RMP
REGIONAL MONITORING PROGRAM FOR WATER QUALITY IN SAN FRANCISCO BAY
sfei.org/rmp

RMP PCB Workgroup Meeting

June 2, 2020
9:00 AM - 12:40 PM

REMOTE ACCESS
https://zoom.us/j/91757750013

Meeting ID: 917 5775 0013
One tap mobile
+16699006833,,91757750013# US (San Jose)
+13462487799,,91757750013# US (Houston)

Dial by your location
+1 669 900 6833 US (San Jose)
+1 346 248 7799 US (Houston)
+1 253 215 8782 US (Tacoma)
+1 301 715 8592 US (Germantown)
+1 312 626 6799 US (Chicago)
+1 929 205 6099 US (New York)

DRAFT AGENDA

1.	**Introductions, Meeting Goals, Agenda Review** Major goals for the meeting: 1. Updates, prioritization of workplan elements, and review of products 2. Discussion of draft report on Steinberger Slough conceptual model 3. Updates on studies in progress 4. Recommend a package of PCB special study proposals for 2020 5. Update multi-year workplan for PCBs 6. Identify potential SEP studies Materials: • Summary of last meeting on 4/20/20 (pages 4-6)	9:00 Jay Davis
2.	**Information: RMP Planning Overview** An overview of the RMP planning process will be provided. An update on the Multi-Year Plan (which includes the PCB multi-year plan) and budget status will be given. Updates on management will be discussed. Materials: • RMP Multi-Year Plan that includes the PCB Workgroup Multi-Year Plan (pages 7-8) **Desired Outcome:** Group understanding of the RMP planning process and	9:10 Jay Davis

	existing plans for PCB studies.	
3.	**Discussion: Steinberger Slough - Draft Conceptual Model Report** The draft report will be discussed. The report was distributed on February 3. The final deadline for comments is May 29. Materials: • Draft report (Attached separately) **Desired Outcome:** Group discussion and feedback on the report.	9:25 Jay Davis
4.	**Information, Decision: Updates on Studies in Progress** Updates will be provided on the studies funded for 2019 and 2020. • Stormwater sampling in Emeryville Crescent and San Leandro Bay watersheds o Recommendation on carrying over unspent funds • Shiner surfperch survey • Steinberger Slough/Redwood Creek Passive Sampling and Coring Study Materials: None **Desired Outcomes:** • Informed workgroup • Recommendation on carrying over unspent stormwater sampling funds	10:10 Alicia Gilbreath, Jay Davis, Diana Lin
	Break	11:00
5.	**Information: PCB Modeling in the RMP** A review of past modeling of PCBs in the RMP, provided as background for consideration of the modeling strategy proposal for 2021. Materials: None **Desired Outcome:** Informed workgroup.	11:15 Jay Davis

6.	**Decision: PCB Workgroup Proposals for 2021, Updated Multi-Year Plan, and SEP Ideas** 1) Ambient PCB Concentrations in Margins Sediment ($37K) 2) Monitoring the Impact of Remediation Actions on San Leandro Bay Recovery from PCB Contamination ($101K) 3) PCB Modeling Strategy ($35K) SFEI staff will present a description of each proposal, followed by group discussion. Materials: • Proposal 1 (pages 9-12) • Proposal 2 (pages 13-19) • Proposal 3 (will be sent separately) **Desired Outcomes:** Workgroup consensus on 1) a recommendation to the TRC regarding the funding of proposals for 2020; 2) an updated multi-year plan for PCBs; and 3) a list of study ideas for the SEP list.	11:45 Jay Davis, Diana Lin, Don Yee, Bridgette DeShields
7.	**Review Next Steps and Action Items and Adjourn**	1:25 Jay, Bridgette, and Group

REGIONAL MONITORING PROGRAM FOR WATER QUALITY IN SAN FRANCISCO BAY

sfei.org/rmp

RMP PCB Workgroup Meeting

April 20, 2020 (teleconference)

Meeting Summary

Attendees:
Nina Buzby (SFEI)
Jay Davis (SFEI)
Luisa Valiela (USEPA)
Marco Sigala (MLML)
Craig Jones (Integral Consulting)
Xavier Fernandez (SFBRWQCB)
Jon Konnan (EOA)
Yeo Myoung Cho (Stanford)
Ned Black (US EPA)
Setenay Frucht (SFBRWQCB)
Bridgette DeShields (Integral Consulting)
Biruk Imagnu (SFEI)
Yuyun Shang (EBMUD)
Tom Mumley (SFBRWQCB)
Jalyn Babitch (City of San Jose)
Jan O'Hara (SFBRWQCB)
Bryan Frueh (City of San Jose)
Mary Lou Esparza (CCCSD)
Lester McKee (SFEI)
Don Yee (SFEI)
Anne Balis (City of San Jose)
Alicia Gilbreath (SFEI)

1. Introductions and Agenda Review

Jay Davis began the meeting by acknowledging the key stakeholders participating in the call and asked any other participants to introduce themselves and their affiliation. Jay then reviewed the desired goals, most importantly to provide insight on which proposal ideas to develop for 2021 Special Study funding consideration.

2. Discussion: Perspectives on Information Needs in Support of Re-Opening the TMDL

To begin the discussion, Jay briefly reviewed a table of study ideas that were organized by how the findings would relate to any possible TMDL revision or management action. For example, Jay noted that a segment-specific management approach would be well served by the potential development of a multi-box fate model. Jan O'Hara introduced Setenay Frucht, a Water Board staffperson that is new to the Workgroup. While explaining her experience in fate and transport modeling work, Setenay noted an interest in studying responses of load reduction from high-leverage watersheds (i.e., PMU watersheds) to observe responses. Jan indicated that the Water Board continues to have an interest in establishing baselines and monitoring PMU trends in response to watershed load reductions. Jan also noted that action on the Union Pacific Railroad property in San Leandro Bay is on hold at present as the responsible party is looking for partners. Actions on Pulgas Creek and Redwood Creek are in process. Setenay indicated that the Water Board is also interested in PCB movement from PMUs into the open Bay.

Jon Konnan noted that stormwater agencies are concerned about the achievability of a 90% reduction in loads by 2030. Small reductions in uncertainty around the TMDL target are not that important. A key question about multibox modeling is whether it would reduce uncertainty. He expressed in interest in tracking whether load reductions that do occur result in actual changes in concentrations in Bay fish.

Tom Mumley expressed interest in exploring modeling improvements, including consideration of the one-box model or multibox modeling. When considering previous multi-box model efforts, the members noted that there were limitations in the underlying sediment model developed by Schoellhamer et. al. and that results were similar to that of the one-box model. Setenay, Ned Black, and Craig Jones suggested making use of shear stress data to improve both multi-box and conceptual model updates. Reflection on other modeling proposal ideas (e.g. updated sensitivity analysis of the one-box model) led to an idea for an overarching task to update a modeling strategy in order to explore model improvement, building on the Conceptual Model for Contaminant Fate in the Bay Margins written by Craig Jones and SFEI staff in 2012, leveraging the modeling efforts of the Sediment Workgroup and NMS, and incorporating new RMP margins data into the conceptual model.

The group then discussed a more fleshed out proposal idea developed by Bridgette DeShields to conduct a statistical evaluation of new margins and open-bay data. This sort of effort could potentially be used to establish cleanup targets for nearshore sediment. Tom Mumley asked about PCB influence on dredged disposal decisions, to which Bridgette responded that the study would primarily inform nearshore cleanups. The discussion also brought up three other considerations. The first being carefully defining what areas should be considered as 'margins' (different from the RMP sampling definition) and harvesting data accordingly. Additionally, looking through a variety of datasets will require some sort of aggregation to correct for areas that have been sampled more than others and random versus targeted designs. Lastly, Jay noted that the North Bay margins data will not be available until late in 2021, meaning that the work would either have to occur at the end of the year or be split between 2021 and 2022.

Ned Black commented that a food web model update will eventually be needed to incorporate new data and to have a technical foundation for the TMDL that withstands peer review. Luisa Valiela noted that we should make use of the data that has been generated over the years.

After discussing Bridgette's idea, Jay pointed out that so far priorities have boiled down to evaluating modeling efforts and developing a plan to answer questions about fate and transport relating PMUs to the open Bay. Jay asked the stakeholders if they supported additional baseline monitoring in the PMUs. Participants were in agreement that monitoring with passive samplers in San Leandro Bay, similar to what is being done in Steinberger Slough, would be a worthwhile effort. Yeo Myoung from Stanford expressed interest in partnering again with SFEI. Craig Jones expressed interest in working with SFEI on a PCB modeling strategy.

Jay agreed to clean up the table summarizing study ideas and related management decisions and distribute it to the group.

3. Next Steps and Future Agenda Items

When outlining the agenda at the beginning of the meeting, Jay noted that stakeholders would have an opportunity to provide their perspectives on the information needs that they believe the RMP could meet. This desired meeting outcome in combination with group discussions surrounding the goal to reach 90% reductions of PCBs in urban runoff by 2030, prompted a conversation on multi-year planning for the workgroup. All the stakeholders agreed that use attainability analysis is not a high priority based on progress in load reduction to date. Additionally, there was a consensus that working on the food web model was not time critical for 2021, but given the 2030 threshold, it will be a necessary effort for the future.

After reiterating the group's consensus to prioritize studies on modeling strategy, passive sampling in San Leandro Bay, and statistical analysis of margins data, Jay told likely collaborators Yeo Myoung and Craig Jones that he would reach out to them soon about developing proposals. Jay then presented his proposed agenda items for a future meeting to be held in early June. These included updates on stormwater monitoring, passive sampling and core work in Steinberger Slough as well as further discussion of 2021 proposals and future workgroup priorities. Luisa suggested that it would be valuable to add an item to discuss contingency options for field work, given the current obstacles posed by health concerns.

Action Items:

- Send updated table of special study ideas to PCBWG (Jay Davis, 5/1/20)
- Contact Yeo Myoung and Craig Jones about proposal development (Jay Davis, 5/1/20)
- Schedule June Workgroup meeting (Jay Davis, 5/8/20)

PCBs

Relevant Management Policies and Decisions

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

Recent Noteworthy Findings

Shiner surfperch have a Bay-wide average concentration nine times higher than the TMDL target, and 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 no clear sign of decline. Average concentrations in Suisun Bay sediments are lower than in the other Bay segments, indicating a lower degree of impairment in this region.

Urban stormwater is the 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 are being measured as an index of the degree of watershed contamination and potential for effective management action. Stormwater samples from Pulgas Creek Pump Station North and South, Industrial Road Ditch, an outfall to Colma Creek, and Gull Drive Storm Drain in San Mateo County; Santa Fe Channel in Contra Costa County; Line 12H at Coliseum Way, and Outfall at Gilman Street in Alameda County; and Outfall to Lower Silver Creek in Santa Clara County had the highest concentrations of PCBs on suspended sediment particles measured to date.

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

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

MULTI-YEAR PLAN FOR PCBs

Special studies and monitoring in the RMP from 2015 to 2024. Numbers indicate budget allocations in $1000s. Budgets in parentheses represent funding or in-kind services from external sources. Items included in planning budget are shaded in yellow. Bold boxes indicate multi-year studies.

Element	Study	Funder	Questions addressed	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
General	Develop and update multi-year workplan and continued support of PCB Workgroup meetings	RMP		10	10	10	10	10	10	Covered by core workgroup funding			
PMU	Prioritize Margin Units	RMP	1, 4, 5, 6	30									
	Develop Conceptual Site Models and Mass Balances for PMUs (4 PMUs)	RMP SEP	1, 4, 5, 6	45	30 (30)	60							
	PMU Field Studies to Support the Development of Conceptual Site Models and Monitoring Plans	RMP SEP	1, 4, 5, 6		(202)		51[a]	(40)[b]	91[d]		90[e]	98[f]	
	PMU Trend Monitoring (4 PMUs)	SEP	1, 4, 5, 6					(60)[c]			64[g]		50[c]
DMMO	Synthesis of DMMO data for PCB hot spots and mass removed	SEP	1				(45)						
General	Updated Fate and Food Web Model	RMP	1,3,5,6							100			100
	PCB Synthesis	RMP	1,2,3,4,5,6										
RMP-funded Special Studies Subtotal – PCBs				**85**	**40**	**70**	**31**	**40**	**101**	**100**	**154**	**98**	**150**
High Priority Special Studies for RMP Funding									**101**	**100**	**154**	**98**	**150**
RMP-funded Special Studies Subtotal – Other Workgroups				**0**	**0**	**0**	**0**	**0**					
RMP Supplemental Environmental Projects Subtotal				**0**	**232**	**0**	**45**	**97**					
Pro-Bono & Externally Funded Studies Subtotal				**0**	**0**	**0**	**0**	**0**					
OVERALL TOTAL				**85**	**272**	**70**	**76**	**137**	**101**	**100**	**154**	**98**	**150**

[a] San Leandro Bay gut contents ($21K) and PMU Stormwater sampling ($30K); [b] PMU stormwater sampling; [c] Shiner surfperch; [d] Steinberger Slough passive sampling and cores; [e] SLB PSDs; [f] Steinberger prey fish ($48K) and Steinberger sediment ($50K); [g] SLB prey fish

PCB Workgroup 2021 Proposal #1: Ambient PCB Concentrations in Margins Sediment

Summary: This study would statistically evaluate the existing and forthcoming (North Bay) margins data to develop a set of margin ambient values for use in decision-making. The primary focus will be on PCBs, but other analytes (e.g., mercury and other trace elements) will also be evaluated. The effort will include looking at different geographic units (including subembayments), an expression of the confidence in the values developed, and provide recommendations for filling any data gaps, as well as data needed to improve confidence in the values.

Proposed Funding: $37,000

Oversight group: PCB Workgroup

Proposed by: Don Yee and Jay Davis, SFEI

Time Sensitive: No

Proposed Deliverables and Timeline

Deliverable	Due Date
Draft analysis plan	May 2021
Draft technical report	Dec 2021
Final technical report	Mar 2022

Introduction and Background

Prior to 2015, sediment in the Bay margins (shallower than one foot below mean lower low water) had been largely unsampled by the Regional Monitoring Program. In 2013, the RMP approved the first in a series of studies to sample Bay margin sediment. The Central and South Bay margins have been sampled (in 2015 and 2017, respectively [Yee et al. 2017, 2019), and North Bay (San Pablo Bay and Suisun Bay) sampling is planned for 2020. There are long-range plans to resample the Bay margins at some frequency in the future to monitor trends.

The margins sampling was designed to test the current conceptual model expectation that margin sediment is more contaminated than sediment in the subtidal open bay. The study validated this assumption for PCBs in the Central Bay. The study provided:

- spatially unbiased data supporting improved estimates of mean concentrations and contaminant inventories in the margins;
- a useful baseline against which the severity of contamination at specific sites can be compared; and

- baseline data that could be used in setting targets and tracking improvements in watershed loads and their near-field receiving waters, or for appropriate re-use or disposal of dredged sediment.

The RMP currently provides "ambient-based thresholds" derived from RMP Status and Trends data for use in assessing dredged sediment proposed to be discharged at unconfined open water disposal sites in the Bay. However, the margins data are not used in these calculations. There also is a broader need for understanding the nature and extent of contaminants in the Bay margins for use in decision-making. Currently, decisions are being made for site cleanup projects on a site-specific basis, but a more holistic approach would be useful. The publication of such an evaluation, led by the RMP program, would lend credibility to the technical approach and provide a peer-reviewed publication that can be used and cited in decision-making documents.

In this proposed study, RMP staff would first convene with regional stakeholders to establish the potential applications of thresholds in decision-making, such as in setting targets for sediment cleanup, dredged sediment re-use, and disposal. These discussions will identify statistical criteria to support those applications (e.g., would a clean-up target be the median or lowest quartile of existing margins concentrations for a given Bay segment). Even if final criteria cannot be fully decided *a priori*, several candidates should be identified beforehand to better constrain the data analysis.

SFEI staff would statistically evaluate the existing and forthcoming (North Bay) margins data to develop a set of margin ambient values for use in decision-making. The primary focus will be on PCBs, but multiple analytes (e.g., mercury and other trace elements) can be processed simultaneously to characterize their distributions. The effort would include looking at different geographic units (including subembayments), an expression of the confidence in the values developed, and provide recommendations for filling any data gaps, as well as data needed to improve confidence in the values.

Study Objective and Applicable RMP Management Questions

The objective of this study is to statistically characterize the distributions of select pollutants (PCBs, and several trace elements) in margin areas. This study would address the following management question articulated in the PCB Strategy.

4. Which small tributaries and contaminated margin sites are the highest priorities for cleanup?

The study would also address additional specific management questions of current interest:

- What are appropriate cleanup thresholds for contaminated sites in the Bay margins?
- What are appropriate thresholds for use in decisions on disposal or re-use of dredged sediment?

Approach

Tasks

1. Review available datasets and reports
2. Discuss goals and scope with stakeholders
3. Prepare outline of draft analysis plan
    a. Carefully define margins
    b. Identify datasets to include
    c. Describe aggregation approach
    d. Describe statistical approach
    e. Describe presentation of results
4. Present outline of draft analysis plan to PCBWG and stakeholders for discussion
5. Perform statistical analysis
6. Write draft technical report, including:
    a. Evaluation of different geographic units
    b. Quantification of confidence limits of calculated values
    c. Recommendations to fill data gaps and improve confidence
7. Write final technical report

Budget

The budget will cover labor hours for Don Yee, Adam Wong, Jay Davis, and Melissa Foley.

Task		Total
1	Review datasets and reports	$ 3,829
2	Stakeholder goals discussion	$ 5,354
3	Prepare outline of analysis plan	$ 3,829
4	Present outline to PCBWG	$ 3,409
5	Perform statistical analysis	$ 6,426
6	Draft technical report	$ 8,065
7	Final technical report	$ 5,110
	Total	$36,021

References

Yee D., A. Wong, I. Shimabuku, and P. Trowbridge. 2017. Characterization of Sediment Contamination in Central Bay Margin Areas. SFEI Contribution No. 829. San Francisco Estuary Institute, Richmond, CA.

Yee D., A. Wong, and N. Buzby. 2019. Characterization of Sediment Contamination in South Bay Margin Areas. SFEI Contribution No. 962. San Francisco Estuary Institute, Richmond, CA.

PCB Workgroup 2021 Proposal #2: Monitoring the Impact of Remediation Actions on San Leandro Bay Recovery from PCB Contamination

Summary: This study would establish baseline conditions to monitor changes in PCB loadings to the San Leandro Bay Priority Margin Unit expected from recent and pending upstream management actions in the watershed. Cleanup action at a former GE facility, an expected major source of PCBs to the watershed, has largely been completed. Cleanup activity at a second site (Union Pacific Railroad) is planned in the next few years. Passive samplers and sediment traps will be deployed downstream of completed and planned management activities to monitor PCB loadings to San Leandro Bay. A reference site in San Leandro Bay further away from direct watershed influences will also be sampled to evaluate spatial patterns. Since management activities either have been implemented or are planned in the next few years, there is urgency to establishing baseline conditions in order to document expected changes in PCB loadings.

Proposed Funding: $101,300 from RMP ($60,000 in-kind from Stanford)

Oversight group: PCB Workgroup

Proposed by: Diana Lin and Don Yee, SFEI
Yeo-Myoung Cho and Richard Luthy, Stanford University

Time Sensitive: Yes. Management activities in the watershed either have been implemented or are planned in the next few years, there is urgency to establish baseline conditions. Also, the match from Stanford is available now, but may not be in the future.

Proposed Deliverables and Timeline

Tasks	Due Date
Task 1: Field reconnaissance	January 2021
Task 2: Field sampling	March 2021
Task 3: Laboratory analysis	October 2021
Task 4: Draft technical report	March 2022
Task 5: Final technical report	June 2022

Introduction and Background

The objective of this study is to establish baseline conditions with which to monitor changes in PCB loadings to San Leandro Bay (SLB) Priority Margin Unit (PMU) to evaluate

and document benefits from upstream management action. The overarching goal of the RMP PCB studies in the PMUs is to establish a conceptual foundation and baseline data to evaluate the response of these nearshore environments to reductions in PCB loading from adjoining watersheds. San Leandro Bay is of particular interest because management activity at two identified sources of PCBs in the watershed are in different stages of completion. The former GE station is expected to be a major source of PCBs, and cleanup action at the site has largely been completed. The site has been completely capped and building demolition is planned. Cleanup activity is expected at another expected PCB source, at the former Union Pacific Railroad (UPRR) site, over the next few years. All of these activities are expected to provide ongoing and future PCB loading reductions to SLB.

The RMP recently completed a conceptual model study of the SLB PMU (Yee et al. 2019). A mass balance model for SLB projects that the water and surficial sediment concentrations will decrease proportional to reductions in loading, but the timing and magnitude of any decline is highly uncertain. The recommended monitoring strategy includes monitoring near-field immediately downstream of major management actions.

Passive samplers have been developed to measure the freely dissolved water concentration for nonpolar organic contaminants, and there is growing use of passive samplers to monitor site recovery from management activities for PCBs and PAHs (Menzie et al., 2016). In 2016, a pro bono study led by Yeo-Myoung Cho at Stanford University demonstrated the use of PSDs at San Leandro Bay by measuring dissolved water concentration profiles above and below the sediment-water interface at three locations in San Leandro Bay. Measured dissolved water concentrations in San Leandro Bay were at the mouth of East Creek Channel (ECM20m), near Damon Slough (SLBsub1), and in Airport Channel (G4g). PCB concentration trends among the three sites were consistent with surface sediment concentrations and expected loading trends from upstream sources.

The goal of this study is to establish a baseline for monitoring expected PCB loading reductions from cleanup actions at the GE and UPRR sites. Monitoring results are important for demonstrating loading reductions and validating the conceptual model (Yee et al., 2019). Additionally, this study will develop new tools and methods to monitor stormwater flows that may be more widely implemented.

Study Objective and Applicable RMP Management Questions

The objective of this study is to examine PCB loadings and spatial patterns in the SLB PMU through the use of PSDs and sediment traps. This study would address, or contribute to addressing, the following management questions articulated in the PCB Strategy.

1. What are the rates of recovery of the Bay, its segments, and in-Bay contaminated sites from PCB contamination?

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

The study would also address the overarching RMP management questions that are related to these PCB management questions.

Approach

Dissolved water concentrations and suspended sediment samples will be collected at a total of eight sites in San Leandro Bay PMU during the wet season to develop baseline conditions to evaluate future changes in PCB loadings expected from remediation actions at the GE and UPRR site (Figure 1). The sampling sites are briefly described below:

- 1 - East Creek Channel downstream of GE site
- 2 - East Creek Channel further downstream near Interstate-880
- 3 - ECM20 where East Creek Channel discharges in San Leandro Bay, which was also sampled using passive samplers in 2016
- 4 - Damon Slough Channel downstream of UPRR site
- 5 - Damon Slough Channel further downstream near Interstate-880
- 6 - SLBsub1 where Damon Slough Channel discharges to San Leandro Bay, which was also sampled using passive samplers in 2016
- 7 - San Leandro Bay between East Creek and Damon Slough
- 8 - G4g in Airport Channel, which was also sampled using passive samplers in 2016. This site can be used as the reference site away from direct influence downstream of GE and UPRR site.

New configurations of sampling equipment will be designed and developed in collaboration with Stanford University to collect suspended sediment using sediment traps and to measure dissolved water concentration profiles using passive samplers. Each equipment setup is expected to include a small sediment trap, and passive samplers measurements at 3 depths (overlying water, overlying water water within 1 cm above sediment-water interface, porewater within 1 cm below sediment-water-interface). Duplicates will be collected at all sites. One field blank (sediment trap and passive sampler) will be collected during deployment and retrieval. These passive sampling efforts would demonstrate a new approach that could enable the RMP to monitor stormwater at locations that have previously been difficult to sample during storms, reducing reliance on manual collection of samples from individual storm events. Similar approaches have been deployed in other locations to evaluate recovery from upstream contamination sources (Lin et al., 2017).

The purpose of sampling at Sites 1-6 is to analyze PCBs concentrations along a transect downstream of the GE and UPRR site. Site 1 will be selected as close to the GE station as possible, and Site 4 will be selected as close to the UPRR site as possible. Site 7 in San Leandro Bay is added to understand mixing nearfield of these slough inputs in San Leandro Bay. Site 8 is included to provide a reference site away from direct influence from the GE and UPRR site. This site was also sampled in 2016. Because there is the possibility of losing sampling equipment or samples (e.g., washout during high stormwater flows, or accidental or intentional removal by humans or animals) we will deploy replicate sets of equipment at nearby sites along the transect, and prioritize analysis of the most successful/least disturbed collections after samples have been retrieved.

We expect this sampling design to provide valuable baseline data to monitor future changes in tributary loadings in East Creek channel and Damon Slough Channel. Future monitoring efforts may potentially rely on PSD devices to monitor PCB concentration trends and complement monitoring trends in the sediment and biota. We expect that passive samplers may correlate well with trends in these other matrices and reduce the number of sediment and biota samples needed, reducing future sampling and analytical costs, or help track progress in environments where sufficient biota for pollutant analysis are sporadically or not at all found (such as in a recent effort to find shiner surfperch and small fish in Steinberger Slough, another PMU).

Stanford collaborators will also provide in-kind support to the project by collecting and analyzing additional samples. In particular, Stanford will conduct equilibrium partitioning studies to understand equilibrium concentrations with suspended sediment using PSDs. This will be compared with measured dissolved water concentrations in the field.

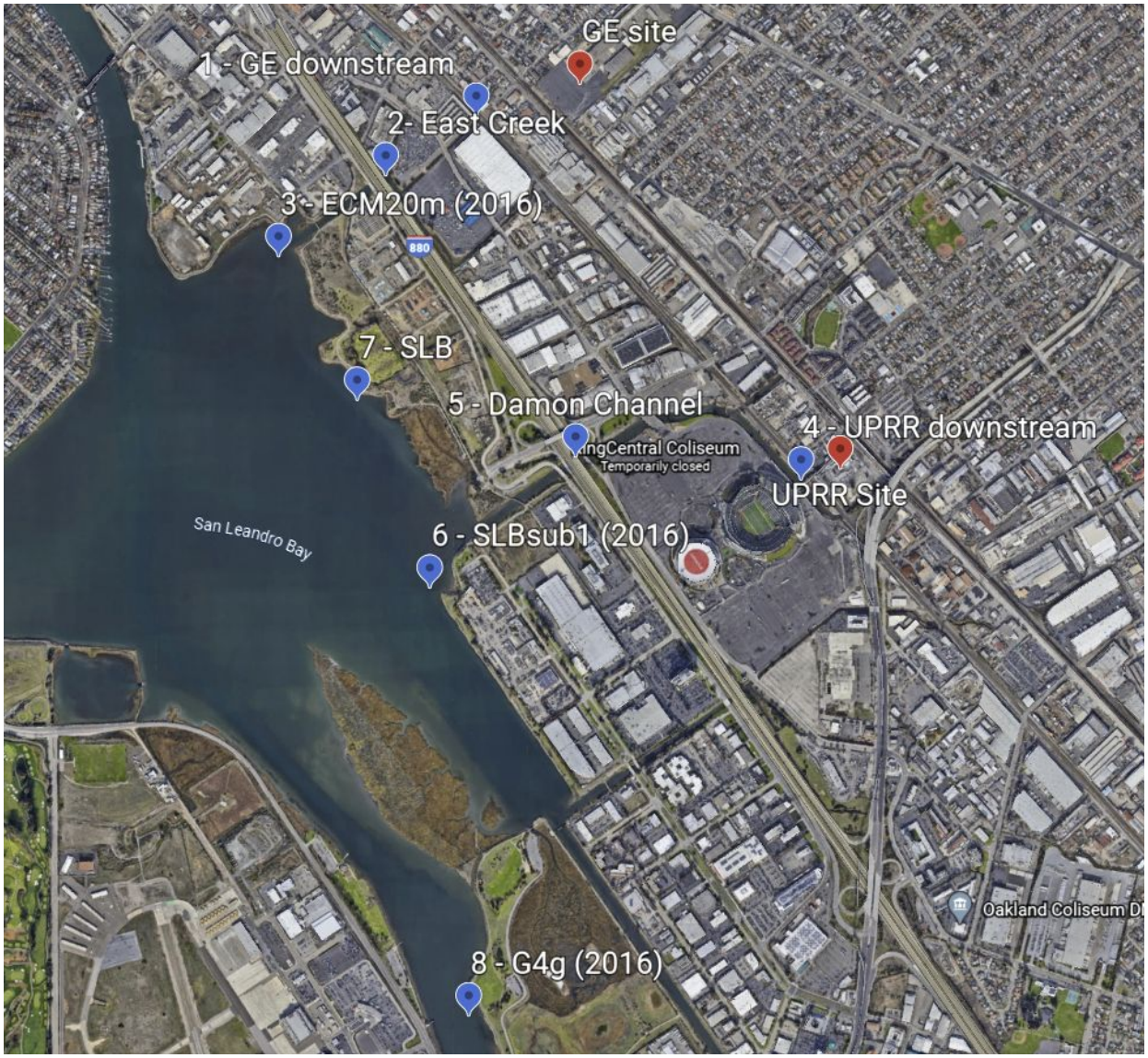

Figure 1: Proposed sampling locations.

Budget Item	Hours	Budget
Project management	15	$2,300
Field reconnaissance and sampling	72	$12,300
Reporting	50	$10,000
Stanford subcontract - labor and equipment		$12,000
Stanford subcontract - laboratory analysis ($1,000/sample)		$48,000
SGS Axys subcontract - laboratory analysis ($1,000/sample)		$18,000

Direct costs - travel and shipping		$600
Total		**$109,200**

Project management
This includes SFEI labor costs to manage project budget, develop contracts, and coordinate activities with subcontractors.

Field reconnaissance and sampling
This includes estimated SFEI labor hours to conduct field reconnaissance to develop sampling design and support Stanford University to collect field samples. Hours estimated includes preparing field equipment, and traveling to the field to deploy and retrieve equipment on separate days

Reporting
This includes estimated SFEI labor hours needed to support Stanford researchers for developing a report. Reporting cost are significantly reduced because Yeo-Myoung Cho of Stanford University will be the lead author for the report. Dr. Cho's time spent report writing will be an in-kind contribution from Stanford.

Stanford sub-contract
Field sampling will be led by Stanford University, who will provide sediment trap and passive sampling equipment, and deploy and retrieve equipment. Estimated sub-contract costs for field sampling activity including use of equipment and labor is estimated to be $12,000. Analytical cost for analysis of passive samplers is estimated to be $48,000 based on $1,000/sample for 48 samples (8 sites * 3 passive sampling depths * 2 duplicates). LDPE samplers (Stanford University). Costs may be scaled based on increasing or reducing the number of samples.

SGS Axys subcontract - sediment analysis
Analytical cost for analysis of sediment samples is estimated to be $1000/sediment sample (PCBs (209 congeners) by SGS Axys; grain size, TOC, and total solids by another contract lab). The number of sediment samples for analysis is 18 (8 sites * 2 sediment trap samples) If the solids mass in the sediment trap is too low to analyze as a sediment sample, it may instead be analyzed as a water sample, with subsamples taken for SSC and TOC.

Direct costs
This includes estimated costs for shipping sediment samples to SGS Axys for analysis (British Columbia, Canada), and direct cost for purchasing equipment and travel to site.

Matching Funds from Stanford

In addition to the in-kind contribution from Stanford for report preparation ($20,000), other in-kind contribution items include: 1) field equipment and samplers

(~1K), 2) sediment trap processing (~2K), and 3) Stanford's additional PSD sampling and equilibrium validation studies (~ 40K). The overall amount of matching funds is estimated to be at least $60K.

Amount from RMP:	**$101,300**
In-kind from Stanford:	**$60,000**
Total Budget	**$161,300**