; F = fish. Approximate analytical costs are provided to indicate CECs resources provided by Status and Trends monitoring. A review of the Status and Trends design has resulted in expected modifications over future years, with scheduling for some activities uncertain at this time. A new designation, “wet,” indicates trial wet season water monitoring, which may be funded in 2022. For purposes of this planning document, sediment monitoring activities have been indicated as occurring in 2023, though a specific schedule has not been established.
5 – This 2018 special study ($129k) included analyses of pesticides and fragrance ingredients; the budget has been split between these two groups.
6 – A special study suggested for 2024 could analyze cleaning product ingredients including QACs and other antimicrobials; costs are split among these three groups.
7 – A suggested special study that uses non-targeted analysis to identify additives in microplastics is listed as potentially co-funded via both ECWG and MPWG.

Photo by Melissa Foley

MICROPLASTIC

Relevant Management Policies and Decisions

State-wide microplastic strategy and state-wide drinking water monitoring

Federal policy on microplastics and microfiber pollution

State agency decisions on regulation of chemicals in tires and microplastics

Regional bans on plastic bags, foam packaging materials, plastic straws, and proposed bans on single-use plastic

State and Federal bans on microbeads

State-wide trash requirements

Municipal pollution prevention strategy including green stormwater infrastructure

Potential for public outreach and education regarding pollution prevention for microplastics and macroplastics that can disintegrate to microplastics

Recent Noteworthy Findings

Microplastics are commonly defined as plastic particles smaller than 5 mm.

Microplastics include fragments, fibers or fiber bundles, pellets or spheres, films, and foam.

Microplastics have been evaluated in Bay surface water, sediment, prey fish, bivalves, and coastal ocean waters for microplastics. Two pollution pathways have also been evaluated, urban stormwater runoff and treated wastewater effluent. Recent investigations provide one of the first comprehensive regional studies of microplastics published to-date, and was made possible with a generous grant from the Gordon and Betty Moore Foundation and additional financial support from the RMP, EBMUD, City of Palo Alto, Patagonia, the Virginia Cabot Wellington Foundation, and the Ocean Protection Council.

Urban runoff was identified as a major pathway for microplastics to enter receiving waters, with average concentrations of microplastics in urban stormwater approximately two orders of magnitude higher than those in treated wastewater effluent.

Nearly half of the particles identified in stormwater were black rubbery fragments that were identified as tire wear particles. Subsequent modeling publications support our estimate that tire wear fragments are among the most important sources of microplastics to the Bay and to the environmental globally, with reported microplastic loads of ranging from 3-6 kg/year per capita.

Fibers were the second most common class of microplastics observed in stormwater. However, there is minimal understanding of what are the major sources of fibers observed in urban stormwater.

Air transport of microplastics is a key data gap in our understanding of microplastic sources and pathways. Air transport is particularly important for both tire wear particles and fibers because both types of particles have characteristics that make them easily suspended in air and potential to be transported long distances. Other important data gaps remain including exposure of Bay aquatic organisms and risk for adverse impacts, and the effects of current and future solutions implemented to reduce microplastic pollution.

Priority Questions for the Next Five Years

1. How much microplastic pollution is 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 could be effective in reducing microplastic pollution?

MULTI-YEAR PLAN FOR MICROPLASTICS

Microplastic studies and monitoring in the RMP from 2016 to 2025. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external partners. Italicized dollar amounts indicate external funds that are needed but not yet secured. Items shaded in yellow are considered high priority for the 2023-2025 funding cycle. Bold boxes indicate multi-year studies.

Element	Study	Funder	Questions Addressed	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Strategy	Microplastic Strategy	RMP Patagonia	1,2,3,4,5	25			15	20 (30)	10	10	13	13	13
	Additional funding for the SF Bay Microplastics Project	RMP Others*	1,2,3,4,5		75 (40)		(50)						
	Tires Strategy	RMP								25.5			
Monitoring biota	Bivalves	RMP	1,2			46							
	Sport Fish (archive)	RMP					15						
	Prey Fish	Moore Foundation			(130)								
	Assessing Information on Ecological Impacts	RMP NSF/CCCSD/External						(50)	18 (7.5+50)				
Monitoring water and sediment	Open Bay and Margins Sediment	RMP Moore/External	1,2,3		(100)								20 (50)
	Surface Water: Bay and Sanctuaries	Moore Foundation Bay Keeper/External			(238)								(50)
	Limited particle size distribution analysis to refine water and sediment measurements	RMP NSF/CCCSD/External										20	
	Sediment core (archive)	RMP							3.5				
Characterizing sources, pathways, loadings, processes	Wastewater	Moore/SCCWRP	1,3,5			(45)			(26)				
	Stormwater	Moore/External				(45)							
	Stormwater Conceptual Model	RMP OPC						30 (30)	30 (90)				
	Investigate sources and pathways to inform management (e.g. air monitoring, understanding microplastics as possible transport pathway for bisphenols, and other moderate concern CECs)	RMP External/ECWG/SPLWG									75 (75)	75 (75)	75 (75)
	Tire market synthesis to inform science (pro bono)	UC Berkeley								(20)			

	Tire particle characterization fate and transport	SEP/External									(110)		
	Green stormwater infrastructure: Evaluating the efficacy of rain gardens	EPA/External			(10)					(62)	(62)	(62)	
	Model transport in Bay & ocean	Moore/External				(80)							
Evaluating control options	Options for source control	Moore Foundation	1,5			(40)							
Synthesis	Synthesize findings (e.g., report, factsheet, video, symposium	Moore Foundation	1,3,5				(290)						
RMP-funded Special Studies Subtotal – MPWG				**25**	**75**	**46**	**30**	**50**	**61.5**	**35.5**	**75**	**95**	**95**
High Priority Special Studies for Future RMP Funding											**75**	**75**	**75**
Externally-funded Special Studies Subtotal				**0**	**518**	**210**	**340**	**110**	**173.5**	**82**	**247**	**137**	**175**
OVERALL TOTAL				**25**	**593**	**256**	**370**	**160**	**235**	**117.5**	**335**	**245**	**283**

NUTRIENTS

Relevant Management Policies and Decisions

Developing nutrient numeric endpoints and assessment framework

Evaluating need for revised objectives for dissolved oxygen and other parameters

Assessing water quality impairment status

Implementing NPDES permits for wastewater and stormwater

Recent Noteworthy Findings

High frequency sensors are providing continuous data at nine sites in South Bay and Lower South Bay. These data show that elevated phytoplankton biomass and low dissolved oxygen are frequently observed in Lower South Bay margin habitats and suggest that water from the salt ponds introduces high phytoplankton biomass into Lower South Bay sloughs and increases the potential for low dissolved oxygen events.

Unprecedented fog and smoke coverage from wildfires in 2020 led to the lowest dissolved oxygen concentrations ever observed in Lower South Bay. The absence of light resulted in a shift in the metabolic balance of the system, causing oxygen concentrations to plummet, putting fish and other biota at risk.

Progress continues on model simulations of nutrient transport, phytoplankton blooms, oxygen cycling, biogeochemical processes, and quantifying uncertainty in models.

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. To what extent is nutrient over-enrichment, versus other factors, responsible for current impairments?

4. What management actions would be required to mitigate such impairments and protect beneficial uses?

5. Under what future scenarios could nutrient-related impairments occur and which of these scenarios warrant pre-emptive management actions?

6. What management actions would be required to protect beneficial uses under those scenarios?

7. 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?

8. When nutrients exit the Bay through the Golden Gate, where are they transported and how do they influence water quality in coastal areas?

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

The Nutrient Management Strategy (NMS) is a major collaborative regional science program. The RMP funds monitoring and special studies that are complementary to the studies funded by the NMS.

MULTI-YEAR PLAN FOR NUTRIENTS

Special studies and monitoring in the RMP from 2016 to 2025. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources. The projects funded by non-RMP sources are not specified; only general allocations are indicated. This table does not show nutrient monitoring done for Status & Trends. Items included in the planning budget are shaded in yellow. Bold boxes indicate multi-year studies.

Element	Study	Funder	Questions Addressed	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Strategy	Program coordination	RMP	1-5										
Monitoring	Moored sensors	RMP	1	39.3	220	230	250	250	250	250	400	400	400
	Ship-based channel monitoring	RMP	1		153	120							
	Algal biotoxins	RMP SEP	1			(195)							
	Stormwater loads	RMP	3										
	Monitoring program development	RMP	1,3	20									
	Dissolved oxygen	RMP		200									
	HF mapping	RMP											
	Chl-a analysis	RMP		15.7									
	Data management	RMP		25									
Modeling	Modeling	RMP SEP	4,5		(240)								
Synthesis	Conceptual model report	RMP	1-5										
	Synthesis: nutrient loads and data gaps	RMP	3										
RMP-funded Special Studies Subtotal				**300**	**373**	**350**	**250**	**250**	**250**	**250**	**400**	**400**	**400**
High Priority Special Studies for RMP Funding											**400**		
RMP Supplemental Environmental Projects Subtotal				**0**	**240**	**195**	**0**						
Pro-Bono & Externally-funded Special Studies Subtotal[1]				**880**	**1437**	**1952**	**1480**	**2200**	**2200**	**2200**	**2200**	**2200**	**2200**
OVERALL TOTAL				**1372**	**2022**	**2537**	**1730**	**2450**	**2450**	**2450**	**2600**	**2600**	**2600**

[1] Funding provided by BACWA, CCCSD, DSP, Regional San, City of Palo Alto, City of Sunnyvale, State Water Resources Control Board, and DWR-EMP for a range of studies that support the Nutrient Management Strategy. The descriptions of these projects are not included here for simplicity. More details about the projects being funded by the Nutrient Management Strategy can be found here: http://sfbaynutrients.sfei.org/books/nutrient-strategy-goals-and-work-elements

PCBs

Relevant Management Policies and Decisions

PCBs TMDL – support for appropriate changes to the TMDL

NPDES Municipal Regional Stormwater Permit and wastewater permit requirements

Focusing management actions and/or locations for reducing PCB impairment (upland)

Determining cleanup priorities (in-Bay)

Recent Noteworthy Findings

In 2019, shiner surfperch had a Bay-wide average concentration 18 times higher than the TMDL target. These concentrations have resulted in an advisory from the Office of Environmental Health Hazard Assessment (OEHHA) recommending no consumption for all surfperch in the Bay. Concentrations in shiner surfperch and white croaker show limited signs of decline.

Urban stormwater is the pathway carrying the greatest PCB loads to the Bay and with the greatest load reduction goals. Concentrations of PCBs and mercury on suspended sediment particles from a wide range of watersheds have been measured as an index of the degree of watershed contamination and potential for effective management action. The three sites with the highest estimated particle PCB concentrations as of 2019 were Pulgas Pump Station South (8,220 ng/g), Industrial Rd Ditch in San Carlos (6,139 ng/g), and Line 12H at Coliseum Way in Oakland (2,601 ng/g).

Assessments of three “priority margin units” (Emeryville Crescent, San Leandro Bay [SLB], and the Steinberger Slough/Redwood Creek area [SS/RC]) established conceptual models as a foundation for monitoring response to load reductions and for planning management actions. A key finding was that PCB concentrations in sediment and the food webs in the Crescent and SLB could potentially decline fairly quickly (within 10 years) in response to load reductions from the watershed. In contrast, recovery in SS/RC appears likely to be ultimately limited by the relatively high PCB concentrations that prevail in the South Bay compared to other subembayments.

In spite of the expected responsiveness of SLB, extensive field studies there have documented persistent sediment contamination that is likely due to continuing inputs 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?
    a. What would be the impact of focused management of PMU watersheds?
    b. What would be the impact of management of in-Bay contaminated sites (e.g., removing and/or capping hot spots), both within the sites and at a regional scale?

MULTI-YEAR PLAN FOR PCBs

Special studies and monitoring in the RMP from 2019 to 2027. Numbers indicate budget allocations in $1000s. Items shaded in yellow are considered high priority for the 2023-2025 funding cycle. Budgets that are starred represent funding that has been allocated for the given study within other workgroups. Bold boxes indicate multi-year studies. Budgets in parentheses represent funding or in-kind services from SEPs. ss – Steinberger Slough; sl – San Leandro Bay

Category	Study	Funder	Qs	2019	2020	2021	2022	2023	2024	2025
General	Develop and update multi-year workplan and continued support of PCB Workgroup meetings	RMP	1a,b	10	10					
	Upgraded Fate Model	RMP	1a,b			45	75	145	75	75
	Watershed-Bay Model	SEP	1a,b			(200)*				
	Margins Ambient	RMP								
PMU	PMU Stormwater	SEP	1a	(40)						
	PMU Sport Fish Monitoring (3 PMUs)	SEP	1a	(60)[a]					50[a]	
	Passive Samplers	RMP	1a		91ss	87sl				
	PMU Prey Fish Monitoring (4 PMUs)	RMP	1a				26ss[b]	37ss[c]	64sl	
	PMU Sediment	RMP	1a,b				26ss[b]	38ss[c]		
PMU/General	Food Web Model	RMP	1a,b							
RMP-funded Special Studies Subtotal – PCBWG				**10**	**101**	**132**	**127**	**220**	**189**	**75**
High Priority Special Studies for Future RMP Funding								**220**	**189**	**75**
RMP-funded Special Studies Subtotal – Other Workgroups				**0**	**0**	**200**	**0**			
RMP Supplemental Environmental Projects Subtotal				**60**	**0**	**200**	**0**			
Pro-Bono & Externally-funded Special Studies Subtotal				**40**	**0**	**0**	**0**			
OVERALL TOTAL				**170**	**101**	**132**	**127**	**220**	**189**	**75**

[a] Shiner surfperch; [b] Sample collection; [c] Sample analysis and reporting

SEDIMENT

The mission of the Sediment Workgroup is to provide technical oversight and stakeholder guidance on RMP studies addressing questions about sediment delivery, sediment transport, dredging, and beneficial reuse of sediment.

Relevant Management Policies and Decisions

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

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

PCB TMDL

Mercury TMDL

Regional Restoration Plans[1]

Recent Noteworthy Findings

A 2018 RMP special study used PCB data from the DMMO database to estimate PCB concentrations in dredged sediment around the Bay. PCB concentrations from sediment in dredged nearshore sites were found to often be similar to ambient RMP margin sites and higher than those in the ambient open-Bay, but one to two orders of magnitude less than the most contaminated sites in the Bay. The study also found that ~50% of the PCB mass in dredged sediment is removed from the Bay via upland disposal and reuse.

Suspended sediment monitoring by USGS at Dumbarton Bridge in WY 2016 showed particle flocculation is an important factor when calculating sediment flux. Based on these findings, the RMP funded studies at Dumbarton Bridge and at Benicia Bridge to investigate the importance of flocculation in sediment flux estimates. Analysis of suspended sediment flux at Dumbarton Bridge for WY2009-2016 showed changes in the magnitude and direction of cumulative suspended sediment flux measurements when flocculation is accounted for.

In WY2016 and WY2017, the USGS monitored sediment flux through the Golden Gate. Results indicated net sediment flux into the Bay during a short period of high Delta and local tributary flow. Based on recommendations in the study report, the RMP funded a modeling study in 2020 that evaluated suspended sediment flux through the Golden Gate over the entire 2017 wet season and related findings from the model simulation to the USGS measurements. The model results showed net sediment flux out the Golden Gate, and that the duration of the flux analysis plays a large role in the estimate net flux direction.

In 2022, the Workgroup will complete the development of a Bay sediment conceptual model that will highlight what is known and not known about sediment delivery and deposition dynamics at multiple spatial and temporal scales. These findings will be used in the development of a multi-year Sediment Monitoring and Modeling Workplan that will describe studies aimed at addressing key sediment knowledge gaps.

Priority Questions for the Next Five Years

1. What are acceptable levels of chemicals in sediment 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 sediment?

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

5. What are the concentrations of suspended sediment in the Estuary and its segments?

[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 Estuary Blueprint.

MULTI-YEAR PLAN FOR SEDIMENT

Workgroup special studies for 2016 to 2025. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources (e.g., SEP funds). Budgets that are starred represent funding that has been allocated for the given study within other workgroups. This table does not show suspended sediment monitoring done for Status & Trends. Bold boxes indicate multi-year studies. Items shaded in yellow are considered high priority for the 2023 funding cycle.

Element	Study	Funder	Questions addressed	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Strategy	Sediment Monitoring Strategy	RMP WQIF	1,3,4		50 (238)		78			(200)*			15
	Strategy/Workgroup Support	RMP	1,2,3,4			10		10	Workgroup support covered by core program				
	Sediment Modeling Strategy	RMP	1,2,3,4					26					15
	Sediment Conceptual Model	SEP BCDC USACE	1,2,3,4					(142)	(239) (508)				
Screening Values	Sediment Bioaccumulation Guidance	RMP	1			30*		23					
	Benthic Index Development	RMP	1			21*					30		
	Toxicity Reference Value Refinement	RMP	1								40		
Dredging Impacts on Essential Fish Habitat	Benthic Invertebrate Assessment	RMP LTMS	2								40		
	Light Attenuation Near Dredging Sites & Eelgrass	RMP LTMS	1,2								40		
Data Mining	DMMO Database and Online Tools	RMP	1			55	Database maintenance costs covered by core program						
	DMMO Data Synthesis	RMP SEP	1,2		12*	(45)							
	DMMO Database Enhancement	RMP	1,2						40	20			
Beneficial Reuse	Beneficial Reuse Sediment Guidelines	RMP	1,2				30		34			40	

Element	Study	Funder	Questions addressed	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Loading to the Bay	Sediment Supply Synthesis	RMP USGS	3,4		40 (40)								50
	Maintain Stream Gages and Add New Ones	RMP SEP	3,4			(115)							
	Monitor Mallard Island Suspended Load and Bedload Flux	RMP	3,4			30						50	
	Monitor Tributary Suspended Load and Bedload Flux	RMP						(385)*			100	75	
	Model Tributary Suspended Load and Bedload Flux	RMP											75
	Monitor Sediment Flux at Key Locations in the Bay (e.g., major creek mouths downstream of head of tide, mudflats/shallows, major bridges, Golden Gate)	RMP SEP	3,4	33 (98)	(69)	120	(158)				100	100	
	Model Current and Future Sediment Flux at Key Locations throughout the Bay	RMP	3,4					45					75
Sinks & reservoirs	Monitor Sediment Deposition at Key Locations in the Bay (e.g., creek reaches downstream of head of time, mudflats/shallows)	RMP (SEP)	3,4						140	155 (60)	135	100	100
	Model Current and Future Sediment Deposition Dynamics throughout the Bay	RMP	3,4									75	75
	Bathymetric Change Studies	RMP USGS	3,4				77 (5)	77 (5)					
	Bathymetric Data Collection	RMP	3,4										75

Element	Study	Funder	Questions addressed	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Sediment characteristics	Bulk Density of Sediment Types	RMP	4				30						
	Mapping Bed Sediment Characteristics for Model Calibration	RMP	3,4									75	
	Characterizing Impacts of Flocculation on Settling Velocity	RMP SEP	3,4					(228, 36)					
Bay water column characteristics	Using Satellite Imagery to Analyze Turbidity and Suspended Sediment Concentration	RMP	5										75
RMP-funded Special Studies Subtotal – Sediment				**33**	**90**	**215**	**215**	**181**	**214**	**175**	**485**	**515**	**555**
High Priority Special Studies for RMP Funding											***235***		
RMP-funded Special Studies Subtotal – Other Workgroups				**0**	**12**	**51**	**0**	**385**	**0**	**200**			
RMP Supplemental Environmental Projects Subtotal				**98**	**69**	**160**	**158**	**406**	**0**	**60**			
Pro-Bono & Externally Funded Studies Subtotal				**0**	**278**	**0**	**50**	**5**	**747**				
OVERALL TOTAL				**131**	**449**	**426**	**423**	**977**	**961**	**435**	**485**	**515**	**555**

SOURCES, PATHWAYS AND LOADING

Relevant Management Policies and Decisions

Refining pollutant loading estimates for mercury and PCBs and developing preliminary load estimates for Contaminants of Emerging Concern (CECs) (collaboration with ECWG)

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

Identifying small tributaries and specific CECs (and their sources) to prioritize for management actions

Informing decisions on the control measures for reducing pollutant concentrations and loads

Using monitoring and modeling to estimate load reduction in small tributaries

Estimating sediment loads to the Bay (collaboration with SedWG)

Recent Noteworthy Findings and Future Directions

Shifting Focus: The Sources, Pathways and Loadings Workgroup (SPLWG) is continuing to shift its focus to an integrated approach that combines modeling and monitoring rather than separate entities. The SPLWG is also shifting away from legacy contaminants, including PCBs and Hg, and moving towards developing information on contaminants of emerging concern (CECs).

Modeling: A suite of models is being developed to simulate hydrology, sediment, and water quality in Bay watersheds. The watershed dynamic model (WDM) for the Bay Area is capable of simulating large complex regions with mixed land-use types, a wide range of pollutants, upland erosion and sediment transport, and in-stream processes at an hourly scale over multiple years. The SPLWG will continue to support an integrated framework that includes both modeling and monitoring to answer management questions. Our CECs load modeling review project will investigate and recommend appropriate ways of combining limited monitoring data and modeling to estimate regional scale CEC loads. In addition, in 2022 we will begin developing a strategy and pilot application of a coupled watershed-bay model to simulate the fate of sediment and contaminants in Bay margin areas.

Monitoring: Winter storm sampling by the RMP has been conducted in 91 watersheds. Due to the notably dry recent winters, information has not increased greatly in the past two years. Planned sampling during WY2022 includes industrial sites for stormwater PCB characterization, suspended sediment loads, PCBs and Hg co-located with existing flow gauging to support model development, PCBs the watersheds of priority margin units (PMUs), and CECs characterization.

Data Interpretation: An advanced data analysis method based on loads, yields, and PCB congener patterns has been developed to provide information to support management decisions. This analysis reveals insights on areas within watersheds to consider for PCB management and provides decision support for further sampling.

Contaminants of Emerging Concern: Prior RMP studies have identified the presence of CECs of moderate and potential concern in urban runoff and provided evidence that stormwater is an important pathway for CECs to reach the Bay. A four-year preliminary investigation of CECs in stormwater culminates in 2022, at the same time two new projects begin—one to explore potential models to estimate CEC stormwater loads (mentioned above) and another to develop a stormwater CECs monitoring approach that integrates modeling. These projects will feed into a proposed 2023 SPLWG strategy update to reflect the pivot toward CECs and to re-examine activities addressing legacy pollutants.

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?

*Recent workgroup discussions pointed to the need for a Strategy update that could include revising the management question in relation to the changing emphases (particularly on CECs) and greater cross-workgroup collaboration.

Photo by Shira Bezalel

MULTI-YEAR PLAN FOR SMALL TRIBUTARY LOADING STRATEGY

Small tributaries loading studies in the RMP from 2016 to 2025. 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. Bold boxes indicate multi-year studies. Items shaded in yellow are considered high priority for the 2023-2025 funding cycle.

Element	Study	Funder	Collaborations with other WGs	Questions addressed	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Strategy	SPLWG strategy (formerly STLS coordination	RMP			26	30	32	40	40	25	35	35	35	35
	SPLWG strategy report & management questions update	RMP	ECWG	1,2,3,4,5								30		
Monitoring	Monitoring to support regional loads and trends	RMP		1,3								100	100	100
	Air Deposition monitoring and modeling of select CEC's	RMP	ECWG										75	75
	POC reconnaissance monitoring	RMP		1,2,3,4	150	200	125	125	110	65	43			
	Guadalupe PCBs trends monitoring design	RMP		1,3,4,5		40								
	CECs stormwater monitoring	RMP	ECWG	1,2,4				132*	181*	148*	100*	125*	125*	125*
	Stormwater CECs monitoring strategy (approach)	RMP	ECWG								50*	55*		
	Priority Margin Units (PMU) PCB monitoring	SEP		1,2,4				(40)						
	Flow and Sediment gauging in support of modeling	SEP		2,3,4				(380)						
Modeling	Integrated watershed monitoring and modeling strategy	RMP								50				
	Modeling to support regional loads and trends (PCB/Hg)	RMP		3,5	100	100		60	100	150	90	60	30	30
	CECs stormwater modeling	RMP	ECWG								25	100	100	100
	Stormdrain and GI regional data layer update	RMP										15	15	15

	Regional Watershed Spreadsheet model	RMP		1,2,4	35	40	7							
	Advanced Data Analysis	RMP		1,2,3,4			100	50	50					
	AFR Conceptual Model Development	RMP		1,4			13							
Modeling	Update San Francisco Bay region land-use map	SEP		2,4,5					(50)					
	Regional Watershed Spreadsheet Model Update	SEP									(23)			
	Integrated Watershed-bay modeling strategy and pilot implementation	SEP									(200)			
	Source Area monitoring/EMC development and RAA	BASMAA/ BAMSC		1,2,3,4	(350)	(450)	(950)	(1000)	(750)	(500)	(500)	(500)	(500)	(500)
	POC reconnaissance monitoring	BASMAA/ BAMSC		1,2,3,4	(200)	(200)								
RMP-funded Special Studies Subtotal – STLS					**311**	**410**	**167**	**275**	**300**	**290**	**193**	**340**	**355**	**355**
High Priority Special Studies for RMP Funding												**325**	**340**	**340**
RMP-funded Special Studies Subtotal – Other Workgroups								**132**	**181**	**148**	**150**	**180**	**125**	**125**
RMP Supplemental Environmental Projects								**420**	**50**	**0**	**223**			
Pro-Bono & Externally Funded Studies Subtotal					**550**	**650**	**950**	**1000**	**750**	**500**	**500**	**500**	**500**	**500**
Overall Total					**861**	**1060**	**1117**	**1827**	**1283**	**938**	**1066**	**1345**	**1320**	**1310**

STATUS AND TRENDS PROGRAM REVIEW

The Status and Trends (S&T) Program is a vital component of the RMP. The S&T Program represents a large annual investment and a huge investment over the long term. The RMP spends about one third of its annual $4 million budget on the S&T Program every year, and $30 million has been spent on the S&T Program over the last 20 years. Monitoring in the current S&T Program is almost exclusively focused on legacy contaminants, including mercury, PCBs, PAHs, dioxins, copper, and selenium. While these contaminants are still of concern in the Bay and important to monitor, contaminants of emerging concern (CECs) are becoming a higher priority for the RMP based on the growing list of CECs that have been classified as Moderate Concern (due to a high probability of some impact on Bay aquatic life) using the tiered risk-based framework and a desire on the part of managers to focus on a more proactive approach to protecting Bay water quality.

Peer review is essential to the success of the RMP, ensuring the Program is technically sound and obtaining the greatest value for the funds that are invested.

The last full review of the S&T Program was completed in 2002, and resulted in fundamental changes to the spatial distribution of stations, as well as the timing and frequency of sampling for water and sediment.

Goals of the Review and Redesign

1. Developing an optimized design that prioritizes informing management decisions for CECs;
2. Ensuring the Program is generating information that is relevant to management needs;
3. Evaluating the power of the current and revised sampling design to inform management decisions.

Review Process

The S&T Program Review, which started in April 2020, is being conducted by a S&T Workgroup that includes eight external science advisors with extensive expertise in long-term monitoring programs, CECs and legacy contaminants, and statistical analysis. The advisors are working in collaboration with RMP staff and stakeholders to review the existing Program, perform statistical analyses, and define sampling priorities to inform the updated design. The S&T Program will be reviewed by matrix: water, sediment, and biota.

The S&T Workgroup will meet five times over the next year to develop the revised S&T design. One meeting will be devoted to each matrix, with the last two meetings reserved for synthesizing the recommendations and developing an integrated design for the Program as a whole. The review is expected to be completed by December 2021. In 2022 a new chapter of RMP Status and Trends monitoring will begin, with a design that enhances the ability of water quality managers to proactively detect and prevent emerging threats while maintaining our ability to track progress on the persistent problems of the past.

STATUS AND TRENDS MONITORING

Relevant Management Policies and Decisions

Define ambient conditions in the Bay

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

Determination if there is a 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

Inform CEC tiered risk-based framework and CEC management actions

Recent Noteworthy Findings

In 2020, the RMP monitored the margin areas of North Bay for contaminants in sediment. Similar to the findings from the South Bay study, contaminant concentrations were lower in North Bay margins than Central Bay margins, likely due to fewer industrialized areas in North Bay and sediment transport from the Delta. There was also minimal difference between the margins and open Bay sites in North Bay. A full report comparing all three margin areas—Central, South, and North Bays—will be completed in 2022.

Sport fish monitoring in 2019 showed that PCB concentrations in shiner surfperch exceed the no-consumption limits established by the Office of Environmental Health Hazard Assessment (OEHHA). PCB concentrations may be declining in sport fish, albeit slowly. Mercury concentrations in striped bass were above the no-consumption limit for sensitive populations. Mercury concentrations have not shown any sign of decrease since the beginning of the time series in 1971. Concentrations of selenium in white sturgeon remain higher in fish caught in North Bay than South Bay, but fish in both areas tend to be below the TMDL numeric target. Finally, PFAS were analyzed in a subset of fish. Based on those results, Lower South Bay is an area of interest for further investigation.

Pilot monitoring for CECs in Bay water during the wet season will commence in WY2022. CEC concentrations will be compared between wet and dry seasons to understand how long CECs are present in the Bay and if they are found at levels of concern. Lower South Bay will be the focus of the pilot monitoring effort. A suite of CECs were also monitored in Bay water in 2021 as part of the revised S&T Program.

Priority Questions for the Next Five Years

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

2. Are contaminants at levels of concern?

3. Are there particular regions of concern?

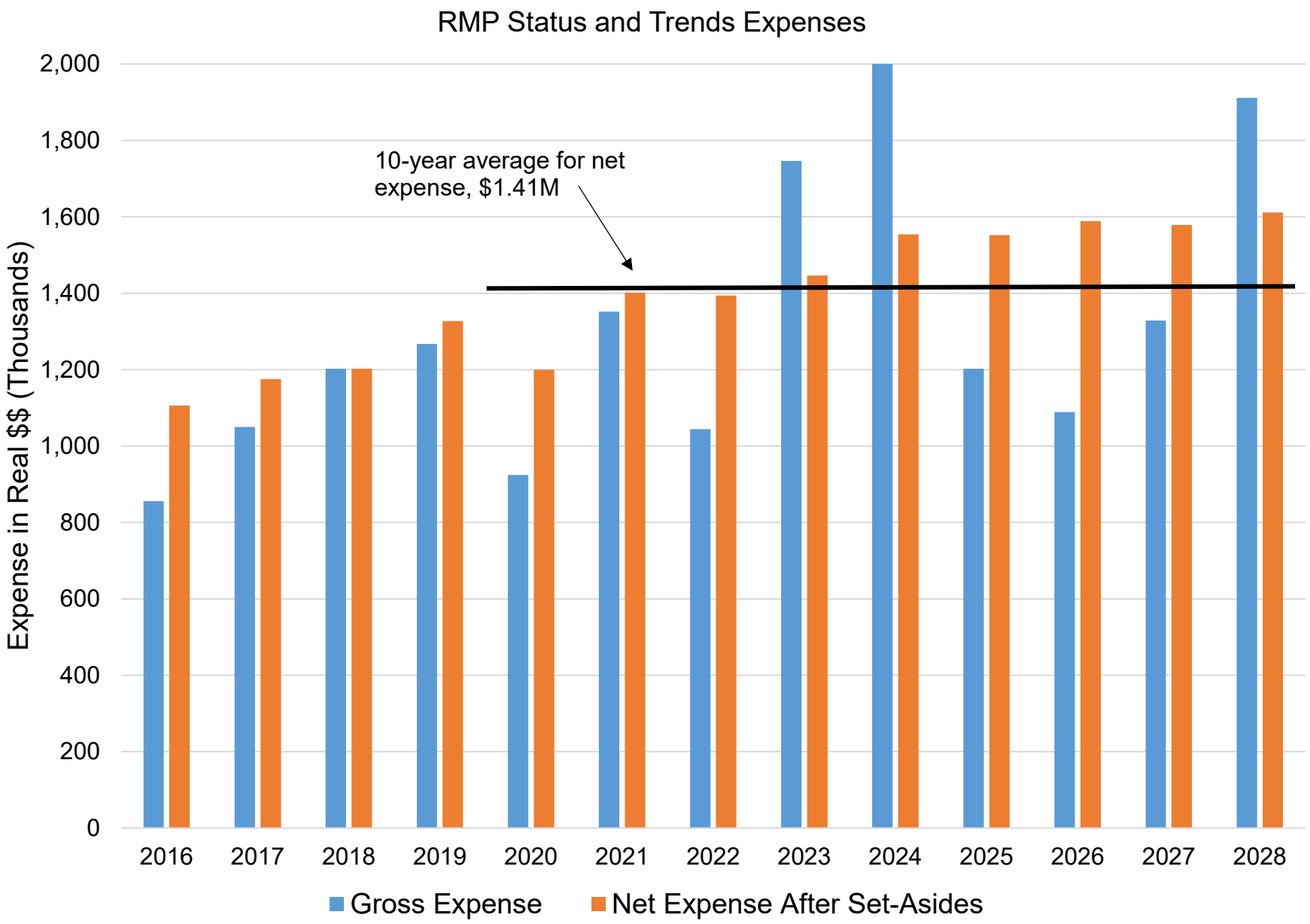
4. Have concentrations and masses increased or decreased?

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

MULTI-YEAR PLAN FOR STATUS AND TRENDS MONITORING

Status and Trends Monitoring costs in the RMP from 2016 to 2028. Values for 2023-2028 are provisional based on the final outcome of the S&T Review. Numbers indicate budget allocations in $1000s.

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Monitoring Type	*Actl*	*Actl*	*Actl*	*Actl*	*Actl*	*Actl*	*Bdgt*	*Fcst*	*Fcst*	*Fcst*	*Fcst*	*Fcst*	*Fcst*
USGS Moored Sensor Network for Suspended Sediment	250	250	250	250	300	400	400	400	400	400	460	460	460
USGS Monthly Cruises for Nutrients and Phytoplankton	223	229	235	242	250	250	258	265	273	281	290	299	307
S&T North Bay Selenium						72	127		131		136		140
S&T Water		221		216		243	25	257	27	27		309	0
Water-Wet season							127	131	135		143		
Water-CTR and Organics										88			
Water-Non-target analysis									12	30			
Water-Passives									51				
S&T Bivalves	144		118										
Bivalves-archive							20		21		21		22
S&T Bird Eggs	198		222			256			160			165	
S&T Margins Sediment		281			319			105					235
S&T Sediment			291					205					320
S&T Target Sediment								95					190
S&T Prey Fish								120					126
S&T Sport Fish				405					531				
S&T Harbor Seals									300				
Archives	22	51	47	84	62	84	53	80	56	85	60	90	63
Reporting	19	8	10	22	23	12	12	20	25	14	14	14	25
Lab Intercomp Studies		10	30	55	37	28	22	67	82	30	25	52	82
Grand Total	**856**	**1,050**	**1,203**	**1,273**	**991**	**1,345**	**1,044**	**1,745**	**2,204**	**1,202**	**1,088**	**1,328**	**1,911**
Set-Aside Funds Used	**0**	**0**	**0**	**0**	**88**	**0**	**0**	**300**	**650**	**0**	**0**	**0**	**300**
Set-Aside Funds Saved	**250**	**125**	**0**	**60**	**275**	**50**	**350**	**0**	**0**	**350**	**500**	**250**	**0**
Set-Aside Funds Balance	**468**	**593**	**593**	**653**	**928**	**978**	**1,328**	**1,028**	**378**	**728**	**1,228**	**1,478**	**1,178**
Net S&T Funding Needed	**1,106**	**1,175**	**1,203**	**1,340**	**1,178**	**1,395**	**1,394**	**1,445**	**1,554**	**1,561**	**1,588**	**1,578**	**1,611**


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, $1.41M
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
Gross Expense
Net Expense After Set-Asides

Regional Monitoring Program for Water Quality in San Francisco Bay

Monitoring Design for the Status and Trends Monitoring Program (2015-2029); sampling frequency from 2022-2029 is reflective of changes made to the Program through the Status and Trends Review process.

Program	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
USGS Moored Sensor Network for Suspended Sediment (5 targeted sites)[1]															
Parameters: SSC, Water temperature, Salinity	X	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 stations)															
Parameters: CTD profiles, light attenuation, SSC, DO, Chl-a, Phytoplankton speciation, Nutrients (NO_2, NO_3, NH_4, PO_4, Si)[2]	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Every 2 Years: Toxic Contaminants in Water – dry season (5 targeted stations and 17 random stations)															
MeHg, Se, Cu (dissolved & particulate fractions in 2017 and onwards); Cu only after 2019	X		X		X		X		X		X		X		X
CN, Hardness, SSC, DOC, POC	X		X		X		X	X	X	X	X		X		X
Chl-a			X		X		X		X		X		X		X
CECs – PFAS, bisphenols, organophosphate esters							X	X	X	X	X		X		X
Non-target analysis (5 stations)											?				
Aquatic Toxicity (9 stations)[3]	X		X		X						X				
CTR parameters (10 samples at 3 targeted stations)[4], including PCBs and PAHs	X										X				

Program	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Every 2 years: Toxic Contaminants in Water – wet season (5 targeted stations, 4 ambient stations)															
CECs – PFAS, bisphenols, organophosphate esters								X	X	X		?		?	
Non-target analysis												?			
Every 2 years: Selenium in Water, Clams, and Sturgeon (2 targeted North Bay stations)															
Water – dissolved and particulate Se, chl-a, SSC, DOC					X	X	X	X		X		X		X	
Clam tissue – selenium, stable isotopes (δ13C, δ15N, δ34S)					X	X	X	X		X		X		X	
Sturgeon tissue - selenium								X		X		X		X	
Every 2 years: Toxic Contaminants in Bivalve Tissue (7 targeted Bay stations until 2018[6]; Bay edge stations 2022 onward)															
Se, PAHs (archive only after 2018)		X		X				X		X		X		X	
PBDEs		X													
CECs (archive only)								X		X		X		X	
Every 3 Years: Toxic Contaminants in Bird Egg Tissue															
Cormorant Eggs: Hg, Se, PCBs, PBDEs, PFAS, legacy pesticides[5] (3 targeted stations)[7]		X		X			X			X			X		
Tern Eggs: Hg, Se, PBDEs (variable fixed stations)[8]		X		X											
Every 5 Years: Toxic Contaminants in Near-field Bay Sediment (12 targeted near-field stations every 5 years)															
PFAS, bisphenols, TOC, N, % solids, grain size									X					X	

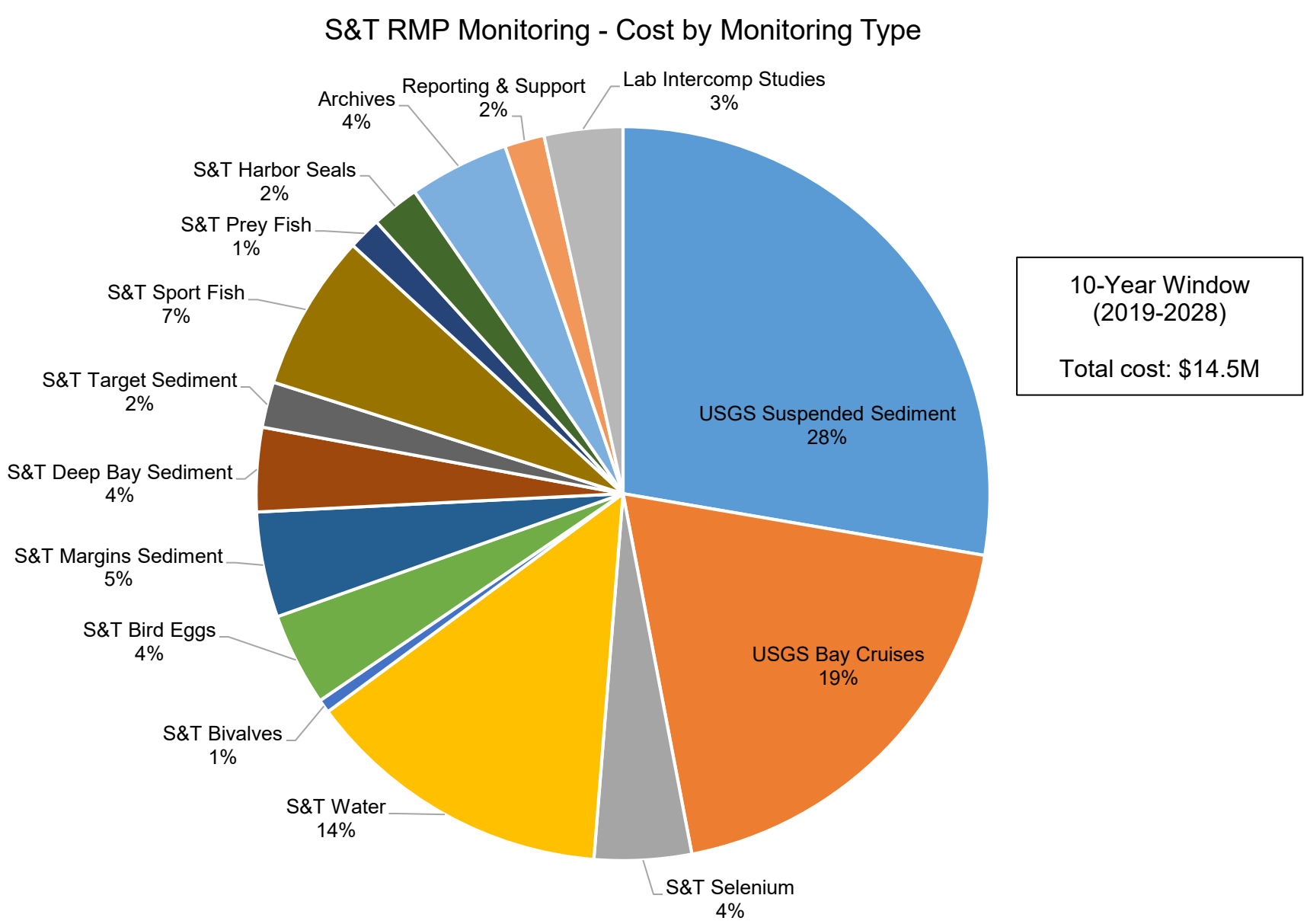
Program	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Every 5 Years: Toxic Contaminants in Bay Margin Sediments (12 random stations every 5 years/24 random station every 10 years)															
PFAS, bisphenols, TOC, N, % solids, grain size									X					X	
Ag, Al, As, Cd, Cu, Fe, Hg, MeHg, Mn, Ni, Pb, Se, Zn, PCBs	X		X			X								X	
Every 5 Years: Toxic Contaminants in Sediment (7 targeted stations and 10 random stations)[9]															
PFAS, bisphenols, TOC, N, % solids, grain size									X					X	
Ag, Al, As, Cd, Cu, Fe, Hg, MeHg, Mn, Ni, Pb, Se, Zn, PAHs, PCBs				X										X	
PBDEs (discontinued after 2023)				X					X						
Fipronil (discontinued after 2018)				X											
Every 5 Years: Toxic Contaminants in Sport Fish Tissue (7 targeted stations)															
Hg, Se, PCBs, PBDEs, dioxins					X					X					X
PFAS					X					X					X
Legacy pesticides[5]										X					X
Fipronil					X					?					
Every 5 Years: Toxic Contaminants in Prey Fish Tissue (4 targeted stations, 3 species)															
PFAS, bisphenols									X					X	
PCBs (PMUs only)									X					X	
Every 10 Years: **Toxic Contaminants in Harbor Seals**															
PFAS												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.

1. The RMP Status and Trend Program provides direct support to the U.S. Geological Survey (PI: Paul Work) for four SSC stations (Richmond Bridge, Pier 17, Alcatraz Island, Dumbarton Bridge). However, this contribution leverages SSC data at two more stations and salinity at eight stations funded by other partners. In addition, since 2012, the RMP has used Special Studies funds to add DO sensors at eight stations and nutrient-related sensors to three stations.
2. Monthly cruises are completed by the U.S. Geological Survey (PI: Brian Bergamaschi). Phytoplankton speciation and nutrient samples are collected at 14 stations.
3. Aquatic Toxicity is measured following EPA Method 1007.0 (*Americamysis bahia*).
4. CTR sampling occurs at the Sacramento River, Yerba Buena Island, and Dumbarton Bridge sites.
5. "Pesticides" includes 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).
6. Mussels (*Mytilus californianus*) are collected from Bodega Head State Marine Reserve, an uncontaminated "background" site of known chemistry, and are transplanted to seven 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 seven transplant sites serve as back-ups in case something goes wrong with the transplants at the four primary sites. At the same time, resident clams (*Corbicula fluminea*) are collected from two sites in the Sacramento River and San Joaquin River.
7. Double-crested Cormorant (*Phalacrocorax auritus*) eggs are collected at three sites: Don Edwards National Wildlife Refuge, the Richmond-San Rafael Bridge, and Wheeler Island.
8. Forster's Tern (*Sterna forsteri*) eggs are typically collected from multiple sites in the Don Edwards National Wildlife Refuge and the Hayward Shoreline Regional Park.
9. Sediment samples are collected in the dry season (summer).

Abbreviations:
Ag: Silver
Al: Aluminun
As: Arsenic
Cd: Cadmium
CECs – Contaminants of emerging concern
Chl-a: Chlorophyll-a
CTD: Conductivity, Temperature, and Depth
CTR: California Toxics Rule, see http://water.epa.gov/lawsregs/rulesregs/ctr/
Cu: Copper
DO: Dissolved Oxygen
DOC: Dissolved Organic Carbon
Fe: Iron
Hg: Mercury
MeHg: Methylmercury
Mn: Manganese
NH_4: Ammonia (dissolved)
Ni: Nickel
NO_2: Nitrite (dissolved)
NO_3: Nitrate (dissolved)
PAHs: Polynuclear Aromatic Hydrocarbons
Pb: Lead
PBDEs: Polybrominated Diphenyl Ethers
PCBs: Polychlorinated Biphenyls
PFAS – Perfluorinated alkyl substances

PFCs: Perfluorinated Compounds
PMU – Priority Margin Unit (Emeryville Crescent, San Leandro Bay, Redwood Creek/Steinberger Slough)
PO_4: Phosphate (dissolved)
POC: Particulate Organic Carbon
Se: Selenium
Si: Silica (dissolved)
SSC: Suspended Sediment Concentration
TN: Total Nitrogen
TOC: Total Organic Carbon
TP: Total Phosphorus
Zn: Zinc


S&T RMP Monitoring - Cost by Monitoring Type
Lab Intercomp Studies 3%
Reporting & Support 2%
Archives 4%
S&T Harbor Seals 2%
S&T Prey Fish 1%
S&T Sport Fish 7%
S&T Target Sediment 2%
S&T Deep Bay Sediment 4%
S&T Margins Sediment 5%
S&T Bird Eggs 4%
S&T Bivalves 1%
S&T Water 14%
S&T Selenium 4%
USGS Bay Cruises 19%
USGS Suspended Sediment 28%
10-Year Window (2019-2028)
Total cost: $14.5M

PROGRAM MANAGEMENT

Approximately 10% 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 and 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
- Twenty 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

Approximately 10% 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 Figures 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.

Photo by Jay Davis

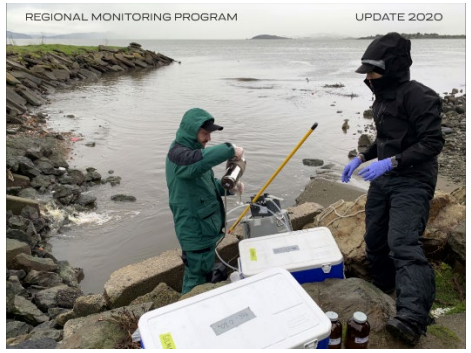
ANNUAL REPORTING & COMMUNICATIONS

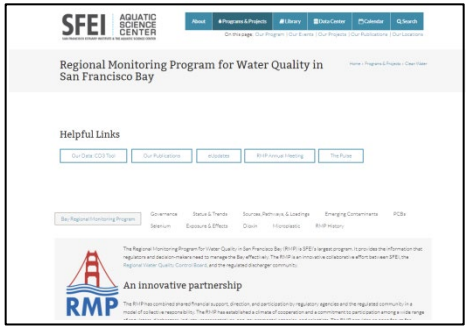
Approximately 10% of the total budget (+$85,000 in years when a full Pulse report is produced)

Includes the Pulse of the Bay, Annual Meeting, RMP Update, Multi-Year Plan, State of the Estuary report card, RMP website, Annual Monitoring Report, technical reports, journal publications, Estuary News, oral presentations, posters, & 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 website, 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**.





www.sfei.org/rmp

Highlights for the Next Five Years

- RMP Update (2022)
- Pulse of the Bay (2023)
- Continued partnership with SFEP's "Estuary News" to reach broader audience
- Continued website improvement

QUALITY ASSURANCE AND DATA SERVICES

Approximately 6% 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 (cd3.sfei.org); coordinating with statewide data management initiatives (e.g., SWAMP and CEDEN); and supporting quality assurance evaluation, data analysis, and RMP report production.

Quality Assurance

Quality assurance includes the review of data submitted by analytical laboratories; development and application of the QAPP; review 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.

Online Data Access

CD3 (cd3.sfei.org) is an online visualization tool that makes the RMP data available to water quality managers, stakeholders, scientists, and the public. A data download tool allows users to customize their queries and easily download large quantities of data.

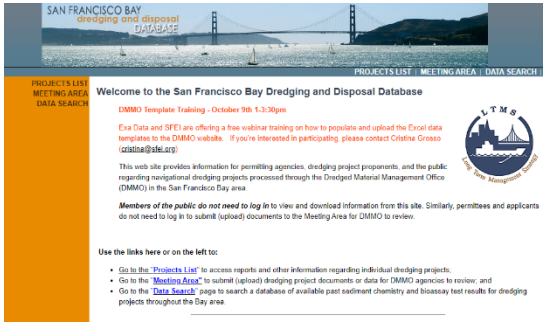
Recent Noteworthy Findings

The RMP's over 25-year dataset contains more than 3.5 million records standardized across all years. All data are stored in SFEI's Regional Data Center database, are comparable to statewide standards, and are regularly exchanged with CEDEN.

CD3 provides public access and visualizes RMP data along with relevant datasets from other programs.

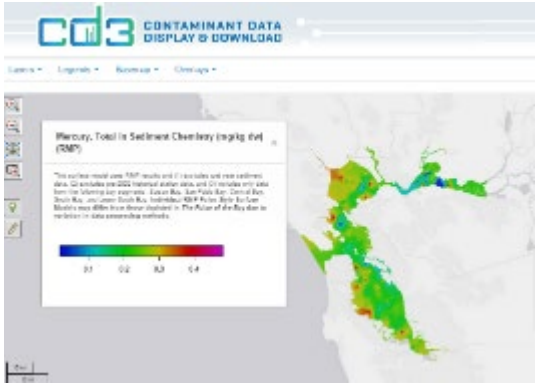
DMMO Database and Website

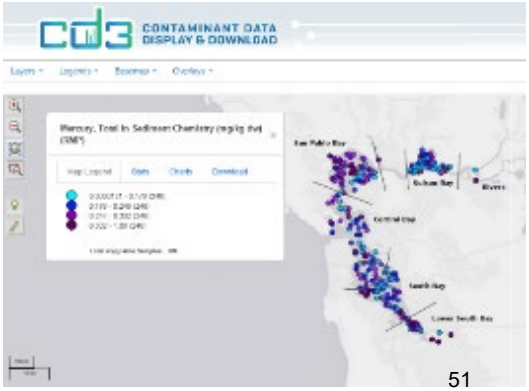
In 2018, the DMMO database and website were transferred to SFEI's Regional Data Center. Costs for the first few years include upgrading outdated technology, training SFEI staff, developing standard operating procedures, uploading a backlog of data to the database, and integrating DMMO data into CD3. After completing these security and backlog tasks, annual costs can be reduced to uploading data and hosting and maintaining the system.



Priority Initiatives for the Next Five Years

- Efficiencies in Data Uploading and Formatting
- Enhancement of Data Access and Visualization Tools
- Coordination with SFEI's Environmental Informatics Program
- Hosting, managing, enhancing, and 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; review sediment guidelines for the beneficial reuse of dredged sediment	USGS Suspended Sediment Monitoring, Bay sediment budgets, Beneficial Reuse workshop

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)
North Bay Selenium TMDL	Monitor selenium in food web to inform TMDL	North Bay selenium in water, clams, and sturgeon

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.