Quality Assurance Project Plan

For Constituents of Emerging Concern Monitoring

Under The

Sacramento-San Joaquin Delta Regional Monitoring Program

Version 3.3

Submitted On

May 1, 2023

Revised July 14, 2023, and August 17, 2023

Prepared By:

MLJ ENVIRONMENTAL

1 APPROVAL SIGNATURES

* This is a contractual document. The signature dates indicate the earliest date when the project can start.

Delta Regional Monitoring Program Personnel

Title	Name	Affiliation	Signature	Date
Board of Directors President	Debbie Mackey	CVCWA	DocuSigned by: Debbie Mackey 75932D30E03248D...	9/14/2023
Program Manager	Melissa Turner	MLJ Environmental	DocuSigned by: Melissa Turner 9796DD915C44446...	9/14/2023
Quality Assurance Officer	Will Hagan	MPSL-MLML	DocuSigned by: Will Hagan A1D771E8E56040F...	9/13/2023
Data Manager	Cassandra Lamerdin	MLJ Environmental	DocuSigned by: Cassandra Lamerdin 2801D2DF64FB454...	9/13/2023

Central Valley Regional Water Quality Control Board

Title	Name	Affiliation	Signature	Date
Environmental Program Manager	Meredith Howard	CVRWQCB	DocuSigned by: Meredith Howard ACF6CE07B4CD4E5...	10/9/2023
Quality Assurance Representative	Selina Cole	CVRWQCB	DocuSigned by: Selina Cole F3102A0E248746B...	10/6/2023

State Water Resources Control Board

Title	Name	Affiliation	Signature	Date
Quality Assurance Officer	Andrew Hamilton	SWRCB	DocuSigned by: Andrew Hamilton 7CBAC1C276074C6...	10/6/2023

Project Personnel

Title	Name	Affiliation	Signature	Date
Field Lead	Matthew Bundock	MLJ Environmental	DocuSigned by: A0F27356BD35406...	9/13/2023

Laboratory Personnel

Title	Name	Affiliation	Signature	Date
Laboratory QA Officer	Joseph Evans	Physis Laboratories	DocuSigned by: Joseph Evans D6B1E37719BF4B6...	9/14/2023
Laboratory QA Officer	Teresa Morrison	Enthalpy Analytical Laboratory [1]	DocuSigned by: Teresa Morrison 3B7BB1D27DC2410...	9/13/2023
Laboratory QA Officer	Alan Ching	Weck Laboratories	DocuSigned by: Alan Ching 4DC2BDF31A43426...	9/12/2023

[1] Enthalpy Analytical Laboratory purchased Vista Analytical Laboratory; previous data were reported under Vista.

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2.4 LIST OF ACRONYMS

BOD	Board of Directors
CDEC	California Data Exchange Center
CEDEN	California Environmental Data Exchange Network
COC	Chain of Custody
CRM	Certified Reference Material
CV RDC	Central Valley Regional Data Center
CVRWQCB	Central Valley Regional Water Quality Control Board
Delta RMP	Delta Regional Monitoring Program

DMT	Data Management Team
DQI	Data Quality Indicator
DQO	Data Quality Objective
DWR	Department of Water Resources
E	Environmental Sample
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	Environmental Protection Agency
FD	Field Duplicate
LCS	Lab Control Sample
LCSD	Lab Control Sample Duplicate
MLJ Environmental	Michael L. Johnson Environmental
MLML	Moss Landing Marine Laboratory
MPSL	Marine Pollution Studies Laboratory
MQO	Measurement Quality Objective
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MS4	Municipal Separate Stormwater Sewer System
NOAA	National Oceanic and Atmospheric Administration
PDF	Portable Document Format
POTW	Publicly Owned Treatment Works
PR	Percent Recovery
PTFE	Polytetrafluoroethylene; brand name Teflon™
QA	Quality Assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
SC	Steering Committee
SOP	Standard Operating Procedure
SRM	Standard Reference Material
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee

2.5 LIST OF UNITS

°C	degrees Celsius
cfs	cubic feet per second
cm	centimeter
g	gram
kg	kilogram
L	liter
mg	milligram
mL	milliliter
ng	nanogram
µg	microgram
µS	microsiemen

2.6 REVISION HISTORY

Version	Date	Revision Description
3.0	May 1, 2023	Original submittal to the CVRWQCB.
3.1	July 14, 2023	Resubmittal incorporating comments from CVRWQCB and SWRCB.
3.2	August 17, 2023	Resubmittal incorporating comments from CVRWQCB and SWRCB. Signatories and distribution list updated. **Table 14** updated to reflect the final sample location coordinates and station codes.

GROUP A. PROJECT MANAGEMENT

This Quality Assurance Project Plan (QAPP) describes the procedures, objectives, and responsible personnel for ensuring the quality of data generated by the Constituents of Emerging Concern (CEC) Project under the Delta Regional Monitoring Program (Delta RMP).

3 DISTRIBUTION LIST

The individuals and groups listed below will receive a final, executed copy of this document and any subsequent revisions. Copies of this document will be made available to the public via the Delta RMP website, https://DeltaRMP.org/.

Title	Name	Affiliation	Contact Information
Delta RMP Steering Committee	Distribution List	NA	--
CEC Technical Advisory Committee	Distribution List	NA	--
Delta RMP Board of Directors President	Debbie Mackey	CVCWA	eofficer@cvcwa.org
Delta RMP Technical Program Manager	Melissa Turner	MLJ Environmental	mturner@mljenvironmental.com
Delta RMP Quality Assurance Officer	Will Hagan	MPSL-MLML	William.hagan@sjsu.edu
Delta RMP Data Manager	Cassandra Lamerdin	MLJ Environmental	clamerdin@mljenvironmental.com
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Project Manager	Rajwinder Kaur	Enthalpy Analytical Laboratory[1]	rajwinder.kaur@enthalpy.com

Title	Name	Affiliation	Contact Information
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Project Manager	Kim Tu	Weck Laboratories	kim.tu@wecklabs.com
Quality Assurance Officer	Alan Ching	Weck Laboratories	alan.ching@wecklabs.com

[1] Enthalpy Analytical Laboratory purchased Vista Analytical Laboratory; previous data were reported under Vista.

4 PROJECT TASK/ORGANIZATION

4.1 DELTA REGIONAL MONITORING PROGRAM STRUCTURE

The purpose of the Delta RMP is to educate and inform decisions on how to protect, and where necessary, restore beneficial uses of water in the Sacramento-San Joaquin River Delta area of California, by producing objective and cost-effective scientific information critical to understanding regional water quality conditions and trends. The Implementing Entity for the Delta RMP is a nonprofit public benefit corporation under which the Board of Directors (BOD) oversees operations of the program.

The Delta RMP pursues the following objectives:

a) Improve the efficiency of water quality data collection and management in the Delta.

b) Generate information that informs and educates the public, agencies, and decision makers.

c) Raise awareness of Delta water quality conditions and how they impact beneficial uses.

d) Foster independent science, objective peer review, and a transparent review process.

The Delta RMP is implemented with the participation of various coordinated monitoring, resource, regulatory and regulated entities. These groups give technical and policy recommendations to the BOD through participation in the Steering Committee and various project-specific technical advisory committees (TACs). The Program structure is illustrated below in **Figure 1**.

Participation in the Delta RMP by a discharger consists of providing funds and/or in-kind services to the Delta RMP at least equivalent to discontinued individual monitoring and study efforts. Participating discharger agencies in the Delta RMP include wastewater treatment, stormwater, agriculture, flood control, ports, and dredgers. The implementation of the Program is therefore done in close coordination with the Central Valley Regional Water Quality Control Board (CVRWQCB) to ensure that the participating dischargers remain in compliance with their individual regulatory requirements. The expectations of these requirements are outlined in Resolution R5-2021-0054, Approval of Delta Regional Monitoring Program Governance Structure and Implementing Entity (Resolution), which provides the general approval of the Delta RMP Implementing Entity and governance structure (see **Regulatory Criteria**). All monitoring and data generation occurring under this QAPP must be in accordance with the submission requirements and due dates defined in the Resolution Attachment A.

4.2 GOVERNING BOARDS AND ADVISORY COMMITTEES

4.2.1 Board of Directors

The BOD is dedicated to the purposes of the Delta RMP and appointed by their sector's appointing agency(ies). The BOD makes all binding decisions for the Delta RMP. The BOD will appoint both standing committees of the Board and advisory committees to the BOD. The BOD also appoints four Board Officers from among the existing members including a President, Vice President, Secretary, and Treasurer.

On a two-year rotation, agencies will put forth a nominee for their respective seat(s) to represent them on the BOD. Currently, the Bylaws provide for 11 director seats as follows:

- Agricultural interest (2 seats).
- Publicly Owned Treatment Works (POTW– 3 seats).
- Storm Water Agencies (MS4s – 3 seats).
- Water Supply Agencies (1 seat).
- Habitat Restoration/Flood Management (1 seat).
- 'At large' seat appointed by the Board of Directors (1 seat).

The responsibilities of the Board include (also See Article V, Section 1 of the Bylaws):

- Adopt policies, rules and procedures for the management and operation of the Delta RMP.
- Develop the financial operations of the nonprofit.
    - Create and approve budgets and expenditures.
    - Receive and accept contributions, grants, etc.
- Hire leadership staff, as necessary, to run the nonprofit and implement the Delta RMP program.
- Enter into contracts with entities and individuals as necessary to operate and implement the Delta RMP.
- Appoint and/or form Committees of the Board or Advisory Committees (technical and administrative) (See Section VI).
    - Under nonprofit law, committees of the Board must be comprised of only Board members. Advisory Committees can be made up of both Board members and non-Board members.
    - The Bylaws currently identify two Standing committees, the Executive Committee and the Steering Committee (SC). All other committees (i.e.,

those that are not Standing Committees, either of the Board or Advisory) are formed by resolution of the Board.

- Establish and oversee the implementation of policies and priorities of the Delta RMP.

4.2.2 Executive Committee

The Executive Committee is a standing Committee of the Board and has the authority between Board meetings to make decisions and take action relative to the operation of the nonprofit organization on behalf of the Board following developed policies and procedures of the Board. The Executive Committee consists of the four Board officers. The Executive Committee is responsible for authorizing the daily management of the Corporation including setting agendas for Board meetings, making/approving authorized limit expenditures, and similar. The Executive Committee may develop policies for Board approval and may review and recommend to the Board changes to the bylaws and to other operating policies.

The Executive Committee consists of the following Board officers which are selected from existing members of the Board: President, Vice President, Secretary, and Treasurer.

4.2.3 Steering Committee

The Steering Committee is a standing Advisory Committee to the BOD as described in the Bylaws and consists of representatives of the same categories as those defined for the members of the BOD, and with the same number of seats per category, plus representatives of regulatory agencies. These representative categories are listed below, specifically:

- Agricultural interest - 2 seats.
- Publicly Owned Treatment Works (POTWs) – 3 seats.
- Storm Water Agencies (MS4s) – 3 seats.
- Water Supply Agencies – 1 seat.
- Habitat Restoration/Flood Management – 1 seat.
- Dredgers – 1 seat.
- Coordinated monitoring (Interagency Ecological Program/California Department of Fish and Wildlife) - 1 seat.
- Resource Agencies (NOAA Fisheries) - 1 seat.
- Regulatory Agencies (US Environmental Protection Agency, State Water Resource Control Board, and CVRWQCB-Management level staff) - 3 seats.

The Steering Committee is charged with the authority and responsibility to:

- Serve as an advisory body to the BOD.
- Advise on strategic direction and the policies and procedures to implement the DRMP in a manner consistent with regulatory conditions and priorities.
- Recommend direction for technical committees on priorities, constraints, and management questions to develop technical recommendations and products within the resource allocations determined by the BOD.
- Recommend DRMP work products and any other plans or products.

All decisions by the Steering Committee will be in the form of advice/recommendations to the Board. The Steering Committee will have no binding authority on Delta RMP implementation. The Board will consider all recommendations by the Steering Committee in a timely manner.

All decisions by the Steering Committee are subject to subsequent timely consideration by the Board including but not limited to pursuit of opinions by others (e.g., the Executive Director, the Program Manager and other technical specialists (as warranted)).

Some decisions by the Steering Committee that are time-sensitive or less significant can be made via e-mail or telephone conference, but only if these items have previously been discussed in a Steering Committee meeting.

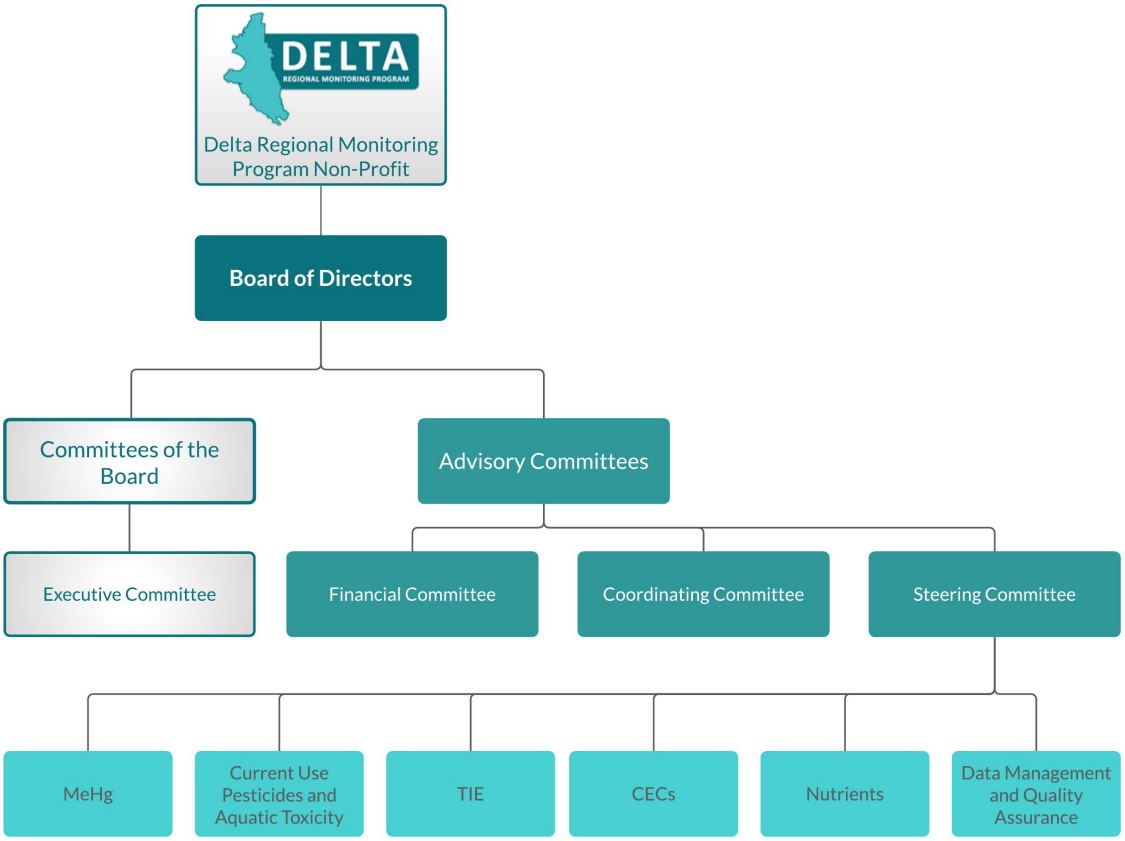
4.2.4 Constituents of Emerging Concern Technical Advisory Committee

For this project, the Constituents of Emerging Concern Technical Advisory Committee (TAC) has been established to provide recommendations to the Steering Committee and the Board of Directors regarding technical recommendations for the implementation of this project. The TAC has been provided a specific responsibility and/or deliverables by the Board (e.g., the "Charge") as also informed by Steering Committee recommendations. The TAC members serving as technical advisors for this project are identified in **Table 1**.

Table 1. Constituents of Emerging Concern Technical Advisory Committee members.

Title	Name	Affiliation	Contact Information
Contributing Entities Representative	Michael Johnson	MLJ Environmental	mjohnson@mljenvironmental.com
Contributing Entities Representative	Lisa Thompson	Regional San	thompsonlis@sacsewer.com
Contributing Entities Representative	Brian Laurenson	LWA	brianl@lwa.com
Regulator Representative	Selina Cole	CVRWQCB	selina.cole@waterboards.ca.gov

Figure 1. DRMP Non-Profit Structure (as of January 2022).



4.3 PROGRAM MANAGEMENT

4.3.1 Delta RMP Program Manager Role

The BOD has hired Melissa Turner of MLJ Environmental as the Program Manager. The Program Manager oversees all technical programs and associated leadership and staff for each technical area of the Delta RMP. The Program Manager will be responsible for planning and overseeing Delta RMP projects to ensure that they are completed in a timely manner and within budget. It is the Program Manager's responsibility to plan projects, prepare budgets, monitor progress, and keep stakeholders informed.

The Program Manager is responsible for the implementation of the project in accordance with Resolution R5-2021-0054, the approved fiscal year Workplan, and the QAPP. The Program Manager ensures the communication of direction, decisions, and challenges to implementation between technical staff and committees, the CVRWQCB, the Steering Committee, and the BOD.

4.4 QUALITY ASSURANCE OVERSIGHT

4.4.1 Program Quality Assurance Officer Role

The Delta RMP Program Quality Assurance (QA) Officer is Will Hagan of the Moss Landing Marine Laboratories, Marine Pollution Studies Lab (MLML-MPSL). The Program QA Officer provides ultimate quality assurance oversight for field and laboratory procedures, and final data review and assessment of completeness, accuracy, and precision of data generated by this project. The Delta RMP QA Officer is independent of any direct data generation, such as sample collection, field parameter recording, or laboratory analysis.

In addition to procedural QA/QC, the Program QA Officer, in coordination with the Program Manager, is responsible for reviewing laboratory protocols to confirm laboratory compliance with the overall requirements of the Delta RMP and is ultimately responsible for reviewing project data both for accuracy and comparability with the State Water Resource Control Board's Surface Water Ambient Monitoring Program (SWAMP). The Program QA Officer may stop all actions, including those conducted by the laboratories, if there are significant deviations from required QAPP practices or if there is evidence of a systematic failure.

Quality assurance oversight for the implementation of Delta RMP projects and studies is conducted in coordination with the CVRWQCB QA Representative, Selina Cole. The State Water Resource Control Board (SWRCB) QA Officer, Andrew Hamilton, will also be consulted to ensure consistency with SWRCB data management policies; the SWRCB QA Officer is a signatory of the QAPP and their approval is required prior to the implementation of this project.

Deviations to this QAPP will be reviewed by the Program QA Officer, the Program Manager, and the CVRWQCB QA Representative to assess impacts on data quality and project objectives. All deviations must be approved by the CVRWQCB QA Representative or the SWRCB QA Officer prior to implementation. When prior approval is not possible, the deviations must be reported to the CVRWQCB QA Representative within seven (7) calendar days per Resolution R5-2021-0054. Deviations to this QAPP are documented according to the procedures outlined in **Element 20**.

4.4.2 Data Manager Role

The Central Valley Regional Data Center (CV RDC) Manager (Victoria Bowles) coordinates the Data Management Team, which performs data review and verification to ensure that data submitted by subcontractor laboratories are timely, complete, and properly incorporated into the Regional Data Center database. Cassandra Lamerdin (MLJ Environmental) will be the project Data Manager leading the DMT under the direction of the CV RDC Manager. Ms. Lamerdin is responsible for data processing, QA/QC review,

and data upload to the California Environmental Data Exchange Network (CEDEN). Once the data have been reviewed and processed, they will undergo a final review and qualification by Will Hagan, the Program QA Officer and/or a delegate of the QA Officer. In the event there are changes to the data after it has been published, they will be communicated to data users in a timely manner.

4.5 CONSTITUENTS OF EMERGING CONCERN PROJECT PERSONNEL

4.5.1 Field, Laboratory, and Technical Services

Field and analytical services are coordinated by MLJ Environmental. Melissa Turner will be the Program Manager and the Project Manager for the Delta RMP CEC Year 3 Pilot Study. Ms. Turner is responsible for the implementation of the project, including overseeing that samples are collected, transferred, analyzed, and reported according to the requirements outlined in this QAPP. Ms. Turner is also responsible for receiving project data from the laboratories and providing the results to the CV RDC DMT.

Field sampling is conducted by MLJ Environmental. Matthew Bundock serves as the MLJ Environmental field lead and is responsible for proper training of field staff, ensuring that samples are collected and preserved according to the approved procedures, initial logging and processing of water samples, and transfer of samples to the associated laboratory for analysis.

Samples are analyzed for constituents of emerging concern and ancillary constituents by Physis Laboratories, Weck Laboratories, and Enthalpy Analytical Laboratory. Each laboratory has an appointed QA Officer who is responsible for ensuring that all activities are completed following the procedures established in this QAPP.

All commercial contract laboratories must maintain the appropriate accreditation with the California Environmental Laboratory Accreditation Program (ELAP). Wherever possible, the laboratories must be accredited in the specific analytical methods used for performing analysis under this QAPP. The ELAP certificate numbers of each of the contract laboratories are listed in **Table 2**.

Table 2. Commercial laboratories ELAP certificate numbers.

Laboratory	ELAP Certificate No.
Physis Laboratories	2769
Weck Laboratories Inc.	1132
Enthalpy Analytical Laboratory [1]	2892

[1] Enthalpy Analytical Laboratory purchased Vista Analytical Laboratory. Accreditation and CEDEN agency codes are currently maintained under Vista.

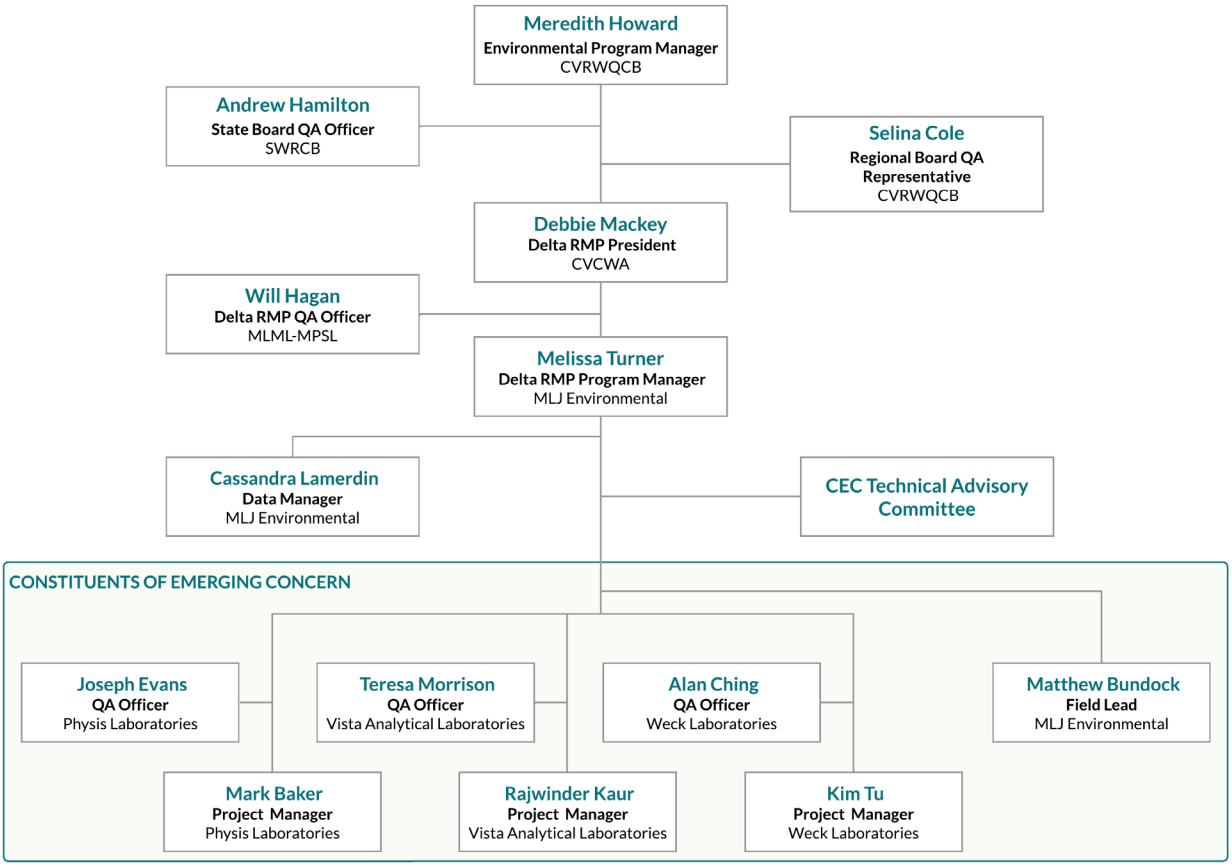
4.6 PERSONS RESPONSIBLE FOR QAPP MAINTENANCE

The Delta RMP Program Manager and Program QA Officer are responsible for creating, maintaining, and updating this QAPP, including the submission of amendments to reflect updates to the project implementation. This QAPP must be reviewed and approved by the CVRWQCB QA Representative and SWRCB QA Officer. Project implementation cannot occur until the QAPP is approved.

Amendments to this document should be made in concurrence with the associated TAC and must be approved by either the SWRCB QA Officer or the CVRWQCB QA Representative prior to implementation. The Steering Committee Co-Chairs will be notified of all amendments to this QAPP. The Delta RMP Program Manager is responsible for documenting changes, submitting these changes for review and approval by Waterboards staff, and obtaining final signatures for all revisions and amendments to the QAPP..

4.7 ORGANIZATIONAL CHART AND RESPONSIBILITIES

Figure 2. Project organizational chart for oversight of project data generation.



5 PROJECT DEFINITION/BACKGROUND

5.1 PROBLEM STATEMENT

The Sacramento-San Joaquin Delta (Delta) is an important water supply for municipal, industrial, and agricultural use for much of the state and is a critical ecosystem for fish and wildlife, including many rare and endangered species. The native fishes of the Sacramento–San Joaquin Delta have been declining at an increasingly rapid rate for more than two decades. This decline has significant consequences for water resource management in the Delta. There is no single cause for the decline of these fishes. All facets of the Delta ecosystem have changed dramatically in the past two decades and most changes have been detrimental to native fishes. Climate change, recent droughts, and increasing wildfires are a few of these changes. Another factor that can cause harm to native species are point or non-point discharges that alter water quality (through land and water use activities). Upstream water diversions also affect increased contaminant concentrations and water temperatures through changes in flows, and current export pumping practices can exacerbate poor water quality conditions in altered habitats. Contaminants have been documented in all major aquatic habitats in the Delta and Suisun Marsh. Discharges that alter water quality can affect both individual and populations of native species. The magnitude of cumulative effects of interaction multiple contaminants that alter water quality is not well documented in the Delta. However, cumulative effects of harmful contaminants may also affect native species through direct toxicity or disruption of food webs.

The Delta RMP was initiated under the encouragement of the CVRWQCB with the primary goal of tracking and documenting the effectiveness of beneficial use protection and restoration efforts through comprehensive monitoring of water quality constituents and their effects in the Delta. Understanding the current water quality conditions within the Delta and the potential impacts to water quality conditions are important to preserve and enhance the Delta and inform corresponding regulatory and management decisions, which should be based upon sound science.

A better understanding of the role of contaminants in the apparent decline of Delta ecosystems is a priority for regulators and stakeholders. There is little information known about how CECs impact the beneficial uses of water in the Central Valley. Therefore, the CEC Pilot Study aims to develop preliminary information to better understand the presence of CECs in ambient waters, sediments, and, to a limited extent, tissues of fish and bivalves of the Delta.

5.2 DECISIONS AND OUTCOMES

The CEC Pilot Study was developed in reaction to public interest as part of a statewide effort to address CEC monitoring needs. The study was designed to take place over a three-year period beginning in fiscal year (FY) 2019-20. The CEC Pilot Study is intended to provide a better understanding of the potential risks that these contaminants pose to beneficial uses of waters in the Delta. This study includes just one of the many regions that are being monitored throughout the state, and the data gathered will be used to inform the SWRCB and CVRWQCB CEC programs. The results will not be used for regulatory enforcement actions.

5.2.1 Management and Assessment Questions

The purpose of the CEC pilot study will be to provide incremental assessments to inform the following Delta RMP Assessment Questions:

- Is there a problem or are there signs of a problem?
- How quickly (i.e., at what distance from a source) do the CECs attenuate once discharged?

This study provide information from which to develop future studies of CECs. To provide incremental assessments of CECs in the Delta, sampling is set to occur over a three-year period. Year 1 monitoring occurred during FY 2019-20 and included ambient monitoring at specific locations in the Delta to evaluate the presence of targeted CECs. Year 2 monitoring occurred in FY 2020-21 and characterized sources of CECs by sampling POTW effluent and MS4 urban runoff sites, in addition to continuing the ambient monitoring of CECs. Year 3, for which this QAPP is written, will consist of two gradient studies to evaluate attenuation of POTW CEC discharges, and additional monitoring of two MS4 urban runoff sites. Year 3 of the pilot study will occur during FY 2023-24 and address the following statewide monitoring question:

- How quickly (i.e., at what distance from a source) do the CECs attenuate once discharged?

The data collected from the CEC pilot study in Year 3 is intended to inform scientists, water managers, and regulators of the spatial distribution and hydraulic dilution or transformation of CECs.

5.3 REGULATORY CRITERIA

A variety of permittees throughout the Central Valley regulated by the CVRWQCB contribute and participate in the Delta RMP. In 2013, the CVRWQCB passed R5-2013-0130 allowing permittees with sufficient participation in the Delta RMP to modify or reduce some of the requirements of their own permits in exchange for their contribution to the Program. As such, the close collaboration with the CVRWQCB is essential to

ensure the continued value and effectiveness of regional monitoring in lieu of individual monitoring and special studies that otherwise might be required by CVRWQCB for participating permittees.

In October 2021, the CVRWQCB passed Resolution R5-2021-0054 approving the updated Delta RMP governance structure as a vehicle for this modified monitoring to occur. Attachment A of Resolution R5-2021-0054 outlines the reporting requirements of the Delta RMP to the CVRWQCB in order to ensure added value of the coordinated efforts under the Program are adequate to investigate water quality issues in lieu of individual monitoring and special studies.

The requirements in Resolution R5-2021-0054 relevant to the QAPP include:

- Developing QAPPs that meet the requirements of the Water Boards and US Environmental Protection Agency (EPA)
- A documentation process for deviations and an assessment and a corrective action process
- Approval by the SWRCB QA Officer (Andrew Hamilton) prior to implementation of monitoring
- Deviations to the QAPP must be approved by the CVRWQCB QA Representative (Selina Cole) or the SWRCB QA Officer (Andrew Hamilton)
    - When prior approval is not possible for QAPP deviations, they must be reported to the Central Valley Water Board Quality Assurance Representative within 7 Calendar Days of the BOD or contractors becoming aware of the deviation

Any results reported above these Water Quality Metrics must be reported to the CVRWQCB within 60 calendar days of the sample analysis, per R5-2021-054. The Water Quality Metrics constitute the project action limits for samples collected under this QAPP and are defined by the CVRWQCB by July 1 of each year, also per R5-2021-054. These metrics are provided in **Table 16**, which also includes the laboratory analysis limits (Reporting and Method Detection Limits).

State guidance on the Occurrence and Risk Screening of Emerging Contaminants in Ambient Aquatic Ecosystems of California is being developed by the SWRCB. This QAPP will be amended to incorporate new WQM should this guidance determine relevant values associated with the constituents identified in **Table 15**.

6 PROJECT DESCRIPTION

6.1 WORK STATEMENT AND DELIVERABLES

The Delta RMP CEC Pilot Study monitors targeted chemicals in multiple locations across the Delta over three, year-long periods. The Study is designed to monitor CECs in a phased approach that includes ambient monitoring, source characterization and gradient studies with the goal of providing preliminary information for future CEC studies.

In Years 1 and 2 of the Pilot Study, ambient water monitoring took place quarterly at eight sites in the Central Valley during FY 2019-20 (Year 1) and FY 2020-21 (Year 2). In addition to ambient monitoring, two POTW sources and two MS4 urban runoff sites were monitored in Year 2. Year 1 and Year 2 data were used to identify the constituents and locations to be monitored in Year 3 of the Pilot Study. Year 3 monitoring will consist of continued sampling of the POTW and urban source sites added during Year 2, with a gradient study to be conducted at each of the two POTW sources to evaluate downstream receiving waters. Data collected in these gradient studies will be used to characterize CEC attenuation in effluent-dominated waters flowing to the Delta and inform future CEC monitoring efforts. The detailed CEC study plan is provided as an appendix to the FY 23-24 Delta RMP Workplan.

The phased three-year study design allows for the evaluation of the presence of CECs in the Delta and how these constituents, once discharged, attenuate through hydraulic dilution or transformation. The POTW gradient studies in Year 3 represent two entry points into the Delta and allows for an assessment of the attenuation or degradation of CECs in surface water.

Year 3 CEC monitoring will occur over two dry-weather sampling events taking place in the summer/early fall of 2023. Samples will be collected from the two POTW sites and from a minimum of seven gradient study sites at each of the POTW effluent areas according to the procedures outlined in **Element 10** and **Appendix I**. Samples collected for Year 3 CEC monitoring will be analyzed for the same list of CECs assessed in the water column for the ambient and source monitoring in Years 1 and 2 of the Pilot Study. The analyte groups for CEC monitoring includes two categories of chemicals that are referred to as Per-, Poly- Fluoroalkyl Substances (PFAS) and Pharmaceuticals and Personal Care Products (PPCPs). The monitoring of Suspended Sediment Concentration (SSC) and turbidity act as ancillary variables that allow for further characterization of the CECs being monitored. In addition, field crews will collect standard field variables, as well as flow and depth measurements to inform attenuation assessments of the gradient site results. The list of Year 3 CEC analytes is provided in **Table 3**.

The Year 3 CEC monitoring results will be summarized in the Year 3 Data Report, which will present the field and analytical results, as well as perform the data analyses identified in the Year 3 Study Plan and **Element 21** of this QAPP. Data summaries, reporting, and publication will occur according to the schedule identified in **Table 4**.

6.2 CONSTITUENTS TO BE MONITORED

Table 3 lists the constituents and variables associated with this project. The entire suite of constituents and variables are monitored at each site during each of the two sampling events, with the exception of flow and depth measurements, which are only required at gradient sites.

Table 3. Year 3 CEC constituents.

Analyte Category	Analyte	Parameter Type [1]	Agency	Matrix	Method	Fraction	Units
Field Measures	Dissolved Oxygen	Required	MLJ	Water	SM 4500-O	Total	mg/L
Field Measures	Dissolved Oxygen	Required	MLJ	Water	SM 4500-O	Total	% saturation
Field Measures	pH	Required	MLJ	Water	EPA 150.1	NA	pH units
Field Measures	Specific Conductivity [2]	Required	MLJ	Water	EPA 120.1	Total	µS/cm
Field Measures	Temperature	Required	MLJ	Water	SM 2550	NA	°C
Field Measures	Midstream Depth [3]	NA	MLJ	Water	--	NA	m
Field Measures	Flowrate [3]	NA	MLJ	Water	USGS methods [4]	NA	cfs
PFAS	Perfluorooctanesulfonic acid (PFOS)	Required	Enthalpy	Water	EPA 537M	Total	ng/L
PFAS	Perfluorooctanoic acid (PFOA)	Required	Enthalpy	Water	EPA 537M	Total	ng/L
PPCPs	Bisphenol A [5]	Required	Weck	Water	EPA 1694M	Total	ng/L
PPCPs	Bisphenol A [5]	Required	Physis	Water	EPA 625.1M	Total	ng/L
PPCPs	Diclofenac	Required	Weck	Water	EPA 1694M	Total	ng/L
PPCPs	Estradiol, 17beta-	Required	Weck	Water	EPA 1694M	Total	ng/L

Analyte Category	Analyte	Parameter Type [1]	Agency	Matrix	Method	Fraction	Units
PPCPs	Estrone	Required	Weck	Water	EPA 1694M	Total	ng/L
PPCPs	Ibuprofen	Required	Weck	Water	EPA 1694M	Total	ng/L
PPCPs	Triclosan	Required	Weck	Water	EPA 1694M	Total	ng/L
PPCPs	Ethynylestradiol, 17alpha-	Additional	Weck	Water	EPA 1694M	Total	ng/L
PPCPs	Gemfibrozil	Additional	Weck	Water	EPA 1694M	Total	ng/L
PPCPs	Iopromide	Additional	Weck	Water	EPA 1694M	Total	ng/L
PPCPs	Naproxen	Additional	Weck	Water	EPA 1694M	Total	ng/L
PPCPs	Progesterone	Additional	Weck	Water	EPA 1694M	Total	ng/L
PPCPs	Salicylic Acid	Additional	Weck	Water	EPA 1694M	Total	ng/L
PPCPs	Testosterone	Additional	Weck	Water	EPA 1694M	Total	ng/L
PPCPs	Galaxolide	Required	Physis	Water	EPA 625.1M	Total	ng/L
PPCPs	Triclocarban	Required	Physis	Water	EPA 625.1M_MRM	Total	ng/L
Ancillary	SSC	Ancillary	Weck	Water	ASTM D3977	Particulate	mg/L
Ancillary	Turbidity	Ancillary	Physis	Water	EPA 180.1	Total	NTU

[1] Required analytes indicate those that were requested in the original Stakeholder Workplan for analysis during Years 1 and 2 of the Pilot Study. Analytes were added by laboratories where available at minimal to no additional cost. The Year 3 gradient study design aims to be consistent with the data collected during the first two years, and therefore all analytes listed will be analyzed in Year 3. Additional constituents included in the method used will be reported in the data deliverable (CEDEN and appendix of results), but not included in the data report body.

[2] Specific conductivity may also be referenced as specific conductance. Specific conductivity is the naming convention follow by CEDEN and is defined as electrical conductivity at 25°C.

[3] Flow and depth measurements will only be collected at gradient study sites. These measurements will not be collected at the two urban runoff sites.

[4] Flow measurements may be collected using a variety of methods depending on the site conditions. The acceptable flow methods are outlined in **Element 11.1.1**.

[5] Bisphenol A will be analyzed twice for each sample and event by two separate laboratories and methods per recommendations based on Years 1 and 2 sample results. Both sets of results will be used indiscriminately and submitted to CEDEN.

6.3 PHOTO MONITORING

Site photos are taken for each sampling event at each collection site. Site photos are taken, regardless of the presence of water for sample collection. These photos are included in the Year 3 Data Report and the field reports generated for each monitoring event.

6.3.1 Pre-Sampling Photo Monitoring

As described in **Element 11**, sampling crews will visit each gradient study area two days prior to sample collection to determine the anticipated sample locations according to the requirements outlined in **11.1.2 Pre-Sample Reconnaissance**. Samplers will visit and take site photos at each of the approved collection sites during this visit, regardless of the presence of water or likelihood of anticipated sample collection. All site photos will be included with the pre-sampling summary.

6.3.2 Photo Monitoring the Day of Sampling

On the day of gradient sample collection, photos will only be taken from the seven sites at which water is collected. Additional photos will also be taken to document any unanticipated conditions that occur on the day of sampling that prevent field crews from following the sample plan developed during the pre-sampling visit (**Element 11**).

Only sample collection photos will be taken from the urban sites during each event as these locations will only be visited once.

6.4 HABITAT OBSERVATION

In addition to the samples and measurements collected in the field, sampling crews shall record habitat parameters documenting the qualitative site condition information at the time that samples were collected. The required habitat observations are consistent with SWAMP surface water sample collection protocols and are defined on the SWAMP field sheets used for this project (**Figure 9**). The following observations should be recorded by field crews with each sample collection:

- Site odor
- Sky code
- Other presence
- Dominant substrate
- Water clarity
- Water odor
- Water color
- Overland runoff (last 24 hours)
- Observed flow
- Wadeability

- Wind speed (Beaufort scale)
- Wind direction
- Precipitation (at time of sampling)
- Precipitation (last 24 hours)
- Occupation Method
- Starting bank (facing downstream)
- Distance from bank (m)
- Stream width (m)
- Water depth (m)
- Location
- Hydromodification

6.5 PROJECT SCHEDULE

Monitoring priorities and designs are assessed on an annual basis based on recommendations from the Steering Committee as part of developing annual Workplans and associated budgets which are developed on a fiscal year basis (July 1 through June 30). Workplans outlining the study goals, designs, and budgets for all projects in the upcoming fiscal year are provided to the CVRWQCB by May 1 annually and must be approved by the CVRWQCB prior to implementation.

All deliverable dates will, at a minimum, meet the reporting requirements outlined in Resolution R5-2021-005. Preliminary data must be reported to the CVRWQCB within 60 calendar days of the sample analysis and Annual Reports are due on February 1 each year for the previous fiscal year.

Monitoring under the CEC Pilot Study occurs on a FY basis; the third and final year of monitoring under this QAPP will be completed during FY 2023-24. A summary of the schedule of work to be performed and deliverables to be submitted is shown in **Table 4**.

Year 3 CEC monitoring will occur over two dry-weather events to be scheduled from July through October of 2023 (see **Element 10**). Monitoring data will be made available to the CVRWQB within 60 calendar days of sample analysis date (for preliminary raw data) and the fully reviewed data will be made publicly accessible no more than six months after the last sample collection event, consistent with the Board Resolution Number R5-2021-0054. Monitoring may commence within the fiscal year beginning July 1, upon approval of this QAPP, and the last sample date is expected to be no later than October 31, 2023.

Data collected during Year 3 of the Study are evaluated in the CEC Year 3 Data Report which includes an overview of the monitoring activities that occurred during FY 2023-24, the results received, and the data evaluations identified in the Year 3 Study Plan and **Element 21** of this QAPP. The data report also includes a QA assessment that evaluates the results received according to the quality objectives outlined in the QAPP. Reports

will be submitted to the CEC TAC for technical review prior to publication on the Delta RMP website. The CEC Year 3 Data Report will be developed within six months of the final sample event, in coordination with the publication of the final dataset. A summary of the Year 3 CEC monitoring and QA assessment will also be provided in the Delta RMP Annual Report, to be submitted to the CVRWQC February 1, 2025 according to the requirements outlined in R5-2021-0054.

Finalized data will be reported to CEDEN within six months of the final sample collection. Finalized data will be verified by the steps outlined in this QAPP prior to publication and ideally the Year 3 Data Report will be approved in coordination with the transfer of these data to CEDEN; however, data publication timelines are not to exceed those required in R5-2021-0054 unless otherwise approved by the CVRWQCB Executive Officer (EO).

Table 4. Project deliverable schedule timeline.

Deliverable	Deliverable Due Date	Activity Period or Trigger	Frequency
Resolution Deliverables			
CEC Year 3 Study Plan [1]	May 1, 2023	FY 23-24	Once
CEC QAPP	May 1, 2023	FY 23-24	Once
Year 3 Study Finalized Budget	June 30, 2023	FY 23-24	Once
Preliminary CEC Data	60 calendar days	From sample analysis date	Per event
Finalized CEC Data	6 months	From sample analysis date	Per event
Transfer of CEC Year 3 Data to CEDEN	6 months	From final sampling event of the water year	Once
Delta RMP FY Annual Report	February 1, 2025	FY 23-24	Annually
Anticipated Implementation Schedule			
Year 3 Monitoring Event 1	August 2023 – September 2023	July 2023 through October 2023	Once
Year 3 Monitoring Event 2	September 2023 – October 2023	July 2023 through October 2023	Once
CEC Year 3 Data Report and transfer of CEC Year 3 Data to CEDEN	February 2024	August 2023 through October 2023	Once

[1] The CEC Year 3 Study Plan will be submitted to the CVRWQCB as part of the FY 23-24 Workplan due May 1, 2023.

6.6 GEOGRAPHICAL SETTING

The geographic scope of the Delta RMP encompasses the legal Delta (as defined by Section 12220 of the Water Code), as well as water bodies that directly drain into the Delta, the Yolo Bypass, and Suisun Bay. The ambient and source monitoring locations identified as a part of the multi-year CEC Pilot Study were selected to assess the presence of targeted CECs both within the Delta and in selected tributaries to the Delta waters. All ambient and source sites monitored during Years 1 and 2 of the Pilot Study are shown in **Figure 3**. The ambient sampling locations include entry points into the Delta, in-Delta waters, and ambient locations in the vicinity of POTW discharges and under the influence of urban runoff. Source monitoring locations of POTW effluent and urban runoff during Years 2 and 3 focused on entry points into the Delta and characterization of potential inputs of CECs from these entry points. The Year 3 monitoring also adds the gradient study sites upstream and downstream of the POTWs identified in **Element 10**.

The gradient study areas will focus on effluent-dominated inland waterways where the majority of the flow or volume during the dry season is POTW effluent, as recommended by the Statewide Pilot Study Monitoring Plan. The areas selected are both located outside of the legal Delta, near the cities of Roseville and Vacaville, California. The Roseville study location is the receiving waterbody of Dry Creek, which terminates into Steelhead Creek, which in turn drains into the Sacramento River immediately upstream of the confluence with the American River. Sacramento River waters cross the boundary into the legal Delta directly downstream of this confluence.

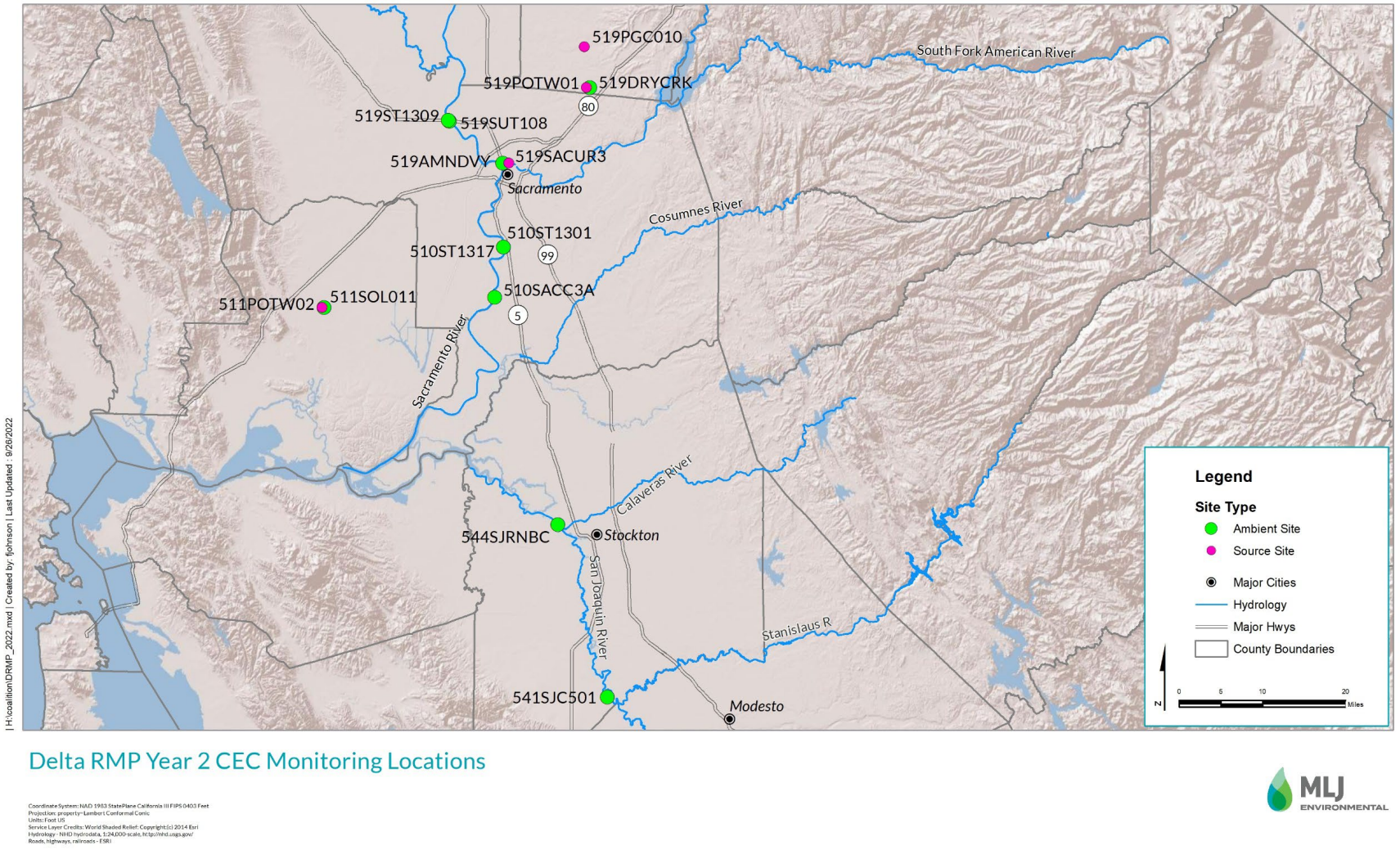
The Vacaville study location is the receiving water of Old Alamo Creek. Old Alamo Creek terminates into New Alamo Creek, which enters the Delta by way of Ulatis Creek; Ulatis Creek forms the western boundary of the legal Delta at the point of the terminus of New Alamo Creek.

6.7 CONSTRAINTS

The CEC monitoring design calls for collecting samples within a constrained time period to capture the presence of an effluent as it attenuates into the waterbody. To ensure that sample collection occurs within the constrained time period, field crew members will scout the sampling locations of the gradient studies one day prior to collection to verify that monitoring locations meet the minimum requirements for sampling. In the event that the initial confluence site does not meet sampling requirements, alternate confluence sites have been established to allow for the minimum number of seven samples to be collected for each gradient study location in each of the two sampling events. To optimize the outcome of the sampling events, a decision tree has been developed to guide field crews during the sample collection process as shown in **Figure 5**.

Figure 3. Delta RMP multi-year Pilot Study monitoring locations.

Source sites indicated in pink are the locations for Year 3 monitoring, in addition to the gradient study locations specified in **Element 10.**



7 QUALITY OBJECTIVES AND CRITERIA

7.1 DATA QUALITY OBJECTIVES

In order to account for the inherent level of uncertainty that can occur from the sampling design process through the result documentation, it is important for the project to have set limits of allowable error to ensure data are useable and supportive of the project goals.

Data quality objectives (DQOs) are the qualitative and quantitative statements that define the appropriate metrics that will be used to establish the level of quality for the project (EPA 2006). Data will be considered valid if DQOs for each of the data quality indicators outlined below are achieved. The effectiveness of the QA/QC program will be assessed by the quality of the data generated by the analytical laboratory and determination of field parameters.

7.2 DATA QUALITY INDICATORS

Data Quality Indicators (DQIs) are the quantitative statistics and qualitative descriptors used to interpret the degree of acceptability or utility of data to the user (US EPA QA/G-5, 2002). The principal data quality indicators are precision, accuracy (bias), representativeness, comparability, completeness, and sensitivity.

Limits for error must be established for all applicable DQIs for every measurement conducted under the Delta RMP. Program definitions for each DQI are provided below. Minimum targets associated with each of the following DQIs are outlined below in **Element 7.3 Performance Criteria.**

7.2.1 Precision and Accuracy (Bias)

Precision measures the agreement among repeated measurements of the same property under identical, or substantially similar, conditions. The closer two values that result from the same measurement under the same conditions are, the higher the degree of precision. The degree of precision can be a result of error and or the limits of the measurement system. A measurement quality objective (MQO) can be set for the allowable amount of variation between multiple measurements to account for limits of the measurement system and the inherent amount of user error associated with the measurement system. Program precision is monitored using duplicate quality control samples, including but not limited to field duplicates (or replicates), laboratory duplicates, and matrix spike duplicates.

Accuracy is a measure of the overall agreement of a measurement to a known value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations.

MQOs can be set to limit bias and to set an amount of error as compared to a true value achieved for a measurement. Contamination, measurement error, and matrix interference are all examples of causes of reduction in accuracy of a measurement.

Contamination that may be introduced during sample handling, preparation, or analysis can be monitored with the use of field blanks and laboratory blanks. If contamination is introduced, blank sample results can provide the degree of bias resulting from the error or analytical bias.

Measurement errors can be monitored through the analysis of a known concentration range and compared to measured results. This can be done using certified reference materials and laboratory control spike samples.

Bias introduced through interfering conditions present in the sample matrix can be monitored by duplicate environmental samples with a known concentration of target analytes prior to analytical process, known as matrix spike samples.

Data quality will be attained by maximizing the accuracy and precision of the methods used. Any changes in procedures due to equipment changes or to improved precision and accuracy will be documented. All analyses and determinations must be performed by qualified personnel in conformance with all current EPA standards and procedures. All laboratories will employ only methods and techniques which have been determined to produce measurement data of a known and verifiable quality and which are of quality sufficient to meet the overall objectives of the project.

Bias in field sampling quality control monitoring is minimized by randomly distributing QC samples among all sites throughout the year. Bias in analysis is minimized through the use of professional, private, objective third-party labs. Any potential bias that may be introduced by these labs is assessed with QC samples.

7.2.2 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness for the Delta RMP can be defined as the degree to which the environmental data generated by the monitoring program accurately and precisely represent actual environmental conditions. For this project, this objective is addressed by the overall study design, adherence with sampling SOPs, and meeting holding times. Assuring that the data are representative of the program objectives is addressed primarily by selecting appropriate locations, methods,

times, and frequencies of sampling for each environmental parameter, and by maintaining the integrity of the sample after collection. The overall study design and rationale is provided in the workplan and is summarized in **Element 10**.

7.2.3 Comparability

Comparability is a measure of the confidence with which one data set or method can be compared to another. Project data are comparable when evaluated against similar quality objectives and when utilizing similar methodology and reporting requirements. All projects contributing to the Delta RMP must maintain comparability by following the provisions outlined in the Delta RMP Data Management Plan (to be completed in December 2023).

7.2.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system. This assessment is typically expressed as a percentage of measurements reported within the prescribed limits associated with the respective DQOs, compared to those initially planned. Completeness evaluations ensure program requirements for data generation and reporting are met by contributing projects. Program completeness is assessed on three levels: field and transport, analytical, and batch completeness. Field completeness requires that sampling crews successfully visit each site, document the visit, and collect the field information and samples as outlined in **Elements 10-12**. Transport completeness requires that the samples collected by field crews are successfully transported to the laboratories. Analytical completeness is based on the number of samples successfully analyzed by the laboratory and for which valid results are generated. Batch completeness is based on whether batches were processed with the appropriate QC samples, as prescribed by the method or defined by the laboratory. Minimum QC sample frequency requirements can be found in **Element 14**.

7.2.5 Sensitivity and Resolution

Analytical sensitivity is commonly defined as the lowest value an instrument or method can measure with reasonable degree of certainty. Resolution is the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. These limits are important to know when evaluating the appropriateness of a method or instrument for the requirements of a given study. Reporting limits represent the level at which a method or instrument can accurately measure a target compound. Wherever analytically feasible, reporting limits should be lower than the required project action limit to be appropriate for the project.

7.3 PERFORMANCE CRITERIA

Measurement quality objectives are the specific criteria to which environmental or quality control measures are compared to determine acceptability. Measurement quality objectives for accuracy, precision, completeness, recovery, and contamination are assessed through a combination of instrument calibration and the analysis of duplicates, blanks, and spikes. Completeness is assessed based on the number of samples successfully obtained and validated for use and the proportion of quality control samples that are within acceptance criteria. Measurement quality objectives are listed below and in **Table 5** and **Table 6** and are the performance criteria utilized to evaluate whether the data quality objectives were met.

Field measurements are taken with multi-parameter systems; accuracy and precision are measured during calibration (if applicable), taking into account the manufacturer's specifications. For all other types of analyses, accuracy, precision, and recovery are assessed through the use of QC samples, including laboratory spikes and matrix spikes to assess accuracy and recovery, and laboratory and field duplicates to assess precision.

Table 5. Measurement quality objectives for field accuracy, precision, and completeness measurements.

Measurement quality objectives in measurements of accuracy, precision, and completeness. Field measurements occur once per event at each sampling site.

Constituent	Accuracy/Precision	Completeness
Dissolved Oxygen	±0.5 mg/L or ±10%	90%
pH	±0.5 units	90%
Specific Conductivity	±5%	90%
Temperature	±0.5 °C or ±10%	90%
Flow	±2%	90%

Table 6. Measurement quality objectives for laboratory accuracy, precision, and completeness measurements.

Constituent	Matrix Spike Frequency	Lab Control Spike Frequency[1]	Matrix Spike Recovery	Lab Control Spike Recovery	Lab Duplicate Frequency[2]	Precision	Completeness
Ancillary Parameters							
Suspended Sediment Concentration	NA	1 per batch	NA	50-150%	NA	NA	90%
Turbidity	NA	1 per batch	NA	80-120%	1 per batch	RPD ≤ 25	90%
PFAS							
Perfluorooctanesulfonic acid (PFOS)	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 30	90%
Perfluorooctanoic acid (PFOA)	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 30	90%
PPCPs							
Bisphenol A	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%
Diclofenac	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%
Estradiol, 17beta-	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%
Estrone	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%
Ethynylestradiol, 17alpha-	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%
Gemfibrozil	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%
Ibuprofen	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%
Iopromide	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%
Naproxen	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%
Progesterone	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%
Salicylic Acid	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%
Testosterone	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%
Triclosan	NA	1 per batch	NA	50-150%	1 per batch	RPD ≤ 25	90%

Constituent	Matrix Spike Frequency	Lab Control Spike Frequency[1]	Matrix Spike Recovery	Lab Control Spike Recovery	Lab Duplicate Frequency[2]	Precision	Completeness
Galaxolide	1 per batch	1 per batch	50-150%	50-150%	1 per batch	RPD ≤ 25 n/a if concentration of either sample < MDL	90%
Triclocarban	1 per batch	1 per batch	50-150%	50-150%	1 per batch	RPD ≤ 25 n/a if concentration of either sample < MDL	90%

[1] A certified reference material (CRM) may be used in place of a laboratory control spike.

[2] A matrix spike duplicate or a laboratory control spike duplicate may function as the laboratory duplicate in any batch.

All environmental and QC samples analyzed for PPCPs by gas chromatography must also be spiked and processed with a mixture of surrogate analytes to monitor extraction efficiency and analytical performance. The required surrogate analytes and their acceptability criteria are outlined in **Table 7**.

Table 7. Surrogate sample requirements for CEC constituents analyzed in water.

Surrogate Constituent	Laboratory	Method	Fraction	Frequency	Surrogate Recovery
Galaxolide-d_6	Physis	EPA 625.1M	Total	Every sample	30-130%
Triclocarban-$^{13}C_6$	Physis	EPA 625.1M_ MRM	Total	Every sample	50-150%

Constituents analyzed using isotope dilution methods are spiked and processed with standards containing isotopically labelled versions of the target analytes or chemicals similar to the target analyte (the analogue). The response of the isotope dilution analogues (IDAs) is used to quantify the result concentrations of the unlabeled analytes present in the sample matrix, and the percent recovery of these IDAs can also be used to monitor extraction efficiency and analytical performance. All environmental and QC sample results analyzed for PFAS and PPCPs using an isotope dilution method must be reported with the recovery of the associated IDA used for the quantitation of that result. The required IDAs and their acceptability criteria are outlined in **Table 8.**

Table 8. Isotope Dilution Analogue sample requirements for CEC constituents analyzed in water.

IDA	Target Analyte	Quantification Type	Agency	Method	Frequency	Surrogate Recovery
PFAS						
Perfluorooctanesulfonic acid-$^{13}C_8$ (IsoDilAnalogue)	Perfluorooctanesulfonic acid	Direct Isotope	Enthalpy	EPA 537M	Every sample	25-150%
Perfluorooctanoic acid-$^{13}C_2$ (IsoDilAnalogue)	Perfluorooctanoic acid-	Direct Isotope	Enthalpy	EPA 537M	Every sample	25-150%
PPCPs						
Bisphenol A-d_{16}(IsoDilAnalogue)	Bisphenol A	Direct Isotope	Weck	EPA 1694M	Every sample	50-200%
Estradiol-d_3, 17beta-(IsoDilAnalogue)	Estradiol, 17beta-	Direct Isotope	Weck	EPA 1694M	Every sample	50-200%
Ethynylestradiol-d_4, 17alpha-(IsoDilAnalogue)	Diclofenac	Indirect Isotope	Weck	EPA 1694M	Every sample	50-200%
	Estrone	Indirect Isotope	Weck	EPA 1694M	Every sample	50-200%
	Ethynylestradiol, 17alpha	Direct Isotope	Weck	EPA 1694M	Every sample	50-200%
Gemfibrozil-d_6 (IsoDilAnalogue)	Gemfibrozil	Direct Isotope	Weck	EPA 1694M	Every sample	50-200%
Ibuprofen-d_3 (IsoDilAnalogue)	Ibuprofen	Direct Isotope	Weck	EPA 1694M	Every sample	50-200%
Naproxen-d_3 (IsoDilAnalogue)	Naproxen	Direct Isotope	Weck	EPA 1694M	Every sample	50-200%
Progesterone-d_9 (IsoDilAnalogue)	Progesterone	Direct Isotope	Weck	EPA 1694M	Every sample	50-200%
Salicylic Acid-d_4 (IsoDilAnalogue)	Iopromide	Indirect Isotope	Weck	EPA 1694M	Every sample	50-200%
	Salicylic Acid	Direct Isotope	Weck	EPA 1694M	Every sample	50-200%
Testosterone-d_3 (IsoDilAnalogue)	Testosterone	Direct Isotope	Weck	EPA 1694M	Every sample	50-200%
Triclosan-d_3 (IsoDilAnalogue)	Triclosan	Direct Isotope	Weck	EPA 1694M	Every sample	50-200%

7.4 PROJECT ACTION LIMITS

Water Quality Metrics are provided to the Delta RMP by the CVRWQCB by July 1 annually; these values are provided in **Table 16**. Water quality results that exceed these Water Quality Metrics must be reported to the CVRWQCB within 60 calendar days of sample analysis, per R5-2021-0054. At this time there are no Water Quality Metrics identified for CEC constituents.

7.5 ACCEPTANCE CRITERIA

Previously collected information (not generated under this QAPP) or data collected by other monitoring entities will undergo a more general QA/QC review to identify potentially erroneous data. **Element 18** identifies non-direct measurements that may be used for this project and provides general guidance for evaluating the data quality. Non-direct measurements must meet the minimum requirements outlined within **Element 18** before being accepted for use. The necessity and means by which external data are used and evaluated will be specified in the relevant data reports.

8 SPECIAL TRAINING/CERTIFICATIONS

8.1 SPECIALIZED TRAINING OR CERTIFICATIONS

All personnel performing sampling are trained in proper sampling techniques. Training includes a review of all SOPs and detailed information on filling sample bottles for the various types of analysis and proper procedures for filling field QC samples. Other topics covered are sample transport, calibration, use and maintenance of meters, and sample site confirmation. To further safeguard against sampling error, all sampling by personnel undergoing training is done under the supervision of more experienced personnel who accompany sampling crews each time they go in the field until training is completed. In addition to sampling training all sampling staff attend a field safety course.

8.2 TRAINING OF PERSONNEL

The Field Lead is responsible for training all sampling personnel in field sampling and safety (**Table 9**). Laboratory training takes place at the appropriate laboratory. Laboratory training procedures are outlined in the respective laboratory Quality Assurance Manual (QAM); QAMs are on file with the respective laboratories and are available for review upon request.

Table 9. Specialized personnel training and certification.

Specialized Training Course Title or Description	Training Provider	Personnel Receiving Training/ Organizational Affiliation	Location of Records & Certificates
Field Sampling	Matthew Bundock, Field Lead	All Sampling Personnel	MLJ Environmental Offices
Field Safety	Matthew Bundock, Field Lead	All Sampling Personnel	MLJ Environmental Offices

8.3 TRAINING AND CERTIFICATION DOCUMENTATION

Field training documentation will record the types of training provided in preparation for sampling activities including the name of trainer, name(s) of trainee(s), and dates on which training occurred. These records will be maintained at the respective field office. Laboratory training records and documentation of demonstrations of capability are maintained by the respective Laboratory QA Officer.

8.4 TRAINING AND CERTIFICATION OVERSIGHT

It is the responsibility of the QA Officers for contracted laboratories, and the responsibility of the Field Lead for the samplers, to ensure that all employees achieve satisfactory training, including any necessary certifications. Signatures of participants are collected as evidence of attendance and this documentation is kept at the respective laboratory or field office.

8.5 OBTAINING TRAINING AND CERTIFICATION RECORDS.

To obtain copies of sampler training materials and documentation, contact the Program Manager. Contract laboratory training and certification records can be obtained from the contract Laboratory QA Officer identified in **Element 3** of this QAPP.

9 DOCUMENTATION AND RECORDS

9.1 REPORT FORMAT

Field records, sample records, and data records for each sample collected are submitted by field and laboratory staff to the CV RDC Data Manager. These records are filed and maintained by the CV RDC DMT and are distributed to the appropriate Delta RMP Stakeholders and interested parties. All laboratory data are received as CEDEN-comparable EDDs, which are uploaded to the CV RDC by the DMT.

Preliminary raw data and monitoring results shall be provided to the CVRWQCB within 60 calendar days from the date of sample analysis. Sampling and monitoring results shall be submitted to the CVRWQCB within 6 months from the date of sample analysis and the data must go through primary quality verification and corrective actions completed, if applicable.

9.2 ADDITIONAL DOCUMENTS AND RECORDS

Additional documents may include photographic documentation, summary reports, meeting notes, presentations, and reports. All forms of documentation must be held on file where they are readily available if requested.

Reporting of results that exceed any Water Quality Metrics provided in **Table 16** will occur within 60 calendar days of the sample analysis, per R5-2021-0054. Exceedance reports will be submitted electronically to the CVRWQCB by the Program Manager or a delegate. Copies of exceedance reports will be retained and maintained by the Program Manager.

9.3 RETENTION OF DOCUMENTS AND RECORDS

All data and/or other products created by the program will be retained by the participating entities and contract laboratories for a minimum of 10 years. The documents may be held for 10 years as electronic copies. Servers where the files reside will be backed up nightly.

Table 10. Document and record retention, archival, and disposition information.

Record Type	Record Needed	Retention	Archival	Disposition
Sample Collection Records	Field Sheets	MLJ Environmental	MLJ Environmental	Stored in MLJ office for at least 10 years
Sample Transfer Records	COC/Analytical Request Forms	MLJ Environmental	MLJ Environmental	Stored at lab or in MLJ office for at least 10 years
Analytical Records	Laboratory Reports and Electronic Data Deliverables	MLJ Environmental	MLJ Environmental	Stored at lab or in MLJ office for at least 10 years
Data Records	CV RDC	Remote Server, Moss Landing	Remote Server, Moss Landing	Permanent Storage on Remote Server
Assessment Records	CEC Data Reports	MLJ Environmental	MLJ Environmental	Permanent Storage on Delta RMP Website

9.4 ELECTRONIC RECORD BACKUPS

All electronic copies of files maintained by MLJ Environmental are stored on a third-party cloud server. Records maintained on this server are backed up every 12 hours to a remote data center and backups are retained for 14 hours.

Files stored by MLJ Environmental on a web-based sharing platform to provide access to Delta RMP stakeholders are housed on a third-party cloud server with nightly backups replicated to at least one independent server to create redundancy and allow for instant replication if a failure occurs.

The Program Manager in coordination with the Data Manager will maintain the records in the CV RDC database; data management procedures including back-up plans for data stored in the CV RDC are outlined in **Element 19** of this QAPP.

9.5 QAPP DISTRIBUTION

The Program Manager will ensure that copies of this QAPP will be distributed to all parties involved with the project. Electronic copies will be sent to all labs for review and reference. Final, approved copies will also be published on the Delta RMP website (DeltRMP.org). Any future amended QAPPs will be held and distributed in the same fashion. All originals and subsequent amended QAPPs will also be held at the CVRWQCB.

GROUP B. DATA GENERATION AND ACQUISITION

10 SAMPLING PROCESS DESIGN

Any deviations from the design outlined in the approved Monitoring Workplan and in this QAPP must be approved by the CVRWQCB prior to implementation. When prior approval is not possible, deviations must be reported to the CVRWQCB QA Representative within 7 calendar days of the BOD or contractors becoming aware of the deviation.

10.1 DESIGN STRATEGY

The CEC Pilot Study specifies collection of CECs in aqueous, sediment, and tissue matrices over a three-year period in the Delta. The study was designed to include different monitoring elements for each of the three years. The third year of this monitoring will be conducted under this QAPP according to the design summarized below.

Year 3 sample collection is scheduled for FY 23-24, with the goal of addressing the following element to complete the CEC Pilot Study:

- Year 3– gradient study and second year of source monitoring. The third year continues only the source monitoring from Year 2 and adds gradient studies upstream and downstream of POTWs.

The Year 3 gradient study evaluates POTW discharge CEC attenuation in Dry Creek in Roseville, CA and in Old Alamo Creek near Vacaville, CA. These receiving waters are consistent with effluent dominated inland waters (Scenario 1) identified in the Statewide CEC Pilot Study Monitoring Plan.[1] The Delta RMP CEC TAC reviewed the Year 1 and Year 2 preliminary data summaries and recommended including all Stakeholder Work Plan constituents in the Year 3 study. All constituents except testosterone were detected in POTW source waters or immediately downstream. Bisphenol A was detected in method blanks and/or field blanks in each event at concentrations similar to environmental concentrations. Therefore, bisphenol A was recommended for Year 3 sample collection and analysis methods evaluation.

[1] "Alamo Creek downstream of the Vacaville Easterly WWTP and Pleasant Grove downstream of the City of Roseville Pleasant Grove WWTP" is specified in the Statewide CEC Pilot Study Monitoring Plan.

For each POTW gradient study, samples are collected from one effluent discharge location, one location upstream of the effluent discharge, and five downstream locations which represent the effluent flow path in the waterbody. Sample collection of two MS4 urban runoff sites is scheduled to occur during the two gradient study sampling events. Year 3 MS4 urban runoff monitoring sites are in Roseville, CA and Sacramento, CA.

Surface water samples will be collected for the CEC constituents identified in **Table 3** over the course of two sampling events. These events will occur during dry-weather conditions when treated wastewater is expected to be the largest source of CECs in the effluent-dominated receiving waters monitored for the gradient studies, as recommended by the Statewide CEC Pilot Study Monitoring Plan. Upon approval of this QAPP, monitoring may begin as early as July 1, 2023, and is anticipated to be completed by October 31, 2023, provided significant storms have not occurred prior to the sample collection period (see **Table 13**).

10.1.1 Gradient Study Sampling Design

The Year 3 gradient study will characterize the spatial distribution of CECs and hydraulic dilution or degradation of CECs. The study reaches are designed to be long enough to gather information about both the attenuation of CECs expected to attenuate rapidly and persistent CECs. The study will inform future studies on degradation rates and sample collection strategies and methods.

CECs may have different attenuation rates, these processes were assumed to follow an exponential decay [2] for this design strategy where the attenuation rate is higher where CECs exist at higher concentrations (i.e., near to the source). The downstream sites were chosen at increasing distances downstream from the POTW source to follow the expected exponential decay curve model for attenuation of CECs along the study reaches. **Figure 4** identifies the study "flow path" which is the downstream path of POTW effluent where attenuation distance is measured.

At each of the flow path sample locations, a mass balance spatial boundary can be defined as shown in **Figure 4**. For each of these spatial boundaries (i.e., each flow path sample location) a mass flux balance can be performed where mass flux (mass per time) is the product of flow and concentration. A generalized mass balance equation would be:

$$mass\ flux_{in} = mass\ flux_{out} + unmeasured\ massflux + mass\ acumulation\ rate - mass\ decay\ rate + error$$

[2] dC/dt = -kC for a first order decay reaction. Where k is the decay rate and C is the concentration of the contaminant.

In the case of this study design, the mass flux in and the mass flux out (blue terms in the above equation) are the only factors measured; the remaining factors could result in the mass flux in and the mass flux out being unequal, or could contribute to unknown error (e.g., unmeasured mass flux [in] and mass decay rate, if equal, could lead to an incorrect conclusion that there was no change in mass flux in/out when there was a change).

An assessment of observed attenuation and mass balance at each study location will be assessed as a part of the Year 3 Study Plan (see **Element 21**).

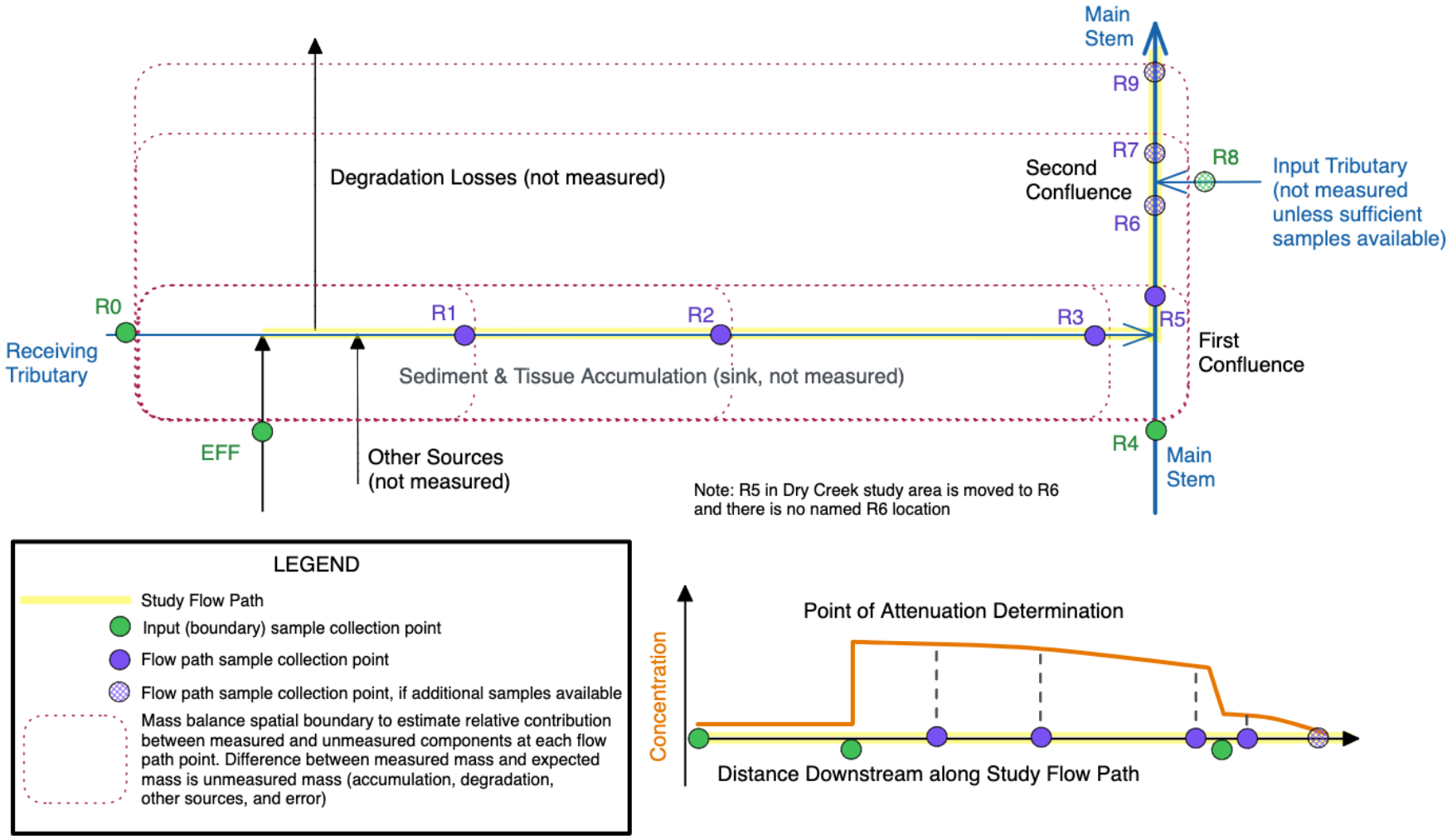
The waterbodies in which attenuation of CECs will be evaluated for each study area are defined in **Table 11**. Wherever possible, inputs to the study flow path will be measured upstream of the study flow path and immediately downstream to evaluate the effects of additional inputs on any observed attenuation. For each study area (i.e., "POTW 1" for Dry Creek and "POTW 2" for Old Alamo Creek), the three waterbodies evaluated are:

- **Receiving tributary** – the immediate receiving water for the effluent. The effluent input and, if applicable, any upstream inputs will be monitored as the input samples for this waterbody. Three study flow path samples will be collected from the first confluence with the main stem as shown in **Table 12**.
- **Main stem** – the larger waterbody into which the receiving tributary flows at the first confluence. If there is water upstream of the receiving tributary, the upstream input and immediately downstream of the confluence will be monitored. Includes the additional sites along the main stem leading up to the second confluence.
- **Input tributary** – an additional tributary which meets the main stem at the second confluence. The input tributary upstream and downstream of the main stem confluence will only be monitored when there are insufficient input sites on the receiving tributary and main stem to reach seven sample locations.

Table 11. Waterbodies assessed for each gradient study area.

Waterbody Type	Sites	Study Area POTW 1	Study Area POTW 2
Effluent	EFF	POTW1	POTW2
Receiving Tributary	R0, R1, R2, R3	Dry Creek	Old Alamo Creek
Main Stem	R4, R5, R6, R7, R9	Steelhead Creek	New Alamo Creek
Input Tributary	R8	Robla Creek	Ulatis Creek

Figure 4. Gradient study mass balance schematic and flow path of point of attenuation diagram.



10.1.2 Gradient Study Sampling Strategy

A total of nine possible sample collection sites are identified for each gradient study area. A description of each of these locations and sample types is provided in **Table 12**.

The seven required gradient study samples will be collected according to the strategy outlined in **Figure 5** and **Figure 6.** The preferred sample locations would assess the effluent (EFF), an upstream input (R0), and five downstream locations (R1-R5). Given the dry season conditions in which sampling will occur, up to four alternate sites (R6-R9) further downstream on the main stem and input tributaries have also been identified such that a total of seven samples can still be collected if the upstream input site (R0) and/or the main stem input site (R4) do not have flowing water to be sampled.

Any samples collected immediately downstream of a confluence with both waterbodies flowing should be collected as spatial (transect) composite samples (if safe to do so). All other samples will be collected as single grab samples as outlined below.

Table 12. Gradient sample types, descriptions, and sampling priority for additional sites.

Gradient Sample Type	Waterbody	Sample Type	Site Location Description
Preferred Sites			
R0	Receiving Tributary	Input	Upstream location in NPDES permit. If site has no upstream flow, do not collect sample and add a downstream location.
EFF	NA	Input	Effluent sample at NPDES permit location as a grab sample.
R1	Receiving Tributary	Flow Path	First receiving water (tributary) downstream location.
R2	Receiving Tributary	Flow Path	Second receiving water (tributary) downstream location.
R3	Receiving Tributary	Flow Path	Third receiving water (tributary) downstream location.
R4	Main Stem	Input	Upstream of confluence on main stem, if flow is not measurable, move to R6.
R5	Main Stem	Flow Path	Downstream of confluence on main stem if flow is measurable at R4.
Alternate Sites			
R6	Main Stem	Flow Path	Main stem upstream of next flowing tributary confluence.
R7	Main Stem	Flow Path	Main stem downstream of next flowing tributary confluence.

Gradient Sample Type	Waterbody	Sample Type	Site Location Description
R8	Input Tributary	Input	Tributary upstream of confluence with main stem.
R9	Main Stem	Flow Path	Main stem gradient site not associated with a confluence

The strategy for sampling is summarized below. A determination or measurement of "dry" means that there is either 1) no water present at the site, 2) water only present in isolated pools, or 3) no positive water velocity present (i.e., measured as zero flow).

- On the day of sample collection, field crews will measure flow at the site upstream of the POTW discharge.
    - If flow is present at this site, a grab sample (Upstream) will be collected to measure ambient CEC levels of the receiving water.
- Following the upstream sample collection, an effluent grab sample (EFF) will be collected at the POTW discharge site.
- Moving downstream from the POTW source site, three consecutive downstream samples (R1, R2, and R3) will be collected.
- If flow is present in the upstream site, a grab sample (R4) will be collected. If the stream is not wadable, a shore grab as far into the stream is acceptable.
- Following this upstream collection (R4), a downstream main stem composite sample (R5) will be collected by filling the sample bottle one-third for each of the three mid-third, mid-depth locations in a transect across the main stem.
    - If there is no flow at the main stem upstream location (R4), a grab sample will be collected from R5.
- Sampling will occur at the next flowing main stem upstream of the next flowing tributary confluence (R6) if the upstream confluence site (R4) is dry.
    - For the POTW 1 study area, samplers will proceed directly from R5 to the Steelhead Creek site downstream of the second confluence with Robla Creek (R7). There is no R6 site identified for Steelhead Creek because the distance along the main stem between the first confluence (terminus of Dry Creek) and the second confluence (terminus of Robla Creek) is relatively short compared to the scale of the overall study area (500 meters compared to > 20 kilometer study area) with no known inputs between those two confluences. Therefore, there is not likely an appreciable difference in attenuation between a sample collected immediately downstream of Dry Creek and a sample collected immediately upstream of Robla Creek and an additional sample (R6) along this section of the main stem would be redundant. The R5 site on Steelhead Creek will serve the

purpose of evaluating the sample flow path as influenced by any upstream inputs from Steelhead Creek, as well as establishing the main stem conditions prior to the input tributary of Robla Creek.

- If both upstream sites (R0 and R4) are dry, a main stem downstream location (R7) of the alternate confluence will be sampled.
- If seven samples are not yet reached, the tributary upstream of the confluence with the main stem (R8) will be sampled.
- If seven samples are still not yet reached, the final downstream site (R9) is sampled.

For the POTW 1 study area, field crews will scout the area from Magpie Creek to the Sacramento River to determine if there is a feasible access point for the farthest downstream alternate site (R9) that is closer to the other gradient study sites. Any changes to monitoring locations will require CVRWQCB and State Board QA Officer approval prior to implementation.

Figure 5. Gradient study sample collection strategy with associated sample counts.

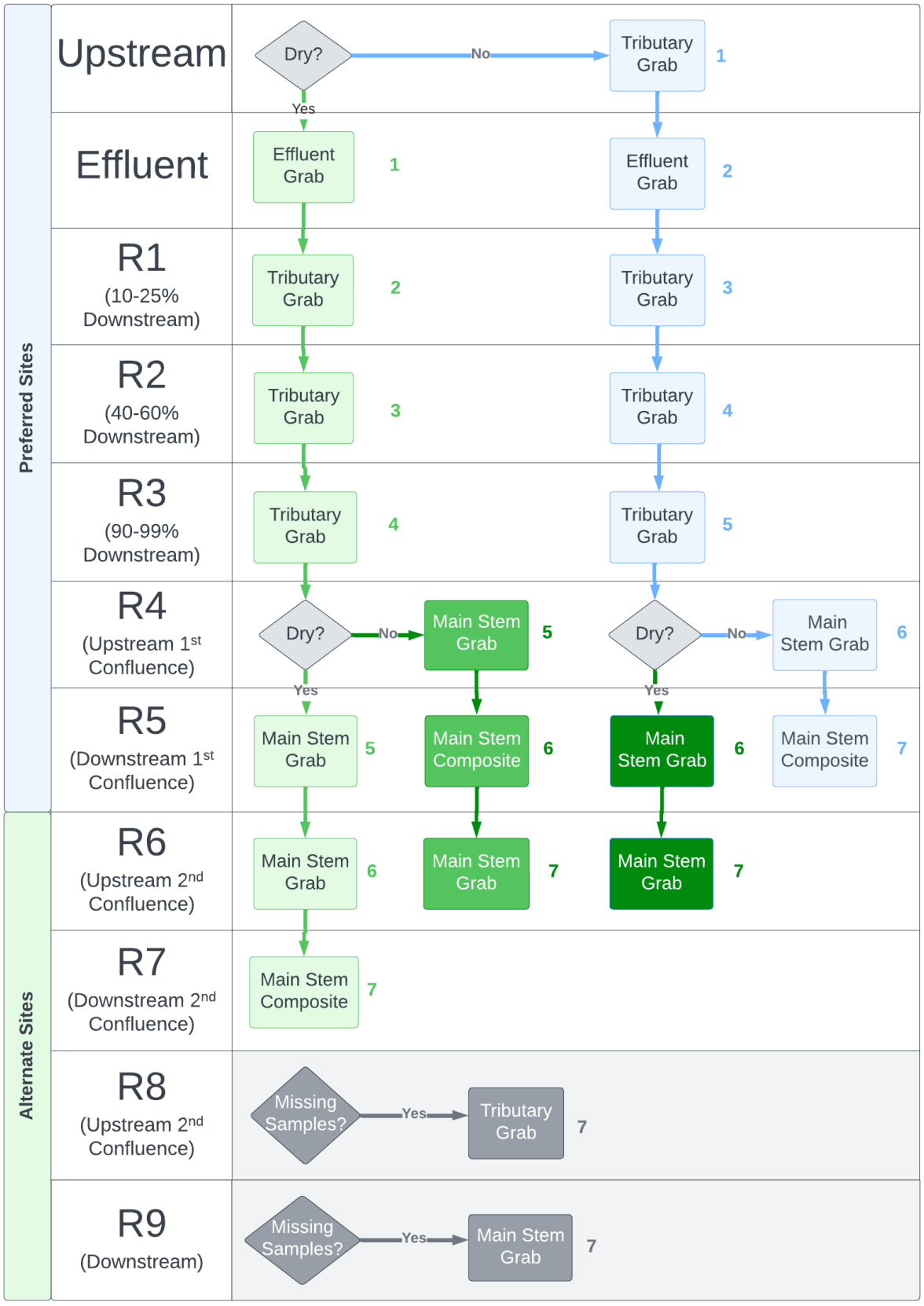
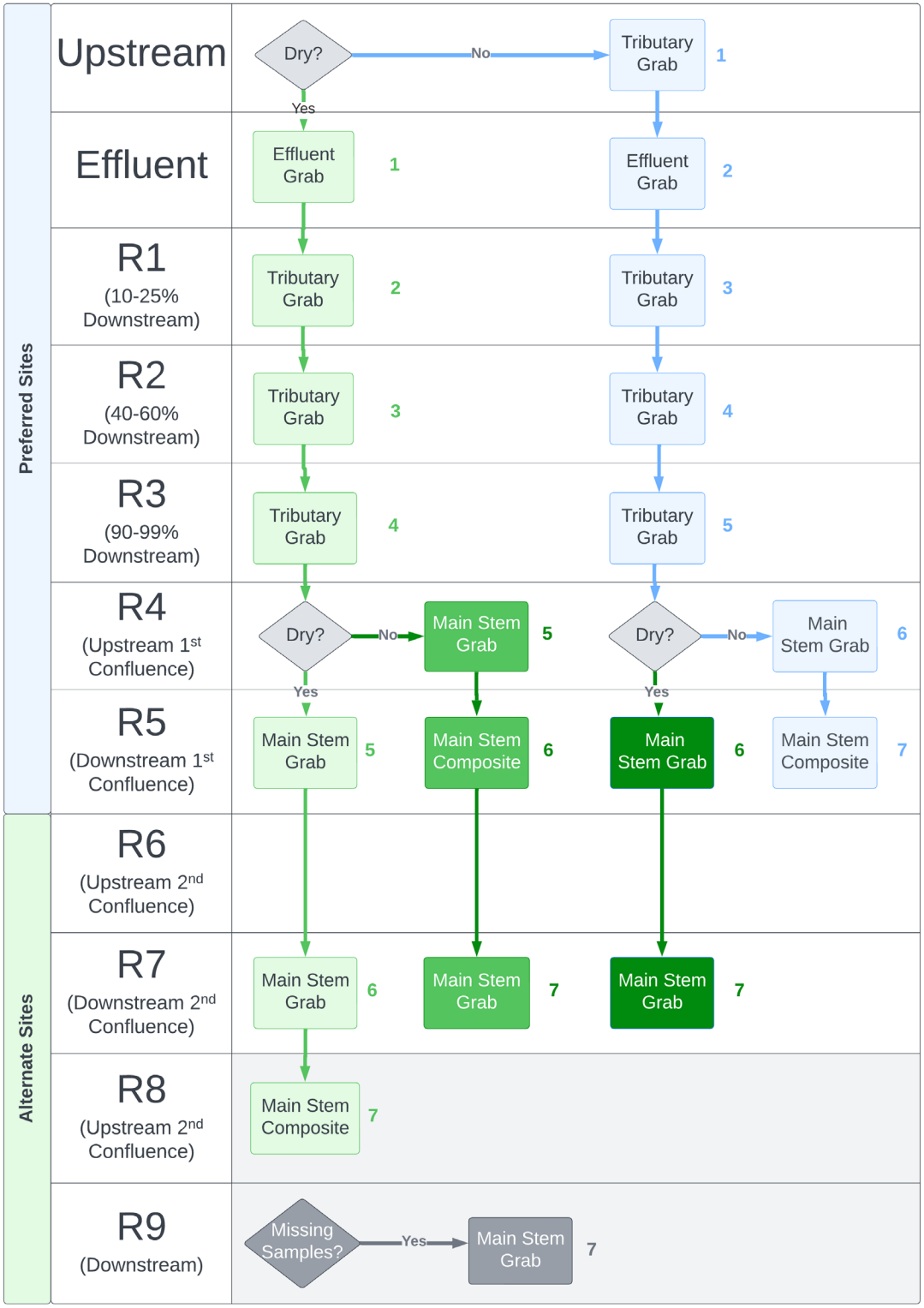


Figure 6. Adjusted gradient sample collection strategy for the POTW 1 study area.
An R6 monitoring site is not identified for the POTW 1 study area because the relatively short distance (500 meters) between the first and second confluence would result in redundant data collection. If necessary, samplers will proceed from R5 (downstream of the first confluence) to R7 (downstream of the second confluence) for the POTW 1 study area.



10.2 SAMPLE COLLECTION

For each sampling event, a total of seven samples will be collected for each gradient study and one sample for each MS4 urban runoff site. Urban runoff sites may be collected within 1-3 days of the gradient study monitoring, as deemed necessary by field crews. In addition, field crews will visit the gradient study sites two days prior to monitoring to evaluate the conditions and accessibility of each monitoring site and prepare a sampling plan (see **Element 11.1.2**). All gradient sample locations within a study area must be sampled on the same day; samples will be collected in consecutive order from upstream to downstream locations.

Sampling events should reflect dry conditions in each gradient study area. Therefore, gradient sample areas must not have received rainfall for a minimum of two weeks prior to the sample date. In addition, there must be at least two weeks between the first and second sampling events, as recommended in the Year 3 Study Plan. Sample collection schedule requirements are outlined in **Table 13**.

Table 13. Sample event timing criteria for CEC monitoring.

Sampling Event	Sample Collection	Sampling Period	Additional Criteria
Events 1 and 2	MS4 Urban Runoff Sampling	Within 3 days of each gradient monitoring.	None
Events 1 and 2	Pre-Sampling Reconnaissance	Two days prior to gradient monitoring.	Sampling Plan will be developed prior to gradient collection (**Element 10.3**).
Event 1	Gradient Study Event 1	August through September	No rainfall greater than 0.1 inches within the study area for 72 hours prior to sampling. [1,2]
Events 2	Gradient Study Event 2	September through October	The second sampling event must occur at least two weeks after the first sampling event. No rainfall greater than 0.1 inches within the study area for 72 hours prior to sampling. [1,2]

[1] Rainfall for the POTW 1 study area will be determined using DWR CDEC precipitation gauge: RLN (https://cdec.water.ca.gov/dynamicapp/staMeta?station_id=RLN)
[2] Rainfall for the POTW 2 study area will be determined using DWR CDEC precipitation gauge: VEW (https://cdec.water.ca.gov/dynamicapp/staMeta?station_id=VEW)

The specific monitoring locations selected to follow the sampling strategy outlined above in **Element 10.1.2** are provided in **Table 14**. The Gradient study area sites are shown in **Figure 7** and **Figure 8.** Specific rationale for each site selected for monitoring is provided in **Table 14**.

Table 14. Sampling locations.

Study Area	Station Type	Water body	Station Description	CEDEN Station Code	Latitude	Longitude	Datum	Distance From Discharge (meters)	Site Location Basis
Source Locations									
NA	MS4	Runoff	Sacramento Urban Runoff 3; Sump 111	519SACUR3	38.60127	-121.49296	WGS 84	NA	CEC Pilot Study
NA	MS4	Runoff	Roseville Urban Runoff	519PGC010	38.80477	-121.32733	WGS 84	NA	CEC Pilot Study
1	EFF	Effluent	POTW Source 1 effluent discharge to Dry Creek	519POTW01	38.73402	-121.32185	WGS 84	NA	CEC Pilot Study
2	EFF	Effluent	POTW Source 2 effluent discharge to Old Alamo Creek	511POTW02	38.34664	-121.90156	WGS 84	NA	CEC Pilot Study
POTW 1 Gradient Study Area									
1	R0	Receiving Tributary	Dry Creek before POTW Source 1	519DRYCRK	38.7341	-121.31444	WGS 84	60	NA
1	R1	Receiving Tributary	Dry Creek at Cook Riolo Rd bridge	519DRYCRB	38.73672	-121.33670	WGS 84	2,200	Accessible from roadway
1	R2	Receiving Tributary	Dry Creek at Watt Ave bridge	519DRYWAB	38.73456	-121.39290	WGS 84	7,300	Accessible from roadway; increasing distance from previous location
1	R3	Receiving Tributary	Terminus of Dry Creek at Rio Linda Blvd	519DRYRLB	38.67109	-121.45415	WGS 84	17,000	Accessible from roadway; increasing distance from previous location

Study Area	Station Type	Water body	Station Description	CEDEN Station Code	Latitude	Longitude	Datum	Distance From Discharge (meters)	Site Location Basis
1	R4	Main Stem	Steelhead Creek main stem Upstream of confluence with Dry Creek	519SHCUDC	38.665806	-121.477325	WGS 84	NA	Accessible upstream on main stem
1	R5	Main Stem	Steelhead Creek main stem Downstream of confluence with Dry Creek	519SHCDDC	38.66407	-121.47720	WGS 84	19,700	Accessible downstream on main stem.
1	R6 [1]	Main Stem	NA	NA	NA	NA	NA	NA	NA
1	R7	Main Stem	Steelhead Creek main stem downstream of Robla and Steelhead Creek confluence	519SHCDRC	38.6565	-121.475453	WGS 84	20,600	Closest accessible downstream of Robla Creek
1	R8	Input Tributary	Terminus of Robla Creek at Rio Linda Blvd	519RCARLB	38.66811	-121.45018	WGS 84	NA	Closest accessible location to terminus of Robla Creek
1	R9	Main Stem	Steelhead Creek main stem upstream of San Juan Rd overpass	519SHCUSJ	38.63031	-121.47053	WGS 84	23,600	Closest accessible downstream location with minimal additional influence.

Study Area	Station Type	Water body	Station Description	CEDEN Station Code	Latitude	Longitude	Datum	Distance From Discharge (meters)	Site Location Basis
1	R10	Main Stem	Steelhead Creek main stem upstream of Arcade and Steelhead Creek confluence	519SHCUAC	38.62185	-121.46890	WGS 84	24,600	Additional accessible downstream location.
POTW 2 Gradient Study Area									
2	R0	Receiving Tributary	Old Alamo Creek Before POTW Source 2	511OACUPS	38.34741	-121.90507	WGS 84	320	NA
2	R1	Receiving Tributary	Old Alamo Creek at Chicorp Ln.	511OACCLN	38.347147	-121.887617	WGS 84	1,300	Accessible location used as part of other study
2	R2	Receiving Tributary	Old Alamo Creek at Sunnybrook Ln.	511OACSBL	38.344197	-121.869089	WGS 84	3,200	Accessible location used as part of other study. Samples to be collected upstream of ag drains
2	R3	Receiving Tributary	Terminus of Old Alamo Creek upstream of confluence with New Alamo Creek	5110ACUNA	38.329869	-121.869231	WGS 84	4,800	Furthest downstream accessible location prior to confluence. Available flow measurement structure
2	R4	Main Stem	New Alamo Creek upstream of confluence with Old Alamo Creek	511NACUOA	38.329939	-121.888569	WGS 84	NA	Available flow measurement structure

Study Area	Station Type	Water body	Station Description	CEDEN Station Code	Latitude	Longitude	Datum	Distance From Discharge (meters)	Site Location Basis
2	R5	Main Stem	New Alamo Creek downstream of confluence between New and Old Alamo Creeks	511NACDOA	38.329789	-121.860019	WGS 84	5,500	Available flow measurement structure
2	R6	Main Stem	Terminus of New Alamo Creek at Rio Dixon Rd before confluence with Ulatis Creek	511NACARD	38.336511	-121.823136	WGS 84	9,500	Available flow measurement structure
2	R7	Main Stem	Ulatis Creek at Maine Prairie Rd downstream of confluence with Alamo Creek	511UCAMPR	38.329431	-121.813564	WGS 84	10,800	Nearest accessible downstream location
2	R8	Input Tributary	Ulatis Creek at Rio Dixon Rd upstream of confluence with Alamo Creek	511UCARDR	38.337831	-121.823219	WGS 84	NA	Nearest accessible upstream (Ulatis) location
2	R9	Main Stem	Ulatis Creek additional downstream site not associated with a confluence	511ULCABR	38.3070 [2]	-121.7942 [2]	WGS 84	13,900	Furthest downstream additional location

[1] An R6 monitoring site is not identified for the POTW 1 study area because the relatively short distance (500 meters) between the first and second confluence would result in redundant data collection.
[2] The coordinates provided are the target values referenced in CEDEN. Sampling personnel will use latitude 38.07011 and longitude -121.79425 to verify the sample location in the field.

Figure 7. Dry Creek and downstream gradient locations.

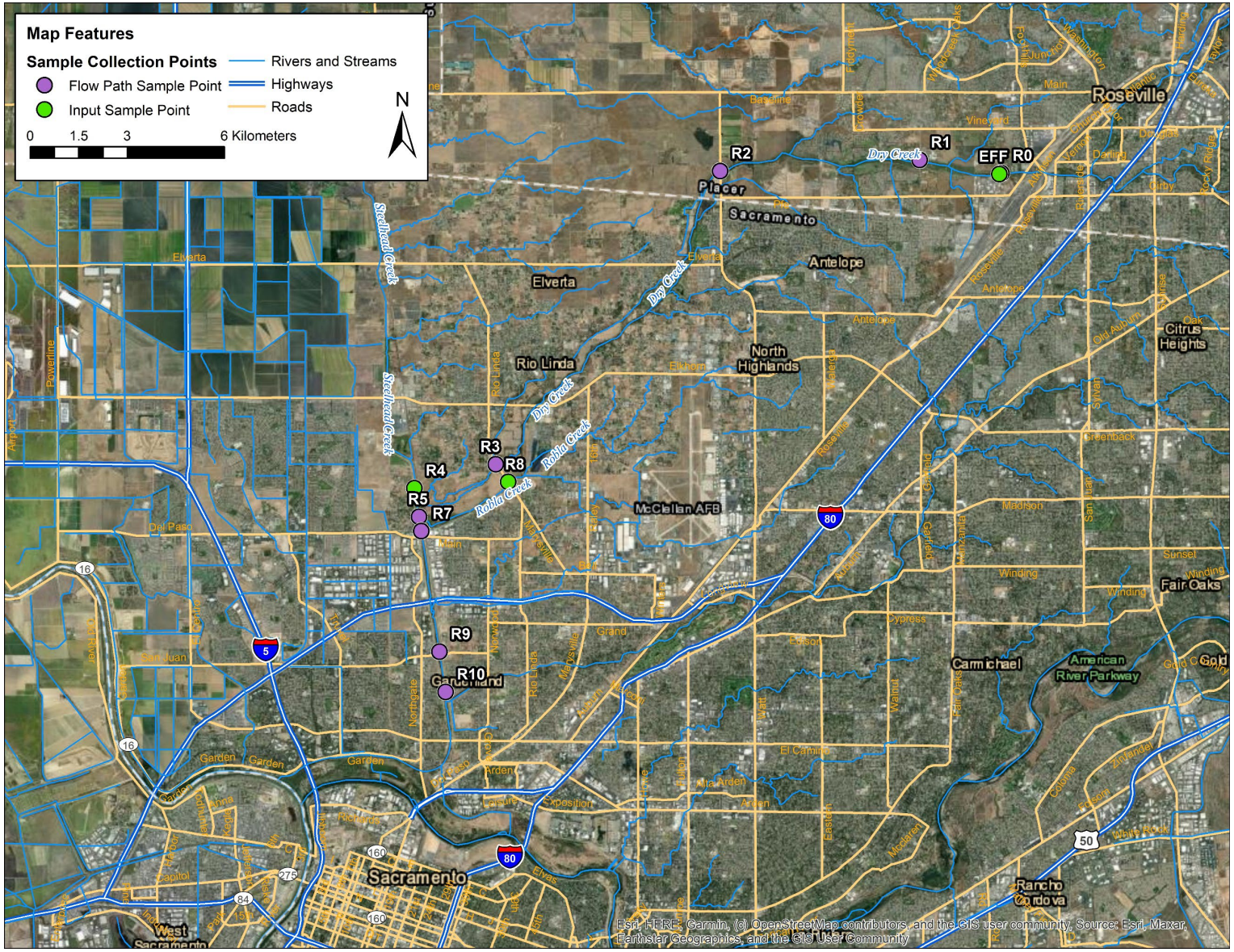
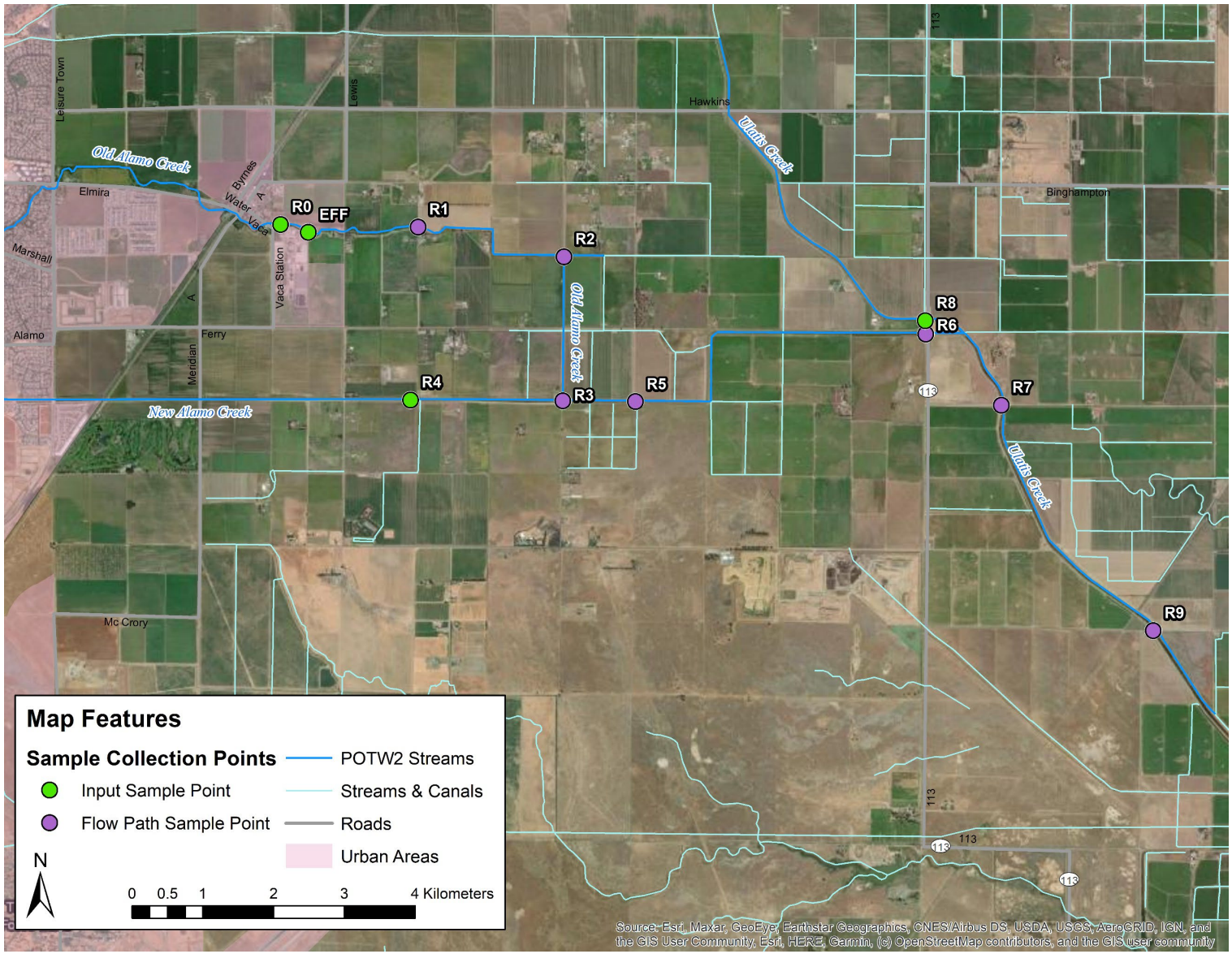


Figure 8. Old Alamo and downstream gradient locations.



10.3 TOTAL NUMBER OF SAMPLES

For each of the two events, seven samples will be collected at each gradient study waterbody and one sample will be collected at each of the two MS4 urban runoff sites, totaling 16 environmental samples for each event; a total of 32 environmental samples are anticipated for the Year 3 monitoring.

11 SAMPLING METHODS

All samples are collected according to detailed SOPs (**Appendix I**). The SOPs contain instructions for collecting and preserving samples and cleaning equipment between samples. These methods are summarized below.

Sampling methods for the CEC Pilot Study have been developed to minimize influences of targeted CECs that could contaminate sample collection. To reduce potential contamination, materials used for collection are limited to items that are unlikely to be a source of contamination. Materials that could be a source of contamination and are used for staging the collection are not allowed in direct contact with sample collection bottles and equipment. Furthermore, materials that are known sources of contamination are restricted from being within the staging area.

Field crews will collect mid-stream, mid-depth ambient grab samples, unless otherwise specified (i.e., cross sectional composites). Composite samples are collected by filling the sample bottle one-third for each of three mid-third, mid-depth location in a transect across the main stem. If water is not wadable, shore grab samples are collected as close to mid-stream as possible considering conditions and safety concerns. Delta RMP field crews will collect one effluent grab sample following collection of the upstream sample and before the first downstream sample.

Gradients sample collection will begin at or before 9AM the day of collection. Effluent samples will be collected at approximately 9AM. If water is present and flowing in the R0 upstream site, the sample will be collected upstream prior to 9AM. Field crews then collect ambient samples moving down the flow path of the waterbody. If receiving water flows are estimated at one foot per second, the total travel distance in 18 hours is just over 12 miles. It is expected that the downstream locations can be sampled in a 6–8-hour period by one Delta RMP field crew. If measured velocities are slower than one foot per second, Delta RMP field crews may want to adjust the pace of downstream sample collection. While the goal of the gradient studies is to best capture the attenuation of the measured discharge concentration and mass, this Year 3 Study Plan is not designed or expected to track a single parcel of sampled effluent as it moves downstream.

Field crews will complete the standard field sheet provided in **Figure 9** for each location at which samples are collected. Any deviation to the procedures outlined in this QAPP must be either approved prior to implementation (if anticipated) or reported to the CVRWQCB within seven days (if unanticipated).

11.1.1 Flow Measurement Methods

Flow measurements are necessary to estimate mass flux of constituents and to answer study Question 2: "For each of the CEC constituents, can the relative magnitude of the type of attenuation (hydraulic or degradation/inputs) be quantified based on a simple mass balance with available flow, travel time, and concentration measurements or estimates?"

Where possible, in-stream flow gauges may be used to measure flow. Where installed gauges do not exist, field crews will make all in-stream flow measurements to calculate discharge (volumetric flow in cfs) according to USGS methodologies[3] wherever possible. The preferred methods for field flow measurements are methods 1 and 2 listed below. In-stream velocity measurements will be collected using rotating-element mechanical, electromagnetic, acoustic doppler, or acoustic digital current point velocity current meters. A determination or measurement of "dry" means that there was no water present at the site, water was only present in isolated pools, or that a positive water velocity was not present (i.e., measured as zero flow). A determination of "unmeasurable flow" means that site conditions did not allow flow measurement and the flow was estimated based on wetted perimeter measurement and an average velocity estimate.

1. At any monitoring location where there is measurable stream flow velocity and a wadable channel deep enough to measure velocity using a current meter, field crews will estimate volumetric flow using the current-meter midsection method. Data will be collected using the USGS current meter measurements by wading protocol. The USGS current-meter midsection method is an accurate method of measuring volumetric flow in the field and is the preferred field flow measurement method for the CEC gradient study. Field staff will select a cross section for current meter midsection flow measurements according to the USGS site selection methodology.[3]
2. At monitoring locations with culverts or weirs, field staff will collect the necessary data about culvert or weir geometry, flow depth, and in-stream velocity to calculate volumetric flow rates in cfs.
3. Field staff will decide if there are "unmeasurable flow" conditions at monitoring locations where in-stream velocities and stream depths are below the specified limits of current meters in all accessible cross sections at the monitoring site. When a site has unmeasurable flow, field staff will use a surface float method to estimate volumetric flow rates if possible. The cross-sectional area of the stream

[3] USGS (2010). Discharge Measurements at Gauging Stations. Chapter 8 of Book 3, Section A. Techniques and Methods 3-8A

will be measured in the field and a surface float will be used with a stopwatch to estimate velocity.

4. If any monitoring location lacks a wadable cross section (i.e., stream is too deep and current is too strong to safely wade across the channel), field staff will follow the USGS discharge measurement of deep, swift streams with a mechanical current meter. If there is a bridge located near the monitoring site, depth and velocity measurements should be taken from the bridge if safe to do so.

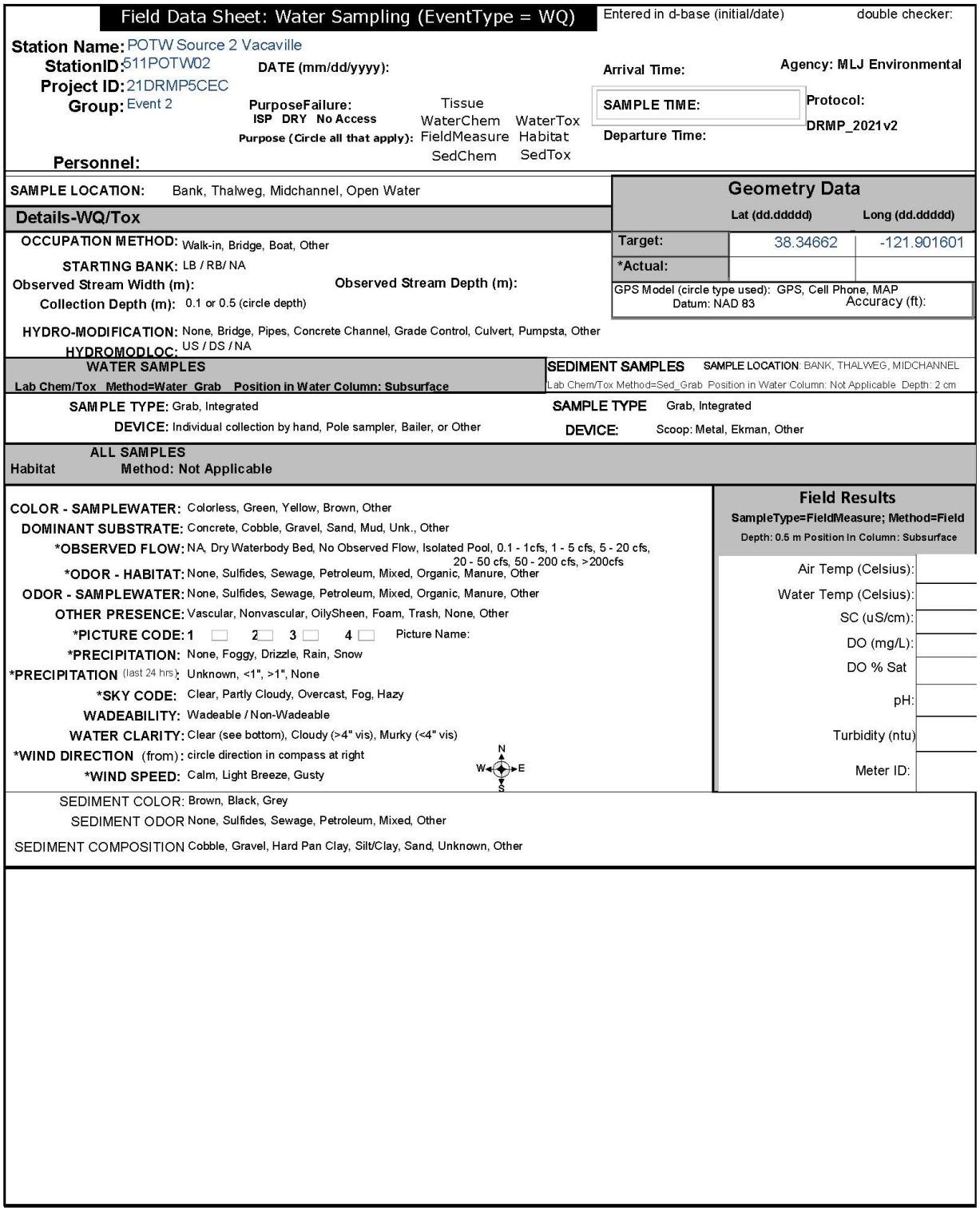
11.1.2 Pre-Sample Reconnaissance

Before each monitoring event, Delta RMP field crews will visit all gradient study downstream receiving water monitoring sites no less than two days and no more than three days before samples are collected. There will be at least one full day between the pre-monitoring visit and the day of sample collection to allow sufficient time to communicate the list of anticipated sample locations and for field crews to prepare sampling materials. Pre-event site visits will allow field staff to determine if any of the sites do not have measurable flow (are dry) or have safety concerns that make sampling infeasible at that location. The Delta RMP field crews will then generate a list of monitoring sites to collect samples from during the upcoming monitoring event based on the field conditions they observed during the pre-monitoring event site visits and the collection strategy outlined in **Figure 5**. The Project Manager and CVRWQCB QA Representative will review and approve the list of sites prior to monitoring. Actual sampling locations may deviate +/- 50 m from the Study Plan latitude and longitude coordinates if required by site conditions.

During the pre-sampling visit, field crews will visit all nine potential sampling locations for each study area and document site conditions using the Field Reconnaissance Sheet provided in **Figure 10**. Field crews will also collect site photos at all nine study locations. The Field Reconnaissance Sheet and site pictures will be provided to the Program Manager and the CVRWQCB QA Representative with the list of anticipated sample locations as the Sample Plan for each study area prior to sampling. This plan and any additional requested rationale or details of site conditions will be approved prior to sample collection.

The Program Manager will also provide Sample Plans and field summaries developed by field crews to stakeholders and CEC TAC members as monitoring coordination occurs. The Program Manager will track the planned and actual monitoring dates as they are established and communicate these events to the necessary stakeholders and advisors; the Delta RMP Program Manager is responsible for tracking and communicating to the CVRWQCB QA Representative, CEC TAC, and Steering Committee the status of monitoring.

Figure 9. Field sheet completed by field crews for collecting water samples.



Field Data Sheet: Water Sampling (EventType = WQ)

Entered in d-base (initial/date) double checker:

Station Name: POTW Source 2 Vacaville
StationID: 511POTW02
Project ID: 21DRMP5CEC
Group: Event 2
Personnel:

DATE (mm/dd/yyyy):
Arrival Time:
Agency: MLJ Environmental
SAMPLE TIME:
Departure Time:
Protocol: DRMP_2021v2

PurposeFailure: ISP DRY No Access
Purpose (Circle all that apply): Tissue WaterChem FieldMeasure SedChem WaterTox Habitat SedTox

SAMPLE LOCATION: Bank, Thalweg, Midchannel, Open Water

Geometry Data

	Lat (dd.ddddd)	Long (dd.ddddd)
Target:	38.34662	-121.901601
*Actual:		

GPS Model (circle type used): GPS, Cell Phone, MAP
Datum: NAD 83
Accuracy (ft):

Details-WQ/Tox

OCCUPATION METHOD: Walk-in, Bridge, Boat, Other
STARTING BANK: LB / RB/ NA
Observed Stream Width (m):
Observed Stream Depth (m):
Collection Depth (m): 0.1 or 0.5 (circle depth)
HYDRO-MODIFICATION: None, Bridge, Pipes, Concrete Channel, Grade Control, Culvert, Pumpsta, Other
HYDROMODLOC: US / DS / NA

WATER SAMPLES
Lab Chem/Tox Method=Water Grab Position in Water Column: Subsurface
SAMPLE TYPE: Grab, Integrated
DEVICE: Individual collection by hand, Pole sampler, Bailer, or Other

SEDIMENT SAMPLES SAMPLE LOCATION: BANK, THALWEG, MIDCHANNEL
Lab Chem/Tox Method=Sed_Grab Position in Water Column: Not Applicable Depth: 2 cm
SAMPLE TYPE Grab, Integrated
DEVICE: Scoop: Metal, Ekman, Other

ALL SAMPLES
Habitat Method: Not Applicable

COLOR - SAMPLEWATER: Colorless, Green, Yellow, Brown, Other
DOMINANT SUBSTRATE: Concrete, Cobble, Gravel, Sand, Mud, Unk., Other
*OBSERVED FLOW: NA, Dry Waterbody Bed, No Observed Flow, Isolated Pool, 0.1 - 1cfs, 1 - 5 cfs, 5 - 20 cfs, 20 - 50 cfs, 50 - 200 cfs, >200cfs
*ODOR - HABITAT: None, Sulfides, Sewage, Petroleum, Mixed, Organic, Manure, Other
ODOR - SAMPLEWATER: None, Sulfides, Sewage, Petroleum, Mixed, Organic, Manure, Other
OTHER PRESENCE: Vascular, Nonvascular, OilySheen, Foam, Trash, None, Other
*PICTURE CODE: 1 ☐ 2 ☐ 3 ☐ 4 ☐ Picture Name:
*PRECIPITATION: None, Foggy, Drizzle, Rain, Snow
*PRECIPITATION (last 24 hrs): Unknown, <1", >1", None
*SKY CODE: Clear, Partly Cloudy, Overcast, Fog, Hazy
WADEABILITY: Wadeable / Non-Wadeable
WATER CLARITY: Clear (see bottom), Cloudy (>4" vis), Murky (<4" vis)
*WIND DIRECTION (from): circle direction in compass at right
*WIND SPEED: Calm, Light Breeze, Gusty

N W E S

Field Results
SampleType=FieldMeasure; Method=Field
Depth: 0.5 m Position In Column: Subsurface

Air Temp (Celsius):	
Water Temp (Celsius):	
SC (uS/cm):	
DO (mg/L):	
DO % Sat	
pH:	
Turbidity (ntu)	
Meter ID:	

SEDIMENT COLOR: Brown, Black, Grey
SEDIMENT ODOR None, Sulfides, Sewage, Petroleum, Mixed, Other
SEDIMENT COMPOSITION Cobble, Gravel, Hard Pan Clay, Silt/Clay, Sand, Unknown, Other

Figure 10. Gradient study Field Reconnaissance sheet completed prior to sampling.

Field Reconnaissance Sheet
DRMP CEC Gradient Study

Sample Event: 1 2 Reconnaissance Date: _____
Personnel: _____ Anticipated Sample Date: _____

General Trip Comments:

Study Location:

Site	Site Name	Coordinates	Dry / ISP?	Can Sample?	Wade-able?	Sample Equipment	Flow Method	Comments
R0		Lat: Long:						
R1		Lat: Long:						
R2		Lat: Long:						
R3		Lat: Long:						
R4		Lat: Long:						
R5		Lat: Long:						
R6		Lat: Long:						
R7		Lat: Long:						
R8		Lat: Long:						
R9		Lat: Long:						

12 SAMPLING HANDLING AND CUSTODY

All sample bottles are labeled with indelible marker clearly stating sample ID, collection date and time, and collector. Immediately after collection, sample containers are checked for integrity (e.g., bottle caps are tightened, no leakage is occurring) and preserved according to the requirements provided in **Table 15.**

Field crews are required to fill out standardized field sheets for each sampling event. Examples of standardized field sheets are provided as **Figure 9** and **Figure 10**.

Custody of all samples is documented and traceable from collection time to submittal for analysis on a COC form. An example COC form is provided as **Figure 11**. The COC accompanies the samples at all times. Samples are considered under custody if:

- they are in actual possession;
- they are in view after being in physical possession;
- they are placed in a secure area (accessible by or under the scrutiny of authorized personnel only after being in possession).

Custody forms are completed by samplers and must be signed by the sampler in charge to relinquish samples into the custody of the laboratory and/or intermediate couriers. Individuals relinquishing custody must provide their name, the date, and the time at which custody was transferred. Individuals taking custody of samples must also sign and date the forms to indicate the time at which the samples were received. Errors or amendments to COC forms should be clearly documented in order to maintain a clear record of sample possession from collection to analysis.

It is the responsibility of the field crews, laboratory personnel, and any intermediate sample custodians to maintain proper documentation of sample custody from sample collection through transit to and receipt by the laboratory.

Once in the laboratory's possession, it is the responsibility of the analyzing laboratory to maintain custody logs sufficient to track each sample submitted, and to analyze or preserve each sample within specified holding times. The contract laboratory follows sample custody procedures outlined in their QAM; contract laboratory QAMs are on file with the respective laboratories and are available for review upon request. It is the responsibility of the personnel of each analytical laboratory to ensure that all applicable regulations are followed in the disposal of samples or related chemicals remaining after successful completion of analyses.

Table 15. Sampling handling and custody.

Constituent Category	Fraction	Sample Container Material and Volume	Initial Preservation/ Holding Requirements	Extraction/ Preparation Holding Time	Analysis Holding Time
SSC	Particulate	1 L Polyethylene [1]	<6 °C	NA	14 days
Turbidity	Total	2 L Polyethylene	<6 °C	NA	48 hours
PPCPs	Total	2 x 40 mL Amber Glass	Preserve with sodium azide and ascorbic acid; store at <6 °C	NA [2]	30 days
PPCPs (Galaxolide, Triclocarban, and BPA)	Total	2 x 1 L Amber Glass [3]	<6 °C	7 days	40 days
PFAS	Total	250 mL HDPE or Polypropylene [4]	<10 °C	14 days	28 days

[1] Glass containers may also be used for SSC.
[2] PPCPs analyzed using direct injection; no extraction conducted.
[3] Clear glass may be used if samples are protected from the light.
[4] PFAS sampling containers must have Teflon-free caps.

12.1 STANDARDIZED FORMS

Figure 9, Figure 10, and **Figure 11** are examples of the standardized forms for field sheets and COC forms.

Figure 11. Chain of custody form.

MLJ ENVIRONMENTAL

WECK CHAIN-OF-CUSTODY RECORD

Client Name:	MLJ Environmental
Address:	1480 Drew Ave #130, Davis, CA 95618
Sampled By:	
Phone:	(530) 756-5200
Fax:	(530) 756-5225
Project Manager:	Melissa Turner
Project Name:	Delta RMP - CEC

Sample Identification	Sample Date	Sample Time	Number	Type	Notes	EPA Method 1694M: Estradiol, 17beta-	Estrone	Ethynylestradiol, 17alpha-	Progesterone	Testosterone	Bisphenol A	Diclofenac	Gemfibrozil	Ibuprofen	Iopromide	Naproxen	Salicylic Acid	Triclosan	SAMPLE COMMENTS
			2	250mL Amber w/ Sodium Azide		X	X	X	X	X	X	X	X	X	X	X	X	X	
			2	250mL Amber w/ Sodium Azide		X	X	X	X	X	X	X	X	X	X	X	X	X	
			2	250mL Amber w/ Sodium Azide		X	X	X	X	X	X	X	X	X	X	X	X	X	
			2	250mL Amber w/ Sodium Azide		X	X	X	X	X	X	X	X	X	X	X	X	X	
			2	250mL Amber w/ Sodium Azide		X	X	X	X	X	X	X	X	X	X	X	X	X	

Comments:

Temperature at Log In: (°C)

Please fax signed and completed COC to MLJ Environmental: (530) 756-5225, or email to mbundock@mljenvironmental.com

Relinquished By	Relinquished By
Signature	Signature
Print Name	Print Name
Organization	Organization
Date Time	Date Time
Received By	**Received By**
Signature	Signature
Print Name	Print Name
Organization	Organization
Date Time	Date Time

13 ANALYTICAL METHODS

Field measurements will be performed according to the standard procedures outlined in **Appendix I**. Field technicians will be properly trained on how to deploy, operate, and maintain field instruments according to the requirements outlined in **Element 8**. Laboratory analyses will be performed according to the methods and SOPs outlined in **Table 16**. Analytical results will be reported to the detection and reporting limits outlined in **Table 16.** These limits may change based on specific sample conditions or dilutions. In such cases the associated results will be flagged according to the Data Management SOP.

Field and laboratory analyses will require the equipment listed in **Table 19**. In the event of equipment failure or deviation, the Laboratory QA Officer or Project Manager should notify the Program Manager and the Program QA Officer as soon as possible and provide the appropriate documentation including whether corrective actions were initiated. Specifics regarding the type of failure or deviation, reasons, and any laboratory corrective actions that were already initiated will be provided to the CVRWQCB QA Representative within seven calendar days of notification. Any additional corrective actions required by the CVRWQCB QA Representative or requested by TAC members will then be communicated back to the laboratory by the Program Manager.

Corrective actions must be implemented by the laboratory on a case-by-case basis to address a root cause of failure or deviation. Once corrective actions are implemented, re-extraction, re-analysis, or resampling may be requested if the sample cannot be salvaged (**Table 18**). If the failure necessitates a qualifier or flag in the database, it is the Program QA Officer's responsibility to ensure that the correct qualifier or flag is applied. Once the appropriate corrective actions have been implemented, the failure and the associated corrective actions will be documented on a QAPP Deviation Form and submitted to the CVRWQCB for approval.

Laboratory reporting turnaround times (beginning at the time of sample receipt) may vary according to the specific analytical method, sample preparation, and sample holding time requirements. Regardless of turnaround times specified in individual laboratory contracts, the reporting of preliminary data to the Delta RMP is not to exceed 60 calendar days from the time of sample analysis by the laboratory, per R5-2021-0054.

A laboratory must store surplus volume for re-extraction or reanalysis according to their laboratory policies. Sample extracts are stored frozen for the duration of the project after the initial analysis and may be reanalyzed as necessary. All laboratories shall dispose of all samples in accordance with state and federal regulations.]

Table 16. Field and laboratory analytical methods.

Constituent (CEDEN Analyte Name)	Agency	Method	Fraction	Units	MDL	RL	Water Quality Metric [1]	SOP
Dissolved oxygen	MLJ	SM 4500-O	Total	mg/L	NA	0.1	--	**Appendix I** – Field SOP
Dissolved oxygen	MLJ	SM 4500-O	Total	%	NA	NA	--	**Appendix I**– Field SOP
pH	MLJ	EPA 150.1	NA	pH units	NA	0.1	--	**Appendix I** – Field SOP
Specific conductivity	MLJ	EPA 120.1	Total	µS/cm	NA	100	--	**Appendix I**– Field SOP
Temperature	MLJ	SM 2550	NA	ºC	NA	0.1	--	**Appendix I**– Field SOP
Bisphenol A [2]	Weck	EPA 1694M	Total	ng/L	4	10	--	**Appendix III** [3]
Bisphenol A [2]	Physis	EPA 625.1M	Total	ng/L	1	10	--	**Appendix III** – PPCPs by EPA 625.1M
Diclofenac	Weck	EPA 1694M	Total	ng/L	4	10	--	**Appendix III** [3]
Estradiol, 17beta-	Weck	EPA 1694M	Total	ng/L	4	10	--	**Appendix III** [3]
Estrone	Weck	EPA 1694M	Total	ng/L	4	10	--	**Appendix III** [3]
Ibuprofen	Weck	EPA 1694M	Total	ng/L	4	10	--	**Appendix III** [3]
Triclosan	Weck	EPA 1694M	Total	ng/L	8	20	--	**Appendix III** [3]
Perfluorooctanesulfonic acid (PFOS)	Enthalpy	EPA 537M	Total	ng/L	1 [4]	2	--	**Appendix III** – PFAS by EPA 537M
Perfluorooctanoic acid (PFOA)	Enthalpy	EPA 537M	Total	ng/L	1 [4]	2	--	**Appendix III** – PFAS by EPA 537M
Galaxolide	Physis	EPA 625.1M	Total	ng/L	0.1	1	--	**Appendix III** – PPCPs by EPA 625.1M
Triclocarban	Physis	EPA 625.1M MRM	Total	ng/L	1	5	--	**Appendix III** – PPCPs by EPA 625.1M
Suspended sediment concentration	Weck	ASTM D3977	Particulate	mg/L	3.1	5	--	**Appendix III** [3]

Constituent (CEDEN Analyte Name)	Agency	Method	Fraction	Units	MDL	RL	Water Quality Metric [1]	SOP
Turbidity	Physis	EPA 180.1	Total	NTU	0.05	0.05	--	**Appendix III** – Turbidity by EPA 180.1
Ethynylestradiol, 17alpha-	Weck	EPA 1694M	Total	ng/L	4	10	--	**Appendix III** [3]
Gemfibrozil	Weck	EPA 1694M	Total	ng/L	4	10	--	**Appendix III** [3]
Iopromide	Weck	EPA 1694M	Total	ng/L	4	50	--	**Appendix III** [3]
Naproxen	Weck	EPA 1694M	Total	ng/L	4	10	--	**Appendix III** [3]
Progesterone	Weck	EPA 1694M	Total	ng/L	4	10	--	**Appendix III** [3]
Salicylic acid	Weck	EPA 1694M	Total	ng/L	100	500	--	**Appendix III** [3]
Testosterone	Weck	EPA 1694M	Total	ng/L	4	10	--	**Appendix III** [3]

[1] The CVRWQCB provides a list of relevant Water Quality Metrics by July 1 annually. No Water Quality Metrics were identified for CECs for FY 22-23. Any updated metrics provided by July 1, 2023 will be incorporated into this table and compared to results according to the requirements outlined in **Project Action Limits**.

[2] Bisphenol A will be analyzed twice for each sample and event by two separate laboratories and methods per recommendations based on Years 1 and 2 sample results. Both sets of results will be used indiscriminately and submitted to CEDEN.

[3] Weck SOPs are not provided to the Delta RMP. Revisions are submitted directly to the SWRCB QA Officer for review.

[4] Enthalpy reports sample specific detection limits (SDLs), which are determined from the data of each individual analysis and vary between analytical batches; the estimated minimum detectable area is determined based on the signal to noise ratio for each individual result, per the method. SDL data will be reported in the MDL field in CEDEN per State Board guidance.

14 QUALITY CONTROL

This project will comply with the QC guidelines and corrective actions listed in **Table 17** (field sampling QC) and **Table 18** (analytical QC). Field QC frequencies are calculated to ensure that a minimum of 5% of all analyses are for QC purposes (both field duplicate and field blanks). The percent total is calculated as follows:

$$\%\ Total\ =\ \left(\frac{N_{FB}\ or\ N_{FD}}{N_E}\right)\ \times 100$$

N_{FB} = The number of field blanks
N_{FD} = The number of field duplicates
N_E = The number of environmental samples

All analytical QC samples must be analyzed at a frequency of one1 per analytical batch; an analytical batch is not to exceed 20 environmental samples. Quality Control activities for this project are listed in **Table 17** and **Table 18**.

Precision is assessed through a combination of field duplicate samples and laboratory duplicate samples. Precision of a pair of samples is measured as the relative percent difference (RPD) between a sample and its duplicate—a laboratory control sample (LCS) and its duplicate (LCSD), a matrix spike (MS) and matrix spike duplicate (MSD), an environmental sample (E) and field duplicate (FD), or an environmental sample and its associated laboratory generated duplicate. It is calculated as follows:

$$RPD\,(\%)\ =\ \left|\frac{2(V_i\ -\ V_D)}{V_i\ +\ V_D}\right|\ \times 100$$

V_i = The measured concentration of the initial sample
V_D = The measured concentration of the sample duplicate

For precision assessment purposes any laboratory duplicate, including a matrix spike duplicate, an un-spiked environmental laboratory duplicate, or a lab control spike duplicate, may function as the lab duplicate in any batch.

Accuracy is assessed using either an LCS or MS. For an LCS, lab water is spiked with a known concentration of a target analyte and the percent recovery (PR) is reported. The PR in an LCS is calculated as follows:

$$\%\ Recovery = \left(\frac{V_{LCS}}{V_{Spike}}\right) \times 100$$

V_{LCS} = The measured concentration of the spiked control sample
V_{Spike} = The expected spike concentration

An MS can also be used to assess accuracy. For an MS, environmental water is spiked with a known concentration of a target analyte and the PR is reported. The PR in an MS is calculated as follows:

$$\%\ Recovery = \left(\frac{V_{MS} - V_E}{V_{Spike}}\right) \times 100$$

V_{MS} = The measured concentration of the spiked matrix sample
V_{Spike} = The concentration of the spike added
V_E = The measured concentration of the original (unspiked) matrix sample

The MS should not be used solely to assess accuracy due to the likelihood of matrix interference; however, if an LCS does not fall within acceptance criteria an MS may be used to validate a batch if the MS is within acceptance criteria. Some constituents are difficult to spike and therefore a laboratory may choose to analyze a certified/standard reference material (CRM or SRM). A CRM or SRM analysis may be used in place of an LCS analysis.

When quality control sample results do not meet the data quality objectives provided in this QAPP the laboratory must implement corrective measures as outlined in **Table 18**. Detections in blanks must be sourced and field, analytical, or cleaning practices must be modified to reduce the risk of further contamination. Excessive RPD values or percent recoveries outside of criteria may also require a change of field or laboratory practices. Exceedances of analytical control limits must be reported in the appropriate lab report and qualified in the EDD according to the procedures outlined in the Data Management SOP.

If corrective measures require reanalysis of the sample, and the results repeatedly fail to meet the objectives, then the lab is obligated to halt the analysis of samples, identify the source of the imprecision, and make corrections where appropriate before proceeding. In scenarios where the actions outlined below cannot be completed and/or results cannot be brought within control limits the laboratory must notify the Program Manager and the Program QA Officer as soon as possible and provide the appropriate documentation and details of corrective actions taken. Specifics regarding the type of failure, reasons for failure, and any laboratory corrective actions that were already initiated will be provided to the CVRWQCB QA Representative, and the TAC within

seven calendar days of notification. Any additional corrective actions required by the CVRWQCB QA Representative or requested by TAC members will then be communicated back to the laboratory by the Program Manager.

Control failures that cannot be rectified are documented with a QAPP Deviation Form (**Figure 12**) and submitted to the CVRWQCB for approval. The Steering Committee Co-Chairs will be notified of all deviations submitted to the CVRWQCB.

If results for any field duplicates and associated environmental samples do not meet the data quality objectives listed in the above tables then the samplers must assess sampling practices and make corrections to their field procedures which will ensure homogeneity in the samples before proceeding. Any deviation from the sampling procedures outlined in this QAPP must approved by the CVRWQCB QA Representative prior to implementation (if anticipated) or be reported to within seven calendar days (if unanticipated).

Analytical QC results must adhere to the minimum limits of error and frequency requirements detailed in **Table 18.**

Table 17. Field sampling QC.

Sample Type	Frequency	Acceptable Limits	Corrective Action	Sampling SOP
Field Blank	1 per event	< RL	Investigate and remove sources of contamination.	**Appendix I**. – Field SOP
Travel Blank	1 per event	< RL	Investigate and remove sources of contamination.	
Field Duplicate	1 per event	RPD ≤ 35 n/a if concentration of either sample < RL	Determine cause, take appropriate corrective action.	

Table 18. Analytical QC.

Sample Type	Frequency	Acceptable Limits	Corrective Action	Analytical SOP
Ancillary Parameters - SSC				
Laboratory Blank	1 per batch	< MDL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.	**Appendix III** [1]
Ancillary Parameters – Turbidity				
Laboratory Blank	1 per batch	< RL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.	**Appendix III** – Turbidity by EPA 180.1
Laboratory Duplicate	1 per batch	RPD ≤ 25 n/a if concentration of either sample < RL	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
PPCPs by EPA 1694M				
Laboratory Blank	1 per batch	< MDL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.	**Appendix III** [1]
Laboratory Control Sample	1 per batch	50-150%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
Laboratory Control Sample Duplicate	1 per batch	RPD ≤ 25	Visually inspect the samples to determine if a high RPD could be attributed to sample heterogeneity. Reanalyze suspect samples or qualify the results and document the heterogeneity.	
Isotope Dilution Analogue	Every sample	50-200%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	

Sample Type	Frequency	Acceptable Limits	Corrective Action	Analytical SOP
PPCPs by EPA 625.1M (Galaxolide, Triclocarban, and BPA)				
Laboratory Blank	1 per batch	< MDL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.	**Appendix III** – PPCPs by EPA 625.1M
Laboratory Control Spike	1 per batch	50-150%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
Matrix Spike	1 per batch	50-150%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
Matrix Spike Duplicate [2]	1 per batch	RPD ≤ 25 n/a if concentration of either sample < MDL	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
Surrogate	Every sample	50-150%	Determine cause, take appropriate corrective action. Recalibrate and reanalyze all suspect samples or flag all suspect data.	
PFAS				
Laboratory Blank	1 per batch	< MDL	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.	**Appendix III** – PFAS by EPA 537M
Laboratory Control Spike	1 per batch	50-150%	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.	
Laboratory Control Spike Duplicate	1 per batch	RPD ≤ 30	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.	

Sample Type	Frequency	Acceptable Limits	Corrective Action	Analytical SOP
Isotope Dilution Analogue	Every sample	25-150%	Determine cause of problem, remove sources of contamination, reanalyze suspect samples or flag all suspect data.	

[1] Weck SOPs are not provided to the Delta RMP. Revisions are submitted directly to the SWRCB QA Officer for review.
[2] For the purposes of this project it is acceptable for the matrix spike duplicate or the laboratory control duplicate to stand in for the lab duplicate as a measure of the precision of the analytical method.

15 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Laboratory equipment is maintained by a qualified technician at the frequency listed in **Table 19**. Field equipment and meters are maintained according to standard procedures and at the frequency listed in **Table 19.** Laboratories are responsible for maintaining all laboratory equipment according to manufacturer specifications. Frequency and procedures for maintenance of analytical equipment used by each laboratory are documented in the Quality Assurance Manual for each laboratory, which is available from the laboratory on request. Laboratories are responsible for testing, inspecting, and maintaining all analytical equipment. In the event of equipment failure, the source of the failure must be identified and rectified, the equipment must be recalibrated, and any samples analyzed outside of calibration limits must be reanalyzed. The Program Manager, Delta RMP QA Officer, and CVRWQCB QA Representative will then work with the laboratory to identify the causes and address deficiencies in the SOPs that resulted in failures. If the problem is serious and cannot be corrected by the laboratory, the Program Manager, Delta RMP QA Officer, and CVRWQCB QA Representative will discuss and identify alternatives, including changing the sampling materials and methods, the extraction and analytical methods, the laboratory, or any combination of these. Any changes to the Monitoring Workplan must be approved by the EO prior to implementation. Amendments to the QAPP must be approved by the SWRCB QA Officer and/or the CVRWQCB QA Officer.

Table 19. Testing, inspection, maintenance of field and analytical instruments.

Due to the complexity and sensitivity of most laboratory instruments the testing, inspection, and maintenance procedures are difficult to summarize. A brief and general summary for each instrument follows; however, this table is not intended to describe all testing, inspection, and maintenance procedures for all tests, nor will this QAPP attempt to report SOPs for all such procedures. It is expected that laboratories will employ knowledgeable staff capable of testing, inspecting, and maintaining analytical instruments to ensure a level of data quality that matches or exceeds that demanded in this QAPP.

Analyte Type	Equipment / Instrument	Maintenance, Testing, or Inspection Activity	Frequency	Responsible Individual	SOP Reference
Field Measures	YSI 556MPS with Glass Electrode pH	Clean glass bulb and visually inspect	<24 hours before sampling	Field Lead	**Appendix I** – Field SOP
	YSI 556MPS with Steady State Polarographic DO Sensor	Change membrane and KCl solution	Every 30 days	Field Lead	
	YSI 556MPS with Electrode Cell EC and Thermistor Temperature Probe	Clean electrodes	<24 hours before sampling	Field Lead	
	Hach Flow FH950	Visually inspect	Before sampling	Field Lead	
PPCPs - Hormones	LC System with Tandem Mass Spectrophotometer and Atmospheric Pressure Chemical Ionization (APCI) source	Visually inspect mobile phase, solvent levels, and wipe down. Replace parts as needed.	Inspections daily. Maintenance according to manufacturer specifications.	Weck QA Officer	**Appendix III** [1]
PPCPs - Pharmaceuticals	LC System with Tandem Mass Spectrophotometer	Visually inspect mobile phase, solvent levels, and wipe down.	Inspections daily. Maintenance according to	Weck QA Officer	**Appendix III** [1]

Analyte Type	Equipment / Instrument	Maintenance, Testing, or Inspection Activity	Frequency	Responsible Individual	SOP Reference
	and Electrospray Ionization (ESI) source	Replace parts as needed.	manufacturer specifications.		
PPCP – Galaxolide, Triclocarban, and BPA	Gas Chromatograph/ Mass Spectrometer	Visually inspect and check carrier gas and solvent levels, Replace parts as needed.	Inspections daily. Maintenance according to manufacturer specifications.	Physis QA Officer	**Appendix III** – PPCPs by EPA 625.1M
PFAS – PFOS and PFOA	Ultra Performance LC System with Triple Quadrupole Mass Spectrometer	Visually inspect mobile phase, solvent levels, and wipe down. Replace parts as needed.	Inspections daily. Maintenance according to manufacturer specifications.	Enthalpy QA Officer	**Appendix III** – PFAS by EPA 537M
Suspended Sediment Concentration	Analytical Balance	Wipe down.	Daily	Weck QA Officer	**Appendix III** [1]
Turbidity	Turbidimeter	Visually inspect filters/cells for scratches or damage. Clean and replace as necessary.	Maintenance according to manufacturer specifications.	Physis QA Officer	**Appendix III** – Turbidity by EPA 180.1

[1] Weck SOPs are not provided to the Delta RMP. Revisions are submitted directly to the SWRCB QA Officer for review.

16 INSTRUMENT/EQUIPMENT CALIBRATION

Field equipment and meters are calibrated according to standard procedures and at the frequency listed in **Table 20**. Laboratories are responsible for calibrating all laboratory equipment according to manufacturer specifications. Frequency and procedures for calibration of analytical equipment used by each laboratory are documented in the Quality Assurance Manual for each laboratory, which is available from the laboratory on request. A record of pre- and post-calibration results are logged and maintained for calibration records. All equipment capable of being calibrated must be successfully calibrated before analysis. If calibration fails, all affected samples must be re-analyzed, or the data flagged, and the equipment must be repaired before further analysis.

Table 20. Calibration of field and analytical equipment.

Analyte Type	Equipment / Instrument	Calibration Description and Criteria	Frequency of Calibration	Responsible Individual	SOP Reference
Field Measures	YSI 556MPS with Glass Electrode pH	3 Point calibration at pH 4, 7, and 10; calibration must be accepted by YSI meter	<24 hours before sampling	Field Lead	**Appendix I** – Field SOP
	YSI 556MPS with Steady State Polarographic DO Sensor	H20 Saturated air calibration (%O2) at default 760mm Hg	Before first measurement each day of sampling	Field Lead	
	YSI 556MPS with Electrode Cell EC and Thermistor Temperature Probe	Calibration to 1413 µS/cm; calibration must be accepted by YSI meter. Temperature calibration is factory set and does not require user calibration	<24 hours before sampling	Field Lead	
	Hach Flow FH950	For manual calibration, place probe in still water and calibrate to show no flow. Automatic calibration occurs when instrument is turned on.	Manual calibration performed annually / Automatic calibration before every measurement	Field Lead	
PPCPs - Hormones	LC System with Tandem Mass Spectrophotometer and Atmospheric Pressure Chemical Ionization (APCI) source	According to SOPs.	According to SOPs.	Weck QA Officer	**Appendix III** [1]

Analyte Type	Equipment / Instrument	Calibration Description and Criteria	Frequency of Calibration	Responsible Individual	SOP Reference
PPCPs - Pharmaceuticals	LC System with Tandem Mass Spectrophotometer and Electrospray Ionization (ESI) source	According to SOPs.	According to SOPs.	Weck QA Officer	**Appendix III** [1]
PPCP – Galaxolide, Triclocarban, and BPA	Gas Chromatograph/ Mass Spectrometer	Five-point calibration with coefficient ≥ 0.92/RSD 35%.	CCV at the beginning of each 12-hour shift.	Physis QA Officer	**Appendix III** – PPCPs by EPA 625.1M
PFAS – PFOS and PFOA	Ultra Performance LC System with Triple Quadrupole Mass Spectrometer	Five- (linear) or six- (quadratic) point curve with coefficient ≥ 0.99. Recovery 70-130% with S/N ≥ 3:1 (for PFOS and PFOA).	CCV every 10 samples and at beginning/end of analytical run. Initial curve at least annually.	Enthalpy QA Officer	**Appendix III** – PFAS by EPA 537M
Suspended Sediment Concentration	Analytical Balance	Calibrate using certified weights.	Daily.	Weck QA Officer	**Appendix III** [1]
Turbidity	Turbidimeter	Calibrate using certified standards.	Performance check standards every 10 samples.	Physis QA Officer	**Appendix III** – Turbidity by EPA 180.1

[1] Weck SOPs are not provided to the Delta RMP. Revisions are submitted directly to the SWRCB QA Officer for review.

17 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Project consumables are listed in **Table 21**. Consumables are rejected for use if obvious signs of contamination or tampering exist. All laboratories are responsible for inspecting and testing all consumables against laboratory-specific acceptance criteria and maintaining adequate records.

Table 21. Inspection/acceptance testing requirements for consumables and supplies.

Project-Related Supplies (source)	Inspection / Testing Specifications	Acceptance Criteria	Frequency	Responsible Individual
Sample Bottles	Bottles are inspected for physical integrity	Bottles and caps intact	At receipt date of shipment	Field Lead
Calibration Standards	Solution bottles are inspected to verify factory seal and expiration date; initial measurements are compared to prior standard measurement	Manufacturer's seal intact, measurements within MQOs	Upon opening a fresh standard solution	Field Lead
Nitrile Gloves	Carton seal is visually inspected for damage or tampering	Carton is intact and gloves within are clean and intact	At receipt date of shipment	Field Lead

18 NON-DIRECT MEASUREMENTS (EXISTING DATA)

Non-direct measurements are any types of data that will be used for the project implementation or decision making that are obtained from outside or existing sources. For the Year 3 CEC monitoring, all measurements will be taken by project staff and contactors under the requirements outlined in this QAPP with the following exceptions.

Rainfall information will be used prior to each event to verify that sampling will occur in dry weather conditions according to the procedures identified in **Element 10.2**. Precipitation data used for this verification will be obtained from the California Department of Water Resources (DWR) California Data Exchange Center (CDEC). Provisional data from the two stations closest to the sample locations (**Table 13**) will only be used to inform sample scheduling and will not be reported outside of communications with the CEC TAC and the CVRWQCB regarding sample planning and preparation. Only finalized (QA-reviewed according to the DWR requirements) will be used for analysis and reporting.

Discharge values must be obtained for each gradient study sample location to be used in estimating mass flux to answer the Year 3 study questions. Some of the gradient monitoring locations have culverts or weirs where known geometry information can be used to calculate the discharge in cfs (see **Element 11.1.1**). Field staff will collect stage and flow measurements at each site; however, wherever available, stage-discharge rating curves that have been established by outside agencies may be used to convert in-situ water-level measurements taken during sampling into discharge values. No additional studies will be conducted to verify such conversion values.

19 DATA MANAGEMENT

As established in **Element 9** above, MLJ Environmental will maintain an inventory of data and will periodically check the inventory against the records in their possession.

The Field Lead will scan and send an electronic copy of field sheets and COCs to the Program Manager. All scanned copies will be stored on the Droplet which is a shared file system that is accessible to TAC members and the CVRWQCB. All field data are entered into the CV RDC database after being reviewed and qualified. All data transcribed or transformed, electronically and otherwise, are double checked for accuracy by MLJ Environmental staff and records of this double-checking are maintained at the MLJ Environmental office.

The process for receiving and finalizing data is detailed below and will occur according to the following general steps:

1. Receive EDD within 60 days of sample analysis (shared with Regional Board and TAC).
2. Verify data per the Data Management SOP.
3. Communicate with laboratory regarding any questions/concerns regarding data received; receive updated data, if necessary.
4. Stage 1 verified data are loaded into the CV RDC (shared with Regional Board and TAC).
5. Second verification of the data.
6. Stage 2 final data are ready for TAC review and discussion (shared with Regional Board and TAC).

Transfer of data from laboratories to MLJ Environmental is accomplished by electronic submittal. Lab reports are received as electronic Portable Document Formats (PDFs) and in CEDEN templates, both of which are filed on the Droplet. The EDDs are uploaded to the CV RDC according to the procedures outlined in the **Appendix II – Data Management Procedures.**

According to the requirements outlined in Resolution R5-2021-0054, preliminary data in the form of unverified/raw results provided by the project laboratories will be submitted within 60 days of the sample analysis date for each sampling event. Raw data and laboratory reports (where applicable) are provided to the CEC TAC and CVRWQCB staff via upload to a shared file storage site. Preliminary data on the file storage site (DRMP Droplet) are stored in a specific file under the CEC TAC primary folder; these files are considered static and are only updated if the laboratory resubmits new files. An associated Excel tracker (also stored on the Droplet) tracks the date the files were received, the project they are associated with, the file name, and the file location.

The Delta RMP will also email the following CVRWQCB staff with the preliminary data attached to the email when the files are uploaded to the file storage site: Executive Officer Patrick Pulupa, Program Manager Meredith Howard, and Environmental Scientists Selina Cole and Ryan Brown.

The Data Management Team (DMT) consists of Cassandra Lamerdin, who is the Data Manager for Delta RMP data, and Data Specialists at MLJ Environmental. The DMT is responsible for reviewing reports and EDDs to ensure completeness, assessing whether project MQOs were met, and ensuring CEDEN/SWAMP comparability. The DMT is responsible for uploading data to the CV RDC, performing final checks, and transferring data to CEDEN annually within 6 months of the last sampling date per Resolution R5-2021-0054. The CV RDC will track completion of monitoring events and data received; this information will be used to complete the QA Report at the end of the FY.

Stage 1 data are reviewed by DMT staff during the data loading process for each individual EDD received. Data verification by the CV RDC DMT according to the approved Data Management SOP (**Appendix II**) occurs as close to receipt of the EDD as possible to ensure that any analytical issues identified during review can be communicated with laboratories and resolved in a timely manner. Once loaded into the CV RDC, an additional data verification is conducted by the Program QA Officer (or a delegate) on a result and batch level for individual results sets. The Program QA Officer (or a delegate) applies the appropriate compliance codes to each reviewed record, indicating the data are finalized on the result and batch level. These Stage 2 data are considered final data and are then exported and provided to the CEC TAC, stakeholders, and CVRWQCB staff. Per Resolution R5-2021-0054, this is done within six months of sample analysis.

Per the Resolution R5-2021-0054 requirement, a quality assurance assessment for samples collected in the previous fiscal year must be included in the Delta RMP Annual Report. This assessment will include all of the quality assurance section elements identified in R5-2021-0054 and is considered an intermediate QA Assessment since not all samples will have been received, verified, and finalized for the WY. The Program QA Officer (or a delegate) will conduct a final review and assessment of the data prior to transfer to CEDEN including a QA Report for data collected during the WY.

All data residing on the Droplet is housed on a third-party cloud server with nightly backups replicated to at least one independent server to create redundancy and allow for instant replication if a failure occurs.

The CV RDC database resides on a server housed at Moss Landing Marine Laboratories (MLML) main laboratory server room. Server RDC-Gamma hosts both the CV RDC and MLML RDC database and connects to a second server (MLML RDC) which hosts the

Central Valley Checker System. Servers are monitored daily with weekly software maintenance and backed up nightly. Hardware maintenance occurs on an as needed basis. The most recent month of database backups are available for retrieval if needed; older backups are archived.

Monitoring reports which summarize the monitoring data are submitted to the Delta RMP and the CVRWQCB following the schedule outlined in **Element 6**.

The handling of pesticide analysis data generated by the OCRL is different from other Delta RMP datasets because the USGS is not simply a contract lab, but a federal science agency with its own long-standing policies and procedures. According to USGS policy, results from their labs shall be included in NWIS. This is an online database where results are freely available to the public.

OCRL staff perform a quality assurance review of the results generated in their lab, and then upload provisional data to the NWIS database. Afterwards, OCRL transmits the data to CV RDC in the CEDEN data template format. Data management staff format these data and perform a thorough and independent QA review. As with other datasets, if serious issues arise, data management staff will communicate with OCRL to resolve these issues in coordination with the Program Manager.

GROUP C. ASSESSMENT AND OVERSIGHT

20 ASSESSMENTS AND RESPONSE ACTIONS

Quality assurance reviews of data generated under the project will be made by the Program QA Officer according to this QAPP, and may include the Program Manager and CVRWQCB QA Representative, if necessary. Contract laboratories are responsible for self-assessment and oversight of finalized data submitted in laboratory reports and electronic deliverables, by the data managers, and/or the laboratory QA Officer. Once data are received, they will be reviewed and flagged according to the procedures outlined in **Appendix II**. The Program QA Officer and Program Manager are responsible for ensuring the proper flagging of all data that do not meet established QA/QC criteria.

If a discrepancy is discovered during a review, the Program Manager and Program QA Officer will discuss the discrepancy with the personnel responsible for the activity. The discussion will include the accuracy of the information, potential cause(s) leading to the deviation, how the deviation might impact data quality and the corrective actions that might be considered. Deviations to the QAPP that can prevent project and data quality objectives from being met shall be described in the QAPP and must be approved by the CVRWQCB QA Representative or the SWRCB QA Officer prior to implementation. When prior approval is not possible, the deviations must be reported to the CVRWQCB QA Representative within seven calendar days, per R5-2021-0054. The Steering Committee Co-Chairs will be notified of all deviations submitted to the CVRWQCB. The Program Manager is responsible for documenting and communicating all deviations from this QAPP to the TAC and appropriate stakeholder groups. For immediate deviation notification, communication will include the following information: the applicable Workplan and/or QAPP, constituents and/or locations affected, sampling dates, whether the deviation is affecting one or multiple events, description of the concern, the proposed solution and rationale, and a place for a final decision to be communicated.

Once QAPP deviations are identified and a resolution determined, the process is documented on a Delta RMP QAPP Deviation Form (**Figure 12**). Deviation forms shall be completed and included in the Quarterly Reports submitted to the CVRWQCB. At a minimum, deviation forms must document:

- A description of the deviation that occurred.
- Reason for the deviation.
- Impact on the present and completed work.

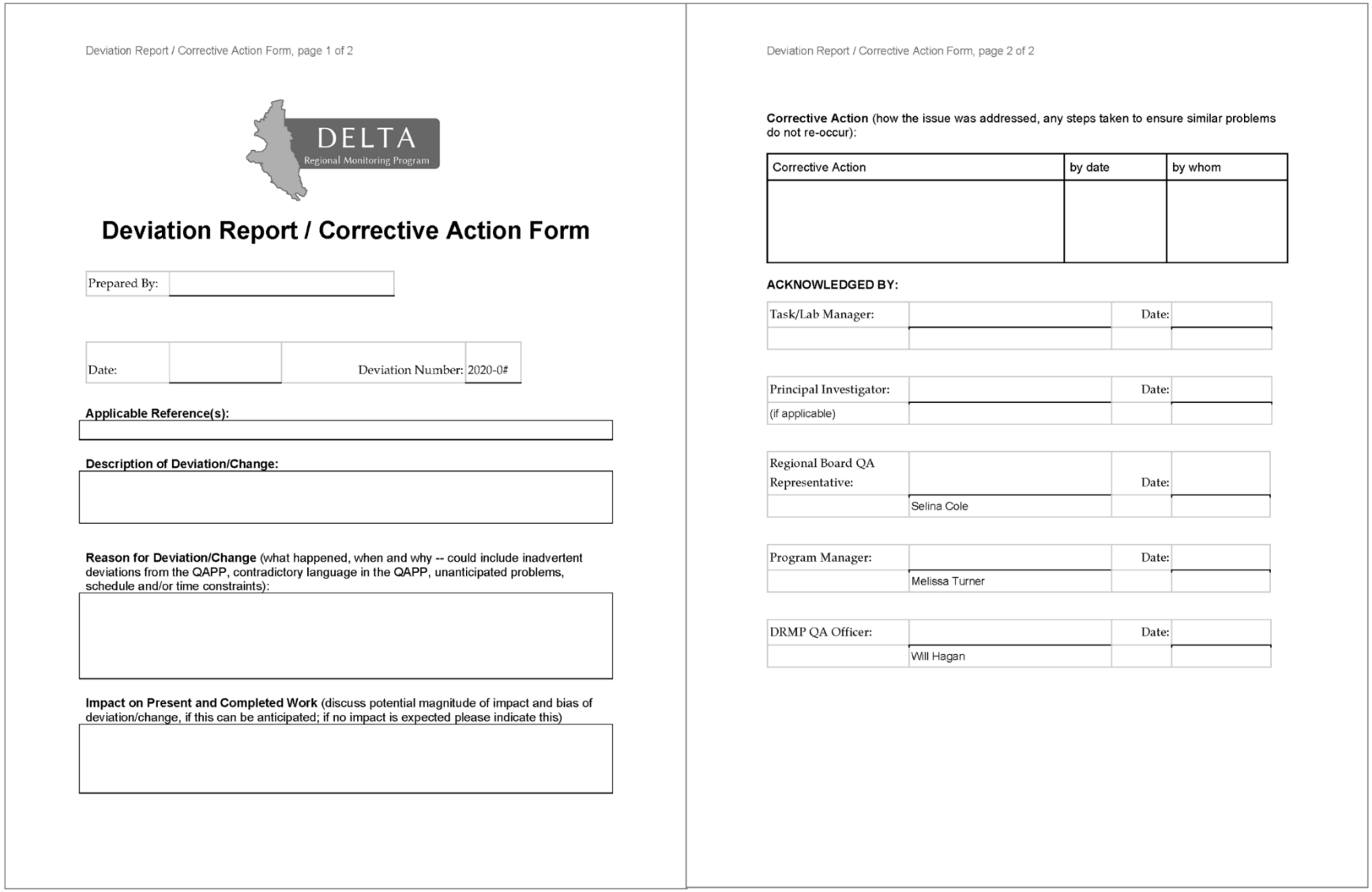
- Corrective actions taken as a result, by when and by whom.

Once completed, deviation forms are reviewed and approved by the CVRWQCB QA Representative. The Program Manager will follow up with the responsible party tasked with implementing the corrective actions and track when they are performed. Deviations and corrective actions are reported for the previous fiscal year in the Delta RMP Annual Report that is submitted annually to the CVRWQCB on February 1.

The Program Manager and the Program QA Officer have the power to halt all sampling and analytical work by both the field crews and contracted laboratory if the deviation(s) noted are considered detrimental to data quality.

The quality of data are routinely reviewed as a whole and assessed to determine if procedural (field and analytical) changes are necessary for improved data quality. The Program QA Officer (or designee) may request to visit the laboratory to discuss the review and data quality. Laboratory visits may occur as frequently as once a year or less depending on the need. Other assessments that occur periodically will be oral or electronic via email correspondences; if no discrepancies are noted and corrective action is not required, additional records are neither maintained nor reported. If discrepancies are observed, the details of the discrepancy and any corrective action will be reported in the quarterly and final monitoring report.

Figure 12. Deviation Form template.



Deviation Report / Corrective Action Form, page 1 of 2

DELTA
Regional Monitoring Program

Deviation Report / Corrective Action Form

Prepared By:

Date: | Deviation Number: 2020-0#

Applicable Reference(s):

Description of Deviation/Change:

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):

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)

Deviation Report / Corrective Action Form, page 2 of 2

Corrective Action (how the issue was addressed, any steps taken to ensure similar problems do not re-occur):

Corrective Action	by date	by whom

ACKNOWLEDGED BY:

Task/Lab Manager:		Date:	
Principal Investigator:		Date:	
(if applicable)			
Regional Board QA Representative:		Date:	
	Selina Cole		
Program Manager:		Date:	
	Melissa Turner		
DRMP QA Officer:		Date:	
	Will Hagan		

21 REPORTS TO MANAGEMENT

Quality assurance assessments are provided in individual project data reports, which are drafted upon the completion of a study or monitoring cycle, as needed. Data reports are reviewed by the appropriate TAC, recommended for approval by the steering Committee, and approved for publication by the BOD. Quality assurance assessments are also provided in the Delta RMP Annual Report according to the requirements outlined in Resolution R5-2021-0054.

The Data Manager is responsible for summarizing QA issues with reported data and communicating those issues to the Program Manager and the Program QA Officer. The Program Manager is responsible for communicating delays in data deliverables and/or QA issues to the CVRWQCB QA Representative and the appropriate stakeholders and committees.

Deviation Forms (**Figure 12**) are generated on an ad hoc basis to document any significant changes to the implementation of this QAPP, the impacts on project data, and the corrective actions that should be taken as a result. A record of all deviations, including copies of completed Deviation Forms that occurred within a given reporting period, is provided in the Delta RMP Quarterly Reports, submitted November 1, February 1, May 1, and August 1, annually, and in the Delta RMP Annual Report, submitted on February 1 of each year.

21.1.1 Year 3 CEC Data Report Deliverables

The Year 3 Data Report will be the primary data deliverable for the Year 3 Study Plan and will present the CEC gradient study analytical results.

The primary data deliverables and data products associated with the Year 3 Data Report are:

1. CEDEN-submitted ambient water quality results and quality assurance quality control data.
2. Summary of any deviations to the QAPP or any other project deviations that impacted the quality of the Delta RMP data in order to ensure data of known and documented quality including corrective action(s).
3. Summary of dataset completeness, precision, and accuracy.
4. A list and description of sample comparisons or tests that did not meet minimum test acceptability criteria for analyses or were considered invalid.
5. POTW and MS4 urban runoff source results and quality assurance quality control data in CEDEN reporting format.

6. Concentration vs. distance from discharge data plots for each gradient location and each constituent.
7. Mass flux vs. distance from discharge data plots for each gradient location and each constituent.
8. Evaluate mass balance and in cases where inputs are not equal to outputs, provide an estimate of the error and unmeasured sources and sinks.
9. Identification of the monitoring location where attenuation is observed for each constituent. Two metrics will be used to identify this location: a) where receiving water concentrations return to background concentrations or b) where a negative change in concentration is observed from the previous two monitoring locations. Additionally, there may be a finding that attenuation was not observed in the study area. The Statewide CEC Pilot Study Monitoring Plan does not specify how the point of attenuation is determined so these two approaches provide a means to make an assessment. Additional attenuation determination methodologies may be developed.
10. Estimate of the contribution of attenuation caused by hydraulic dilution in each study area, if any occurs.
11. Provide a list and brief description of the unmeasured variables, field observations, and/or potential conditions that may influence CEC attenuation.

The Delta RMP Steering Committee and Board of Directors may further specify preparation of an overall CEC Pilot Study report for all three years of data collection. This may include more detailed assessment and interpretation of the data and data summaries provided in the Year 3 Data Report.

GROUP D. DATA VALIDATION AND USABILITY

22 DATA REVIEW, VERIFICATION, AND VALIDATION REQUIREMENTS

Data generated by this project will be reviewed against the measurement quality objectives cited in **Element 23** and QA/QC practices outlined in **Elements 14 – 17**. Data will be qualified according to the methods outlined in **Element 23**. The Program QA Officer will complete a secondary review to ensure that all data are properly qualified according to the project requirements. Data collected by other agencies, projects, or studies that are to be used in conjunction with the data generated under this QAPP will undergo the review requirements outlined in **Element 18**.

22.1 REJECTION OF DATA

The decision to accept or reject data will be made jointly by the Program QA Officer, the Program Manager, the CVRWQCB QA Representative, and if necessary, SWRCB QA staff. Data rejections will be documented with a deviation form or QAPP amendment and require the approval of the QA Representative and/or the SWRCB QA Officer. Decisions regarding accepting and rejecting data should also be informed by input from the TAC.

There are three time-steps where data may be identified for rejection: 1) identified by the laboratory prior to reporting to the Delta RMP, 2) during data verification (either Stage 1 or Stage 2), and 3) during the finalization of the data through the TAC process (Stage 3). Missing analytical records will be discussed in the Delta RMP Annual Report and Data Reports; rejection decisions may also lead to amendments to the Data Management SOP and/or the QAPP.

- Laboratory Review: The following situations will be communicated to the Program QA Officer, the Program Manager, the QA Representative, and, if necessary, the SWRCB QA Officer and documented in the laboratory report. The QA Representative or the SWRCB QA Officer will determine if a deviation form or other documentation is necessary.
    - The laboratory identifies that the analysis did not meet performance standards (e.g., instrument failure) or a quality control failure that results in the inability to accurately quantify the analyte.

    - When the QAPP does not clearly identify the performance standard not being met or quality control failure, the laboratory will provide a justification for the recommendation to omit the results from the EDDs.
- Data Management Verification: data verification occurs when the data are reviewed and flagged by the Data Manager (Stage 1) and again when the Program QA Officer reviews and verifies that data are flagged according to this QAPP (Stage 2).
    - Stage 1 – the Data Manager identifies egregious or numerous failures of MQOs during data review and notifies Program QA Officer, the Program Manager, the QA Representative, and, if necessary, the SWRCB QA Officer about the concern and potential for data rejection.
    - Stage 2 – the Program QA Officer identifies a situation during the secondary verification procedures where rejection of data is recommended.
    - In both cases, the Program QA Officer, the Program Manager, the QA Representative, and, if necessary, the SWRCB QA Officer will determine if the data should be rejected. The QA Representative or the SWRCB QA Officer will determine if a deviation form or QAPP amendment is necessary.
- TAC Review: the TAC will review the finalized dataset (Stage 3) and associated Data Report to assess the quality of the data relative to the project goals. During this review, TAC members may identify project-level data quality concerns that were not previously identified by the laboratory, Data Manager, or Program QA Officer. These situations will be communicated to the Program QA Officer, the Program Manager, the QA Representative, and the SWRCB QA Officer to determine if the results should be rejected. The QA Representative or the SWRCB QA Officer will determine if a deviation form or QAPP amendment is necessary.

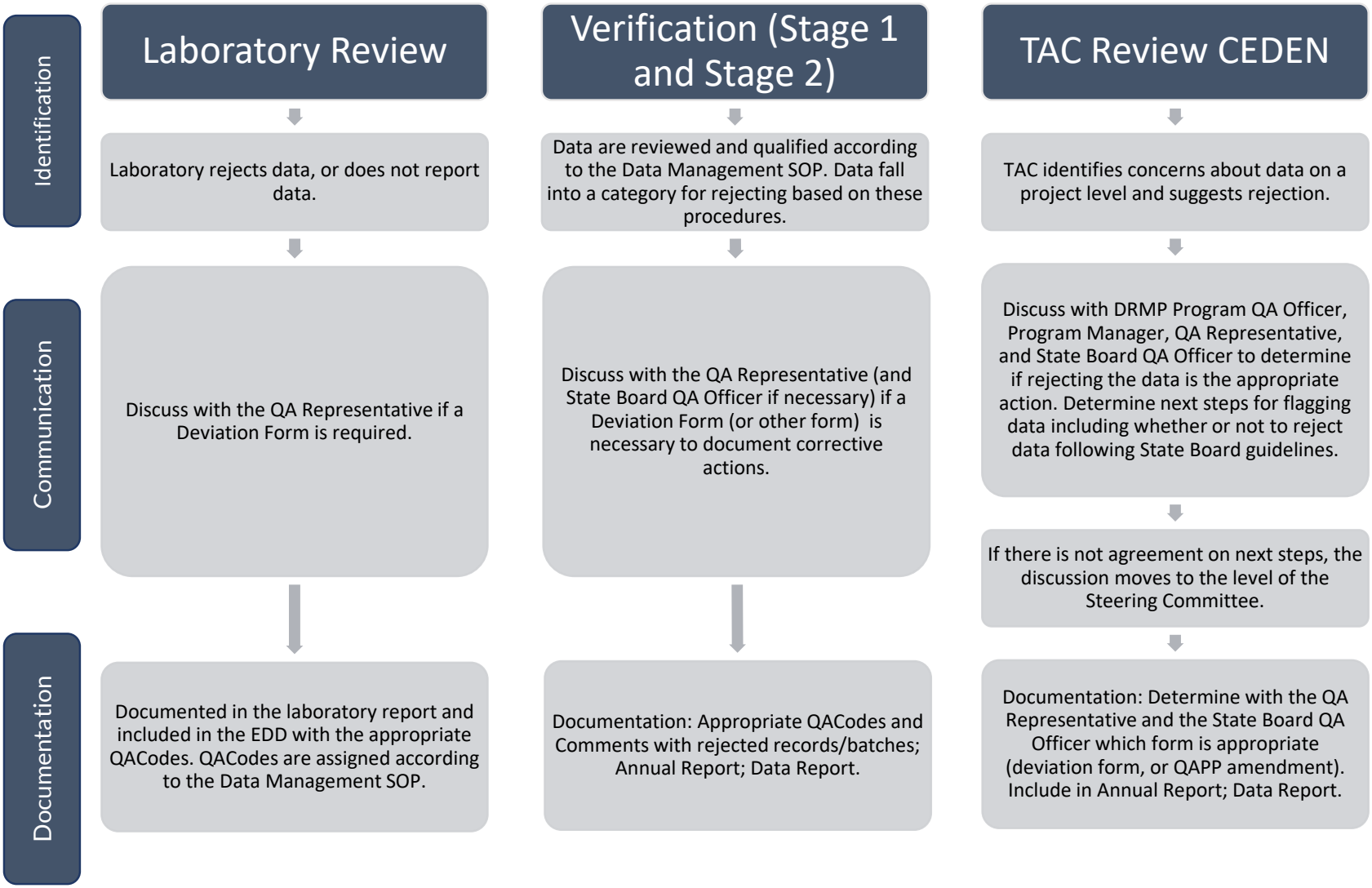
If the Program QA Officer, Program Manager, CVRWQCB QA Representative, and SWRCB QA Officer agree to reject, qualify, or not publish data, the agreed upon next steps will be documented, implemented, and communicated to the CEC TAC and Steering Committee. If the Program QA Officer, Program Manager, CVRWQCB QA Representative, and SWRCB QA Officer cannot agree on whether to reject, qualify, or not publish data, the discussion will be elevated to the Steering Committee for a recommendation, and then on to the CVRWQCB Executive Officer and DRMP Executive Committee for discussion prior to a final decision by the CVRWQCB Executive Officer.

In the case where the Program QA Officer, Program Manager, CVRWQCB QA Representative, and SWRCB QA Officer cannot agree on whether to reject, qualify, or not publish data, two short memos, each authored by the proponents of the solution and

describing the issue and proposed resolution, will be provided to the Steering Committee Co-Chairs for dissemination to the Steering Committee and discussion at the next Steering Committee meeting. The Steering Committee will be asked to provide advice and/or make a recommendation to the Board of Directors/Executive Committee concerning the data. As described in the Steering Committee Responsibilities and Voting language, consensus on a recommendation may come from an informal vote or simple question such as “Is any SC member opposed to a recommendation?”. If there is clear consensus, the recommendation will be included in the meeting summary as being reached by consensus and that no vote was needed. If the Steering Committee members cannot come to consensus on a recommendation, the Steering Committee member(s) that are not in agreement should put forth a workable compromise to see if consensus can be gained. After discussion, if consensus cannot be gained informally, the Steering Committee Chairs should ask for a recommendation to vote on (i.e., moved and seconded by SC members). Voting should be recorded as green (in favor), white (abstain), yellow (stand aside), and red (opposed/block). A single block means that consensus has not been achieved. Majority and minority opinions, reservations, and oppositions will be noted verbally at the meeting, including the member who has made such recommendations, and documented in the meeting summary.

Following the Steering Committee meeting, the DRMP BOD President and the CVRWQCB Steering Committee member will provide the two memos and communicate the Steering Committee’s recommendation (either consensus or non-consensus) to the CVRWQCB Executive Officer. The CVRWQCB Executive Officer will consult with the DRMP Executive Committee prior to making a final decision.

Figure 13. Process for identifying, communicating, and documenting data rejection decisions.



23 VERIFICATION AND VALIDATION METHODS

23.1 DATA VERIFICATION

The DMT will perform all data verification according to the methods outlined in **Appendix II**. These minimum requirements for data verification procedures are summarized below; however, the detailed procedures defined in the Data Management SOP must conform to the data management principles of the Water Boards. Conformity to these principles ensures that the data generated by this project are comparable and properly verified according to both the Delta RMP and Water Boards needs. The attached SOP has been reviewed by the SWRCB to ensure agreement with data processing procedures and SWRCB requirements.

All field collection records are entered either directly into the database or into a CEDEN comparable EDD format. Field data should be verified against the original collection records before finalized and, if necessary, exported to provide field collection details to laboratories.

The contract laboratories are responsible for the reduction of the raw data generated by the methods used to a data deliverable format determined by agreement between the laboratory and the Program Manager. Each contract laboratory's QA Officer will perform checks of all of its records at a frequency that the lab determines sufficient. The analytical process includes verification or a quality assurance review of the data, which includes:

- Verifying the calibration samples for compliance with the laboratory and project criteria;
- Verifying that the batch QC samples were analyzed at a proper frequency and the results were within specifications;
- Comparing the raw data (e.g., chromatogram) with reported concentration for accuracy and consistency;
- Verifying that the holding times were met and that the reporting units and quantitation limits are correct;
- Determining whether a corrective action was performed, and control was re-established and documented prior to reanalysis of QC or project samples;
- Verifying that all project and QC sample results were properly reported and flagged;

- Preparing batch narratives that adequately identify and discuss any problems encountered; and
- Verifying that all testing requirements were met and reporting any inconsistencies as deviations.

Data verification for the Delta RMP CEC project will take place on two levels: initial verification (Stage 1) and secondary verification (Stage 2).

23.1.1 Stage 1 – Reviewed Data

The purpose of the initial verification is to ensure that the original data provided by the laboratory includes the required data fields, formatted correctly, and flagged according to the QAPP requirements. Initial verifications are completed by the DMT, who communicate with the laboratory regarding any missing values or inconsistent reporting of data.

Once results are received from laboratories, the DMT reviews 100% of the reports and deliverables generated. Data verification procedures should at a minimum include:

- Verification of the results against the original sample collection records to ensure all expected results are received.
    - This may include the removal of superfluous results (such as non-project QC data) that should not be included in the final dataset.
- Verification of electronic data against lab reports or additional analysis records received to ensure consistent results between formats.
- Verification of sample processing and analysis information against the requirements outlined in this QAPP; this should include checks for
    - Expected analytes,
    - Expected methods,
    - Reporting limits and minimum detection limits,
    - Batch definition, and
    - Reporting units.
- Verification that fields not controlled by lookup lists (e.g., comment fields) are formatted in a way that is consistent with the project requirements and the business rules of the database into which the dataset will be loaded.
- Verification that all quality control evaluation calculations are complete (e.g., RPDs)

- Verification of all environmental and QC sample results against the MQOs outlined in this QAPP, and, where results do not meet the MQOs, verification that the proper data qualifier is applied to the record. Checks against MQOs should include an evaluation of:
    - Holding time compliance,
    - QC sample frequency,
    - Detections in blank samples,
    - Recoveries of spiked samples and surrogates, and
    - Precision metrics of duplicate samples.
- Verification that all records are unique, and no duplicated data exist in the dataset.
- Verification that all required fields are completed.

Once all data verification steps are completed, DMT staff apply the appropriate CEDEN comparable Lab Submission Code and Batch Verification Code according to the project requirements, the results of the data review, and data verification steps that were completed. The list of acceptable codes can be found in the documentation of CEDEN lookup lists (http://ceden.org/CEDEN_Checker/Checker/LookUpLists.php). In addition, data processors may add to comment fields of the final data records any pertinent information from the laboratory report case narrative to further qualify data, as needed. If available for the data deliverable template that was provided, the finalized results should be run through an appropriate data checker once verification is complete to ensure that the final data meet the minimum requirements of the database into which they will eventually be loaded.

Data having completed initial verification are loaded into the CV RDC. At a minimum, data used for the intermediate QA Assessment conducted as a part of the February 1 Annual Report must have undergone this initial verification and be loaded into the CV RDC database.

23.1.2 Stage 2 – Verified Data

Once data are loaded into the CV RDC, they can undergo the secondary verification. The purpose of the secondary verification is to perform a second check of the data against the MQOs in the QAPP to ensure that all qualifying codes are applied consistently throughout the dataset on both a result and batch level. Once secondary verification is completed, the appropriate CEDEN compliance codes are applied to each data record. The secondary verification is completed by the Program QA Officer or a delegate independent of data generation. Data that have undergone secondary verification and

have the appropriate compliance codes applied are considered “final” on a results level and on a batch level. These data are then exported and provided to the CEC TAC, stakeholders, and CVRWQCB staff. Per Resolution R5-2021-0054, this is done within six months of sample analysis. Data used in the final Data Reports generated at the end of a WY must have undergone initial and secondary verification.

All QA issues will be noted, and the associated results qualified with the appropriate data flag. When QA issues affect the useability of the associated results, reconciliation and correction of these issues will be done by a committee composed of the Program Manager, the Program QA Officer, the CVRWQC QA Representative, and the appropriate field and/or laboratory staff. Any resulting corrective actions will be documented with a Deviation Form (**Figure 12**) according to the procedures outlined in **Element 20**. The Program Manager is responsible for distributing results to the appropriate committees, stakeholders, and data users, and for ensuring data are submitted to the CVRWQCB within the timelines outlined in R5-2021-0054.

23.2 DATA VALIDATION

Data validation steps provide a broader assessment of data compliance with project requirements, useability, and suitability for their intended use. Such assessments may be conducted in long-term interpretive reports, trend analyses, or ad hoc quality assessments as requested by the Steering Committee or BOD; however, at this time there are no data validation requirements for the data generated under this QAPP.

24 RECONCILIATION WITH USER REQUIREMENTS

Procedures to review, verify, and validate data generated under this QAPP are outlined in **Element 23** and included as a part of **Appendix II**. These procedures ensure that all data uploaded into the database have been qualified on a result, batch, and project level with each deviation being coded and comments provided.

Data are reported to the CVRWQCB and TAC in a variety of formats including CEDEN templates, narrative data summaries (including data compiled into tables and charts), and laboratory reports. The Annual Report will include a quality assurance section that shall identify and describe all QAPP deviations and any other project deviations that impacted the quality of the Delta RMP data in order to ensure data are of known and documented quality.

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APPENDIX I – FIELD SAMPLING PROCEDURES

Standard Operating Procedures for Monitoring

APPENDIX II – DATA MANAGEMENT PROCEDURES

Standard Operating Procedures for Data Management

APPENDIX III – LABORATORY SOPS

Proprietary – Do Not Distribute

The following SOPs are on kept file and only available for regulatory review and approval of this QAPP.

Section	Reference	SOP	Title
A. Physis Laboratories	A.1	SOP – PPCPs by EPA 625.1M	Standard Operating Procedure for EPA Method 625.1(m), Revision 4.0
	A.2	SOP – Turbidity by EPA 180.1	Standard Operating Procedure for EPA 180.1 Determination of Turbidity by Nephelometry, Revision #4
B. Enthalpy Analytical Laboratories	B.1	SOP – PFAS by EPA 537M	SOP 49: Preparation and Analysis for the Determination of Per and Poly Fluorinated Compounds, Revision 22
C. Weck Laboratories	C.1	SOP – PPCPs by EPA 1694M	*Weck SOPs confidential and are not provided to the Delta RMP. Revisions are submitted directly to the SWRCB QA Officer.*
	C.2	SOP – SSC by ASTM D3977	*Weck SOPs confidential and are not provided to the Delta RMP. Revisions are submitted directly to the SWRCB QA Officer.*