February 1, 2023

Mr. Patrick Pulupa, Executive Officer
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670

Sent via electronic mail to Patrick.Pulupa@waterboards.ca.gov

RE: SUBMITTAL OF FY 21-22 DELTA REGIONAL MONITORING PROGRAM ANNUAL REPORT PER RESOLUTION R5-2021-0054

Dear Mr. Pulupa,

Please find attached the Delta Regional Monitoring Program's (DRMP) fiscal year (FY) 2021-2022 Annual Report, as required by Resolution R5-2021-0054, Item 5 of Attachment A.

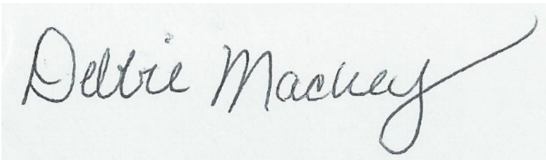
As required by the Resolution, the 2021-2022 Annual Report summarizes all monitoring projects or studies conducted during fiscal year 2021-2022 (FY 21-22). The report includes a list of all publicly available datasets (including data and metadata), explanations for why any aspect of the Monitoring Workplan was not completed, and any deviations from the Monitoring Workplan, Data Management Plan, or the Quality Assurance Project Plans (QAPPs).

The Annual Report includes two quality assurance sections, one for data managed by the DRMP and one where data is not managed by the DRMP. The Annual Report identifies and describes all QAPP deviations and any other project deviations that impacted the quality of the DRMP data to ensure data are of known and documented quality. This section also includes: a list and description of all deviations to the QAPP; the corrective action(s) taken to address the deviation(s); a description of how the Delta RMP monitors the effectiveness of any corrective actions and ensures any deviations do not occur frequently in the future; a summary of dataset completeness, precision, and accuracy; a list and description of sample comparisons or tests that did not meet minimum test acceptability criteria for analyses or were considered invalid; results for all analyses completed during the reporting period and comparison of results to previous year's observations, if applicable; and, a list of monitoring data (and associated metadata) that do not meet predetermined quality control measures and measurement quality objectives.

The FY 21-22 Annual Report is included below. Additionally, three files (Attachment A – C) are attached separately as Excel workbooks and transmitted in the email with this letter.

If you have any questions regarding the report, please do not hesitate to reach out to Melissa Turner, the DRMP's Program Director at mturner@mljenvironmental.com or by phone at (530) 756-5200, or to me at eofficer@cvcwa.org or at (530) 268-1338.

Sincerely,



Debbie Mackey, President
Delta Regional Monitoring Program

Attached Separately:

- Attachment A Current Use Pesticides and Toxicity Data for Fiscal Year 21-22
- Attachment B Constituents of Emerging Concern Year 2 Data
- Attachment C Mercury Electronic Data Deliverables for Year 5 Data

cc: via email
Adam Laputz - CVRWQCB
Meredith Howard – CVRWQCB
Selina Cole - CVRWQCB
Melissa Turner – DRMP Program Director
Jennifer Glenn – DRMP Program Administrator
DRMP Board of Directors

Delta RMP Annual Report

Fiscal Year July 1, 2021 – June 30, 2022

Submitted to the Central Valley Regional Water Quality Control Board on
February 1, 2023

Prepared By:

MLJ ENVIRONMENTAL

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LIST OF ACRONYMS

AMS	Applied Marine Sciences
AQT	Advanced Query Tool
ASC	Aquatic Science Center
ASTM	American Society for Testing and Materials
BOD	Board of Directors
CDEC	California Data Exchange Center
CEC	Constituent of Emerging Concern
CEDEN	California Environmental Data Exchange Network
CHAB	Cyanobacteria Harmful Algal Bloom
CRM	Certified Reference Material
CUP	Current Use Pesticides
CV RDC	Central Valley Regional Data Center
CVRWQCB	Central Valley Regional Water Quality Control Board
Delta RMP	Delta Regional Monitoring Program
DOC	Dissolved Organic Carbon
DMT	Data Management Team
DWR	Department of Water Resources
EDD	Electronic Data Deliverable
ELISA	Enzyme-linked Immunoassay
EPA	Environmental Protection Agency
EVR	Effluent Valve Replacement
FY 21-22	Fiscal Year 2020-2021
HAB	Harmful Algal Bloom
LC/MS/MS	Liquid Chromatography Tandem Mass Spectrometry
LCS	Laboratory Control Spike

LCSD	Laboratory Control Spike Duplicate
LOD	Limit of Detection
MDL	Method Detection Limit
MeHg	Methylmercury
MLML	Moss Landing Marine Laboratories
NWIS	National Water Information System
NWQL	National Water Quality Laboratory
OCRL	Organic Chemistry Research Laboratory
PBDE	Polybrominated Diphenyl Ethers
PER	Pacific EcoRisk
PFAS	Per- and Polyfluoroalkyl Substances
PPCP	Pharmaceuticals and Personal Care Product
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
qPCR	Quantitative Polymerase Chain Reaction
RL	Reporting Limit
RMA	Risk Management Agency
SC	Steering Committee
SEP	Supplemental Environmental Project
SOP	Standard Operating Procedure
SPATT	Solid Phase Adsorption Toxin Tracking
SPoT	Stream Pollution Trends Monitoring
SRiNCS	Sacramento River Nutrient Change Study
SRWTP	Sacramento Regional Wastewater Treatment Plant
SSC	Suspended Sediment Concentration
SWAMP	State Board Surface Water Ambient Monitoring Program
SWRCB	State Water Resource Control Board
TAC	Technical Advisory Committee
TIE	Toxicity Identification Evaluation
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USGS	United States Geological Survey
VSS	Volatile Suspended Solids
WY	Water Year
YSI	Yellow Springs Instrument

1 INTRODUCTION

This Annual Report is being submitted to the Central Valley Regional Water Quality Control Board (Regional Board or CVRWQCB) in accordance with Resolution R5-2021-0054 which was adopted October 15, 2021. The Annual Report documents the status of monitoring and special studies conducted by the Delta Regional Monitoring Program (Delta RMP) during the 2021-2022 Fiscal Year (FY 21-22), spanning from July 1, 2021, through June 30, 2022. Work conducted during this period was based on the Technical Workplan and Budget of the 2021-2022 Fiscal Year recommended by the Delta RMP Steering Committee (SC) and approved by the Board of Directors (BOD) on July 29, 2021. An Amendment to the FY 21-22 Workplan was recommended by the SC and approved by the BOD on January 24, 2022, in order to provide additional funding for a cyanotoxin study.

Monitoring during FY 21-22 occurred across four monitoring sectors and is described in the FY 21-22 Technical Workplan and Budget:

- Current Use Pesticides (CUP)
- Constituents of Emerging Concern (CEC)
- Nutrients
- Mercury

The status of each planned monitoring project is outlined below. A **Summary of Public Datasets**, **Deviations and Corrective Actions**, and the status of all projects and studies conducting **Delta RMP Monitoring** is provided below in **Progress of FY 21-22 Monitoring Projects**. Quality assurance assessments for each project and study are provided in the **Quality Assurance** sections according to the requirements outlined in **Table 1**. An overview of the progress of monitoring events, data acquisition, and reports for each of the Delta RMP projects and studies during FY 21-22 is summarized in **Figure 1**.

Table 1. Quality assurance assessment requirements of Resolution R5-2021-0054.

Annual Report Requirement from Resolution (Attachment A, 5)	Section Number	Section Header
Summarize all monitoring projects or studies conducted during the prior fiscal year.	2.2	**Delta RMP Monitoring**
Explanation for why any aspect of the Monitoring Workplan was not completed.	2.2	**Delta RMP Monitoring**
List of all publicly available datasets (including data and metadata).	2.1	**Summary of Public Datasets**
Deviations from the Monitoring Workplan, Data Management Plan, and Quality Assurance Project Plan (QAPP).	2.2, 2.3	**Delta RMP Monitoring, Deviations and Corrective Actions**
Quality Assurance Section	3	**Quality Assurance – Data Managed by the Delta RMP**
	4	**Quality Assurance – Data Not Managed by the Delta RMP**
List and description of all deviations to the QAPP.	2.3	**Deviations and Corrective Actions**
Corrective action(s) taken to address the deviation(s)	2.3	**Deviations and Corrective Actions**
Description of how the Delta RMP monitors the effectiveness of any corrective actions and ensure any deviations do not occur frequently in the future.	2.3	**Deviations and Corrective Actions**
Summary of dataset completeness.	3.1.1.1, 3.2.1.1	Quality Control Sample Completeness
Summary of dataset precision.	3.1.1.2, 3.2.1.2,	Acceptability of Precision Measurements
Summary of dataset accuracy.	3.1.1.3, 3.2.1.3	Acceptability of Accuracy Measurements
List and description of sample comparisons or tests that did not meet minimum test acceptability criteria for analyses or were considered invalid.	3.1.1.4, 3.2.1.4	Invalid Data
Results for all analyses completed during the reporting period and comparison of results to previous year's observations, if applicable.	Attachments A-C	NA

Annual Report Requirement from Resolution (Attachment A, 5)	Section Number	Section Header
List of monitoring data (and associated metadata) that do not meet predetermined quality control measures and measurement quality objectives.	Attachments A-C	NA

Figure 1. Overview of progress of Delta RMP projects and studies during FY 21-22.
Not all studies start and end within a fiscal year; the number of events listed indicates the number of events completed in the fiscal year.

	Mercury	Nutrients - Microcystis	Nutrients - Cyanotoxins	Pesticides & Toxicity	CECs
Monitoring	Year 6 Monitoring 3 of 3 Events	Study Monitoring 2 of 6 Events	Study Monitoring 12 of 24 Events	Year 2 (Extended) Monitoring 2 of 6 Events	Year 2 Monitoring 4 of 4 Events
Data	Data Under SWAMP Review	Data Submitted Dec 2021	Data Incomplete Publication Spring 2023	Data Publication April / Aug 2022	Data Publication Dec 2022
Reports	Field Cruise Reports Submitted Jun 2022	Study Report Submitted Dec 2021	Study Report Expected in 2023	Year 2 Data Report Finalized April / Aug 2022	Year 2 Data Report Finalized Nov 2022

2 PROGRESS OF FY 21-22 MONITORING PROJECTS

2.1 SUMMARY OF PUBLIC DATASETS

A summary of datasets collected during FY 21-22 that have been published to an approved public database are outlined in **Table 2** for data in the California Environmental Data Exchange Network (CEDEN) and in **Table 3** for data in other publicly available databases such as National Water Information System (NWIS).

For the FY 21-22, two of the five monitoring sectors have datasets transferred to CEDEN:

- Current use pesticides (CUP) and aquatic toxicity
- Constituents of Emerging Concern (CECs)

The CUP project data are processed and evaluated on a water year (WY) basis. The CUP WY 2021 data were transferred from the Central Valley Regional Data Center (CV RDC) to CEDEN. A majority of the data were verified and transferred to CEDEN in April 2022 including pesticide and toxicity data. In August 2022, the remaining data from the National Water Quality Laboratory (NWQL) were transferred to CEDEN. The transfer of these data to CEDEN coincided with a data report which evaluates the WY 2021 dataset in its entirety. The WY 2021 CUP Data Report is provided in **Appendix I**; the data for the WY 2021 are included as Attachment A to this report.

The CEC Year 2 data set has been successfully transferred from the CV RDC to CEDEN. Data were transferred upon approval by the CEC Technical Advisory Committee (CEC TAC) in December 2022. The Year 2 Data Report is included in **Appendix II** and the finalized CEC data are included as Attachment B.

Data collection for the Microcystis Source Tracking Study conducted by Bend Genetics and the CVRWQCB was completed in July 2021. Additional funding from outside the Delta RMP was procured to continue and expand the study into 2022. The dataset collected with Delta RMP funding has been submitted to the CVRWQCB and the State Water Resources Control Board (State Board or SWRCB) in tabular form and was included as Attachment D in the FY 20-21 Delta RMP Annual Report. When the final report has been approved by the BOD, the report and dataset will be available on the Delta RMP website.

Mercury data were submitted to the State Board Surface Water Ambient Monitoring Program (SWAMP) staff by Moss Landing Marine Laboratories (MLML) as CEDEN comparable Electronic Data Deliverable (EDDs). Mercury results were submitted to the State Board between September 2021 through June 2022; as of January 31, 2023, the FY

21-22 mercury data were still under review or in the process of being loaded to CEDEN. For this Annual Report, the original mercury CEDEN EDDs submitted to SWAMP are included as Attachment C.

Table 2. Publicly available datasets on CEDEN under the Program Code Delta RMP.

Parent Project Name	Parent Project Code	Project Name	Project Code	Agency	Sample Period	Status
Delta RMP – Current Use Pesticides	DRMP_CUP	2020 Delta RMP Current Use Pesticides	20DRMP5CUP	USGS	10/1/2020 – 9/30/2021	Available on CEDEN.
		2019 Delta RMP Current Use Pesticides	19DRMP5CUP	USGS	10/1/2019 – 9/30/2020	Available on CEDEN.
		2018 Delta RMP Current Use Pesticides	18DRMP5CUP	USGS	10/1/2018 – 9/30/2019	Available on CEDEN.
		2016 Delta RMP Current Use Pesticides	16DRMP5CUP	USGS	7/1/2016 – 6/30/2017	Available on CEDEN.
		2015 Delta RMP Current Use Pesticides	15DRMP5CUP	USGS	7/1/2015 – 6/30/2016	Available on CEDEN.
Delta RMP - Constituents of Emerging Concern	DRMP_CEC	2021 Delta RMP Constituents of Emerging Concern	21DRMP5CEC	MLJ	7/1/2021-06/30/2022	Available on CEDEN [1].
		2020 Delta RMP Constituents of Emerging Concern	20DRMP5CEC	SFEI	7/1/2020 – 6/30/2021	Available on CEDEN.
Delta RMP - Mercury	DRMP_Hg	2021 Delta RMP Mercury	21DRMP5Hg	MPSL-DFW	7/1/2021 – 6/30/2022	Data finalization underway; project is being managed by SWRCB.
		2021 Delta RMP Wetland Restoration Fish Mercury	21DRMP5Rest	MPSL-DFW	7/1/2021 – 6/30/2022	Data finalization underway; project is being managed by SWRCB.
		2020 Delta RMP Mercury	20DRMP5Hg	MPSL-DFW	7/1/2020 – 6/30/2021	Available on CEDEN.

DELTA Regional Monitoring Program

Parent Project Name	Parent Project Code	Project Name	Project Code	Agency	Sample Period	Status
		2020 Delta RMP Wetland Restoration Fish Mercury	20DRMP5Rest	MPSL-DFW	7/1/2020 – 6/30/2021	Available on CEDEN.
		2019 Delta RMP Mercury	19DRMP5Hg	MPSL-DFW	7/1/2019 – 6/30/2020	Available on CEDEN.
		2019 Delta RMP Wetland Restoration Fish Mercury	19DRMP5Rest	MPSL-DFW	7/1/2019 – 6/30/2020	Available on CEDEN.
		2018 Delta RMP Mercury	18DRMP5Hg	MPSL-DFW	7/1/2018 – 6/30/2019	Available on CEDEN.
		2017 Delta RMP Mercury	17DRMP5Hg	MPSL-DFW	7/1/2017 – 6/30/2018	Available on CEDEN.
		2016 Delta RMP Mercury	16DRMP5Hg	MPSL-DFW	7/1/2016 – 6/30/2017	Available on CEDEN.
Delta RMP - Pathogens	DRMP_PAT	2016 Delta RMP Pathogens	16DRMP5PAT	SFEI	4/1/2016 – 3/31/2017	Available on CEDEN.
		2015 Delta RMP Pathogens	15DRMP5PAT	SFEI	4/1/2015 – 3/31/2016	Available on CEDEN.

[1]Source monitoring data (runoff and effluent) are available on the Delta RMP website only (https://deltarmp.org/Water%20Quality%20Monitoring/Pesticides/AttachmentB_DRMP_CEC_Monitoring_Results_Yr2_Final_120522.xlsx).

The results of the cyanotoxin study conducted by the United States Geological Survey (USGS) and California Department of Water Resources (DWR) is not yet complete and ready for publication. Once these data are received and finalized, they will be uploaded to a combination of USGS and DWR public databases. The whole water sample analysis results generated by this study will be uploaded to NWIS under the USGS site numbers identified in **Table 3**. These results, along with those generated by the analyses of the Solid Phase Adsorption Toxin Tracking (SPATT) samples, will be published to the USGS ScienceBase; data are expected to be publicly available in Spring of 2023.

Continuous data collected are available through NWIS for the stations managed by USGS (LIB and MDM). Continuous data collected at stations managed by DWR (P8, RRI, and C10A) are available through the California Data Exchange Center (CDEC). There were delays in deploying the fluoroprobe at MDM which is described in a memo addressed to the DRMP BOD (**Appendix IV**); USGS will inform the DRMP when the fluoroprobe is working at this location.

Table 3. Publicly available datasets not on CEDEN.

Study	Location	Type	Site Code	USGS Site Numbers	Sample Period	Status
USGS/DWR Cyanobacteria Study	NWIS Web Interface [1]	Whole Water Cyanotoxin Results	LIB	11455315	3/1/2021 – 2/1/2023	Data Publication in 2023
			MDM	11312676		
			P8	375841121225601		
			RRI	375747121215401		
			C10A	374045121155200		
	USGS ScienceBase [2]	Whole Water and SPATT Sampler Cyanotoxin Results	NA	NA	3/1/2021 – 2/1/2023	Anticipated publication of provisional results in Spring 2023

[1]NWIS Web Interface is located: https://nwis.waterdata.usgs.gov/usa/nwis/qwdata
[2]USGS ScienceBase is located: https://www.sciencebase.gov/catalog/

2.2 DELTA RMP MONITORING

During FY 21-22, monitoring and reporting activities occurred for pesticides and aquatic toxicity, CECs, nutrients, and mercury. **Figure 2** is an overview of the monitoring events that occurred during FY 21-22 relative to the monitoring design study period. Below is a description of the monitoring studies and associated activities that occurred during FY 21-22.

2.2.1 Pesticides and Toxicity Multi-Year Study

Water year 2021 (October 1, 2020 – September 30, 2021; WY 2021) was an extension of Year 2 of a multi-year study of current-use pesticides and aquatic toxicity in the Sacramento-San Joaquin Delta. A rotating basin monitoring design with monitoring at two fixed sites began in October 2018. The study design originally included a 4-year monitoring program covering six Delta sub-regions followed by an interpretive report that will inform adaptive management and improve future monitoring. There were setbacks in continuing the Year 2 monitoring past March of 2020 due to delays in selecting a new toxicity laboratory. The Steering Committee decided to pause monitoring until the new toxicity laboratory was hired and to resume the Year 2 monitoring design in March 2021.

During that time, the Delta RMP solicited proposals for a new toxicity laboratory (previously the toxicity laboratory was the Aquatic Health Program Laboratory at UC Davis) and selected Pacific EcoRisk (PER) to perform toxicity analysis of the samples. Monitoring resumed in April 2021. There was a total of four events completed for WY 2021 comprising Events 3 through 6 of the extended Year 2 monitoring. Two of the four events were completed in the FY 21-22 – Event 5 (sample dates August 10 and 11, 2021) and Event 6 (sample dates (September 13 and 14, 2021; **Figure 2**).

Samples were analyzed for a suite of 174 pesticides by the USGS Organic Chemistry Research Laboratory (OCRL). Compounds include fungicides, herbicides, insecticides, and their degradation products. In addition, crews measured field parameters (water temperature, pH, conductivity, dissolved oxygen, and turbidity), and documented conditions at the field site. The USGS NWQL analyzed samples for copper and ancillary parameters (total nitrogen, total particulate carbon, particulate organic carbon(POC), and dissolved organic carbon (DOC)).

Pacific EcoRisk analyzed the toxicity of water samples for a suite of test organisms based on current Environmental Protection Agency (EPA) and SWAMP methods:

- *Ceriodaphnia dubia*, a daphnid or water flea (survival, reproduction) – sensitive to organophosphate pesticides.
- *Hyalella azteca*¸ an aquatic invertebrate (survival) – sensitive to pyrethroids
- *Selenastrum capricornutum* (also known as *Raphidocelis subcapitata*), a single-celled algae (growth) – sensitive to herbicides.
- *Chironomus dilutes*, midge larvae (formerly *Chironomus tentans*) – sensitive to fipronil and more sensitive in chronic exposures to imidacloprid than *C. dubia*.
- *Pimephales promelas* (growth, survival) – chronic and acute effects on whole organism growth and survival.

The Delta RMP convened a Toxicity Identification Evaluation (TIE) Subcommittee in 2015 with the main responsibility of rapidly deciding, on a case-by-case basis, whether and how to allocate resources to conduct TIEs for samples exceeding a toxicity threshold (≥50% reduction in organism response relative to the lab control) and whether to conduct any follow-up analyses (e.g., additional TIE treatments, supporting analytical chemistry) with a sample where results may not clearly indicate a pesticide or class of contaminants causing toxicity. The TIE Subcommittee was originally created to report results to the Delta RMP TAC. The Delta RMP reconvened the TIE Subcommittee in March 2021 with the charge that the subcommittee shall be lead and coordinated by the Delta RMP Program Manager along with the contracted toxicity laboratory and be composed of a representative from each of the following categories: agriculture, stormwater agencies, publicly owned treatment works, coordinated monitoring, and regulatory agencies. There were four samples with TIEs performed during WY 2021 and one of the four TIEs was performed during FY 21-22 on a sample collected on August 10, 2021.

All data collected for the WY 2021 events were summarized in the CUP WY 2021 Data Report which was reviewed by the CUP TAC who recommended approval by the BOD. The CUP WY 2021 Data Report was approved in two stages by the BOD, with the main report approved in April of 2022 and Appendix A (containing the NWQL data) approved in August of 2022; both are included as **Appendix I.**

2.2.2 Constituents of Emerging Concern

During FY 21-22, the Delta RMP completed Year 2 of the July 2018 Central Valley Pilot Study for Monitoring Constituents of Emerging Concern Work Plan (CEC Stakeholder Workplan). For the Year 2 monitoring design, Supplemental Environmental Project (SEP) funds were not available and DWR was unable to provide in-kind services to collect samples. The second year of the CEC Stakeholder Workplan included “source” water sample collection—wastewater treatment plant effluent and stormwater runoff. The CEC Year 2 Quality Assurance Project Plan (QAPP) was approved by the Steering Committee in October of 2021 and sample collection began later that month.

The first CEC Year 2 event occurred in October 2021, included monitoring of water (12 sites), sediment (3 sites), fish (4 sites), and clams (6 sites). One exception in the first event was sediment that was collected by the SWAMP Stream Pollution Trends Monitoring (SPoT) Program which collected samples at Discovery Cove in July of 2021. A second event occurred in October (first flush event, Event 2) followed by monitoring in March 2022 (wet event, Event 3) and June 2022 (dry event, Event 4). All four CEC Year 2 events occurred during FY 21-22 (**Figure 2**).

The data from CEC Year 2 were reviewed and assessed by MLJ Environmental and MLML; all results have been shared with the Regional Board and were uploaded into the CV RDC throughout FY 21-22. Data were finalized and ambient water data were transferred to CEDEN in November 2022. All data collected in Year 2 are available on the Delta RMP website including the source monitoring location data.

MLJ Environmental provided a Year 2 Data Report to the CEC TAC. Upon review, the CEC TAC recommended the report be sent for review and recommendation of approval by the Steering Committee. The CEC Year 2 Data Report was approved by the BOD in November 2022 and is included as **Appendix II**.

2.2.3 Nutrients Studies

2.2.3.1 2016 Water Year Modeling Report

The Delta-Suisun Water Year 2016 Hydrodynamic Biogeochemical Modeling Report conducted by Aquatic Science Center (ASC) was reviewed by the Nutrient TAC and recommended for approval on November 18, 2021. The SC recommended approval of the report on February 8, 2022, and it was approved by the BOD on February 22, 2022. The 2016 WY Modeling Report is included as **Appendix III**.

2.2.3.2 Sacramento River Nutrient Change Study (SRiNCS) Report

Sampling for the Sacramento River Nutrient Change Study Phase 1: Effluent Valve Replacement Hold was conducted in September 2019. This study was a collaborative effort between Regional San, Applied Marine Sciences (AMS), USGS, and San Francisco State University.This study tracked the effects of changes in nutrient loading resulting from a short-term wastewater hold at the Sacramento Regional Wastewater Treatment Plant (SRWTP). In the summer of 2019, scheduled wastewater effluent holds occurred during the Effluent Valve Replacement (EVR) project, part of the EchoWater upgrade at the SRWTP. During an EVR hold, no treated effluent entered the Sacramento River for a period of up to 48 hours. Based on prior USGS research, this should create a parcel of effluent-free river water over six miles long in the Sacramento River. The impacts of short-term changes in nutrient loading were tracked in parcels of water with and without effluent during movement downstream in the Sacramento River and nearby channels. The project consisted of a one week-long river sampling campaign, field measurements, laboratory analyses, numeric modeling, and reporting. The project used multiple methods, including boat-mounted, high frequency monitoring of nutrients and fluorescence; discrete sampling for analyses of water quality, phytoplankton and zooplankton abundances, clam biomass, and phytoplankton carbon uptake (to determine growth rates). Data and hydrodynamic modeling were used to evaluate the response of phytoplankton to a range of nutrient loads and forms, as well as factors of light, turbidity, water residence time, and grazing by zooplankton and clams. A modeling report by Risk Management Agency (RMA) (standalone deliverable for the SRiNCS project) was previously approved and is available on the website (https://deltarmp.org/Documents/RMA2020.zip). Results from the SRiNCS project and a draft report were presented to the Nutrient TAC in April 2022, as well as a presentation of the results to the SC in June 2022. The SRiNCS report is undergoing the second internal review by the USGS. Once the review process is complete, the final report will be brought to the SC for recommendation to the BOD for approval.

2.2.3.3 Microcystis Study

The Source Tracking of Cyanobacteria Blooms in the Sacramento-San Joaquin Delta (also referred to as the Microcystis Study) is focused on the knowledge gap of understanding where blooms of the common Cyanobaceria Harmful Algal Bloom (CHAB) genus, *Microcystis*, originate in the Delta. The project's primary hypothesis is that there are specific areas, where flows and tidal velocity are low, that contain high concentrations of benthic resting cells (*Microcystis* cells that overwinter at the sediment surface). This project was approved by the Delta RMP in August 2020 and is funded using Supplemental Environmental Project (SEP) funds obtained by the Regional Board as a result of enforcement actions.

The project began in November 2020 with a combination of water and sediment samples collected over the course of six total events. Water samples were collected during four events from June 2021 through August 2021 at 8 sites and sediment was collected during four events from November 2020 through June 2021 at 7-8 sites. The final two of the six sampling events (occurring in July and August of 2021) were conducted during FY 21-22 (**Figure 2**).

Dr. Ellen Preece, project lead, presented the results from the study to the Nutrient TAC on September 22, 2021. The report was completed with funding by the Delta RMP and Regional Board was submitted to both Regional Board and the Delta RMP on December 31, 2021 including all associated data. The Microcystis Source Tracking report was included as Appendix II in the FY 20-21 Annual Report. The Nutrient TAC reviewed the report on February 25, 2022

The Nutrient TAC decided to wait to make a recommendation on the report until the second phase of the study, funded with non-Delta RMP funds, is complete. It was originally expected that the final report would be available in summer 2022; it is now expected that the report will be available in late spring 2023.

2.2.3.4 USGS/DWR Cyanobacteria Study

The Delta RMP agreed to contribute funds to the following USGS/DWR monitoring effort, "Cyanotoxin Monitoring in the Delta: Leveraging existing USGS and DWR field efforts to identify cyanotoxin occurrence, duration and drivers," which included funds for the deployment of an additional instrument that monitors phytoplankton taxonomy continuously (bbe Fluoroprobe) at the Middle River station.

The study originally proposed to collect cyanotoxin data year-round (fall 2020 to fall 2021) from 4 stations in the Delta to enhance existing monitoring programs for flow, nutrients, water quality and phytoplankton, including Harmful Algal Blooms (HABs). Due to COVID-19 restrictions, sampling did not begin until March 2021 and the Delta RMP funds were set to continue to fund this project through February 2022. An amendment to the FY 21-22 Workplan was approved to continue funding an additional 12 months of cyanotoxin monitoring at the Middle River Station in the Delta to continue the work. Funding to continue the study at the other 5 monitoring locations was provided by Proposition 1. This amendment was recommended by the SC and was approved by the BOD on January 24, 2022. The final eight months of the initial study funding (July 2021 through February 2022) and the first four months of the extended funding for the Middle River station (March through June 2022) occurred during FY 21-22 (**Figure 2**). The USGS provided a memo to the DRMP BOD regarding delays in deploying the bbe Fluoroprobe at the Middle River location (**Appendix IV**); the USGS will inform the DRMP when the bbe Fluoroprobe is deployed and consistently collecting data.

The project includes measuring the presence of cyanotoxins with SPATT samplers and with discrete whole water sample collection at four locations: (1) Middle River at Middle River (MDM; USGS), (2) Liberty Island (LIB; USGS), (3) Vernalis (C10; DWR), and (4) Rough and Ready (P8; DWR). All stations measure flow and are equipped with Yellow Springs Instrument (YSI) EXOs field probes which measure water temperature, specific conductivity, turbidity, pH, dissolved oxygen, and chlorophyll-a/blue-green algae. These stations also have a SUNA nitrate analyzer, except Rough and Ready.

The data will help identify linkages between environmental drivers (nutrients, flow, temperature) on HAB formation and cyanotoxin production, and can be used by managers and modelers to inform the design of future monitoring programs and to develop predictive models. The project will include online access to data and visualizations of spatial and temporal trends in cyanotoxins and associated data for use by managers and scientists. Findings will be presented at local conferences (e.g., Bay Delta, Interagency Ecological Program) and presented to the Delta RMP upon request. At the end of the project, a status and trend report that describes the approach and methods, summarizes any issues or lessons learned that occurred during data collection, provides tabular and/or graphical summaries of the spatial and temporal patterns in the data, evaluates the data quality, and relates study findings to the Delta RMP management questions will be provided. The report will also include comparison between the whole water and SPATT data and between the Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS) and Enzyme-linked Immunoassay (ELISA) data. The report is expected for Nutrient TAC review in spring 2023.

2.2.4 Mercury Study

Fiscal Year 2021-2022 mercury monitoring evaluated mercury cycling in Delta water, and the uptake of methylmercury (MeHg) into fish. This year completed the sixth year of this project to support annual monitoring of higher trophic level fish and correlated this information to mercury and MeHg water and sediment concentrations measured at co-located sites. This information is critical to implementing the Delta MeHg Total Maximum Daily Load (TMDL), providing calibration and validation data for a California DWR mercury model, and informing other management and regulatory decisions related to water quality improvement and ecosystem restoration in the Delta.

This monitoring has provided essential evidence for regulators implementing the TMDL and contributed to ongoing analytical work by DWR.

The DWR model was used to guide regulations and operational decisions related to farming, flood control, and wetland management. Regional Board staff used these data to inform the 2020 Delta Mercury Control program including Phase 2 potential modifications and options.

As outlined in Appendix 5 of the FY 21-22 Workplan, there were three main elements of the FY 21-22 mercury monitoring design:

1. **Subregional trends in bass** - Continued annual monitoring of methylmercury in black bass ("black bass" includes largemouth, smallmouth, and spotted bass) at seven stations (distributed among the TMDL subregions) to firmly establish baseline concentrations and interannual variation in support of monitoring of long-term trends as a critical performance measure for the TMDL. The design from the initial

phase was planned to continue unchanged in the next phase. This design was planned to be re-evaluated after completion of a 10-year period (2016-2025).

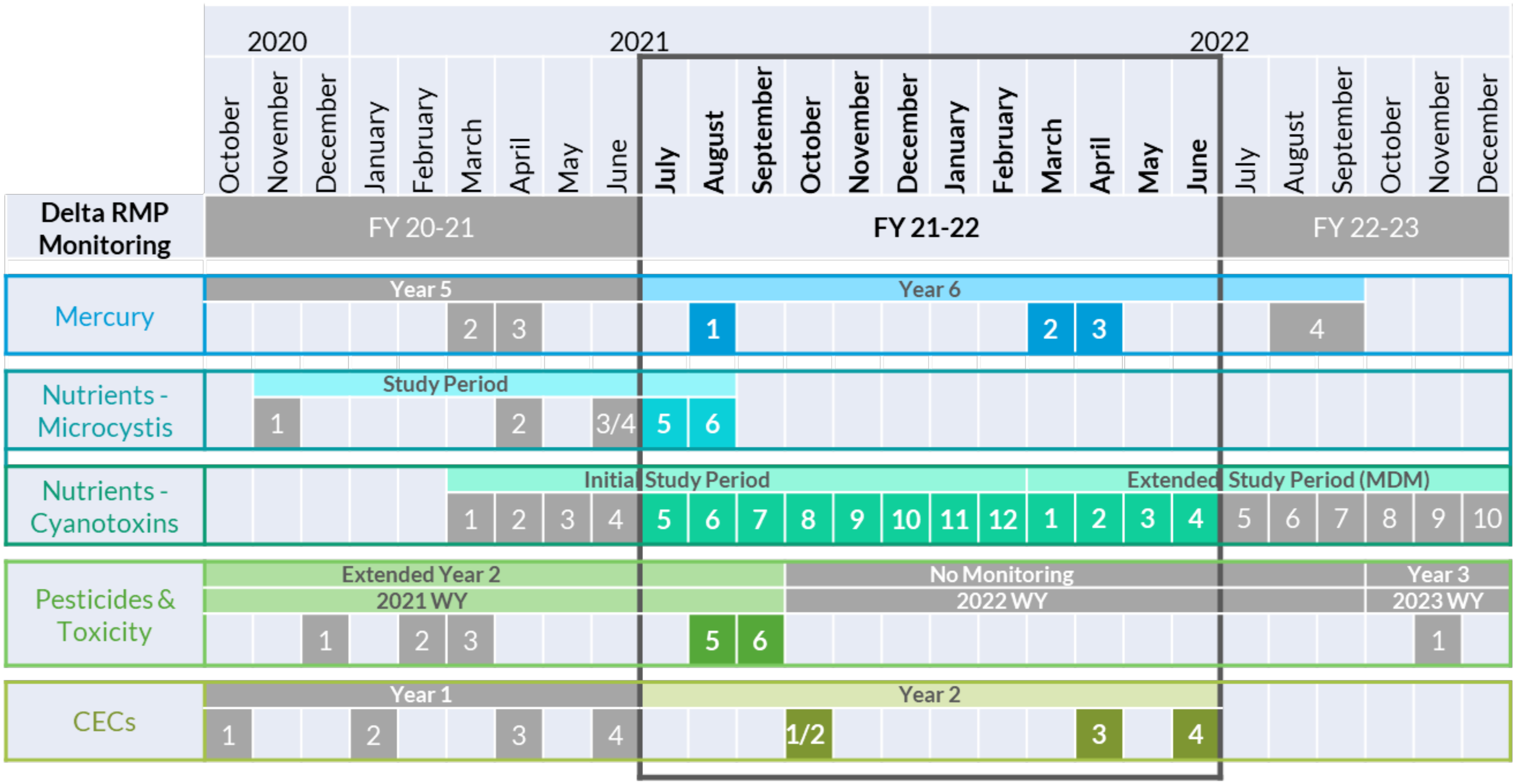
2. **Subregional trends in water** – Monitoring of methylmercury in water at seven stations in three sampling events (August 2021, and March and April 2022) extended the time series, with a low-cost approach, for time periods that are representative of conditions in high-flow (March and April) and low-flow (August) regimes and that link to concentrations in prey fish and black bass. These data may also be valuable in verifying trends and patterns predicted by numerical models of methylmercury transport and cycling being developed for the Delta and Yolo Bypass by the California DWR. These models may allow testing of various land and water management scenarios.
3. **Restoration monitoring** – In a new element added in FY19-20, annual monitoring of methylmercury in black bass and prey fish at new stations (five for black bass and eight for prey fish) located near habitat restoration projects will continue to assess the subregional impact of the projects on impairment. The details of the design for the restoration monitoring (station locations, mix of black bass and prey fish stations) have been determined with input from restoration managers and Delta RMP Mercury Subcommittee members.

Annual sport fish sampling started in August 2016 and was completed in August 2022 under the current monitoring design. The indicator of primary interest is total mercury in muscle fillet of 350-mm largemouth bass (or similar predator species). Total mercury in muscle fillet is a close surrogate for the element's more toxic form, methylmercury. The seven sites sampled are located to represent different subareas of the Delta and are located with the water monitoring sites.

Three monitoring events were conducted during FY 21-22 (**Figure 2**). Sport fish monitoring occurred in August 2021 at 5 core locations and 4 restoration locations. Water sampling was conducted during two events (March, and April) at seven sites that align with sport fish monitoring sites. Indicators of primary interest are concentrations of methylmercury and total mercury in water. Important ancillary parameters include chlorophyll-a, DOC, suspended sediment concentrations (SSC), total suspended solids (TSS), and volatile suspended solids (VSS). The May prey fish monitoring identified in the original study design was not included in the FY 21-22 mercury monitoring due to Delta smelt concerns and sensitive habitat permit restrictions. Cruise reports for the monitoring events conducted during FY 21-22 were provided to the Delta RMP on June 29, 2022 and are included as **Appendix** V.

During the FY 21-22, a Quality Assurance Summary for Year 4 was approved by the Delta RMP and is available on the website.

Figure 2. Summary of monitoring events in relation to study periods occurring during FY 21-22 for all monitoring sectors.



2.3 DEVIATIONS AND CORRECTIVE ACTIONS

The process to track deviations using the Delta RMP deviation forms was first implemented in 2019 by ASC. Under Resolution R5-2021-0054, all procedures that constitute a deviation from the associated approved QAPP must be approved by the CVRWQCB prior to implementation. Where deviations occur due to unanticipated circumstances and prior approval is not possible, the Delta RMP must notify the CVRWQCB Quality Assurance (QA) Representative within seven calendar days of becoming aware of the deviation. The Resolution was adopted in mid-October, 2021, therefore some of the deviations associated with activities in the early FY 21-22 may not adhere to the timelines and process of notification as outlined within the Resolution.

Deviations from approved QAPPs are documented via deviation forms which include:

- Description of the deviation that occurred
- Reason for the deviation
- Impact on the present and completed work
- Corrective actions taken as a result, by when and by whom

The deviation forms generated during FY 21-22, the associated corrective actions, and any resolutions are summarized below in **Table 4**.

Table 4. Summary of QAPP deviation forms submitted during FY 21-22.

Deviation Number	Status	Deviation Date	QAPP	Title	Description	Corrective Actions	Resolution
2020-20	Final	12/14/ 2021	DRMP QAPP v6.4 (CUP)	Updated USGS OCRL Method Detection Limits (MDLs)	During the review of USGS-OCRL data for Events 1 & 2, staff noted that the MDL and Reporting Limit (RL) values were the same and 71 results reported below the MDL/RL and were flagged according to the CV RDC business rule.	MDLs were updated to reflect the Limit of Detection (LOD). Results between the MDL and RL were updated to be consistent with data flagging rules. Updates to the OCRL method were discussed with SWRCB.	The dataset was updated by the CV RDC. The OCRL completed an MDL study in accordance with Water Boards guidance; updated method procedures were approved by CVRWQCB and SWRCB QA staff in June of 2022.
2020-21	Final	4/7/2022	DRMP QAPP v6.4 (CUP)	Delay in Uploading 2021WY data to CEDEN	Sampling for WY 2021 concluded on 9/14/21 and the goal date for submitting WY 2021 data to CEDEN agreed on with CVRWQCB staff was 4/1/22; however, this goal could not be met due to delays in receiving data.	Provide preliminary data to TAC and update data exports as soon as possible. Updates to future QAPPs to be consistent with Resolution timelines.	Preliminary data were provided within 2 days of receiving files. Data were transferred to CEDEN on 4/16/22. For WY 2023, NWQL was replaced by a commercial lab that can meet Resolution turnaround time; efforts are ongoing during WY 2023 to prevent data delays and to meet Resolution requirements.

Deviation Number	Status	Deviation Date	QAPP	Title	Description	Corrective Actions	Resolution
2020-22	Final	4/8/2022	DRMP QAPP v6.4 (CUP)	Method Updates for *Chironomus* and *Hyalella*	A discrepancy between the method references in the WY 2021 data report and the QAPP for *Chironomus dilutus* and *Hyallela azteca* was identified during the CUP TAC meeting on 4/8/22.	Consensus on the correct method references was reached between the CUP TAC, SWRCB, and PER; methods in the WY 2021 dataset were verified. Updates to the toxicity methods were made in the draft CUP QAPP.	The correct method references were agreed upon and will be included in future reports and QAPPs.
2021-01	Final	10/21/2022	CEC QAPP v2	Year 2 Clam Tissue Collection	Field crews could not collect the desired number and sizes of clams at San Joaquin River at Airport Way near Vernalis during Event 1, which may result in insufficient tissue for Polybrominated Diphenyl Ethers (PBDE) analysis.	AXYS to inform the DRMP Program Manager if there will be impacts on the analysis once it is known how much tissue is available.	Clam samples from three sites did not reach the 12g goal for a complete sample aliquot, resulting in raised RLs. All clam tissue samples reported PBDE detections in the quantifiable range, indicating that all RLs were at an appropriate resolution.

Deviation Number	Status	Deviation Date	QAPP	Title	Description	Corrective Actions	Resolution
2021-02	Final	10/25/2022	CEC QAPP v2	Buckley Cove Location Offset	San Joaquin River at Buckley Cove was sampled approximately 350 meters downstream of target coordinates for Event 2.	Sampling crews were instructed to contact the Program Manager and obtain approval from the CVRWQCB QA Representative prior to collecting samples from non-target location.	Sample location issues persisted at Buckley Cove in the subsequent events (see deviation 2021-06); the site location was eventually updated in the QAPP.
2021-03	Final	9/8/2021	CEC QAPP v2	TOC Missing Lab Duplicate Event 1 July	Weck Laboratories informed CV RDC staff that the analyst ran an LCSD instead of an unspiked laboratory duplicate as requested and required by the CEC QAPP v2.	The analytical batch missing the lab duplicate will be flagged with a Lab Submission Code of QI and a Lab Batch Comment. Weck was reminded of the Quality Control (QC) requirements for sediment TOC analysis.	All required laboratory QC samples (including an unspiked duplicate) were included with sediment TOC analysis associated with the subsequent sampling event.
2021-04	Final	12/22/2021	CEC QAPP v2	Missing Laboratory Duplicate for SSC Analysis	Weck informed CV RDC staff they were unable to generate an LCSD for the batches analyzed for SSC with the Events 1 and 2 samples.	Submit a deviation form to document missed QC sample and a QAPP amendment form to remove duplicate requirement.	An amendment to the CEC QAPP v2 (Amendment 2.3, **Table 5)** was approved on 4/28/2022.

Deviation Number	Status	Deviation Date	QAPP	Title	Description	Corrective Actions	Resolution
2021-05	In Review	2/14/ 2022	CEC QAPP v2	Weck MDLs and RL elevated for some Analytes	CV RDC verifying Pharmaceuticals and Personal Care Product (PPCP) results for Events 1 and 2 noted a discrepancy between the reported MDLs and RLs and the expected values in the CEC QAPP. Weck staff noted the values had been updated since QAPP approval.	Submit a QAPP Amendment to reflect update MDLs and RL.	An amendment to the CEC QAPP v2 (Amendment 2.4, **Table 5**) was approved on 6/2/2022; deviation form is still under review and is not yet approved.
2021-06	In Review	3/28/ 2022	CEC QAPP v2	Event 3 Field Sampling Deviations for 1 Site Offset and O_2 Saturation Not Reported	Samples for Event 3 were again collected offset from the target location at San Joaquin R at Buckley Cove. Also, sampling personnel did not record DO as % saturation at San Joaquin R at Buckley Cove and San Joaquin River at Airport Way near Vernalis.	The new CEC station code was updated to 544SJRNBC, San Joaquin River near Buckley Cove. MLJ will ensure, prior to next sampling event, that all field measures listed in the QAPP are able to be reported from all field crews and instruments.	An amendment to the CEC QAPP v2 was signed on 6/8/2022. All required field parameters were collected during Event 4
2021-07	Final	3/14/ 2022	DRMP QAPP v7 (CUP)	CUP Monitoring will not be collected for WY 2022.	On 3/14/22, the SC recommended to the BOD to postpone CUP sampling for WY 2022 until WY 2023.	A deviation was created to document that no monitoring would occur in WY 2022.	Monitoring resumed with the first storm of WY 2023 in November of 2022.

Deviation Number	Status	Deviation Date	QAPP	Title	Description	Corrective Actions	Resolution
2021-11	Final	4/11/22	DRMP QAPP v6.4 (CUP)	Buckley Cove Location Offset	USGS field crews confirmed that previous samples collected by Boat at San Joaquin River at Buckley Cove were collected approximately 350 meters downstream of target coordinates.	USGS will sample within 100 meters of the target coordinates beginning WY 2023. USGS will record actual coordinates with each sample collection moving forward.	Actual coordinates were recorded for all sites and the Buckley Cove samples were collected within the allowable range of the target locations for Event 1 of WY 2023.

2.3.1 Summary of Deviations from Delta RMP QAPP v6.4

2.3.1.1 Current Use Pesticides and Aquatic Toxicity

There were four deviations to the previous version of the Delta RMP QAPP which occurred during FY 21-22 and were associated with current use pesticides and aquatic toxicity. Deviation 2020-20 was related to updated MDLs and RLs associated with the results that were reported by USGS. The dataset required updates prior to the project being finalized. Ongoing updates to the analytical method procedures and documentation were coordinated with State Water Board guidance; an updated Standard Operating Procedure (SOP) and the associated method validation information was approved by Regional and State Board QA staff in June of 2022, to be included with the updated CUP QAPP covering the remaining two years of the monitoring design.

Deviation 2020-21 was related to a delayed transfer of data to CEDEN. The goal to transfer data by April 1, 2022 was agreed upon with CVRWQCB staff (which was slightly delayed from the six-month Resolution requirement); however, data reporting was delayed as a result of staffing issues associated with COVID at the NWQL and the additional time focused on MDL studies and the development of method documentation by USGS-OCRL staff, per State Board requests. The Delta RMP provided preliminary data and final data exports to TAC and CVRWQCB via the Delta RMP Droplet as soon as possible. The WY 2023 data were synchronized with CEDEN on April 16, 2022, with the exception of the NWQL data, which were received at a later date and transferred to CEDEN in August of 2022. Future QAPPs and data submittals will be consistent with Resolution timelines.

Deviation 2020-22 was related to toxicity method updates by PER and the dataset that was provided. There was clarification and consensus between CUP TAC, State Board, and PER for *Chironomus* and *Hyallela* methods cited in the WY 2021 dataset. These updates were added to the QAPP drafted for the next project year (v7.0) and included in future CUP QAPPs.

Finally, Deviation 2021-11 was caused by a monitoring location offset for samples collected at the San Joaquin River at Buckley Cove. Due to efforts to refine the sample collection location at the same site for the CEC project (Deviation 2021-02), DRMP staff reached out to USGS staff regarding the location from which they have historically collected samples at this site. Exact locations could not be compared to the target site coordination because USGS field crews did not historically record the actual collection locations coordinates with the field data; however, USGS staff confirmed that the typical location from which boat samples were collected was approximately 350 m from the target location, outside of the 100 m distance allowed by the QAPP. It was agreed that USGS field crews should begin collecting samples from the target location when sampling resumed for WY 2023, as well as begin to record actual collection coordinates at each site moving forward. The first WY 2023 event took place on November of 2022; actual coordinates were recorded at each sample location and the coordinates for the San Joaquin River at Buckley Cove were within the allowable distance of the target location.

2.3.2 Summary of Deviations from Delta RMP QAPP v7

2.3.2.1 Current Use Pesticides and Aquatic Toxicity

There was one deviation to the Delta RMP QAPP (v7) which occurred during FY 21-22. Deviation 2021-07 was associated with current use pesticides and aquatic toxicity and was identified prior to the study being implemented. On March 14, 2022, the SC recommended to the BOD to postpone CUP sampling for WY 2022 until WY 2023. The next project year for CUP Year 3 sampling will be associated with its own CUP QAPP. Monitoring resumed in November of 2022 with the first storm event of WY 2023.

2.3.3 Summary of Deviations from Delta RMP CEC QAPP v2

2.3.3.1 Constituents of Emerging Concern

Monitoring for CECs in FY 21-22 was the second year of the three-year monitoring design outlined in the CEC Pilot Study. The deviations that occurred during FY 21-22 were due to circumstances that became known once implementation of the study design had begun. Three of these had corrective actions associated with the deviations lead to QAPP amendments to reflect the implementation of the project more accurately (**Table 5**). Version 2 (v2) of the CEC QAPP was approved on October 11, 2021.

The following are summaries of each deviation that occurred during FY 21-22 and can also be found in the Year 2 Data Report (**Appendix II**) section on Deviations and Corrective Actions. On October 21, 2021, clams were collected at San Joaquin River at Airport Way near Vernalis (541SJC501) during the late Summer/ early Fall sampling (Event 1) for tissue analysis. Deviation 2021-01 was generated because field crews could not obtain the desired number and size of organisms and there was a potential for insufficient tissue for PBDE analysis for this site. It was agreed that the Delta RMP would follow up with SGS-AXYS to ensure that the Delta RMP was informed within 5 business days of compositing and weighing the samples to communicate the amount of tissue available for analysis. The clams were homogenized on June 8, 2022, and the Delta RMP was notified on June 14, 2022, that there were three composites that were below the desired 12 grams of wet weight tissue. The Delta RMP provided a summary of the homogenized clam weights to the CVRWQCB and informed them of the samples with low tissue mass on June 15, 2022. No concerns were raised, and the laboratory was instructed to proceed with the analysis. The required PBDE constituents were detected in the quantifiable range for all bivalve samples, indicating that despite being raised from the original level, the RLs reported were of a sufficient resolution for the study goals.

Deviation 2021-02 related to sample collection at San Joaquin River at Buckley Cove occurring more than 100 meters from the target site location. Corrective actions for this deviation included adding a comment to the CV RDC identifying that the collection occurred 350 meters from target and specifying that field crews should contact the Program Manager and receive approval from the CVRWQCB QA Representative prior to attempting to sample outside of the acceptable distance from the target location.

Site location issues persisted at the Buckley Cove location and were further addressed with Deviation 2021-06. Field sampling during Event 3 (March 28, 2022) at Buckley Cove again occurred at a distance greater than 100 m from the target. During this same sample event, it was also recognized that the field crew did not take Dissolved Oxygen at two sites. For this deviation on the sample location, information about the sample offset was identified and sent to the DRMP Program Manager and Regional Board Representative on the same day of occurrence. It was agreed that a new station code would be created, and the existing data would be updated to the new station code. An amendment to the CEC QAPP v2 was approved on June 8, 2022. To address the missed DO measurements, MLJ confirmed prior to the next sampling event that all field measures listed in the QAPP would be reported from all field crews and instruments.

Deviations 2021-03, -04, and -05 were all related to analyses run by Weck Laboratories (Weck). On September 8, 2021, Weck informed the CV RDC that the analyst ran a laboratory control spike duplicate (LCSD) instead of an unspiked laboratory duplicate as requested and required by the CEC QAPP v2 (Deviation 2021-03). The analytical batch missing the lab duplicate was flagged with a Lab Submission Code of QI and a Lab Batch Comment and it was confirmed that an unspiked TOC laboratory duplicate was analyzed in all subsequent events.

Deviation 2021-04 occurred when Weck informed the Delta RMP Data Management Team (DMT) on December 22, 2021 that given the constraints of the American Society for Testing and Materials (ASTM) method and the procedure for preparing laboratory control spike (LCS) samples, they were unable to generate a duplicate sample (i.e., a laboratory control spike duplicate (LCSD)) that could be used to asses laboratory precision for water samples collected during Event 1 (October 20-21) and Event 2 (October 25-26) SSC analyses. it was agreed that given the constraints of the analytical method and SWAMP guidance, an amendment to the CEC QAPP v2 should be submitted to revise the quality control requirements for SSC. An amendment to the QAPP was submitted for signatures on January 20, 2022.

Finally, Deviation 2021-05 was initiated when CV RDC staff reviewing data noted that the reported MDLs and one RL for PPCPs analyzed by Weck did not match the CEC QAPP v2. Staff confirmed with Weck that the MDLs RL were updated since the approval of the original QAPP; a QAPP amendment was also created to update the MDLs and RLs in accordance with the laboratory capabilities and submitted for signatures on June 2, 2022.

2.4 QAPP AMENDMENTS

When appropriate, an amendment to the approved QAPP is required. Amendments that were created during the FY 21-22 reporting period are summarized in **Table 5**.

Table 5 Summary of QAPP Amendments submitted during FY 21-22.

QAPP Name	Amendment	Monitoring Sector	Title	Description	Approval Status
CEC QAPP v2	2.1	CEC	Amendment to the Suspended Sediment Concentration (SCC) Method Reference	The reference to MPSL-108 in Table 7-3 of the DRMP CEC QAPP updated to ASTM D3977-97.	Approved 11/18/2021
CEC QAPP v2	2.2	CEC	Amendment to the Data Management Procedures for Laboratory Blank Contamination	The Data Management SOP were updated to incorporate the use of the QACode "FI" (analyte in field sample and associated blank).	Approved 1/3/2021
CEC QAPP v2	2.3	CEC	Amendment to the SSC Quality Control Sample Requirements	The requirement of a laboratory duplicate for SSC was removed to be consistent with the ASTM method and SWAMP guidance.	Approved 4/28/2022
CEC QAPP v2	2.4	CEC	Amendment to the Isotope Dilution Analogue reporting requirements and PPCP MDLs	The QAPP was updated to explicitly require that IDA recoveries be reported with all results analyzed using isotope dilution methods.	Approved 6/2/2022
CEC QAPP v2	2.5	CEC	Amendment to Update Station Location for San Joaquin River at Buckley Cove	The monitoring location at the San Joaquin River at Buckley Cove (544LSAC13) was updated to the San Joaquin River near Buckley Cove (544SJRNBC) to reflect the location more accurately at which sample collection occurred during previous events.	Approved 6/14/2022

QAPP Name	Amendment	Monitoring Sector	Title	Description	Approval Status
CEC QAPP v2	2.6	CEC	Amendment to Update Reporting Limit for Perfluorooctane-sulfonate and Perfluorooctanoate in sediments.	The RL for Perfluorooctanesulfonate and Perfluorooctanoate was updated to correct an erroneous value that was inadvertently included in the original QAPP.	Approved 7/14/2022
DRMP QAPP v7	7.1	Mercury	Amendment to Add an Additional Monitoring Event for Mercury	The time frame covered by version 7 of the DRMP QAPP was extended to account for an additional mercury monitoring event for fish and water in August of 2022.	Approved 7/14/2022

3 QUALITY ASSURANCE – DATA MANAGED BY THE DELTA RMP

3.1 PESTICIDES AND AQUATIC TOXICITY

Current-use pesticides and associated aquatic toxicity monitoring are conducted on a water year basis (October 1 through September 30). The samples collected during FY 21-22 were for the extended Year 2 of the monitoring design; the first two events were collected in FY 20-21 and monitoring was paused due to a delay in selecting a new toxicity laboratory (see **Pesticides and Toxicity Multi-Year Study**). Samples collected for pesticide analysis and toxicity testing during FY 21-22 included two of the additional four sampling events in WY 2021 (Events 3 and 4 were assessed in the last annual report).

- Event 5, occurring on August 10 and 11, 2021
- Event 6, occurring September 13 and 14, 2021

The WY 2021 samples were collected by USGS sampling crews for pesticide analysis at the USGS OCRL, copper and ancillary parameters analysis at the USGS NWQL, and toxicity testing by PER. The CUP WY 2021Data Report provides an assessment of the data generated from all four events that occurred during WY 2021 and is included as **Appendix I**. The Data Report includes a QA Report and an evaluation of the acceptability of the WY 2021 data. A summary of completeness, precision, and accuracy assessments is provided in the report and is briefly summarized here.

3.1.1 WY 2021 Monitoring Results for Pesticides and Aquatic Toxicity

3.1.1.1 Quality Control Sample Completeness

Of the samples planned for CUP monitoring during WY 2021, 100% (9,696 of 9,696) were collected and analyzed by USGS OCRL, the NWQL, and PER.

The Delta RMP QAPP (v6.4) requires that field duplicates and field blanks be collected with associated chemistry analyses at an annual rate of 5%, if applicable. For WY 2021, filed blanks comprised 6.1% (594 of 9,704) and field duplicates comprised 6.2% (606 of 9,704) of results received.

Laboratory QC sample requirements for chemistry analyses are a combination of method blanks, laboratory duplicates, matrix spikes, and laboratory control spikes and are method/analyte specific. Laboratory QC are required at a frequency of 1 in 20 samples or one per batch. Laboratory QC for toxicity testing entails the inclusion of a negative control sample with each batch. For WY 2021, Laboratory QC completeness was met by each laboratory at the following rates:

- 100% (12 of 12) of batches analyzed for pesticides by the OCRL,
- 35% (6 of 17) of batches analyzed by the NWQL, and
- 100% (40 of 40) of the toxicity batches analyzed by PER.

During WY 2021, overall batch completeness for WY 2021 was 84% (58 of 69). A comprehensive assessment of the QC completeness for the entire Water Year is addressed in the CUP WY 2021Data Report provided in **Appendix I**.

3.1.1.2 Acceptability of Precision Measurements

Precision is measured by a combination of field and laboratory duplicate samples including matrix spike duplicates (MSDs) and/or LCSDs for chemistry analyses.

During WY 2021, precision acceptability criteria were met at the following rates for all chemistry and toxicity results:

- 99.8% (605 of 606) of field duplicate samples,
- 99.8% (1,929 of 1,932) of laboratory duplicate samples,
- 100% (18 of 18) of LCSD samples, and
- 100% (583 of 583) of MSD samples.

Analyte-specific precision acceptability evaluations are provided in **Appendix I**.

3.1.1.3 Acceptability of Accuracy Measurements

Accuracy and bias in the field and laboratory are measured through a combination of negative and positive control samples. Bias introduced by field or chemistry laboratory contamination is monitored through field and laboratory blank samples. Laboratory accuracy for chemistry samples is also monitored through LCS, certified reference material (CRM), and MS samples, which contain a known amount of the target analytes and are processed alongside environmental samples and assessed against the expected results. Similarly, the accuracy of environmental results can be assessed with surrogate samples in which environmental samples are fortified with a known amount of an analyte that is chemically similar to the target analytes and therefore expected to perform similarly to laboratory conditions. Accuracy and bias in toxicity testing is assessed through the use of negative control samples performed with each batch and reference toxicant tests performed periodically by the laboratory.

During WY 2021, accuracy acceptance criteria were met at the following rates:

- 99.5% (591 of 594) of field blank samples,
- 100% (4 of 4) of filter blank samples,
- 99.8% (1,326 of 1,328) of laboratory blank samples,

- 100% (1,242 of 1,242) of LCS samples,
- 100% (42 of 42) of CRM samples,
- 100% (1,172 of 1,172) of MS samples,
- 100% (468 of 468) of surrogate samples, and
- 100% (68 of 68) of toxicity negative control samples.

Analyte-specific accuracy acceptability evaluations are provided in **Appendix I**.

3.1.1.4 Invalid Data

All results analyzed by USGS OCRL, NWQL, and PER for WY 2021 are considered valid and flagged according to DRMP QAPP v6.4 criteria.

3.2 CONSTITUENTS OF EMERGING CONCERN

The CEC Year 2 Data Report includes a QA Report which evaluates the acceptability of the data collected in FY 21-22 for the CEC Pilot Study (**Appendix II**). A summary of completeness, precision, and accuracy is included in the report and is briefly summarized here.

3.2.1 CEC Year 2 Monitoring Results

3.2.1.1 Quality Control Sample Completeness

Of the CEC samples planned for the Year 2 monitoring, 99.3% (1,273 out of 1,282) were collected and analyzed by the laboratories. Field QC sample requirements are outlined in the CEC Year 2 QAPP (v2). The requirements differ by matrix:

- Water samples require both field duplicates and field blanks,
- Sediment samples require only field duplicates, and
- Tissue samples require neither field duplicates nor field blanks.

Where required, field QC samples must be collected at a minimum frequency of 5%. For the Year 2 monitoring, field blanks comprised 8% (4 of 48) and field duplicates comprised 8% (4 of 48) of the water sample results received. Field blanks comprised 33% (1 of 3) of the sediment results analyzed.

Laboratory QC sample requirements are a combination of method blanks, laboratory duplicates, matrix spikes, and laboratory control spikes and are method/analyte specific. Laboratory QC are required at a frequency of 1 in 20 samples or one per batch. Laboratory QC completeness was met by each laboratory at the following rates:

- 64% (18 of 28) batches analyzed by Physis,
- 78% (7 of 9) of batches analyzed by SGS-AXYS,
- 100% (14 of 14) of batches analyzed by Vista, and

- 56% (28 of 50) of batches analyzed by Weck.

Overall batch completeness for Year 2 analyses was 66% (67 of 101). Analyte-specific QC completeness is addressed in the CEC Year 2 Data Report provided in **Appendix II**.

3.2.1.2 Acceptability of Precision Measurements

Precision is measured by a combination of field and laboratory duplicate samples including MSD and LCSD samples. During Year 2 monitoring, precision acceptability criteria were met at the following rates:

- 90% (111 of 123) of field duplicate samples,
- 95% (110 of 116) of laboratory duplicate samples,
- 95% (131 of 138) of LCSD samples, and
- 100% (36 of 36) of the MSD samples.

Analyte-specific precision acceptability evaluations are addressed in the CEC Year 2 Data Report provided in **Appendix II**.

3.2.1.3 Acceptability of Accuracy Measurements

Accuracy and bias in the field and laboratory are measured through a combination of negative and positive control samples. Bias introduced by field or laboratory contamination is monitored through field and laboratory blank samples. Laboratory accuracy is also monitored through LCS and MS samples, which are spiked with a known amount of the target analytes, processed alongside the environmental samples, and assessed against the expected results. For samples analyzed using isotopic dilution techniques, each sample is also spiked with an Isotope Dilution Analogue (IDA), which is an isotopically (mass) labeled form the target analyte. The responses of the IDAs are identical to non-labeled analytes present in the samples and are used to quantify the sample results. During Year 2 monitoring, accuracy acceptance criteria were met at the following rates:

- 87.5% (63 of 72) of the field blank samples,
- 91.8% (156 of 170) of the lab blank samples,
- 96.4% (378 of 392) of the LCS samples,
- 91.7% (66 of 72) of the MS samples,
- 94.6% (1,421 of 1,502) of the IDA results.

Analyte-specific accuracy acceptability evaluations are addressed in the CEC Year 2 Data Report provided in **Appendix II**.

3.2.1.4 Invalid Data

Analytical completeness is based on the number of constituents in each sample successfully analyzed and reported by the laboratory; completeness counts by individual constituent are provided in **Appendix II**. A total of nine expected environmental results and 10 QC results were not reported for Year 2 monitoring. Four of the nine missing environmental results were lipids associated with bivalve samples analyzed for PBDEs by SGS-AXYS which were not completed due to laboratory oversight.

The remaining five environmental and 10 QC results were flagged as rejected by the laboratory due to associated control sample failures and were provided as informational value only. All 15 results were associated with analyses of Per- and Polyfluoroalkyl Substances (PFAS) in fish tissue by SGS-AXYS.

4 QUALITY ASSURANCE – DATA NOT MANAGED BY THE DELTA RMP

4.1 NUTRIENTS

4.1.1 Cyanotoxin Monitoring in the Delta, USGS, and DWR

Data collection for the cyanotoxin study was originally planned for a 12-month period ending in February 2022 but was extended through February 2023. Data collection began in March 2021.

Quality assurance and QC procedures for these samples are conducted according to the individual quality assurance manuals and standard operating procedures maintained by USGS and DWR. Field QC sample collection follows the USGS and DWR quality assurance protocols for blanks and replicates. A minimum of one QC sample (e.g., blank, replicate) will be collected every 10 samples (10% of the total environmental samples). Quality control data will be reviewed by the project chief and QC failures are assessed by staff. Corrective actions are taken with either field or laboratory staff, as necessary.

Data generated by this study are still being analyzed by the laboratories and processed by USGS. Study data have not yet been provided to the Delta RMP. Once complete, whole water sample results will be made available on NWIS. Both whole water and SPATT sampler results will be made available via the USGS ScienceBase once processed and reviewed.

4.1.2 Source Tracking of Cyanotoxin Blooms in the Delta, Bend Genetics, and CVRWQCB

Field sampling began in November 2020 and concluded in July 2021 for the phase of the Microcystic study with funding by the Delta RMP. A final report, *Mapping benthic overwintering Microcystis sp. within the Sacramento-San Joaquin Delta*, was provided to the Data are not yet published to CEDEN and are pending SWRCB guidance on storing Quantitative Polymerase Chain Reaction (qPCR) results.

4.2 MERCURY MONITORING

Mercury monitoring for FY 21-22 was originally planned to take place over four events. Prey fish monitoring at wetland restoration sites was scheduled for May of 2022 but due to permitting constraints, prey fish monitoring was cancelled for FY 21-22. Three of the four originally planned events were completed as planned in September 2021, March 2022, and April 2022. The Department of Fish and Wildlife would not issue permits to collect prey fish in areas of sensitive habitat for Delta smelt for the planned May 2022 event. Cruise reports were provided to the Delta RMP on June 29, 2022 and are included as **Appendix** V**.** An amendment to the DRMP QAPP v7 (**Table 5)** for mercury monitoring was drafted in March of 2022 and approved on July 14, 2022 to allow for an additional collection of fish tissue from core (5 stations) and restoration (4 stations) sites and water (7 stations) in the fall of 2022.

The data generated during the three sampling events conducted during FY 21-22 have been processed and submitted to SWAMP for final data review and upload to CEDEN. These data are currently under review by SWRCB staff and not yet available to the public via the CEDEN Advanced Query Tool (AQT). The preliminary EDDs processed by MLML and provided to SWAMP are included in Attachment B to this report; these data are considered preliminary because they have not yet undergone a full SWAMP evaluation.

Mercury monitoring includes the collection of samples to be analyzed for total mercury in fish tissue (September only) and for mercury, methylmercury, and additional parameters in water (September, March, and April). Field QC sample requirements are outlined in the Delta RMP QAPP (v6.4):

- Mercury and methylmercury in water require field duplicates, field blanks, and equipment blanks,
- Additional parameters in water require field duplicates and field blanks, and
- Tissue samples require neither field duplicates nor field blanks.

Where required, field QC samples must be collected at a frequency of 5% of annual environmental samples. A complete assessment of the field QC frequency will be conducted when data are finalized and available to the public.

Lab QC samples required by the QAPP are a combination of laboratory blanks, duplicates, matrix spikes, control spikes, and CRMs. A complete assessment of the precision, accuracy, and completeness given the acceptability criteria for each of these samples will be conducted once the data are finalized and available to the public.

APPENDIX I – WY2021 CURRENT USE PESTICIDES USGS DATA REPORT

DELTA
Regional Monitoring Program

Data Report and Quality Assurance Evaluation

For Current Use Pesticide Monitoring during the 2021 Water Year

Submitted for Review by the Current Use Pesticide Technical Advisory Committee March 18, 2022

Prepared By:

USGS science for a changing world

MPSL

MLJ ENVIRONMENTAL

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LIST OF ACRONYMS

ACRONYM	DEFINITION
CEDEN	California Environmental Data Exchange Network
CRM	Certified Reference Material
CUP	Current Use Pesticide
CV RDC	Central Valley Regional Data Center
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DRMP	Delta Regional Monitoring Program
EDD	Electronic Data Deliverable
EPA	U.S. Environmental Protection Agency
GRTS	Generalized Random Tessellation Stratified
GC/MS	Gas Chromatography/Mass Spectrometry
LC/MS/MS	Liquid Chromatography/Tandem Mass Spectrometry
LCS	Laboratory Control Standard
m	Meter(s)
MDL	Method Detection Limit
MLJ	MLJ Environmental
MPSL-MLML	Marine Pollution Studies Laboratory at Moss Landing Marine Laboratories
MQO	Measurement Quality Objective
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PER	Pacific EcoRisk
PIC	Particulate Inorganic Carbon
POC	Particulate Organic Carbon
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
SD	Standard Deviations
SWAMP	State Water Resources Control Board's Surface Water Ambient Monitoring Program

TIC	Total Inorganic Carbon
TPC	Total Particulate Carbon
TPN	Total Particulate Nitrogen
TSS	Total Suspended Solids
USGS	U.S. Geological Survey
USGS CWSC	USGS California Water Science Center
USGS NWQL	USGS National Water Quality Laboratory
USGS OCRL	USGS Organic Chemistry Research Laboratory
WY	Water Year

LIST OF UNITS

°C	degrees Celsius
cfs	cubic feet per second
cm	centimeter
ft	feet
L	liter
m	meter
mg	milligram
mL	milliliter
ng	nanogram
NTU	Nephelometric Turbidity Unit
µg	microgram
µm	micrometer (micron)
µS	microsiemen

INTRODUCTION

BACKGROUND

This report summarizes the Delta Regional Monitoring Program's (DRMP's) sample collection and data verification of Water Year (WY) 2021 data for its Current Use Pesticide (CUP) project. These data represent the second and final year of sampling the Sacramento River and Northeast Delta subregions (see Sampling Locations), and the third year of monitoring under the revised monitoring design approved by the DRMP Steering Committee in 2018.

A revised QAPP was prepared for the DRMP pesticide and toxicity research program and was approved by the DRMP Steering Committee on March 18, 2021. Additional revisions/updates were made based on the review and feedback from the State Board QA Officer. Work going forward will follow the guidelines established in this version of the QAPP and the program design approved in 2018.

ANALYTICAL SCOPE

Water Year 2021 DRMP CUP monitoring includes the sampling and analysis of numerous pesticides, six ancillary parameters, and a single metal. During the sampling for these analytes, field measurements are performed on a suite of water quality parameters. Potential biological impacts of the above analytes are assessed with the performance of five toxicity tests.

The entire DRMP CUP analytical scope appears in **Table 1**.

Table 1. Analytical scope.

MATRIX	ANALYTE/PARAMETER
Samplewater	Current Use Pesticides[1]
Samplewater	Total Suspended Solids
Samplewater	Dissolved Copper
Samplewater	Dissolved Organic Carbon
Samplewater	*Pimephales promelas* (7-day Chronic)
Samplewater	*Ceriodaphnia dubia* (6-8 day Chronic)
Samplewater	*Selenastrum capricornutum* (96-hour Chronic)
Samplewater	*Chironomus dilutus* (10-day Chronic)
Samplewater	*Hyalella azteca* (96-hour Acute)

Matrix	Analyte/Parameter
Samplewater	Dissolved oxygen
Samplewater	pH
Samplewater	Specific conductance
Samplewater	Turbidity
Suspended Sediment	Particulate Organic Carbon
Suspended Sediment	Total Carbon
Suspended Sediment	Total Inorganic Carbon
Suspended Sediment	Total Nitrogen

[1] See appendix **Table C.1** for complete list.

Toxicity Identification Evaluations

Toxicity Identification Evaluations (TIEs) are follow-up toxicity tests recommended by the TIE Subcommittee (a select group of appropriate Pesticides Subcommittee representatives). The toxicity laboratory notifies the TIE Subcommittee by telephone, text message, and email within 24 hours of observation that a sample (or samples) exceeds the TIE trigger (as outlined in the QAPP Appendix I).

Delta RMP TIE testing (as described in the QAPP section 13.2.5) has the primary goal of identifying whether pesticides are causing or contributing to toxic effects. This includes identification (or exclusion) of other factors (i.e., water quality conditions or other toxicants) contributing to reduced survival, growth, or reproduction. A phased TIE approach is used, to the extent possible, to achieve these goals by initially focusing on treatments that identify major classes of contaminants including pesticides. If the cause of an observed effect is not clear after initial TIE testing, or if further detail describing the type or specific toxicant is desired, then the TIE Subcommittee may choose to have the laboratory conduct additional TIE treatments. TIEs are not expected to require dilutions but are expected to use the minimum number of test replicates and organisms per replicate required by the method, unless otherwise determined in consultation with the TIE Subcommittee.

During WY 2021, the TIE Subcommittee became an Advisory Committee of the DRMP Board of Directors and is now referred to as the TIE Advisory Committee.

Delayed Data

A total of 32 environmental samples were analyzed by the United State Geological Survey (USGS) National Water Quality Laboratory (NWQL) for dissolved copper, dissolved organic carbon (DOC), total inorganic carbon (TIC), particulate organic carbon (POC), total particulate carbon (TPC), and total particulate nitrogen (TPN). Associated results were unavailable during the preparation of this report. To ensure a complete and consistent record of WY 2021, verification of USGS NWQL results will be detailed in a future **Appendix A** to this document.

INVOLVED ORGANIZATIONS

Water Year 2021 DRMP CUP monitoring includes six organizations performing administrative, laboratory, and/or field tasks. Details appear in **Table 2**.

Table 2. Involved organizations.

ORGANIZATION	TASK(S)
Marine Pollution Studies Laboratory (Moss Landing Marine Laboratories)	Data Management, Quality Assurance
MLJ Environmental	Project Management, Data Management, Quality Assurance
Pacific EcoRisk	Toxicity Testing
USGS California Water Science Center	Sample Collection
USGS National Water Quality Laboratory	Sample Analysis
USGS Organic Chemistry Research Laboratory	Sample Analysis

SAMPLING OVERVIEW

Sampling logistics for WY 2021 DRMP CUP monitoring are summarized in **Table 3** and detailed in the sections that follow.

Table 3. Sampling event information for Events 3-6 of Year 3 CUP monitoring taking place in WY 2021.

EVENT	CEDEN CODE	USGS SITE NAME	USGS SITE NUMBER	LATITUDE	LONGITUDE	DATE	TIME
3	544LSAC13	SAN JOAQUIN R A BUCKLEY COVE NR STOCKTON CA	375831121223701	37.97528	-121.37694	4/29/21	9:10
3	511ULCABR	ULATIS C A BROWNS RD NR ELMIRA CA	11455261	38.30667	-121.79361	4/28/21	8:25
3	NORT-009	DELTA RMP NORT-009	380720121295401	38.12235	-121.49829	4/29/21	11:25
3	NORT-010	DELTA RMP NORT-010	381612121283901	38.26999	-121.47745	4/28/21	14:25
3	NORT-011	DELTA RMP NORT-011	380845121360201	38.14596	-121.60069	4/29/21	12:55
3	NORT-012	DELTA RMP NORT-012	380722121313101	38.1228	-121.52521	4/29/21	11:55
3	SACR-017	DELTA RMP SACR-017	381627121351901	38.27415	-121.58859	4/28/21	10:45
3	SACR-018	DELTA RMP SACR-018	381423121322401	38.23966	-121.53999	4/28/21	11:45
4	544LSAC13	SAN JOAQUIN R A BUCKLEY COVE NR STOCKTON CA	375831121223701	37.97528	-121.37694	6/16/21	8:35
4	511ULCABR	ULATIS C A BROWNS RD NR ELMIRA CA	11455261	38.30667	-121.79361	6/15/21	8:25
4	NORT-013	DELTA RMP NORT-013	381235121302601	38.20981	-121.50713	6/16/21	11:10
4	NORT-014	DELTA RMP NORT-014	381449121295401	38.24697	-121.49829	6/16/21	12:05
4	NORT-015	DELTA RMP NORT-015	380747121334201	38.12969	-121.56176	6/15/21	11:45
4	NORT-016	DELTA RMP NORT-016	381206121322901	38.20163	-121.54138	6/15/21	13:30

Event	CEDEN Code	USGS Site Name	USGS Site Number	Latitude	Longitude	Date	Time
4	SACR-019	DELTA RMP SACR-019	383431121304201	38.57538	-121.51169	6/16/21	14:15
4	SACR-020	DELTA RMP SACR-020	381105121385301	38.1846	-121.64806	6/15/21	10:00
5	544LSAC13	SAN JOAQUIN R A BUCKLEY COVE NR STOCKTON CA	375831121223701	37.97528	-121.37694	8/11/21	9:20
5	511ULCABR	ULATIS C A BROWNS RD NR ELMIRA CA	11455261	38.30667	-121.79361	8/10/2021	14:25
5	NORT-017	DELTA RMP NORT-017	380834121281301	38.14276	-121.47036	8/11/21	12:05
5	NORT-018	DELTA RMP NORT-018	381008121281301	38.16881	-121.47039	8/11/21	11:25
5	NORT-019	DELTA RMP NORT-019	381710121301101	38.28613	-121.50318	8/10/21	9:35
5	NORT-020	DELTA RMP NORT-020	380751121342701	38.13087	-121.57406	8/11/21	12:50
5	SACR-021	DELTA RMP SACR-021	381837121355501	38.31035	-121.59847	8/10/21	11:45
5	SACR-022	DELTA RMP SACR-022	382451121311701	38.41424	-121.52147	8/10/21	11:00
6	544LSAC13	SAN JOAQUIN R A BUCKLEY COVE NR STOCKTON CA	375831121223701	37.97528	-121.37694	9/14/21	9:20
6	511ULCABR	ULATIS C A BROWNS RD NR ELMIRA CA	11455261	38.30667	-121.79361	9/13/21	8:25
6	NORT-021	DELTA RMP NORT-021	380922121301101	38.15614	-121.50311	9/14/21	11:55
6	NORT-022	DELTA RMP NORT-022	381611121294701	38.26963	-121.49641	9/13/21	12:20
6	NORT-023	DELTA RMP NORT-023	380604121334701	38.10115	-121.56298	9/14/21	13:20
6	NORT-024	DELTA RMP NORT-024	380806121334701	38.13515	-121.5631	9/14/21	12:40
6	SACR-023	DELTA RMP SACR-023	382939121332101	38.49416	-121.55587	9/13/21	14:05
6	SACR-024	DELTA RMP SACR-024	381347121361201	38.2297	-121.60339	9/13/21	10:40

STUDY BACKGROUND

The current monitoring design is focused on understanding pesticide occurrence and toxicity within the Sacramento/San Joaquin Delta by sampling a large number of sites (i.e., 36 per year), selected using a Generalized Random Tessellation Stratified (GRTS) approach. For logistical reasons, this revised design divides the Delta into six sub-regions based on water source, and only two adjacent sub-regions are sampled in any WY (**Figure 1** and **Figure 2**). The driver behind using the GRTS approach is that it generates a random sample of points across the delta and allows statistical analyses that do not violate the major assumption of all statistical tests, and that the samples collected are representative of the entire delta. The DRMP can now do comparisons across regions or over time and be able to state that the Delta is in good or bad condition. For the two sub-regions sampled, one sub-region is sampled completely (i.e., 24 GRTS sites) and the other sub-region is partially sampled (i.e., 12 GRTS sites). The remaining 12 GRTS sites within the partially sampled sub-region are sampled in the following WY.

In addition to the GRTS sites, two Delta input sites sampled during the 2015-2017 DRMP monitoring (i.e., Ulatis Creek at Brown Rd, San Joaquin River at Buckley Cove) continue to be sampled during the current program. It was decided to continue sampling at the two fixed sites to provide long term monitoring data. Additionally, these sites were chosen because they generally had the highest concentrations of pesticides and the most instances of aquatic toxicity of the five sites sampled in 2015-2017.

Under the current monitoring design, samples are collected during six targeted events (i.e., two fall/winter storms, spring runoff, and spring, summer, and fall irrigation period events). Samples are collected once per event at each of the two fixed sites and at six GRTS sites per event. A total of 48 environmental water samples are collected per year (i.e., 24 in one completely sampled sub-region, 12 in the partially sampled sub-region, and 12 samples collected at the fixed sites, **Table 4**).

The rotating sub-regional strategy is designed to complete sampling of the entire Delta over four years of monitoring. The second year of the current monitoring design was scheduled to be completed during WY 2020; however, sampling was paused after the second monitoring event due to a combination of the process to select a new toxicity laboratory and restrictions caused by COVID-19. Events 1 and 2 of the second monitoring year were fully completed during WY 2020 and the remaining sites planned for that year were continued during WY 2021, beginning with Event 3. Therefore, the WY 2021 monitoring described in this report encompasses Events 3-6 of the second year of monitoring under the current study design.

Table 4. Count of sites in each Subregion by WY and event.

WY	Event	Event Type	GRTS Sites Subregion 1	GRTS Sites Subregion 2	GRTS Sites Subregion 3	GRTS Sites Subregion 4	GRTS Sites Subregion 5	GRTS Sites Subregion 6	Fixed Site 1	Fixed Site 2	Total
WY 2019 (Year 1)	Event 1	Storm	4	2	--	--	--	--	1	1	8
	Event 2	Storm	4	2	--	--	--	--	1	1	8
	Event 3	Storm	4	2	--	--	--	--	1	1	8
	Event 4	Irrigation	4	2	--	--	--	--	1	1	8
	Event 5	Irrigation	4	2	--	--	--	--	1	1	8
	Event 6	Irrigation	4	2	--	--	--	--	1	1	8
WY 2020 (Year 2)	Event 1	Storm	--	2	4	--	--	--	1	1	8
	Event 2	Storm	--	2	4	--	--	--	1	1	8
WY 2021 (Year 2)	Event 3 [1]	Runoff	--	2	4	--	--	--	1	1	8
	Event 4	Irrigation	--	2	4	--	--	--	1	1	8
	Event 5	Irrigation	--	2	4	--	--	--	1	1	8
	Event 6	Irrigation	--	2	4	--	--	--	1	1	8
WY 2023 (Year 3)	Event 1	Storm	--	--	--	4	2	--	1	1	8
	Event 2	Storm	--	--	--	4	2	--	1	1	8
	Event 3	Storm	--	--	--	4	2	--	1	1	8
	Event 4	Irrigation	--	--	--	4	2	--	1	1	8
	Event 5	Irrigation	--	--	--	4	2	--	1	1	8
	Event 6	Irrigation	--	--	--	4	2	--	1	1	8
WY 2024 Year 4	Event 1	Storm	--	--	--	--	2	4	1	1	8
	Event 2	Storm	--	--	--	--	2	4	1	1	8
	Event 3	Storm	--	--	--	--	2	4	1	1	8
	Event 4	Irrigation	--	--	--	--	2	4	1	1	8
	Event 5	Irrigation	--	--	--	--	2	4	1	1	8
	Event 6	Irrigation	--	--	--	--	2	4	1	1	8
Total Samples			**24**	**24**	**24**	**24**	**24**	**24**	**24**	**24**	**192**

[1] Samples were collected from subregions 2 and 3 in March 2020 but where not tested for toxicity due to COVID-19 restrictions. Chemical analyses were run on the March 2020 samples; however, all sites scheduled for Event 3 in Year 2 were resampled and analyzed for both chemical constituents and toxicity in March of 2021.

Figure 1. Delta subregions with fixed and GRTS sampling sites in WY 2021.

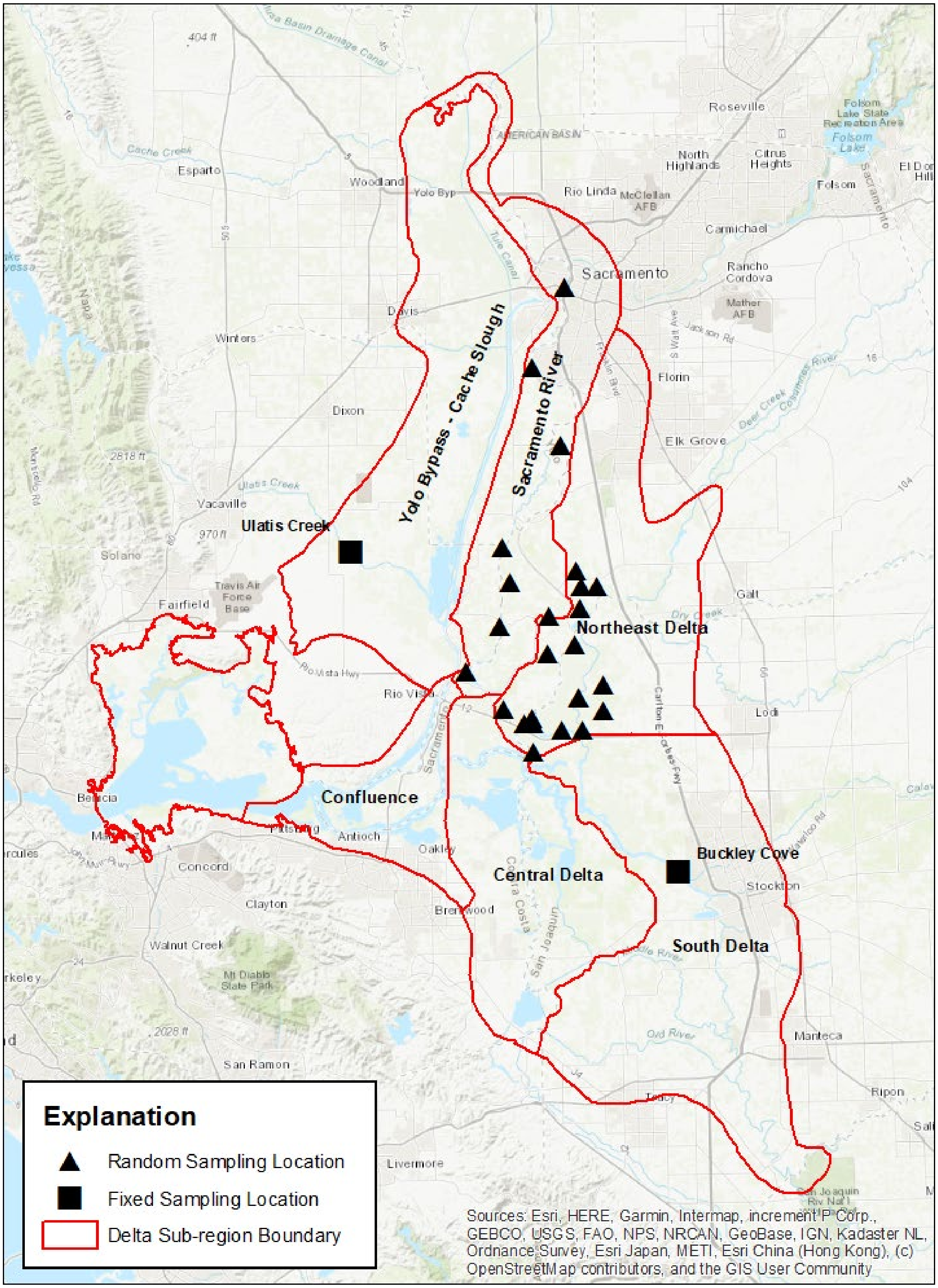
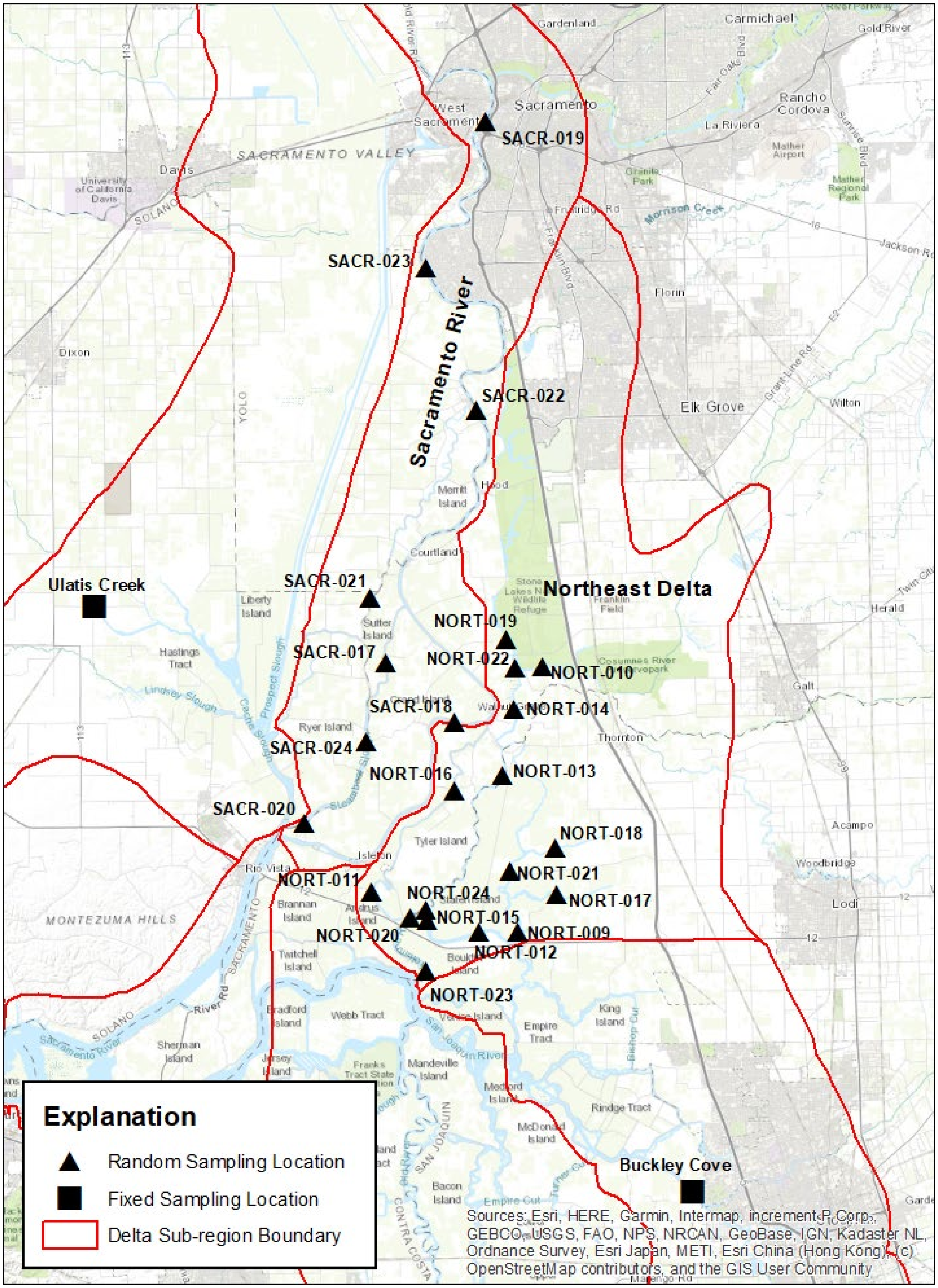


Figure 2. Fixed and GRTS sites sampled in WY 2021 (detailed map).



SAMPLING METHODS

Sampling for Events 3-6 was conducted by personnel from the USGS California Water Science Center (CWSC) at sites shown in **Figure 1** and **Figure 2** and following procedures described in Version 6.4 of the *Delta Regional Monitoring Program Quality Assurance Project Plan for Fiscal Year 2020–2021 Monitoring* (DRMP QAPP). Water samples were collected concurrently for analysis of pesticides, DOC, PIC, POC, TPC, TPN, and copper analyses as well as for multispecies toxicity testing. Monitoring photos taken by field crews during each event are provided in **Appendix B**.

All samples were collected as grab samples and all sites were accessed by boat with the exception of the fixed sampling station, Ulatis Creek at Browns Road. The study design approved by the DRMP called for grab samples because of the large volume of water required for collecting toxicity and pesticide samples concurrently. Samples were collected between the high and low tide, or on the ebb tide (for tidally influenced sites) by submerging narrow-mouthed bottles at mid-channel to a depth of 0.5 meters (m).

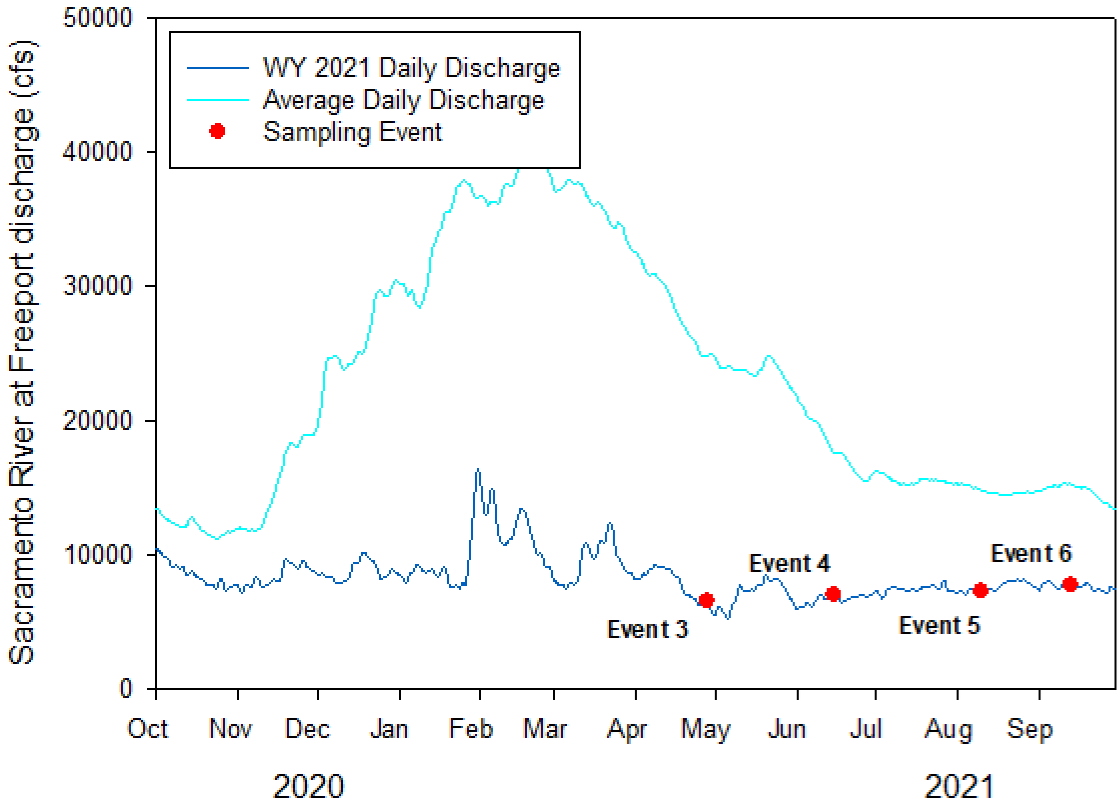
Pesticide samples were collected in pre-cleaned, baked amber-glass bottles and transported on ice to the USGS Organic Chemistry Research Laboratory (USGS OCRL) in Sacramento, California. Samples for analysis at the USGS NWQL (i.e., copper, DOC, POC, PIC, TPC, and TPN) were collected in Teflon bottles, processed at the USGS CWSC, and shipped on ice to the USGS NWQL. Sample collection and handling methods are described in more detail in De Parsia and others (2018 and 2019) and in the Delta RMP QAPP (2021). Water samples for toxicity analyses were collected in pre-cleaned, 4-liter, amber-glass bottles provided by Pacific EcoRisk (PER). Bottles were triple rinsed with native water on-site before sample collection. Ten bottles were collected at each site and transported on ice to the USGS CWSC where they were picked up by a PER courier at the end of each sampling day.

FIELD ACTIVITIES

Event 3

This was the first sampling event following the discontinuance of sampling in March 2020. Water year 2021 was characterized by below normal precipitation. Little to no rain occurred in the Sacramento and Delta region in either March or April 2021. As a result, Event 3 of WY 2021 can be considered a dry season/spring runoff event. Flow on area rivers was below normal (**Figure 3**).

Figure 3. Water year 2021 discharge for the Sacramento River at Freeport; sampling event dates and Sacramento River at Freeport Average Discharge.



At the time of sampling, some agricultural irrigation had been occurring for permanent crops like nuts and stone fruits, but most row crops and rice fields were still in the planting/preparation stage. A very minor precipitation event occurred on April 25, 2021, with precipitation totals in the Sacramento and Delta area totaling roughly 0.1" or less.

Sampling occurred over a two-day span from April 28th to April 29th. On April 28, 2021 water samples were collected from Ulatis Creek by wading at 08:25. It was noted that the low-flow channel had switched from the left bank and center of the channel to the right bank and center of the channel as it had been in previous years (**Figure B.1**). Samples were collected by hand dipping bottles in the center of the channel at 0.3-m depth.

Following sampling at Ulatis Creek, the full sampling crew met at the Rio Vista public boat ramp, launched the sampling boat, and proceeded on an approximately 30-mi loop course to collect samples at SACR-017 and SACR-018. Samples were collected at 10:45 at SACR-017 on Steamboat Slough and at 11:45 at SACR-018 on the Sacramento River (**Figure B.2**). The crew then returned to Rio Vista, pulled the boat and moved to Wimpy's Marina off Walnut Grove Road in Walnut Grove. Sampling of site NORT-010 on Lost Slough occurred at 14:25 (**Figure B.3**). Conditions were clear and warm with no precipitation. Samples were kept on wet ice and transported to the USGS CWSC at the Sacramento State campus. Toxicity samples were picked up by PER personnel at approximately 18:00.

On April 29, 2021 USGS personnel collected samples from the San Joaquin River near Buckley Cove, NORT-009, NORT-012, and NORT-011. The boat was launched from Ladd's Marina in Stockton at approximately 09:00 and samples were taken at Buckley Cove at 09:10. A toxicity duplicate sample was collected at this site. The boat was then relaunched from B&W Resort Marina in Isleton to better access the remaining sites. NORT-009 was sampled at 11:25 on South Mokelumne River. The exact sampling location could not be reached due to blockage by aquatic vegetation (**Figure B.4**). This vegetation looked dead, and it is unknown if it had recently been sprayed with herbicide or if it was killed by winter temperatures. Samples were collected approximately 40 m northwest of the target location. It was also noted while collecting samples at this site that two, spray-boom equipped helicopters flew overhead (less than 0.25 mi away). No spray was noted coming from the equipment, and the helicopters looked to be transiting from one location to another rather than making spraying passes. Additionally, agricultural disking was taking place on islands adjacent to the site and large volumes of dust were blowing around in the immediate area.

NORT-012 was sampled at 11:55 on the South Mokelumne River (**Figure B.5**). Again, agricultural disking was taking place on islands adjacent to the site and some dust was blowing around in the immediate area. NORT-011 was sampled at 12:55 on Georgiana Slough (**Figure B.6**). This site is close to numerous riverside residences and boat docks. All sites were sampled within acceptable distances from their respective target locations. Conditions were sunny and very warm. Samples were kept on wet ice and transported to the USGS CWSC at Sacramento State campus. Toxicity samples were picked up by PER personnel at approximately 16:30.

Event 4

This was the second sampling event of WY 2021 and is considered Event 4 of the second year of sampling under the current monitoring design. Samples were collected on June 15th and 16th. This is considered an irrigation runoff sampling event. On June 15, 2021, water samples were collected from Ulatis Creek by wading at 08:35 (**Figure B.7**). It was noted that flows seemed to be slightly higher than during the April sampling event. It was also noted that the water had a faint smell of treated wastewater and the water appeared cloudy. Dissolved oxygen (DO) was measured at 3.6 mg/L (**Table 15**). Samples were collected by hand dipping bottles in the center of the channel at a depth of 0.1 m.

Following sampling at Ulatis Creek, the full sampling crew met at the Rio Vista public boat ramp, launched the sampling boat, and proceeded to sample SACR-020. Samples were collected at 10:00 on Steamboat Slough near the confluence with Cache Slough (**Figure B.8**). The crew then returned to Rio Vista, pulled the boat, and moved to B&W Marina off Hwy 12. Sampling of site NORT-015 on the South Mokelumne River occurred at 11:45 (**Figure B.9**) and at NORT-016 on Georgianna Slough at 13:30 (**Figure B.10**). Conditions were clear and warm with no precipitation. Samples were kept on wet ice and transported to the USGS CWSC at the Sacramento State campus. Toxicity samples were picked up by PER personnel at approximately 17:00.

On June 16, 2021, USGS personnel collected samples from the San Joaquin River near Buckley Cove, NORT-013, NORT-014, and SACR-019. The boat was launched from Ladd's Marina in Stockton at approximately 08:25 and samples were taken at Buckley Cove at 08:35 (**Figure B.11**). The boat was then pulled and relaunched from Wimpy's Marina in near Walnut Grove. NORT-013 was sampled at 11:10 on North Mokelumne River (**Figure B.12**). It was noted that agricultural harvesting or roadside mowing was taking place adjacent to the sampling site and quite a bit of grass/fine vegetation debris was blowing onto the surface of the water during sample collection.

NORT-014 was sampled at 12:05 on Snodgrass Slough (**Figure B.13**). The boat and crew then returned to the marina, pulled the boat and drove to Miller Park in Sacramento. The boat was launched from Miller Park at approximately 14:00. Samples were collected at SACR-019 at 14:15 (**Figure B.14**). At this point field personnel realized that the site names for SACR-020 and SACR-019 had been switched during the previous day's sampling. PER personnel were immediately contacted by phone and notified of the mistake in bottle labeling. All sites were sampled within acceptable distances from their respective target locations. Conditions were sunny and very warm. Samples were kept on wet ice and transported to the USGS CWSC at Sacramento State campus. Toxicity samples were picked up by PER personnel at approximately 16:30.

Event 5

This was the third sampling event of WY 2021 and is considered Event 5 of the second year of sampling under the current monitoring design. Samples were collected August 10th and 11th. This is considered an irrigation runoff sampling event. Flows on area rivers were much below normal (**Figure 3**). Some agricultural land (e.g., rice) was fallowed in the Sacramento Valley due to the drought, resulting in lower-than-normal flows in agricultural drainage water influenced waterways.

On August 10, 2021, USGS personnel launched the boat at New Hope Landing Marina near Walnut Grove and proceeded to site NORT-019 on Snodgrass Slough (**Figure B.15**).

Sampling took place at 09:35 approximately 30 m west of the target coordinates due to the presence of abundant aquatic vegetation at the target coordinates. The presence of bright green algae was also noted at the site and personnel donned protective equipment (i.e., shoulder length gloves, face masks, and eye protection) during sampling (**Figure B.16**).

The crew then traveled through the Delta Cross Channel into the Sacramento River and proceeded approximately 15 miles north to site SACR-022 located on the Sacramento River at Clarksburg. It was noted that a barge and crane were conducting levee excavation work approximately 400 m upstream and that some woody debris was present at the site during sampling (**Figure B.17**). Samples were collected at 11:00 at the target coordinates. The crew then motored back south, entered Sutter Slough, and proceeded to site SACR-021 where samples were collected at the target coordinates at 11:35 (**Figure B. 18**). The crew then returned to New Hope Landing Marina.

At this point Jim Orlando and Matt Uychutin returned with the boat and samples collected so far to Sacramento while Matt de Parsia and Elisabeth Newman proceeded to Ulatis Creek to collect a sample there. Conditions at Ulatis Creek were similar to those encountered during the June sampling event with low water and the presence of much aquatic vegetation. Samples were collected at 14:25 by wading and hand dipping sample bottles (**Figure B.19**). It was noted that as during the previous sampling event, DO saturation was measured at a very low level (16.5%). Samples were kept on wet ice and transported to the USGS CWSC at the Sacramento State campus. Toxicity samples were picked up by PER personnel at approximately 17:00.

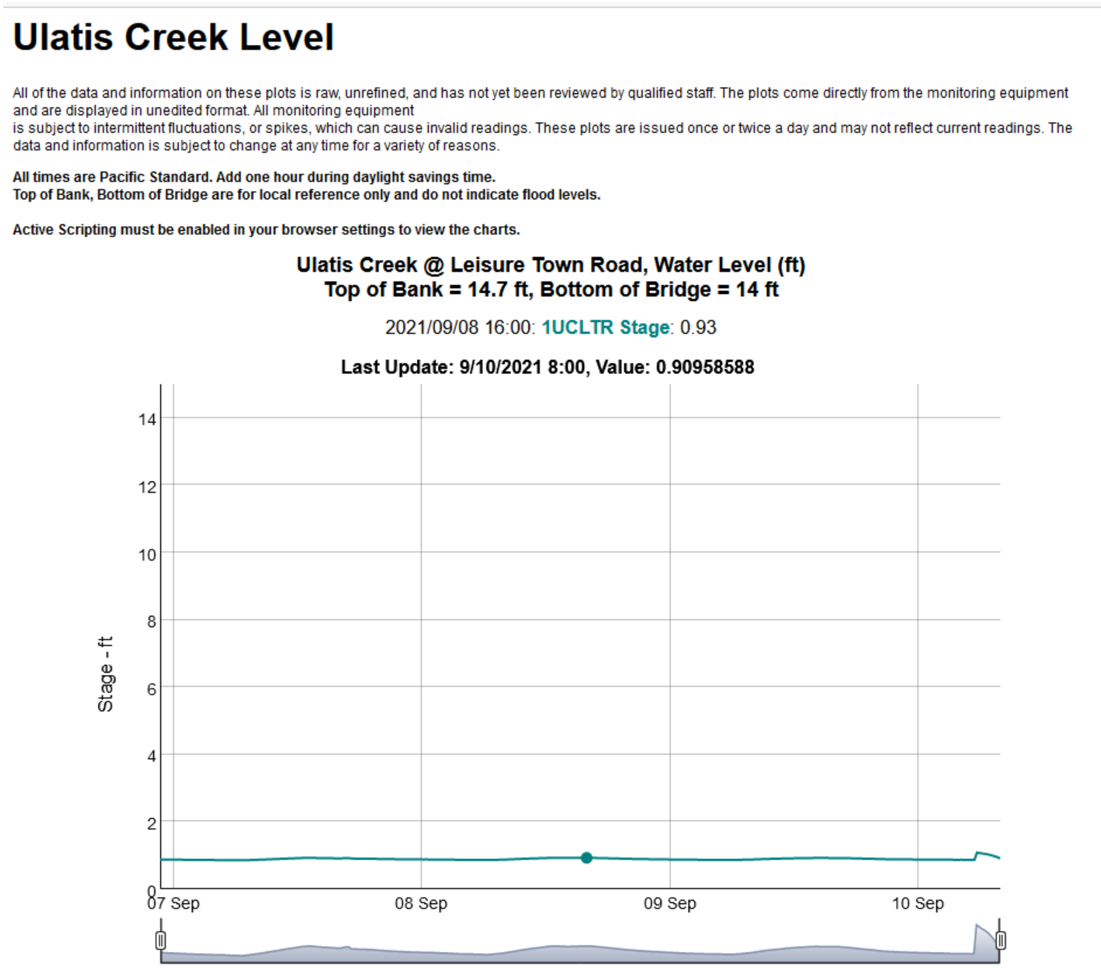
On August 11, 2021, USGS personnel collected samples from the San Joaquin River near Buckley Cove, NORT-017, NORT-08, and NORT-020. The boat was launched from Ladd's Marina in Stockton at approximately 09:00 and samples were taken at Buckley Cove at 09:20 (**Figure B. 20**). The presence of bright green algae was noted throughout the water column at the site and personnel donned protective equipment. The boat was then pulled and relaunched from B&W Marina. NORT-018 was sampled at 11:25 on Hog Slough (**Figure B.21**). It was noted that agricultural drain water was being pumped into the waterway approximately 500 m west of the sampling site (**Figure B.22**).

NORT-017 was sampled at 12:05 on Sycamore Slough at the target coordinates. It was noted that aquatic vegetation in both Hog Slough and Sycamore Slough looked wilted/browned in spots and was likely recently sprayed with herbicides (**Figure B.23**). The crew then proceeded to site NORT-020 at the confluence of the North and South Mokelumne Rivers. Samples (including a toxicity field duplicate) were collected at 12:50 (**Figure B.24**). Samples were kept on wet ice and transported to the USGS CWSC at the Sacramento State campus. Toxicity samples were picked up by PER personnel at approximately 17:00.

Event 6

This was the fourth sampling event of WY 2021 and is considered Event 6 of the second year of sampling under the current monitoring design. Samples were collected September 13th and 14th. This is considered an irrigation runoff sampling event. A very minor rainfall event occurred on September 10th and 11th which produced generally less than 0.1" of at most Valley locations. Despite the rainfall no flow occurred on Arcade Creek in Sacramento and only a very minor rise in stage occurred on Ulatis Creek (see **Figure 4**).

Figure 4. Stage at Ulatis Creek during minor rainfall event on September 10 and 11, 2021.



On September 13, 2021, USGS personnel sampled Ulatis Creek by wading at 08:25. Flows were low and much of the channel was choked with aquatic vegetation (**Figure B.25**). Following sampling at Ulatis the full sampling crew met up at the Hogback Island Boat Launch on Steamboat Slough. While assembling at the boat ramp Jim Orlando spoke with Sacramento County Sheriff's deputies who were conducting several cannabis eradication operations by helicopter in the area (**Figure B.26**). Deputies reported that there were numerous grow sites in the area on farmed islands, on the channel side of local levees, as well as on in-channel islands. They also reported seeing used pesticide containers at these sites on a routine basis. The boat was launched at approximately 10:00 and samples were collected at SACR-024 at 10:40 (**Figure B.27**). The crew then pulled the boat and relaunched it from New Hope Landing Marina near Walnut Grove. Samples were collected from NORT-022 on Snodgrass Slough at 12:20 (**Figure B.28**). The crew then pulled the boat once again and transported it to Garcia Bend Park in Sacramento where it was relaunched. Sampling occurred at SACR-023 at 14:05 (**Figure B.29**). Samples were kept on wet ice and transported to the USGS CWSC at the Sacramento State campus. Toxicity samples were picked up by PER personnel at approximately 17:00.

On September 14, 2021, USGS personnel collected samples from the San Joaquin River near Buckley Cove, NORT-021, NORT-23, and NORT-024. The boat was launched from Ladd's Marina in Stockton at approximately 09:00 and samples were taken at Buckley Cove at 09:20 (**Figure B.30**). The boat was then pulled and relaunched from B&W Marina. NORT-021 was sampled at 11:55 on the South Mokelumne River (**Figure B.31**). NORT-024 was sampled at 12:40 on the North Mokelumne River near the confluence with the South Mokelumne River (**Figure B.32**). The crew then proceeded to site NORT-023 on the Mokelumne River near the San Joaquin River confluence. Samples were collected at 13:20 (**Figure B.33**). All samples were collected at the target coordinates. Samples were kept on wet ice and transported to the USGS CWSC at the Sacramento State campus. Toxicity samples were picked up by PER personnel at approximately 17:00.

ANALYTICAL OVERVIEW

FIELD MEASUREMENTS

During each of the four sampling events described in the **Sampling Overview**, the USGS CWSC took basic water-quality measurements (i.e., water temperature, specific conductance, DO, pH, and turbidity) at a depth of 0.5 m using a YSI EXO multi-parameter meter equipped with conductivity/temperature, DO, pH, and turbidity sensors. The meter was calibrated using appropriate procedures and standards before each sampling event as described in the USGS National Field Manual (U.S. Geological Survey, variously dated). Basic water-quality parameter data are shown in **Table 15**.

ANALYTICAL LABORATORY METHODS

The preparation and analytical methods applied to DRMP CUP samples are identified in **Table 5**.

Table 5. Analytical laboratory methods.

Matrix	Analyte	Laboratory	Preparation Method	Analytical Method
Samplewater (<0.7 µm)	Dissolved Pesticides	USGS OCRL	USGS-OCRL LC/MS/MS Sanders 2018	USGS-OCRL LC/MS/MS Sanders 2018
Samplewater, Particulate (>0.70 µm)	Particulate Pesticides	USGS OCRL	USGS-OCRL GC/MS Sanders 2018	USGS-OCRL GC/MS Sanders 2018
Samplewater, Particulate (>0.70 µm)	Total Suspended Solids	USGS OCRL	None	EPA 160.2
Samplewater	Dissolved Copper	USGS NWQL	USGS TM-5-B1	USGS TM-5-B1
Samplewater	Dissolved Organic Carbon	USGS NWQL	None	SM 5310B
Suspended Sediment	Particulate Organic Carbon	USGS NWQL	None	EPA 440.0
Suspended Sediment	Total Particulate Nitrogen	USGS NWQL	None	EPA 440.0
Suspended Sediment	Total Particulate Carbon	USGS NWQL	None	EPA 440.0
Suspended Sediment	Total Inorganic Carbon	USGS NWQL	None	EPA 440.0

Matrix	Analyte	Laboratory	Preparation Method	Analytical Method
Samplewater	*Pimephales promelas* (Chronic)	PER	None	EPA 821/R-02-013
Samplewater	*Ceriodaphnia dubia* (Chronic)	PER	None	EPA 821/R-02-013
Samplewater	*Selenastrum capricornutum* (Chronic)	PER	None	EPA 821/R-02-013
Samplewater	*Chironomus dilutus* (Chronic)	PER	None	EPA 821/R-02-013M
Samplewater	*Hyalella azteca* (Acute)	PER	None	EPA 821/R-02-012M

Analytical Methods – USGS OCRL

Pesticide concentrations in surface water were measured by the USGS OCRL using two methods: (1) liquid chromatography/tandem mass spectrometry (LC/MS/MS) and (2) gas chromatography/mass spectrometry (GC/MS). Thirty-five compounds were analyzed using the LC/MS/MS method described in Hladik and Calhoun (2012) and 127 compounds were analyzed using the GC/MS methods described in Hladik and others (2008, 2009) and Hladik and McWayne (2012). Pesticide concentrations for 127 compounds in suspended sediment were measured by the OCRL using the GC/MS methods described in Hladik and others (2008, 2009) and Hladik and McWayne (2012). Individual constituents and the associated methods are provided in **Appendix C**. More detailed information on the sample processing and analytical methods employed along with method detection limits can be found in De Parsia and others (2018 and 2019).

Analytical Methods – USGS NWQL

Dissolved organic carbon, PIC, POC, TPC, TPN and copper analyses were performed by the USGS NWQL. Dissolved organic carbon was analyzed at the NWQL using the method described in Open-File Report 92–480 (Brenton and Arnett, 1993). Particulate inorganic carbon, POC, TPC, and TPN were analyzed at the NWQL using U.S. Environmental Protection Agency (EPA) method 440.0 (Zimmermann and others, 1997). Copper was analyzed at the NWQL using the method described by Garbarino and others (2006).

Toxicity Methods – PER

Toxicity testing was conducted on five test organisms by PER according to the methodology defined by the US EPA. Chronic toxicity testing for *Ceriodaphnia dubia, Pimephales promelas,* and *Selenastrum capricornutum* followed the protocols outlined in *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (EPA-821-R-02-013, 2002). *Chironomus dilutus* water-only testing protocols and MQOs are defined by SWAMP. Organism responses to sample water were evaluated at various endpoints, including survival and growth (measured as ash-free dry weight per surviving individual) for *C. dilutus*, survival and reproduction (measured as number of young per surviving female) for *C. dubia*, survival and growth (measured as biomass as wight per original individual) for *P. promelas*, and growth (measured as total cell count) for *S. capricornutum*.

Acute 96-hour toxicity testing for *Hyalella azteca* followed acute protocols and MQOs outlined in SWAMP Guidance and *Methods for Measuring Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (EPA 821/R-02-012, 2002). *H. azteca* was conducted at 23^{o} C in accordance with SWAMP Guidance. The response of *H. azteca* was evaluated as the survival of individuals.

DATA VERIFICATION OVERVIEW

VERIFICATION PROCESS

The US EPA defines data verification as the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. Verification of DRMP CUP data was performed by MLJ Environmental (MLJ) and the Marine Pollution Studies Laboratory at Moss Landing Marine Laboratories (MPSL-MLML) based on the sample handling requirements and measurement quality objectives (MQOs) of the DRMP QAPP. Verification of instrument tuning, calibration standards, calibration verifications, and internal standards were the responsibility of the submitting laboratory.

Initial data verification by MLJ staff was conducted as individual electronic data deliverables (EDDs) received by the laboratories were processed and uploaded into the Central Valley Regional Data Center (CV RDC). These data processing steps occurred according to the procedures outlined in the DRMP QAPP. All project data underwent a final verification review by MPSL-MLML staff as a part of the data finalization process, at which point all verified data were assigned a classification and the corresponding California Environmental Data Exchange Network (CEDEN) compliance code described in the following sections.

Compliant

Data classified as “Compliant” meet all requirements specified in the DRMP QAPP. These data are considered usable for their intended purpose without additional assessment.

Qualified

Data classified as “Qualified” do not meet one or more of the requirements specified in the DRMP QAPP. These data are considered usable for their intended purpose following an additional assessment to determine the scope and impact of the deficiency.

Estimated

Data classified as “Estimated” (i.e., EPA “J” flag) are assigned to data batches and sample results that are not considered quantifiable.

Screening

Data classified as "Screening" are considered non-quantitative and may or may not meet the minimum requirements specified in the DRMP QAPP. These data may not be usable for their intended purpose and require additional assessment.

Rejected

Data classified as "Rejected" do not meet the minimum requirements specified in the DRMP QAPP. These data are not considered usable for their intended purpose.

Not Applicable

Data classified as "Not Applicable" were not verified since there were no DRMP QAPP requirements for the specific parameter (e.g., oxygen saturation) or a failure was reported and could not be verified.

Verified Datasets

This report details the above verification process as applied to the datasets appearing in **Table 6**. The findings of the data verification process are outlined in the sections below. A complete summary of the completeness and quality control (QC) sample acceptability for each analysis performed during WY 2021 is provided in **Appendix D**.

Table 6. Verified datasets associated with WY 2021 monitoring.

Lab	Analytical Category	Matrix	Datasets Produced	Datasets Reviewed	Reviewed Dataset (Batch) IDs
USGS OCRL	Pesticides	Samplewater, Particulate (>0.70 µm)	4	4	USGS-OCRL_DRMP _CUP_1155_W_ GCMS; USGS-OCRL_DRMP_CUP_1167_W GCMS
	Pesticides	Samplewater (<0.7 µm)	4	4	USGS-OCRL_DRMP_CUP_1156_W_ LCMSMS; USGS-OCRL_DRMP_CUP_1166_ W_LCMSMS
	Total Suspended Solids	Samplewater, Particulate (>0.70 µm)	4	4	USGS-OCRL_DRMP_CUP_4292021_4302021_W_ TSS; USGS-OCRL_DRMP_CUP_6162021_6172021_W_ TSS
PER	*Pimephales promelas* (Chronic)	Samplewater	8	8	PER_DRMP_CUP_0421PP_C1_W_TOX; PER_DRMP_CUP_0421PP_C2_W_TOX; PER_DRMP_CUP_0621PP_C1_W_TOX; PER_DRMP_CUP_0621PP_C2_W_TOX; PER_DRMP_CUP_0821PP_C1_W_TOX; PER_DRMP_CUP_0821PP_C2_W_TOX; PER_DRMP_CUP_0921PP_C1_W_TOX; PER_DRMP_CUP_0921PP_C2_W_TOX
	Ceridodaphnia dubia (Chronic)	Samplewater	8	8	PER_DRMP_CUP_0421CD_C1_W_TOX; PER_DRMP_CUP_0421CD_C2_W_TOX; PER_DRMP_CUP_0621CD_C1_W_TOX; PER_DRMP_CUP_0621CD_C2_W_TOX; PER_DRMP_CUP_0821CD_C1_W_TOX; PER_DRMP_CUP_0821CD_C2_W_TOX; PER_DRMP_CUP_0921CD_C1_W_TOX; PER_DRMP_CUP_0921CD_C2_W_TOX

Lab	Analytical Category	Matrix	Datasets Produced	Datasets Reviewed	Reviewed Dataset (Batch) IDs
	Selenastrum capricornutum (Chronic)	Samplewater	8	8	PER_DRMP_CUP_0421SC_C1_W_TOX; PER_DRMP_CUP_0421SC_C2_W_TOX; PER_DRMP_CUP_0621SC_C1_W_TOX; PER_DRMP_CUP_0621SC_C2_W_TOX; PER_DRMP_CUP_0821SC_C1_W_TOX; PER_DRMP_CUP_0821SC_C2_W_TOX; PER_DRMP_CUP_0921SC_C1_W_TOX; PER_DRMP_CUP_0921SC_C2_W_TOX
	Chironomus dilutus (Chronic)	Samplewater	8	8	PER_DRMP_CUP_0421CHD_C1_W_TOX; PER_DRMP_CUP_0421CHD _C2_W_TOX; PER_DRMP_CUP_0621CHD _C1_W_TOX; PER_DRMP_CUP_0621CHD_C2_W_TOX; PER_DRMP_CUP_0821CHD_C1_W_TOX; PER_DRMP_CUP_0821CHD_C2_W_TOX; PER_DRMP_CUP_0921CHD_C1_W_TOX; PER_DRMP_CUP_0921CHD_C2_W_TOX
	Hyalella azteca (Acute)	Samplewater	8	8	PER_DRMP_CUP_0421HA_C1_W_TOX; PER_DRMP_CUP_0421HA_C2_W_TOX; PER_DRMP_CUP_0621HA_C1_W_TOX; PER_DRMP_CUP_0621HA_C2_W_TOX; PER_DRMP_CUP_0821HA_C1_W_TOX; PER_DRMP_CUP_0821HA_C2_W_TOX; PER_DRMP_CUP_0921HA_C1_W_TOX; PER_DRMP_CUP_0921HA_C2_W_TOX

DATA VERIFICATION: SAMPLE HANDLING

During data verification, storage and holding times of DRMP CUP samples were evaluated to ensure the integrity of the target analyte(s) in each matrix. For consistency with the State Water Resources Control Board's Surface Water Ambient Monitoring Program (SWAMP) and the Code of Federal Regulations, Title 40 *Protection of the Environment*, Section 136 *Guidelines Establishing Test Procedures for the Analysis of Pollutants*, DRMP holding times are defined as follows:

- *Pre-Preservation/Extraction*: Required holding times for sample preservation or extraction begin at the time of sample collection and conclude when the sample is preserved or extracted, respectively.
- *Pre-Analysis*: Required holding times for sample analysis begin either at the time of sample collection, filtration or extraction and conclude when sample analysis is completed.

In WY 2021, 32 DRMP CUP samples were verified against the sample handling requirements in **Table 7**. 100% of verified samples met these DRMP CUP requirements.

Table 7. Sample handling requirements defined in the DRMP QAPP.

Parameter Group	Pre-Preservation/Extraction		Pre-Analysis	
	Storage	Holding Time	Holding Time	Storage
Dissolved Organic Carbon (Water)	0 to 6°C in dark	Filtration within 24 hours of collection	DOC: 30 days/ POC: 100 days	0 - 6°C in dark
Total Suspended Solids (Water)	4 ±2°C in dark	Cool to 4 ±2°C	7 days	4 ±2°C
Copper (Dissolved)	0 to 6°C in dark	Filter in the field as soon as possible after collection	180 days	0 - 6°C in dark
Pesticides (Dissolved)	0 to 6°C in dark	Extract within 48 hours of collection	Not to exceed 90 days	≤ −20°C in dark
Pesticides (Particulate)	0 to 6°C in dark	Extract within 48 hours of collection	Not to exceed 180 days	≤ −20°C in dark
Aquatic Toxicity Tests	0 to 6°C in dark	Initiate Test within 48 hours of sample collection	NA	NA

DATA VERIFICATION: USGS ORGANIC CHEMISTRY RESEARCH LABORATORY

DRMP CUP chemistry data verification assesses QC samples associated with contamination, precision, and accuracy. For consistency with SWAMP, QC sample definitions are based on the January 2022 *Surface Water Ambient Monitoring Program Quality Assurance Program Plan* (SWAMP QAPrP).

Contamination

For USGS OCRL's pesticide and total suspended solids (TSS) analyses, contamination is assessed with the analysis of field blanks and laboratory blanks. Associated data verification results are detailed below.

Field Blanks

A field blank is a sample of analyte-free media that is carried to the sampling site, exposed to the sampling conditions, returned to the laboratory, and treated as a routine environmental sample. Preservatives, if any, are added to the sample container in the same manner as the environmental sample. The field blank matrix should be comparable to the sample of interest. This blank is used to provide information about contaminants that may be introduced during sample collection, storage, and transport.

For WY 2021 DRMP CUP monitoring, field blanks were collected for pesticide and TSS analyses. Four pesticide (i.e., two for analysis by GC/MS and two for analysis by LC/MS/MS) and two TSS field blanks were analyzed. 100% of these results met the DRMP MQO by being below the method detection limit (MDL).

Laboratory Blanks

A laboratory blank is free from the target analyte(s) and is used to represent the environmental sample matrix as closely as possible. The laboratory blank is processed simultaneously with and under the same conditions and steps of the analytical procedures (e.g., including exposure to all glassware, equipment, solvents, reagents, labeled compounds, internal standards, and surrogates that are used with samples) as all samples in the analytical batch (including other QC samples). The laboratory blank is used to determine if target analytes or interferences are present in the laboratory environment, reagents, or instruments. Results of laboratory blanks provide a measurement of bias introduced by the analytical procedure.

For WY 2021 DRMP CUP monitoring, laboratory blanks were prepared and analyzed for all pesticide and TSS batches. Four TSS and eight pesticide laboratory blanks were analyzed at the required frequency of one per 20 samples or per batch (whichever is more frequent). 100% of these results met the DRMP MQO by being below the MDL.

Precision

For USGS OCRL's DRMP CUP analyses, precision is studied with the analysis of field duplicates, laboratory duplicates, and matrix spike (MS) duplicates (MSDs). Associated data verification results are detailed below.

Field Duplicates

A field duplicate is an independent sample that is collected as close as possible to the same point in space, time, and collection methodology as the field sample.

For WY 2021 DRMP CUP monitoring, field duplicates collected and analyzed for pesticides and TSS appear in **Table 8**.

Table 8. Field duplicates.

Duplicate ID	Sample Date	Analyte
544LSAC13	9/14/2021	Total Suspended Solids Pesticides by GC/MS
Nort-012	4/29/2021	Pesticides by LCMSMS
Nort-013	6/16/2021	Total Suspended Solids Pesticides by GC/MS
Nort-017	8/11/2021	Pesticides by LCMSMS

99% of these results met the DRMP MQO by having a relative percent difference (RPD) <25% (n/a if concentration of either sample < MDL). Analyses resulting in qualification appear in **Table 9**.

Table 9. Field duplicate qualification.

Dataset ID	Duplicate ID	Analyte	Matrix	Sample Result	Duplicate Result	RPD	Project Qualifier
USGS-OCRL_DRMP_CUP_6162021_6172021_W_TSS	Nort-013	Total Suspended Solids	Samplewater, Particulate (>0.70 µm)	6.3	4.8	27	Qualified

Laboratory Duplicates

A laboratory duplicate is an analysis or measurement of the target analyte(s) performed identically on two sub-samples of the same sample, usually taken from the same container. The results from laboratory duplicate analyses are used to evaluate analytical or measurement precision, and include variability associated with sub-sampling and the matrix (not the precision of field sampling, preservation, or storage internal to the laboratory).

For WY 2021 DRMP CUP monitoring, eight pesticide laboratory duplicates were analyzed at the required frequency of one per 20 samples or per batch (whichever is more frequent). 100% of these results met the DRMP MQO by having an RPD <25% (n/a if concentration of either sample < MDL).

Matrix Spike Duplicates

An MSD is prepared with an MS. Both the MS and MSD samples are analyzed exactly like an environmental sample within the lab batch. The purpose of analyzing the MS and MSD samples is to determine whether the sample matrix contributes bias to the analytical results, and to measure precision of the duplicate analysis.

For WY 2021 DRMP CUP monitoring, four matrix spike duplicate pairs were prepared and analyzed for pesticides at the required frequency of one per 20 samples or per batch (whichever is more frequent). 100% of these results met the DRMP MQO by having an RPD <25%.

Accuracy

For USGS OCRL's DRMP pesticide analyses, accuracy is studied with the analysis of MSs, laboratory control samples (LCSs), and surrogates. Associated data verification results are detailed below.

Matrix Spikes

An MS is a sample prepared by adding a known amount of the target analyte to an environmental sample in order to increase the concentration of the target analyte. The MS is used to determine the effect of the matrix on a method's recovery efficiency and is a measure of accuracy. The MS is analyzed exactly like an environmental sample within the lab batch. The purpose of analyzing the MS is to determine whether the sample matrix contributes bias to the analytical results.

For WY 2021 DRMP CUP monitoring, eight matrix spikes (i.e., four matrix spike duplicate pairs) were prepared and analyzed for pesticides at the required frequency of 1 per 20 samples. 100% of these results met the 70-130% DRMP recovery MQO.

Laboratory Control Samples

An LCS is a sample matrix representative of the environmental sample (e.g., water, sand) that is prepared in the laboratory and is free from the analytes of interest. The LCS is spiked with verified amounts of analytes or a material containing known and verified amounts of analytes. It is either used to establish intra-laboratory or analyst-specific precision and bias, or to assess the performance of a portion of the measurement system.

For DRMP CUP monitoring in WY 2021, eight LCSs were prepared and analyzed for all pesticide batches at the required frequency of one per 20 samples or per batch (whichever is more frequent). 100% of these results met the 70-130% DRMP recovery MQO.

Surrogates

A surrogate is a non-target analyte that has similar chemical properties to the analyte of interest. The surrogate standard is added to the sample in a known amount and used to evaluate the response (i.e., loss of analyte) of the analyte to sample preparation and analysis procedures.

For DRMP CUP monitoring in WY 2021, surrogates $^{13}C_3$-atrazine, ^{13}C-fipronil, and d_{14}-trifluralin (GC/MS); and monuron and d_4-imidacloprid (LC/MS/MS) were added to all environmental and QC samples analyzed for dissolved pesticides. Surrogates d_{14}-trifluralin, $^{13}C_{12}$-p,p'-DDE, and $^{13}C_6$-cis-permethrin (GC/MS) were added to all environmental and QC samples analyzed for particulate pesticides. 100% of these results met the 70-130% DRMP recovery MQO.

DATA VERIFICATION: USGS CALIFORNIA WATER SCIENCE CENTER

USGS CWSC equipment used to take field data measurements must be calibrated according to Table 14.1 of the DRMP QAPP. At a minimum, the following equipment must be calibrated:

- Thermometers
- DO meters
- pH meters
- Conductivity meters
- Multi-parameter field meters

After post-calibration checks are performed, the percent drift should be evaluated to confirm compliance with Table 14.1 of the DRMP QAPP. Non-compliant results should not be reported unless they have been flagged to indicate non-compliance.

Of the 256 field measurement results reported, four turbidity results were classified as "Qualified" because field calibration was not performed at the correct frequency. One pH result was classified as "Not Applicable" due to probe failure. None of the 32 oxygen saturation results were verified since no MQO exists for this field measurement. Affected oxygen saturation results were classified as "Not Applicable".

DATA VERIFICATION: PACIFIC ECORISK

DRMP CUP toxicity data verification assesses QC samples associated with negative and positive controls that address sensitivity, test manipulations, tolerance thresholds, and intra-laboratory precision for both acute and chronic test methods. Also verified are the associated water quality measurements and required testing parameters to assess toxicity test conditions. For consistency with SWAMP, QC sample definitions are based on the January 2022 SWAMP QAPrP.

NEGATIVE CONTROLS

Laboratory control water is used to evaluate the health and sensitivity of the test organisms. It must be used with each analytical batch and meet all test acceptability criteria for the species of interest.

Additional control water for manipulated samples (i.e., a treatment control) is used to evaluate the effects of manipulations upon the test organisms. The same treatment must be performed on the control water when manipulations are performed on one or more of the ambient samples in the analytical batch and the treatment control must meet the test acceptability criteria.

Additional control water (i.e., a tolerance control) for unmanipulated samples is used to evaluate the effects of parameters near the tolerance threshold of the test organisms. They can be performed when samples have parameters near the tolerance threshold of the organism and the tolerance control must meet the test acceptability criteria if it is to be used for statistical comparisons.

For WY 2021 DRMP CUP monitoring, laboratory control water was used for all toxicity testing batches except when conductivity was insufficient for the test species (see **Table 10).** 100% of these results met the MQO specified in Table 14.4 of the DRMP QAPP.

Table 10. Additional control water.

Tox Batch ID	QA Control ID	Sample ID	Sample Date	Organism	Reason for Additional Control
PER_DRMP_CUP_0421CD_C1_W_TOX	DRMP_0421CD_CC_CNSL	Nort-010	4/28/21	*Ceriodaphnia dubia*	Conductivity insufficient for test species; alternative control used in toxicity statistical analysis.

Tox Batch ID	QA Control ID	Sample ID	Sample Date	Organism	Reason for Additional Control
PER_DRMP_CUP_0621CD_C2_W_TOX	DRMP_0621CD_CC_CNSL	Sacr-019	6/16/21	*Ceriodaphnia dubia*	Conductivity insufficient for test species; alternative control used in toxicity statistical analysis.

POSITIVE CONTROLS

Reference Toxicant Test

A reference toxicant test is used to assess intra-laboratory precision. One reference toxicant test is required per batch when using organisms that are either commercially supplied or wild-caught. Monthly reference toxicant tests are required for laboratories utilizing in-house cultures. The last-plotted data point (LC50 or EC50) should be within two standard deviations (SD) of the cumulative mean. One reference toxicant test performed with *Hyalella azteca* (Event 6, September 2021) was above 3SD of the cumulative mean. A non-conforming data evaluation was performed by Pacific EcoRisk and did not identify a cause of the decreased organism sensitivity. More information can be found in the Pacific EcoRisk data report.

For WY 2021 DRMP CUP monitoring, reference toxicant tests were performed at the required frequency and 100% of these results met the MQO specified in Table 14.4 of the DRMP QAPP.

Test Acceptability Criteria

The required number of organisms were processed per replicate, and organism survival met the test criteria for all batches except those appearing in **Table 11;** 100 % of tests met test acceptability criteria. 78% of toxicity testing results met the MQOs specified in Table 14.4 in the DRMP QAPP.

Table 11. Organism and survival qualifications.

Tox Batch ID	Sample ID	Sample Date	Organism	Issue	Project Qualifier
PER_DRMP_CUP_0621CHD_C1_W_TOX	All samples in batch	6/15/21	*Chironomus dilutus*	Test organisms exceeds maximum weight requirement at test initiation	Qualified

Tox Batch ID	Sample ID	Sample Date	Organism	Issue	Project Qualifier
PER_DRMP_CUP_0921CHD_C1_W_TOX	All samples in batch	9/13/21	*Chironomus dilutus*	Test organisms exceeds maximum weight requirement at test initiation	Qualified
PER_DRMP_CUP_0921CHD_C2_W_TOX	All samples in batch	9/14/21	*Chironomus dilutus*	Test organisms exceeds maximum weight requirement at test initiation	Qualified
PER_DRMP_CUP_0921CHD_C2_W_TOX	Nort-023	9/14/21	*Chironomus dilutus*	Pupated organism incorrectly included in growth statistics	Qualified
PER_DRMP_CUP_0421CHD_C1_W_TOX	511ULCABR	4/28/21	*Chironomus dilutus*	Unequal quantity of organisms per replicate was used	Qualified
PER_DRMP_CUP_0421CHD_C2_W_TOX	544LSAC13	4/29/21	*Chironomus dilutus*	Unequal quantity of organisms per replicate was used	Qualified
PER_DRMP_CUP_0421CHD_C2_W_TOX	544LSAC13 – Field Duplicate	4/29/21	*Chironomus dilutus*	Unequal quantity of organisms per replicate was used	Qualified
PER_DRMP_CUP_0421CHD_C2_W_TOX	CNEG	4/30/21	*Chironomus dilutus*	Unequal quantity of organisms per replicate was used	Qualified
PER_DRMP_CUP_0621CHD_C2_W_TOX	544LSAC13	6/16/21	*Chironomus dilutus*	Unequal quantity of organisms per replicate was used	Qualified
PER_DRMP_CUP_0621CHD_C2_W_TOX	Nort-013	6/16/21	*Chironomus dilutus*	Unequal quantity of organisms per replicate was used	Qualified
PER_DRMP_CUP_0821CHD_C1_W_TOX	511ULCABR	8/10/21	*Chironomus dilutus*	Unequal quantity of organisms per replicate was used	Qualified
PER_DRMP_CUP_0821CHD_C1_W_TOX	Sacr-021	8/10/21	*Chironomus dilutus*	Unequal quantity of organisms per replicate was used	Qualified
PER_DRMP_CUP_0821CHD_C2_W_TOX	Nort-020	8/11/21	*Chironomus dilutus*	Unequal quantity of organisms per replicate was used	Qualified

TOX BATCH ID	SAMPLE ID	SAMPLE DATE	ORGANISM	ISSUE	PROJECT QUALIFIER
PER_DRMP_CUP_0421HA_C2_W_TOX	Nort-011	4/29/21	*Hyalella azteca*	Unequal quantity of organisms per replicate was used	Qualified
PER_DRMP_CUP_0421PP_C1_W_TOX	CNEG	4/29/21	*Pimephales promelas*	Unequal quantity of organisms per replicate was used	Qualified
PER_DRMP_CUP_0821CHD_C1_W_TOX	511ULCABR	8/10/21	*Chironomus dilutus*	Organism was missing at the end of the test	Qualified
PER_DRMP_CUP_0821CHD_C1_W_TOX	Sacr-022	8/10/21	*Chironomus dilutus*	Organism was missing at the end of the test	Qualified
PER_DRMP_CUP_0821PP_C2_W_TOX	544LSAC13	8/11/21	*Pimephales promelas*	Organism was missing at the end of the test	Qualified
PER_DRMP_CUP_0921CHD_C1_W_TOX	511ULCABR	9/13/21	*Chironomus dilutus*	Organism pupated and was not used in the statistics	Qualified
PER_DRMP_CUP_0921CHD_C1_W_TOX	Nort-022	9/13/21	*Chironomus dilutus*	Organism pupated and was not used in the statistics	Qualified
PER_DRMP_CUP_0921CHD_C1_W_TOX	Sacr-023	9/13/21	*Chironomus dilutus*	Organism pupated and was not used in the statistics	Qualified
PER_DRMP_CUP_0921CHD_C1_W_TOX	Sacr-024	9/13/21	*Chironomus dilutus*	Organism pupated and was not used in the statistics	Qualified
PER_DRMP_CUP_0421PP_C1_W_TOX	Nort-010	4/28/21	*Pimephales promelas*	Low survival in toxicity test resulted from test interference due to pathogen-related mortality	Qualified
PER_DRMP_CUP_0421PP_C1_W_TOX	Nort-011	4/29/21	*Pimephales promelas*	Low survival in toxicity test resulted from test interference due to pathogen-related mortality	Qualified

Tox Batch ID	Sample ID	Sample Date	Organism	Issue	Project Qualifier
PER_DRMP_CUP_0621PP_C1_W_TOX	Sacr-020	6/15/21	*Pimephales promelas*	Low survival in toxicity test resulted from test interference due to pathogen-related mortality	Qualified
PER_DRMP_CUP_0621PP_C2_W_TOX	Nort-013	6/16/21	*Pimephales promelas*	Low survival in toxicity test resulted from test interference due to pathogen-related mortality	Qualified
PER_DRMP_CUP_0621PP_C2_W_TOX	Nort-014	6/16/21	*Pimephales promelas*	Low survival in toxicity test resulted from test interference due to pathogen-related mortality	Qualified
PER_DRMP_CUP_0621PP_C2_W_TOX	Sacr-019	6/16/21	*Pimephales promelas*	Low survival in toxicity test resulted from test interference due to pathogen-related mortality	Qualified
PER_DRMP_CUP_0821PP_C1_W_TOX	Nort-019	8/10/21	*Pimephales promelas*	Low survival in toxicity test resulted from test interference due to pathogen-related mortality	Qualified
PER_DRMP_CUP_0821PP_C2_W_TOX	544LSAC13	8/11/21	*Pimephales promelas*	Low survival in toxicity test resulted from test interference due to pathogen-related mortality	Qualified
PER_DRMP_CUP_0821PP_C2_W_TOX	Nort-017	8/11/21	*Pimephales promelas*	Low survival in toxicity test resulted from test interference due to pathogen-related mortality	Qualified

Tox Batch ID	Sample ID	Sample Date	Organism	Issue	Project Qualifier
PER_DRMP_CUP_0921PP_C1_W_TOX	511ULCABR	9/13/21	*Pimephales promelas*	Low survival in toxicity test resulted from test interference due to pathogen-related mortality	Qualified
PER_DRMP_CUP_0921CD_C1_W_TOX	SACR-024	9/13/21	*Ceriodaphnia dubia*	Replicate was lost during solution renewal	Qualified
PER_DRMP_CUP_0921CD_C1_W_TOX	Nort-022	9/13/2021	*Ceriodaphnia dubia*	Male replicate excluded from test analysis	Qualified

FIELD DUPLICATES

A field duplicate is an independent sample that is collected as close as possible to the same point in space, time, and collection methodology as the field sample.

For WY 2021 DRMP CUP monitoring, field duplicates collected and analyzed for all aquatic toxicity test species appear in **Table 12**. 100% of these results met the DRMP MQO by having a relative percent difference (RPD) <25%.

Table 12. Field duplicates.

Duplicate ID	Sample Date	Analyte
544LSAC13	4/29/21	Aquatic Toxicity Tests
Nort-020	8/11/21	Aquatic Toxicity Tests

WATER QUALITY PARAMETERS

Water quality parameters (i.e., temperature, pH, DO, specific conductance, hardness, alkalinity, and ammonia) are monitored to assess toxicity testing conditions and are required to meet the MQOs specified in the DRMP QAPP. Deviations from recommended test conditions were noted in the data set.

For WY 2021 DRMP CUP monitoring, the required number of organisms were processed per replicate, and organism survival met the test criteria for all toxicity testing batches except those appearing in **Table 13**.

In addition, water quality parameters were performed at the required frequency for all toxicity testing batches except those appearing in **Table 13**. 95% of toxicity testing results met the water quality parameter MQOs specified in Table 14.3 of the DRMP QAPP.

Table 13. Water quality parameter qualifications.

Tox Batch ID	Sample IDs	Sample Date	Organism	Missing Water Quality Parameter	Project Qualifier
PER_DRMP_CUP_0921CD_C2_W_TOX	544LSAC13	09/14/21	*Ceriodaphnia dubia*	Old DO solution Day 1	Qualified
PER_DRMP_CUP_0921CD_C2_W_TOX	Nort-021	09/14/21	*Ceriodaphnia dubia*	Old DO solution Day 1	Qualified
PER_DRMP_CUP_0921CD_C2_W_TOX	Nort-023	09/14/21	*Ceriodaphnia dubia*	Old DO solution Day 1	Qualified
PER_DRMP_CUP_0921CD_C2_W_TOX	Nort-024	09/14/21	*Ceriodaphnia dubia*	Old DO solution Day 1	Qualified
PER_DRMP_CUP_0921CD_C2_W_TOX	CNEG	09/15/21	*Ceriodaphnia dubia*	Old DO solution Day 1	Qualified
PER_DRMP_CUP_0921PP_C1_W_TOX	Nort-022	09/13/21	*Pimephales promelas*	Old DO solution Day 4	Qualified
PER_DRMP_CUP_0921PP_C2_W_TOX	Nort-024	09/14/21	*Pimephales promelas*	Old DO solution Day 1	Qualified
PER_DRMP_CUP_0821SC_C2_W_TOX	544LSAC13	08/11/21	*Selenastrum capricornutum*	pH and Temperature Day 3	Qualified

SUMMARY

CHEMISTRY RESULTS

A total of 34 environmental samples (including two field duplicates) were analyzed for dissolved pesticides by the USGS OCRL during WY 2021. During this period, a total of 49 pesticides were detected in the dissolved phase (i.e., 13 fungicides, 17 herbicides, 18 insecticides and the synergist piperonyl butoxide). Each of the 32 samples analyzed contained mixtures of from four to 27 pesticides per sample. Frequently detected pesticides included azoxystrobin and methoxyfenozide (100% of samples), 3,4-DCA (91%), imidacloprid (66%), and fluridone and metolachlor (59%). Maximum concentrations ranged from below method detection limits to 3,710 ng/L (metolachlor).

All 8,632 environmental and QC sample results for dissolved pesticides met the MQOs specified in the DRMP QAPP and are considered “Compliant”.

A total of 34 environmental samples (including two field duplicates) were analyzed for suspended-sediment-associated (i.e., particulate) pesticides by the USGS OCRL. During this period, three pesticides were detected on suspended sediments. The pesticides detected included bifenthrin (two detections), cyhalothrin (one detection), and metolachlor (one detection).

Ten of the 32 field samples contained at least one pesticide with a concentration above an EPA aquatic life benchmark. Bifenthrin was detected above its chronic invertebrate benchmark of 1.3 ng/L in the Event 3 sample collected at NORT-009 and in the Event 4 Buckley Cove and Ulatis Creek samples. Cyhalothrin was detected in the Event 4 Ulatis Creek sample at 25.3 ng/L (the acute fish toxicity benchmark is 14.5 ng/L). Imidacloprid was detected above its chronic invertebrate benchmark of 10.0 ng/L in the Event 3 SACR-017 sample and the Event 5 and 6 Ulatis Creek samples. Dichlorvos was detected above its chronic invertebrate toxicity benchmark of 5.8 ng/L in two Event 6 samples (i.e., NORT-021 and SACR-023). Metolachlor was detected above its chronic invertebrate benchmark of 1,000 ng/L in the Event 3 Ulatis Creek sample. Diuron was detected above its recently (2021) lowered vascular plant acute toxicity benchmark of 130 ng/L in the Event 3 Buckley Cove sample and the Event 5 Ulatis Creek sample.

All 6,812 environmental and QC sample results for particulate pesticides met the MQOs specified in the DRMP QAPP and are considered “Compliant”.

A total of 34 environmental samples (including field QC) were analyzed for TSS by USGS OCRL. While the field duplicate results were addressed in **Table 9**, the remaining 32 results met the MQOs specified in the DRMP QAPP and are considered "Compliant".

TOXICITY TESTING

A total of 34 environmental samples (including two field duplicates) were analyzed by PER for each the following aquatic toxicity test species: *Ceriodaphnia dubia*, *Pimephales promelas*, *Selenastrum capricornutum*, *Chironomus dilutus*, and *Hyalella azteca*. 1,034 environmental and QC sample results were qualified for organism and survival findings (see **Table 11**) and/or missing water quality parameters (see **Table 13**). The remaining 4,746 environmental sample and QC results met the MQOs specified in the DRMP QAPP and are considered "Compliant".

During WY 2021, 21 toxicity tests produced results that were significantly different from the control. These test results are outlined in **Table 14**. Four of the five test species had significant results for at least one endpoint, with *S. capricornutum* being the only species for which no significant reductions were observed during the WY.

Six of the significant results had a percent effect of 50% or less compared to the control, which is the threshold at which the decision to conduct a toxicity identification evaluation (TIE) is presented to the TIE Technical Advisory Committee (TAC). TIEs were conducted for four of the five toxic samples during the WY, with the TIE TAC opting to forego additional TIE testing to investigate *P. promelas* response to samples collected at Nort-017 on August 11, 2021 for the sublethal growth endpoint and for the survival endpoint due to the laboratory attributing mortality to the presence of pathogens.

For the four TIEs that were conducted, two were in response to significant reductions of *H. azteca* survival observed in samples collected from NORT-009 on April 29, 2021 and from Ulatis Creek at Brown Road on June 15, 2021. In both cases, the TIE results suggested pyrethroid-induced toxicity, but could not rule out metals as a potential cause for some toxicity. Several pesticides, including the pyrethroid bifenthrin, were detected in the associated pesticide samples collected concurrently with both the April and June toxicity samples. The June samples also included detections for total cyhalothrin.

The additional two TIEs conducted were due to a 33% percent control response for *C. dubia* reproduction in samples collected from NORT-016 on June 15, 2021 and a 12% percent control response in reproduction for samples collected at Sacr-021 on August 10, 2021. The results of June 15 TIE were inclusive due to the toxicity not persisting through the TIE testing period, suggesting the cause of initial toxicity was an organic subject to rapid degradation or an initial false positive. The TIE results for the August sample were also inconclusive though the toxicity was persistent. None of the applied treatments reduced the toxicity and there was blank interference observed, which may indicate that an organic or metals toxicant saturated the columns causing breakthrough, or that the toxicant was neither of these types of compounds.

Table 14. Significant toxicity results from WY 2021.

Station Code	Station Name	Sample Date	Organism	Endpoint	Pct Control	Sig. Effect [1]	TIE?	TIE Narrative
Sacr-018	Sacramento River Subregion - Sacr-018	4/28/2021	*Pimephales promelas*	Growth [2]	74	SL	No	None
Nort-011	Northeast Delta Subregion - Nort-011	4/29/2021	*Ceriodaphnia dubia*	Reproduction [3]	73	SL	No	None
Nort-009	Northeast Delta Subregion - Nort-009	4/29/2021	*Hyalella azteca*	Survival	0	SL	Yes	Phase I TIE (5/4/21) treatment results: No blank interference; toxicity persistent. Toxicity removal in C18, WCX, partial removal in carboxylesterase. Suggests pyrethroid-induced toxicity; metals not ruled out as potential cause for some toxicity.
Nort-016	Northeast Delta Subregion - Nort-016	6/15/2021	*Ceriodaphnia dubia*	Reproduction [3]	33	SL	Yes	Phase I TIE was initiated on 6/24/2021. No blank interference in TIE treatments. Toxicity was not persistent. Results suggest cause of initial toxicity was an organic subject to rapid degradation.

Station Code	Station Name	Sample Date	Organism	Endpoint	Pct Control	Sig. Effect [1]	TIE?	TIE Narrative
511ULCABR	Ulatis Creek at Brown Road	6/15/2021	*Hyalella azteca*	Survival	0	SL	Yes	Phase I Acute TIE (6/20/21) treatment results: No blank interference; toxicity persistent. Toxicity removal in C18, WCX, partial removal in carboxylesterase. Suggests pyrethroid-induced toxicity; metals not ruled out as potential cause for some toxicity.
Sacr-020	Sacramento River Subregion - Sacr-020	6/15/2021	*Pimephales promelas*	Growth [2]	80	SG	No	Pathogen related mortality.
544LSAC13	San Joaquin R at Buckley Cove	6/16/2021	*Ceriodaphnia dubia*	Reproduction [3]	63	SL	No	None
Sacr-019	Sacramento River Subregion - Sacr-019	6/16/2021	*Ceriodaphnia dubia*	Reproduction [3]	53	SL	No	None
544LSAC13	San Joaquin R at Buckley Cove	6/16/2021	*Chironomus dilutus*	Survival	67	SL	No	None
Sacr-019	Sacramento River Subregion - Sacr-019	6/16/2021	*Chironomus dilutus*	Survival	87	SG	No	None

Station Code	Station Name	Sample Date	Organism	Endpoint	Pct Control	Sig. Effect [1]	TIE?	TIE Narrative
Nort-013	Northeast Delta Subregion - Nort-013	6/16/2021	*Pimephales promelas*	Growth [2]	54	SL	No	None
Nort-013	Northeast Delta Subregion - Nort-013	6/16/2021	*Pimephales promelas*	Survival	67	SL	No	None
Nort-014	Northeast Delta Subregion - Nort-014	6/16/2021	*Pimephales promelas*	Growth [2]	86	SG	No	None
Sacr-021	Sacramento River Subregion - Sacr-021	8/10/21	*Ceriodaphnia dubia*	Reproduction [3]	12	SL	Yes	TIE 8/18/21: toxicity persistent; baseline half as toxic vs initial. No treatment reduced tox. Blank interference in BSA. Could indicate organic/metal toxicant saturated columns causing breakthrough or multiple at toxic levels; or toxicant not organic/metal.
Sacr-022	Sacramento River Subregion - Sacr-022	8/10/21	*Ceriodaphnia dubia*	Reproduction [3]	66	SL	No	
511ULCABR	Ulatis Creek at Brown Road	8/10/2021	*Chironomus dilutus*	Survival	72	SL	No	None

Station Code	Station Name	Sample Date	Organism	Endpoint	Pct Control	Sig. Effect [1]	TIE?	TIE Narrative
Sacr-021	Sacramento River Subregion - Sacr-021	8/10/2021	*Pimephales promelas*	Growth [2]	86	SG	No	None
Nort-020	Northeast Delta Subregion - Nort-020	8/11/2021	*Ceriodaphnia dubia*	Reproduction [3]	70	SL	No	None
Nort-020	Northeast Delta Subregion - Nort-020	8/11/2021	*Ceriodaphnia dubia*	Reproduction [3]	60	SL	No	None
Nort-017	Northeast Delta Subregion - Nort-017	8/11/2021	*Pimephales promelas*	Growth [2]	38	SL	No	TIE Subcommittee recommended not performing a TIE due to Pathogen Related Mortality.
Nort-017	Northeast Delta Subregion - Nort-017	8/11/2021	*Pimephales promelas*	Survival	29	SL	No	TIE Subcommittee recommended not performing a TIE due to Pathogen Related Mortality.
Nort-018	Northeast Delta Subregion - Nort-018	8/11/2021	*Pimephales promelas*	Growth [2]	87	SG	No	None
Sacr-023	Sacramento River Subregion - Sacr-023	9/13/21	*Chironomus dilutus*	Growth [4]	93	SG	No	None

Station Code	Station Name	Sample Date	Organism	Endpoint	Pct Control	Sig. Effect [1]	TIE?	TIE Narrative
Nort-023	Northeast Delta Subregion - Nort-023	9/14/2021	*Chironomus dilutus*	Growth [4]	89	SG	No	None

[1] Significant effect: SG indicates significantly different from the control and greater than the evaluation threshold; SL indicates significantly different from the control and less than the evaluation threshold.
[2] Growth for *Pimephales promelas* is evaluated as biomass as weight per original individual. dry weight per surviving individual.
[3] Reproduction for *Ceriodaphnia dubia* is evaluated as the number of young per female.
[4] Growth for *Chironomus dilutus* is evaluated as the ash-free dry weight.

FIELD MEASUREMENTS

Per **Table D.2**, there were no completeness concerns associated with WY 2021 DRMP CUP monitoring. Field measurement results appear in their entirety in **Table 15**.

DATA AVAILABILITY

All analytical and field parameter results generated by USGS CWSC, USGS OCRL, and USGS NWQL will be made available for download through the USGS National Water Information System (NWIS; https://nwis.waterdata.usgs.gov/ca/nwis/qwdata) using the sampling event and station identification information found in **Table 3** and **Table 15**. All project data, including the USGS datasets as well as those provided by PER, will be published to CEDEN and can be accessed through the Advance Query Tool (https://ceden.waterboards.ca.gov/AdvancedQueryTool) under the project code “2020 Delta RMP Current Use Pesticides”.

Table 15. Sampling event information and basic water quality parameters measured during sample collection.

Event	CEDEN Code	USGS Site Number	Date	Time	Air Temp °C	Water Temp °C	pH	DO (mg/L)	DO (%)	Specific Conductance (µS/cm)	Salinity	Turbidity (NTU)
3	544LSAC13	375831121223701	4/29/21	9:10	18.6	19.6	7.5	7.8	84.8	755	0.37	2.1
3	511ULCABR	11455261	4/28/21	8:25	14.9	16.8	7.6	3.3	34.3	805	0.39	6.2
3	NORT-009	380720121295401	4/29/21	11:25	24.7	18.6	7.8	9.7	103.6	191	0.1	1.3
3	NORT-010	381612121283901	4/28/21	14:25	26.9	20.0	IM	8.9	98.0	140	0.06	5.2
3	NORT-011	380845121360201	4/29/21	12:55	30.1	19.2	7.5	8.3	89.2	168	0.08	2.3
3	NORT-012	380722121313101	4/29/21	11:55	27.3	19.3	8.4	10.9	118.0	173	0.08	1.3
3	SACR-017	381627121351901	4/28/21	10:45	19.5	18.5	7.7	8.2	86.9	161	0.08	2.7
3	SACR-018	381423121322401	4/28/21	11:45	24.4	18.8	7.8	8.2	88.0	165	0.08	3.4
4	544LSAC13	375831121223701	6/16/21	8:35	20.9	23.3	7.7	7.3	85.9	633	0.31	2.2
4	511ULCABR	11455261	6/15/21	8:25	20.7	19.0	7.7	3.6	39.0	835	0.41	24.5
4	NORT-013	381235121302601	6/16/21	11:10	25.0	23.1	8.1	8.5	99.1	176	0.08	2.9
4	NORT-014	381449121295401	6/16/21	12:05	31.2	23.8	8.1	8.6	102.1	171	0.08	3.2
4	NORT-015	380747121334201	6/15/21	11:45	28.5	22.8	8.0	8.4	96.9	176	0.08	1.3
4	NORT-016	381206121322901	6/15/21	13:30	29.6	23.0	7.8	8.4	97.7	141	0.07	0.8
4	SACR-019	383431121304201	6/16/21	14:15	32.1	24.0	7.9	8.3	98.2	123	0.06	1.0
4	SACR-020	381105121385301	6/15/21	10:00	21.5	21.7	8.0	8.1	91.9	197	0.09	3.4
5	544LSAC13	375831121223701	8/11/21	9:20	21.49	25.04	7.41	7.07	85.7	276.8	0.13	2.6
5	511ULCABR	11455261	8/10/21	14:25	30.81	21.02	7.38	1.46	16.5	901	0.44	5.64
5	NORT-017	380834121281301	8/11/21	12:05	26.01	25.1	7.87	7.86	95.3	237.5	0.11	0.29
5	NORT-018	381008121281301	8/11/21	11:25	23.96	24.84	7.52	7.8	94.6	323	0.15	1.65
5	NORT-019	381710121301101	8/10/21	9:35	20.16	24.71	7.78	8.04	96.7	149.8	0.07	3.21
5	NORT-020	380751121342701	8/11/21	12:50	31.49	24.7	7.96	8.55	103.1	145.2	0.07	1.27
5	SACR-021	381837121355501	8/10/21	11:45	26.55	23.58	7.68	8.08	95.9	150	0.07	1.08
5	SACR-022	382451121311701	8/10/21	11:00	26.9	24.65	7.59	7.94	93.8	160.3	0.07	1.28

Event	CEDEN Code	USGS Site Number	Date	Time	Air Temp °C	Water Temp °C	pH	DO (mg/L)	DO (%)	Specific Conductance (µS/cm)	Salinity	Turbidity (NTU)
6	544LSAC13	375831121223701	9/14/21	9:20	23.54	25.22	7.43	7.59	92.3	537	0.26	2.89
6	511ULCABR	11455261	9/13/21	8:25	19.76	20.97	7.41	0.44	4.8	789	0.39	4.01
6	NORT-021	380922121301101	9/14/21	11:55	26.99	24.51	7.67	7.42	88.9	235	0.11	1.07
6	NORT-022	381611121294701	9/13/21	12:20	29	24.5	7.66	8.04	96.5	199.6	0.09	1.87
6	NORT-023	380604121334701	9/14/21	13:20	26.12	25.14	8.63	11.64	141.5	214.3	0.1	33.34
6	NORT-024	380806121334701	9/14/21	12:40	25.21	24.36	7.75	7.82	93.6	198.8	0.09	1.05
6	SACR-023	382939121332101	9/13/21	14:05	32.89	24.97	8.01	8.98	108.5	187.7	0.09	1.53
6	SACR-024	381347121361201	9/13/21	10:40	23.19	24.04	7.77	8.32	99.4	199.2	0.09	0.56

CORRECTIVE ACTIONS

On April 2, 2021, DRMP deviation form 2020-10 was initiated to document incomplete WY 2020 field QC sampling due to the cancelation of three planned sampling events. In response, the USGS CWSC modified its sampling design to reduce the impact of future sampling cancellations on field QC completeness. In WY 2021, this modification enabled the sampling and analysis of a full suite of field QC samples. A complete assessment of field QC sample frequency is provided in **Field Quality Control Frequency, Table D.3**. Relevant DRMP QAPP deviation forms are outlined in **Table 16**.

No deviations from the DRMP QAPP or necessary corrective actions were identified during WY 2021.

Table 16. Referenced deviations from the DRMP QAPP.

Deviation Number	Status	Deviation Date	Monitoring Sector	Title	Description	Corrective Actions	Resolution
2020-10 [1]	Created, pending final review	4/2/2021	Pesticides and toxicity	USGS Did Not Meet Planned QA Frequencies	Not all of the planned field QA samples were collected, due to the final three events being cancelled	USGS will modify the sampling design in future years to collect QA samples more proportionally to the field samples collected at each event to reduce the impact of event cancelations on QA sample completeness.	The evaluation of 2021 field QC frequency indicates new procedures are effective.

[1] Though this deviation occurred during WY 2020 and referenced a previous version of the DRMP QAPP, data evaluated in this report indicate a satisfactory resolution. A complete assessment of field QC sample frequency is provided in **Field Quality Control Frequency, Table D.3**.

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Appendix A. Quality Assurance Evaluation for WY 2021 Results Received from the USGS National Water Quality Laboratory

[NWQL Results still Pending: Not Included with the Current Draft of this Report]

Appendix B. Sampling Photos for WY 2021 Monitoring (Current Use Pesticides Year 3, Events 3-6)

Sampling for the second year of the Delta Regional Monitoring Program (RMP) Current Use Pesticides (CUP) monitoring during water year (WY) 2021 occurred over Events 3 through 6 in April through September of 2021. Photos taken by field crews during each monitoring event are provided below.

Event 3 – April 28 and 29, 2021

Figure B.1. Flow conditions at Ulatis Creek, April 28, 2021.

Figure B.2. SACR-018 on the Sacramento River, April 28, 2021.

Figure B.3. NORT-010 on Lost Slough, April 28, 2021.

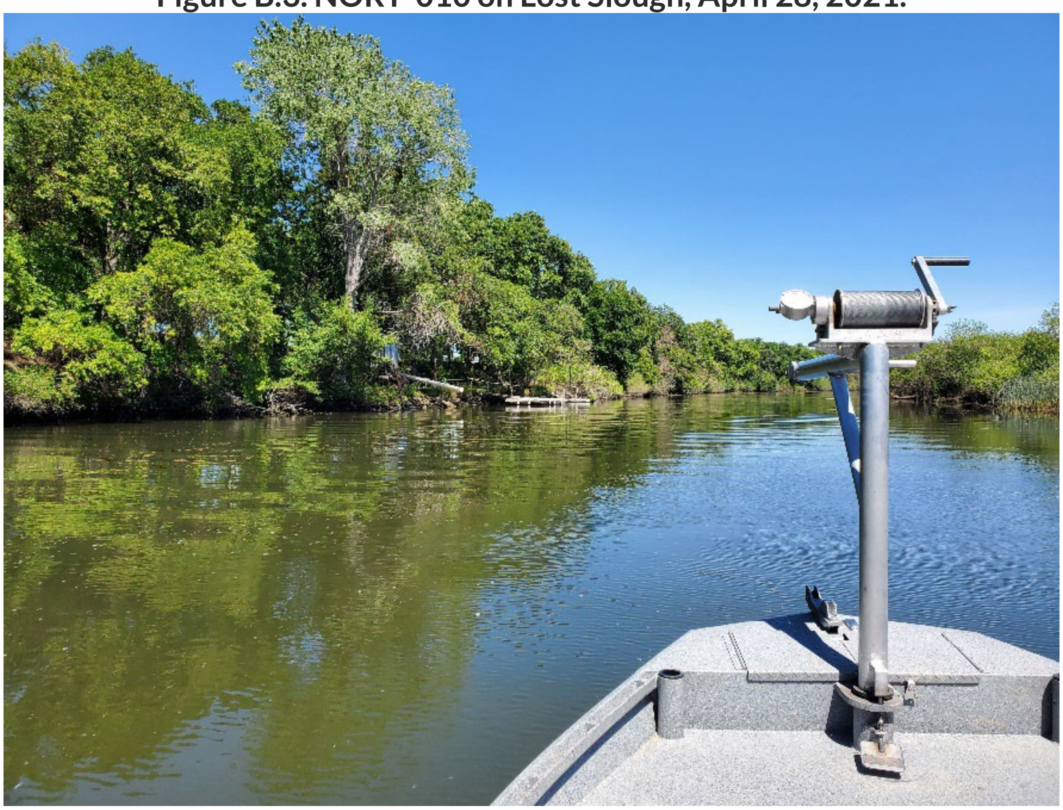

Figure B.4. Vegetation covering site NORT-009, April 29, 2021.

Figure B.5. Preparing to sample at NORT-012 on the South Mokelumne River, April 29, 2021.

Figure B.6. Approaching site NORT-011 on Georgiana Slough, April 29, 2021.

Event 4 – June 15 and 16, 2021

Figure B.7. Flow conditions at Ulatis Creek, June 15, 2021.

Figure B.8. SACR-020 on Steamboat Slough, June 15, 2021.

Figure B.9. NORT-015 on South Mokelumne River, June15, 2021.

Figure B.10. NORT-016 on Georgiana Slough, June 15, 2021.

Figure B.11. San Joaquin River near Buckley Cove, June 16, 2021.

Figure B.12. NORT-013 on the North Mokelumne River, June 16, 2021.

Figure B.13. NORT-014 on Snodgrass Slough, June 16, 2021.

Figure B.14. Approaching site SACR-019 on the Sacramento River, June 16, 2021.

Event 5 – August 10 and 11, 2021

Figure B.15. NORT-019 on Snodgrass Slough, August 10, 2021.

Figure B.16. Algae and aquatic vegetation at NORT-019, August 10, 2021.

Figure B.17. Barge and crane removing vegetation upstream of SACR-022, August 10, 2021

Figure B. 18. SACR-021 on Sutter Slough, August 10, 2021.

Figure B.19. Ulatis Creek looking downstream, August 10, 2021.

Figure B. 20. San Joaquin River near Buckley Cove, August 11, 2021.

Figure B.21. NORT-018 Hog Slough (agricultural drain in proceeding figure is in the background), August 11, 2021.

Figure B.22. Agricultural drain water being pumped into the waterway near NORT-018, August 11, 2021.

Figure B.23. Burnt aquatic vegetation on Hog Slough, August 11, 2021.

Figure B.24. NORT-020 at the confluence of the North and South Mokelumne Rivers, August 11,2021

Event 6 – September 13 and 14, 2021

Figure B.25. Ulatis Creek looking downstream, September 13, 2021.

Figure B.26. Cannabis eradication operations by helicopter near Steamboat Slough on September 13, 2021

Figure B.27. Sampling at SACR-024 on Steamboat Slough, September 13, 2021.

Figure B.28. NORT-022 on Snodgrass Slough, September 13, 2021.

Figure B.29. SACR-023 on the Sacramento River, September 13, 2021.

Figure B.30. San Joaquin River at Buckley Cove, September 14, 2021.

Figure B.31. NORT-021 on the South Mokelumne River, September 14, 2021.

Figure B.32. NORT-024 on the North Mokelumne River, September 14, 2021.

Figure B.33. NORT-023 Mokelumne River, September 14, 2021.

Appendix C. List of Current Use Pesticide Constituents

Pesticides Constituents Analyzed by USGS OCRL

Table C.1. Fiscal Year 2020-2021 DRMP current use pesticides.

Matrix	Analyte	Fraction	Unit
samplewater, <0.7 um	Acibenzolar-S-methyl	Dissolved	ng/L
samplewater, <0.7 um	Allethrin	Dissolved	ng/L
samplewater, <0.7 um	Atrazine	Dissolved	ng/L
samplewater, <0.7 um	Atrazine-13C3(Surrogate)	Dissolved	% recovery
samplewater, <0.7 um	Azoxystrobin	Dissolved	ng/L
samplewater, <0.7 um	Benfluralin	Dissolved	ng/L
samplewater, <0.7 um	Benzovindiflupyr	Dissolved	ng/L
samplewater, <0.7 um	Bifenthrin	Dissolved	ng/L
samplewater, <0.7 um	Boscalid	Dissolved	ng/L
samplewater, <0.7 um	Butralin	Dissolved	ng/L
samplewater, <0.7 um	Captan	Dissolved	ng/L
samplewater, <0.7 um	Carbaryl	Dissolved	ng/L
samplewater, <0.7 um	Carbofuran	Dissolved	ng/L
samplewater, <0.7 um	Chlorfenapyr	Dissolved	ng/L
samplewater, <0.7 um	Chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide, 2-	Dissolved	ng/L
samplewater, <0.7 um	Chlorothalonil	Dissolved	ng/L
samplewater, <0.7 um	Chlorpyrifos	Dissolved	ng/L
samplewater, <0.7 um	Chlorpyrifos oxon	Dissolved	ng/L
samplewater, <0.7 um	Clomazone	Dissolved	ng/L
samplewater, <0.7 um	Coumaphos	Dissolved	ng/L
samplewater, <0.7 um	Cycloate	Dissolved	ng/L
samplewater, <0.7 um	Cyfluthrin, Total	Dissolved	ng/L
samplewater, <0.7 um	Cyhalofop-butyl	Dissolved	ng/L
samplewater, <0.7 um	Cyhalothrin, Total	Dissolved	ng/L
samplewater, <0.7 um	Cypermethrin, Total	Dissolved	ng/L
samplewater, <0.7 um	Cyproconazole	Dissolved	ng/L
samplewater, <0.7 um	Cyprodinil	Dissolved	ng/L
samplewater, <0.7 um	Dacthal	Dissolved	ng/L
samplewater, <0.7 um	DDD(p,p')	Dissolved	ng/L
samplewater, <0.7 um	DDE(p,p')	Dissolved	ng/L
samplewater, <0.7 um	DDT(p,p')	Dissolved	ng/L
samplewater, <0.7 um	Deltamethrin	Dissolved	ng/L
samplewater, <0.7 um	Diazinon	Dissolved	ng/L
samplewater, <0.7 um	Diazoxon	Dissolved	ng/L
samplewater, <0.7 um	Dichloroaniline, 3,5-	Dissolved	ng/L

Matrix	Analyte	Fraction	Unit
samplewater, <0.7 um	Dichlorvos	Dissolved	ng/L
samplewater, <0.7 um	Difenoconazole	Dissolved	ng/L
samplewater, <0.7 um	Dimethomorph	Dissolved	ng/L
samplewater, <0.7 um	Dithiopyr	Dissolved	ng/L
samplewater, <0.7 um	EPTC	Dissolved	ng/L
samplewater, <0.7 um	Esfenvalerate	Dissolved	ng/L
samplewater, <0.7 um	Ethalfluralin	Dissolved	ng/L
samplewater, <0.7 um	Ethofenprox	Dissolved	ng/L
samplewater, <0.7 um	Etoxazole	Dissolved	ng/L
samplewater, <0.7 um	Famoxadone	Dissolved	ng/L
samplewater, <0.7 um	Fenamidone	Dissolved	ng/L
samplewater, <0.7 um	Fenbuconazole	Dissolved	ng/L
samplewater, <0.7 um	Fenhexamid	Dissolved	ng/L
samplewater, <0.7 um	Fenpropathrin	Dissolved	ng/L
samplewater, <0.7 um	Fenpyroximate	Dissolved	ng/L
samplewater, <0.7 um	Fipronil	Dissolved	ng/L
samplewater, <0.7 um	Fipronil Desulfinyl	Dissolved	ng/L
samplewater, <0.7 um	Fipronil Desulfinyl Amide	Dissolved	ng/L
samplewater, <0.7 um	Fipronil Sulfide	Dissolved	ng/L
samplewater, <0.7 um	Fipronil Sulfone	Dissolved	ng/L
samplewater, <0.7 um	Fipronil-C13(Surrogate)	Dissolved	% recovery
samplewater, <0.7 um	Fluazinam	Dissolved	ng/L
samplewater, <0.7 um	Flubendiamide	Dissolved	ng/L
samplewater, <0.7 um	Fludioxonil	Dissolved	ng/L
samplewater, <0.7 um	Flufenacet	Dissolved	ng/L
samplewater, <0.7 um	Flumetralin	Dissolved	ng/L
samplewater, <0.7 um	Fluopicolide	Dissolved	ng/L
samplewater, <0.7 um	Fluopyram	Dissolved	ng/L
samplewater, <0.7 um	Fluoxastrobin	Dissolved	ng/L
samplewater, <0.7 um	Flutolanil	Dissolved	ng/L
samplewater, <0.7 um	Flutriafol	Dissolved	ng/L
samplewater, <0.7 um	Fluxapyroxad	Dissolved	ng/L
samplewater, <0.7 um	Hexazinone	Dissolved	ng/L
samplewater, <0.7 um	Imazalil	Dissolved	ng/L
samplewater, <0.7 um	Indaziflam	Dissolved	ng/L
samplewater, <0.7 um	Indoxacarb	Dissolved	ng/L
samplewater, <0.7 um	Ipconazole	Dissolved	ng/L
samplewater, <0.7 um	Iprodione	Dissolved	ng/L
samplewater, <0.7 um	Isofetamid	Dissolved	ng/L
samplewater, <0.7 um	Kresoxim-methyl	Dissolved	ng/L
samplewater, <0.7 um	Malaoxon	Dissolved	ng/L

Matrix	Analyte	Fraction	Unit
samplewater, <0.7 um	Malathion	Dissolved	ng/L
samplewater, <0.7 um	Metalaxyl	Dissolved	ng/L
samplewater, <0.7 um	Metconazole	Dissolved	ng/L
samplewater, <0.7 um	Methoprene	Dissolved	ng/L
samplewater, <0.7 um	Metolachlor	Dissolved	ng/L
samplewater, <0.7 um	Myclobutanil	Dissolved	ng/L
samplewater, <0.7 um	Napropamide	Dissolved	ng/L
samplewater, <0.7 um	Novaluron	Dissolved	ng/L
samplewater, <0.7 um	Oxadiazon	Dissolved	ng/L
samplewater, <0.7 um	Oxyfluorfen	Dissolved	ng/L
samplewater, <0.7 um	Paclobutrazol	Dissolved	ng/L
samplewater, <0.7 um	Parathion, Methyl	Dissolved	ng/L
samplewater, <0.7 um	Pendimethalin	Dissolved	ng/L
samplewater, <0.7 um	Pentachloroanisole	Dissolved	ng/L
samplewater, <0.7 um	Pentachloronitrobenzene	Dissolved	ng/L
samplewater, <0.7 um	Permethrin, Total	Dissolved	ng/L
samplewater, <0.7 um	Phenothrin	Dissolved	ng/L
samplewater, <0.7 um	Phosmet	Dissolved	ng/L
samplewater, <0.7 um	Picoxystrobin	Dissolved	ng/L
samplewater, <0.7 um	Piperonyl Butoxide	Dissolved	ng/L
samplewater, <0.7 um	Prodiamine	Dissolved	ng/L
samplewater, <0.7 um	Prometon	Dissolved	ng/L
samplewater, <0.7 um	Prometryn	Dissolved	ng/L
samplewater, <0.7 um	Propanil	Dissolved	ng/L
samplewater, <0.7 um	Propargite	Dissolved	ng/L
samplewater, <0.7 um	Propiconazole	Dissolved	ng/L
samplewater, <0.7 um	Propyzamide	Dissolved	ng/L
samplewater, <0.7 um	Pyraclostrobin	Dissolved	ng/L
samplewater, <0.7 um	Pyridaben	Dissolved	ng/L
samplewater, <0.7 um	Pyrimethanil	Dissolved	ng/L
samplewater, <0.7 um	Pyriproxyfen	Dissolved	ng/L
samplewater, <0.7 um	Quinoxyfen	Dissolved	ng/L
samplewater, <0.7 um	Resmethrin	Dissolved	ng/L
samplewater, <0.7 um	Sedaxane	Dissolved	ng/L
samplewater, <0.7 um	Simazine	Dissolved	ng/L
samplewater, <0.7 um	Tebuconazole	Dissolved	ng/L
samplewater, <0.7 um	Tebupirimfos	Dissolved	ng/L
samplewater, <0.7 um	Tebupirimfos oxon	Dissolved	ng/L
samplewater, <0.7 um	Tefluthrin	Dissolved	ng/L
samplewater, <0.7 um	Tetraconazole	Dissolved	ng/L
samplewater, <0.7 um	Tetramethrin	Dissolved	ng/L

Matrix	Analyte	Fraction	Unit
samplewater, <0.7 um	T-Fluvalinate	Dissolved	ng/L
samplewater, <0.7 um	Thiobencarb	Dissolved	ng/L
samplewater, <0.7 um	Triadimefon	Dissolved	ng/L
samplewater, <0.7 um	Triadimenol	Dissolved	ng/L
samplewater, <0.7 um	Triallate	Dissolved	ng/L
samplewater, <0.7 um	Tributyl Phosphorotrithioate, S,S,S-	Dissolved	ng/L
samplewater, <0.7 um	Trifloxystrobin	Dissolved	ng/L
samplewater, <0.7 um	Triflumizole	Dissolved	ng/L
samplewater, <0.7 um	Trifluralin	Dissolved	ng/L
samplewater, <0.7 um	Trifluralin-d14(Surrogate)	Dissolved	% recovery
samplewater, <0.7 um	Triticonazole	Dissolved	ng/L
samplewater, <0.7 um	Zoxamide	Dissolved	ng/L
samplewater, <0.7 um	Acetamiprid	Dissolved	ng/L
samplewater, <0.7 um	Acetamiprid	Dissolved	ng/L
samplewater, <0.7 um	Acetamiprid	Dissolved	ng/L
samplewater, <0.7 um	Carbendazim	Dissolved	ng/L
samplewater, <0.7 um	Carbendazim	Dissolved	ng/L
samplewater, <0.7 um	Carbendazim	Dissolved	ng/L
samplewater, <0.7 um	Carboxin	Dissolved	ng/L
samplewater, <0.7 um	Carboxin	Dissolved	ng/L
samplewater, <0.7 um	Carboxin	Dissolved	ng/L
samplewater, <0.7 um	Chlorantraniliprole	Dissolved	ng/L
samplewater, <0.7 um	Chlorantraniliprole	Dissolved	ng/L
samplewater, <0.7 um	Chlorantraniliprole	Dissolved	ng/L
samplewater, <0.7 um	Clothianidin	Dissolved	ng/L
samplewater, <0.7 um	Clothianidin	Dissolved	ng/L
samplewater, <0.7 um	Clothianidin	Dissolved	ng/L
samplewater, <0.7 um	Cyantraniliprole	Dissolved	ng/L
samplewater, <0.7 um	Cyantraniliprole	Dissolved	ng/L
samplewater, <0.7 um	Cyantraniliprole	Dissolved	ng/L
samplewater, <0.7 um	Cyazofamid	Dissolved	ng/L
samplewater, <0.7 um	Cyazofamid	Dissolved	ng/L
samplewater, <0.7 um	Cyazofamid	Dissolved	ng/L
samplewater, <0.7 um	Cymoxanil	Dissolved	ng/L
samplewater, <0.7 um	Cymoxanil	Dissolved	ng/L
samplewater, <0.7 um	Cymoxanil	Dissolved	ng/L
samplewater, <0.7 um	Desthio-prothioconazole	Dissolved	ng/L
samplewater, <0.7 um	Desthio-prothioconazole	Dissolved	ng/L
samplewater, <0.7 um	Desthio-prothioconazole	Dissolved	ng/L
samplewater, <0.7 um	Dichlorobenzenamine, 3,4-	Dissolved	ng/L

Matrix	Analyte	Fraction	Unit
samplewater, <0.7 um	Dichlorobenzenamine, 3,4-	Dissolved	ng/L
samplewater, <0.7 um	Dichlorobenzenamine, 3,4-	Dissolved	ng/L
samplewater, <0.7 um	Dichlorophenyl Urea, 3,4-	Dissolved	ng/L
samplewater, <0.7 um	Dichlorophenyl Urea, 3,4-	Dissolved	ng/L
samplewater, <0.7 um	Dichlorophenyl Urea, 3,4-	Dissolved	ng/L
samplewater, <0.7 um	Dichlorophenyl-3-methyl Urea, 3,4-	Dissolved	ng/L
samplewater, <0.7 um	Dichlorophenyl-3-methyl Urea, 3,4-	Dissolved	ng/L
samplewater, <0.7 um	Dichlorophenyl-3-methyl Urea, 3,4-	Dissolved	ng/L
samplewater, <0.7 um	Dinotefuran	Dissolved	ng/L
samplewater, <0.7 um	Dinotefuran	Dissolved	ng/L
samplewater, <0.7 um	Dinotefuran	Dissolved	ng/L
samplewater, <0.7 um	Diuron	Dissolved	ng/L
samplewater, <0.7 um	Diuron	Dissolved	ng/L
samplewater, <0.7 um	Diuron	Dissolved	ng/L
samplewater, <0.7 um	Ethaboxam	Dissolved	ng/L
samplewater, <0.7 um	Ethaboxam	Dissolved	ng/L
samplewater, <0.7 um	Ethaboxam	Dissolved	ng/L
samplewater, <0.7 um	Flonicamid	Dissolved	ng/L
samplewater, <0.7 um	Flonicamid	Dissolved	ng/L
samplewater, <0.7 um	Flonicamid	Dissolved	ng/L
samplewater, <0.7 um	Flupyradifurone	Dissolved	ng/L
samplewater, <0.7 um	Flupyradifurone	Dissolved	ng/L
samplewater, <0.7 um	Flupyradifurone	Dissolved	ng/L
samplewater, <0.7 um	Fluridone	Dissolved	ng/L
samplewater, <0.7 um	Fluridone	Dissolved	ng/L
samplewater, <0.7 um	Fluridone	Dissolved	ng/L
samplewater, <0.7 um	Imidacloprid	Dissolved	ng/L
samplewater, <0.7 um	Imidacloprid	Dissolved	ng/L
samplewater, <0.7 um	Imidacloprid	Dissolved	ng/L
samplewater, <0.7 um	Imidacloprid urea	Dissolved	ng/L
samplewater, <0.7 um	Imidacloprid urea	Dissolved	ng/L
samplewater, <0.7 um	Imidacloprid urea	Dissolved	ng/L
samplewater, <0.7 um	Imidacloprid-d4(Surrogate)	Dissolved	% recovery
samplewater, <0.7 um	Imidacloprid-d4(Surrogate)	Dissolved	% recovery
samplewater, <0.7 um	Imidacloprid-d4(Surrogate)	Dissolved	% recovery
samplewater, <0.7 um	Mandipropamid	Dissolved	ng/L
samplewater, <0.7 um	Mandipropamid	Dissolved	ng/L
samplewater, <0.7 um	Mandipropamid	Dissolved	ng/L

MATRIX	ANALYTE	FRACTION	UNIT
samplewater, <0.7 um	Methoxyfenozide	Dissolved	ng/L
samplewater, <0.7 um	Methoxyfenozide	Dissolved	ng/L
samplewater, <0.7 um	Methoxyfenozide	Dissolved	ng/L
samplewater, <0.7 um	Monuron(Surrogate)	Dissolved	% recovery
samplewater, <0.7 um	Monuron(Surrogate)	Dissolved	% recovery
samplewater, <0.7 um	Monuron(Surrogate)	Dissolved	% recovery
samplewater, <0.7 um	Oryzalin	Dissolved	ng/L
samplewater, <0.7 um	Oryzalin	Dissolved	ng/L
samplewater, <0.7 um	Oryzalin	Dissolved	ng/L
samplewater, <0.7 um	Oxathiapiprolin	Dissolved	ng/L
samplewater, <0.7 um	Oxathiapiprolin	Dissolved	ng/L
samplewater, <0.7 um	Oxathiapiprolin	Dissolved	ng/L
samplewater, <0.7 um	Penoxsulam	Dissolved	ng/L
samplewater, <0.7 um	Penoxsulam	Dissolved	ng/L
samplewater, <0.7 um	Penoxsulam	Dissolved	ng/L
samplewater, <0.7 um	Penthiopyrad	Dissolved	ng/L
samplewater, <0.7 um	Penthiopyrad	Dissolved	ng/L
samplewater, <0.7 um	Penthiopyrad	Dissolved	ng/L
samplewater, <0.7 um	Sulfoxaflor	Dissolved	ng/L
samplewater, <0.7 um	Sulfoxaflor	Dissolved	ng/L
samplewater, <0.7 um	Sulfoxaflor	Dissolved	ng/L
samplewater, <0.7 um	Tebufenozide	Dissolved	ng/L
samplewater, <0.7 um	Tebufenozide	Dissolved	ng/L
samplewater, <0.7 um	Tebufenozide	Dissolved	ng/L
samplewater, <0.7 um	Thiabendazole	Dissolved	ng/L
samplewater, <0.7 um	Thiabendazole	Dissolved	ng/L
samplewater, <0.7 um	Thiabendazole	Dissolved	ng/L
samplewater, <0.7 um	Thiacloprid	Dissolved	ng/L
samplewater, <0.7 um	Thiacloprid	Dissolved	ng/L
samplewater, <0.7 um	Thiacloprid	Dissolved	ng/L
samplewater, <0.7 um	Thiamethoxam	Dissolved	ng/L
samplewater, <0.7 um	Thiamethoxam	Dissolved	ng/L
samplewater, <0.7 um	Thiamethoxam	Dissolved	ng/L
samplewater, <0.7 um	Thiamethoxam Degradate (CGA-355190)	Dissolved	ng/L
samplewater, <0.7 um	Thiamethoxam Degradate (CGA-355190)	Dissolved	ng/L
samplewater, <0.7 um	Thiamethoxam Degradate (CGA-355190)	Dissolved	ng/L
samplewater, <0.7 um	Thiamethoxam Degradate (NOA-407475)	Dissolved	ng/L

Matrix	Analyte	Fraction	Unit
samplewater, <0.7 um	Thiamethoxam Degradate (NOA-407475)	Dissolved	ng/L
samplewater, <0.7 um	Thiamethoxam Degradate (NOA-407475)	Dissolved	ng/L
samplewater, <0.7 um	Tolfenpyrad	Dissolved	ng/L
samplewater, <0.7 um	Tolfenpyrad	Dissolved	ng/L
samplewater, <0.7 um	Tolfenpyrad	Dissolved	ng/L
samplewater, <0.7 um	Tricyclazole	Dissolved	ng/L
samplewater, <0.7 um	Tricyclazole	Dissolved	ng/L
samplewater, <0.7 um	Tricyclazole	Dissolved	ng/L
samplewater, particulate, >0.70 um	Total Suspended Solids	Particulate	mg/L
samplewater, particulate, >0.70 um	Acibenzolar-S-methyl	Particulate	ng/L
samplewater, particulate, >0.70 um	Allethrin	Particulate	ng/L
samplewater, particulate, >0.70 um	Atrazine	Particulate	ng/L
samplewater, particulate, >0.70 um	Azoxystrobin	Particulate	ng/L
samplewater, particulate, >0.70 um	Benfluralin	Particulate	ng/L
samplewater, particulate, >0.70 um	Benzovindiflupyr	Particulate	ng/L
samplewater, particulate, >0.70 um	Bifenthrin	Particulate	ng/L
samplewater, particulate, >0.70 um	Boscalid	Particulate	ng/L
samplewater, particulate, >0.70 um	Butralin	Particulate	ng/L
samplewater, particulate, >0.70 um	Captan	Particulate	ng/L
samplewater, particulate, >0.70 um	Carbaryl	Particulate	ng/L
samplewater, particulate, >0.70 um	Carbofuran	Particulate	ng/L
samplewater, particulate, >0.70 um	Chlorfenapyr	Particulate	ng/L
samplewater, particulate, >0.70 um	Chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide, 2-	Particulate	ng/L
samplewater, particulate, >0.70 um	Chlorothalonil	Particulate	ng/L
samplewater, particulate, >0.70 um	Chlorpyrifos	Particulate	ng/L
samplewater, particulate, >0.70 um	Chlorpyrifos oxon	Particulate	ng/L
samplewater, particulate, >0.70 um	Clomazone	Particulate	ng/L
samplewater, particulate, >0.70 um	Coumaphos	Particulate	ng/L
samplewater, particulate, >0.70 um	Cycloate	Particulate	ng/L
samplewater, particulate, >0.70 um	Cyfluthrin, Total	Particulate	ng/L
samplewater, particulate, >0.70 um	Cyhalofop-butyl	Particulate	ng/L
samplewater, particulate, >0.70 um	Cyhalothrin, Total	Particulate	ng/L
samplewater, particulate, >0.70 um	Cypermethrin, Total	Particulate	ng/L
samplewater, particulate, >0.70 um	Cyproconazole	Particulate	ng/L
samplewater, particulate, >0.70 um	Cyprodinil	Particulate	ng/L
samplewater, particulate, >0.70 um	Dacthal	Particulate	ng/L
samplewater, particulate, >0.70 um	DDD(p,p')	Particulate	ng/L

Matrix	Analyte	Fraction	Unit
samplewater, particulate, >0.70 um	DDE(p,p')	Particulate	ng/L
samplewater, particulate, >0.70 um	DDE(p,p')(Surrogate)	Particulate	% recovery
samplewater, particulate, >0.70 um	DDT(p,p')	Particulate	ng/L
samplewater, particulate, >0.70 um	Deltamethrin	Particulate	ng/L
samplewater, particulate, >0.70 um	Diazinon	Particulate	ng/L
samplewater, particulate, >0.70 um	Diazoxon	Particulate	ng/L
samplewater, particulate, >0.70 um	Dichloroaniline, 3,5-	Particulate	ng/L
samplewater, particulate, >0.70 um	Dichlorobenzenamine, 3,4-	Particulate	ng/L
samplewater, particulate, >0.70 um	Dichlorvos	Particulate	ng/L
samplewater, particulate, >0.70 um	Difenoconazole	Particulate	ng/L
samplewater, particulate, >0.70 um	Dimethomorph	Particulate	ng/L
samplewater, particulate, >0.70 um	Dithiopyr	Particulate	ng/L
samplewater, particulate, >0.70 um	EPTC	Particulate	ng/L
samplewater, particulate, >0.70 um	Esfenvalerate	Particulate	ng/L
samplewater, particulate, >0.70 um	Ethalfluralin	Particulate	ng/L
samplewater, particulate, >0.70 um	Ethofenprox	Particulate	ng/L
samplewater, particulate, >0.70 um	Etoxazole	Particulate	ng/L
samplewater, particulate, >0.70 um	Famoxadone	Particulate	ng/L
samplewater, particulate, >0.70 um	Fenamidone	Particulate	ng/L
samplewater, particulate, >0.70 um	Fenbuconazole	Particulate	ng/L
samplewater, particulate, >0.70 um	Fenhexamid	Particulate	ng/L
samplewater, particulate, >0.70 um	Fenpropathrin	Particulate	ng/L
samplewater, particulate, >0.70 um	Fenpyroximate	Particulate	ng/L
samplewater, particulate, >0.70 um	Fipronil	Particulate	ng/L
samplewater, particulate, >0.70 um	Fipronil Desulfinyl	Particulate	ng/L
samplewater, particulate, >0.70 um	Fipronil Desulfinyl Amide	Particulate	ng/L
samplewater, particulate, >0.70 um	Fipronil Sulfide	Particulate	ng/L
samplewater, particulate, >0.70 um	Fipronil Sulfone	Particulate	ng/L
samplewater, particulate, >0.70 um	Fipronil-C13(Surrogate)	Particulate	% recovery
samplewater, particulate, >0.70 um	Fluazinam	Particulate	ng/L
samplewater, particulate, >0.70 um	Flubendiamide	Particulate	ng/L
samplewater, particulate, >0.70 um	Fludioxonil	Particulate	ng/L
samplewater, particulate, >0.70 um	Flufenacet	Particulate	ng/L
samplewater, particulate, >0.70 um	Flumetralin	Particulate	ng/L
samplewater, particulate, >0.70 um	Fluopicolide	Particulate	ng/L
samplewater, particulate, >0.70 um	Fluopyram	Particulate	ng/L
samplewater, particulate, >0.70 um	Fluoxastrobin	Particulate	ng/L
samplewater, particulate, >0.70 um	Flutolanil	Particulate	ng/L
samplewater, particulate, >0.70 um	Flutriafol	Particulate	ng/L
samplewater, particulate, >0.70 um	Fluxapyroxad	Particulate	ng/L
samplewater, particulate, >0.70 um	Hexazinone	Particulate	ng/L

Matrix	Analyte	Fraction	Unit
samplewater, particulate, >0.70 um	Imazalil	Particulate	ng/L
samplewater, particulate, >0.70 um	Indaziflam	Particulate	ng/L
samplewater, particulate, >0.70 um	Indoxacarb	Particulate	ng/L
samplewater, particulate, >0.70 um	Ipconazole	Particulate	ng/L
samplewater, particulate, >0.70 um	Iprodione	Particulate	ng/L
samplewater, particulate, >0.70 um	Isofetamid	Particulate	ng/L
samplewater, particulate, >0.70 um	Kresoxim-methyl	Particulate	ng/L
samplewater, particulate, >0.70 um	Malaoxon	Particulate	ng/L
samplewater, particulate, >0.70 um	Malathion	Particulate	ng/L
samplewater, particulate, >0.70 um	Metalaxyl	Particulate	ng/L
samplewater, particulate, >0.70 um	Metconazole	Particulate	ng/L
samplewater, particulate, >0.70 um	Methoprene	Particulate	ng/L
samplewater, particulate, >0.70 um	Metolachlor	Particulate	ng/L
samplewater, particulate, >0.70 um	Myclobutanil	Particulate	ng/L
samplewater, particulate, >0.70 um	Napropamide	Particulate	ng/L
samplewater, particulate, >0.70 um	Novaluron	Particulate	ng/L
samplewater, particulate, >0.70 um	Oxadiazon	Particulate	ng/L
samplewater, particulate, >0.70 um	Oxyfluorfen	Particulate	ng/L
samplewater, particulate, >0.70 um	Paclobutrazol	Particulate	ng/L
samplewater, particulate, >0.70 um	Parathion, Methyl	Particulate	ng/L
samplewater, particulate, >0.70 um	Pendimethalin	Particulate	ng/L
samplewater, particulate, >0.70 um	Pentachloroanisole	Particulate	ng/L
samplewater, particulate, >0.70 um	Pentachloronitrobenzene	Particulate	ng/L
samplewater, particulate, >0.70 um	Permethrin, cis-(Surrogate)	Particulate	% recovery
samplewater, particulate, >0.70 um	Permethrin, Total	Particulate	ng/L
samplewater, particulate, >0.70 um	Phenothrin	Particulate	ng/L
samplewater, particulate, >0.70 um	Phosmet	Particulate	ng/L
samplewater, particulate, >0.70 um	Picoxystrobin	Particulate	ng/L
samplewater, particulate, >0.70 um	Piperonyl Butoxide	Particulate	ng/L
samplewater, particulate, >0.70 um	Prodiamine	Particulate	ng/L
samplewater, particulate, >0.70 um	Prometon	Particulate	ng/L
samplewater, particulate, >0.70 um	Prometryn	Particulate	ng/L
samplewater, particulate, >0.70 um	Propanil	Particulate	ng/L
samplewater, particulate, >0.70 um	Propargite	Particulate	ng/L
samplewater, particulate, >0.70 um	Propiconazole	Particulate	ng/L
samplewater, particulate, >0.70 um	Propyzamide	Particulate	ng/L
samplewater, particulate, >0.70 um	Pyraclostrobin	Particulate	ng/L
samplewater, particulate, >0.70 um	Pyridaben	Particulate	ng/L
samplewater, particulate, >0.70 um	Pyrimethanil	Particulate	ng/L
samplewater, particulate, >0.70 um	Pyriproxyfen	Particulate	ng/L
samplewater, particulate, >0.70 um	Quinoxyfen	Particulate	ng/L

Matrix	Analyte	Fraction	Unit
samplewater, particulate, >0.70 um	Resmethrin	Particulate	ng/L
samplewater, particulate, >0.70 um	Sedaxane	Particulate	ng/L
samplewater, particulate, >0.70 um	Simazine	Particulate	ng/L
samplewater, particulate, >0.70 um	Tebuconazole	Particulate	ng/L
samplewater, particulate, >0.70 um	Tebupirimfos	Particulate	ng/L
samplewater, particulate, >0.70 um	Tebupirimfos oxon	Particulate	ng/L
samplewater, particulate, >0.70 um	Tefluthrin	Particulate	ng/L
samplewater, particulate, >0.70 um	Tetraconazole	Particulate	ng/L
samplewater, particulate, >0.70 um	Tetramethrin	Particulate	ng/L
samplewater, particulate, >0.70 um	T-Fluvalinate	Particulate	ng/L
samplewater, particulate, >0.70 um	Thiobencarb	Particulate	ng/L
samplewater, particulate, >0.70 um	Triadimefon	Particulate	ng/L
samplewater, particulate, >0.70 um	Triadimenol	Particulate	ng/L
samplewater, particulate, >0.70 um	Triallate	Particulate	ng/L
samplewater, particulate, >0.70 um	Tributyl Phosphorotrithioate, S,S,S-	Particulate	ng/L
samplewater, particulate, >0.70 um	Trifloxystrobin	Particulate	ng/L
samplewater, particulate, >0.70 um	Triflumizole	Particulate	ng/L
samplewater, particulate, >0.70 um	Trifluralin	Particulate	ng/L
samplewater, particulate, >0.70 um	Trifluralin-d14(Surrogate)	Particulate	% recovery
samplewater, particulate, >0.70 um	Triticonazole	Particulate	ng/L
samplewater, particulate, >0.70 um	Zoxamide	Particulate	ng/L

Appendix D. Summary of Completeness and Quality Control Sample Acceptability for WY 2021

The following sections outline the completeness and overall acceptability of each analysis completed for the Delta Regional Monitoring Program (DRMP) Current Use Pesticide (CUP) monitoring that occurred during WY 2021.

A total of 32 environmental samples were analyzed by the United State Geological Survey (USGS) National Water Quality Laboratory (NWQL) for dissolved copper, dissolved organic carbon (DOC), total inorganic carbon (TIC), particulate organic carbon (POC), total particulate carbon (TPC), and total particulate nitrogen (TPN). Associated results were unavailable during the preparation of this report. To ensure a complete and consistent record of WY 2021, verification of USGS NWQL results will be detailed in a future **Appendix A** to this document. These analytes are not included in the assessment below.

Summary of Completeness

Sample Completeness

Table D.1. Field and transport and analytical completeness for WY 2021.
Samples are counted as individual results, i.e., separate endpoints for toxicity results and separate sample fractions analyzed for chemistry results.

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
EPA 160.2	Water	Total Suspended Solids	32	32	100	32	100
EPA 821/R-02-012	Water	*Hyalella azteca*	32	32	100	32	100
EPA 821/R-02-013	Water	*Ceriodaphnia dubia*	64	64	100	64	100
EPA 821/R-02-013	Water	*Pimephales promelas*	64	64	100	64	100
EPA 821/R-02-013	Water	*Selenastrum capricornutum*	32	32	100	32	100
EPA 600/R-99-064M	Water	*Chironomus dilutus*	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Acibenzolar-S-methyl	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Allethrin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Atrazine	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Azoxystrobin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Benfluralin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Benzovindiflupyr	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Bifenthrin	64	64	100	64	100

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Boscalid	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Butralin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Captan	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Carbaryl	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Carbofuran	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Chlorfenapyr	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide, 2-	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Chlorothalonil	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Chlorpyrifos	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Chlorpyrifos oxon	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Clomazone	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Coumaphos	64	64	100	64	100

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cycloate	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cyfluthrin, Total	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cyhalofop-butyl	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cyhalothrin, Total	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cypermethrin, Total	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cyproconazole	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cyprodinil	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Dacthal	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	DDD(p,p')	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	DDE(p,p')	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	DDT(p,p')	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Deltamethrin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Diazinon	64	64	100	64	100

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Diazoxon	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Dichloroaniline, 3,5-	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Dichlorobenzenamine, 3,4-	32	32	100	32	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Dichlorvos	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Difenoconazole	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Dimethomorph	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Dithiopyr	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	EPTC	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Esfenvalerate	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Ethalfluralin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Ethofenprox	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Etoxazole	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Famoxadone	64	64	100	64	100

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fenamidone	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fenbuconazole	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fenhexamid	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fenpropathrin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fenpyroximate	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fipronil	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fipronil Desulfinyl	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fipronil Desulfinyl Amide	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fipronil Sulfide	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fipronil Sulfone	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fluazinam	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Flubendiamide	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fludioxonil	64	64	100	64	100

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Flufenacet	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Flumetralin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fluopicolide	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fluopyram	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fluoxastrobin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Flutolanil	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Flutriafol	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fluxapyroxad	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Hexazinone	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Imazalil	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Indaziflam	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Indoxacarb	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Ipconazole	64	64	100	64	100

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Iprodione	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Isofetamid	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Kresoxim-methyl	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Malaoxon	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Malathion	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Metalaxyl	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Metconazole	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Methoprene	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Metolachlor	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Myclobutanil	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Napropamide	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Novaluron	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Oxadiazon	64	64	100	64	100

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Oxyfluorfen	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Paclobutrazol	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Parathion, Methyl	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Pendimethalin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Pentachloroanisole	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Pentachloronitrobenzene	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Permethrin, Total	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Phenothrin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Phosmet	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Picoxystrobin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Piperonyl Butoxide	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Prodiamine	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Prometon	64	64	100	64	100

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Prometryn	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Propanil	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Propargite	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Propiconazole	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Propyzamide	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Pyraclostrobin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Pyridaben	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Pyrimethanil	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Pyriproxyfen	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Quinoxyfen	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Resmethrin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Sedaxane	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Simazine	64	64	100	64	100

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tebuconazole	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tebupirimfos	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tebupirimfos oxon	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tefluthrin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tetraconazole	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tetramethrin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	T-Fluvalinate	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Thiobencarb	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Triadimefon	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Triadimenol	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Triallate	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tributyl Phosphorotrithioate, S,S,S-	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Trifloxystrobin	64	64	100	64	100

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Triflumizole	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Trifluralin	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Triticonazole	64	64	100	64	100
USGS-OCRL_GC/ MS_Sanders_2018	Water	Zoxamide	64	64	100	64	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Acetamiprid	32	32	100	32	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Carbendazim	32	32	100	32	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Carboxin	32	32	100	32	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Chlorantraniliprole	32	32	100	32	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Clothianidin	32	32	100	32	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Cyantraniliprole	32	32	100	32	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Cyazofamid	32	32	100	32	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Cymoxanil	32	32	100	32	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Desthio-prothioconazole	32	32	100	32	100

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Dichlorobenzenamine, 3,4-	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Dichlorophenyl Urea, 3,4-	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Dichlorophenyl-3-methyl Urea, 3,4-	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Dinotefuran	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Diuron	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Ethaboxam	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Flonicamid	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Flupyradifurone	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Fluridone	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Imidacloprid	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Imidacloprid urea	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Mandipropamid	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Methoxyfenozide	32	32	100	32	100

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Oryzalin	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Oxathiapiprolin	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Penoxsulam	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Penthiopyrad	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Sulfoxaflor	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Tebufenozide	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Thiabendazole	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Thiacloprid	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Thiamethoxam	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Thiamethoxam Degradate (CGA-355190)	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Thiamethoxam Degradate (NOA-407475)	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Tolfenpyrad	32	32	100	32	100
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Tricyclazole	32	32	100	32	100
Total			**9504**	**9504**	**100**	**9512**	**100**

Field Measurement Completeness

Table D.2. Field measurement completeness counts for WY 2021.

Analyte	Samples Scheduled	Instrument Failure	Measurements taken	Completeness (%)
Dissolved Oxygen, mg/L	32	0	32	100
Oxygen Saturation (%)	32	0	32	100
pH	32	1	31	96
Salinity	32	0	32	100
Specific Conductivity, µS/cm	32	0	32	100
Temperature, ^{o}C	32	0	32	100
Turbidity, NTU	32	0	32	100
Total	**224**	**1**	**223**	**99.6**

Field Quality Control Frequency

Table D.3. Field quality control sample completeness.
Samples are counted as individual results, i.e., separate endpoints for toxicity results and separate sample fractions analyzed for chemistry results.

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
EPA 160.2	Water	Total Suspended Solids	32	2	2	36	6.3	6.3
EPA 821/R-02-012	Water	*Hyalella azteca*	32	2	NA	34	6.3	NA
EPA 821/R-02-013	Water	*Ceriodaphnia dubia*	64	4	NA	68	5.6	NA
EPA 821/R-02-013	Water	*Pimephales promelas*	64	4	NA	68	6.3	NA
EPA 821/R-02-013	Water	*Selenastrum capricornutum*	32	2	NA	34	6.3	NA
EPA 600/R-99-064M	Water	*Chironomus dilutus*	64	4	NA	68	6.3	NA
USGS-OCRL_GC/ MS_Sanders_2018	Water	Acibenzolar-S-methyl	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Allethrin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Atrazine	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Azoxystrobin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Benfluralin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Benzovindiflupyr	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Bifenthrin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Boscalid	64	4	4	72	6.3	6.3

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Butralin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Captan	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Carbaryl	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Carbofuran	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Chlorfenapyr	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide, 2-	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Chlorothalonil	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Chlorpyrifos	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Chlorpyrifos oxon	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Clomazone	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Coumaphos	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cycloate	64	4	4	72	6.3	6.3

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cyfluthrin, Total	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cyhalofop-butyl	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cyhalothrin, Total	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cypermethrin, Total	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cyproconazole	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Cyprodinil	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Dacthal	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	DDD(p,p')	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	DDE(p,p')	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	DDT(p,p')	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Deltamethrin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Diazinon	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Diazoxon	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Dichloroaniline, 3,5-	64	4	4	72	6.3	6.3

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Dichlorobenzenamine , 3,4-	32	2	2	36	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Dichlorvos	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Difenoconazole	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Dimethomorph	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Dithiopyr	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	EPTC	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Esfenvalerate	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Ethalfluralin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Ethofenprox	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Etoxazole	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Famoxadone	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fenamidone	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fenbuconazole	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fenhexamid	64	4	4	72	6.3	6.3

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fenpropathrin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fenpyroximate	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fipronil	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fipronil Desulfinyl	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fipronil Desulfinyl Amide	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fipronil Sulfide	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fipronil Sulfone	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fluazinam	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Flubendiamide	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fludioxonil	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Flufenacet	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Flumetralin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fluopicolide	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fluopyram	64	4	4	72	6.3	6.3

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fluoxastrobin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Flutolanil	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Flutriafol	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Fluxapyroxad	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Hexazinone	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Imazalil	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Indaziflam	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Indoxacarb	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Ipconazole	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Iprodione	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Isofetamid	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Kresoxim-methyl	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Malaoxon	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Malathion	64	4	4	72	6.3	6.3

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS-OCRL_GC/MS_Sanders_2018	Water	Metalaxyl	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Metconazole	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Methoprene	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Metolachlor	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Myclobutanil	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Napropamide	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Novaluron	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Oxadiazon	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Oxyfluorfen	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Paclobutrazol	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Parathion, Methyl	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Pendimethalin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Pentachloroanisole	64	4	4	72	6.3	6.3
USGS-OCRL_GC/MS_Sanders_2018	Water	Pentachloronitrobenzene	64	4	4	72	6.3	6.3

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Permethrin, Total	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Phenothrin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Phosmet	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Picoxystrobin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Piperonyl Butoxide	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Prodiamine	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Prometon	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Prometryn	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Propanil	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Propargite	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Propiconazole	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Propyzamide	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Pyraclostrobin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Pyridaben	64	4	4	72	6.3	6.3

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Pyrimethanil	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Pyriproxyfen	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Quinoxyfen	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Resmethrin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Sedaxane	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Simazine	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tebuconazole	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tebupirimfos	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tebupirimfos oxon	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tefluthrin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tetraconazole	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tetramethrin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	T-Fluvalinate	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Thiobencarb	64	4	4	72	6.3	6.3

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS-OCRL_GC/ MS_Sanders_2018	Water	Triadimefon	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Triadimenol	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Triallate	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Tributyl Phosphorotrithioate, S,S,S-	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Trifloxystrobin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Triflumizole	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Trifluralin	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Triticonazole	64	4	4	72	6.3	6.3
USGS-OCRL_GC/ MS_Sanders_2018	Water	Zoxamide	64	4	4	72	6.3	6.3
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Acetamiprid	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Carbendazim	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Carboxin	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/ MS_Sanders_2018	Water	Chlorantraniliprole	32	2	2	36	6.3	6.3

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Clothianidin	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Cyantraniliprole	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Cyazofamid	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Cymoxanil	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Desthio-prothioconazole	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Dichlorobenzenamine, 3,4-	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Dichlorophenyl Urea, 3,4-	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Dichlorophenyl-3-methyl Urea, 3,4-	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Dinotefuran	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Diuron	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Ethaboxam	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Flonicamid	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Flupyradifurone	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Fluridone	32	2	2	36	6.3	6.3

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Imidacloprid	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Imidacloprid urea	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Mandipropamid	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Methoxyfenozide	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Oryzalin	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Oxathiapiprolin	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Penoxsulam	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Penthiopyrad	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Sulfoxaflor	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Tebufenozide	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Thiabendazole	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Thiacloprid	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Thiamethoxam	32	2	2	36	6.3	6.3

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Thiamethoxam Degradate (CGA-355190)	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Thiamethoxam Degradate (NOA-407475)	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Tolfenpyrad	32	2	2	36	6.3	6.3
USGS-OCRL_LC/MS/MS_Sanders_2018	Water	Tricyclazole	32	2	2	36	6.3	6.3
Total			**9512**	**594**	**578**	**10684**	**6.2**	**6.1**

Quality Control Sample Acceptability

Field Blanks Samples

Table D.4. Field blank (FB) acceptability for WY 2021.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Acetamiprid	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Carbendazim	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Carboxin	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Chlorantraniliprole	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Clothianidin	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Cyantraniliprole	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Cyazofamid	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Cymoxanil	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Desthio-prothioconazole	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorobenzenamine, 3,4-	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorophenyl Urea, 3,4-	< MDL	2	2	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorophenyl-3-methyl Urea, 3,4-	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dinotefuran	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Diuron	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Ethaboxam	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Flonicamid	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Flupyradifurone	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Fluridone	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid urea	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Mandipropamid	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Methoxyfenozide	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Oryzalin	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Oxathiapiprolin	< MDL	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Penoxsulam	< MDL	2	2	100

METHOD	LAB	MATRIX	FRACTIONS	ANALYTE	ACCEPTABILITY CRITERIA	TOTAL FB SAMPLES	FB SAMPLES WITHIN LIMITS	ACCEPTABILITY MET (%)
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Penthiopyrad	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Sulfoxaflor	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Tebufenozide	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Thiabendazole	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Thiacloprid	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam Degradate (CGA-355190)	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam Degradate (NOA-407475)	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Tolfenpyrad	< MDL	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Tricyclazole	< MDL	2	2	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Acibenzolar-S-methyl	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Allethrin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Atrazine	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Azoxystrobin	< MDL	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Benfluralin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Benzovindiflupyr	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Bifenthrin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Boscalid	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Butralin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Captan	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Carbaryl	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Carbofuran	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorfenapyr	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide, 2-	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorothalonil	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorpyrifos	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorpyrifos oxon	< MDL	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Clomazone	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Coumaphos	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cycloate	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyfluthrin, Total	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyhalofop-butyl	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyhalothrin, Total	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cypermethrin, Total	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyproconazole	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyprodinil	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dacthal	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDD(p,p')	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDE(p,p')	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDT(p,p')	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Deltamethrin	< MDL	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Diazinon	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Diazoxon	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dichloroaniline, 3,5-	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate	Dichlorobenzenamine, 3,4-	< MDL	2	2	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dichlorvos	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Difenoconazole	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dimethomorph	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dithiopyr	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	EPTC	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Esfenvalerate	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ethalfluralin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ethofenprox	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Etoxazole	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Famoxadone	< MDL	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenamidone	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenbuconazole	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenhexamid	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenpropathrin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenpyroximate	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Desulfinyl	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Desulfinyl Amide	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Sulfide	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Sulfone	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluazinam	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flubendiamide	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fludioxonil	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flufenacet	< MDL	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flumetralin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluopicolide	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluopyram	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluoxastrobin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flutolanil	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flutriafol	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluxapyroxad	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Hexazinone	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Imazalil	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Indaziflam	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Indoxacarb	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ipconazole	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Iprodione	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Isofetamid	< MDL	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Kresoxim-methyl	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Malaoxon	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Malathion	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metalaxyl	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metconazole	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Methoprene	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metolachlor	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Myclobutanil	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Napropamide	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Novaluron	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Oxadiazon	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Oxyfluorfen	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Paclobutrazol	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Parathion, Methyl	< MDL	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pendimethalin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pentachloroanisole	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pentachloronitrobenzene	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Permethrin, Total	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Phenothrin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Phosmet	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Picoxystrobin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Piperonyl Butoxide	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prodiamine	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prometon	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prometryn	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propanil	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propargite	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propiconazole	< MDL	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propyzamide	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyraclostrobin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyridaben	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyrimethanil	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyriproxyfen	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Quinoxyfen	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Resmethrin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Sedaxane	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Simazine	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebuconazole	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebupirimfos	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebupirimfos oxon	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tefluthrin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tetraconazole	< MDL	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tetramethrin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	T-Fluvalinate	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Thiobencarb	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triadimefon	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triadimenol	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triallate	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tributyl Phosphorotrithioate, S,S,S-	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Trifloxystrobin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triflumizole	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Trifluralin	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triticonazole	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Zoxamide	< MDL	4	4	100
EPA 160.2	OCRL	Water	Particulate	Total Suspended Solids	< MDL	2	2	100
Total						**578**	**578**	**100**

Field Duplicate Samples

Table D.5. Field duplicate acceptability for WY 2021.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
EPA 821/R-02-013M	PER	Water	Survival, Growth [1]	*Chironomus dilutus*	RPD ≤ 25	4	4	100
EPA 821/R-02-013	PER	Water	Survival, Reproduction [2]	*Ceriodaphnia dubia*	RPD ≤ 25	4	4	100
EPA 821/R-02-013	PER	Water	Survival, Growth [3]	*Pimephales promelas*	RPD ≤ 25	4	4	100
EPA 821/R-02-013	PER	Water	Growth [4]	*Selenastrum capricornutum*	RPD ≤ 25	2	2	100
EPA 821/R-02-012M	PER	Water	Survival	*Hyalella azteca*	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Acetamiprid	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Carbendazim	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Carboxin	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Chlorantraniliprole	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Clothianidin	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cyantraniliprole	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cyazofamid	RPD ≤ 25	2	2	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cymoxanil	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Desthio-prothioconazole	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorobenzenamine, 3,4-	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorophenyl Urea, 3,4-	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorophenyl-3-methyl Urea, 3,4-	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dinotefuran	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Diuron	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Ethaboxam	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Flonicamid	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Flupyradifurone	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Fluridone	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid urea	RPD ≤ 25	2	2	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Mandipropamid	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Methoxyfenozide	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Oryzalin	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Oxathiapiprolin	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Penoxsulam	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Penthiopyrad	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Sulfoxaflor	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Tebufenozide	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Thiabendazole	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Thiacloprid	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/ MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam Degradate (CGA-355190)	RPD ≤ 25	2	2	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam Degradate (NOA-407475)	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tolfenpyrad	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tricyclazole	RPD ≤ 25	2	2	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Acibenzolar-S-methyl	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Allethrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Atrazine	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Azoxystrobin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Benfluralin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	articulate, Dissolved	Benzovindiflupyr	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Bifenthrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Boscalid	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Butralin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Captan	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	articulate, Dissolved	Carbaryl	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Carbofuran	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorfenapyr	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide, 2-	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorothalonil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorpyrifos	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorpyrifos oxon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Clomazone	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Coumaphos	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cycloate	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyfluthrin, Total	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyhalofop-butyl	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyhalothrin, Total	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cypermethrin, Total	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyproconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyprodinil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dacthal	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDD(p,p')	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDE(p,p')	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDT(p,p')	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Deltamethrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Diazinon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Diazoxon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dichloroaniline, 3,5-	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate	Dichlorobenzenamine, 3,4-	RPD ≤ 25	2	2	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dichlorvos	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Difenoconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dimethomorph	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dithiopyr	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	EPTC	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Esfenvalerate	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ethalfluralin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ethofenprox	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Etoxazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Famoxadone	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenamidone	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenbuconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenhexamid	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenpropathrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenpyroximate	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Desulfinyl	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Desulfinyl Amide	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Sulfide	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Sulfone	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluazinam	RPD ≤ 25	4	4	100
USGS-OCRL_GC/- MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flubendiamide	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fludioxonil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flufenacet	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flumetralin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluopicolide	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluopyram	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluoxastrobin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flutolanil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flutriafol	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluxapyroxad	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Hexazinone	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Imazalil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Indaziflam	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Indoxacarb	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ipconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Iprodione	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Isofetamid	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Kresoxim-methyl	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Malaoxon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Malathion	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metalaxyl	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Methoprene	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metolachlor	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Myclobutanil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Napropamide	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Novaluron	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Oxadiazon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Oxyfluorfen	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Paclobutrazol	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Parathion, Methyl	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pendimethalin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pentachloroanisole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pentachloronitrobenzene	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Permethrin, Total	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Phenothrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Phosmet	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Picoxystrobin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Piperonyl Butoxide	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prodiamine	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prometon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prometryn	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propanil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propargite	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propiconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propyzamide	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyraclostrobin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyridaben	RPD ≤ 25	4	4	100
USGS-OCRL_GC/- MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyrimethanil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyriproxyfen	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Quinoxyfen	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Resmethrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Sedaxane	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Simazine	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebuconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebupirimfos	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebupirimfos oxon	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tefluthrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tetraconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tetramethrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	T-Fluvalinate	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Thiobencarb	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triadimefon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triadimenol	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triallate	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tributyl Phosphorotrithioate, S,S,S-	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Trifloxystrobin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triflumizole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Trifluralin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triticonazole	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Zoxamide	RPD ≤ 25	4	4	100
EPA 160.2	OCRL	Water	Particulate	Total Suspended Solids	RPD ≤ 25 [5]	2	1	50
Total						**594**	**593**	**99.8**

[1] Growth for *Chironomus dilutus* is evaluated as the ash-free dry weight per surviving individual.
[2] Reproduction for *Ceriodaphnia dubia* is evaluated as the number of young per female.
[3] Growth for *Pimephales promelas* is evaluated as biomass as weight per original individual.
[4] Growth for *Selenastrum capricornutum* is evaluated as total cell count.
[5] RPD criteria not applicable id the concentration of either sample is below the MDL.

Laboratory Blank Samples

Table D.6. Laboratory blank (LB) acceptability for WY 2021.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Acetamiprid	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Carbendazim	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Carboxin	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Chlorantraniliprole	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Clothianidin	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cyantraniliprole	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cyazofamid	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cymoxanil	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Desthio-prothioconazole	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorobenzenamine, 3,4-	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorophenyl Urea, 3,4-	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorophenyl-3-methyl Urea, 3,4-	< MDL	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dinotefuran	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Diuron	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Ethaboxam	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Flonicamid	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Flupyradifurone	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Fluridone	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid urea	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Mandipropamid	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Methoxyfenozide	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Oryzalin	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Oxathiapiprolin	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Penoxsulam	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Penthiopyrad	< MDL	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Sulfoxaflor	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tebufenozide	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiabendazole	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiacloprid	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam Degradate (CGA-355190)	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam Degradate (NOA-407475)	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tolfenpyrad	< MDL	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tricyclazole	< MDL	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Acibenzolar-S-methyl	< MDL	8	8	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Allethrin	< MDL	8	8	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Atrazine	< MDL	8	8	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Azoxystrobin	< MDL	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Benfluralin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Benzovindiflupyr	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Bifenthrin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Boscalid	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Butralin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Captan	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Carbaryl	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Carbofuran	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Chlorfenapyr	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide, 2-	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Chlorothalonil	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Chlorpyrifos	< MDL	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Chlorpyrifos oxon	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Clomazone	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Coumaphos	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Cycloate	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Cyfluthrin, Total	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Cyhalofop-butyl	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Cyhalothrin, Total	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Cypermethrin, Total	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Cyproconazole	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Cyprodinil	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Dacthal	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	DDD(p,p')	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	DDE(p,p')	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	DDT(p,p')	< MDL	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Deltamethrin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Diazinon	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Diazoxon	< MDL	8	8	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Dichloroaniline, 3,5-	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate	Dichlorobenzenamine, 3,4-	< MDL	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Dichlorvos	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Difenoconazole	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Dimethomorph	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Dithiopyr	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	EPTC	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Esfenvalerate	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Ethalfluralin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Ethofenprox	< MDL	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Etoxazole	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Famoxadone	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fenamidone	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fenbuconazole	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fenhexamid	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fenpropathrin	< MDL	8	8	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fenpyroximate	< MDL	8	8	100
USGS-OCRL_GC/-MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fipronil	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fipronil Desulfinyl	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fipronil Desulfinyl Amide	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fipronil Sulfide	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fipronil Sulfone	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fluazinam	< MDL	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Flubendiamide	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fludioxonil	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Flufenacet	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Flumetralin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fluopicolide	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fluopyram	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fluoxastrobin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Flutolanil	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Flutriafol	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Fluxapyroxad	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Hexazinone	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Imazalil	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Indaziflam	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Indoxacarb	< MDL	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Ipconazole	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Iprodione	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Isofetamid	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Kresoxim-methyl	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Malaoxon	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Malathion	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Metalaxyl	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Metconazole	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Methoprene	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Metolachlor	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Myclobutanil	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Napropamide	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Novaluron	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Oxadiazon	< MDL	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Oxyfluorfen	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Paclobutrazol	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Parathion, Methyl	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Pendimethalin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Pentachloroanisole	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Pentachloronitrobenzene	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Permethrin, Total	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Phenothrin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Phosmet	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Picoxystrobin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Piperonyl Butoxide	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Prodiamine	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Prometon	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Prometryn	< MDL	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Propanil	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Propargite	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Propiconazole	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Propyzamide	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Pyraclostrobin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Pyridaben	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Pyrimethanil	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Pyriproxyfen	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Quinoxyfen	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Resmethrin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Sedaxane	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Simazine	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Tebuconazole	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Tebupirimfos	< MDL	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Tebupirimfos oxon	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Tefluthrin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Tetraconazole	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Tetramethrin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	T-Fluvalinate	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Thiobencarb	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Triadimefon	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Triadimenol	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Triallate	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Tributyl Phosphorotrithioate, S,S,S-	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Trifloxystrobin	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Triflumizole	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Trifluralin	< MDL	8	8	100

METHOD	LAB	MATRIX	FRACTIONS	ANALYTE	ACCEPTABILITY CRITERIA	TOTAL LB SAMPLES	LB SAMPLES WITHIN LIMITS	ACCEPTABILITY MET (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Triticonazole	< MDL	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Dissolved, Particulate	Zoxamide	< MDL	8	8	100
EPA 160.2	OCRL	Water	Particulate	Total Suspended Solids	< MDL	4	4	100
Total						**1156**	**1156**	**100**

Laboratory Control Spike Samples

Table D.7. Laboratory control spike (LCS) recovery acceptability for WY 2021.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Acetamiprid	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Carbendazim	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Carboxin	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Chlorantraniliprole	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Clothianidin	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cyantraniliprole	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cyazofamid	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cymoxanil	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Desthio-prothioconazole	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorobenzenamine, 3,4-	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorophenyl Urea, 3,4-	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorophenyl-3-methyl Urea, 3,4-	PR 70-130	2	2	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dinotefuran	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Diuron	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Ethaboxam	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Flonicamid	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Flupyradifurone	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Fluridone	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid urea	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Mandipropamid	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Methoxyfenozide	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Oryzalin	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Oxathiapiprolin	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Penoxsulam	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Penthiopyrad	PR 70-130	2	2	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Sulfoxaflor	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tebufenozide	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiabendazole	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiacloprid	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam Degradate (CGA-355190)	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam Degradate (NOA-407475)	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tolfenpyrad	PR 70-130	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tricyclazole	PR 70-130	2	2	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Acibenzolar-S-methyl	PR 70-130	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Allethrin	PR 70-130	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Atrazine	PR 70-130	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Azoxystrobin	PR 70-130	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Benfluralin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Benzovindiflupyr	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Bifenthrin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Boscalid	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Butralin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Captan	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Carbaryl	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Carbofuran	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorfenapyr	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide, 2-	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorothalonil	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorpyrifos	PR 70-130	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorpyrifos oxon	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Clomazone	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Coumaphos	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cycloate	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyfluthrin, Total	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyhalofop-butyl	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyhalothrin, Total	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cypermethrin, Total	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyproconazole	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyprodinil	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dacthal	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDD(p,p')	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDE(p,p')	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDT(p,p')	PR 70-130	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Deltamethrin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Diazinon	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Diazoxon	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dichloroaniline, 3,5-	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate	Dichlorobenzenamine, 3,4-	PR 70-130	2	2	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dichlorvos	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Difenoconazole	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dimethomorph	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dithiopyr	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	EPTC	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Esfenvalerate	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ethalfluralin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ethofenprox	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Etoxazole	PR 70-130	4	4	100

METHOD	LAB	MATRIX	FRACTIONS	ANALYTE	ACCEPTABILITY CRITERIA	TOTAL LCS SAMPLES	LCS SAMPLES WITHIN LIMITS	ACCEPTABILITY MET (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Famoxadone	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenamidone	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenbuconazole	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenhexamid	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenpropathrin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenpyroximate	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Desulfinyl	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Desulfinyl Amide	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Sulfide	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Sulfone	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluazinam	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flubendiamide	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fludioxonil	PR 70-130	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flufenacet	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flumetralin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluopicolide	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluopyram	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluoxastrobin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flutolanil	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flutriafol	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluxapyroxad	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Hexazinone	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Imazalil	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Indaziflam	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Indoxacarb	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ipconazole	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Iprodione	PR 70-130	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Isofetamid	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Kresoxim-methyl	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Malaoxon	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Malathion	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metalaxyl	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metconazole	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Methoprene	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metolachlor	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Myclobutanil	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Napropamide	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Novaluron	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Oxadiazon	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Oxyfluorfen	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Paclobutrazol	PR 70-130	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Parathion, Methyl	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pendimethalin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pentachloroanisole	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pentachloronitrobenzene	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Permethrin, Total	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Phenothrin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Phosmet	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Picoxystrobin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Piperonyl Butoxide	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prodiamine	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prometon	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prometryn	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propanil	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propargite	PR 70-130	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propiconazole	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propyzamide	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyraclostrobin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyridaben	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyrimethanil	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyriproxyfen	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Quinoxyfen	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Resmethrin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Sedaxane	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Simazine	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebuconazole	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebupirimfos	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebupirimfos oxon	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tefluthrin	PR 70-130	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tetraconazole	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tetramethrin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	T-Fluvalinate	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Thiobencarb	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triadimefon	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triadimenol	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triallate	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tributyl Phosphorotrithioate, S,S,S-	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Trifloxystrobin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triflumizole	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Trifluralin	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triticonazole	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Zoxamide	PR 70-130	4	4	100
Total						**1152**	**1152**	**100**

Matrix Spike Samples

Table D.8. Matrix spike (MS) recovery acceptability for WY 2021.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Acetamiprid	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Carbendazim	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Carboxin	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Chlorantraniliprole	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Clothianidin	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cyantraniliprole	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cyazofamid	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cymoxanil	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Desthio-prothioconazole	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorobenzenamine, 3,4-	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorophenyl Urea, 3,4-	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorophenyl-3-methyl Urea, 3,4-	PR 70-130	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dinotefuran	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Diuron	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Ethaboxam	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Flonicamid	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Flupyradifurone	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Fluridone	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid urea	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Mandipropamid	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Methoxyfenozide	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Oryzalin	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Oxathiapiprolin	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Penoxsulam	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Penthiopyrad	PR 70-130	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Sulfoxaflor	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tebufenozide	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiabendazole	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiacloprid	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam Degradate (CGA-355190)	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam Degradate (NOA-407475)	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tolfenpyrad	PR 70-130	4	4	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tricyclazole	PR 70-130	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Acibenzolar-S-methyl	PR 70-130	8	8	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Allethrin	PR 70-130	8	8	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Atrazine	PR 70-130	8	8	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Azoxystrobin	PR 70-130	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Benfluralin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Benzovindiflupyr	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Bifenthrin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Boscalid	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Butralin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Captan	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Carbaryl	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Carbofuran	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorfenapyr	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide, 2-	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorothalonil	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorpyrifos	PR 70-130	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorpyrifos oxon	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Clomazone	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Coumaphos	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cycloate	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyfluthrin, Total	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyhalofop-butyl	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyhalothrin, Total	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cypermethrin, Total	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyproconazole	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyprodinil	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dacthal	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDD(p,p')	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDE(p,p')	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDT(p,p')	PR 70-130	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Deltamethrin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Diazinon	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Diazoxon	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dichloroaniline, 3,5-	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate	Dichlorobenzenamine, 3,4-	PR 70-130	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dichlorvos	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Difenoconazole	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dimethomorph	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dithiopyr	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	EPTC	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Esfenvalerate	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ethalfluralin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ethofenprox	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Etoxazole	PR 70-130	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Famoxadone	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenamidone	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenbuconazole	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenhexamid	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenpropathrin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenpyroximate	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Desulfinyl	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Desulfinyl Amide	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Sulfide	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Sulfone	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluazinam	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flubendiamide	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fludioxonil	PR 70-130	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flufenacet	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flumetralin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluopicolide	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluopyram	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluoxastrobin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flutolanil	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flutriafol	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluxapyroxad	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Hexazinone	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Imazalil	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Indaziflam	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Indoxacarb	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ipconazole	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Iprodione	PR 70-130	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Isofetamid	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Kresoxim-methyl	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Malaoxon	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Malathion	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metalaxyl	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metconazole	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Methoprene	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metolachlor	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Myclobutanil	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Napropamide	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Novaluron	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Oxadiazon	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Oxyfluorfen	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Paclobutrazol	PR 70-130	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Parathion, Methyl	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pendimethalin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pentachloroanisole	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pentachloronitrobenzene	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Permethrin, Total	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Phenothrin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Phosmet	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Picoxystrobin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Piperonyl Butoxide	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prodiamine	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prometon	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prometryn	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propanil	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propargite	PR 70-130	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propiconazole	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propyzamide	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyraclostrobin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyridaben	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyrimethanil	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyriproxyfen	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Quinoxyfen	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Resmethrin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Sedaxane	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Simazine	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebuconazole	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebupirimfos	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebupirimfos oxon	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tefluthrin	PR 70-130	8	8	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tetraconazole	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tetramethrin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	T-Fluvalinate	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Thiobencarb	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triadimefon	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triadimenol	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triallate	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tributyl Phosphorotrithioate, S,S,S-	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Trifloxystrobin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triflumizole	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Trifluralin	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triticonazole	PR 70-130	8	8	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Zoxamide	PR 70-130	8	8	100
Total						**1152**	**1152**	**100**

Table D.9. Matrix spike duplicate acceptability for WY 2021.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Acetamiprid	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Carbendazim	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Carboxin	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Chlorantraniliprole	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Clothianidin	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cyantraniliprole	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cyazofamid	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Cymoxanil	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Desthio-prothioconazole	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorobenzenamine, 3,4-	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorophenyl Urea, 3,4-	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dichlorophenyl-3-methyl Urea, 3,4-	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Dinotefuran	RPD ≤ 25	2	2	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Diuron	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Ethaboxam	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Flonicamid	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Flupyradifurone	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Fluridone	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid urea	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Mandipropamid	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Methoxyfenozide	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Oryzalin	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Oxathiapiprolin	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Penoxsulam	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Penthiopyrad	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Sulfoxaflor	RPD ≤ 25	2	2	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tebufenozide	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiabendazole	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiacloprid	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam Degradate (CGA-355190)	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Thiamethoxam Degradate (NOA-407475)	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tolfenpyrad	RPD ≤ 25	2	2	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Tricyclazole	RPD ≤ 25	2	2	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Dissolved	Acibenzolar-S-methyl	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Allethrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Atrazine	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Azoxystrobin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Benfluralin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Benzovindiflupyr	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Bifenthrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Boscalid	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Butralin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Captan	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Carbaryl	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Carbofuran	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorfenapyr	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide, 2-	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorothalonil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorpyrifos	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Chlorpyrifos oxon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Clomazone	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Coumaphos	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cycloate	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyfluthrin, Total	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyhalofop-butyl	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyhalothrin, Total	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cypermethrin, Total	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyproconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Cyprodinil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dacthal	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDD(p,p')	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDE(p,p')	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	DDT(p,p')	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Deltamethrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Diazinon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Diazoxon	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dichloroaniline, 3,5-	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate	Dichlorobenzenamine, 3,4-	RPD ≤ 25	2	2	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dichlorvos	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Difenoconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dimethomorph	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Dithiopyr	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	EPTC	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Esfenvalerate	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ethalfluralin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ethofenprox	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Etoxazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Famoxadone	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenamidone	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenbuconazole	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenhexamid	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenpropathrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fenpyroximate	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Desulfinyl	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Desulfinyl Amide	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Sulfide	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil Sulfone	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluazinam	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flubendiamide	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fludioxonil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flufenacet	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flumetralin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluopicolide	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluopyram	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluoxastrobin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flutolanil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Flutriafol	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fluxapyroxad	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Hexazinone	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Imazalil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Indaziflam	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Indoxacarb	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Ipconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Iprodione	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Isofetamid	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Kresoxim-methyl	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Malaoxon	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Malathion	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metalaxyl	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Methoprene	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Metolachlor	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Myclobutanil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Napropamide	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Novaluron	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Oxadiazon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Oxyfluorfen	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Paclobutrazol	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Parathion, Methyl	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pendimethalin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pentachloroanisole	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pentachloronitrobenzene	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Permethrin, Total	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Phenothrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Phosmet	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Picoxystrobin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Piperonyl Butoxide	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prodiamine	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prometon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Prometryn	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propanil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propargite	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propiconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Propyzamide	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyraclostrobin	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyridaben	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyrimethanil	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Pyriproxyfen	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Quinoxyfen	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Resmethrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Sedaxane	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Simazine	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebuconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebupirimfos	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tebupirimfos oxon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tefluthrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tetraconazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tetramethrin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	T-Fluvalinate	RPD ≤ 25	4	4	100

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Thiobencarb	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triadimefon	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triadimenol	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triallate	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Tributyl Phosphorotrithioate, S,S,S-	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Trifloxystrobin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triflumizole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Trifluralin	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Triticonazole	RPD ≤ 25	4	4	100
USGS-OCRL_GC/ MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Zoxamide	RPD ≤ 25	4	4	100
Total						**576**	**576**	**100**

Surrogate Samples

Table D.10. Surrogate recovery acceptability for WY 2021.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Surrogate Samples	Surrogate Samples Within Limits	Acceptability Met (%)
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Imidacloprid-d4(Surrogate)	PR 70-130	52	52	100
USGS-OCRL_LC/MS/MS_Sanders_2018	OCRL	Water	Dissolved	Monuron(Surrogate)	PR 70-130	52	52	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Dissolved	Atrazine-13C3(Surrogate)	PR 70-130	52	52	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate	DDE(p,p')(Surrogate)	PR 70-130	52	52	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Fipronil-C13(Surrogate)	PR 70-130	104	104	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate	Permethrin, cis-(Surrogate)	PR 70-130	52	52	100
USGS-OCRL_GC/MS_Sanders_2018	OCRL	Water	Particulate, Dissolved	Trifluralin-d14(Surrogate)	PR 70-130	104	104	100
Total						**468**	**468**	**100**

Toxicity Control Samples

Table D.11. Toxicity control sample acceptability for WY 2021.

Method	Lab	Control	Matrix	Organism	Endpoint	Acceptability Criteria	Total Control Samples	Control Samples Within Limits	Acceptability Met (%)
EPA 600/R-99-064M	PER	Negative Control	Water	*Chironomus dilutus*	Survival	≥ 80%	8	8	100
					Growth [1]	≥ 0.60 mg	8	8	100
EPA 821/R-02-013	PER	Negative Control	Water	*Ceriodaphnia dubia*	Reproduction [2]	60% of females ≥3 broods and average ≥15 young	8	8	100
					Survival	≥ 80%	8	8	100
EPA 821/R-02-013	PER	Salinity Control	Water	*Ceriodaphnia dubia*	Reproduction [2]	60% of females ≥3 broods and average ≥15 young	2	2	100
					Survival	≥ 80%	2	2	100
EPA 821/R-02-013	PER	Negative Control	Water	*Pimephales promelas*	Survival	≥ 80%	8	8	100
					Growth [3]	≥ 0.25 mg	8	8	100
EPA 821/R-02-013	PER	Negative Control	Water	*Selenastrum capricornutum*	Growth [4]	Growth >200,000 cells/mL and variability <20%	8	8	100
EPA 821/R-02-012	PER	Negative Control	Water	*Hyalella azteca*	Survival	≥ 90%	8	8	100
Total							**68**	**68**	**100**

[1] Growth for *Chironomus dilutus* is evaluated as the ash-free dry weight per surviving individual.
[2] Reproduction for *Ceriodaphnia dubia* is evaluated as the number of young per female.
[3] Growth for *Pimephales promelas* is evaluated as biomass as weight per original individual.
[4] Growth for *Selenastrum capricornutum* is evaluated as total cell count.

Appendix A. Data Verification: United States Geological Survey National Water Quality Laboratory

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DATA VERIFICATION OVERVIEW

A total of 32 environmental samples were analyzed by the United State Geological Survey National Water Quality Laboratory (USGS NWQL) for the Delta Regional Monitoring Program (DRMP) Current-Use Pesticides (CUP) project constituents specified in **Table A.1**.

Table A.1. Analytical scope.

Matrix	Analyte/Parameter
Samplewater (<0.45 µm)	Dissolved Copper
Samplewater (<0.7 µm)	Dissolved Organic Carbon (DOC)
Samplewater, Particulate (>0.70 µm)	Particulate Organic Carbon (POC)
Samplewater, Particulate (>0.70 µm)	Total Carbon (TC)
Samplewater, Particulate (>0.70 µm)	Total Inorganic Carbon (TIC)
Samplewater, Particulate (>0.70 µm)	Total Nitrogen (TN)

Associated results were unavailable during the preparation of this report's main body. To ensure a complete and consistent record of WY 2021, verification of USGS NWQL CUP project results (see **Table A.2**) is detailed in this appendix.

Table A.2. Verified datasets associated with WY 2021 monitoring.

Lab	Analyte	Matrix	Datasets Produced	Datasets Reviewed	Reviewed Dataset (Batch) IDs
USGS NWQL	Dissolved Copper	Samplewater (<0.45 µm)	7	7	NWQL_DRMP_CUP_241234_W_CU; NWQL_DRMP_CUP_242083_W_CU; NWQL_DRMP_CUP_243653_W_CU; NWQL_DRMP_CUP_241502_W_CU; NWQL_DRMP_CUP_242116_W_CU; NWQL_DRMP_CUP_243628_W_CU; NWQL_DRMP_CUP_244291_W_CU
	DOC	Samplewater (<0.7 µm)	4	4	NWQL_DRMP_CUP_240552_W_DOC; NWQL_DRMP_CUP_242572_W_DOC; NWQL_DRMP_CUP_243525_W_DOC; NWQL_DRMP_CUP_241629_W_DOC
	POC, TC, TIC, TN	Samplewater, Particulate (>0.70 µm)	6	6	NWQL_DRMP_CUP_241536_W_ANCIL; NWQL_DRMP_CUP_242788_W_ANCIL; NWQL_DRMP_CUP_244117_W_ANCIL; NWQL_DRMP_CUP_244574_W_ANCIL; NWQL_DRMP_CUP_244792_W_ANCIL; NWQL_DRMP_CUP_244945_W_ANCIL

DATA VERIFICATION: SAMPLE HANDLING

During data verification, storage and holding times of DRMP CUP project samples were evaluated to ensure the integrity of the target analyte(s) in each matrix. For consistency with the State Water Resources Control Board's Surface Water Ambient Monitoring Program (SWAMP) and the Code of Federal Regulations, Title 40 *Protection of the Environment*, Section 136 *Guidelines Establishing Test Procedures for the Analysis of Pollutants*, DRMP holding times are defined as follows:

- *Pre-Preservation/Extraction*: Required holding times for sample preservation or extraction begin at the time of sample collection and conclude when the sample is preserved or extracted, respectively.
- *Pre-Analysis*: Required holding times for sample analysis begin either at the time of sample collection, filtration or extraction and conclude when sample analysis is completed.

In WY 2021, 32 USGS NWQL samples were verified against the sample handling requirements in **Table A.3**.

Table A.3. Sample handling requirements defined in the DRMP QAPP.

Analyte	Pre-Preservation/Extraction		Pre-Analysis	
	Storage	Holding Time	Holding Time	Storage
Dissolved Copper	0–6 °C in dark	Filter in the field as soon as possible after collection	180 days	0–6 °C in dark
DOC	0–6 °C in dark	Filtration within 24 hours of collection	30 days	0–6 °C in dark
POC	0–6 °C in dark	Filtration within 24 hours of collection	100 days	0–6 °C in dark
TC, TIC, TN	NA	NA	100 days[1]	NA

[1] Per Environmental Protection Agency (EPA) Method 440; No requirements specified in DRMP QAPP

91% of verified samples met these DRMP CUP project requirements. Analyses resulting in qualification appear in **Table A.4**.

Table A.4. Sample handling qualification.

Dataset ID	Sample ID	Sample Date	Matrix	Analyte	Project Qualifier
NWQL_DRMP_CUP_244792_W_ANCIL	511ULCABR	9/13/2021	Samplewater, Particulate (>0.70 µm)	POC, TC, TIC, TN	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	544LSAC13	9/14/2021	Samplewater, Particulate (>0.70 µm)	POC, TC, TIC, TN	Qualified
NWQL_DRMP_CUP_244792_W_ANCIL	Nort-021	9/14/2021	Samplewater, Particulate (>0.70 µm)	POC, TC, TIC, TN	Qualified
NWQL_DRMP_CUP_244792_W_ANCIL	Nort-022	9/13/2021	Samplewater, Particulate (>0.70 µm)	POC, TC, TIC, TN	Qualified
NWQL_DRMP_CUP_244792_W_ANCIL	Nort-023	9/14/2021	Samplewater, Particulate (>0.70 µm)	POC, TC, TIC, TN	Qualified
NWQL_DRMP_CUP_244792_W_ANCIL	Nort-024	9/14/2021	Samplewater, Particulate (>0.70 µm)	POC, TC, TIC, TN	Qualified
NWQL_DRMP_CUP_244792_W_ANCIL	Sacr-023	9/13/2021	Samplewater, Particulate (>0.70 µm)	POC, TC, TIC, TN	Qualified
NWQL_DRMP_CUP_244792_W_ANCIL	Sacr-024	9/13/2021	Samplewater, Particulate (>0.70 µm)	POC, TC, TIC, TN	Qualified
NWQL_DRMP_CUP_244574_W_ANCIL	FilterBlank	8/12/2021	Samplewater, Particulate (>0.70 µm)	POC, TC, TIC, TN	Qualified

DATA VERIFICATION: LABORATORY ANALYSES

DRMP CUP project chemistry data verification assesses quality control (QC) samples associated with contamination, precision, and accuracy. For consistency with SWAMP, QC sample definitions are based on the January 2022 *Surface Water Ambient Monitoring Program Quality Assurance Program Plan* (SWAMP QAPrP).

Contamination

For USGS NWQL's analyses, contamination is assessed with the analysis of field blanks, laboratory blanks, and filter blanks. Associated data verification results are detailed below.

Field Blanks

A field blank is a sample of analyte-free media that is carried to the sampling site, exposed to the sampling conditions, returned to the laboratory, and treated as a routine environmental sample. Preservatives, if any, are added to the sample container in the same manner as the environmental sample. The field blank matrix should be comparable to the sample of interest. This blank is used to provide information about contaminants that may be introduced during sample collection, storage, and transport.

For WY 2021 DRMP CUP project monitoring, field blanks were collected for all USGS NWQL analyses (i.e., two for dissolved copper and DOC, three for POC, TC, TIC, and TN, **Table A.22**). 81% (**Table A.5**) of these results met the DRMP measurement quality objective (MQO) by being below the method detection limit (MDL). Analyses resulting in qualification appear in **Table A.6**.

Table A.5. Field blank (FB) acceptability.

Method	Lab	Matrix	Fractions	Analyte	Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
USGS I-2020-05	NWQL	Water	Dissolved	Copper	< MDL	2	2	100
METH011.00	NWQL	Water	Dissolved	DOC	< MDL	2	1	50
EPA 440	NWQL	Water	Particulate	TC	< MDL	3	2	66.7
EPA 440	NWQL	Water	Particulate	TN	< MDL	3	3	100
EPA 440	NWQL	Water	Particulate	POC	< MDL	3	2	66.7
EPA 440	NWQL	Water	Particulate	TIC	< MDL	3	3	100
Total						**16**	**13**	**81.3**

Table A.6. Field blank qualification.

Field Blank ID	Sample Date	Analyte	Sample Result (mg/L)	MDL	Project Qualifier
Nort-016	6/15/2021	DOC	0.23	0.23	Qualified
Nort-016	6/15/2021	TC	0.08	0.05	Qualified
Nort-016	6/15/2021	POC	0.08	0.05	Qualified

Laboratory Blanks

A laboratory blank is free from the target analyte(s) and is used to represent the environmental sample matrix as closely as possible. The laboratory blank is processed simultaneously with and under the same conditions and steps of the analytical procedures (e.g., including exposure to all glassware, equipment, solvents, reagents, labeled compounds, internal standards, and surrogates that are used with samples) as all samples in the analytical batch (including other QC samples). The laboratory blank is used to determine if target analytes or interferences are present in the laboratory environment, reagents, or instruments. Laboratory blank results provide a measurement of bias introduced by the analytical procedure.

For WY 2021 DRMP CUP project monitoring, laboratory blanks were prepared and analyzed for all USGS NWQL batches at the required frequency of one per 20 samples or per batch (whichever is more frequent) with the exception of those batches identified in **Table A.7**.

Table A.7. Laboratory blank omission.

Dataset ID	Analyte	Project Qualifier
NWQL_DRMP_CUP_241502_W_CU	Dissolved Copper	Qualified
NWQL_DRMP_CUP_242116_W_CU	Dissolved Copper	Qualified

Dataset ID	Analyte	Project Qualifier
NWQL_DRMP_CUP_243628_W_CU	Dissolved Copper	Qualified
NWQL_DRMP_CUP_244291_W_CU	Dissolved Copper	Qualified

98.8% of these results met the DRMP MQO by being below the MDL (**Table A.8**). Qualified laboratory blanks and associated environmental samples with detectable results above the MDL appear in **Table A.9** and **Table A.10**, respectively.

Table A.8. Laboratory blank (LB) acceptability.

Method	Lab	Matrix	Fractions	Analyte	Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
USGS I-2020-05	NWQL	Water	Dissolved	Copper	< MDL	37	37	100
METH01 1.00	NWQL	Water	Dissolved	DOC	< MDL	15	15	100
EPA 440	NWQL	Water	Particulate	TC	< MDL	30	29	96.7
EPA 440	NWQL	Water	Particulate	TN	< MDL	30	30	100
EPA 440	NWQL	Water	Particulate	POC	< MDL	28	27	96.4
EPA 440	NWQL	Water	Particulate	TIC	< MDL	28	28	100
Total						**168**	**166**	**98.8**

Table A.9. Laboratory blank qualification.

Dataset ID	Lab Blank ID	Analyte	Blank Result (mg/L)	MDL (mg/L)	Project Qualifier
NWQL_DRMP_CUP_241536_W_ANCIL	QC2102352-006	TC	0.05	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	QC2102352-006	POC	0.05	0.05	Qualified

Table A.10. Laboratory blank qualification: associated environmental samples.

Dataset ID	Sample ID	Sample Date	Analyte	Sample Result (mg/L)	MDL (mg/L)	Project Qualifier
NWQL_DRMP_CUP_241536_W_ANCIL	511ULCABR	4/28/2021	TC	1.88	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	544LSAC13	4/29/2021	TC	0.34	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Nort-009	4/29/2021	TC	0.37	0.05	Qualified

Dataset ID	Sample ID	Sample Date	Analyte	Sample Result (mg/L)	MDL (mg/L)	Project Qualifier
NWQL_DRMP_CUP_241536_W_ANCIL	Nort-009	4/29/2021	TC	0.39	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Nort-010	4/28/2021	TC	0.58	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Nort-011	4/29/2021	TC	0.17	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Nort-012	4/29/2021	TC	0.51	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Sacr-017	4/28/2021	TC	0.17	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Sacr-018	4/28/2021	TC	0.12	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	511ULCABR	4/28/2021	POC	1.88	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	544LSAC13	4/29/2021	POC	0.34	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Nort-009	4/29/2021	POC	0.37	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Nort-009	4/29/2021	POC	0.39	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Nort-010	4/28/2021	POC	0.58	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Nort-011	4/29/2021	POC	0.17	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Nort-012	4/29/2021	POC	0.51	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Sacr-017	4/28/2021	POC	0.17	0.05	Qualified
NWQL_DRMP_CUP_241536_W_ANCIL	Sacr-018	4/28/2021	POC	0.12	0.05	Qualified

Filter Blanks

Filter blanks are samples of analyte-free media that have been used to rinse the sampling equipment. They are collected after completion of decontamination and prior to sampling through clean equipment. This blank is useful in documenting adequate decontamination of sampling equipment. It is used to provide information about contaminants/bias that may be introduced during sample collection when using filtration equipment or equipment that must be decontaminated between uses.

For DRMP CUP project monitoring, USGS NWQL filter blanks are performed with POC, TC, TIC, and TN analyses. In WY 2021, one filter blank was analyzed. 100% of these results met the DRMP MQO by being below the MDL (**Table A.11**).

Table A.11. Filter blank acceptability.

Method	Lab	Matrix	Fractions	Analyte	Criteria	Total Filter Blank Samples	Filter Blank Samples Within Limits	Acceptability Met (%)
EPA 440	NWQL	Water	Particulate	TC	< MDL	1	1	100
EPA 440	NWQL	Water	Particulate	TN	< MDL	1	1	100
EPA 440	NWQL	Water	Particulate	POC	< MDL	1	1	100
EPA 440	NWQL	Water	Particulate	TIC	< MDL	1	1	100
Total						**4**	**4**	**100**

Precision

For USGS NWQL's DRMP CUP project analyses, precision is studied with the analysis of field duplicates, laboratory duplicates, and matrix spike (MS) duplicates (MSDs). Associated data verification results are detailed below.

Field Duplicates

A field duplicate is an independent sample that is collected as closely as possible to the same point in space, time, and collection methodology as the field sample.

For WY 2021 DRMP CUP project monitoring, field duplicates collected and analyzed for USGS NWQL analyses appear in **Table A.12**.

Table A.12. Field duplicates.

Duplicate ID	Sample Date	Analyte
511ULCABR	6/15/2021	DOC, POC, TC, TIC, TN
511ULCABR	8/10/2021	Dissolved Copper
511ULCABR	9/13/2021	DOC, POC, TC, TIC, TN
544LSAC13	4/29/2021	Dissolved Copper

For WY 2021 DRMP CUP project monitoring, two field duplicates were analyzed at the required frequency of one per 20 samples. 100% of these results met the DRMP MQO by having a relative percent difference (RPD) <25% for TIC and dissolved copper, and an

RPD <25% (n/a if concentration of either sample < MDL) for DOC (**Table A.13**). POC, TC, and TN do not have a DRMP CUP project field duplicate MQO.

Table A.13. Field duplicate acceptability.

Method	Lab	Matrix	Fractions	Analyte	Criteria	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
USGS I-2020-05	NWQL	Water	Dissolved	Copper	RPD ≤ 25	2	2	100
METH011.00	NWQL	Water	Dissolved	DOC	RPD ≤ 25 [1]	2	2	100
EPA 440	NWQL	Water	Particulate	TC	NA	2	2	100
EPA 440	NWQL	Water	Particulate	TN	NA	2	2	100
EPA 440	NWQL	Water	Particulate	POC	NA	2	2	100
EPA 440	NWQL	Water	Particulate	TIC	RPD ≤ 25	2	2	100
Total						**12**	**12**	**100**

[1] n/a if concentration of either sample < MDL

Laboratory Duplicates

A laboratory duplicate is an analysis or measurement of the target analyte(s) performed identically on two sub-samples of the same sample, usually taken from the same container. The results from laboratory duplicate analyses are used to evaluate analytical or measurement precision, and include variability associated with sub-sampling and the matrix (not the precision of field sampling, preservation, or storage internal to the laboratory).

For WY 2021 DRMP CUP project monitoring, USGS NWQL laboratory duplicates were analyzed at the required frequency of one per 20 samples or per batch (whichever is more frequent) with the exception of those batches identified in **Table A.14**.

Table A.14. Laboratory duplicate omission.

Dataset ID	Analyte	Project Qualifier
NWQL_DRMP_CUP_241234_W_CU; NWQL_DRMP_CUP_241502_W_CU; NWQL_DRMP_CUP_242083_W_CU; NWQL_DRMP_CUP_242116_W_CU; NWQL_DRMP_CUP_243628_W_CU; NWQL_DRMP_CUP_243653_W_CU; NWQL_DRMP_CUP_244291_W_CU	Dissolved Copper	Qualified

Dataset ID	Analyte	Project Qualifier
NWQL_DRMP_CUP_241629_W_DOC; NWQL_DRMP_CUP_240552_W_DOC; NWQL_DRMP_CUP_242572_W_DOC; NWQL_DRMP_CUP_243525_W_DOC	DOC	Qualified
NWQL_DRMP_CUP_244574_W_ANCIL; NWQL_DRMP_CUP_244945_W_ANCIL	POC, TC, TIC, TN	Qualified

98% of these results met the DRMP MQO by having an RPD <10% for POC; an RPD <25% for TC, TN, TIC, and dissolved copper; and an RPD <25% (n/a if concentration of either sample < MDL) for DOC (**Table A.15**). Laboratory duplicate analyses resulting in qualification appear in **Table A.16**.

Table A.15. Laboratory duplicate (LD) acceptability.

Method	Lab	Matrix	Fractions	Analyte	Criteria	Total Lab Dup Samples	Lab Dup Samples Within Limits	Acceptability Met (%)
USGS I-2020-05	NWQL	Water	Dissolved	Copper	RPD ≤ 25	3	3	100
METH011.00	NWQL	Water	Dissolved	DOC	RPD ≤ 25 [1]	15	15	100
EPA 440	NWQL	Water	Particulate	TC	RPD ≤ 25	52	51	98.1
EPA 440	NWQL	Water	Particulate	TN	RPD ≤ 25	52	51	98.1
EPA 440	NWQL	Water	Particulate	POC	RPD ≤ 10	26	24	92.3
EPA 440	NWQL	Water	Particulate	TIC	RPD ≤ 25	50	50	100
Total						**198**	**194**	**98.0**

[1] n/a if concentration of either sample < MDL

Table A.16. Laboratory duplicate qualification.

Dataset ID	Duplicate ID	Analyte	Sample Result (mg/L)	Duplicate Result (mg/L)	RPD	Project Qualifier
NWQL_DRMP_CUP_244117_W_ANCIL	Nort-020	POC	0.26	0.23	11.3	Qualified
NWQL_DRMP_CUP_244792_W_ANCIL	Nort-023	TC	0.14	0.09	45	Qualified
NWQL_DRMP_CUP_244792_W_ANCIL	Nort-023	TN	0.031	ND	200	Qualified

Dataset ID	Duplicate ID	Analyte	Sample Result (mg/L)	Duplicate Result (mg/L)	RPD	Project Qualifier
NWQL_DRMP_CUP_244792_W_ANCIL	Nort-023	POC	0.14	0.09	45	Qualified

Matrix Spike Duplicates

An MSD is prepared with an MS. Both the MS and MSD samples are analyzed exactly like environmental samples within the lab batch. The purpose of analyzing the MS and MSD samples is to determine whether the sample matrix contributes bias to the analytical results, and to measure precision of the duplicate analysis.

For WY 2021 DRMP CUP project monitoring, three USGS NWQL matrix spike duplicate pairs were prepared and analyzed for dissolved copper and DOC at the required frequency of one per 20 samples or per batch (whichever is more frequent). 100% of these results met the DRMP MQO by having an RPD <25% (**Table A.17**).

Table A.17. Matrix spike duplicate (MSD) acceptability.

Method	Lab	Matrix	Fractions	Analyte	Criteria	Total MSD Samples	MSD Samples Within Limits	Acceptability Met (%)
USGS I-2020-05	NWQL	Water	Dissolved	Copper	RPD ≤ 25	3	3	100
METH011.00	NWQL	Water	Dissolved	DOC	RPD ≤ 25 [1]	4	4	100
Total						**7**	**7**	**100**

[1] n/a if concentration of either sample < MDL

Accuracy

For USGS NWQL's DRMP CUP project analyses, accuracy is studied with the analysis of MSs, laboratory control samples (LCSs), and certified reference materials (CRMs). Associated data verification results are detailed below.

Matrix Spikes

An MS is a sample prepared by adding a known amount of the target analyte to an environmental sample in order to increase the concentration of the target analyte. The MS is used to determine the effect of the matrix on a method's recovery efficiency and is a measure of accuracy. The MS is analyzed exactly like an environmental sample within the lab batch. The purpose of analyzing the MS is to determine whether the sample matrix contributes bias to the analytical results.

For WY 2021 DRMP CUP project monitoring, nine dissolved copper and 10 DOC matrix spikes were prepared and analyzed at the required frequency of 1 per 20 USGS NWQL samples. 100% of these results met the DRMP recovery MQO of ±20% for DOC and ±25% for dissolved copper (**Table A.18**).

Table A.18. Matrix spike (MS) recovery acceptability.

Method	Lab	Matrix	Fractions	Analyte	Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
USGS I-2020-05	NWQL	Water	Dissolved	Copper	PR 75-125	9	9	100
METH011.00	NWQL	Water	Dissolved	DOC	PR 80-120	11	11	100
Total						**20**	**20**	**100**

Laboratory Control Samples

An LCS is a sample matrix representative of the environmental sample (e.g., water, sand) that is prepared in the laboratory and is free from the analytes of interest. The LCS is spiked with verified amounts of analytes or a material containing known and verified amounts of analytes. It is either used to establish intra-laboratory or analyst-specific precision and bias, or to assess the performance of a portion of the measurement system.

For DRMP CUP project monitoring in WY 2021, LCSs were prepared and analyzed for all USGS NWQL POC, TC, TIC, and TN batches at the required frequency of one per 20 samples or per batch (whichever is more frequent). 100% of these results met the ±10% DRMP recovery MQO (**Table A.19**).

Table A.19. Laboratory control spike (LCS) recovery acceptability.

Method	Lab	Matrix	Fractions	Analyte	Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
EPA 440	NWQL	Water	Particulate	TC	PR 90-110	30	30	100
EPA 440	NWQL	Water	Particulate	TN	PR 90-110	30	30	100
EPA 440	NWQL	Water	Particulate	TIC	PR 90-110	30	30	100
Total						**90**	**90**	**100**

Certified Reference Materials

A CRM or substance has one or more properties that are characterized by a metrologically valid procedure, accompanied by a certificate that provides the value of the specified property, its associated uncertainty, and a statement of metrological traceability (typically from EPA or the National Institute of Science and Technology). CRMs are used for calibrating an apparatus, assessing a measurement method, or assigning values to materials (FEM Glossary, 2017). CRMs are used to measure the accuracy of analytical processes, either quantitatively to calibrate or determine concentration accuracy, or qualitatively to identify a substance or species.

For DRMP CUP project monitoring in WY 2021, CRMs were prepared and analyzed for USGS NWQL dissolved copper batches at the required frequency of one per 20 samples or per batch (whichever is more frequent). 100% of these results met the ±25% DRMP recovery MQO (**Table A.20**).

Table A.20. Certified reference material (CRM) recovery acceptability.

Method	Lab	Matrix	Fractions	Analyte	Criteria	Total CRM Samples	CRM Samples Within Limits	Acceptability Met (%)
USGS I-2020-05	NWQL	Water	Dissolved	Copper	PR 75-125	42	42	100
Total						**42**	**42**	**100**

SUMMARY

During WY 2021, the USGS NWQL analyzed a total of 32 environmental samples (not including field duplicates) for dissolved copper, DOC, POC, TC, TIC, and TN. All scheduled samples were successfully collected, transported, and analyzed by the laboratory (**Table A.21**). Additionally, field QC were successfully collected at a minimum rate of 5% of the total environmental samples (**Table A.22**).

All 127 environmental and QC sample results for dissolved copper presented in Tables **Table A.7** and **Table A.14** were outside the MQOs specified in the DRMP QAPP and are considered “Qualified”.

All 66 environmental and QC sample results for DOC presented in Tables **Table A.6** and **Table A.14** were outside the MQOs specified in the DRMP QAPP and are considered “Qualified”.

228 out of a total of 374 environmental and QC sample results for POC, TC, TIC, and TN met the MQOs specified in the DRMP QAPP and are considered “Compliant”. The remaining 146 environmental and QC sample results presented in Tables **Table A.4**, **Table A.6**, **Table A.9**, **Table A.10**, **Table A.14**, and **Table A.16** were outside the MQOs specified in the DRMP QAPP and are considered “Qualified”.

SUMMARY OF COMPLETENESS

Sample Completeness

Table A.21. Field and transport and analytical completeness for WY 2021 data from the USGS NWQL.
Samples are counted as individual results, i.e., separate endpoints for toxicity results and separate sample fractions analyzed for chemistry results.

Method	Matrix	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
USGS I-2020-05	Water	Copper	32	32	100	32	100
METH011.00	Water	DOC	32	32	100	32	100
EPA 440	Water	TC	32	32	100	32	100
EPA 440	Water	TN	32	32	100	32	100
EPA 440	Water	POC	32	32	100	32	100
EPA 440	Water	TIC	32	32	100	32	100
Total			**192**	**192**	**100**	**192**	**100**

Field Quality Control Frequency

Table A.22. Field quality control sample completeness for sample analyzed by the USGS NWQL.

Samples are counted as individual results, i.e., separate endpoints for toxicity results and separate sample fractions analyzed for chemistry results.

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
USGS I-2020-05	Water	Copper	32	2	2	36	5.6	5.6
METH011.00	Water	DOC	32	2	2	36	5.6	5.6
EPA 440	Water	TC	32	2	3	37	5.4	8.1
EPA 440	Water	TN	32	2	3	37	5.4	8.1
EPA 440	Water	POC	32	2	3	37	5.4	8.1
EPA 440	Water	TIC	32	2	3	37	5.4	8.1
Total			**192**	**12**	**16**	**220**	**6.3**	**8.3**

APPENDIX II – CEC YEAR 2 DATA REPORT

DELTA
Regional Monitoring Program

Year 2 Data Report and Quality Assurance Evaluation

For the Pilot Study of Constituents of Emerging Concern During Fiscal Year 2021-22

Version 1.0
Submitted for Review by the Steering Committee December 15, 2022

Prepared By:

MPSL

MLJ ENVIRONMENTAL

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LIST OF ABBREVIATIONS AND ACRONYMS

AMS-CA	Applied Marine Sciences, Inc. California
ASTM	American Society of Testing and Materials
BFR	Brominated Flame Retardants
CEC	Constituents of Emerging Concern
CEDEN	California Environmental Data Exchange Network
CV RDC	Central Valley Regional Data Center
CVRWQCB	Central Valley Regional Water Quality Control Board
DO	Dissolved Oxygen
Delta RMP	Delta Regional Monitoring Program
DWR	California Department of Water Resources
EDD	Electronic Data Deliverable
EPA	United States Environmental Protection Agency
ESI	Electrospray Ionization
GC/MS	Gas Chromatography/Mass Spectrometry
HRGC-HRMS	High-Resolution Gas Chromatography – High-Resolution Mass Spectrometry
IDA	Isotope Dilution Analogue
LC/MS/MS	Liquid Chromatography/Tandem Mass Spectrometry
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MDL	Method Detection Limit
MLJ	MLJ Environmental
MPSL-MLML	Marine Pollution Studies Laboratory at Moss Landing Marine Laboratories
MPSL-DFW	Marine Pollution Studies Laboratory, Department of Fish and Wildlife
MQO	Measurement Quality Objective

MRM	Multiple Reaction Mode
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PBDE	Polybrominated Diphenyl Ether
PFAS	Per- and Polyfluoroalkyl Substances
Physis	Physis Environmental Laboratories, Inc.
PPCP	Pharmaceutical and Personal Care Product
PR	Percent Recovery
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
SGS-AXYS	SGS AXYS Analytical Services Ltd.
SPoT	Stream Pollution Trends Monitoring Program
SSC	Suspended Sediment Concentration
SWAMP	State Water Resources Control Board’s Surface Water Ambient Monitoring Program
SWRCB	State Water Resource Control Board
TOC	Total Organic Carbon
UPLC/MS/MS	Ultra-Performance Liquid Chromatography/Tandem Mass Spectrometry
WKL	Weck Laboratories, Inc.
VAL	Vista Analytical Laboratory

LIST OF UNITS

°C	degrees Celsius
cfs	cubic feet per second
cm	centimeter
ft	feet
km	kilometer
L	liter
m	meter
mg	milligram
mL	milliliter
ng	nanogram
ng/g dw	nanogram per gram, dry weight
ng/L	nanogram per liter
NTU	Nephelometric Turbidity Unit
µg	microgram
µm	micrometer (micron)
µS	microsiemen

INTRODUCTION

BACKGROUND

This report summarizes the Delta Regional Monitoring Program's (Delta RMP's) sample collection, laboratory analysis, and data verification for Year 2 as part of the *Central Valley Pilot Study for Monitoring Constituents of Emerging Concern (CECs) Work Plan* (Stakeholder Work Plan). Implementation of the Stakeholder Work Plan by the Delta RMP is referred to as the CEC Pilot Study). The CEC Pilot Study includes a three-year study design which began in 2020 for Year 1; Year 2 sampling occurred from July of 2021 through June of 2022.

Year 2 CEC monitoring and data management was conducted under the *Quality Assurance Project Plan for the Pilot Study of Constituents of Emerging Concern in the Sacramento-San Joaquin Delta, Version 2*. The CEC Quality Assurance Project Plan (QAPP) was revised ahead of the second year of monitoring, with the final revision receiving approval from all signatories, including the State Water Resource Control Board (SWRCB) Quality Assurance (QA) Officer on November 29, 2021. Approval to conduct monitoring while the document was being finalized was provided by the Central Valley Regional Water Quality Control Board (CVRWQC) via email on October 13, 2021, prior to the first October sampling event (**Table 3**).

ANALYTICAL SCOPE

Year 2 CEC monitoring included the sampling and analysis for three major groups of CEC constituents: polybrominated diphenyl ethers (PBDEs), per- and polyfluoralkyl substances (PFAS), and pharmaceutical and personal care products (PPCPs). In addition, two ancillary parameters, total organic carbon (TOC) and suspended sediment concentration (SSC), were analyzed to facilitate interpretation of the ecotoxicity of the targeted CEC analytes. Analysis for various combinations of these constituents is conducted on three different sample matrices including water, sediment, and tissue (fish and bivalves). The analyses conducted in each matrix and sample fraction or organism are defined in **Table 1** .

The specific CECs analyzed within each constituent group is based on the Stakeholder Work Plan suite list. In addition to these high priority, required constituents, the Delta RMP has requested that laboratories include results for any additional analytes that may be included in the same analytical suite that will not cost extra for analysis and reporting by the laboratory. This is similar to the direction in Year 1; however, it should be noted that there were differences in what additional analytes could be included in the Year 2 analysis for no additional cost. Based on discussions at the July 2021 Steering Committee meeting, it was agreed by the Board of Directors (BOD) to develop a Year 2 Study Plan that would remain consistent with the CECs analyzed in Year 1. Both the required and additional CEC analytes are included in the summaries provided below. A complete list of the analytical constituents and their designation as required, additional, or ancillary is provided in **Appendix B**, **Table B.1.**

Field measurements for dissolved oxygen (DO), pH, specific conductivity, temperature, and turbidity are collected during each sampling event alongside the collection of samples for chemical analysis, except for fish tissue samples which were collected separately by Marine Pollution Studies Laboratory, Department of Fish and Wildlife (MPSL-DFW) (**Table 1**).

Table 1. Analytical scope of CEC Year 2 monitoring.

Matrix	Fraction/ Organism	Analyte/Parameter
Water	Total	Galaxolide (PPCP)
Water	Total	Hormones (PPCP)
Water	Total	Pharmaceuticals (PPCPs) [1]
Water	Total	Hormones (PPCPs) [1]
Water	Particulate	Suspended Sediment Concentration (SSC)
Water	Total	Per- and Polyfluoroalkyl Substances (PFAS) [1]
Water	NA	Dissolved Oxygen (DO)
Water	NA	pH
Water	NA	Specific Conductivity
Water	NA	Turbidity
Water	NA	Temperature
Sediment	Total	Total Organic Carbon (TOC)
Sediment	Total	Polybrominated Diphenyl Ethers (PBDEs) [1]
Sediment	Total	Per- and Polyfluoroalkyl Substances (PFAS) [1]
Tissue	Bivalves, Fish	Polybrominated Diphenyl Ethers (PBDEs) [1]
Tissue	Fish	Per- and Polyfluoroalkyl Substances (PFAS) [1]

[1] See **Appendix B Table B.1** for complete list.

INVOLVED ORGANIZATIONS

The CEC Year 2 monitoring includes ten organizations performing administrative, laboratory, and/or field tasks. Organization details are included in **Table 2**.

Table 2. Involved organizations for CEC Year 2 monitoring.

ORGANIZATION	TASK(S)
Marine Pollution Studies Laboratory at Moss Landing Marine Laboratories (MPSL-MLML)	Data Management, Quality Assurance
MLJ Environmental (MLJ)	Project Management, Data Management, Quality Assurance, Sample Collection (water and sediment)
Applied Marine Sciences, Inc. California (AMS)	Sample Collection (water, sediment, and bivalves)
ICF International (ICF)	Sample Collection (water, sediment, and bivalves)
Marine Pollution Studies Laboratory, Department of Fish and Wildlife (MPSL-DFW)	Sample Collection (fish)
Stream Pollution Trends Monitoring Program (SPoT)	Sample Collection (sediment)
Physis Environmental Laboratories, Inc.	Sample Analysis – PPCPs (water)
SGS AXYS Analytical Services Ltd.	Sample Analysis – PBDEs, PFAS (sediment, bivalves, and fish)
Vista Analytical Laboratory	Sample Analysis – PFAS (water)
Weck Laboratories, Inc.	Sample Analysis – PPCPs (water)

SAMPLING OVERVIEW

Sampling logistics for Year 2 CEC monitoring are summarized in **Table 3** and detailed in the sections that follow.

Table 3. Sampling event information for CEC Year 2 CEC monitoring.

Event	Season	CEDEN Station Code	CEDEN Station Name	Matrix	Agency	Latitude [1]	Longitude [1]	Date	Time
1	Late Summer/ Early Fall	519AMNDVY	American River at Discovery Park	Sediment	SPoT	38.60099	-121.50546	7/22/2021	9:00
1	Late Summer/ Early Fall	519ST1309	Sacramento River at Veterans Bridge-03SWSBIO-519ST1309	Fish Tissue	MPSL-DFW	38.67299	-121.62657	10/18/2021	9:00
1	Late Summer/ Early Fall	510ST1317	Sacramento River/Freeport-510ST1317	Fish Tissue	MPSL-DFW	38.45920	-121.50252	10/18/2021	11:32
1	Late Summer/ Early Fall	544LSAC13	San Joaquin R at Buckley Cove	Fish Tissue	MPSL-DFW	37.97768	-121.38235	10/18/2021	16:45
1	Late Summer/ Early Fall	541SJC501	San Joaquin River at Airport Way near Vernalis	Fish Tissue	MPSL-DFW	37.674241	-121.26511	10/20/2021	10:30
1	Late Summer/ Early Fall	519PGC010	Roseville Urban Runoff	Water	AMS	38.80474	-121.32738	10/20/2021	10:25
1	Late Summer/ Early Fall	541SJC501	San Joaquin River at Airport Way near Vernalis	Water, Bivalve Tissue	AMS	37.67571	-121.2649	10/20/2021	11:15
1	Late Summer/ Early Fall	519DRYCRK	Dry Creek at Roseville WWTP	Water, Sediment	AMS	38.7342	-121.31444	10/20/2021	11:48
1	Late Summer/ Early Fall	519POTW01	POTW Source No. 1	Water	AMS	38.73404	-121.32186	10/20/2021	13:00
1	Late Summer/ Early Fall	519SACUR3	Sacramento Urban Runoff 3; Sump 111	Water	AMS	38.60127	-121.49299	10/20/2021	14:20

Event	Season	CEDEN Station Code	CEDEN Station Name	Matrix	Agency	Latitude[1]	Longitude[1]	Date	Time
1	Late Summer/ Early Fall	544SJRNBC	San Joaquin River near Buckley Cove	Water, Bivalve Tissue	AMS	37.97124	-121.37426	10/21/2021	7:45
1	Late Summer/ Early Fall	511SOL011	Old Alamo Creek at Lewis Road	Water, Sediment	AMS	38.34649	-121.89686	10/21/2021	10:20
1	Late Summer/ Early Fall	519AMNDVY	American River at Discovery Park	Water, Bivalve Tissue	AMS	38.60083	-121.50458	10/21/2021	10:55
1	Late Summer/ Early Fall	511POTW02	POTW Source No. 2	Water	AMS	38.3466	-121.901603	10/21/2021	12:20
1	Late Summer/ Early Fall	519SUT108	Sacramento River at Elkhorn Boat Launch Facility	Water, Bivalve Tissue	AMS	38.672077	-121.625008	10/21/2021	12:57
1	Late Summer/ Early Fall	510SACC3A	Sacramento River at Hood Monitoring Station Platform	Water, Bivalve Tissue	AMS	38.367739	-121.521217	10/21/2021	15:15
1	Late Summer/ Early Fall	510ST1301	Sacramento River at Freeport	Water, Bivalve Tissue	AMS	38.455413	-121.501925	10/21/2021	16:20
2	First Flush	519PGC010	Roseville Urban Runoff	Water	AMS	38.8047	-121.3273	10/25/2021	10:40
2	First Flush	541SJC501	San Joaquin River at Airport Way near Vernalis	Water	ICF	37.67565	-121.26484	10/25/2021	11:05
2	First Flush	519SACUR3	Sacramento Urban Runoff 3; Sump 111	Water	AMS	38.6013	-121.49298	10/25/2021	12:10
2	First Flush	544SJRNBC	San Joaquin River near Buckley Cove	Water	ICF	37.97417	-121.37601	10/25/2021	12:40
2	First Flush	511SOL011	Old Alamo Creek at Lewis Road	Water	AMS	38.34649	-121.89685	10/25/2021	13:20
2	First Flush	511POTW02	POTW Source No. 2	Water	AMS	38.34658	-121.90162	10/25/2021	14:30

Event	Season	CEDEN Station Code	CEDEN Station Name	Matrix	Agency	Latitude[1]	Longitude[1]	Date	Time
2	First Flush	519AMNDVY	American River at Discovery Park	Water	AMS	38.6008	-121.50475	10/26/2021	9:50
2	First Flush	519SUT108	Sacramento River at Elkhorn Boat Launch Facility	Water	AMS	38.67177	-121.62465	10/26/2021	11:00
2	First Flush	519DRYCRK	Dry Creek at Roseville WWTP	Water	MLJ	38.73423	-121.31445	10/26/2021	11:20
2	First Flush	519POTW01	POTW Source No. 1	Water	MLJ	38.73405	-121.32187	10/26/2021	12:30
2	First Flush	510SACC3A	Sacramento River at Hood Monitoring Station Platform	Water	AMS	38.36729	-121.5213	10/26/2021	13:10
2	First Flush	510ST1301	Sacramento River at Freeport	Water	AMS	38.45541	-121.50195	10/26/2021	14:00
3	Spring Storm	519SACUR3	Sacramento Urban Runoff 3; Sump 111	Water	MLJ	38.60122	-121.49307	3/28/2022	9:40
3	Spring Storm	519PGC010	Roseville Urban Runoff	Water	MLJ	38.80475	-121.32735	3/28/2022	10:00
3	Spring Storm	519DRYCRK	Dry Creek at Roseville WWTP	Water	MLJ	38.73422	-121.31445	3/28/2022	11:00
3	Spring Storm	511POTW02	POTW Source No. 2	Water	MLJ	38.34666	-121.9016	3/28/2022	11:20
3	Spring Storm	519POTW01	POTW Source No. 1	Water	MLJ	38.73401	-121.32188	3/28/2022	11:30
3	Spring Storm	511SOL011	Old Alamo Creek at Lewis Road	Water	MLJ	38.34642	-121.89709	3/28/2022	11:50
3	Spring Storm	541SJC501	San Joaquin River at Airport Way near Vernalis	Water	ICF	37.67539	-121.26468	3/28/2022	12:10
3	Spring Storm	519SUT108	Sacramento River at Elkhorn Boat Launch Facility	Water	AMS	38.67173	-121.62488	3/28/2022	12:15
3	Spring Storm	544SJRNBC	San Joaquin River near Buckley Cove	Water	ICF	37.974196	-121.376	3/28/2022	13:20

Event	Season	CEDEN Station Code	CEDEN Station Name	Matrix	Agency	Latitude[1]	Longitude[1]	Date	Time
3	Spring Storm	519AMNDVY	American River at Discovery Park	Water	AMS	38.60085	-121.50462	3/28/2022	13:50
3	Spring Storm	510ST1301	Sacramento River at Freeport	Water	AMS	38.45552	-121.50189	3/28/2022	15:00
3	Spring Storm	510SACC3A	Sacramento River at Hood Monitoring Station Platform	Water	AMS	38.36715	-121.52088	3/28/2022	15:45
4	Summer	519AMNDVY	American River at Discovery Park	Water	AMS	38.60102	-121.50454	6/8/2022	9:05
4	Summer	511POTW02	POTW Source No. 2	Water	MLJ	38.34662	-121.90157	6/8/2022	9:10
4	Summer	519SACUR3	Sacramento Urban Runoff 3; Sump 111	Water	MLJ	38.6013	-121.49297	6/8/2022	9:30
4	Summer	544SJRNBC	San Joaquin River near Buckley Cove	Water	ICF	37.97419	-121.37608	6/8/2022	9:35
4	Summer	511SOL011	Old Alamo Creek at Lewis Road	Water	MLJ	38.34649	-121.89687	6/8/2022	9:50
4	Summer	519SUT108	Sacramento River at Elkhorn Boat Launch Facility	Water	AMS	38.67191	-121.62515	6/8/2022	10:09
4	Summer	519DRYCRK	Dry Creek at Roseville WWTP	Water	MLJ	38.73423	-121.31441	6/8/2022	10:40
4	Summer	519POTW01	POTW Source No. 1	Water	MLJ	38.73403	-121.32181	6/8/2022	11:20
4	Summer	541SJC501	San Joaquin River at Airport Way near Vernalis	Water	ICF	37.67542	-121.26462	6/8/2022	11:20
4	Summer	510ST1301	Sacramento River at Freeport	Water	AMS	38.45545	-121.50199	6/8/2022	12:00
4	Summer	519PGC010	Roseville Urban Runoff	Water	MLJ	38.80474	-121.32733	6/8/2022	12:10

Event	Season	CEDEN Station Code	CEDEN Station Name	Matrix	Agency	Latitude [1]	Longitude [1]	Date	Time
4	Summer	510SACC3A	Sacramento River at Hood Monitoring Station Platform	Water	AMS	38.36769	-121.52079	6/8/2022	12:45

[1] Where the recorded latitude and longitude measurements occur over multiple locations for a single sample collection, the first recorded coordinate values are provided.

STUDY BACKGROUND

The *Central Valley Pilot Study for Monitoring Constituents of Emerging Concern (CECs) Work Plan* (Stakeholder Work Plan) was developed by a stakeholder group to better understand methods of evaluating ambient concentrations and sources of CECs in different Central Valley surface water scenarios based on the guidance provided by the SWRCB 2016 Statewide Monitoring Plan (Tadesse 2016). This CEC Pilot Study is the Delta RMP's implementation of the Stakeholder Work Plan as part of a statewide pilot study of CECs being conducted in different regions of California following a mandate and guidelines by the SWRCB. The stated goals in the statewide guidance document are:

> "This statewide pilot study implements the second phase of the recommendation which is to gather data to determine the occurrence and biological impacts of CECs. The result of this pilot study will help the State Water Board to develop a statewide CEC monitoring strategy and control action."
>
> "The objective of the CEC statewide pilot study monitoring plan is to generate statewide data to inform Water Board managers of the status and trends of CECs in water. The plan is designed to narrow the data gap among regions by producing comparable CEC data throughout the state."

The CEC Pilot Study is designed to collect samples for targeted chemistry analyses from ambient and source locations over a three-year period with phased study components and some adaptive management elements as follows:

- Year 1 – ambient monitoring. The first year of monitoring includes ambient monitoring to assess the presence of the targeted CECs at specific locations in the Delta.
- Year 2 – ambient and source monitoring. The second year of monitoring continues the ambient monitoring conducted during the first year and adds source characterization sites to monitor Publicly Owned Treatment Works (POTW) effluent and urban runoff.
- Year 3 – gradient source study. The third year continues only the source monitoring from Year 2 and adds gradient sampling upstream and downstream of POTWs and other identified sources.

The ambient sampling locations include entry points into the Delta, in-Delta waters, and locations in the vicinity of POTW discharges and within the influence of urban runoff. Ambient monitoring to characterize background conditions is the strategy recommended in the CEC Statewide Pilot Study Monitoring Plan.

Year 1 monitoring was completed in June 2021 (Delta RMP CEC Year 1 Data Report). Year 2 monitoring assesses both ambient and source locations and occurred between July

2021 and June 2022. The Year 2 results discussed in this report are being used to inform the design of the third year of monitoring. Results from all three years of the study will be used by the Delta RMP and the State Board to inform regional and statewide assessments of future CEC monitoring needs.

Year 2 Sampling Events

Year 2 CEC monitoring occurred over four sampling events throughout 2021 and 2022. Events 1 and 2 occurred in October of 2021, with the first event capturing dry weather conditions while the second, which occurred the following week, captured the runoff conditions produced by the first flush storm event of the season (**Table 3**). Event 3 occurred in March of 2022, following a spring storm event, while Event 4 occurred in June to reflect dry season conditions. Storm sampling triggers are defined in the CEC QAPP (v2); descriptions of the hydrologic conditions are provided in **Appendix A. Table 4** includes event descriptions and storm trigger criteria from the CEC QAPP (v2). Storm triggers are evaluated across the basin and therefore one monitoring site may have more rain than another leading up to the sampling event. This is likely true for the October first flush rain event where there was more rain in localized areas but samples were not collected until the storm trigger for the basin was met.

Table 4. CEC Year 2 event descriptions and associated storm trigger criteria (reproduced from Tables 10-2 and 10-3 from the QAPP).

Event Number	Description	Timing	Storm trigger for wet-weather events
1	Late summer, early Fall	August, September, or October	n/a
2	First flush (Wet 1)	October - January	0.5 inches in 24 hours over the basin based on NWS forecasts for Sacramento and Stockton (50% probability 48 hours prior to event)
3	Spring storm (Wet 2)	Feb, Mar, or April of	0.25 inches in 24 hours over the basin based on NWS forecasts for Sacramento and Stockton (75% probability 48 hours prior to event)
4	Summer - dry season	May, June, or July	n/a

In addition, a single sediment sample from the American River at Discovery Park was collected by SPoT crews in July 2021 during their normally scheduled collections. These samples were stored frozen at the MLJ office and submitted to the laboratory with the rest of the sediment samples collected in October (except for TOC).

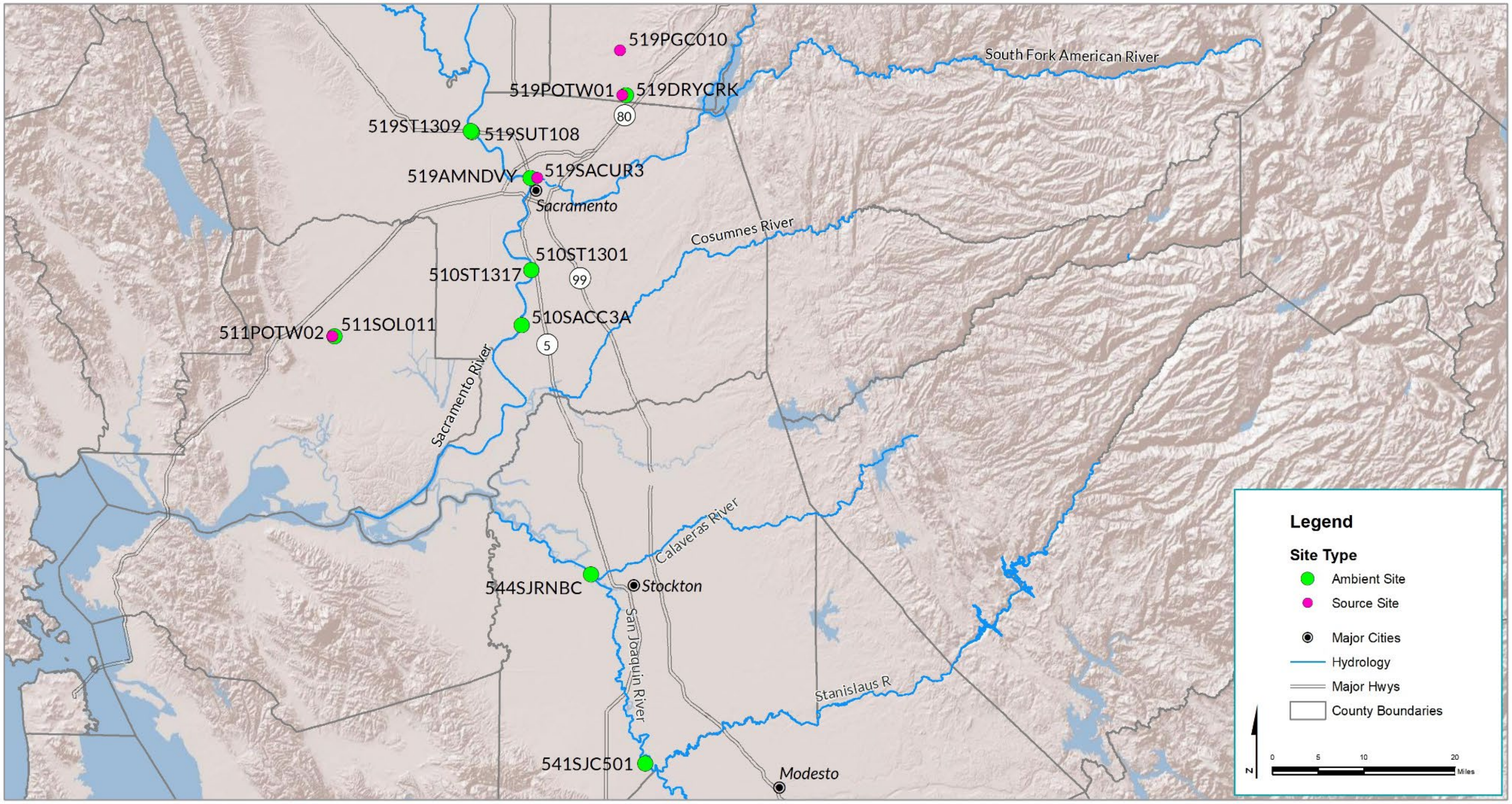
Year 2 Monitoring Locations

The Year 2 CEC monitoring was conducted at the same ambient sites that were monitored in Year 1 with the addition of four source sites (**Figure 1)**. The source sites added for Year 2 monitoring include two urban runoff sites and two POTW effluent locations. All Year 2 monitoring locations were consistent with the CEC Pilot Study Workplan with the following exceptions.

The Year 2 fish tissue collections were conducted by MPSL-DFW field crews. Two of the four fish collection sites are reported under different stations names than the associated water and bivalve samples. Fish tissue samples were collected near the Sacramento River at Elkhorn Boat Launch Facility and the Sacramento River at Freeport sites but due to the specifics listed on the permits were associated with the SWAMP station names of Sacramento River at Veterans Bridge -03SWSBIO-519ST1309 and Sacramento River/Freeport-510ST1317, respectively. These additional monitoring stations are identified in the approved CEC QAPP (v2) and the results associated with the MPSL-DFW fish tissue collections can be found under station codes 510ST1317 and 519ST1309.

During Year 2 of the CEC Pilot Study, the ambient sampling location on the San Joaquin River at Buckley Cove was re-evaluated and updated from the original Station Code and coordinates identified in the Pilot Study Workplan and CEC QAPP. After repeated sample collections that occurred farther than 100 meters from the target coordinates that is allowed by the QAPP, the decision was made to move the site approximately 350 m downstream to a location more consistently accessible and more easily identifiable by field crews. The QAPP was amended (approved and signed on June 8, 2022) to identify the updated station name “San Joaquin River near Buckley Cove,” as the correct targeted monitoring location; all sample collection results for Year 2 were updated to reflect the new location. For more details, see **Deviations and Corrective Actions**.

Figure 1. Sampling sites for Year 2 CEC monitoring.



| H:\coalition\DRMP_2022.mxd | Created by: fjohnson | Last Updated : 9/26/2022

Delta RMP Year 2 CEC Monitoring Locations

Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
Projection: property–Lambert Conformal Conic
Units: Foot US
Service Layer Credits: World Shaded Relief: Copyright:(c) 2014 Esri
Hydrology - NHD hydrodata, 1:24,000-scale, http://nhd.usgs.gov/
Roads, highways, railroads - ESRI

MLJ ENVIRONMENTAL

SAMPLING METHODS

Sampling for Events 1-4 was conducted by personnel from AMS, ICF, SPoT, MPSL-DFW, and MLJ field crews at sites shown in **Figure 1** and following procedures described in the CEC QAPP (v2). Water, sediment, bivalve tissue, and fish tissue samples were collected for analysis of the CECs listed in **Appendix B**. Field measurements were taken alongside all sample collections except for the fish tissue collected by MPSL-DFW field crews.

Water Sample Collection

Water samples were collected from 12 locations throughout the Delta during all four Year 2 sampling events. Sites were sampled midchannel via a vessel operated by ICF using a pole sampler or via land access by hand collection or bailer. Samples were collected directly into sample bottles wherever possible or, where sample containers were pre-charged with preservatives, poured off from a pre-cleaned bottle of the same material as the sample bottle. Water samples were stored in coolers with double-bagged wet ice from time of collection until delivery to the laboratory. Field crews collecting and handling water samples for PFAS analysis adhered to the contamination prevention protocols outlined in the CEC QAPP (v2)and Sampling and Analysis Plan (SAP). Water samples collected by all field crews were delivered to MLJ Environmental under standard Chain of Custody protocols; MLJ staff submitted all samples to the associated laboratory by shipment or hand delivery.

Sediment Sample Collection

Sediment samples were collected by AMS and SPoT field crews at three locations during Event 1. Samples for PBDE analysis were collected by taking 2-3 grabs of sediment and placing them into a clean stainless-steel bucket. The sediment composite was then homogenized before being subsampled into the appropriate laboratory containers and placed in a cooler on wet ice. Sediment samples for PFAS analysis were collected by scooping the sediment sample directly into the sample jars provided by the laboratory. Field crews collecting and handling sediment samples for PFAS analysis adhered to the contamination prevention protocols outlined in the CEC QAPP (v2)and SAP. When collection was complete, samples were placed in a cooler with double bagged wet ice and delivered to MLJ Environmental where they were then frozen. Samples were stored frozen to -20 °C until being shipped to SGS-AXYS on January 4, 2022. Although the last sediment samples were collected in October, the samples were not shipped due to customs clearance concerns and winter storms in British Columbia that reduced the laboratory's capacity and jeopardized the ability for timely sample delivery. Samples were received within method hold time requirements and there were no issues with customs;

all sample handling requirements were met for Year 2 sediment samples (see **Data Verification: Sample Handling**).

Tissue Sample Collection

Bivalves of the species *Corbicula fluminea* (freshwater clam) were collected by AMS staff from six locations during Event 1. Organisms were collected by a clam dredge towed behind a vessel or manually using rakes and shovels. Repeated dredge or hand collection attempts were made at each site until the target sample composite of 20 individual clams comprised of roughly the same proportion of various size classes was reached. Clams were placed in a metal bucket for sorting and a subsample of live specimens were selected for measurement and processing. All organisms from a single site were individually wrapped in aluminum foil, compiled in a zip-top bag, and kept frozen on dry ice until delivered to MLJ Environmental. Bivalve composite samples were stored frozen to -20 °C until being shipped to SGS-AXYS on January 4, 2022. The field report for the bivalve collection noted that there was potential for insufficient tissue from the 25 clams collected at San Joaquin River at Airport Way near Vernalis (541SJC501) on October 21, 2021. Although more than 20 individual clams were collected per the protocol the sample collected was limited by the availability of the clams at the location and therefore there was a concern that the amount of tissue available would not meet the minimum requirements for analysis. To try to remediate this issue the samplers collected more than 20 clams. This potential for a deviation was documented in deviation **2021-01: Year 2 Clam Tissue Collection**.

Fish tissue samples were collected by MPSL-DFW staff from four locations during Event 1 with the target size for fish collection being 30-50 cm in total length. Up to five benthivorous fish of the same species were collected using an electrofishing boat for each of the four stations. Upon collection, each fish was tagged with a unique ID and physical parameters were collected for each individual fish, which included: weight, total length, fork length, and presence of any abnormalities. Large fish were partially dissected in the field using the following protocol: fish were placed on a cutting board covered with a clean plastic bag where the head, tail, and guts were removed using a clean (laboratory detergent, DI) cleaver. The sex of the fish was noted. The fish were then wrapped in tin foil, with the dull side inward, and double-bagged in zipper-closure bags with other fish from the same location. Fish samples were placed on wet ice in the field and frozen within 48 hours of collection. Samples were stored in a freezer at the MPSL until they were processed for authorized dissection as skin-off filets. The frozen dissected filets were shipped overnight in coolers to SGS-AXYS for analysis on January 24, 2022.

SAMPLE COLLECTION COMPLETENESS

Sample collection completeness is based on the number of samples successfully collected and transported to the laboratory for analysis. Completeness is assessed as each analysis scheduled for each site over all events in the year; completeness counts by individual constituent are provided in Appendix **Table C.2**. All 1,282 samples scheduled for Year 2 monitoring were successfully collected and transferred to the appropriate laboratories and Year 2 sample collection completeness was 100%.

FIELD ACTIVITIES

Field and cruise reports for Year 2 CEC sample collection are provided in **Appendix A**; collection activities are summarized below.

Event 1

Event 1 sampling was conducted to capture water, sediment, and tissue samples from the end of the dry weather season and occurred during October 18, 2021 through October 21, 2021 (except the July sediment collection performed by SPoT). While there was light rainfall recorded in the project vicinity, there was no measurable rainfall prior to initiation of sampling, nor was there observable flow into the channels from stormwater sources. Sampling crews recorded low observed flows (0.1-1 cfs) at the Dry Creek at Roseville WWTP, Roseville Urban Runoff, and Sacramento Urban Runoff sites during this dry weather event. Water quality collections were completed before other types of sampling were performed per the field SAP and the CEC QAPP (v2).

AMS staff collected water samples midchannel via a vessel operated by ICF on October 21, 2021, from the sampling sites located at the Sacramento River at Elkhorn Boat Launch Facility, Sacramento River at Freeport, Sacramento River at Hood Monitoring Station Platform, American River at Discovery Park, and San Joaquin River near Buckley Cove. Water samples from the remaining eight stations were collected by land on October 20, 2021 and October 21, 2021 **(Table 3**).

AMS field crews collected sediment samples at two stream locations: Dry Creek at Roseville WWTP on October 20, 2021 and Old Alamo Creek at Lewis Road on October 21, 2021. SPoT field crews collected deep-water sediment samples at American River at Discovery Park on July 22, 2021. The SPoT sample collection occurred at a sediment depth of five cm using core equipment.

Clam tissue samples were collected by hand using rakes and shovels from San Joaquin River at Airport Way near Vernalis on October 20, 2021. Samples were collected by boat using a clam dredge from San Joaquin River near Buckley Cove, American River at Discovery Park, Sacramento River at Elkhorn Boat Launch Facility, Sacramento River at

Hood Monitoring Station Platform, and Sacramento River at Freeport on October 21, 2021. Sufficient amounts and size distributions of organisms was obtained from all sites except for at the San Joaquin River at Airport Way near Vernalis, where field crews attempted hand collection for three hours and encountered a low abundance of clams, the majority of which fell into the smallest size class (see deviation **2021-01: Year 2 Clam Tissue Collection).**

Fish samples were collected on October 18, 2021 and October 19, 2021, by MPSL-DFW within 1 km of the target sites, per the QAPP. Organisms were collected from three sites October 18, 2021, including seven total fish (5 White Catfish and 2 Sacramento Suckers) collected from the Sacramento River at Freeport, five total fish (5 Sacramento Suckers) collected from the Sacramento River at Veteran's Bridge, and 10 total fish (10 White Catfish) collected from the San Joaquin River at Buckley Cove. Five total fish (5 Common Carp) were collected from the San Joaquin River at Airport Way near Vernalis on October 19, 2021.

Event 2

Event 2 was a water sample collection event to capture the first flush storm event on October 25, 2021 and October 26, 2021. Sampling during this event was associated with the first major rainfall of the season. The storm event was the result of an atmospheric river that produced over 4.5 inches of rainfall at the Sacramento International Airport and over 3.5 inches at the Stockton Airport between 9 pm on Saturday, October 23, 2021 and 8 am on Monday, October 25, 2021. Other locations around the sampling area reported even higher precipitation levels. Water quality collections were completed per the field SAP and CEC QAPP (v2). Some locations within the large study area reported rainfall exceeding 0.5" prior to the event and experienced a seasonal first flush prior to October 25, 2021; sampling triggers were assessed using the rain gauges at the Stockton and Sacramento Airports, per the requirements in the CEC QAPP (v2).

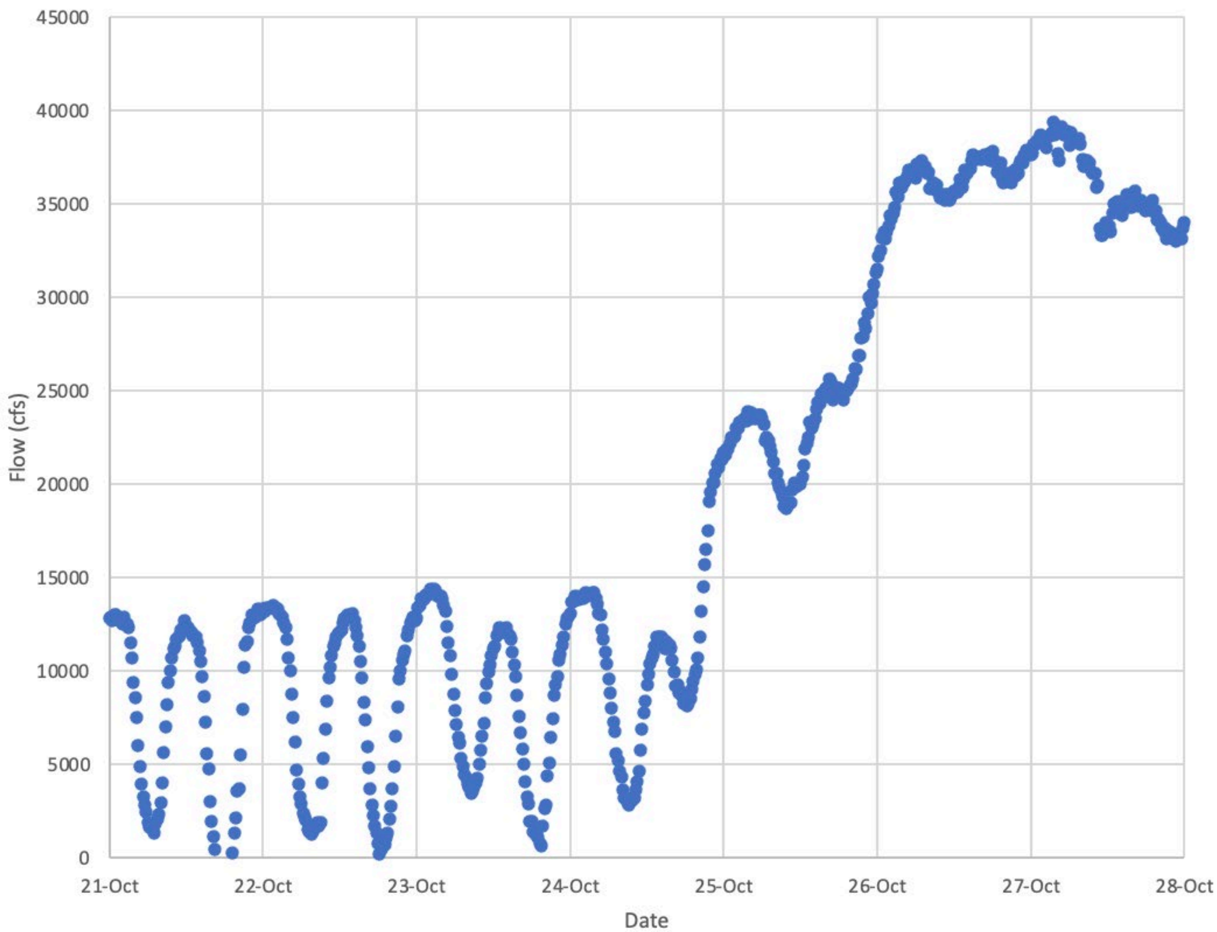
AMS staff collected water samples midchannel via a vessel operated by ICF on October 26, 2021 from the sampling sites located at the Sacramento River at Elkhorn Boat Launch Facility, Sacramento River at Freeport, Sacramento River at Hood Monitoring Station Platform, American River at Discovery Park, and San Joaquin River near Buckley Cove. Water samples collected at the remaining eight stations were collected by land. All sample collections were originally attempted on October 25, 2022, in an effort to follow to the guidance provided in the CEC QAPP which states the preference is to complete collections within 12 hours from last rainfall intensity of 0.1" per hour. Vessel-based sample collections were postponed to the following day (October 26, 2022) due to daylight restrictions and flooding that precluded the vessel launch. In addition, AMS field crews attempting land collections were unable to access the sites at Dry Creek at

Roseville WWTP and POTW Source No. 1 on October 25, 2021 due to flooding and unsafe weather conditions. MLJ staff were able to revisit these locations the following day on October 26, 2021 when there was no longer a risk of flooding and successfully collected the samples.

Flow measurements as reported at USGS sampling station 11447650 near Freeport, California are shown in **Figure 2**. Pre-storm flow measurements remained below 15,000 cfs before the rainfall. During sampling operations, flow rates ranged from 18,700 to 31,300 cfs on October 25, 2021, and 31,500 to 37,900 cfs on October 26, 2021. Elevated flow conditions continued throughout the duration of the sampling event and peaked several days after cessation of major rainfall (39,400 cfs on October 27, 2021, at 3:30 am), indicating the desire to capture the rising limb of the hydrograph was achieved for this storm event.

The QAPP states that "The strategy is to best capture the rising limb, or near the peak of the hydrograph, in safe conditions, while allowing reasonable mobilization times." The intent of this targeting strategy is to more consistently characterize a specific condition particularly for the smaller drainages that may have more variable concentrations over the course of a runoff event. Logistical and safety considerations constrain sample collection timing. While the downstream river sites generally met this target, urban runoff samples collected for Event 2 were generally later in the hydrograph.

Figure 2. Flow measurements recorded at USGS Station 11447650 near Freeport, California during Event 2 sample collections (October 25 and 26, 2021).



Event 3

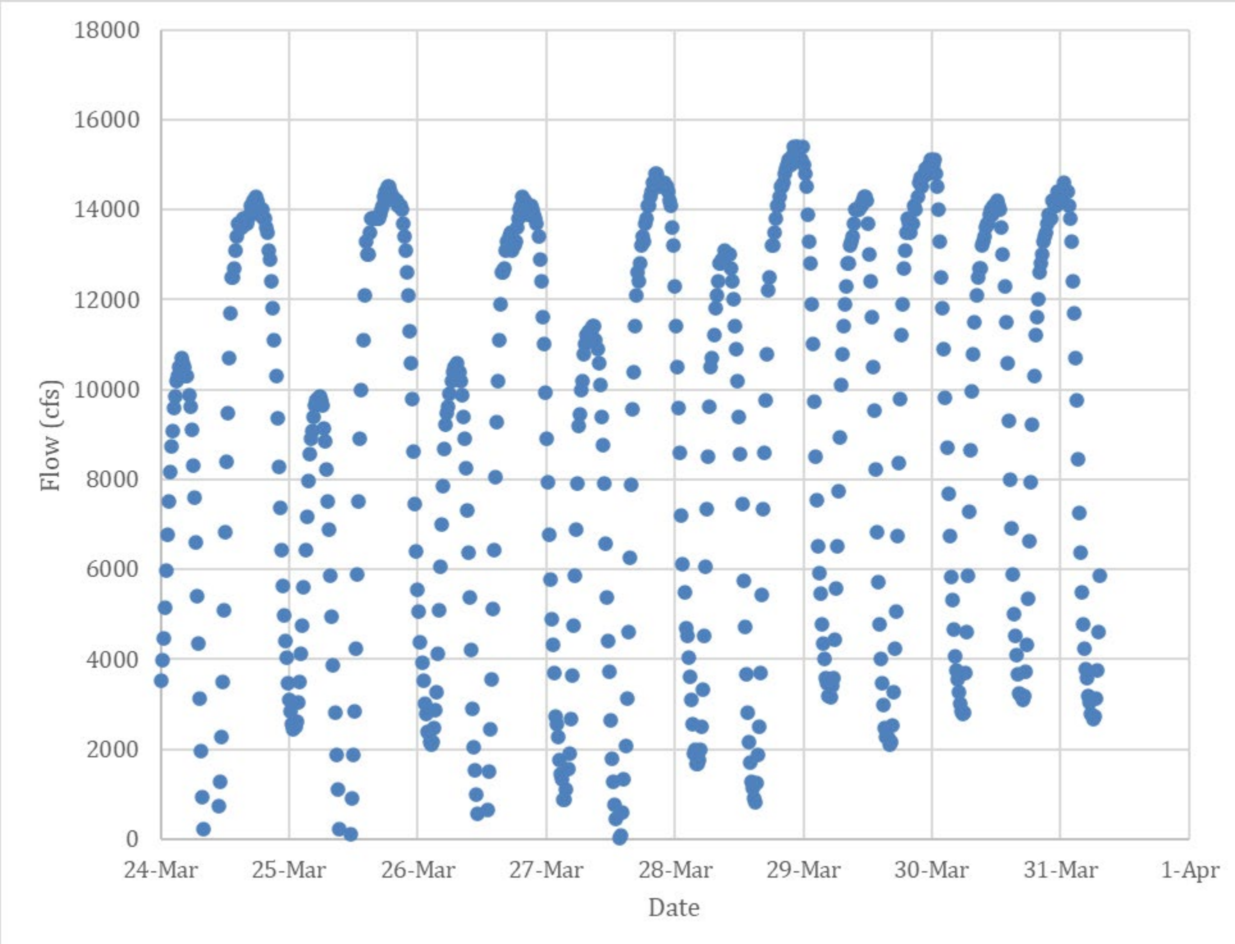
Event 3 water sampling was conducted during the second of two wet season sampling events on March 28, 2022. Sampling for this event was associated with a late season spring storm that produced approximately 1.2 inches of rainfall at the Sacramento International Airport and approximately 0.7 inches at the Stockton Airport between 10 pm on Sunday, March 27, 2022 and 6 pm on Monday, March 28, 2022. Monitoring activities were staggered over the course of the day, as well as geographically, and therefore rainfall totals varied by station. This storm event represented the first significant rainfall for 2022. The previous storm event that exceeded 0.25" occurred in late December of 2021, indicating over 90 days of antecedent dry condition prior to Event 3 sampling. Water quality collections were completed per the field SAP and the CEC QAPP (v2).

AMS staff collected water samples midchannel via a vessel operated by ICF from the sampling sites located at Sacramento River at Elkhorn Boat Launch Facility, Sacramento

River at Freeport, Sacramento River at Hood Monitoring Station Platform, and American River at Discovery Park. The San Joaquin River near Buckley Cove was not sampled at the target location because the marina was closed on the day of sampling. Instead, field crews collected water samples from the bank downstream of the target location. Water samples collected at the remaining eight stations were also collected from land. Sample collections from land occurred in the earlier part of the day during peak runoff and sample collection from a vessel occurred several hours after to allow runoff to have more time to reach the downstream receiving waters. All water samples and field measurements were successfully collected with the exceptions of dissolved oxygen as percent saturation, which was not recorded at San Joaquin River near Buckley Cove or San Joaquin River at Airport Way near Vernalis due to an oversight by sampling crews (see deviation **2021-06: Event 3 Field Sampling Deviations for 1 Site Offset and 2 O2 Saturation Not Reported**).

Flow measurements as reported at USGS sampling station 11447650 near Freeport, California, are shown in **Figure 3**. Unlike the first flush event, a large difference in discharge between pre-storm and intra- and post-storm discharge was not easily observable, with patterns following typical diurnal patterns associated with tidal influence. Daily peak discharge results, coinciding with maximum ebb tides, ranged in the 14,000 to 14,500 cfs range before the rainfall. Discharge rates peaked at 15,400 during the peak ebb flow on March 28th and returned to pre-storm conditions approximately 1 day later.

Figure 3. Flow measurements recorded at USGS Station 11447650 near Freeport, California. Event 3 monitoring occurred on March 28, 2022.



Event 4

Event 4 water sampling occurred on June 8, 2022 following antecedent dry conditions that lasted for a minimum 48 hours. Prior to this event, rainfall occurred the morning of June 5, 2022, with total precipitation for the date reported as 0.1" at the Sacramento Airport. Water quality collections were completed per the field SAP and CEC QAPP (v2).

AMS staff collected water samples midchannel via a vessel operated by ICF on June 8, 2022 from the sampling sites located at the Sacramento River at Elkhorn Boat Launch Facility, American River at Discovery Park, Sacramento River at Freeport, and Sacramento River at Hood Monitoring Station Platform. Water samples collected at the remaining eight stations were collected from land by MLJ and ICF field crews. All water samples and field measurements were successfully collected and delivered to MLJ Environmental. Dry weather sampling at storm runoff locations presented a challenge due to the lack of flows. Sampling crews recorded no observed flow at the Dry Creek at Roseville WWTP, Roseville Urban Runoff, and Sacramento Urban Runoff sites during this dry weather event. In addition, samplers also noted a fair amount of algae was present, and emergent aquatic vegetation surrounded the small pool of stagnant water, where samples were collected at the Roseville Urban Runoff location during this dry-weather sampling.

ANALYTICAL OVERVIEW

FIELD MEASUREMENTS

During each of the four sampling events described in the **Sampling Overview**, field crews collected basic water-quality measurements (i.e., air temperature, water temperature, specific conductivity, DO, pH, and turbidity) at a depth of 0.5 m using either a Horiba or YSI ProDSS multi-parameter meter equipped with conductivity/temperature, DO, pH, and turbidity sensors. The meters were calibrated using appropriate procedures and standards before each sampling event as described in the CEC QAPP (v2). Three hundred and twenty of the scheduled 336 field measurements (95.2%) were successfully measured during the Year 2 CEC Monitoring (**Table C.3**).

ANALYTICAL LABORATORY METHODS

The preparation and analytical methods applied to Delta RMP CEC samples are identified in **Table 5**.

Table 5. Analytical laboratory methods for CEC Year 2 monitoring.

Matrix	Analyte	Laboratory	Preparation Method	Analytical Method
Water	PPCPs – Hormones	Weck	EPA 3535	EPA 1694M
Water	PPCPs – Pharmaceuticals	Weck	EPA 3535	EPA 1694M
Water	PPCP - Galaxolide	Physis	None	EPA 625.1M
Water	PPCP - Triclocarbon	Physis	None	EPA 625.1M_MRM
Water	Suspended Sediment Concentration	Weck	None	ASTM D3977-97
Water	PFAS	Vista	None	EPA 537M
Sediment	Total Organic Carbon (TOC)	Weck	None	EPA 9060M
Sediment; Tissue - Fish, Bivalves	PBDEs	SGS-AXYS	None	SGS AXYS MLA-033 Rev 06
Sediment; Tissue - Fish only	PFAS	SGS-AXYS	None	SGS AXYS MLA-110 Rev 02

Analytical Methods – Physis Laboratories

Physis analyzed PPCPs using a laboratory modification of EPA 625.1, for "Base/Neutrals and Acids by GC/MS." Samples were serially extracted with methylene chloride at pH 11 - 13 and again at a pH less than 2. The extract was concentrated to a reduced volume and analyzed by GC/MS. Qualitative identification of an analyte was made using the retention time and the relative abundance of two or more characteristic masses (m/z's) and quantified using an internal standard technique.

Analytical Methods – SGS-AXYS Laboratories

SGS AXYS analyzed sediment samples for PBDEs using AXYS method MLA-033 Rev. 06 "Analytical Method for The Determination of Brominated Diphenyl Ethers (BDE) And Other Brominated Flame Retardants (BFR)", a lab modification of EPA Method 1614A. Samples were spiked with 13C-labelled isotopic standards before analysis, then the solvent was extracted. The extracts were cleaned up by column chromatography, reduced to a final extract, and analyzed by high-resolution gas chromatography with high-resolution mass spectrometric detection (HRGC-HRMS). Final sample concentrations were determined by isotope dilution/internal standard quantification.

SGS AXYS analyzed sediment samples for PFAS using AXYS method MLA-110 Rev. 02 "Analytical Procedure for the Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous Samples, Solids, Tissues, AFFF Products and Solvent Extracts by LC-MS/MS." After spiking with isotopically labeled surrogate standards, samples were solvent extracted and cleaned up by solid phase extraction (SPE). The extracts were then treated with carbon powder, spiked with recovery standards, and analyzed by liquid chromatography/mass spectrometry (LC-MS/MS). Final sample concentrations were determined by isotope dilution/internal standard quantification.

SGS AXYS received whole bivalves shipped frozen. Bivalves were removed from their shells and homogenized. Following homogenization, samples were analyzed for PBDEs using MLA-033 Rev. 06. Bivalve collection protocols are to collect 20 clams of varying sizes with the goal of having a composite of 12 grams of tissue for analysis. SGS AXYS reported to the Delta RMP on June 14, 2022 that three composites did not have enough tissue to conduct all requested analysis (one of the composites was a duplicate).

SGS AXYS received fish composites shipped frozen. Fish samples were placed in clean amber glass jars with screw caps and frozen to -20°C and stored in the dark prior to analysis. After samples were removed from frozen storage, they were thawed and processed using the same homogenization protocols as bivalve samples. Homogenized samples were analyzed for PBDEs (MLA-033 Rev. 06) and PFAS (MLA-110 Rev. 02) using the same methods as sediment sample analysis.

Analytical Methods – Vista Analytical Laboratories

Vista analyzed samples for PFAS (PFOA and PFOS) in water using laboratory modification of EPA Method 537 for "Determination of PFAS in Drinking Water by 13 Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)." Target analytes were loaded by passing the collected samples, spiked with internal standards, through a solid phase extraction cartridge, which was then eluted with methanol. The extract was concentrated to a reduced final volume, and the final extract analyzed on the ultra-performance liquid chromatography/tandem mass spectrometry (UPLC/MS/MS) system.

Analytical Methods – Weck Laboratories

Weck analyzed water samples for PPCPs using their internal protocol for "Determination of Endocrine Disrupting Compounds, Pharmaceuticals, and Personal Care Products." The method is a variant of EPA Method 1694. Solid phase extraction was used for aqueous samples, with the extract quantified by liquid chromatography and electrospray ionization tandem mass spectrometry (LC- ESI/MS/MS). Isotopic dilution was used as an attempt to account for effects from the analytical process and matrix interferences.

Weck analyzed water samples for SSC using a method derived from ASTM D3977. Suspended solids are separated from water samples, dried, and weighed.

Weck analyzed sediment samples for TOC using a modified version of EPA Method 9060. Organic carbon was measured using a carbonaceous analyzer, which converts the organic carbon in a sample to carbon dioxide which is then measured by a detector.

ANALYTICAL COMPLETENESS

Analytical completeness is based on the number of constituents in each sample successfully analyzed and reported by the laboratory. Completeness is assessed as each analysis scheduled for each site over all events in the year; completeness counts by individual constituent are provided in Appendix **Table C.2**. For Year 2 monitoring, results from 1,273 of the total 1,282 constituents scheduled for analysis were successfully reported and the overall analytical completeness was therefore 99.3%.

Analysis Failures

Four of the total nine missing analytical results were lipid analyses scheduled to be completed with each bivalve sample analyzed for PBDEs by SGS-AXYS. The lipid analysis was not completed due to a laboratory oversight, and after realizing the error, the laboratory analyzed two of the original six samples with available tissue remaining. See **Deviations and Corrective Actions** for further discussion.

The remaining five missing environmental analyses were rejected by the laboratory due to associated control sample failures. A total of 15 environmental and QC results were flagged as rejected by the laboratory and provided as informational value only for the Year 2 results. These records are provided below in **Table 6**. All 15 results were associated with analyses of PFAS in fish tissues by SGS-AXYS.

Results for two analytes were not reported in the fish tissue environmental samples, including a single result for N-Ethyl-perfluorooctanesulfonamidoethanol (N-EtFOSE) at Sacramento River at Veterans Bridge, and N-Methyl-perfluorooctanesulfonamidoethanol (N-MeFOSE) from all four sampling locations with fish tissue samples. In addition, N-MeFOSE results were not reported for the associated laboratory blank, laboratory duplicate, LCS and LCSD. The laboratory report notes that N-EtFOSE and N-MeFOSE typically perform poorly in tissue samples, and that the associated IDAs, D_9-N-EtFOSE and D_7-N-MeFOSE often show poor recoveries. For this reason, all N-MeFOSE results in tissues are for information only. Likewise, the laboratory notes that isotope dilution analogue (IDA) recoveries D_9-N-EtFOSE in tissue samples may be low with increased uncertainty in the analyte concentration when the surrogate recovery is below 8%. Under these conditions, N-EtFOSE are for information only.

In addition, Fluorotelomer Carboxylic Acid, 3:3- (3:3 FTCA), Perfluoro-3-methoxypropanoate (PFMPA), Perfluoro-4-methoxybutanoate (PFMBA), Perfluorobutanoate (PFBA), and Perfluoropentanoate (PFPeA) in the fish tissue laboratory duplicate sample were also flagged as rejected by the laboratory.

For these results, the laboratory noted that the percent recovery for the surrogate compounds $13C_4$-PFBA and $13C_5$-PFPeA were below 10%. The results for the related target analytes PFBA, PFPeA, 3:3 FTCA, PFMBA and PFMPA, were flagged as laboratory rejected and reported for information only. In all other cases where the percent recovery for an IDA compound did not meet the MQO, the results were reported and flagged according to the Data Management SOP. As the isotope dilution method of quantification produces data that is recovery corrected, these variances from method criteria were deemed to not affect the quantification of the target analytes.

Percent surrogate recoveries that did not meet MQOs are provided in **Table 22**. A list of analytes with their associated IDA compounds is provided in Appendix **Table B.2**. All results reported as informational by the laboratory are additional analytes that are not required by the CEC Pilot Study Workplan.

Table 6. Analytical results rejected by the laboratory for CEC Year 2 monitoring.

Sample Type	Station Code	Matrix	Analyte	Tissue Result Comments	Project Qualifier
Environmental	519ST1309	Fish Tissue	Ethyl-perfluorooctanesulfonamidoethanol, N- (N-EtFOSE)	information value only; result was 5.14 ng/g DNQ	Rejected
Environmental	519ST1309	Fish Tissue	Methyl-perfluorooctanesulfonamidoethanol, N- (N-MeFOSE)	information value only, not detected	Rejected
Environmental	510ST1317	Fish Tissue	Methyl-perfluorooctanesulfonamidoethanol, N- (N-MeFOSE)	information value only, not detected	Rejected
Environmental	544LSAC13	Fish Tissue	Methyl-perfluorooctanesulfonamidoethanol, N- (N-MeFOSE)	information value only, not detected	Rejected
Environmental	541SJC501	Fish Tissue	Methyl-perfluorooctanesulfonamidoethanol, N- (N-MeFOSE)	information value only, not detected	Rejected
Lab Blank	LABQA	Fish Tissue	Methyl-perfluorooctanesulfonamidoethanol, N- (N-MeFOSE)	information value only, not detected	Rejected
Lab Duplicate	510ST1317	Fish Tissue	Fluorotelomer Carboxylic Acid, 3:3- (3:3 FTCA)	RPD Not Calculable; IDA: Perfluoropentanoate-13C5(IsoDilAnalogue); information value only, not detected	Rejected
Lab Duplicate	510ST1317	Fish Tissue	Methyl-perfluorooctanesulfonamidoethanol, N- (N-MeFOSE)	RPD Not Calculable; information value only, not detected	Rejected
Lab Duplicate	510ST1317	Fish Tissue	Perfluoro-3-methoxypropanoate (PFMPA)	RPD Not Calculable; IDA: Perfluoropentanoate-13C5(IsoDilAnalogue); information value only, not detected	Rejected

Sample Type	Station Code	Matrix	Analyte	Tissue Result Comments	Project Qualifier
Lab Duplicate	510ST1317	Fish Tissue	Perfluoro-4-methoxybutanoate (PFMBA)	RPD Not Calculable; IDA: Perfluoropentanoate-13C5(IsoDilAnalogue); information value only, not detected	Rejected
Lab Duplicate	510ST1317	Fish Tissue	Perfluorobutanoate (PFBA)	RPD Not Calculable; information value only, result was 31.6 ng/g	Rejected
Lab Duplicate	510ST1317	Fish Tissue	Perfluoropentanoate (PFPeA)	RPD Not Calculable; information value only	Rejected
LCS	LABQA	Fish Tissue	Methyl-perfluorooctanesulfonamidoethanol, N- (N-MeFOSE)	PR 196; information value only; result was 49 ng/g	Rejected
LCS	LABQA	Fish Tissue	Methyl-perfluorooctanesulfonamidoethanol, N- (N-MeFOSE)	PR 231; information value only; result was 18.5 ng/g	Rejected
LCSD	LABQA	Fish Tissue	Methyl-perfluorooctanesulfonamidoethanol, N- (N-MeFOSE)	PR 237, RPD 19; information value only; result was 59.5 ng/g	Rejected

DATA VERIFICATION OVERVIEW

VERIFICATION PROCESS

The US EPA defines data verification as the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications. Verification of Delta RMP CEC data was performed by MLJ and the Marine Pollution Studies Laboratory at Moss Landing Marine Laboratories (MPSL-MLML) based on the sample handling requirements and measurement quality objectives (MQOs) of the CEC QAPP (v2). Verification of instrument tuning, calibration standards, calibration verifications, and internal standards were the responsibility of the submitting laboratory.

Initial data verification by MLJ staff was conducted as individual electronic data deliverables (EDDs) received from the laboratories were processed and uploaded into the Central Valley Regional Data Center (CV RDC). These data processing steps occurred according to the procedures outlined in the CEC QAPP (v2). All project data underwent a secondary verification review by MPSL-MLML staff as a part of the data finalization process, at which point all verified data were assigned a classification and the corresponding California Environmental Data Exchange Network (CEDEN) compliance code described in the following sections.

Compliant

Data classified as "Compliant" meet all requirements specified in the CEC QAPP. These data are considered usable for their intended purpose without additional assessment.

Qualified

Data classified as "Qualified" do not meet one or more of the requirements specified in the CEC QAPP. These data are considered usable for their intended purpose following an additional assessment to determine the scope and impact of the deficiency.

Estimated

Data classified as "Estimated" (i.e., EPA "J" flag) are assigned to data batches and sample results that are not considered quantifiable.

Screening

Data classified as “Screening” are considered non-quantitative and may or may not meet the minimum requirements specified in the CEC QAPP. These data may not be usable for their intended purpose and require additional assessment.

Rejected

Data classified as “Rejected” do not meet the minimum requirements specified in the CEC QAPP. These data are not considered usable for their intended purpose.

Not Applicable

Data classified as “Not Applicable” were not verified since there were no CEC QAPP requirements for the specific parameter (e.g., oxygen saturation) or a failure was reported and could not be verified.

VERIFIED DATASETS

This report details the above verification process as applied to the analytical batches appearing in **Table 7**. The findings of the data verification process are outlined in the sections below. A complete summary of the completeness and quality control (QC) sample acceptability for each analysis performed during Year 2 is provided in **Appendix D**.

Table 7. Verified datasets (analytical batches) for CEC Year 2 monitoring.

Lab	Analytical Category	Matrix	Datasets Produced	Datasets Reviewed	Reviewed Dataset (Batch) IDs
Vista	PFAS	Water	4	4	VAL_DRMP_CEC_B1J0182_W_PFAS; VAL_DRMP_CEC_B1K0022_W_PFAS; VAL_DRMP_CEC_B22D021_W_PFAS VAL_DRMP_CEC_B22F131_W_PFAS;
Physis	PPCPs (Galaxolide and Triclocarban only)	Water	8	8	Physis_DRMP_CEC_O-33146_W_BNs; Physis_DRMP_CEC_O-33146b_W_BNs; Physis_DRMP_CEC_O-35002_W_BNs; Physis_DRMP_CEC_O-35002b_W_BNs; Physis_DRMP_CEC_O-35136_W_BNs; Physis_DRMP_CEC_O-35136b_W_BNs; Physis_DRMP_CEC_O-38036_W_BNs; Physis_DRMP_CEC_O-38036b_W_BNs
Weck	PPCPs	Water	9	9	WKL_DRMP_CEC_W2D0037_W_PPCP; WKL_DRMP_CEC_W2D0038_W_PPCP; WKL_DRMP_CEC_W2F1171_W_PPCP; WKL_DRMP_CEC_W2F1171b_W_PPCP WKL_DRMP_CEC_W2F1172_W_PPCP; WKL_DRMP_CEC_W1K1219_W_PPCP_Neg; WKL_DRMP_CEC_W1K1527_W_PPCP_Neg; WKL_DRMP_CEC_W1K1221_W_PPCP_Horm; WKL_DRMP_CEC_W1K1523_W_PPCP_Horm
Weck	SSC	Water	4	4	WKL_DRMP_CEC_W2D0661_W_SSC; WKL_DRMP_CEC_W2F1561_W_SSC; WKL_DRMP_CEC_W1K0517_W_SSC; WKL_DRMP_CEC_W1K0183_W_SSC
SGS-AXYS	PFAS	Sediment	1	1	AXYS_DRMP_CEC_WG81568_S_PFAS
SGS-AXYS	PBDEs	Sediment	1	1	AXYS_DRMP_CEC_WG81579_S_PBDE

Lab	Analytical Category	Matrix	Datasets Produced	Datasets Reviewed	Reviewed Dataset (Batch) IDs
Weck	TOC	Sediment	2	2	WKL_DRMP_CEC_W1H1243_S_TOC; WKL_DRMP_CEC_W1K0706_S_TOC
SGS-AXYS	PFAS	Tissue	1	1	AXYS_DRMP_CEC_WG81677_T_PFAS
SGS-AXYS	PBDEs	Tissue	2	2	AXYS_DRMP_CEC_WG81851_T_PBDE; AXYS_DRMP_CEC_WG82732_T_Lipid

DATA VERIFICATION: SAMPLE HANDLING

During data verification, storage and holding times of CEC Year 2 samples were evaluated to ensure the integrity of the target analyte(s) in each matrix. For consistency with the SWRCB SWAMP and the Code of Federal Regulations, Title 40 *Protection of the Environment*, Section 136 *Guidelines Establishing Test Procedures for the Analysis of Pollutants*, Delta RMP holding times are defined as follows:

- *Pre-Preservation/Extraction*: Required holding times for sample preservation or extraction begin at the time of sample collection and conclude when the sample is preserved or extracted, respectively.
- *Pre-Analysis*: Required holding times for sample analysis begin either at the time of sample collection, filtration or extraction and conclude when sample analysis is completed.

In Year 2, 70 Delta RMP CEC samples were verified against the sample handling requirements in **Table 8**.

Table 8. Year 2 CEC QAPP sample handling requirements.

Matrix	Parameter Group	Pre-Preservation/Extraction		Pre-Analysis
		Storage	Holding Time	Holding Time
Fish and Bivalve Tissue	PBDEs	<-10 °C, dark	365 days	40 days
	PFAS	<-10 °C, dark	NA	365 days
Sediment	PBDEs	<-10°C, dark	365 days	40 days (not to exceed 365 days from sample collection)
	PFAS	<-10 °C, dark	NA	365 days
	TOC	<6 °C, dark	NA	28 days
Water	PPCPs (Weck)	Preserve with sodium azide (200 mg) and Ascorbic acid (100 mg); store at <6 °C	28 days	40 days
	PPCPs (Galaxolide and Triclocarban only - Physis)	<6 °C	7 days	40 days
	PFAS	<10 °C	28 days	30 days
	SSC	<6 °C	NA	14 days

98.6% of verified samples (1480 of 1501) met these Delta RMP CEC requirements (**Table C.15**). Analyses resulting in a hold time qualification appear in **Table 9** and includes environmental samples analyzed for galaxolide (sample date = 10/26/21) and triclocarban (sample date = 3/28/22)

Table 9. Sample handling qualification for CEC Year 2 monitoring.
Results appearing in this table were all flagged with the CEDEN QA code: H. QA code definitions are provided in Appendix **Table C.1.**

Dataset ID	Sample ID	Sample Date	Matrix	Analyte	Project Qualifier	Qualifier Description
Physis_DRMP_CEC_O-35002_W_BNs	510SACC3A	10/26/2021	Water	Galaxolide	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35002_W_BNs	510SACC3A	10/26/2021	Water	Galaxolide-d6 (Surrogate)	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35002_W_BNs	510ST1301	10/26/2021	Water	Galaxolide	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35002_W_BNs	510ST1301	10/26/2021	Water	Galaxolide-d6 (Surrogate)	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35002_W_BNs	519DRYCRK (Fieldblank)	10/26/2021	Water	Galaxolide	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35002_W_BNs	519DRYCRK (Fieldblank)	10/26/2021	Water	Galaxolide-d6 (Surrogate)	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35002_W_BNs	519DRYCRK	10/26/2021	Water	Galaxolide	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35002_W_BNs	519DRYCRK	10/26/2021	Water	Galaxolide-d6 (Surrogate)	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35002_W_BNs	519POTW01	10/26/2021	Water	Galaxolide	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35002_W_BNs	519POTW01	10/26/2021	Water	Galaxolide-d6 (Surrogate)	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35002_W_BNs	519SUT108	10/26/2021	Water	Galaxolide	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35002_W_BNs	519SUT108	10/26/2021	Water	Galaxolide-d6 (Surrogate)	Qualified	Hold time violation. Samples were analyzed 1 day past hold time

Dataset ID	Sample ID	Sample Date	Matrix	Analyte	Project Qualifier	Qualifier Description
Physis_DRMP_CEC_O-35136b_W_BNs	510SACC3A	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 2 days past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	510ST1301	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 2 days past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	511POTW02	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	511SOL011	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	519AMNDVY	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 2 days past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	519DRYCRK	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 2 days past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	519PGC010	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 2 days past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	519POTW01	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 2 days past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	519SACUR3	3/28/2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	519SUT108 (Fieldblank)	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 2 days past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	519SUT108 (MS)	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	519SUT108 (Rep1)	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	519SUT108 (MS)	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 1 day past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	519SUT108 (Lab Rep 2)	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 2 days past hold time

Dataset ID	Sample ID	Sample Date	Matrix	Analyte	Project Qualifier	Qualifier Description
Physis_DRMP_CEC_O-35136b_W_BNs	541SJC501	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 2 days past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	544SJRNBC	3/28/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were analyzed 2 days past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	96278-B1 (Labblank)	4/4/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were digested 1 day past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	96278-BS2 (LCS)	4/4/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were digested 1 day past hold time
Physis_DRMP_CEC_O-35136b_W_BNs	96278-BS1 (LCS)	4/4/ 2022	Water	Triclocarban	Qualified	Hold time violation. Samples were digested 1 day past hold time

DATA VERIFICATION: FIELD MEASUREMENTS

Equipment used to take field data measurements must be calibrated according to Table 14.1 of the CEC QAPP (v2). At a minimum, the following equipment must be calibrated:

- Thermometers
- DO meters
- pH meters
- Conductivity meters
- Multi-parameter field meters

After post-calibration checks are performed, the percent drift should be evaluated to confirm compliance with Table 14.1 of the CEC QAPP (v2). Non-compliant results should not be reported unless they have been flagged to indicate non-compliance.

A total of 320 (95.2%) field measurements were successfully collected for Year 2 monitoring (**Table C.3**). Of the 336 expected field measurement results reported, 274 results were classified as compliant. Fourteen air temperature results were classified as "Not Applicable" since the values were not reported by the field crew. None of the 48 oxygen saturation results were verified since no MQO exists for this field measurement. Affected oxygen saturation results were classified as "Not Applicable".

DATA VERIFICATION: CHEMISTRY

Delta RMP CEC chemistry data verification assesses QC samples associated with contamination, precision, and accuracy. For consistency with SWAMP, QC sample definitions are based on the January 2022 *Surface Water Ambient Monitoring Program Quality Assurance Program Plan.*

Contamination

For Physis, SGS-AXYS, Vista, and Weck, PBDE, PFAS, PPCP, SSC, and TOC analyses, contamination is assessed with the analysis of field blanks and laboratory blanks. Associated data verification results are detailed below.

Field Blanks

A field blank is a sample of analyte-free media that is transported to the sampling site, exposed to the sampling conditions, returned to the laboratory, and treated as a routine environmental sample. Preservatives, if any, are added to the sample container in the same manner as the environmental sample. The field blank matrix should be comparable to the sample of interest. This blank is used to provide information about contaminants that may be introduced during sample collection, storage, and transport.

For Delta RMP CEC monitoring in Year 2, four field blanks were collected for PFAS, PPCP, and SSC analyses in water. 87.5% of these results (63 of 72, **Table C.5** met the Delta RMP MQO by being below the method detection limit (MDL). Analyses resulting in qualification appear in **Table 10** and include galaxolide, salicylic acid, diclofenac, and bisphenol A.

Table 10. Field blank qualification for CEC Year 2 monitoring.
Results appearing in this table were all flagged with the CEDEN QA code: IP. QA code definitions are provided in Appendix **Table C.1**.

Field Blank ID	Sample Date	Matrix	Analyte	Sample Result (ng/L)	MDL (ng/L)	Project Qualifier
511SOL011	10/21/2021	Water	Galaxolide	148	0.1	Qualified
519DRYCRK	10/26/2021	Water	Galaxolide	216	0.1	Qualified
519SUT108	3/28/2022	Water	Galaxolide	162	0.1	Qualified
541SJC501	6/8/2022	Water	Galaxolide	120	0.1	Qualified
511SOL011	10/21/2021	Water	Salicylic Acid	100	100	Qualified
511SOL011	10/21/2021	Water	Diclofenac	40	4	Qualified
511SOL011	10/21/2021	Water	Bisphenol A	260	4	Qualified
519DRYCRK	10/26/2021	Water	Bisphenol A	84	4	Qualified

Field Blank ID	Sample Date	Matrix	Analyte	Sample Result (ng/L)	MDL (ng/L)	Project Qualifier
541SJC501	6/8/2022	Water	Bisphenol A	26	4	Qualified

The Delta RMP qualifies only the field blank sample itself when contamination is detected, and the data qualifiers are not propagated to the affected environmental samples. Data users must cross reference environmental sample batch numbers with the associated field blank. In the case of bisphenol A, systematic contamination was reported in the laboratory blanks for the first three Year 2 events. The fourth Year 2 bisphenol A field blank sample was detected at concentrations near to the environmental concentrations. For these reasons, the Delta RMP recommends that data users do not use Year 2 bisphenol A data for characterization or assessment purposes.

Laboratory Blanks

A laboratory blank is free from the target analyte(s) and is used to represent the environmental sample matrix as closely as possible. The laboratory blank is processed simultaneously with and under the same conditions and steps of the analytical procedures (e.g., including exposure to all glassware, equipment, solvents, reagents, labeled compounds, internal standards, and surrogates that are used with samples) as all samples in the analytical batch (including other QC samples). The laboratory blank is used to determine if target analytes or interferences are present in the laboratory environment, reagents, or instruments. Results of laboratory blanks provide a measurement of bias introduced by the analytical procedure.

For Delta RMP CEC monitoring in Year 2, laboratory blanks were prepared and analyzed for all PBDE, PFAS, PPCP (including galaxolide and triclocarban), SSC, and TOC batches. Laboratory blanks were analyzed at the required frequency of one per 20 samples or per batch (whichever is more frequent). 91.8% of these results (156 of 170) met the Delta RMP MQO by being below the MDL (**Table C.7**). If a laboratory blank is flagged, the associated results in the same batch are also flagged. Analyses resulting in qualification appear in **Table 11** (laboratory blank results with concentrations above the MDL) and **Table 12** (results associated with the laboratory blank contamination that were flagged).

Table 11. Laboratory blank qualification for CEC Year 2 monitoring.
Results appearing in this table were all flagged with the CEDEN QA code: IP. QA code definitions are provided in Appendix **Table C.1**.

Dataset ID	Lab Blank ID	Matrix	Analyte	Blank Result	MDL	Units	Project Qualifier
AXYS_DRMP_CEC_WG81579_S_PBDE	WG81579-101 i	Sediment	PBDE 154	0.000160	0.000144	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	WG81579-101 i	Sediment	PBDE 047	0.00212	0.000193	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	WG81579-101 i	Sediment	PBDE 100	0.000245	0.0001	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	WG81579-101 i	Sediment	PBDE 099	0.00110	0.000116	ng/g dw	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	91542-B1	Water	Galaxolide	65.19999	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	92110-B1	Water	Galaxolide	67.8	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	96278-B1	Water	Galaxolide	126	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	97455-B1	Water	Galaxolide	105	0.1	ng/L	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	W1K1219-BLK1	Water	Bisphenol A	67.7	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	W1K1527-BLK1	Water	Bisphenol A	63.4	4	ng/L	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	LabBlank_WG81851-AXYS	Tissue	PBDE 100	0.00294	0.00116	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	LabBlank_WG81851-AXYS	Tissue	PBDE 099	0.00946	0.00183	ng/g dw	Qualified

Dataset ID	Lab Blank ID	Matrix	Analyte	Blank Result	MDL	Units	Project Qualifier
AXYS_DRMP_CEC_WG81851_T_PBDE	LabBlank_WG81851-AXYS	Tissue	PBDE 209	0.331	0.0287	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81677_T_PFAS	LabBlank_WG81677-AXYS	Tissue	Perfluoro-3,6-dioxaheptanoate	0.383	0.300	ng/g dw	Qualified

Table 12. Laboratory blank qualification for CEC Year 2 monitoring: associated samples.
Results appearing in this table were all flagged with the CEDEN QA code: FI. QA code definitions are provided in Appendix **Table C.1**.

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Sample Result	MDL	Units	Project Qualifier
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	Sediment	10/21/2021	PBDE 047	5.25	0.000211	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	Sediment	10/21/2021	PBDE 047	3.24	0.000111	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	Sediment	10/21/2021	PBDE 099	4.76	0.00303	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	Sediment	10/21/2021	PBDE 099	3.32	0.00201	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	Sediment	10/21/2021	PBDE 100	0.960	0.00154	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	Sediment	10/21/2021	PBDE 100	1.45	0.00233	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	Sediment	10/21/2021	PBDE 154	0.403	0.000232	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	Sediment	10/21/2021	PBDE 154	0.539	0.000438	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	519AMNDVY	Sediment	7/22/2021	PBDE 047	0.126	0.000214	ng/g dw	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Sample Result	MDL	Units	Project Qualifier
AXYS_DRMP_CEC_WG81579_S_PBDE	519AMNDVY	Sediment	7/22/2021	PBDE 047	0.0942	0.000203	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	519AMNDVY	Sediment	7/22/2021	PBDE 099	0.0885	0.000477	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	519AMNDVY	Sediment	7/22/2021	PBDE 099	0.125	0.000471	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	519AMNDVY	Sediment	7/22/2021	PBDE 100	0.0267	0.000309	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	519AMNDVY	Sediment	7/22/2021	PBDE 100	0.0340	0.000312	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	519AMNDVY	Sediment	7/22/2021	PBDE 154	0.0141	0.000154	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	519AMNDVY	Sediment	7/22/2021	PBDE 154	0.0130	0.000151	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	519DRYCRK	Sediment	10/20/2021	PBDE 047	0.190	0.000142	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	519DRYCRK	Sediment	10/20/2021	PBDE 099	0.274	0.000673	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	519DRYCRK	Sediment	10/20/2021	PBDE 100	0.0717	0.000475	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	519DRYCRK	Sediment	10/20/2021	PBDE 154	0.0457	0.000105	ng/g dw	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	510SACC3A	Water	10/21/2021	Galaxolide	647	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	510ST1301	Water	10/21/2021	Galaxolide	114	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	511POTW02	Water	10/21/2021	Galaxolide	44300	0.1	ng/L	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Sample Result	MDL	Units	Project Qualifier
Physis_DRMP_CEC_O-33146_W_BNs	511SOL011	Water	10/21/2021	Galaxolide	25000	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	511SOL011	Water	10/21/2021	Galaxolide	25900	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	519AMNDVY	Water	10/21/2021	Galaxolide	94.4	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	519DRYCRK	Water	10/20/2021	Galaxolide	326	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	519PGC010	Water	10/20/2021	Galaxolide	506	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	519POTW01	Water	10/20/2021	Galaxolide	32000	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	519SACUR3	Water	10/20/2021	Galaxolide	490	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	519SUT108	Water	10/21/2021	Galaxolide	300	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	541SJC501	Water	10/20/2021	Galaxolide	82.5	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-33146_W_BNs	544SJRNBC	Water	10/21/2021	Galaxolide	658	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	510SACC3A	Water	10/26/2021	Galaxolide	658	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	510ST1301	Water	10/26/2021	Galaxolide	177	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	511POTW02	Water	10/25/2021	Galaxolide	41500	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	511SOL011	Water	10/25/2021	Galaxolide	25500	0.1	ng/L	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Sample Result	MDL	Units	Project Qualifier
Physis_DRMP_CEC_O-35002_W_BNs	519AMNDVY	Water	10/26/2021	Galaxolide	126	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	519DRYCRK	Water	10/26/2021	Galaxolide	125	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	519DRYCRK	Water	10/26/2021	Galaxolide	229	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	519PGC010	Water	10/25/2021	Galaxolide	170	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	519POTW01	Water	10/26/2021	Galaxolide	37900	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	519SACUR3	Water	10/25/2021	Galaxolide	210	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	519SUT108	Water	10/26/2021	Galaxolide	157	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	541SJC501	Water	10/25/2021	Galaxolide	97.7	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	544SJRNBC	Water	10/25/2021	Galaxolide	915	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	510SACC3A	Water	3/28/2022	Galaxolide	508	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	510ST1301	Water	3/28/2022	Galaxolide	236	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	511POTW02	Water	3/28/2022	Galaxolide	17100	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	511SOL011	Water	3/28/2022	Galaxolide	14300	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	519AMNDVY	Water	3/28/2022	Galaxolide	229	0.1	ng/L	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Sample Result	MDL	Units	Project Qualifier
Physis_DRMP_CEC_O-35136_W_BNs	519DRYCRK	Water	3/28/2022	Galaxolide	219	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	519PGC010	Water	3/28/2022	Galaxolide	217	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	519POTW01	Water	3/28/2022	Galaxolide	16000	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	519SACUR3	Water	3/28/2022	Galaxolide	217	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	519SUT108	Water	3/28/2022	Galaxolide	126	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	519SUT108	Water	3/28/2022	Galaxolide	255	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	541SJC501	Water	3/28/2022	Galaxolide	261	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-35136_W_BNs	544SJRNBC	Water	3/28/2022	Galaxolide	776	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	510SACC3A	Water	6/8/2022	Galaxolide	766	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	510ST1301	Water	6/8/2022	Galaxolide	97.2	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	511POTW02	Water	6/8/2022	Galaxolide	16800	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	511SOL011	Water	6/8/2022	Galaxolide	22000	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	519AMNDVY	Water	6/8/2022	Galaxolide	272	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	519DRYCRK	Water	6/8/2022	Galaxolide	86.8	0.1	ng/L	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Sample Result	MDL	Units	Project Qualifier
Physis_DRMP_CEC_O-38036_W_BNs	519PGC010	Water	6/8/2022	Galaxolide	135	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	519POTW01	Water	6/8/2022	Galaxolide	21200	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	519SACUR3	Water	6/8/2022	Galaxolide	158	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	519SUT108	Water	6/8/2022	Galaxolide	120	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	541SJC501	Water	6/8/2022	Galaxolide	92.2	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	541SJC501	Water	6/8/2022	Galaxolide	76.7	0.1	ng/L	Qualified
Physis_DRMP_CEC_O-38036_W_BNs	544SJRNBC	Water	6/8/2022	Galaxolide	564	0.1	ng/L	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	510SACC3A	Water	10/21/2021	Bisphenol A	75	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	510ST1301	Water	10/21/2021	Bisphenol A	140	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	511POTW02	Water	10/21/2021	Bisphenol A	94	4.4	ng/L	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	511SOL011	Water	10/21/2021	Bisphenol A	81	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	511SOL011	Water	10/21/2021	Bisphenol A	130	4.6	ng/L	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	519AMNDVY	Water	10/21/2021	Bisphenol A	670	4.5	ng/L	Estimated[1]
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	519DRYCRK	Water	10/20/2021	Bisphenol A	150	4.7	ng/L	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Sample Result	MDL	Units	Project Qualifier
WKL_DRMP_CEC_W1K1 219_W_PPCP_Neg	519PGC010	Water	10/20/2021	Bisphenol A	330	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1 219_W_PPCP_Neg	519POTW01	Water	10/20/2021	Bisphenol A	80	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1 219_W_PPCP_Neg	519SACUR3	Water	10/20/2021	Bisphenol A	67	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1 219_W_PPCP_Neg	519SUT108	Water	10/21/2021	Bisphenol A	80	4.7	ng/L	Qualified
WKL_DRMP_CEC_W1K1 219_W_PPCP_Neg	541SJC501	Water	10/20/2021	Bisphenol A	370	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1 219_W_PPCP_Neg	544SJRNBC	Water	10/21/2021	Bisphenol A	110	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1 219_W_PPCP_Neg	544SJRNBC	Water	10/21/2021	Bisphenol A	1280	4	ng/L	Estimated[1]
WKL_DRMP_CEC_W1K1 527_W_PPCP_Neg	510SACC3A	Water	10/26/2021	Bisphenol A	60	8	ng/L	Qualified
WKL_DRMP_CEC_W1K1 527_W_PPCP_Neg	510ST1301	Water	10/26/2021	Bisphenol A	20	7	ng/L	Qualified
WKL_DRMP_CEC_W1K1 527_W_PPCP_Neg	511POTW02	Water	10/25/2021	Bisphenol A	39	5.1	ng/L	Qualified
WKL_DRMP_CEC_W1K1 527_W_PPCP_Neg	511SOL011	Water	10/25/2021	Bisphenol A	1500	4.9	ng/L	Estimated[1]
WKL_DRMP_CEC_W1K1 527_W_PPCP_Neg	519AMNDVY	Water	10/26/2021	Bisphenol A	25	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1 527_W_PPCP_Neg	519DRYCRK	Water	10/26/2021	Bisphenol A	310	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1 527_W_PPCP_Neg	519DRYCRK	Water	10/26/2021	Bisphenol A	13	4	ng/L	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Sample Result	MDL	Units	Project Qualifier
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519PGC010	Water	10/25/2021	Bisphenol A	55	4.6	ng/L	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519POTW01	Water	10/26/2021	Bisphenol A	81	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519DRYCRK	Water	10/26/2021	Bisphenol A	11.9	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519SACUR3	Water	10/25/2021	Bisphenol A	160	4.5	ng/L	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519SUT108	Water	10/26/2021	Bisphenol A	8	4	ng/L	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	541SJC501	Water	10/25/2021	Bisphenol A	51	4.7	ng/L	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	544SJRNBC	Water	10/25/2021	Bisphenol A	38	4	ng/L	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-510SACC3A-2021-10-21	Tissue	10/21/2021	PBDE 099	15.1	0.0306	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-510SACC3A-2021-10-21	Tissue	10/21/2021	PBDE 100	31.6	0.0194	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-510SACC3A-2021-10-21	Tissue	10/21/2021	PBDE 209	0.404	0.0354	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-510ST1301-2021-10-21	Tissue	10/21/2021	PBDE 099	4.29	0.0123	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-510ST1301-2021-10-21	Tissue	10/21/2021	PBDE 100	11.1	0.00712	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-510ST1301-2021-10-21	Tissue	10/21/2021	PBDE 209	0.209	0.0284	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	PBDE 099	2.34	0.00328	ng/g dw	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Sample Result	MDL	Units	Project Qualifier
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	PBDE 100	1.42	0.00210	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	PBDE 209	0.0233	0.0163	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-519AMNDVY-2021-10-21	Tissue	10/21/2021	PBDE 099	1.84	0.00891	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-519AMNDVY-2021-10-21	Tissue	10/21/2021	PBDE 100	3.31	0.00507	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-519AMNDVY-2021-10-21	Tissue	10/21/2021	PBDE 209	1.21	0.122	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-519ST1309-2021-10-18-SAS	Tissue	10/18/2021	PBDE 099	0.00515	0.00242	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-519ST1309-2021-10-18-SAS	Tissue	10/18/2021	PBDE 100	4.68	0.00153	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-519ST1309-2021-10-18-SAS	Tissue	10/18/2021	PBDE 209	0.107	0.0179	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-519SUT108-2021-10-21	Tissue	10/21/2021	PBDE 099	1.31	0.00451	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-519SUT108-2021-10-21	Tissue	10/21/2021	PBDE 100	4.07	0.00252	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-541SJC501-2021-10-20	Tissue	10/20/2021	PBDE 099	0.439	0.00588	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-541SJC501-2021-10-20	Tissue	10/20/2021	PBDE 100	0.817	0.00346	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-541SJC501-2021-10-20	Tissue	10/20/2021	PBDE 209	0.532	0.0909	ng/g dw	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Sample Result	MDL	Units	Project Qualifier
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-541SJC501-2021-10-20-CAR	Tissue	10/20/2021	PBDE 099	0.00952	0.00433	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-541SJC501-2021-10-20-CAR	Tissue	10/20/2021	PBDE 100	4.53	0.00259	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-544LSAC13-2021-10-18-WHC	Tissue	10/18/2021	PBDE 099	1.72	0.00187	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-544LSAC13-2021-10-18-WHC	Tissue	10/18/2021	PBDE 100	1.25	0.00134	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-544LSAC13-2021-10-18-WHC	Tissue	10/18/2021	PBDE 209	0.0671	0.0166	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-544SJRNBC-2021-10-21	Tissue	10/21/2021	PBDE 099	1.47	0.00928	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-544SJRNBC-2021-10-21	Tissue	10/21/2021	PBDE 099	1.53	0.00941	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-544SJRNBC-2021-10-21	Tissue	10/21/2021	PBDE 100	4.70	0.00527	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-544SJRNBC-2021-10-21	Tissue	10/21/2021	PBDE 100	5.06	0.00521	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-544SJRNBC-2021-10-21	Tissue	10/21/2021	PBDE 209	0.572	0.0442	ng/g dw	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	DRMP-CEC-544SJRNBC-2021-10-21	Tissue	10/21/2021	PBDE 209	0.615	0.0689	ng/g dw	Qualified

[1] Estimated compliance codes applied by laboratory due to application of CJ QA Code: analyte concentration in excess of the instrument calibration; considered estimated. See **Table 24**.

Galaxolide and bisphenol A had contamination in both field blanks and laboratory blanks in both Year 1 and Year 2 data. Field samplers were reminded about sampling procedures to reduce contamination and the laboratory was also communicated with regarding contamination concerns. Weck confirmed that there was not contamination coming from the instrument itself but rather during the extraction process and they continue to try and minimize contamination during the process. However, both galaxolide and bisphenol A are present in most materials and is difficult to avoid contamination.

Bisphenol A field and laboratory blank concentrations were distributionally similar to the observed environmental data (median blank concentration = 66.35 ng/L, median environmental concentration = 26 ng/L , rank sum test p-value = 0.277). It is therefore difficult to distinguish concentration differences between blanks and environmental samples. For these reasons, the Delta RMP recommends that data users do not use Year 2 bisphenol A data for characterization or assessment purposes. The Delta RMP also recommends collection of additional QC samples in Year 3 for bisphenol A to assess laboratory variability (split sample to another laboratory) and better establish baseline contamination in transit and laboratory methods (trip blank).

Galaxolide contamination was persistent in field (percent detected = 100%, median = 145 ng/L) and laboratory (percent detected = 88%, median = 66.5 ng/L) blanks. However, some site environmental concentrations were significantly greater than the observed contamination. The Delta RMP recommends that data users consider the associated field and laboratory blank concentrations relative to the environmental concentrations before using galoxolide data for characterization or assessment purposes.

Precision

For SGS-AXYS, Physis, Vista, and Weck Delta RMP CEC analyses, precision is studied with field duplicates, laboratory duplicates, matrix spike (MS) duplicates (MSDs), and/or laboratory control spike duplicates (LCSDs). Associated data verification results are detailed below.

Field Duplicates

A field duplicate is an independent sample that, as closely as possible, utilizes the same sampling location, time, and methodology as the field sample.

For Delta RMP CEC monitoring in Year 2, field duplicates collected and analyzed for PFAS, PBDEs, PPCPs, SCC, and TOC appear in **Table 13**.

Table 13. Field duplicates for CEC Year 2 monitoring.

DUPLICATE ID	SAMPLE DATE	MATRIX	ANALYTE
511SOL011	10/21/2021	Sediment, Water	PBDEs, PFAS, PPCPs, SSC, TOC
519DRYCRK	10/26/2021	Water	PFAS, PPCPs, SSC
519SUT108	3/28/2022	Water	PFAS, PPCPs, SSC
541SJC501	6/8/2022	Water	PFAS, PPCPs, SSC

90.2% of field duplicate results (111 of 123, **Table C.6**) met the Delta RMP MQO by having a relative percent difference (RPD) <35% (n/a if concentration of either sample <MDL). Analyses resulting in qualification appear in **Table 14**.

Table 14. Field duplicate qualification for CEC Year 2 monitoring.
Results appearing in this table were all flagged with the CEDEN QA code: FDP. QA code definitions are provided in Appendix **Table C.1**.

Dataset ID	Duplicate ID	Analyte	Matrix	Units	Sample Result	Duplicate Result	RPD	Project Qualifier
Physis_DRMP_CEC_O-35136_W_BNs	519SUT108	Galaxolide	Water	ng/L	255	126	68	Qualified
Physis_DRMP_CEC_O-35002_W_BNs	519DRYCRK	Galaxolide	Water	ng/L	125	229	59	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	511SOL011	Bisphenol A	Water	ng/L	130	81	46	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	511SOL011	Diclofenac	Water	ng/L	12	34	96	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519DRYCRK	Bisphenol A	Water	ng/L	310	13	184	Qualified
WKL_DRMP_CEC_W2F1171b_W_PPCP	541SJC501	Bisphenol A	Water	ng/L	23	10	79	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	PBDE 028/33	Sediment	ng/g dw	0.0573	0.0339	51	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	PBDE 047	Sediment	ng/g dw	5.25	3.24	47	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	PBDE 099	Sediment	ng/g dw	4.76	3.32	36	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	PBDE 100	Sediment	ng/g dw	1.45	0.960	41	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	PBDE 153	Sediment	ng/g dw	0.563	0.456	153	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	PBDE 209	Sediment	ng/g dw	1.91	0.753	87	Qualified

Laboratory Duplicates

A laboratory duplicate is an analysis or measurement of the target analyte(s) performed identically on two sub-samples of the same sample, usually taken from the same container. The results from laboratory duplicate analyses are used to evaluate analytical or measurement precision, and include variability associated with sub-sampling and the matrix (not the precision of field sampling, preservation, or storage internal to the laboratory).

For Delta RMP CEC Year 2 monitoring, PBDE, PFAS, and TOC sediment laboratory duplicates were analyzed at the required frequency of one per 20 samples or per batch (whichever is more frequent) with the exception of the batch identified in **Table 15**. Laboratory duplicates were not required for water samples.

Table 15. Laboratory duplicate frequency qualification for CEC Year 2 monitoring. Results appearing in this table were all flagged with the CEDEN Lab Submission Code: QI (Incomplete QC).

Dataset ID	Matrix	Analyte	Project Qualifier
WKL_DRMP_CEC_W1H1243_S_TOC	Sediment	TOC	Qualified

94.8% of laboratory duplicate results (110 of 116) met the Delta RMP MQO by having an RPD <35% (n/a if concentration of either sample <MDL) for PBDE, PFAS and total organic carbon (**Table C.8**). Laboratory duplicate analyses resulting in qualification appear in **Table 16**.

Table 16. Laboratory duplicate precision qualification for CEC Year 2 monitoring.
Results appearing in this table were all flagged with the CEDEN QA code: IL. QA code definitions are provided in Appendix **Table C.1**.

DATASET ID	DUPLICATE ID	ANALYTE	MATRIX	SAMPLE RESULT (ng/g dw)	DUPLICATE RESULT (ng/g dw)	RPD	PROJECT QUALIFIER
AXYS_DRMP_CEC_WG81568_S_PFAS	519DRYCRK	Perfluorodecanoate	Sediment	0.069	0.048	35.9	Qualified
AXYS_DRMP_CEC_WG81568_S_PFAS	519DRYCRK	Perfluorododecanoate	Sediment	0.151	0.061	84.9	Qualified
AXYS_DRMP_CEC_WG81568_S_PFAS	519DRYCRK	Perfluorooctanesulfonate	Sediment	0.226	0.153	38.5	Qualified
AXYS_DRMP_CEC_WG81568_S_PFAS	519DRYCRK	Perfluorooctanoate	Sediment	0.039	0.057	37.5	Qualified
AXYS_DRMP_CEC_WG81568_S_PFAS	519DRYCRK	Perfluorotetradecanoate	Sediment	0.166	0.056	99.1	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	519AMNDVY	PBDE 209	Sediment	0.839	3.92	129	Qualified

Matrix Spike Duplicates

An MSD is prepared with an MS. Both the MS and MSD samples are analyzed exactly like an environmental sample within the laboratory batch. The purpose of analyzing the MS and MSD samples is to determine whether the sample matrix contributes bias to the analytical results, and to measure precision of the duplicate analysis.

For Delta RMP CEC monitoring in Year 2, four matrix spike duplicate pairs were prepared and analyzed for PPCPs in water (including galaxolide and triclocarban) and TOC in sediment at the required frequency of one per 20 samples or per batch (whichever is more frequent). In addition, though not required by the CEC QAPP (v2), two MS duplicate pairs were provided by Weck for PPCPs analyzed by EPA 1694M. 100% of the MSD results (36 of 36) met the MQO (**Table C.12**).

Laboratory Control Spike Duplicates

An LCSD is prepared with a laboratory control spike (LCS). The LCS and LCSD are a sample matrix representative of the environmental sample (e.g., water, sand) that is prepared in the laboratory and is free from the analytes of interest. The LCSD is spiked with verified amounts of analytes or a material containing known and verified amounts of analytes. It is either used to establish intra-laboratory or analyst-specific precision and bias, or to assess the performance of a portion of the measurement system.

For Delta RMP CEC monitoring in Year 2, 21 LCSD pairs were prepared and analyzed for PBDEs, PFAS, and PPCPs at the required frequency of one per 20 samples or per batch (whichever is more frequent) with the exception of those batches listed in **Table 17**.

Table 17. Laboratory control spike duplicate frequency qualification for CEC Year 2 monitoring.

Results appearing in this table were all flagged with the CEDEN Lab Submission Code: QI (Incomplete QC).

Dataset ID	Matrix	Analyte	Project Qualifier
WKL_DRMP_CEC_W2D0037_W_PPCP	Water	PPCPs	Qualified
WKL_DRMP_CEC_W2D0038_W_PPCP	Water	PPCPs	Qualified
WKL_DRMP_CEC_W2F1171_W_PPCP	Water	PPCPs	Qualified
WKL_DRMP_CEC_W2F1171b_W_PPCP	Water	PPCPs	Qualified
WKL_DRMP_CEC_W2F1172_W_PPCP	Water	PPCPs	Qualified

Weck analyzed an MS/MSD to evaluate precision in these batches. However, since there is no existing Delta RMP MS/MSD MQO for these analyses, RPDs were not evaluated.

94.9% of LCSD results (131 of 138) met the Delta RMP MQO by having an RPD <35% (n/a if concentration of either sample <MDL) for PBDEs, <30% (n/a if concentration of either sample <MDL) for PFAS and <25% (n/a if concentration of either sample <MDL) for

PPCPs (**Table C.10**). Laboratory control spike duplicate analyses resulting in qualification appear in **Table 18**.

Table 18. Laboratory control spike duplicate precision qualification for CEC Year 2 monitoring.
Results appearing in this table were all flagged with the CEDEN QA code: IL. QA code definitions are provided in Appendix **Table C.1**.

Dataset ID	LCSD ID	Matrix	Analyte	RPD	Project Qualifier
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	W1K1219-BSD1	Water	Ibuprofen	27	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	W1K1219-BSD1	Water	Bisphenol A	126	Qualified
WKL_DRMP_CEC_W1K1221_W_PPCP_Horm	W1K1221-BSD1	Water	Ethynylestradiol, 17alpha-	40	Qualified
WKL_DRMP_CEC_W1K1221_W_PPCP_Horm	W1K1221-BSD1	Water	Estrone	27	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	W1K1527-BSD1	Water	Bisphenol A	49	Qualified
AXYS_DRMP_CEC_WG81568_S_PFAS	WG81568-103	Sediment	Perfluoro-3,6-dioxaheptanoate	41.1	Qualified
AXYS_DRMP_CEC_WG81677_T_PFAS	LCS_WG81677	Tissue	Perfluoro-3,6-dioxaheptanoate	37.6	Qualified

Accuracy

For SGS-AXYS, Physis, Vista, and Weck DRMP analyses, accuracy is studied with the analysis of MSs, LCSs, surrogates, and isotope dilution analogues (IDAs). Associated data verification results are detailed below.

Matrix Spikes

An MS is a sample prepared by adding a known amount of the target analyte to an environmental sample in order to increase the concentration of the target analyte. The MS is used to determine the effect of the matrix on a method's recovery efficiency and is a measure of accuracy. The MS is analyzed exactly like an environmental sample within the laboratory batch. The purpose of analyzing the MS is to determine whether the sample matrix contributes bias to the analytical results.

For Delta RMP CEC monitoring in Year 2, 14 matrix spikes (i.e., seven MSD pairs) were prepared and analyzed for PPCPs in water (including galaxolide and triclocarban) and TOC in sediment at the required frequency of 1 per 20 samples. In addition, though not required by the CEC QAPP (v2), four MS samples were provided by Weck for PPCPs analyzed by EPA 1694M. 91.7% of these results (66 of 72) met the recovery MQO (**Table C.11**). Matrix spike analyses resulting in qualification appear in **Table 19**.

Table 19. Matrix spike qualification for CEC Year 2 monitoring.
Results appearing in this table were all flagged with the CEDEN QA code: GB. QA code definitions are provided in Appendix **Table C.1**.

Dataset ID	MS ID	Analyte	Matrix	Units	MS PR	MSD PR	RPD	Project Qualifier
Physis_DRMP_CEC_O-33146_W_BNs	511SOL011	Galaxolide	Water	ng/L	574 [1]	463 [1]	3	Compliant
Physis_DRMP_CEC_O-35002_W_BNs	519DRYCRK	Galaxolide	Water	ng/L	219	221	3	Qualified
Physis_DRMP_CEC_O-35136b_W_BNs	519SUT108	Triclocarban	Water	ng/L	175	196	7	Qualified
WKL_DRMP_CEC_W1K0706_S_TOC	000NONPJ	TOC	Sediment	ng/g dw	157	163	24	Qualified

[1] Since the native concentration was >4x the spike concentration the percent recovery (PR) cannot be evaluated and therefore the project qualifier remains Compliant.

Laboratory Control Spike

An LCS is a sample matrix representative of the environmental sample (e.g., water, sand) that is prepared in the laboratory and is free from the analytes of interest. The LCS is spiked with verified amounts of analytes or a material containing known and verified amounts of analytes. It is either used to establish intra-laboratory or analyst-specific precision and bias, or to assess the performance of a portion of the measurement system.

For Delta RMP CEC monitoring in Year 2, 54 LCSs were prepared and analyzed for all PBDE, PFAS, PPCP, and SSC in water and TOC in sediment batches at the required frequency of one per 20 samples or per batch (whichever is more frequent). 96.4% of these results (378 of 392) met the 50-150% recovery MQO (**Table C.9**). LCS analyses resulting in qualification appear in **Table 20**.

Table 20. Laboratory control spike qualification for CEC Year 2 monitoring.
Results appearing in this table were all flagged with the CEDEN QA code: EUM. QA code definitions are provided in Appendix **Table C.1**.

Dataset ID	LCS ID	Matrix	Analyte	LCS PR	Project Qualifier
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	W1K1219-BS1	Water	Bisphenol A	204	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	W1K1219-BS1	Water	Naproxen	151	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	W1K1219-BSD1	Water	Bisphenol A	899	Qualified

DATASET ID	LCS ID	MATRIX	ANALYTE	LCS PR	PROJECT QUALIFIER
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	W1K1219-BSD1	Water	Ibuprofen	186	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	W1K1219-BSD1	Water	Naproxen	159	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	W1K1527-BS1	Water	Bisphenol A	317	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	W1K1527-BS1	Water	Diclofenac	155	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	W1K1527-BS1	Water	Ibuprofen	190	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	W1K1527-BS1	Water	Iopromide	544	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	W1K1527-BS1	Water	Naproxen	189	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	W1K1527-BSD1	Water	Bisphenol A	191	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	W1K1527-BSD1	Water	Ibuprofen	161	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	W1K1527-BSD1	Water	Iopromide	614	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	W1K1527-BSD1	Water	Naproxen	172	Qualified

Surrogates

A surrogate is a non-target analyte that has similar chemical properties to the analyte of interest. The surrogate standard is added to the sample in a known amount and used to evaluate the response (i.e., loss) of the analyte to sample preparation and analysis procedures.

Although there is no existing Delta RMP MQO for surrogates, they are required by Method EPA 625.1 (galaxolide and triclocarban in water). Percent recoveries were evaluated using the laboratory recovery control limits. For Delta RMP CEC monitoring in Year 2, surrogate galaxolide-d_6 was added to all environmental and QC samples analyzed for galaxolide. Surrogates were not added for those analyzed for triclocarban for Events 1, 2, and 3, as the method was still under development by the laboratory (**Table 21**). The surrogate triclocarban-$13C_6$ was added to all environmental and QC samples analyzed for triclocarban associated with Event 4. One hundred percent (100%, 97 of 97) of surrogate results met the laboratory recovery MQO (**Table C.13**).

Table 21. Surrogate qualification for CEC Year 2 monitoring.
Results appearing in this table were all flagged with the CEDEN Batch Verification Code: VQI (Incomplete QC, Flagged by QAO).

DATASET ID	ANALYTE	PROJECT QUALIFIER
Physis_DRMP_CEC_O-33146b_W_BNs	Triclocarban	Qualified
Physis_DRMP_CEC_O-35002b_W_BNs	Triclocarban	Qualified
Physis_DRMP_CEC_O-35136b_W_BNs	Triclocarban	Qualified

Isotope Dilution Analogues

Isotope dilution analogues are isotopically labeled versions of the target analytes (or chemicals similar to the target analytes) that are added to each environmental and QC sample prior to extraction and are used to quantify the result concentrations of the unlabeled analytes present in the sample matrix.

For Delta RMP CEC monitoring in Year 2, IDAs were added to all environmental and QC water, sediment, and tissue samples analyzed for PFAS, PBDEs, and the PPCPs by Weck. 94.6% of these results (1421 of 1502) met the laboratory recovery MQO (**Table C.14**). Qualified IDAs appear in **Table 22**.

For each IDA that recovers outside of the MQOs, the target analyte result which the IDA was used to quantify is also flagged to indicate a poor recovery of the associated labeled compound. Analytical results flagged in association with IDA recoveries outside of MQOs are provided in **Table 23**.

Table 22. Isotope dilution analogue qualification for CEC Year 2 monitoring.
Results appearing in this table were all flagged with the CEDEN QA code: GIDA. QA code definitions are provided in Appendix **Table C.1**.

Dataset ID	Sample ID	Matrix	Isotope Dilution Analogue	IDA PR	Project Qualifier
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	Sediment	PBDE 209-13C12(IsoDilAnalogue)	12.2	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	511POTW02	Water	Estradiol-d3, 17beta-(IsoDilAnalogue)	246	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	511POTW02	Water	Gemfibrozil-d6(IsoDilAnalogue)	245	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	511POTW02	Water	Salicylic Acid-d4(IsoDilAnalogue)	206	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	511POTW02	Water	Triclosan-d3(IsoDilAnalogue)	215	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	519AMNDVY	Water	Triclosan-d3(IsoDilAnalogue)	37	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	519SACUR3	Water	Bisphenol A-d16(IsoDilAnalogue)	46	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	519SACUR3	Water	Estradiol-d3, 17beta-(IsoDilAnalogue)	25	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	519SACUR3	Water	Ibuprofen-d3(IsoDilAnalogue)	43	Qualified
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	519SACUR3	Water	Naproxen-d3(IsoDilAnalogue)	29	Qualified
WKL_DRMP_CEC_W1K1221_W_PPCP_Horm	511POTW02	Water	Progesterone-d9(IsoDilAnalogue)	285	Qualified
WKL_DRMP_CEC_W1K1221_W_PPCP_Horm	511POTW02	Water	Testosterone-d3(IsoDilAnalogue)	234	Qualified

Dataset ID	Sample ID	Matrix	Isotope Dilution Analogue	IDA PR	Project Qualifier
WKL_DRMP_CEC_W1K1221_W_PPCP_Horm	519SACUR3	Water	Estradiol-d3, 17beta-(IsoDilAnalogue)	33	Qualified
WKL_DRMP_CEC_W1K1221_W_PPCP_Horm	519SACUR3	Water	Ethynylestradiol-d4, 17alpha-(IsoDilAnalogue)	31	Qualified
WKL_DRMP_CEC_W1K1221_W_PPCP_Horm	519SACUR3	Water	Progesterone-d9(IsoDilAnalogue)	24	Qualified
WKL_DRMP_CEC_W1K1221_W_PPCP_Horm	519SACUR3	Water	Testosterone-d3(IsoDilAnalogue)	14	Qualified
WKL_DRMP_CEC_W1K1523_W_PPCP_Horm	510SACC3A	Water	Estradiol-d3, 17beta-(IsoDilAnalogue)	31	Qualified
WKL_DRMP_CEC_W1K1523_W_PPCP_Horm	510SACC3A	Water	Ethynylestradiol-d4, 17alpha-(IsoDilAnalogue)	26	Qualified
WKL_DRMP_CEC_W1K1523_W_PPCP_Horm	510SACC3A	Water	Progesterone-d9(IsoDilAnalogue)	24	Qualified
WKL_DRMP_CEC_W1K1523_W_PPCP_Horm	510SACC3A	Water	Testosterone-d3(IsoDilAnalogue)	24	Qualified
WKL_DRMP_CEC_W1K1523_W_PPCP_Horm	510ST1301	Water	Ethynylestradiol-d4, 17alpha-(IsoDilAnalogue)	42	Qualified
WKL_DRMP_CEC_W1K1523_W_PPCP_Horm	510ST1301	Water	Progesterone-d9(IsoDilAnalogue)	47	Qualified
WKL_DRMP_CEC_W1K1523_W_PPCP_Horm	510ST1301	Water	Testosterone-d3(IsoDilAnalogue)	43	Qualified
WKL_DRMP_CEC_W1K1523_W_PPCP_Horm	511SOL011	Water	Estradiol-d3, 17beta-(IsoDilAnalogue)	1	Qualified
WKL_DRMP_CEC_W1K1523_W_PPCP_Horm	511SOL011	Water	Ethynylestradiol-d4, 17alpha-(IsoDilAnalogue)	1	Qualified
WKL_DRMP_CEC_W1K1523_W_PPCP_Horm	511SOL011	Water	Progesterone-d9(IsoDilAnalogue)	3	Qualified

Dataset ID	Sample ID	Matrix	Isotope Dilution Analogue	IDA PR	Project Qualifier
WKL_DRMP_CEC_W1K1523_W_PPCP_Horm	511SOL011	Water	Testosterone-d3(IsoDilAnalogue)	1	Qualified
WKL_DRMP_CEC_W1K1523_W_PPCP_Horm	519SACUR3	Water	Testosterone-d3(IsoDilAnalogue)	47	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510SACC3A	Water	Bisphenol A-d16(IsoDilAnalogue)	25	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510SACC3A	Water	Estradiol-d3, 17beta-(IsoDilAnalogue)	31	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510SACC3A	Water	Gemfibrozil-d6(IsoDilAnalogue)	24	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510SACC3A	Water	Ibuprofen-d3(IsoDilAnalogue)	20	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510SACC3A	Water	Naproxen-d3(IsoDilAnalogue)	23	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510SACC3A	Water	Triclosan-d3(IsoDilAnalogue)	12	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510ST1301	Water	Bisphenol A-d16(IsoDilAnalogue)	47	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510ST1301	Water	Gemfibrozil-d6(IsoDilAnalogue)	41	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510ST1301	Water	Ibuprofen-d3(IsoDilAnalogue)	40	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510ST1301	Water	Naproxen-d3(IsoDilAnalogue)	41	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510ST1301	Water	Triclosan-d3(IsoDilAnalogue)	16	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511POTW02	Water	Salicylic Acid-d4(IsoDilAnalogue)	224	Qualified

Dataset ID	Sample ID	Matrix	Isotope Dilution Analogue	IDA PR	Project Qualifier
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	Bisphenol A-d16(IsoDilAnalogue)	1	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	Estradiol-d3, 17beta-(IsoDilAnalogue)	1	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	Gemfibrozil-d6(IsoDilAnalogue)	3	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	Ibuprofen-d3(IsoDilAnalogue)	3	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	Naproxen-d3(IsoDilAnalogue)	2	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	Salicylic Acid-d4(IsoDilAnalogue)	1	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	Triclosan-d3(IsoDilAnalogue)	9	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519AMNDVY	Water	Salicylic Acid-d4(IsoDilAnalogue)	531	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519DRYCRK	Water	Salicylic Acid-d4(IsoDilAnalogue)	391	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519DRYCRK	Water	Salicylic Acid-d4(IsoDilAnalogue)	538	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519DRYCRK	Water	Salicylic Acid-d4(IsoDilAnalogue)	540	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519PGC010	Water	Salicylic Acid-d4(IsoDilAnalogue)	345	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519DRYCRK	Water	Salicylic Acid-d4(IsoDilAnalogue)	604	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519POTW01	Water	Salicylic Acid-d4(IsoDilAnalogue)	317	Qualified

Dataset ID	Sample ID	Matrix	Isotope Dilution Analogue	IDA PR	Project Qualifier
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519SACUR3	Water	Salicylic Acid-d4(IsoDilAnalogue)	457	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	541SJC501	Water	Salicylic Acid-d4(IsoDilAnalogue)	312	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	544SJRNBC	Water	Salicylic Acid-d4(IsoDilAnalogue)	259	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	511SOL011	Water	Gemfibrozil-d6(IsoDilAnalogue)	220	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	519AMNDVY	Water	Gemfibrozil-d6(IsoDilAnalogue)	207	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	519DRYCRK	Water	Gemfibrozil-d6(IsoDilAnalogue)	239	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	519PGC010	Water	Gemfibrozil-d6(IsoDilAnalogue)	267	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	519POTW01	Water	Gemfibrozil-d6(IsoDilAnalogue)	284	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	519SACUR3	Water	Ethynylestradiol-d4, 17alpha-(IsoDilAnalogue)	228	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	519SACUR3	Water	Gemfibrozil-d6(IsoDilAnalogue)	592	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	519SACUR3	Water	Triclosan-d3(IsoDilAnalogue)	305	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	519SUT108	Water	Gemfibrozil-d6(IsoDilAnalogue)	203	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	519SUT108	Water	Gemfibrozil-d6(IsoDilAnalogue)	239	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	544SJRNBC	Water	Gemfibrozil-d6(IsoDilAnalogue)	204	Qualified

Dataset ID	Sample ID	Matrix	Isotope Dilution Analogue	IDA PR	Project Qualifier
WKL_DRMP_CEC_W2F1171_W_PPCP	519SACUR3	Water	Ethynylestradiol-d4, 17alpha-(IsoDilAnalogue)	260	Qualified
WKL_DRMP_CEC_W2F1171_W_PPCP	519SACUR3	Water	Gemfibrozil-d6(IsoDilAnalogue)	315	Qualified
WKL_DRMP_CEC_W2F1171_W_PPCP	519SACUR3	Water	Triclosan-d3(IsoDilAnalogue)	429	Qualified
WKL_DRMP_CEC_W2F1171b_W_PPCP	519SACUR3	Water	Bisphenol A-d16(IsoDilAnalogue)	207	Qualified
AXYS_DRMP_CEC_WG81677_T_PFAS	DRMP-CEC-519ST1309-2021-10-18-SAS	Tissue	Perfluorotetradecanoate-13C2(IsoDilAnalogue)	32.6	Qualified
AXYS_DRMP_CEC_WG81677_T_PFAS	DRMP-CEC-519ST1309-2021-10-18-SAS	Tissue	Ethyl-perfluorooctanesulfonamidoethanol-d9, N-(IsoDilAnalogue)	7.91	Qualified
AXYS_DRMP_CEC_WG81677_T_PFAS	DRMP-CEC-519ST1309-2021-10-18-SAS	Tissue	Ethyl-perfluorooctanesulfonamide-d5, N-(IsoDilAnalogue)	11.0	Qualified
AXYS_DRMP_CEC_WG81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	Perfluorohexanoate-13C5(IsoDilAnalogue)	38.7	Qualified
AXYS_DRMP_CEC_WG81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	Fluorotelomer Sulfonate-13C2, 4:2-(IsoDilAnalogue)	38.6	Qualified
AXYS_DRMP_CEC_WG81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	Perfluorotetradecanoate-13C2(IsoDilAnalogue)	33.7	Qualified
AXYS_DRMP_CEC_WG81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	Perfluoro-2-Propoxypropanoic Acid-13C3(IsoDilAnalogue)	33.6	Qualified
AXYS_DRMP_CEC_WG81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	Perfluorobutanoate-13C4(IsoDilAnalogue)	1.31	Qualified
AXYS_DRMP_CEC_WG81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	Perfluoropentanoate-13C5(IsoDilAnalogue)	5.17	Qualified

Table 23. Isotope dilution analogue qualification for CEC Year 2 monitoring: associated samples.
Results appearing in this table were all flagged with the CEDEN QA code: GIDA. QA code definitions are provided in Appendix **Table C.1**.

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Project Qualifier
AXYS_DRMP_CEC_WG 81579_S_PBDE	511SOL011	Water	10/21/2021	PBDE 209	Qualified
WKL_DRMP_CEC_W1 K1219_W_PPCP_Neg	511POTW02	Water	10/21/2021	Diclofenac	Qualified
WKL_DRMP_CEC_W1 K1219_W_PPCP_Neg	511POTW02	Water	10/21/2021	Gemfibrozil	Qualified
WKL_DRMP_CEC_W1 K1219_W_PPCP_Neg	511POTW02	Water	10/21/2021	Iopromide	Qualified
WKL_DRMP_CEC_W1 K1219_W_PPCP_Neg	511POTW02	Water	10/21/2021	Salicylic Acid	Qualified
WKL_DRMP_CEC_W1 K1219_W_PPCP_Neg	511POTW02	Water	10/21/2021	Triclosan	Qualified
WKL_DRMP_CEC_W1 K1219_W_PPCP_Neg	519AMNDVY	Water	10/21/2021	Triclosan	Qualified
WKL_DRMP_CEC_W1 K1219_W_PPCP_Neg	519SACUR3	Water	10/20/2021	Bisphenol A	Qualified
WKL_DRMP_CEC_W1 K1219_W_PPCP_Neg	519SACUR3	Water	10/20/2021	Diclofenac	Qualified
WKL_DRMP_CEC_W1 K1219_W_PPCP_Neg	519SACUR3	Water	10/20/2021	Ibuprofen	Qualified
WKL_DRMP_CEC_W1 K1219_W_PPCP_Neg	519SACUR3	Water	10/20/2021	Naproxen	Qualified
WKL_DRMP_CEC_W1 K1221_W_PPCP_Horm	511POTW02	Water	10/21/2021	Progesterone	Qualified
WKL_DRMP_CEC_W1 K1221_W_PPCP_Horm	511POTW02	Water	10/21/2021	Testosterone	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Project Qualifier
WKL_DRMP_CEC_W1 K1221_W_PPCP_Horm	519SACUR3	Water	10/20/2021	Estradiol, 17beta-	Qualified
WKL_DRMP_CEC_W1 K1221_W_PPCP_Horm	519SACUR3	Water	10/20/2021	Estrone	Qualified
WKL_DRMP_CEC_W1 K1221_W_PPCP_Horm	519SACUR3	Water	10/20/2021	Ethynylestradiol, 17alpha-	Qualified
WKL_DRMP_CEC_W1 K1221_W_PPCP_Horm	519SACUR3	Water	10/20/2021	Progesterone	Qualified
WKL_DRMP_CEC_W1 K1221_W_PPCP_Horm	519SACUR3	Water	10/20/2021	Testosterone	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	510SACC3A	Water	10/26/2021	Estradiol, 17beta-	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	510SACC3A	Water	10/26/2021	Estrone	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	510SACC3A	Water	10/26/2021	Ethynylestradiol, 17alpha-	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	510SACC3A	Water	10/26/2021	Progesterone	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	510SACC3A	Water	10/26/2021	Testosterone	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	510ST1301	Water	10/26/2021	Ethynylestradiol, 17alpha-	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	510ST1301	Water	10/26/2021	Progesterone	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	510ST1301	Water	10/26/2021	Testosterone	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	511SOL011	Water	10/25/2021	Estradiol, 17beta-	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Project Qualifier
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	511SOL011	Water	10/25/2021	Estrone	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	511SOL011	Water	10/25/2021	Ethynylestradiol, 17alpha-	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	511SOL011	Water	10/25/2021	Progesterone	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	511SOL011	Water	10/25/2021	Testosterone	Qualified
WKL_DRMP_CEC_W1 K1523_W_PPCP_Horm	519SACUR3	Water	10/25/2021	Testosterone	Qualified
WKL_DRMP_CEC_W1 K1527_W_PPCP_Neg	510SACC3A	Water	10/26/2021	Bisphenol A	Qualified
WKL_DRMP_CEC_W1 K1527_W_PPCP_Neg	510SACC3A	Water	10/26/2021	Diclofenac	Qualified
WKL_DRMP_CEC_W1 K1527_W_PPCP_Neg	510SACC3A	Water	10/26/2021	Gemfibrozil	Qualified
WKL_DRMP_CEC_W1 K1527_W_PPCP_Neg	510SACC3A	Water	10/26/2021	Ibuprofen	Qualified
WKL_DRMP_CEC_W1 K1527_W_PPCP_Neg	510SACC3A	Water	10/26/2021	Naproxen	Qualified
WKL_DRMP_CEC_W1 K1527_W_PPCP_Neg	510SACC3A	Water	10/26/2021	Triclosan	Qualified
WKL_DRMP_CEC_W1 K1527_W_PPCP_Neg	510ST1301	Water	10/26/2021	Bisphenol A	Qualified
WKL_DRMP_CEC_W1 K1527_W_PPCP_Neg	510ST1301	Water	10/26/2021	Gemfibrozil	Qualified
WKL_DRMP_CEC_W1 K1527_W_PPCP_Neg	510ST1301	Water	10/26/2021	Ibuprofen	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Project Qualifier
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510ST1301	Water	10/26/2021	Naproxen	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	510ST1301	Water	10/26/2021	Triclosan	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511POTW02	Water	10/25/2021	Iopromide	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511POTW02	Water	10/25/2021	Salicylic Acid	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	10/25/2021	Bisphenol A	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	10/25/2021	Diclofenac	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	10/25/2021	Gemfibrozil	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	10/25/2021	Ibuprofen	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	10/25/2021	Iopromide	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	10/25/2021	Naproxen	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	10/25/2021	Salicylic Acid	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	Water	10/25/2021	Triclosan	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519AMNDVY	Water	10/26/2021	Iopromide	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519AMNDVY	Water	10/26/2021	Salicylic Acid	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Project Qualifier
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519DRYCRK	Water	10/26/2021	Iopromide	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519DRYCRK	Water	10/26/2021	Salicylic Acid	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519PGC010	Water	10/25/2021	Iopromide	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519PGC010	Water	10/25/2021	Salicylic Acid	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519POTW01	Water	10/26/2021	Iopromide	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519POTW01	Water	10/26/2021	Salicylic Acid	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519SACUR3	Water	10/25/2021	Iopromide	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519SACUR3	Water	10/25/2021	Salicylic Acid	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	541SJC501	Water	10/25/2021	Iopromide	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	541SJC501	Water	10/25/2021	Salicylic Acid	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	544SJRNBC	Water	10/25/2021	Iopromide	Qualified
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	544SJRNBC	Water	10/25/2021	Salicylic Acid	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	511SOL011	Water	3/28/2022	Gemfibrozil	Qualified
WKL_DRMP_CEC_W2D0037_W_PPCP	519AMNDVY	Water	3/28/2022	Gemfibrozil	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Project Qualifier
WKL_DRMP_CEC_W2 D0037_W_PPCP	519DRYCRK	Water	3/28/2022	Gemfibrozil	Qualified
WKL_DRMP_CEC_W2 D0037_W_PPCP	519PGC010	Water	3/28/2022	Gemfibrozil	Qualified
WKL_DRMP_CEC_W2 D0037_W_PPCP	519POTW01	Water	3/28/2022	Gemfibrozil	Qualified
WKL_DRMP_CEC_W2 D0037_W_PPCP	519SACUR3	Water	3/28/2022	Ethynylestradiol, 17alpha-	Qualified
WKL_DRMP_CEC_W2 D0037_W_PPCP	519SACUR3	Water	3/28/2022	Gemfibrozil	Qualified
WKL_DRMP_CEC_W2 D0037_W_PPCP	519SACUR3	Water	3/28/2022	Triclosan	Qualified
WKL_DRMP_CEC_W2 D0037_W_PPCP	519SUT108	Water	3/28/2022	Gemfibrozil	Qualified
WKL_DRMP_CEC_W2 D0037_W_PPCP	544SJRNBC	Water	3/28/2022	Gemfibrozil	Qualified
WKL_DRMP_CEC_W2 F1171_W_PPCP	519SACUR3	Water	6/8/2022	Ethynylestradiol, 17alpha-	Qualified
WKL_DRMP_CEC_W2 F1171_W_PPCP	519SACUR3	Water	6/8/2022	Gemfibrozil	Qualified
WKL_DRMP_CEC_W2 F1171_W_PPCP	519SACUR3	Water	6/8/2022	Triclosan	Qualified
WKL_DRMP_CEC_W2 F1171b_W_PPCP	519SACUR3	Water	6/8/2022	Bisphenol A	Qualified
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Fluorotelomer Carboxylic Acid, 3:3-	Rejected [1]
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Fluorotelomer Carboxylic Acid, 5:3-	Qualified

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Project Qualifier
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Fluorotelomer Carboxylic Acid, 7:3-	Qualified
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Fluorotelomer Sulfonate, 4:2-	Qualified
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Perfluoro(2-ethoxyethane)sulfonic acid	Qualified
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Perfluoro-2-Propoxypropanoic Acid	Qualified
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Perfluoro-3,6-dioxaheptanoate	Qualified
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Perfluoro-3-methoxypropanoate	Rejected [1]
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Perfluoro-4-methoxybutanoate	Rejected [1]
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Perfluorobutanoate	Rejected [1]
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Perfluorohexanoate	Qualified
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Perfluoropentanoate	Rejected [1]
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Perfluorotetradecanoate	Qualified
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-510ST1317-2021-10-18-WHC	Tissue	10/18/2021	Perfluorotridecanoate	Qualified
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-519ST1309-2021-10-18-SAS	Tissue	10/18/2021	Ethyl-perfluorooctanesulfonamide, N-	Qualified
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-519ST1309-2021-10-18-SAS	Tissue	10/18/2021	Ethyl-perfluorooctanesulfonamidoethanol, N-	Rejected [1]

Dataset ID	Sample ID	Matrix	Sample Date	Analyte	Project Qualifier
AXYS_DRMP_CEC_WG 81677_T_PFAS	DRMP-CEC-519ST1309-2021-10-18-SAS	Tissue	10/18/2021	Perfluorotetradecanoate	Qualified

[1] Details regarding sample results rejected by the laboratory due to poor IDA recoveries are provided in **Analysis Failures** and in **Table 6**.

Additional Qualification

Sample results in **Table 24** were estimated for exceeding the instrument calibration range. Affected analytes include salicylic acid, bisphenol A, and naproxen.

Table 24. Calibration-related qualification for CEC Year 2 monitoring.
Results appearing in this table were all flagged with the CEDEN QA code: CJ. QA code definitions are provided in Appendix **Table C.1**.

Dataset ID	Sample ID	Sample Date	Analyte	Result (ng/L)	Project Qualifier
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	511SOL011	10/21/2021	Salicylic Acid	18000	Estimated
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	511SOL011	10/21/2021	Salicylic Acid	22000	Estimated
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	519AMNDVY	10/21/2021	Bisphenol A	670	Estimated
WKL_DRMP_CEC_W1K1219_W_PPCP_Neg	544SJRNBC	10/21/2021	Bisphenol A	1280	Estimated
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	511SOL011	10/25/2021	Bisphenol A	1500	Estimated
WKL_DRMP_CEC_W1K1527_W_PPCP_Neg	519SACUR3	10/25/2021	Naproxen	890	Compliant

Sample results in **Table 25** were qualified due to lock mass interference. Three of the five samples qualified due to lock mass interference were laboratory quality control samples. Lock mass is a mass peak in a spectrum that corresponds to a compound of known mass (mass standard). It is used post-acquisition to adjust the mass calibration for the scan so that other mass peaks may be accurately measured. The data were flagged due to disturbance of the mass ion used to monitor instrument performance (lock-mass) present.

Table 25. Interference-related qualification for CEC Year 2 monitoring.
Results appearing in this table were all flagged with the CEDEN QA code: UKM. QA code definitions are provided in Appendix **Table C.1**.

Dataset ID	Sample ID	Matrix	Sample Date[1]	Analyte	Project Qualifier
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	Sediment	10/21/2021	PBDE 154-13C12 (IsoDilAnalogue)	Qualified
AXYS_DRMP_CEC_WG81579_S_PBDE	511SOL011	Sediment	10/21/2021	PBDE 154	Qualified
AXYS_DRMP_CEC_WG81851_T_PBDE	LabBlank_WG81851-AXYS	Tissue	NA	PBDE 154	Qualified

Dataset ID	Sample ID	Matrix	Sample Date[1]	Analyte	Project Qualifier
AXYS_DRMP_CEC_ WG81851_T_PBDE	LCS_WG81851	Tissue	NA	PBDE 154	Qualified
AXYS_DRMP_CEC_ WG81851_T_PBDE	LCS_WG81851	Tissue	NA	PBDE 154	Qualified

[1] NA (Not Applicable) is listed when sample date is not applicable. The date of 1/1/1950 is used in CEDEN when there is not an applicable sample date; this value is treated as a null value in those situations.

SUMMARY

CHEMISTRY RESULTS

A total of 61 environmental samples were collected and analyzed for the CEC Year 2 monitoring as outlined in **Table 26**. These samples consisted of 48 water, three sediment, and ten tissue environmental samples that were analyzed by SGS-AXYS, Weck, and Vista for PBDEs, PFAS, PPCPs (including galaxolide and triclocarban), SSC, and TOC. In addition, four water field duplicates, four water field blanks, and one sediment field duplicate were analyzed with each set environmental samples; no field QC samples were required for bivalve or fish tissues collections. A total of 70 samples were submitted to the laboratories for analysis.

Table 26. Summary of field sample collections for CEC Year 2 monitoring.

<table>
<tr><th>Constituent Group</th><th>Laboratory</th><th>Matrix</th><th>Environmental Samples</th><th>Field Duplicate</th><th>Field Blank</th><th>Total Samples</th></tr>
<tr><td>PFAS</td><td>Vista</td><td rowspan="4">Water</td><td rowspan="4">48</td><td rowspan="4">4</td><td rowspan="4">4</td><td rowspan="4">56</td></tr>
<tr><td>PPCPs [1]</td><td>Physis</td></tr>
<tr><td>PPCPs [2]</td><td>Weck</td></tr>
<tr><td>SSC</td><td>Weck</td></tr>
<tr><td>PBDEs</td><td>SGS-AXYS</td><td rowspan="3">Sediment</td><td rowspan="3">3</td><td rowspan="3">1</td><td rowspan="3">0</td><td rowspan="3">4</td></tr>
<tr><td>PFAS</td><td>SGS-AXYS</td></tr>
<tr><td>TOC</td><td>Weck</td></tr>
<tr><td>PBDEs</td><td>SGS-AXYS</td><td>Bivalves Tissue</td><td>6</td><td>0</td><td>0</td><td>6</td></tr>
<tr><td>PBDEs</td><td>SGS-AXYS</td><td rowspan="2">Fish Tissue</td><td rowspan="2">4</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">4</td></tr>
<tr><td>PFAS</td><td>SGS-AXYS</td></tr>
<tr><td colspan="3">Total</td><td>61</td><td>5</td><td>4</td><td>70</td></tr>
</table>

[1] PPCP constituents analyzed by Physis include galaxolide and triclocarban only
[2] PPCP constituents analyzed by Weck include hormones and pharmaceuticals, excluding galaxolide and triclocarban.

A total of 3,834 (tissue, sediment, and water) environmental and QC sample results for PBDEs, PFAS, PPCPs (including Galaxolide and Triclocarban), SSC, and TOC were verified as a part of the Year 2 dataset (**Table 27**). Of those 2,557 met DRMP QAPP requirements and are considered "Compliant". A total of 1257 environmental and QC (tissue, sediment and water) sample results presented in **Table 9** through **Table 25** did not meet DRMP QAPP requirements and are considered "Qualified".

Five environmental and QC samples (water) presented in **Table 24** are considered "Estimated," and 15 environmental and QC samples (tissue) presented in **Table 6** are considered "Rejected"

Table 27. Summary of verified results for CEC Year 2 monitoring.
Counts of results include all environmental and QC sample results. Percentage of total for each count by constituent group, laboratory, and matrix in parenthesis next to sample count.

Constituent Group	Laboratory	Matrix	Compliant	Qualified	Estimated	Rejected	NA	Total
PFAS	Vista	Water	272 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	272
PPCPs [1]	Physis	Water	126 (50%)	127 (50%)	0 (0%)	0 (0%)	0 (0%)	253
PPCPs [2]	Weck	Water	683 (40%)	1,008 (59%)	5 (0.29%)	0 (0%)	0 (0%)	1,696
SSC	Weck	Water	64 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	64
PBDEs	SGS-AXYS	Sediment	100 (75%)	33 (25%)	0 (0%)	0 (0%)	0 (0%)	133
PFAS	SGS-AXYS	Sediment	569 (98%)	12 (2%)	0 (0%)	0 (0%)	0 (0%)	581
TOC	Weck	Sediment	7 (47%)	8 (53%)	0 (0%)	0 (0%)	0 (0%)	15
PBDEs	SGS-AXYS	Tissue	199 (81%)	44 (18%)	0 (0%)	0 (0%)	2 (0.82%)	245
PFAS	SGS-AXYS	Tissue	538 (93%)	27 (5%)	0 (0%)	15 (2.6%)	0 (0%)	580
Total Verified Results			**2,558 (66.6%)**	**1,259 (32.8%)**	**5 (0.13%)**	**15 (0.39%)**	**2 (0.05%)**	**3,839**

[1] PPCP constituents analyzed by Physis include galaxolide and triclocarban only.
[2] PPCP constituents analyzed by Weck include hormones and pharmaceuticals, excluding galaxolide and triclocarban.

Water Quality Analysis Results

PFAS in Water

PFOS and PFOA were detected consistently at all sites throughout the year except at American River at Discovery Park (all samples were non detect for PFOS), Sacramento River at Freeport (all samples were non detect for PFOS), and San Joaquin River at Airport Way near Vernalis (all samples were non detect for PFOA; **Table 28** and **Figure 4**).

PFOA concentrations were higher than PFOS at most locations for most events.

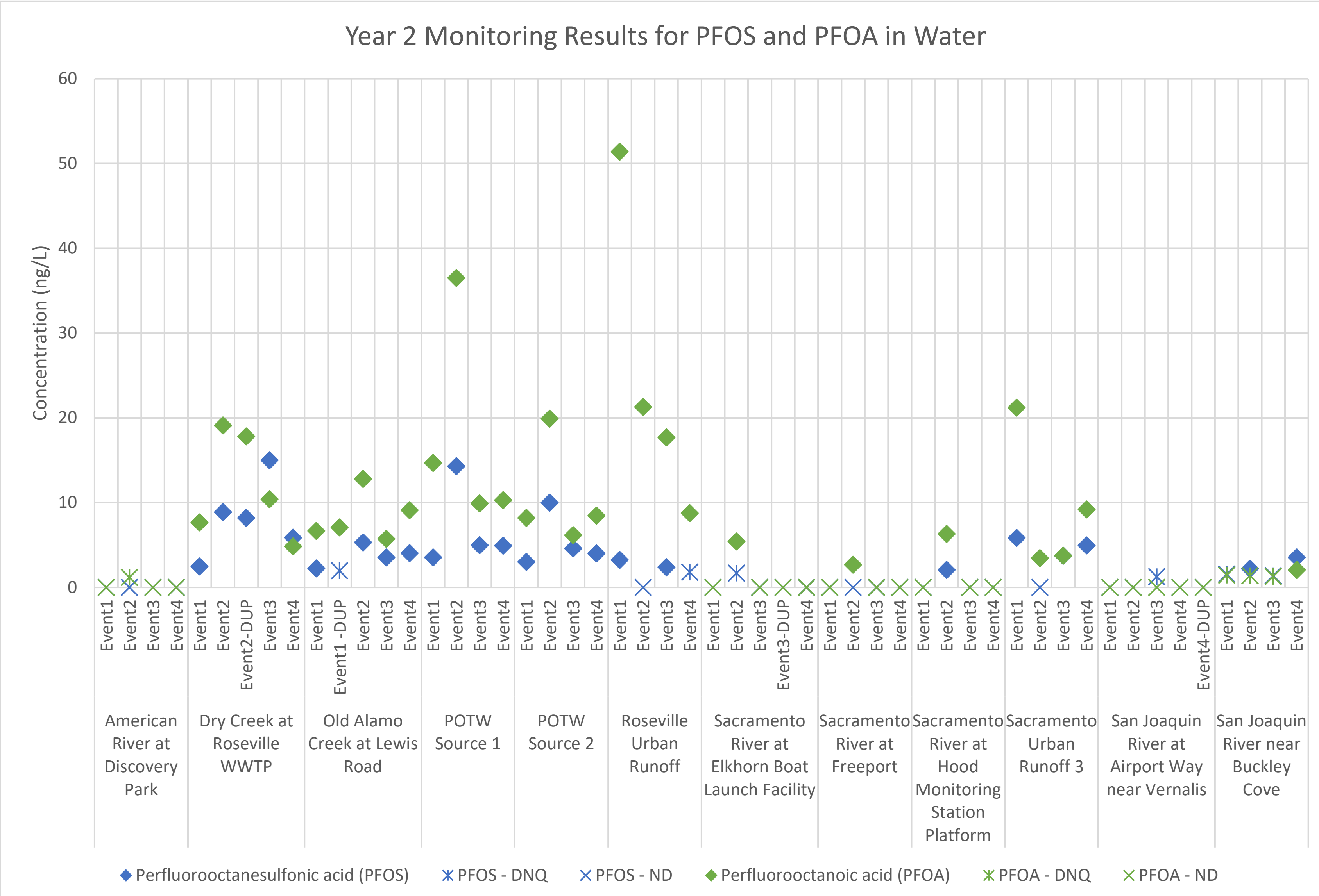
Table 28. PFOS and PFOA concentrations in environmental samples (water, ng/L).

Station	Event	PFOS	PFOA
American River at Discovery Park	Event1	ND	ND

STATION	EVENT	PFOS	PFOA
	Event2	ND	1.17 (DNQ)
	Event3	ND	ND
	Event4	ND	ND
Dry Creek at Roseville WWTP	Event1	2.49	7.66
	Event2	8.87	19.1
	Event2-DUP	8.2	17.8
	Event3	15	10.4
	Event4	5.86	4.83
Old Alamo Creek at Lewis Road	Event1	2.23	6.68
	Event1-DUP	1.98 (DNQ)	7.08
	Event2	5.31	12.8
	Event3	3.54	5.72
	Event4	4.05	9.12
POTW Source 1	Event1	3.54	14.7
	Event2	14.3	36.5
	Event3	5	9.91
	Event4	4.94	10.3
POTW Source 2	Event1	3	8.19
	Event2	10	19.9
	Event3	4.61	6.17
	Event4	4.02	8.46
Roseville Urban Runoff	Event1	3.26	51.4
	Event2	ND	21.3
	Event3	2.38	17.7
	Event4	1.81 (DNQ)	8.76
Sacramento River at Elkhorn Boat Launch Facility	Event1	ND	ND
	Event2	1.69 (DNQ)	5.44
	Event3	ND	ND
	Event3-DUP	ND	ND
	Event4	ND	ND
Sacramento River at Freeport	Event1	ND	ND
	Event2	ND	2.69
	Event3	ND	ND
	Event4	ND	ND
Sacramento River at Hood Monitoring Station Platform	Event1	ND	ND
	Event2	2.06	6.32
	Event3	ND	ND
	Event4	ND	ND
Sacramento Urban Runoff 3	Event1	5.84	21.2
	Event2	ND	3.46
	Event3	3.75	3.74

Station	Event	PFOS	PFOA
	Event4	4.96	9.21
San Joaquin River at Airport Way near Vernalis	Event1	ND	ND
	Event2	ND	ND
	Event3	1.26 (DNQ)	ND
	Event4	ND	ND
	Event4-DUP	ND	ND
San Joaquin River near Buckley Cove	Event1	1.58 (DNQ)	1.44 (DNQ)
	Event2	2.21	1.39 (DNQ)
	Event3	1.38 (DNQ)	1.3 (DNQ)
	Event4	3.53	2.06

Figure 4. PFOS and PFOA concentrations in environmental samples (water, ng/L).



PPCPs in Water

There were eight required PPCPs analyzed in water during Year 2; all analytes had at least one detection. Galaxolide was detected above the RL in all samples, and both BPA and triclocarban were consistently detected at all sites during all events (**Table 29, Figure 5**). However, triclosan was only detected at one location during one event (Old Alamo Creek at Lewis Road, Event 1). Ibuprofen was detected at all sites at least once except in samples from Sacramento River at Elkhorn Boat Launch Facility and San Joaquin River at Airport Way near Vernalis. Diclofenac was present at the source sites and the ambient sites located on smaller water bodies but was not detected at any of the river sites. Estradiol, estrone, and triclosan were not detected above their respective RLs, and were not detected consistently at any site over all four sampling events (**Table 29, Figure 5**).

Galaxolide and BPA both had detections in field blanks (**Table 10**) and laboratory blanks (**Table 11**). The laboratory analyzing BPA believes the laboratory blank contamination is coming from the extraction process since the system blanks are non-detect down to the minimum detection level and therefore the contamination is not coming from the instrument itself. Regarding galaxolide, the laboratory spent additional time investigating the contamination including reviewing several chromatograms from different extraction batches. Their conclusion is that the galaxolide contamination is likely coming from the solvents since galaxolide is present in all the laboratory blanks at various concentrations. The laboratory purchases ultra-clean solvents; however, there is still some level of contamination present since the sample is concentrated down to a small volume and the instrumentation is extremely sensitive. The laboratory confirmed that all glassware used for extracting and analyzing samples is baked at 550°C for 4 hours. To better determine the cause of the contamination, the laboratory indicated it could perform a significant experimental study to determine if it is the solvent as suspected; if it is the solvent, a second step would be to evaluate solvents from different manufacturers to try and find one without galaxolide.

Any batches with laboratory blank contamination have all results in the batch flagged; these results should be used with caution due to the known contamination. A discussion occurred with the Regional Board QA Representative and the State Board QA Officer regarding whether the contamination would result in rejection of these data; it was determined that the data would not be rejected but will remain flagged.

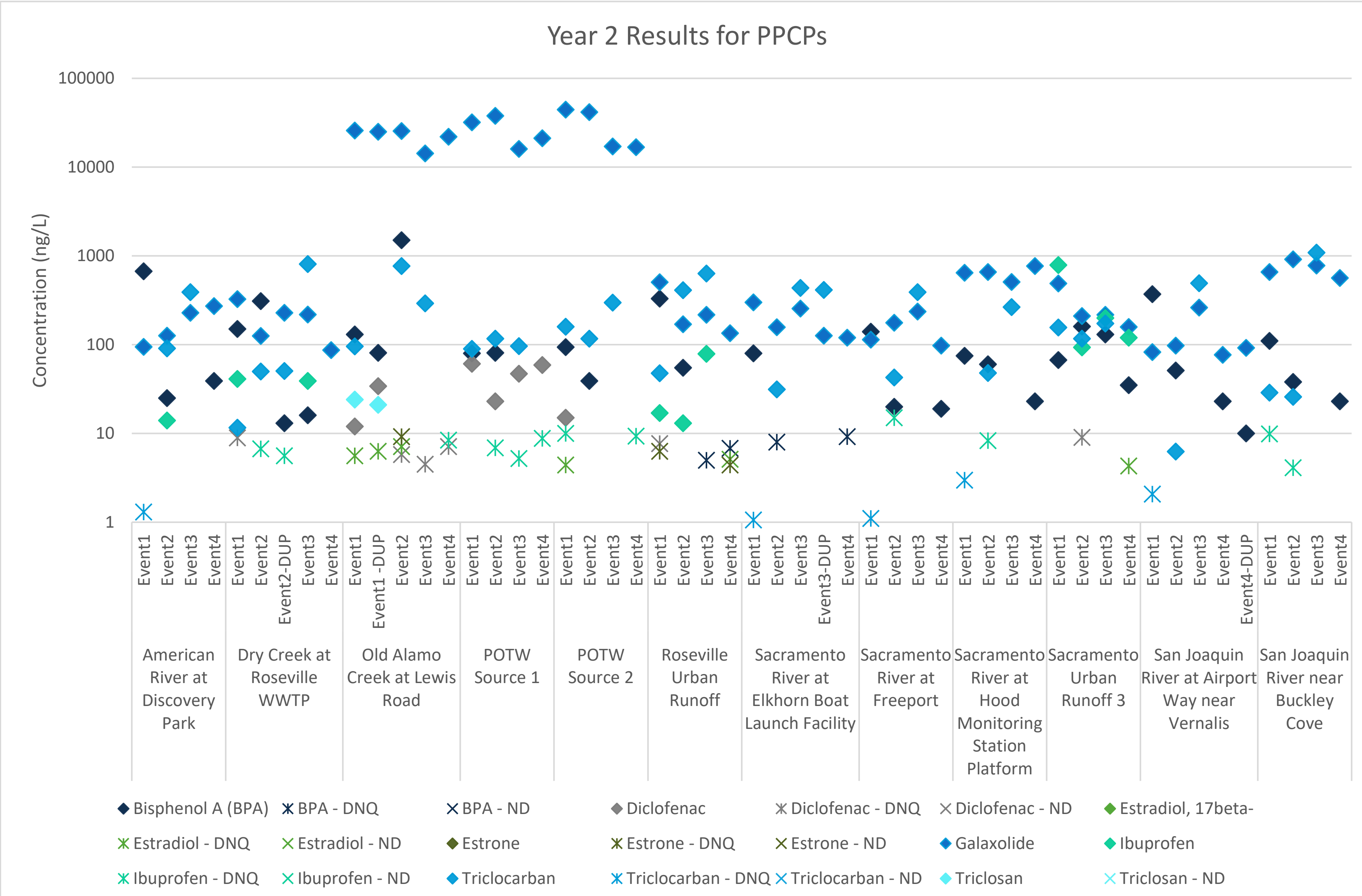
Table 29. PPCP concentrations in environmental samples (water, ng/L).

Station	Event	Bisphenol A	Diclofenac	Estradiol, 17beta-	Estrone	Galaxolide	Ibuprofen	Triclocarban	Triclosan
American River at Discovery Park	Event1	670	ND	ND	ND	94.4	ND	1.3 (DNQ)	ND
	Event2	25	ND	ND	ND	126	14	90.8	ND
	Event3	ND	ND	ND	ND	229	ND	390	ND
	Event4	39	ND	ND	ND	272	ND	ND	ND
Dry Creek at Roseville WWTP	Event1	150	8.9 (DNQ)	ND	ND	326	41	11.6	ND
	Event2	310	ND	ND	ND	125	6.7 (DNQ)	49.9	ND
	Event2-DUP	13	ND	ND	ND	229	5.6 (DNQ)	50.6	ND
	Event3	16	ND	ND	ND	219	39	807	ND
	Event4	ND	ND	ND	ND	86.8	ND	ND	ND
Old Alamo Creek at Lewis Road	Event1	130	12	5.6 (DNQ)	ND	25900	ND	95.4	24
	Event1 -DUP	81	34	6.3 (DNQ)	ND	25000	ND	--	21
	Event2	1500	5.8 (DNQ)	7.1 (DNQ)	9.2 (DNQ)	25500	ND	769	ND
	Event3	ND	4.5 (DNQ)	ND	ND	14300	ND	292	ND
	Event4	ND	7.1 (DNQ)	ND	ND	22000	8.4 (DNQ)	ND	ND
POTW Source 1	Event1	80	61	ND	ND	32000	ND	89.9	ND
	Event2	81	23	ND	ND	37900	6.9 (DNQ)	117	ND
	Event3	ND	47	ND	ND	16000	5.2 (DNQ)	96.2	ND
	Event4	ND	59	ND	ND	21200	8.8 (DNQ)	ND	ND
POTW Source 2	Event1	94	15	4.4 (DNQ)	ND	44300	10 (DNQ)	159	ND
	Event2	39	ND	ND	ND	41500	ND	117	ND
	Event3	ND	ND	ND	ND	17100	ND	298	ND

Station	Event	Bisphenol A	Diclofenac	Estradiol, 17beta-	Estrone	Galaxolide	Ibuprofen	Triclocarban	Triclosan
	Event4	ND	ND	ND	ND	16800	9.3 (DNQ)	ND	ND
Roseville Urban Runoff	Event1	330	7.7 (DNQ)	ND	6.3 (DNQ)	506	17	47.8	ND
	Event2	55	ND	ND	ND	170	13	410	ND
	Event3	5 (DNQ)	ND	ND	ND	217	79	632	ND
	Event4	6.8 (DNQ)	ND	5.1 (DNQ)	4.4 (DNQ)	135	ND	ND	ND
Sacramento River at Elkhorn Boat Launch Facility	Event1	80	ND	ND	ND	300	ND	1.06 (DNQ)	ND
	Event2	8 (DNQ)	ND	ND	ND	157	ND	31.4	ND
	Event3	ND	ND	ND	ND	255	ND	435	ND
	Event3-DUP	ND	ND	ND	ND	126	ND	414	ND
	Event4	9.2 (DNQ)	ND	ND	ND	120	ND	ND	ND
Sacramento River at Freeport	Event1	140	ND	ND	ND	114	ND	1.1 (DNQ)	ND
	Event2	20	ND	ND	ND	177	15 (DNQ)	42.6	ND
	Event3	ND	ND	ND	ND	236	ND	389	ND
	Event4	19	ND	ND	ND	97.2	ND	ND	ND
Sacramento River at Hood Monitoring Station Platform	Event1	75	ND	ND	ND	647	ND	2.98 (DNQ)	ND
	Event2	60	ND	ND	ND	658	8.3 (DNQ)	48.1	ND
	Event3	ND	ND	ND	ND	508	ND	265	ND
	Event4	23	ND	ND	ND	766	ND	ND	ND
Sacramento Urban Runoff 3	Event1	67	ND	ND	ND	490	790	156	ND
	Event2	160	9 (DNQ)	ND	ND	210	93	117	ND
	Event3	130	ND	ND	ND	217	200	173	ND
	Event4	35	ND	4.3 (DNQ)	ND	158	120	ND	ND
	Event1	370	ND	ND	ND	82.5	ND	2.08 (DNQ)	ND
	Event2	51	ND	ND	ND	97.7	ND	6.26	ND

Station	Event	Bisphenol A	Diclofenac	Estradiol, 17beta-	Estrone	Galaxolide	Ibuprofen	Triclocarban	Triclosan
San Joaquin River at Airport Way near Vernalis	Event3	ND	ND	ND	ND	261	ND	491	ND
	Event4	23	ND	ND	ND	76.7	ND	ND	ND
	Event4-DUP	10	ND	ND	ND	92.2	ND	ND	ND
San Joaquin River near Buckley Cove	Event1	110	ND	ND	ND	658	9.9 (DNQ)	28.9	ND
	Event2	38	ND	ND	ND	915	4.1 (DNQ)	25.9	ND
	Event3	ND	ND	ND	ND	776	ND	1090	ND
	Event4	23	ND	ND	ND	564	ND	ND	ND

Figure 5. PPCP concentrations in environmental samples (water, ng/L).



Sediment Analysis Results

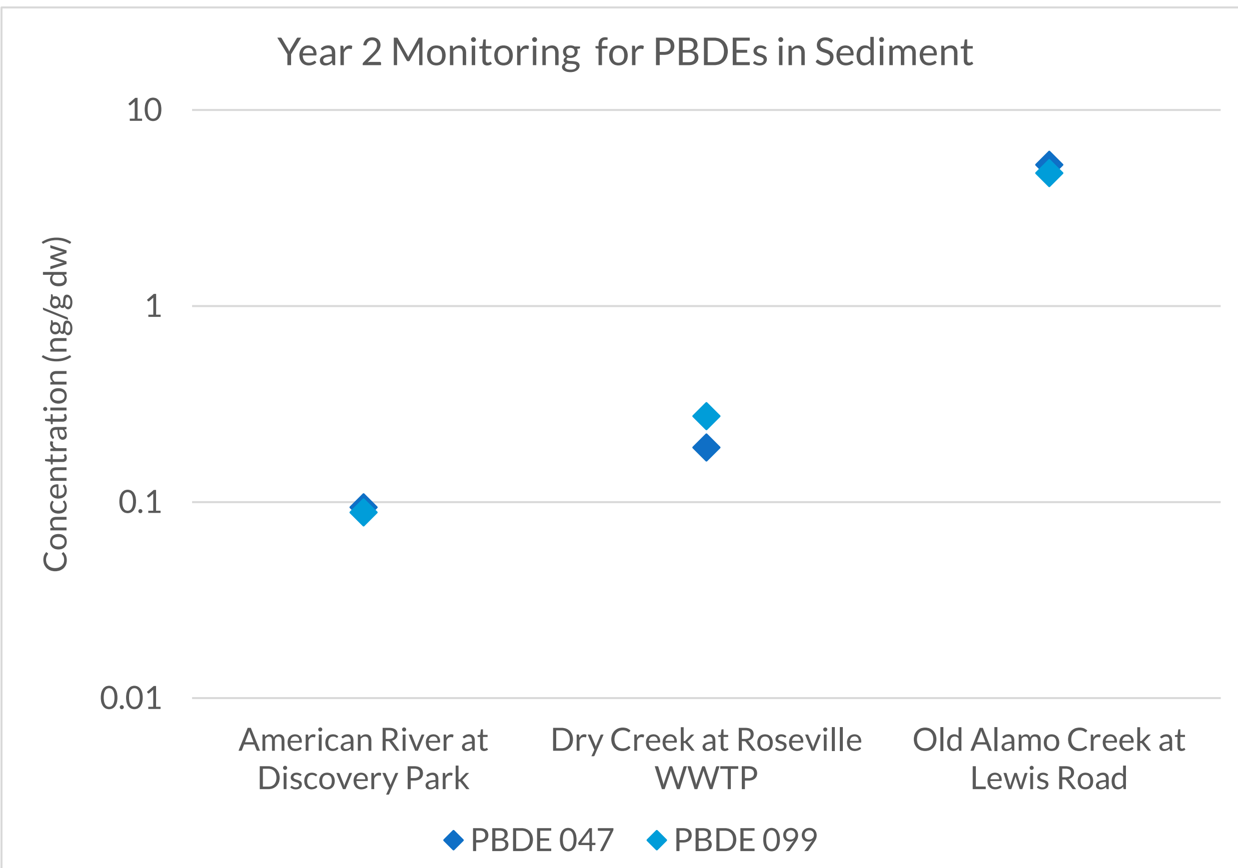
PBDEs in Sediment

Both required PBDEs were detected in all three sediment samples collected in Year 2 during Event 1. The two required PBDE congeners, PBDE 47 and PBDE 99, were detected at consistent concentrations at each site, with the lowest concentrations observed at the American River at Discovery Park and the highest at Old Alamo Creek at Lewis Road (**Table 30, Figure 6**) .

Table 30. PBDE concentrations in environmental samples (sediment, ng/g dw).

Station	Event	PBDE 047	PBDE 099
American River at Discovery Park	Event 1	0.0942	0.0885
Dry Creek at Roseville WWTP	Event 1	0.19	0.274
Old Alamo Creek at Lewis Road	Event 1	5.25	4.76

Figure 6. PBDE concentrations in environmental samples (sediment, ng/g dw).



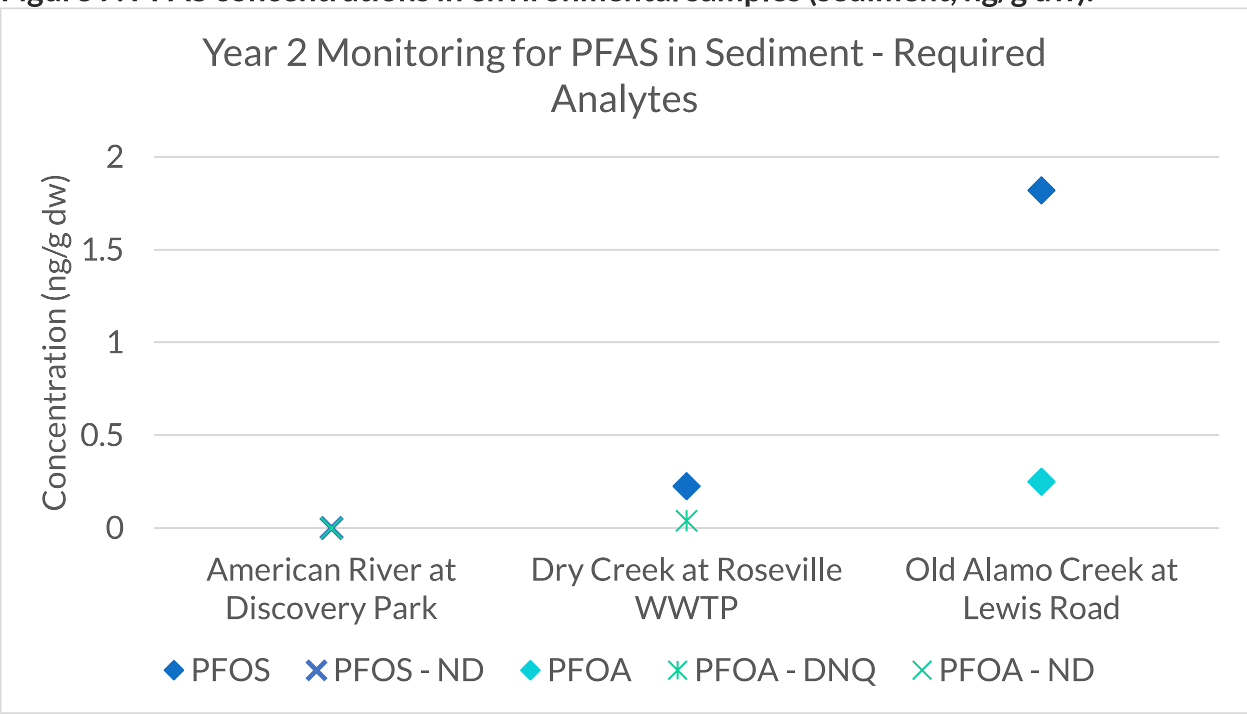
PFAS in Sediment

Neither PFOS nor PFOA were detected in sediment collected at American River at Discovery Park. PFOS was detected at higher concentrations than PFOA in sediment collected from the other two locations with the highest detection for PFOS at Old Alamo Creek at Lewis Road at 1.82 ng/g dw (**Table 31**, **Figure 7**).

Table 31. PFAS concentrations in environmental samples (sediment, ng/g dw).

Station	Event	PFOS	PFOA
American River at Discovery Park	Event 1	ND	ND
Dry Creek at Roseville WWTP	Event 1	0.226	0.039 (DNQ)
Old Alamo Creek at Lewis Road	Event 1	1.82	0.25

Figure 7. PFAS concentrations in environmental samples (sediment, ng/g dw).



Tissue Analysis Results

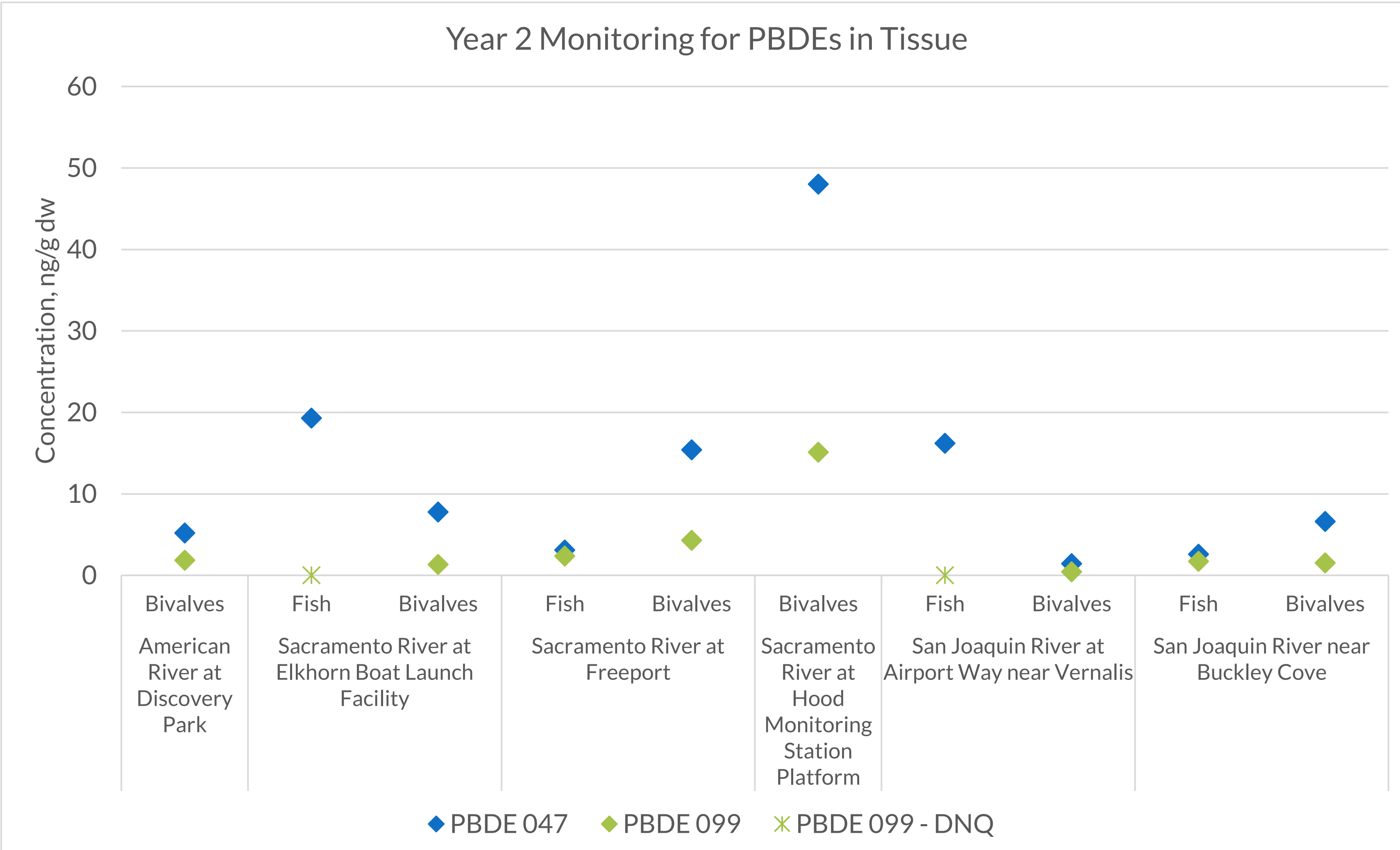
PBDEs in Fish and Bivalve Tissue

PBDEs were detected in all Year 2 tissue samples (both fish and bivalve tissue). PDBE 47 was consistently detected at a higher concentration than PBDE 099 in samples collected at the same site for both bivalves and fish tissue (**Table 32, Figure 8**).

Table 32. PBDE concentrations in environmental samples (fish and bivalve tissue, ng/g dw).

STATION	EVENT	ORGANISM GROUP	ORGANISM NAME	PBDE 047	PBDE 099
American River at Discovery Park	Event 1	Bivalves	Freshwater Clam	5.2	1.84
Sacramento River at Elkhorn Boat Launch Facility	Event 1	Fish	Sacramento Sucker	19.3	0.00515 (DNQ)
	Event 1	Bivalves	Freshwater Clam	7.77	1.31
Sacramento River at Freeport	Event 1	Fish	White Catfish	3.1	2.34
	Event 1	Bivalves	Freshwater Clam	15.4	4.29
Sacramento River at Hood Monitoring Station Platform	Event 1	Bivalves	Freshwater Clam	48	15.1
San Joaquin River at Airport Way near Vernalis	Event 1	Fish	Common Carp	16.2	0.00952 (DNQ)
	Event 1	Bivalves	Freshwater Clam	1.41	0.439
San Joaquin River near Buckley Cove	Event 1	Fish	White Catfish	2.59	1.72
	Event 1	Bivalves	Freshwater Clam	6.61	1.53

Figure 8. PBDE concentrations in environmental samples (fish and bivalve tissue, ng/g dw).



PFAS in Fish Tissue

PFOS was detected in all fish tissue samples whereas PFOA was non-detect in all four samples (**Table 33**).

Table 33. PFAS concentrations in environmental samples (fish tissue, ng/g dw).

Station	Event	Organism Group	Organism Name	PFOS	PFOA
Sacramento River at Elkhorn Boat Launch Facility	Event 1	Fish	Sacramento Sucker	1.64	ND
Sacramento River at Freeport	Event 1	Fish	White Catfish	0.705	ND
San Joaquin River at Airport Way near Vernalis	Event 1	Fish	Common Carp	4.31	ND
San Joaquin River near Buckley Cove	Event 1	Fish	White Catfish	8.25	ND

DATA AVAILABILITY

CEC Year 2 data will be published to CEDEN for ambient locations and can be accessed through the Advance Query Tool (https://ceden.waterboards.ca.gov/AdvancedQueryTool) under the project name "2021 Delta RMP Constituents of Emerging Concern" (21DRMP5CEC).

Table 34. CEC Year 2 station names and associated sample matrices available on CEDEN. Locations associated with CEDEN Project Code "21DRMP5CEC" will have data available on CEDEN.

Station Name	Station Code	Matrix	CEDEN Project Code
American River at Discovery Park	519AMNDVY	Water, Bivalves, Sediment	21DRMP5CEC
Dry Creek at Roseville WWTP	519DRYCRK	Water, Sediment	21DRMP5CEC
Old Alamo Creek at Lewis Road	511SOL011	Water, Sediment	21DRMP5CEC
POTW Source 1	519POTW01	Water	NA
POTW Source 2	511POTW02	Water	NA
Roseville Urban Runoff	519PGC010	Water	NA
Sacramento River at Elkhorn Boat Launch Facility	519SUT108	Water, Bivalves	21DRMP5CEC
Sacramento River at Freeport, CA-510ST1301	510ST1301	Water, Bivalves	21DRMP5CEC
Sacramento River at Hood Monitoring Station Platform	510SACC3A	Water, Bivalves	21DRMP5CEC
Sacramento River at Veterans Bridge-03SWSBIO-519ST1309	519ST1309	Fish	21DRMP5CEC
Sacramento River/Freeport-510ST1317	510ST1317	Fish	21DRMP5CEC

Station Name	Station Code	Matrix	CEDEN Project Code
Sacramento Urban Runoff 3; Sump 111	519SACUR3	Water	NA
San Joaquin R at Buckley Cove	544LSAC13	Fish	21DRMP5CEC
San Joaquin River at Airport Way near Vernalis	541SJC501	Water, Bivalves, Fish	21DRMP5CEC
San Joaquin River near Buckley Cove	544SJRNBC	Water, Bivalves	21DRMP5CEC

DEVIATIONS AND CORRECTIVE ACTIONS

Relevant DRMP QAPP deviation forms are outlined in and a summary for each are provided below. These forms have been drafted and are waiting on final reviews from the CVRWQCB staff and are included in **Appendix D**.

2021-01: Year 2 Clam Tissue Collection

On October 21, 2021, clams were collected at San Joaquin River at Airport Way near Vernalis during the late summer/early fall sampling Event 1. DRMP deviation form **2021-01** was initiated to document the potential for insufficient tissue for PBDE analysis for this site based on the number of clams found at the site. Field crews attempted for three hours to manually collect a sufficient number of organisms with an even distribution of various size classes; however, the final sample was made up of predominantly individuals in the smallest size classes. After the 11/15/2022 TAC Meeting, it was agreed that the Delta RMP would follow up with SGS-AXYS to ensure that the Delta RMP was informed within 5 business days of compositing and weighing the samples to communicate the amount of tissue available for analysis.

The clams were homogenized by SGS-AXYS on 06/08/2022 and the composited tissue amounts were reported to the CV RDC on June 14, 2022 prior to sample analysis. SGS-AXYS informed the Delta RMP that there were three composites that were below the desired 12 grams of wet weight tissue. The composite from San Joaquin River at Airport Way near Vernalis contained 3.77 grams, and, despite being collected according to the protocols outlined in the CEC QAPP v2 and the SAP, the composites for American River at Discovery Park and Sacramento River at Hood Monitoring Station Platform contained 6.58 grams and 9.05 grams, respectively. The final tissue masses and makeup of the sample composites as reported by the laboratory are provided in **Table 35** and **Figure 9**.

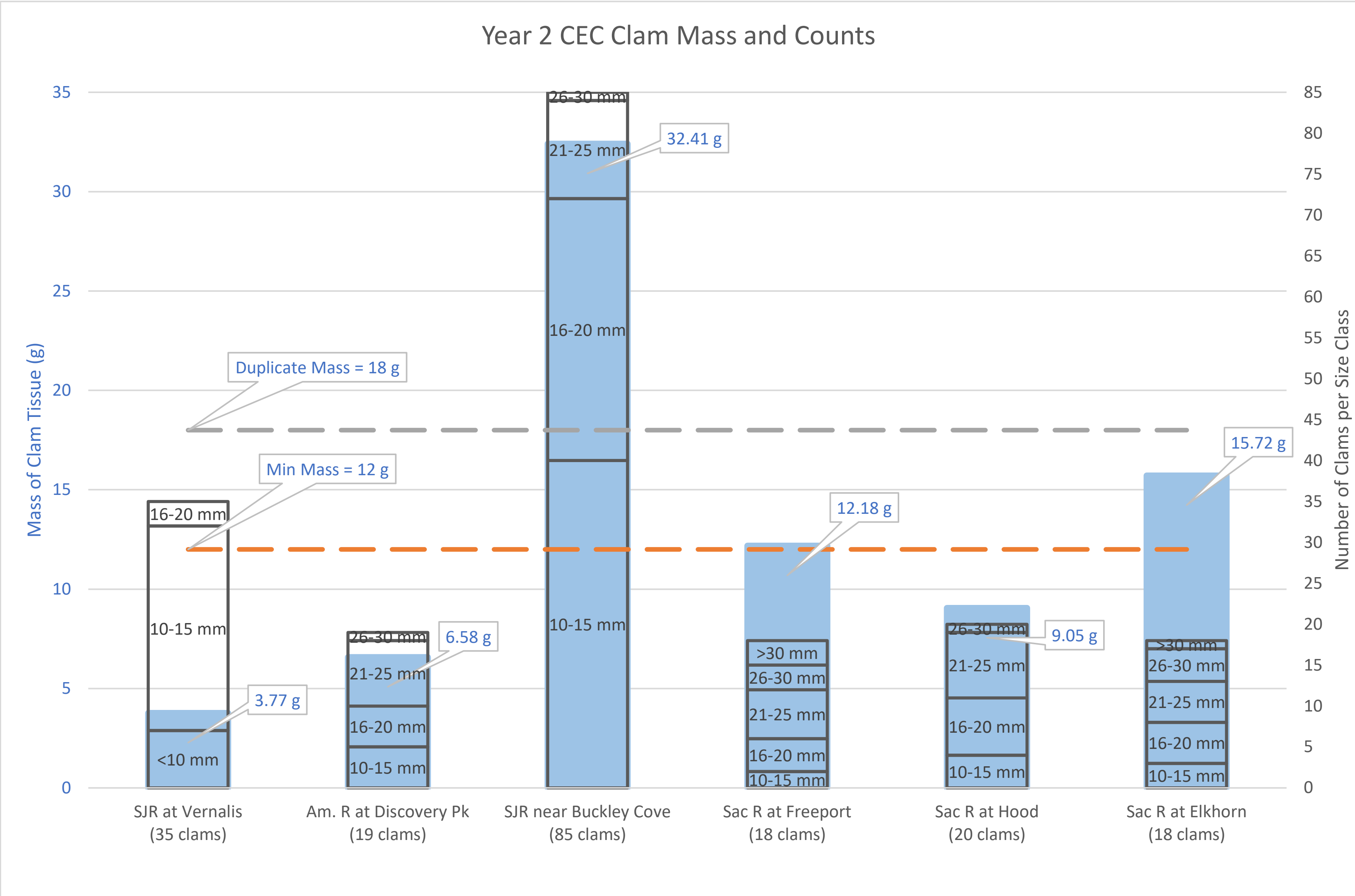
The laboratory was informed to proceed with analysis from all 6 sites on June 15, 2022. SGS-AXYS confirmed that the RLs would be higher in these three samples based on the amount of tissue available. The required PBDE constituents were detected in the quantifiable range for all bivalve samples, indicating that despite being raised from the original level, the RLs reported were of a sufficient resolution for the study goals.

Table 35. Bivalve composite sample masses and size class distributions of individual organisms for Year 2 CEC Monitoring.

The target minimum sample size is 12g for a single sample and 18g for a sample being used as a laboratory duplicate.

Station	Tissue Mass	Total Individuals	Clam Size Classes					
			<10 mm	10-15 mm	16-20 mm	21-25 mm	26-30 mm	>30 mm
San Joaquin River at Airport Way near Vernalis	3.77	35	7	25	3	--	--	--
American River at Discovery Park	6.58	19	--	5	5	8	1	--
San Joaquin River near Buckley Cove	32.41	85	--	40	32	12	--	--
Sacramento River at Freeport	12.18	18	--	2	4	6	3	3
Sacramento River at Hood Monitoring Station Platform	9.05	20	--	5	14	1	--	--
Sacramento River at Elkhorn Boat Launch	15.72	18	--	3	5	5	4	1

Figure 9. Bivalve composite sample masses and size class distributions of individual organisms for Year 2 CEC Monitoring.



2021-02: Buckley Cove Location Offset

On October 25, 2021 (Event 2), samplers collected water samples for CEC analysis from San Joaquin River at Buckley Cove approximately 350 meters downstream of target coordinates due to a locked gate preventing access to the target location. DRMP deviation form **2021-02** was initiated to document the location from which samples were collected and to outline procedures to prevent future sample collection location deviations. The CEC QAPP v2 indicates that samples must be collected within 100 meters of the target coordinate for any samples collected from the bank/shore. Despite being outside of the acceptable range specified in the QAPP, it is expected that the impact of sampling 350 meters downstream of the target location is minimal due to the size of the waterbody and the fact that no additional inputs are present between the target location and the Event 2 sampling location. The Year 2 Event 2 collection location was also similar to the Year 1 water collection location accessed by DWR.

Corrective actions for this deviation included adding a comment to the CV RDC identifying that the collection occurred 350 meters from target and specifying that field crews should contact the Program Manager and receive approval from the CVRWQCB QA Representative prior to attempting to sample outside of the acceptable distance from the target location. Nevertheless, due to continued sample collections from the secondary location, the CEC QAPP (v2) was amended later in the year to update the sampling location near Buckley Cove to the location from which samples were collected during Event 2 – see deviation **2021-06: Event 3 Field Sampling Deviations for 1 Site Offset and 2 O2 Saturation Not Reported** below for further discussion.

2021-03: TOC Missing Lab Duplicate Event 1 July

On September 8, 2021, Weck Laboratories informed the CV RDC that the analyst ran a LCSD for TOC in sediment instead of the unspiked laboratory duplicate that was requested and was required by the CEC QAPP v2. Sediment samples in this batch were collected by University of California -Granite Canyon on July 22, 2021 as part of the SPoT program and as a collaborator on this project. DRMP deviation form **2021-03** was initiated to document the missing QC samples and outline protocols to prevent similar deviations during the October sediment sampling event.

In response to this deviation, the associated TOC results were flagged as having incomplete QC (**Table 15**) and CV RDC staff followed up with Weck laboratory to clarify that the sediment samples that were scheduled to be collected in the upcoming October event would include an unspiked laboratory duplicate with the TOC analyses. Per this communication, all sediment TOC samples for the following event were successfully analyzed with all laboratory QC samples required by the CEC QAPP (v2).

2021-04: Missing Laboratory Duplicate for SSC Analysis

Weck informed the CV RDC on December 22, 2021 that given the constraints of the ASTM method and the procedure for preparing LCS samples, they were unable to generate a duplicate sample (e.g., an LCSD) that could be used to assess laboratory precision for the analysis of SSC for samples collected during Event 1 (October 20-21) and Event 2 (October 25-26). DRMP deviation form **2021-04** was initiated to document the missing laboratory QC and reasons for Weck being unable to generate a duplicate sample.

The situation was discussed with Selina Cole, the CVRWQCB QA Representative, and it was agreed that given the constraints of the analytical method and SWAMP guidance, an amendment to the CEC QAPP v2 should be submitted to revise the quality control requirements for SSC. An amendment to the QAPP was submitted for signatures on January 20, 2022.

2021-05: Weck MDLs and RL elevated for some Analytes

Weck Laboratories provided results for Event 1 (October 20-21) and Event 2 (October 25-26) on January 7 and 10, 2022, respectively. While performing data verification in February, CV RDC staff noted that the reported MDLs and one RL did not match the CEC QAPP v2. On February 14, 2022, CV RDC staff emailed Weck to verify that the limits were reported correctly. On February 28, 2022, the Weck Project Manager informed CV RDC staff that the MDLs had been updated during a recent MDL study and were reported correctly; the limits originally included in the CEC QAPP (v2) were no longer valid. In addition, the RL for triclosan was also elevated, which the laboratory indicated was an oversight that was not noticed during their review of the CEC QAPP v2. DRMP deviation form **2021-05** was initiated to document that seven MDLs and one RL were higher than what was approved in the CEC QAPP v2. A QAPP amendment was also created to update the MDLs and RLs in accordance with the laboratory capabilities; this amendment was finalized and submitted for signatures on June 2, 2022.

2021-06: Event 3 Field Sampling Deviations for 1 Site Offset and 2 O2 Saturation Not Reported

On March 28, 2022, the Delta RMP conducted sampling activities at San Joaquin River at Buckley Cove (Station Code 544LSAC13) for Event 3 (Wet Season 2) where two deviations occurred.

The first deviation that occurred was a sampling offset from the target coordinates at this location. Field crews collected samples from the incorrect location without contacting the Delta RMP Program Manager or receiving approval from the CVRWQCB QA Representative, as was agreed upon following the similar deviation that was identified following Event 2 (see **2021-02: Buckley Cove Location Offset**).

The second deviation that occurred during Event 3 consisted of sampling personnel not recording dissolved oxygen as percent saturation at two locations, San Joaquin River at Buckley Cove and San Joaquin River at Airport Way near Vernalis; dissolved oxygen as a concentration in mg/L was successfully collected and recorded at all sample locations. The omission of these results was identified when the data sheets were being reviewed and DRMP deviation form **2021-06** was initiated to document both deviations for Event 3.

A meeting occurred with Selina Cole and Melissa Turner on May 18, 2022 to discuss whether a new station code to reflect the location where water quality samples were collected for Event 2 and 3 and determine from which location samples should be collected during the subsequent Event 4. It was agreed that a new station code would be created, and the existing data will be updated to the new station code. An amendment to the CEC QAPP v2 was approved on June 8, 2022. To address the second deviation, MLJ confirmed, prior to the next sampling event, that all field measures listed in the QAPP would be reported from all field crews and instruments.

2021-08: Weck Event 3 Missed Resolution Reporting Timeline

During a conference call with Weck, the Delta RMP Program Manager (Melissa Turner), the Regional Board QA Representative (Selina Cole), the State Board QA Officer (Andrew Hamilton), and CV RDC data management staff (Lisa McCrink and Cassandra Lamerdin) on March 22, 2022, Weck agreed to update their reporting system to allow for the reporting of IDA standard results as percent recoveries. Due to these updates to the analysis and laboratory reporting system, PPCP results for the samples collected on March 28, 2022, for Event 3 were not provided until July 21, 2022, exceeding the 60-calendar day requirement for the Delta RMP to provide preliminary results according to R5-2021-0054 by 51 days. DRMP deviation form **2021-08** was initiated to document the missed reporting deadline. This deviation only affected the timing for when preliminary results were received; there were no hold time violations associated with these results. Event 4 data were reported within the 60-day timeframe and included the percent recoveries as requested. In addition, it was agreed that the CEC QAPP should be amended to clarify the requirement that IDA percent recoveries be reported with any results quantified using an isotopic dilution method. The QAPP amendment was submitted for signatures on May 27, 2022 and approved on June 2, 2022.

2021-09: CEC Year 2 Tissue RLs and Missing Lipids and Moisture Results

On September 2, 2022, the CV RDC reviewed the EDD for clams and fish sampled on October 2021 (received from SGS-AXYS on August 19, 2022) and identified three potential deviations:

- The RLs in the EDD were higher than the RLs the CEC QAPP v2.

- The lab did not complete the required laboratory duplicates for lipid and moisture in each batch. In addition,
  - Lipids could not be analyzed with the PFAS batch as required by the CEC QAPP v2, and,
  - Clams were not analyzed for lipids with the PBDE batch due to laboratory oversight.

DRMP deviation form **2021-09** has been drafted to document these deviations. With respect to the difference in method RLs, SGS-AXYS cited that these differences are due to a conversion issue specifically between dry weight (dw) units required by the CEC QAPP v2 and the wet weight (ww) units reported in the EDD. With respect to the moisture and lipid reporting, SGS-AXYS reported that for the PFAS batch, the method extraction technique does not allow for a lipid analysis, and it was incorrectly identified in the QAPP as an analyte to be analyzed by this method; however, lipids were analyzed with the PBDE batch for fish. It was laboratory oversight that a moisture split was not analyzed on one of the four composites in the PFAS batch. In the PBDE batch, the laboratory confirmed it was an oversight to not include lipid analysis for the clams in the batch, and a laboratory duplicate was not run on the fish that did have lipids reported. The data are flagged as missing the required QC. SGS-AXYS conducted additional analysis and reported lipids for the two clam samples with sufficient remaining tissue mass; results were reported on 10/14/2022. The two clam samples with enough remaining tissue to conduct the lipid analysis were collected from San Joaquin River Near Buckley Cove and Sacramento River at Elkhorn Boat Launch Facility on 10/21/2021. A laboratory duplicate has also been run as a part of the additional analysis in accordance with batch requirements outlined in the CEC QAPP v2. The laboratory reported two additional quality control results (a blank and a reference material) with this additional lipid analysis that were not required and for which no criteria exist in the QAPP. These results are reported with the results in the CV RDC but are not evaluated in this report.

Future QAPPs will include language clarifying discrepancies in RL values that occur when converting between wet and dry weight concentrations.

2021-10: CEC Year 2 Clam Laboratory Measurements

On September 7, 2022, CV RDC data management staff used the laboratory report to populate the bivalve composite EDD and noted a discrepancy with the clam widths recorded on the bench sheets during laboratory dissections prior to homogenization. The laboratory was contacted to verify if the measurements were taken according to the definition of shell length and width provided in the CEC QAPP v2. The original analyst who recorded the measurements was eventually contacted, who was able to confirm that the measurements were not taken in a manner consistent with the QAPP definitions.

Deviation form **2021-10** was drafted to document the incorrect measurements recorded by the laboratory. The values originally recorded as “width” were updated in the CV RDC to the length values. The values originally recorded as “length” were confirmed to be shell height (which is not required measurement for completing the bivalve composite information in the database); these values were added to the comment field as height measurements. The shell width field was not populated in the CV RDC as these values were not recorded.

Table 36. Referenced deviations from the Delta RMP CEC QAPP.

Deviation Number	Status	Deviation Date	Title	Description	Corrective Actions	Resolution
2021-01	Final	10/21/ 2022	Year 2 Clam Tissue Collection	Field crews could not collect the desired number and sizes of clams at San Joaquin River at Airport Way near Vernalis during Event 1, causing a potential for insufficient tissue for PBDE analysis.	AXYS to inform the DRMP Program Manager if there will be impacts on the analysis once it is known how much tissue is available.	Clam samples from three sites did not reach the 12g goal for a complete sample aliquot, resulting in raised RLs. All clam tissue samples reported PBDE detections in the quantifiable range, indicating that all RLs were at an appropriate resolution.
2021-02	Final	10/25/ 2021	Buckley Cove Location Offset	San Joaquin River at Buckley Cove was sampled approximately 350 meters downstream of target coordinates for Event 2.	Sampling crews were instructed to contact the Program Manager and obtain approval from the CVRWQCB QA Representative prior to collecting samples from non-target location.	Sample location issues persisted at Buckley Cove in the subsequent events (see deviation 2021-06); the site location was eventually updated in the QAPP.
2021-03	Final	9/8/ 2021	TOC Missing Lab Duplicate Event 1 July	Weck Laboratories informed CV RDC staff that the analyst ran an LCSD instead of an unspiked laboratory duplicate as requested and required by the CEC QAPP v2.	The analytical batch missing the lab duplicate will be flagged with a Lab Submission Code of QI and a Lab Batch Comment. Weck was reminded of the QC requirements for sediment TOC analysis.	All required laboratory QC samples (including an unspiked duplicate) were included with sediment TOC analysis associated with the subsequent sampling event.

Deviation Number	Status	Deviation Date	Title	Description	Corrective Actions	Resolution
2021-04	Final	12/21/2022	Missing Laboratory Duplicate for SSC Analysis	Weck informed CV RDC staff they were unable to generate an LCSD for the batches analyzed for SCC with the Events 1 and 2 samples.	Submit a deviation form to document missed QC sample and a QAPP amendment form to remove duplicate requirement.	An amendment to the CEC QAPP was submitted for signatures on 01/20/2022
2021-05	In Review	1/7/ 2022	Weck MDLs and RL elevated for some Analytes	CV RDC staff performing verification on PPCP results provided by Weck for Events 1 and 2 noted a discrepancy between the reported MDLs and RLs and the expected values in the CEC QAPP. Weck staff noted the values had been updated since QAPP approval.	Submit a QAPP Amendment to reflect update MDLs and RL.	An amendment to the CEC QAPP was submitted for signatures on 06/02/2022
2021-06	In Review	3/28/2022	Event 3 Field Sampling Deviations for 1 Site Offset and 2 O2 Saturation Not Reported	Samples for Event 3 were again collected offset from the target location at San Joaquin R at Buckley Cove. Also, sampling personnel did not record DO as % saturation at San Joaquin R at Buckley Cove and San Joaquin River at Airport Way near Vernalis.	The new CEC station code was updated to 544SJRNBC, San Joaquin River near Buckley Cove. MLJ will ensure, prior to next sampling event, that all field measures listed in the QAPP are able to be reported from all field crews and instruments.	An amendment to the CEC QAPP v2 was signed on June 8, 2022. All required field parameters were collected during Event 4.

Deviation Number	Status	Deviation Date	Title	Description	Corrective Actions	Resolution
2021-08	In Review	7/21/ 2022	Weck Event 3 Missed Resolution Reporting Timeline	Weck reported Event 3 results 51 days past the R5-2021-0054 deadline for providing preliminary data due to new IDA reporting formats causing reporting delays.	Amend the CEC QAPP (v2) to include language requiring IDAs be reported as percent recoveries with all isotope dilution analyses.	An amendment to the CEC QAPP was approved on 06/02/2022. Event 4 data were reported within the 60-day timeframe and included the percent recoveries as requested.
2021-09	Final	9/2/ 2022	CEC Year 2 Tissue RLs and Missing Lipids and Moisture Results	Tissue RLs were generated from wet weight and do not match the QAPP units of dry weight. The lab did not analyze for the correct frequency of duplicates in the PBDE lipid batch and clams did not have lipid reported.	Future QAPPs will include language to clarify the reporting limits for wet weight vs dry weight. Additional lipid analyses will be conducted on remaining tissue and- any batches missing lab duplicates will be flagged with QI.	The Delta RMP has received the results of the additional lipid analyses; all other data are reported as indicated.
2021-10	In Prep	9/7/2022	CEC Year 2 Clam Laboratory Measurements	Bivalve shell measurements taken by the laboratory were not recorded according to the definitions provided in the QAPP.	Clam measurements considered suspect were verified with SGS-AXYS.	The CV RDC was updated to have the correct length values; height was included in the comments field and no widths were reported.

REFERENCES

Anderson, Paul D., Nancy D. Denslow, Jörg E. Drewes, Adam W. Olivieri, Daniel Schlenk, Geoffrey I. Scott, and Shane A. Snyder. 2012. "Monitoring Strategies for Contaminants of Emerging Concern (CECs) in California's Aquatic Ecosystems: Recommendations of a Science Advisory Panel." Technical Report 692. Costa Mesa, CA: Southern California Coastal Water Research Project. https://www.waterboards.ca.gov/water_issues/programs/swamp/cec_aquatic/docs/cec_ecosystems_rpt.pdf

Larry Walker Associates. 2018. Central Valley Pilot Study for Monitoring Constituents of Emerging Concern (CECs) Work Plan. Larry Walker Associates, Davis, CA. https://deltarmp.org/Water%20Quality%20Monitoring/CECs/drmp_cec_pilot_study.pdf

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

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Appendix A. Field Reports for Year 2 Monitoring for Constituents of Emerging Concern

Event 1 – October 18, 20 and 21, 2021

AMS Field Report – Event 1 Water, Sediment, and Bivalve Tissue Samples

Field Report

Delta RMP CECs Year 2 Monitoring

Event 1 – Late Summer / Early Fall Season Water, Sediment, and Biota

November 10, 2021 Final

Submitted to:
MLJ Environmental
1480 Drew Ave Suite #130
Davis, CA 95618

Submitted by:
APPLIED marine SCIENCES
4749 Bennett Drive, Suite L
Livermore, CA 94551
925-373-7142

1. Introduction

This field report summarizes activities associated with implementation of the Delta Regional Monitoring Program (Delta RMP) Constituents of Emerging Concern (CEC) monitoring performed by the combined AMS, ICF, and MLJ team during the Year 2 implementation. This report covers dry season sampling conducted for the water quality, sediment quality, and bioaccumulation components. All sampling and analysis was conducted under the dictates of the Delta RMP CECs Pilot Project Quality Assurance Project Plan version 2 (QAPP, v2) [ASC 2021].

1.1. Objectives

The objectives of the sampling effort were as follows:

1. Collect water quality measurements (pH, temperature, dissolved oxygen, specific conductance, and turbidity) and ambient/outflow water samples from twelve sites for analysis of Galaxolide and Triclocarban by Physis, PFAS (PFOS, PFOA) by Vista Labs; hormones (estrone, estradiol), pharmaceuticals (Ibuprofen, Diclofenac, Triclosan, Bisphenol A), and SSC by Weck Labs.
2. Collect depositional sediment samples from two sites for analysis of PBDEs (PBDE 047, PBDE 099, and moisture) and PFAS (PFOS, PFOA, and moisture) by SGS Axys and TOC by Weck.
3. Collect a minimum mass of the clam, *Corbicula fluminea*, from six sites for analysis of PBDEs (PBDE 047, PBDE 099, moisture, and lipids) by SGS Axys.

1.2. Sampling Sites

Collection information for Event 1 sampling sites is summarized in Table 1.

Table 1. Sampling Activities for Delta RMP CECs Year 2 Monitoring Event 1, Dry Season Late Summer / Early Fall, October 2021

Station Code	Sample Date	Actual Latitude	Actual Longitude	Depth (m)	Water	Sed	Biota
519SUT108	10/21/21	38.67208	-121.62501	5.2	x		x
510ST1301	10/21/21	38.45541	-121.50193	8.0	x		x
510SACC3A	10/21/21	38.36774	-121.52122	8.0	x		x
519AMNDVY	10/21/21	38.60083	-121.50458	3.4	x		x
541SJC501	10/20/21	37.67571	-121.26490	1	x		x
544LSAC13	10/21/21	37.97124	-121.37426	12.9	x		x
519DRYCRK	10/20/21	38.7342	-121.31444	1.5	x	x	
511SOL011	10/21/21	38.34649	-121.89686	0.5	x	x	
519POTW01	10/20/21	38.73404	-121.32186	1	x		
519POTW02	10/21/21	38.34660	-121.90160	0.8	x		
519SACUR3	10/20/21	38.60127	-121.49299	0.5	x		
519PGC010	10/20/21	38.80474	-121.32738	0.1	x		

1.3. Sampling Event Selection

Initial sampling was conducted as part of a two-day event during the dry season, and with the goal of achieving at least 48 hours of antecedent dry weather. The sampling event was scheduled at the tail end of the expected dry season, allowing sufficient time to compile staffing and complete training, secure sampling materials and equipment, and finalize the Project QAPP. A small amount of rainfall was recorded in the project vicinity over the 48-hr period covering October 20 and 21, 2021[1]: 0.07" at the Sacramento International Airport and 0.02" at the Stockton Airport. There was no measurable rainfall prior to initiation of sampling, nor was there observable flow into the channels from stormwater sources.

1.4. Sampling Procedures

Sampling sites 519SUT108, 510ST1301, 510SACC3A, 519AMNDVY, and 544LSAC13 were sampled midchannel via a vessel operated by ICF. All other sampling locations were sampled from land. Per the field Sampling and Analysis Plan (SAP), stations with multiple sampling media, water quality collections were completed first, followed by water quality measurements, then sediment or biota collections.

In most cases, collections were completed in accordance with the project SAP (AMS 2021) and QAPP (ASC 2021). At most biota stations, a sufficient number of clams were collected to support all analyses. After retrieval of the clam dredge, all *Corbicula fluminea* were placed into a metal bucket for sorting (e.g., Figure 1). At stations where a large number of clams were collected (i.e., several hundred), sampling personnel selected a manageable subsample of live specimens for measurement and processing.

The sole deviation from protocol occurred at site 541SJC501, where field staff were unable to collect the desired number of clams or specimens of sufficient size. At this location, clam collections were conducted manually using rakes and shovels in lieu of the dredge dragged behind a vessel due to shallow water depth and a lack of nearby vessel launch facilities. Three field staff attempted collections for approximately 3 hours and found a low abundance of clams, of mostly smaller size classes (10-15 mm), resulting in an estimated 5 g of tissue sample mass. Some prioritization of laboratory analyses may be required for samples collected at this location. A deviation form will be created to document this situation.

For future efforts at this location, AMS will attempt to construct handheld dredges using rake heads and net/basket combinations. However, due to the small size of clams observed at this location and unknown density, it is unknown if this step will increase the collected tissue mass.

Clam collections easily achieved laboratory minimum requirements at all other locations and typically included a broader range of sizes (Table 2).

[1] Reported via Weather Underground, for Sacramento (https://www.wunderground.com/history/daily/us/ca/sacramento/KSMF) and Stockton (https://www.wunderground.com/history/daily/us/ca/stockton/KSCK), downloaded October 28th, 2021.

Figure 1. ***Corbicula fluminea*** **harvested at 519SUT108.**

Table 2. Dry Season Clam Composite Make-up by Station

		Shell Length (mm)					
Station	**Total #**	**<10**	**10-15**	**16-20 m**	**21-25**	**26-30**	**>30mm**
541SJC501	25	1	21	3			
544LSAC13	20		5	6	6	3	
519AMNDVY	20		6	6	8		
519SUT108	20		4	4	3	8	1
510ST1301	20		3	5	6	4	2
510SACC3A	20		4	5	10	1	

1.5. Sample Handling

All samples were delivered to MLJ Environmental at the conclusion of sampling efforts under standard Chain of Custody protocols. All water quality and sediment samples were stored on double-bagged wet ice from time of collection until delivery. All clam samples were individually wrapped in aluminum foil, compiled in a zip-top bag, and kept frozen on dry ice until time of delivery.

1.6. Quality Assurance

QA samples collected for this event are described below, by media:

Water Quality – Field blank, field duplicate, and MS/MSD samples were collected at site 511SOL011.

Sediment Quality – Field duplicate samples were collected at site 511SOL011.

Biota – There are no requirements for field blanks or duplicates, but an additional volume of clams was included within the composite for site 519AMNDVY to support additional lab analyses as required.

2. References

AMS 2021. *Sampling and Analysis Plan for the Delta RMP CECs Pilot Study*. Prepared for MLJ Environmental. August 10, 2021.

Aquatic Science Center, 2021. *Quality Assurance Project Plan for the Pilot Study of Constituents of Emerging Concern in the Sacramento – San Joaquin Delta, Version 2*. Prepared by the Aquatic Science Center, updated by MLJ Environmental. October 2021.

MPSL-DFW Cruise Report – Event 1 Fish Tissue Samples

Appendix 1

Cruise Report for the Delta Regional Monitoring Program (Delta RMP) Pilot Study Work Plan Monitoring For Constituents of Emerging Concern

Year 2 FY21/22

Sampling Dates: October 18, 2021 – October 20, 2021

Prepared by Marine Pollution Studies Laboratory Staff (MPSL-DFW)
at Moss Landing Marine Laboratories; San Jose State University

Introduction

This report describes the sampling activities in the Delta region of California as the second of three years in the Pilot Study Work Plan for Constituents of Emerging Concern (CEC) monitoring. This sampling effort focuses on preliminary monitoring of targeted CECs in fish tissue in the Delta. Results from this study will evaluate and identify potentially problematic CECs, which can then be targeted in future studies and monitoring efforts. Sampling activities included the collection of fish tissue (benthivorous species) and basic field parameters. Samples were collected by Marine Pollution Studies Laboratory (MPSL-DFW) at Moss Landing Marine Laboratories (MLML).

1.0 Cruise Report

1.1 Objectives

The objectives were to collect Benthivorous fish at four (4) selected stations. The target was to collect five (5) individuals at each station and composite into a single sample for analysis. The fish in each composite were to be within 75% of the total length of each other.

1.2 MPSL Sampling personnel

Wesley Heim	Project Director
Chris Beebe	Research Technician
Scot Lucas	Research Technician

1.3 Authorization to collect samples

All sampling personnel are MPSL staff (San Jose State University Foundation) contracted through MLJ Environmental to conduct the sample collection activities listed herein.

1.4 Station selection

Based upon the recommendations of the Delta RMP Steering Committee and Technical Advisory Committee with representatives from the Central Valley Regional Water Quality Control Board, State Water Resources Control Board (State Water Board), the Central Valley Clean Water Association (CVCWA) and several Central Valley Municipal Separate Storm Sewer System (MS4) representatives, stations were selected at entry points into the Delta, in-Delta waters, and ambient locations in the vicinity of POTW discharges and within the influence from urban runoff. When applicable, existing sampling stations and efforts were utilized to minimize project costs.

1.5 Summary of types of samples authorized to be collected

Up to five (5) benthivorous fish of the same species were collected using an electofisher boat for each of the four (4) stations. Upon collection, each fish was tagged with a unique ID that corresponded to the location it was collected. Physical parameters were collected for each individual fish, which included: weight, total length, fork length, and presence of any abnormalities. Fish samples were stored on ice until returned to the laboratory. Large fish were partially dissected in the field using the following protocol: fish were placed on a cutting board covered with a clean plastic bag where the head, tail, and guts were removed using a clean (laboratory detergent, DI) cleaver. The sex of the fish was noted. The fish were then wrapped in tin foil, with the dull side inward, and double-bagged in zipper-closure bags with other fish from the same location. All equipment was re-cleaned between stations.

At the laboratory, samples were stored in a freezer until they were processed for authorized dissection and analysis.

Basic station information (station depth, location, weather, hydromodifications and habitat) were noted. All collections and sample processing for fish followed the Delta RMP QAPP, version 2 (approved October 11, 2021).

1.6 Results

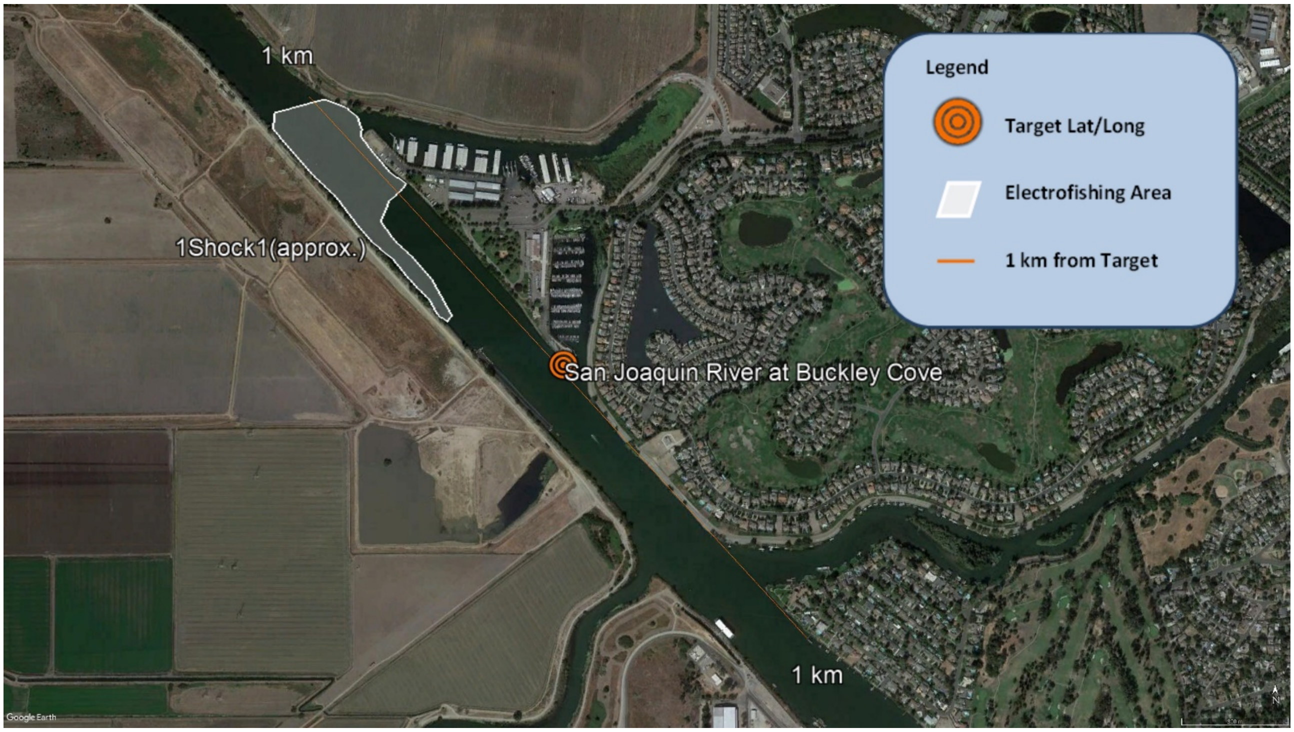
A detailed fish catch, fish total length, descriptions and maps of sample collection for all stations can be found below. Table 1 indicates on which page collection details for each station can be found.

Table 1. Delta RMP CEC Pilot Study Collection Sites 2021

Station Code	Station Name	Page Number
544LSAC13	San Joaquin River at Buckley Cove	5
519ST1309	Sacramento River at Veterans Bridge	6
510ST1317	Sacramento River at Freeport	7
541SJC501	San Joaquin River at Vernalis/Airport	8

San Joaquin River at Buckley Cove (544LSAC13)

Latitude: 37.971833
Longitude: -121.373619
Collection Method: Electroshock
Date(s) of Fish Collection: 10/18/21
Samplers: Chris Beebe, Scot Lucas



White Catfish, TL (mm)				
210	239	230	250	264
234	221	260	270	305

Comments: The sampling vessel was launched from Buckley Cove Park in Stockton, CA. Due to the size of Catfish seen an additional 5 Catfish were collected to ensure enough tissue for analysis.

Back to Table 1

Sacramento River at Veterans Bridge (519ST1309)

Latitude: 38.674679
Longitude: -121.62751
Collection Method: Electroshock
Date(s) of Fish Collection: 10/18/21
Samplers: Chris Beebe, Scot Lucas

Sacramento Sucker, TL (mm)				
381	466	483	478	469

Comments: The sampling vessel was launched from the Elkhorn Boat Launch Facility in Sacramento, CA. Five (5) Sacramento suckers were sampled along the transect adjacent to the target station.

Back to Table 1

Sacramento River at Freeport (510ST1317)

Latitude: 38.45556
Longitude: -121.50189
Collection Method: Electroshock
Date(s) of Fish Collection: 10/18/2021
Samplers: Chris Beebe, Scot Lucas

White Catfish, TL (mm)				
310	320	372	355	339

Sacramento Sucker, TL (mm)	
382	435

Comments: The sampling vessel was launched from Garcia-Bend Park in Sacramento, CA. Five (5) White Catfish were sampled along the transect adjacent to the target station. An additional two (2) Sacramento Suckers were collected within the sampling reach.

Back to Table 1

San Joaquin River at Vernalis/Airport (541SJC501)

Latitude: 37.67556
Longitude: -121.26417
Collection Method: Electroshock, Cast Net
Date(s) of Fish Collection: 10/19/21, 10/20/21
Samplers: Chris Beebe, Scot Lucas

Common Carp, TL (mm)				
718	655	549	584	561

Comments: Due to low water levels samplers initially attempted to sample using gill nets but were unsuccessful. Returning the following day, a small electrofishing vessel was launched along the bank. Five (5) Common Carp were sampled along the bank adjacent to the target station.

Back to Table 1

1.7 Discussion

A total of four (4) stations were successfully sampled for fish tissue using a large dedicated electrofishing vessel as well as a smaller vessel outfitted with electrofishing equipment.

Event 2 – October 25 and 26, 2021

AMS Field Report – Event 2 Water Samples

Field Report

Delta RMP CECs Year 2 Monitoring

Event 2 – Wet Season Water (1 of 2)

November 10, 2021 Final

Submitted to:
MLJ Environmental
1480 Drew Ave Suite #130
Davis, CA 95618

Submitted by:
APPLIED marine SCIENCES
4749 Bennett Drive, Suite L
Livermore, CA 94551
925-373-7142

1. Introduction

This field report summarizes activities associated with implementation of the Delta Regional Monitoring Program (Delta RMP) Constituents of Emerging Concern (CEC) monitoring performed by the combined AMS, ICF, and MLJ team during the Year 2 implementation. This report covers first flush, wet season sampling conducted for the water quality component. All sampling and analysis was conducted under the dictates of the Delta RMP CECs Pilot Project Quality Assurance Project Plan version 2 (QAPP, v2) [ASC 2021].

1.1. Objectives

The objectives of the sampling effort were as follows:

1. Collect water quality measurements (pH, temperature, dissolved oxygen, specific conductance, and turbidity) and ambient / outflow water samples from twelve sites for analysis of Galaxolide and Triclocarban by Physis, PFAS (PFOS, PFOA) by Vista Labs; hormones (estrone, estradiol), pharmaceuticals (Ibuprofen, Diclofenac, Triclosan, Bisphenol A), and SSC by Weck Labs.

1.2. Sampling Sites

Collection information for Event 1 sampling sites is summarized in in Table 1.

Table 1. Sampling Activities for Delta RMP CECs Year 2 Monitoring Event 2, Wet Season Water Event 1 of 2, October 2021

Station Code	Sample Date	Actual Latitude	Actual Longitude	Depth (m)	Water	Sed	Biota
519SUT108	10/26/21	38.67177	-121.62465	7.6	x		
510ST1301	10/26/21	38.45541	-121.50195	9.6	x		
510SACC3A	10/26/21	38.36729	-121.52130	9.2	x		
519AMNDVY	10/26/21	38.60080	-121.50475	5.2	x		
541SJC501	10/25/21	37.67565	-121.26484	1	x		
544LSAC13	10/25/21	37.97417	-121.37601	1	x		
519DRYCRK	10/26/21	38.73423	-121.31445	NR	x		
511SOL011	10/25/21	38.34649	-121.89685	1	x		
519POTW01	10/26/21	38.73405	-121.32187	NR	x		
519POTW02	10/25/21	38.34658	-121.90162	1.5	x		
519SACUR3	10/25/21	38.60130	-121.49298	2	x		
519PGC010	10/25/21	38.80470	-121.32730	0.5	x		

1.3. Sampling Event Selection

Initial sampling was conducted as part of a two-day event associated with the first major rainfall of the season. The storm event was the result of an atmospheric river that produced over 4.5 inches of rainfall at the Sacramento International Airport and over 3.5 inches at the Stockton Airport between 9pm on Saturday, October 23 and 8am on Monday, October 25, 2021.[1,2] Other locations around the sampling area reported even higher precipitation levels (Figure 1).

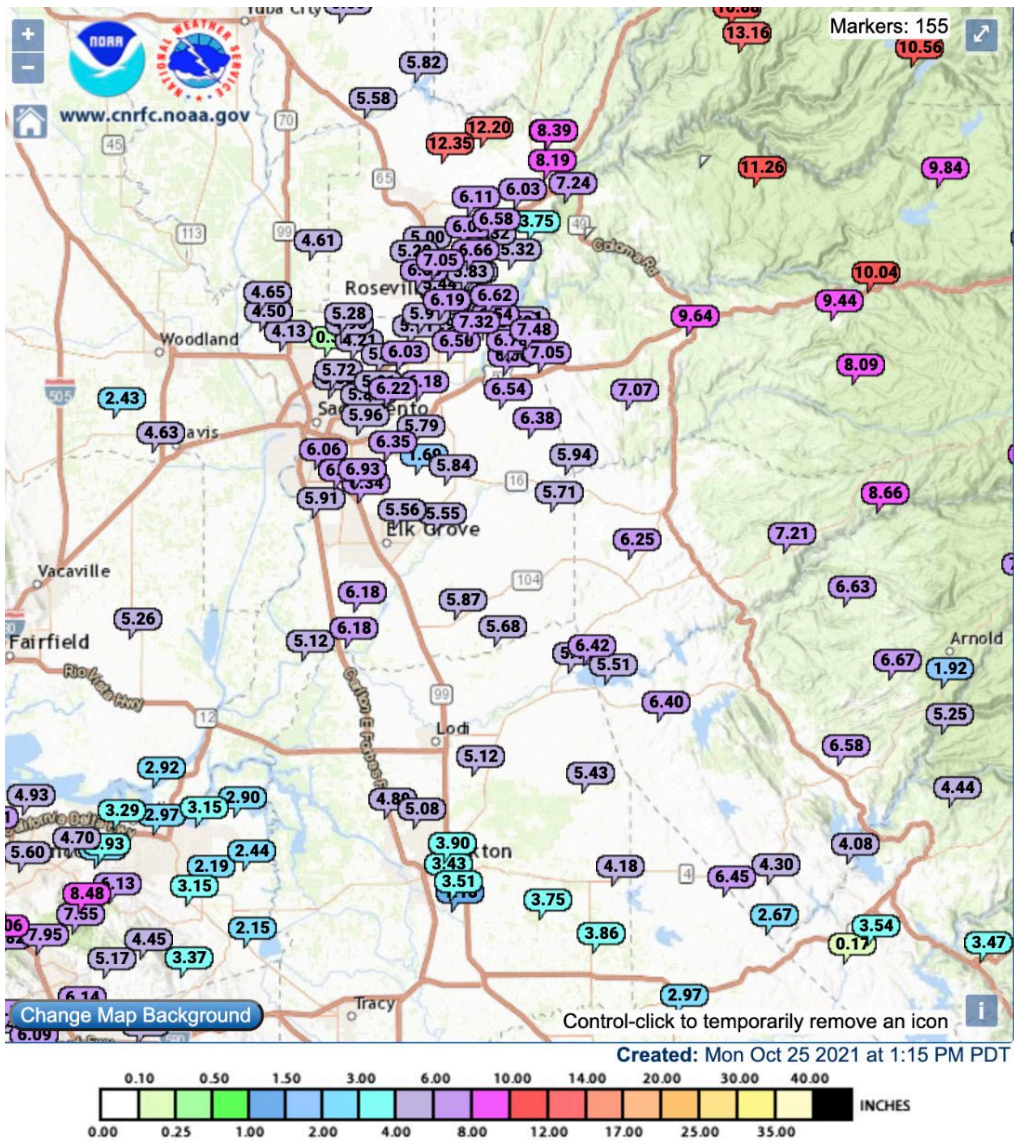


Figure 1. Observed 48-hr Precipitation Levels Reported by NOAA California Nevada River Forecast Center for the period ending 13:00 on October 25, 2021.

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[1] Reported via Weather Underground, for Sacramento Airport (https://www.wunderground.com/history/daily/us/ca/sacramento/KSMF) downloaded October 28th, 2021.

[2] Reported via Weather Underground, for Stockton Airport (https://www.wunderground.com/history/daily/us/ca/stockton/KSCK), downloaded October 28th, 2021.

1.4. Sampling Procedures

Sites 519SUT108, 510ST1301, 510SACC3A, 519AMNDVY, and 544LSAC13 were sampled midchannel via an ICF operated vessel. All other sampling locations were accessed from land.

In general, all collections were completed in accordance with the project SAP (AMS 2021) and QAPP (ASC 2021). All sampling was conducted on October 25 and 26, 2021 (Table 1). The identified goals of the QAPP to sample the rising hydrograph and complete collections within 12 hours of last rainfall intensity of 0.1" per hour were not possible at all locations due to daylight restrictions and flooding that precluded vessel launch and created unsafe driving conditions.

In the Sacramento area, predicted afternoon thunderstorms and wind gusts above 30 knots cancelled vessel-based sampling on October 25, 2021. Additionally, flooding in the Roseville POTW prevented field staff from accessing sites 519DRYCRK and 519POTW01 on October 25, 2021; these two sites were sampled by MLJ staff on October 26, 2021.

All vessel-based sampling was completed on October 26, 2021. Field staff noted large numbers of downed trees, vegetation, trash, and other hazards floating downriver (e.g., Figure 1), but daylight conditions allowed vessel operator to avoid major hazards and complete sampling safely.

Figure 2. A partially submerged log on the Sacramento River.

Flow measurements as reported at USGS sampling station 11447650 near Freeport, California are shown in Figure 3. Pre-storm flow remained below 15,000 cfs before the rainfall. During sampling operations, flow rates ranged from 18,700 to 31,300 cfs on October 25, 2021 and 31,500 to 37,900 cfs on October 26, 2021. Elevated flow conditions continued throughout the duration of the sampling event and peaked several days after cessation of major rainfall (39,400 cfs on October 27, 2021 at 3:30 am).

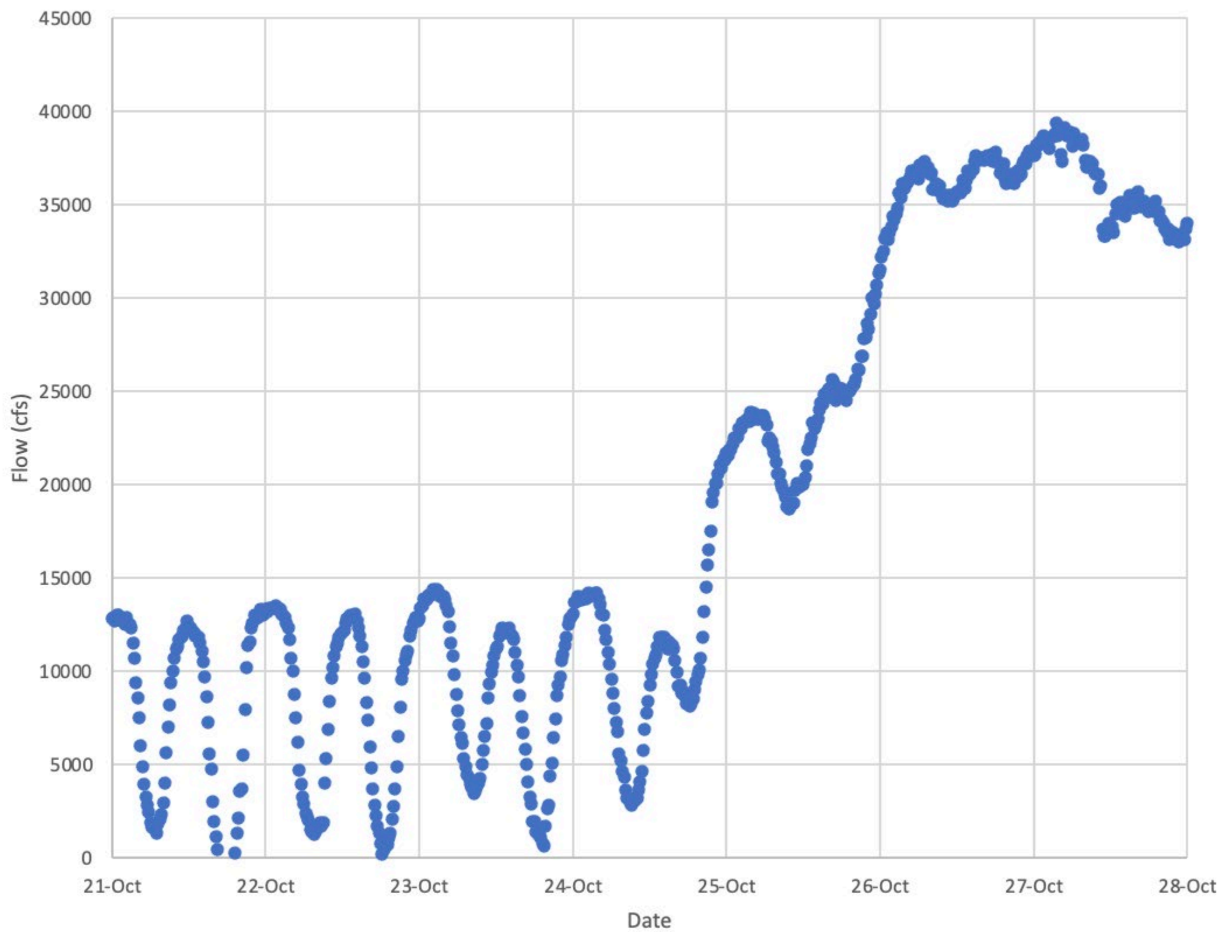


Figure 3. Flow measurements recorded at USGS Station 11447650 near Freeport, California.

A slight variation from protocol occurred at site 544LSAC13. The associated marina was temporarily closed, and field staff were unable to sample at the target coordinates. After discussion with Project staff, sampling personnel identified a nearby publicly accessible sampling location, approximately 325 m from the target coordinates (Figure 4). It was determined that this location was appropriate for collecting the sample due to issues with accessing the marina; there were not any additional inputs or influences between the actual sample location and the target sample location. A deviation form will be created to document this situation.

In addition to high wet season flows, field staff noted several instances of active discharges into the creek that were not present during the dry weather sampling. In some cases, outflow had observable negative effects (e.g., foam observed in Figure 5).

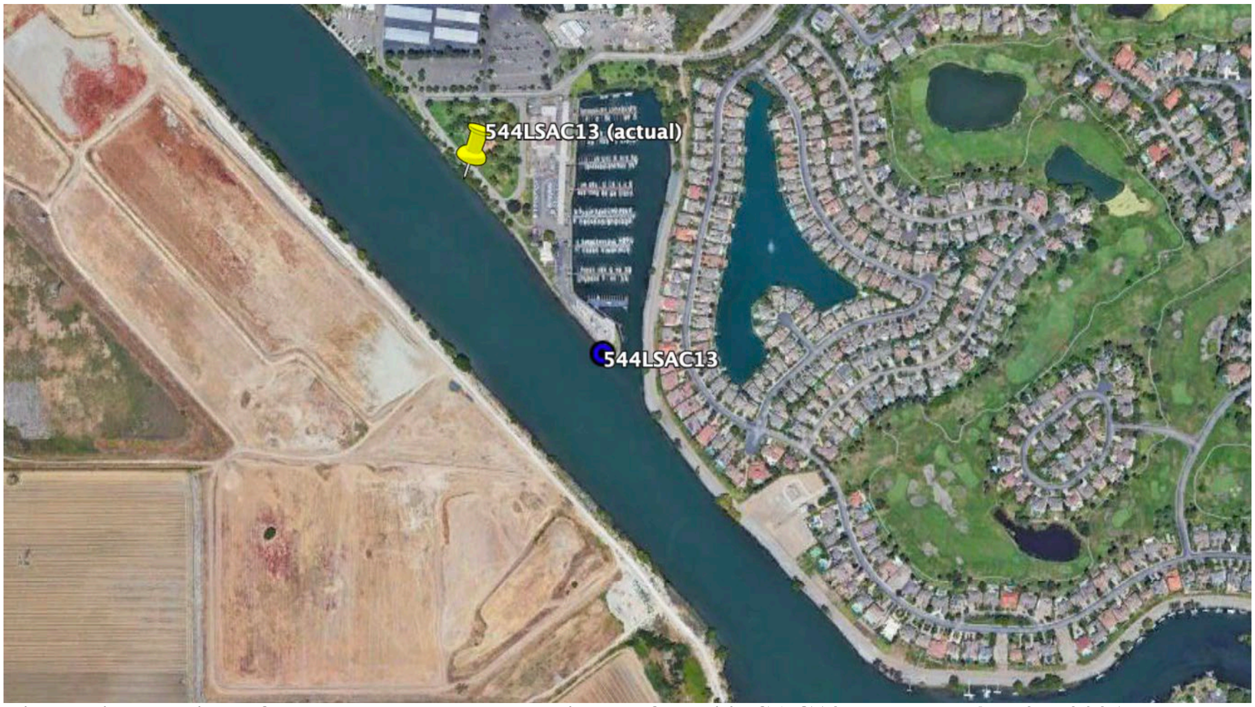


Figure 4. Location of target and actual coordinates for 544LSAC13, sampled Oct 25, 2021.

Figure 5. Foam emanating from outfall downstream of 519SUT108.

1.5. Sample Handling

All samples were delivered to MLJ Environmental under standard Chain of Custody protocols. All water quality samples were stored on double-bagged wet ice from time of collection until delivery.

1.6. Quality Assurance

QA samples collected for this event are described below, by media:

Water Quality – Field blank, field duplicate, and MS/MSD samples were collected at site 519DRYCRK.

2. References

AMS 2021. *Sampling and Analysis Plan for the Delta RMP CECs Pilot Study*. Prepared for MLJ Environmental. August 10, 2021.

Aquatic Science Center, 2021. *Quality Assurance Project Plan for the Pilot Study of Constituents of Emerging Concern in the Sacramento – San Joaquin Delta, Version 2*. Prepared by the Aquatic Science Center, updated by MLJ Environmental. October 2021.

Event 3 – March 28, 2022

AMS Field Report – Event 3 Water Samples

Field Report

Delta RMP CECs Year 2 Monitoring

Event 2 – Wet Season Water (2 of 2)

March 31, 2022 Draft

Submitted to:

MLJ Environmental
1480 Drew Ave Suite #130
Davis, CA 95618

Submitted by:

APPLIED marine SCIENCES
4749 Bennett Drive, Suite L
Livermore, CA 94551
925-373-7142

1. Introduction

This field report summarizes activities associated with implementation of the Delta Regional Monitoring Program (Delta RMP) Constituents of Emerging Concern (CEC) monitoring performed by the combined AMS, ICF, and MLJ team during the Year 2 implementation. This report covers the second of two wet season sampling events conducted for the water quality component. All monitoring was conducted under the dictates of the Delta RMP CECs Pilot Project Quality Assurance Project Plan version 2 (QAPP, v2) [ASC 2021].

1.1. Objectives

The objectives of the sampling effort were as follows:

1. Collect water quality measurements (pH, temperature, dissolved oxygen, specific conductance, and turbidity) and ambient / outflow water samples from twelve sites for analysis of Galaxolide and Triclocarban by Physis, PFAS (PFOS, PFOA) by Vista Labs; hormones (estrone, estradiol), pharmaceuticals (Ibuprofen, Diclofenac, Triclosan, Bisphenol A), and SSC by Weck Labs.

1.2. Sampling Sites

Collection information for Event 1 sampling sites is summarized in in Table 1.

Table 1. Sampling Activities for Delta RMP CECs Year 2 Monitoring Event 4, Wet Season Water Event 2 of 2, March 2022.

Station Code	Sample Date	Actual Latitude	Actual Longitude	Depth (m)	Water	Sed	Biota
519SUT108	3/28/22	38.67173	-121.62488	4.5	x		
510ST1301	3/28/22	38.45552	-121.50189	8.5	x		
510SACC3A	3/28/22	38.36715	-121.52088	8.9	x		
519AMNDVY	3/28/22	38.60085	-121.50462	2.0	x		
541SJC501	3/28/22	37.67539	-121.26468	0.5	x		
544LSAC13	3/28/22	37.97420	-121.37600	1	x		
519DRYCRK	3/28/22	38.73422	-121.31445	NR	x		
511SOL011	3/28/22	38.34642	-121.89709	1.5	x		
519POTW01	3/28/22	38.73401	-121.32188	NR	x		
511POTW02	3/28/22	38.34666	-121.90160	1	x		
519SACUR3	3/28/22	38.60122	-121.49307	NR	x		
519PGC010	3/28/22	38.80475	-121.32735	NR	x		

1.3. Sampling Event Selection

Sampling was conducted associated with a late season storm event that produced approximately 1.2 inches of rainfall at the Sacramento International Airport and approximately 0.7 inches at the Stockton Airport between 10pm on Sunday, March 27 and 6pm on Monday, March 28.[1,2] Other locations in the vicinity of Sacramento reported significantly higher precipitation levels (Figure 1). Monitoring activities were staggered over the course of the day, as well as geographically, so rainfall totals experienced will vary by station.

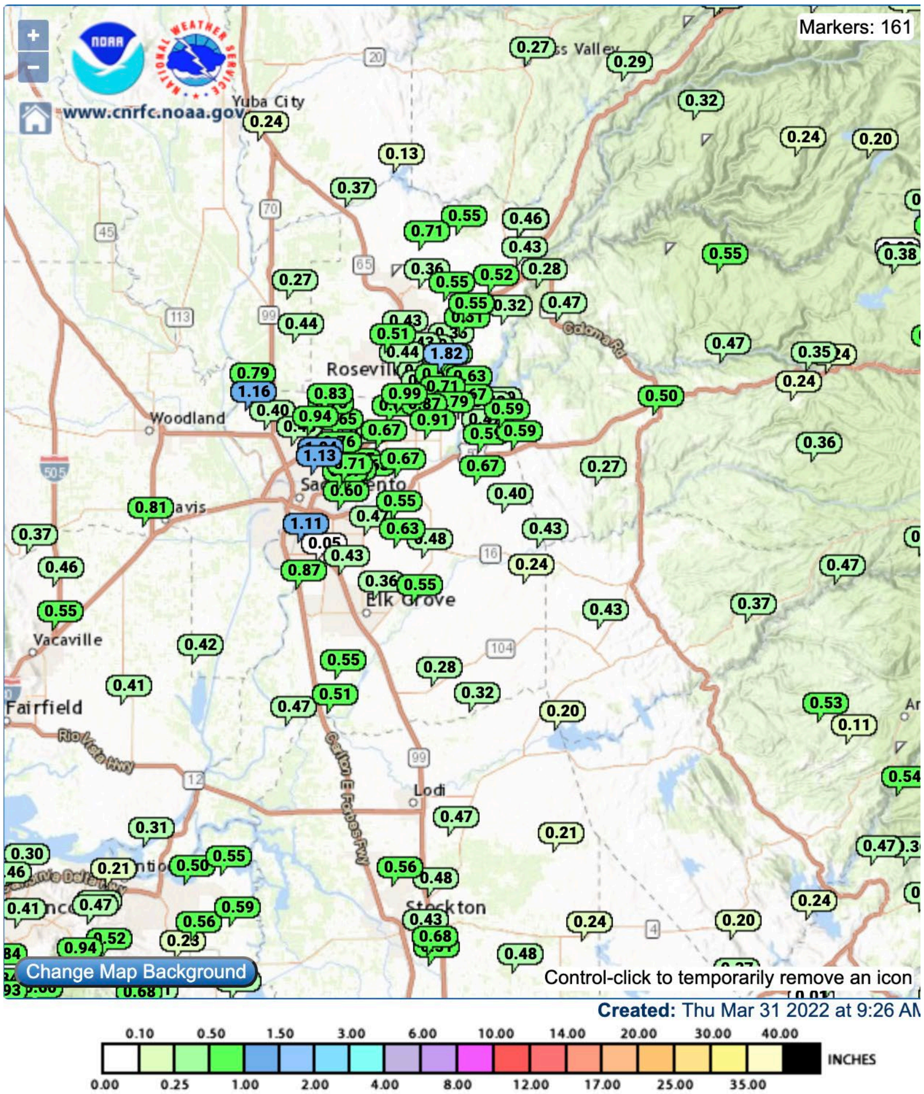


Figure 1-1. Observed Precipitation Levels Reported by NOAA California Nevada River Forecast Center for the March 27 through March 28 storm event.

[1] Reported via Weather Underground, for Sacramento Airport (https://www.wunderground.com/history/daily/us/ca/sacramento/KSMF) downloaded March 31st, 2022.

[2] Reported via Weather Underground, for Stockton Airport (https://www.wunderground.com/history/daily/us/ca/stockton/KSCK), downloaded March 31st, 2022.

1.4. Sampling Procedures

The late March storm event represented the first significant rainfall of the calendar year (Figure 1-2). The previous storm event that exceeded the 0.25" planning target occurred in late December 2021, indicating over 90 days of antecedent dry condition prior to the sampling event.

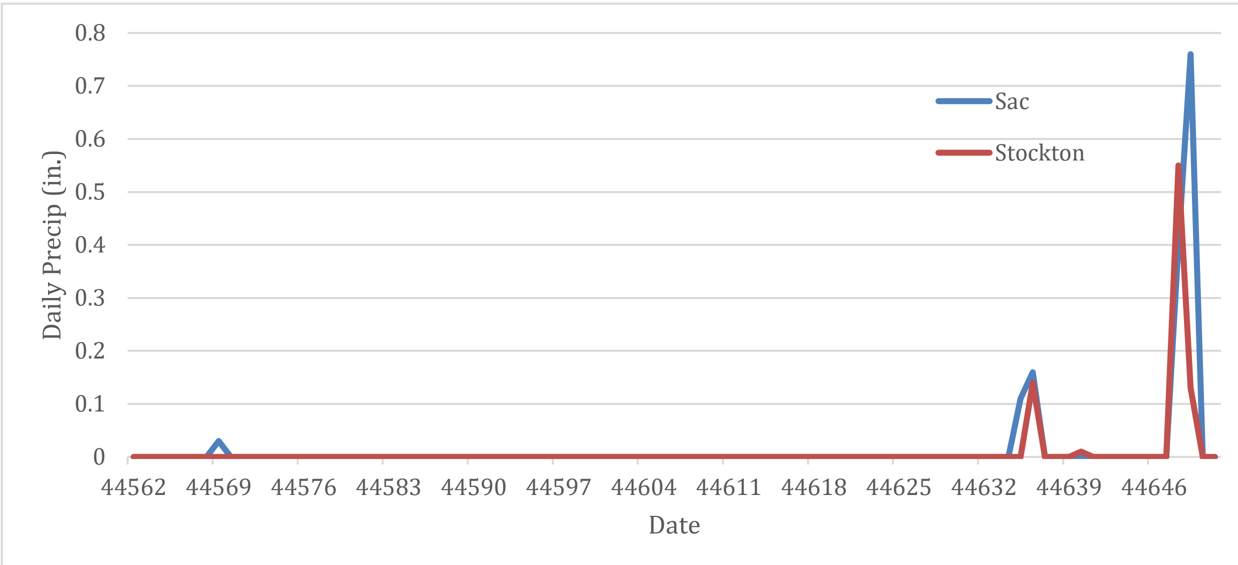


Figure 1-2. Daily precipitation measurements recorded at Sacramento and Stockton airports, January 1, 2022 – March 31, 2022.

The sampling achieved the QAPP sampling trigger of a minimum 0.25" rainfall at targeted precipitation gauges. Land-based collections were scheduled earlier in the day as peak runoff was expected to more closely follow onset of precipitation in the smaller drainage areas. Vessel-based sampling was initiated several hours after start of land-based efforts to allow for runoff to have more time to reach the downstream receiving waters. All sampling was scheduled to allow completion within daylight hours.

In general, all collections were completed in accordance with the project SAP (AMS 2021) and QAPP (ASC 2021). All sampling was conducted on March 28, 2022 (Table 1). Sites 519SUT108, 519AMNDVY, 510ST1301, 510SACC3A were sampled midchannel via an ICF operated vessel. All other sampling locations were accessed from land.

Flow measurements as reported at USGS sampling station 11447650 near Freeport, California, are shown in Figure 1-3. Unlike the first flush event, a large difference in discharge between pre-storm and intra- and post-storm discharge was not easily observable, with patterns following typical diurnal patterns associated with tidal influence. Daily peak discharge results, coinciding with maximum ebb tides, ranged in the 14,000 to 14,500 cfs range before the rainfall. Discharge rates peaked at 15,400 during the peak ebb flow on March 28th and returned to pre-storm condition approximately 1 day later.

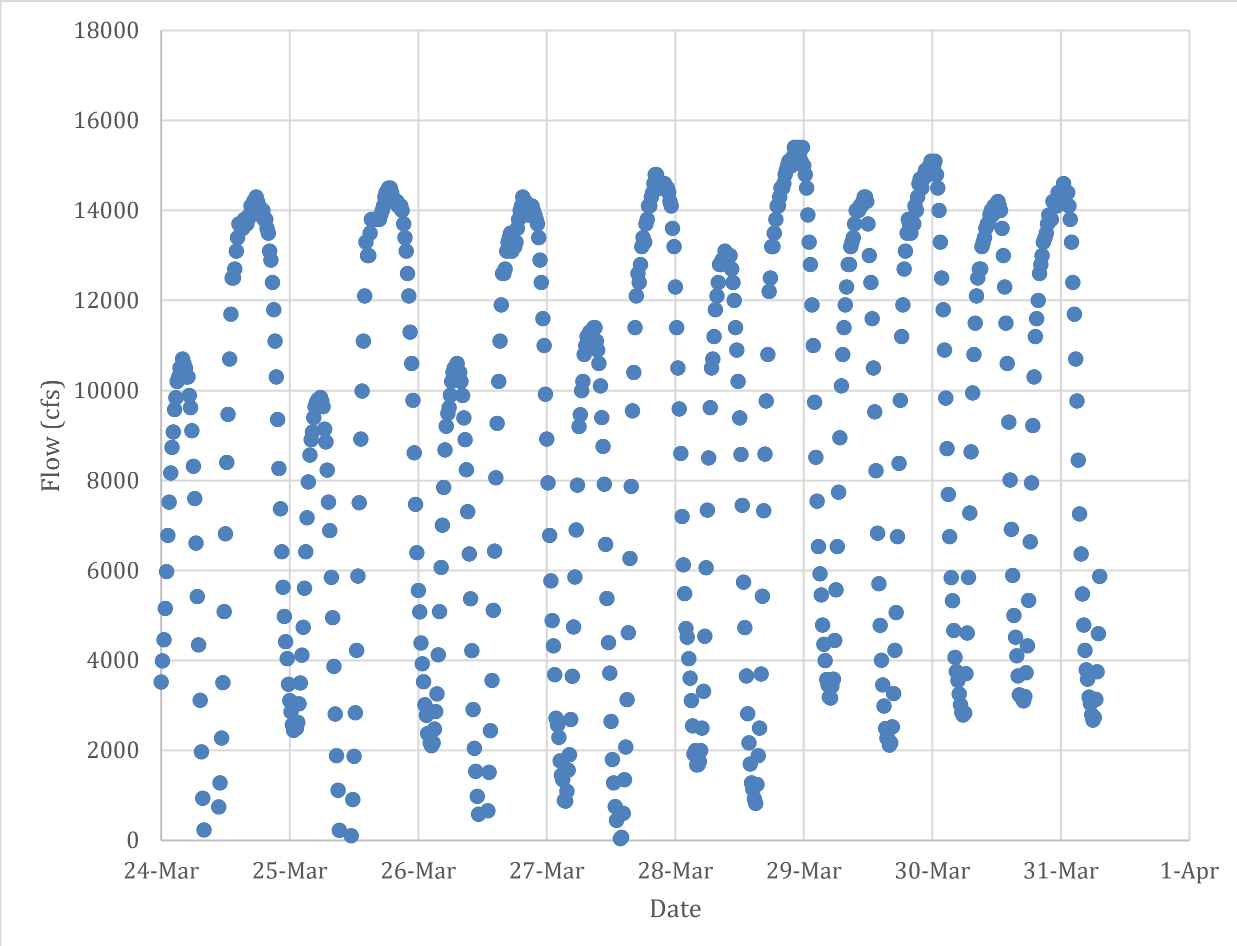


Figure 1-3. Flow measurements recorded at USGS Station 11447650 near Freeport, California.

There were two deviations identified for this event. First, as was the case for prior wet season monitoring conducted at the target sampling site near Buckley Cove (site 544LSAC13), closure of the marina adjacent to the sampling site precluded sample collection at the target coordinates. Samples were again collected at a publicly-accessible location nearby and upstream of the target coordinates. Second, sampling personnel did not record dissolved oxygen percent saturation at two locations, 544LSAC13 and 541SJC501.

1.5. Sample Handling

All samples were delivered to MLJ Environmental under standard Chain of Custody protocols. All water quality samples were stored on double-bagged wet ice from time of collection until delivery.

1.6. Quality Assurance

QA samples collected for this event are described below, by media:

Water Quality – Field blank, field duplicate, and MS/MSD samples were collected at site 510SUT108.

2. References

AMS 2021. *Sampling and Analysis Plan for the Delta RMP CECs Pilot Study*. Prepared for MLJ Environmental. August 10, 2021.

Aquatic Science Center, 2021. *Quality Assurance Project Plan for the Pilot Study of Constituents of Emerging Concern in the Sacramento – San Joaquin Delta, Version 2*. Prepared by the Aquatic Science Center, updated by MLJ Environmental. October 2021.

Event 4 – June 8, 2022

AMS Field Report – Event 4 Water Samples

Field Report

Delta RMP CECs Year 2 Monitoring

Event 4 – Dry Season Water

June 10, 2022

Submitted to:
MLJ Environmental
1480 Drew Ave Suite #130
Davis, CA 95618

Submitted by:
APPLIED marine SCIENCES
4749 Bennett Drive, Suite L
Livermore, CA 94551
925-373-7142

1. Introduction

This field report summarizes activities associated with implementation of the Delta Regional Monitoring Program (Delta RMP) Constituents of Emerging Concern (CEC) monitoring performed by the combined AMS, ICF, and MLJ team during the Year 2 implementation. This report covers the dry season sampling event conducted for the water quality component. All monitoring was conducted under the dictates of the Delta RMP CECs Pilot Project Quality Assurance Project Plan version 2 (QAPP, v2) [ASC 2021].

1.1. Objectives

The objectives of the sampling effort were as follows:

1. Collect water quality measurements (pH, temperature, dissolved oxygen, specific conductance, and turbidity) and ambient / outflow water samples from twelve sites for analysis of Galaxolide and Triclocarban by Physis, PFAS (PFOS, PFOA) by Vista Labs; hormones (estrone, estradiol), pharmaceuticals (Ibuprofen, Diclofenac, Triclosan, Bisphenol A), and SSC by Weck Labs.

1.2. Sampling Sites

Collection information for Event 1 sampling sites is summarized in in Table 1.

Table 1. Sampling Activities for Delta RMP CECs Year 2 Monitoring Event 4, Dry Season Water Quality, June 2022.

Station Code	Sample Date	Actual Latitude	Actual Longitude	Depth (m)	Water	Sed	Biota
519SUT108	6/8/22	38.67191	-121.62515	5.2	x		
510ST1301	6/8/22	38.45545	-121.50199	8	x		
510SACC3A	6/8/22	38.36769	-121.52079	9	x		
519AMNDVY	6/8/22	38.60102	-121.50454	2.7	x		
541SJC501	6/8/22	37.67542	-121.26462	0.75	x		
544SJRNBC*	6/8/22	37.97419	-121.37608	5	x		
519DRYCRK	6/8/22	38.73423	-121.31441	NR	x		
511SOL011	6/8/22	38.34649	-121.89687	NR	x		
519POTW01	6/8/22	38.73403	-121.32181	NR	x		
511POTW02	6/8/22	38.34662	-121.90157	NR	x		
519SACUR3	6/8/22	38.60130	-121.49297	NR	x		
519PGC010	6/8/22	38.80474	-121.32733	NR	x		

*Updated from 544LSAC13 based on CEC QAPP Amendment May 27, 2022.

1.3. Sampling Event Selection

Sampling was targeted for a date with an antecedent dry condition of a mnimum of 48 hours (ASC 2021). The previous rainfall occurred the morning of June 5, 2022, with total precipitation for the date reported as 0.1" at the Sacramento Airport.[1]

1.4. Sampling Procedures

All collections were completed in accordance with the project SAP (AMS 2021) and QAPP (ASC 2021). All sampling was conducted on June 8, 2022. Sites 519SUT108, 519AMNDVY, 510ST1301, 510SACC3A were sampled midchannel via an ICF operated vessel. All other sampling locations were accessed from land.

Flow measurements as reported at USGS sampling station 11447650[2] near Freeport, California, are shown in Figure 1-1. Hydrographs throughout the five-day period including and preceding the sampling event appear generally consistent and typical of the tidally-influenced flow regime here. All samples for this monitoring event were collected on the morning ebb to slack tide.

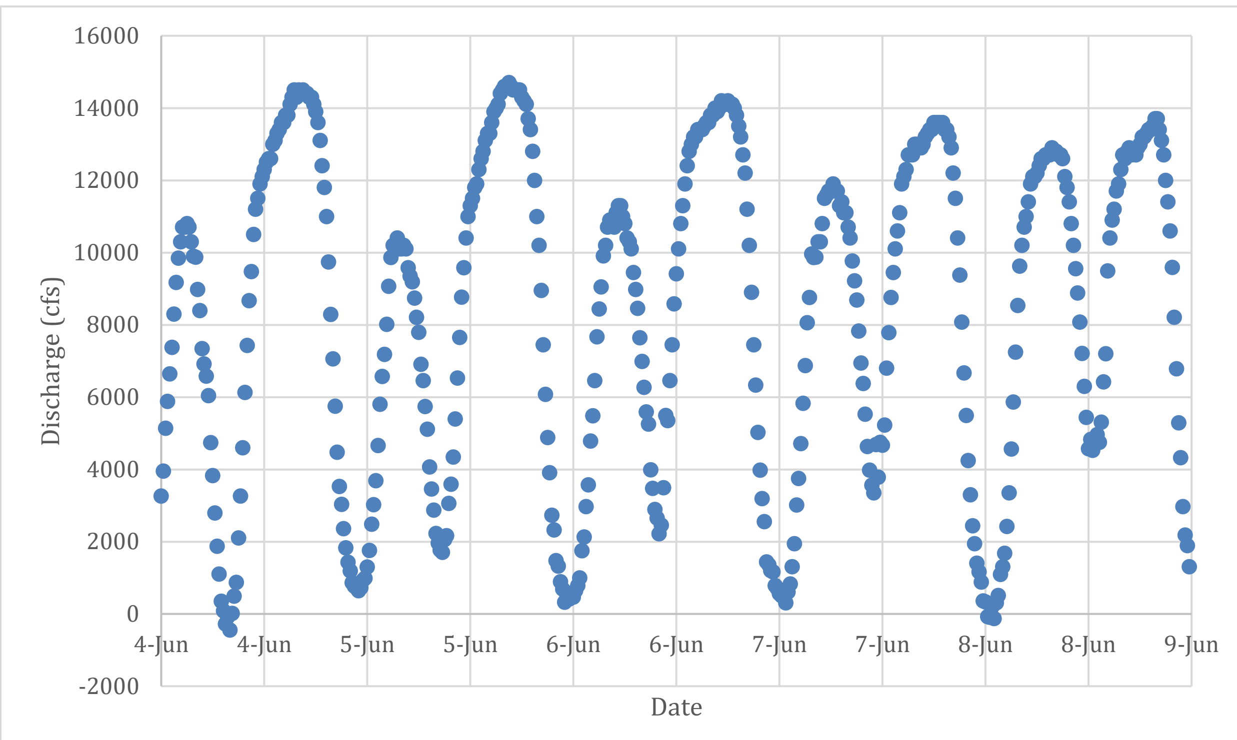


Figure 1-1. Flow measurements recorded at USGS Station 11447650 near Freeport, California.

[1] Weather Underground, https://www.wunderground.com/history/daily/us/ca/sacramento/KSMF, accessed 6/9/2022.

[2] USGS, https://waterdata.usgs.gov/usa/nwis/uv?site_no=11447650, accessed 6/9/2022.

There were no deviations identified for this event. However, there is one change to site naming convention that was discussed but not incorporated in advance of monitoring. As was the case for the prior two wet season monitoring events conducted from shore, sampling personnel collected samples from a nearby location due to limited access at target coordinates for the Buckley Cove listed in CEDEN (site 544LSAC13). Prior to initiation of sampling for Event 4, the decision was made to transition to the nearby location and assign a new ID (544SJRNBC, San Joaquin River near Buckley Cove). However, the modification was not approved in time for monitoring and the prior site identification was used again in the field for this event. If the modification is approved in time, the new site name may be used for other data management and reporting functions associated with this event.

1.5. Sample Handling

All samples were delivered to MLJ Environmental under standard Chain of Custody protocols. All water quality samples were stored on double-bagged wet ice from time of collection until delivery.

1.6. Quality Assurance

QA samples collected for this event are described below, by media:

Water Quality – Field blank, field duplicate, and MS/MSD samples were collected at site 541SJC501.

2. References

AMS 2021. *Sampling and Analysis Plan for the Delta RMP CECs Pilot Study*. Prepared for MLJ Environmental. August 10, 2021.

Aquatic Science Center, 2021. *Quality Assurance Project Plan for the Pilot Study of Constituents of Emerging Concern in the Sacramento – San Joaquin Delta, Version 2*. Prepared by the Aquatic Science Center, updated by MLJ Environmental. October 2021.

Appendix B. List of all CEC Analytes Reported for Year 2 Monitoring

Constituents of Emerging Concern Analytes Reported

Table B.1. Year 2 Delta RMP constituents of emerging concern.
Required analytes according to the Delta RMP CEC Pilot Study are indicated in bold.

Analyte Category	Analyte	Analyte Type	Analyte Alias	Agency	Method	Matrix	Unit
PBDEs	**PBDE 047**	**Required**	**--**	**SGS-AXYS**	**AXYS MLA-033 Rev 06**	**Sediment, Tissue**	**ng/g dw**
PBDEs	**PBDE 099**	**Required**	**--**	**SGS-AXYS**	**AXYS MLA-033 Rev 06**	**Sediment, Tissue**	**ng/g dw**
PBDEs	PBDE 028/33	Additional	--	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue	ng/g dw
PBDEs	PBDE 100	Additional	--	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue	ng/g dw
PBDEs	PBDE 153	Additional	--	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue	ng/g dw
PBDEs	PBDE 154	Additional	--	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue	ng/g dw
PBDEs	PBDE 183	Additional	--	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue	ng/g dw
PBDEs	PBDE 209	Additional	--	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue	ng/g dw
PBDEs	Lipid	Ancillary	--	SGS-AXYS	AXYS MLA-033 Rev 06	Tissue	% ww
PBDEs	Moisture	Ancillary	--	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue	% ww
PFAS	**Perfluorooctanoic acid**	**Required**	**PFOA**	**Vista**	**EPA 537M**	**Water**	**ng/L**
PFAS	**Perfluorooctanesulfonic acid**	**Required**	**PFOS**	**Vista**	**EPA 537M**	**Water**	**ng/L**
PFAS	**Perfluorooctanesulfonate**	**Required**	**PFOS**	**SGS-AXYS**	**SGS AXYS MLA-110 Rev 02**	**Sediment, Tissue**	**ng/g dw**

Analyte Category	Analyte	Analyte Type	Analyte Alias	Agency	Method	Matrix	Unit
PFAS	**Perfluorooctanoate**	**Required**	**PFOA**	**SGS-AXYS**	**SGS AXYS MLA-110 Rev 02**	**Sediment, Tissue**	**ng/g dw**
PFAS	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	Additional	11Cl-PF3OUdS	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	Additional	9Cl-PF3ONS	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Dioxa-3H-Perfluorononanoate Acid, 4,8-	Additional	ADONA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	Additional	EtFOSAA, N-	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Ethyl-perfluorooctanesulfonamide, N-	Additional	EtFOSA, N-	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Ethyl-perfluorooctanesulfonamido ethanol, N-	Additional	EtFOSE, N-	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Fluorotelomer Carboxylic Acid, 3:3-	Additional	3:3 FTCA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Fluorotelomer Carboxylic Acid, 5:3-	Additional	5:3 FTCA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Fluorotelomer Carboxylic Acid, 7:3-	Additional	7:3 FTCA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Fluorotelomer Sulfonate, 4:2-	Additional	4:2 FTS	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Fluorotelomer Sulfonate, 6:2-	Additional	6:2 FTS	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw

Analyte Category	Analyte	Analyte Type	Analyte Alias	Agency	Method	Matrix	Unit
PFAS	Fluorotelomer Sulfonate, 8:2-	Additional	8:2 FTS	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	Additional	MeFOSAA, N	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Methyl-perfluorooctanesulfonamide, N-	Additional	MeFOSA, N-	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Methyl-perfluorooctanesulfonamido ethanol, N-	Additional	MeFOSE, N-	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluoro(2-ethoxyethane)sulfonic acid	Additional	PFEESA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluoro-2-Propoxypropanoic Acid	Additional	HFPO-DA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluoro-3,6-dioxaheptanoate	Additional	NFDHA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluoro-3-methoxypropanoate	Additional	PFMPA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluoro-4-methoxybutanoate	Additional	PFMBA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluorobutanesulfonate	Additional	PFBS	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluorobutanoate	Additional	PFBA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluorodecanesulfonate	Additional	PFDS	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluorodecanoate	Additional	PFDA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw

Analyte Category	Analyte	Analyte Type	Analyte Alias	Agency	Method	Matrix	Unit
PFAS	Perfluorododecanesulfonate	Additional	PFDoS	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluorododecanoate	Additional	PFDoA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluoroheptanesulfonate	Additional	PFHpS	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluoroheptanoate	Additional	PFHpA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluorohexanesulfonate	Additional	PFHxS	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluorohexanoate	Additional	PFHxA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluorononanesulfonate	Additional	PFNS	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluorononanoate	Additional	PFNA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluorooctanesulfonamide	Additional	PFOSA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluoropentanesulfonate	Additional	PFPeS	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluoropentanoate	Additional	PFPeA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluorotetradecanoate	Additional	PFTrDA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluorotridecanoate	Additional	PFTrDA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw
PFAS	Perfluoroundecanoate	Additional	PFUnA	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	ng/g dw

Analyte Category	Analyte	Analyte Type	Analyte Alias	Agency	Method	Matrix	Unit
PFAS	Lipid	Ancillary	--	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Tissue	% ww
PFAS	Moisture	Ancillary	--	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue	% ww
PPCPs-Hormones	**Estradiol, 17beta-**	**Required**	**--**	**Weck**	**EPA 1694M**	**Water**	**ng/L**
PPCPs-Hormones	**Estrone**	**Required**	**--**	**Weck**	**EPA 1694M**	**Water**	**ng/L**
PPCPs-Pharma	**Bisphenol A**	**Required**	**--**	**Weck**	**EPA 1694M**	**Water**	**ng/L**
PPCPs-Pharma	**Diclofenac**	**Required**	**--**	**Weck**	**EPA 1694M**	**Water**	**ng/L**
PPCPs-Pharma	**Ibuprofen**	**Required**	**--**	**Weck**	**EPA 1694M**	**Water**	**ng/L**
PPCPs-Pharma	**Triclosan**	**Required**	**--**	**Weck**	**EPA 1694M**	**Water**	**ng/L**
PPCPs-Pharma	**Triclocarban**	**Required**	**--**	**Physis**	**EPA 625.1M_MRM**	**Water**	**ng/L**
PPCPs-Pharma	**Galaxolide**	**Required**	**--**	**Physis**	**EPA 625.1M**	**Water**	**ng/L**
PPCPs-Hormones	Ethynylestradiol, 17alpha-	Additional	--	Weck	EPA 1694M	Water	ng/L
PPCPs-Hormones	Progesterone	Additional	--	Weck	EPA 1694M	Water	ng/L
PPCPs-Hormones	Testosterone	Additional	--	Weck	EPA 1694M	Water	ng/L
PPCPs-Pharma	Gemfibrozil	Additional	--	Weck	EPA 1694M	Water	ng/L
PPCPs-Pharma	Iopromide	Additional	--	Weck	EPA 1694M	Water	ng/L
PPCPs-Pharma	Naproxen	Additional	--	Weck	EPA 1694M	Water	ng/L
PPCPs-Pharma	Salicylic Acid	Additional	--	Weck	EPA 1694M	Water	ng/L
Physical and Conventional Parameters	Suspended Sediment Concentration	Ancillary	--	Weck	ASTM D3977	Water	mg/L

Analyte Category	Analyte	Analyte Type	Analyte Alias	Agency	Method	Matrix	Unit
Physical and Conventional Parameters	Total organic carbon	Ancillary	--	Weck	EPA 9060M	Sediment	mg/Kg dw

Isotope Dilution Analogues and Associated Analytes

Table B.2. Year 2 Delta RMP constituents of emerging concern Isotope Dilution Analogue quantitation relationships. Required analytes according to the Delta RMP CEC Pilot Study are indicated in bold.

Analyte Category	Target Analyte	Analyte Alias	Quantified With	Quant. Type	Analyte Type	Agency	Method	Matrix
PBDEs	**PBDE 047**	**--**	**PBDE 047-13C12 (IsoDilAnalogue)**	**Direct Isotope**	**Required**	**SGS-AXYS**	**AXYS MLA-033 Rev 06**	**Sediment, Tissue**
PBDEs	**PBDE 099**	**--**	**PBDE 099-13C12 (IsoDilAnalogue)**	**Direct Isotope**	**Required**	**SGS-AXYS**	**AXYS MLA-033 Rev 06**	**Sediment, Tissue**
PBDEs	PBDE 028/33	--	PBDE 028-13C12 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue
PBDEs	PBDE 100	--	PBDE 100-13C12 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue
PBDEs	PBDE 153	--	PBDE 153-13C12 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue
PBDEs	PBDE 154	--	PBDE 154-13C12 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue
PBDEs	PBDE 183	--	PBDE 183-13C12 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue
PBDEs	PBDE 209	--	PBDE 209-13C12 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	AXYS MLA-033 Rev 06	Sediment, Tissue
PFAS	**Perfluorooctanesulfonic acid**	**PFOS**	**Perfluorooctanesulfonic acid-13C8 (IsoDilAnalogue)**	**Direct Isotope**	**Required**	**Vista**	**EPA 537M**	**Water**
PFAS	**Perfluorooctanoic acid**	**PFOA**	**Perfluorooctanoic acid-13C2 (IsoDilAnalogue)**	**Direct Isotope**	**Required**	**Vista**	**EPA 537M**	**Water**

Analyte Category	Target Analyte	Analyte Alias	Quantified With	Quant. Type	Analyte Type	Agency	Method	Matrix
PFAS	**Perfluorooctanesulfonate**	**PFOS**	**Perfluorooctanesulfonate-13C8 (IsoDilAnalogue)**	**Direct Isotope**	**Required**	**SGS-AXYS**	**SGS AXYS MLA-110 Rev 02**	**Sediment, Tissue**
PFAS	**Perfluorooctanoate**	**PFOA**	**Perfluorooctanoate-13C8 (IsoDilAnalogue)**	**Direct Isotope**	**Required**	**SGS-AXYS**	**SGS AXYS MLA-110 Rev 02**	**Sediment, Tissue**
PFAS	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	11Cl-PF3OUdS	Perfluoro-2-Propoxypropanoic Acid-13C3 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	9Cl-PF3ONS	Perfluoro-2-Propoxypropanoic Acid-13C3 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Dioxa-3H-Perfluorononanoate Acid, 4,8-	ADONA	Perfluoro-2-Propoxypropanoic Acid-13C3 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	EtFOSAA, N-	Ethyl Perfluorooctane Sulfonamido Acetic Acid-d5, N- (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Ethyl-perfluorooctanesulfonamide, N-	EtFOSA, N-	Ethyl-perfluorooctanesulfonamide-d5, N- (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue

Analyte Category	Target Analyte	Analyte Alias	Quantified With	Quant. Type	Analyte Type	Agency	Method	Matrix
PFAS	Ethyl-perfluorooctanesulfonamidoethanol, N-	EtFOSE, N-	Ethyl-perfluorooctanesulfonamidoethanol-d9, N- (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Fluorotelomer Carboxylic Acid, 3:3-	3:3 FTCA	Perfluoropentanoate-13C5 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Fluorotelomer Carboxylic Acid, 5:3-	5:3 FTCA	Perfluorohexanoate-13C5 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Fluorotelomer Carboxylic Acid, 7:3-	7:3 FTCA	Perfluorohexanoate-13C5 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Fluorotelomer Sulfonate, 4:2-	4:2 FTS	Fluorotelomer Sulfonate-13C2, 4:2- (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Fluorotelomer Sulfonate, 6:2-	6:2 FTS	Fluorotelomer Sulfonate-13C2, 6:2- (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Fluorotelomer Sulfonate, 8:2-	8:2 FTS	Fluorotelomer Sulfonate-13C2, 8:2- (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	MeFOSAA, N-	Methyl Perfluorooctane Sulfonamido Acetic Acid-d3, N- (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue

Analyte Category	Target Analyte	Analyte Alias	Quantified With	Quant. Type	Analyte Type	Agency	Method	Matrix
PFAS	Methyl-perfluorooctanesulfonamide, N-	MeFOSA, N-	Methyl-perfluorooctanesulfonamide-d3, N- (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Methyl-perfluorooctanesulfonamidoethanol, N-	MeFOSE, N-	Methyl-perfluorooctanesulfonamidoethanol-d7, N- (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	Perfluorohexanoate-13C5 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluoro-2-Propoxypropanoic Acid	HFPO-DA	Perfluoro-2-Propoxypropanoic Acid-13C3 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluoro-3,6-dioxaheptanoate	NFDHA	Perfluorohexanoate-13C5 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluoro-3-methoxypropanoate	PFMPA	Perfluoropentanoate-13C5 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluoro-4-methoxybutanoate	PFMBA	Perfluoropentanoate-13C5 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluorobutanesulfonate	PFBS	Perfluorobutanesulfonate-13C3 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue

Analyte Category	Target Analyte	Analyte Alias	Quantified With	Quant. Type	Analyte Type	Agency	Method	Matrix
PFAS	Perfluorobutanoate	PFBA	Perfluorobutanoate-13C4 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluorodecanesulfonate	PFDS	Perfluorooctanesulfonate-13C8 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluorodecanoate	PFDA	Perfluorodecanoate-13C6 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluorododecanesulfonate	PFDoS	Perfluorooctanesulfonate-13C8 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluorododecanoate	PFDoA	Perfluorododecanoate-13C2 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluoroheptanesulfonate	PFHpS	Perfluorooctanesulfonate-13C8 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluoroheptanoate	PFHpA	Perfluoroheptanoate-13C4 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluorohexanesulfonate	PFHxS	Perfluorohexanesulfonate-13C3 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluorohexanoate	PFHxA	Perfluorohexanoate-13C5 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue

Analyte Category	Target Analyte	Analyte Alias	Quantified With	Quant. Type	Analyte Type	Agency	Method	Matrix
PFAS	Perfluorononanesulfonate	PFNS	Perfluorooctanesulfonate-13C8 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluorononanoate	PFNA	Perfluorononanoate-13C9 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluorooctanesulfonamide	PFOSA	Perfluorooctanesulfonamide-13C8 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluoropentanesulfonate	PFPeS	Perfluorohexanesulfonate-13C3 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluoropentanoate	PFPeA	Perfluoropentanoate-13C5 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluorotetradecanoate	PFTetrDA	Perfluorotetradecanoate-13C2 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluorotridecanoate	PFTrDA	Perfluorotetradecanoate-13C2 (IsoDilAnalogue) & Perfluorododecanoate-13C2 (IsoDilAnalogue)	Indirect Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PFAS	Perfluoroundecanoate	PFUnA	Perfluoroundecanoate-13C7 (IsoDilAnalogue)	Direct Isotope	Additional	SGS-AXYS	SGS AXYS MLA-110 Rev 02	Sediment, Tissue
PPCPs-Hormones	**Estradiol, 17beta-**	**--**	**Estradiol-d3, 17beta- (IsoDilAnalogue)**	**Direct Isotope**	**Required**	**Weck**	**EPA 1694M**	**Water**

Analyte Category	Target Analyte	Analyte Alias	Quantified With	Quant. Type	Analyte Type	Agency	Method	Matrix
PPCPs-Hormones	**Estrone**	**--**	**Ethynylestradiol-d4, 17alpha-(IsoDilAnalogue)**	**Indirect Isotope**	**Required**	**Weck**	**EPA 1694M**	**Water**
PPCPs-Pharma	**Bisphenol A**	**--**	**Bisphenol A-d16 (IsoDilAnalogue)**	**Direct Isotope**	**Required**	**Weck**	**EPA 1694M**	**Water**
PPCPs-Pharma	**Diclofenac**	**--**	**Ethynylestradiol-d4, 17alpha-(IsoDilAnalogue)**	**Indirect Isotope**	**Required**	**Weck**	**EPA 1694M**	**Water**
PPCPs-Pharma	**Ibuprofen**	**--**	**Ibuprofen-d3 (IsoDilAnalogue)**	**Direct Isotope**	**Required**	**Weck**	**EPA 1694M**	**Water**
PPCPs-Pharma	**Triclosan**	**--**	**Triclosan-d3(IsoDilAnalogue)**	**Direct Isotope**	**Required**	**Weck**	**EPA 1694M**	**Water**
PPCPs-Hormones	Ethynylestradiol, 17alpha-	--	Ethynylestradiol-d4, 17alpha-(IsoDilAnalogue)	Direct Isotope	Additional	Weck	EPA 1694M	Water
PPCPs-Hormones	Progesterone	--	Progesterone-d9 (IsoDilAnalogue)	Direct Isotope	Additional	Weck	EPA 1694M	Water
PPCPs-Hormones	Testosterone	--	Testosterone-d3 (IsoDilAnalogue)	Direct Isotope	Additional	Weck	EPA 1694M	Water
PPCPs-Pharma	Gemfibrozil	--	Gemfibrozil-d6(IsoDilAnalogue)	Direct Isotope	Additional	Weck	EPA 1694M	Water
PPCPs-Pharma	Iopromide	--	Salicylic Acid-d4 (IsoDilAnalogue)	Indirect Isotope	Additional	Weck	EPA 1694M	Water
PPCPs-Pharma	Naproxen	--	Naproxen-d3 (IsoDilAnalogue)	Direct Isotope	Additional	Weck	EPA 1694M	Water
PPCPs-Pharma	Salicylic Acid	--	Salicylic Acid-d4 (IsoDilAnalogue)	Direct Isotope	Additional	Weck	EPA 1694M	Water

Appendix C. Summary of Completeness and Quality Control Sample Acceptability for Year 2 CEC Monitoring

The following sections outline the completeness and overall acceptability of each analysis completed for the Delta Regional Monitoring Program (RMP) Constituents of Emerging Concern (CEC) monitoring that occurred during Year 2.

All results for Year 2 CEC Monitoring were reviewed according to the CEC QAPP v2 and the Delta RMP Data Management Standard Operating Procedures (SOP) and were flagged with California Environmental Data Exchange Network (CEDEN) comparable QA Codes. All codes applied to the Year 2 CEC Monitoring are defined in **Table C.1**.

Table C.1. QA Codes Used in Year 2 CEC Dataset (water, sediment, and tissue).

QA Code	QA Name
AWM	Detection limit increased due to dilution prior to final sample volume (not a secondary dilution)
BB	Sample > 4x spike concentration
CJ	Analyte concentration is in excess of the instrument calibration; considered estimated
DB	QA results outside of acceptance limits due to matrix effects
DF	Reporting limits elevated due to matrix interferences
DO	Coelution
EUM	LCS is outside of control limits
FDP	Field duplicate RPD above QC limit
FI	Analyte in field sample and associated blank
GB	Matrix spike recovery not within control limits
GIDA	Isotope Dilution Analogue recovery not within control limits
GR	Internal standard recovery is outside method recovery limit
H	A holding time violation has occurred.
IDA	Isotope Dilution Analogue corrected
IL	RPD exceeds laboratory control limit
IP	Analyte detected in field or lab generated blank
LRJ	Data rejected - Estimated value - EPA Flag, flagged by laboratory
M	A matrix effect is present
None	None - No QA Qualifier
PJM	Result from re-extract/re-anal to confirm original result
QAX	When the native sample for the MS/MSD or DUP is not included in the batch reported
UKM	Lock mass interference present
VIL	RPD exceeds control limit, flagged by QAO

QA CODE	QA NAME
VIP	Analyte detected in field or lab generated blank, flagged by QAO

Summary of Completeness

Year 2 CEC monitoring samples were collected from a variety of matrices from 12 ambient and source monitoring sites over four sampling events, per the Central Valley CEC Pilot Study Workplan (see **Sampling Overview**). An evaluation of field, transport and analytical completeness, along with field quality control sample completeness are provided in tables.

Sample Completeness

Table C.2. Field and transport and analytical completeness for Year 2 CEC Monitoring.
Samples are counted as individual results, i.e., separate organism composites for tissue samples and separate sample fractions analyzed for chemistry results.

Method	Matrix	Analyte Type	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
ASTM D3977	Water	Ancillary	Suspended Sediment Concentration	48	48	100.0	48	100.0
EPA 1694M	Water	Required	Bisphenol A	48	48	100.0	48	100.0
EPA 1694M	Water	Required	Diclofenac	48	48	100.0	48	100.0
EPA 1694M	Water	Required	Estradiol, 17beta-	48	48	100.0	48	100.0
EPA 1694M	Water	Required	Estrone	48	48	100.0	48	100.0
EPA 1694M	Water	Required	Ibuprofen	48	48	100.0	48	100.0
EPA 1694M	Water	Required	Triclosan	48	48	100.0	48	100.0
EPA 1694M	Water	Additional	Ethynylestradiol, 17alpha-	48	48	100.0	48	100.0
EPA 1694M	Water	Additional	Gemfibrozil	48	48	100.0	48	100.0
EPA 1694M	Water	Additional	Iopromide	48	48	100.0	48	100.0
EPA 1694M	Water	Additional	Naproxen	48	48	100.0	48	100.0
EPA 1694M	Water	Additional	Progesterone	48	48	100.0	48	100.0
EPA 1694M	Water	Additional	Salicylic Acid	48	48	100.0	48	100.0
EPA 1694M	Water	Additional	Testosterone	48	48	100.0	48	100.0
EPA 537M	Water	Required	Perfluorooctanesulfonic acid (PFOS)	48	48	100.0	48	100.0
EPA 537M	Water	Required	Perfluorooctanoic acid (PFOA)	48	48	100.0	48	100.0
EPA 625.1M	Water	Required	Galaxolide	48	48	100.0	48	100.0

Method	Matrix	Analyte Type	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
EPA 625.1M_MRM	Water	Required	Triclocarban	48	48	100.0	48	100.0
AXYS MLA-033 Rev 06	Sediment	Required	PBDE 047	3	3	100.0	3	100.0
AXYS MLA-033 Rev 06	Sediment	Required	PBDE 099	3	3	100.0	3	100.0
AXYS MLA-033 Rev 06	Sediment	Additional	PBDE 028/33	3	3	100.0	3	100.0
AXYS MLA-033 Rev 06	Sediment	Additional	PBDE 100	3	3	100.0	3	100.0
AXYS MLA-033 Rev 06	Sediment	Additional	PBDE 153	3	3	100.0	3	100.0
AXYS MLA-033 Rev 06	Sediment	Additional	PBDE 154	3	3	100.0	3	100.0
AXYS MLA-033 Rev 06	Sediment	Additional	PBDE 183	3	3	100.0	3	100.0
AXYS MLA-033 Rev 06	Sediment	Additional	PBDE 209	3	3	100.0	3	100.0
AXYS MLA-033 Rev 06	Sediment	Ancillary	Moisture	3	3	100.0	3	100.0
EPA 9060M	Sediment	Ancillary	Total Organic Carbon	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Required	Perfluorooctanesulfonate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Required	Perfluorooctanoate	3	3	100.0	3	100.0

Method	Matrix	Analyte Type	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Dioxa-3H-Perfluorononanoate Acid, 4,8-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Ethyl-perfluorooctanesulfonamide, N-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Ethyl-perfluorooctanesulfonamidoethanol, N-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Fluorotelomer Carboxylic Acid, 3:3-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Fluorotelomer Carboxylic Acid, 5:3-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Fluorotelomer Carboxylic Acid, 7:3-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Fluorotelomer Sulfonate, 4:2-	3	3	100.0	3	100.0

Method	Matrix	Analyte Type	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Fluorotelomer Sulfonate, 6:2-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Fluorotelomer Sulfonate, 8:2-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Methyl-perfluorooctanesulfonamide, N-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Methyl-perfluorooctanesulfonamidoethanol, N-	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluoro(2-ethoxyethane)sulfonic acid	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluoro-2-Propoxypropanoic Acid	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluoro-3,6-dioxaheptanoate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluoro-3-methoxypropanoate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluoro-4-methoxybutanoate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorobutanesulfonate	3	3	100.0	3	100.0

Method	Matrix	Analyte Type	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorobutanoate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorodecanesulfonate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorodecanoate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorododecanesulfonate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorododecanoate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluoroheptanesulfonate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluoroheptanoate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorohexanesulfonate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorohexanoate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorononanesulfonate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorononanoate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorooctanesulfonamide	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluoropentanesulfonate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluoropentanoate	3	3	100.0	3	100.0

Method	Matrix	Analyte Type	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorotetradecanoate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluorotridecanoate	3	3	100.0	3	100.0
SGS AXYS MLA-110 Rev 02	Sediment	Additional	Perfluoroundecanoate	3	3	100.0	3	100.0
AXYS MLA-033 Rev 06	Bivalves Tissue	Required	PBDE 047	6	6	100.0	6	100.0
AXYS MLA-033 Rev 06	Bivalves Tissue	Required	PBDE 099	6	6	100.0	6	100.0
AXYS MLA-033 Rev 06	Bivalves Tissue	Additional	PBDE 028/33	6	6	100.0	6	100.0
AXYS MLA-033 Rev 06	Bivalves Tissue	Additional	PBDE 100	6	6	100.0	6	100.0
AXYS MLA-033 Rev 06	Bivalves Tissue	Additional	PBDE 153	6	6	100.0	6	100.0
AXYS MLA-033 Rev 06	Bivalves Tissue	Additional	PBDE 154	6	6	100.0	6	100.0
AXYS MLA-033 Rev 06	Bivalves Tissue	Additional	PBDE 183	6	6	100.0	6	100.0
AXYS MLA-033 Rev 06	Bivalves Tissue	Additional	PBDE 209	6	6	100.0	6	100.0
AXYS MLA-033 Rev 06	Bivalves Tissue	Ancillary	Lipids	6	6	100.0	2 [1]	33.3
AXYS MLA-033 Rev 06	Bivalves Tissue	Ancillary	Moisture	6	6	100.0	6	100.0
AXYS MLA-033 Rev 06	Fish Tissue	Required	PBDE 047	4	4	100.0	4	100.0

METHOD	MATRIX	ANALYTE TYPE	ANALYTE	ENV. SAMPLES SCHEDULED	ENV. SAMPLES COLLECTED	FIELD AND TRANSPORT COMPLETENESS (%)	TOTAL SAMPLES ANALYZED	ANALYTICAL COMPLETENESS (%)
AXYS MLA-033 Rev 06	Fish Tissue	Required	PBDE 099	4	4	100.0	4	100.0
AXYS MLA-033 Rev 06	Fish Tissue	Additional	PBDE 028/33	4	4	100.0	4	100.0
AXYS MLA-033 Rev 06	Fish Tissue	Additional	PBDE 100	4	4	100.0	4	100.0
AXYS MLA-033 Rev 06	Fish Tissue	Additional	PBDE 153	4	4	100.0	4	100.0
AXYS MLA-033 Rev 06	Fish Tissue	Additional	PBDE 154	4	4	100.0	4	100.0
AXYS MLA-033 Rev 06	Fish Tissue	Additional	PBDE 183	4	4	100.0	4	100.0
AXYS MLA-033 Rev 06	Fish Tissue	Additional	PBDE 209	4	4	100.0	4	100.0
AXYS MLA-033 Rev 06	Fish Tissue	Ancillary	Lipid	4	4	100.0	4	100.0
AXYS MLA-033 Rev 06	Fish Tissue	Ancillary	Moisture	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Required	Perfluorooctanesulfonate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Required	Perfluorooctanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	4	4	100.0	4	100.0

Method	Matrix	Analyte Type	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Dioxa-3H-Perfluorononanoate Acid, 4,8-	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Ethyl-perfluorooctanesulfonamide, N-	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Ethyl-perfluorooctanesulfonamidoethanol, N-	4	4	100.0	3	75.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Fluorotelomer Carboxylic Acid, 3:3-	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Fluorotelomer Carboxylic Acid, 5:3-	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Fluorotelomer Carboxylic Acid, 7:3-	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Fluorotelomer Sulfonate, 4:2-	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Fluorotelomer Sulfonate, 6:2-	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Fluorotelomer Sulfonate, 8:2-	4	4	100.0	4	100.0

Method	Matrix	Analyte Type	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Methyl-perfluorooctanesulfonamide, N-	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Methyl-perfluorooctanesulfonamidoethanol, N-	4	4	100.0	0	0.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluoro(2-ethoxyethane)sulfonic acid	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluoro-2-Propoxypropanoic Acid	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluoro-3,6-dioxaheptanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluoro-3-methoxypropanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluoro-4-methoxybutanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorobutanesulfonate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorobutanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorodecanesulfonate	4	4	100.0	4	100.0

Method	Matrix	Analyte Type	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorodecanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorododecanesulfonate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorododecanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluoroheptanesulfonate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluoroheptanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorohexanesulfonate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorohexanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorononanesulfonate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorononanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorooctanesulfonamide	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluoropentanesulfonate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluoropentanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorotetradecanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluorotridecanoate	4	4	100.0	4	100.0

Method	Matrix	Analyte Type	Analyte	Env. Samples Scheduled	Env. Samples Collected	Field and Transport Completeness (%)	Total Samples Analyzed	Analytical Completeness (%)
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluoroundecanoate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Additional	Perfluoropentanesulfonate	4	4	100.0	4	100.0
SGS AXYS MLA-110 Rev 02	Fish Tissue	Ancillary	Moisture	4	4	100.0	4	75.0
Total				**1282**	**1282**	**100.0**	**1273**	**99.3**

[1] Lipid analysis for bivalve tissue samples was originally not performed due to laboratory oversight. SGS-AXYS agreed to use the available remaining tissue for the two composites with enough mass available to run this analysis; results have not been provided at the time of writing this report. See **Deviations and Corrective Actions**.

Field Measurement Completeness

Table C.3. Field measurement completeness counts for Year 2.
Fish tissue collections by MPSL-DFW do not require the collection of field measurements. Field measurements associated with the July sediment samples collected by SPoT crews are being reported directly to SWAMP and are not stored in the CV RDC.

Analyte	Samples Scheduled	Instrument Failure	Measurements Taken	Completeness (%)
Dissolved Oxygen, mg/L	48	0	48	100.0
Oxygen Saturation (%)	48	0	46	95.8
pH	48	0	48	100.0
Specific Conductivity, µS/cm	48	0	48	100.0
Temperature, water, ºC	48	0	48	100.0
Temperature, air, ºC	48	0	34	70.8
Turbidity, NTU	48	0	48	100.0
Total	**336**	**0**	**320**	**95.2**

Field Quality Control Frequency

Table C.4. Field quality control sample completeness for Year 2 CEC Monitoring.
Samples are counted as individual results, i.e., separate sample fractions analyzed for chemistry results.

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
ASTM D3977	Water	Suspended Sediment Concentration	48	4	4	56	8.3	8.3
EPA 1694M	Water	Bisphenol A	48	4	4	56	8.3	8.3
EPA 1694M	Water	Diclofenac	48	4	4	56	8.3	8.3
EPA 1694M	Water	Estradiol, 17beta-	48	4	4	56	8.3	8.3
EPA 1694M	Water	Estrone	48	4	4	56	8.3	8.3
EPA 1694M	Water	Ethynylestradiol, 17alpha-	48	4	4	56	8.3	8.3
EPA 1694M	Water	Gemfibrozil	48	4	4	56	8.3	8.3
EPA 1694M	Water	Ibuprofen	48	4	4	56	8.3	8.3
EPA 1694M	Water	Iopromide	48	4	4	56	8.3	8.3
EPA 1694M	Water	Naproxen	48	4	4	56	8.3	8.3
EPA 1694M	Water	Progesterone	48	4	4	56	8.3	8.3
EPA 1694M	Water	Salicylic Acid	48	4	4	56	8.3	8.3
EPA 1694M	Water	Testosterone	48	4	4	56	8.3	8.3
EPA 1694M	Water	Triclosan	48	4	4	56	8.3	8.3
EPA 537M	Water	Perfluorooctanesulfonic acid (PFOS)	48	4	4	56	8.3	8.3
EPA 537M	Water	Perfluorooctanoic acid (PFOA)	48	4	4	56	8.3	8.3
EPA 625.1M	Water	Galaxolide	48	4	4	56	8.3	8.3
EPA 625.1M_MRM	Water	Triclocarban	48	4	4	56	8.3	8.3
AXYS MLA-033 Rev 06	Sediment	Moisture	3	1	NA	4	33.3	NA

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
AXYS MLA-033 Rev 06	Sediment	PBDE 028/33	3	1	NA	4	33.3	NA
AXYS MLA-033 Rev 06	Sediment	PBDE 047	3	1	NA	4	33.3	NA
AXYS MLA-033 Rev 06	Sediment	PBDE 099	3	1	NA	4	33.3	NA
AXYS MLA-033 Rev 06	Sediment	PBDE 100	3	1	NA	4	33.3	NA
AXYS MLA-033 Rev 06	Sediment	PBDE 153	3	1	NA	4	33.3	NA
AXYS MLA-033 Rev 06	Sediment	PBDE 154	3	1	NA	4	33.3	NA
AXYS MLA-033 Rev 06	Sediment	PBDE 183	3	1	NA	4	33.3	NA
AXYS MLA-033 Rev 06	Sediment	PBDE 209	3	1	NA	4	33.3	NA
EPA 9060M	Sediment	Total Organic Carbon	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Dioxa-3H-Perfluorononanoate Acid, 4,8-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Ethyl-perfluorooctanesulfonamide, N-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Ethyl-perfluorooctanesulfonamidoethanol, N-	3	1	NA	4	33.3	NA

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
SGS AXYS MLA-110 Rev 02	Sediment	Fluorotelomer Carboxylic Acid, 3:3-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Fluorotelomer Carboxylic Acid, 5:3-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Fluorotelomer Carboxylic Acid, 7:3-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Fluorotelomer Sulfonate, 4:2-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Fluorotelomer Sulfonate, 6:2-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Fluorotelomer Sulfonate, 8:2-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Methyl-perfluorooctanesulfonamide, N-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Methyl-perfluorooctanesulfonamidoethanol, N-	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Moisture	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluoro(2-ethoxyethane)sulfonic acid	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluoro-2-Propoxypropanoic Acid	3	1	NA	4	33.3	NA

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
SGS AXYS MLA-110 Rev 02	Sediment	Perfluoro-3,6-dioxaheptanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluoro-3-methoxypropanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluoro-4-methoxybutanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorobutanesulfonate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorobutanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorodecanesulfonate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorodecanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorododecanesulfonate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorododecanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluoroheptanesulfonate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluoroheptanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorohexanesulfonate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorohexanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorononanesulfonate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorononanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorooctanesulfonamide	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorooctanesulfonate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorooctanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluoropentanesulfonate	3	1	NA	4	33.3	NA

Method	Matrix	Analyte	Env. Samples	Field Duplicates	Field Blanks	Total Samples	Field Duplicate Completeness (%)	Field Blank Completeness (%)
SGS AXYS MLA-110 Rev 02	Sediment	Perfluoropentanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorotetradecanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluorotridecanoate	3	1	NA	4	33.3	NA
SGS AXYS MLA-110 Rev 02	Sediment	Perfluoroundecanoate	3	1	NA	4	33.3	NA
Total			**1017**	**123**	**72**	**1212**	**12.1**	**7.1**

Quality Control Sample Acceptability

Field Blanks Samples

Table C.5. Field blank (FB) acceptability for Year 2 CEC Monitoring.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total FB Samples	FB Samples Within Limits	Acceptability Met (%)
ASTM D3977	Weck	Water	Particulate	Suspended Sediment Concentration	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Bisphenol A	< MDL	4	1	25.0
EPA 1694M	Weck	Water	Total	Diclofenac	< MDL	4	3	75.0
EPA 1694M	Weck	Water	Total	Estradiol, 17beta-	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Estrone	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Ethynylestradiol, 17alpha-	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Gemfibrozil	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Ibuprofen	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Iopromide	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Naproxen	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Progesterone	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Salicylic Acid	< MDL	4	3	75.0
EPA 1694M	Weck	Water	Total	Testosterone	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Triclosan	< MDL	4	4	100.0
EPA 537M	Vista	Water	Total	Perfluorooctanesulfonic acid (PFOS)	< MDL	4	4	100.0
EPA 537M	Vista	Water	Total	Perfluorooctanoic acid (PFOA)	< MDL	4	4	100.0
EPA 625.1M	Physis	Water	Total	Galaxolide	< MDL	4	0	0.0
EPA 625.1M_MRM	Physis	Water	Total	Triclocarban	< MDL	4	4	100.0
Total						**72**	**63**	**87.5**

Field Duplicate Samples

Table C.6. Field duplicate acceptability for Year 2 CEC Monitoring.

Method	Lab	Matrix	Analyte	Acceptability Criteria [1]	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
ASTM D3977	Weck	Water	Suspended Sediment Concentration	RPD ≤ 35	4	4	100.0
EPA 1694M	Weck	Water	Bisphenol A	RPD ≤ 35	4	1	25.0
EPA 1694M	Weck	Water	Diclofenac	RPD ≤ 35	4	3	75.0
EPA 1694M	Weck	Water	Estradiol, 17beta-	RPD ≤ 35	4	4	100.0
EPA 1694M	Weck	Water	Estrone	RPD ≤ 35	4	4	100.0
EPA 1694M	Weck	Water	Ethynylestradiol, 17alpha-	RPD ≤ 35	4	4	100.0
EPA 1694M	Weck	Water	Gemfibrozil	RPD ≤ 35	4	4	100.0
EPA 1694M	Weck	Water	Ibuprofen	RPD ≤ 35	4	4	100.0
EPA 1694M	Weck	Water	Iopromide	RPD ≤ 35	4	4	100.0
EPA 1694M	Weck	Water	Naproxen	RPD ≤ 35	4	4	100.0
EPA 1694M	Weck	Water	Progesterone	RPD ≤ 35	4	4	100.0
EPA 1694M	Weck	Water	Salicylic Acid	RPD ≤ 35	4	4	100.0
EPA 1694M	Weck	Water	Testosterone	RPD ≤ 35	4	4	100.0
EPA 1694M	Weck	Water	Triclosan	RPD ≤ 35	4	4	100.0
EPA 537M	Vista	Water	Perfluorooctanesulfonic acid (PFOS)	RPD ≤ 35	4	4	100.0
EPA 537M	Vista	Water	Perfluorooctanoic acid (PFOA)	RPD ≤ 35	4	4	100.0
EPA 625.1M	Physis	Water	Galaxolide	RPD ≤ 35	4	2	50.0
EPA 625.1M_MRM	Physis	Water	Triclocarban	RPD ≤ 35	4	4	100.0
EPA 9060M	Weck	Sediment	Total Organic Carbon	RPD ≤ 35	1	1	100

Method	Lab	Matrix	Analyte	Acceptability Criteria [1]	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Dioxa-3H-Perfluorononanoate Acid, 4,8-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Ethyl-perfluorooctanesulfonamide, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Ethyl-perfluorooctanesulfonamidoethanol, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Fluorotelomer Carboxylic Acid, 3:3-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Fluorotelomer Carboxylic Acid, 5:3-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Fluorotelomer Carboxylic Acid, 7:3-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Fluorotelomer Sulfonate, 4:2-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Fluorotelomer Sulfonate, 6:2-	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Analyte	Acceptability Criteria [1]	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Fluorotelomer Sulfonate, 8:2-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Methyl-perfluorooctanesulfonamide, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Methyl-perfluorooctanesulfonamido ethanol, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Moisture	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluoro(2-ethoxyethane)sulfonic acid	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluoro-2-Propoxypropanoic Acid	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluoro-3,6-dioxaheptanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluoro-3-methoxypropanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluoro-4-methoxybutanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorobutanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorobutanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorodecanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorodecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorododecanesulfonate	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Analyte	Acceptability Criteria [1]	Total Field Dup Samples	Field Dup Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorododecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluoroheptanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluoroheptanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorohexanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorohexanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorononanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorononanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorooctanesulfonamide	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorooctanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorooctanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluoropentanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluoropentanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorotetradecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluorotridecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Perfluoroundecanoate	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Moisture	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	PBDE 028/33	RPD ≤ 35	1	0	0
AXYS MLA-033 Rev 06	AXYS	Sediment	PBDE 047	RPD ≤ 35	1	0	0
AXYS MLA-033 Rev 06	AXYS	Sediment	PBDE 099	RPD ≤ 35	1	0	0
AXYS MLA-033 Rev 06	AXYS	Sediment	PBDE 100	RPD ≤ 35	1	0	0
AXYS MLA-033 Rev 06	AXYS	Sediment	PBDE 153	RPD ≤ 35	1	0	0
AXYS MLA-033 Rev 06	AXYS	Sediment	PBDE 154	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	PBDE 183	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	PBDE 209	RPD ≤ 35	1	0	0
Total					**123**	**111**	**90.2**

[1] RPD criteria not applicable if the concentration of either sample is below the MDL.

Laboratory Blank Samples

Table C.7. Laboratory blank (LB) acceptability for Year 2 CEC Monitoring.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
ASTM D3977	Weck	Water	Particulate	Suspended Sediment Concentration	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Bisphenol A	< MDL	5	3	60.0
EPA 1694M	Weck	Water	Total	Diclofenac	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Estradiol, 17beta-	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Estrone	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Ethynylestradiol, 17alpha-	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Gemfibrozil	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Ibuprofen	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Iopromide	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Naproxen	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Progesterone	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Salicylic Acid	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Testosterone	< MDL	4	4	100.0
EPA 1694M	Weck	Water	Total	Triclosan	< MDL	4	4	100.0
EPA 537M	Vista	Water	Total	Perfluorooctanesulfonic acid (PFOS)	< MDL	4	4	100.0
EPA 537M	Vista	Water	Total	Perfluorooctanoic acid (PFOA)	< MDL	4	4	100.0
EPA 625.1M	Physis	Water	Total	Galaxolide	< MDL	4	0	0.0
EPA 625.1M_MRM	Physis	Water	Total	Triclocarban	< MDL	4	4	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 028/33	< MDL	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 047	< MDL	1	0	0.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 099	< MDL	1	0	0.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 100	< MDL	1	0	0.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 153	< MDL	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 154	< MDL	1	0	0.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 183	< MDL	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 209	< MDL	1	1	100.0
EPA 9060M	Weck	Sediment	Total	Total Organic Carbon	< MDL	2	2	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Dioxa-3H-Perfluorononanoate Acid, 4,8-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl-perfluorooctanesulfonamide, N-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl-perfluorooctanesulfonamidoethanol, N-	< MDL	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 3:3-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 5:3-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 7:3-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 4:2-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 6:2-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 8:2-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl-perfluorooctanesulfonamide, N-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl-perfluorooctanesulfonamidoethanol, N-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro(2-ethoxyethane)sulfonic acid	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-2-Propoxypropanoic Acid	< MDL	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-3,6-dioxaheptanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-3-methoxypropanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-4-methoxybutanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorobutanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorobutanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorodecanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorodecanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorododecanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorododecanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroheptanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroheptanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorohexanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorohexanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorononanesulfonate	< MDL	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorononanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanesulfonamide	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoropentanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoropentanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorotetradecanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorotridecanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroundecanoate	< MDL	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 028/33	< MDL	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 047	< MDL	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 099	< MDL	1	0	0.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 100	< MDL	1	0	0.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 153	< MDL	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 154	< MDL	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 183	< MDL	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 209	< MDL	1	0	0.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Dioxa-3H-Perfluorononanoate Acid, 4,8-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl-perfluorooctanesulfonamide, N-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl-perfluorooctanesulfonamidoethanol, N-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Carboxylic Acid, 3:3-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Carboxylic Acid, 5:3-	< MDL	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Carboxylic Acid, 7:3-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Sulfonate, 4:2-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Sulfonate, 6:2-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Sulfonate, 8:2-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Methyl-perfluorooctanesulfonamide, N-	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro(2-ethoxyethane)sulfonic acid	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-2-Propoxypropanoic Acid	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-3,6-dioxaheptanoate	< MDL	1	0	0.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-3-methoxypropanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-4-methoxybutanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorobutanesulfonate	< MDL	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorobutanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorodecanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorodecanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorododecanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorododecanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoroheptanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoroheptanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorohexanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorohexanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorononanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorononanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorooctanesulfonamide	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorooctanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorooctanoate	< MDL	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LB Samples	LB Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoropentanesulfonate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoropentanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorotetradecanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorotridecanoate	< MDL	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoroundecanoate	< MDL	1	1	100.0
Total						**170**	**156**	**91.8**

Laboratory Duplicate Samples (Unspiked)

Table C.8. Laboratory duplicate (LD) acceptability for Year 2 CEC Monitoring.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LD Samples	LD Samples Within Limits	Acceptability Met (%)
EPA 1694M	Weck	Water	Total	Bisphenol A	NA [2]	2	2	100.0
EPA 1694M	Weck	Water	Total	Diclofenac	NA [2]	2	2	100.0
EPA 1694M	Weck	Water	Total	Estradiol, 17beta-	NA [2]	1	1	100.0
EPA 1694M	Weck	Water	Total	Estrone	NA [2]	1	1	100.0
EPA 1694M	Weck	Water	Total	Ethynylestradiol, 17alpha-	NA [2]	1	1	100.0
EPA 1694M	Weck	Water	Total	Gemfibrozil	NA [2]	2	2	100.0
EPA 1694M	Weck	Water	Total	Ibuprofen	NA [2]	2	2	100.0
EPA 1694M	Weck	Water	Total	Iopromide	NA [2]	2	2	100.0
EPA 1694M	Weck	Water	Total	Naproxen	NA [2]	2	2	100.0
EPA 1694M	Weck	Water	Total	Progesterone	NA [2]	1	1	100.0
EPA 1694M	Weck	Water	Total	Salicylic Acid	NA [2]	2	2	100.0
EPA 1694M	Weck	Water	Total	Testosterone	NA [2]	1	1	100.0
EPA 1694M	Weck	Water	Total	Triclosan	NA [2]	2	2	100.0
EPA 9060M	Weck	Sediment	Total	Total Organic Carbon	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	Moisture	RPD ≤ 34	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 028/33	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 047	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 099	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 100	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 153	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 154	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 183	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 209	RPD ≤ 35	1	0	0.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LD Samples	LD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Dioxa-3H-Perfluorononanoate Acid, 4,8-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl-perfluorooctanesulfonamide, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl-perfluorooctanesulfonamido ethanol, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 3:3-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 5:3-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 7:3-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 4:2-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 6:2-	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LD Samples	LD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 8:2-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl-perfluorooctanesulfonamide, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl-perfluorooctanesulfonamido ethanol, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Moisture	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro(2-ethoxyethane)sulfonic acid	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-2-Propoxypropanoic Acid	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-3,6-dioxaheptanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-3-methoxypropanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-4-methoxybutanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorobutanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorobutanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorodecanesulfonate	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LD Samples	LD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorodecanoate	RPD ≤ 35	1	0	0.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorododecanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorododecanoate	RPD ≤ 35	1	0	0.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroheptanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroheptanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorohexanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorohexanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorononanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorononanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanesulfonamide	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanesulfonate	RPD ≤ 35	1	0	0.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanoate	RPD ≤ 35	1	0	0.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoropentanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoropentanoate	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LD Samples	LD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorotetradecanoate	RPD ≤ 35	1	0	0.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorotridecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroundecanoate	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	Lipid	RPD ≤ 35	2	1	50.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	Moisture	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 028/33	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 047	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 099	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 100	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 153	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 154	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 183	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 209	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LD Samples	LD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Dioxa-3H-Perfluorononanoate Acid, 4,8-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl-perfluorooctanesulfonamide, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl-perfluorooctanesulfonamido ethanol, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Carboxylic Acid, 5:3-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Carboxylic Acid, 7:3-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Sulfonate, 4:2-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Sulfonate, 6:2-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Sulfonate, 8:2-	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LD Samples	LD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Methyl-perfluorooctanesulfonamide, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro(2-ethoxyethane)sulfonic acid	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-2-Propoxypropanoic Acid	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-3,6-dioxaheptanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorobutanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorodecanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorodecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorododecanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorododecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoroheptanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoroheptanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorohexanesulfonate	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LD Samples	LD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorohexanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorononanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorononanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorooctanesulfonamide	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorooctanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorooctanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoropentanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorotetradecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorotridecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoroundecanoate	RPD ≤ 35	1	1	100.0
Total						**116**	**110**	**94.8**

[1] RPD criteria not applicable if the concentration of either sample is < MDL.
[2] There are no Delta RMP laboratory duplicate MQOs for PPCPs analyzed by EPA method 1694M; unspiked duplicate results provided by Weck were evaluated against the laboratory criteria of RPD ≤ 35.

Laboratory Control Spike Samples

Table C.9. Laboratory control spike (LCS) recovery acceptability for Year 2 CEC Monitoring.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
ASTM D3977	Weck	Water	Particulate	Suspended Sediment Concentration	PR 50-150	4	4	100.0
EPA 1694M	Weck	Water	Total	Bisphenol A	PR 50-150	7	3	42.9
EPA 1694M	Weck	Water	Total	Diclofenac	PR 50-150	6	5	83.3
EPA 1694M	Weck	Water	Total	Estradiol, 17beta-	PR 50-150	6	6	100.0
EPA 1694M	Weck	Water	Total	Estrone	PR 50-150	6	6	100.0
EPA 1694M	Weck	Water	Total	Ethynylestradiol, 17alpha-	PR 50-150	6	6	100.0
EPA 1694M	Weck	Water	Total	Gemfibrozil	PR 50-150	6	6	100.0
EPA 1694M	Weck	Water	Total	Ibuprofen	PR 50-150	6	3	50.0
EPA 1694M	Weck	Water	Total	Iopromide	PR 50-150	6	4	66.7
EPA 1694M	Weck	Water	Total	Naproxen	PR 50-150	6	2	33.3
EPA 1694M	Weck	Water	Total	Progesterone	PR 50-150	6	6	100.0
EPA 1694M	Weck	Water	Total	Salicylic Acid	PR 50-150	6	6	100.0
EPA 1694M	Weck	Water	Total	Testosterone	PR 50-150	6	6	100.0
EPA 1694M	Weck	Water	Total	Triclosan	PR 50-150	6	6	100.0
EPA 537M	Vista	Water	Total	Perfluorooctanesulfonic acid (PFOS)	PR 50-150	8	8	100.0
EPA 537M	Vista	Water	Total	Perfluorooctanoic acid (PFOA)	PR 50-150	8	8	100.0
EPA 625.1M	Physis	Water	Total	Galaxolide	PR 50-150	10	10	100.0
EPA 625.1M_MRM	Physis	Water	Total	Triclocarban	PR 50-150	10	10	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 028/33	PR 50-150	2	2	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 047	PR 50-150	2	2	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 099	PR 50-150	2	2	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 100	PR 50-150	2	2	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 153	PR 50-150	2	2	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 154	PR 50-150	2	2	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 183	PR 50-150	2	2	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 209	PR 50-150	2	2	100.0
EPA 9060M	Weck	Sediment	Total	Total Organic Carbon	PR 50-150	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Dioxa-3H-Perfluorononanoate Acid, 4,8-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl-perfluorooctanesulfonamide, N-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl-perfluorooctanesulfonamidoethanol, N-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 3:3-	PR 50-150	3	3	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 5:3-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 7:3-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 4:2-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 6:2-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 8:2-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl-perfluorooctanesulfonamide, N-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl-perfluorooctanesulfonamidoethanol, N-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro(2-ethoxyethane)sulfonic acid	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-2-Propoxypropanoic Acid	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-3,6-dioxaheptanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-3-methoxypropanoate	PR 50-150	3	3	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-4-methoxybutanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorobutanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorobutanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorodecanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorodecanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorododecanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorododecanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroheptanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroheptanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorohexanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorohexanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorononanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorononanoate	PR 50-150	3	3	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanesulfonamide	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoropentanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoropentanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorotetradecanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorotridecanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroundecanoate	PR 50-150	3	3	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 028/33	PR 50-150	2	2	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 047	PR 50-150	2	2	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 099	PR 50-150	2	2	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 100	PR 50-150	2	2	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 153	PR 50-150	2	2	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 154	PR 50-150	2	2	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 183	PR 50-150	2	2	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 209	PR 50-150	2	2	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Dioxa-3H-Perfluorononanoate Acid, 4,8-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl-perfluorooctanesulfonamide, N-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl-perfluorooctanesulfonamidoethanol, N-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Carboxylic Acid, 3:3-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Carboxylic Acid, 5:3-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Carboxylic Acid, 7:3-	PR 50-150	3	3	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Sulfonate, 4:2-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Sulfonate, 6:2-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Sulfonate, 8:2-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Methyl-perfluorooctanesulfonamide, N-	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro(2-ethoxyethane)sulfonic acid	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-2-Propoxypropanoic Acid	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-3,6-dioxaheptanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-3-methoxypropanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-4-methoxybutanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorobutanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorobutanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorodecanesulfonate	PR 50-150	3	3	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorodecanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorododecanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorododecanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoroheptanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoroheptanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorohexanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorohexanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorononanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorononanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorooctanesulfonamide	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorooctanesulfonate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorooctanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoropentanesulfonate	PR 50-150	3	3	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total LCS Samples	LCS Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoropentanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorotetradecanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorotridecanoate	PR 50-150	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoroundecanoate	PR 50-150	3	3	100.0
Total						**392**	**378**	**96.4**

Table C.10. Laboratory control spike duplicate (LCSD) recovery acceptability for Year 2 CEC Monitoring.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LCSD Samples	LCSD Samples Within Limits	Acceptability Met (%)
EPA 1694M	Weck	Water	Total	Bisphenol A	RPD ≤ 25	2	0	0.0
EPA 1694M	Weck	Water	Total	Diclofenac	RPD ≤ 25	2	2	100.0
EPA 1694M	Weck	Water	Total	Estradiol, 17beta-	RPD ≤ 25	2	2	100.0
EPA 1694M	Weck	Water	Total	Estrone	RPD ≤ 25	2	1	50.0
EPA 1694M	Weck	Water	Total	Ethynylestradiol, 17alpha-	RPD ≤ 25	2	1	50.0
EPA 1694M	Weck	Water	Total	Gemfibrozil	RPD ≤ 25	2	2	100.0
EPA 1694M	Weck	Water	Total	Ibuprofen	RPD ≤ 25	2	1	50.0
EPA 1694M	Weck	Water	Total	Iopromide	RPD ≤ 25	2	2	100.0
EPA 1694M	Weck	Water	Total	Naproxen	RPD ≤ 25	2	2	100.0
EPA 1694M	Weck	Water	Total	Progesterone	RPD ≤ 25	2	2	100.0
EPA 1694M	Weck	Water	Total	Salicylic Acid	RPD ≤ 25	2	2	100.0
EPA 1694M	Weck	Water	Total	Testosterone	RPD ≤ 25	2	2	100.0
EPA 1694M	Weck	Water	Total	Triclosan	RPD ≤ 25	2	2	100.0
EPA 537M	Vista	Water	Total	Perfluorooctanesulfonic acid (PFOS)	RPD ≤ 30	4	4	100.0
EPA 537M	Vista	Water	Total	Perfluorooctanoic acid (PFOA)	RPD ≤ 30	4	4	100.0
EPA 625.1M	Physis	Water	Total	Galaxolide	NA	4	4	100.0
EPA 625.1M_MRM	Physis	Water	Total	Triclocarban	NA	4	4	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 028/33	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 047	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 099	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 100	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria[1]	Total LCSD Samples	LCSD Samples Within Limits	Acceptability Met (%)
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 153	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 154	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 183	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 209	RPD ≤ 35	1	1	100.0
EPA 9060M	Weck	Sediment	Total	Total Organic Carbon	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Dioxa-3H-Perfluorononanoate Acid, 4,8-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl-perfluorooctanesulfonamide, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl-perfluorooctanesulfonamidoethanol, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 3:3-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 5:3-	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LCSD Samples	LCSD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 7:3-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 4:2-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 6:2-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 8:2-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl-perfluorooctanesulfonamide, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl-perfluorooctanesulfonamidoethanol, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro(2-ethoxyethane)sulfonic acid	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-2-Propoxypropanoic Acid	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-3,6-dioxaheptanoate	RPD ≤ 35	1	0	0.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-3-methoxypropanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-4-methoxybutanoate	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LCSD Samples	LCSD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorobutanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorobutanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorodecanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorodecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorododecanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorododecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroheptanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroheptanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorohexanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorohexanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorononanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorononanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanesulfonamide	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LCSD Samples	LCSD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoropentanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoropentanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorotetradecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorotridecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroundecanoate	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 028/33	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 047	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 099	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 100	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 153	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 154	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LCSD Samples	LCSD Samples Within Limits	Acceptability Met (%)
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 183	RPD ≤ 35	1	1	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 209	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Dioxa-3H-Perfluorononanoate Acid, 4,8-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl-perfluorooctanesulfonamide, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl-perfluorooctanesulfonamidoethanol, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Carboxylic Acid, 3:3-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Carboxylic Acid, 5:3-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Carboxylic Acid, 7:3-	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria[1]	Total LCSD Samples	LCSD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Sulfonate, 4:2-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Sulfonate, 6:2-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Fluorotelomer Sulfonate, 8:2-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Methyl-perfluorooctanesulfonamide, N-	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro(2-ethoxyethane)sulfonic acid	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-2-Propoxypropanoic Acid	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-3,6-dioxaheptanoate	RPD ≤ 35	1	0	0.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-3-methoxypropanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoro-4-methoxybutanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorobutanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorobutanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorodecanesulfonate	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LCSD Samples	LCSD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorodecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorododecanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorododecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoroheptanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoroheptanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorohexanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorohexanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorononanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorononanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorooctanesulfonamide	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorooctanesulfonate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorooctanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoropentanesulfonate	RPD ≤ 35	1	1	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria [1]	Total LCSD Samples	LCSD Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoropentanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorotetradecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluorotridecanoate	RPD ≤ 35	1	1	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Perfluoroundecanoate	RPD ≤ 35	1	1	100.0
Total						**138**	**131**	**94.9**

[1] RPD criteria not applicable if concentration of either sample < MDL

Matrix Spike Samples

Table C.11. Matrix spike (MS) recovery acceptability for Year 2 CEC Monitoring.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
EPA 1694M	Weck	Water	Total	Bisphenol A	NA [1]	4	4	100.0
EPA 1694M	Weck	Water	Total	Diclofenac	NA [1]	4	4	100.0
EPA 1694M	Weck	Water	Total	Estradiol, 17beta-	NA [1]	4	4	100.0
EPA 1694M	Weck	Water	Total	Estrone	NA [1]	4	4	100.0
EPA 1694M	Weck	Water	Total	Ethynylestradiol, 17alpha-	NA [1]	4	4	100.0
EPA 1694M	Weck	Water	Total	Gemfibrozil	NA [1]	4	4	100.0
EPA 1694M	Weck	Water	Total	Ibuprofen	NA [1]	4	4	100.0
EPA 1694M	Weck	Water	Total	Iopromide	NA [1]	4	4	100.0
EPA 1694M	Weck	Water	Total	Naproxen	NA [1]	4	4	100.0
EPA 1694M	Weck	Water	Total	Progesterone	NA [1]	4	4	100.0
EPA 1694M	Weck	Water	Total	Salicylic Acid	NA [1]	4	4	100.0
EPA 1694M	Weck	Water	Total	Testosterone	NA [1]	4	4	100.0
EPA 1694M	Weck	Water	Total	Triclosan	NA [1]	4	4	100.0
EPA 625.1M	Physis	Water	Total	Galaxolide	PR 50-150	8	6 [2]	75.0 [2]
EPA 625.1M_MRM	Physis	Water	Total	Triclocarban	PR 50-150	8	6	75.0
EPA 9060M	Weck	Sediment	Total	Total Organic Carbon	PR 50-150	4	2	50.0
Total						**72**	**66**	**91.7**

[1] There are no Delta RMP MS recovery MQOs for PPCPs analyzed by EPA method 1694M; MS results provided by Weck were evaluated against the laboratory criteria of 50-150%.
[2] Two MS samples exceeded the upper control limit of 150% but were not flagged because the native concentration was >4x the spike concentration.

Table C.12. Matrix spike duplicate (MSD) acceptability for Year 2 CEC Monitoring.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total MS Samples	MS Samples Within Limits	Acceptability Met (%)
EPA 1694M	Weck	Water	Total	Bisphenol A	NA [1]	2	2	100.0
EPA 1694M	Weck	Water	Total	Diclofenac	NA [1]	2	2	100.0
EPA 1694M	Weck	Water	Total	Estradiol, 17beta-	NA [1]	2	2	100.0
EPA 1694M	Weck	Water	Total	Estrone	NA [1]	2	2	100.0
EPA 1694M	Weck	Water	Total	Ethynylestradiol, 17alpha-	NA [1]	2	2	100.0
EPA 1694M	Weck	Water	Total	Gemfibrozil	NA [1]	2	2	100.0
EPA 1694M	Weck	Water	Total	Ibuprofen	NA [1]	2	2	100.0
EPA 1694M	Weck	Water	Total	Iopromide	NA [1]	2	2	100.0
EPA 1694M	Weck	Water	Total	Naproxen	NA [1]	2	2	100.0
EPA 1694M	Weck	Water	Total	Progesterone	NA [1]	2	2	100.0
EPA 1694M	Weck	Water	Total	Salicylic Acid	NA [1]	2	2	100.0
EPA 1694M	Weck	Water	Total	Testosterone	NA [1]	2	2	100.0
EPA 1694M	Weck	Water	Total	Triclosan	NA [1]	2	2	100.0
EPA 625.1M	Physis	Water	Total	Galaxolide	RPD ≤ 25 [2]	4	4	100.0
EPA 625.1M_MRM	Physis	Water	Total	Triclocarban	RPD ≤ 25 [2]	4	4	100.0
EPA 9060M	Weck	Sediment	Total	Total Organic Carbon	RPD ≤ 35 [2]	2	2	100.0
Total						**36**	**36**	**100**

[1] There are no Delta RMP MSD MQOs for PPCPs analyzed by EPA method 1694M; MS results provided by Weck were evaluated against the laboratory criteria of RPD ≤ 30.

[2] RPD criteria not applicable if the concentration of either sample is < MDL.

Surrogate Samples

Table C.13. Surrogate recovery acceptability for Year 2 CEC Monitoring.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Surrogate Samples	Surrogate Samples Within Limits	Acceptability Met (%)
EPA 625.1M	Physis	Water	Total	Galaxolide-d6(Surrogate)	PR 30-130	78	78	100.0
EPA 625.1M_MRM	Physis	Water	Total	Triclocarban-13C6(Surrogate)	PR 50-150	19	19	100.0
Total						**97**	**97**	**100.0**

Isotope Dilution Standards

Table C.14. Isotope dilution analogue recovery acceptability for Year 2 CEC Monitoring.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total IDA Samples	IDA Samples Within Limits	Acceptability Met (%)
EPA 1694M	Weck	Water	Total	Bisphenol A-d16(IsoDilAnalogue)	PR 50-200	74	69	93.2
EPA 1694M	Weck	Water	Total	Estradiol-d3, 17beta-(IsoDilAnalogue)	PR 50-200	108	101	93.5
EPA 1694M	Weck	Water	Total	Ethynylestradiol-d4, 17alpha-(IsoDilAnalogue)	PR 50-200	72	66	91.7
EPA 1694M	Weck	Water	Total	Gemfibrozil-d6(IsoDilAnalogue)	PR 50-200	72	58	80.6
EPA 1694M	Weck	Water	Total	Ibuprofen-d3(IsoDilAnalogue)	PR 50-200	72	68	94.4
EPA 1694M	Weck	Water	Total	Naproxen-d3(IsoDilAnalogue)	PR 50-200	72	68	94.4
EPA 1694M	Weck	Water	Total	Progesterone-d9(IsoDilAnalogue)	PR 50-200	72	67	93.1
EPA 1694M	Weck	Water	Total	Salicylic Acid-d4(IsoDilAnalogue)	PR 50-200	72	59	81.9
EPA 1694M	Weck	Water	Total	Testosterone-d3(IsoDilAnalogue)	PR 50-200	72	66	91.7
EPA 1694M	Weck	Water	Total	Triclosan-d3(IsoDilAnalogue)	PR 50-200	72	65	90.3
EPA 537M	Vista	Water	Total	Perfluorooctanesulfonic acid-13C8(IsoDilAnalogue)	PR 25-150	68	68	100.0
EPA 537M	Vista	Water	Total	Perfluorooctanoic acid-13C2(IsoDilAnalogue)	PR 25-150	68	68	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 028-13C12(IsoDilAnalogue)	PR 25-200	8	8	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 047-13C12(IsoDilAnalogue)	PR 25-200	8	8	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 099-13C12(IsoDilAnalogue)	PR 25-200	8	8	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total IDA Samples	IDA Samples Within Limits	Acceptability Met (%)
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 100-13C12(IsoDilAnalogue)	PR 25-200	8	8	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 153-13C12(IsoDilAnalogue)	PR 25-200	8	8	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 154-13C12(IsoDilAnalogue)	PR 25-200	8	8	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 183-13C12(IsoDilAnalogue)	PR 25-200	8	8	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 209-13C12(IsoDilAnalogue)	PR 10-200	8	7	87.5
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl Perfluorooctane Sulfonamido Acetic Acid-d5, N-(IsoDilAnalogue)	PR 50-200	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl-perfluorooctanesulfonamide-d5, N-(IsoDilAnalogue)	PR 24-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl-perfluorooctanesulfonamidoethanol-d9, N-(IsoDilAnalogue)	PR 30-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate-13C2, 4:2-(IsoDilAnalogue)	PR 47-186	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate-13C2, 6:2-(IsoDilAnalogue)	PR 50-154	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate-13C2, 8:2-(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl Perfluorooctane Sulfonamido Acetic Acid-d3, N-(IsoDilAnalogue)	PR 47-200	9	9	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total IDA Samples	IDA Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl-perfluorooctanesulfonamide-d3, N-(IsoDilAnalogue)	PR 25-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl-perfluorooctanesulfonamidoethanol-d7, N-(IsoDilAnalogue)	PR 34-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-2-Propoxypropanoic Acid-13C3(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorobutanesulfonate-13C3(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorobutanoate-13C4(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorodecanoate-13C6(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorododecanoate-13C2(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroheptanoate-13C4(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorohexanesulfonate-13C3(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorohexanoate-13C5(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorononanoate-13C9(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanesulfonamide-13C8(IsoDilAnalogue)	PR 50-150	9	9	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total IDA Samples	IDA Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanesulfonate-13C8(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanoate-13C8(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoropentanoate-13C5(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorotetradecanoate-13C2(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroundecanoate-13C7(IsoDilAnalogue)	PR 50-150	9	9	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 028-13C12(IsoDilAnalogue)	PR 25-200	14	14	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 047-13C12(IsoDilAnalogue)	PR 25-200	14	14	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 099-13C12(IsoDilAnalogue)	PR 25-200	14	14	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 100-13C12(IsoDilAnalogue)	PR 25-200	14	14	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 153-13C12(IsoDilAnalogue)	PR 25-200	14	14	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 154-13C12(IsoDilAnalogue)	PR 25-200	14	14	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 183-13C12(IsoDilAnalogue)	PR 25-200	14	14	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	PBDE 209-13C12(IsoDilAnalogue)	PR 10-200	14	14	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total IDA Samples	IDA Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish	Ethyl Perfluorooctane Sulfonamido Acetic Acid-d5, N-(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Ethyl-perfluorooctanesulfonamide-d5, N-(IsoDilAnalogue)	PR 15-150	9	8	88. 9
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Ethyl-perfluorooctanesulfonamidoethanol-d9, N-(IsoDilAnalogue)	PR 9-150	9	8	88. 9
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Fluorotelomer Sulfonate-13C2, 4:2-(IsoDilAnalogue)	PR 50-157	9	8	88. 9
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Fluorotelomer Sulfonate-13C2, 6:2-(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Fluorotelomer Sulfonate-13C2, 8:2-(IsoDilAnalogue)	PR 50-156	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Methyl Perfluorooctane Sulfonamido Acetic Acid-d3, N-(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Methyl-perfluorooctanesulfonamide-d3, N-(IsoDilAnalogue)	PR 15-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Methyl-perfluorooctanesulfonamidoethanol-d7, N-(IsoDilAnalogue)	NA [1]	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluoro-2-Propoxypropanoic Acid-13C3(IsoDilAnalogue)	PR 43-150	9	8	88. 9
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluorobutanesulfonate-13C3(IsoDilAnalogue)	PR 50-150	9	9	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total IDA Samples	IDA Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluorobutanoate-13C4(IsoDilAnalogue)	PR 50-150	9	8	88. 9
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluorodecanoate-13C6(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluorododecanoate-13C2(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluoroheptanoate-13C4(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluorohexanesulfonate-13C3(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluorohexanoate-13C5(IsoDilAnalogue)	PR 50-150	9	8	88. 9
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluorononanoate-13C9(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluorooctanesulfonamide-13C8(IsoDilAnalogue)	PR 50-155	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluorooctanesulfonate-13C8(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluorooctanoate-13C8(IsoDilAnalogue)	PR 50-150	9	9	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluoropentanoate-13C5(IsoDilAnalogue)	PR 50-150	9	8	88. 9
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluorotetradecanoate-13C2(IsoDilAnalogue)	PR 34-150	9	7	77. 8
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Total	Perfluoroundecanoate-13C7(IsoDilAnalogue)	PR 50-150	9	9	100.0
Total						**1502**	**1421**	**94.6**

[1] There are no recovery criteria for D7-N-MeFOSE. Per the laboratory, recoveries of D7-N-MeFOSE and D9-N-EtFOSE in tissue samples may be low, with increased uncertainty in the analyte concentration when the surrogate recovery is below 8%. Under these conditions, N-Et-FOSE and N-Me-FOSE results are for information only.

Summary of Sample Handling Acceptability

Hold Time Evaluations

Table C.15. Sample hold time acceptability for Year 2 CEC Monitoring.

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
ASTM D3977	Weck	Water	Particulate	Suspended Sediment Concentration	14 Days	56	56	100.0
EPA 1694M	Weck	Water	Total	Bisphenol A	Extract within 28 days, analyze within 30 Days	58	58	100.0
EPA 1694M	Weck	Water	Total	Diclofenac	Extract within 28 days, analyze within 30 Days	58	58	100.0
EPA 1694M	Weck	Water	Total	Estradiol, 17beta-	Extract within 28 days, analyze within 30 Days	58	58	100.0
EPA 1694M	Weck	Water	Total	Estrone	Extract within 28 days, analyze within 30 Days	58	58	100.0
EPA 1694M	Weck	Water	Total	Ethynylestradiol, 17alpha-	Extract within 28 days, analyze within 30 Days	58	58	100.0
EPA 1694M	Weck	Water	Total	Gemfibrozil	Extract within 28 days, analyze within 30 Days	58	58	100.0
EPA 1694M	Weck	Water	Total	Ibuprofen	Extract within 28 days, analyze within 30 Days	58	58	100.0
EPA 1694M	Weck	Water	Total	Iopromide	Extract within 28 days, analyze within 30 Days	58	58	100.0
EPA 1694M	Weck	Water	Total	Naproxen	Extract within 28 days, analyze within 30 Days	58	58	100.0
EPA 1694M	Weck	Water	Total	Progesterone	Extract within 28 days, analyze within 30 Days	58	58	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
EPA 1694M	Weck	Water	Total	Salicylic Acid	Extract within 28 days, analyze within 30 Days	58	58	100.0
EPA 1694M	Weck	Water	Total	Testosterone	Extract within 28 days, analyze within 30 Days	58	58	100.0
EPA 1694M	Weck	Water	Total	Triclosan	Extract within 28 days, analyze within 30 Days	58	58	100.0
EPA 537M	Vista	Water	Total	Perfluorooctanesulfonic acid (PFOS)	Extract within 28 days, analyze within 30 Days	56	56	100.0
EPA 537M	Vista	Water	Total	Perfluorooctanoic acid (PFOA)	Extract within 28 days, analyze within 30 Days	56	56	100.0
EPA 625.1M	Physis	Water	Total	Galaxolide	Extract within 7 days, analyze within 40 Days	60	54	90.0
EPA 625.1M_MRM	Physis	Water	Total	Triclocarban	Extract within 7 days, analyze within 40 Days	60	45	75.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	Moisture	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	4	4	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 028/33	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	4	4	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 047	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	4	4	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 099	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	4	4	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 100	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	4	4	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 153	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	4	4	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 154	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	4	4	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 183	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	4	4	100.0
AXYS MLA-033 Rev 06	AXYS	Sediment	Total	PBDE 209	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	4	4	100.0
EPA 9060M	Weck	Sediment	Total	Total Organic Carbon	28 Days	6	6	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Dioxa-3H-Perfluorononanoate Acid, 4,8-	365 days	4	4	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl-perfluorooctanesulfonamide, N-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Ethyl-perfluorooctanesulfonamidoethanol, N-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 3:3-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 5:3-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Carboxylic Acid, 7:3-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 4:2-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 6:2-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Fluorotelomer Sulfonate, 8:2-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	365 days	4	4	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl-perfluorooctanesulfonamide, N-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Methyl-perfluorooctanesulfonamidoethanol, N-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Moisture	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro(2-ethoxyethane)sulfonic acid	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-2-Propoxypropanoic Acid	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-3,6-dioxaheptanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-3-methoxypropanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoro-4-methoxybutanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorobutanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorobutanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorodecanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorodecanoate	365 days	4	4	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorododecanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorododecanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroheptanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroheptanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorohexanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorohexanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorononanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorononanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanesulfonamide	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorooctanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoropentanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoropentanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorotetradecanoate	365 days	4	4	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluorotridecanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Sediment	Total	Perfluoroundecanoate	365 days	4	4	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish	Lipid	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	4	4	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish, Total	Moisture	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	10	10	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish, Not Applicable, Total	PBDE 028/33	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	10	10	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish, Not Applicable, Total	PBDE 047	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	10	10	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish, Not Applicable, Total	PBDE 099	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	10	10	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish, Not Applicable, Total	PBDE 100	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	10	10	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish, Not Applicable, Total	PBDE 153	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	10	10	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish, Not Applicable, Total	PBDE 154	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	10	10	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish, Not Applicable, Total	PBDE 183	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	10	10	100.0
AXYS MLA-033 Rev 06	AXYS	Tissue	Bivalves, Fish, Not Applicable, Total	PBDE 209	Extract within 365 days, analyze within 40 days not to exceed 365 days from sample collection	10	10	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid, 11-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Chlorohexadecafluoro-3-Oxanonane-1-Sulfonic Acid, 9-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Dioxa-3H-Perfluorononanoate Acid, 4,8-	365 days	4	4	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Ethyl Perfluorooctane Sulfonamido Acetic Acid, N-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Ethyl-perfluorooctanesulfonamide, N-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Ethyl-perfluorooctanesulfonamidoethanol, N-	365 days	3	3	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Fluorotelomer Carboxylic Acid, 3:3-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Fluorotelomer Carboxylic Acid, 5:3-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Fluorotelomer Carboxylic Acid, 7:3-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Fluorotelomer Sulfonate, 4:2-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Fluorotelomer Sulfonate, 6:2-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Fluorotelomer Sulfonate, 8:2-	365 days	4	4	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Methyl Perfluorooctane Sulfonamido Acetic Acid, N-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Methyl-perfluorooctanesulfonamide, N-	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Total	Moisture	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluoro(2-ethoxyethane)sulfonic acid	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluoro-2-Propoxypropanoic Acid	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluoro-3,6-dioxaheptanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluoro-3-methoxypropanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluoro-4-methoxybutanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorobutanesulfonate	365 days	4	4	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorobutanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorodecanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorodecanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorododecanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorododecanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluoroheptanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluoroheptanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorohexanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorohexanoate	365 days	4	4	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorononanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorononanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorooctanesulfonamide	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorooctanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorooctanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluoropentanesulfonate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluoropentanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorotetradecanoate	365 days	4	4	100.0
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluorotridecanoate	365 days	4	4	100.0

Method	Lab	Matrix	Fractions	Analyte	Acceptability Criteria	Total Samples	Samples Within Limits	Acceptability Met (%)
SGS AXYS MLA-110 Rev 02	AXYS	Tissue	Fish, Not Applicable, Total	Perfluoroundecanoate	365 days	4	4	100.0
Total						**1501**	**1480**	**98.6**

Appendix D. Deviation Forms

2021-01. Year 2 Clam Tissue Collection

Deviation Report / Corrective Action Form

Title:	**CEC Year 2 Clam Tissue Collection**
Deviation Number:	2021-01_CECv2_Dev_Vernalis_Clams
Prepared By:	Cassandra Lamerdin

Applicable Reference(s):

Delta Regional Monitoring Program Pilot Study of Constituents of Emerging Concern in the Sacramento-San Joaquin Delta Quality Assurance Project Plan Version 2.0, October 11, 2021

Complete the following table regarding the major milestones for the relevant deviation. Add additional rows as needed.

	Date	**Notes/Description (optional)**
Date Deviation Occurred:	10/21/2021	Sampling occurred for Event 1 Clam collections
Field Report Submitted for Review by AMS:	11/9/2021	
Date CVRWQCB QA Staff Notified:	11/15/2021	TAC Meeting
Deviation Form Drafted:	11/17/2021	Internal Review
Deviation Form sent for Review:	11/23/2021	Sent to Selina Cole (RB QA) and Will Hagan (DRMP QAO)
New information received from laboratory:	6/14/2022	Composite weights received from SGS-AXYS via email to determine if the expected tissue amount was received.
Updates provided via email:	6/15/2022	Selina Cole/ Will Hagan notified of tissue amounts available for each composite
Deviation Form Revised:	6/29/2022	Revised to include clam sample homogenization tissue amounts reported from SGS-AXYS.
Individual clam sizes added to dataset:	9/9/2022	MLJ added lengths, widths and tissue weight of individual clams that were used in Year 2 analysis from laboratory report. MLJ added

	Date	Notes/Description (optional)
		RLs and MLDs from EDD reported on same day.
Deviation Form Revised:	9/12/2022	Deviation form was revised to reflect the actual number and tissue composite weights that were used in the analyses.
Deviation Form Sent for Signatures:	10/31/2022	

Description of Deviation/ Change:
The QAPP requires a composite of a minimum of 20 *Corbicula fluminea* clams to be collected using roughly the same proportion of clams that is representative of the size classes observed at the sample location. The minimum mass required to support all analyses is 12 g of wet tissue mass per composite (18 g for replicate sites). If less than this amount of tissue is provided, reporting limits for the analysis increase.

Clam collections occurred for the late Summer/ early Fall sampling Event 1 on October 20 and 21, 2021 by Applied Marine Science (AMS). AMS submitted the field report on November 9, 2021 notifying that AMS collected at least 20 clams at each site. However, it was noted that there was potential for insufficient tissue from the 25 clams collected at San Joaquin River at Airport Way near Vernalis (541SJC501) on October 21, 2021 since the size of the clams collected may not yield a sufficient tissue amount. The sample collected was limited by the availability of the clams at the location and to try to remediate this issue the samplers collected more than 20 clams. Table 1 indicates the number of clams measured in the field at each site per size class in millimeters.

Table 1 Clam total length size reported from representative clams collected in the field.

Station Code	Station Name	Shell size in mm						
		Total Measured in the Field	<10	10-15	16-20	21-25	26-30	>30
541SJC501	San Joaquin River at Airport Way near Vernalis	25*	1	21	3			
544SJRNBC	San Joaquin River near Buckley Cove	20*		5	6	6	3	
519AMNDVY	American River at Discovery Park	20		6	6	8		
519SUT108	Sacramento River at Elkhorn Boat Launch Facility	20		4	4	3	8	1
510ST1301	Sacramento River at Freeport, CA-510ST1301	20		3	5	6	4	2
510SACC3A	Sacramento River at Hood Monitoring Station Platform	20		4	5	10	1	

* SGS-AXYS laboratory used more than the number of clams measured in the field for the analytical composites at these sites.

The field report from AMS was shared with the CEC Technical Advisory Committee on November 15, 2021 and the concern regarding the potential for insufficient clam tissue was discussed. However, it was unknown if there was the expected wet tissue mass of 12 g for all of the sites until SGS-AXYS was able to process the samples. This deviation form was originally drafted on November 17 and sent to the Delta RMP Quality Assurance Officer (QAO), Will Hagan, and the Regional Board QA Representative, Selina Cole, for review and comments on November 23; however, the deviation was not finalized with signatures at that time. It was agreed that the Delta RMP would follow up with SGS-AXYS to ensure that the Delta RMP was informed within 5 business days of compositing and weighing the samples to communicate the amount of tissue available for analysis.

The clams were homogenized by SGS-AXYS on June 8, 2022 and the composited tissue amounts were reported to the CV RDC on June 14, 2022 prior to sample analysis. SGS-AXYS informed the Delta RMP that there were three composites that were below the desired 12 grams of wet weight tissue. The composites for American River at Discovery Park (519AMNDVY) contained 6.58 grams, San Joaquin River at Airport Way near Vernalis (541SJC501) contained 3.77 grams, and Sacramento River at Hood Monitoring Station Platform (510SACC3A) contained 9.05 grams. The laboratory was informed to proceed with analysis from all 6 sites on June 15, 2022. This information was forwarded to the Delta RMP QAO and the Regional Board QA Representative on June 15, 2022. SGS -AXYS provided the clam size and count results in the laboratory report on August 18, 2022 which allowed for a more accurate accounting of the number of clams and tissue amounts used in each composite (Table 2).

Table 2 Clam Numbers and Composite Weights Reported from SGS-AXYS Lab Report.

Station Code	Station Name	Total Clams used in Composite	Composite Tissue Weight (g)
541SJC501	San Joaquin River at Airport Way near Vernalis	35	3.77
544SJRNBC	San Joaquin River near Buckley Cove	85	32.41
519AMNDVY	American River at Discovery Park	19	6.58
519SUT108	Sacramento River at Elkhorn Boat Launch Facility	18	15.72
510ST1301	Sacramento River at Freeport, CA-510ST1301	18	12.18
510SACC3A	Sacramento River at Hood Monitoring Station Platform	20	9.05

Reason for Deviation/Change (what happened, when and why -- could include inadvertent deviations from the QAPP, contradictory language in the QAPP, unanticipated problems, schedule and/or time constraints):

Deviations occurred at site San Joaquin River at Airport Way near Vernalis (541SJC501), where field staff were unable to collect the desired number of clams of sufficient size. At this location, clam collections were conducted manually using rakes and shovels in lieu of the dredge dragged behind a vessel due to shallow water depth and a lack of nearby vessel launch facilities. Three field staff attempted collections for approximately 3 hours and found a low abundance of clams, of mostly smaller size classes (10-15 mm), resulting in an estimated 5 g of tissue sample mass.

Deviations also occurred at sites American River at Discovery Park (519AMNDVY) and Sacramento River at Hood Monitoring Station Platform (510SACC3A) which lacked the desired amount of tissue upon homogenization at the laboratory.

Impact on Present and Completed Work (discuss potential magnitude of impact and bias of deviation/change, if this can be anticipated, if no impact is expected please indicate this)
These clams were scheduled for analysis of PBDEs, moisture and lipids. Ideally the lab (SGS-AXYS) would like to have ~ 10 grams for analysis of PBDEs and 2 grams for lipids and moisture; the ideal weight is 12 grams total (18 g for a replicate site) to ensure there is enough tissue for all analysis. Table 3 lists the three samples that are below the ideal mass but were still analyzed for all the constituents at raised minimum detection and reporting limits.

Table 3 Reporting Limits for the 3 stations with limited tissue availability.
Per DRMP Deviation 2021-09, the QAPP RL is based on the wet weight (ww) concentration. The Expected RL represents the QAPP value as converted to the dry weight (dw) concentration based on the tissue weights of each sample. Reported RLs and MDLs are the dw values provided by the laboratory in the EDD.

	Value	**Units**	**American R at Discovery Park**	**Sacramento R at Hood Platform**	**San Joaquin R near Vernalis**
Analyte	Wet Weight	g ww	5.303	7.381	2.721
	Dry Weight	g dw	0.3805	0.8506	0.3247
PBDE 028/33	*QAPP RL*	ng/g ww	0.005	0.005	0.005
	Expected RL	ng/g dw	0.0697	0.0434	0.0419
	Reported RL	ng/g dw	0.185	0.0705	0.158
	Reported MDL	ng/g dw	0.00876	0.00737	0.00982
PBDE 047	*QAPP RL*	ng/g ww	0.005	0.005	0.005
	Expected RL	ng/g dw	0.0697	0.0434	0.0419
	Reported RL	ng/g dw	0.154	0.0588	0.131
	Reported MDL	ng/g dw	0.00635	0.00179	0.00603
PBDE 099	*QAPP RL*	ng/g ww	0.005	0.005	0.005
	Expected RL	ng/g dw	0.0697	0.0434	0.0419
	Reported RL	ng/g dw	0.154	0.0588	0.131
	Reported MDL	ng/g dw	0.00891	0.0306	0.00588
PBDE 100	*QAPP RL*	ng/g ww	0.005	0.005	0.005
	Expected RL	ng/g dw	0.0697	0.0434	0.0419
	Reported RL	ng/g dw	0.154	0.0588	0.131
	Reported MDL	ng/g dw	0.00507	0.0194	0.00346
PBDE 153	*QAPP RL*	ng/g ww	0.005	0.005	0.005
	Expected RL	ng/g dw	0.0697	0.0434	0.0419
	Reported RL	ng/g dw	0.154	0.0588	0.131
	Reported MDL	ng/g dw	0.0102	0.00448	0.00855
PBDE 154	*QAPP RL*	ng/g ww	0.005	0.005	0.005
	Expected RL	ng/g dw	0.0697	0.0434	0.0419
	Reported RL	ng/g dw	0.154	0.0588	0.131
	Reported MDL	ng/g dw	0.00496	0.00223	0.00426
PBDE 183	*QAPP RL*	ng/g ww	0.005	0.005	0.005
	Expected RL	ng/g dw	0.0697	0.0434	0.0419
	Reported RL	ng/g dw	0.154	0.0588	0.0151
	Reported MDL	ng/g dw	0.00883	0.0034	0.00477

	Value	Units	American R at Discovery Park	Sacramento R at Hood Platform	San Joaquin R near Vernalis
PBDE 209	*QAPP RL*	ng/g ww	0.05	0.05	0.05
	Expected RL	ng/g dw	0.697	0.434	0.419
	Reported RL	ng/g dw	1.54	0.588	1.31
	Reported MDL	ng/g dw	0.122	0.0354	0.0909

Corrective Action (how the issue was addressed, any steps taken to ensure similar problems do not re-occur):

Corrective Action	By date	By whom
1) Inform the Delta RMP Program Manager if there are any concerns with the amount of tissue received by SGS-AXYS and the impact on analysis.	Within 5 business days of receiving the information from SGS-Axys	Sean Campbell, SGS-AXYS Project Manager
2) The Regional Board QA Representative will be notified within 7 days as per the Board Resolution R5-2021-0054 when it is determined that there is a potential deviation (e.g. insufficient clam mass collected). An email template has been developed to allow for quicker notification prior to submitting a formal deviation form and will be used for expeditated communication.	Future Sampling Efforts	Melissa Turner, Delta RMP Program Manager

ACKNOWLEDGED BY:

Regional Board Representative:	DocuSigned by: Selina Cole F3102A0E248746B...	Date:	11/10/2022
	Selina Cole		

Program Manager:	DocuSigned by: Melissa Turner 9796DD915C44446...	Date:	11/12/2022
	Melissa Turner		

DRMP QA Officer:	DocuSigned by: Will Hagan A1D771E8E56040F...	Date:	11/10/2022
	Will Hagan		

2021-02. Buckley Cove Location Offset

Deviation Report / Corrective Action Form

Title:	**CEC Buckley Cove Location Offset**
Deviation Number:	2021-02_CECv2_Dev_Buckley_LocationOffset
Prepared By:	Cassandra Lamerdin

Applicable Reference(s):

Delta Regional Monitoring Program Pilot Study of Constituents of Emerging Concern in the Sacramento-San Joaquin Delta Quality Assurance Project Plan Version 2.0, October 11, 2021

Complete the following table regarding the major milestones for the relevant deviation. Add additional rows as needed.

	Date	Notes/Description (optional)
Date Deviation Occurred:	10/25/2021	Sampling Occurred for Event 2; DRMP PM notified
Field Report Submitted for Review by AMS	11/9/2021	
Date CVRWQCB QA Staff Notified:	11/15/2022	TAC Meeting
Deviation Form Drafted:	11/17/2022	Internal Review
Deviation Form sent for Review:	11/23/2021	Sent to Selina Cole (Regional Board QA Representative) and Will Hagan (DRMP QA Officer)
Deviation Form Sent for Signatures:	10/24/2022	

Description of Deviation/Change:

On 10/25/2021 (Event 2), samplers collected water samples for CEC analysis from San Joaquin R at Buckley Cove (544LSAC13) approximately 350 meters downstream of target coordinates. The CEC QAPP indicates that samples must be collected within 100 meters of the target coordinate for any samples collected from the bank/shore.

Reason for Deviation/Change

Samplers arrived at the San Joaquin R at Buckley Cove location and found that the gate to the marina was closed which prevented them from accessing the end of the dock which is where the target coordinates are. The gate was closed due to a Monday holiday. Sampling personnel notified the sampling coordinator for the project of the situation and identified a nearby publicly accessible sampling location, approximately 350 meters from the target coordinates. The sampling coordinator communicated to the Delta RMP Program Manager, Melissa Turner, that the samplers were going to collect samples as close to the target coordinates as possible and confirmed that there were no additional inputs between the two locations (the actual lat/longs and the target lat/longs) and that the sample locations were very similar. It was unknown at the time if the actual sample location would be more than the 100 meters prescribed in the QAPP. During discussions with field crews, it was not anticipated that this would be a reoccurring issue and that additional steps would be taken to contact the marina and make sure the gate is open.

It was also noted that in Year 1, Department of Water Resources (DWR) also sampled closer to this location than the target latitude and longitudes (see map below).

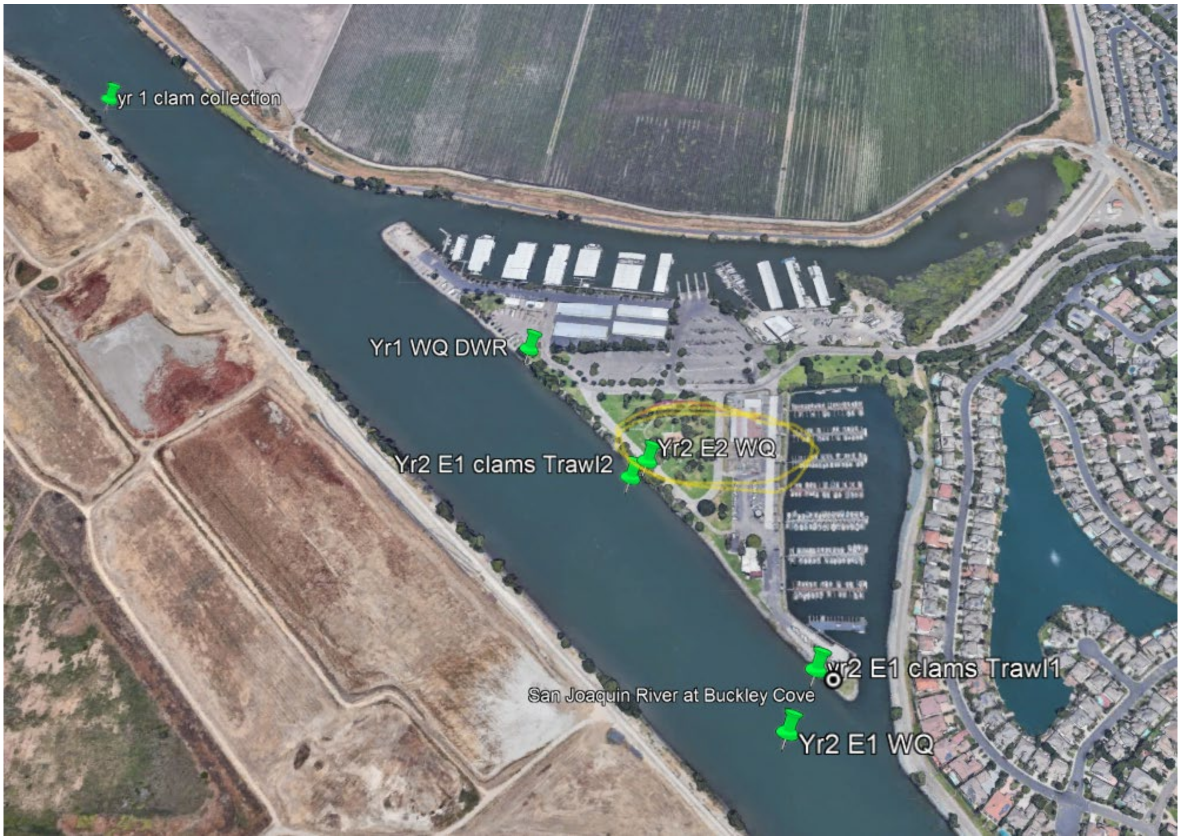
Table 1. Target and actual latitude and longitudes for San Joaquin R at Buckley Cove (544LSAC13) sampled on October 25, 2021.

Station Code	Sample Date	Actual Latitude	Actual Longitude	Target Latitude	Target Longitude
544LSAC13	10/25/21	37.97417	-121.37601	37.97183	-121.373619

Impact on Present and Completed Work (discuss potential magnitude of impact and bias of deviation/change, if this can be anticipated, if no impact is expected please indicate this)

It is expected that the impact of sampling 350 meters downstream of the target location will be minimal. The Year 2 Event 2 collection location for 544LSAC13 is similar to the Year 1 water collection location accessed by DWR. Figure 1 shows the locations where water was collected in Year 1 and Year 2 relative to where water samples were collected for Event 2.

Figure 1. Image of where water samples were collected for San Joaquin R at Buckley Cove (544LSAC13) in Year 1 with DWR (Yr1 WQ DWR) and Year 2 for Event 1 (Yr2 E1 WQ – water collection from the boat, Yr E1 clams trawl2 – clam collection from the boat) and Event 2 (Yr2 E2 WQ).



Corrective Action

Corrective Action	by date	by whom
1) Add the following comment to the sample comment field in database: Water collected ~ 350 m downstream of target location due to marina closure.	12/13/21	Cassandra Lamerdin Delta RMP Data Manager
2) Field crews will contact the marina prior to sampling to ensure gate is open.	Future Sampling Efforts	CEC Field Crews
3) In accordance with the QAPP page 64, if the target location is not accessible by more than 100 meters, the field crew will contact the DRMP Project Manager who will in turn obtain approval from the CVRWQCB QA Representative or the SWB QA Officer prior to sample collection.	Future Sampling Efforts	Melissa Turner Delta RMP Program Manager
4) The RB will be notified within 7 days as per the Board Resolution R5-2021-0054 when it has been identified that a site was collected in a location greater than 100 m from the target coordinates. An	Future Sampling Efforts	Melissa Turner Delta RMP Program Manager

Corrective Action	by date	by whom
email notification template has been created to allow for expedited to allow for more prompt notifications.		

ACKNOWLEDGED BY:

Task/Lab Manager:	DocuSigned by: Paul Salop 5770F12ED7504A9...	Date:	10/26/2022
Lead Field Scientist	Paul Salop		

Regional Board Representative:	DocuSigned by: Selina Cole F3102A0E248746B...	Date:	10/26/2022
	Selina Cole		

Program Manager:	DocuSigned by: Melissa Turner 9796DD915C44446...	Date:	10/26/2022
	Melissa Turner		

DRMP QA Officer:	DocuSigned by: Will Hagan A1D771E8E56040F...	Date:	10/26/2022
	Will Hagan		

2021-03. TOC Missing Lab Duplicate Event 1 July

Deviation Report / Corrective Action Form

Prepared By:	Cassandra Lamerdin

Date:	3/1/2022	Deviation Number:	2021-03_CECv2_Dev_TOCsed_NoLabDup
Title:	TOC Sediment Missing Lab Duplicate Event 1 July		

Applicable Reference(s):

Delta Regional Monitoring Program Pilot Study of Constituents of Emerging Concern in the Sacramento-San Joaquin Delta Quality Assurance Project Plan Version 2.0, October 11, 2021

Description of Deviation/Change:

On 09/08/2021, Weck Laboratories informed the Central Valley Regional Data Center (CV RDC) who is managing the CEC Year 2 data, that the analyst ran a laboratory control spike duplicate (LCSD) instead of an unspiked laboratory duplicate as requested and required by the CEC QAPP v2. Sediment samples in this batch were collected by University California -Granite Canyon on July 22, 2021 as part of the SPoT program and as a collaborator on this project.

Reason for Deviation/Change (what happened, when and why -- could include inadvertent deviations from the QAPP, contradictory language in the QAPP, unanticipated problems, schedule and/or time constraints):

This deviation occurred at the laboratory even though there had been previous email communication between CV RDC and Weck to ensure there was enough sample available for an unspiked duplicate. The Chain of Custody (COC) form did request a laboratory duplicate. It was determined to be an oversight by the analyst at the laboratory and flagged appropriately according to the Data Management SOP.

The Regional Board Resolution requiring deviations to be reported within 7 days of the DRMP being notified of the deviation was adopted in October after this occurred. It was also unclear if this constituted a deviation since the data were flagged according to the Data Management SOP. This situation was discussed with the Regional Board QA Representative, Selina Cole, on February 18, 2022 and it was recommended to submit a deviation form. This form was created to fulfill that request.

Impact on Present and Completed Work (discuss potential magnitude of impact and bias of deviation/change, if this can be anticipated, if no impact is expected please indicate this)

The analytical batch will not have representation of precision from an environmental sample for this batch; however, the analyst did perform prepare and analyze a laboratory control spike duplicate (LCSD) instead.

The following is the definition of laboratory duplicate in the CEC QAPP : replicate sub-samples of field samples, taken through the full analytical procedure including all laboratory processes combined, to measure analytical precision. Although standard reference materials, laboratory reference materials, matrix spike samples, or laboratory control samples can also be analyzed in replicate, references to those are prefaced by their sample type name, e.g., "matrix spike duplicates".

The expected impact is minimal because although the duplicate was not performed on an unspiked sample, precision can be assessed with the LCSD. The batch has been flagged following the Data Management Standard Operating Procedures to indicate that QC is missing.

Corrective Action (how the issue was addressed, any steps taken to ensure similar problems do not re-occur):

Corrective Action	by date	by whom
1) Weck informed the CV RDC when submitting the lab report that the batch was missing an unspiked duplicate, but an LCSD was performed instead.	09/08/2021	Chris Samatmanakit (Weck Laboratories)
2) The analytical batch missing the lab duplicate will be flagged with a Lab Submission Code of QI and a Lab Batch Comment.	09/24/2021	Cassandra Lamerdin (MLJ Environmental)
3) Conversation occurred between Weck laboratory and MLJ that sediment samples collected in October for Event 1 will include an unspiked laboratory duplicate for TOC analysis.	10/27/2021	Chris Samatmanakit (Weck Laboratories)
4) Confirmed analysis of unspiked TOC laboratory duplicate with sediment samples collected in October as part of Event 1.	01/07/2022	Cassandra Lamerdin (MLJ Environmental)

ACKNOWLEDGED BY:

DRMP Data Manager	DocuSigned by: Cassandra Lamerdin 2801D2DF64FB454...	Date:	10/21/2022
	Cassandra Lamerdin		

Regional Board Representative:	DocuSigned by: Selina Cole F3102A0E248746B...	Date:	10/21/2022
	Selina Cole		

Program Manager:	DocuSigned by: Melissa Turner 9796DD915C44446...	Date:	10/21/2022
	Melissa Turner		

DRMP QA Officer:	DocuSigned by: Will Hagan A1D771E8E56040F...	Date:	10/21/2022
	Will Hagan		

2021-04. Missing Laboratory Duplicate for SSC Analysis

Deviation Report / Corrective Action Form

Title:	**Missing Laboratory Duplicate for CEC SSC Analysis.**
Deviation Number:	2021-04_CECv2_Dev_SSC_NoLabDup
Prepared By:	Cassandra Lamerdin

Applicable Reference(s):

Delta Regional Monitoring Program Pilot Study of Constituents of Emerging Concern in the Sacramento-San Joaquin Delta Quality Assurance Project Plan Version 2.0, October 11, 2021

Complete the following table regarding the major milestones for the relevant deviation. Add additional rows as needed.

Event	Date	Notes/Description (optional)
DRMP Staff Notified:	12/22/2021	Weck Laboratories (Weck) notified Delta RMP DMT that a lab duplicate for SCC was not possible for Events 1 and 2.
CVRWQCB QA Staff Notified:	01/07/2022	Call with Regional Board QA Representative to discuss issue; agreed to submit a deviation form to document missed quality control sample and an amendment form to remove duplicate requirement.
Amendment Form Submitted:	01/20/2022	Amendment form submitted for signature.
Deviation Form Drafted:	01/20/2022	
Deviation Form Submitted for Signatures:	10/21/2022	

Description of Deviation/Change:

The CEC QAPP v2 requires a laboratory duplicate to measure laboratory precision at a frequency of 1 per analytical batch for the Suspended Sediment Concentration (SSC) analysis run with method ASTM D3977-97 by Weck . Weck informed the Delta RMP Data Management Team (DMT) on 12/22/2021 that given the constraints of the ASTM method and the procedure for preparing laboratory control spike (LCS) samples, they were unable to generate a duplicate sample (e.g. a laboratory control spike duplicate (LCSD)) that could be used to asses laboratory precision for water samples collected during Event 1 (October 20-21) and Event 2 (October 25-26) SSC analysis.

Reason for Deviation/Change (what happened, when and why -- could include inadvertent deviations from the QAPP, contradictory language in the QAPP, unanticipated problems, schedule and/or time constraints):

The lack of laboratory precision in the batch analysis of SSC occurred for the following reasons. Method ASTM D3977-97 requires the use of the entire collected sample volume which does not allow for the lab taking aliquots from a larger volume of water. SSC standard capsules are available from a vendor and utilized in the batch analysis; however, these capsules vary in concentration from sample to sample thus making an LCSD unsuitable to evaluate laboratory precision.

Weck informed the DMT that the method does not require a laboratory duplicate sample and most projects do not require this additional quality control. The Program QA Officer, Will Hagan, noted that a laboratory duplicate is not required by SWAMP providing additional justification for removing this requirement from the QAPP for this method/analyte. This situation was discussed with Selina Cole, the Regional Board (RB) QA Representative, and it was agreed that an amendment to the QAPP should be submitted to revise the quality control requirements.

Impact on Present and Completed Work (discuss potential magnitude of impact and bias of deviation/change, if this can be anticipated, if no impact is expected please indicate this)

The QAPP will still require a positive and negative control which is more than is required by SWAMP. A field duplicate is required and is a control to inform the precision of both field and laboratory activities; therefore, information about laboratory precision is still required by the QAPP.

Corrective Action (how the issue was addressed, any steps taken to ensure similar problems do not re-occur):

Corrective Action	By Date	By Whom
1) Weck informed the Delta RMP Program Manager and associated data management staff of the issues with being able to perform a laboratory duplicate. This information was emailed to the DRMP Program QA Officer, Will Hagan, and Regional Board QA Representative, Selina Cole.	12/22/2021	Lisa McCrink (MLJ Environmental)
2) Independent research regarding method QC requirements and SWAMP criteria; discussions with laboratory to further understand situation and impact on data.	01/06/2022	Will Hagan (MLML), Lisa McCrink (MLJ Environmental)
3) Discussion with Selina Cole produced consensus to recommend an amendment to the CEC QAPP v2 as well as create a deviation for Event 1 and 2.	01/07/2022	Melissa Turner (DRMP Program Manager), Lisa McCrink (MLJ Environmental)

ACKNOWLEDGED BY:

Regional Board QA Representative:	DocuSigned by: Selina Cole F3102A0E248746B...	Date:	10/21/2022
	Selina Cole		

DRMP Program Manager:	DocuSigned by: Melissa Turner 9796DD915C44446...	Date:	10/21/2022
	Melissa Turner		

DRMP Program QA Officer:	DocuSigned by: Will Hagan A1D771E8E56040F...	Date:	10/21/2022
	Will Hagan		

2021-05. Weck MDLs and RL elevated for some Analytes

Deviation Report / Corrective Action Form

Prepared By:	Cassandra Lamerdin

Date:	03/04/2022	Deviation Number:	2021-04 CECv2_Dev_Weck_MDLS_RL_Elevated
Title:	Weck Elevated MDLs and RL		

Applicable Reference(s):

Delta Regional Monitoring Program Pilot Study of Constituents of Emerging Concern in the Sacramento-San Joaquin Delta Quality Assurance Project Plan Version 2.0, October 11, 2021

Complete the following table regarding the major milestones for the relevant deviation. Add additional rows as needed.

Event	Date	Notes/Description (optional)
Date Deviation Occurred:	02/14 /2022	Data review process of Weck EDD from Event 1 and 2 identified potential deviations in MDLs reported vs the MDLs in the QAPP.
Lab Confirmed Deviation:	02/28/2022	
Date CVRWQCB QA Staff Notified:	03/02/2022	Email sent to Selina Cole (Regional Board QA Representative) indicating that the MDLs are different and that the QAPP needs to be amended.
Deviation Form Drafted:	03/04/2022	
Amendment Form Finalized:	06/02/2022	
Deviation Form Submitted for Signatures:		

Description of Deviation/Change and Timelines related with the Deviation:

Weck Laboratories provided results for the October Events 1 and 2 (October 20-21 and 25-26, 2022) on January 7 and 10, 2022, respectively. While performing internal review of the data in February, data management staff noted that the reported Minimum Detection Limits (MDLs) and one Reporting Limit (RL) did not match the QAPP. On February 14, 2022, data management staff emailed Weck to verify that the MDLs and single RL were reported correctly. In response, the Weck Project Manager originally informed data management staff that the discrepancies in the MDLs were a mistake and would be corrected in an updated Electronic Data Deliverable (EDD);

however, on February 28, 2022, the Weck Project Manager informed MLJ staff that the MDLs reported were not a mistake and that they could not be changed. The laboratory indicated that due to a recent MDL study, the detection limits that were included in the QAPP were no longer valid. In addition to the updated MDLs, the Reporting Limit (RL) for triclosan was also elevated, which the laboratory indicated was an oversight that was not noticed during their review of the CEC QAPP v2.

On March 2, 2022, data management staff (Lisa McCrink) emailed Selina Cole and Will Hagan to inform them of this deviation within the Resolution timeline for notification of 7 days.

The table below summarizes the MDLs and RLs that were reported in the QAPP and those that were reported for the October events. The analytes for which the reported values are higher than what Weck originally provided are in red and bolded. While some MDLs are marginally increased, it should be noted that the MDLs for gemfibrozil and salicylic acid have increased significantly (50X and 116X, respectively).

Analyte	Analyte Type	MDL in QAPP	MDL Reported for October Events	RL in QAPP	RL Reported for October Events	Units
Bisphenol A	Required	**2**	**4**	10	10	ng/L
Diclofenac	Required	**0.26**	**4**	10	10	ng/L
Estradiol, 17beta-	Required	10	4	10	10	ng/L
Estrone	Required	10	4	10	10	ng/L
Ethynylestradiol, 17alpha-	Additional	10	4	10	10	ng/L
Gemfibrozil	Additional	**0.08**	**4**	10	10	ng/L
Ibuprofen	Required	5	4	10	10	ng/L
Iopromide	Additional	**1.8**	**4**	50	50	ng/L
Naproxen	Additional	**2**	**4**	10	10	ng/L
Progesterone	Additional	10	4	10	10	ng/L
Salicylic Acid	Additional	**0.86**	**100**	500	500	ng/L
Testosterone	Additional	10	4	10	10	ng/L
Triclosan	Required	10	8	**10**	**20**	ng/L
Total Organic Carbon	Ancillary	36	**41**	200	200	mg/Kg dw

Reason for Deviation/Change (what happened, when and why -- could include inadvertent deviations from the QAPP, contradictory language in the QAPP, unanticipated problems, schedule and/or time constraints):

Upon inquiry to the lab, Chris Samatmanakit provided the following description for the deviation. "Weck is now required to perform a new MDL study every calendar year using the new format of performing the MDL study for 3 consecutive days of data to establish the MDL for the method in accordance to the operation and instrument capabilities. This would mean that the MDL (and possibly the MRL) may evolve every year when we are required to do the MDL study or if there are any significant changes to either the method operations or the instrument. We have not made any changes to the method procedure or the instrument prior to the commencement of this project.

The RL for Triclosan may have been an oversight during the review of the QAPP. We were reporting a RL of 20 for the first year of this project and fixed the RL's based on those parameters. This RL should be 20."

Impact on Present and Completed Work (discuss potential magnitude of impact and bias of deviation/change, if this can be anticipated, if no impact is expected please indicate this)

Based on the QAPP Table 7-3, the elevated Triclosan RL is still below the the Monitoring Trigger Limit. None of the other RLs changed and all RLs remained less than the Monitoring Trigger Limits identified in Table 7-3 (for those with trigger limits identified). No impact is expected in the interpretation of the results.

Corrective Action (how the issue was addressed, any steps taken to ensure similar problems do not re-occur):

Corrective Action	by date	by whom
1) MLJ staff found that seven MDLs and one RL were higher than what was reported in the QAPP and confirmed with Weck that the MDLs (and one RL) need to be updated in the QAPP.	02/28/2022	Cassandra Lamerdin (MLJ Environmental)
2) Ensure next CEC QAPP (Year 3 Study Plan) will have MDLs and RLs that are in sync with the capabilities of the laboratory MDL study.	February-April 2023	Melissa Turner (DRMP Program Manager)
3) Submit a QAPP Amendment to reflect update MDLs and RL.	06/22/2022	Lisa McCrink (MLJ Environmental)

ACKNOWLEDGED BY:

Regional Board Representative:		Date:	
	Selina Cole		

DRMP Program Manager:		Date:	
	Melissa Turner		

DRMP QA Officer:		Date:	
	Will Hagan		

2021-06. Event 3 Field Sampling Deviations for 1 Site Offset and 2 O2 Saturation Not Reported

Deviation Report / Corrective Action Form

Title:	**CEC Event 3 Field Sampling Deviations for 1 Site Offset and 2 O2 Saturation Not Reported**
Deviation Number:	2021-06_CEC_Dev_WY21_Event3FieldSampling
Prepared By:	Cassandra Lamerdin

Applicable Reference(s):

Delta Regional Monitoring Program Pilot Study of Constituents of Emerging Concern in the Sacramento-San Joaquin Delta Quality Assurance Project Plan Version 2.0, October 11, 2021

Deviation Timeline

Complete the following table regarding the major milestones for the relevant deviation. Add additional rows as needed.

	Date	**Notes/Description (optional)**
Date Deviation Occurred:	03/28/2022	Date of field sampling when two issues occurred: 1) samplers were unable to collect water samples within 100 meters of the Buckley Cove target latitude/longitudes, and 2) one sampling team had to use a rented field meter which did not have the ability to collect percent oxygen saturation.
Date DRMP Staff Notified:	03/28/2022; 04/01/2022	Field sampling lead contacted the DRMP Program Manager regarding the deviation from the Buckley Cover target latitude / longitude. The field sampling lead noticed on the field sheets that percent oxygen

	Date	Notes/Description (optional)
		saturation was not recorded on the field sheet due to the meter not having that capacity.
Date CVRWQCB QA Staff Notified:	03/28/2022; 04/05/2022	Email sent from the DRMP Program Manager to the Regional Board QA Representative regarding Buckley Cove potential deviation. Follow up email from Data Manager, Cass Lamerdin, to the DRMP QA Officer, Will Hagan, and the Regional Board QA Representative, Selina Cole, regarding the percent oxygen saturation and the need to create a deviation form for the Event 3 deviations.
Deviation Form Drafted:	04/07/2022	
Date of meeting to discuss station location:	05/18/2022	DRMP Program Manager to the Regional Board QA Representative regarding Buckley Cove
Amendment Submitted for Signatures:	05/27/2022	
Deviation Form Submitted for Signatures:		

DESCRIPTION / BACKGROUND OF DEVIATION:

On 03/28/2022, the Delta RMP conducted sampling activities at twelve sites for Event 3 (Wet Season 2). There were four teams total that sampled the event and the two deviations identified occurred with the ICF sample team that was sampled locations from the bank in the Sacramento area.

The first deviation that occurred during Event 3 was a sampling offset from the target location at San Joaquin R at Buckley Cove (Station Code 544LSAC13; see Figure 1; Table 1). This deviation occurred without discussing with the Delta RMP Program Manager (Melissa Turner) until after samples were collected. Once this deviation was communicated to the Delta RMP Program Manager (evening of the same sample date, 3/28/2022), an email notification was sent to the Regional Board QA Representative, Selina Cole. This is not the first time that the target location for the Buckley Cove has not been accessible. During Event 2 (Deviation Form # 21-02), samplers were unable to access the target location and sampled this same alternative spot. At the time of the Event 2 deviation, it was discussed that the issue with access (locked gate) should not be an ongoing issue and that if it is an issue the DRMP Program Manager should be identified right away.

The second deviation that occurred during Event 3 consisted of sampling personnel not recording dissolved oxygen percent saturation at two locations, San Joaquin R at Buckley Cove (544LSAC13) and San Joaquin River at Airport Way near Vernalis (541SJC501); dissolved oxygen was collected and recorded. This deviation was identified when the data sheets were being reviewed by the field sampling lead for completion, Matthew Bundock, and communicated to the Delta RMP Program Manager on 4/5/2022. Notification of the missed field parameter was communicated to the Regional Board QA Representative and the DRMP QA Officer, Will Hagan, on 4/5/2022 by Cassandra Lamerdin (Data Manager).

Figure 1. Map of Target and Actual Locations for Events 1 (CEC_Yr2_E1), Event 2 (CEC_Yr2_E2) and Event 3 (CECYr2_E3).

Table 1. Location information for Buckley Cove water quality collections.

Station Code	Sample Date	Event	Actual Latitude	Actual Longitude	Target Latitude	Target Longitude
544LSAC13	10/21/2021	Event 1	37.97124	-121.374256	37.971833	-121.373619
	10/25/2021	Event 2	37.97417	-121.37601	37.971833	-121.373619
	03/28/2022	Event 3	37.974196	-121.37600	37.971833	-121.373619

REASON FOR DEVIATION:

The sample collection offset at Buckley Cove occurred due to a misunderstanding with the samplers. The samplers saw No Trespassing signs and thought that they should sample where they sampled the previous event which was a deviation (Deviation Form # 21-02). Samples were again collected at a publicly accessible location nearby and downstream of the target coordinates (Table 1). When the samplers met with the sampling lead at the end of the day to discuss how their day went, it was communicated that they did not go through the gate to the end of the marina to collect samples. The sampling lead let them know that this was a deviation which the samplers did not originally understand.

The field crew from ICF was using a rental YSI meter and output was not set up to record percent oxygen saturation. All other schedule field measurements were collected (including percent oxygen saturation) from all field crews at all sites.

IMPACT ON PRESENT AND COMPLETED WORK

It is expected that the impact of sampling downstream of the target location will be minimal. The Year 2 Event 2 & 3 collection locations for 544LSAC13 are similar to the Year 1 water collection location accessed by Department of Water Resources (DWR), where all collections were from the bank.

A meeting occurred with Selina Cole and Melissa Turner on May 18, 2022 to discuss whether a new station code to reflect the location where water quality samples were collected for Event 2 and 3 and determine where the fourth collection would be collected. Consensus was that a new station code will be created, and the existing data will be updated to the new station code. An amendment to the QAPP would further document this process.

The new CEC station code was updated from 544LSAC13, San Joaquin R at Buckley Cove to 544SJRNBC, San Joaquin River near Buckley Cove. The target coordinate for 544SJRNBC San Joaquin River near Buckley Cove will be 37.97417, -121.37601 (WGS84).

Table 2 list the oxygen results for both sites. Percent saturated oxygen can be approximated with the dissolved oxygen and temperature results which were recorded from all sites. There is no expected impact of missing the dissolved saturated oxygen measurements from these two sites due to the other field parameters being collected.

Table 2. Year 1 and 2 oxygen results for the two sites missing oxygen saturation during Event 3 (03/28/2022).

Project Year	Station Code	Sample Date	Oxygen, Dissolved (mg/L)	Oxygen, Saturation (% Saturation)
20DRMP5CEC	544LSAC13	09/20/2020	8.38	99.2
20DRMP5CEC	544LSAC13	10/16/2020	7.12	80.8
20DRMP5CEC	544LSAC13	4/14/2021	8.93	93.9
20DRMP5CEC	544LSAC13	6/16/2021	8.02	93.8
21DRMP5CEC	544LSAC13	10/21/2021	8.25	86.4
21DRMP5CEC	544LSAC13	10/25/2021	9.34	97.3
21DRMP5CEC	544LSAC13	3/28/2022	10.45	Not Recorded
20DRMP5CEC	541SJC501	09/30/2020	8.15	93.4
20DRMP5CEC	541SJC501	04/14/2021	9.32	96.6
20DRMP5CEC	541SJC501	06/16/2021	9.48	100.6
21DRMP5CEC	541SJC501	10/20/2021	9.34	91.1
21DRMP5CEC	541SJC501	10/25/2021	7.51	75.2
21DRMP5CEC	541SJC501	03/28/2022	9.05	Not Recorded

CORRECTIVE ACTIONS

Identify steps taken to ensure similar problems do not re-occur:

Corrective Action	Completion Date	Responsible Party
1) Information about the sample offset was identified and sent to the DRMP Program Manager and Regional Board Representative on the same day of occurrence.	03/28/22	Melissa Turner Delta RMP Program Manager
2) Discussion with Selina Cole and Melissa Turner to determine where the final event should be collected for this site.	Prior to Future Event 4	Melissa Turner Delta RMP Program Manager
3) MLJ will ensure, prior to next sampling event, that all field measures listed in the QAPP are able to be reported from all field crews and instruments.	Prior to Future Event 4	Matthew Bundock Sample Coordinator

ACKNOWLEDGED BY:

Regional Board Representative:		Date:	
	Selina Cole		

DRMP Program Manager:		Date:	
	Melissa Turner		

DRMP QA Officer:		Date:	
	Will Hagan		

2021-08. Weck Event 3 Missed Resolution Reporting Timeline

Deviation Report / Corrective Action Form

Title:	**Weck Laboratories Late Reporting of PPCPs Preliminary Data for Event 3**
Deviation Number:	2021-08_CEC_Dev_Weck_MissedResolutionTimeline
Prepared By:	Cassandra Lamerdin

Applicable Reference(s):

Delta Regional Monitoring Program Pilot Study of Constituents of Emerging Concern in the Sacramento-San Joaquin Delta Quality Assurance Project Plan Version 2.0, October 11, 2021

Resolution R5-2021-0054 Approval of Delta Regional Monitoring Program Governance Structure and Implementing Entity

Complete the following table regarding the major milestones for the relevant deviation. Add additional rows as needed.

Event	Date	Notes/Description (optional)
Date DRMP Staff Notified	7/21/2022	Weck Laboratories (Weck) sent preliminary lab report for review which contained analysis date of 4/8/2022
Date CVRWQCB QA Staff Notified:	7/21/2022	Email was sent to Selina Cole noting the potential deviation of the Resolution R5-2021-0054 reporting timeline requirements.

Event	Date	Notes/Description (optional)
60- day deadline:	6/6/2022	60-day deadline for reporting preliminary results. Analysis Date: 4/08/22; Preliminary Data Received: 7/27/2022
Amendment sent for signatures:	5/28/2022	
Deviation Form Drafted:	8/01/2022	
Deviation Form Submitted for Signatures:		

DESCRIPTION / BACKGROUND OF DEVIATION:

On 3/28/2022, the Delta RMP conducted sampling activities at twelve sites for Event 3. Samples were sent to Weck on 3/30/2022 for Pharmaceutical and Personal Care Product (PPCP) analysis.

Based on the Regional Board Resolution R5-2021-0054, preliminary results are required to be reported within 60 calendar days of the sample analysis date. Weck should have reported the preliminary results to the Delta RMP by 6/6/2022. Weck reported Event 3 results on 7/21/2022 which was 51 days past the Resolution deadline.

REASON FOR DEVIATION:

The delay in reporting of preliminary results is due to extra time that Weck spent to refine their laboratory report and Electronic Data Deliverable (EDD) to include percent recoveries of isotope dilution analogues (IDAs) in the extraction standards. Weck agreed to update their reporting system to allow for the reporting of percent recoveries based on a conference call with the Delta RMP Program Manager, the Regional Board QA Representative (Selina Cole), the State Board QA Officer (Andrew Hamilton), and data management staff (Lisa McCrink) on 3/22/22.

Weck analyzed a total of 13 PPCP constituents in water samples collected on 3/28/2022 using EPA 1694. Weck performs the analysis with a modified version of EPA 1694, which uses an isotope dilution method to quantify the analytical results. Though the isotopically labeled standards used for this quantification are added at the beginning of the extraction process, the previous methodology by which Weck processed and analyzed the samples for Events 1 and 2 did not allow for the calculation of the percent recovery results of the isotope dilution analogues (IDAs) in the extraction standards.

Given recent CEDEN guidance regarding the reporting of isotope dilution methods, the recoveries of each IDA associated with a sample result should be reported with the result concentration; this requirement was discussed with Weck on 3/23/2022. Moving forward, Weck agreed to provide these percent recoveries with each analysis performed with EPA 1694M even though this requirement was not listed in the QAPP. This deviation occurred because Weck was refining their laboratory report and EDD reporting capabilities and the time to make the adjustments took longer than anticipated. Data management staff began following up with Weck on 5/9/2022 via email to determine when staff could expect to receive the results and ensure that they could amend their reporting process. Data management staff continued to inquire with the laboratory via email 5/16, 5/22, 6/2, 6/21, and 7/6 with minimal response. It was not until the results were received on 7/21/2022 that data management staff could confirm that the results were reported outside of the Resolution timeframe which is based on the sample analysis date.

This deviation only affects the timing for when preliminary results were received; there were no hold time violations associated with these results. Event 4 data were reported within the 60-day timeframe and included the percent recoveries as requested.

IMPACT ON PRESENT AND COMPLETED WORK

There will be no specific impact on the present or complete work, Delta RMP has prioritized getting these data internally reviewed, loaded, and ready for data verification to meet all other Resolution reporting timelines.

CORRECTIVE ACTIONS

Identify steps taken to ensure similar problems do not re-occur:

Corrective Action	Completion Date	Responsible Party
1. Amend the CEC QAPP (v2.0) include language requiring the percent recovery reporting for methods with IDAs.	6/2/22 (signed amendment form)	Melissa Turner (DRMP Program Manager

ACKNOWLEDGED BY:

Regional Board Representative:		Date:	
	Selina Cole		

DRMP Program Manager:		Date:	
	Melissa Turner		

DRMP QA Officer:		Date:	

	Will Hagan		

2021-09. CEC Year 2 Tissue RLs and Missing Lipids and Moisture Results

DELTA
Regional Monitoring Program

Deviation Report / Corrective Action Form

Title:	**CEC Year 2 Tissue RLs and Missing Lipids and Moisture Results**
Deviation Number:	2021-09_CECv2_Dev_AXYS_Tissue_RLs_MissingResults
Prepared By:	Cassandra Lamerdin

Applicable Reference(s):

Delta Regional Monitoring Program Pilot Study of Constituents of Emerging Concern in the Sacramento-San Joaquin Delta Quality Assurance Project Plan Version 2.0, October 11, 2021

Complete the following table regarding the major milestones for the relevant deviation. Add additional rows as needed.

	Date	Notes/Description (optional)
EDD Submitted by SGS-AXYS:	08/19/2022	
Date Deviation Occurred:	09/02/2022	On 9/2/22, the CV RDC reviewed the EDD for clams and fish sampled in October 2021 (received from SGS-AXYS on 8/19/22) and identified the potential deviation; confirmation occurred with SGS-AXYS that they did not do the QC.
Date CVRWQCB QA Staff Notified:	09/07/2022	Email identifying deviation sent to Selina Cole (RB QA Representative) and Will Hagan (DRMP QAO).
SGS-AXYS notified by DRMP Program Manager to run lipids on 2 samples as a corrective measure	09/09/2022	There are two clam samples (544SJRNBC & 519SUT108) that have enough tissue to run lipids and one (544SJRNBC) of the two samples has enough to report a duplicate. SGS-AXYS will analyze and report on the results as soon as possible
Deviation Form Drafted:	09/10/2022	Internal development of Deviation Form and follow up with AXYS-SGS to determine corrective actions and additional analysis that could be performed.
Deviation Form sent for Review:	10/12/2022	Sent to Will Hagan (DRMP QAO).

	Date	Notes/Description (optional)
Deviation Form Sent for signatures:	10/21/2022	Sent to Selina Cole (RB QA Representative) and other for signatures.

Description of Deviation/ Change:
This deviation form reflects multiple deviations noted in the tissue PBDE and PFAS batches submitted by SGS-AXYS including 1) deviation from the QAPP reporting limits (RL), and 2) missing required batch Quality Control samples, and 3) missing analysis of lipids in clam tissue. The Central Valley Regional Water Quality Control Board Quality Assurance Representative (QA Representative) and the Program QA Officer were notified via email on September 7 regarding these deviations including actions that the Central Valley Regional Data Center (CV RDC) would be doing to follow up with SGS-AXYS to confirm results.

1. **Deviation from the QAPP RL**
The SGS-AXYS tissue results for PDBE and PFAS were reported on August 19, 2022 for the October 2021 sample event (clams were sampled on October 20 -21, 2021 and fish were sampled October 18-20, 2021). During the data review by the Central Valley Regional Data Center (CV RDC), it was determined that the reporting limits (RL) in the Electronic Data Deliverable (EDD) are higher than what is listed in the QAPP. These deviations are summarized in Table 1.

Table 1. Summary of tissue reporting limits (RL) and minimum detection limits (MDL) reported in the EDD versus the QAPP.

Required Analyte	Matrix	EDD MDL (ng/g dw)	EDD RL (ng/g dw)	QAPP MDL	QAPP RL (ng/g dw)
PBDE 047	blankmatrix	0.00245	0.0179	Not Applicable	0.005
	Tissue[1]	0.000804	0.0248		
PBDE 099	blankmatrix	0.00183	0.0575	Not Applicable	0.005
	Tissue[1]	0.00187	0.0284		
Perfluorooctanesulfonate	blankmatrix	0.150	0.600	Not Applicable	0.4
	Tissue[1]	0.410	1.64		
Perfluorooctanoate	blankmatrix	0.150	0.600	Not Applicable	0.4
	Tissue[1]	0.410	1.64		

[1]the lowest tissue MDL and RL reported in the EDD are captured in this table; the MDL and RL vary based on the amount of tissue analyzed.

2. **Missing required batch QC samples**
The QAPP requires a laboratory duplicate for both moisture and lipids at a frequency of 1 per batch and an RPD ≤ 35% (not applicable if the concentration of either sample is less than the minimum detection limit or MDL). During the data review by the CV RDC, it was determined that in the PFAS batch analyzed on fish, there was no lipids reported and there were no moisture or lipid duplicates reported. For the PBDE batch that was analyzed on fish and clams, there was no duplicate reported for lipids.

3. **Missing lipid analysis for clam tissue**
The project schedule required a lipid to be analyzed on each of the tissue samples. In the PBDE batch, lipids were reported for all four fish composites (519ST1309, 510ST1317, 544LSAC13, 541SJC501) and one clam composite (from the laboratory replicate for 544SJRNBC). Five clam composites did not have lipids reported (519AMNDVY, 519SUT108, 510ST1301, 510SACC3A, 541SJC501).

Reason for Deviation/Change (what happened, when and why -- could include inadvertent deviations from the QAPP, contradictory language in the QAPP, unanticipated problems, schedule and/or time constraints):

With respect to the difference in method RLs, SGS-AXYS cited that these differences are due to a conversion issue specifically between dry weight (dw) units which are reported in QAPP and the wet weight (ww) units reported in the EDD. The actual RLs are generated from a wet weight sample and are recalculated to account for moisture. In sediment analyses, the wet weight of the subsample taken for analysis is adjusted so that the dry weight equals 10 grams (or whatever the standard sample size is). That is not possible in tissues because lipid is the limiting factor. If the subsample is greater than what the method is designed for extract, cleanup will not remove enough lipid and the instrument will be overwhelmed. When SGS-AXYS reports tissue data on a dry weight basis, the sample size taken for analysis is still the maximum wet weight allowed by the method (10 g for PBDE and 2 g for PFAS). The sample mass used for quantification is then adjusted based on the moisture content and the RLs are prorated to sample size.

For example, for PBDE 047 above where the result of sample L36462-2 is 10.07 g ww and 2.34 g dw, which is 1/5 the wet weight or original sample size. The detection is increased proportionally to the reduced sample size (e.g., 0.005 * 5 = 0.025 where 0.005 is the QAPP RL as ww and the 0.025 EDD RL is the converted dw for the specific sample). SGS-AXYS checked the other examples, and the following formula was applied consistently:

wet weight/dry weight * QAPP RL = EDD RL

With respect to the moisture and lipid reporting, SGS-AXYS reported that for the method SGS AXYS MLA-110 Rev 02 (PFAS) batch, the extraction technique does not allow for a lipid analysis, and it was incorrectly identified in the QAPP as an analyte to be analyzed by this method. However, lipids were analyzed with method AXYS MLA-033 Rev 06 (PBDE) batch but in fish only not clams. For this same batch, a lab duplicate was not performed on the fish that did have lipids reported.

It was laboratory oversight that a moisture split was not analyzed on one of the four composites in the PFAS batch. It was also laboratory oversight that the clams did not have lipid analysis or a laboratory duplicate in the PBDE batch.

Impact on Present and Completed Work (discuss potential magnitude of impact and bias of deviation/change, if this can be anticipated, if no impact is expected please indicate this)

Lipids were not analyzed on five (519SUT108 (15.72 g), 510ST1301 (12.18 g), 541SJC501 (3.77 g), 519AMNDVY (6.58 g) and 510SACC3A (9.05 g)) of the six clam samples due to a laboratory oversight. When the laboratory was contacted regarding this oversight, SGS-AXYS determined that they could not perform analysis on four of the six composite samples due to a lack of available tissue. SGS-AXYS agreed to run a lipid analysis on the two samples (544SJRNBC (32.41 g; plus a lab duplicate which was absent in the initial batch) and 519SUT108 (15.72 g)) that had enough tissue remaining for analysis.

Corrective Action (how the issue was addressed, any steps taken to ensure similar problems do not re-occur):

Corrective Action	By date	By whom
Future QAPPs will include language to clarify the reporting limits for wet weight vs dry weight. There were two clam samples (544SJRNBC & 519SUT108) that have enough tissue to run lipids and one (544SJRNBC) of the two samples has enough to report a duplicate. SGS-AXYS will analyze	Future CEC QAPPs Reported on 10/14/2022	Melissa Turner, DRMP Program Manager Sean Campbell, SGS-AXYS Project Manager

Corrective Action	By date	By whom
and report on the clam tissues results as soon as possible. MLJ reviewed the relevant QAPP requirements for clam tissue analyses with the project manager to prevent missing results due to lab oversight going forward.	09/09/2022	Cassandra Lamerdin, DRMP Data Manager

ACKNOWLEDGED BY:

Regional Board Representative:	DocuSigned by: Selina Cole F3102A0E248746B...	Date:	10/21/2022
	Selina Cole		

DRMP Program Manager:	DocuSigned by: Melissa Turner 9796DD915C44446...	Date:	10/21/2022
	Melissa Turner		

DRMP QA Officer:	DocuSigned by: Will Hagan A1D771E8E56040F...	Date:	10/21/2022
	Will Hagan		

2021-10. CEC Year 2 Clam Laboratory Measurements

DELTA
Regional Monitoring Program

Deviation Report / Corrective Action Form

Title:	**CEC Year 2 Clam Laboratory Measurements**
Deviation Number:	2021-10_CECv2_Dev_AXYS_ClamMeasurements
Prepared By:	Cassandra Lamerdin

Applicable Reference(s):

Delta Regional Monitoring Program Pilot Study of Constituents of Emerging Concern in the Sacramento-San Joaquin Delta Quality Assurance Project Plan Version 2.0, October 11, 2021

Complete the following table regarding the major milestones for the relevant deviation. Add additional rows as needed.

	Date	**Notes/Description (optional)**
Lab Report Submitted by SGS-AXYS:	08/19/2022	
Date Deviation Occurred:	09/07/2022	On 9/07/22, the CV RDC used the lab report to populate the bivalve composite EDD for clams dissected in the lab at SGS-AXYS. The clam widths were identified as a potential deviation.
MLJ Staff checked in with SGS-AXYS	09/12/2022	Sean Campbell will ask analysts and get back to CV RDC.
MLJ Staff checked in with SGS-AXYS	09/20/2022	MLJ staff sent email asking Sean Campbell for updates with no response from S. Campbell.
MLJ Staff left message with S. Campbell	10/10/2022	No call back from SGS-AXYS.
MLJ Staff called S. Campbell	10/13/2022	Sean (SGS-AXYS) said he will check with analyst.
Date CVRWQCB QA Staff Notified:	10/13/2022	Email identifying potential deviation sent to Selina Cole (RB QA Representative)
Deviation Form Drafted:	10/14/2022	Internal development of Deviation Form and follow up with AXYS-SGS.

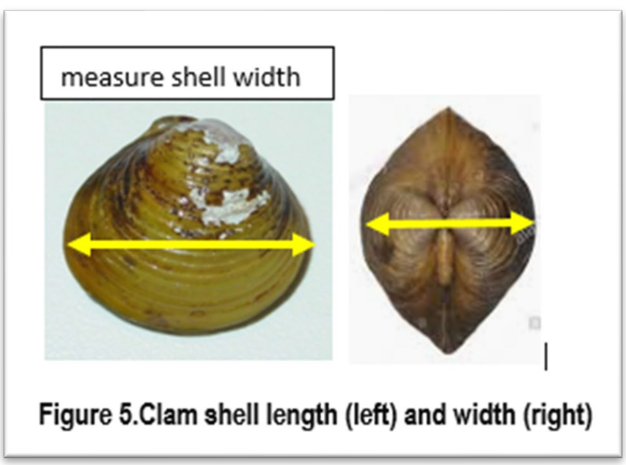
	Date	Notes/Description (optional)
Lab verified measurements	10/14/2022	Email back from Sean Campbell confirming how measurements were recorded.
Deviation Form sent for Review:	11/18/2022	Will Hagan (DRMP QAO)
Deviation Form Sent for signatures:	11/18/2022	

Description of Deviation/ Change:
This deviation form was created to document the clarification of bivalve length and width measures recorded in the lab in order to determine if QAPP measuring guidelines were followed.

Upon review of the SGS-AXYS lab report (received on 8/19/2022), it was noted by Central Valley Regional Data Center (CV RDC) data management staff that clam widths were consistently larger than the lengths (Figure 3). This is opposite from the measurements recorded in the database for Year 1 where in Year 1 the lengths were consistently larger than the widths.

The CEC v2 QAPP (Figure 1) shows how the clam measurements should be recorded. On a phone call between Cassandra Lamerdin (DRMP Data Manager) and Sean Campbell (SGS-AXYS Project Manager) on 9/22/2022, Sean said he would double check with the lab analyst who recorded the measurements.

Figure 1 Figure from CEC QAPP v2 to describe the clam length and width measurements.



The CV RDC received email confirmation on 10/14/2022 from Sean Campbell that the clams were incorrectly measured in the fashion described in Figure 2. Based on the verification of how the clams were measured, the database was corrected to reflect the correct shell length which were recorded in the data report (Figure 4) as width. The records associated with the width measurement include a comment where the height measurement was recorded in the comments field of the CV RDC table ProcessedOrganismExpandedBivalves. The following standard comment was applied to these records: “Shell width not recorded; shell height equals XX millimeters” where xx refers to the recorded width.

Shell width was left blank in the database because those measurements were not actually recorded.

Figure 2 SGS-AXYS lab confirmed that the red line was recorded as length and yellow line was recorded as width in the lab report.

Figure 3 Datasheet from lab report by SGS-AXYS and MLJ annotation to clam measurements (in red) based on lab technician confirmation.

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L36293-2

	Updated to shell height	Updated to shell length
Weight (g) muscle with shell – shell = muscle	length (cm)	width (cm)
1.13 – 0.78 = 0.35	1.2	1.6
3.87 – 3.39 = 0.48	2.3	2.5
0.94 – 0.72 = 0.22	1.3	1.5
2.15 – 1.70 = 0.45	2.0	2.2

Reason for Deviation/Change (what happened, when and why -- could include inadvertent deviations from the QAPP, contradictory language in the QAPP, unanticipated problems, schedule and/or time constraints):

The reason for the deviation was due to the laboratory technician not understanding how to measure the clam dimensions.

There are no future tissue analyses from SGS-AXYS planned for this project.

Impact on Present and Completed Work (discuss potential magnitude of impact and bias of deviation/change, if this can be anticipated, if no impact is expected please indicate this)

The clam lengths recorded in the CV RDC database have been corrected. The width is unknown because it was not measured, and this might affect a full understanding of the size of the clam shell. However, both width and height were measured in Year 1 and that information could be used to understand a relationship of width and height that could be inferred to the Year 2 data.

Corrective Action (how the issue was addressed, any steps taken to ensure similar problems do not re-occur):

Corrective Action	By date	By whom
CV RDC Database was updated to have the correct shell length; shell height was added to the comments field in the table ProcessedOrganismExpandedBivalve.	10/17/2022	Cassandra Lamerdin CV RDC Data Manager.

ACKNOWLEDGED BY:

Regional Board Representative:		Date:	
	Selina Cole		

DRMP Program Manager:		Date:	
	Melissa Turner		

DRMP QA Officer:		Date:	
	Will Hagan		

APPENDIX III – DELTA-SUISUN BIOGEOCHEMICAL MODEL: CALIBRATION AND VALIDATION (WY2016, WY2011)

Delta-Suisun Biogeochemical Model: Calibration and Validation (WY2016, WY2011)

Contributors:

Sienna R. White, Pradeep Mugunthan, Allie T. King, Farid Karimpour,
Lisa V. Lucas, David B. Senn

With technical assistance from:

Elizabeth B. Stumpner, Tamara E.C. Kraus, Brian A. Bergamaschi

September 2021

SFEI Contribution No. 1056

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ACRONYMS AND ABBREVIATIONS

ADVM	acoustic Doppler velocity meters
chl-a	chlorophyll-a
CTDEN	critical cut-off temperature
DCC	Delta Cross Channel
DEB	dynamic energy budget
Delta	Sacramento and San Joaquin River Delta
DFM	D-Flow Flexible Mesh
DIN	dissolved inorganic nitrogen levels
DO	dissolved oxygen
DWAQ	D-Water Quality
DWR	California Department of Water Resources
EMP	Environmental Monitoring Program
GRTS	generalized random tessellation stratified
Kd	light extinction
nSFE	northern San Francisco Estuary
nSFE-BGCM	northern San Francisco Estuary biogeochemical model
POTW	publicly-owned treatment work
SFB-BGCM	San Francisco Bay biogeochemical model
SFB-LSB-BGCM	Lower South Bay biogeochemical model
SFE-BGCM	San Francisco Estuary biogeochemical model
USGS	U.S. Geological Survey
WY2011	water year 2011
WY2016	water year 2016

ACKNOWLEDGEMENTS

The work presented in this report was supported by funding from the Delta Regional Monitoring Program, a grant from the California State Water Board, and funding from the San Francisco Bay Nutrient Management Strategy. Thank you to J. Thompson (USGS), and W. Kimmerer (SFSU) for sharing data and insights related to benthic and zooplankton grazing.

Suggested Citation:

SFEI (2021) Delta-Suisun Biogeochemical Model: Calibration and Validation (WY2016, WY2011). SFEI Contribution #1056. San Francisco Estuary Institute, Richmond, CA.

1 Introduction

The northern San Francisco Estuary (nSFE), including Suisun Bay and the Delta, serves as a critical aquatic habitat and vital water resource for both domestic consumption and irrigation. The nSFE receives large inputs of anthropogenic nutrients, resulting in elevated dissolved inorganic nitrogen levels (DIN; Jassby 2008; SFEI 2015) that exceed levels linked to adverse impacts in many other freshwater and estuarine systems (Paerl 2009; Dahm et al. 2016). The nSFE's nutrient-enriched status is a high-priority management issue, with regulators and environmental managers evaluating potential linkages between excess nutrients and several pressing ecological health issues (SFBRWQCB 2012; DSC 2013; CVRWQCB 2015; Cooke et al. 2018; SFEI 2020a). Quantitative, mechanistic understanding of nutrient cycling and nutrient-related ecosystem responses are needed to help inform on-going adaptive management and future management decisions in the Delta and San Francisco Bay. Given the physical and biogeochemical complexities of the nSFE, numerical models which are capable of simulating coupled hydrodynamics and biogeochemistry will be important tools in supporting science-based decision making.

Work has been underway over the past several years developing the San Francisco Estuary Biogeochemical Model (SFE-BGCM), a 3-D coupled hydrodynamic-biogeochemical model capable of simulating nutrient transport, nutrient cycling, and ecosystem responses (e.g., phytoplankton production). Initial work focused on model development, sensitivity analysis, and model calibration (SFEI 2018a,b; 2019a,b,c; 2020b,c).

This report describes recent (Sep 2020 – Aug 2021) improvements to the biogeochemical model and updates the model calibration and validation, which includes comparisons with additional observational data. This project's goals are summarized below:

- Set up a numerical biogeochemical simulation of the Delta and Suisun Bay systems for water year 2016 (WY2016) using the previously-developed version of the model that had been used to simulate WY2011.
- Implement refinements to the model, including improvements to boundary conditions, initial conditions, and key model inputs (e.g., light attenuation), along with refinements to sediment diagenesis, clam and zooplankton grazing, phytoplankton growth, and water column nutrient transformations.
- Incrementally refine the model to obtain the best "global" calibration for WY2016 and WY2011, two water years that differed considerably in both physical forcings (dry vs. wet) and biogeochemical responses.
- Evaluate model performance against additional observational data, including from high-frequency moorings and high-resolution biogeochemical mapping surveys from WY2016.

2 Methods

This section begins with an overview of the model platform and domain (Section 2.1-2.2), and then describes changes and improvements to the original model (nSFE-BGCM.v1; SFEI 2018, 2019) that have been incorporated into the current version (nSFE-BGCM.v2). The improvements include changes to: water column transformations and sediment diagenesis (Section 2.3.1); adjustments to clam and zooplankton initial conditions and grazing rates informed by comparisons with biomass and grazing data from a complementary modeling effort (Section 2.3.1, 2.4.5); refining boundary conditions for nutrient loading from both freshwater sources and publicly-owned treatment works (POTWs; Section 2.3.2); developing spatially varying initial conditions for nutrient concentrations (Section 2.3.3); and an interim fix of a wetting/drying-related issue within the Yolo Bypass (Section 2.3.6).

While the majority of this report's simulations and interpretations focused on WY2016, the model version, nSFE-BGCM.v2, represents the best "global" calibration currently available across WY2016 and WY2011. Compared to WY2016, WY2011 was a relatively wet year, without major bloom activity during the spring. Additionally, there are benthic grazing data available during WY2011 that enabled further refinements of the dynamic energy budget (DEB) grazing module.

2.1 Overview of Coupled Hydrodynamic-Biogeochemical Model

For this project, model development and WY2016 Delta-Suisun biogeochemical simulations were carried out using the San Francisco Estuary Biogeochemical Model (SFE-BGCM; SFEI 2018a,b, 2019a, 2020b), a 3D, process-based, spatially-explicit model that is externally coupled to the hydrodynamic model. The SFE-BGCM uses the public-domain/open-source models D-Flow Flexible Mesh (DFM; Deltares 2019a) to simulate hydrodynamics; D-Water Quality (DWAQ; Deltares 2019b) to simulate water quality; and a suite of Python-based utilities to facilitate model setup and post-processing (more info on the original open-source project can be found here: [https://www.usgs.gov/mission-areas/water-resources/science/cascade-computational-assessments-scenarios-change-delta]).

SFEI maintains three branches of the overarching SFE-BGCM, which focus on different regions of the San Francisco Estuary: the northern San Francisco Estuary model (Delta, Suisun; nSFE-BGCM); the San Francisco Bay model (SFB-BGCM); and the Lower South Bay model (SFB-LSB-BGCM). The biogeochemical modules for each of the regional models have the same baseline capabilities, and relevant updates or improvements made initially within one regional model are easily applied to other regional models. This project, which focuses on the Delta, utilized the northern San Francisco Estuary model.

The nSFE-BGCM grid and bathymetry were originally developed as part of the USGS CASCaDE project (Martyr-Koller et al. 2017). The nSFE-BGCM domain includes the Delta and San Francisco Bay and extends into the Pacific Ocean, about 20 km west of Point Reyes in the north and 40 km west of Half Moon Bay in the south, roughly encompassing the San Francisco Bight (Figure 2.1). The model employs a 3D unstructured grid with 75,019 horizontal cells and 10 vertical sigma layers. The grid has a higher resolution in the Delta and Suisun Bay and lower resolution in San Francisco Bay and the coastal ocean. Martyr-Koller et al. (2017) calibrated the hydrodynamics for March-September 2000 by adjusting spatially varying bottom friction to predict flow, water surface elevation, and salinity throughout the Delta and Suisun Bay. The model was then validated for WY2011 and WY2012. Vroom et al. (2017)

further developed the hydrodynamic model by incorporating a heat budget module and adding meteorological forcing to predict water temperature.

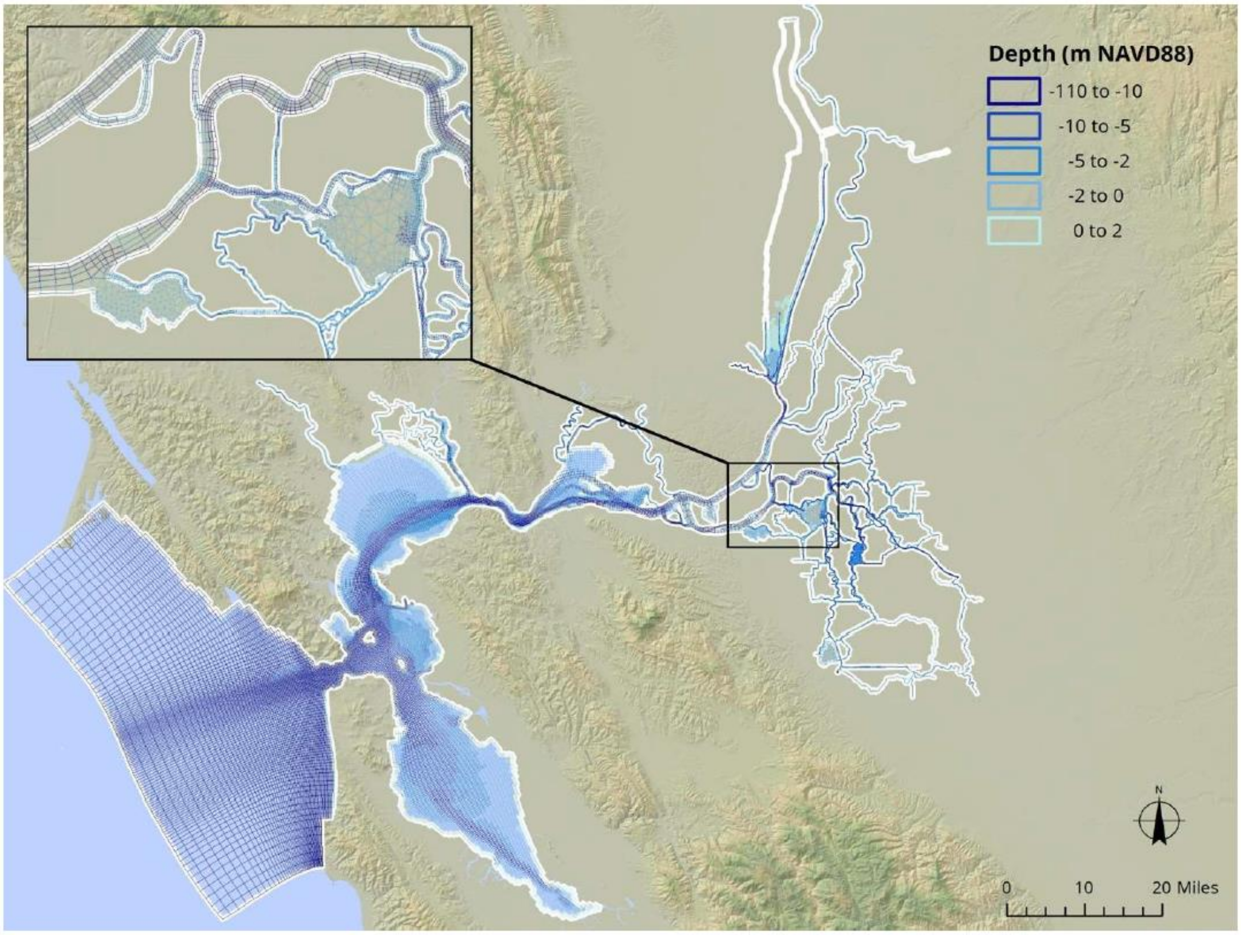


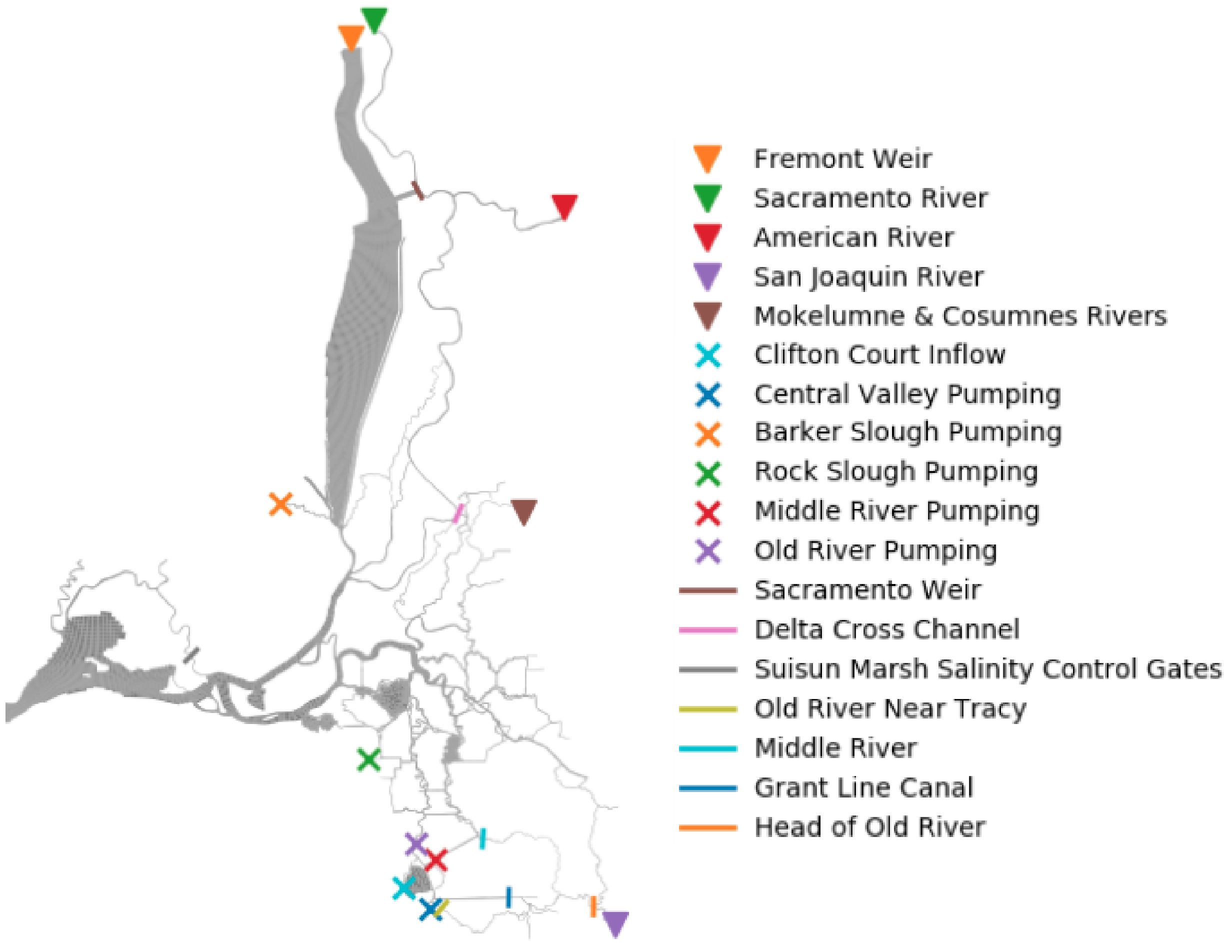
Figure 2.1. Computational domain and full-resolution model grid.

The first round of model development for the nSFE-BGCM focused on WY2011 (SFEI 2018b, 2019a). The updated biogeochemical module from the SFB-BGCM (SFEI 2018a) was applied to the WY2011 hydrodynamic model from Martyr-Koller et al. (2017) and calibrated for the Delta. A next major round of biogeochemical model development was carried out using the SFB-BGCM (SFEI 2020b).

2.2 Hydrodynamic Model Development and Validation

The hydrodynamic model was originally developed, calibrated, and validated for WY2011-WY2012 (Martyr-Koller et al. 2017). An early component of the current project involved refining and updating the model to simulate WY2016, including developing WY2016 boundary conditions and forcing datasets, and validating model output against observational data. The validation demonstrated good agreement between WY2016 predictions and observations, specifically continuous and tidally-averaged elevation, discharge, salinity, and temperature across locations in the Delta and Suisun Bay (SFEI 2019b). The WY2016 hydrodynamic output was used to drive this project's WY2016 biogeochemical simulations.

The locations of freshwater inflows, pumps, permanent structures, and temporary barriers for the hydrodynamic model within the Suisun-Delta domain are illustrated in Figure 2.2. Figure 2.3 shows a time series of model boundary conditions most relevant to the interpretation of the biogeochemical model results, namely the freshwater inflows, the two largest withdrawals (from the State Water Project [at Clifton Court] and Central Valley Project), and the operation of the Delta Cross Channel (DCC). More complete hydrodynamic model boundary conditions are plotted in Appendix A.



Notes: Tributaries (triangles), pumps (x), permanent structures (Sacramento Weir, Delta Cross Channel, Suisun Marsh Salinity Control Gates, indicated by short lines), and temporary barriers (remaining short lines)

Figure 2.2. Hydrodynamic model boundary locations within the Suisun-Delta domain.

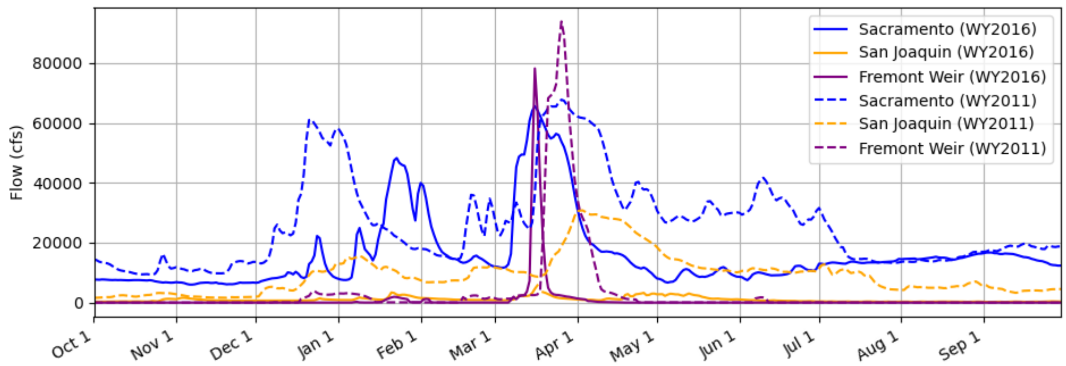


Figure 2.3. Hydrodynamic model boundary conditions relevant to the interpretation of biogeochemical model results for WY2011 and WY2016.

For WY2016, the California Department of Water Resources (DWR) runoff index was specified as "below normal" for the Sacramento Valley and "dry" for the San Joaquin Valley. Figures 2.4 and 2.5 show historical flow rates for the Sacramento River (at Verona) and the San Joaquin River (near Vernalis) by water year from 2001 through 2018, illustrating that in early WY2016 the Sacramento and San Joaquin River flows were moderately low and low, respectively. These figures also illustrate that the variance in San Joaquin River flows from year to year is high compared to the variance in Sacramento River flows, and while Sacramento River flows are typically much higher than San Joaquin River flows, as they were in WY2016 (by an order of magnitude), in some years, such as WY2011, the flows from the two rivers are more comparable. Note that while during the winter (Jan-April), the flow from the Sacramento River is comparable between water years (Figure 2.3), the flow over the Fremont Weir into the Yolo Bypass is significantly higher in WY2011. For the rest of the springtime, flows in the Sacramento are nearly 2x higher in WY2011 than WY2012.

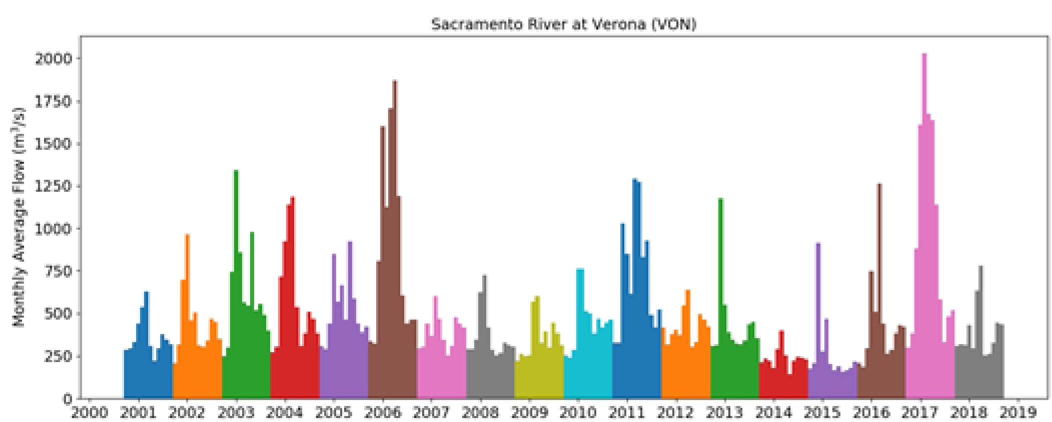


Figure 2.4. Sacramento River flow (near Verona), monthly averages, colored by water year.

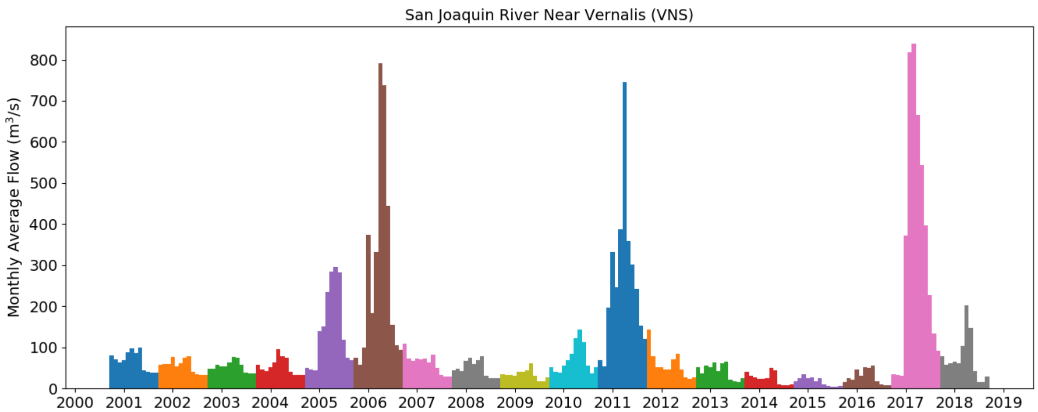


Figure 2.5. San Joaquin River flow (near Vernalis), monthly averages, colored by water year.

2.3 Biogeochemical Model Development

2.3.1 Model Framework and Processes Simulated

2.3.1.1 Water Column and Sediment Biogeochemical Process Framework

The conceptual diagram in Figure 2.6 provides an overview of the processes and state variables simulated within the current implementation of the SFE-BGCM. Equations for all processes included in the model (listed below) can be found in Deltares (2019b).

Water Column Processes

- Microbial water column processes: nitrification, respiration (DO consumption), and remineralization of organic matter (converting organic forms of nutrients, including dead phytoplankton, to inorganic forms)
- Phytoplankton: growth (including uptake/assimilation of nutrients, production of new biomass) and death
- Grazers: grazing (consumption of phytoplankton), excretion of nutrients, growth (increased biomass), and death
- Oxygen (O2) exchange between the water column and atmosphere
- Light attenuation by suspended sediment and phytoplankton

Sediment Processes

- Microbial sediment processes: nitrification, denitrification, aerobic respiration (DO consumption), and mineralization of organic matter (converting organic forms of nutrients to inorganic forms)
- Benthic grazing: filtration/consumption of phytoplankton and detritus, excretion of nutrients, growth (increased biomass), reproduction, and death
- Accumulation of organic matter (settling from the water column) and mixing/bioturbation of sediments
- Sediment-water exchanges: flux of ammonium (NH4), nitrate (NO3), phosphate (PO4), and silicon (Si) from the sediments to the water column; flux of nitrate and oxygen from the water column to the sediments; and denitrification and oxygen consumption at the sediment-water interface

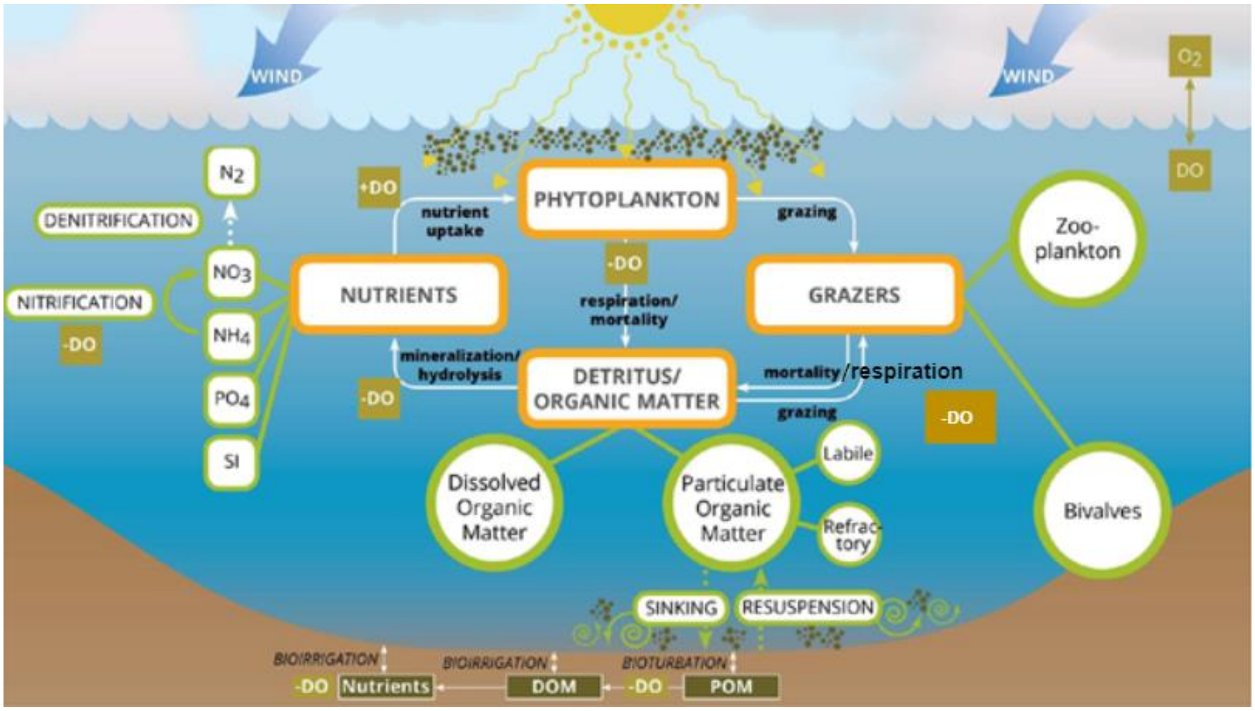


Figure 2.6. Conceptual diagram illustrating the processes and state variables simulated in the current version of the SFE-BGCM.

2.3.1.2 Dynamic Energy Budget Grazing Model

Grazing by both benthic (clams) and pelagic (zooplankton) grazers is thought to play a prominent and often dominant role in regulating primary production levels and activity throughout the Delta (Cloern 1982; Lucas et. al 2016; Crauder 2016; Lucas and Thompson 2012). Grazing is simulated in SFE-BGCM using DWAQ's DEB module for two species of clams: *Corbicula Fluminea*, a freshwater clam, and *Potamocorbula Amurensis*, a saltwater clam. Compared to other methodologies, where grazing is imposed as a boundary condition (via time and/or space varying grazing rates), the DEB module allows for clam and zooplankton biomass to react dynamically to changing food availability and environmental conditions. This means that grazing pressure at any point in time is a function of both current conditions as well as conditions over prior days to months within the system. The DEB approach complicates calibration/validation significantly, as the module requires calibration over a large parameter space and is difficult to validate with the limited data available. However, developing biogeochemical models with predictive/forecasting capacities remains an ongoing priority within the modeling project scope, and effort was invested into strengthening the application of the DEB model to improve the understanding of grazing throughout the system.

2.3.2 Boundary Conditions

2.3.2.1 Freshwater Inflows

The methodology used to derive nutrient loading for the WY2016 model is similar to that of the WY2011 Delta biogeochemical model (SFEI 2019a). The nitrate concentration time series imposed at the Sacramento River (at Verona) was estimated using high-frequency mooring data from Freeport (note the Freeport is downstream of Sacramento at Verona). The mooring data was down-sampled from 15-

minutes to a daily average. All other freshwater nitrate boundary conditions were estimated using concentration data from nearby DWR Environmental Monitoring Program (EMP) monthly discrete sampling sites. For WY2016, phosphate and silica data were not available for the Sacramento River. The Sacramento River phosphate load at Verona was estimated using a mass balance on the phosphate loads from the American River and the Sacramento River at Freeport (which is downstream of the confluence with the American River). The difference was assumed to be the phosphate load from the Sacramento River (at Verona) and the resulting mass was converted back into concentration. Silica data were not available at the American River and Sacramento River boundaries. Therefore, silica concentrations from the USGS discrete sampling station at Freeport were used for both boundaries. The Freemont Weir was assigned a constant dissolved silica concentration of 5.6 mg/L based on historical observations of background silica levels (Peterson 1978). Ammonium and DO loading data were available at discrete sampling sites for all boundaries. The resulting time series for nutrient loading from freshwater sources are shown in Figure 2.7. Chlorophyll-a is imposed at the San Joaquin and Sacramento River boundaries in units of algal biomass (gC/m^3), with data obtained from nearby DWR-EMP discrete sampling sites.

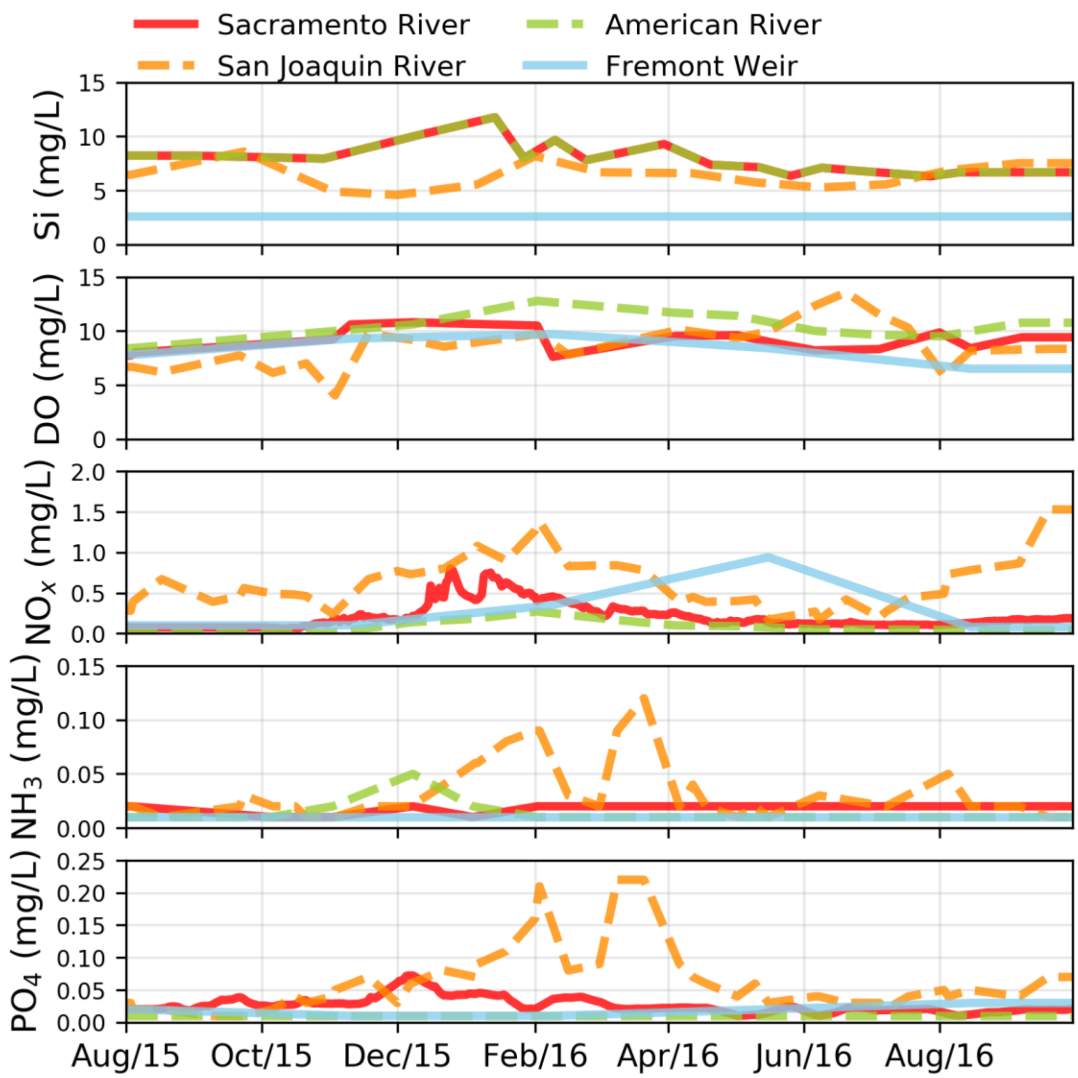
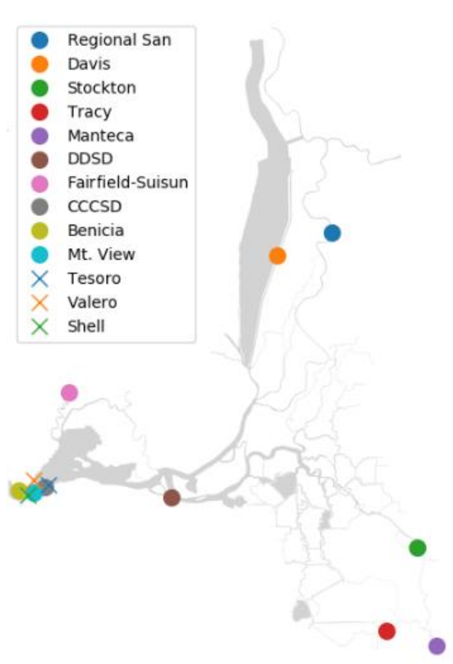


Figure 2.7. Time series of nutrient loadings at the freshwater boundary points for Sacramento @ Verona, San Joaquin near Mossdale, the American River and the Fremont Weir.

2.3.2.2 Point Sources

At point sources, including POTWs and refineries (Figure 2.8), influx (mass per unit time) of ammonia, nitrogen oxide, and phosphate is specified based on monitoring data (Figure 2.8). For sources with data gaps, long-term trend analysis was used to fill the gaps. Loads for the Stockton POTW were updated to use measurements rather than a long-term trend analysis, thereby increasing the accuracy of loading in the South Delta region. The resulting nutrient loading time series are shown in Appendix B.



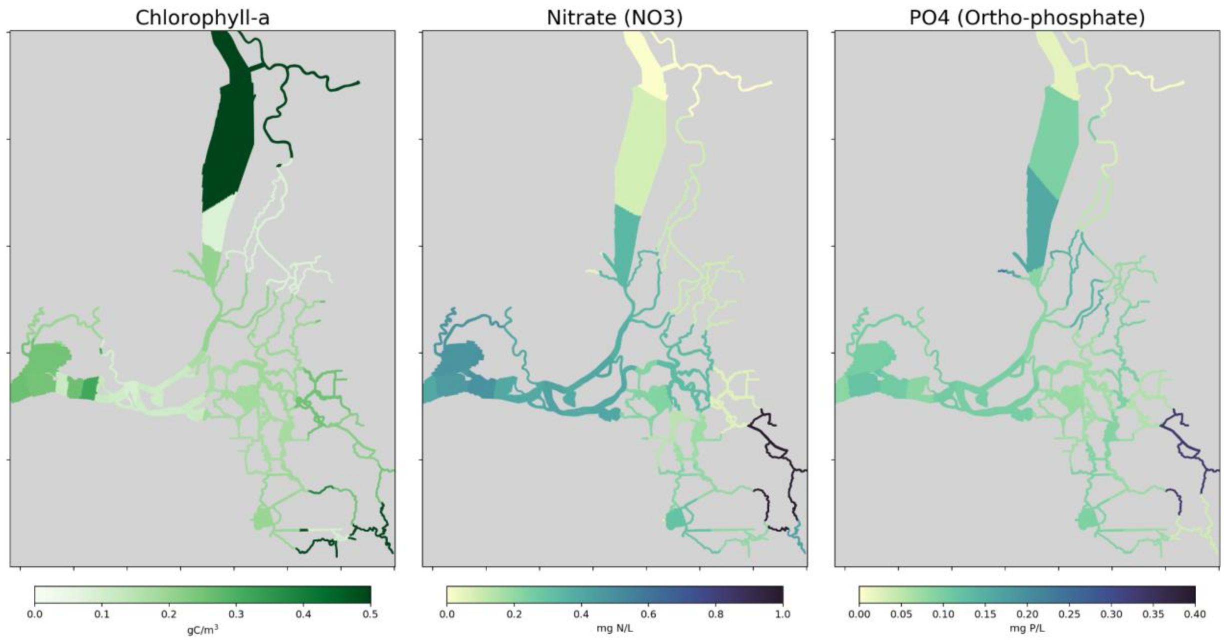
Note: Publicly-owned treatment works (circles) and refineries (x).

Figure 2.8. Locations of point source inputs for the biogeochemical model.

2.3.3 Initial Conditions

2.3.3.1 Water Column

Due to the drought conditions preceding WY2016, residence times in the Delta were likely longer than normal during the model spin-up (August 1-October 1) such that any uncertainty in the initial condition may not be fully resolved during spin-up. In order to account for the relatively long residence time, the model was initialized with spatially-varying concentrations for DO, ortho-phosphate, nitrate, ammonium, silica, and chl-a. These initial conditions were created by interpolating discrete (EMP) data across the grid and creating a 2D concentration field (Martinez and Perry 2021). The interpolation used the data collected closest to the start date of the simulation (i.e., August 1, 2015). By initializing the model based on data, any lingering effects of the initial concentrations that propagate into WY2016 (i.e., on October 1, 2015) are more representative of the actual concentrations that resulted from the low flow conditions. The initial concentrations used for a subset of model state variables are shown in Figure 2.9.



NOTE: Chlorophyll-a is depicted in units of gC/m³. For reference, 0.5 gC/m³ is equivalent to ~11.25 ug/L.

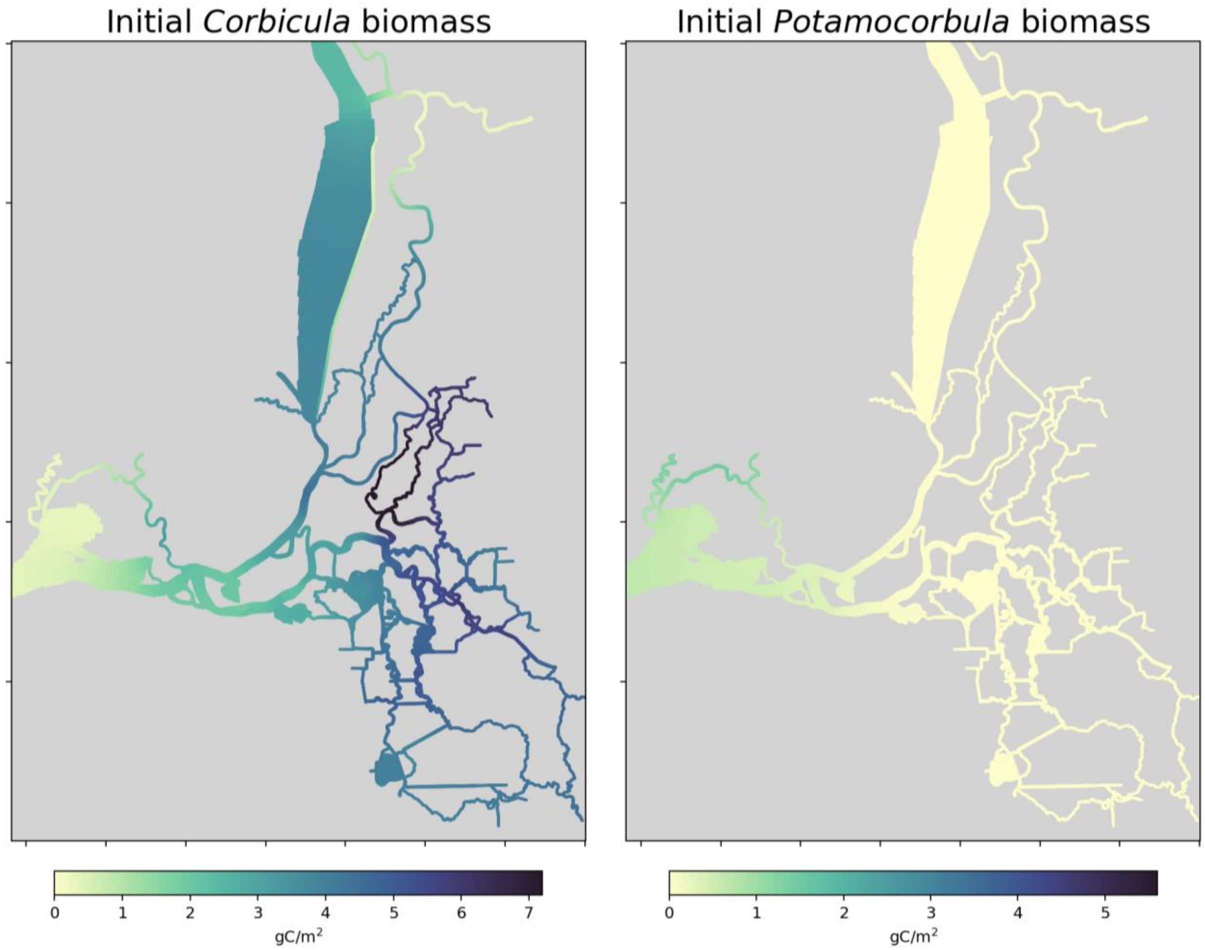
Figure 2.7. Spatial maps of interpolated initial conditions for chlorophyll-a, nitrate, and phosphate.

2.3.3.2 Sediments

The sediment model has two simplified layers, with the top layer representing the mineralization of labile—freshly deposited organic matter—and the bottom layer representing refractory organic matter. Sediment data within the Delta are limited. Therefore, the initial concentrations for carbon, nitrogen, and phosphorus within the sediments were derived from the improvements identified in the Open Bay biogeochemical model (SFEI 2020a). The sediment initial concentrations are spatially constant and were adjusted during calibration to provide reasonable sediment fluxes. The top layer sediment concentrations were approximately an order of magnitude lower than the second layer to reflect the rapid turnaround of freshly deposited labile organic matter.

2.3.3.3 Clams

In the DEB model, both clam species are initialized with biomass concentrations (gC/m^2) because they are treated as immobile state variables that are attached to a substrate (sediments). The initial conditions were derived from estimates of clam biomass provided by USGS (Jan Thompson, personal communication, May 12, 2021), which in-turn are derived from field measurements of clam density (Crauder et al. 2016), collected through the benthic component of DWR's Environmental Monitoring Program (EMP) (Zierdt et al. 2021). These data were collected as part of a generalized random tessellation stratified (GRTS) mapping survey and contain clam samples from approximately 50+ sites, which were collected roughly every 4 to 5 months. Data collected on October 15, 2015 (about 2 months after the start of the simulation) were used to initialize the WY2016 model. The clam data are interpolated across the grid in order to produce initial conditions for the model (Figure 2.10). This interpolation technique, used for several initial condition datasets, finds an iterative solution to the heat equation that approximates the input data, resulting in a smooth interpolated field that respects land boundaries (“as the fish swims” vs. “as the bird flies”). More information about the benthic data, including the collection methodology, can be found in Crauder et al. (2016).

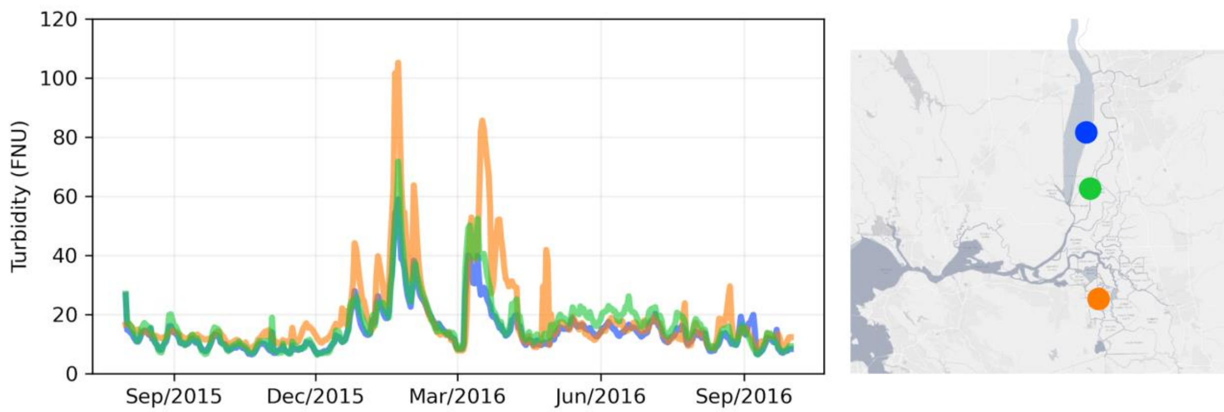


NOTE: Clam biomass in the figure above is depicted in units of gC/m². For reference, the conversion ratio between ash free dry weight (AFDW) and gC is ~0.4 gC per gAFDW.

Figure 2.8. Clam initial condition for *Corbicula* (freshwater clam) and *Potamocorbula* (saltwater clam).

2.3.4 Light Extinction

Accurately representing light attenuation in the nSFE is important for predicting phytoplankton production, because of the system’s high suspended sediment concentrations (also highly variable in space and time), that can strongly regulate growth rates. However, without a mechanistic sediment transport model, representing short-term changes in the spatial gradients of turbidity is infeasible. To address this need, a spatially-interpolated, time-varying empirical light-extinction coefficient (K_D) field was developed using turbidity data from high-frequency sensors throughout the system and a relationship for turbidity:K_D based on nSFE data. Compared to the sparse spatial coverage of turbidity data in San Francisco Bay, the Delta contains a wealth of monitoring stations that collect turbidity data at 15-minute to monthly frequencies. There are 71 stations in the Delta that obtained turbidity data over WY2016. Daily-averaged turbidity data were interpolated over the model grid using the interpolation scheme described in Section 2.3.3.3. Examples of the daily-averaged turbidity data that were used in the interpolation are shown in Figure 2.11. These turbidity values were converted to spatio-temporally variable light extinction inputs for the model using existing linear transformations derived from paired turbidity (FNU/NTU) and light extinction data (1/m) from the Delta (Figure 2.12 shows model light extinction inputs for two dates). Additional details about the light field data and the turbidity regression are provided in Appendix C.



Note: Lines are color coded to match the stations in the right panel.

Figure 2.9. Time series extracted from the interpolated turbidity grid.

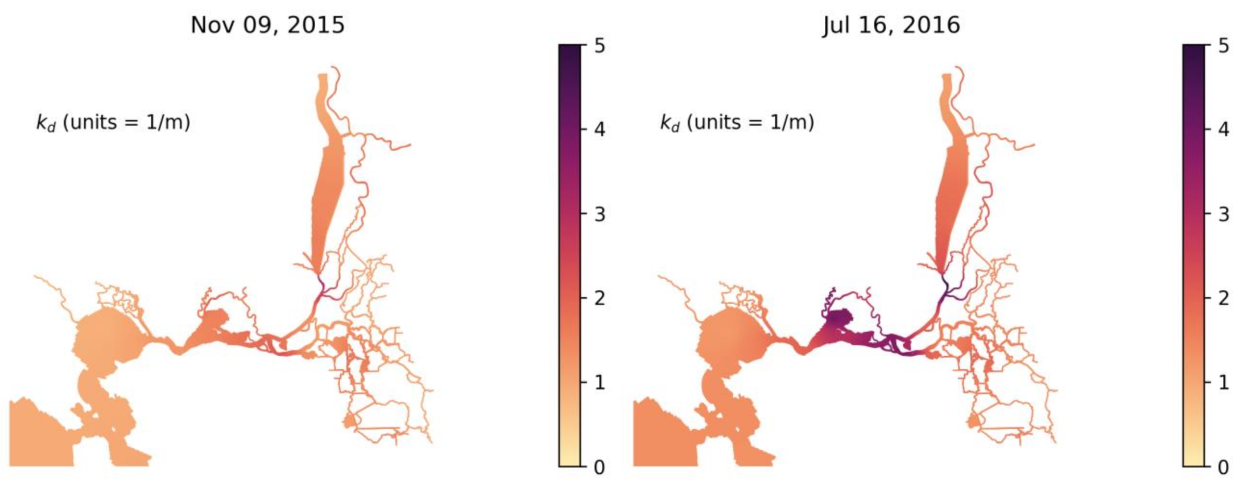


Figure 2.10. Spatial maps of light attenuation coefficient (k_d) at timestamps in November and July 2016.

2.3.5 Wind

Wind speed is used by DWAQ to parameterize oxygen flux across the water surface (reaeration rate). For WY2016 and WY2011, spatially and temporally varying wind speeds were derived from measurements at 52 stations across the San Francisco Bay-Delta region. The wind measurements were linearly interpolated using the SFEI_Wind package onto the model grid and provided as forcing to the SFE-BGCM (SFEI 2019c).

2.3.6 Other Model Updates

An apparent problem within the DWAQ code was identified during earlier runs through unrealistically high phytoplankton production and biomass and artificially elevated nutrient levels due to mineralization in some regions of the Yolo Bypass. The problem stemmed from wetting/drying in some grid cells that become shallowly and temporarily inundated. The issue was limited to the Yolo Bypass region and emerged after high flows are directed into the system from the Sacramento River. As waters drained from the Yolo Bypass floodplain (Figure 2.13, red hatched area) and some cells became disconnected from flow paths, DWAQ continued to treat those isolated, shallowly-inundated cells as active cells. In many of those cells, unrealistically-high phytoplankton biomass and nutrient concentrations accumulated. Because the cells were disconnected from major flow paths, the issue remained local, and did not substantially affect Cache Slough Complex nutrient net export or net transformations. However, it did exaggerate gross internal mass balance terms. As an interim fix, a local adjustment to phytoplankton growth (decreased phytoplankton growth rate by 80%) was implemented within those areas (Figure 2.13), which substantially mitigated the issue from a nutrient cycling perspective. Work is underway to more fully remedy the issue.

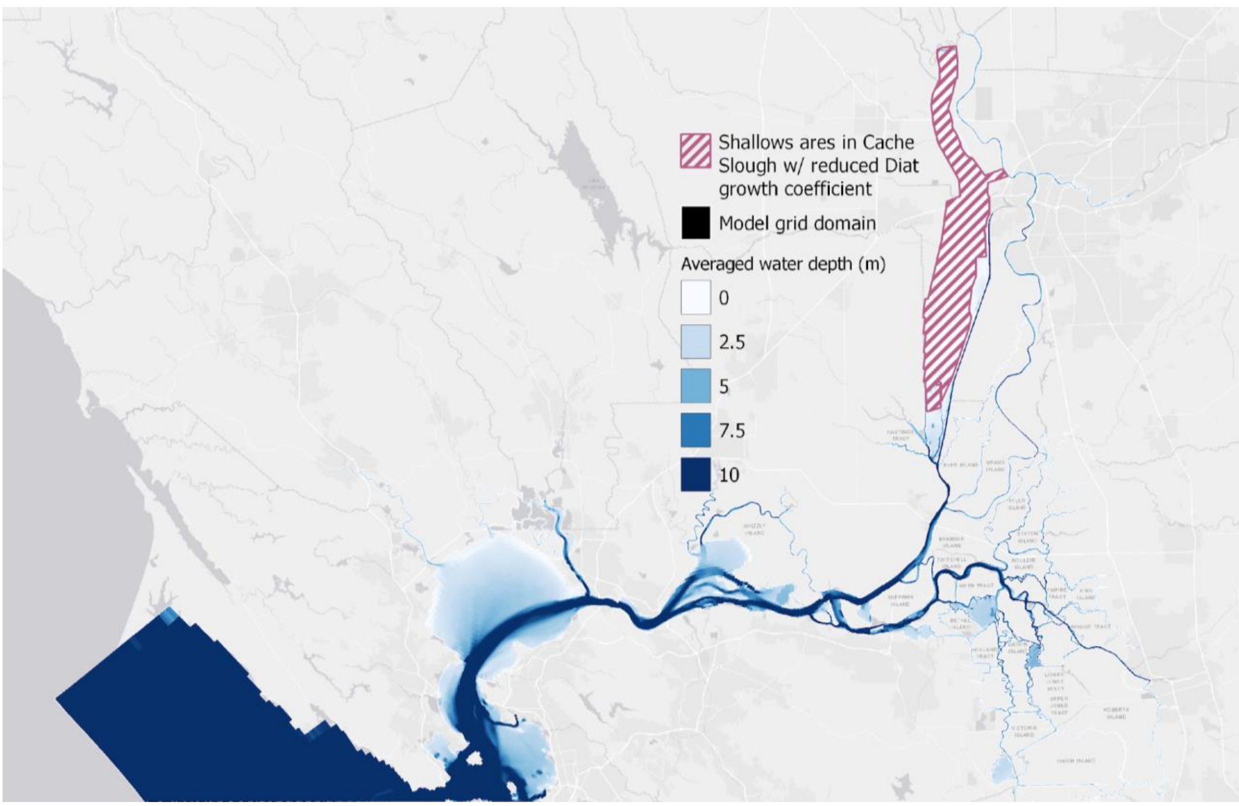


Figure 2.11. Shallow cells in the Yolo Bypass with adjusted diatom growth rate during the simulation.

2.4 Biogeochemical Model Validation Data

2.4.1 Discrete Data

Discrete monthly and semi-monthly data from nine sites in the Delta and Suisun Bay were used for comparisons of model predictions with field observations (Table 2.1, Figure 2.14). Data are from two programs, the DWR EMP Interagency Ecological Program (Lesmeister and Martinez 2020) and the USGS San Francisco Bay Water Quality Program (Schraga and Cloern 2017; Schraga et al. 2020). Stations were selected to represent diverse regions, and selections were based on data availability, both in scope (parameters available) and range (time span of available parameters). In order to compare model output with these discrete data, each data site was specified as a monitoring location in the DWAQ model to generate outputs of surface-level time series of the state variables at each site.

Table 2.1. Discrete sampling stations used for model validation.

Site Name[1]	Station Number	Latitude	Longitude	Agency
D28A	B9D75821344	37.9705	-121.573	EMP
P8	B9D75871229	37.9782	-121.382	EMP
D19	B9D80261369	38.0438	-121.615	EMP
D6	E3B80272071	38.0444	-122.118	EMP
C3A-Hood	B9D82211312	38.3677	-121.521	EMP
D7	E0B80702024	38.1171	-122.0397	EMP
D8	E3B80361594	38.0599	-121.99	EMP
D26	B9D80461340	38.0766	-121.567	EMP
649	USGS-649	38.0617	-121.8	USGS Polaris/Peterson

Note:
1. Samples were collected at depth of 1 meter.

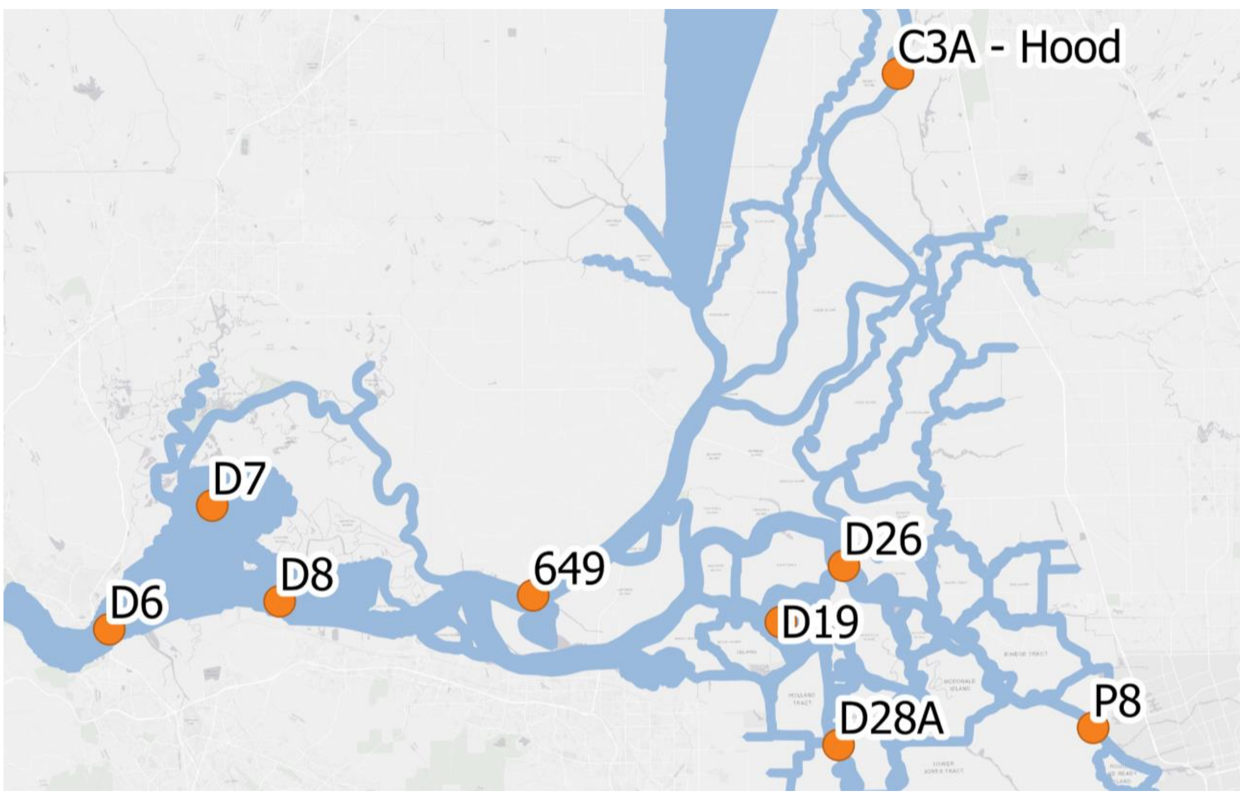


Figure 2.12. Map of the discrete sampling stations used for model validation.

2.4.2 High Frequency Mooring Data

Continuous water-quality and flow (Q) data were collected every quarter hour at USGS-operated fixed stations throughout the Delta during water years 2015 - 2016 (Figure 2.15, Table 2.2). Water-quality measurements were collected with a multiparameter water-quality sonde (YSI EXO2; Xylem Inc. (EXO), Rye Brook, NY) equipped with sensors to measure temperature, specific conductance (SpC), turbidity, pH, DO, dissolved organic matter fluorescence (fDOM), and chlorophyll fluorescence (fCHL). Nitrate measurements are collected with a submersible ultraviolet nitrate analyzer (SUNA V1; Sea-Bird Scientific, Bellevue, WA). Wipers clean the optical sensor windows of each instrument before every 15-minute sample interval. Data are collected over a 30 second sample period at the 15-minute timestamp following sensor warm-up and wiping and the median value of the bursts are reported. Instruments are deployed in 4-inch PVC pipes at a depth of 1 m at Mean Lower Low Water and operated according to the manufacturer's recommendations, USGS field manual (Wilde 2018), and Pellerin et al (2013). More continuous monitoring network specific considerations are described in Bergamaschi et al. (2017), Downing et al. (2017), and Kraus et al (2017). Most stations are also equipped with side-looking acoustic Doppler velocity meters (ADVM). Channel discharge from the ADVM data is computed using the index velocity method according to Ruhl and Simpson (2005) and Levesque and Oberg (2012).

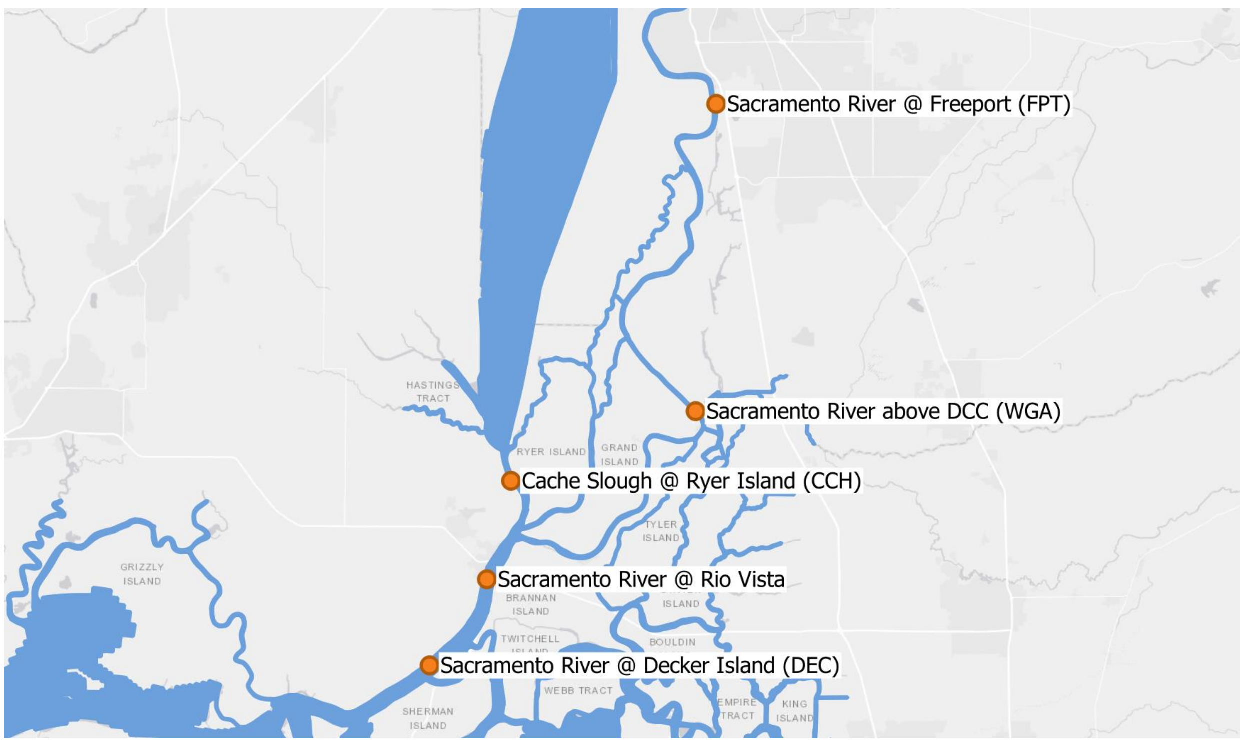


Figure 2.13. Map of U.S. Geological Survey-operated continuous monitoring flow and water-quality stations in the Delta.

Table 2.2. U.S. Geological Survey operated continuous monitoring flow and water-quality stations in the Delta.

USGS Site Abbreviation	Site ID	Site Name	Latitude	Longitude
CCH	11455350	Cache Slough at Ryer Island	38.212778	-121.66917
DEC	11455478	Sacramento River at Decker Island near Rio Vista CA	38.093333	-121.73611
FPT	11447650	Sacramento River at Freeport CA	38.456111	-121.50028
WGA	11447890	Sacramento River above Delta Cross Channel CA	38.257778	-121.51722

RIO	11455420	Sacramento River at Rio Vista (discharge used for flux calculations)	38.149044	-121.68894

Source: USGS National Water Information System database metadata

Water-quality station visits routinely occur for instrument maintenance and discrete sample collection. EXO sonde measurements are checked in native water before and after cleaning and compared to a gold-standard sonde used specifically for quality assurance purposes. Sensors are also checked in certified standards and calibrated when necessary. Data are reported to the National Water Information System database where lower and upper-level thresholds are applied, outliers are removed, and fouling and calibration drifts are corrected according to the USGS National Field Manual (Wilde 2018), Wagner et al (2006), and Pellerin et al. (2013). The 15-minute ADVM data is routinely compared to cross channel transects and a rating curve is generated to compute discharge using the cross-sectional area and channel average velocity that is further described in Ruhl and Simpson (2005). These data are also reported to the National Water Information System database.

Fixed-station water-quality and flow measurements are made under the assumption these data represent well-mixed vertical and lateral reaches of a channel. The data generated by algal and organic matter fluorescence and nitrate absorbance measurements have not been corrected by site-specific calibrations; dissolved organic matter fluorescence is adjusted by a temperature, turbidity, and inner-filter effect correction according to Downing et al. (2012). Whereas all federal scientific records generated by this project are managed and archived in accordance with Survey Manual Chapter 431.1, Records Management Program (https://www.usgs.gov/about/organization/science-support/survey-manual/4311-records-management-roles-and-responsibilities), the Water Resources Discipline Scientific Records Disposition Schedule 1400 and the USGS General Records Disposition Schedule, data at the time of this reporting is provisional. The local records officer at the USGS California Water Science Center will ensure scientific records are appropriately archived. Note that the high-frequency nitrate data at Freeport had not yet been regressed to discrete laboratory sample at the time of this report; however, based on previous experience, any changes to these values are expected to be inconsequentially small.

Model data for the mooring sites were produced by outputting data at each mooring site at 15-minute intervals. The model data were down-sampled to a daily average and averaged across the top meter of the water column.

2.4.3 High Frequency Flux Data

Flux-based monitoring is possible within the USGS station network as water-quality instruments are co-located with ADVM measurements. Flux measurements/estimates are calculated using the high frequency continuous monitoring station data described in Section 2.4.2. The stations identified in Figures 2.15 and Table 2.2 are used to compare field measurements with model output and to calculate fluxes for model validation. Discharge measurements from RIO are used to calculate fluxes at DEC because there is no ADVM located at DEC. Flux is estimated as a function of discharge and concentration. Modeled flux was output directly at the sampling sites every 15 minutes. Modeled fluxes at Rio Vista are used to compare to the DEC fluxes from USGS.

To compute tidally filtered and cumulative fluxes, it is first necessary to fill gaps in the observed discharge and concentration data. To fill gaps, the time series was smoothed using a simple running mean, where discharge was smoothed over one tidal cycle and concentration over a quarter tidal cycle.

The smoothed time series were then linearly interpolated and the interpolated values were used to fill gaps in the original, unsmoothed time series. These time series with gaps filled were then used to compute tidally filtered and cumulative fluxes. A Butterworth filter was used for tidal filtering.

2.4.4 U.S. Geological Survey Mapping Cruises

The USGS collected 17 high-resolution datasets aboard the R/V Mary Landsteiner between August 14, 2015 and September 30, 2016, according to methods described in Bergamaschi et al. (2020). The geographic extent of the data includes the western and central tidal zones and the Cache Slough Complex. The location of high-resolution data collections, dates, and event descriptions are described in Table 2.3. The datasets include underway measurements of nitrate, chlorophyll fluorescence, temperature, salinity, DO, pH, turbidity, and dissolved organic matter fluorescence. Briefly, sample water was continuously pumped onto the boat while underway at variable boat speeds up to 30 mph using a pick-up tube mounted at a fixed depth of 1 m below the surface. Sample water was pumped through a screen to remove large debris and into a pressure-compensated manifold, as described in Downing et al. (2016). Methods detailing the data quality assurance and quality control process are provided in Appendix D.

Table 2.3. List of USGS high-resolution water-quality mapping dates, location, and associated project or event used for calibration and validation of WY2016 model.

Water Year	Field Date	Geographical Location	Project
2015	8/14/2015	Lower Sac R – Central Delta	Emergency Drought Barrier
2015	9/10/2015	Lower Sac R – Central Delta	Emergency Drought Barrier
2015	9/14/2015	Lower Sac R – Central Delta	Emergency Drought Barrier
2016	10/5/2015	Cache Slough Complex	Zoop.-Kimmerer
2016	10/21/2015	Lower Sac R – Central Delta	Emergency Drought Barrier
2016	3/31/2016	Cache Slough Complex	CSC Mapping
2016	4/18/2016	Lower Sac R – Central Delta	Emergency Drought Barrier
2016	5/2/2016	Rio Visto to Golden Gate	Algae Bloom
2016	5/6/2016	Cache Slough Complex-Lower Sac R	Algae Bloom
2016	5/20/2016	Cache Slough Complex-Lower Sac R	Algae Bloom
2016	5/25/2016	Cache Slough Complex-Lower Sac R	Algae Bloom
2016	6/9/2016	Cache Slough Complex-Lower Sac R	Algae Bloom
2016	6/28/2016	Cache Slough Complex-Lower Sac R	Algae Bloom
2016	7/13/2016	Lower Sac R – Central Delta	Emergency Drought Barrier
2016	7/19/2016	Cache Slough Complex	North Delta Directed Flow Action
2016	8/3/2016	Cache Slough Complex	North Delta Directed Flow Action + Little Holland Tract Survey
2016	8/30/2016	Cache Slough Complex	CSC Mapping

Model data comparisons were made by taking the daily and depth-averaged value of each modeled constituent (nitrate, DO, etc.) on each cruise date and plotting the spatial map alongside the mapping cruise data. Daily averages were used to validate whether or not the model was properly capturing the general magnitude and gradient of each constituent as seen by the mapping cruise data collection.
Clams and Zooplankton

In order to improve the representation of grazing (both benthic and pelagic) in the model, additional field data and modeling insights from collaborators working on the USGS-led CASCaDE project were used to refine and improve the DEB model implementation (L Lucas, J Thompson, W Kimmerer, personal communication).

Benthic grazer field data is sparse in time and space. Biomass field surveys provided estimates of clam biomass (g/m^2) across sampling sites which were converted to a filtration rate (m^3/m^2/day) using empirical parameterizations developed by O'Riordan et al. (1995), described further by Crauder et. al (2016). An example of sites sampled during one such survey is provided in Figure 2.16.

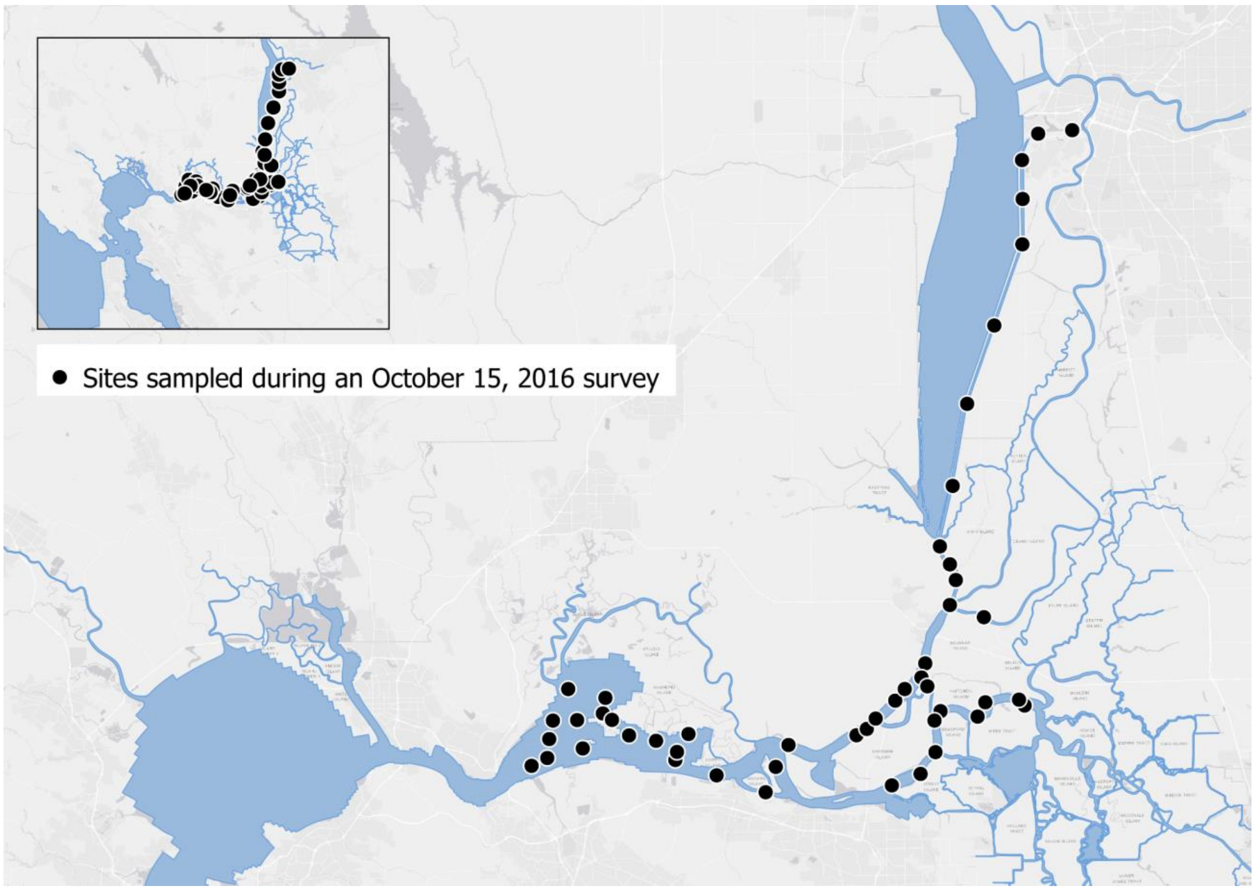
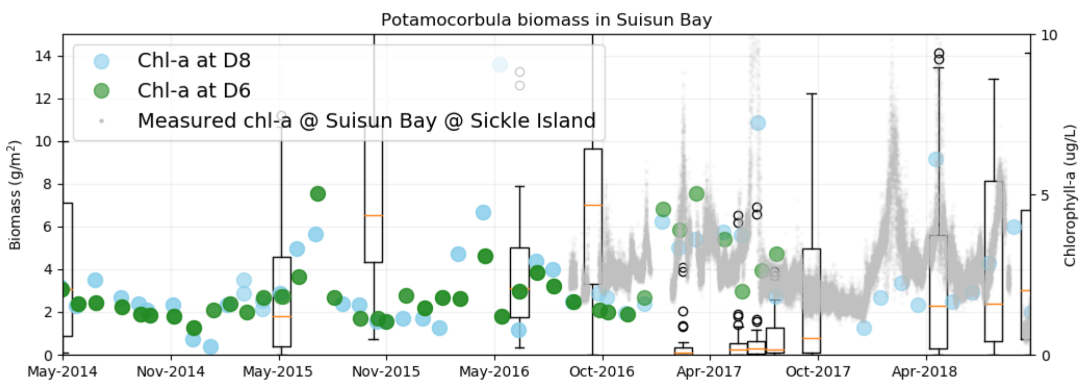


Figure 2.14. Map of sites sampled during a benthic survey on October 15, 2016.

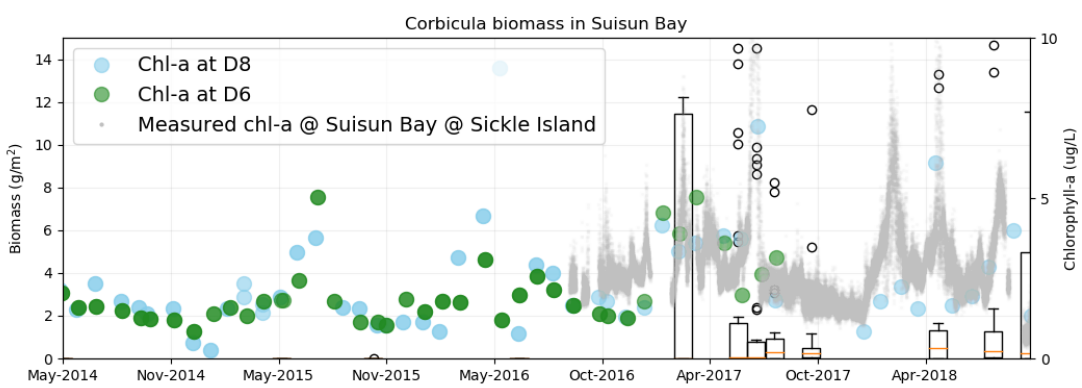
USGS field data were used to create a greater understanding of the system as a whole in addition to guiding model validation. Figures 2.17 – 2.21 show different data processing methodologies used to inform understanding of grazing control on phytoplankton. Because the exact location and number of sites tend to vary survey to survey, to understand trends over time, biomass data was binned by region (Suisun Bay, lower and upper Cache Slough, Sacramento River stem, South Delta). The binned data was then plotted as a series of box plots in order to depict how clam biomass might vary across a region over a series of sampling dates. To give a rough idea of food availability, we also plot chlorophyll-a measured from a site within each polygon. This approach offers several interpretative findings. For example, Figure 2.17 shows the shifts in clam populations within Suisun Bay during 2017 when *Potamocorbula* biomass declined and *Corbicula* biomass increased, likely a result of the large freshwater runoff event in spring of 2017 that reduced salinity within Suisun Bay. Due to the complexity and heterogeneity of the system, however, clear correlations and trends between chl-a and grazer biomass were less evident. Nonetheless, these boxplots provide an estimate of the general range of biomass expected in each region.

Empirically-based clam biomass and grazing estimates developed for the CASCaDE project were compared with DEB-predicted values from this work to refine DEB implementation. Unlike the DEB module approach used here (which simulates grazer biomass and grazing rates), the CASCaDE project incorporates benthic grazing into the model (also DFM-DELWAQ) by imposing empirically-derived grazing rates (as a model input or boundary condition). This provided an opportunity to compare the specified grazing rates in the USGS model to modeled grazing rates in the SFEI model (WY2011 only). Zooplankton grazing pressure in the USGS model simulated by supplying the model with a spatially uniform time series of zooplankton biomass. This biomass time series is then converted to a grazing pressure within the CONSBL model. USGS developed the zooplankton biomass time series (Figure 2.20) using measured data (Kimmerer 2006; Kimmerer et al. 2014). For a sense of magnitude, we converted the biomass time series into a grazing pressure (in gC/m^3/day) using the formulation set forth by Lopez (2006) in Figure 2.21. We referenced both the zooplankton biomass time series (and estimated zooplankton grazing pressure) alongside the maps of benthic grazing rate to validate the grazing pressure calculated by the SFEI model.



Note: Right-ordinate shows chlorophyll-a measured within Suisun Bay.

Figure 2.15. Box plots of *Potamocorbula* biomass in Suisun Bay.



Note: Right-ordinate shows chlorophyll-a measured within Suisun Bay.

Figure 2.16. Boxplots of *Corbicula* biomass in Suisun Bay.

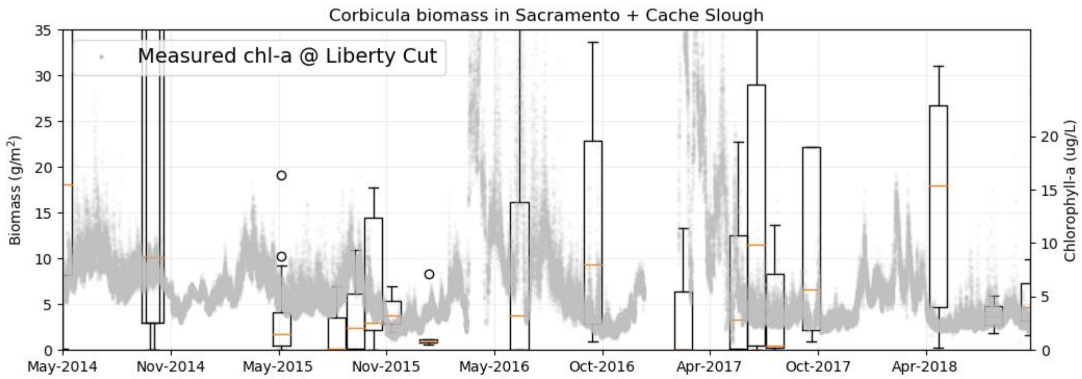
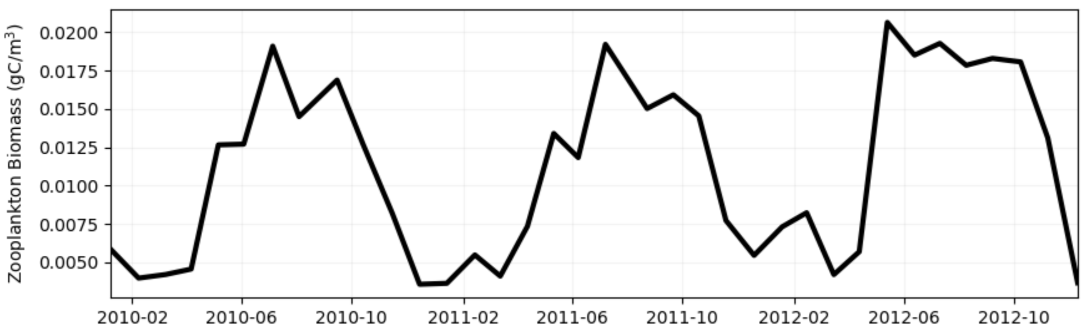


Figure 2.17. *Corbicula* Biomass in Cache Slough and the lower Sacramento River.



Source: Kimmerer (2014, 2006)

Figure 2.18. Zooplankton biomass time series.

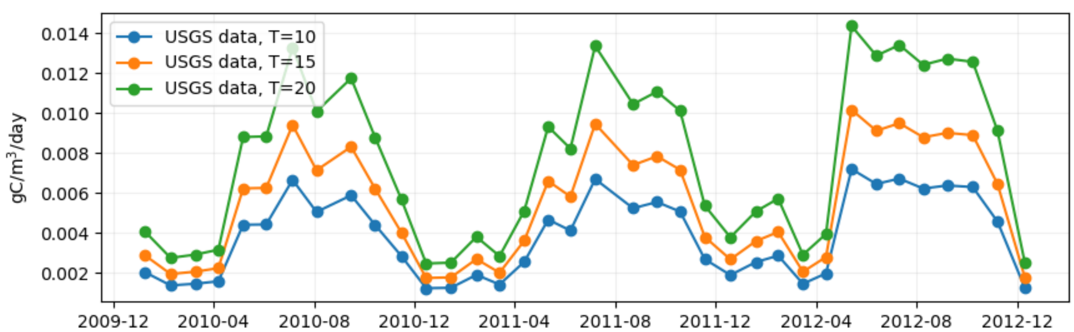


Figure 2.19. Zooplankton biomass time series (Figure 2.18) converted to grazing rate using methodology defined by Lopez (2006) at a variety of temperatures (10, 15, and 20 deg C).

2.5 Biogeochemical Model Validation Approach

With the biogeochemical processes (Section 2.4) included, the full resolution model takes approximately 7 days of wall clock time to complete a DWAQ simulation for a single water year, including 2 months of spin up (an approximately 14-month simulation). Because a large number of simulations (typically hundreds) are required to adequately explore the sensitivity of the biogeochemical model parameters, a horizontally aggregated grid with approximately 5,000 cells was developed for fast running biogeochemical model simulations. The aggregated grid model is capable of completing a full water year simulation within 4 to 5 hours. After ensuring that the aggregated model predictions had sufficient fidelity relative to the full-resolution model predictions, the faster-running aggregated grid model was used to carry out approximately 100+ model simulations to explore the model parameter space.

Calibration of the model focused on denitrification, primary production, and DEB grazing module parameters. These parameters were selected based on an extended set of sensitivity runs done in the past and also reflect the key processes and state variables of interest. For denitrification, the calibration focused on the critical cut-off temperature (CTDEN), the temperature correction factor, and the first order denitrification rate. In calibrating the grazing module, a focus was placed on the maximum ingestion rate (j_xm) for both clam species. The “minimum food threshold” was also adjusted, which allows a small concentration of phytoplankton to persist such that when grazer levels decline phytoplankton can rebound without additional seeding from model boundaries. The final set of model parameters is presented in Table 2.4, and a complete list of parameter values can be found in Appendix E.

Table 2.4. Final calibrated model parameter values.

Parameter	Description	Unit	Model Value	Literature Values (Where Available)	Default DWAQ Values
z_shape	Shape coefficient for zooplankton DEB model	(-)	0.5	0.3143 (Troost et al. 2018)	0.314
j_xm (*Corbicula*)	Max ingestion rate for *Corbicula* grazer	$J/cm^2/d$	40	2660 (Petter et al. 2014)	196.8
j_xm (*Potamocorbula*)	Max ingestion rate for *Potamocorbula* grazer	$J/cm^2/d$	60	91.5 [*Cerastoderma edule*] (Troost et al. 2010), 273 [*Mytilus edulis*] (Troost et al. 2010)	196.8
minfood	Minimum food threshold for grazers (set individually for all grazer species)	gC/m^3	0.1		0.0
TCDEN	Temperature coefficient for denitrification	(-)	1.2		0.0
CTDEN	Critical temperature for denitrification	°C	2.0		2.0
RCDENsed	First-order denitrification rate in the sediments	m/d	0.1		0.1

3 Results and Discussion

Model performance was evaluated across a range of time and space scales using several different datasets for both WY2011 (discrete data) and WY2016 (discrete data, high frequency mooring and flux data, mapping cruises). The diversity of the validation datasets allowed model performance to be evaluated through different lenses. Monthly data from the EMP's long-term and region-wide network was well-suited for characterizing the model's ability to capture regional-scale water quality patterns, along with seasonal and inter-annual variability (Section 3.1). The high-frequency mooring data, including flux estimates, were used to examine tidal and tidally-averaged performance at intensively monitored fixed locations, and to assess the importance of deviations in terms of both concentrations and mass fluxes (Section 3.2-3.3). Lastly, the mapping cruises offered the opportunity to compare observed and modeled water quality over a range of spatial scales (sub-regional to regional), including locations of sharp biogeochemical gradients (Section 3.4). A brief exploration of grazing in the model and an assessment of modeled grazing pressure is also discussed in Section 3.5.

3.1 Discrete Data: Modeled-Measured Comparisons

Time series plots of model predictions and field observations at the discrete EMP + USGS sites (Figure 2.14) for a range of parameters (nitrate, ammonium, DIN, phosphate, silica, DO, and chl-a) for WY2016 and WY2011 are shown in Figures 3.1 - 3.7 and Figures 3.8 - 3.14, respectively. Model data represents the surface-level value and has been down-sampled to a daily average.

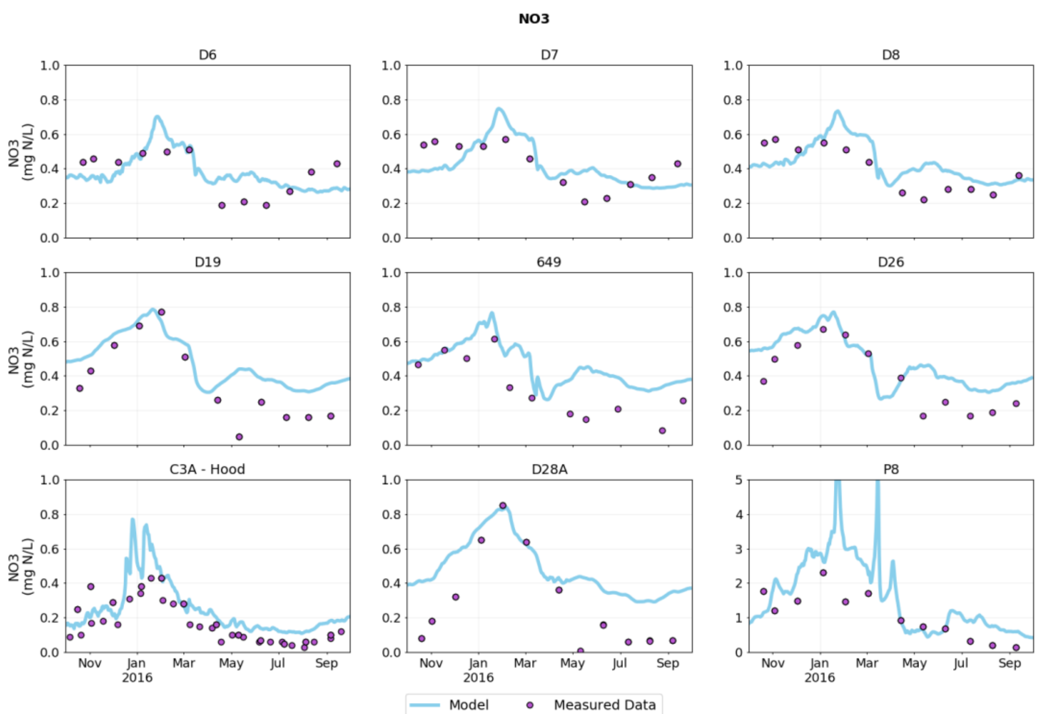


Figure 3.1. WY2016 model validation of nitrate at discrete sampling sites.

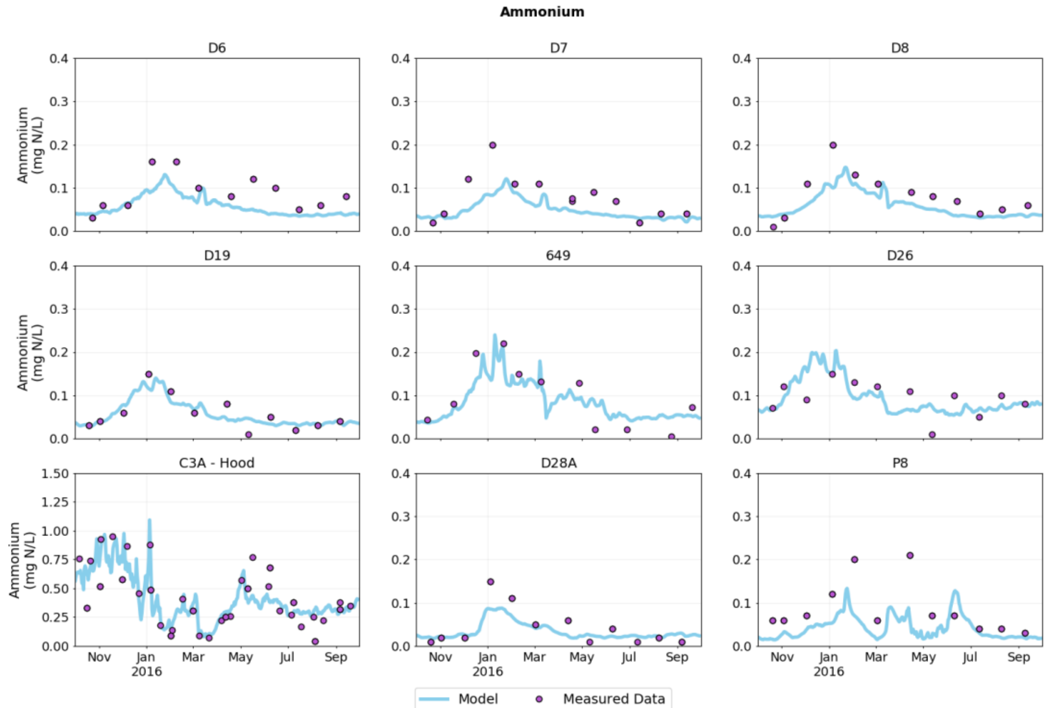


Figure 3.2. WY2016 model validation of ammonium at discrete sampling sites.

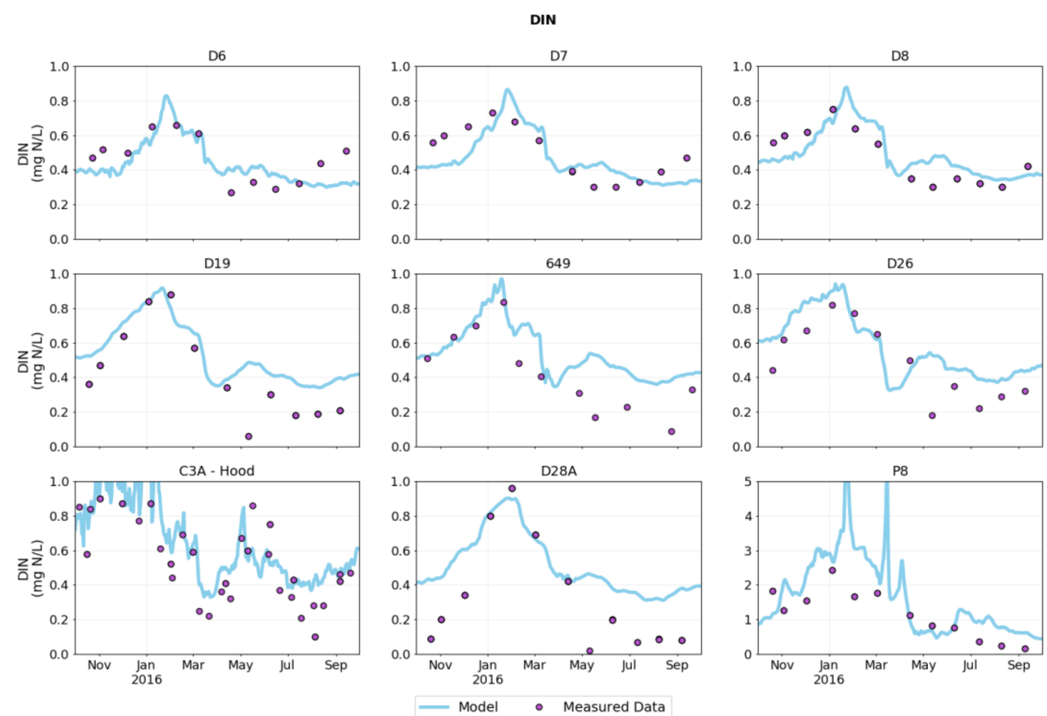


Figure 3.3. WY2016 model validation of dissolved inorganic nitrogen at discrete sampling sites.

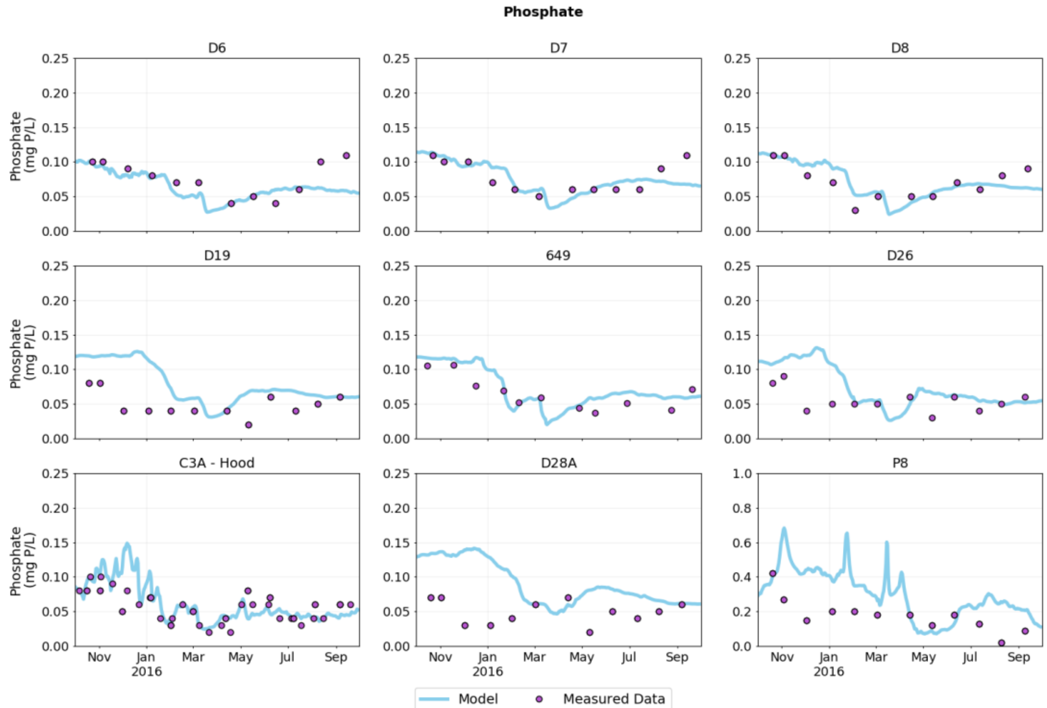


Figure 3.4. WY2016 model validation of phosphate at discrete sampling sites.

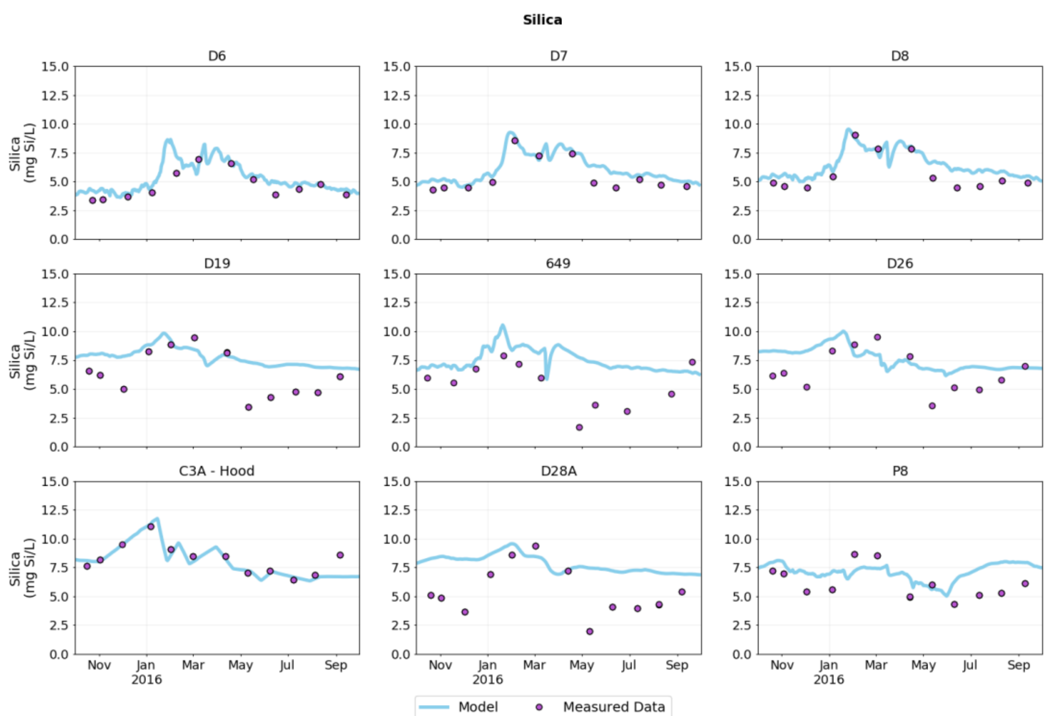


Figure 3.5. WY2016 model validation of silica at discrete sampling sites.

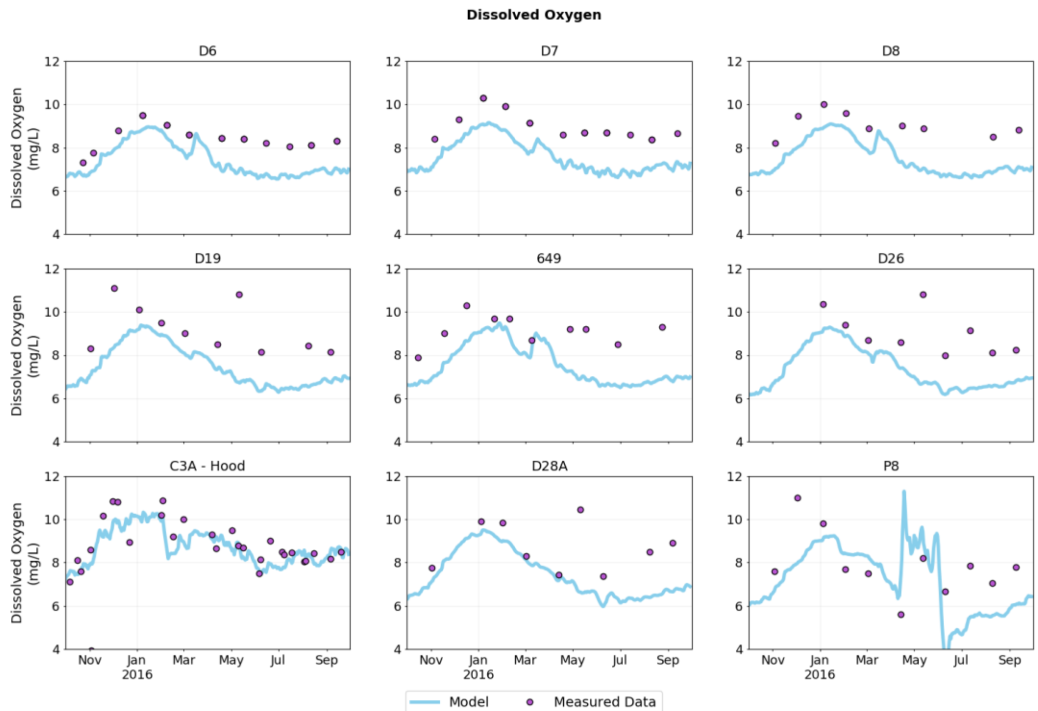


Figure 3.6. WY2016 model validation of dissolved oxygen at discrete sampling sites.

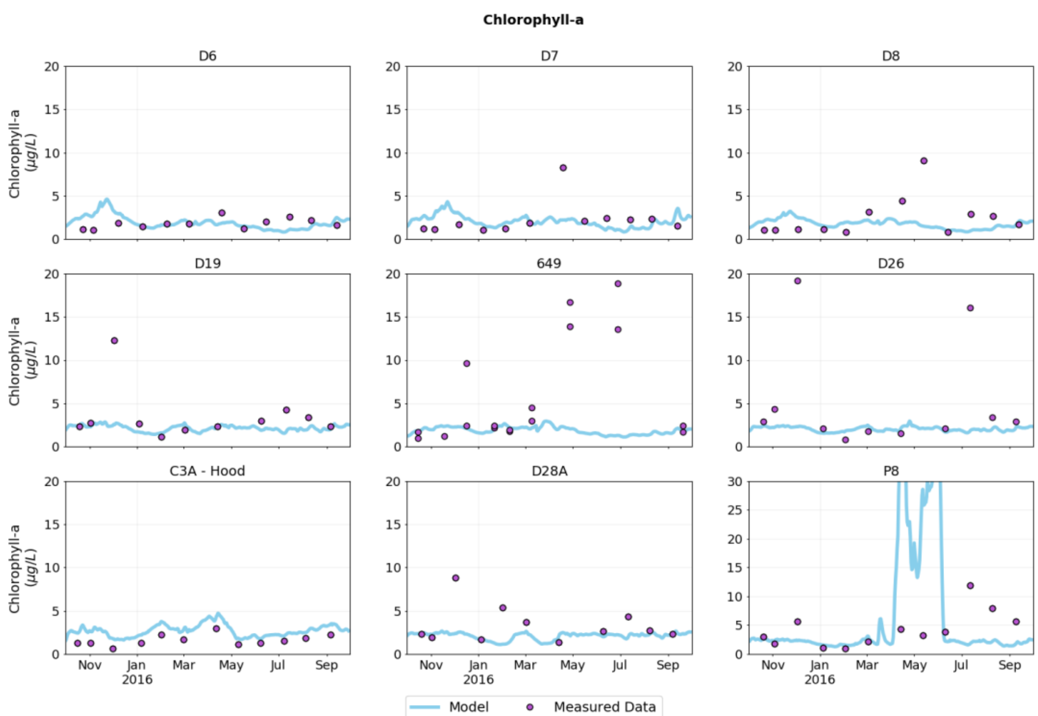


Figure 3.7. WY2016 model validation of chlorophyll-a at discrete sampling sites.

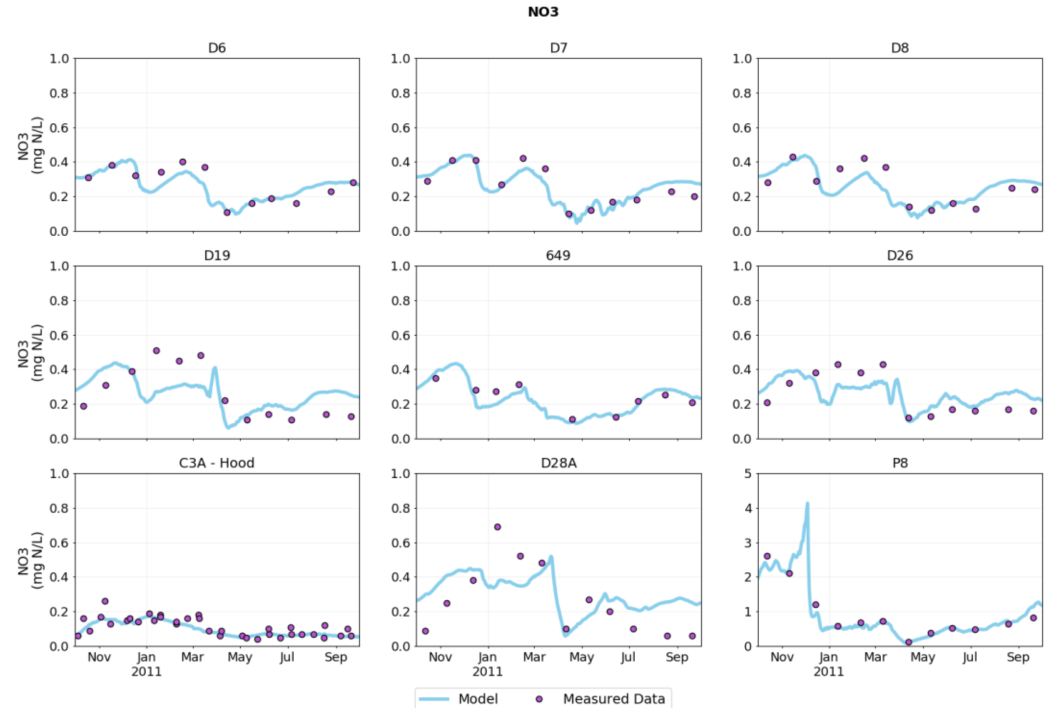


Figure 3.8. WY2011 model validation of nitrate at discrete sampling sites.

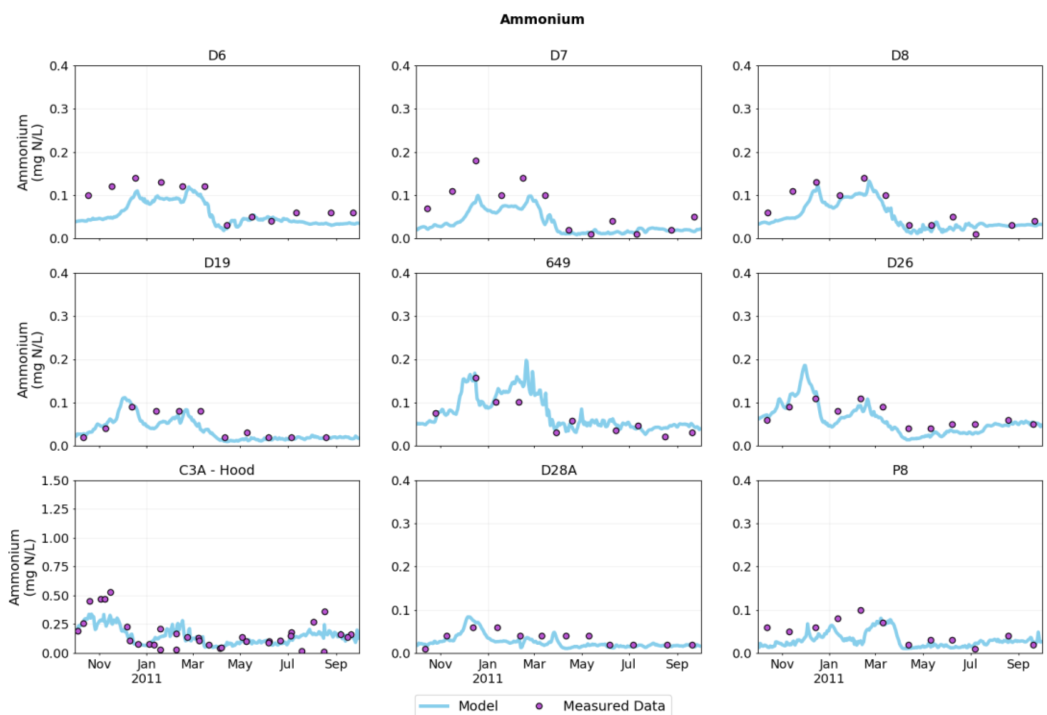


Figure 3.9. WY2011 model validation of ammonium at discrete sampling sites.

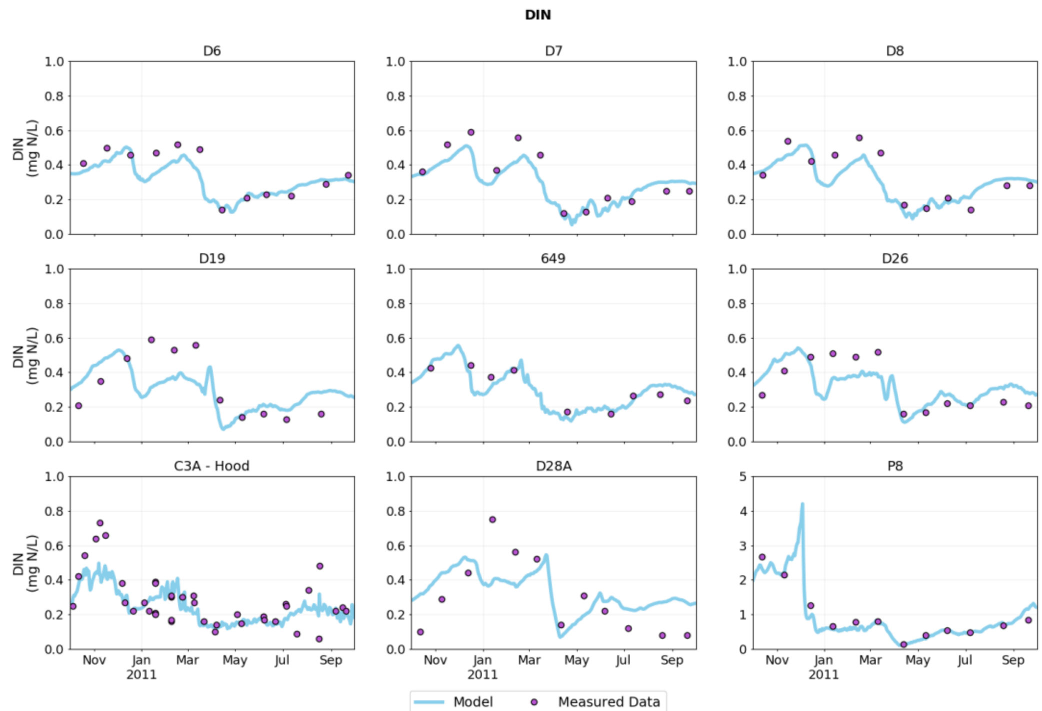


Figure 3.10. WY2011 model validation of dissolved inorganic nitrogen at discrete sampling sites.

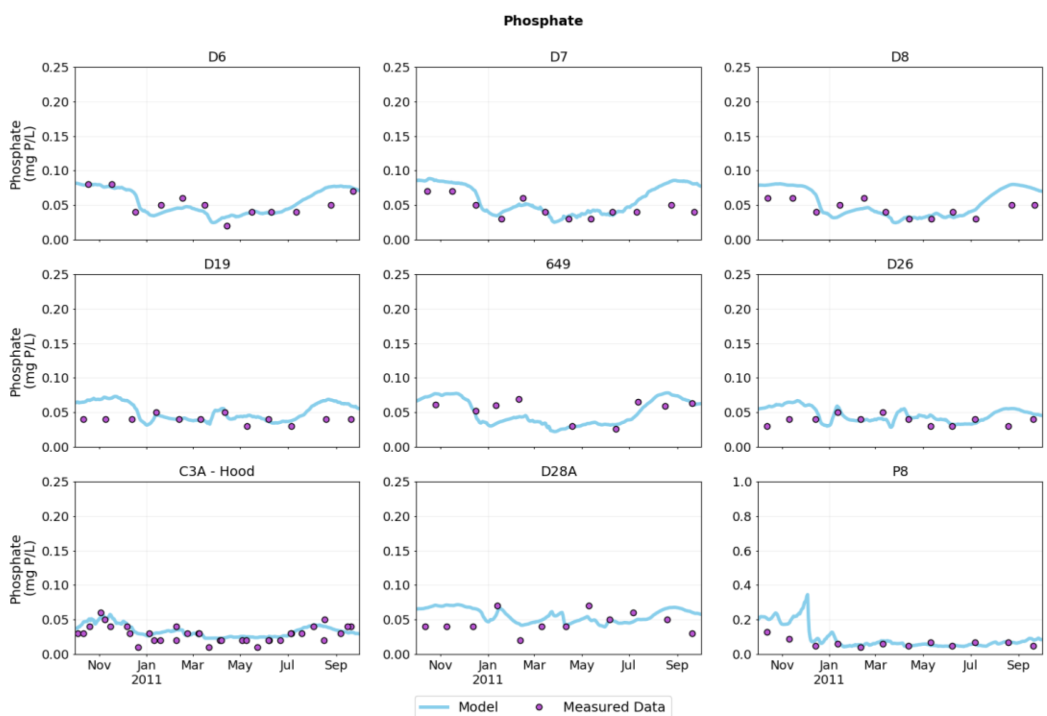
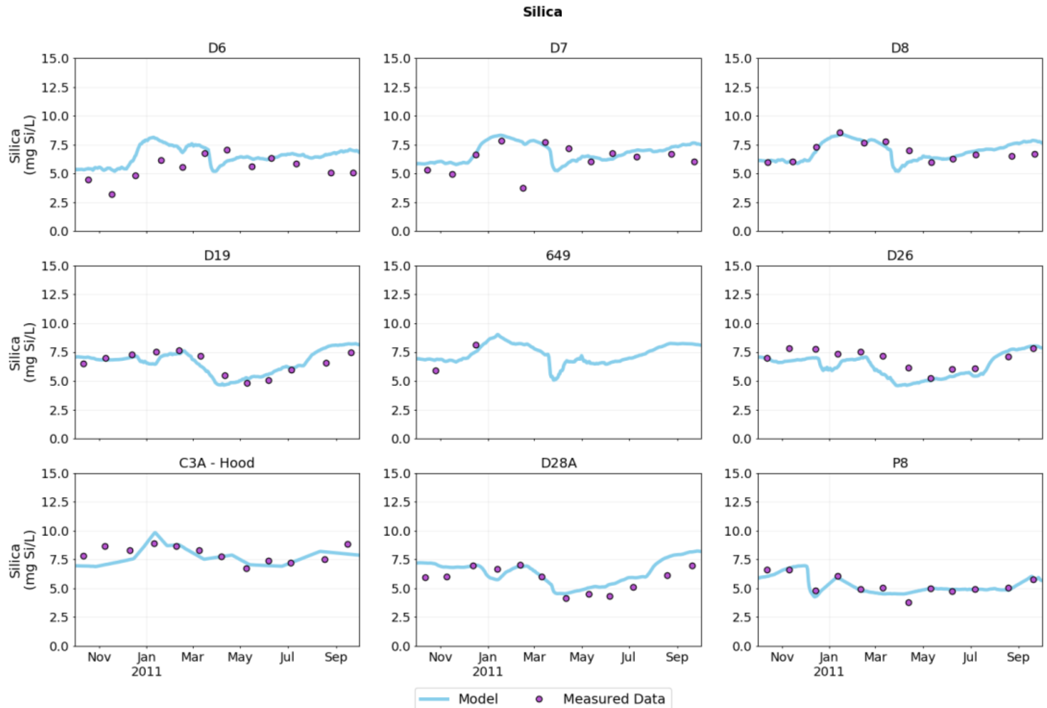


Figure 3.11. WY2011 model validation of phosphate at discrete sampling sites.



NOTE: Silica data from January 1 - October 1 2011 at Station 649 were flagged during a U.S. Geological Survey quality assurance/quality control check. The flagged data has been omitted from the plots.

Figure 3.12. WY2011 model validation of silica at discrete sampling sites.

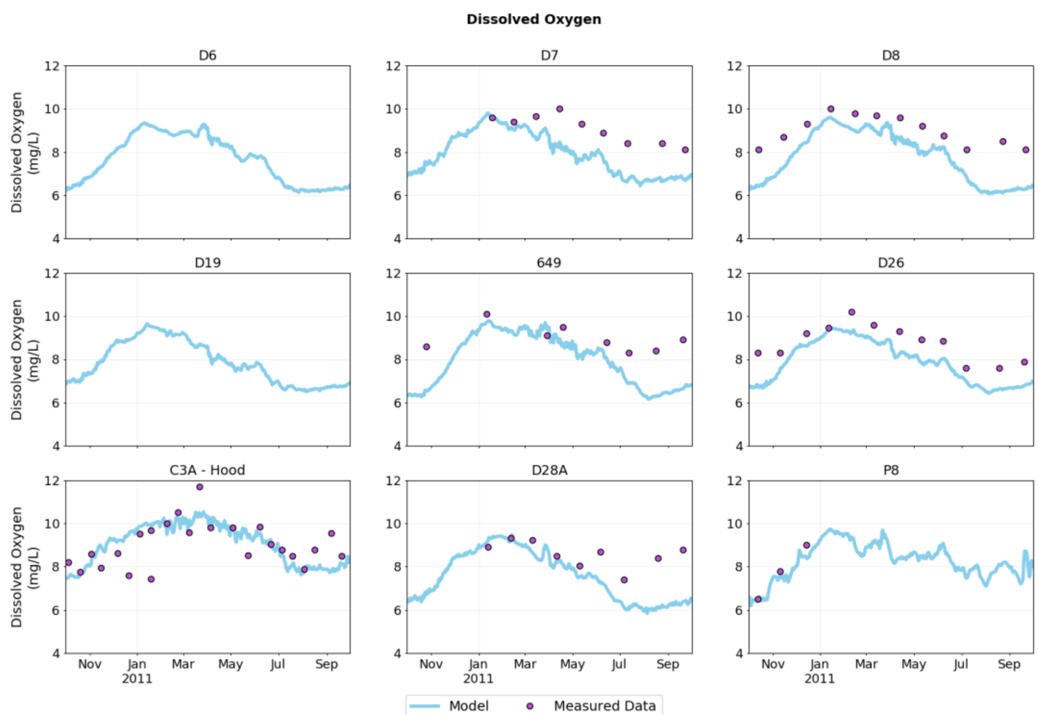


Figure 3.13. WY2011 model validation of dissolved oxygen at discrete sampling sites.

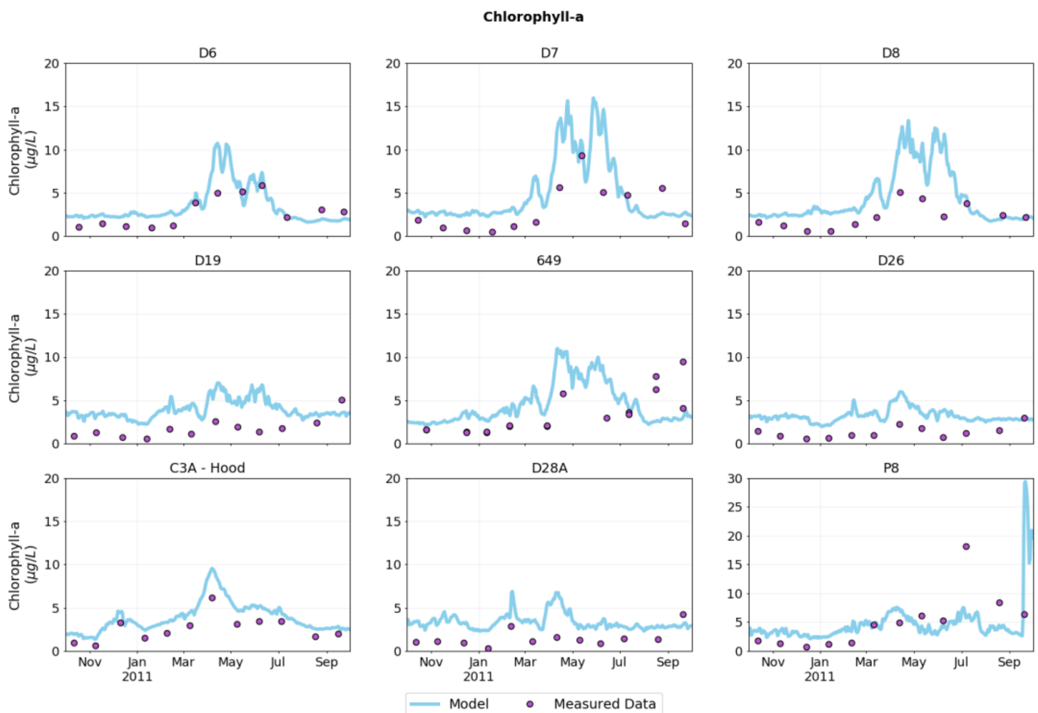


Figure 3.14. WY2011 model validation of chlorophyll-a at discrete sampling sites.

The model captures the seasonal and spatial variations in the observed concentrations of nitrate (Figures 3.1 and 3.8), ammonium (Figures 3.2 and 3.9), and DIN (Figures 3.3 and 3.10) in WY2016 and WY2011. Considering that each parameter varied over a 30-100 fold concentration range over the 2 years and throughout the Delta-Suisun region, the agreement between observed and modeled concentrations indicates that the most important transport and water column processes affecting these state variables are well-represented by the model. Nitrate, ammonium, and overall DIN concentrations in the Delta-Suisun region are influenced by numerous factors, including point sources and nonpoint sources, flow-routing (including water diversions), and transformations in the water column and sediments. The observed seasonal DIN patterns (Figures 3.3 and 3.10), consisting of yearly maximums in winter and lower levels in late spring and summer were generally well represented by the model.

Observed and simulated ammonium levels were relatively low (as a percentage of DIN) throughout the Delta, except in the Sacramento River downstream of the Regional San wastewater treatment plant (C3A), indicating that ammonium loaded from C3A underwent nitrification at relatively fast rates (relative to transport rates within the system), and that this relatively rapid nitrification was well-predicted by the model (Figures 3.2 and 3.9). The observed and simulated late-fall and winter peaks in concentrations of both nitrate and ammonium are likely shaped by two factors. The gradual increases in nitrate and ammonium over Oct-Dec 2015 at all sites, which preceded increases in flow rates, are consistent with the interpretation that they resulted from seasonal, system-wide slow-downs in nitrogen transformation or loss processes (e.g., nitrification; uptake of ammonium and nitrate by phytoplankton or other primary producers; denitrification) due to colder temperatures and shorter days, as previously observed (SFEI 2015). The second cause is likely related to low Sacramento discharge throughout October and November. Decreased river discharge results in slower flushing of nitrogen loaded from the Sacramento Regional WTP, and the resulting accumulation can produce increased ammonium and nitrate concentrations. The two ammonium concentration minima at C3A in late January and March 2016 coincide with the two major Sacramento River flow peaks, pointing to dilution of C3A's loads by high river flows being the primary cause. The subsequent increase in observed ammonium levels at C3A in late spring (May-June 2016) likely resulted from two factors: 1) decreasing Sacramento River flows, translating to higher ammonium concentrations; and 2) a window of increased loading from C3A (Appendix B, C3A shows a distinct increase in ammonium levels during this time).

Model performance predicting DIN within the central Delta (D26, D19, D28A) varied over time and by station, with concentrations over-predicted in D28A, D26, and D19 during WY2016 (fall, spring-summer), but with substantially better performance in WY2011. Potential explanations for these differences include: overestimating modeled nitrogen fluxes from sediments to the water column (which would have more pronounced effects on concentration during low-flow years, such as WY2016); underestimating modeled phytoplankton production; or DIN uptake by aquatic macrophytes, which can grow to high densities in this region of the Delta, but are not currently represented in the model. Additional work is needed to examine this issue and elucidate the most likely causal factor(s).

While the majority of nutrient model development focused on nitrogen dynamics, tracking phosphate and silicate concentrations can offer additional useful insights into underlying processes. Unlike DIN, measured phosphate concentrations generally reached their maximum levels in summer and fall and were typically at lower levels in winter and early spring (Figures 3.4 and 3.11). This pattern was particularly pronounced in WY2016 in Suisun Bay (D6 through D8) and the central Delta (D26 and D28A). This phosphate signal indicates that fluxes from the sediment to the water column are an important source of phosphorus during summer and fall. Measured phosphate levels were generally between 0.05 - 0.1 mg/L throughout the year, much higher than concentrations that would slow phytoplankton growth. Silicate, an important nutrient for diatom growth, is transported into the system as a natural constituent in runoff and is also recycled from the sediments to the water column. The model captures the general spatial, seasonal, and inter-annual patterns in phosphate and silicate concentrations throughout most of Delta and Suisun Bay and the Sacramento River (Figures 3.4-3.5, 3.11-3.12). The largest deviations between modeled and measured phosphate and silicate concentrations tended to concur in space and time with the largest deviations between modeled and measured DIN concentrations, and may be caused by similar explanations. While multiple potential explanations are being examined through ongoing work, one primary focus is on the role of sediment fluxes, in particular because sediment chemistry and flux data are a major gap throughout the region.

Ambient chl-a concentrations were generally low across the Delta and Suisun Bay throughout most of WY2016 and WY2011, with the exception of several space-time windows with elevated biomass (Figures 3.7 and 3.14). The model reproduces the generally-low chl-a levels in observational data, along with the timing and magnitude of higher chl-a levels at several locations during WY2011. However, the model underestimated chl-a levels in WY2016 during the spring (multiple locations) and fall (in Frank's Tract area). Capturing the bloom magnitude in WY2016 proved challenging because relaxing any set of controlling factors for phytoplankton growth (primarily grazing and light—as indicated earlier there were seldom any nutrient limiting condition periods during the simulation) typically resulted in windows with excessively large biomass predictions that were not supported by the observations. A similar phenomenon (excessively high modeled chl-a values) also occurred when forcings were relaxed for the WY2011 simulation. The current set of phytoplankton growth, grazing, and light extinction parameters provided the best overall fit across both of the water years. Modeled DO values followed similar seasonal patterns as observed DO, although the model generally under-predicted observations by ~20% (Figures 3.6 and 3.13). The dominant seasonal patterns (across sites and years) are consistent with the variations caused by temperature-driven variations in DO %-saturation, however there were some contribution from temperature-dependent respiration rates. The shortfall in predicted DO concentrations is likely partially attributable to our underestimates of primary production. This underestimation includes both underestimation of phytoplankton during some space-time windows, and the fact that floating and submerged macrophytes (e.g., around the Frank's Tract area), which grow densely in some regions, are not included within the current model.

3.2 High-Frequency Moorings

Figures 3.15 - 3.18 present model results and observations from high-frequency mooring locations at four Delta sites during WY2016 (see Figure 2.15 for site locations; Sacramento River at Freeport [FPT]; Sacramento River above the Delta Cross Channel near Walnut Grove [WGA]), Cache Slough at Ryer Island [CCH], and Sacramento River at Decker Island [DEC]). The results include observed and simulated chl-a, nitrate, DO, and temperature, with modeled values presented for the surface 1 m (no or little vertical variability was observed for predicted values, indicating that the modeled water column was generally well-mixed vertically). Observed light attenuation coefficients (KD) are also presented. These time series of KD at each mooring site were calculated by converting *in-situ* turbidity values to KD using the approach described in Section 2.3.4 and Appendix C. The modeled light limitation factor is included for comparison with KD. The light limitation factor is calculated internally within the model and represents the degree to which predicted phytoplankton growth rates are decreased relative to their maximum growth rate due to light availability (zero indicates total light limitation; one indicates no light limitation). Similarly, the modeled nutrient limitation factor (a quantity indicating to what extent modeled phytoplankton growth is limited by nutrient availability—which could include nitrate, ammonium, ortho-phosphate, etc) is plotted alongside chl-a for reference. The model equations for both these factors can be found within Deltares (2019b).

Depth-averaged light limitation factor values are presented in Figures 3.15-3.18, recognizing that the simulated water column was typically well-mixed at these sites, and that phytoplankton would therefore, on average, be exposed to depth-averaged light levels. Temperature was predicted within the hydrodynamic model, not the water quality model. However, many of the quantitatively-important biogeochemical rates vary strongly with temperature; therefore temperature is included here to provide information about the model's ability to represent seasonal variations in rates.

At Freeport (Figure 3.15), the model shows a close match to the high frequency nitrate data, which aligns with expectations given the Freeport nitrate concentration data were used for the upstream Sacramento River at Verona boundary condition. Considering that the model's Sacramento River boundary is ~30 miles away, this goodness of fit suggests that little transformation (either uptake or denitrification) of nitrate occurs between the boundary (Sacramento at Verona) and Freeport. Chlorophyll-a levels at Freeport are low throughout the year, and the model generally captures the magnitude and seasonal trend. The sharp changes in estimated KDs (increase) and predicted light limiting factor (decrease) during periods of high flow illustrate the strong influence elevated suspended sediment concentrations have on phytoplankton production, with predicted growth rates (depth-averaged) being 80-90% lower than maximum rates.

Observed conditions at Walnut Grove (Figure 3.16) were similar to those ~30 km upstream at Freeport, including elevated KD coinciding with high flows, moderate to low chl-a, and a similar 4-fold difference between high-flow and low-flow nitrate concentrations. Model predictions for light limitation, chl-a, dissolved oxygen and nitrate track observations reasonably well, although the modeled chl-a varied more smoothly than observed chl-a. While at first glance the two stations' observed nitrate concentrations appear similar, some substantial differences emerge when focusing on lower-flow

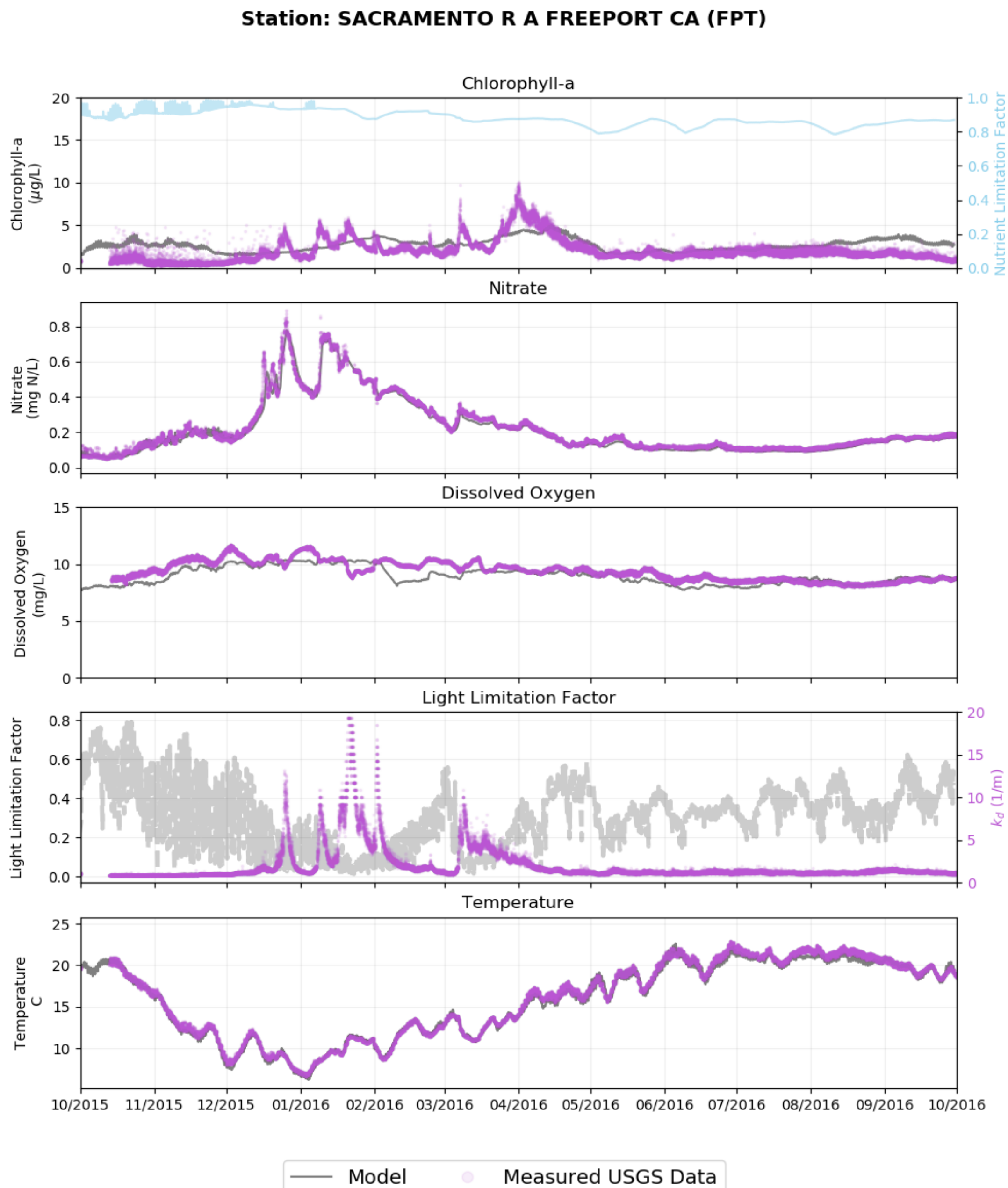


Figure 3.15. Model validation with the high frequency mooring site at the Sacramento River at Freeport

periods. During Nov 2015 and May 2016, WGA observed nitrate concentrations exceeded those at Freeport by ~50% and 30-40%, respectively, consistent with conversion of ammonium discharged by Regional San (released ~0.2 km downstream of Freeport) to nitrate during transit to WGA, along with some nitrate increase related to ammonium flux from the sediments (followed by nitrification; see Kraus et al., 2017). Predictions agree well with observations at FPT and WGA during these time periods, indicating that the combined effect of those two processes is being well-represented by the model. Robust predictions of nitrate concentration, discharge, and flux at Walnut Grove are particularly important because of this station's proximity to DCC, where large flows (and mass fluxes) are diverted to the interior Delta when the DCC is open.

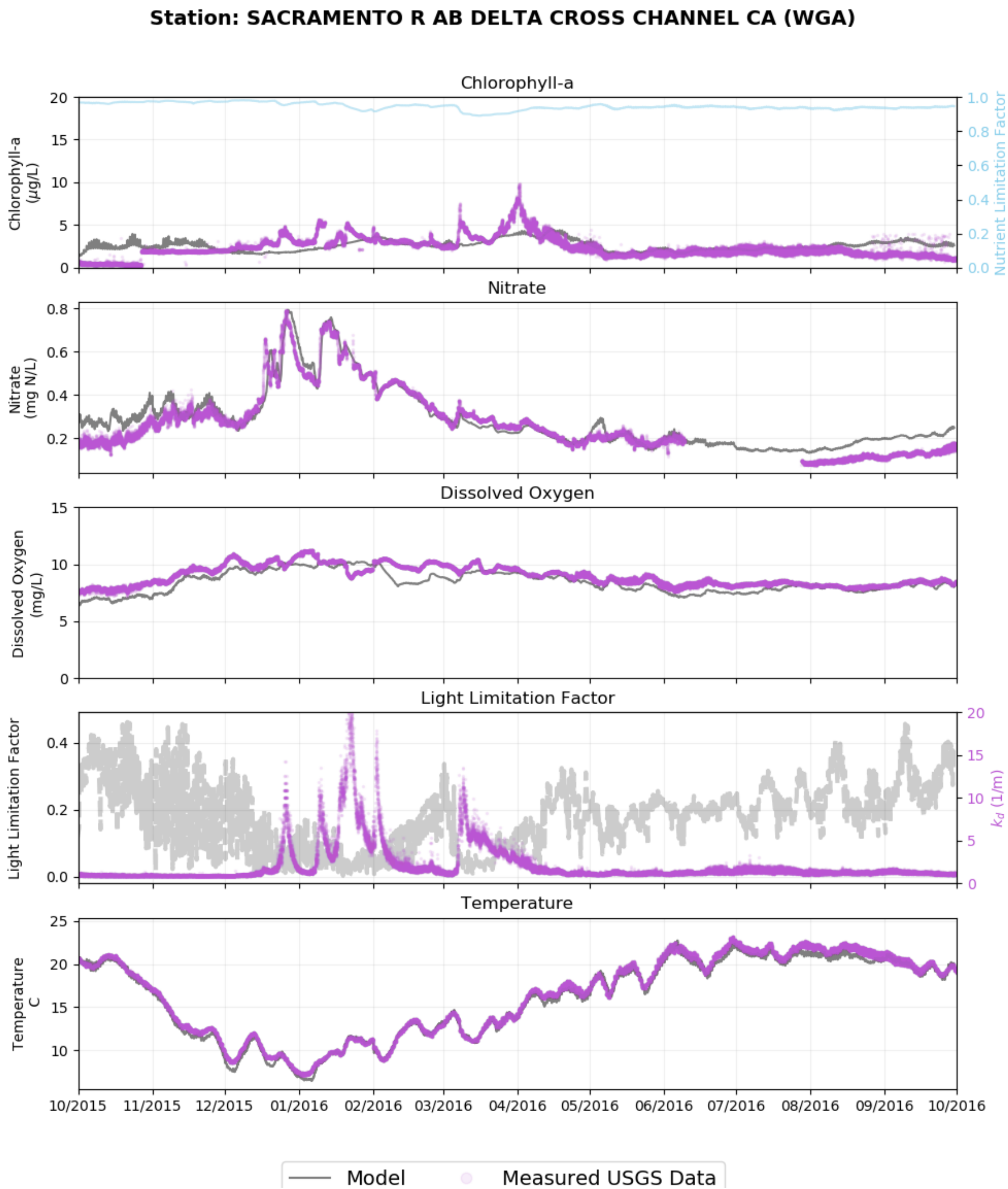


Figure 3.16. Model validation with the high frequency mooring site at the Delta Cross Channel

Observational and model data at the Cache Slough at Ryer Island site are presented in Figure 3.17. The mooring chl-a data highlights the occurrence of short-lived elevated biomass events during fall 2015, along with several elevated biomass events spanning 1-3 weeks during late spring and summer 2016. Simulations did not produce similar events; instead, the model predicted consistently low chl-a concentrations throughout most of the year at CCH. Modeled nitrate concentrations do, however, track observed nitrate throughout much of the year, although modeled values deviated increasingly from observed values through the spring-summer windows with elevated biomass and during September 2016. Further comparisons of model predictions and high frequency data are explored in Section 3.3 in terms of mass flux, along with some exploration of the relative magnitude or importance of events and deviations. Several factors could be contributing to the deviations between observed and modeled chla and nitrate: limited data on benthic grazer densities; submerged and floating aquatic vegetation, which have a substantial presence in the Cache region, and are not simulated in the current model; and potential limitations of the hydrodynamic model's representation of transport within the Cache region and exchange with the Sacramento River. These potential issues will be further examined and remedied through on-going work.

At Decker Island, modeled nitrate concentrations tracked observations from January through September 2016, but underestimated concentrations by 20-30% during some windows (Figure 3.18). As noted previously (Section 3.1), the model did not capture the observed elevated phytoplankton biomass in spring 2016, a point that is further reinforced by the high frequency data from Decker Island. We see additional bloom activity from the mooring site at Decker Island throughout the summer through August 2016. These activities are also not captured by the model. The observed chl-a signal at Decker appears quite similar -- in terms of timing and concentration -- to observations at CCH (Figure 3.17). On the one hand, the similar chl-a signals might point to a hypothesis that the Cache Slough Complex served as the source of the biomass observed at Decker Island and other down-estuary sites (see Figure 3.7, model comparisons with monthly discrete chl-a observations). On the other hand, however, relative flow rates and mass fluxes must also be considered. For example, the observed nitrate concentrations were substantially higher at Decker Island than at Cache Slough during some times of the year (e.g., fall 2015), and more consistent with most of the flow and mass (at least nitrate mass) being transported from the Sacramento River (i.e., from WGA). Modeled nitrate was consistently lower than measured nitrate (by about 0.2 mg/L) throughout the fall, but converged with measured nitrate in the winter, around February/March, when freshwater runoff from the Sacramento River peaked.

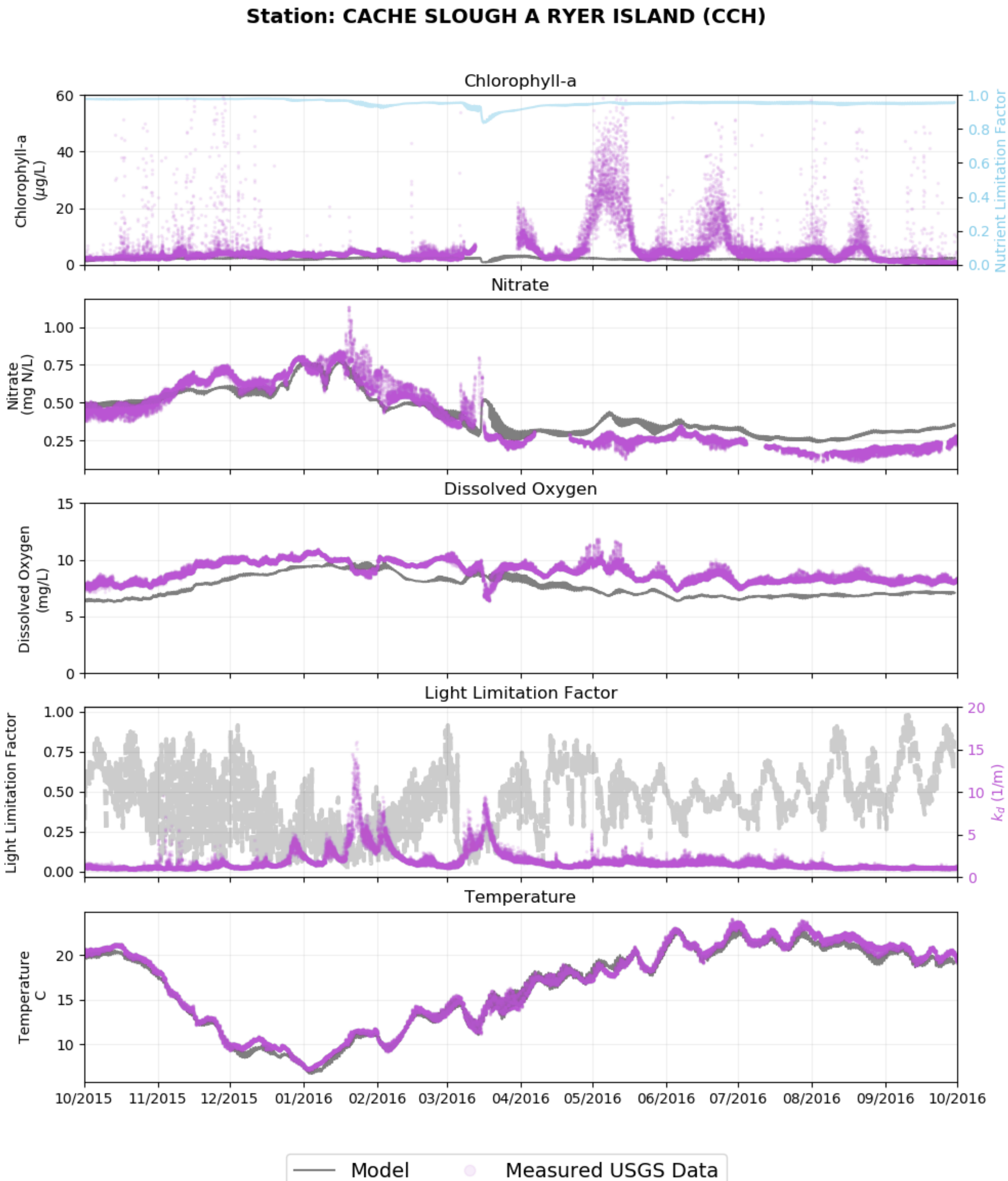


Figure 3.17. Model validation with the high frequency mooring site at Cache Slough at Ryer Island

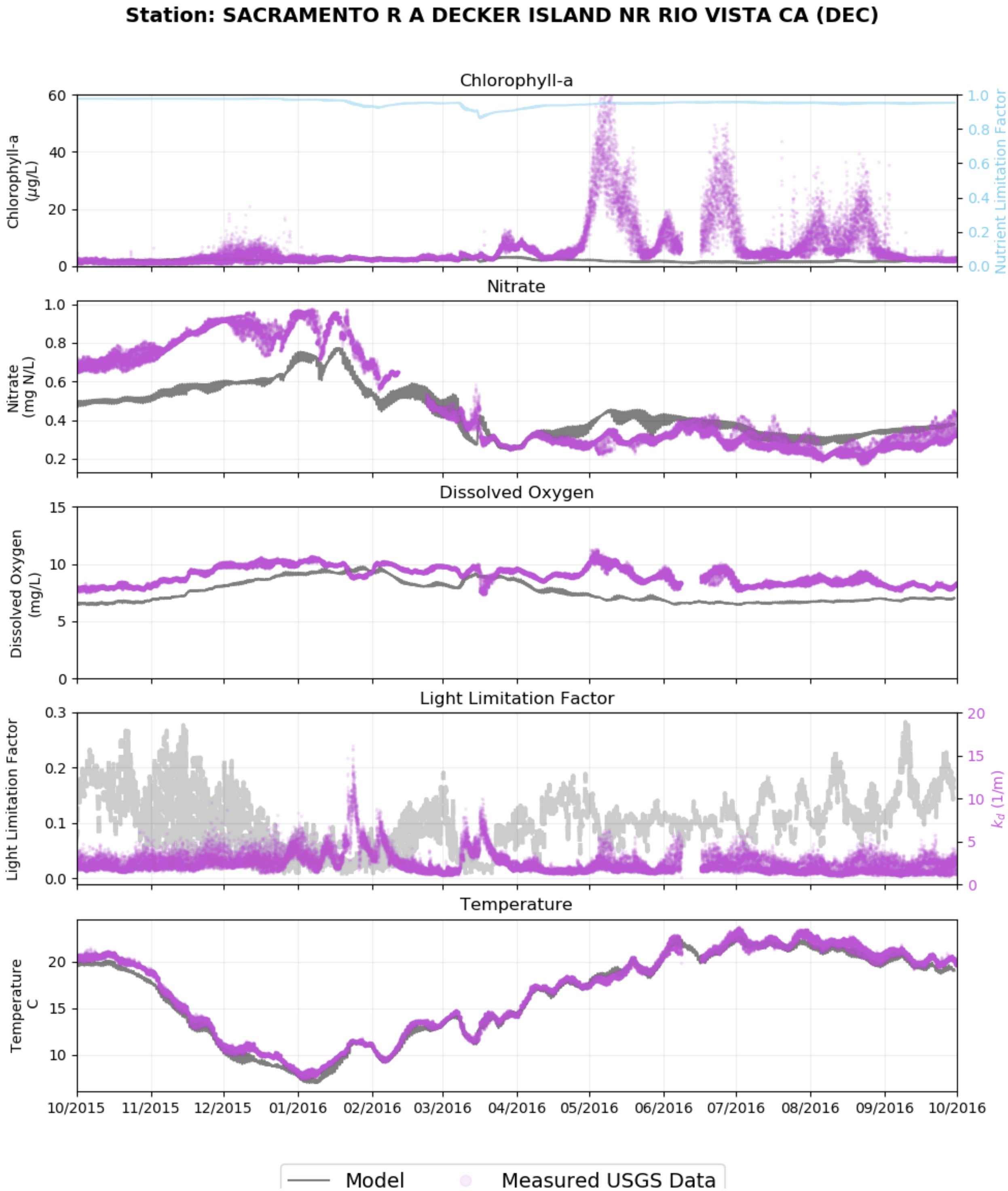


Figure 3.18. Model validation with the high frequency mooring site at Decker Island near Rio Vista

3.3 High-Frequency Flux Measurements

High frequency flux comparisons are presented in Figures 3.19-3.22 for Freeport, the Sacramento River above the Delta Cross Channel (also referred to as Walnut Grove), Cache Slough, and Decker Island, respectively.

As discussed in Section 3.2, the good agreement between observed and modeled nitrate concentrations result in large part from Freeport data's use to develop the northern nitrate boundary condition. The agreement between modeled and measured gives an indication of the very limited net losses or sources from transformation processes in the upper reaches of the Sacramento River (Figure 3.19). Similarly good agreement is observed at Walnut Grove, despite it being 30 km and 1.5 travel days (during low flow) downstream of Freeport. Modeled and measured concentrations also agreed well (Figure 3.20). While modeled chl-a concentrations on-average track measured concentrations at both locations, the model does not reproduce the relatively short-lived chl-a peaks in the observational record, which appear to occur during runoff events, with at least some of that chl-a introduced upstream of the model's Sacramento boundary (and that current boundary conditions apparently do not include). Comparing modeled and measured fluxes offers additional perspective for considering the importance of individual events. Because both discharge (from the hydrodynamic model) and nitrate concentrations (from the biogeochemical model) are used to calculate modeled fluxes, it also offers an additional lens through which to asses overall model performance and confidence in model predictions. At both locations, modeled nitrate fluxes (tidally-averaged and cumulative, bottom two panels) agree well with observations. Chlorophyll-a fluxes also agree well with observations. When the time periods with chl-a spikes are examined through the lens of tidal-averaged and cumulative fluxes (bottom two panels), the deviations between observed and modeled concentrations are minor, with the exception of the deviation introduced during the Mar 2016 high flow event. Interestingly, from April - August 2016, modeled and measured cumulative fluxes again have comparable slopes, indicating that tidally-averaged fluxes agree well during that period (also evident from the tidal-averaged flux plot).

The discussion of predicted and observed phytoplankton biomass in Section 3.1 (Figures 3.7, 3.14) established that the simulations captured the system’s generally year-round low-biomass along with several elevated biomass events that punctuated WY2011, but did not reproduce WY2016’s sub-regional and weeks-to-month time-scale events identified through monthly discrete monitoring. It is therefore no surprise that the high-frequency chl-a peaks at Cache Slough and Decker Island were also not predicted by the model (Figures 3.21 and 3.22). A comparison of the high-frequency-mooring and monthly-discrete time-series at those sites provides a degree of confirmation or validation of the high frequency-sensor results reliability. The comparison also offers mechanistic context about the characteristic time scales of events, and the scales (time, areal extent, concentration) of events that can be resolved through different monitoring approaches. In addition, germane to assessing model performance, the diverse data sources (high-frequency-observed, monthly-observed, modeled) offer an opportunity to examine the ecological significance of individual events or event-types, and provide information relevant to determining what events or conditions need to be detected through monitoring and reliably predicted by numerical models in order to accurate characterize system behavior. The cumulative chl-a mass flux estimates at Decker Island during WY2016 (Figure 3.22) could be described as having ~3 prominent features or phases: first, a moderate increase (late-Jan: 6-7 Mg increase over 30 days, ~0.2 Mg/d); followed by a second, substantial increase (mid-Mar: 20 Mg increase over 15 days, ~1.3 Mg/d); and then finally, a third, moderate but sustained increase (April through mid-July, 20 Mg increase over ~100 days, 0.2 Mg/d). The first two phases contributed 50-60% of cumulative annual net chl-a flux to Suisun Bay.

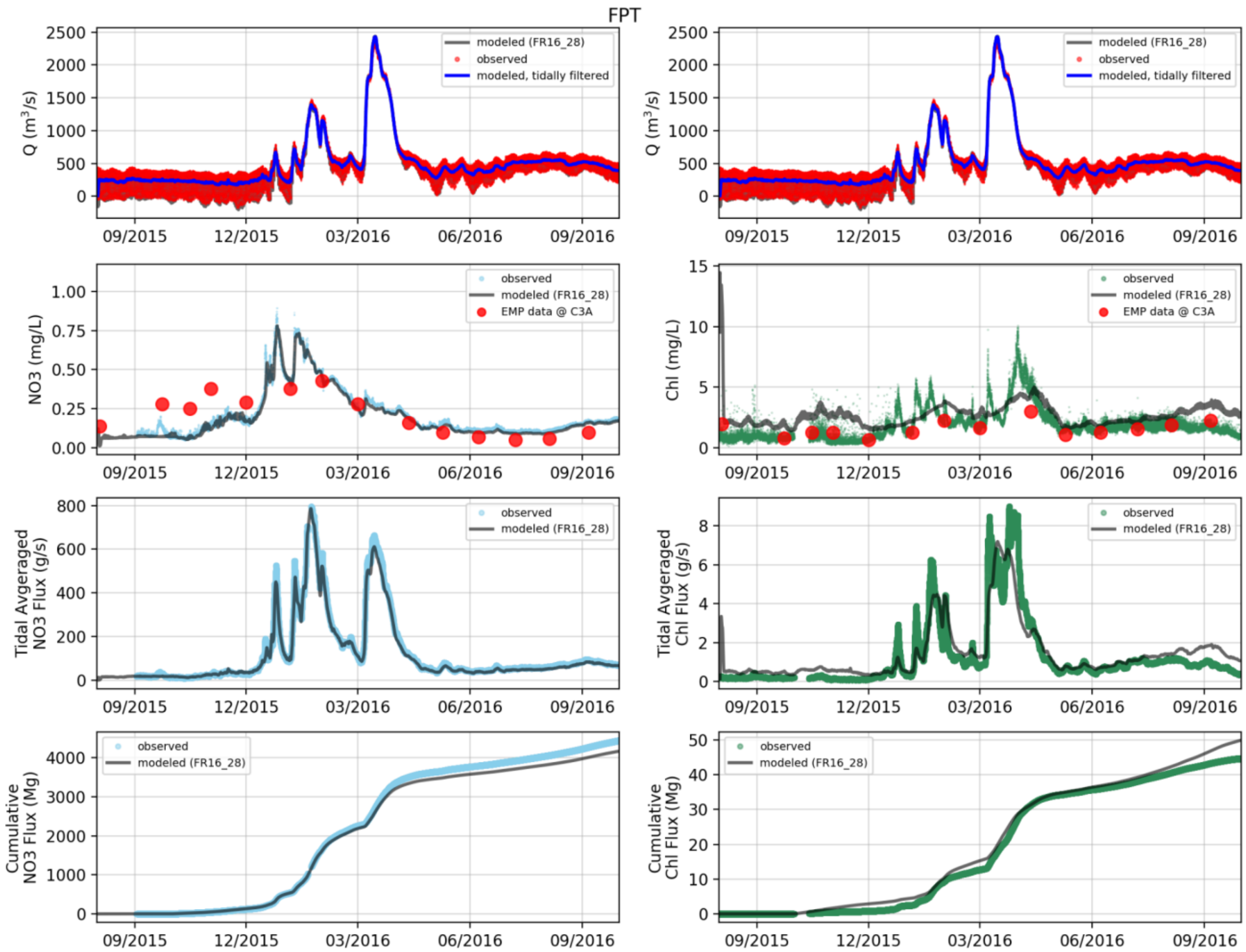


Figure 3.19. Plots of discharge, concentration, instantaneous and cumulative flux of both nitrate and chlorophyll-a at Freeport.

During Jan 2016 (first phase), chl-a concentrations were fairly constant around 2-3 ug/L, however, sharp increases in discharge resulted in increased phytoplankton biomass flux. Through mid- to late-March at Decker (roughly 40% of cumulative annual flux), model tidally-averaged and cumulative fluxes closely tracked the empirical flux estimates, reflecting the close agreement between the model predicted and observed chl-a concentrations throughout that time period.

Although flows decreased sharply between mid-March and early-April (75% decrease), tidally-averaged empirical fluxes remained elevated (Figure 3.22). During that time, the substantially-decreased flows were offset by the modest biomass increase that began in late March and continued into early April March (5-10 ug/L), resulting in the mass flux rate remaining similar. The remaining 40% of the cumulative annual flux was delivered to Suisun Bay at an average rate of 0.2 Mg/d, roughly a factor of 10 lower than the second phase. Of particular note is the fact that the three to four elevated biomass events (i.e., higher concentration of chl-a) during WY2016 occurred during this final phase. However, net export was much lower than during March, despite two to five times greater chl-a concentrations during the events. In fact, the empirical estimates identify time periods when net chl-a flux was up-estuary (Figures 3.20 and 3.21, tidal averaged flux panel).

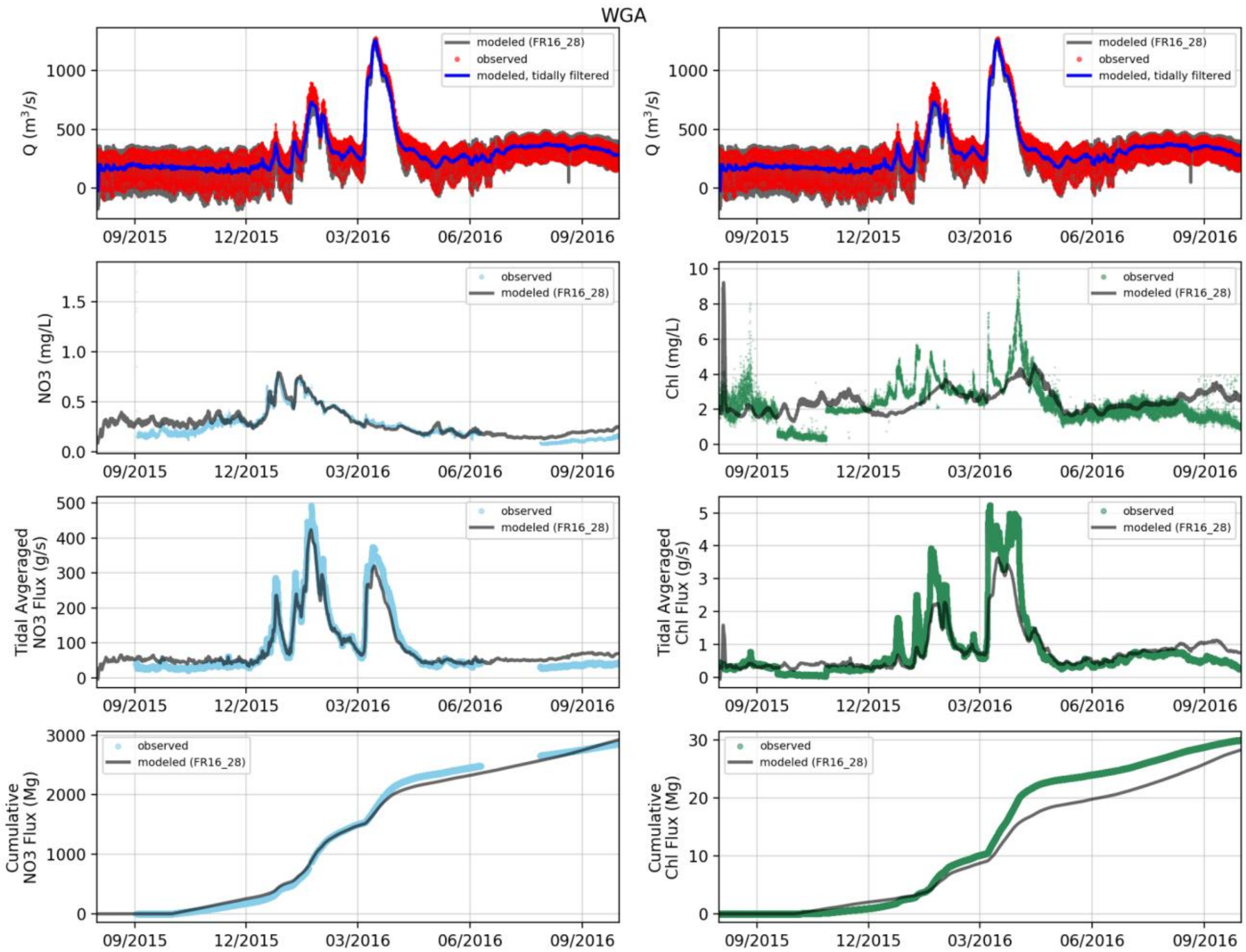


Figure 3.20. Plots of discharge, concentration, instantaneous and cumulative flux of both nitrate and chlorophyll-a above Delta Cross Channel near Walnut Grove.

Empirically-derived mass flux rates were roughly a factor of two greater than modeled fluxes, with the observation's higher baseline and three to four events being the primary reasons for the difference. Over the entire water year, modeled cumulative biomass fluxes past Decker (down-estuary) were 40% lower than observed fluxes (Figure 3.22, bottom right panel). Half of that difference (20% of net annual export) was due to the late March event, with moderately elevated chl-a concentrations (up to 10 ug/L) sustained over 1-2 weeks. The deviations between modeled and observed concentrations during April-August 2016 were responsible for the remaining 20% difference. Some of that difference is simply due to the low predicted baseline chl-a concentration. The prominent events — in terms of concentration (4-10 fold higher concentrations) and duration (7-8 weeks at concentrations greater than 5 ug/L)— therefore contributed a maximum of 20%.

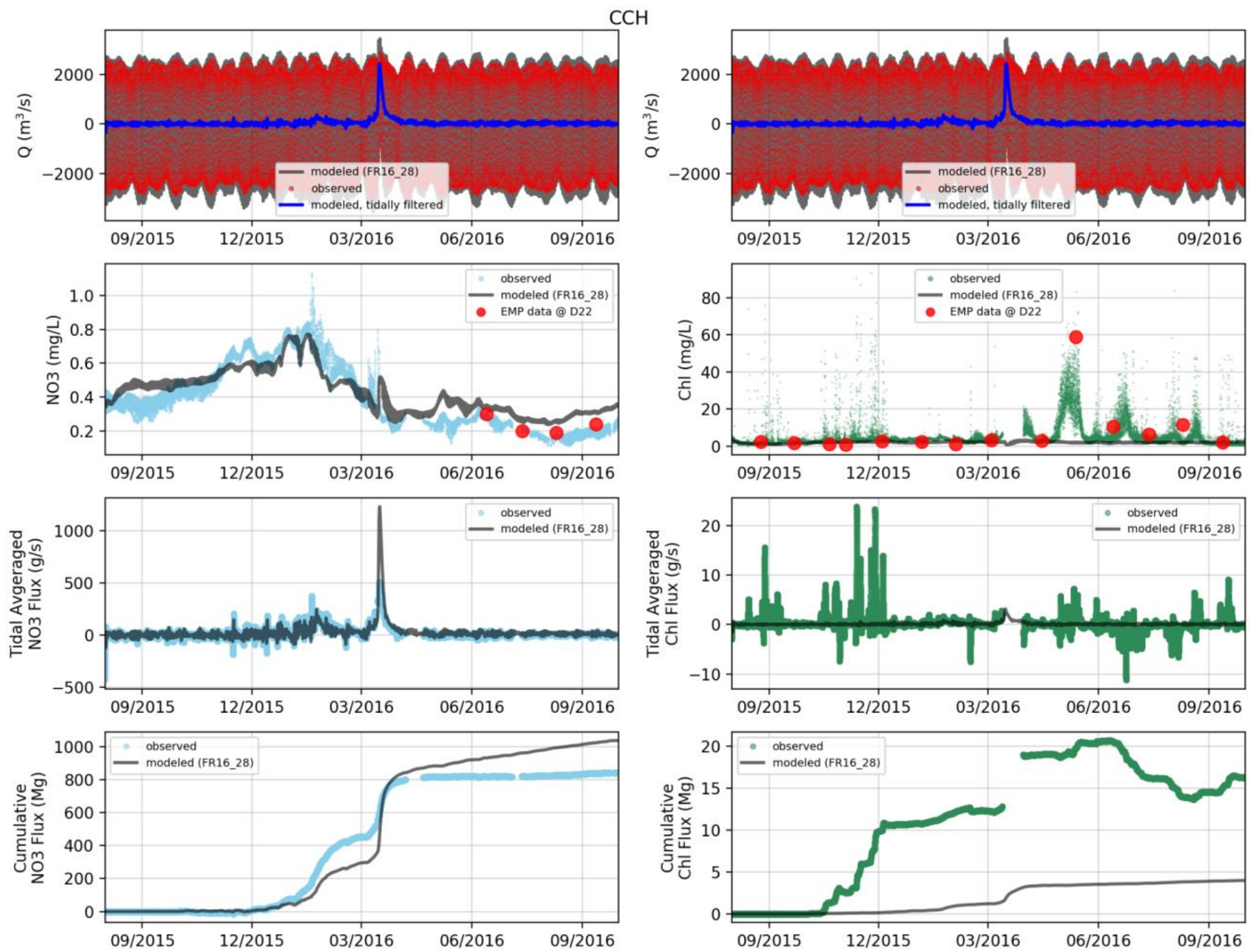


Figure 3.21. Plots of discharge, concentration, instantaneous and cumulative flux of both nitrate and chlorophyll-a above Delta Cross Channel at Cache Slough near Ryer Island.

Modeled and observed nitrate fluxes agreed reasonably well at CCH and DEC (Figure 3.21-3.22). Modeled cumulative nitrate fluxes at Cache Slough aligned closely with observations until mid-January, when they deviated during the high flow event. The model captured the timing of the March event, but underestimated the events integrated flux by ~30%. During April-August 2016, the model over-predicts cumulative flux, which observations suggest had plateaued, resulting in approximately 20% higher annual cumulative flux by the end of the simulation. One potential explanation for this difference is that the model is under-predicting N removal within the Cache Slough Complex (e.g., denitrification, burial, uptake by aquatic vegetation not represented in the model). At Decker Island, the model and data exhibit similar nitrate flux patterns, with the model underestimating annual cumulative flux by ~20%. Notably, the cumulative flux curves have nearly identical slopes from April-August 2016. The bulk of the difference between modeled and measured cumulative flux therefore occurred during the January and March 2016 high flow events. The agreement between modeled and measured fluxes from April-August 2016 is encouraging, given DEC's location at the down-estuary edge of the Delta, and suggests that major components of the simulated N mass-balance provide reasonable approximations of actual losses and recycling upstream.

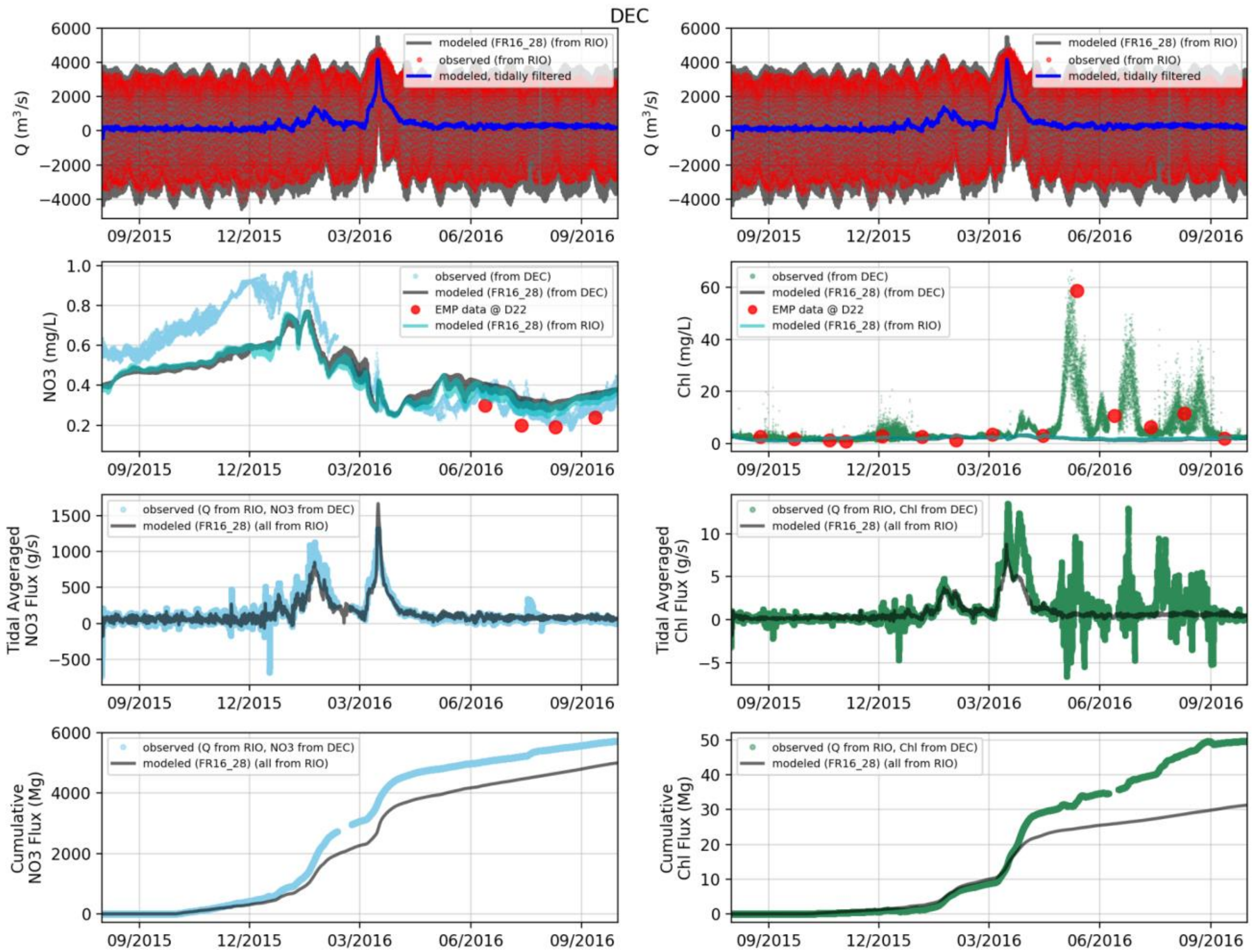


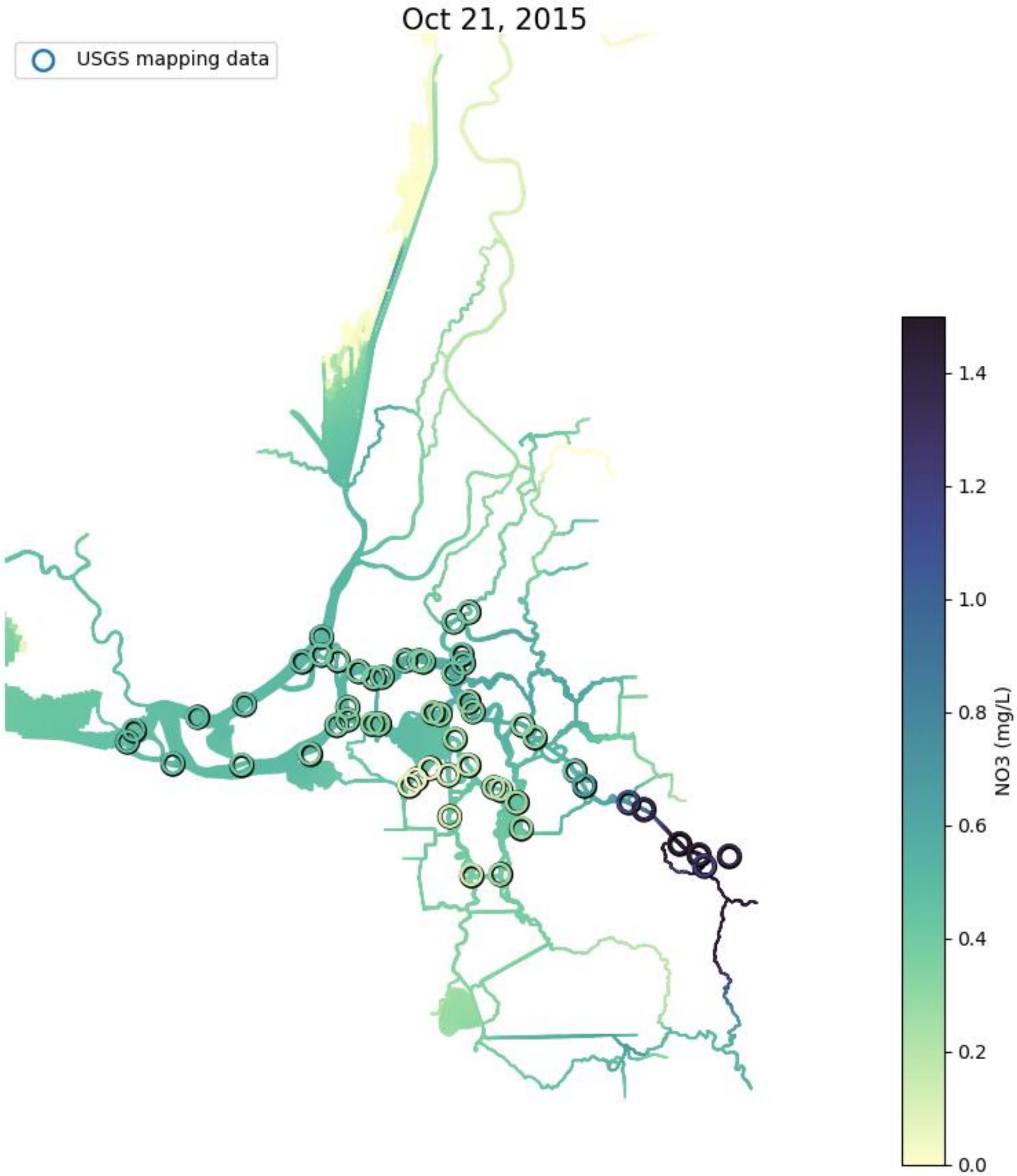
Figure 3.22. Plots of discharge, concentration, instantaneous and cumulative flux of both nitrate and chlorophyll-a at Decker Island.

While a more detailed mass balance analysis is needed to fully determine whether biomass export from the Cache Slough Complex was responsible for the elevated biomass at, and fluxing past, DEC, a preliminary look focusing on mass fluxes offers some useful insights, including for evaluating model performance. Cumulative chl-a flux past DEC totaled ~10 Mg. During the same time period, net chl-a export past CCH was 1-2 Mg. From mid-June through August, another 10 Mg of chl fluxed past DEC; and net fluxes past CCH were -5 Mg (net flux into Cache Slough Complex). The March 2016 flux estimates suggest that, while biomass from the Cache Slough Complex could have seeded production along the lower Sacramento River, net export from the Cache region could only account for a maximum 10-20% of the total export past DEC. During April-August, observations suggest there was net biomass import to the Cache region. A more comprehensive assessment is needed to fully understand the events during spring 2016. From the perspective of evaluating the current model's performance -- although making targeted improvements to the simulation of processes within the Cache region, low predicted phytoplankton production within the Cache region was not the root cause of underestimating biomass down-estuary at CCH. Phytoplankton production is a key management issue in the nSFE, because of the limited supply of high quality food for primary and secondary consumers. Phytoplankton biomass, estimated by measuring chl-a, is often used as a key indicator of ecosystem health in the Delta-Suisun region (gross primary production has also been used in in-depth synthesis studies, e.g., Jassby et al 2002 and Jassby 2008; but chl-a concentration is more readily accessible and therefore more regularly used). The discussion above highlights how viewing the system through concentration-focused vs. mass-flux focused lenses can result in different interpretations. The discussion did not include other important mass balance terms, in particular production rate, grazing rate, mortality, etc.; the model does simulate those processes, and those types of mass balance explorations are planned for subsequent application work using the model. Nonetheless, the comparison of modeled and measured fluxes provides useful context for considering the importance of capturing different types of events.

3.4 USGS Mapping Cruises

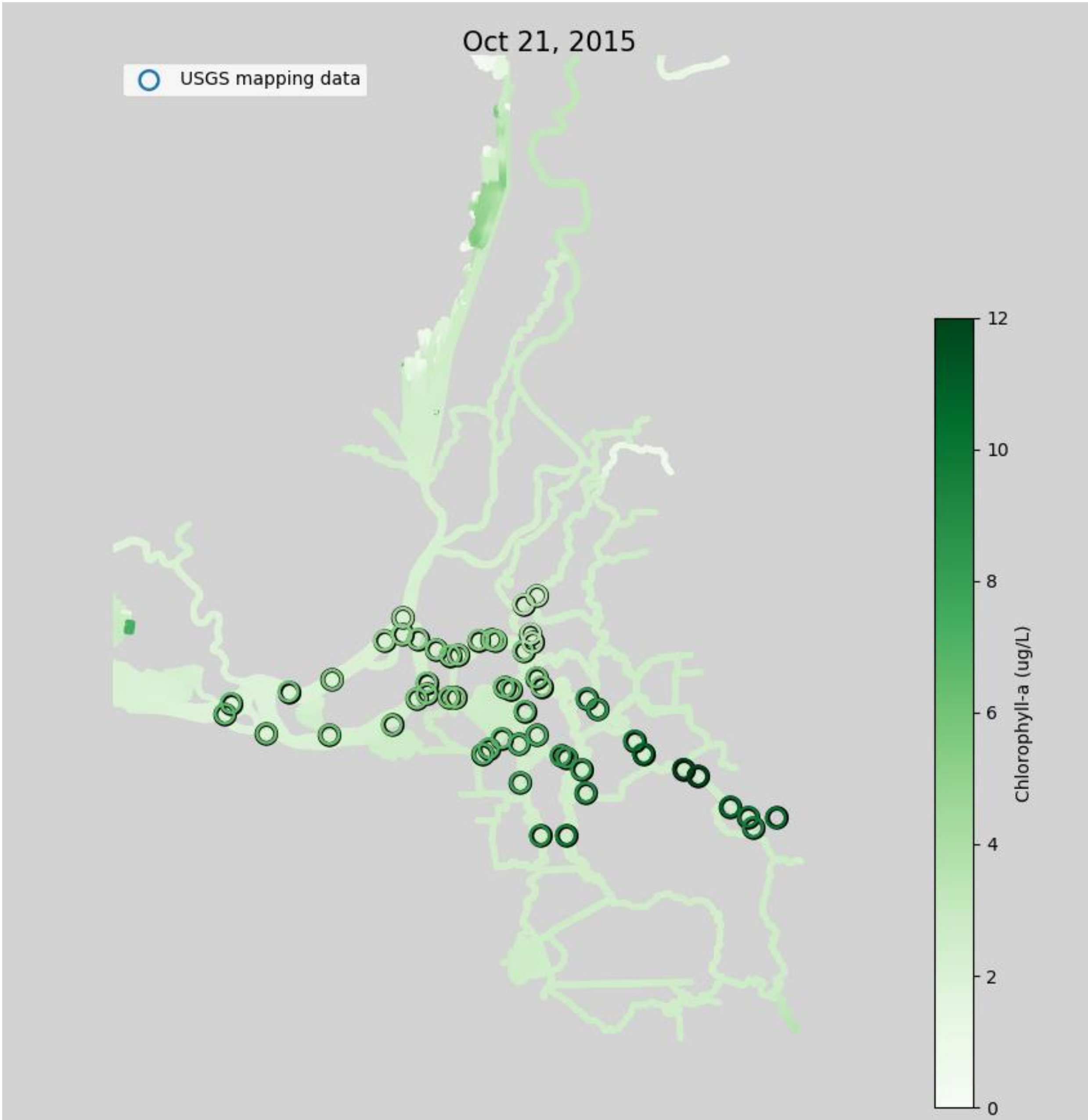
Validation plots of the biogeochemical model using USGS mapping cruise data are shown below in Figures 3.23 - 3.34 on four dates (October 21, 2015; April 18, 2016; May 6, 2016; June 9, 2016).

The October 21, 2015 cruise focused on the interior Delta, from the confluence toward Frank’s Tract and Stockton. Figure 3.23 shows that the model successfully captures the east-west nitrate gradient (with high nitrate levels greater than 1 mg/L near Stockton and lower levels (less than 0.5 mg/L) moving west toward Suisun Bay. The mapping data of chl-a in the same region (Figure 3.24) shows higher concentrations than the model (greater than 4-10 ug/L vs ~4 mg/L), as well as a trend of increasing chl-a (~10 ug/L) moving east toward Stockton, which is not captured by the model (chl-a is low across the entire region). Oxygen levels are also slightly higher in the measured data than reported by the model by about ~1-2 mg/L (Figure 3.25). The measured data suggests near-saturated conditions, which would be expected with high levels of primary production.



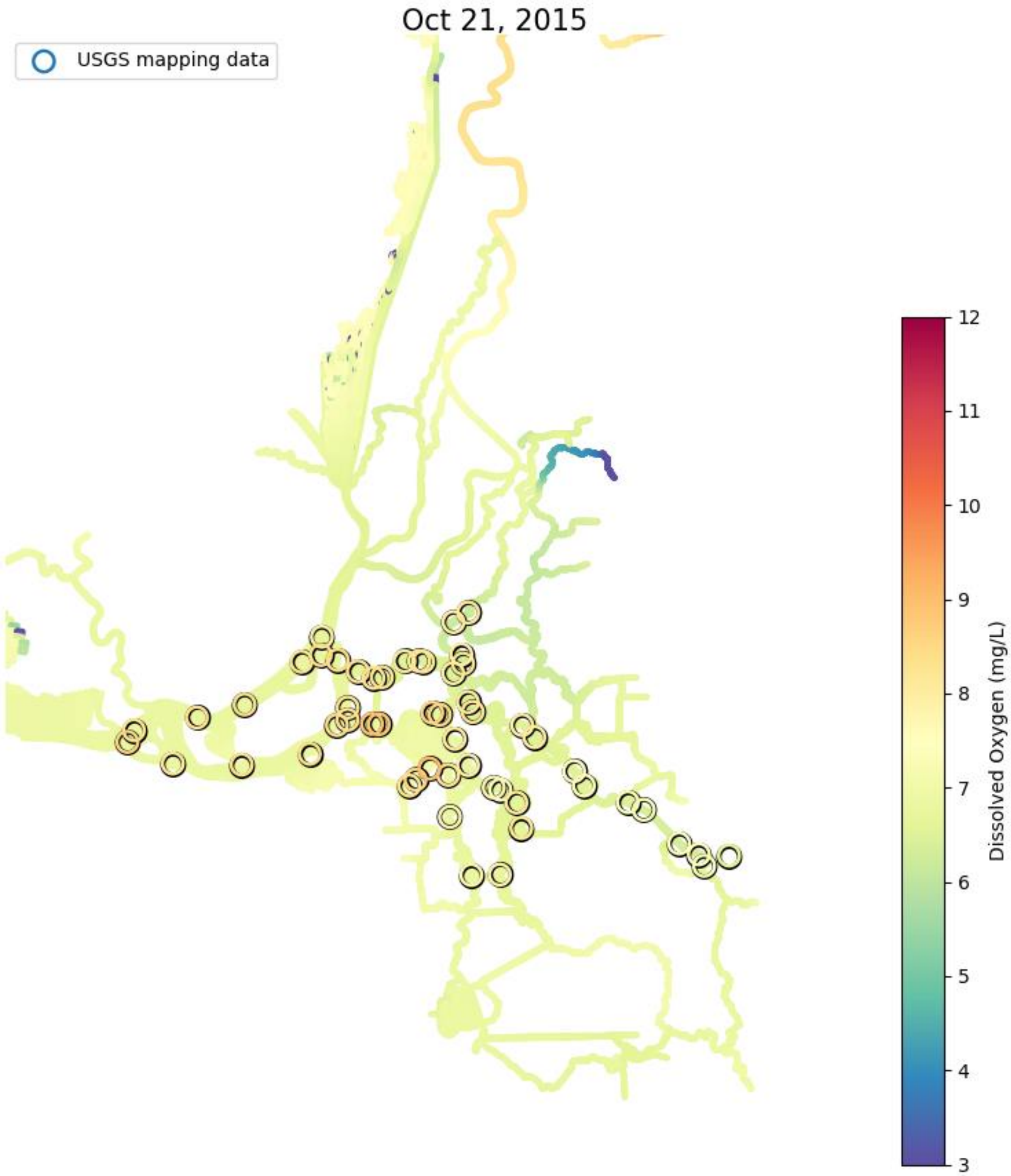
Note: Model results are shown in the map (as a daily and depth-averaged concentration) while the high frequency mapping data is shown as the overlying circles, with circle colors scaled in the same manner as the model results.

Figure 3.23. Model validation with mapping cruise data on October 21, 2015 for nitrate.



Note: Model results are shown in the map (as a daily and depth-averaged concentration) while the high frequency mapping data is shown as the overlying circles, with circle colors scaled in the same manner as the model results.

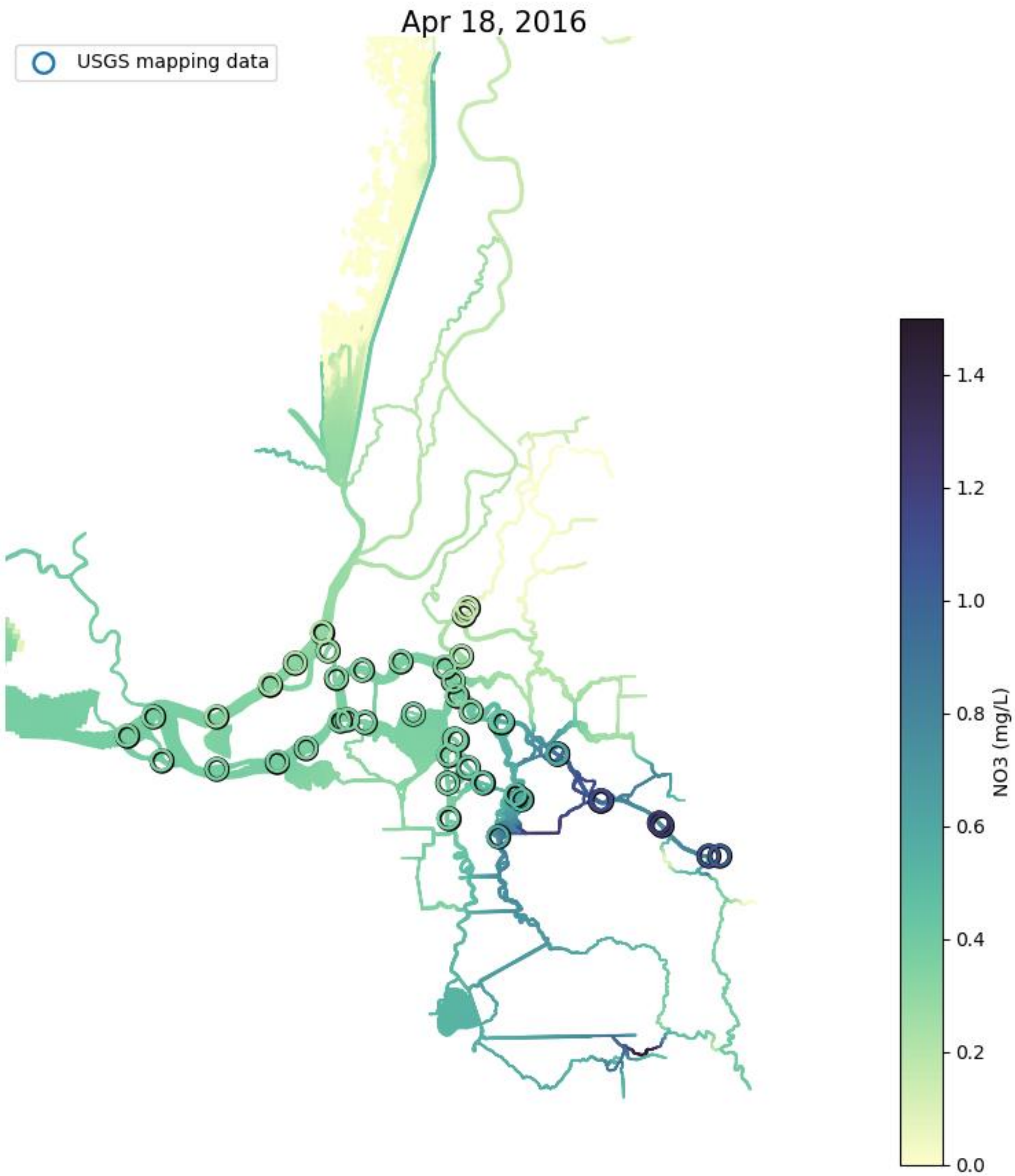
Figure 3.24. Model validation with mapping cruise data on October 21, 2015 for chlorophyll-a.



Note: Model results are shown in the map (as a daily and depth-averaged concentration) while the high frequency mapping data is shown as the overlying circles, with circle colors scaled in the same manner as the model results.

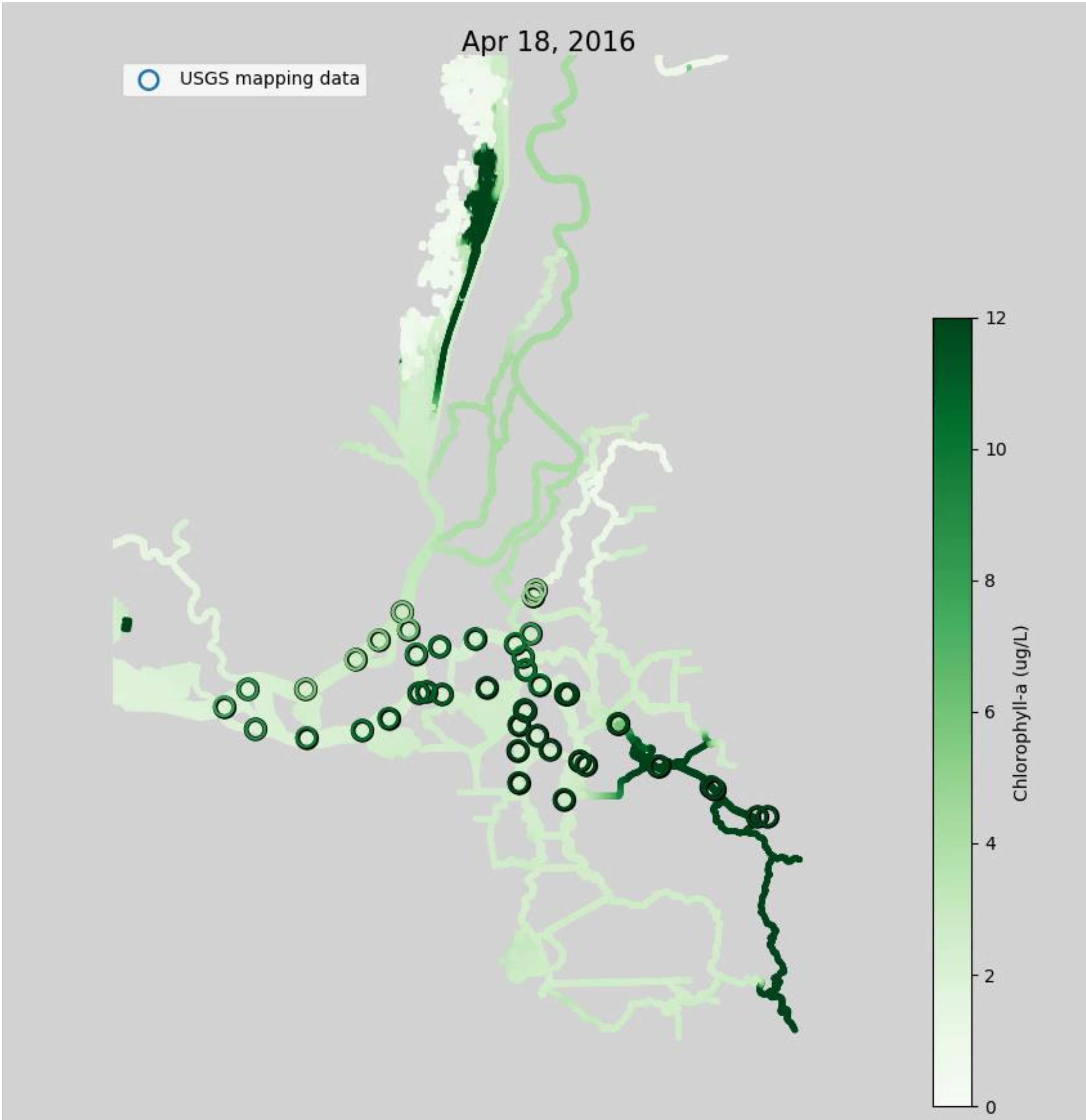
Figure 3.25. Model validation with mapping cruise data on October 21, 2015 for DO.

The April 18th, 2016 cruise followed a similar route (interior Delta). The nitrate magnitude and gradient are well-captured by the model, and still evident in the measured data, suggesting this is a year-round persistent gradient (increasing nitrate moving east; Figure 3.26). The model-predicted chl-a shows a strong gradient, with high values near the Stockton Deepwater Ship Channel (greater than 12 ug/L), which sharply decrease moving toward the central Delta to about 4 ug/L. The measured data shows a similar gradient; however, the high chl-a values persistent moving west across the interior Delta, remaining greater than 10 ug/L till around the Frank's Tract region. Overall, the DO levels are on the same order between the measured and modeled data (~7-9 mg/L), and there is little gradient in the mapping cruise data moving eastward across the interior Delta, which is consistent with the little bloom activity in WY2016.



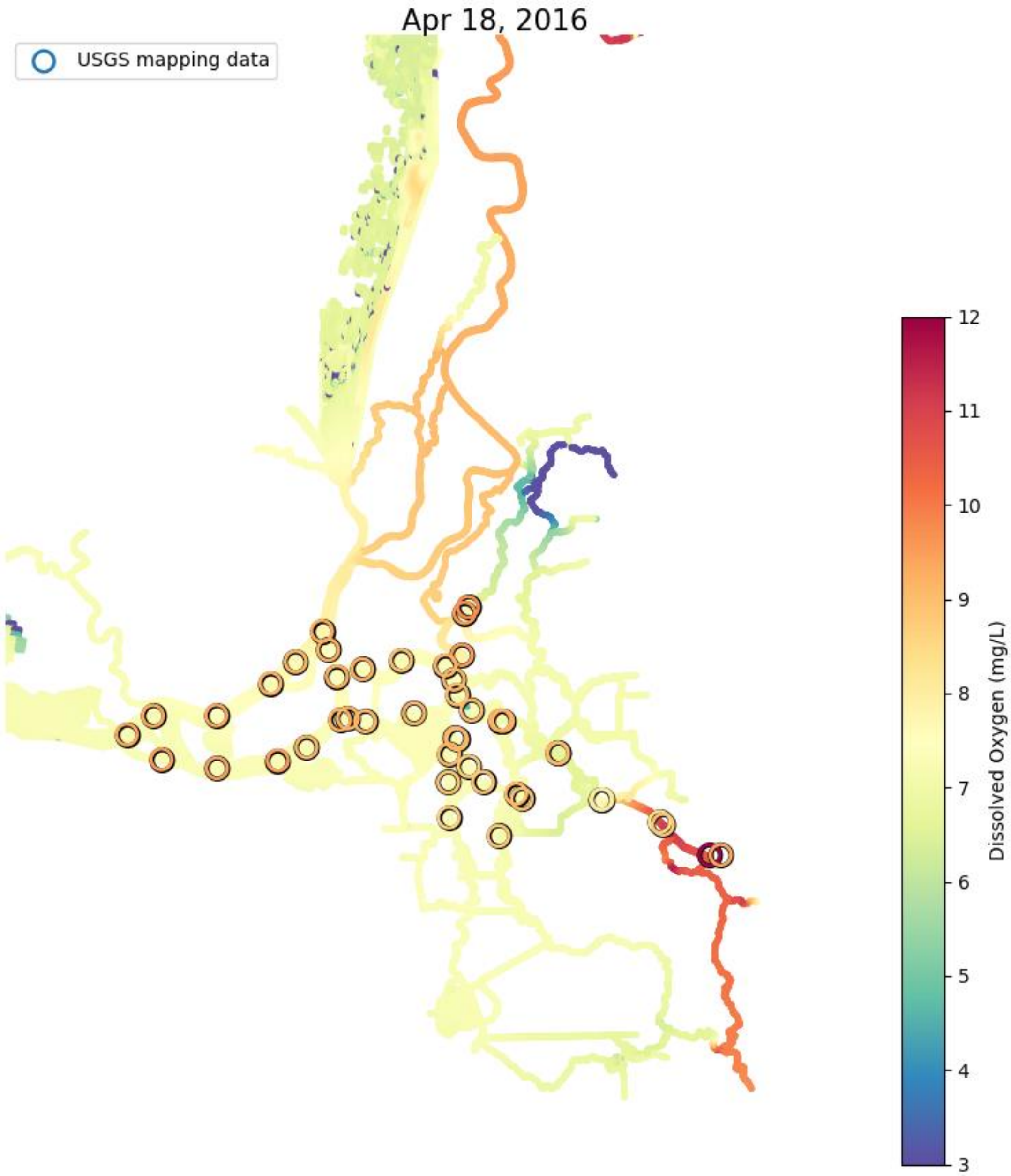
Note: Model results are shown in the map (as a daily and depth-averaged concentration) while the high frequency mapping data is shown as the overlying circles, with circle colors scaled in the same manner as the model results.

Figure 3.26. Model validation with mapping cruise data on April 18, 2016 for nitrate.



Note: Model results are shown in the map (as a daily and depth-averaged concentration) while the high frequency mapping data is shown as the overlying circles, with circle colors scaled in the same manner as the model results.

Figure 3.27. Model validation with mapping cruise data on April 18, 2016 for chlorophyll-a.

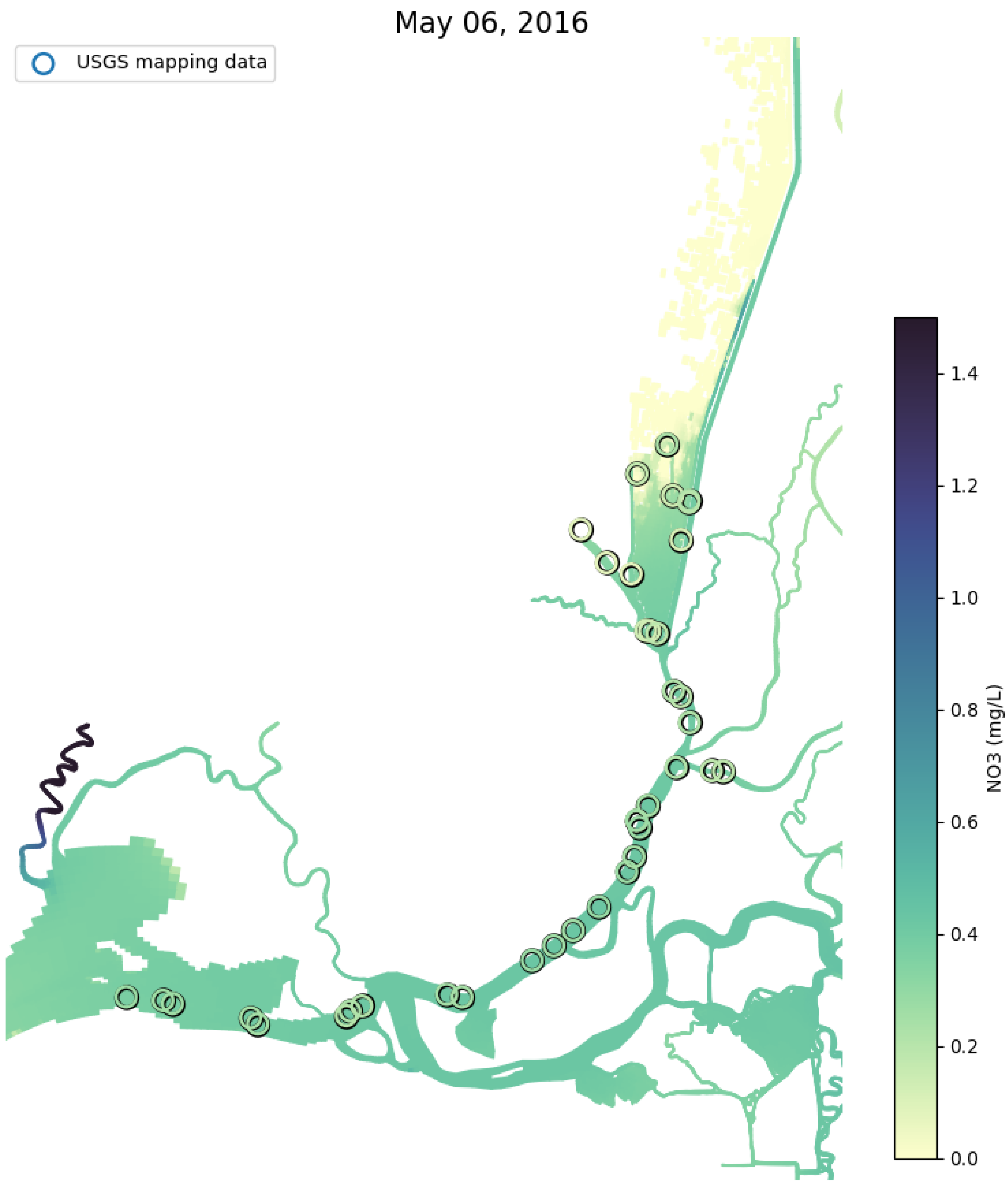


Note: Model results are shown in the map (as a daily and depth-averaged concentration) while the high frequency mapping data is shown as the overlying circles, with circle colors scaled in the same manner as the model results.

Figure 3.28. Model validation with mapping cruise data on April 18, 2016 for dissolved oxygen.

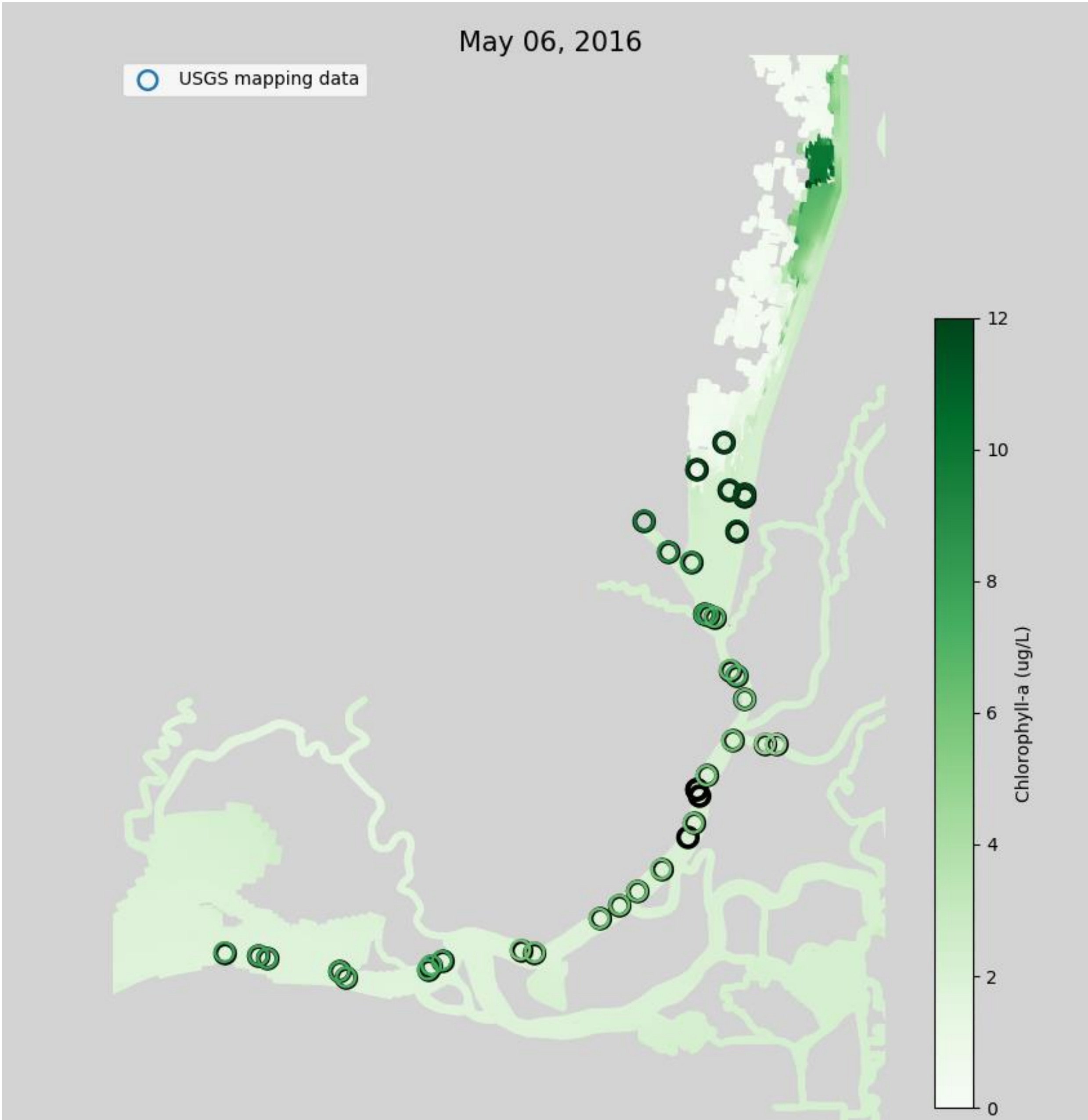
The May 6 and June 9 cruises follow a different track, from Suisun Bay into the lower reaches of the Cache Slough Complex (Figures 3.29 - 3.34). During both the May and June cruise, good alignment in nitrate levels is displayed between the model and observations. The mapping cruise detected little gradient between Suisun Bay and Cache Slough with the exception of lowered nitrate in the Cache Slough Complex itself. The model predicts a similar nitrate magnitude across the Sacramento channel (~0.3-0.5 mg/L) but does not replicate the low nitrate conditions (~0.1 mg/L) in the lower Cache Slough

Complex in May (Section 3.3). The model also under-predicts chl-a by a significant margin. The mapping cruises recorded levels on the order of greater than 5- 12 ug/L while the model predicts ~2-3 ug/L of chlorophyll throughout the main channel, with concomitant underestimation in DO by ~5 mg/L. There is little difference in the mapping cruise data between May and June, suggesting that the gradients and magnitude of nitrate, chlorophyll, and oxygen remain relatively constant throughout the late spring/early summer period.



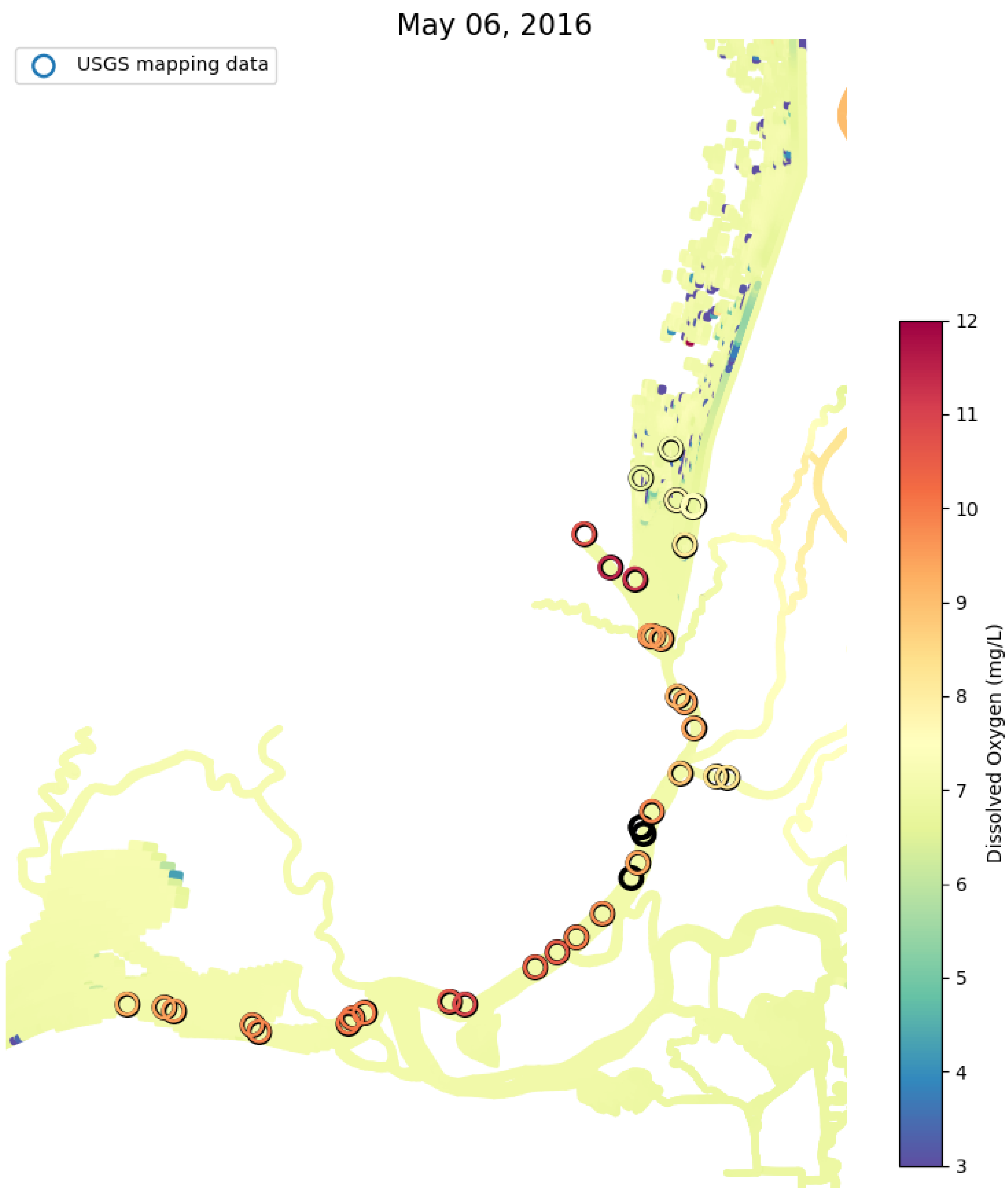
Note: Model results are shown in the map (as a daily and depth-averaged concentration) while the high frequency mapping data is shown as the overlying circles, with circle colors scaled in the same manner as the model results.

Figure 3.29. Model validation with mapping cruise data on May 6, 2016 for nitrate.



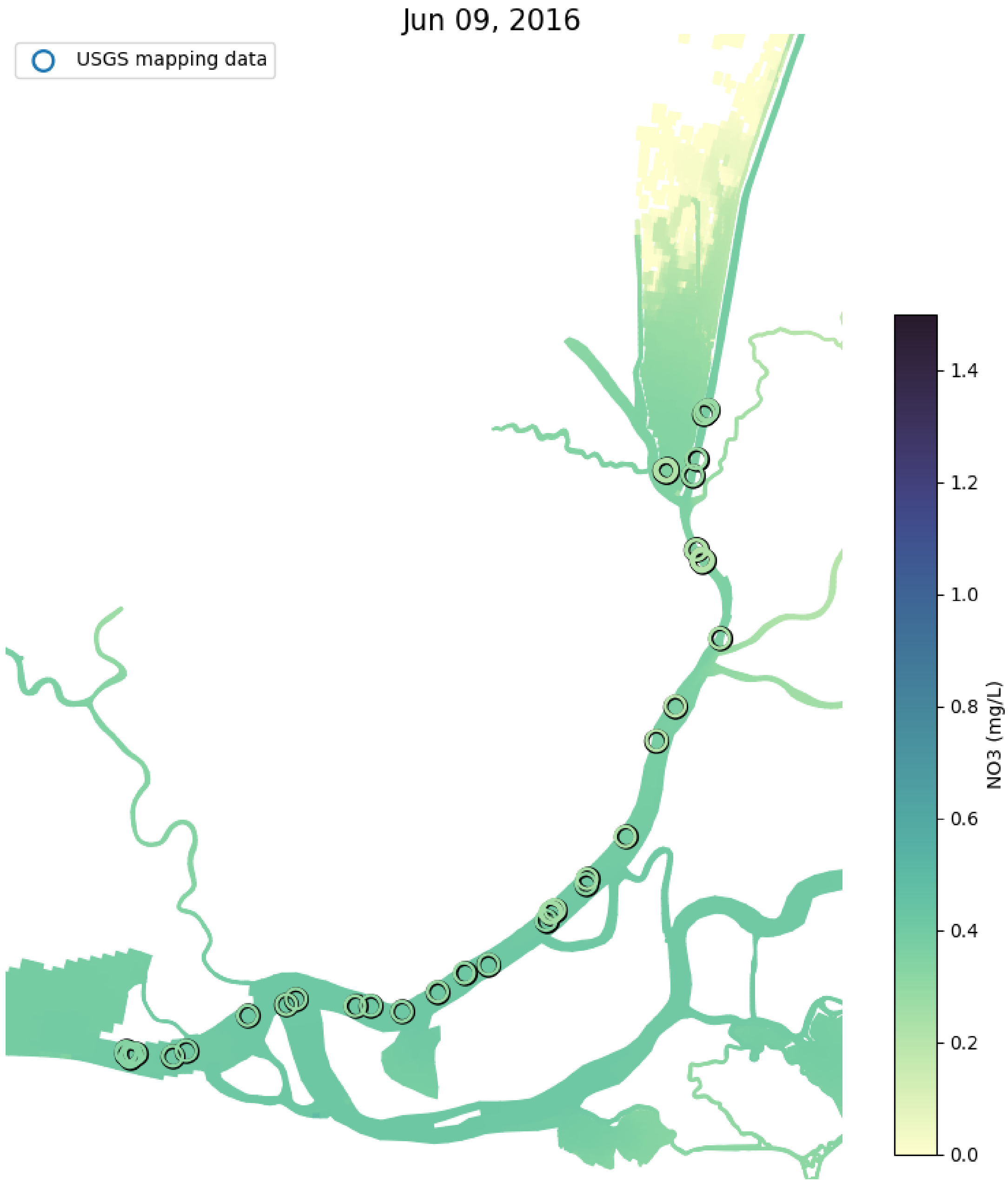
Note: Model results are shown in the map (as a daily and depth-averaged concentration) while the high frequency mapping data is shown as the overlying circles, with circle colors scaled in the same manner as the model results.

Figure 3.30. Model validation with mapping cruise data on May 6, 2016 for chlorophyll-a.



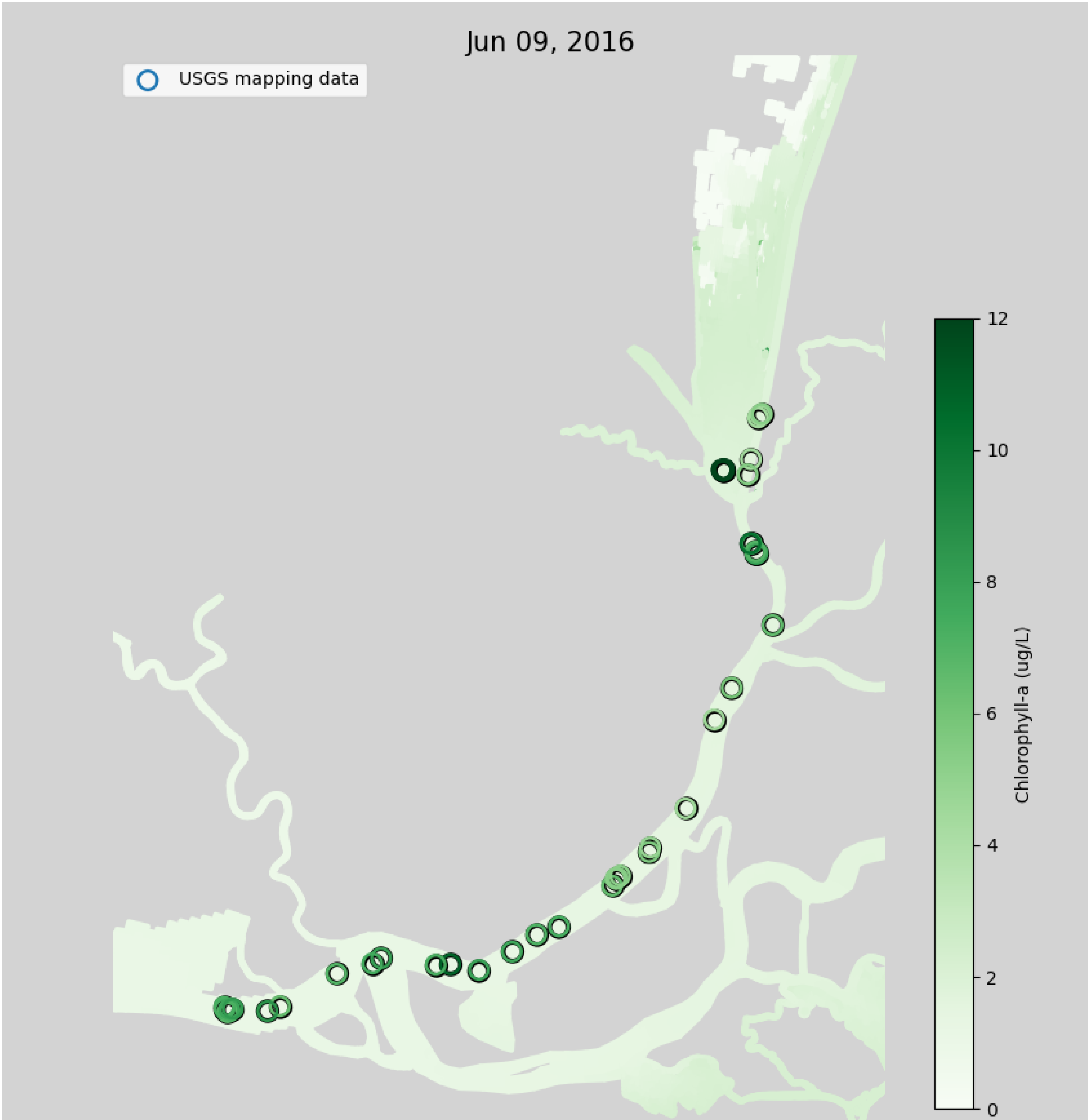
Note: Model results are shown in the map (as a daily and depth-averaged concentration) while the high frequency mapping data is shown as the overlying circles, with circle colors scaled in the same manner as the model results.

Figure 3.31. Model validation with mapping cruise data on May 6, 2016 for dissolved oxygen.



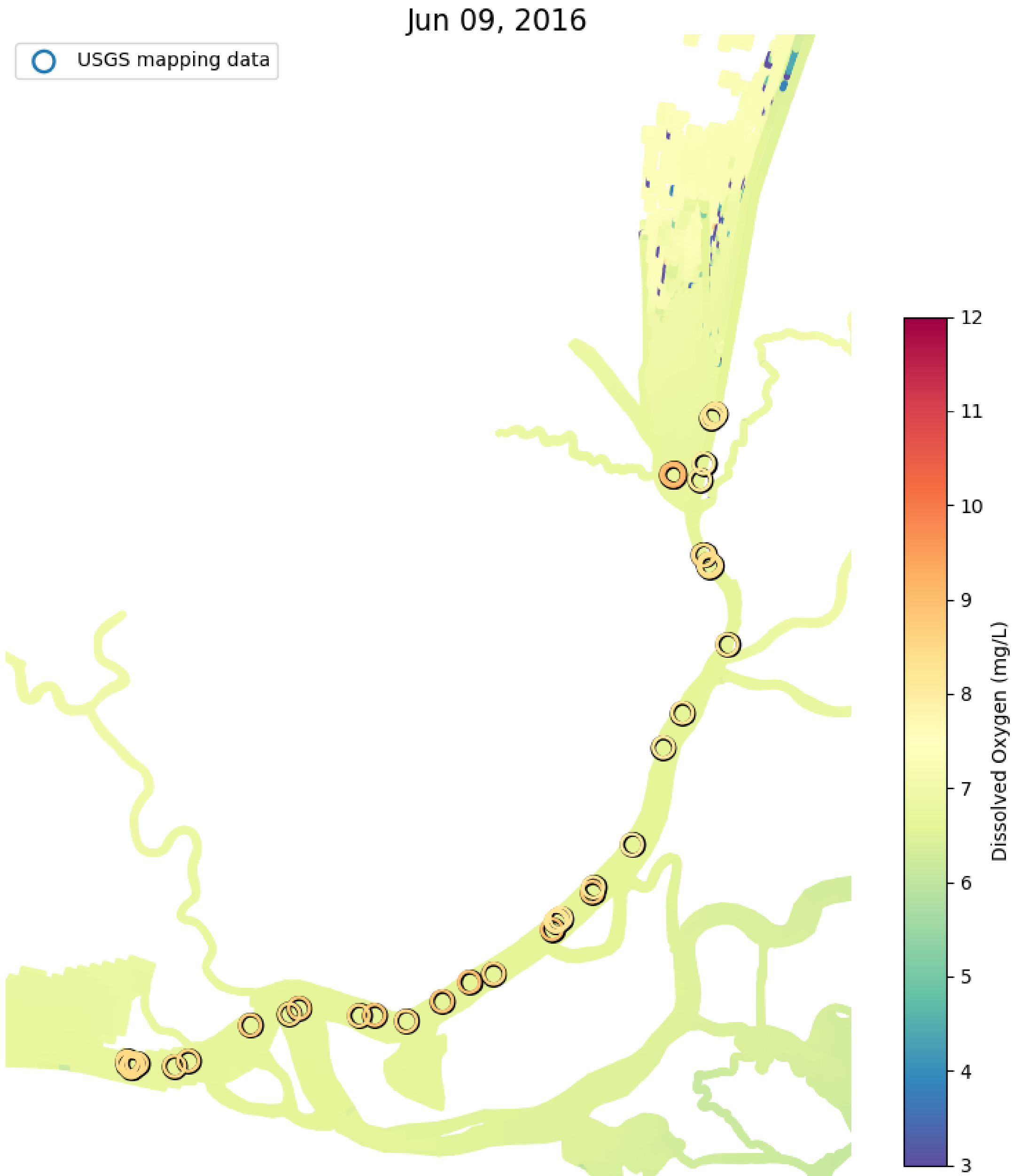
Note: Model results are shown in the map (as a daily and depth-averaged concentration) while the high frequency mapping data is shown as the overlying circles, with circle colors scaled in the same manner as the model results.

Figure 3.32. Model validation with mapping cruise data on June 9, 2016 for nitrate.



Note: Model results are shown in the map (as a daily and depth-averaged concentration) while the high frequency mapping data is shown as the overlying circles, with circle colors scaled in the same manner as the model results.

Figure 3.33. Model validation with mapping cruise data on June 9, 2016 for chlorophyll-a.



Note: Model results are shown in the map (as a daily and depth-averaged concentration) while the high frequency mapping data is shown as the overlying circles, with circle colors scaled in the same manner as the model results.

Figure 3.34. Model validation with mapping cruise data on June 9, 2016 for dissolved oxygen.

In conjunction with the moored sensor data, overall, the mapping cruises suggest that the May/June bloom originated upstream of Decker Island (potentially even upstream of Cache Slough in the Cache Slough Complex). The potential factors contributing to the model's inability to simulate these blooms were discussed earlier. However, the cruise data also show that the model successfully simulates nitrate gradients on all four dates, which further confirms that the model's inability to simulate the blooms does not severely limit its utility to simulate the large-scale nutrient dynamics in the Delta.

3.5 Grazing

The grazing rates simulated for WY2011 from the SFEI model were compared to the rates used as boundary conditions in the USGS model. These grazing rates effectively represent a grazing pressure imposed on diatoms by benthic grazers (consumption of detritus and other organic matter is out of the scope of the current project). Modeled grazing rates are plotted in both mass units ($gC/m^2/day$) as well as volumetric units ($m^3/m^2/day$) for December 2010, and April and June 2011 in Figures 3.35 – 3.37 respectively. The grazing rates imposed in the USGS model for these months (specified as monthly averages of the volumetric filtration rate) are also shown in these figures. The daily (SFEI) model output of clam diatom consumption ($gC/m^2/day$) was converted to volumetric units by dividing by the corresponding diatom concentration (gC/m^3) in the bottom cell of the water layer. To keep the presentation consistent with the USGS model's imposed grazing rate, the daily (SFEI) model outputs were converted to monthly averages for the months shown in Figures 3.35 – 3.37.

The imposed (USGS model) and simulated (SFEI model) grazing rates show various similarities: relatively low grazing levels in December and higher grazing levels in June. Grazing is generally higher in Suisun Bay, which is dominated by *Potamocorbula* (a saltwater clam) compared to interior Delta and Cache Slough where the freshwater clam *Corbicula* is more prevalent; within Suisun Bay, shallow areas such as Grizzly Bay have greater grazing compared to the channel. Higher grazing rates are present in the central Delta near Frank's Tract and in the northern portions of Old and Middle rivers.

However, there are also important differences: grazing rates are higher in April in the SFEI model in general, while the USGS model does not appreciably differ in the imposed grazing between December and April; moreover, in both April and June, grazing is substantially higher in the SFEI model within the Cache Slough Complex, the San Joaquin River, and the south Delta, and there is also a small but non-zero grazing in the upper Sacramento River in the SFEI model, whereas the USGS model does not impose any grazing in that area.

While there are some inherent uncertainties in comparing these volumetric rates—for example, the SFEI model volumetric rates may over (or under) estimate grazing when the diatom concentrations are under (or over) estimated in the model—the comparison above illustrates that DEB model predictions loosely capture the seasonality (fall to spring changes) imposed in the USGS model. Furthermore, the SFEI model's prediction of chl-a concentrations is generally consistent with observations (see Figure 3.14). This suggests that: 1) the grazing pressure simulated within the model (at least in the areas where there are discrete chl-a measurements) is reasonable; and 2) the uncertainty in the conversion to a volumetric rate is probably small, particularly in June when the watershed-derived organic matter loading is small and much of the organic matter in the system is autochthonous. These results also provide confidence that the balance between top-down control on phytoplankton is appropriately imposed in the model in WY2011. Considering that the top-down control is dynamic in the DEB model, with appropriate initial conditions and the current set of parameters, the model appears to generally provide acceptable time-varying grazing.

These results also show that conditions in WY2016 were unusual due to the March 2016 large freshwater inflow event in Cache Slough Complex that probably reset the grazer balance even if only for one to two growing seasons (see Figures 2.17 and 2.18, the clam populations rebounded by the end of WY2017). Improved grazer measurements in Cache Slough and the south Delta (areas where there is divergence between the imposed grazing pressure in the USGS model and the SFEI model) will provide more reliable top-down control in the DEB model simulations.

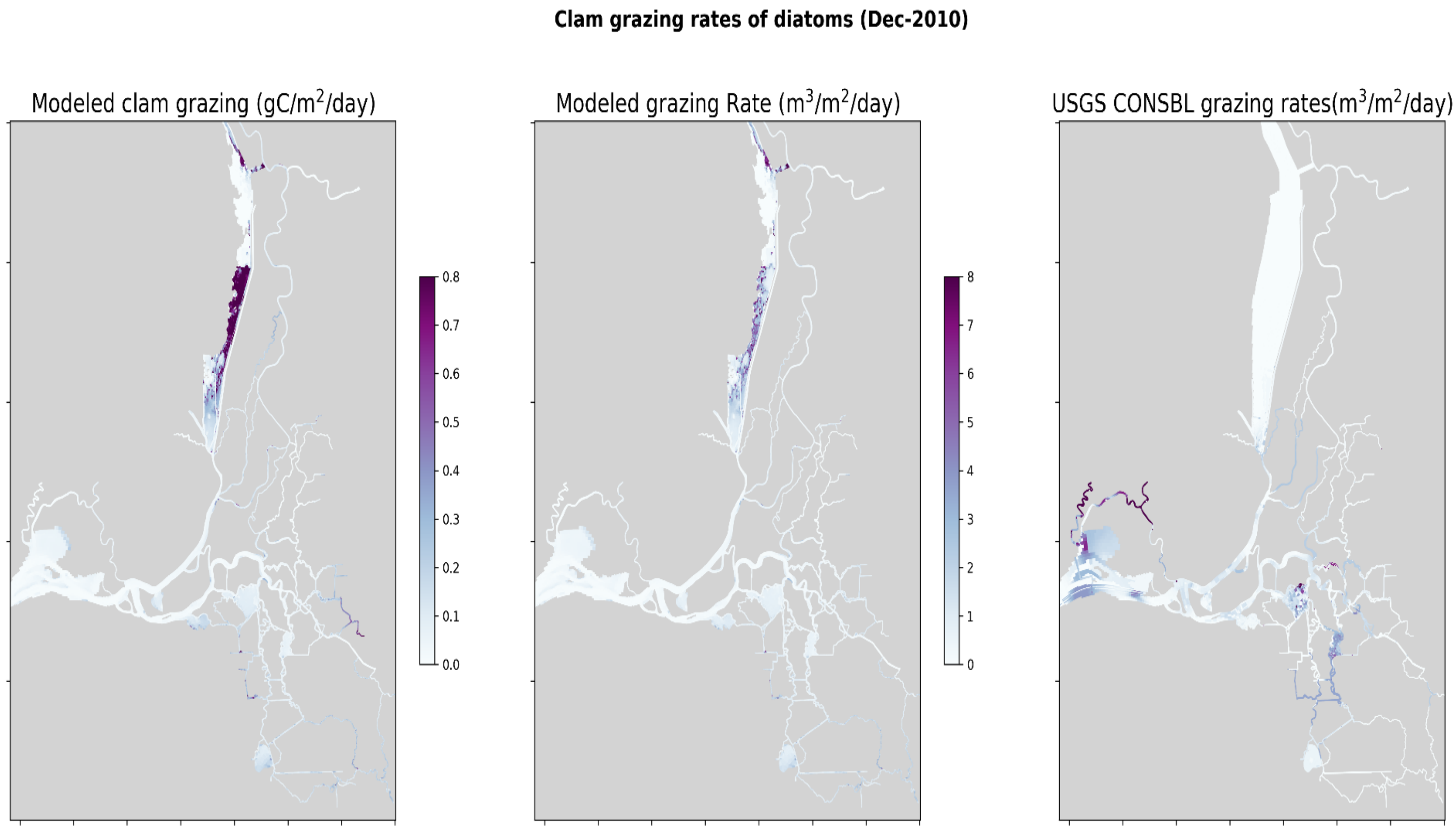


Figure 3.35. WY2011 modelled grazing rates compared to U.S. Geological Survey CONSBL grazing rates (December 2010).

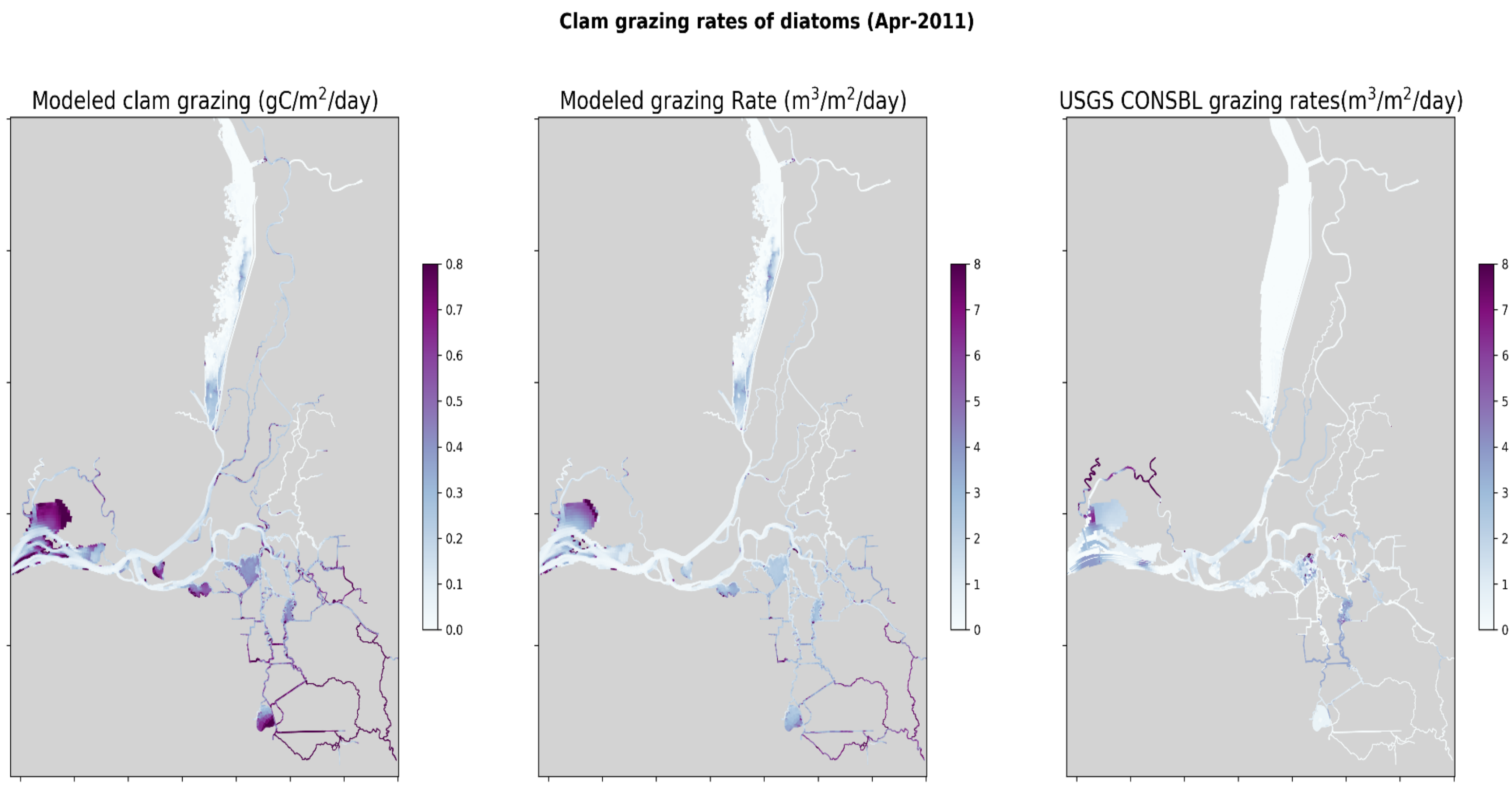


Figure 3.36. WY2011 modelled grazing rates compared to U.S. Geological Survey CONSBL grazing rates (April 2011).

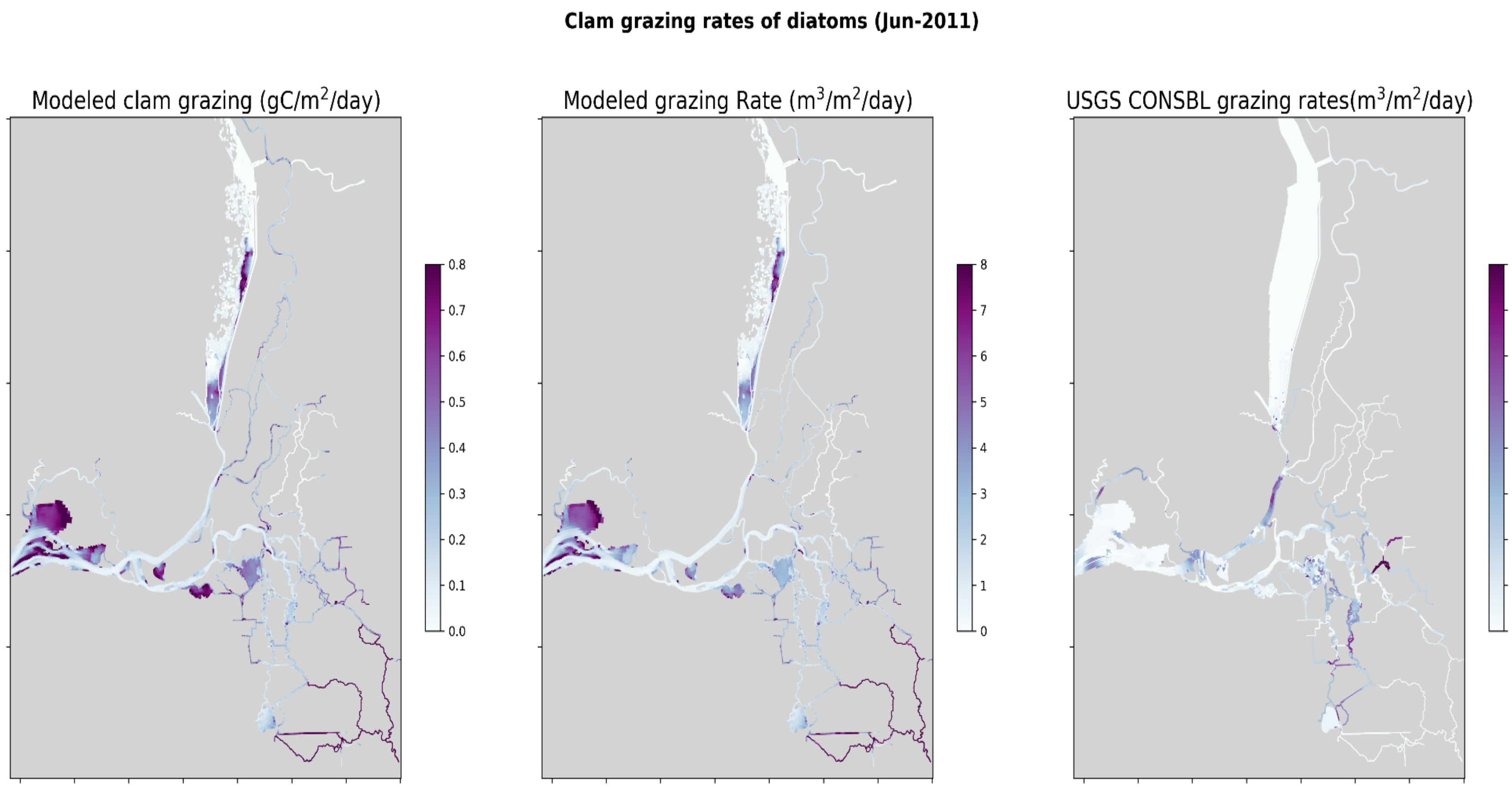


Figure 3.37. WY2011 modelled grazing rates compared to U.S. Geological Survey CONSBL grazing rates (June 2011).

4 Summary

This report described recent work updating the northern San Francisco Estuary Biogeochemical Model (nSFE-BGCMv2), including calibration and simulation across two water years that differed considerably in both their physical forcings (dry vs. wet) and biogeochemical responses (WY2016, WY2011). The model was initialized with spatially-varying concentration fields and clam biomass in order to provide a most-realistic-possible model start, which proved especially important during WY2016 model spin-up because of drought and low-flow conditions during summer and fall 2015. An empirically-derived, space-and-time varying light attenuation coefficient field was also developed to serve as model input for estimating light availability. In addition, refinements were made to the sediment diagenesis and grazing modules, along with tuning of water column rates and calibration/validation of a dynamic grazing model.

To identify the best-current calibration, emphasis was placed on best capturing spatial and seasonal variability across both years for nitrogen cycling and fluxes alongside phytoplankton production and biomass. The model performed well for both water years, especially with regards to predicting seasonal, spatial, and inter-annual variations in DIN concentrations and DIN speciation, and NO3 flux (at locations with appropriate data to calculate observed fluxes). Dissolved inorganic nitrogen is well-captured along the upper Sacramento River, and the general phasing and magnitude of the DIN signal throughout the Delta suggests that the main processes affecting DIN are accurately represented. In terms of phytoplankton production and biomass, the model captures the generally low chl-a concentrations that define the system throughout most of both water years, and also reproduces the key features (approximate timing and magnitude) of a modest bloom event in Suisun Bay in WY2011. As of now, however, the model does not capture several short-lived bloom events in WY2016. The mechanisms precipitating these blooms remains a subject of ongoing inquiry, which makes validating our model's performance difficult. It is possible some of these 2016 bloom events may have originated from stratification events, however, we did not evaluate the correlation between stratification and bloom events within the Delta for this modeling effort. Validation with several high-frequency datasets offered insight into model performance, indicating that the SFEI model can successfully capture large spatial gradients in DIN (moving across the Delta east-to-west) and reliably predict nitrate mass fluxes. There was better agreement between observed and modeled nitrate fluxes than chl-a fluxes, which mainly resulted from the above-noted periods when biomass was not adequately reproduced.

One major focus of upcoming work will be applying the model to extract mechanistic insights, e.g., related to nutrient sources, transport, and fate (cycling, losses, using mass balance approaches); predicting the influence of the Regional San upgrade on ambient nutrient concentrations and fluxes (including exports to Suisun Bay) and subsequent changes in response (e.g., phytoplankton production); and exploring factors or conditions under which phytoplankton production may increase or decrease. As with any model, there also remain uncertainties or areas for continued improvement. Upcoming rounds of model refinements could focus on better capturing the bloom events in spring/summer of WY2016. This work would involve mass balance evaluations to better identify dominant mechanisms (e.g., light limitation, grazing, flushing rates) followed by targeted calibration. That topic, and the mass-balance diagnostic approach, also lends itself to applications related to understanding what conditions could result in higher or lower production in the future. For some applications, there may be benefit to refining the hydrodynamic model (specifically in the Cache Slough Complex). Lastly, the abundance of water column organic nutrient data (DON, PON) in the Delta-Suisun region from long-term EMP monitoring could make it possible to substantially improve the model's ability to predict organic/detrital carbon and nutrient pools, which would be valuable for exploring food availability.

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APPENDIX IV – USGS FLUOROPROBE MEMO

United States Geological Survey
Water Resources Division
California Water Science Center
California State University, Placer Hall, 6000 J Street
Sacramento, California 95819-6129
(916) 278-3000 Fax (916) 278-3071

Memorandum

TO: Delta Regional Monitoring Program Board of Directors

FROM: Tamara Kraus, Keith Bouma-Gregson, Chuck Hansen, Brian Bergamaschi; U.S. Geological Survey, California Water Science Center

DATE: July 26, 2022

SUBJECT: Fluoroprobe deployment at Middle River for cyanobacteria monitoring

The U.S. Geological Survey (USGS) was funded by the Delta Regional Monitoring Program (DRPM) to a conduct cyanobacterial monitoring project which was originally scheduled to occur from March 2021 through February 2022. The project was unable to begin until April 2021 due to delays with Covid and extended through April 2022. This project involved collecting samples for cyanotoxin analysis at 4 sites in the Delta as well as deploying a Fluoroprobe at a site in Middle River (MDM; **Error! Reference source not found.**) – a location we have periodically observed high concentrations of blue green algae, particularly *Microcystis*. The Fluoroprobe is an in-situ instrument designed to measure the overall concentration of chlorophyll as well as differentiate the abundance of 4 classes of phytoplankton: cyanobacteria, diatoms, green algae, and cryptophytes by simultaneously measuring the fluorescence of a variety of accessory pigments.

The cyanotoxin samples were collected as proposed and the samples have been sent for analysis. As we communicated previously to DRMP, we needed to change analytical laboratories for cyanotoxins in 2021. This slowed down the analysis of samples for several months. We have subsequently received the data from the analytical laboratory and are in the process of quality assuring the data and preparing the data release. However, while the cyanotoxin sampling element of the project is now on track, we have been unable to complete the Fluoroprobe data collection during the project period.

Technical and logistical challenges and data quality concerns have delayed the deployment of the Fluoroprobe, and no usable data was collected during the 2021-2022 project period. Nevertheless, we remain committed to providing a full year-long deployment of a Fluoroprobe at MDM for this project even after this project term ends. We continue to believe that the results will be highly informative with respect to the goals of the study and the Fluoroprobe is uniquely capable of collecting needed data.

We realized when we wrote the proposal that deploying Fluoroprobes to make continuous measurements in situ would require significant technical development because the instrument is optimized for short-term measurements and not for long-term deployments. This is a process we have undertaken with other instrument types and therefore felt confident in our ability to similarly develop the ability to deploy the Fluoroprobe. Initial test deployments at MDM revealed that the technical and other challenges were larger than expected. For example:

- The pressure cases used on the instruments initially shipped for this and another project were not appropriate to conditions in the Delta and estuary and thus the instruments needed to be returned to Germany for re-fit.
- There was a significant delay in receiving the modified instruments due to COVID-related supply and shipping issues.
- The communications protocol used by the Fluoroprobe was incompatible with our data collection and telemetry platforms. This slowed technical development for the field deployment because we did not have access to real-time data for analysis and troubleshooting. We

eventually realized that we would be unable to complete the development without this capability. Thus,…

- We needed to write new software that would interpret the output from the Fluoroprobe and convert it into a form our data collection platforms could telemeter in real time. We presently have this code successfully running at three stations.
- Upon having access to real time data, we found significant light contamination in our Fluoroprobe data. Unlike all other fluorometers we have deployed for our studies, the Fluoroprobe does not have stray light rejection capabilities built into the electronics. Instead, it relies on a physical light shield. We found the light shield provided allowed light to enter the instruments and contaminate the signal, and, in any case, the physical light shield is not compatible with a wiper needed for long-term deployment. We are in the process of developing and deploying a light baffle for Fluoroprobe deployments.
- This is all on top of an extremely difficult few years for our technical staff trying to keep our portfolio of studies going despite COVID restrictions on work and travel.

As we mentioned above, the USGS California Water Science Center is still committed to meeting the goals of the study by continuing to work through the challenges of Fluoroprobe deployment until we are confident that it is providing high quality. Although the project funds supplied by DRMP have been expended to support the technical development thus far, the USGS has committed to completion of the project through use of internal funds to complete any further necessary technical developments and to deploy the Fluoroprobe at MDM for one full year as well as to prepare the final reports.

We plan to deploy a Fluoroprobe for 1 year at MDM and will provide those data and report to the DRMP after the deployment period. We are unable to commit to a specific date we will re-deploy a Fluoroprobe at MDM because our QA/QC testing is not yet complete. We anticipate a 1-2 month timeline is reasonable. A test deployment planned for next week. We are funded to continue cyanotoxin monitoring in the Delta, and those data can be compared to Fluoroprobe data to meet the goals of the original project: The Delta Science Program has funded cyanotoxin sampling at 5 sites in the Delta through April 2024, and the DRMP has continued to fund cyanotoxins at MDM through April 2023.

Once we have the Fluoroprobe deployed at MDM, we will notify the DRMP and provide an updated draft timeline for the data acquisition, data release, and status/trends report as well as real time access to the data. We will work with Melissa Turner to receive comments from DRMP and agree on a final timeline.

We thank the DRMP for funding this project. Through this process we have learned much about Fluoroprobes and have developed the framework to integrate them into the continuous monitoring stations in the Delta.

Please contact us if you have any questions or if you would like us to attend a future meeting and give a presentation with more details.

APPENDIX V –MERCURY MONITORING CRUISE REPORTS

Appendix 2: Cruise Report

Appendix 2

Cruise Report for the Delta Regional Monitoring Program (Delta RMP) Mercury Restoration Monitoring for Black Bass

Year 6 FY21/22 Restoration Work

Sampling Dates: August 17, 2021 – August 25, 2021

Prepared by Marine Pollution Studies Laboratory Staff (MPSL-DFW)
at Moss Landing Marine Laboratories; San Jose State University

Introduction

This report describes sampling activities in the Delta region of California as part of the Delta Regional Monitoring Program (DRMP). This sampling effort focuses on monitoring the impacts of wetland restoration projects on accumulation of mercury in black bass, specifically Largemouth Bass, in the Delta. Sampling activities included the collection of fish tissue (black bass) and basic field parameters. Samples were collected by Marine Pollution Studies Laboratory (MPSL) at Moss Landing Marine Laboratories (MLML).

1.0 Cruise Report

1.1 Objectives

The objectives were to collect fish samples from restoration or planned restoration wetlands in the Delta and analyze the samples for mercury concentration. The generated dataset will be used to support answers to DRMP management and assessment questions related to wetland restoration and mercury.

Fish were collected under California Department of Fish and Wildlife (CDFW) specific use permit S-183470004-20339-002; Title: State Water Board Anadromous Monitoring. Sample sites were reached by boating and fish were collected by hook and line or electro-shocking boats in accordance with the permit**.**

1.2 MPSL Sampling personnel

Wesley Heim	Project Director
Gary Ichikawa	Project Assistant, Crew Lead
Jon Goetzl	Project Assistant
Scot Lucas	Research Technician, Crew Lead
Evan Mattiasen	Research Technician

1.3 Authorization to collect samples

All sampling personnel are MPSL-DFW staff (San Jose State University Research Foundation) contracted through the State of California Water Board SWAMP Program to conduct the sample collection activities listed herein.

1.4 Station selection

Based upon the recommendations of the Delta RMP Steering Committee and Technical Advisory Committee with representatives from the Central Valley Regional Water Quality Control Board, USEPA, California Department of Water Resources, the State and Federal Contractors Water Agency, and various discharger groups, stations were selected near restoration zones in the Delta.

1.5 Summary of types of samples authorized to be collected

Up to sixteen (16) black bass individuals of the same species were collected using an electrofisher boat or hook and line for each of the five (5) stations. The sixteen individuals spanned a broad size range to support assessment of the length:mercury relationship and ANCOVA analysis. Upon collection, each fish collected was tagged with a unique ID that corresponded to the latitude/longitude where it was collected. Physical parameters were collected for each individual fish, which included: weight, total length, fork length, and presence of any abnormalities. Fish samples were stored on ice until returned to the laboratory. Large fish were partially dissected in the field using the following protocol: fish were placed on a cutting board covered with a clean plastic bag where the head, tail, and guts were removed using a clean (laboratory detergent, DI) cleaver. The sex of the fish was noted. The fish were then wrapped in tin foil, with the dull side inward, and double-bagged in zipper-closure bags with other fish from the same location. All equipment was re-cleaned between stations.

At the laboratory, samples were stored in a freezer until they were processed for authorized dissection and analysis.

Basic station information (station depth, location, weather, hydromodifications and habitat) were noted. All collections and sample processing for fish followed the Delta RMP QAPP.

1.6 Results

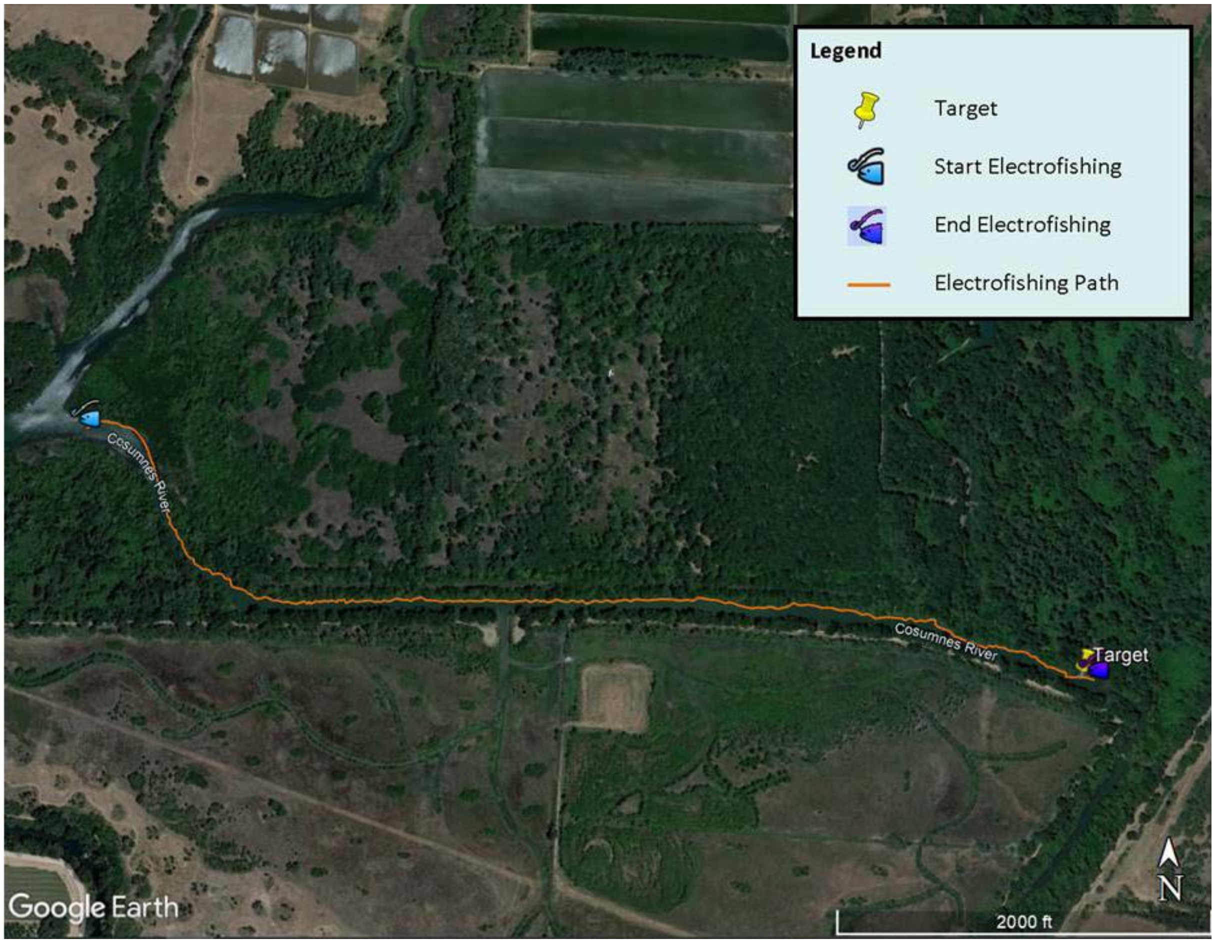
A detailed fish catch, fish total length, descriptions and maps of sample collection for all stations can be found below. Table 1 indicates on which page collection details for each station can be found.

Table 1. Delta RMP Collection Sites for Year 6 (FY21/22) Restoration Work.

Station Code	Station Name	Page Number
544GZSLWC	Grizzly Slough - Westervelt - Cougar	5
544MCWILT	McCormack-Williamson Tract	6
510ST0787	Lindsey Slough	7
510TDNLHT	Yolo Flyway Farms	8
511XSSLIB	Lookout Slough	9

Grizzly Slough - Westervelt - Cougar (544GZSLWC)

Latitude: 38.25343
Longitude: -121.4069
Collection Method: Electroshock
Date(s) of Fish Collection: 08/17/2021
Samplers: Gary Ichikawa, Jon Goetzl



Largemouth Bass, TL (mm)							
205	210	220	250	251	261	306	340
360	370	370	390	392	410	425	428

Comments: The sampling vessel was launched from New Hope Landing in Walnut Grove, CA. Sixteen (16) Largemouth bass were sampled along the transect adjacent to the target station.

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McCormack-Williamson Tract (544MCWILT)

Latitude: 38.2264
Longitude: -121.49144
Collection Method: Electroshock
Date(s) of Fish Collection: 08/17/2021
Samplers: Gary Ichikawa, Jon Goetzl

Largemouth Bass, TL (mm)							
230	210	227	260	272	292	335	335
341	350	358	388	400	410	420	505

Comments: The sampling vessel was launched from New Hope Landing in Walnut Grove, CA. Sixteen (16) Largemouth bass were sampled along the transect adjacent to the target station.

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Lindsey Slough (510ST0787)

Latitude: 38.25843
Longitude: -121.75801
Collection Method: Electroshock
Date(s) of Fish Collection: 08/18/2021
Samplers: Gary Ichikawa, Jon Goetzl

Largemouth Bass, TL (mm)							
201	210	218	272	272	300	330	335
355	362	362	372	398	420	440	490

Comments: The sampling vessel was launched from Arrowhead Marina in Clarksburg, CA. Sixteen (16) Largemouth bass were sampled along the transect adjacent to the target station.

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Yolo Flyway Farms (510TDNLHT)

Latitude: 38.33842
Longitude: -121.64953
Collection Method: Hook and line
Date(s) of Fish Collection: 08/25/2021
Samplers: Scot Lucas, Wesley Heim, Evan Mattiasen

Largemouth Bass, TL (mm)							
195	208	228	264	294	301	318	320

Comments: The sampling vessel was launched from Arrowhead Marina in Clarksburg, CA. Eight (8) Largemouth bass were sampled along the transect adjacent to the target station.

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Lookout Slough (511XSSLIB)

Latitude: 38.31038
Longitude: -121.69304
Collection Method: Hook and line
Date(s) of Fish Collection: 08/24/2021
Samplers: Scot Lucas, Wesley Heim, Evan Mattiasen

Largemouth Bass, TL (mm)	
223	320

Comments: The sampling vessel was launched from Arrowhead Marina in Clarksburg, CA. Two (2) Largemouth bass were sampled along the transect adjacent to the target station.

Back to Table 1

1.7 Discussion

A total of five (5) stations were sampled for fish tissue. Three (3) stations were sampled using a dedicated electrofishing vessel and two (2) using hook and line. Collection method restrictions of hook and line only, listed in the scientific collection permit for Lookout Slough and Yolo Flyway Farms reduced fishing success per unit effort at these sites.

Appendix 1: Cruise Report

Appendix 1

Cruise Report for the Delta Regional Monitoring Program (Delta RMP) Mercury Monitoring for Subregional Trends in Black Bass and Water

Sampling Dates: September 09, 2021– April 05, 2022

Prepared by Marine Pollution Studies Laboratory Staff (MPSL-DFW)

at Moss Landing Marine Laboratories; San Jose State University

Introduction

This report describes mercury sampling activities of the Delta Regional Monitoring Program (DRMP) in subareas of the Delta region of California. Sampling activities included the collection of fish tissue (black bass), and water samples with basic field parameters. Samples were collected by Marine Pollution Studies Laboratory (MPSL-DFW) at Moss Landing Marine Laboratories (MLML) staff.

1.0 Cruise Report

1.1 Objectives

The objectives were to collect fish and water samples that would provide spatial and temporal data to answer DRMP management and assessment questions. Black bass were sampled annually at seven (7) fixed stations selected for long-term monitoring. The annual fish collection was paired with water collection at each of the seven stations.

Fish were collected under California Department of Fish and Wildlife (CDFW) specific use permit S-183470004-20339-002; Title: State Water Board Anadromous Monitoring. Sample sites were reached by boating and fish were collected by hook and line or electro-shocking boats in accordance with the permit**.**

Depth-integrated water samples were collected in the thalweg at seven (7) stations. These stations are strategically located to correlate with the fish monitoring and Delta water import and export locations. Chemical analyte groups for the water collection include: total Hg, dissolved Hg, total MeHg and dissolved MeHg. The following ancillary water parameters were collected to aid in interpretation of the MeHg data: chlorophyll *a*, dissolved organic carbon (DOC), total suspended solids (TSS), and volatile suspended solids (VSS).

1.2 MPSL Sampling personnel

Wesley Heim	Project Director
Autumn Bonnema	Associate Project Director
Gary Ichikawa	Project Assistant, Crew Lead
Jon Goetzl	Project Assistant
April Sjoboen Guimarães	Research Technician, Crew lead
Scot Lucas	Research Technician, Crew Lead
Evan Mattiasen	Research Technician

1.3 Authorization to collect samples

All sampling personnel are MPSL-DFW staff (San Jose State University Research Foundation) contracted through the State of California Water Board SWAMP Program to conduct the sample collection activities listed herein.

1.4 Station selection

Based upon the recommendations of the Delta RMP Steering Committee and Technical Advisory Committee with representatives from the Central Valley Regional Water Quality Control Board, USEPA, California Department of Water Resources, the State and Federal Contractors Water Agency, and various discharger groups, stations were selected to represent key subareas of the Delta.

1.5 Summary of types of samples authorized to be collected

Up to sixteen (16) black bass individuals of the same species were collected using an electrofisher boat or hook and line for each of the seven (7) stations. The sixteen individuals spanned a broad size range to support assessment of the length:mercury relationship and ANCOVA analysis. Upon collection, each fish collected was tagged with a unique ID that corresponded to the latitude/longitude where it was collected. Physical parameters were collected for each individual fish, which included: weight, total length, fork length, and presence of any abnormalities. Fish samples were stored on ice until returned to the laboratory. Large fish were partially dissected in the field using the following protocol: fish were placed on a cutting board covered with a clean plastic bag where the head, tail, and guts were removed using a clean (laboratory detergent, DI) cleaver. The sex of the fish was noted. The fish were then wrapped in tin foil, with the dull side inward, and double-bagged in zipper-closure bags with other fish from the same location. All equipment was re-cleaned between stations.

At the laboratory, samples were stored in a freezer until they were processed for authorized dissection and analysis.

A depth-integrated water sample was collected at seven (7) stations following MPSL-DFW SOP MPSL-111 Revision 3 using a bucket sampler (SWAMP Clean Water Team SOP 2.1.1.4) modified to accommodate a trace metal cleaned 4L glass bottle (I-Chem Part # 145-4000) (MPSL-101). A new trace metal cleaned 4L glass bottle, tubing (MPSL-101) and filter (Pall Laboratory Part # 12180) were used for each station. In the thalweg, the bucket sampler with the 4L was lowered to 0.5m from the bottom to a maximum depth of 15m and raised through the water column at a sufficient rate so that the bottle was not completely filled upon retrieval, achieving a depth-integrated sample. Total samples were aliquoted into analyte-specific bottles by pouring. The 4L bottle was agitated between samples to maintain consistency. Filtered samples were collected by attaching a 0.45µm ground water filter to trace metal clean tubing and a peristaltic pump, and aliquoted into the analyte-specific bottle. At each water station, four analytes were collected: total Hg, filtered Hg, total MeHg and filtered MeHg. Ancillary water samples were collected to help interpretation of mercury data at each station: chlorophyll *a*, DOC and TSS/VSS. DOC samples were acidified upon collection. All samples were stored on wet ice until returned to the laboratory.

At the laboratory, Hg and MeHg samples were acidified. MeHg, DOC and TSS/VSS samples were stored in a refrigerator and chlorophyll *a* samples were stored in a freezer until they were analyzed.

Basic field parameters (temperature, pH, specific conductance, salinity, dissolved oxygen concentration, dissolved oxygen saturation, and turbidity) along with station information (station depth, location, weather, hydromodifications and habitat) were also noted. All collections and sample processing for water and fish followed the Delta RMP QAPP.

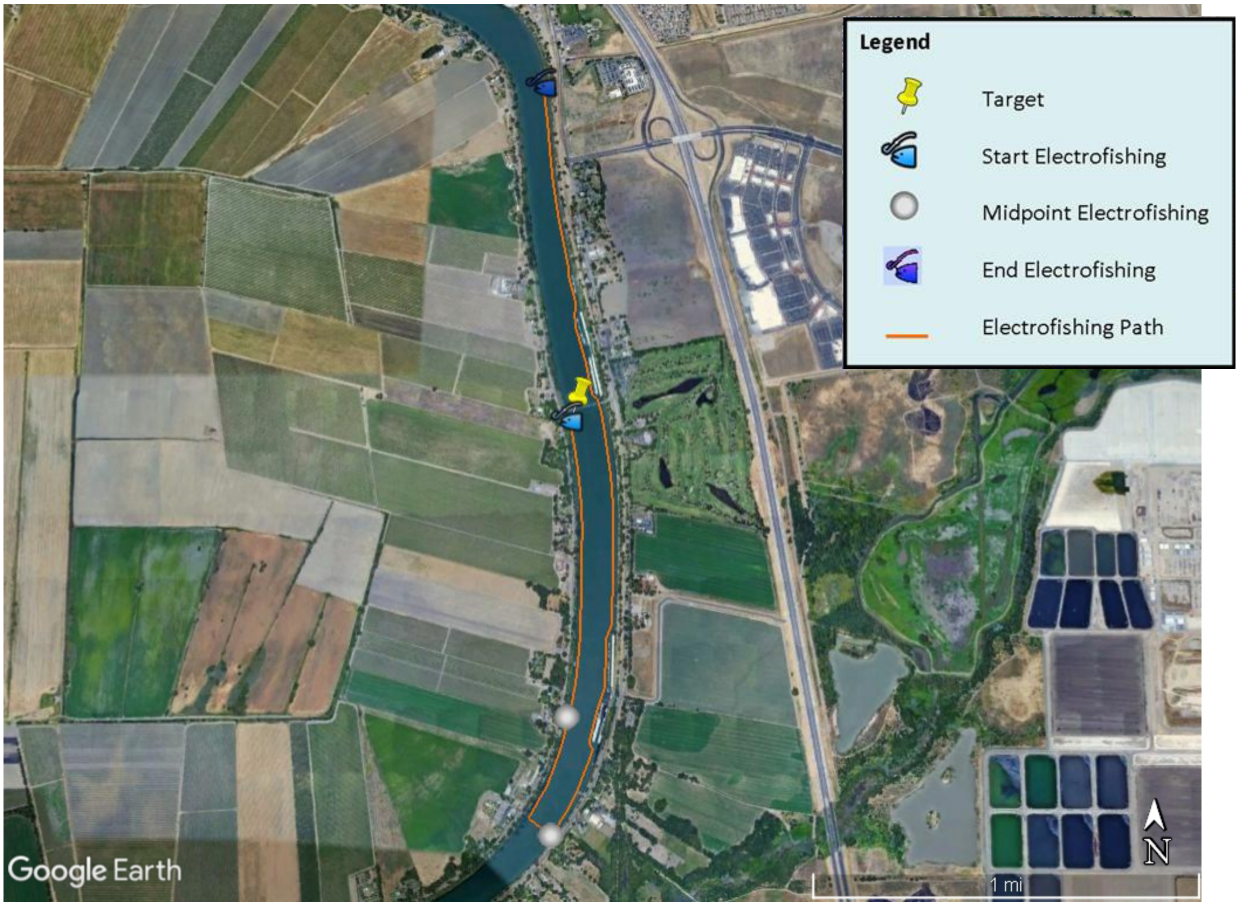
1.6 Results

A detailed fish catch, fish total length, descriptions and maps of sample collection for all stations can be found below. Also included are the dates of the depth-integrated water sampling events. Table 1 indicates on which page collection details for each station can be found.

Table 1. Delta RMP Collection Stations for Year 6 (FY21/22) Trend Work.

Sacramento River at Freeport (510ST1317)

Latitude: 38.45556
Longitude: -121.50189
Collection Method: Electroshock, depth-integrated grab
Date(s) of Fish Collection: 08/09/2021
Date(s) of Water Collection: 08/09/2021, 03/07/2022, 04/04/2022
Samplers: April Sjoboen Guimarães, Scot Lucas, Autumn Bonnema



Largemouth Bass							
204	219	225	272	279	280	282	291
300	306	310	317	335	357	386	410

Comments: The sampling vessel was launched from Stan's Yolo Marina or Garcia Bend Park in Sacramento, CA. Sixteen (16) Largemouth bass were sampled along the transect adjacent to the target station. Spotted bass and Smallmouth bass were also present. All water collection was done in close proximity of the target station where the channel discharge was greatest.

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Cache Slough at Liberty Island Mouth (510ADVLIM)

Latitude: 38.24213
Longitude: -121.68539
Collection Method: Hook and line, depth-integrated grab
Date(s) of Fish Collection: 08/09/2021, 08/18-19/2021, 08/24/2021
Date(s) of Water Collection: 08/09/2021, 03/07/2022, 04/04/2022
Samplers: April Sjoboen Guimarães, Gary Ichikawa, Jon Goetzl, Scot Lucas, Wesley Heim, Evan Mattiasen

Comments: The sampling vessel was launched from Arrowhead Marina in Clarksburg, CA. Samplers were not successful in collecting fish samples through hook and line techniques. All water collection was done in close proximity of the target station where the channel discharge was greatest.

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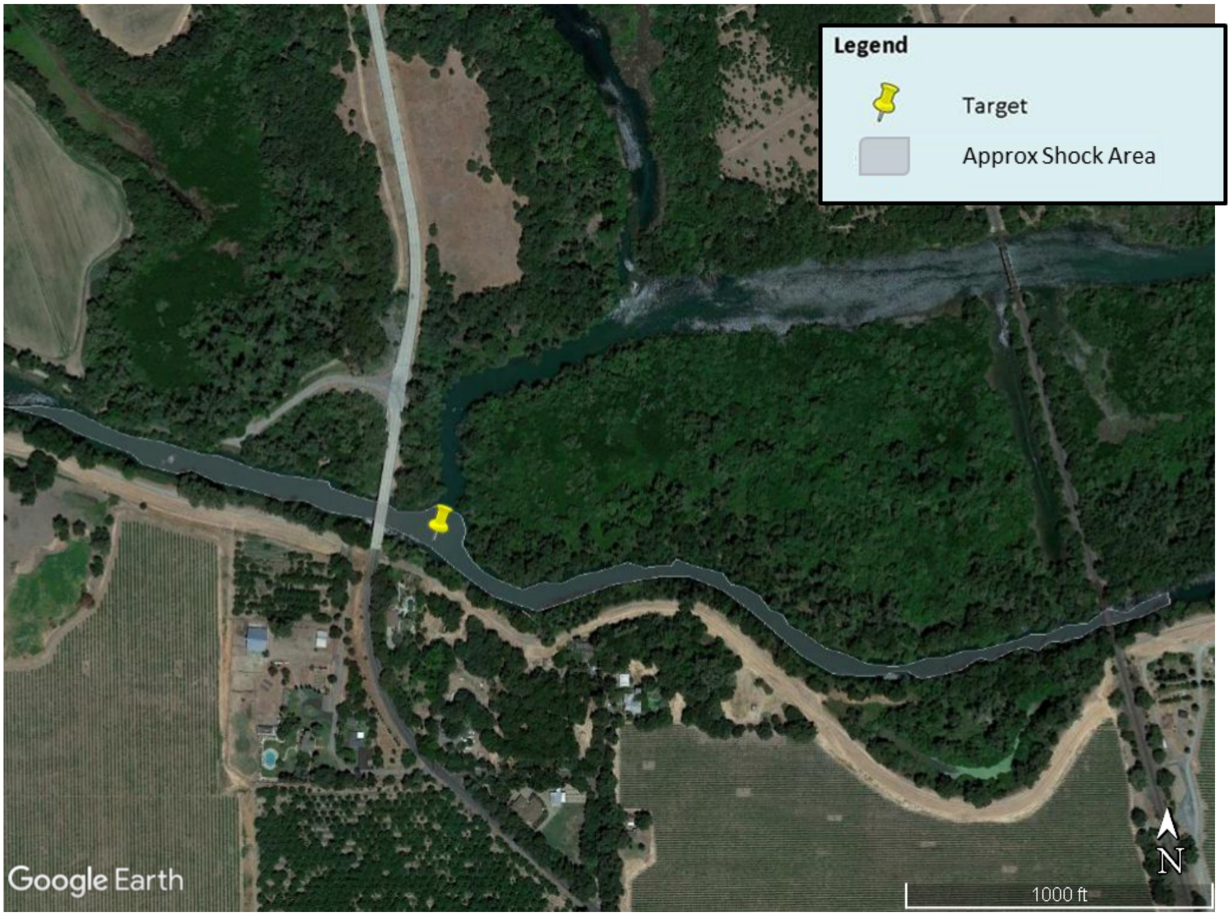
Lower Mokelumne River 6 (544ADVLM6)

Latitude: 38.25542
Longitude: -121.44006
Collection Method: Electroshock, depth-integrated grab
Date(s) of Fish Collection: 08/10/2021
Date(s) of Water Collection: 08/10/2021, 03/07/2022, 04/04/2022
Samplers: April Sjoboen Guimarães, Scot Lucas, Autumn Bonnema



Largemouth Bass							
228	235	254	280	285	290	302	305
318	322	344	367	393	437	460	496

Comments: The sampling vessel was launched from New Hope Landing in Walnut Grove, CA. Sixteen (16) Largemouth bass were sampled along the transect adjacent to the target station. All water collection was done in close proximity of the target station where the channel discharge was greatest.

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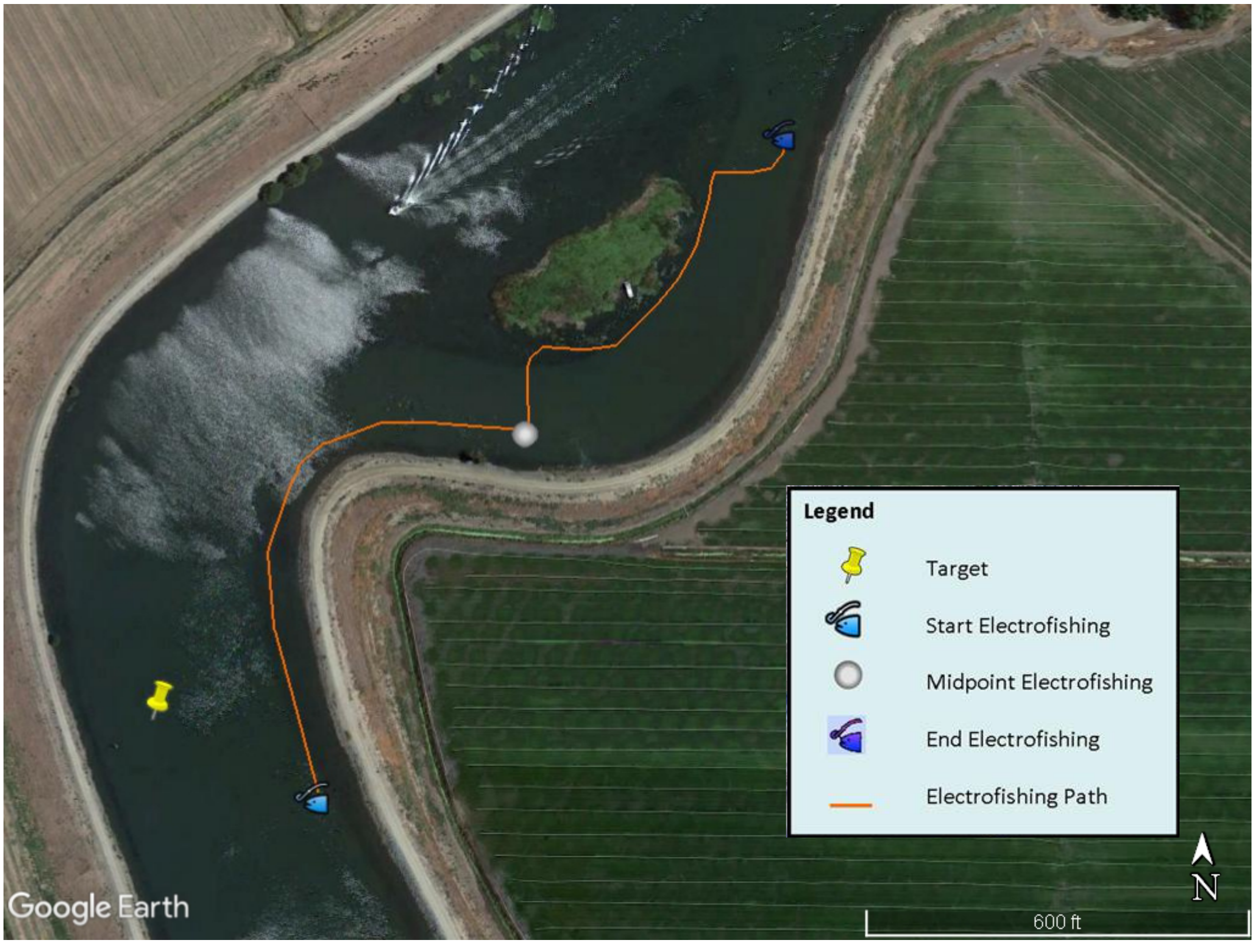
Little Potato Slough (544LILPSL)

Latitude: 38.09627
Longitude: -121.49602
Collection Method: Electroshock, depth-integrated grab
Date(s) of Fish Collection: 08/10/2021
Date(s) of Water Collection: 08/10/2021, 03/07/2022, 04/04/2022
Samplers: April Sjoboen Guimarães, Scot Lucas, Autumn Bonnema



Largemouth Bass, TL (mm)							
215	239	245	252	253	280	302	322
326	357	368	369	385	423	458	498

Comments: The sampling vessel was launched from Tower Park Marina in Lodi, CA. Sixteen (16) Largemouth bass were sampled along the transect adjacent to the target station. All water collection was done in close proximity of the target station where the channel discharge was greatest.

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Sacramento River at Mallard Island (207SRD10A)

Latitude: 38.04288
Longitude: -121.92011
Collection Method: Depth-integrated grab
Date(s) of Water Collection: 08/11/2021, 03/08/2022, 04/05/2022
Samplers: April Sjoboen Guimarães, Scot Lucas, Autumn Bonnema

Comments: The sampling vessel was launched from Pittsburg Yacht Club in Pittsburg, CA. All water collection was done in close proximity of the target station where the channel discharge was greatest. The corresponding fish were collected from Sherman Island (510ST1666).

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Sherman Island (510ST1666)

Latitude: 38.0431
Longitude: -121.80440
Collection Method: Hook and line
Date(s) of Fish Collection: 08/23/2021
Samplers: Scot Lucas, Wesley Heim, Evan Mattiasen

Largemouth Bass, TL (mm)	
270	540

Comments: The sampling vessel was launched from Sherman Island County Park in Rio Vista, CA. Two (2) Largemouth bass were sampled by hook and line adjacent to the target station. This station was chosen to correspond with the water samples from Mallard Island (207SRD10A).

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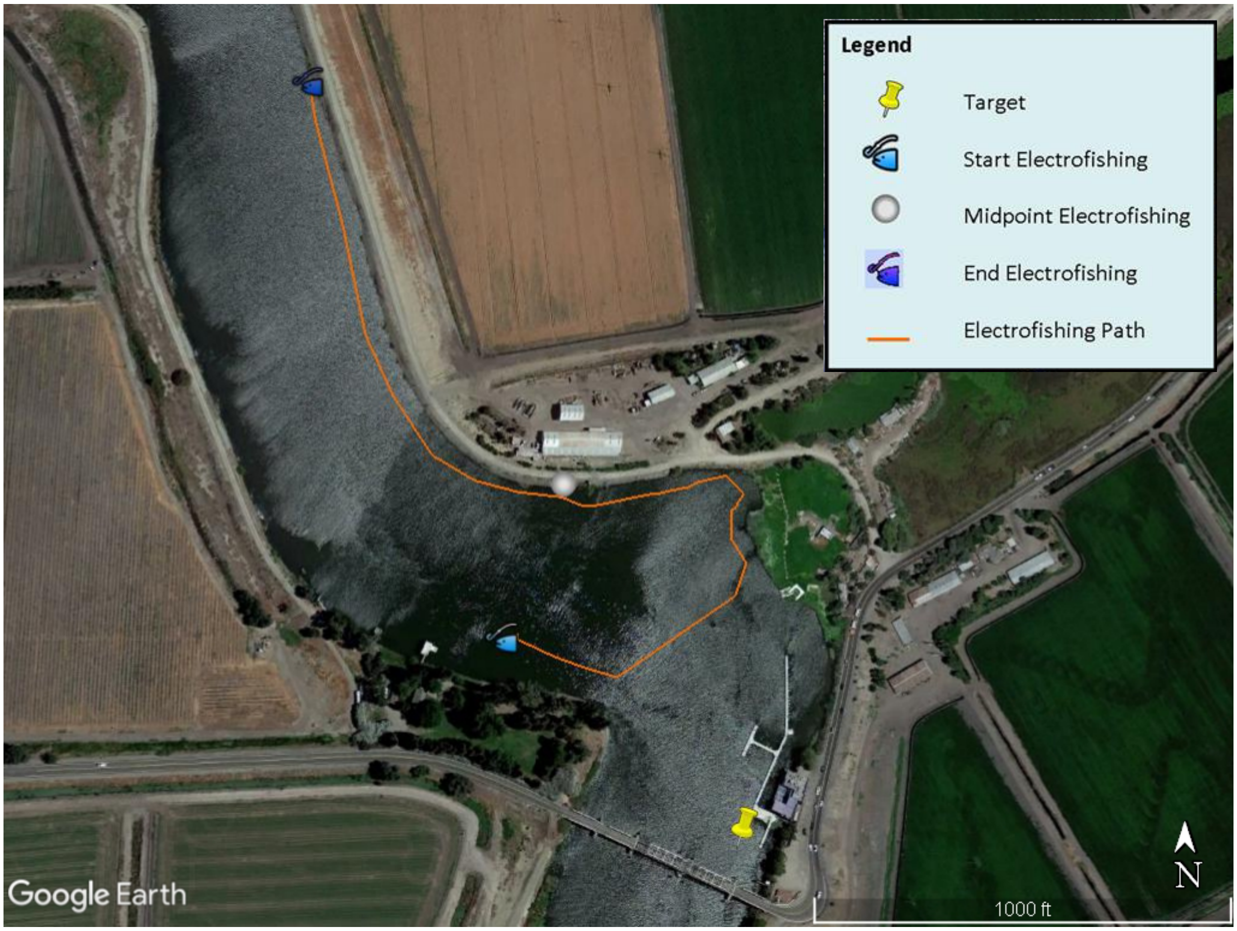
Middle River at Borden Hwy (544MDRBH4)

Latitude: 37.89083
Longitude: -121.48833
Collection Method: Electroshock, depth-integrated grab
Date(s) of Fish Collection: 08/11/2021
Date(s) of Water Collection: 08/11/2021, 03/08/2022, 04/05/2022
Samplers: April Sjoboen Guimarães, Scot Lucas, Autumn Bonnema



Largemouth Bass, TL (mm)							
231	235	239	282	290	300	313	313
352	364	366	384	402	430	471	535

Comments: The sampling vessel was launched from Discovery Bay Yacht Harbor in Discovery Bay, CA. Sixteen (16) Largemouth bass were sampled along the transect adjacent to the target station. All water collection was done in close proximity of the target station where the channel discharge was greatest.

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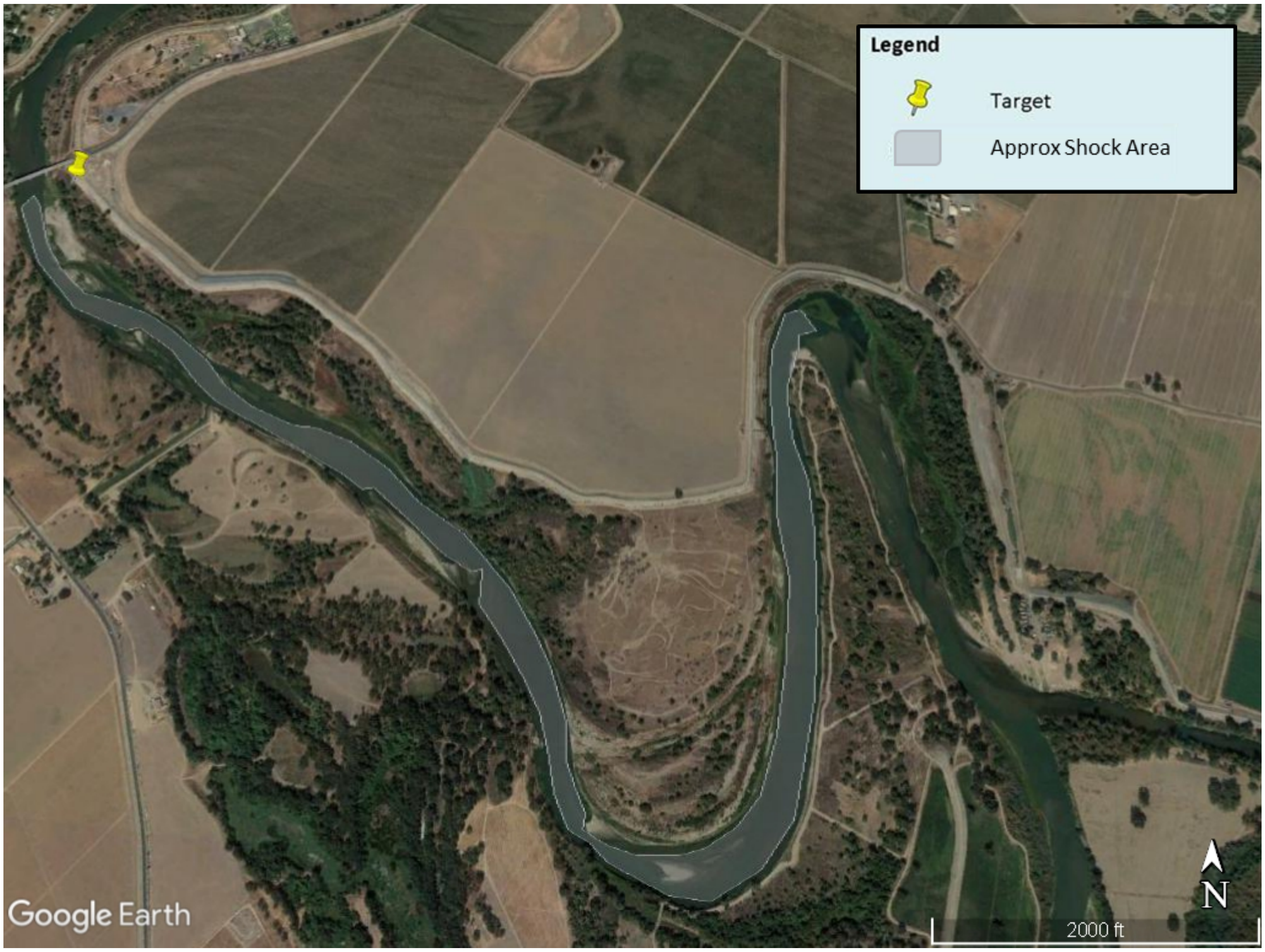
San Joaquin River at Vernalis/Airport (541SJC501)

Latitude: 37.67556
Longitude: -121.26417
Collection Method: Electroshock, depth-integrated grab
Date(s) of Fish Collection: 08/12/2021
Date(s) of Water Collection: 08/12/2021, 03/08/2022, 04/05/2022
Samplers: April Sjoboen Guimarães, Scot Lucas, Autumn Bonnema



Largemouth Bass TL, (mm)							
214	224	233	259	275	295	310	367
369	370	381	396	398	419	433	440

Comments: Sixteen (16) Largemouth bass were sampled along the transect adjacent to the target station. All water collection was done from the bridge as an integrated bucket grab in close proximity of the target station.

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1.7 Discussion

A total of seven (7) Stations were sampled for fish tissue. Five (5) stations were sampled using an electrofishing vessel and two (2) using hook and line. Collection method restrictions of hook and line only, listed in the scientific collection permit for Sherman Island and Cache Slough reduced fishing success per unit effort at these sites.

Seven (7) stations were successfully sampled for depth-integrated water samples and basic water parameters.