Detailed Workplan and Budget for Fiscal Year 2019 - 2020

As approved by the Delta RMP Steering Committee on May 29, 2019

AQUATIC SCIENCE CENTER

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Introduction

The purpose of this document is to provide the Delta RMP Steering Committee (SC) with a detailed workplan and budget for Fiscal Year 2019-2020 (FY19-20). The fiscal year covers the period from July 1, 2019 to June 30, 2020, and matches the fiscal year of the state of California and state agencies with whom the program works closely.

This workplan covers the core functions of administration, finance, and governance. These annual tasks are planned to take place over the course of the fiscal year. In addition, the workplan describes monitoring projects for mercury, pesticides and aquatic toxicity, special studies for nutrients, and year one of a pilot study of contaminants of emerging concern (CECs). Monitoring projects authorized under this workplan have a project duration of 1.5 to 2 years and are planned to be completed by June 30, 2021.

For the upcoming fiscal year, the overall planned expense is **$966,884**. Of this, 28% is for core functions, governance, and administration, and 72% is for water quality monitoring and special studies.

Forecast revenue from Delta RMP participants is **$1,215,663**. Additional cash on hand and expected revenues are sufficient to cover all planned expenses.

In addition, the workplan leverages an estimated **$837,630** of in-kind contributions from other agencies, including the U.S. Geological Survey (USGS), U.S. Army Corps of Engineers, California Department of Water Resources (DWR), U.S. Bureau of Reclamation (USBR), Moss Landing Marine Laboratory (MLML), the State Water Resources Control Board's Surface Water Ambient Monitoring Program (SWAMP), Regional San, the State Water Contractors, and Metropolitan Water District of Southern California (Met).

Staff of the Aquatic Science Center (ASC) have worked with technical subcommittees to develop study proposals that are consistent with planning budgets set by the Steering Committee. Proposals for monitoring and special studies were vetted by the respective subcommittees and brought to the Technical Advisory Committee (TAC) on May 9, 2019. The subcommittees have continued to endeavor to develop proposals consistent with feedback of the 2016 External Review Panel.

In the spring of 2019, the TAC reviewed and prioritized the scientific studies based on the planning budgets for each focus area. Detailed workplans for these studies are provided as attachments to this workplan. ASC then prepared this detailed workplan for the recommended studies and core functions of the program. This document summarizes:

- Expected revenue for the 2019 – 2020 fiscal year;
- A detailed budget and workplan for the core functions of the program;
- A detailed budget and workplan for monitoring and special studies;
- The overall FY19-20 Delta RMP budget.

Revenue Forecast

In July 2018, the SC voted for a one-time fee increase to all participants of 3%. Expected contributions from new and continuing participants amount to **$1,215,663**.

The Delta RMP has access to some in-kind funds that we can use at our discretion, such as a State Board contract with UC-Davis for toxicity testing (the "SWAMP Contract"). These funds are not "fungible." In other words, they cannot be used for any purpose other than toxicity testing, nor can they be used with a different vendor. Our budgeting and financial reporting for the Delta RMP only includes funds that we manage. However, we carefully track in-kind contributions to the program. See Table 9, **In-Kind Contributions** on page 25.

The number of Delta RMP participants has steadily grown over the life of the program, as shown below. Table 1 shows the how the number of Delta RMP participants has evolved, along with their financial contributions.

Table 1. History of Delta RMP participation and revenue

Fiscal Year	Number of Participants		Contributions by Participants	
FY 15-16	33		$751,733	
FY 16-17	35	+6%	$862,082	+15%
FY 17-18	49	+40%	$997,356	+16%
FY 18-19	52	+6%	$1,180,256*	+18%
FY 19-20	52	–	$1,215,663	+3%

*The figures for contributions in FY18-19 and FY19-20 do not include a $50,000 contribution by the Army Corps of Engineers, who joined as a contributor during FY18-19. The Corps is contributing by directly funding the USGS California Water Science Center to perform pesticides monitoring for the Delta RMP, offsetting our costs for monitoring. We are tracking this as an in-kind contribution to the program.

Below, Table 2 summarizes the past and expected revenue for FY19-20 summarized by category of participant. Figure 1 shows revenue growth by participant category, showing actual revenue for the past three fiscal years and expected revenue for FY19-20.

Table 2. Delta RMP revenue schedule.

Participant Category	FY15-16 Actual	FY16-17 Actual	FY17-18 Actual	FY18-19 Actual*	FY19-20 Expected	Comment
Agriculture	$113,780	$148,780	$148,780	$148,780	$153,243	
Dredgers		$60,000	$60,000	$63,000	$64,890	Includes the Ports of Stockton and West Sacramento (joined during FY16-17) and the Sacramento Yacht Club (joined in FY17-18).
Flood Control and Habitat Restoration				$200,000	$206,000	The California Department of Water Resources joined the program in FY18-19.
POTW (Wastewater)	$209,754	$205,103	$197,077	$197,077	$202,989	The City of Discovery Bay did not participate in the RMP in FY16-17 but did in FY17-18 and thereafter. By approval of the CV Water Board, the City of Stockton contributed $24,777 in FY16-17 but is permitted to pay $12,100 in other years.
State of California	$17,649					The state directly funded the program in FY15-16, but since then has lent in-kind support.
Stormwater	$328,199	$348,199	$491,399	$571,399	$588,541	12 new participants joined in FY17-18. CalTrans joined the program in FY18-19, contributing $80,000.
Water supply	$100,000	$100,000	$100,000			SFCWA announced its dissolution in 2018. To date, no other water supply agency has pledged to support the program.
Total	$769,382	$862,082	$997,256	$1,180,256	$1,215,663	

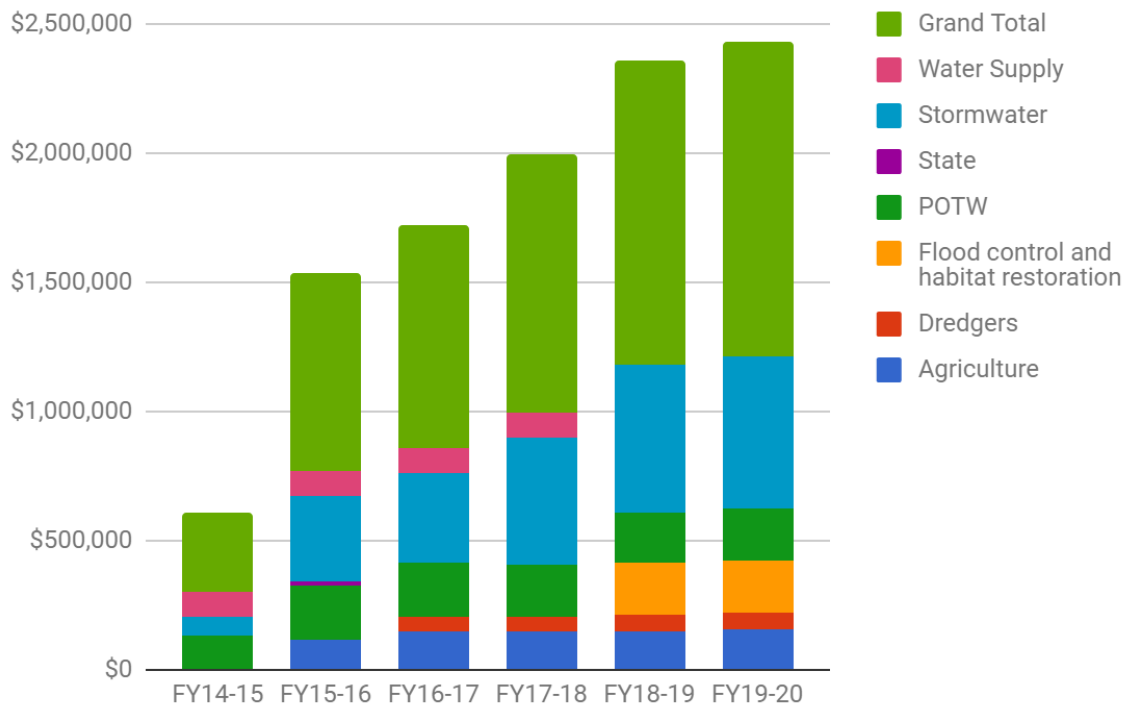

Figure 1. Bar chart of revenue by fiscal year and by participant category, showing actual revenue for the past 4 fiscal years and expected revenue for FY19-20.

Program Core Function Expenses

Delta RMP expenses fall into two categories: core function expenses associated with administering a multi-faceted, stakeholder-driven monitoring program; and special studies and monitoring to answer Delta RMP assessment questions. This section details the core function expenses for FY19-20. The core function budget includes the following categories of tasks:

- Preparation of program planning documents (e.g., Workplan, Monitoring Design)
- Contracts and financial management
- Governance
- Quality assurance

The planned budget for core functions is **$273,455**, slightly lower than the budgeted and projected expenses for core functions in FY18-19. Below are notes on certain tasks:

- **Travel expenses** are no longer included under any task. Due to a change in SFEI-ASC's policies and accounting practices, travel expenses are not charged to the Delta RMP when employees use a company vehicle.
- **Task 2A, Steering Committee Meetings, and Task 2B Technical Advisory Committee Meetings ($33,000 each)**. These budget lines are slightly lower than in past years as billing has tracked low as we have become more efficient at running meetings, and current staff have lower billing rates than those in the past.
- **Direct expenses for Tasks 2A and 2B (SC and TAC meetings)**: In FY19-20, we are planning to have ASC staff to attend meetings to take notes and write meeting summaries rather than hiring a contractor for this function. We are also planning to have lunch delivered by a caterer. This should be more convenient for meeting participants and help boost *esprit de corps*.
- **Subcontractor budget for Task 2B, TAC meetings** has been increased to $38,955 to account for actual staff time contributed by the TAC chair, Stephen McCord, who makes significant contributions to the program outside of meetings, by participating in subcommittees, reviewing documents, and contributing to planning efforts.
- **Task 2D, Multi-Year Planning Workshop ($8,000)** – this new budget line has been added to cover a day-long strategic planning workshop requested by the Steering Committee.
- **Task 2E, Science Advisors Honoraria ($5,000)** – this budget line is lower than when it was introduced two years ago, as several of our advisors are state employees and are barred from receiving an honorarium by state ethics rules.

Full details about the labor, subcontract, and direct costs as well as the deliverables to be accomplished for each of the core functions tasks are provided in Table 3.

Table 3. Delta RMP 2019 – 2020 fiscal year planned expenses for core functions and administration, including task descriptions, budget justifications, and deliverables.

Task	Subtask	Expense Type	Budgeted Expense	Budget Justification	Deliverables
1. Core Functions	A. Program Planning	Labor	$45,000	Planning, preparing annual workplans and budgets, including technical proposals for monitoring and special studies. Tracking deliverables and action items. Updating foundational documents including Charter, Multi-Year Plan, Communications Plan, and Monitoring Design as needed.	40 hours for Program Manager to produce the Annual Workplan and Budget. 100 hours (2 hrs/wk) for Program Manager to track and execute deliverables/ action items. 200 hours (4 hrs/wk) for technical staff to develop study designs and monitoring designs, contribute to workplan, complete project management tasks, and update program documents. (340 hours total.)
	B. Contract and Financial Management	Labor	$55,000	Tracking expenditures versus budget. Providing quarterly financial updates to the Steering Committee. Developing contracts and managing subcontractors. Invoicing program participants.	300 hours for Finance Associates (1.5 hrs/$5000 budget), 80 hours for Contracts Manager (10 hours for each new contract), 80 hours for Program Manager and 40 hours for technical staff to draft and negotiate contracts and compile legal advice (500 hours total).
2. Governance	A. SC meetings	Labor	$31,000	Preparing agendas, agenda packages, participating in meetings, editing meeting summaries, following up on action items, meeting with Co-Chairs and stakeholders outside of meetings.	4 full-day meetings per year plus 1-2 teleconferences as needed. For each meeting: 40 hours for Program Manager, 20 hours for Lead Scientists, 20 hours for Environmental Analyst. Facilitation by the co-chairs at no additional cost to the program.
		Direct Expense	$2,000	Lunch for SC meetings	$500 for each meeting; lunch for 25-30 people.
	B. TAC meetings	Labor	$31,000	Preparing agendas, agenda packages, participating in meetings, writing meeting summaries, following up on action items, meeting with Co-Chairs and stakeholders outside of meetings. The cost for this function includes a subcontract for Stephen McCord, who will continue as chair of the TAC, with ASC serving in a coordination role.	4 meetings per year plus 1-2 teleconferences as needed. For each meeting: 20 hours for Program Manager, 24 hours for Environmental Scientist, 12 hours for Environmental Analyst, 4 hours for Senior Environmental Scientist. TAC Chair services provided by MEI.
	B. TAC meetings	Direct Expense	$2,000	Lunch for TAC meetings	$500 for each meeting; lunch coffee for 25-30 people.

Task	Subtask	Expense Type	Budgeted Expense	Budget Justification	Deliverables
2. Governance		Subcontracts	$38,955	Contract with McCord Environmental, TAC chair	Total of 159 hours for Stephen McCord: Prepare for and facilitate 4 TAC meetings (64 hrs), participate in SC meetings (47 hrs), review documents and coordinate with Delta RMP participants and leadership (48 hrs).
	C. Technical Subcommittees	Labor	$38,000	Preparing agendas, agenda materials and presentations, participating in meetings, writing meeting summaries, following up on action items, discussion with participants and stakeholders outside of meetings. Note that subcommittee meetings are typically shorter than SC & TAC meetings, often 2-3 hours long, and some are held by phone and internet.	16 meetings per year. For each meeting: 4 hours for Program Manager, 12 hours for Lead Staff, 4 hours for Environmental Analyst. Includes leading and participating in technical subcommittee meetings covering pesticides, aquatic toxicity, CECs, Data Management, and Nutrients.
	D. Multi-Year Planning Workshop	Labor	$7,250	Funds a day-long planning workshop requested by the Steering Committee, to be held in the summer or fall of 2019. Budget estimate does not include the fee for a professional facilitator and assumes that facilitation will be pro bono or by program staff.	32 hours for program managers, 8 hours each for analyst and senior scientist.
	D. Multi-Year Planning Workshop	Direct Expense	$750	Lunch for the day-long multi-year planning workshop	Lunch, coffee, and snacks for 30 people.
	E. Science Advisors Honoraria	Subcontracts	$5,000	Honoraria and travel expenses for our independent experts to attend meetings and review program documents.	Note that several of our advisors are state employees and are barred from receiving an honorarium by state ethics rules, hence this budget line is decreased from previous years. Other option is to maintain higher funding and recruit more advisors from industry or academia.
3. Quality Assurance	A. Quality Assurance Project Plan	Labor	$17,500	Updating the Quality Assurance Project Plan, writing Quality Assurance Reports for datasets, coordinating interlaboratory comparison tests (as needed), researching analytical methods, maintaining laboratory SOP file system.	40 hours for ASC QA Officer. 16 hours for ASC senior chemist, 16 hours for chief data scientist, 12 hours for GIS specialist, 44 hours for RMP technical staff. (124 hours total)

Expenses for Monitoring and Special Studies

This workplan contains monitoring and special studies for mercury, nutrients, pesticides and aquatic toxicity, and contaminants of emerging concern (CECs). No further studies are planned for pathogens at this time.

The total cost for the monitoring programs and special studies amounts to **$693,429**.

The planned expense of each of the planned monitoring programs is shown in Table 6 on page 17. Further details of the budget by task for monitoring and special studies are shown in Table 7 on page 18. The tasks to be completed, subcontractors, and deliverables for these tasks are described briefly below and in detailed monitoring designs attached as appendices to this document:

Appendix A: Nutrients
Appendix B: Mercury
Appendix C: Pesticides and Aquatic Toxicity
Appendix D: Contaminants of Emerging Concern

Nutrients - $258,688

A special study is planned for FY19-20: Sacramento River Nutrient Change Study Phase 1: Effluent Valve Replacement Hold.

This study will track the effects of changes in nutrient loading resulting from a short-term wastewater hold at the Sacramento River Wastewater Treatment Plant (SRWTP). In the summer of 2019, scheduled wastewater effluent holds will occur during the Effluent Valve Replacement (EVR) project, part of the EchoWater upgrade at the SRWTP. During an EVR hold, no treated effluent will enter the Sacramento River for a period of up to 48 hours. Based on prior research (Kraus et al. 2017) this should create a parcel of effluent-free river water over six miles long in the Sacramento River. The impacts of short-term changes in nutrient loading will be tracked in parcels of water with and without effluent during movement downstream in the Sacramento River and nearby channels.

The project consists of one week-long river sampling campaign, field measurements laboratory analyses, numeric modeling, and reporting. The project will use multiple methods, including boat-mounted, high frequency monitoring of nutrients and fluorescence; discrete sampling for analyses of water quality, phytoplankton and zooplankton abundances, clam biomass, and phytoplankton carbon uptake (to determine growth rates). Data and hydrodynamic modeling will be used to evaluate the response of phytoplankton to a range of nutrient loads and forms, as well as factors of light, turbidity, water residence time, and grazing by zooplankton and clams. See the end of the document for conceptual model and project hypotheses.

The project team is targeting an EVR hold in August 2019 for the field work. All data review and submissions, data analyses, modeling, and reporting would be complete within 18 months of the field work.

Regional San will provide staff hours and equipment for project oversight, development of the QAPP, collection of water samples, and coordination of a final report. ASC will provide financial management and contracting services. Other cooperators include (with the amount of their subcontract):

Phytoplankton and zooplankton enumeration (BSA Environmental Services)	$30,000
Phytoplankton growth evaluations (Applied Marine Sciences, Inc.).	$103,000
Numeric modeling of proportional water volumes and mixing (Resource Management Associates)	$125,688
Zooplankton growth and condition (San Francisco State University)	$170,000
Zooplankton growth and condition (San Francisco State University) [2]	$170,000
Discrete water quality sampling (Regional San) [3]	$211,635
High frequency data collection and mapping (USGS) [4]	$210,000

1. Task supported by State Water Contractors and Metropolitan Water District
2. Applied Marine Sciences and SFSU will have staff on Regional San boat to collect data and samples for tasks 2 and 4, respectively.
3. Task supported by USGS ($60,000 for in-kind boat and equipment resources) and US Bureau of Reclamation ($150,000).

Mercury - $282,394

Mercury monitoring in FY19-20 will collect samples of sport fish and water in order to address the highest priority information needs related to implementation of the Methylmercury TMDL. The focus of Delta RMP mercury monitoring is on the concentrations of organic mercury, or methylmercury in fish. This is a toxic form of mercury, and thresholds have been established for protection of human and wildlife health. The program continues annual sport fish sampling at 7 sites. Water sampling will be decreased to 4 times per year at 6 sites. Sediment monitoring is not planned in FY19-20.

As shown in Table 4 below, the scope and budget for mercury monitoring has grown steadily, as the program seeks to provide timely information to the Central Valley Regional Water Quality Control Board as it is updating the Delta Methylmercury TMDL. After FY19-20, budgets for status and trends water monitoring can be reduced, while continuing to conduct annual sportfish monitoring in order to build up a long-term time series that will be useful to managersf or evaluating long term trends. We anticipate conducting restoration monitoring for the next three to five years to understand whether wetland restoration causes an increase in methylmercury in fish.

An interpretive report is planned in FY19-20 that will synthesize data from the first three years of Delta RMP mercury monitoring into information to guide important upcoming management decisions. First, staff of the Central Valley Regional Water Quality Control Board will use Delta RMP mercury data to revise the Methylmercury TMDL.[1] Second, scientists at the California Department of Water Resources (DWR) will use these data for modeling and analysis that guides regulations and operational decisions related to farming, flood control, and wetland management.[2]

[1]Delta Methylmercury Total Maximum Daily Load, Phase II, see https://www.waterboards.ca.gov/rwqcb5/water_issues/tmdl/central_valley_projects/delta_hg/

[2] Delta Mercury Control Program, see https://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/delta_hg/control_studies/deltahg_oct2015pr_openwater.pdf

Table 4. Sampling frequency for the first three years of Delta RMP mercury monitoring, and planned frequency in FY19-20.

	Sportfish (bass)			Water			Sediment		
	Events	Sites	# Samples	Events	Sites	# Samples*	Events	Sites	# Samples*
FY16-17	1	6	6	4	5	20	-	-	-
FY17-18	1	6	6	7	6-8	54	4	6	24
FY18-19	1	7	7	8	8	64	-	-	-
FY19-20	1	7	7	4	6	24	-	-	-

*Indicates the number of environmental samples. Additional field duplicates and field blanks shall be collected as specified in the Quality Assurance Project Plan.

Pesticides and Aquatic Toxicity - $118,026

The Pesticides Subcommittee requested funding for the second year of a four-year monitoring design for pesticides and aquatic toxicity in the Delta. At its May 29, 2019 meeting, the Steering Committee voted to fund the first 6 months of the study, and directed staff to seek competitive bids for subsequent aquatic toxicity testing. Therefore, the project described here covers 3 of the 6 monitoring events planned in Water Year 2020.

The study will be led by ASC with assistance from USGS through a subcontract. Analyses of aquatic toxicity will be performed by the Aquatic Health Program Laboratory at UC Davis. During the first half of Water Year 2020, aquatic toxicity testing will be paid for by the State Water Resources Control Board. During the first half of the fiscal year, staff of the State Board's Office Information Management and Analysis (OIMA) will be responsible for Data Management and Quality Assurance of toxicity data.

This contract is set to expire in March 2020. As a result, the SWAMP funding will likely only carry us through half of Water Year 2020's planned monitoring. The Steering Committee voted to fund the first half of the sampling program, and directed staff to seek out competitive bids from aquatic toxicity testing labs before considering funding the second half of the Water Year 2020 monitoring program.

Additional details of the pesticides study are shown in Attachment C. This monitoring project includes a $50,000 cost share from the US Army Corps of Engineers, a $6,975 cost share from the USGS for labor and travel expenses and leverages up to $164,020 in funding from the State Water Board to fund aquatic toxicity testing.

Contaminants of Emerging Concern - $34,321

At its May 29, 2019 meeting, the Steering Committee voted to fund *only the fish monitoring portion* of the planned pilot study of Contaminants of Emerging Concern (CECs) meant to begin in FY19-20. The SC approved implementation of other components of the proposed study, but is

anticipating that external funding via Supplemental Environmental Project (SEP) funds will become available in the near future to fund other components of the study.

This pilot study has been designed to better understand the occurrence of Contaminants of Emerging Concern (CECs) in the Sacramento-San Joaquin Delta. It is part of a statewide pilot study of CECs being conducted in different regions of California following a mandate and guidelines by the State Water Resources Control Board.[3] The Delta RMP is implementing a workplan for this pilot study that was developed by Central Valley Regional Water Quality Control Board (Central Valley Water Board) and the State Water Resources Control Board (State Water Board), the Central Valley Clean Water Association (CVCWA) and several Central Valley Municipal Separate Storm Sewer System (MS4) representatives (collectively "Stakeholders").

The pilot study was planned to sample water, sediment, fish, and bivalve (clam) tissue and analyze these samples for a range of emerging contaminants, including pharmaceuticals, personal care products, and industrial chemicals. While some researchers include pesticides under the heading of CECs, this study does *not* include pesticides, as the Delta RMP already conducts a comprehensive program to monitor current use pesticides.

The full version of the planned study is a relatively complicated pilot study with 5 organizations doing field work and 4 analytical labs, so a significant amount of oversight and coordination by ASC will be needed. Table 5 gives an overview of the CEC Pilot study sampling locations, target matrices, and field agencies. Details on the monitoring design for this study can be found in the Central Valley Pilot Study for Monitoring Constituents of Emerging Concern Work Plan and in the Quality Assurance Project Plan, currently in draft, but scheduled to be finalized and signed before monitoring begins in the summer/fall of 2019.

[3] Tadesse, Dawit. 2016. "Constituents of Emerging Concern (CECs) Statewide Pilot Study Monitoring Plan." State Water Resources Control Board. https://www.waterboards.ca.gov/water_issues/programs/swamp/cec_aquatic/docs/oima_sw_cec_mon_plan.pdf.

Table 5. Overview of the CEC Pilot study sampling locations, target matrices, and field agencies

		Number of sampling events per year, for each target matrix:					Agency doing sampling for each matrix:			
Station Name		Water	Sediment	Fish	Bivalves		Water	Sediment	Fish	Bivalves
Sacramento River at Veterans Bridge		4	-	1	1		SFEI	-	MLML	AMS
Sacramento River at Freeport		4	-	1	1		DWR-MWQI	-	MLML	AMS
Sacramento River at Hood Monitoring Station Platform		4	-	-	1		DWR-MWQI	-	MLML	AMS
American River at Discovery Park		4	1	-	1		DWR-MWQI	SPOT	MLML	AMS
San Joaquin River at Airport Way near Vernalis		4	-	1	1		DWR-MWQI	-	MLML	AMS
San Joaquin River at Buckley Cove		4	-	1	1		DWR-MWQI	-	MLML	AMS
Dry Creek u/s of WWTP		4	1	-	-		SFEI	SFEI		-
Old Alamo Creek at Lewis Road		4	1	-	-		SFEI	SFEI		-

Summary

On the following page, Table 6 summarizes planned expenses for monitoring and special studies planned in FY19-20 and described in this workplan.

Table 6. Summary of Delta RMP 2019 – 2020 fiscal year monitoring and special studies

Task, Subtask	Direct Expense	ASC Labor	Subcontracts	Total
4. Sacramento River Nutrient Change Study			$258,688	$258,688
5. Mercury Monitoring FY19-20				
A. Field Sampling and Lab Analysis[1]			$222,394	$222,394
B. Mercury in Water Data Mgmt and QA		$15,000		$15,000
C. Mercury in Fish Data Mgmt and QA		$15,000		$15,000
D. Mercury Reporting		$30,000		$30,000
		$60,000	$222,394	$282,394
6. Pesticides Monitoring Water Year 2020				
A. Field sample collection and pesticides chemical analysis[2, 3]			$79,477	$79,477
D. Pesticides Data Mgmt and QA		$38,549		$21,202
		$38,549	$79,477	$118,026
7. CEC Pilot Study Year 1				
C. Fish Sampling			$14,360	$14,360
D. Chemical Laboratory Analysis			$7,260	$7,260
H. Fish Data Mgmt and QA		$12,351		$12,351
S. Sample Shipping	$350			$350
	$350	$12,351	$21,620	$34,321
Monitoring & Special Studies Total	$350	$110,900	$582,179	$693,429

[1]Represents the cost to the Delta RMP. Moss Landing Marine Laboratory (MLML) has pledged $25,000 as in-kind services for mercury field sampling and analytical work.

[2]Cost to the Delta RMP. Includes a contribution of $50,000 by the US Army Corps of Engineers made directly to the USGS. Also includes an in-kind contribution by the USGS in terms of a cost-share on labor and supplies.

[3]Toxicity lab work by the Aquatic Health Program Laboratory at UC Davis (AHPL) is funded directly by the State Water Resources Control Board through the Surface Water Ambient Monitoring Program (SWAMP).

Table 7. Budget details for monitoring and special studies

Task	Subtask	Expense Type	Budget	Description	Budget Justification	Deliverables
4. Sacramento River Nutrient Change Study	A. Sacramento River Study	Sub-contract	$258,688	Phytoplankton and zooplankton enumeration (BSA Environmental Services) Phytoplankton growth evaluations (Applied Marine Sciences, Inc). Numeric modeling of proportional water volumes and mixing (Resource Management Associates)	Project includes $591,635 in in-kind contributions by San Francisco State University, Regional San, and the USGS.	(1) Final report describing background information for the modeling applications, data acquisition, modeling results, and interpretation of results. (2) Modeling results will include estimates of source water volumes and mixing at sampled locations and times, documentation on grid updates and checks of flow and stage calibration, metadata used in modeling refinements. (3) Particle-tracking products will be documentation describing the particle tracking model set-up, travel time estimates and two movie-style visualizations of particle transport.
5. Mercury Monitoring FY19-20	A Field Sampling and Lab Analysis	Sub-contract	$222,394	Field collection of fish and water samples and laboratory analyses by the Moss Landing Marine Laboratory (MLML).	Includes a $25,000 in-kind contribution from MLML	Cruise report, Electronic data deliverables of lab results

Task	Subtask	Expense Type	Budget	Description	Budget Justification	Deliverables
5. Mercury Monitoring FY19-20	B. Mercury in Water Data Management and Quality Assurance	Labor	$15,000	Project Management and Coordination: setting up internal tracking system, communicate with DS team, PIs and labs on deliverables and issues. Data Management: manage collection info, create electronic data deliverable (EDD) templates, populate data into CEDEN templates from lab spreadsheet, log in Data sets, format data; Data Validation: Conduct data quality assurance procedures outlined in the Quality Assurance Project Plan (QAPP), data storage and release, upload final data CEDEN. Create summary tables for reporting.	45 hours for data services manager, 63 hours for data analysts, and 10 hours for QA officer.	(1) Provisional data provided to TAC and CEC Subcommittee (2) Final data published in CEDEN (3) QA Summary, distributed to TAC and included as an appendix in annual report"
5. Mercury Monitoring FY19-20	C. Mercury in Fish Data Management and Quality Assurance	Labor	$15,000	Same as above. Water and fish are different "matrices," therefore are handled separately.	20 hours for data services manager, 55 hours for data analysts, and 14 hours for QA officer.	(1) Provisional data provided to TAC and CEC Subcommittee (2) Final data published in CEDEN (3) QA Summary, distributed to TAC and included as an appendix in annual report
	D. Mercury Reporting	Labor	$30,000	Interpretive report summarizing the first 3 years of Delta RMP mercury monitoring, with a goal of providing information to staff at the Central Valley Water Board responsible for updating the Methylmercury TMDL.	Includes 80 hours for Principal Investigator, 80 hours for Environmental Analyst, 16 hours for program manager, 16 hours for data analyst, and 8 hours for programmer.	Mercury Interpretive Report: (1) Draft report (2) Response to comments (3) Final draft report (4) Final report

Task	Subtask	Expense Type	Budget	Description	Budget Justification	Deliverables
6. Pesticides Monitoring Water Year 2020	A. Field sample collection and pesticides chemical analysis	Sub-contract	$79,477	USGS subcontract for field sample collection, laboratory analysis.	Subcontract with USGS PFRG for collecting 24 environmental water samples and laboratory analysis for a suite of Current Use Pesticides. Includes a $50,000 contribution by the Corps of Engineers, paid directly to USGS, and a USGS cost share on labor and supplies.	(1) Field data sheets (2) Chain of Custody Forms (3) Electronic Data Deliverables of pesticide chemistry results in CEDEN template format. (4) Pesticides Chemistry Lab Report (Report to the Delta RMP; not a formal USGS Data Series Report)
	D. Pesticides Data Management and Quality Assurance	Labor	$38,549	Includes: DS Project Management and Coordination (40 hours); Data Receipt and Data Management (160 hours); Data Validation (52 hours); Data Storage and Release (46 hours);	Includes 40 hours for data services manager, 203 hours for data analysts, and 52 hours for QA officer.	(1) Pesticides chemistry QA Summary; (2) Spreadsheets of provisional data for sharing with Technical Advisory Committee (twice annually); (3) Data and metadata uploaded to CEDEN.
7. CEC Pilot Study Year 1	C. Fish Sampling	Sub-contract	$14,360	Subcontract with Moss Landing Marine Laboratory. CEC fish collection at Delta RMP Mercury Monitoring site CEC fish collection at new site specific to this study Fish compositing (2) Archive sample storage for up to two years	Cost is held low as MLML are combining fishing with Delta RMP mercury sampling. Fish collection at 2 current Delta RMP mercury monitoring sites, and at 2 "new" sites. Compositing of fish tissue from 5 fish into a homogenized sample in ultra-clean laboratory.	(1) Field Collection Info in the CEDEN template (2) Chain of Custody Forms (3) Cruise Report
	D. Chemical Laboratory Analysis	Sub-contract	$7,260	Subcontract with SGS Axys Laboratory.	Laboratory analysis of a suite of Contaminants of Emerging Concern (CECs) in fish tissue.	Electronic data deliverables in CEDEN templates submitted by lab to ASC.

Task	Subtask	Expense Type	Budget	Description	Budget Justification	Deliverables
7. CEC Pilot Study Year 1	H. CECs in fish data management and quality assurance	Labor	$12,351	as above	10 hours for data services manager, 61 hours for data analysts, and 22 hours for QA officer.	Fish chemistry data uploaded to CEDEN
	S. Sample Shipping	Direct Expense	$350	Shipping of samples fish tissue sample to analytical lab.	Cost to ship (FedEx or equivalent): (1)Fish tissue from MLML to Axys	

Science Advisors

This year's workplan includes a $5,000 budget to cover honoraria and travel for up to 4 independent science advisors. Having advisors work with the Program over multiple years is efficient because they will become familiar with the Program and be able to help with adaptive management and review technical reports. The Bay RMP uses this approach to have ongoing, independent peer review of plans and final reports. The science advisor program is *not* a formal program review. Nor do we expect a great deal of written material in the form of reports or papers.

At its May 11, 2018 meeting the Steering Committee requested additional details and a strategy on how we will work with our advisors and engage their expertise. The section below provides the job description that we shared with nominated advisors, and outlines a process to gather input from the advisors in FY19-20.

Job Description

The Delta RMP seeks to work with scientists who can lend their expertise according to our needs and their skills and interest. This includes reviewing proposed monitoring plans, draft reports, and other program documents and give comments on how they can be improved to better support the goals of the Delta RMP. We would like to have advisors attend one meeting per year in person, it could be a meeting of our Technical Advisory Committee, which is a single day usually from 10 am to 4, or a technical subcommittee meeting, which are typically a maximum of 3 to 4 hours long. Further, we would also expect advisors to be available for infrequent, and informal, consultations with program staff to answer questions or discuss technical matters by phone and email. It is difficult to give an exact estimate for time commitment but will likely be on the order of 5 – 15 hours per quarter.

The science advisor program is *not* a formal program review. Nor do we expect a great deal of written material in the form of reports or papers.

In the winter of 2017, the SC and TAC agreed that the program's greatest need was for statistical expertise. Beyond this, the SC and TAC identified three other areas of support: Environmental Statistics/Large Scale Monitoring Programs, Monitoring Design/Interpretation of Data, and Ecosystem Level Effects. Members of the TAC, SC, and technical subcommittees were asked to nominate advisors. In May 2018, the SC confirmed the following advisors (one of them later declined):

- **Statistics and Monitoring Design**
    1) Dr. Neal Willits, UC Davis
    2) Dr. Thomas Grieb, TetraTech
    3) Steve Saiz, Central Valley Regional Water Quality Control Board
- **Toxicity / Pesticides / Contaminants**

1) Dr. Lisa Nowell, USGS
2) Dr. Gary Cherr, UC Davis

Plan for Engaging Advisors

During the 2019 - 2020 fiscal year, the Science Advisors will be asked to provide input on:

1. Draft reports when they are sent to the TAC (ongoing)
2. Draft Pesticides Interpretive Report (fall 2019)
3. Proposed studies for FY20-21 (spring 2020)
4. Attend and participate in our Multi-Year Planning Workshop (summer/fall 2019)

For the FY20-21 proposed studies, the advisors will be asked to review proposals and attend the TAC meeting or technical subcommittee meetings where proposals are discussed.

Subcontractors

Table 8 lists the subcontractors included in the Delta RMP FY19-20 workplan. The contractors and service providers listed below are experienced and familiar with the Delta RMP and the program's needs. Per the Delta RMP Charter, sole source justifications are provided in Appendix E for the subcontracts greater than $50,000.

Table 8. Delta RMP Subcontractors in FY19-20

Contractor	Task	Services	Budget amount
McCord Environmental	2B	TAC Co-Chair, meeting facilitation, coordination with stakeholders	$38,955
Science Advisors	2E	Not technically subcontractors, but categorized this way for budgeting and accounting: Honoraria for science advisors	$5,000
Moss Landing Marine Laboratory	5A	Mercury Monitoring – field sampling and laboratory analysis	$222,394
U.S. Geological Survey Pesticide Fate Research Group (PFRG)	6A	Field sampling and laboratory analysis for pesticides	$79,477
BSA Environmental Services	4A	Phytoplankton and zooplankton enumeration	$30,000
Applied Marine Sciences, Inc.	4A	Phytoplankton growth evaluations	$103,000
Resource Management Associates	4A	Numeric modeling of proportional water volumes and mixing	$125,688
Moss Landing Marine Laboratory	7C	Fish collection for the CEC Pilot study	$14,360
SGS Axys Laboratory	7D	Analysis of fish tissue for PBDEs and perfluorinated compounds.	$7,260
TOTAL			**$626,134**

In-Kind Contributions

Financial reporting for the Delta RMP only includes funds managed by ASC. However, we carefully track in-kind contributions to the program. The success of the program relies on leveraging valuable contributions from partner agencies. Table 9 shows the value of planned in-kind contributions to the Delta RMP during FY19-20.

Table 9. Planned in-kind contributions to the Delta RMP in FY19-20.

Agency	Description	Value
U.S. Geological Survey (USGS, Pesticide Fate Research Group, PFRG)	Matching funds for pesticide monitoring project (10% of labor and travel)	$6,975
Moss Landing Marine Laboratory (MLML)	Cost share for mercury field sampling and laboratory analysis to cover staff time, equipment, and supplies	$25,000
State Water Resources Control Board, Surface Water Ambient Monitoring Program (SWAMP)	Direct funding to the Aquatic Health Program Laboratory at UC Davis covering aquatic toxicity laboratory testing	$164,020
State Water Contractors and Metropolitan Water District of Southern California	Direct funding to San Francisco State University to analyze zooplankton growth and condition, as part of the Sacramento River Nutrient Change Study	$170,000
Regional San	Discrete water quality sampling performed as part of the Sacramento River Nutrient Change Study	$211,635
US Bureau of Reclamation	Funding to the USGS for high frequency data collection and mapping, as part of the Sacramento River Nutrient Change Study	$150,000
USGS California Water Science Center	Use of boat and equipment for high frequency data collection and mapping, as part of the Sacramento River Nutrient Change Study	$60,000
US Army Corps of Engineers	Direct funding to USGS to cover a portion of the costs of pesticide sample collection and analysis.	$50,000
Total		**$837,630**

Overall Delta RMP FY19-20 Budget

The programmatic and scientific budgets for the Delta RMP are shown together in Table 10 on the next page.

Table 10. Delta RMP FY19-20 Overall Budget

Task	*Subtask*	Direct Expense	Labor	Subcontracts	Grand Total
1. Core Functions	A. Program Planning		$46,714		$46,714
	B. Contract and Financial Management		$55,000		$55,000
1. Core Functions Total			$101,714		$101,714
2. Governance	A. SC meetings	$2,000	$31,000		$33,000
	B. TAC meetings	$2,000	$31,000	$38,955	$71,955
	C. Technical Subcommittees		$38,000		$38,000
	D. Multi-Year Planning Workshop	$750	$7,250		$8,000
	E. Science Advisors Honoraria			$5,000	$5,000
2. Governance Total		$4,750	$107,250	$43,955	$155,955
3. Quality Assurance	A. Quality Assurance Project Plan		$17,500		$17,500
3. Quality Assurance Total			$17,500		$17,500
4. Sacramento River Nutrient Change Study	A. Sacramento River Study			$258,688	$258,688
4. Sacramento River Nutrient Change Study Total				$258,688	$258,688
5. Mercury Monitoring FY19-20	A Field Sampling and Lab Analysis			$222,394	$222,394
	B. Mercury in Water Data Management and Quality Assurance		$15,000		$15,000
	C. Mercury in Fish Data Management and Quality Assurance		$15,000		$15,000
	D. Mercury Reporting		$30,000		$30,000
5. Mercury Monitoring FY19-20 Total			$60,000	$222,394	$282,394
6. Pesticides Monitoring Water Year 2020	A. Field sample collection and pesticides chemical analysis			$79,477	$79,477
	D. Pesticides Data Management and Quality Assurance		$38,549		$38,549
6. Pesticides Monitoring Water Year 2020 Total			$38,549	$79,477	$118,026
7. CEC Pilot Study Year 1	C. Fish Sampling			$14,360	$14,360
	D. Chemical Laboratory Analysis			$7,260	$7,260
	H. CECs in fish data management and quality assurance		$12,351		$12,351
	S. Sample Shipping	$350			$350
7. CEC Pilot Study Year 1 Total		$350	$12,351	$21,620	$34,321
Grand Total		$5,100	$337,364	$626,134	$968,598

Attachment A Sacramento River Nutrient Change Study

See project proposal on following pages.

Delta RMP Nutrient Subcommittee FY19/20 Workplan Proposal

Sacramento River Nutrient Change Study Phase 1: Effluent Valve Replacement Hold

Investigators: Lisa Thompson and Tim Mussen (Regional San), Mine Berg (Applied Marine Sciences), Brian Bergamaschi and Tamara Kraus (USGS), and Wim Kimmerer (San Francisco State University)

Project Description

This study will track the effects of changes in nutrient loading resulting from a short-term wastewater hold at the Sacramento River Wastewater Treatment Plant (SRWTP). In the summer of 2019, scheduled wastewater effluent holds will occur during the Effluent Valve Replacement (EVR) project, part of the EchoWater upgrade at the SRWTP. During an EVR hold, no treated effluent will enter the Sacramento River for a period of up to 48 hours. Based on prior research (Kraus et al. 2017) this should create a parcel of effluent-free river water over six miles long in the Sacramento River. The impacts of short-term changes in nutrient loading will be tracked in parcels of water with and without effluent during movement downstream in the Sacramento River and nearby channels.

The project consists of one week-long river sampling campaign, field measurements laboratory analyses, numeric modeling, and reporting. The project will use multiple methods, including boat-mounted, high frequency monitoring of nutrients and fluorescence; discrete sampling for analyses of water quality, phytoplankton and zooplankton abundances, clam biomass, and phytoplankton carbon uptake (to determine growth rates). Data and hydrodynamic modeling will be used to evaluate the response of phytoplankton to a range of nutrient loads and forms, as well as factors of light, turbidity, water residence time, and grazing by zooplankton and clams. See the end of the document for conceptual model and project hypotheses.

The project team is targeting an EVR hold in **August 2019** for the field work. All data review and submissions, data analyses, modeling, and reporting would be complete within 18 months of the field work.

Delta RMP is asked to fund a portion of the project. Regional San will provide staff hours and equipment for project oversight, development of the QAPP, collection of water samples, and coordination of a final report. Other support is described within the task list and budget.

Study Area

The study will occur in the lower Sacramento River and downstream connecting channels, including Georgiana Slough and the Mokelumne River (Figure 1). The channels in the study area are close enough to the SRWTP that water parcels with or without treated effluent can still be detected and tracked in the river water (i.e., prior to complete mixing). In the shallower lower Mokelumne River and Georgiana Slough, light penetrates a greater proportion of the water column than in the deeper lower Sacramento River. Elevated light levels increase the potential for rapid phytoplankton growth when other regulating factors are favorable, namely low turbidity, shallow water depth or stratification, sufficient nutrient concentrations, and low grazing pressure.

Figure 1. Map of the Sacramento-San Joaquin River Delta showing project sampling sites in the lower Sacramento River, Georgiana Slough, and North and South Forks Mokelumne River. (Credit: Regional San)

Study Design

Regional San staff will sample at a total of 12 “grab sample” stations, three along the Sacramento River, three along Georgiana Slough, three along the North Fork Mokelumne River and three along the South Fork Mokelumne River. The USGS high frequency sampling boat will sample these river segments daily during the week of field work. At each “grab sample” station, vertical profiles of temperature, pH, electrical

conductivity, dissolved oxygen and photosynthetically active radiation (PAR) will be taken. Discrete samples will be collected for turbidity, chlorophyll *a*, picoplankton and phytoplankton enumeration, zooplankton enumeration and growth rates, and dissolved inorganic nutrient concentrations. If visual survey of a station indicates that potentially harmful algal species such as *Microcystis sp*. are present, the team will collect separate water samples for BSA Environmental Services to measure microcystins. Clams will be collected using benthic trawls.

Phytoplankton enumeration will allow examination of any changes in the proportions of beneficial and potentially harmful phytoplankton. During the 1-week study, changes in phytoplankton growth rates and zooplankton growth rates are expected to be detectable and potentially also changes in phytoplankton biomass. Because changes in zooplankton abundance would be minimal during this short time period and difficult to detect, the study will examine growth of zooplankton.

River discharge, velocity, and other water-quality characteristics from three of USGS' fixed monitoring stations Freeport (0.2 km upstream of SRWTP) and Walnut Grove and Decker Island (29.2 km and 39 km downstream of SRWTP, respectively) will be used to plan sampling events and document continuous river conditions. Treated effluent flow rate data (hourly averages) will be provided by SRWTP personnel, along with effluent water quality data, including daily ammonia (NH_4^+) and weekly nitrate (NO_3^-) concentrations.

Tasks and Scope of Work

This proposal is for the Delta RMP to provide $250,000 for project tasks plus up to $30,000 for ASC to manage subcontracts.

All of the project tasks are described below, with tasks proposed for funding by the Delta RMP listed first. Funds from sources outside of the Delta RMP for other tasks have been secured. Although it would not be funding the entire project, Delta RMP will receive updates and final reports for the entire project. Regional San will provide staff for preparation and review of submissions of data to be uploaded to CEDEN.

Tasks to be funded by the Delta RMP:

1. Plankton and Zooplankton Enumerations: This task will be led by Dr. John Beaver, BSA Environmental Services, Inc. For discrete water samples, BSA staff will identify and count phytoplankton and zooplankton to the lowest taxonomic level possible (e.g., family, genus, or species). Three replicate phytoplankton and zooplankton samples, and one picoplankton sample will be enumerated per station. The purpose of this task is to describe changes to phytoplankton abundance and species composition in the river resulting from reduced nutrient concentrations, compared to high-nutrient control water.

2. Phytoplankton Growth Evaluations: This task will be performed by Dr. Mine Berg, Applied Marine Sciences, Inc. (AMS). Onboard the Regional San boat, AMS will measure photosynthetically active radiation (PAR) [measure of light availability in different parts of the water column], variable fluorescence (Fv/Fm) [a metric of photosynthetic activity and health status of photosynthetic cells], and carbon (C) uptake by phytoplankton. The purpose of this task is to directly measure phytoplankton growth during changes in nutrient conditions. This work will help determine when and where growth is occurring and identify if growth changes occurred at particular nutrient concentrations.

3. Numeric Modeling of Proportional Water Volumes and Mixing, Subtasks 1-3: This task will be performed by Resource Management Associates (RMA) using their suite of Delta numerical model applications. The modelers and field researchers will be in close contact both before and after the field surveys take place to ensure that: the models focus on confluences in the study area where there is uncertainty regarding water inflows and tidal fluxes, the field data are collected at locations that will assist the modelers in calibrating their models to the water movements occurring during the specific week of the field work, and that the field researchers have a clear understanding of the modeling results. The purpose of this task is to better understand water sources, mixing, transport time and age, which will improve interpretation of the data collected. For example, having proportions of source waters at each location sampled, along with travel time estimates, allows more accurate determination of whether changes in phytoplankton biomass and species composition are due to growth, grazing, or dilution by tributary inflows.

    a. RMA will estimate the percentage of source waters supplied to Georgiana Slough and North and South Forks Mokelumne River during the EVR hold. Model calculations will help identify sources of phytoplankton, zooplankton, nutrients, and other chemical constituents by identifying the proportion of water in each river sample from different sources. Upstream sources include SRWTP effluent stream, Sacramento River, Mokelumne River and Cosumnes River, and potentially a downstream source from the San Joaquin River depending on inflow levels and tidal mixing.

    b. RMA will refine the existing RMA model grid of the study area to improve the spatial resolution by increasing the grid dimension from 1-D to 2-D at major confluences and other areas of interest. The existing RMA model grid is one-dimensional at some confluences, so increasing the grid to two dimensions will improve the spatial resolution of the flow and transport and stage calibration locally and at selected downstream locations.

c. RMA will test and refine model performance of the 2-D grid at the confluences of the Sacramento River and Georgiana Slough, the Sacramento River and the Delta Cross Channel, and the Delta Cross Channel and Snodgrass Slough. The model will be refined using data collected by Regional San in this study. Vertical and cross-channel profiles of temperature, dissolved oxygen, and electroconductivity measurements will be used to test the model's replications of water mixing.

d. RMA will use their particle tracking module to calculate particle transport through the study area and estimate travel time of parcels of water entering the study area from different sources or time points.

Task 3 deliverables will include a final report describing background information for the modeling applications, data acquisition, modeling results, and interpretation of results. Modeling results will include estimates of source water volumes and mixing at sampled locations and times, documentation on grid updates and checks of flow and stage calibration, metadata used in modeling refinements. Particle-tracking products will be documentation describing the particle tracking model set-up, travel time estimates and two movie-style visualizations of particle transport.

Tasks supported by other funds and in-kind contributions:

4. Zooplankton Growth and Condition: This task will be led by Dr. Wim Kimmerer, RTC-SFSU. Dr. Kimmerer and his staff will sample zooplankton while onboard the Regional San boat. SFSU staff will determine zooplankton abundance, biomass using a FlowCam, and life-stage (copepods) or size (cladocera) distributions, and reproductive rates. Zooplankton growth rates will be determined by sorting field-collected zooplankton into cohorts by size and monitoring their growth in short-term incubations. Analyses will evaluate zooplankton abundance, growth, reproduction, and mortality relative to environmental and nutrient conditions. They will also collect and analyze samples molecularly for identification of foods consumed by the zooplankton.

5. Discrete water quality sampling: Regional San staff will collect grab samples for laboratory analyses of chlorophyll *a*, dissolved inorganic nutrients, and phytoplankton and zooplankton abundance plus associated field measurements (temperature, dissolved oxygen, pH, electrical conductivity, and turbidity) aboard Regional San's vessel, the Guardian. Regional San Environmental Laboratory staff operate this vessel for monthly Sacramento River water quality compliance sampling. Collection of grab samples will be closely coordinated with the high frequency data collection to ensure the correct timing of grab samples in parcels with and without wastewater.

6. High frequency water quality data collection and analyses with mapping: This task will be led by Dr. Brian Bergamaschi and Dr. Tamara Kraus, USGS. USGS will characterize changes occurring during transport of wastewater-free parcels in comparison to associated wastewater-containing parcels down Sacramento River and into distributary channels, including characterization of changes in nutrients, phytoplankton community, and net ecosystem productivity. High speed maps will be made using boat-mounted, flow-through instrumentation system collecting continuous, underway measurements of location, time, temperature, conductivity, pH, dissolved oxygen, turbidity, beam attenuation, dissolved organic matter fluorescence, chlorophyll-a fluorescence and nitrate. Real-time data will be used to detect the presence and absence of treated wastewater effluent and to quantify wastewater-derived constituent concentrations. A key outcome of the high frequency data collection will be nitrogen transformation (e.g., nitrification) rates across a range of nutrient concentrations and habitat types.
7. Laboratory Analyses of Water Samples: Water will be analyzed by the Regional San Environmental Laboratory for ammonium, nitrate/nitrate, dissolved phosphorus, and dissolved inorganic carbon.
8. Clam collection and analyses: This task will be led by Dr. Tim Mussen, Regional San Environmental Laboratory and Scientific Research Section. Dr. Mussen and a Regional San intern will conduct clam enumerations (counts and biomass) and use these data to calculate clam grazing rates.
9. Reports and manuscripts: This task will be led by Dr. Lisa Thompson, in collaboration with the rest of the Project Team. Products will include quarterly progress reports and a final project report/manuscript. Regional San will also coordinate and ensure preparation of a QAPP for all components of the project. QAPP components for Delta RMP-funded activities can be excerpted and copied into the Delta RMP QAPP. Water quality, phytoplankton, zooplankton, and clam data collected during this project will be subjected to quality assurance/quality control review and then submitted for upload to CEDEN using the Chemistry, Field Collection, and Taxonomy templates.

Relevance to Delta RMP Management and Assessment Questions

This proposal directly addresses the following Delta RMP Management and Assessment Questions. Specific information gaps identified in the Delta Nutrient Research Plan (DNRP, CVRWQCB 2018) are listed on pg 10.

Status and Trends –Questions 1 and 1.C

1. How do concentrations of nutrients (and nutrient-associated parameters) vary spatially and temporally?

C. Are there important data gaps associated with particular water bodies within the Delta subregions

10. Explanation: Previous study of a wastewater hold did not investigate effects in channels other than the Sacramento River.

11.

12. Sources, Pathways, Loadings and Processes – Questions 1, 1.A, and 2A

1. Which sources, pathways, and processes contribute most to observed levels of nutrients?
   A. How have nutrient or nutrient-related source controls and water management actions changed ambient levels of nutrients and nutrient-associated parameters?

2. How are nutrients linked to water quality concerns such as harmful algal blooms, low dissolved oxygen, invasive aquatic macrophytes, low phytoplankton productivity, and drinking water issues?
   A. Which factors in the Delta influence the effects of nutrients on the water quality concerns listed above?

Explanation: The project will track the effects of a significant change in nutrient loading from wastewater. Comparisons among channels and with/without SRWTP effluent will allow examination of factors of light availability and water residence time.

Forecasting Scenarios

How will nutrient loads, concentrations, and water quality concerns from Sources, Pathways, Loadings & Processes Question 2 respond to potential or planned future source control actions, restoration projects, water resource management changes, and climate change?

Explanation: The project is an opportunity to examine effects of a major change in nutrient loads. On an annual average basis, current nitrogen loads from Regional San and the Sacramento River upstream of Regional San are 14,000 and 18,500 kg N/day, respectively. In fall, when the project monitoring will occur, the difference will be more marked as Sacramento River upstream nitrogen loads are lower than the yearly average.

Effectiveness Tracking

How did nutrient loads, concentrations, and water quality concerns from Sources, Pathways, Loadings & Processes Question 2 respond to source control actions, restoration projects, and water resource management changes?

Explanation: The project is a preview of nutrient changes expected due to the Regional San EchoWater upgrade. The project uses an adaptive management approach to monitoring by utilizing pre-planned infrastructure changes to field-test hypotheses of effects of the upgrade.

Budget

Task	Description	**Proposal to Delta RMP** [1]	Other funding and in-kind **secured**
1	Phytoplankton and zooplankton enumeration (BSA Environmental Services)	$30,000	$0
2	Phytoplankton growth evaluations (Applied Marine Sciences, Inc).	$103,000	$0
3	Numeric modeling of proportional water volumes and mixing (Resource Management Associates)	$125,688	$0
4	Zooplankton growth and condition (San Francisco State University) [2]	$0	$170,000
5	Discrete water quality sampling (Regional San) [3]	$0	$211,635
6	High frequency data collection and mapping (USGS) [4]	$0	$210,000
7	Laboratory analyses of water samples (Regional San)	$0	*(within Task 5)*
8	Clam collection and analyses (Regional San)	$0	*(within Task 5)*
9	Reporting and manuscripts (Regional San and project team)	$0	*(within Task 5)*
	Project totals	$258,688	$591,635

1. Proposal calls for Delta RMP support up to $250,000 plus contract administration.
2. Task supported by State Water Contractors and Metropolitan Water District
3. Applied Marine Sciences and SFSU will have staff on Regional San boat to collect data and samples for tasks 2 and 4, respectively.
4. Task supported by USGS ($60,000 for in-kind boat and equipment resources) and US Bureau of Reclamation ($150,000).

Supporting Information

Background - Best Available Science and Conceptual Models

Water and nutrients from the Sacramento River enter Georgiana Slough, and, via the Delta Cross Channel, the North Fork Mokelumne River and South Fork Mokelumne River, providing an opportunity to test the effects of changes in water transit time, depth, light, and nutrient loading on phytoplankton and zooplankton productivity and biomass. High frequency boat mapping, performed by the USGS in support of the Delta Regional Monitoring Program, is able to detect patterns in numerous aquatic variables in these side channels, including nutrient concentrations, turbidity, and chlorophyll a. Biogeochemical model predictions (Zhang et al. 2018) suggest that EchoWater Project upgrades to the SRWTP will result in substantial changes in nutrient concentrations in these side channels. During the EVR holds the load of ammonia and nitrate from SRWTP will be zero, providing an opportunity to investigate the potential impacts of nutrient load reductions that are lower than those mandated in SRWTP's current NPDES permit.

Under our conceptual model, the factors of transit time, light, and nutrient loading will result in different outcomes for phytoplankton productivity and biomass occurring in the side channels compared to those living in the mainstem Sacramento River. In the mainstem Sacramento River, where water depth is sufficient to make light limiting to phytoplankton growth (AMS 2017), we predict that decreased nutrient loading will have little effect on phytoplankton biomass or the higher levels of the aquatic food web (Figure 2). However, in the side channels, where a combination of decreased depth, increased transit time, and decreased turbidity may increase light availability (i.e., euphotic zone depth), we predict that phytoplankton productivity and biomass will be regulated by nutrient availability. Under scenarios with lower nutrient loading, we would expect to see less phytoplankton growth and biomass than under the current loading scenario. The diagrams in Figure 2 assume that nutrient loading from other sources upstream of Freeport are constant across situations, and that during the summer SRWTP effluent is a high proportion of the total nutrient load to the Sacramento River. The diagrams assume a time frame of days, during which increases in phytoplankton and zooplankton growth rates would be detectable, and potentially also changes in phytoplankton biomass. However, changes in zooplankton abundance and clam biomass would be minimal during this short time period and difficult to detect. These diagrams do not make an assumption about whether increased phytoplankton biomass would be in the form of beneficial or harmful algal species, but we would be able to observe any changes through the high frequency boat mapping surveys, and through phytoplankton enumerations (species counts and biomass). Changes in nutrient loading from SRWTP will be apparent in the mainstem Sacramento River, but are unlikely to manifest in changes in phytoplankton response until the water reaches the river side channels, where other key factors, namely depth, transit time, and euphotic zone depth are more favorable for phytoplankton growth.

This project, termed "Sacramento River Nutrient Change Study Phase 1" will generate useful stand-alone information. Furthermore, the Phase 1 project is part of a larger proposal to study impacts of other events that change nutrient loads. These events include steps in SRWTP upgrade process and operation

of Delta cross-channel gates. The project design makes use of these already-planned operations to conduct adaptive management experiments to inform future nutrient management in the Delta.[1]

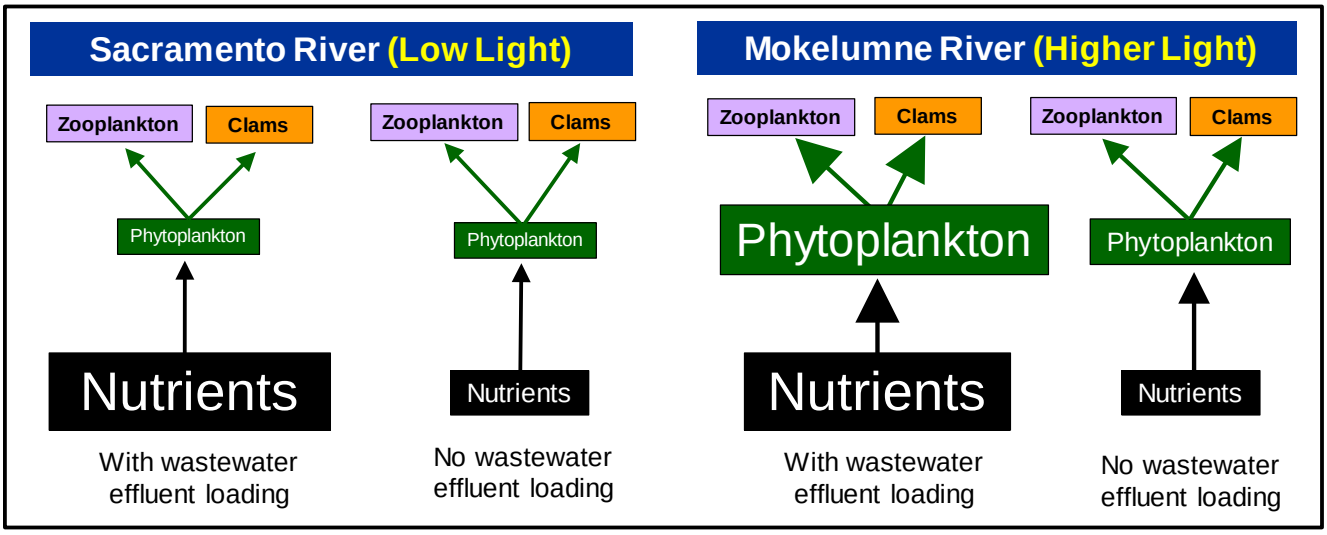

Figure 2. Food web diagrams showing potential nutrient load (focusing on dissolved inorganic nitrogen, DIN) and biomass transfer under four situations: (1) Current effluent nutrient loading, (2) No effluent loading, as will occur during Effluent Valve Replacement holds, (3) Current loading plus increased light availability, and (4) No effluent loading plus increased light availability. The thickness of each arrow indicates the amount of nutrients or biomass transferred through the food web, relative to the other situations. The font size of the text shows biomass at each trophic level relative to the other situations. Outcomes for nutrient loading scenarios BNR Part 1 and BNR Part 2 are anticipated to be intermediate to the more extreme contrast between current effluent nutrient loading and the EVR no effluent loading scenario.

Questions and Hypotheses to be addressed in Phase 1 and future phases

Question 1: Will a substantial reduction in DIN concentrations have a positive, neutral, or negative effect on desirable phytoplankton growth in the Delta?

> Hypothesis 1: A substantial reduction in DIN concentration will have a neutral impact on phytoplankton growth in the Delta.

[1] Operational changes envisioned for investigation in future phases of the Sacramento River Nutrient Change Study:

(1) In the summer of 2020, there will be a moderate reduction in Sacramento River nutrient concentrations when roughly half of the EchoWater Project Biological Nutrient Removal (BNR) process is initiated.

(2) In the summer of 2021, the EchoWater Project BNR process will be fully operational, which will further reduce average nutrient concentrations in the Sacramento River.

(3) In early spring 2020, near the end of the seasonal winter closure of the Delta Cross Channel, there may be a long slow drawdown of nutrient concentrations by phytoplankton and denitrification in the Mokelumne River.

Question 2: How will low and high irradiance combined with a substantial reduction in DIN concentrations impact phytoplankton growth in the Delta?

Hypothesis 2A: A substantial reduction in DIN concentration will have a neutral impact on phytoplankton growth in the Delta under low irradiance.

Hypothesis 2B: A substantial reduction in DIN concentration will have a negative impact on phytoplankton growth in the Delta under high irradiance.

Question 3: How will increased residence time combined with a substantial reduction in DIN concentrations impact phytoplankton growth and biomass accumulation in the Delta?

Hypothesis 3A: A substantial reduction in DIN concentration will have a neutral impact on phytoplankton growth in the Delta under low residence time.

Hypothesis 3B: A substantial reduction in DIN concentration will have a negative impact on phytoplankton growth in the Delta under high residence time.

Question 4: How will grazing pressure change and impact phytoplankton biomass accumulation with increased irradiance and water residence times under high and low nutrient scenarios?

Hypothesis 4A: Under low residence time and low irradiance, grazing pressure will not impact phytoplankton biomass accumulation with either low or high DIN concentrations.

Hypothesis 4B: Under high irradiance and low residence time, grazing pressure will not impact phytoplankton biomass accumulation with either low or high DIN concentrations.

Hypothesis 4C: Under high residence time and high irradiance, grazing pressure will negatively impact phytoplankton biomass accumulation with high DIN concentrations but not with low DIN concentrations.

Relevance to Delta RMP Management Driver – Delta Nutrient Research Plan

This proposal addresses key scientific uncertainties and fills important information gaps identified in the Delta Nutrient Research Plan (DNRP, CVRWQCB 2018. Specifically, this project will address, in part, six management sub-questions posed in the DNRP.

1. What are the main factors affecting potential nutrient-related effects and how does the relative importance of these factors vary with space and time? (Delta Nutrient Research Plan, Table 1, p. 23)
2. What are the important processes that transform nutrients in the Delta and what are the rates at which these processes occur? (Delta Nutrient Research Plan, Table 1, p. 23)
3. Can nutrient management in the northern Delta (e.g., Yolo Bypass, Sacramento River, and Sacramento Deep Water Ship Channel) increase abundance or nutritional quality of pelagic phytoplankton? (Delta Nutrient Research Plan, Table 1, p. 23)
4. What is the level and type of change in nutrients needed to affect change in HABS, macrophytes, or phytoplankton abundance? (Delta Nutrient Research Plan, Table 1, p. 23)

5. What are the most likely alterations in nutrient conditions due to climate change, Delta habitat restoration, and changes in nitrogen forms and loads? (Delta Nutrient Research Plan, Table 1, p. 24)
6. What nutrient levels are needed to support adequate primary productions and a healthy food web, particularly for endangered fish species? (Delta Nutrient Research Plan, Table 1, p. 24)

References

Applied Marine Sciences, Inc. (AMS). 2017. Final Report: Spatial and seasonal patterns in irradiance phytoplankton, and grazers along the Sacramento River, California. Submitted to Sacramento Regional County Sanitation District, Sacramento, California. August 14, 2017. 65 p.

Central Valley Regional Water Control Board (CVRWQCB). 2018. Delta Nutrient Research Plan. 40 p.

Kraus TEC, Carpenter KD, Bergamaschi, BA, Parker AE, Stumpner EB, Downing BD, Travis NM, Wilkerson FP, Kendall C, Mussen TD. 2017. A river-scale Lagrangian experiment examining controls on phytoplankton dynamics in the presence and absence of treated wastewater effluent high in ammonium Limnology and Oceanography 62 (3): 1234-1253.

Zhang, Z., Senn, D., Holleman, R., & Nuss, E. (2018). Annual Progress Report for Delta-Suisun Bay Biogeochemical Modeling Project (Progress report). Richmond, CA: San Francisco Estuary Institute. URL: http://sfbaynutrients.sfei.org/sites/default/files/2018_nms_fy2018_annual_report.pdf

Attachment B Mercury Monitoring

The Delta RMP Steering Committee approved funding for Option A described in the proposal on the following pages. This option includes monitoring for:

- Monitoring of sportfish (bass) annually at 7 site
- Monitoring of water at 8 sites during 4 months and 6 sites during four months.
- No sediment sampling in FY19-20
- Oversight, coordination, data management and reporting.

Summary of Mercury Proposal for FY19/20 (Year 4 of Delta RMP Mercury Monitoring)

Continued monitoring of methylmercury in Delta fish and water is proposed to address the highest priority information needs related to revision and implementation of the Methylmercury TMDL (re-opening of the TMDL is scheduled for 2020). The window for inclusion of new data in the TMDL revision could close as soon as December 2019. Monitoring with the current design is proposed to continue through October 2019. During the second half of the fiscal year (January-June 2020) a transition to a second phase of monitoring is proposed. The second phase would address the critical need for continued monitoring of subregional trends in fish and water, and would add a monitoring element focused on assessing the subregional impact of habitat restoration projects on methylmercury impairment.

Three monitoring elements are proposed.

1. **Subregional trends in bass** - Continued annual monitoring of methylmercury in black bass at seven stations (distributed among the TMDL subregions) will firmly establish baseline concentrations and interannual variation in support of monitoring of long-term trends as a critical performance measure for the TMDL. This design will be re-evaluated after completion of a 10-year period (2014-2023).
2. **Subregional trends in water** - Continued monitoring of methylmercury in water at six stations on a near-monthly basis during the biologically-relevant time period (Mar-Oct) will further solidify the linkage analysis (the quantitative relationship between methylmercury in water and mercury in sport fish) in the TMDL and be valuable in verifying trends and patterns predicted by numerical models of methylmercury transport and cycling being developed for the Delta and Yolo Bypass by the California Department of Water Resources (DWR) and the USGS. These models will allow testing of various land and water management scenarios.
3. **Restoration monitoring** - Annual monitoring methylmercury in black bass and prey fish at new stations (seven for black bass and 16 for prey fish) located near habitat restoration projects will assess the subregional impact of the projects on impairment. The San Francisco Bay Regional Water Board has obtained $30,000 for monitoring methylmercury impacts of a restoration project on Winter Island in the West Delta and is interested in coordinating with the Delta RMP.

At the level of funding allocated in the Multi-Year Plan ($290,000), the design would include:

- Subregional trends in bass;
- Subregional trends in water (8 stations, 4 events from Jul – Oct 2019; 6 stations, 4 events from Mar-Jun 2020)
- An interpretive report on the 3.5 years of monitoring to date that would inform the TMDL revision

At an increased funding level (Multi-Year Plan amount plus 25%, or $360,000), the design would include:

- All elements from the $290,000 funding level; and
- Initiation of baseline restoration monitoring in three Delta tidal wetland restoration areas, with seven added black bass stations and 16 added prey fish stations.

At a decreased funding level (Multi-Year Plan amount minus 25%, or $220,000), the design would include:

- Subregional trends in bass;
- Subregional trends in water (reduced level) (8 stations, 4 events from Jul – Oct 2019; 6 stations, 2 events from Mar-Jun 2020); and
- No interpretive report on the 3.5 years of monitoring to date.

Management Drivers Addressed

Mercury monitoring addresses the Delta Methylmercury TMDL, which establishes goals for cleanup and calls for a variety of control studies and actions.

Management and Assessment Questions Addressed

The management and assessment questions addressed by each of the methylmercury monitoring elements are indicated in Table 1. In addition, the combination of water and fish monitoring addresses a critical data need for management that is not captured in the current set of questions for the Program: data to strengthen the linkage analysis that is a key component of the technical foundation for the TMDL.

Data Quality Objectives/Null Hypothesis

The initial and preliminary data quality objective (DQO) for subregional bass trend monitoring is the ability to detect a trend of mercury in fish tissue of 0.040 ppm/yr. This DQO can be refined when additional data are available. The null hypothesis is that there is no trend. MQOs are identical to those used in other mercury studies throughout the state and the country

for determinations of impairment and trend detection. These MQOs generally call for indices of accuracy and precision to be within 30% of expected values.

The subregional water monitoring is primarily being collected to solidify understanding of the correlation of fish methylmercury with aqueous methylmercury (i.e., the linkage analysis) and to provide essential input data for the models being developed by DWR and USGS. Hypothesis testing will not be a primary use of the water data.

The restoration monitoring with bass and prey fish will focus on the same kind of trend evaluation described for subregional bass trend monitoring above, and the same considerations apply.

Table 1. Delta RMP mercury management and assessment questions addressed by each mercury monitoring element. Questions highlighted in yellow were identified by the Steering Committee as the highest priority for initial studies.

Type	Core Management Questions	Assessment Questions	Sub-Questions	Subregional Trends in Bass	Subregional Trends in Water	Restoration Monitoring
Status and Trends	Is there a problem or are there signs of a problem ? a. Is water quality currently, or trending towards, adversely affecting beneficial uses of the Delta? b. Which constituents may be impairing beneficial uses in subregions of the Delta? c. Are trends similar or different across different subregions of the Delta?	1. What are the status and trends in ambient concentrations of total mercury and methylmercury (MeHg) in fish, water, and sediment, particularly in subareas likely to be affected by major sources or new sources (e.g., large-scale restoration projects)?	A. Are trends over time in MeHg in sport fish similar or different among Delta subareas?	X		
			B. Are trends over time in MeHg in water similar or different among Delta subareas?		X	
Sources, Pathways, Loadings, and Processes	Which sources and processes are most important to understand and quantify? a. Which sources, pathways, loadings, and processes (e.g., transformations, bioaccumulation) contribute most to identified problems? b. What is the magnitude of each source and/or pathway (e.g., municipal wastewater, atmospheric deposition) c. What are the magnitudes of internal sources (e.g., benthic flux) and sinks in the Delta?	1. Which sources, pathways, and processes contribute most to observed levels of MeHg in fish?	A. What are the loads from tributaries to the Delta (measured at the point where tributaries cross the boundary of the legal Delta)?		X	
			B. How do internal sources and processes influence MeHg levels in fish in the Delta?	X	X	X
			C. How do currently uncontrollable sources (e.g., atmospheric deposition, both as direct deposition to Delta surface waters and as a contribution to nonpoint runoff) influence MeHg levels in fish in the Delta?			
Forecasting Scenarios	a. How do ambient water quality conditions respond to different management scenarios? b. What constituent loads can the Delta assimilate without impairment of beneficial uses? c. What is the likelihood that the Delta will be water quality-impaired in the future?	1. What will be the effects of in-progress and planned source controls, restoration projects, and water management changes on ambient methylmercury concentrations in fish in the Delta?		X	X	X
Effectiveness Tracking	a. Are water quality conditions improving as a result of management actions such that beneficial uses will be met? b. Are loadings changing as a result of management actions?	[none]		X	X	X

Monitoring to Support Implementation of the Methylmercury TMDL

Background and Motivation

Concentrations of methylmercury in fish from the Delta exceed thresholds for protection of human and wildlife health. The Methylmercury TMDL (Wood et al. 2010) is the driver of actions to control methylmercury in the Delta, establishing water quality goals and directing various discharger groups to conduct monitoring and implement measures to minimize methylmercury impairment of beneficial uses.

The TMDL established three water quality objectives for methylmercury in fish tissue: 0.24 ppm in muscle of large, trophic level four (TL4) fish such as black bass ("black bass" includes largemouth, smallmouth, and spotted bass); 0.08 ppm in muscle of large TL3 fish such as carp; and 0.03 ppm in whole TL2 and TL3 fish less than 50 mm in length. Furthermore, the TMDL established an implementation goal of 0.24 ppm in largemouth bass at a standard size of 350 mm as a means of ensuring that all of the fish tissue objectives are met. Largemouth bass are widely distributed throughout the Delta and are excellent indicators of spatial variation due to their small home ranges. Past data for largemouth bass were a foundation for the development of the TMDL, including the division of the Delta into eight subregions. Monitoring of largemouth bass in these subregions therefore provides the most critical performance measure of progress in addressing methylmercury impairment in the Delta.

The TMDL describes a statistically significant relationship between the annual average concentration of methylmercury in unfiltered water and average mercury in 350 mm largemouth bass when data are organized by subregion. This linkage provides a connection, essential for management, between methylmercury inputs from various pathways (e.g., municipal wastewater, municipal stormwater, agricultural drainage, sediment flux in open waters, and wetland restoration projects) and impairment of beneficial uses. Because of this linkage, the TMDL established an implementation goal of 0.06 ng/L of unfiltered aqueous methylmercury. In response to TMDL control study requirements, the Department of Water Resources (DWR) is leading development of numerical methylmercury transport and cycling simulation models for the Delta and Yolo Bypass. Monitoring of aqueous methylmercury is therefore needed to:

1) better quantify the fish-water linkage that is the foundation of the TMDL,
2) evaluate attainment of the TMDL implementation goal,

3) support calculations of mercury and methylmercury loads and mass balances,
4) support development of mercury models for the Delta and Yolo Bypass, and
5) support evaluation of the fish data by providing information on processes and trends.

In FY 2016/2017 the Delta RMP initiated a methylmercury monitoring program for fish and water. Largemouth bass were collected in late summer 2016 (September) from six stations distributed across the subregions. Quarterly sampling of methylmercury and mercury (and ancillary parameters) in water at five stations began in August 2016.

In FY 2017/2018, methylmercury monitoring of fish and water continued. Funding was allocated to sample fish at six stations and water at six stations for eight months. The eight months to be sampled were to be the March-October period used for the linkage analysis in the TMDL. In late 2017, the Mercury Subcommittee decided, based on data needs related to a Regional Board decision to revise the TMDL in 2020, that a more optimal use of the available funds would be to shift to sampling water at eight stations (adding stations in the West Delta and at the export pumps) and to add sampling in January and February (Table 2). This design would provide information to update the methylmercury mass balance for the Delta by sampling two export stations (in the West Delta and at the pumps) and sampling during high flows in the winter. The FY 2017/2018 plan also included funds for quarterly sediment sampling to support the DWR methylmercury modeling effort, and any future methylmercury modeling.

In FY 2018/2019, the design that was established in the latter part of FY 2017/2018 was continued, with sampling of fish at seven stations in August/September and sampling of water at eight stations monthly during the biologically-relevant period (March-October) plus two high flow months (January and February of 2019) to inform the loads assessment (Table 2). Sediment sampling was discontinued due to funding limitations.

Proposed Approach for FY 2019/2020

The window for inclusion of new data in the TMDL revision is planned to close in December 2019. Monitoring with the current design is proposed to continue through October 2019. An interpretive report covering the first 3.5 years of monitoring (from August 2016 to October 2019) will be prepared in December 2019 to inform the TMDL deliberations. During the second half of the fiscal year (January-June 2020) a transition to a second phase of monitoring is proposed. The second phase would add a monitoring element focused on assessing the subregional impact of habitat restoration projects on methylmercury impairment.

Three monitoring elements are proposed for the second phase of Delta RMP methylmercury monitoring.

1. **Subregional trends in bass** - Continued annual monitoring of methylmercury in black bass at seven stations will firmly establish baseline concentrations and interannual variation in support of monitoring of long-term trends as a critical performance measure for the TMDL. This design will be re-evaluated after establishment of a 10-year time series.
2. **Subregional trends in water** - Continued monitoring of methylmercury in water on a near-monthly basis will further solidify the linkage analysis (the quantitative relationship between methylmercury in water and mercury in sport fish) in the TMDL. It will also be valuable in verifying trends and patterns predicted by a numerical model of methylmercury transport and cycling being developed for the Delta and Yolo Bypass by the California Department of Water Resources (DWR). This model will allow testing of various land and water management scenarios. The need for continuation of this monitoring, including the duration and the level of effort, will be assessed as part the interpretive report on phase 1 of the monitoring.
3. **Restoration monitoring** - A new element of annual monitoring methylmercury in black bass and prey fish at new stations located near habitat restoration projects will assess the subregional impact of the projects on impairment. The San Francisco Bay Regional Water Board (Region 2) has obtained $30,000 for monitoring methylmercury impacts of a restoration project on Winter Island in the West Delta and is interested in coordinating with the proposed Delta RMP monitoring. This monitoring should begin with a level of effort that is sufficient to detect the potential subregional impact of restoration projects, and could be tapered off over time if the results indicate a lack of impact.

Applicable Management Decisions and Assessment Questions

The Delta Methylmercury TMDL is the embodiment of management decisions for methylmercury in the Delta, establishing goals for cleanup and calling for a variety of control studies and actions. With providing information to support TMDL implementation in mind, the Mercury Subcommittee carefully considered the assessment questions articulated by the Steering Committee and Technical Advisory Committee for mercury.

The Delta RMP management and assessment questions addressed by each of the methylmercury monitoring elements are indicated in Table 1. In addition, the combination of water and fish monitoring addresses a critical data need for management that is not captured in

the current set of questions for the Program: data to strengthen the linkage analysis that is a key component of the technical foundation for the TMDL.

Monitoring of subregional trends in bass is addressing questions relating to Status and Trends, Forecasting, and Effectiveness Tracking. Status and Trends Question 1A is a high priority for managers that relates to the TMDL, and is a primary driver of the sampling design for subregional bass trend monitoring. Annual monitoring of bass mercury is urgently needed to 1) firmly establish a baseline for each Delta subregion and 2) to characterize the degree of interannual variation, which is essential to designing an efficient monitoring program for detection of long-term trends. In addition to addressing status and trends, this monitoring will provide an essential foundation for Forecasting Scenarios (past trends are a starting point for projecting future conditions) and Effectiveness Tracking (evaluating whether water quality is improving at the subregional scale as a result of management actions).

Monitoring of subregional trends in water is addressing all of the major categories of Delta RMP management questions (Status and Trends; Sources, Pathways, Loadings, and Processes [SPLP]; Forecasting Scenarios; and Effectiveness Tracking). Data on concentrations of methylmercury in water are valuable as an indicator of Status and Trends as they can be compared to the TMDL implementation goal of 0.06 ng/L of unfiltered aqueous methylmercury. The use of water data to update the mass budget addresses SPLP Question 1A and is a key element of the TMDL. Aqueous methylmercury concentrations are essential input and validation data for the models that DWR and USGS are developing for the Delta that will elucidate the processes affecting methylmercury patterns and allow forecasting and testing of various water management scenarios (DiGiorgio et al. 2016; Windham-Myers et al., 2016). Water concentration data will also be valuable in Effectiveness Tracking, allowing assessment of status relative to the implementation goal and of changes in loading in the context of the overall mass budget for the Delta.

Monitoring of subregional trends in bass and water will also provide information on the influence of climate, hydrology, and ecology. For example, the first two years of monitoring have already spanned the end of a prolonged drought and a high flow year, providing an opportunity to examine the impact of extreme variation in flow on methylmercury concentrations in fish and water.

Restoration monitoring will address questions relating to SPLP, Forecasting Scenarios, and Effectiveness Tracking. The basic concern with restoration projects is that they may enhance net methylmercury production within the Delta ecosystem, and represent an internal source that increases as the projects proceed (SPLP Question 1B) – restoration monitoring will track

whether this occurs or not. Restoration monitoring will yield insights into which types of projects, if any, impact net methylmercury production and food web accumulation (Forecasting Scenarios Question 1) and whether internal loadings change and ambient water quality shows net improvement as a result of restoration projects (Effectiveness Tracking).

Approach

Subregional Trends in Bass

Design	7 fixed stations (Figure 1), largemouth bass only
Key Indicator	Annual average methylmercury in muscle fillet of 350 mm largemouth bass (or similar predator species), derived through analysis of 16 individual bass or other predator species at each station
Parameters	Total mercury*, Total length, Fork length, Weight, Sex, Moisture, Estimated age
Frequency	Annual
Schedule	Sample in August and September
Duration	Monitor through 2025 and then re-evaluate
Co-location	Water MeHg and Hg Other water parameters
Contractors	SFEI (design, data management, reporting), MLML (sample collection, chemical analysis, reporting)
Coordination	DWR, USGS (sampling of flow monitoring stations)
Cost	$61,000

* Total mercury measured as proxy of methylmercury because methylmercury comprises more than 90% of the total mercury in sport fish.

Summary of Results to Date

Results from the first year of DRMP methylmercury monitoring are presented in the Year One Data Report (Davis et al. 2018) and the Year Two Data Report (in prep). The reports provide details on the sample collection and processing, chemical analysis, quality assurance, and the results. Highlights of the results are briefly discussed here.

Results from the first two rounds of DRMP fish monitoring are presented in **Figure 2**, with data from prior fish sampling in or near these stations provided for context. Time series

with more than three observations are available for four of the six stations. The existing time series are characterized by a high degree of inconsistency in stations, species, and sampling approach over time, highlighting the need to build a consistent dataset for trend evaluation. The data do suggest a preliminary answer to management question 1A, and a possible effect of the very high flows in 2017. Up through 2016, the data suggested a decline in concentrations at the San Joaquin River at Vernalis over the period of record, while concentrations appeared to be stable at the other three stations. Therefore, the data give a preliminary indication that trends do vary among the Delta subregions. In 2017, concentrations were significantly higher than 2016 at four of the six stations, most markedly at the Mokelumne River station, suggesting a possible effect of the high flows in that year, again with variation among the subregions in the degree of elevation. Additional rounds of consistent sampling are needed to confirm the long-term patterns and the potential influence of hydrology in 2017.

Subregional Trends in Water

Design	8 fixed stations through October 2019; 6 stations after that (dropping the Mallard Island and Mendota Canal stations (**Figure 1**)
Key Indicator	March-October average total (unfiltered) methylmercury at each station
Parameters	Total (unfiltered) methylmercury, filtered methylmercury, unfiltered total mercury, filtered total mercury, total suspended solids (TSS), chlorophyll a, dissolved organic carbon, volatile suspended solids. Field measurements will include dissolved oxygen, pH, and specific conductance.
Frequency	8 events per year
Schedule	Two 4-month blocks (Jul-Oct; Mar-Jun) of monthly samples
Duration	Monitor through FY 19/20 and then re-evaluate
Co-location	Sport fish sampling Other water parameters
Coordination	DWR, USGS (sampling of flow monitoring stations)
Cost	$187,000

Summary of Results to Date

In this section, we briefly summarize results for March through October average total (unfiltered) methylmercury at each station for the first year of sampling. Data for the other water quality parameters are presented in the Year One Data Report (Davis et al. 2018) and the Year Two Data Report (in preparation-).

Concentration of MeHg in unfiltered water ranged from 0.044 – 0.385 ng/L. **Figure 3** presents long-term time series of March to October annual averages of unfiltered MeHg concentrations for Delta RMP stations. Sacramento River concentrations have remained constant with good agreement between historic data and current data. Lower Mokelumne results were similar to previously reported values given the large variability of MeHg concentrations for this site. Cache Slough MeHg concentrations were in good agreement with previously reported values. No historic data are available for Little Potato Slough, but MeHg concentrations were consistent with results reported for 2016. Middle River MeHg concentrations were within the range of historic data. San Joaquin River 2017 and 2018 MeHg concentrations were similar to previously reported values with 2017 on the higher end and 2018 on the lower end when compared to historic results. Sacramento River at Mallard 2018 results were in good agreement with previously reported MeHg concentrations. Delta Mendota Canal MeHg concentrations were within the range of previously reported values.

Restoration Monitoring

Design (Preliminary)	7 new black bass fixed stations and 16 new prey fish fixed stations (Figures 4-6)
Key Indicator	Bass: annual average methylmercury in muscle fillet of 350 mm largemouth bass (or similar predator species), derived through analysis of 16 individuals at each station Prey fish: Annual average methylmercury in whole fish, based on 6 composites of 10 individuals of the indicator species at each station
Parameters	Total mercury, Total length, Fork length, Weight, Sex, Moisture, Estimated age*
Frequency	Annual
Schedule	Bass: sample in August-September Prey fish: sample in April – June
Duration	Monitor through 2023 and then re-evaluate
Co-Location	None
Contractors	SFEI (design, data management, reporting), MLML (sample collection, chemical analysis, reporting)
Coordination	Coordinated with Region 2 monitoring in the West Delta ($30K over 2 years in funds from Region 2)
Cost	$122,000 total for the year**: $108,000 from Delta RMP**; $14,000 from Region 2 to cover 4 prey fish sites in and around Winter Island

* for bass only

Restoration monitoring will focus on three areas in the Delta where restoration activity is concentrated (Figures 4-6). In each of these areas, bass stations and prey fish stations will be strategically located. The bass station locations will be selected to detect the potential aggregate impact of restoration projects at the subregional scale. Prey fish station locations will be selected to a) link specific restoration projects to the trends that are observed in the bass, and b) track trends in reference tidal wetlands to aid in the interpretation of the prey fish data from the project-specific stations. The time series obtained for the bass and prey fish at these stations will be compared to each other, to the Subregional Bass Trend stations, and to historic data to evaluate whether restoration causes an increase in methylmercury in fish.

The San Francisco Bay Regional Water Board (Region 2) has obtained $30,000 for monitoring methylmercury impacts of a restoration project on Winter Island in the West Delta and is interested in coordinating and fitting in with the proposed Delta RMP monitoring. The

Region 2 funds can help allow for monitoring in the West Delta, and for more intensive sampling in and around the Winter Island project.

The sampling station locations shown in Figures 4-6 are preliminary. The allocation and placement of stations will be refined by the Mercury Subcommittee if the Steering Committee approves the mercury monitoring at the higher funding level.

The sooner these restoration monitoring time series are initiated, the more valuable they will be for detecting the impacts of restoration projects. Some of the restoration projects have not yet been implemented, and some have been implemented recently.

Other biosentinel restoration monitoring projects in the region have shown that restoration in some instances does not lead to methylmercury increases (e.g., Robinson et al. 2018). If prey fish stations are yielding results that indicate a lack of change from baseline conditions, they can be phased out. Results from the first three years of this monitoring can be evaluated in 2024 to determine whether monitoring can be tapered back.

Data Quality

The measurement quality objectives (MQOs) for measurements of methylmercury and mercury in fish and water are shown in Appendix 1. These MQOs are the same as MQOs used in mercury studies throughout California, with statewide fish monitoring by the Surface Water Ambient Monitoring Program as a prominent example. The MQOs generally call for indices of accuracy and precision to be within 30% of expected values. Data of this quality are routinely used for determinations of impairment and trend detection throughout the state and the country. The variance attributable to the analytical process is one of the contributors to the overall variance observed in the data. This variance is therefore accounted for in the power estimates provided in the next section.

Power to Detect Long-term Trends - Bass Sampling

The power to detect interannual trends in largemouth bass mercury on a per station basis was evaluated using existing data. Even the best existing time series for the Delta have low statistical power to detect trends due to infrequent sampling and varying sampling designs of studies performed over the years (**Figure 2**). One of the goals of the initial phase of Delta RMP fish mercury monitoring is to obtain robust information on interannual variation to support future power analysis. As part of the mercury proposal for FY 2017/2018 we conducted a power analysis on the small amount of information presently on hand. Appendix 2 provides

the methods and details on the results. This analysis will be updated after a few years of new data have accumulated.

Power analysis summary

Power for trend detection at a single station based on grand mean estimates of observed variance across stations. Pink shading indicates scenarios with greater than 80% power.

		10 Years		20 Years		30 Years	
Trend	N Fish/Yr	Annual	Biennial	Annual	Biennial	Annual	Biennial
0.010 ppm/yr	12	0.11	0.09	0.20	0.15	0.40	0.27
0.020 ppm/yr	12	0.13	0.13	0.44	0.27	0.81	0.60
0.030 ppm/yr	12	0.21	0.17	0.69	0.45	0.99	0.85
0.040 ppm/yr	12	0.29	0.19	0.88	0.61	1.00	0.98
0.010 ppm/yr	16	0.21	0.19	0.33	0.27	0.55	0.44
0.020 ppm/yr	16	0.27	0.24	0.65	0.46	0.93	0.77
0.030 ppm/yr	16	0.36	0.32	0.86	0.64	1.00	0.96
0.040 ppm/yr	16	0.47	0.36	0.97	0.82	1.00	1.00

These preliminary results indicated that increasing the number of fish per station would be effective in increasing power. With 16 fish per station and annual sampling, 80% power would be expected for several of the 20-year scenarios. Beginning with year 2 (FY 2017/2018) the design for fish monitoring was therefore modified to include 16 fish per station. The monitoring results for the San Joaquin at Vernalis suggest that trends of up to 0.040 ppm/yr are possible. The results highlight the importance of initiating consistent time series.

Power Analysis - Water Sampling

Not applicable. The primary objectives of the water sampling are to strengthen the linkage analysis and support model development. The water monitoring is not intended as a primary tool for long-term trend monitoring.

Reporting and Deliverables

With three years of monitoring completed, and an opportunity to inform the revision of the TMDL, the fall of 2019 will be an opportune time to prepare an interpretive report that provides a more thorough assessment of the dataset generated by this program and a comparison to data from other studies. This report will be drafted by December 2019 so the findings can be considered in the process of TMDL revision.

Deliverable	**Due Date**
Draft Interpretive Report on Years 1-3	December 2019
Final Interpretive Report on Years 1-3	March 2020
Draft Data Report on Year 4 (FY 19/20)	December 2020
Final Data Report on Year 4 (FY 19/20)	March 2021

Budget

	Levels specified by the SC		
OPTIONS FOR 19/20	220	290	360
	19/20	**19/20**	**19/20**
Core Bass (7 sites from 18/19 on)	61	61	61
Water (6 sites, 8 events after Jan 20)	146	186	186
Sediment			
Oversight, Coord., Data Mgt, Reporting	35	60	60
Restoration	0	0	122
Total	242	307	429
Region 2			15
MLML In-Kind	25	25	25
Delta RMP	217	282	389
Over SC Level	-3	-8	29

Proposed Multi-Year Plan With Restoration	16/17	17/18	18/19	19/20	20/21	21/22	22/23
Core Bass (7 sites from 18/19 on)	45	52	61	61	63	65	67
Water (6 sites, 8 events after Jan 20)	65	153	259	186	164	169	174
Sediment		29					
Oversight, Coord., Data Mgt, Reporting	18	25	35	60	35	35	35
Restoration				122	122	122	122
Total	128	259	355	429	384	391	398
Region 2 In-Kind				15	15		
MLML In-Kind	21	25	30	25	25	25	25
Delta RMP	107	234	325	389	344	366	373

Table 2. *Sampling schedule for Delta RMP mercury monitoring. The March-October period used for the linkage analysis in the TMDL is indicated with gray shading.*

Year →	2016						2017						2018						2019						2020					
Fiscal Yr →	FY 16/17												FY17/18												FY18/19					
Month →	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Monitoring element (# of sites sampled)																														
Fish		6												6													7			
Water		5			5			5		5						6			8	8	8	8	8	8	8	8	8	8		
Sediment																6			6			6		6						

Year →	2019						2020					
Fiscal Yr →	FY19/20											
Month →	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
Monitoring element (# of sites sampled)																		
Fish								7										
Water			8	8	8	8	8	8	8	8					6	6	6	6
Sediment																		

This proposal

Figure 1. *Planned subregional bass and water sampling stations for methylmercury in FY19-20. Note: Water will not be sampled at Mallard Island or Mendota Canal after Oct 2019.*

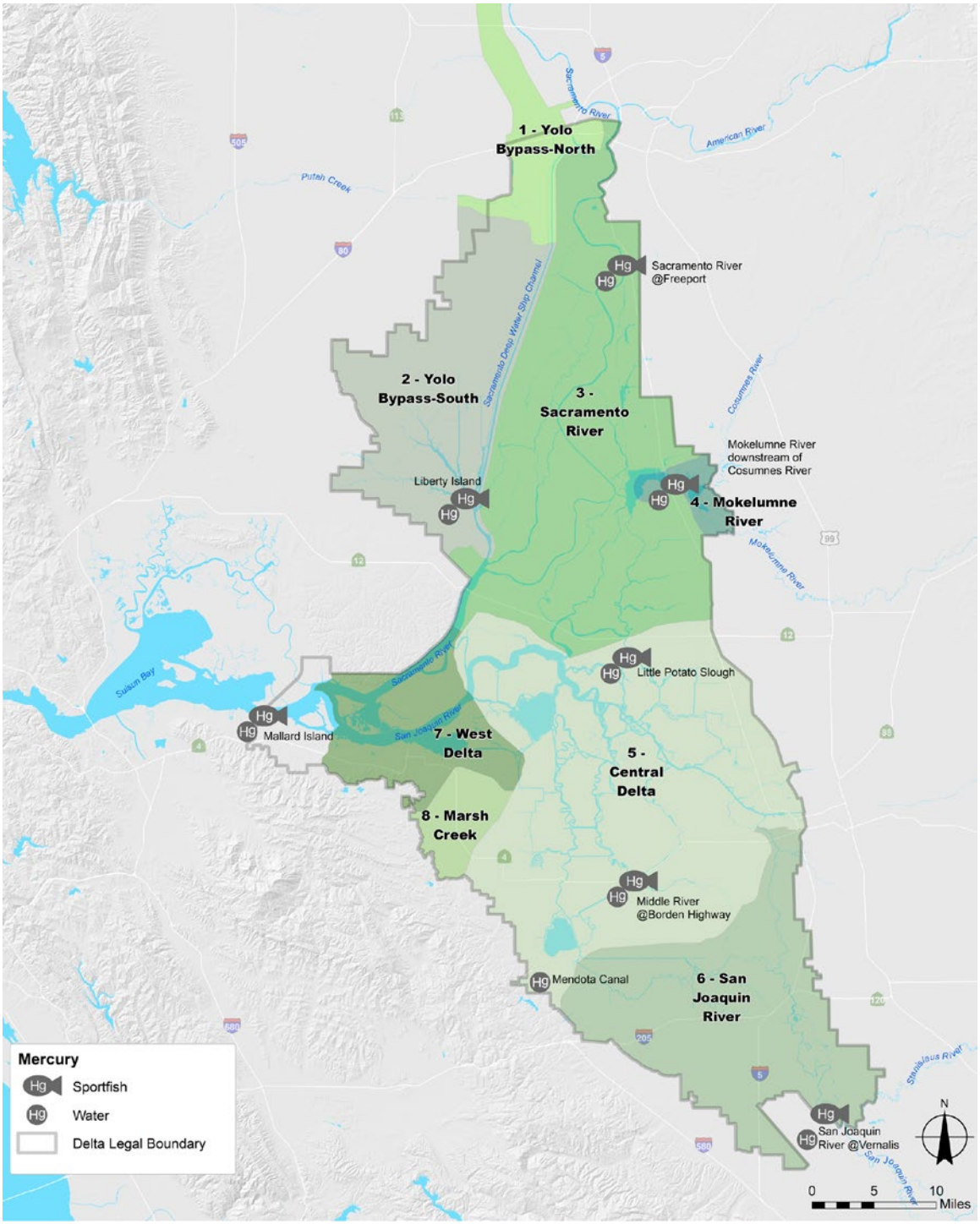

Figure 2. *Long-term time series of mean mercury (ppm wet weight) in black bass for Delta RMP stations and nearby stations sampled historically. Details on following page.*

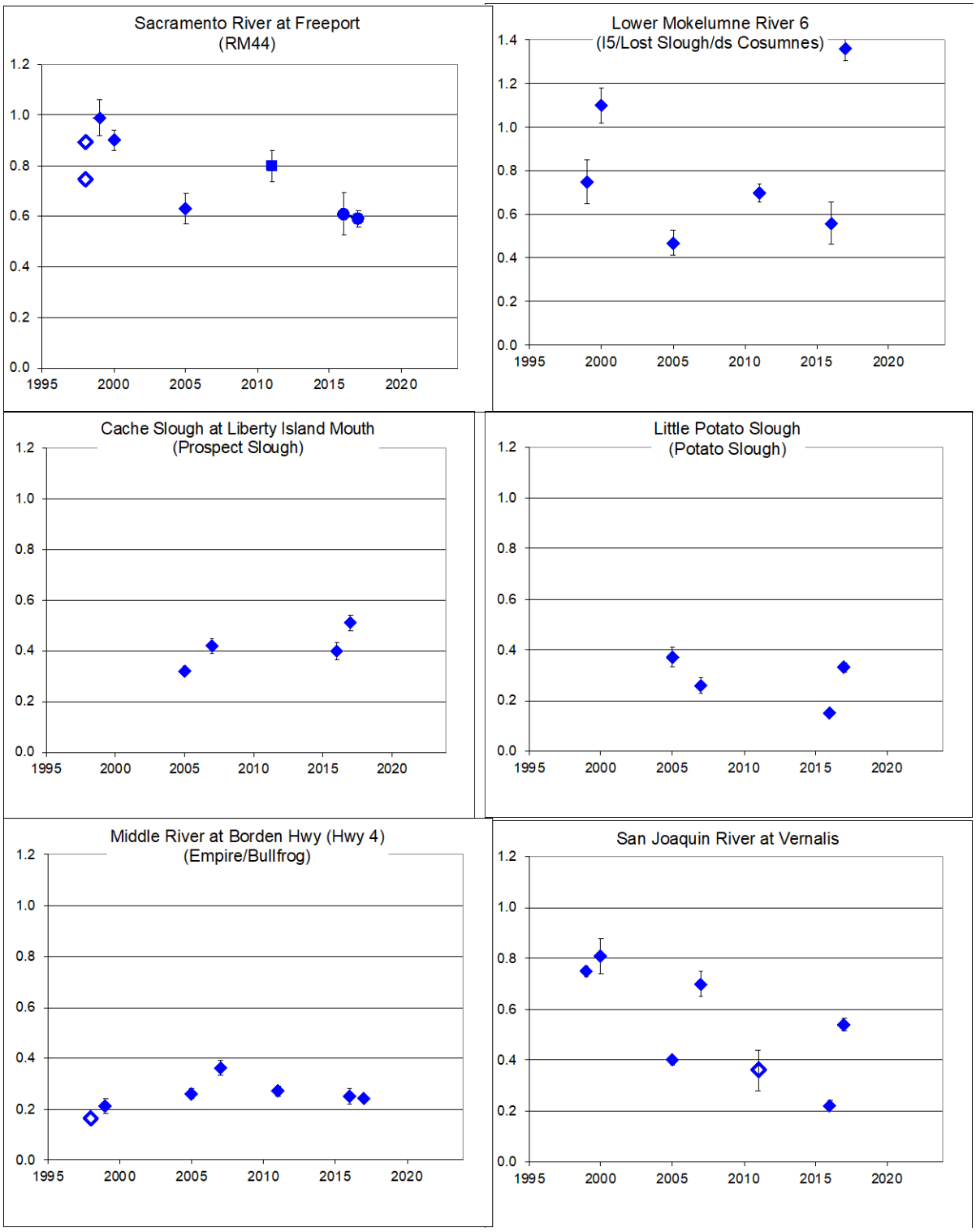

Figure 2 Details

Points generally show 350 mm length-adjusted means (exceptions to this noted in plot details below) and error bars indicate two times the standard error. Filled symbols indicate 350 mm length-adjusted means, hollow symbols indicate individual composite samples or arithmetic means when the station did not have a significant length:mercury correlation. Diamonds indicate largemouth bass; squares are spotted bass; circles are smallmouth bass. Data sources: Delta RMP - 2016; the Surface Water Ambient Monitoring Program (Davis et al. 2013) - 2011; the Fish Mercury Project (Melwani et al. 2009) - 2005-2007; the CALFED Mercury Project (Davis et al. 2003) - 1999-2000; the Delta Fish Study (Davis et al. 2000) - 1998; and the Sacramento River Watershed Program (2002) - 1998.

Sacramento River at Freeport
Stations - Freeport: 2016; RM44: All other years
Statistics - Individual composite results: 1998; 350 mm length adjusted mean: all other years

Lower Mokelumne River 6
Stations - Lower Mokelumne River 6: 2016; Mokelumne River near I-5: 2011; Lost Slough: 2005; Mokelumne River downstream of the Cosumnes River: 1999, 2000

Cache Slough at Liberty Island Mouth
Stations - Cache Slough at Liberty Island Mouth: 2016; Prospect Slough: 2005, 2007

Little Potato Slough
Stations - Little Potato Slough: 2016; Potato Slough (aka San Joaquin River at Potato Slough): 2005, 2007

Middle River at Borden Hwy (Hwy 4)
Stations - Middle River at Borden Hwy (Hwy 4): 2016; Middle River near Empire Cut: 2011; Middle River at Bullfrog: 1998, 1999, 2007; Middle River at HWY 4: 2005
Statistics - Individual composite result: 1998; 350 mm length adjusted mean: all other years

San Joaquin River at Vernalis
Stations - Same station all years

Figure 3. *Annual mean aqueous unfiltered methylmercury concentration at each Delta RMP monitoring station sampled from October 2017 through June 2018. Plots based on March-October data.*

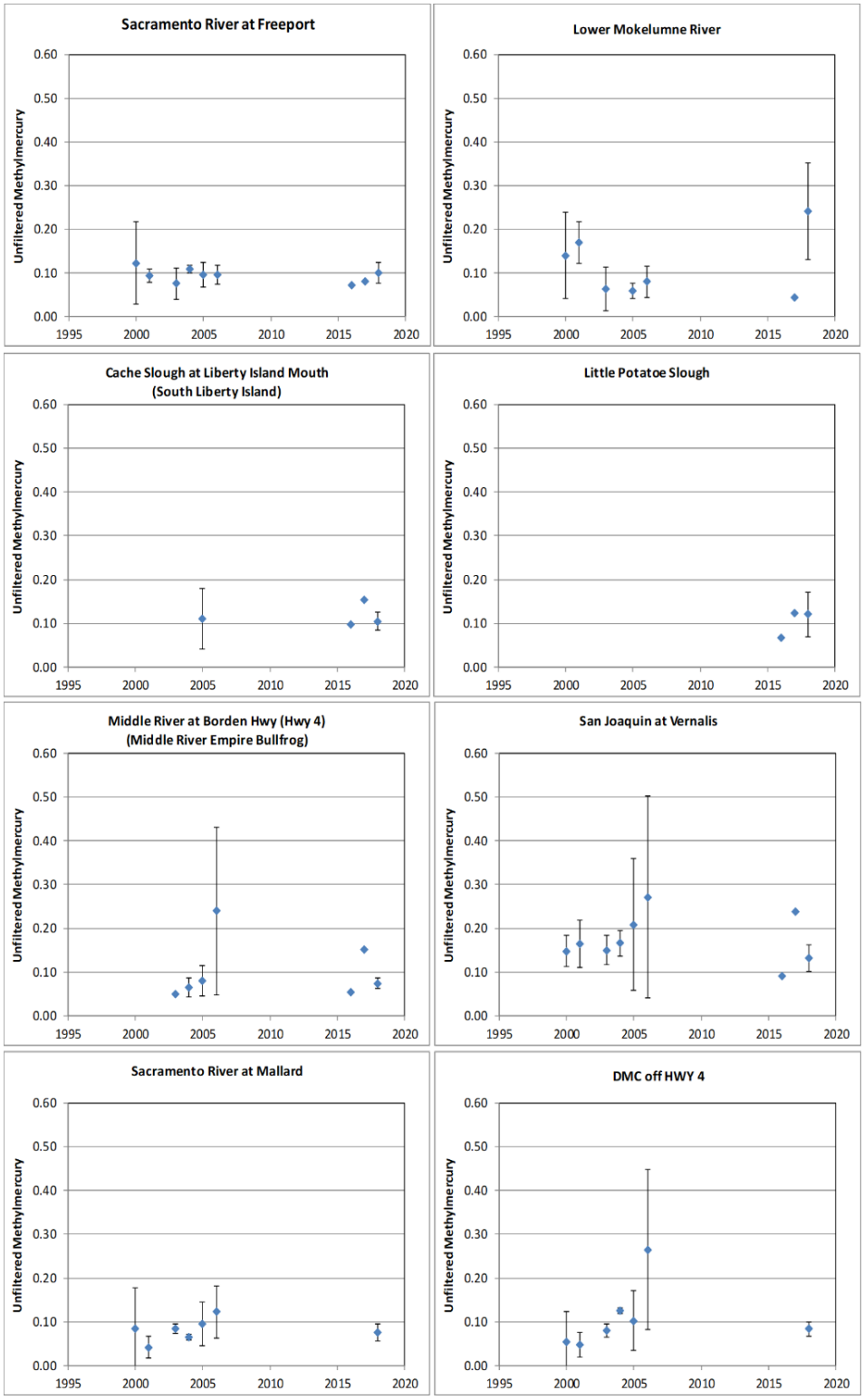

Figure 4. *Preliminary design for restoration monitoring in the northwest Delta.*

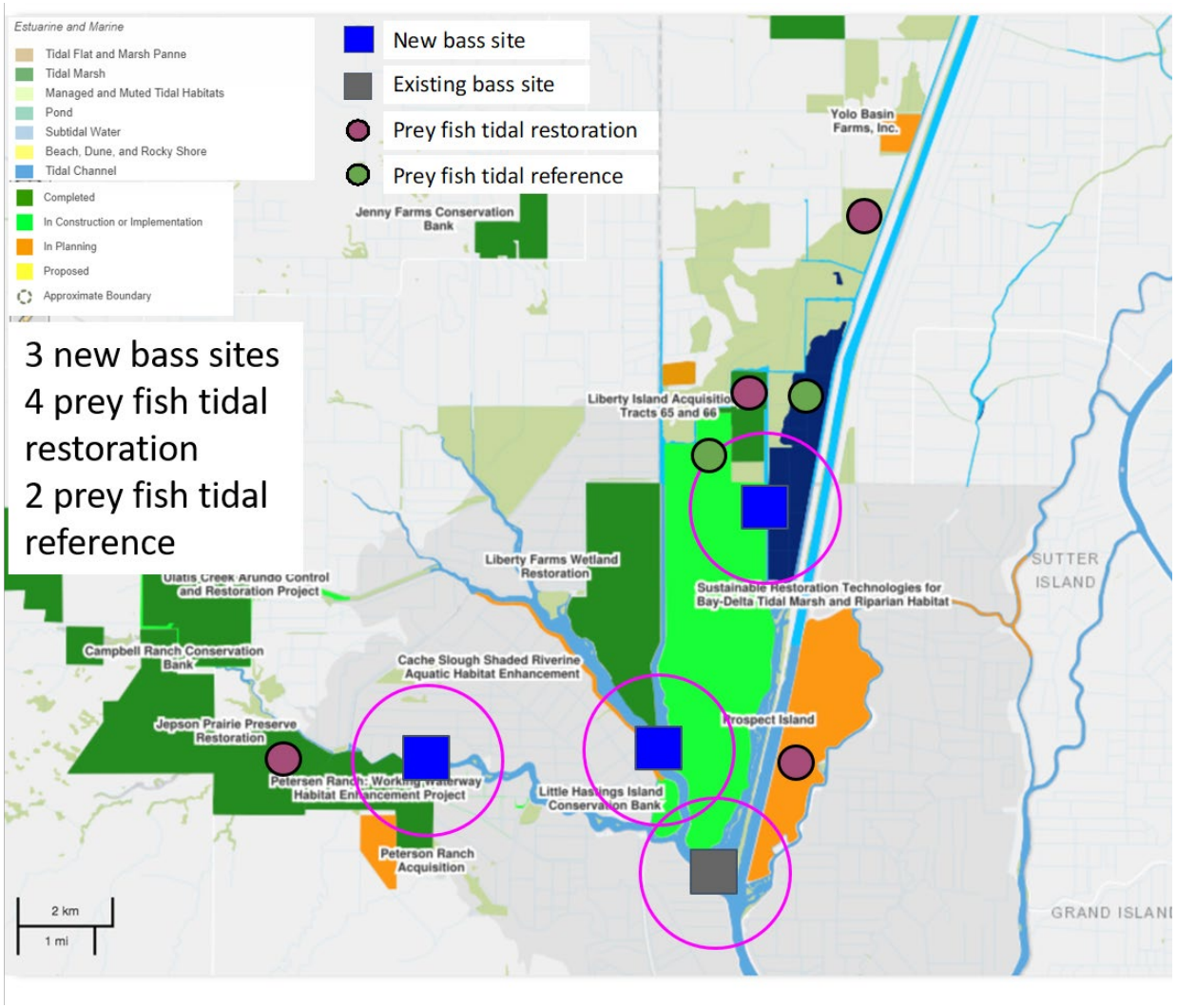

Figure 5. *Preliminary design for restoration monitoring in the northeast Delta.*

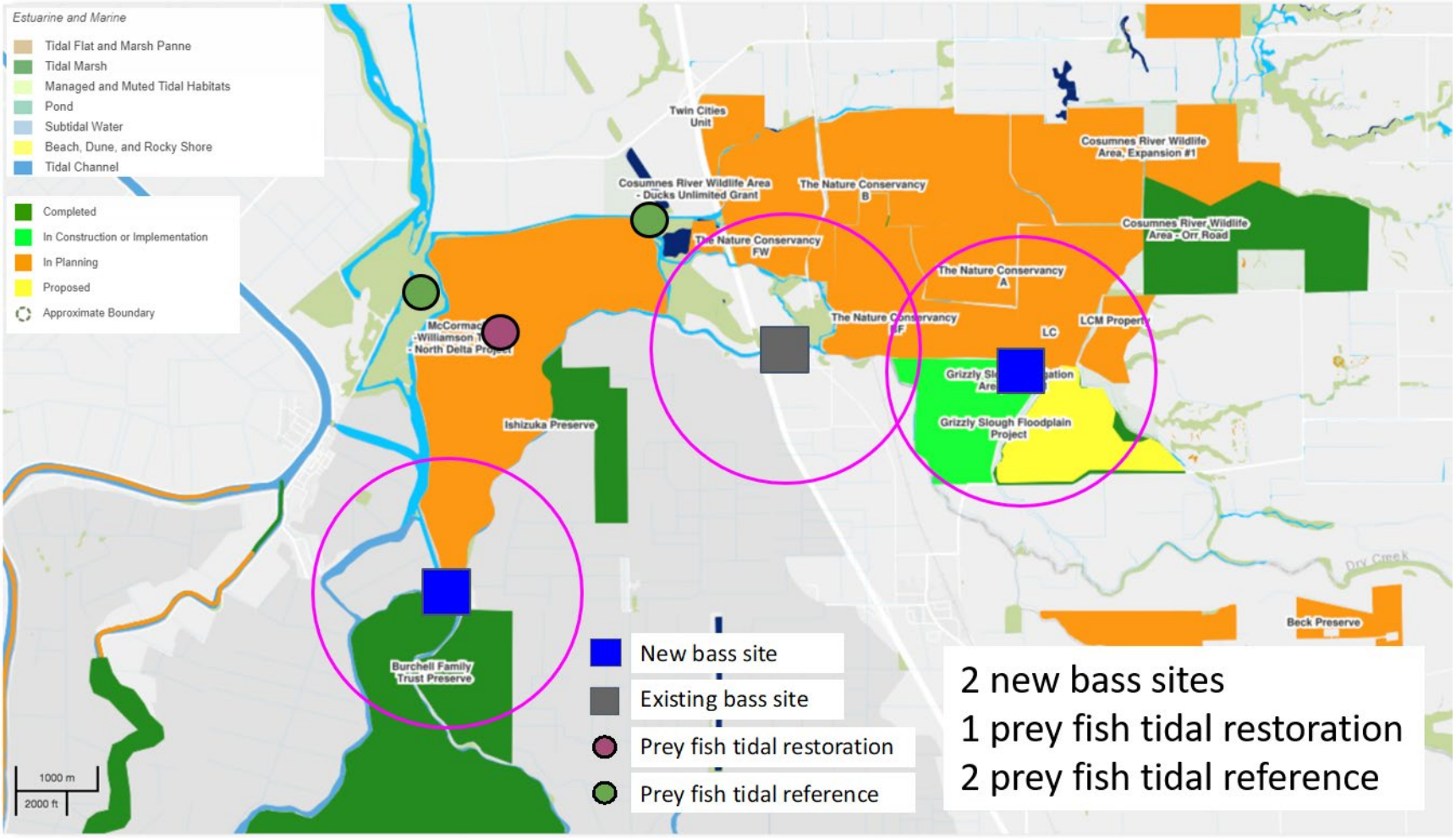

Figure 6. Preliminary design for restoration monitoring in the west Delta.

References

DiGiorgio, C., H. Amos, J. Anderson, M. Bahia, C. Beals, D. Beals, D. Bosworth, G. Gill, R. Harris, W. Heim, E. Hsu, and D. Hutchinson. "Creation of Mercury Models for the Delta and Yolo Bypass: Linking Modeling and Delta Regulatory Decisions." Sacramento, California, 2016. http://scienceconf2016.deltacouncil.ca.gov/content/creation-mercury-models-delta-and-yolo-bypass-linking-modeling-and-delta-regulatory

Robinson, A., A. Richey, D. Slotton, J. Collins, and J.A. Davis. 2018. *North Bay Mercury Biosentinel Project 2016-2017*. Contribution #868. San Francisco Estuary Institute and the Aquatic Science Center. Richmond, CA. https://www.sfei.org/documents/north-bay-mercury-biosentinel-project

Windham-Myers, L., L. Lucas, J.A. Fleck, A.R. Stewart, R.C. Martyr, and M. Marvin-DiPasquale. 2016. *The Delta doughnut: A persistent pattern for methylmercury metrics. Presentation at the Bay-Delta Science Conference*, November 15-17, 2016. http://scienceconf2016.deltacouncil.ca.gov/content/delta-doughnut-persistent-pattern-methylmercury-metrics

Wood, M.L., C.G. Foe, J. Cooke, and S.J. Louie. "Sacramento – San Joaquin Delta Estuary TMDL for Methylmercury: Staff Report." Sacramento, California: Central Valley Regional Water Quality Control Board, 2010. http://www.waterboards.ca.gov/rwqcb5/water_issues/tmdl/central_valley_projects/delta_hg/april_2010_hg_tmdl_hearing/apr2010_tmdl_staffrpt_final.pdf.

Attachment C Pesticides and Aquatic Toxicity Monitoring

In 2018, staff of the Aquatic Science Center (ASC), in collaboration with the Delta RMP Technical Advisory Committee (TAC) and its technical subcommittees, created a new 4-year monitoring plan for pesticides and aquatic toxicity in the Sacramento-San Joaquin Delta. The monitoring design was created from the ground up, and is based on probabilistic, or random, monitoring locations across Delta subregions. The monitoring design is described in detail in the current Delta RMP FY18-19 Workplan, Attachment C, Pesticides and Aquatic Toxicity Monitoring. Detailed information can also be found in the Delta RMP Quality Assurance Project Plan, v. 4.3.

We are currently mid-way through half of the first year of this study, having recently completed the third of six planned monitoring events. While the monitoring design covers four years, it was always intended to be "adaptively managed," where adjustments could be made as we go along.

Recommended changes to triggers for monitoring during wet-weather/ high-flow

In the fall/winter 2018, we received quite a bit of rain before the river rose enough to meet the "trigger" for sampling. The USGS crew first mobilized to sample on December 19. As a result, we may have missed non-point source pollution from local runoff.

The subcommittee recommended updated triggers for Water Year 2020 as follows:

1. The first event shall be an "urban first flush" event. The trigger shall be 0.5" of rainfall forecast in 24 hours for the basin.
2. There should be at least 10 consecutive dry days between sampling events. This allows pesticide applicators time to go out and spray.

Changes to funding for aquatic toxicity testing

For the past 3 years, all of the program's aquatic toxicity testing has been performed by the Aquatic Health Program Laboratory at UC Davis (AHPL). This work has been funded directly by the State Water Board through the Surface Water Ambient Monitoring Program (SWAMP). This contract is set to expire in March 2020. As a result, the SWAMP funding will likely only carry us through half of Water Year 2020's planned monitoring.

We propose to continue the toxicity testing program as designed through the end of Water Year 2020, with funding for the final 3 events coming from the Delta RMP, i.e. funds contributed by Delta RMP participants and managed by ASC. This will maintain continuity and allow us to

finish up year 2 of the study. Sufficient funds should be allocated to allow for toxicity identification evaluations (TIEs) if they are called for.

We may wish to open a competitive bidding process for toxicity testing in Year 3, or Water Year 2021. In the instance that we do switch laboratories, it may be appropriate to send split samples to both old and new labs for a period of time to evaluate intercomparability of the results. A Steering Committee member has suggested inviting labs from around the state to participate in a round-robin style lab intercomparison exercise. The suggestion was that labs will participate in this for free, as a condition for being eligible to bid on future work with the Delta RMP. These are both ideas that should be considered by both the TAC and SC to determine if this is the direction we would like to go.

Detailed budget:
https://docs.google.com/spreadsheets/d/1RNvmvAM3dzc_Z5zsJfqHi6wrYOrbeknraPjQ85_SjRQ/edit#gid=1210191734

Attachment D Contaminants of Emerging Concern

Details on the monitoring design for this study can be found in the Central Valley Pilot Study for Monitoring Constituents of Emerging Concern Work Plan and in the Quality Assurance Project Plan, currently in draft, but scheduled to be finalized and signed before monitoring begins in the summer/fall of 2019.

Detailed budget:
https://docs.google.com/spreadsheets/d/1JE0X6VgUEpE3JDhOTm2tX6UQKQsYfk7JQuwpU_3Ivmo/edit#gid=772836422

Attachment E Sole Source Justification Documents

Delta Regional Monitoring Program

FY19-20 Detailed Workplan and Budget

Attachment E

Sole Source Vendor Justification Forms

Section 8.B.1 of the Delta RMP Charter states:

> *For third-party contracts exceeding $50,000, the Implementing Entity will use a competitive process. Proposals may be obtained by either (a) issuance of a formal Request for Proposals, or (b) solicitation of at least three proposals from qualified contractors; recognizing that, for highly specialized work, it may only be possible to obtain proposals from fewer contractors. The requirement for a competitive process may be waived by the Implementing Entity when it determines that there is only one source for the merchandise or service needed, and no other product/service reasonably meets the stated need or specifications. Criteria that may be considered in agreeing upon a sole source contract include, for example: unique or specialized technical expertise, unique or specialized access to data or information, a joint venture already specified in a proposal, and access to matching funds or in-kind services.*

For the FY19-20 Workplan and Budget, 4 subcontracts greater than $50,000 are proposed:

- U.S. Geological Survey (USGS)
- Moss Landing Marine Laboratory (MLML)
- Resource Management Associates (RMA)
- Applied Marine Sciences (AMS)

Each subcontract meets the criteria for a sole source justification. The rationale for each justification is provided in the following sections.

Vendor Selection Form for the U.S. Geological Survey

In order to provide open and free competition and to obtain the maximum value for each dollar expended, SFEI-ASC has a competitive bidding policy for purchasing services or goods greater than or equal to $50,000. In addition, positive efforts shall be made by SFEI-ASC to utilize small business, minority owned firms, and women business enterprises, whenever possible. Such efforts, as outlined in 45 CFR Part 74.44 will allow these sources the maximum feasible opportunity to compete for contracts. SFEI-ASC will use, but not be limited to, the State of California DBE online directory as a source for possible references: http://www.dot.ca.gov/hq/bep/find_certified.htm

Submit this form, along with original quotes, to the Program Director or Executive Director for review. Original documents go to the Contracts Manager for retention. An electronic copy will be made available on the shared drive.

Date: 5/2/2019 *Requestor*: Matthew Heberger

Stage of funding for vendor: ☒ Proposal ☐ In negotiations ☐ Contracted

Program: Delta RMP *Project/Task # (if known)*: 8111.20.

☐ I have obtained at least three (3) competitive quotes and have chosen the supplier based on price, reliability, delivery, service, or other factors (attach quotes). If chosen vendor is not lowest cost bidder, detail the reason(s) why the vendor was selected on the next page.

VENDOR	Date of Quote	Total $	Comments
USGS		$165,563	Field sample collection and pesticides chemical analysis

Vendor Selected:

Vendor Name: U.S. Geological Survey
Contact: James Orlando
Address: 6000 J. Street, Sacramento, CA 95819
Phone: 916-278-3271 Fax: Email: jorlando@usgs.gov

Reason for Selection (explanation required below):

☐ Vendor is the lowest cost provider ☒ Vendor is sole acceptable provider

☐ Vendor provided best overall offer ☐ Emergency/Urgency

☐ Vendor is sole provider ☐ Other

Explanation (attach additional information if necessary):

ASC staff recommend a **sole source** subcontract with the US Geological Survey (USGS) for this work because of the unique, specialized, technical experience and unique or specialized access to data or information as documented by:

- The specialized nature of the proposed work, which is research outside the domain of typical contractors.
- USGS unique ability to analyze 160+ Current Use Pesticides (CUP) in water and suspended sediment, with detection limits much lower than available from commercial laboratories.
- As a project partner, USGS staff have played a significant role in project planning.
- Further, the USGS PFRG has offered to contribute $14,261 in matching funds for pesticide monitoring project (10% of labor and travel).

For these reasons, staff recommend a sole source contract with the USGS because this vendor is the sole acceptable provider for the work.

We respectfully request your approval.

To be completed by Program Director or Executive Director

☑ Yes ☐ No The vendor quote(s)/explanation have been reviewed and appear reasonable for the proposed work.

Matthew Heberger
Requestor's Printed / Typed Name

Matth Heb
Requestor's Signature

5/23/2019
Date

W. Chabot
Program Director or Executive Director's Signature

5-23-19
Date

Contracts Manager's Signature

Date

Vendor Selection Form – Moss Landing Marine Laboratory

In order to provide open and free competition and to obtain the maximum value for each dollar expended, SFEI-ASC has a competitive bidding policy for purchasing services or goods greater than or equal to $50,000. In addition, positive efforts shall be made by SFEI-ASC to utilize small business, minority owned firms, and women business enterprises, whenever possible. Such efforts, as outlined in 45 CFR Part 74.44 will allow these sources the maximum feasible opportunity to compete for contracts. SFEI-ASC will use, but not be limited to, the State of California DBE online directory as a source for possible references: http://www.dot.ca.gov/hq/bep/find_certified.htm

Submit this form, along with original quotes, to the Program Director or Executive Director for review. Original documents go to the Contracts Manager for retention. An electronic copy will be made available on the shared drive.

Date: 5/2/2018 *Requestor*: Matthew Heberger

Stage of funding for vendor: ☒ Proposal ☐ In negotiations ☐ Contracted

Program: Delta RMP *Project/Task # (if known)*: 8111.18

☐ I have obtained at least three (3) competitive quotes and have chosen the supplier based on price, reliability, delivery, service, or other factors (attach quotes). If chosen vendor is not lowest cost bidder, detail the reason(s) why the vendor was selected on the next page.

VENDOR	Date of Quote	Total $	Comments
Marine Pollution Studies Laboratory at Moss Landing		$360,000	MPSL will provide a partial cost match of $25,000

Vendor Selected:

Vendor Name: Marine Pollution Studies Laboratory at Moss Landing
Contact: Wes Heim (Director)
Address: 7544 Sandholdt Road Moss Landing, CA 95039
Phone: (831) 771-4459 Fax: Email: wheim@mlml.calstate.edu

Reason for Selection (explanation required below):

☐ Vendor is the lowest cost provider
☐ Vendor provided best overall offer
☐ Vendor is sole provider
☒ Vendor is sole acceptable provider
☐ Emergency/Urgency
☐ Other

Explanation (attach additional information if necessary):

ASC staff recommend a **sole source** subcontract with the Marine Pollution Studies Laboratory (MPSL) at Moss Landing for this work because of the unique, specialized, technical experience as documented by:

- MPSL is a SWAMP contractor and has been involved with state-wide studies of mercury over many years. Therefore, data collected by MPSL will be comparable to regional and statewide datasets.
- MPLS has collected the first two years of Delta RMP data in FY16/17 and FY17/18. Continuing to use MPSL will ensure consistency of analytical and field sampling protocols.
- Wes Heim and his colleagues are recognized as national experts on the monitoring of mercury in biological tissues and in water, having developed trace metal methods for measuring mercury speciation in these matrices. This laboratory group has been involved with the State Surface Water Ambient Monitoring Program since 2001 and has extensive experience collecting and analyzing water and fish tissues for mercury as evident by the following projects they have completed in the Delta: Assessment of ecological and human health impacts of mercury in the Bay-Delta watershed (1999-2003); Transport, cycling, and fate of mercury and monomethyl mercury in the San Francisco Delta and tributaries – An integrated mass balance assessment approach (2003-2006); and Development of best management practices to reduce methyl mercury exports and concentrations from seasonal wetlands in the Yolo Wildlife Area (2011-2016)
- Measuring mercury concentrations at low levels requires high precision and accuracy. ASC recommend a sole source laboratory that can conduct the collection and the analyses to avoid the potential cross contamination that can occur when multiple laboratories and field collection teams are involved in a project. In addition, it is more cost-effective to have one entity conducting the field sampling and chemical analyses.
- This laboratory has participated in multiple interlaboratory exercises and consistently been able to obtain high quality results. MPSL has participated in multiple interlaboratory exercises including those conducted by the CALFED Mercury Program, State of Florida Department of Environmental Protections, and Brooks Rand Labs. MPSL placements in interlaboratory studies are consistently in the top ranks. Furthermore, MPSL analytical results consistently exceed the quality assurance and quality control requirements outlined in the SWAMP Laboratory Quality Assurance Program Plan. Finally, MPSL has been audited to assess mercury analytical abilities as a requirement for participation in both the federal and California State sponsored CALFED Mercury Program and SWAMP. Audits concluded: 1) MPSL laboratory's preparation and analytical spaces are more than sufficient for the utilized methods and SOPs; 2) Instrumentation and equipment is current, and in many cases, state-of-the-art; 3) staff expertise and retention are outstanding; and 4) QA systems implemented at

MPSL have greatly benefitted SWAMP, and are certainly worthy of federal and state-level certifications.

In addition to the unique technical experience, MPSL is also providing $25,020 of in-kind matching funds (10% of the value of the contract).

For these two reasons, staff recommend a sole source contract with the Marine Pollution Studies Laboratory because this vendor is the sole acceptable provider for the work.

We respectfully request your approval.

To be completed by Program Director or Executive Director

[x] Yes [ ] No The vendor quote(s)/explanation have been reviewed and appear reasonable for the proposed work.

Matthew Heberger

Requestor's Printed / Typed Name

Matthew Heberger 5/23/2019

Requestor's Signature Date

W. Chelf 5-23-19

Program Director or Executive Director's Signature Date

Contracts Manager's Signature Date

Vendor Selection Form – Resource Management Associates

In order to provide open and free competition and to obtain the maximum value for each dollar expended, SFEI-ASC has a competitive bidding policy for purchasing services or goods greater than or equal to $50,000. In addition, positive efforts shall be made by SFEI-ASC to utilize small business, minority owned firms, and women business enterprises, whenever possible. Such efforts, as outlined in 45 CFR Part 74.44 will allow these sources the maximum feasible opportunity to compete for contracts. SFEI-ASC will use, but not be limited to, the State of California DBE online directory as a source for possible references: http://www.dot.ca.gov/hq/bep/find_certified.htm

Submit this form, along with original quotes, to the Program Director or Executive Director for review. Original documents go to the Contracts Manager for retention. An electronic copy will be made available on the shared drive.

Date: 6/7/2019 *Requestor*: Matthew Heberger

Stage of funding for vendor: ☒ Proposal ☐ In negotiations ☐ Contracted

Program: Delta RMP *Project/Task # (if known)*: 8111.18

☐ I have obtained at least three (3) competitive quotes and have chosen the supplier based on price, reliability, delivery, service, or other factors (attach quotes). If chosen vendor is not lowest cost bidder, detail the reason(s) why the vendor was selected on the next page.

VENDOR	Date of Quote	Total $	Comments

Vendor Selected:

Vendor Name: Resource Management Associates, Inc.
Contact: Marianne Guerin
Address: 1756 Picasso Avenue, Suite G, Davis, CA 95618
Phone: 925-373-7142 Fax: Email: maguerin@rmanet.com

Reason for Selection (explanation required below):

☐ Vendor is the lowest cost provider
☐ Vendor provided best overall offer
☐ Vendor is sole provider
☐ Vendor is sole acceptable provider
☐ Emergency/Urgency
☒ Other

Explanation (attach additional information if necessary):

ASC staff recommend a sole source subcontract with the Resource Management Associates (RMA) as they are uniquely qualified to provide the specific hydrological modeling analyses identified in this project proposal. The Delta RMP sole source justification criteria includes contractors that can provide "unique or specialized technical expertise."

RMA staff have developed hydrological models that can specifically address this study's research questions. RMA has modeled the movement of water parcels with and without wastewater effluent for the 2013-2014 Lagrangian Study lead by the US Geological Survey. RMA also has the capability to model the proportion of source waters present at particular sample stations, and to perform particle tracking modeling to estimate transit time that are needed for calculating phytoplankton growth rates. The sole source criterion of "a joint venture already specified in a proposal" is also relevant, because RMA staff contributed to the development of the Delta RMP Nutrient Sub-committee's proposal. In addition to developing the proposal's modeling tasks, RMA staff were involved in discussions of the experimental design, with key contributions to the selection of the seasonal timing of the fieldwork, and the locations and parameters that need to be sampled to calibrate hydrological models at river confluences under various tidal conditions.

For these reasons, staff recommend a sole source contract with RMA.

We respectfully request your approval.

To be completed by Program Director or Executive Director

☑ Yes ☐ No The vendor quote(s)/explanation have been reviewed and appear reasonable for the proposed work.

Matthew Heberger

Requestor's Printed / Typed Name

Matthew Heberger 7/5/2019

Requestor's Signature Date

W. Ebert 7-8-19

Program Director or Executive Director's Signature Date

7-5-19

Contracts Manager's Signature Date

Vendor Selection Form – Applied Marine Science

In order to provide open and free competition and to obtain the maximum value for each dollar expended, SFEI-ASC has a competitive bidding policy for purchasing services or goods greater than or equal to $50,000. In addition, positive efforts shall be made by SFEI-ASC to utilize small business, minority owned firms, and women business enterprises, whenever possible. Such efforts, as outlined in 45 CFR Part 74.44 will allow these sources the maximum feasible opportunity to compete for contracts. SFEI-ASC will use, but not be limited to, the State of California DBE online directory as a source for possible references: http://www.dot.ca.gov/hq/bep/find_certified.htm

Submit this form, along with original quotes, to the Program Director or Executive Director for review. Original documents go to the Contracts Manager for retention. An electronic copy will be made available on the shared drive.

Date: 6/7/2019 *Requestor*: Matthew Heberger

Stage of funding for vendor: ☒ Proposal ☐ In negotiations ☐ Contracted

Program: Delta RMP *Project/Task # (if known)*: 8111.18

☐ I have obtained at least three (3) competitive quotes and have chosen the supplier based on price, reliability, delivery, service, or other factors (attach quotes). If chosen vendor is not lowest cost bidder, detail the reason(s) why the vendor was selected on the next page.

VENDOR	Date of Quote	Total $	Comments

Vendor Selected:

Vendor Name: Applied Marine Science (AMS)
Contact: Paul Salop
Address: 4749 Bennett Drive, Ste L, Livermore, CA 94551
Phone: 925-373-7142 Fax: Email: salop@amarine.com

Reason for Selection (explanation required below):

☐ Vendor is the lowest cost provider
☐ Vendor provided best overall offer
☐ Vendor is sole provider
☐ Vendor is sole acceptable provider
☐ Emergency/Urgency
☒ Other

Explanation (attach additional information if necessary):

ASC staff recommend a **sole source** subcontract with the Applied Marine Science for this work because of their role joint venture already specified in a proposal.

Aquatic Marine Science (AMS) staff were coauthors in developing a Prop. 1 research proposal that was subsequently used as the basis for the development of the Delta RMP Nutrient Sub-committee's study proposal. The Delta RMP Charter's sole source criterion states that "a joint venture already specified in a proposal" can be used for justification in hiring a specific contractor. AMS staff participated in discussions that resulted in the project's study design, choice of project locations, field logistics, and field and laboratory methods. In addition, AMS staff drafted the Delta RMP study's research hypotheses, and edited most other sections of the main text in the proposal. During the development of the Delta RMP Nutrient Sub-committee's proposal, AMS staff continued to be engaged in discussions regarding the proposal text, field logistics, and field sampling equipment needs.

For these two reasons, staff recommend a sole source contract with the Aquatic Health Program Laboratory at UC Davis.

We respectfully request your approval.

To be completed by Program Director or Executive Director

☑ Yes ☐ No The vendor quote(s)/explanation have been reviewed and appear reasonable for the proposed work.

Matthew Heberger

Requestor's Printed / Typed Name

Matthew Heberger — 7/5/2019

Requestor's Signature — Date

W. Elliott — 7-8-19

Program Director or Executive Director's Signature — Date

7-5-19

Contracts Manager's Signature — Date