Delta Regional Monitoring Program

FY17/18 Detailed Workplan and Budget

As approved by the Delta RMP Steering Committee on May 3, 2017

AQUATIC SCIENCE CENTER

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Introduction

The purpose of this document is to provide the Steering Committee (SC) with a Detailed Workplan for FY17/18 Delta RMP budget.

For the upcoming year, the overall budget is slightly larger than the previous fiscal year. Thanks to slightly higher anticipated revenues coming from a growing number of Delta RMP participants, we have planned a modest increase in expenditures from the previous two fiscal years. Planned expenditures for FY17/18 is $863,165. Planned expenses for FY16/17 were $1,053,030 (which included $254,145 from the Water Board).

Earlier this year, the technical subcommittees (i.e., mercury, pesticides, nutrients, and pathogens subcommittees) developed study proposals consistent with the planning budgets and the monitoring design. The FY17/18 study proposals were vetted by the respective subcommittees and brought to the Technical Advisory Committee (TAC) on March 14, 2017. The subcommittees worked to develop proposals that are consistent with:

- the multi-year plan presented at the December 2015 SC meeting;
- feedback received by the 2016 External Review Panel;
- Data Quality Objectives being developed for each monitoring area.

The TAC reviewed and prioritized the scientific studies based on the planning budget for monitoring and special studies. ASC then prepared this detailed workplan for the recommended studies and core functions of the program.

This report summarizes the:

- Expected revenue for FY17/18;
- A detailed budget and workplan for the core functions of the program;
- A detailed budget and workplan for monitoring and special studies; and
- The overall FY17/18 Delta RMP budget.

This Detailed Workplan was be submitted for approval by the Steering Committee on May 3, 2017. The Steering Committee voted to approve the proposed workplan without pesticides monitoring, which will be reconsidered in July 2017 or at a subsequent meeting.

Anticipated Revenue

On January 26, 2017, the SC voted for a zero percent fee increase for existing participants for FY17/18. Contributions from continuing participants amounts to $787,782. As of this writing, the State and Federal Contractors Water Agency (SFCWA) has confirmed that it is not likely to contribute to the Delta RMP. SFWCA has contributed $100,000 per year for each of the last 3 years. Because we are unlikely to receive these funds, we have **not** included their contribution under expected revenue for FY17/18. There are two confirmed new participants, who will be contributing to the Delta RMP for the first time in FY17/18 (City of Modesto and Sutter County), for a gain of an additional $25,700. Finally, expected revenue includes $205,600 of in-kind support from the Central Valley Water Board via funding from the Surface Water Ambient Monitoring Program (SWAMP). Therefore, the total anticipated revenue for FY17/18 is **$993,382**.

Some of the Delta RMP funds are in-kind, such as a State Board contract with UC-Davis for toxicity testing (the "SWAMP Contract"). These in-kind funds are treated as revenue but are not fungible. They cannot be used for more than one purpose. For example, the SWAMP contract funds can only be used for toxicity testing.

It is likely that additional revenue will become available later in FY17/18. In March 2017, the Central Valley Regional Water Quality Control Board issued 13267 Orders to 12 communities, offering them the option of participating in the Delta RMP as a condition of their stormwater discharge (MS4 Phase II) permits. As of the date this budget was prepared, only one of these 12 communities has confirmed that it will participate in the program and contribute to the RMP. If the other 11 communities join the program, it would likely mean an estimated additional $110,000 in revenue. However, because we are not certain to collect this revenue, we have not included it in our revenue forecast. Further, if SFWCA's board decides to authorize funding for the RMP, it would mean another $100,000 in funds.

The number of Delta RMP participants has steadily grown over the life of the program, as shown below. If, as noted above, SFWCA elects to contribute at the level they have in the past, it would mean a *growth* in contributions by participants of +6%. If not, there may be a decrease in 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	37	+6%	$787,782	–9%

Below, Table 1 summarizes the expected revenue for FY17/18, summarized by category of participant. Figure 1 shows revenue growth by participant category, showing actual revenue for FY15/16 and FY16/17 and expected revenue for FY17/18.

Table 1 Delta RMP FY17/18 Revenue Schedule

Participant	FY15/16 Actual	FY16/17 Actual	FY17/18 Forecast	Comment
Regional Board	$212,855	$254,145	**$205,600**	In-kind contribution via the SWAMP program 3-year contract.
Dredgers		$60,000*	**$60,000**	New participant category in FY16/17
Irrigated Lands	$113,780	$148,780	**$148,780**	
Stormwater (MS4 Phase 1)	$158,200	$158,200	**$181,400**	The City of Modesto will join the Delta RMP in FY17/18, contributing $23,200. Only counts communities whose participation has been confirmed in writing.
Stormwater (MS4 Phase 2)	$169,999	$189,999	**$192,499**	El Dorado County joined in FY16/17, for $20,000.
Wastewater	$209,754	$205,103	**$205,103**	Sutter County will join in FY17/18, for $2,500. The City of Discovery Bay did not participate in the RMP in FY16/17, resulting in a drop in revenue. We have not included their contribution as expected revenue for FY17/18.
Water suppliers (SFCWA)	$100,000	$100,000		As of this writing, SFWCA contribution to the Delta RMP in FY17/18 is under discussion, pending approval of their Board, hence we have not included their contribution in our planned revenue.
Total	**$964,588**	**$1,040,878**	**$993,382**	

* Revenue from dredgers in FY16/17 includes funds that have been invoiced but not received as of this writing.

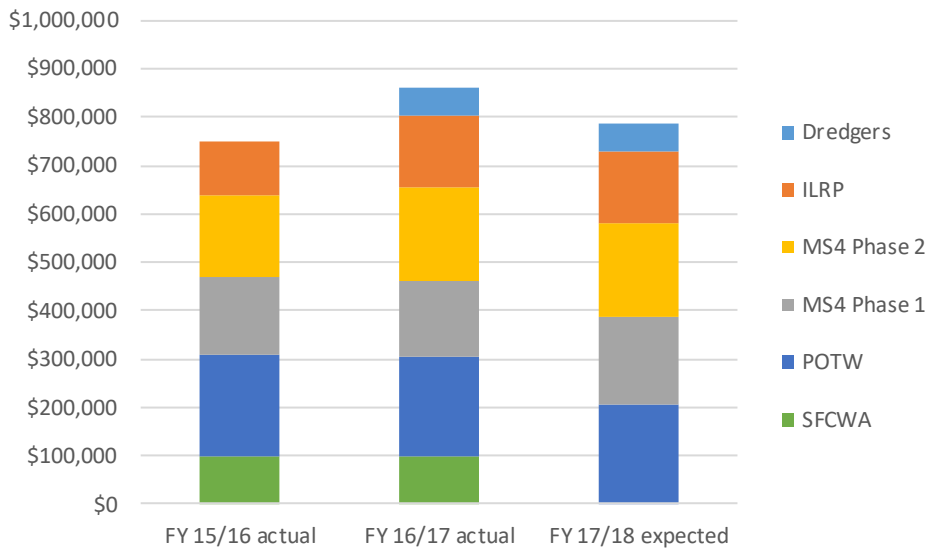


Figure 1 Bar chart of revenue growth by participant category, showing actual revenue from FY15/16 to FY16/17 and expected revenue for FY17/18.

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 management questions. This section details the core function expenses for FY17/18.

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 and
- Communications

The bar chart in **Figure 2** shows how the proposed program budget for FY17/18 compares to budgets for the past two fiscal years. In addition, **Table 2** shows how the planned core function budget for FY17/18 compares to the previous fiscal year, both in terms of the number of hours of staff time and total expense. The planned budget for core functions is $35,504 larger than the core functions budget for FY/16/17 of $304,100, an increase of 12%. Part of the cost increase is due to the normal escalation in costs: cost of living adjustments (i.e. staff raises) and cost increases due to inflation. However, the main reason for the increase is that we have set more ambitious targets, and plan several new areas of work, indicated in the addition of four new budget line items, detailed below.

- **Task 2D, Technical Subcommittees ($20,000).** This is intended to cover ASC staff time to organize and participate in technical subcommittee meetings. This is an important part of program planning and monitoring design, and a key part of our strategy to respond to the critiques of the 2016 External Review Panel. Even though Task 2D is a new budget item, it does not represent at new cost to the Program. The cost to do this work in FY16/17 was billed to the TAC budget line, which went over budget. We are creating this new budget line to split out the costs for subcommittee work from TAC work to more accurately account for effort on these two different tasks.

- **Task 2E, Science Advisors ($10,000)** will pay the honoraria and travel for 2 to 4 independent science advisors. The External Review highlighted the value of having independent scientists involved with monitoring design planning. Ultimately, the Program would benefit from having a Chief Scientist to guide the program and to efficiently integrate feedback from the TAC. However, there is insufficient revenue to support a Chief Scientist without scaling back monitoring efforts. Therefore, as an alternative, we recommend paying honoraria to a few independent science advisors on specific topics (e.g., pesticide monitoring design). The advisors would be selected by the Steering Committee with input from the TAC and would commit to a 3-4 year term. 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.

- **Task 4B Draft the Pulse of the Delta ($40,000)** is to begin drafting the *Pulse of the Delta report*. In the Communications Plan, there is a placeholder for a *Pulse of the Delta* report to be released in fall 2018 at the State of the Bay Delta Science Conference. A *Pulse* document typically requires having 3-4 technical reports completed and approved by the Steering Committee a 9-12 months in advance, after which the Steering Committee works on high level messaging. The Delta RMP will not have enough technical reports in time to justify a *Pulse* report. However, a "Pulse lite" report would be achievable and would be helpful to raise the profile of the Program at the conference. Writing a *Pulse* report would also give the Steering Committee and TAC the opportunity to craft a consensus message about water quality in the Delta. In general, the report would summarize the Delta RMP's management questions, efforts during the first 3 years, and future plans. For an example see the *RMP Update* report produced by the Bay RMP (www.sfei.org/rmp/update). The funds budgeted in FY17/18 would be sufficient to develop a detailed outline with RMP committees, prepare a comprehensive budget and schedule, engage authors, and start work on the report. Depending on the scope of the report chosen by the Steering Committee, additional funds may need to be allocated, either from Reserve or in the FY18/19 budget, to complete the whole report. See Appendix D for a more detailed description of this product.

- **Task 4A Stakeholder Board Meetings ($10,500)** is for ASC staff to provide support to the Delta RMP co-chairs and others to meet with stakeholders' Boards of Directors to present information about the value of the Program. These meetings can be with existing participants or potential future participants. Maintaining good relationships with existing participants and recruiting new participants is a critical fundraising activity that was not funded in past years. These meetings are also a critical communication link for ensuring that the Program is meeting the needs of participants.

If the new costs for the four new tasks is removed, the budget for core functions in FY17/18 is actually $15,000 *lower* than last year. Part of the reason is that we have carefully considered staffing needs for the project, and plan to make greater use of junior staff and administrative staff (with lower hourly rates) for certain functions. For example, we have arranged to contract with an administrative professional to take notes and to prepare meeting summaries at meetings of the TAC and Steering Committee. This is significantly less expensive than using an ASC Environmental Scientist for this job.[1] In other cases, data analysis, report writing, and

[1] For an estimated 12 hours per meeting, and 8 meetings per year at $40 per hour, this represents a savings to the program of approximately $9,000 compared to the fully loaded rates for a mid-level ASC Environmental Scientist.

preparing of maps, figures, and tables can be done by ASC Environmental Analysts, or junior staff members. In all cases, we have budgeted what we believe is sufficient time by Senior Environmental Scientists to provide guidance and oversight, and be responsible for technical deliverables. In short, the core budget has been planned to do a great deal more with only a modest price increase.

There are a number of tasks which we did **not** include in the FY17/18 budget because there was insufficient revenue and we deemed them to be lower priority. These tasks would benefit the program in the long-term but are not crucial for this year.

- **Update to the Monitoring Design Document** – Updating the Monitoring Design document is a major undertaking. As a result of the External Review recommendations, major changes are being made to the monitoring programs. It would be ideal update the Monitoring Design document at the same time to keep it from becoming obsolete. However, some of the recommended monitoring activities are being conducted as pilot studies. The long-term monitoring design may change again based on the results of these pilot studies. Each of the FY18/19 studies have detailed plans (see attachments to this document) that can serve as an interim Monitoring Design. In the response to the External Review, the co-chairs stated that the Monitoring Design document would be updated in 2020, which would be 5 years after the first version. In order to avoid unnecessary extra costs, we recommend updates to the Monitoring Design document be delayed until the FY19/20 budget.
- **Factsheets and Outreach Products** – not essential as we have created a new factsheet in FY17/18 that should serve the program for at least a year.
- **Workshops and Technical Meetings** – While there are no workshops planned at the moment, the Steering Committee may wish to revisit this following the scoping of work related to Harmful Algal Blooms (HABs) or as other needs arise.
- **Presentations and Conferences and Meetings** - while desirable to help publicize the accomplishments of the program and encourage data sharing, it was felt that the time will be ripe for this in the next fiscal year after more data has been collected, more work has been done to analyze and synthesize these results, and once the technical committees and Steering Committee have met to develop key messages. Presentations can also build off of forthcoming reports such as the Current Use Pesticides (CUP) interpretive report and the *Delta RMP Update.*

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 2 Delta RMP FY17/18 Core Function Budget.

	FY16/17 Projected Staff Hours*	FY17/18 Planned Staff Hours	FY16/17 Budgeted Expenses	FY16/17 Projected Expenses*	FY17/18 Budgeted Expense
1. Core Functions					
A. Program Planning	525	528	$76,000	$66,991	$65,000
B. Contract and Financial Management	464	480	$52,000	$51,298	$54,000
External Review Response	75	–	$10,000	$10,529	–
	1,064	**1,008**	**$138,000**	**$128,800**	**$119,000**
2. Governance					
A. SC meetings	270	272	$51,300	$38,544	$48,484
B. TAC meetings	453	304	$64,800	$77,714	$61,620
NEW: C. Technical Subcommittees	–	152	–	–	$20,000
NEW: D. Science Advisors	–	–	–	–	$10,000
	723	**728**	**$116,100**	**$116,258**	**$140,104**
3. Quality Assurance					
A. Quality Assurance System	106	104	$15,000	$12,966	$15,000
B. Technical Oversight and Coordination	62	88	$15,000	$14,065	$15,000
	168	**192**	**$30,000**	**$27,031**	**$30,000**
4. Communications					
Factsheet	32	–	$5,000	$2,700	–
Technical Workshop	114	–	$15,000	$0	–
NEW: A. Stakeholder Board Meetings	–	68	–	–	$10,500
NEW: B. Delta RMP Update Draft	–	312	–	–	$40,000
	146	**380**	**$20,000**	**$2,700**	**$50,500**
Grand Total	**2,101**	**2,308**	**$304,100**	**$274,789**	**$339,604**

*FY16/17 Projected staff hours includes hours billed to date plus our best estimate of the number of hours to complete tasks.

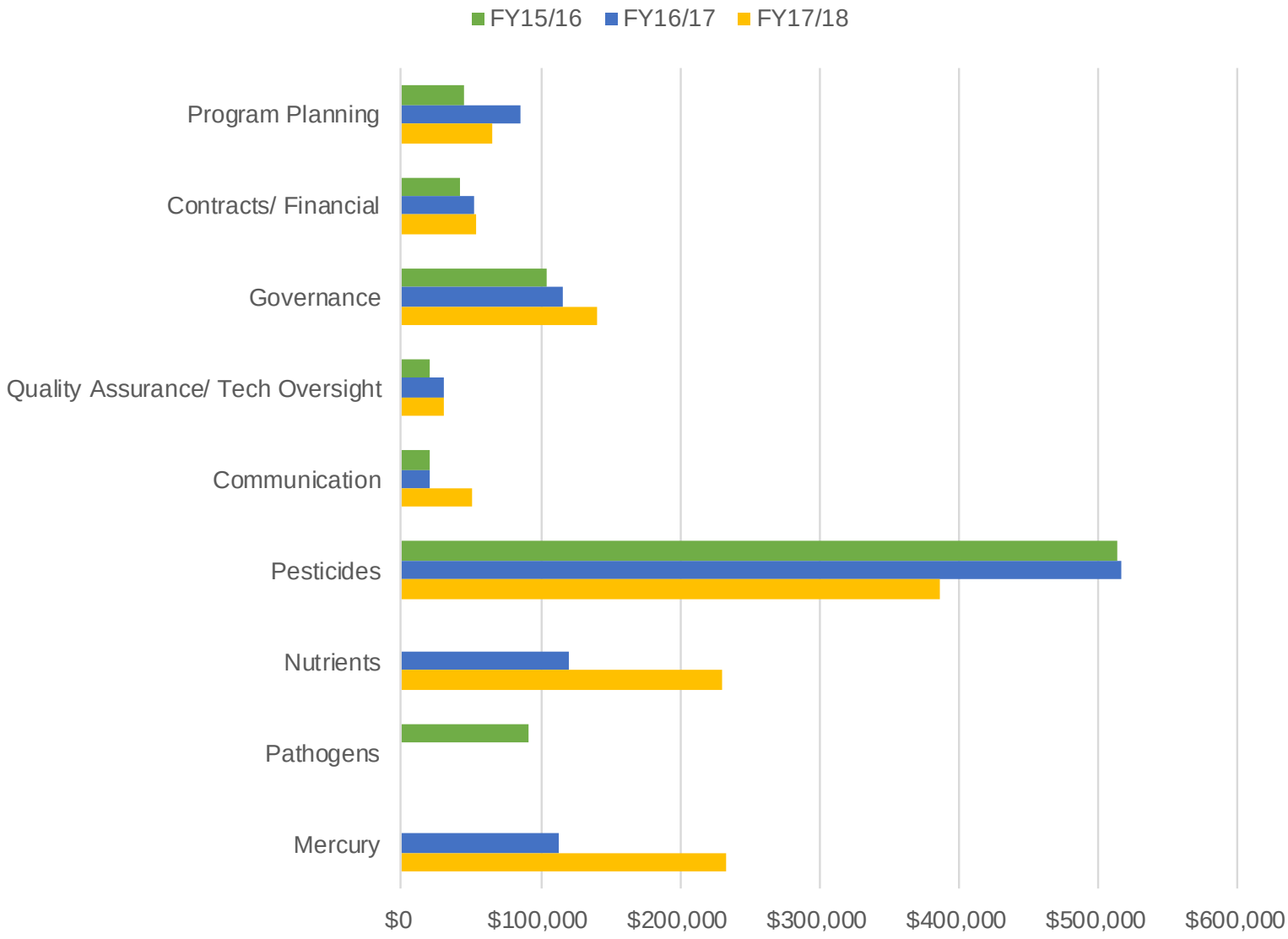


Figure 2 **Bar chart of budgeted expenses for the Delta RMP across 3 fiscal years.**

Table 3 Delta RMP FY17/18 Programmatic Task Descriptions, Budget Justifications, and Deliverables.

Task	Subtask	Budget	Description	Budget Justification	Deliverables
1. Program Management	A. Program Planning	$65,000	Preparing annual workplan/budgets, updating foundational documents including Multi-Year Plan, Annual Workplan, and Monitoring Design. Coordinate activities among stakeholders via e-mail and telephone calls, tracking deliverables. Preparing scopes for Supplemental Environmental Projects	80 hours for Program Manager to produce the Annual Workplan and Budget. 170 hours (3.5 hrs/wk) for Program Manager to update Multi-Year Plan, Charter, and Communication plan. 240 hours (4.6 hr/wk) for technical staff to contribute to workplans, follow up on action items, and update program documents. 60 hours for Program Director (1.2 hr/wk) to provide oversight and continuity.	FY18/19 Annual Workplan and Budget (June 2018). Amended Charter and Communication Plan if needed. Quarterly reports on deliverables and action items.
	B. Contract and Financial Management	$54,000	Tracking expenditures versus budget. Providing quarterly financial updates to the Steering Committee. Developing contracts and managing subcontractors. Invoicing program participants.	Approximately 5% of assets under management. 240 hours for Contracts Manager (4.8 hr/wk) and 72 hours for accountant. 120 hours for Program Manager (2.4 hr/wk) and 40 hours for Program Director to provide oversight (3 hr/wk). Tasks include issuing invoices and subcontracts, checking on subcontracts and finances weekly. $1,000 for direct costs, direct costs e.g., shipping, courier, supplies.	Quarterly updates on FY17/18 Budget provided in the SC agenda package. Contract management.

Task	Subtask	Budget	Description	Budget Justification	Deliverables
2. Governance	A. SC meetings	$48,484	Preparing agendas, agenda packages, participating in meetings, writing meeting summaries, following up on action items, meeting with co-chairs and stakeholders in preparation for SC meetings/follow-up.	4 meetings per year. For each meeting: 40 hours for Program Manager, 16 hours for Program Director, and 12 hours for Environmental Scientist. Travel from Richmond to Sacramento ($125/meeting). Facilitation services by Brock Bernstein (quote: $10,064) Note-taking and summary of SC meetings by Daphne Orzalli (quote: $1,920).	4 Steering Committee meetings and meeting summaries. 8 teleconferences with the Coordinating Committee.
	B. TAC meetings	$61,620	Preparing agendas, agenda packages, participating in meetings, writing meeting summaries, following up on action items, meeting with co-chairs and stakeholders outside of meetings. Facilitation of TAC subcommittee meetings as needed. The cost for this function assumes that MEI and USGS continue to serve as co-chairs of the TAC, with ASC serving in a coordination role. As discussed with the Finance Subcommittee and TAC, ASC and MEI will avoid duplication of effort.	4 meetings per year. For each meeting: 28 hours for Program Manager, 8 hours for Program Director, and 40 hours for Environmental Scientist. Travel from Richmond to Sacramento ($125/meeting). McCord Environmental (MEI) paid chair (quote: $19,200). Note-taking and summary of SC meetings by Daphne Orzalli (quote: $1,920).	4 TAC meetings and meeting summaries. 4 pre-calls with the TAC Chairs.

Task	Subtask	Budget	Description	Budget Justification	Deliverables
	C. Technical Subcommittees	$20,000	Organizing and facilitating the meetings and decisions of the technical subcommittees on Nutrients, Pesticides, Mercury, and potentially Harmful Algal Blooms (HABs). Preparing agendas, agenda packages, participating in meetings, writing informal meeting summaries with action items as necessary, following up on action items, meeting with co-chairs and stakeholders outside of meetings.	8+ meetings per year. For each meeting: 7 hours for Program Manager, 2 hours for Program Director, and 10 hours for Environmental Scientist.	8 Subcommittee meetings and informal meeting summaries.
	D. Science Advisors	$10,000	Science Advisors would be independent scientists who would agree to review documents and proposals. With the funding requested, 2-4 scientists with expertise in a few specific areas would be hired.	Honoraria and travel (subject to negotiation, but typical honoraria of $2,000 to review documents and consult 4+ times per year). Travel to attend SC or TAC meetings plus rental car and hotel.	Participation of 2–4 science advisors.
3. Quality Assurance	A. Quality Assurance System	$15,000	Updating the *Quality Assurance Project Plan* to cover the FY18/19 workplan and incorporating any changes from the revised Monitoring Design, writing Quality Assurance Reports for datasets, coordinating inter-laboratory comparison tests (as needed), researching analytical methods, maintaining laboratory SOP file system.	40 hours for ASC QA Officer. 16 hours for ASC senior chemist. 32 hours for Environmental Scientist, and 32 hours for Environmental Analysts.	Revisions to QAPP (June 2018).
	B. Technical Oversight and Coordination	$15,000	Trouble-shooting technical issues associated with TIE, pesticide, and mercury monitoring. This budget line also covers time for Senior Scientists to review draft reports and advise junior staff..	48 hours for technical staff (12 hours per quarter). 40 hours for ASC Senior Scientists (nutrients/Hg) (10 hours per quarter).	

Task	Subtask	Budget	Description	Budget Justification	Deliverables
4. Commun-ications	A. Stakeholder Board Meetings	$10,500	Program staff will conduct outreach by meeting with the staff or Boards of wastewater agencies, City Councils, etc. to describe the mission and purpose of the Delta RMP, accomplishments, and the benefits of participation.	12 hours for ASC Senior Scientist. 40 hours for Program Manager. 16 hours for Program Director.	3-5 presentations to or meetings with the Boards or Staff of member agencies.
	B. *Delta RMP Update* Draft	$40,000	The *Delta RMP Update* report would summarize the Delta RMP's management questions, efforts during the first 3 years, and future plans. The funds budgeted in FY17/18 would be sufficient to develop a detailed outline with RMP committees, prepare a comprehensive budget and schedule, engage authors, and start work on the report. Depending on the scope of the report chosen by the Steering Committee, additional funds may need to be allocated, either from Reserve or in the FY18/19 budget, to complete the whole report.	40 hours for ASC Senior Scientist. 80 hours EACH for Program Manager, Environmental Analysts, and Environmental Scientists. 32 hours for Program Director.	Draft document to be finalized in Fall of 2018 (FY18/19).
	Total	**$339,604**			

Expenses for Monitoring and Special Studies

The FY17/18 Workplan implements monitoring designs of the priorities proposed for the initial phase of the Delta RMP (e.g., current use pesticides, nutrients, and mercury). At this time, no studies are being proposed for pathogens. The FY17/18 study proposals were developed in collaboration with the respective subcommittees and brought to the TAC on March 14, 2017. The TAC reviewed and prioritized the scientific studies based on the planning budget for monitoring and special studies. The TAC recommendations are summarized below.

The tasks to be completed, subcontractors, and deliverables for these tasks are described briefly below and in detailed monitoring proposals attached as appendices to this document:

Appendix A: Mercury
Appendix B: Nutrients
~~Appendix C: Pesticides~~
Appendix D: Reporting

The monitoring designs in the appendix include details for each project including:

- Background and motivation
- Applicable management decisions and assessment questions
- Approach -detailed description of the project and who is going to do it, including parameters, sampling design, and subcontractors
- Data Quality Objectives
- Reporting/deliverables
- Budget

The total cost for the monitoring programs and special studies amounts to $782,821. This cost is broken down as $233,561 for mercury, $230,000 for nutrients, and $60,000 for pesticides. Each of these focus areas had a planning budget of $250,000 for FY18/19. **Table 4** summarizes the budgeted cost of each of the planned monitoring programs.

Mercury

Mercury monitoring in FY17/18 will collect samples of sport fish, water, and sediment in order to address the highest priority information needs related to implementation of the Methylmercury TMDL. The program builds upon FY16/17 by expanding water sampling from from 4 events per year to 8, expanding water measurement from 5 sites to 6 (adding water measurement at the Mokelumne River site), and continuing to sample sport fish annually and sediment quarterly at the same 6 sites as in previous years,. More frequent monitoring will provide essential evidence for regulators implementing the TMDL and contribute to ongoing analytical work by the California Department of Water Resources (DWR), and which will be used to guide regulations and operational decisions related to farming, flood control, and wetland management.

Nutrients

Nutrients work will encompass a suite of 3 separate but related projects. The first, "Cross-Delta Monitoring Using High-Frequency Tools" ($195,000) will be carried out by scientists from the U.S. Geological Survey. This project will assess spatial variability of nutrients and related water quality constituents in the Delta at the landscape scale. The project will help to identify "hot spots" of nutrient transformation and to locate internal sources and sinks for nutrients within the Delta.

The second Nutrients project, "Continued Nutrient Data Analysis and Biennial Reporting" ($20,000) will be conducted by the Aquatic Science Center. The project will provide continued synthesis and integration of existing data to characterize status and trends of nutrient-related parameters and planning future monitoring and data analysis work. Major outcomes will be 1) convening up to 4 nutrient subcommittee science meetings, 2) completing data analysis and synthesis work funded in FY16/17, and 3) planning and initiating synthesis work for the biennial report to be completed in FY18/19.

The third Nutrients project, "Chlorophyll Sensor Intercalibration" ($15,000) is a joint effort with San Francisco Bay Nutrient Management Strategy. The proposed funds will bring the Delta networks into this effort and enable the Delta RMP to provide input. The chlorophyll sensor intercalibration study will be a significant first step toward ensuring improved sensor network coordination, and was a key recommendation from the September 2016 Delta RMP Nutrient Monitoring Workshop that will help make better use of existing data collection efforts by state and federal agencies.

Pesticides

Pesticides monitoring projects were not approved by the Steering Committee on May 3, 2017 and will be reconsidered in July 2017.

A sum of $60,000 has been allocated to draft a *Current Use Pesticides (CUP) Year 1-2 Interpretive Report*. The Delta RMP Communication Plan calls for a technical report summarizing the first two years of current use pesticides monitoring. The outline for this report will be developed in collaboration with the Pesticides Subcommittee. We expect that a significant amount of time and effort will be required to develop the scope for this report, including what methods will be used to analyze and synthesize the data. We also believe that it will benefit from including the contributions of two or more co-authors, to bring an additional perspective and to help make sure the report is accepted by different stakeholder groups. This project is scalable. The not-to-exceed budget of $60,000 includes 2 honoraria of $10,000 each for two co-authors.

Contaminants of Emerging Concern (CECs)

The Delta RMP Steering Committee has expressed interest in developing a plan to monitor CECs. At this time, no funds have been allocated for this. The Steering Committee may wish to allocate funds from reserves or new funds that arrive mid-year to begin develop a monitoring plan for this are and set up a technical subcommittee.

Table 4 Summary of Delta RMP FY17/18 Monitoring and Special Studies

Project		Cost
MONITORING		
Mercury		
Monitoring at 6 sites of water (8 times), sediment (4 times), and sportfish (once)*		**$233,561**
Nutrients		
1. Cross-Delta Monitoring Using High Frequency Tools	$188,417	
2. Nutrient Data Synthesis and Reporting	$20,000	
3. Chlorophyll Sensor Intercalibration	$15,000	
Nutrients subtotal		**$230,000**
Pesticides		
No pesticides studies approved		
MONITORING TOTAL		**$463,561**
REPORTING		
Current Use Pesticides Year 1-2 Interpretive Report		**$60,000**
Grand Total		**$523,561**

*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, making the total value of the project $258,561.

Subcontractors

Table 5 lists the subcontractors included in the Delta RMP FY17/18 workplan. Per the Delta RMP Charter, sole source justifications are provided in Appendix E for the two subcontracts greater than $50,000: U.S. Geological Survey and Moss Landing Marine Laboratory. The Aquatic Health Program Laboratory at UC Davis will conduct pesticides sampling, chemistry, and toxicity testing. This work is funded by the SWAMP program through a contract with the Central Valley Water Board. Therefore, we have not included a sole source justification here.

For contracts smaller than $50,000, we feel that it is not worth the additional expense to put these out for bid. The contractors and service providers listed below are experienced and familiar with the Delta RMP and the program's needs. For example, we plan to send pesticide samples to the Caltest analytical laboratory because it has a proven track record with the RMP as well as lower detection limits for certain parameters compared to competing labs in California.

Table 5 Subcontractors

Contractor	Budget Amount	Services
Moss Landing Marine Laboratory	$209,016	Mercury Monitoring – field data collection and laboratory analysis
U.S. Geological Survey	$195,000	Nutrients High-Frequency Mapping study
McCord Environmental	$19,200	TAC Co-Chair
Brock Bernstein	$10,064	SC Facilitator
Daphne Orzalli	$3,840	SC and TAC meeting notes and summaries

Overall Delta RMP FY17/18 Budget

The programmatic and scientific budgets for the Delta RMP are shown together in Table 6 on the next page. The total planned expenses for the program in FY17/18 are $863,165. The work plan is "monitoring heavy", represents the priorities of the technical subcommittees, and incorporates feedback from the 2016 External Review. This plan also aims to begin providing more analysis, interpretation, and reporting of the data collected by the Delta RMP, in the form of two significant reports (Pesticides Interpretive Report, Pulse of the Delta) that are described in the Communication Plan.

Table 6 Delta RMP FY17/18 Overall Budget

		Direct Cost	Labor	Subcntrct	Grand Total	Notes
01. Core Functions	A. Program Planning		$65,000		$65,000	See Table 3 for details and justification on Tasks 1 - 4
	B. Contract and Financial Management	$1,000	$53,000		$54,000	
01. Core Functions Total		**$1,000**	**$118,000**		**$119,000**	
02. Governance	A. SC meetings	$500	$36,000	$11,984	$48,484	
	B. TAC meetings	$500	$40,000	$21,120	$61,620	
	C. Technical Subcommittees		$20,000		$20,000	
	D. Science Advisors			$10,000	$10,000	
02. Governance Total		**$1,000**	**$96,000**	**$43,104**	**$140,104**	
03. Quality Assurance	A. Quality Assurance System		$15,000		$15,000	
	B. Technical Oversight and Coordination		$15,000		$15,000	
03. Quality Assurance Total			**$30,000**		**$30,000**	
04. Communications	A. Stakeholder Board Meetings	$500	$10,000		$10,500	
	B. Pulse of the Delta Draft		$40,000		$40,000	
04. Communications Total		**$500**	**$50,000**		**$50,500**	
08. Year 1-2 CUP Technical Report	A. Report		$40,000	$20,000	$60,000	ASC
08. Total			**$40,000**	**$20,000**	**$60,000**	
09. Nutrients	A. Cross-Delta Monitoring Using High Frequency Tools			$195,000	$195,000	USGS[2]
	B. Nutrient Data Synthesis and Reporting		$20,000		$20,000	ASC
	C. Chlorophyll Sensor Intercalibration		$15,000		$15,000	ASC
09. Nutrients Total			**$35,000**	**$195,000**	**$230,000**	
10. Mercury Monitoring FY17/18	A Data Collection and Analysis			$209,016	$209,016	Moss Landing Marine Laboratory (see sole source justification in Appendix)
	B. RMP Data Management		$19,545		$19,545	ASC
	C. Technical Oversight		$5,000		$5,000	ASC
10. Mercury Total			**$24,545**	**$209,016**	**$233,561**	
Grand Total		$2,500	$393,545	$467,120	$863,165	

[1]Aquatic Health Program Laboratory at UC Davis

[2]USGS budget for this project includes salary, supplies, analytical services, and operational costs for a vehicle and boat

Delta Regional Monitoring Program

FY17/18 Detailed Workplan and Budget

Appendix A

Mercury Study Proposals

Summary of Mercury Proposal for FY17/18 Workplan

Monitoring of sport fish, water, and sediment is proposed to address the highest priority information needs related to implementation of the Methylmercury TMDL. Annual monitoring of sport fish will firmly establish baseline concentrations and interannual variation in support of monitoring of long-term trends as a critical performance measure for the TMDL. Monitoring of water on a near-monthly basis will solidify the linkage analysis (the quantitative relationship between mercury in water and mercury in sport fish) in the TMDL. Water monitoring along with quarterly monitoring of sediment will also provide essential input data to a numerical model of mercury transport and cycling being developed for the Delta and Yolo Bypass by the California Department of Water Resources (DWR), will allow testing of various land and water management scenarios.

The estimated cost for the proposed mercury monitoring is $233,561.

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.

Assessment Questions Addressed

Status and Trends

ST1. What are the status and trends in ambient concentrations of methylmercury and total mercury in sport fish and water, particularly in subareas likely to be affected by major existing or new sources (e.g., large-scale restoration projects)?

ST1.A. Do trends over time in methylmercury in sport fish vary among Delta subareas?

ST1.B. How are ambient levels and trends affected by variability in climate, hydrology, and ecology? *Study relates nutrient demand to landscape elements.*

Sources, Pathways, Loadings & Processes

SPLP1. Which sources, pathways and processes contribute most to observed levels of methylmercury in fish?

SPLP1.A. What are the loads from tributaries to the Delta (measured at the point where tributaries cross the boundary of the legal Delta)?

SPLP1.B. How do internal sources and processes influence methylmercury levels in fish in the Delta?

SPLP1.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 methylmercury levels in fish in the Delta?

Forecasting Scenarios

FS2. 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?

Fish-Water Linkage Analysis
(new priority question articulated by Mercury Subcommittee)

FWLA1. Are there key datasets needed to strengthen the technical foundation of contaminant control programs? Obtaining additional data on methylmercury in water is one of these key datasets.

Review Comments Addressed

The FY17/18 mercury monitoring proposal addresses the question about the goal of the program by providing a more detailed explanation about the linkage of the proposed monitoring and the Methylmercury TMDL for the Delta as the important management driver. All other comments on the mercury monitoring proposal were fully addressed in the written response to the review panel.

Data Quality Objectives/Null Hypothesis

The initial and preliminary data quality objective (DQO) 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. 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 25% to 30% of expected values.

Monitoring to Support Implementation of the Methylmercury TMDL

Executive Summary

Monitoring of sport fish, water, and sediment is proposed to address the highest priority information needs related to implementation of the Methylmercury TMDL. Annual monitoring of sport fish will firmly establish baseline concentrations and interannual variation in support of monitoring of long-term trends as a critical performance measure for the TMDL. Monitoring of water on a near-monthly basis will solidify the linkage analysis (the quantitative relationship between mercury in water and mercury in sport fish) in the TMDL. Water monitoring along with quarterly monitoring of sediment will also provide essential input data to a numerical model of mercury transport and cycling being developed for the Delta and Yolo Bypass by the California Department of Water Resources (DWR), will allow testing of various land and water management scenarios.

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; 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 subareas. Monitoring of largemouth bass in these subareas 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 subarea. This linkage provides a connection, essential for management, between methylmercury inputs from various pathways (e.g., municipal wastewater, municipal stormwater, agricultural drainage, sediment flux associated with water management, 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 mercury 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) support development of mercury models for the Delta and Yolo Bypass, and

3) support evaluation of the fish data by providing information on processes and trends.

Concentrations of methylmercury and mercury in sediment to use in developing the mercury models have been identified as another significant data need.

In 2016 the Delta RMP initiated a methylmercury monitoring program for fish and water. Largemouth bass were collected in late summer (early September) from six locations distributed across the subareas. Quarterly sampling of mercury and methylmercury (and ancillary parameters) in water began in August 2016.

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, refined, and prioritized the assessment questions articulated by the Steering Committee and Technical Advisory Committee for mercury.

One priority question for this initial phase of methylmercury monitoring is from the Status and Trends category of the DRMP management and assessment questions:

1. What are the status and trends in ambient concentrations of methylmercury and total mercury in sport fish and water, particularly in subareas likely to be affected by major existing or new sources (e.g., large-scale restoration projects)?

A. Do trends over time in methylmercury in sport fish vary among Delta subareas?

Question 1A is a high priority for managers that relates to the TMDL, and is a primary driver of the sampling design for fish monitoring. Annual monitoring of fish mercury is urgently needed to 1) firmly establish a baseline for each Delta subarea 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 establish a foundation for effectiveness tracking - another category of the Delta RMP core management questions.

Other priority assessment questions for this initial phase of methylmercury monitoring relate to one of the major control studies called for in the TMDL: an effort to combine modeling, field data, and laboratory studies to evaluate the potential effects of water project operational changes on methylmercury in Delta channels. The Department of Water Resources (DWR) is currently developing two mathematical models, one each for the Delta and Yolo Bypass, that will allow testing of various land and water management scenarios (DiGiorgio et al. 2016). These models will be useful in addressing the following Delta RMP management questions relating to 1) sources, pathways, loadings, and processes, and 2) forecasting scenarios. The management questions, as defined by the Delta RMP Steering Committee are:

Sources, Pathways, Loadings, and Processes

1. Which sources, pathways and processes contribute most to observed levels of methylmercury 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)?
    B. How do internal sources and processes influence methylmercury levels in fish in the Delta?
    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 methylmercury levels in fish in the Delta?

Forecasting Scenarios

2. 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?

The opportunity to inform these models, which are being developed with a considerable investment of funding from the California Department of Water Resources (DWR), makes monitoring to address these questions a near-term priority for the Delta RMP. The water and

sediment monitoring included in this proposal will provide important data for developing and applying the mercury models.

Another priority question that will be addressed by this proposal relates to the linkage analysis discussed in the previous section, which is a key element of the technical basis for the TMDL. This question was not articulated in the core management questions and assessment questions established by the Steering Committee, but was nevertheless identified as a priority by the Mercury Subcommittee. The question is: Are there key datasets needed to strengthen the technical foundation of contaminant control programs? Obtaining additional data on methylmercury in water is one of these key datasets.

Approach

Fish Sampling

Design	6 fixed sites (**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 location
Parameters	Total mercury*, Total length, Fork length, Weight, Sex, Moisture, Estimated age
Frequency	Annual
Schedule	Monitor for 10 years and then re-evaluate. Sample in summer or early fall.
Co-location	Water Hg Other water parameters
Contractors	SFEI (design, data management, reporting), MLML (sample collection and analysis)
Coordination	DWR, USGS (sampling of flow monitoring stations)

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

Summary of Results to Date

Results from the first round 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 multiple observations are available for four of the six locations. The existing time series are characterized by a high degree of inconsistency in locations, 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. The data suggest 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 locations. Therefore, the data give a preliminary indication that trends do vary among the Delta subareas. Additional rounds of consistent sampling are needed to confirm this preliminary interpretation.

Water Sampling

Design	6 fixed sites (**Figure 1**)
Key Indicator	Annual average total (unfiltered) methylmercury at each location
Parameters	Total (unfiltered) methylmercury, filtered methylmercury, unfiltered total mercury, filtered total mercury, suspended solids, chlorophyll a, dissolved organic carbon (field filtered), volatile suspended solids. Field measurements will include dissolved oxygen, pH, and specific conductance.
Other Important Parameters	Nutrients (ALK, NH3, CL, DOC, HARD, NO3/NO2, N (total), OPO4, TPHOS, SiO2, SO4, TDS, TOC), grain size. Budget assumes these are covered by other studies.
Frequency	Quarterly
Schedule	Monitor for 5 years and then re-evaluate
Co-location	Sport fish sampling Other water parameters
Coordination	DWR, USGS (sampling of flow monitoring stations)

Summary of Results to Date

Not yet available.

Data Quality Objectives

The DQOs for measurements of methylmercury and mercury in fish and water are shown in Appendix 1. These DQOs are the same as DQOs used in mercury studies throughout California, with statewide fish monitoring by the Surface Water Ambient Monitoring Program as a prominent example. The DQOs generally call for indices of accuracy and precision to be within 25% to 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 previous section.

Power to Detect Long-term Trends - Fish Sampling

The power to detect interannual trends in largemouth bass mercury on a per site 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. For now, we based a power analysis on the small amount of information presently on hand. Appendix 2 provides the methods and details on the results.

Power analysis summary

Power for trend detection at a single site based on grand mean estimates of observed variance across sites. 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 indicate that increasing the number of fish per site would be effective in increasing power. With 16 fish per site and annual sampling, 80% power would be expected for several of the 20-year scenarios. The design for year 2 of monitoring is therefore being modified to include 16 fish per site. 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 and Sediment Sampling

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

Reporting/Deliverables

Deliverable	Due Date
Draft Data Report on Year 1	November 2017
Final Data Report on Year 1	December 2017
Draft Data Report on Year 2	November 2018
Final Data Report on Year 2	December 2018
Draft Interpretive Report on Years 1-3	December 2019
Final Interpretive Report on Years 1-3	February 2020

Budget

		Actual	Proposed			
	Fiscal Year	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**
	Sampling Year	**2016**	**2017**	**2018**	**2019**	**2020**
Fish	Bass Monitoring at Six Sites: Sampling and Analysis (DRMP)	$45,344	$51,804	$53,358	$54,959	$56,608
	MLML In-Kind	($8,262)	($5,100)			
Water	Water Monitoring at **Five** Sites, Quarterly: Sampling and Analysis (DRMP)	$65,310				
	MLML In-Kind	($12,392)				
	Water Monitoring at **Six** Sites, 8 months: Sampling and Analysis		$152,952	$157,541	$162,267	$167,135
	MLML In-Kind		($16,700)			
Sediment	Sediment Monitoring at Six Sites, Quarterly: Sampling and Analysis		$29,260	$30,138	$31,042	$31,973
	MLML In-Kind		($3,200)			
Data Management, Oversight, Reporting	SFEI Data Management and QA Review	$15,000	$19,545	$20,131	$20,735	$21,357
	SFEI Oversight and Coordination	$3,000	$5,000	$5,150	$5,305	$5,464
	Interpretive Report			$15,000		
	Study Total	$128,654	$258,561	$281,318	$274,308	$282,537
	MLML In-Kind	($20,654)	($25,000)	$0	$0	$0
	TOTAL FROM DRMP	$108,000	$233,561	$281,318	$274,308	$282,537

Candidate studies for SEP funding	Approx. Cost	Comments
Increase water monitoring to monthly	$80K	
Small fish and water sampling at restoration sites		Depends on the intensity of water sampling
Add a seventh site for fish and water (in Subarea 7 [West Delta])	$35K	8 months of water

Figure 1 Planned sampling sites for methylmercury in FY17/18.

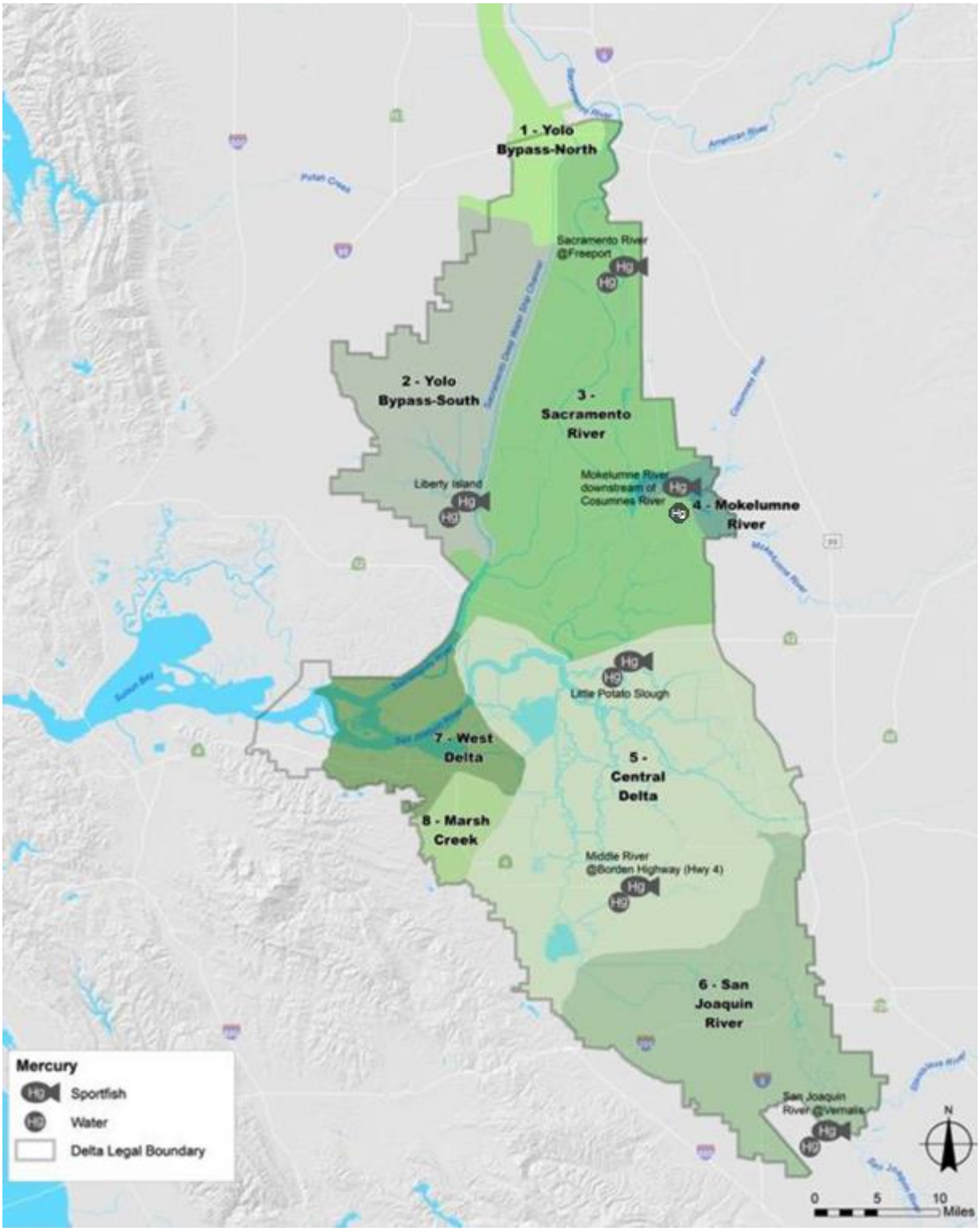
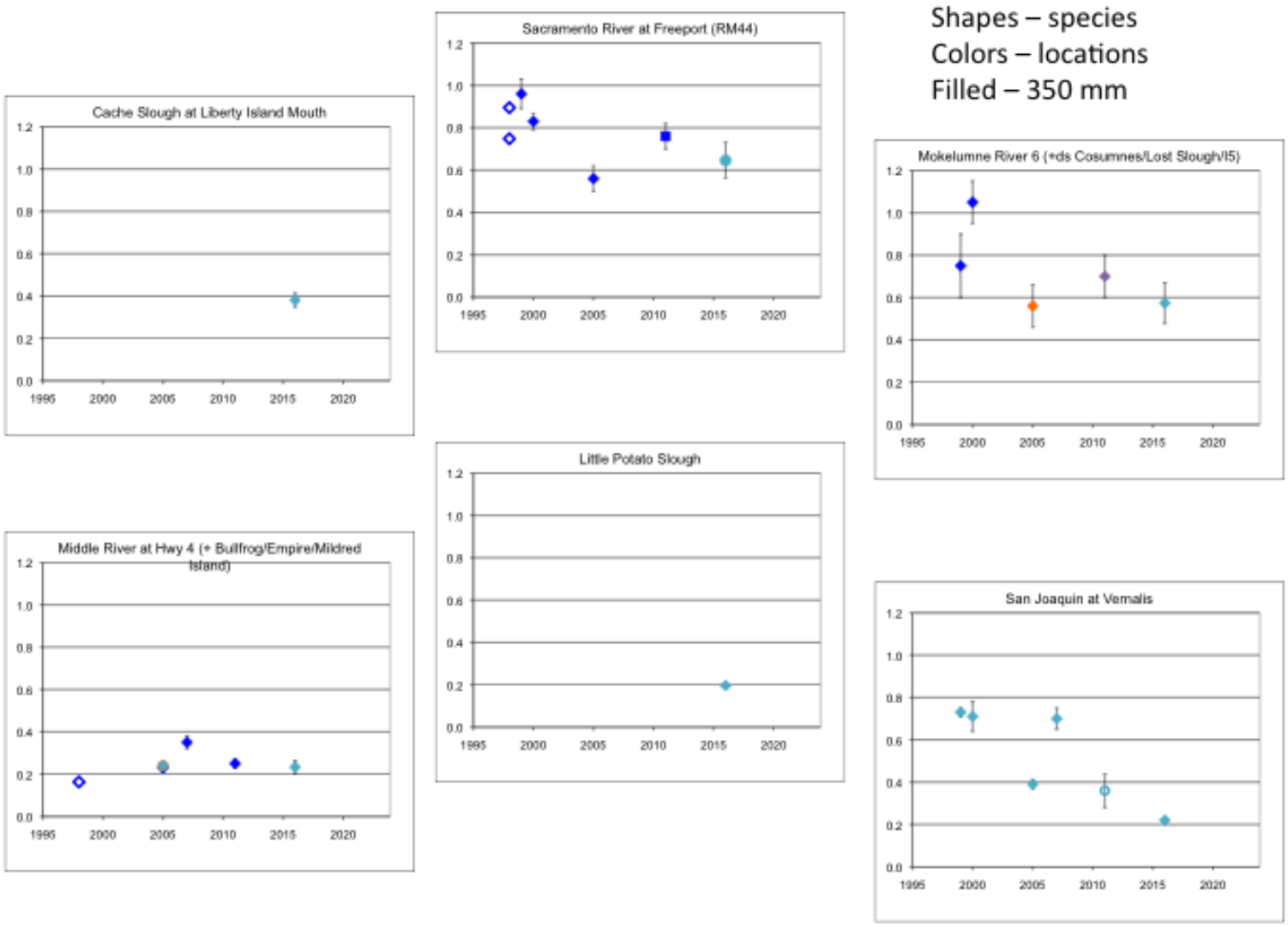


Figure 2 *Methylmercury concentrations at Delta RMP sites. Data for 2016 are from DRMP; earlier data are from past studies. Symbols indicate means; error bars are 2*SE. Largemouth bass - diamonds; smallmouth bass - squares; spotted bass - circles. Filled symbols indicate 350 mm length adjusted values; unfilled represent simple averages. Colors indicate slight differences in location over the years.*



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Appendix 1

Data Quality Objectives for Methylmercury and Mercury Analyses in Fish and Water

(relevant pages from the QAPP)

Method	Sample type	Matrix	Frequency	Acceptable limits
USGS – SIR 2012-5026	Field Duplicate/ Replicate	Water	1 per 20	RPD < 25%
Trace Metals – Copper (dissolved)				
USGS TM-5-B1	Laboratory Blank	Water	1 per 20 or batch	< MDL
USGS TM-5-B1	CRM	Water	1 per 20	Expected value +/- 25%
USGS TM-5-B1	Matrix Spikes/Duplicates	Water	1 per 20 or one batch	Expected value +/- 25%
USGS TM-5-B1	Lab Duplicate	Water	1 per 20	RPD < 25%
USGS TM-5-B1	Instrument Blank	Water	Every 6 samples	<MDL
USGS TM-5-B1	Field Duplicates	Water	5% of all samples	RPD < 25%
Trace Metals – Mercury				
EPA 7473	Laboratory Blank	Tissue	1 per 20 or batch	< RL
EPA 7473	CRM	Tissue	1 per 20 or batch	Expected value +/- 25%
EPA 7473	Matrix Spikes/Duplicates	Tissue	1 per 20 or batch	Expected value +/- 25%
EPA 7473	Lab Duplicate	Tissue	1 per 20	RPD < 25%; n/a if concentration of either sample <RL
EPA 1631, Revision E	Laboratory Blank	Water	1 per 20 or batch.	< RL
EPA 1631, Revision E	CRM	Water	1 per 20 or batch	Expected value +/- 25%
EPA 1631, Revision E	Matrix Spikes/Duplicates	Water	1 per 20 or batch	Expected value +/- 25%
EPA 1631, Revision E	Lab Duplicate	Water	1 per 20	RPD < 25%; n/a if concentration of either sample <RL
EPA 1631, Revision E	Field Duplicates	Water	5% of all samples	RPD < 25%: n/a if concentration of either sample <RL
EPA 1631, Revision E	Field Blank	Water	1 per 20 or batch	<RL
Trace Metals – Mercury, Methyl				
EPA 1630	Laboratory Blank	Water	1 per 20 or batch	< RL
EPA 1630	LCS	Water	1 per 20 or batch	Expected value +/- 30%
EPA 1630	Matrix Spikes/Duplicates	Water	1 per 20 or batch	Expected value +/- 30%
EPA 1630	Lab Duplicate	Water	1 per 20	RPD < 25%; n/a if concentration of either sample

Method	Sample type	Matrix	Frequency	Acceptable limits
				<RL
EPA 1630	Field Duplicates	Water	5% of all samples	RPD < 25%: n/a if concentration of either sample <RL
EPA 1630	Field Blank	Water	1 per 20 or batch	<RL

4.3. Laboratory Quality Control Procedures for Chemical Analyses

Prior to the initial analyses of samples for the project, each laboratory will demonstrate capability and proficiency for meeting MQOs for the Delta RMP. Performance-based measures for chemical analyses consist of two basic elements: initial demonstration of laboratory capability and on-going demonstration of capability during analysis of project samples. Initial demonstration includes documentation that sample analyses can be performed within the data quality objectives and method quality objectives listed in the QAPP (Tables 4.3, 4.4, and 4.5). On-going demonstration of capability during analysis of project samples includes laboratory participation in routine analyses (e.g. inter-comparison studies) to evaluate laboratory capabilities on a continual basis to meet MQOs listed in the QAPP.

4.3.1. Laboratory QC Measurements

4.3.1.1 Sensitivity

In this context, sensitivity refers to the capability of a method or instrument to detect a given analyte at a given concentration and reliably quantitate the analyte at that concentration. Achieving the desired sensitivity requires the selection of appropriate analytical methods. The key measurement quality objectives (MQOs) for achieving sensitivity are the desired Reporting Limit (RL) and Method Detection Limit (MDL) for analytes (Table 4.4) and the ranges and resolution of laboratory meters (Table 4.5). Additional QC information required to evaluate the sensitivity of data include laboratory or method blanks and, if appropriate, instrument blanks (Table 4.3).

4.3.1.2 Precision

Precision is the reproducibility of an analytical method and can be evaluated for any sample that is analyzed in replicate. In general, laboratory replicates of field samples are preferred as measures of precision, but in cases where average values for field samples are expected (based on historical or literature results) to fall in a non-quantitative range, other samples such as CRMs, LRMs, matrix spikes, or blank spikes can be analyzed in replicate to determine precision.

If samples other than field samples are used to evaluate precision, target concentrations should be at least high enough to be quantitative but less than 100 times those in field samples, as precision in high concentration samples is not likely representative for much lower ambient

Appendix 2

Power Analysis Methods and Results for

Long-term Trend Monitoring in Largemouth Bass

Analysis of Delta Bass Mercury Data to Inform the Design of Proposed 2017 Delta RMP Program Studies

Aroon Melwani, Applied Marine Sciences

March 2, 2017

I. Approach

The goal of this power analysis was to estimate the statistical power for detecting trends in largemouth bass Hg concentrations at Delta RMP indicator sites. Specifically, to estimate the sample size, frequency of sampling, and size of trend detectable with 80% power or greater.

Statistical summaries of length-corrected Bass Hg concentrations from four indicator sites were the basis of the assessment. Power was calculated for the following comparison:

H_0 : the slope of the relationship between mean annual Bass Hg and year is zero ($\beta=0$)

H_A : the slope of the relationship between mean annual Bass Hg and year is less than zero ($\beta<0$)

A Monte-Carlo simulation was used to simulate trends. Each scenario was run over 1000 iterations. Statistical power was assessed as the proportion of runs that resulted in a significant slope at $\alpha = 0.05$ based on a linear regression of log(Hg) ~ time.

II. Assumptions

1. Population of interest was four Delta RMP indicator sites that have most frequently been assessed for largemouth bass Hg concentrations
2. Size-standardized Hg concentrations (350 mm) were used to account for differences in Hg by fish length.
3. Trends were imposed on the baseline Hg data (i.e. current geometric mean) using three terms for each year of the simulation: 1) a term to account for local variability in Bass Hg concentrations within-year (determined from mean of standard deviations of individual log Hg annual means); 2) a term to account for local variability in Bass Hg concentrations among-year (determined from the

standard deviation of individual log Hg annual means); and 3) to impose a trend in mean concentrations over time.

   a. Local estimates of inter- and intra-annual variance were determined from the individual site data. Simulations were run for the sites with the lowest and highest estimated variability, as well as using the grand mean of variance estimates among sites. These estimates were assumed constant over time.
   b. Trends in mean concentrations were assessed for declines of 10-40 ppb/yr

4. The statistical tests used to detect a trend (slope < 0) was based on a simple linear regression of the mean concentration versus time

Table 1. Power to Detect Site-Specific Trends in Annual Hg Concentrations
Assumptions:
Linear regression on log(Hg) concentrations
Sample Size Varied 10, 12, 14, 16, 18 fish per site per year
Revisit frequency: annual or biennial
Trend Detected: 10, 20, 30 years
Trend in means over time: 10, 20, 30, 40 ppb/yr
Constant variance over time
Intra-annual variance: mean of standard deviations of individual logHg annual means
Inter-annual variance: standard deviation of logHg annual means

			10 Years		20 Years		30 Years	
Site Variance	Trend	N Fish/Yr	Annual	Biennial	Annual	Biennial	Annual	Biennial
Grand Mean	10 ppb/yr	12	0.11	0.09	0.20	0.15	0.40	0.27
Grand Mean	20 ppb/yr	12	0.13	0.13	0.44	0.27	0.81	0.60
Grand Mean	30 ppb/yr	12	0.21	0.17	0.69	0.45	0.99	0.85
Grand Mean	40 ppb/yr	12	0.29	0.19	0.88	0.61	1.00	0.98
Grand Mean	10 ppb/yr	16	0.21	0.19	0.33	0.27	0.55	0.44
Grand Mean	20 ppb/yr	16	0.27	0.24	0.65	0.46	0.93	0.77
Grand Mean	30 ppb/yr	16	0.36	0.32	0.86	0.64	1.00	0.96
Grand Mean	40 ppb/yr	16	0.47	0.36	0.97	0.82	1.00	1.00

Statistical Assumptions:
Linear regression model of Log(Hg) vs. Time
Inter-annual variation = st. dev. of annual means
Intra-annual variation = mean of st dev. of annual means

Site Variances

	Site	mean	sd	freq	mu	intersd	intrasd	
1	Middle River @ Hwy 4	0.29	0.09	61	-1.28	0.18	0.26	LOWEST ESTIMATES
2	Mokelumne River 6	0.70	0.25	48	-0.42	0.25	0.27	
3	Sacramento @ Freeport	0.73	0.24	60	-0.37	0.33	0.25	
4	San Joaquin @ Vernalis	0.51	0.27	66	-0.79	0.52	0.30	HIGHEST ESTIMATES

Number of Fish Per Site: 10-18 GRAND MEAN> 0.32 0.27
Number of Years To Detect Trend - 10-30 yrs
Trend in Means Per Year - 10-40 ppb/yr

Site Variance: Middle River

		10 Years		20 Years		30 Years	
Trend	N Fish/Event	Annual	Biennial	Annual	Biennial	Annual	Biennial
10 ppb/yr	10	0.05	0.04	0.11	0.08	0.32	0.16
10 ppb/yr	12	0.10	0.07	0.24	0.14	0.55	0.33
10 ppb/yr	14	0.11	0.11	0.33	0.20	0.66	0.47
10 ppb/yr	16	0.18	0.14	0.41	0.30	0.78	0.55
10 ppb/yr	18	0.21	0.16	0.48	0.32	0.83	0.60
20 ppb/yr	10	0.07	0.05	0.40	0.17	0.81	0.49
20 ppb/yr	12	0.15	0.10	0.62	0.37	0.97	0.80
20 ppb/yr	14	0.25	0.16	0.72	0.50	0.99	0.91
20 ppb/yr	16	0.29	0.19	0.83	0.61	1.00	0.94
20 ppb/yr	18	0.34	0.24	0.89	0.65	1.00	0.96
30 ppb/yr	10	0.10	0.05	0.63	0.29	0.99	0.83
30 ppb/yr	12	0.26	0.15	0.89	0.62	1.00	0.99
30 ppb/yr	14	0.33	0.25	0.96	0.78	1.00	1.00
30 ppb/yr	16	0.44	0.33	0.98	0.87	1.00	1.00
30 ppb/yr	18	0.50	0.35	0.99	0.89	1.00	1.00
40 ppb/yr	10	0.17	0.08	0.87	0.53	1.00	0.98
40 ppb/yr	12	0.38	0.20	0.98	0.82	1.00	1.00
40 ppb/yr	14	0.49	0.35	1.00	0.93	1.00	1.00
40 ppb/yr	16	0.60	0.42	1.00	0.98	1.00	1.00
40 ppb/yr	18	0.66	0.47	1.00	0.98	1.00	1.00
		No scenarios attain 80% power		N=16 for 20 N=12 for 30 N=10 for 40	N=16 for 30 N=12 for 40	N=18 for 10 N=10 for 20	N=14 for 20 N=10 for 30

Site Variance: San Joaquin

Trend	N Fish/Event	10 Years Annual	10 Years Biennial	20 Years Annual	20 Years Biennial	30 Years Annual	30 Years Biennial
10 ppb/yr	10	0.04	0.04	0.06	0.04	0.11	0.08
10 ppb/yr	12	0.11	0.11	0.16	0.12	0.27	0.22
10 ppb/yr	14	0.14	0.16	0.22	0.20	0.37	0.29
10 ppb/yr	16	0.20	0.19	0.29	0.24	0.43	0.34
10 ppb/yr	18	0.22	0.25	0.31	0.26	0.48	0.39
20 ppb/yr	10	0.03	0.03	0.14	0.07	0.34	0.17
20 ppb/yr	12	0.13	0.12	0.29	0.21	0.58	0.40
20 ppb/yr	14	0.20	0.18	0.39	0.27	0.67	0.52
20 ppb/yr	16	0.25	0.24	0.43	0.37	0.75	0.59
20 ppb/yr	18	0.28	0.29	0.49	0.41	0.78	0.64
30 ppb/yr	10	0.05	0.04	0.23	0.13	0.60	0.37
30 ppb/yr	12	0.16	0.16	0.47	0.33	0.84	0.60
30 ppb/yr	14	0.27	0.23	0.54	0.41	0.91	0.72
30 ppb/yr	16	0.29	0.28	0.65	0.49	0.94	0.79
30 ppb/yr	18	0.34	0.30	0.70	0.55	0.95	0.84
40 ppb/yr	10	0.09	0.06	0.38	0.19	0.86	0.53
40 ppb/yr	12	0.23	0.17	0.62	0.42	0.96	0.82
40 ppb/yr	14	0.29	0.25	0.73	0.53	0.99	0.87
40 ppb/yr	16	0.36	0.30	0.78	0.61	0.99	0.93
40 ppb/yr	18	0.41	0.35	0.84	0.68	1.00	0.91
		No scenarios attain 80% power		N=18 for 40	none	N=12 for 30 N=10 for 40	N=18 for 30 N=12 for 40

Site Variance: Grand mean of sites

Trend	N Fish/Event	10 Years Annual	10 Years Biennial	20 Years Annual	20 Years Biennial	30 Years Annual	30 Years Biennial
10 ppb/yr	10	0.04	0.02	0.09	0.07	0.18	0.11
10 ppb/yr	12	0.11	0.09	0.20	0.15	0.40	0.27
10 ppb/yr	14	0.15	0.13	0.25	0.19	0.49	0.33
10 ppb/yr	16	0.21	0.19	0.33	0.27	0.55	0.44
10 ppb/yr	18	0.22	0.23	0.38	0.31	0.59	0.47
20 ppb/yr	10	0.05	0.04	0.22	0.12	0.62	0.30
20 ppb/yr	12	0.13	0.13	0.44	0.27	0.81	0.60
20 ppb/yr	14	0.21	0.19	0.56	0.41	0.89	0.70
20 ppb/yr	16	0.27	0.24	0.65	0.46	0.93	0.77
20 ppb/yr	18	0.32	0.29	0.67	0.51	0.96	0.83
30 ppb/yr	10	0.08	0.05	0.43	0.20	0.90	0.60
30 ppb/yr	12	0.21	0.17	0.69	0.45	0.99	0.85
30 ppb/yr	14	0.29	0.26	0.80	0.60	0.99	0.93
30 ppb/yr	16	0.36	0.32	0.86	0.64	1.00	0.96
30 ppb/yr	18	0.40	0.31	0.88	0.69	1.00	0.97
40 ppb/yr	10	0.12	0.08	0.64	0.31	0.99	0.85
40 ppb/yr	12	0.29	0.19	0.88	0.61	1.00	0.98
40 ppb/yr	14	0.40	0.31	0.95	0.75	1.00	0.99
40 ppb/yr	16	0.47	0.36	0.97	0.82	1.00	1.00
40 ppb/yr	18	0.52	0.41	0.97	0.85	1.00	1.00

		No scenarios attain 80% power		N=16 for 30 N=12 for 40	N=16 for 40	N=12 for 20 N=10 for 30	N=18 for 20 N=12 for 30 N=10 for 40

Delta Regional Monitoring Program

FY17/18 Detailed Workplan and Budget

Appendix B

Nutrients Study Proposals

Nutrient Monitoring Proposals

Summary Table of Draft Proposals for FY17/18 Workplan

Project Proposal	FY17/18	FY18/19
START FY17/18		
1 – Cross-Delta Monitoring Using High-Frequency Tools Assessing spatial variability of nutrients and related water quality constituents in the Delta at the landscape scale: High frequency mapping campaigns	$195,000	
2 – Nutrient Data Synthesis and Reporting: Continued Nutrient Data Synthesis and Biennial Reporting. Proposed FY17/18 funds will support Nutrient Subcommittee Science Meetings. The next biennial report is planned for FY18/19.	$20,000 (plus $30,000 from FY16/17)	TBD ($45K+)
3 – Chlorophyll Sensor Intercalibration Joint effort with San Francisco Bay Nutrient Management Strategy. The proposed funds will bring the Delta networks into this effort and enable the Delta RMP to provide input.	$15,000	TBD
FUTURE PLANNING		
Nutrient Workshop/"Science Summit"		($15-50K)
All Proposals	$230,000	TBD

Page numbers for nutrients proposals:

1 - Assessing spatial variability of nutrients and related water quality constituents in the Delta at the landscape scale: Cross-Delta Monitoring Using High-Frequency Tools

Project Team:
Bryan Downing, Brian Bergamaschi, Tamara Kraus

U.S. Geological Survey, Sacramento, CA

Executive Summary

This proposal is to document the variability of nutrients and related water quality parameters at high spatial resolution in the North Delta, Central Delta, and the Western Delta out to Suisun Bay. Measurement will include nitrate, ammonium, phosphate, temperature, conductivity, dissolved oxygen, chlorophyll, blue-green algal pigments, particle size and others. Data-collection cruises will be conducted under three different environmental/flow conditions.

Background and Motivation

Monitoring stations and research sampling cruises in the Delta and Estuary are typically limited by the necessity to make measurements in a small number of well-mixed channels in the interest of collecting "representative" data and samples. Further, data collection is often conducted at locations occupied by historical data-collection efforts to preserve comparability. The result is that we know little about the spatial variability of important water quality parameters in the Delta, and do not know how they vary under different flow and export conditions except through models. Also, historical station locations may no longer be representative as conditions may have changed due to variation in sources and changes in flow patterns. Spatial data will be highly useful for determining future monitoring locations.

Objectives

The objective of the project is to document the spatial variability of nutrients for the purpose of evaluating longitudinal transformation in nutrient concentrations, forms and ratios in different zones within the Delta. The goal is to identify "hot spots" of nutrient transformation and to locate internal sources and sinks for nutrients within the Delta.

Applicable Management Decisions and Assessment Questions

Management Drivers

Delta Nutrient Research Plan

Assessment Questions

Status and Trends

1. How do concentrations of nutrients (and nutrient-associated parameters) vary spatially and temporally?
    a. Are trends similar or different across subregions of the Delta?
    b. How are ambient levels and trends affected by variability in climate, hydrology, and ecology? *Study relates nutrient demand to landscape elements.*

Sources, Pathways, Loadings & Processes

1. Which sources, pathways, and processes contribute most to observed levels of nutrients?
    f. What are the types and sources of nutrient sinks within the Delta?

Forecasting Scenarios

1. How will ambient water quality conditions respond to potential or planned future source control actions, restoration projects, and water resource management changes? *Study provides baseline data against which to evaluate change.*

Approach

The approach is to make high frequency (1/sec) measurements from a high-speed boat across broad areas of the Delta. This is made possible through the recent development of a boat-mounted flow-through sampling system that can be operated at high speeds (~20 mph), permitting rapid collection of high-quality measurements over large regions, within the context of a single tide. The resulting data is then mapped to the simultaneously-collected geopositional data (GPS) to generate maps with high spatial resolution (see example in Figure 1). On-board instruments will measure for nitrate, ammonium, temperature, conductivity, dissolved oxygen, chlorophyll-a, blue-green algal pigments, particle size and others. Transects of the North, Central, and South Delta will be conducted three times on three successive days in May, August and October corresponding to periods of high nutrient transformation based on analysis of historical data.

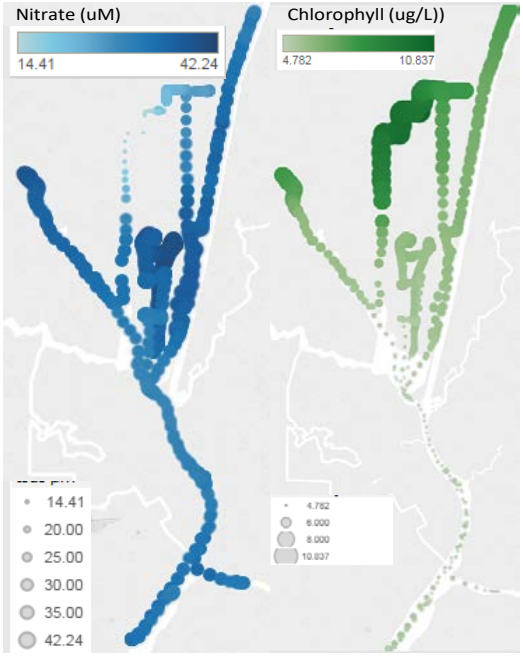

Figure 1. Maps of nitrate (left) and chlorophyll in the North Delta. Both size and color correspond to measured value.

ONBOARD MEASUREMENTS

Parameter	Instrument
Temperature	YSI EXO 2; Seabird model 45 Thermo Salinograph
Specific Conductivity	YSI EXO 2; Seabird model 45 Thermo Salinograph
pH	YSI EXO 2
Dissolved Oxygen	YSI EXO 2
Turbidity	YSI EXO 2 Turbidity: WetLabs beam transmissometer (676 nm)
Chlorophyll-a	YSI EXO 2 Total Algae probe; WETLabs model WETSTar Chlorophyll-a fluoromter
Phycocyanin	YSI EXO 2 Total Algae probe
Fluorescence of dissolved organic matter (FDOM)	YSI EXO 2; WETLabs model
	WETSTar cDOM fluorometer
Nitrate	Satlantic model ISUS V3, Nitrate analyzer
Ammonium	Timberline TL-2800 Analyzer

SAMPLE COLLECTION

At equal spatial intervals, 50 samples will be collected during each transect and analyzed for total phosphate. Approximately 10 samples will be collected during each transect and analyzed for nitrate, ammonium, and total chlorophyll, with selected samples analyzed for large particulate chlorophyll (>5uM) and picocyanobacterial cell density.

Laboratory analyses	
Analyte	***Number of samples***
Nitrate	90
Ammonium	90
Phosphate	450
Chlorophyll - total	90
Chlorophyll - >5uM	45

Proposed Cruise Tracks

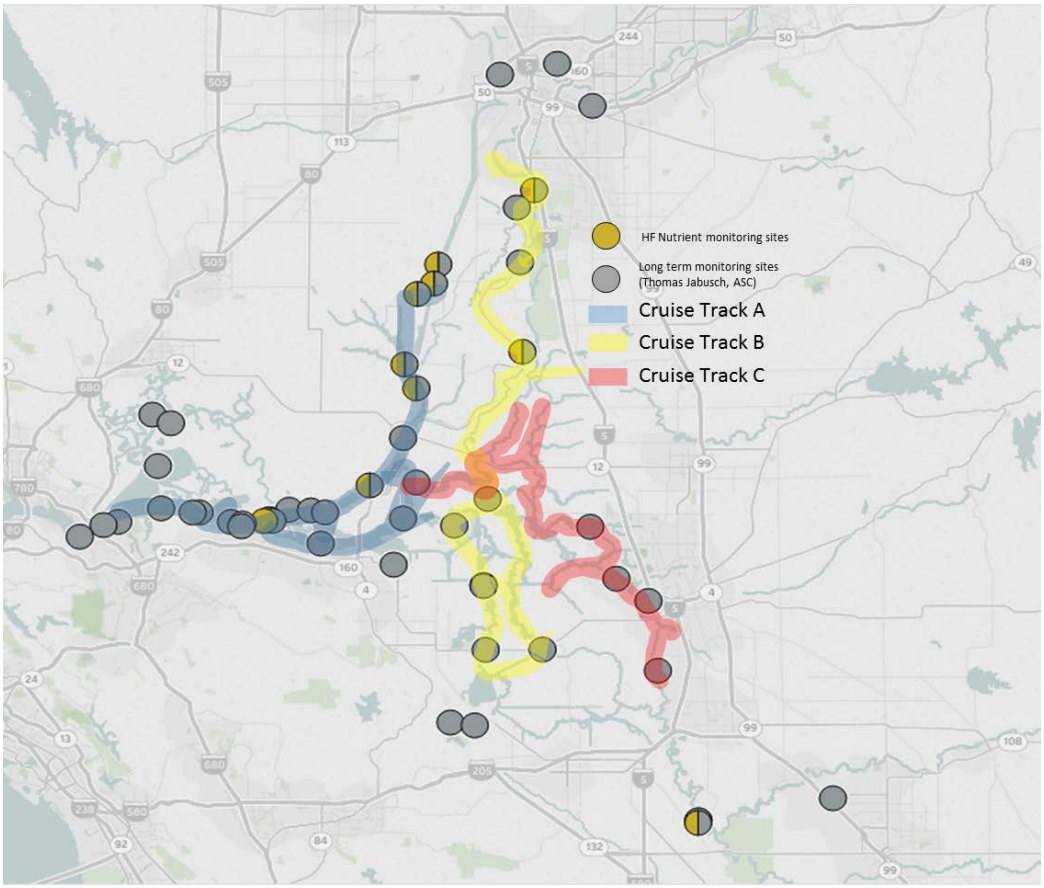

Figure 2, Proposed 3 day cruise track for "Assessing spatial variability of nutrients and related water quality constituents in the Delta at the landscape scale"

Three cruise tracks are proposed. Planned cruise tracks will be finalized in consultation with the RMP nutrient subcommittee. Tracks are subject to change due to navigational- or safety-related issues. Additional areas may be covered as time permits.

- Track A (~75 miles) covers the two major nutrient gradients in the northern Delta: the gradient of declining nitrate and ammonium between the main stem of the Sacramento River and the Cache Slough complex caused by uptake and loss, and the gradient from the main stem of the Sacramento River and Suisun Bay, as defined – we suspect – largely by mixing, and where there is most concern about the effects of ammonium inputs. Significantly, the results should permit explicit calculation of effective ammonium transformation into this area.
- Track B (~60 miles) covers the area immediately above the Regional SAN WWTP and generally follows the path water is drawn across the Delta to the Banks Pumping Plant, down Georgiana Slough, Old and Middle Rivers to Clifton Court. The intent of this cruise

track is to observe the fate of WWTP-derived nutrients as they transit the Delta and assess the causes associated with this nutrient gradient.

- Track C (~65 miles) covers the gradient of San Joaquin River-derived nutrients into the central part of the Delta, and explores potential attenuation of this material in western Delta habitats. It also covers regions in the central Delta not served by long term monitoring and permits comparison of the Mokelumne to the Cosumnes systems.

Data Quality Objectives

Laboratory measurements will be made at the USGS national water quality laboratory. Performance criteria require accuracy to within 5% of the measured value at 3 times the method reporting limit. Underway instruments are calibrated prior to use and are accurate to <2% of the full scale value. Uncertainty due to analytical errors in underway instrumentation is included in the replication inherent in high frequency sampling, and is reported together with natural variation as standard deviation across averaging periods. Underway instrument performance will be validated against laboratory values and the uncertainty published in the report. Analysis of spatial variation will use this uncertainty to only highlight statistically significant variations that exceed uncertainty. The cumulative uncertainty will be estimated in quadrature or using Monte Carlo simulations over the domain of the uncertainty of the individual measurements. This cumulative uncertainty will be used to assess the statistical significance of spatial variation with a defined threshold of $p < 0.001$.

Reporting/Deliverables

The deliverables for the project will be a draft report, electronic versions of maps produced by the project, and corresponding data files containing constituent concentration data and location information.

The report will consist of the following elements:

- An introduction briefly describing the background, goals and objectives for the project.
- A description of the methods used to collect and process the data associated with the project.
- Maps of the spatial distribution of nutrient concentrations, forms and ratios across the Delta as well as graphs showing longitudinal transformations.
- A discussion of the results of the study, with special attention to describing potential processes in areas with high apparent rates of nutrient concentration change as well as the processes that may be responsible for that change.

Budget

The requested USGS budget for this project includes salary, supplies, analytical services, and operational costs for a vehicle and boat. Total costs for the project mapping and data processing component for three seasonal sampling campaigns and preparation of the study report are $195,000.

Costs for the ASC to handle the USGS report and manage data will be included in the Delta RMP FY17/18 budget under Core Functions, and thus are not a part of this project budget.

2 – Continued Nutrient Data Analysis and Biennial Reporting

Project Team

Work to be performed by ASC. External contributions to Task 1 (High-level summary of key findings from recently completed reports) and analytical analyses by USEPA for Task 3 (Advanced Statistical Analyses) will be provided in-kind.

Executive Summary

This task consists of continued synthesis and integration of existing data to characterize status and trends of nutrient-related parameters and planning future monitoring and data analysis work. The proposed FY17/18 funding will provide the nutrient subcommittee an adequate opportunity to discuss and evaluate the existing scientific knowledge as part of the annual planning process. The FY17/18 effort will also be Year 1 in a proposed biennial reporting cycle. The major tasks for FY17/18 are 1) convening up to 4 nutrient subcommittee science meetings, 2) completing data analysis and synthesis work funded in FY16/17, and 3) planning and initiating synthesis work for the biennial report to be completed in FY18/19. The Nutrient Subcommittee meetings will be convened to a) evaluate recently completed studies and synthesis reports for planning purposes, b) provide guidance to continuing data synthesis work funded by the Delta RMP, and c) develop specific recommendations for monitoring and synthesis activities for the Delta RMP.

The proposed additional budget for FY17/18 is $20,000. In addition, retention of remaining FY16/17 funds for data synthesis work is proposed, to complete analyses as guided by the Nutrient Subcommittee.

Background and Motivation

Monitoring and scientific investigations in the Delta over the past several decades have generated tremendous amounts of nutrient and nutrient-related data, much of it through efforts focused on ecosystem health issues fairly distinct from nutrient management questions. Thus, this valuable nutrient-related data archive has received limited attention to date. An important - and large return on investment - focus for Delta RMP work is on the continued synthesis and integration of existing data generated by monitoring agencies, to evaluate the information they provide relative to the Delta RMP assessment questions. This task corresponds to one of the “no regrets” recommendations of the September 2016 Delta RMP Nutrient Monitoring Planning Workshop.

Applicable Management Decisions and Assessment Questions

Management Drivers

- Delta Nutrient Research Plan

Assessment Questions

Status and Trends

1. How do concentrations of nutrients (and nutrient-associated parameters) vary spatially and temporally? *Project will update nutrient indicators from FY16/17 report in FY18/19*

1A. Are trends similar or different across subregions of the Delta?

1B. How are ambient levels and trends affected by variability in climate, hydrology, and ecology?

2. What is the current status of the Delta ecosystem as influenced by nutrients?

2A. What is the current ecosystem status of habitat types in different types of Delta waterways, and how are the conditions related to nutrients? *Project analyses linkages between biological indicators, nutrients, and other drivers*

Forecasting Scenarios

1. How will ambient water quality conditions respond to potential or planned future source control actions, restoration projects, and water resource management changes? *Project will establish a baseline*

Approach

This nutrient program proposal consists of a) continued synthesis and integration of existing data to evaluate the information they provide relative to the Delta RMP assessment questions and b) science-based planning of future monitoring and data analysis work. The nutrient subcommittee is expected to play an active role in planning and guiding these activities. The proposed FY17/18 funding will provide the nutrient subcommittee an adequate opportunity to discuss and evaluate the existing scientific knowledge as part of the annual planning process. The FY17/18 effort will also be Year 1 in a proposed biennial reporting cycle. A biennial report presenting synthesized nutrient information will be produced in FY18/19. The report will build on the FY16/17 synthesis report and provide the current state of knowledge in answering the Delta RMP assessment questions related to nutrient trends and effects.

The major tasks for FY17/18 are

1. Continued Data Synthesis and Data Assessment
2. Completing advanced statistical analyses FY16/17

Task 1. Continued Data Synthesis and Assessment

The core activity will be to convene up to four focused Nutrient Subcommittee science meetings per year for the purpose of evaluating existing information relative to the Delta RMP questions, characterizing data gaps, and developing plans for filling them. The Nutrient Subcommittee will convene to a) review and discuss completed studies and reports, b) assess data needs relative to Delta RMP assessment questions, and c) develop study designs and project plans for monitoring to address data gaps. The Nutrient Subcommittee will also provide guidance to continuing data synthesis work funded by the Delta RMP and the specific content and analyses to be performed for the biennial report planned for FY18/19.

The materials to be reviewed and evaluated include

- FY15/16 Delta RMP Technical Reports (*in preparation*)
    - Updated nutrient indicators (2013-2016 data)
    - Results from RMA modeling
- USEPA/ASC manuscript describing WRTDS analyses (*in preparation*)
- Jabusch T, Bresnahan P, Trowbridge P, Wong A, Salomon M, and Senn D. 2016. Summary and Evaluation of Delta Subregions for Nutrient Monitoring and Assessment. San Francisco Estuary Institute, Richmond, CA. http://www.sfei.org/sites/default/files/biblio_files/MainReport-DSP_2016-06-30.pdf
- Novick E, Holleman H, Jabusch T, Sun J, Trowbridge P, and Senn D, Guerin M, Kendall C, Young M, Peek S. 2015. Characterizing and quantifying nutrient sources, sinks and transformations in the Delta: synthesis, modeling, and recommendations for monitoring. San Francisco Estuary Institute, Richmond, CA. http://sfbaynutrients.sfei.org/sites/default/files/Main manuscript.pdf
- ASC. 2016. Nutrient Monitoring Planning Workshop. Summary of Existing Monitoring Programs, Data Gaps, and Potential Delta RMP "No Regrets" Activities. Background Report prepared for the Delta Regional Monitoring Program. Aquatic Science Center, Richmond, CA. http://www.sfei.org/sites/default/files/biblio_files/MainReport-DSP_2016-06-30.pdf
- Bergamaschi BA, Downing BD, Kraus TEC, Pellerin BA. In review. REVIEW DRAFT: Designing a high frequency nutrient and biogeochemistry monitoring network for the Sacramento-San Joaquin Delta. U.S. Geological Survey Open File Report. U.S. Geological Survey, Reston, Virginia.

Synthesis work for the FY18/19 synthesis report will be planned and, to the extent possible, initiated. The report is expected to include a) an update to the nutrient indicators developed for the FY16/17 nutrient synthesis, and 2) a high-level summary of key findings from recently completed synthesis activities and reports, including

- Delta RMP nutrient projects to be funded in FY17/18 and FY 18/19
- Delta Nutrient Research Plan projects to be funded in FY17/18 and FY18/19
- USGS studies (biogeochemistry group)
- Delta Science Program "Big Experiment" monitoring to evaluate the effects of the Sacramento Regional Wastewater Treatment Plant upgrade

Task 2. Completing advanced statistical analyses

USEPA and ASC are currently collaborating on an evaluation of the IEP-EMP data with the Weighted Regressions on Time, Discharge, and Season (WRTDS) trend analysis method to describe variation over time and relationships between key species of dissolved inorganic nitrogen (ammonium, nitrate/nitrite, total). Other recent statistical methods such as Generalized additive models (GAMs) are promising for analyzing trends in complex systems like the Delta. Analyses conducted to date have been performed in-kind by USEPA. However, the timeline for this effort has been delayed. The results are being prepared for publication in a peer-reviewed journal. Journal submission is expected by the end of March.

The FY16/17 budget includes $37,000 that has been approved for ASC to conduct additional statistical analyses using these tools. Most of these funds have not been spent. The proposed plan is to use the remaining $30,000 as planned for data analysis and synthesis work. The detailed scope will be decided by the nutrient subcommittee when the USEPA manuscript is available for review.

Proposed activities for the remainder of FY16/17 and FY17/18 consist of a) designing the additional analyses with the Nutrient Subcommittee, and b) initiating follow-up analyses. The specific follow-up work to address Delta RMP assessment questions will be planned when the manuscript has been peer-reviewed and accepted for publication.

Follow-up analyses are anticipated to focus on the evaluation of co-variation among nutrient variables and additional indicators to provide mechanistic insight about the relationship of nutrients, biological indicators (e.g. chlorophyll), and additional drivers of ecosystem response (see Figure 1 for an example). The Nutrient Subcommittee and TAC will provide guidance on the questions to be addressed in these follow-up evaluations.

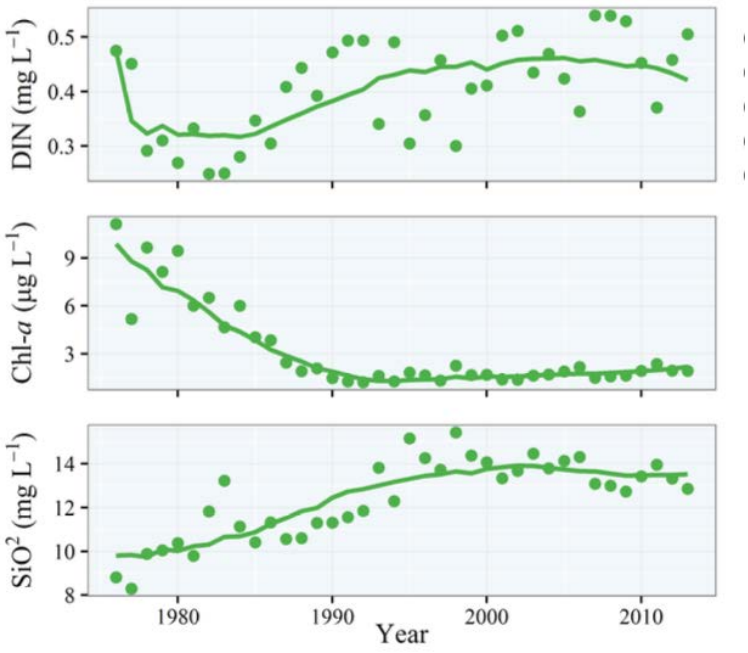

Figure 1. Covariation among dissolved inorganic nitrogen (DIN), chlorophyll, and silicate (SiO2) at a Suisun Bay station. It is well documented that the invasion of the overbite clam resulted in reduced diatom biomass in Suisun Bay. The graphs illustrate that a reduction in chlorophyll (indicator for phytoplankton biomass) is accompanied by upward trends in both SiO2 (an important nutrient for diatoms) and DIN. Follow-up evaluations are examining whether a drop in diatom biomass resulted not only in in reduced drawdown of SiO2 but also of DIN, resulting in an overall increase in both SiO2 and DIN.

Source: Marcus W. Beck, National Health and Environmental Effects Research Laboratory, USEPA (manuscript in preparation).

Parameters

Nutrient parameters: Nitrogen species (ammonia, Kjeldahl nitrogen, nitrite+nitrate, organic nitrogen, total dissolved nitrogen, total nitrogen), phosphorus species (ortho-phosphate, phosphorus, soluble reactive phosphorus), silica.

Nutrient-associated: Chlorophyll a, phaeophytin a, phycocyanin; general water quality and standard minerals (calcium, salinity, dissolved solids, suspended solids); dissolved organic carbon (DOC), particulate organic carbon (POC), total organic carbon (TOC); field measurements (dissolved oxygen, electrical conductivity/salinity, turbidity, pH, temperature); phytoplankton and abundance and taxonomic composition, clams; biological oxygen demand (BOD), carbonaceous biological oxygen demand (CBOD); isotopes.

Sampling Design

Not applicable

Subcontractors

Not applicable. Work to be performed by ASC. The default assumption is any additional analyses by USEPA for Task 3 (Advanced Statistical Analyses) will be provided in-kind.

Data Quality Objectives

- Trends: detect a 30% change in concentration over 20 years with 80% power.
- Hypothesis testing (e.g. significant relationship/co-variance between drivers): p-value of 0.05 as the smallest level of significance at which the null hypothesis would be rejected (e.g. null hypothesis = no relationship/co-variance).

Reporting/Deliverables

Task	Schedule and deliverables
2.1. Data Synthesis and Assessment	*FY17/18* ● Prepare, coordinate, and provide technical support to up to 4 nutrient subcommittee meetings by 6/30/18 *FY18/19* ● Prepare, coordinate, and provide technical support to up to 4 nutrient subcommittee meetings by 6/30/19
2.2. Advanced Statistical Analyses	*FY17/18* ● Finalize the design of additional analyses to be completed in FY17/18 by 9/30/17

	● Complete additional analyses as directed by Nutrient Subcommittee by 12/31/17 ● Tech memo with basic summary of the results and recommendations for FY18/19 follow-up work by 3/31/18 *FY18/19* ● Follow-up work TBD by nutrient subcommittee ● Prepare summary of results as section of FY18/19 Biennial Report (Task 2.3)

Budget

Task	Budget (FY17/18)	Budget (FY18/19)
2.1. Data Needs Assessment	$20,000 for up to four subcommittee meetings/year. Preparing meeting packages; participating in meetings; coordinating meetings; complete assigned action items; preparing study designs and project plans.	20,000 for up to four subcommittee meetings/year. Preparing meeting packages; participating in meetings; coordinating meetings; complete assigned action items; preparing FY19/20 analysis designs and project plans.
4.2. Advanced Statistical Analyses	0$. Use remaining $30,000 from FY15/16 for planning and conducting follow-up analyses as directed by Nutrient Subcommittee, preparing Technical Memo summarizing FY17/18 analyses and results	TBD based on FY17/18 analysis designs and project plans
2.3. Prepare biennial synthesis report	$0	$35,000 for preparing the biennial report
Total/Year	**$20,000** ***(Plus $30,000 from FY16/17 budget)***	**TBD**

3 – Chlorophyll Sensor Intercalibration –Year 1

Executive Summary

High frequency (HF) continuous monitoring is a powerful tool for measuring chlorophyll, a key indicator for understanding the effects of nutrient loadings and concentrations in aquatic ecosystems. There are presently more than 40 moored chlorophyll sensors in the Delta and Suisun Bay operated by state and federal agencies that are collecting an abundance of data. One specific recommendation from the September 2016 Delta RMP Nutrient Monitoring Workshop was to foster coordinated sensor monitoring between different programs as a "no regrets" option for filling data gaps relative to Delta RMP assessment questions.

The proposed chlorophyll sensor intercalibration study will be a significant first step toward ensuring improved sensor network coordination. This project is highly-relevant to multiple monitoring efforts in the Bay-Delta, and is proposed as a jointly-funded study with the San Francisco Bay Nutrient Management Strategy (NMS); we also aim to bring other monitoring efforts and their in-kind support into this collaborative effort (e.g., DWR; USGS-Menlo Park) . Key project goals include:

- Characterize the accuracy and uncertainties of chl-a estimates obtained from HF sensors under a range of representative conditions, and identify practical approaches for improving those estimates (i.e., ancillary HF data collection, statistical approaches, site-specific or condition-specific calibrations)
- Develop, and begin early pilot implementation of, a coordination plan for Bay-Delta HF-sensor monitoring efforts, designed to achieve reliable data QA and allow for direct comparisons of chlorophyll sensor data

The project will consist of two phases: Phase 1) Development of the study design, project plan, and institutional coordination plan; and Phase 2) Implementation of the study. In Phase 1, a Technical Team comprised of chlorophyll sensor network managers and expert scientists will be convened to develop the project plan. Core elements of the study are expected to include:

- Analysis of existing chl-a and ancillary data, i.e., HF sensor and corresponding grab sample measurements, including data from different regions of the Bay-Delta and using different types of sensors
- Evaluation of sensor performance under a range of conditions,
- Interlab comparison of laboratory results used in the calibrations,
- Development of performance-based guidelines for chlorophyll sensor calibration to facilitate network integration
- In-situ calibration exercises and inter-site comparisons in a range of conditions.

The Year 1 budget would fund the completion of Phase 1 and is estimated at $35,000. The proposed Delta RMP contribution is $15,000.

Background and Motivation

Chlorophyll is a key indicator of ecosystem condition relative to nutrients. It is the primary measure of phytoplankton biomass and primary production in aquatic ecosystems. Monitoring of chlorophyll is conducted by discrete water quality sampling programs and by continuous sensor networks.

Sensor monitoring is a powerful tool for assessing conditions and understanding processes in the system. High-frequency data measurements provide sufficient resolution to accurately assess condition, in particular in areas where water quality parameters vary with high temporal frequency (diurnal, semidiurnal, and hourly or sub-hourly time-scales) or sharp spatial gradients. High-frequency measurements are valuable for calibrating and validating water quality and hydrodynamic models and for improving our mechanistic understanding of water quality indicators and their relationships (e.g., phytoplankton biomass and nutrient concentrations). If well-calibrated, high-frequency measurements can also increase the sensitivity for detecting long-term trends.

An abundance of chlorophyll data is being collected in the Delta, due to the importance of this parameter for understanding and managing water quality. There are presently more than 40 moored chlorophyll sensors in the Delta and Suisun Bay, belonging to networks maintained by USGS and different DWR units. However, these networks are not coordinated and currently provide fragmented information.

Improved coordination of the existing networks would provide opportunities to fill data gaps relative to Delta RMP assessment questions. One specific recommendation from the 2016 Delta RMP Nutrient Monitoring Workshop was to foster coordinated sensor monitoring between different programs. Workshop participants from other programs have expressed interest in participating in technical coordination efforts. A coordinated chlorophyll sensor network would be consistent with Delta RMP priorities of leveraging the use of existing data.

A number of technical and institutional barriers will need to be overcome to achieve sensor network coordination. Overcoming technical barriers will include the coordination of sensor acceptance and performance criteria, sensor calibration, performance validation, data collection, data quality assurance, data management, and data access; and identifying a larger

network design (locations, parameters, sensor requirements, etc.). Overcoming institutional barriers will require the identification of mutual objectives and funding mechanisms for accomplishing these objectives.

The proposed chlorophyll sensor intercalibration study will be a significant first step towards improved sensor network coordination. Key questions to resolve include a) how to correctly calibrate sensors in a range of conditions (e.g., how do light regime and turbidity affect the calibration using different sensors); how comparable are the results from different labs used for the calibration; and c) what additional measurements are needed for an accurate calibration, and how should they be collected?[1]

The chlorophyll sensor intercalibration is proposed as a joint effort with the San Francisco Bay Nutrient Management Strategy (NMS). A joint effort of the NMS and Delta RMP commencing in FY17/18 would leverage resources and expertise, and achieve mutual goals more effectively. The San Francisco Bay Nutrient Management Strategy (NMS) is planning to invest FY17/18 funding to address chlorophyll sensor calibration.

Applicable Management Decisions and Assessment Questions

Management Drivers

- Delta Nutrient Research Plan

Assessment Questions

Status and Trends

2A. What is the current status of the Delta ecosystem as influenced by nutrients?

2A-1. What is the current ecosystem status of habitat types in different types of Delta waterways, and how are the conditions related to nutrients?

Forecasting Scenarios

1. How will ambient water quality conditions respond to potential or planned future source control actions, restoration projects, and water resource management changes?

Having interoperable sensors will allow for Delta-wide assessments of primary productivity.

Approach

The total project length will be 2-3 years, depending on the final study design and project plan. The project will consist of two phases. Phase 1 will consist of the development of the study design, project plan, and institutional coordination plan. Phase 1 is expected to take

[1] Jassby (2014). Improving estimates of chlorophyll from fluorescence in San Francisco Bay. Report prepared for the U.S. Geological Survey (Menlo Park, CA) and the San Francisco Estuary Institute (Richmond, CA) .

approximately 9-12 months to complete. Phase 2 consists of the implementation of the study.

A Technical Team composed of chlorophyll sensor network managers and expert scientists will be convened. In Phase 1, the team will identify the core components of the calibration study and highest priority analyses to be conducted, define the range of parameters and conditions to be examined, and develop the overall study design and project plan. The project plan will also address coordination aspects, in-kind contributions of participating programs, and refined funding requirements for Phase 2.

Core elements of the calibration study are likely to include:

- Evaluation of the performance of different sensors in a range of conditions,
- Developing a SOP for the intercalibration study, including what to calibrate against (either or all of a standard (e.g., a dye), measured extracted chlorophyll, or phytoplankton enumeration
- Interlab comparison of laboratory results used in the calibrations,
- Development of performance-based guidelines for chlorophyll sensor calibration to facilitate network integration
- In-situ calibration exercises and inter-site comparisons in a range of conditions.

The Year 1 budget would fund the completion of Phase 1. The scope for Phase 1 consists of 2 in-person meetings and 2 conference calls of the Technical Team. ASC and USGS will develop aspects of a strawman plan prior to the kick-off meeting. One goal of the kick-off meeting will be to get early consensus on a few “no regrets” sampling and analysis activities that could get underway immediately with in-kind support. After some progress on the technical plan development, expert collaborators will be give updates to the Nutrient Subcommittee, TAC, and SC.

Parameters

Nutrient parameters: NO_3

Nutrient-associated: Chlorophyll fluorescence, chlorophyll *a*, fluorescent dissolved organic matter (fDOM), turbidity, photosynthetically active radiation; others TBD

Sampling Design
Will be developed in Year 1

Subcontractors
Not applicable. Technical support and coordination work will be performed by ASC. The default assumption is that workgroup participation, sampling, and laboratory analyses will be in-kind contributions.

Likely Collaborators
Bay Regional Monitoring Program
DWR Environmental Monitoring Program
DWR North Central Region Office, Water Quality Evaluation Section
San Francisco Bay Nutrient Management Strategy
State and Federal Water Contractors Agency
USGS California Water Science Center, Biogeochemistry Group

Data Quality Objectives
Will be developed as part of performance-based guidelines.

Reporting/Deliverables

Task	Schedule and deliverables
5.1. Logistics and Coordination	● Prepare detailed SOW by June 30, 2017 ● Assemble Technical Team by July 31, 2017 ● *Prepare, coordinate, and facilitate Phase 1 Technical Team Meetings* ● Kick-off meeting by September 31, 2017 ● Second meeting by December 31, 2017 ● Third meeting by March 31, 2018 ● Final meeting by May 31, 2018
5.2. Develop project plan, including study design, logistics, and institutional coordination	● Draft project plan by September 15, 2017 ● Final Project Plan by June 30, 2018

Budget
The total proposed budget for Chlorophyll Sensor Calibration – Year 1 is $35,000. ASC staff will convene and coordinate the technical team, provide technical support to the technical team, and prepare the project plan (40 hours for Lead Staff, 60 hours for technical staff, and 10 hours

for Program Manager). The proposed Delta RMP contribution is $15,000.

The budget for Year 2+ will be developed as part of the project plan. The estimated cost of implementing the study in future years (total expected duration of study is 1-3 years) is in the range of $100-$200k/yr.

Delta Regional Monitoring Program

FY17/18 Detailed Workplan and Budget

Appendix D

Technical Report Proposals

Technical Reports Proposals

Summary Table of Draft Proposals for the FY17/18 Workplan

Project Proposal	FY17/18	FY18/19
Pulse of the Delta Report The purpose of the *Pulse Report* will be to provide a concise overview of recent RMP activities and findings, and a look ahead to significant products anticipated in the next two years.	$40,000	TBD
Synthesis of Years 1&2 of Current Use Pesticides and Toxicity Data The purpose of the synthesis is to perform detailed analysis of the data from the first two years of pesticide and toxicity monitoring to answer Delta RMP management questions, inform decisions about future monitoring designs; and develop content on recent findings for the State of the Bay Delta Science Conference and the Pulse reports.	$60,000	$0
All proposals	$100,000	TBD

Pulse of the Delta Report

In the Communication Plan, there is a placeholder for a *Pulse of the Delta* report to be released in fall 2018 at the State of the Bay Delta Science Conference. In order to produce a major publication in the fall of 2018, planning and writing needs to begin in the upcoming fiscal year.

A full *Pulse* document typically requires having 3-4 technical reports completed and approved by the Steering Committee 9-12 months in advance, after which the Steering Committee works on high level messaging. Unfortunately, the Delta RMP will not have enough technical reports in time to justify a *Pulse* report. However, a "Pulse Lite" report would be achievable and would be helpful to raise the profile of the Program at the conference. The longer *Pulse of the Delta* report could be prepared in 2020. After 2 additional years of monitoring and analysis, we will be able to produce a more meaningful report with stronger conclusions.

The purpose of the *Pulse lite* will be to provide a concise overview of recent RMP activities and findings, and a look ahead to significant products anticipated in the next two years. Preparing this report would also give the Steering Committee and TAC the opportunity to craft a consensus message about water quality in the Delta.

The planned report will include:

- a brief summary of some of the most noteworthy findings of this multifaceted Program;
- a description of the management context that guides the Program; and
- a summary of progress in and plans for addressing priority water quality topics.

Proposed Outline

- Program Impact
    - The Impact of the Delta RMP on Management Decisions
    - RMP Goal and Management Questions
- Program Highlights
    - Coming Attractions
    - Recent Publications
- Program Area Updates
    - Pathogens
    - Nutrients
    - Current Use Pesticides
    - Mercury

For an example of a similar report, see the *RMP Update* report produced by the Bay RMP (www.sfei.org/rmp/update) in 2016.

Scope of Work and Schedule

No.	Task	Schedule
1	Develop a detailed outline and scope with RMP committees Prepare a comprehensive budget and schedule	December 31, 2017
2	Manage subcontractors	June 30, 2018
3	Develop draft content	June 30, 2018
4	Manage comments/review by RMP committees	June 30, 2018

Unfunded tasks include:

- Graphic design
- Printing
- Outreach/Communications

Budget

$40,000

This is an approximate, not-to-exceed budget to allow work to start on the report in FY17/18. Depending on the scope of the report chosen by the Steering Committee, additional funds may need to be allocated, either from Reserve or in the FY18/19 budget, to complete the whole report.

Tasks 1, 2 and 4 will be ASC labor. Task 3 will be a combination of ASC labor and subcontractors, depending on the outline that is developed by the RMP committees.

Synthesis of Years 1&2 of Current Use Pesticides and Toxicity Data

The Delta RMP Communication Plan calls for a technical report in FY17/18 that synthesizes the first two years of Delta RMP current use pesticides and toxicity monitoring.

The purpose of the technical report will be to:

- Perform detailed analysis of the data from the first two years of pesticide and toxicity monitoring to answer Delta RMP management questions;
- Inform decisions about future monitoring designs; and
- Develop content on recent findings for the State of the Bay Delta Science Conference and the Pulse reports.

The outline for this report will be developed in collaboration with the Pesticides Subcommittee. We expect that a significant amount of time and effort will be required to develop the scope for this report, including what methods will be used to analyze and synthesize the data. We also believe that it will benefit from including the contributions of two or more co-authors, to bring an additional perspective and to help make sure the report is accepted by different stakeholder groups.

A short data report for year 1 has already been drafted. The year 2 data will be summarized in a similar data report by February 28, 2018 using funding that has already been allocated. The funding requested for the Year 1-2 technical report will allow for detailed analysis of the data from both years, building off the foundation of the yearly data reports.

Scope of Work and Schedule

No.	Task	Schedule
1	Develop a detailed outline with the Pesticide Subcommittee, TAC, and Steering Committee	December 31, 2017
2	Manage subcontractors	June 30, 2018
3	Draft technical report	June 30, 2018
4	Manage comments/review by RMP committees	September 30, 2018
5	Final technical report	October 31, 2018

Unfunded tasks include:

- Presentation of findings at 2018 State of the Bay Delta Science Conference

Budget

$60,000

The cost of this project is scalable, depending on the outline that is chosen. The not-to-exceed budget of $60,000 includes $20,000 for subcontractors to pay honoraria for co-authors.

Tasks 1, 2 4, and 5 will be ASC labor. Task 3 will be a combination of ASC labor and subcontractors, depending on the outline that is developed by the RMP committees.

Delta Regional Monitoring Program

FY17/18 Detailed Workplan and Budget

Appendix 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 FY17/18 Workplan and Budget, two subcontracts greater than $50,000 are proposed:

- USGS and
- the Marine Pollution Studies Laboratory at Moss Landing.

Both subcontracts meet 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: 4/18/2017 *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
USGS		$195,000	Value based on FY17/18 quote.

Vendor Selected:

Vendor Name: U.S. Geological Survey
Contact: Brian Bergamaschi, Bryan Downing, Tamara Kraus
Address: 6000 J. Street, Sacramento, CA 95819
Phone: 916-278-3053 Fax: Email: bbergama@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 as documented by:

- The specialized nature of the proposed work, which is research outside the domain of typical contractors.
- USGS unique access to ship-based flow-through sensors. The approach is to make high frequency (1/sec) measurements from a high-speed boat across broad areas of the Delta. This is made possible through the recent development of a boat-mounted flow-through sampling system that can be operated at high speeds (~20 mph), permitting rapid collection of high-quality measurements over large regions, within the context of a single tide. The resulting data is then mapped to the simultaneously-collected geopositional data (GPS) to generate maps with high spatial resolution.
- Unique access to information in the USGS databases and software.
- USGS prepared a comprehensive synthesis of sensor-based measurements in the Delta and, therefore, is uniquely qualified to perform these types of measurements in the Delta.

For these two 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

_____ _____

Requestor's Signature Date

_____ _____

Program Director or Executive Director's Signature Date

_____ _____

Vendor Selection Form

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: 04/18/2017 *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		$209,016	Value based on FY17/18 quote. MLML will provide a 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 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 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 year of Delta RMP data in FY16/17. Continuing to use MPLS 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 $25,000 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

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

Matthew Heberger

Requestor's Printed / Typed Name

_____ _____

Requestor's Signature Date

_____ _____

Program Director or Executive Director's Signature Date

_____ _____

Contracts Manager's Signature Date