Monitoring and Reporting Program R5-2012-XXXX

Appendix MRP- 1

Quality Assurance Project Plan Requirements

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MRP-1 QUALITY ASSURANCE PROJECT PLAN REQUIREMENTS

MONITORING AND REPORTING PROGRAM R5-2012-XXXX

I. INTRODUCTION

A Quality Assurance Project Plan (QAPP) shall be developed by the third-party and shall include site-specific information and field and laboratory quality assurance requirements. This document identifies the major elements of the quality assurance and quality control (QA/QC) components that need to be described in the QAPP. The QAPP shall be submitted to the Central Valley Water Board Irrigated Lands Regulatory Program (ILRP) for review and approval by the Central Valley Water Board Quality Assurance Officer.

II. OBJECTIVES

The purpose of this document is to identify the QA and QC components that must be described in the QAPP for the third-party monitoring. A QAPP contains the requirements and criteria for the field and laboratory procedures used during planning and implementation of the monitoring program. The QAPP shall identify the procedures that will be used to assure that the monitoring data represent, as closely as possible, the water quality conditions of the water body that is being sampled at the time of sampling. This will be achieved by using accepted methodologies (e.g., U.S. Environmental Protection Agency, USEPA) for sample collection and analysis of water, sediment, and biota. Chemical, bacteriological, and bioassay analyses shall be conducted at a laboratory certified for such analyses by the State Department of Public Health . A copy of the third party's QAPP shall be provided to, and followed by, all laboratories that perform analysis or testing of ILRP samples.

A QAPP must contain adequate detail for Project and Water Board staff to identify and assess the technical and quality objectives, measurement and data acquisition methods, and limitations of the data generated under the Project. This document provides a description of major elements of a QAPP that are also required under the guidelines provided by the USEPA and the State Surface Water Ambient Monitoring Program (SWAMP).

Note: This document provides a compilation of USEPA, SWAMP, and ILRP guidelines. Language has been taken and used directly from the following documents:

> USEPA. 2001 (2006) USEPA Requirements for Quality Assurance Project Plans (QA/R-5) Office of Environmental Information, Washington, D.C. USEPA QA/R-5
>
> SWAMP Quality Assurance Program Plan (SWAMP QAPP Version 1.0 dated01 September 2008.)
> http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/qapp/qaprp082209.pdf

III. QAPP COMPONENTS

The U.S. Environmental Protection Agency details the components, content, and format required for a QAPP. Following the guidelines provided by the USEPA, a QAPP must contain specific information regarding four main components:

A. Project Management

This component addresses basic project management, including the project history and objectives, roles and responsibilities of the participants, and other aspects. These elements ensure that the project has a defined goal, that the participants understand the goal and the approach to be used, and that the planning outputs have been documented.

B. Data Generation and Acquisition

This component addresses all aspects of project design and implementation. Implementation of these elements ensures that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and QC activities are employed and are properly documented.

C. Assessment and Oversight

This component addresses the activities for assessing the effectiveness of the implementation of the project and associated QA and QC activities. The purpose of the assessment is to provide project oversight that will ensure that the QA Project Plan is implemented as prescribed.

D. Data Validation and Usability

This component addresses the QA activities that occur after the data collection, laboratory analysis and data generation phase of the project is completed. Implementation of these elements ensures that the data conform to the specified criteria, thus achieving the project objectives (USEPA 2001).

These four main components are further subdivided into twenty-four (24) specific elements as required by the USEPA. The state SWAMP's QAPP further defines items required under each component to ensure that adequate detail is presented within the Project's QAPP and that data collected are comparable across programs. The ILRP also has program-specific requirements that are included where applicable. In order to provide more information in preparing the QAPP, all required components, elements, and subsections are discussed in the ensuing sections of this document. A QAPP that is submitted for compliance with the ILRP must contain all of the components, elements, and requirements that are described in this document.

IV. QAPP ELEMENTS

This section identifies the elements that further describe the four key QAPP components required by the ILRP.

A. Project Management

1. Title and Approval Sheet (USEPA Element 1)

The Title and Approval Sheet element provides the basic project information including the project title, QAPP version number and date, identifies key project staff, and official approval signatures. The Title and Approval Sheet must include the following components:

1.1 Project title.

1.2 Revision number.

1.3 Organization name.

1.4 Signature and date block for project lead.

1.5 Signature and date block for project manager(s).

1.6 Signature and date block for project QA officer(s).

2. Table of Contents (USEPA Element 2)

The Table of Contents element provides an organized index of the QAPP and must include the following components:

2.1 List of QAPP sections.

2.2 List of tables and figures.

2.3 List and description of appendices.

2.4 List and description of attached SOPs.

2.5 SOPs revision number and date for each referenced SOP.

3. Distribution List (USEPA Element 3)

The Distribution List element provides for a comprehensive list of individuals and organizations that will require a copy of the approved QAPP and subsequent revisions. This element also provides for a list of those responsible for implementation of the approved QAPP as well as assessment of compliance of the terms within. The Distribution List element must include the following components:

3.1 List of contact staff, organization, phone numbers, email addresses.

3.2 List of names of individuals and organizations that will receive and retain a copy of the QAPP.

4. Project Organization (USEPA Element 4)

The Project Organization element provides for a detailed breakdown of key participating individuals and organizations, identifying their individual roles and responsibilities within the project. This element also provides information about the chain of authority and at what level key decisions and project assessment reviews will take place. The Project Organization element must include the following:

4.1 Identify key individuals involved in any major aspect of the project.

4.2 Discuss each individual's responsibility.

4.3 Describe organizational chart detailing lines of authority.

4.4 Designate a QA Manager.

4.5 Identify (if applicable) the individual(s) responsible for maintaining the official, approved QAPP.

4.6 Identify (if applicable) any advisors to the project.

5. Problem Definition/Background (USEPA Element 5)

The Problem Definition/Background element provides for a statement of the project objectives and an overview of historical background for the problem the project is addressing. Existing and applicable regulatory information should also be identified within this section. The Problem Definition/Background element must include the following:

5.1 Describe project objectives.

5.2 Describe approaches to meet the objectives.

5.3 Identify applicable regulatory information, applicable criteria, action limits, TMDLs, and Basin Plan objectives.

5.4 Describe the decisions to be made, actions to be taken, or outcomes from the information to be obtained.

5.5 Describe the project background or historical information for initiating this project.

The requirements in sections IV.A.5.4 and IV.A.5.5 need to be placed in the Project's MRP Plan. However, the QAPP should identify the sections and pages where this information can be found in the specific MRP Plan.

6. Project Description (USEPA Element 6)

The Project Description element provides for a summary of all work that is to be performed and the schedule for implementation. This element also provides for a detailed description of the geographical area where sampling is to be performed. The Project Description element must include the following:

6.1 Detailed summary of work to be performed.

6.2 Detailed schedule of major project work benchmarks.

6.3 Detailed geographical information.

6.4 Photo reconnaissance of the monitoring sites.

6.5 Discussion on resource and time constraints.

Photo reconnaissance of all monitoring sites should include, at a minimum, four pictures that provide:

(a) A general site overview.

(b) Upstream view.

(c) Downstream view.

(d) Entrance to location where the samples will be collected.

7. Quality Objectives and Criteria (USEPA Element 7)

The Quality Objectives and Criteria element provides for a description of the Project quality objectives as well as performance criteria to achieve those objectives. The Project quality objectives and performance criteria should be defined for sampling design, sample collection, and analytical measurements. The quality objectives for analytical measurements must meet the requirements defined for a particular method (Appendix MRP-1A). The following narrative must be included within the Quality Objectives and Criteria element of the Project's QAPP:

7.1 Project Quality Objectives

The collection of samples and evaluation of data shall provide data that are representative, comparable, complete, precise, and accurate.

(a) *Representativeness:* Sampling locations should be selected that adequately represent discharges from the project area, and the affected water bodies. Samples must be collected during times and at locations that are representative and that meet the objectives described in the MRP.

Objectives include adherence to sampling Standard Operating Procedures (SOPs), holding times, decontamination procedures, etc.

(b) *Comparability:* Data collected under the ILRP must be comparable in content and quality to the statewide consistency goals outlined by the SWAMP program. An approved Project QAPP ensures comparability with other state monitoring programs and projects.

(c) *Completeness:* Data completeness is defined as a measure of the amount of valid data obtained from a measurement system as compared to the planned amount, usually expressed as a percentage. Factors that affect data completeness include sample breakage during transport or handling, insufficient sample volume, laboratory error, QC failure and equipment failure. The third-party must strive to meet a goal of 90% data completeness per sample batch (Appendix MRP-1B) and must be calculated and reported as specified within the MRP Order.

Project completeness can be divided into two areas: Field & Transport Completeness and Laboratory Completeness. Completeness goals should be applied to all aspects within these two areas to meet the 90% total requirement.

Field & Transport Completeness refers to the complete event process of successful planned site visit, conditions documentation, in-field measurements, sample collection technique and volume, in-field quality assurance and control sample preparation, chain-of-custody documentation, preservation, and successful transport of samples to the receiving agencies. Note that if a site is inaccessible or dry, the adequate documentation of these conditions through field sheets, photos, and other means meets the completeness goal for that site and event. Meeting this requirement does not supersede any further requirements outlined in the MRP Order that would determine site re-visitation or site location changes.

Laboratory Completeness refers to the complete event process of sample reception, chain-of-custody documentation, storage and in-house preservation, extraction, analysis, and laboratory quality assurance and control samples and measures.

The Project must provide a narrative describing this assessment for each area as well as outline goals for improvement or maintenance of the 90% completeness requirement.

(d) *Precision and Accuracy:* The evaluation of precision and accuracy takes place at the analytical measurement level for values obtained both in the field and in the laboratory. These are further defined in the Appendices of this document, and the calculations to determine the precision and accuracy values are described in section IV.B.5 of this document.

7.2 Measurement Quality Objectives (Appendix MRP-1B).

The table of measurement quality objectives (MQOs) provided in Appendix MRP-1B must be included the Quality Objectives and Criteria element of the third-party's QAPP.

8. Special Training Needs/Certification (USEPA Element 8)

The Special Training Needs/Certification element provides for information regarding any training that will be required for field, laboratory, and other project staff and states the individuals or organizations that are responsible for ensuring that the training is adequate and is completed. The Special Training Needs/Certification element must include the following components:

8.1 Identify project personnel with specialized training or certification.
8.2 Identify project field personnel training.
8.3 Identify QA manager and Training Officer.
8.4 Discuss renewal or how new training/certifications will be provided.
8.5 Discuss how and how often training is provided.
8.6 Identify how training is documented.
8.7 Identify the location for staff training records.

All staff performing field, laboratory, data entry, and data quality assurance procedures shall receive training at an appropriate frequency to ensure that the work is conducted correctly and safely. At a minimum, all staff shall be familiar with the field guidelines and procedures for surface and groundwater, and the laboratory standard operating procedures (SOPs) included in the Project QAPP. It is the responsibility of the third-party and project management to ensure that applicable training is mandatory for all personnel, and that such training is documented through training certifications or records. The QA officer for the project is responsible for training but others may conduct training. These records must be maintained and updated for all participating field and laboratory staff.

9. Documents and Records (USEPA Element 9)

The Documents and Records element describes the required documents and records necessary for project quality assurance, including the Project QAPP. The Documents and Records element must include the following components:

9.1 Identify reporting format as required by the MRP.
9.2 List all other project documents.
9.3 Discuss where project information will be kept and length of retention.
9.4 Discuss paper and electronic backup methods.
9.5 Discuss how documents will be updated and the responsible party for the update and distribution.
9.6 Discuss how those on the distribution list will receive the most current version of the approved QAPP.

In addition to the above elements, the QAPP must address the specific requirements described below.

Copies of field logs, chain-of-custody forms (section IV.B.3), sample integrity forms for the contract and subcontract laboratories, original preliminary and final laboratory reports, and

electronic media reports must be kept for review by the Central Valley Regional Water Quality Control Board (Central Valley Water Board) ILRP staff. The project field crew must retain original field logs with electronic copies submitted to ILRP staff as specified in the MRP Order. The project contract laboratory shall retain original chain-of-custody forms and copies of the preliminary and final data reports for a period of no less than five years.

The third-party shall provide the Central Valley Water Board with electronic copies (e.g., CD, DVD, or other electronic media acceptable to the board) of the field data sheets, relevant pages of field logs, analytical and toxicity laboratory sheets (replicate and in house water quality data) including failed tests, and copies of the chain-of-custody (COC) forms for all samples submitted for analysis. All copies shall be submitted as part of the third-party's Monitoring Data Reports as specified in the MRP Order. The following sample-specific information must be included in the submitted documentation:

(a) Site name
(b) Site code or Well ID
(c) GPS coordinates taken with each sampling event
(d) Sample type, e.g. grab or composite type (Cross-sectional, flow-proportional, etc.)
(e) QC sample type and frequency
(f) Date and time of sample collection (first sample taken)
(g) Results of field measurements
(h) Sample preservation
(i) Requested analyses (specific parameters or method references)
(j) Results of samples collected and all laboratory QC samples (calibrations, blanks, surrogates, laboratory spikes, matrix spikes, reference materials, etc.) and the identification of each analytical sample batch
(k) Results of measurements for tests run prior to toxicity analyses, such as dissolved oxygen, temperature, electrical conductivity, hardness, and ammonia
(l) A description of any unusual occurrences, noted by the field personnel, associated with the sampling event - particularly those that may affect sample or data quality
(m) Any anomalies regarding sample condition noted by the laboratory
(n) Report of any adjustments made to samples prior to running analyses, such as adjustments to dissolved oxygen, alkalinity, de-chlorination, etc.

For data connectivity purposes all surface water samples taken at a site for one sample event should be assigned one designated sampling time. This time designation is the time assigned to the first sample collected, and must be consistent with the time assigned in the chain of custody, field data sheet, and laboratory report forms. An example of a field data sheet form including items (a) through (i) and (l) described above is included in Appendix MRP-1C, Example Form I at the end of this document.

For groundwater samples, the following information is required to determine if a representative sample has been collected:

(a) well construction (well diameter, casing depth, and screen interval)
(b) sampling method (e.g., dedicated pump, bladder pump, bailer)
(c) static water level before purging (measured from top of well casing)
(d) calculated purge volume before sampling

(e) start time/date for purge and sample collection

An example of a field data sheet for groundwater is included in Appendix MRP-1C (Example Form III) at the end of this document.

In the case of field parameters that are continuously monitored through a data logger (e.g. EC, flow, DO, water temperature) field logs are still required as described in items (a) through (i) of this section. The field data should be submitted in the format example provided in Appendix MRP-1C. A similar format to the example provided in Appendix MRP-1C, that contains the required items (see above items (a) through (i) and (l)) may be submitted upon Executive Officer approval.

Before measuring field pH, a daily check standard is required before the pH measurements are taken. This procedure will help demonstrate that the meter is within acceptable limits.

B. Data Generation and Acquisition

This section describes the elements that are necessary to complete the Data Generation and Acquisition component of the QAPP requirements.

1. Sampling Process Design (USEPA Element 10)

The Sampling Process Design element provides for discussion on the Project's data collection design in relation to the Project's objectives. This section should include a description of the monitoring approach as well as follow up methods when water quality problems are detected. The Sampling Process Design element must include the following:

1.1 Discuss the experimental and data collection design.

1.2 Discuss the rationale for the design and objectives of the sampling program.

1.3 Indicate the type of monitoring (surface water or groundwater) and the expected monitoring schedule for each monitoring location.

1.4 Discuss exceedance follow-up plan for each site.

1.5 Indicate the type and total number of samples, matrices, and runs/trials expected or needed for the project.

1.6 Indicate where samples should be taken, and how sites should be identified. A map may be included.

1.7 Describe the course of action should sampling sites became inaccessible.

1.8 Differentiate project data that are critical and data that are for informational purposes only.

1.9 Identify sources of natural variability and how their influence on project data can be minimized.

1.10 Identify potential sources of bias or misrepresentation, and describe how their contribution can be minimized.

The requirements in sections IV.B.1.1 through IV.B.1.10 need to be described in the Project MRP Plan. The QAPP must identify the sections and pages where this information can be found in the specific MRP Plan.

2 Sample Collection Methods (USEPA Element 11)

The Sample Collection Methods element provides for information regarding how samples will be collected. The methods for sample collection preparation, physical collection, handling, and transportation must include measures to avoid contamination, ensure accurate tracking, and preserve sample integrity for analysis.

This element also includes a list of applicable field Standard Operation Procedures (SOPs) identified by number, date, and regulatory citation. The identified SOPs must be attached to the QAPP as appendices. Sample Collection Methods element must also include the following components:

2.A Surface Water and Sediment

2A.1. Identify criteria for acceptable versus unacceptable water and sediment samples.

2A.2. Identify pre-sample collection preparation methods.

2A.3. Identify sample collection method SOPs.

2A.4. Identify sample container sizes, preservation, and transportation (Appendices MRP-1D and MRP-1E).

2A.5. Discuss sampling equipment cleansing and decontamination.

2A.6. Discuss corrective action measures for problematic situations.

2A.7. Discuss, if applicable to the project, how samples are homogenized, composited, split, and/or filtered.

2A.8. Describe field procedures including the required following items:

(a) Photo documentation will occur during all monitoring events, as well as GPS coordinates (actual coordinates at the time of sampling). Any changes in monitoring locations during monitoring events must be photo-documented and accompanied by GPS coordinates.

(b) Field personnel must be instructed in the proper collection of samples prior to the sampling event and in how to recognize and avoid potential sources of contamination.

(c) Field personnel must be able to distinguish acceptable versus unacceptable water and sediment samples in accordance with pre-established criteria.

(d) Sample containers must be pre-cleaned and certified to be free of contamination according to the USEPA specification for the appropriate methods.

(e) All field and sampling equipment that will come in contact with field samples must be decontaminated after each use in a designated area to minimize cross-contamination. These details (proper procedures for how and when to clean the equipment) must be specified in the sampling SOP.

(f) All samples must be identified with a unique number to ensure that results are properly reported and interpreted. Samples must be identified such that the site, sampling location, matrix, sampling equipment, and sample type (i.e., normal field sample or QC sample) can be distinguished by a data reviewer or user.

(g) A field activity coordinator must be responsible for ensuring that the field sampling team adheres to proper custody and documentation procedures. A

master sample logbook or field datasheets shall be maintained for all samples collected during each sampling event.

(h) All field activities must be adequately and consistently documented to ensure defensibility of any data used for decision-making and to support data interpretation. Pertinent field information, including (as applicable), the width, depth, flow rate of the stream, the surface water condition, location of the tributaries, and the actual GPS coordinates where the sample was taken must be recorded on the field sheets, along with field measurements.

(i) All surface water sampling events must include flow information. When possible, the USGS method (Church et al, 1999) should be used at all wadeable and nonwadeable stream sites for accurately determining flow during each specific monitoring event. If the USGS method cannot be used then flow measurements should be taken near the stream bank of the site or the float method can be used. The approximate location and number of stream flow measurements should be documented on the data sheets. Photo documentation should also be used at all sites for every sample event. Data files for flow data should contain a comment column that will allow a flag for flow measurements that have a high degree of uncertainty. Flow data with a high degree of uncertainty should not be used for pesticide (or other constituent) instantaneous loading calculations. More rigorous load calculations might be required for TMDL or other programs' needs.

(j) Sediment samples for toxicity testing and chemical analyses shall be collected using a standardized methodology. The methodology to be used shall be identified and described in the Project QAPP section IV.B.2, Sample Collection Methods. Example protocols can be found in section V, References (USGS Guidelines, 1994). Sediment samples shall be collected with overlying water present at a collection site. Sampling of dry sediment shall not be required, however alternative sampling events must be conducted to meet the minimum sample collection requirements as outlined in the MRP. Sampling conditions shall be documented in both the field notes and photographs for every successful and non-successful monitoring event (i.e., including planned events when the site is dry upon arrival).

2B. Groundwater

A primary objective of this groundwater sampling program is to collect groundwater data that are representative of in-situ conditions within the aquifer. To minimize the potential for sample error (alteration of chemical or physical conditions resulting from collection of the groundwater sample), sampling procedures and devices must be carefully selected. When possible, the California Department of Pesticide Regulation Standard Operating Procedure for Obtaining and Preserving Well Water Samples, SOP Number FSWA001.02 (or more recent) should be used unless superseded by ILRP specified requirements.

The QAPP must include the following components:

2B.1. Objectives of the sampling program.

2B.2. Schedule for sample collection, laboratory analyses, and report submittal.

2B.3. Detailed procedures of the groundwater sampling process. These procedures must include, but are not limited to, the following;

(a) Well integrity inspection.

(b) Depth to groundwater measurement equipment, measurement procedures, and decontamination process used between sampling locations.

(c) Field quality assurance and quality control measures.

(d) Purging and sampling device selection including operation details of the selected devices and decontamination procedures used between sampling locations.

(e) Methodology used to determine purge volume, purging rate, and the depth at which purging will be conducted (if applicable).

(f) Well purging procedures.

i. Groundwater monitoring wells - Important aspects of purging include the purging device, purge volume, purging rate, and depth of the purging device. Groundwater monitoring wells must be purged for a minimum of three casing volumes. Purging may be considered complete when indicator parameters (such as temperature, pH, and E.C.) have stabilized. Low-flow and micropurge techniques may be used provided the specific purging procedures are detailed in the QAPP. Pumping rates that allow sample collection with minimal disturbance of the chemical and physical conditions within and near the well should be used to minimize sampling error.

ii. Domestic supply wells - Stagnant water should be purged from a domestic supply well prior to collecting a groundwater sample. The purge volume required to remove stagnant water will vary based on the activity of the well, which must be determined on a case by case basis. In situations where the domestic well has been recently pumped (active well), reduced purge volumes may be adequate to remove existing stagnant water. In situations where the well has been inactive for an extended period of time (inactive well), stagnant water should be purged from the well for a minimum of 10 to 20 minutes or the equivalent of three casing volumes. If the groundwater sample will be collected downstream of a pressure/storage tank additional purge volume may be required to ensure the tank has been flushed. Purging may be considered complete when indicator parameters (such as temperature, pH, and E.C.) have stabilized. Purge rate calculations may be used to estimate the time necessary to purge a predetermined volume of water. In order to keep the pump operating, hose bibs should be opened to ensure the pressure gauge on the storage tank holds a steady pressure level below the shutoff pressure. Specify the criteria used to determine if the well is active or inactive, the methodology used to determine when purging is complete, and which measurement tools and calculations will be used when a predetermined volume of water will be purged.

iii. Agricultural supply wells - Stagnant water should be purged from an agricultural supply well prior to collecting a groundwater sample. The purge volume required to remove stagnant water from an agricultural

supply well may vary based on the activity of the well, which must be determined on a case by case basis. In situations where the agricultural supply well has been recently pumped (active well), reduced purge volumes may adequate to remove existing stagnant water. In situations where the well has been inactive for an extended period of time (inactive well), stagnant water should be purged from the well for a minimum of 30 minutes. Purging may be considered complete when indicator parameters (such as temperature, pH, and E.C.) have stabilized. Specify the criteria used to determine if the well is active or inactive, the methodology used to determine when purging is complete, and which measurement tools and calculations will be used to estimate the volume of purged water.

(g) Field equipment types and calibration procedures.

(h) Field parameter measurement procedures.

(i) Field equipment decontamination procedures.

(j) Sample collection procedures.

i. Identify any necessary pretreatment requirements.

ii. Groundwater monitoring wells - Sampling devices must be carefully selected based on the design of the monitoring wells, constituents that will be analyzed, and the use of the data that will be generated. Identify the sampling device(s) that will be used, the length of time between well purging and sample collection, and the depth at which groundwater samples will be collected. Identify the decontamination procedures for the selected monitoring devices(s) between locations.

iii. Domestic supply wells - Groundwater samples should be collected prior to the water entering the storage tank whenever possible and may not be collected downstream of a treatment system. Common sampling ports on domestic supply wells include pipe plugs, Schrader® valves, faucets, or petcocks. If a sample cannot be collected prior to water entering the storage tank, the sample should be collected from the outlet most closely plumbed to the wellhead. Specify the sampling procedures used to collect groundwater samples and equipment decontamination procedures used between sampling locations.

iv. Agricultural supply wells - Groundwater samples should be collected from a sample port prior to the water exiting the discharge pipe whenever possible. If the well does not have a sample port, the samples should be collected prior to the water entering the standpipe or surge tank. Samples must be collected prior to the addition of any nutrients, pesticides/herbicides, or mixing with other water sources. Specify the sampling procedures used to collect groundwater samples and the decontamination procedures used between sampling locations.

(k) Include field sheet template. An example of an acceptable field sheet with the minimum information necessary may be found in Appendix MRP-1C of this QAPP.

2B.4. Identify sample container sizes, filtration, preservation, and transportation (Appendix MRP-1D, -1E).

2B.5. Discuss corrective actions for problematic situations.

3. Sample Handling and Custody (USEPA Element 12)

The Sample Handling and Custody element provides for a discussion of the sample integrity maintenance requirements as well as tracking and chain-of-custody procedures. The components of this element must describe the efforts that will be taken to ensure the physical and chemical integrity of a sample from collection to disposal.

Sample Handling Custody element must include the following components:

3.1 Identify sample holding times, integrity, and storage measures (both before and after extraction). See Appendices MRP-1D and MRP-1E for sample handling details.

3.2 Identify corrective action for samples that do not meet preservation and/or holding times (Appendix MRP-1F).

3.3 Identify the physical transport of samples from the field.

3.4 Discuss sample handling and custody documentation.

3.5 Identify sample Chain-of-Custody procedures.

3.6 Identify the individuals responsible for verifying procedures.

3.7 Describe Field Custody Procedures including the following items:

(a) Sample custody must be traceable from the time of sample collection until results are reported. Sample custody procedures provide a mechanism for documenting information related to sample collection and handling.

(b) A chain-of-custody form must be completed after sample collection and prior to sample shipment or release. The chain-of-custody form, sample labels, and field documentation must be cross checked to verify sample identification, type of analyses, number of containers, sample volume, method of preservation, and type of containers.

(c) All sample shipments are accompanied with the chain-of-custody form, which identifies the contents. The original chain-of-custody form accompanies the shipment and a copy is retained in the project file.

(d) All shipping containers must be secured with chain-of-custody seals for transportation to the laboratory. The samples must be transported in ice to maintain sample temperature between 0-6 degrees Celsius. The samples must be sealed in zip lock bags and shipped to the contract laboratories according to Department of Transportation standard.

(e) Samples that do not meet preservation and/or holding times need to be re-sampled.

3.8. Chain of custody forms

Chain of custody forms must include the following items:

(a) Sampler name.

(b) Address (where the results need to be sent).

(c) Ice chest temperature at log-in.

(d) To whom the laboratory results need to be sent.

(e) Sample identification.
(f) Analysis required.
(g) Number of containers of each type (i.e. plastic, glass, vial, whirlpak).
(h) Sample collection date and time.
(i) Comments/special instructions.
(j) Samples relinquished by (signature, print name, date).
(k) Samples received by (signature, print name, date).

3.9. Sample control activities

Sample control activities must be conducted at the laboratory as well as in the field. Project laboratory custody procedures must include the following conditions:

(a) Verify initial sample log-in and verification of samples received with the chain-of-custody form.
(b) Document any discrepancies noted during log-in on the chain-of-custody.
(c) Initiate internal laboratory custody procedure.
(d) Verify sample preservation (e.g., temperature).
(e) Notify the project coordinator if any problems or discrepancies are identified.
(f) Identify proper sample storage, including daily refrigerator temperature monitoring and sample security.

4. Analytical Methods and Field Measurements (USEPA Element 13)

The Analytical Methods and Field Measurements element provides for information regarding the specific methods and procedures used to extract, analyze, and/or take measurements of the samples as well as the performance criteria. Analytical Methods and Field Measurements element must include the following components and address all parameters required to be monitored under the MRP:

4.1 Parameters Table

The monitoring parameters table should include all parameters that will or may be monitored by the third party. For parameters that were not anticipated prior to QAPP approval, the third party must submit an amended monitoring parameters table.

4.2 Identify methods and SOPs, including sample preparation and extraction procedures that meet ILRP requirements (Appendix MRP-1A).

4.3 Identify instrumentation and kits associated with field measurements and laboratory measurements.

4.4 Describe sample disposal procedures (or refer to section IV.B.4.1).

4.5 Identify method and instrument performance criteria (i.e. measurement quality objectives), including the method detection limits (MDLs), and reporting limits (RLs).

4.6 Identify corrective action measures and documentation for test/measurement failure.

4.7 Describe how instruments should store and maintain raw data. Methods or SOPs may be referenced and attached to the QAPP.

4.8 Specify laboratory turnaround times needed.

4.9 Provide method validation and information for all non-standard SOPs and performance based methods (PBMs).

4.10 Indicate where PBMs development records are stored and how they can be accessed.

With the inclusion of the above components, the laboratory analyses discussion in the Project QAPP must also include the following requirements:

(a) Laboratory Quantitation Limits

Laboratories must establish quantitation limits (QLs) that are reported with the analytical results. These laboratory QLs must be less than or equal to the reporting Limits (RLs) that are identified in the ILRP Monitoring and Reporting Program (MRP) requirements (Appendix MRP-1A). The laboratories must have documentation to support quantitation at the required levels. Any modification in reported QLs must be identified and discussed in the laboratory data report. For example, the reported QL for a measurement will change due to sample dilution. The dilution factor, reason for dilution, and other relevant information must be described in the data report.

Laboratories must also report analytical results with measurements equal to or higher than the Method Detection limit (MDL) and lower than the QL. These results must be reported as numerical values and qualified as estimated. Reporting such values as “trace” or “<QL” is not acceptable.

Each laboratory performing analyses for the ILRP program must routinely conduct MDL studies to establish the maximum sensitivity (lowest concentration detectable) for each chemical constituent (Appendix MRP-1A), and to document that the MDLs are less than the PQLs. The MDL studies must be thoroughly documented and conducted in accordance with Revision 1.1, Code of Federal Regulations (CFR), Title 40, Part 136, Appendix MRP-1B (1984), “Definition and Procedure for the Determination of the Method Detection Limit.” New MDL studies should be conducted whenever there is a significant change in methods, reagent type or procedures, or within two years of the date the most recent study was conducted.

An MDL is developed from seven aliquots of a standard containing all analytes of interest spiked at approximately five times the expected MDL, which are taken through the analytical method sample processing steps. The data are then evaluated and used to calculate the MDL. If the calculated MDL is less than one-third the spiked concentration, the MDL study must be repeated using a lower concentration.

Project samples may not be analyzed and reported until the MDL study has been completed according to the CFR requirements. MDL study results must be available for review during audits, data review, or as requested. Current MDL study results must be reported at the beginning of every project for review and inclusion in project files.

If any analytes have MDLs that are higher than the project QLs, the following steps must be taken:

- Optimize the sensitivity of the analytical system (as allowed under the appropriate method), and perform a new MDL study sufficient to establish analyte identification at concentrations less than the project-specified QLs.
- If MDLs below required PQLs still could not be achieved for the required constituents using the methods identified in the MRP, the ILRP staff must be contacted. If an alternate method (accredited, modified or performance based) may be used to meet the desired MDLs, a written request to use that method must be provided to the ILRP. The request to use an alternate method must be approved by the Executive Officer and Quality Assurance Officer prior to sample analysis.
- If methods or laboratories that meet the QL requirements are not available, or cannot be feasibly accessed, a variance or exception to a specific QL may be requested in writing. Variances will only be approved on a case-by-case basis, and after consideration of the impact of the variance, and the documentation provided.

(b) Laboratory Corrective Actions

Corrective action measures should also be discussed in the event of instrument failure or performance criteria exceedances. Specific activities that will take place when a failure occurs must be discussed for chemical measurements, toxicity, and microbiological analyses. Project leads must ensure that the laboratory follow the corrective action procedures stated in their QAPP. At a minimum, the approach for corrective action should state the following in the Project QAPP:

"When an out of control situation occurs, analyses or work must be stopped until the problem has been identified and resolved. The analyst responsible must document the problem and its solution and all analyses since the last control point must be repeated or discarded. The nature and disposition of the problem must be documented in the data report that is sent to the Central Valley Water Board."

(*c) Laboratory Calibration Curves*

Laboratory adjustments to calibration curves and also to recovery acceptance limits are method dependent. However, when these adjustments are changed during Project implementation, these changes need to be communicated to the ILRP Staff in order to ensure that new limits will meet the program requirements.

For the ILRP, only calibration with a linear regression is acceptable for organic analyses. Non-linear calibration is not allowed due to the fact that using a non-linear option creates a potential for poor quantitation or biased concentrations of compounds at low or high concentrations (near the high and low ends of the calibration range). In order to conduct the linear regression, laboratories shall prepare an initial 5-point calibration curve, where the low level standard concentration is less than or equal to the analyte quantitation limits.

(d) Pesticide Analyses

Pesticide analyses must be conducted on unfiltered (whole) fractions of the samples. Prior to the analysis of any environmental samples, the laboratory must

have demonstrated the ability to meet the minimum performance requirements for each analytical method. Initial demonstration of laboratory capabilities includes the ability to meet the Project specified quantitation limits (QL), the ability to generate acceptable precision and recoveries, and other analytical and QC parameters as stated in this document.

(e) Alternative Analytical Methods

Analytical methods should be identified by number, date, and regulatory citation. Analytical methods used for chemistry analyses must follow a procedure approved by USEPA or provided in the most recent edition of Standard Methods for the Examination of Water and Waste Water (Appendix MRP-1A). When there is a program need to analyze for contaminants that do not have USEPA or Standard Methods procedures, then United States Geological Survey (USGS), American Society of Testing Materials (ASTM), and Association of Official Analytical Chemist (AOAC) methods may be used by accredited laboratories.

If an analytical method is not provided in the referenced documents, then laboratories may still achieve compliance by submitting a performance-based evaluation of their procedure for the Central Valley Water Board Executive Officer's approval. This will require a peer-reviewed published method or performance-based validation method based upon the protocol described in the USEPA's "Guide to Methods Flexibility and Approval of USEPA Water Methods" (USEPA, 1996 or an updated version, if applicable).

Laboratory development of a performance-based method (PBM) validation package and Standard Operating Procedures (SOP) are required when quantification levels are greater than the value in the analyte list or differ by ten times the measurement levels stated in the published method. The validation package must include all data for the "Initial Demonstration of Laboratory Capability," which includes:

1. MDL studies (the analyst shall determine the MDL for each analyte according to the procedure in Code 40 of Federal Regulation (CFR) 136, Appendix MRP-1B using the apparatus, reagents, and standards that will be used in the practice of this method).
2. Initial precision and recovery (IPR)
3. QC samples, where applicable
4. Linear calibration ranges (method linearity)

(f) References for Analytical Methods

The analysis of any material required by this program shall be performed by a laboratory that has accreditation or certification pursuant to Article 3 (commencing with section 100825) of Chapter 4 of Part 1 of Division 101 of the Health and Safety Code. General guidance for analytical methods is provided in a list of references in section V of this document. Specific method modifications may be approved by the Executive Officer of the Central Valley Water Board if sufficient justification is provided.

(g) Toxicity Testing Procedures

Requirements for water column and sediment toxicity testing procedures are specified in section III.C.4 of the MRP Order.

5. Quality Control (USEPA Element 14)

The Quality Control (QC) element provides information regarding the activities that will take place for the Project to ensure accuracy, precision, and defensibility. Definitions for all quality control samples described here are included in section VI below. A summary table must be provided, which includes required and optional QC and the frequency. The QC summary table should address all sampling, measurement, and analysis techniques.

The following items must be included within the QC element of the Project QAPP:

(a) For Chemical Analyses

Field Duplicate and Field Blank

At a minimum, one field duplicate and one field blank must be included per sampling event per analysis (or collected at the rate of 5% for each analysis, whichever is more frequent). Analyses of field duplicates and field blanks must include all individual analytes intended to be measured from the successfully collected samples during an event. See section VI for the definition of 'entity' for the ILRP.

Quality Control (QC) Set

At a minimum, one "QC Set" must be included per 20 samples or per analytical batch, whichever is more frequent. The minimum required samples for chemical analyses must include:

1. Matrix spike (MS) and matrix spike duplicate (MSD)
2. Reference material or laboratory control spike (LCS)
3. Laboratory duplicate
4. Laboratory blank

All samples must be submitted to the laboratory and preserved or extracted (if required) within appropriate holding times.

(b) For Microbiological Analyses

Field Duplicate and Field Blank

At a minimum, one field duplicate and one field blank must be included per sampling event per entity. These samples must represent every organism type measured within the entire sampling event.

Quality Control (QC) Set

At a minimum, one "QC Set" must be included per analytical batch. The minimum required samples for microbiological analyses must include:

1. Negative Control
2. Positive Control

All samples must be submitted to the laboratory and initialized within appropriate holding times.

(c) For Toxicity Analyses

Field Duplicate

At a minimum, one field duplicate must be included per sampling event per entity. These samples must represent every type of bioassay organism tested for toxicity within the entire sampling event.

Quality Control (QC) Set

At a minimum, one "Laboratory QC Set" must be included per analytical batch. The minimum required samples for toxicity analyses must include:

1. Negative Control
2. Positive Control

All samples must be submitted to the laboratory and initialized within the appropriate holding times.

The third-party may have several entities responsible for sampling and each of those entities is required to collect and submit a Field QC Set for each third-party sampling event. However, if one entity is providing the sample collection training for all entities contained within the third-party, then it would be appropriate for the third-party to collect and submit one Field QC Set for a sampling event.

Optional QC samples that might be utilized by project management include travel blanks, equipment blanks, equipment blank/rinsate samples, and field split samples. Definitions for all quality control samples described here are included in section VI below.

All samples must meet the approved method-specific field (e.g., preservation, collection, holding time) and laboratory procedures (e.g., extraction, analysis). All data will be flagged, where appropriate, when quality control and assurance measures fall outside of the required limits.

If at any time a problem is detected within the field QC (e.g., blank contamination, RPD outside of recommended precision range), the third-party will attempt to identify the source of the problem and proceed with appropriate corrective actions. Corrective actions for field QC are described in Appendix MRP-1F. However, more specific and appropriate correction actions may be required on a case-by-case basis.

5.1 Field duplicate specifications

Field samples collected in duplicate provide information on precision in the sampling process. The relative percent difference (RPD) must be calculated for each field duplicate set and reported in the electronic record and within the quality control summary report, as specified in the MRP Order. To calculate the RDP, the difference between the two samples is divided by the mean of the two samples and the result is multiplied by 100. The corrective actions detailed in Appendix MRP-1F should be followed in the event a field duplicate RPD is found to fail the MQO (>25%).

For bacterial analyses, no assessment of field precision is required.

A field duplicate sample will be collected at the rate of 5% for each analysis per sampling event (or one set per sampling event, whichever is more frequent). The evaluation of field precision must be addressed in the Project QAPP. QAPP

acceptance criteria for laboratory precision shall be based only on laboratory-based duplicate samples such as duplicate matrix spikes, blank spikes, laboratory control materials, or certified reference materials. For bacterial analyses, no assessment of field precision is required, but laboratories are required to meet methodological precision requirements. Field duplicates with failed results (RPD >25%) do not require re-sampling. However, these data should be flagged and field teams should be notified so that the source of error can be identified and corrective actions taken before the next sampling event.

5.2 Field blank specifications

A field blank is prepared by transporting laboratory purified water into the field, transferring it to an appropriate container and subjecting it to all preservations, transport, and laboratory analytical procedures as a normal sample. Field blanks assess the potential for contamination during the sample handing process. Corrective actions (Appendix MRP-1F) should be followed if a contaminant is detected within a field blank.

5.3 Method blank specifications

Method blanks, and all laboratories positive and negative controls for other media and analytes, should be conducted, when necessary (depending on the method), upon initiation of sampling.

Although laboratory blanks are important for all analyses, method blanks for low-level analyses can be conflictive. Improvements in analytical sensitivity have lowered detection limits down to the point where some amount of analyte may be detected in even the cleanest laboratory blanks. In these circumstances, the magnitude of a contaminant found in blanks should be compared to the concentrations found in the samples. ***Subtracting method blank results from sample results is not permitted***. However, any blank contamination should be discussed with project management, and must be reported in the monitoring reports that are submitted to the ILRP staff.

When laboratories obtain detectable concentrations of a specific analyte in the method blanks as part of their laboratory quality control, they need to re-extract and re-analyze in the following circumstances:

"METALS: If any analyte concentration in the method blank is above the PQL, the lowest concentration of that analyte in the associated samples must be 10 times the method blank concentration. Otherwise, all samples associated with that method blank with the analyte's concentration less than 10 times the method blank concentration and above the PQL must be re-digested and re-analyzed for that analyte. The sample concentration is not to be corrected for the method blank value.

ORGANICS: If any analyte concentration in the method blank is above the PQL, all samples associated with that method blank must be re-extracted and re-analyzed for that analyte. The exception to the above requirement is for common laboratory contaminants such as volatile solvents and phthalates where all samples associated with that method blank, with an analyte concentration less than 10 times the method blank concentration and above the PQL must be re-digested and re-analyzed for that analyte."

5.4 Matrix spike and spike duplicate specifications

A matrix spike (MS) shall be prepared by adding a known concentration of a target analyte to an environmental sample, which is then prepared and analyzed along with samples. Matrix spikes are analyzed in order to assess the magnitude of matrix interference and bias present. A duplicate matrix spike is utilized to assess the precision of the matrix affects. An MS and MSD set must be prepared in the laboratory using sample water collected specifically by the project and be analyzed within the same analytical batch as the original samples. Certified Reference Materials shall be used to prepare MS. After measurement of the MS/ MSD, the Accuracy and Precision must be calculated and noted on the monitoring report and electronic record.

(a) Accuracy of MS Recovery is measured as the percent recovery and provides the accuracy of an analytical test measured against an analyte of known concentration that has been added to an actual field sample. Percent recovery for MS/MSD is calculated as follows:

$$\%Recovery = \left(\frac{V_{MS} - V_{Ambient}}{V_{Spike}} \right) x100$$

Where:

V_{MS} = is the measured concentration of the spiked sample.

$V_{Ambient}$ = is the measured concentration of the original (unspiked) sample.

V_{Spike} = is the concentration of the spike added.

If the percent recovery for any analyte in the MS or MSD is less than the recommended warning limit, the chromatograms and raw data quantitation reports must be reviewed. Corrective action that is taken and verification of acceptable instrument response must be included in the cover letter discussion as well.

(b) Precision of the MS/MSD pair is measured as the relative percent difference (RPD) between two spiked samples and is calculated as follows:

$$RPD = \left| \frac{V_{MS} - V_{MSD}}{Mean} \right| x100\%$$

Where:

RPD = is the relative percent difference

V_{Ms} = is the measured concentration for the matrix spike.

V_{MSD} = is the measured concentration of the matrix spike duplicate.

Mean = is the average of the two concentrations, calculated as follows:

$$Mean = \left[V_{MS} + V_{MSD} / 2 \right]$$

The measurement quality objective (MQO) for precision in MS/MSD pairs is 25% or less. If results for any analytes do not meet this MQO, calculations and instruments must be checked, and the analyst may be required to repeat the analysis to confirm the results. If the results repeatedly fail to meet the objectives indicating inconsistent homogeneity, unusually high concentrations of analytes, or poor laboratory precision, then the laboratory is obligated to:

- Halt the analysis of samples,
- Identify the source of the imprecision, and
- Make corrections where appropriate before proceeding.

If an explanation for a low or high percent recovery value is not discovered, the instrument response may be checked using a calibration standard. Low or high matrix spike recoveries may be a result of matrix interferences and further instrument response checks may not be warranted. An explanation for low or high percent recovery values for MS/MSD results must be discussed in a cover letter accompanying the data package to project management and included in the monitoring report to the Central Valley Water Board.

If the failure to meet the designated MQOs for MS and MSD is indicative of poor laboratory performance, the laboratory is obligated to halt the analysis of the samples and to identify the source of the problem and make corrections before proceeding.

5.5 Laboratory control spike

A Laboratory Control Spike (LCS) provides information on analytical accuracy and instrument bias. After measurement of the LCS is obtained, the Percent Recovery (Accuracy) must be calculated and noted on the report and electronic record.

(a) Accuracy of LCS Recovery is measured as the percent recovery of an analyte of known concentration that has been added to laboratory purified water. Recovery for a Laboratory Control Spike is calculated as follows:

$$\%Recovery = \left(\frac{V_{LCS}}{V_{Spike}} \right) x100$$

Where:

V_{LCS} = is the measured concentration of the spike control sample.

V_{Spike} = is the actual concentration of the spike amount added.

If the percent recovery for any analyte in the LCS is outside the MQO, the chromatograms and raw data quantitation reports must be reviewed. Corrective action that is taken and verification of acceptable instrument response must be included in the cover letter discussion as well.

If an explanation for a low or high percent recovery value is not discovered, the instrument response may be checked using a calibration standard. Low or high matrix spike recoveries may be a result of matrix interferences and further instrument response checks may not be warranted. An explanation for low or high

percent recovery values for an LCS result must be discussed in the laboratory report cover letter.

Failure to meet the designated MQO for an LCS is indicative of poor laboratory performance. In this case, the laboratory is obligated to halt the analysis of the samples and to identify the source of the problem and make corrections before proceeding.

5.6 Laboratory Duplicate

The Laboratory Duplicate sample is an intra-laboratory split of an environmental sample that is used to measure the precision of an analytical process. After measurement of the original sample and laboratory duplicate, the Relative Percent Difference (RPD) must be calculated and noted for the duplicate sample on the report and electronic record.

(a) Precision of the original sample and laboratory duplicate (LD) pair is measured as the RPD between two samples, and is calculated as follows:

$$RPD = \left| \frac{V_{LD} - V_{Sample}}{Mean} \right| x100\%$$

The Mean is the average of the results from the two samples, calculated as follows:

$$Mean = \left[V_{LD} + V_{Sample} / 2 \right]$$

The Measurement Quality Objective (MQO) for Precision in a laboratory duplicate is 25% or less. If results for any analytes do not meet this MQO, calculations and instruments must be checked, and the analyst may be required to repeat the analysis to confirm the results. If the results repeatedly fail to meet the objectives indicating inconsistent homogeneity, unusually high concentrations of analytes or poor laboratory precision, then the laboratory is obligated to:

- Halt the analysis of samples,
- Identify the source of the imprecision, and
- Make corrections where appropriate before proceeding.

Failure to meet the designated MQOs for a laboratory duplicate is indicative of poor laboratory performance. In this case, the laboratory is obligated to halt the analysis of the samples and to identify the source of the problem and make corrections before proceeding.

5.7 Test acceptability criteria for toxicity tests

Test acceptability criteria are specified within the USEPA manuals for acute and chronic toxicity tests (USEPA 2002a and 2002b). These are also applicable to toxicity identification evaluations (TIEs).

Decision Step 1: If the Control treatment meets all USEPA Test Acceptability Criteria (TAC), then proceed to statistical analyses for determination of the presence of statistically significant reductions in organism survival, reproduction, growth, or biomass, as applicable. For samples that exhibit toxicity, the follow-up requirements in Monitoring and Reporting Program Order R5-2012-XXXX (MRP) must be followed.

Decision Step 2 – TAC Failure, sample appears non-toxic (*Ceriodaphnia dubia, Pimephales promelas, Hyalella Azteca, Selenastrum capricornutum*): If the control does not meet TAC criteria, an acute or chronic test of a water or sediment sample appears non-toxic (e.g. 90-100% survival), and the program completeness standard is met (e.g., ≥90% of testing performed successfully to meet ILRP Completeness Objective), the test result need only be "flagged" to denote failure of TAC in the Control treatment. ILRP completeness must be evaluated according to the schedule specified within the MRP.

If an acute or chronic test of a water or sediment sample appears non-toxic (e.g. 90-100% survival), and the program completeness objective is not met, then a re-test of the original sample must be initiated within 24 hours of the observation of TAC failure in a Control treatment.

For the fathead minnow test, the laboratory must take the steps to procure test species within one working day, and the re-test must be initiated the day fish are available. In all cases, both the original test results and the re-test results must be reported to the Central Valley Water Board as part of the third-party's Monitoring Data Report; the re-test results should be flagged to note that the re-test was initiated outside of the holding time. If the re-test does not meet USEPA TAC, new samples must be collected within two working days of the laboratory identifying a second failure in TAC.

Decision Step 3 – TAC Failure, sample appears toxic (*Ceriodaphnia dubia, Pimephales promelas, Selenastrum capricornutum, Hyalella Azteca*): If a Control treatment does not meet USEPA TAC, and the associated ambient water sample(s) appear toxic (e.g. <90% survival), then the Central Valley Water Board will be notified within 1 business day of the observation of the results in question so that an agreement can be reached regarding how to proceed. At a minimum, re-testing of the original sample within 24 hours of the observed test failure will be required and test results must be "flagged."

For the fathead minnow test, the laboratory must take the steps to procure test species within one working day, and the re-test must be initiated the same day fish are available. In all cases, both the original test results and re-test results must be reported to the Central Valley Water Board as part of the third-party's Monitoring Data Report. Re-test results should be flagged to note that the re-test was initiated outside of the holding time. If the re-test does not meet USEPA TAC, new samples must be collected within two working days of the laboratory identifying a second failure in TAC.

Note: it is important to recognize that when re-testing a sample beyond the 36-hour holding time prescribed in the test method manual, there is a possibility that toxicity will be reduced or completely gone. In addition, when re-sampling at a site, the new sample does not represent the same conditions under which the original sample was collected (this is particularly important to note when sampling is meant to characterize

a specific event such as storm water runoff). A new field sheet and associated field measurements and observations will be required when re-sampling a site.

The reporting of data that do not meet USEPA TAC must also include an assessment from the laboratory as to what may have caused the test control performance issue, the laboratory's corrective measures to prevent future control failures, a comparison of the data against the USEPA test performance measures, and a comparison of the data against the ILRP required completeness criteria in the Project's QAPP.

6. Instrument/Equipment Testing, Inspection and Maintenance (USEPA Element 15)

The Instrument/Equipment Testing, Inspection and Maintenance element provides for information regarding how personnel can assure that equipment will function properly when needed, as well as the methods for recording equipment failure to track problematic units. The Instrument/Equipment Testing, Inspection, and Maintenance element must include the following components:

6.1 Identify field and laboratory equipment that require periodic maintenance and the schedule.

6.2 Identify equipment testing criteria and procedures.

6.3 Identify the individual(s) responsible for instrument/equipment testing, inspection, and maintenance.

6.4 Note the availability and location of spare parts.

6.5 Identify pre-use equipment inspection procedures.

6.6 Identify corrective action measures and documentation for equipment failure.

7. Instrument/Equipment Calibration and Frequency (USEPA Element 16)

The Instrument/Equipment Calibration and Frequency element provides for information regarding how continual quality performance of equipment and instruments will be ensured. The Instrument/Equipment Calibration and Frequency element must include the following components:

7.1 Identify field and laboratory equipment that require calibration.

7.2 Identify the calibration procedure and schedule.

7.3 Identify calibration documentation methods.

7.4 Identify corrective action measures and documentation for equipment deficiencies.

Routine field instrument calibration must be performed at least once per day prior to instrument use to ensure instruments are operating properly and producing accurate and reliable data. Calibration should be performed at a frequency recommended by the manufacturer, if more frequent than once per day and in case of instrument failure. The calibration should be recorded within a field calibration log or directly on the corresponding field sheet.

8. Inspection/Acceptance of Supplies and Consumables (USEPA Element 17)

The Inspection/Acceptance of Supplies and Consumables element provides for information regarding how supplies and consumables (e.g., standard materials and solutions, sample bottles, calibration gases, reagents, hoses, DI water, potable water, electronic data storage

media) shall be inspected and accepted for use in the project if applicable. All stock standards and reagents used for extraction and standard solutions must be tracked through the laboratory. The preparation and use of all working standards must be recorded in bound laboratory notebooks that document standards traceable to USEPA, A2 LA or National Institute for Standards and Technology (NIST) criteria.

Records must have sufficient detail to allow determination of the identity, concentration, and viability of the standards including any dilutions performed to obtain the working standard. Date of preparation, analyte or mixture, concentration, name of preparer, lot or cylinder number, and expiration date, if applicable, must be recorded on each working standard. The Inspection/Acceptance of Supplies and Consumables element must include the following components:

8.1 Identify critical supplies and consumables for the field and laboratory.

8.2 Identify the source, acceptance criteria, and procedures for the tracking, storing, and retrieving of the above materials.

8.3 Identify the individual responsible for these tasks.

9. Non-Direct Measurements (USEPA Element 18)

The Non-Direct Measurements element provides for identification and discussion of the types of data needed for project implementation or decision making that is obtained from non-measurement sources such as computer data bases, programs, literature files, and historical data bases. The Non-Direct Measurements element must include the following components:

9.1 Identify non-direct sources of data that will be used within the project.

9.2 Discuss the intended use of this information.

9.3 Identify the acceptance criteria for the data used.

9.4 Identify any required resources and support facilities (e.g. Data Logger, Controllers).

9.5 Describe the process by which the project determines limits to validity and operating conditions.

10. Data Management (USEPA Element 19)

The Data Management element provides for a detailed discussion of the data management process, tracing the path of the data from their generation to their final use and storage.

Data generated shall follow the data entry and loading requirements specified in the MRP Order and shall be maintained by the responsible party and available for electronic data submission to the Central Valley Water Board staff. With the inclusion of the above requirement, the Data Management element must include the following components:

10.1 Identify the data management scheme from field to final use and storage for all data types.

10.2 Identify standard record keeping and tracking practices and the corresponding SOPs where applicable.

10.3 Discuss how field data and laboratory data will be entered or uploaded into the required data submission format.

10.4 Discuss the control mechanism for detecting and correcting errors and for preventing loss of data during data reduction, data reporting, and data entry to forms, reports, and/or database.

10.5 Identify the individual(s) responsible for data management.

10.6 Verify that continuous monitoring data will be stored in its original Sonde file.

10.7 Include any checklists or forms used in data management.

Procedures for data reduction with respect to significant figures must incorporate the following conventions:

A digit is significant if it is required to express the numerical value of a measurement. The number of significant digits in a measurement must be restricted by the least accurate of its input measurements. These input measurements include all of those associated with sample processing, including aliquots measured during sampling, preparation, and laboratory analysis.

Results of mathematical calculations shall have the same number of significant figures as the calculation's least precise input value. Results of addition and subtraction of measurements shall reflect the decimal position of the calculation's least precise input value. The number of significant figures can vary during these calculations. The final digit in an expressed measurement inherently possesses an uncertainty. This is especially relevant in the discussion of method detection limits (MDLs) and reporting limits (RLs). In these instances, the number of reported significant digits must realistically reflect the laboratory's analytical precision.

When the result of a calculation contains too many significant digits, it must be rounded. If a result's trailing digit is less than five, the last significant digit is not changed. If this trailing digit is equal to or greater than five, the last significant digit is rounded up.

C. Assessment and Oversight

1. Assessment and Response Actions (USEPA Element 20)

The Assessments and Response Actions element provides information regarding how a project's activities will be assessed during the project to ensure that the QAPP is being implemented as approved. The Assessments and Response Actions element must include the following:

1.1 The number, frequency, and type of project assessment activities that will be conducted.

1.2 The individual(s) responsible for conducting assessments and indicate their authority to stop work as necessary.

1.3 How and to whom assessment information should be reported.

1.4 Corrective action measures and documentation for assessment conclusions.

For projects using existing data, the data may be assessed to determine suitability for their intended use and to identify whether project specifications were met. Field operation audits, laboratory performance evaluations, and technical system audits should also be included in a Project's assessment element. Central Valley Water Board staff may also audit laboratories during sample analyses for this program.

The contractor should routinely observe field operations to ensure consistency and compliance with sampling specifications presented in this document and QAPP that will be developed later. An audit checklist should document field observations and activities.

Performance evaluation (PE) audits quantitatively assess the data produced by a measurement system. Performing an evaluation audit involves submitting certified samples for each analytical method. The matrix standards are selected to reflect the concentration range expected for the sampling program. Any problem associated with PE samples must be evaluated to determine the influence on field samples analyzed during the same time period. The laboratory must provide a written response to any PE sample result deficiencies.

A technical system audit is a quantitative review of a sampling or analytical system. Qualified technical personnel perform audits. The laboratory system audit results are used to review operations and ensure that the technical and documentation procedures provide valid and defensible data.

2. Reports to Management (USEPA Element 21)

The Reports to Management element provides for information regarding how management will be kept informed of project oversight, assessment, activities, scheduling, and findings. The Reports to Management element must include the following components:

2.1 Identify which project QA status reports will be needed and frequency.

2.2 Identify individual(s) responsible for composing the reports and the individual/s who will receive and respond to the reports.

The element will identify those responsible for writing reports, when and how often these reports will be written, and identify who will be notified of audit findings. The element will also include the actions project management will take in response to the reports.

D. Data Validation and Usability

1. Data Review, Verification and Validation (USEPA Element 22)

The Data Review, Verification, and Validation element provides the criteria used to review and validate data (data quality assessment). These steps help ensure that the data satisfy the quality criteria detailed and required by the ILRP. The Data Review, Verification, and Validation element must include the following:

Assess the Criteria Used to Validate Project Data (refer to Element A.7)
Data must be consistently assessed and documented to determine whether project quality objectives have been met, quantitatively assess data quality, and identify potential limitations on data use. Assessment and compliance with QC procedures should be under-taken throughout the project to ensure the accuracy of sample collection, laboratory analysis, exceedance communications, and the submitted monitoring reports. Data communicated to Central Valley Water Board staff will be considered draft until the receipt of the monitoring report, which will include copies of signed laboratory data sheets.

The Project QAPP must be used to accept, reject, or qualify the data generated by the laboratory. The Project Manager shall convey the QA/QC acceptance criteria to the laboratory management. The laboratory management will be responsible for validating the data generated by the laboratory. The laboratory personnel must verify that the

measurement process was “in control” (i.e., all specified data quality objectives were met or acceptable deviations explained) for each batch of samples before proceeding with analysis of a subsequent batch. In addition, each laboratory will establish a system for detecting and reducing transcription and/or calculation errors prior to reporting data.

The laboratory will submit only data which have met MQO’s, or which have deviations that are thoroughly evaluated and described. When QA requirements have not been met, the samples will be reanalyzed when possible and only the results of the reanalysis will be submitted, provided they are acceptable. The Project Manager will be responsible for determining if the validated laboratory data meet the project acceptance criteria.

After data entry or data transfer procedures are completed for each sample event, data should be inspected for data transcription errors, and corrected as appropriate. After the final QA checks for errors are completed, the data should be added to the final database. Quality assurance checks shall be performed at a project level prior to submission within monitoring reports and electronic data submittals.

2. Verification and Validation Methods (USEPA Element 23)

The Verification and Validation Methods element provides for the identification of methods or processes for verifying and then validating project information. The Verification and Validation Methods element must include the following components:

2.1 Identify the methods and processes used to verify and validate project data.

2.2 Identify the individual(s) responsible for verification and validation of each type of data (e.g., Field Logs, Chain-of-Custodies, Calibration Information, Completeness).

2.3 Identify documentation and or corrective action for discrepancies.

2.4 Attach any checklists, forms, and calculations that will be used.

The methods to be used or processes to be followed can be identified as SOPs, if available, or described in the text.

3. Reconciliation with User Requirements (USEPA Element 24)

The Reconciliation with User Requirements element provides for a discussion on how validated data will be evaluated to see if it answers the original questions asked within the monitoring objectives. The Reconciliation with User Requirements element must include the following components:

3.1 Discuss the procedures to evaluate the uncertainty of the validated data.

3.2 Discuss how limitations on data use should be reported to data users.

This element outlines the proposed methods to analyze the data and determine possible anomalies or departures from assumptions established in the planning phase of data collection. The element will also describe how reconciliation with user requirements will be documented, issues will be resolved, and how limitations on the use of the data will be reported to decision makers.

V. REFERENCES

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VI. DEFINITIONS AND ACRONYMS

The following information is presented to provide definition and clarification of terminology and acronyms used within the Monitoring and Reporting Program documents.

Definitions

The following definitions apply to the Monitoring and Reporting Program as related to discharges from irrigated lands as described in this Order and all attached documents.

1. **Accuracy** - The closeness or agreement of the observed value or test response to the true or acceptable reference value or the test response from a reference method. It is influenced by both random error (precision) and systematic error (bias). The terms “bias” and “precision” are often used in lieu of “accuracy”.
2. **Analytical Batch** - A group of 20 or fewer samples analyzed by the same method and instrument within a 24-hr period. An analytical batch may be comprised of several sample batches and therefore represent multiple collection and preservation/extraction dates, as long as holding time are met for each sample. Sample batches can be from different entities.
3. **Assessment** - A general evaluation process used to evaluate the performance, effectiveness, and processes of a management and/or technical system.
4. **Batch** - A group of samples, to include quality control samples, which is to be collected and/or analyzed in one, test run or inspected together within a specific time limit and traceable as a unit.
5. **Bias** - The constant or systematic distortion of a measurement process that manifests itself as a persistent positive or negative deviation from the known or true value. This can result from improper data collection, poorly calibrated analytical or sampling equipment, or limitations or errors in analytical methods and techniques.
6. **Blank** - A specimen that is intended to contain none of the analytes of interest and which is subjected to the usual analytical or measurement process to establish method purity, a zero baseline, or background value.
7. **Calibration** - A comparison of a measurement standard, instrument, or item with one having higher accuracy to detect, quantify, and record any inaccuracy or variation; the process by which an instrument setting is adjusted based on response to a standard to eliminate the inaccuracy.
8. **Calibration Standard** - A reference solution or substance of known value or chemical concentration used to establish a correct instrument reading.
9. **Certified Reference Materials** - A substance or solution for which the composition or concentration of a particular chemical constituent is known, and which is traceable with documentation pertaining to its composition and uniformity to an established standardization organization such as the National Institute for Standards and Technology (NIST) or the American Association for Laboratory Accreditation (A2LA).
10. **Chain-of-Custody** - An unbroken, documented trail of accountability that ensures the physical security and/or integrity of samples, data, and records.

11. **Comparability** - A measure of the confidence with which one data set, element, or method can be considered as similar to another, e.g., taken from the same location, taken in a similar manner, etc.
12. **Completeness** - A measure of the amount of valid data obtained from a measurement system, compared to the planned or expected amount. For the ILRP, completeness goals will be evaluated with the submittal of each annual monitoring report. The completeness evaluation will include the number of samples successfully obtained and the proportion of quality control samples that are within acceptance criteria.
13. **Contamination** - The unintentional addition of analytical constituents to a sample or system.
14. **Continuing Calibration Verification** - A periodic standard used to assess instrument drift between calibrations.
15. **Control Limit** - The upper and lower acceptable ranges of process data used to judge whether the process is within or outside of statistical limitations. Control limits are determined by the variation in a process data set expressed as the mean value plus or minus a pre-determined number of standard deviations (typically three standard deviations from the mean).
16. **Corrective Action** - Any measures taken to rectify conditions adverse to quality and/or to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent reoccurrence.
17. **Data Quality Assessment** - A statistical and scientific evaluation of a data set to determine the validity and performance of the data collection design and execution, and to determine the adequacy of the data set for its intended use.
18. **Data Quality Indicators** - The quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of information to the user. The principal DQIs are precision, accuracy (or bias), representativeness, comparability, completeness, and sensitivity.
19. **Data Quality Objectives** - Qualitative and quantitative statements derived from the DQO Planning Process that clarify the purpose of the study, define the most appropriate type of information to collect, determine the most appropriate conditions from which to collect that information, and specify tolerable levels of potential decision errors.
20. **Data Quality Objectives Process** - A systematic strategic development tool based on the scientific method that identifies and defines the type, quality, and quantity of information needed to satisfy a specified use, including data precision, accuracy, and completeness requirements.
21. **Data Validation** - An analyte- and sample-specific process that evaluates analytical information after the verification process (i.e., determination of method, procedural, or contractual compliance) to determine analytical quality and any limitations on the data.
22. **Data Verification** - The process of evaluating the completeness, correctness, and conformance/compliance of a specific information set against the method, procedural, or contractual specifications for that activity.

23. **Drift** - The deviation in instrument response from its set or reference value over a period of time.
24. **Entity** – An organization, group, or contractor directly responsible for sample collection. Entities may include: laboratories, private consulting firms, and subwatershed groups.
25. **Equipment Blank** - An aliquot of reagent water that is subjected to all aspects of sample collection and analysis, including contact with all sampling devices and apparatus. The purpose of the equipment blank is to determine if the sampling devices and apparatus for sample collection have been adequately cleaned prior to use.
26. **Field Blank** - An aliquot of reagent water which is exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample. This blank is used to provide information about contaminants that may be introduced during sample collection, storage, and transport.
27. **Field Duplicate (Co-located) -** An independent specimen collected from (as closely as possible) the same point in time and space as the primary specimen. This would include duplicate sample containers filled simultaneously and in close proximity to one another from the same medium, or duplicate containers filled in rapid succession from the same location or source.
28. **Field Duplicate (Sub-sample) or Field Split -** A test specimen that is homogenized before being divided into two or more portions with the same laboratory analyzing all portions, to evaluate sampling and analysis precision. This type of field duplicate (or split) sample analysis can also be performed by more than one lab to evaluate inter-laboratory precision.
29. **Field Measurements -** Those activities associated with performing analyses or measurements in the habitat being examined.
30. **Holding Time -** The period of time a sample may be stored following collection, preservation, extraction, or analysis. While exceeding the holding time does not necessarily negate the validity of analytical results, associated analytical data are typically qualified as estimated.
31. **Indicators -** Items, elements, or measures used to determine or identify a basic condition or how well a process or program is meeting its objectives.
32. **Inter-comparison -** An exercise in which samples are prepared and split by a reference laboratory, then analyzed by one or more testing laboratories and the reference laboratory. The inter-comparison, with a reputable laboratory as the reference laboratory, serves as a test of the precision and accuracy of the analyses from different laboratories at natural environmental levels.
33. **Interference -** An element, compound, or other matrix effect present in a sample, which disturbs the detection of a target analyte leading to inaccurate concentration results for the target analyte.
34. **Internal Standard -** Pure analyte (s) added to a sample, extract, or standard solution in known amount(s) and used to measure the relative responses of other method analytes that are components of the same sample or solution. The internal standard must be an analyte that is not a sample component.

35. **Laboratory Blank (also known as a Method Blank) -** An aliquot of reagent water (or for solid matrices, an inert solid similar to the sample matrix) that is prepared by the laboratory and treated exactly as a sample, including exposure to all glassware, equipment, solvents, reagents, internal standards, and surrogates that are used with samples. The laboratory blank is used to determine if method analytes or interferences are present in the laboratory environment, the reagents, or the apparatus.
36. **Laboratory Duplicate -** Two or more representative portions taken from one homogeneous sample by the laboratory analyst and analyzed in the same testing facility to evaluate the effects of laboratory conditions on analytical precision.
37. **Laboratory Control Spike -** A specimen of known composition prepared using contaminant-free reagent water, or an inert solid, that is spiked with the analyte of interest at the midpoint of the calibration curve or at the level of concern; and then analyzed using the same preparation, reagents, and analytical methods employed for regular specimens and at the intervals set in the Quality Assurance Project Plan.
38. **Matrix -** The material of which the sample is composed or the substrate containing the analyte of interest, such as drinking water, waste water, air, soil/sediment, biological material, etc. Also called medium or media.
39. **Matrix Spike -** A test specimen that is prepared by adding a known concentration of the target analyte(s) to a specified amount of a specific homogenized specimen and is then subjected to the entire analytical protocol.
40. **Matrix Spike Duplicate -** A sample prepared simultaneously as a split with the matrix spike sample with each specimen being spiked with identical, known concentrations of targeted analyte.
41. **Measurement Quality Objectives -** The individual performance or acceptance goals (or requirements) for the individual Data Quality Indicators such as precision or bias.
42. **Method -** A procedure, technique, or tool for performing a scientific activity.
43. **Method Detection Limit -** The minimum concentration of an analyte that undergoes the entire measurement process and can be reported with a stated level of confidence that the analyte concentration is greater than zero.
44. **Method Linearity –** The ability of an analytical method to demonstrate an increase in sample concentration of a given analyte, as the instrument response also increases. Demonstration of instrument linearity, as well as the upper and lower limits of linearity, are considered part of a laboratory method validation procedure and should take place before the procedure is used to report analytical results.
45. **Monitoring -** All types of monitoring undertaken in connection with determining water quality conditions and factors that may affect water quality conditions, including but not limited to, in-stream water quality monitoring undertaken in connection with agricultural activities, monitoring to identify short and long-term trends in water quality, active inspections of operations, and management practice implementation and effectiveness monitoring.
46. **Negative Control -** Measures taken to insure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

47. **Parameter -** A statistical quantity, usually unknown, such as a mean or a standard deviation, which characterizes a population or defines a system. The term Parameter (or sometimes “Analytical Parameter”) can also be defined as a measured analytical constituent such as an individual chemical, a group of chemicals, or a physical property (i.e. Total Organic Carbon, electrical Conductivity, etc.).
48. **Performance Based Measurement System -** A set of processes wherein the data needs, mandates, or limitations of a program or project are specified and serve as criteria for selecting appropriate methods to meet those needs in a cost-effective manner.
49. **Positive Control -** A prepared standard which undergoes an analytical procedure to provide comparison with an unknown specimen thereby monitoring recovery to assure that a test and/or its components are working properly and producing correct or expected results.
50. **Precision -** A measure of mutual agreement between two or more individual measurements of the same property, obtained under similar conditions.
51. **Proficiency Test -** A type of external assessment in which a stable sample, the composition of which is unknown to the analyst, is provided to determine whether the analyst/laboratory can produce analytical results within the specified acceptance criteria. Also known as a Performance Evaluation Test.
52. **Proficiency Test Sample -** A test specimen of known composition and/or chemical concentration that mimics an actual specimen in all possible aspects, except that its composition is unknown to the laboratory at the time of analysis, and which is used to assess the laboratory’s capability to produce results within acceptable criteria.
53. **Qualified Data -** Any numerical information that may be of limited use for a specific function, and is identified (flagged) as such.
54. **Quality Assurance -** An integrated system of management activities (planning, implementation, assessment, reporting, and quality improvement) that focuses on providing confidence in the data or product by ensuring that it is of the type and worth needed and expected for its expressed, intended use.
55. **Quality Assurance Officer -** The individual designated within an organization having management oversight and responsibilities for planning, documenting, coordinating, and assessing the system effectiveness for ensuring the value of the work.
56. **Quality Assurance Project Plan -** A document that describes the intended technical activities and project procedures that will be implemented to ensure that the results of the work to be performed will satisfy the stated performance or acceptance criteria. The amount of information presented and the planned activities to ensure the value of the work will vary according the type of study and the intended use of the data.
57. **Quality Control -** The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established; operational techniques and activities that are used to fulfill requirements.

58. **Quality Control Sample -** One of any number of test specimens, such as a Proficiency Test or blank, intended to demonstrate that a measurement system or activity is in check.

59. **Quality Management Plan -** A document that describes an organization's system in terms of its organizational structure, policy and procedures, staff functional responsibilities, lines of authority, and interfaces for those planning, implementing, documenting, and assessing all activities conducted.

60. **Quality Objectives -** The combined characteristics of Data Quality Objectives and Measurement Quality Objectives; the overall criteria related to sample design and analytical measurements intended to assure that analytical data meet the requirements associated with the intended use.

61. **Quantitation Limit or Practical Quantitation Limit (PQL) -** The level above which numerical results may be obtained with a specified degree of confidence, the minimum concentration of an analyte, or category of analytes, in a specific matrix that can be identified and quantified within specified limits of precision and accuracy during routine analytical operating conditions. The manner of establishing the quantitation limit is method-specific, and typically involves the successful (within established acceptance criteria) analysis of calibration standards at the quantitation limit concentration -- either as part of the instrument calibration procedure, or as a routine control sample.

62. **QC Set (Quality Control Set) -** A group of quality control samples (i.e. a laboratory blank, a matrix spike and matrix spike duplicate, etc.) used to evaluate (control) a specific set or sample batch. Section IV.B.5 provides further detail of what constitutes a QC Set for chemical, microbiological, and toxicity analyses.

63. **Recovery -** The measure of accuracy for an analytical procedure, including determining whether or not the methodology measures all of the analyte contained in a sample, often expressed in percent recovered.

64. **Reference Toxicant -** A substance used as a positive control for toxicological analyses to test the sensitivity of the test organisms to a known toxic substance, and to assure appropriate lab procedures have been performed.

65. **Relative Percent Difference -** The absolute value of the difference of two measurements divided by the statistical mean of the same two measurements, used to evaluate the precision of duplicate samples analysis, or two repeated measurements.

66. **Relative Standard Deviation -** The standard deviation divided by the mean; a unit-free measure of variability.

67. **Repeatability -** The degree of agreement between independent test results produced by the same analyst, using the same test method and equipment on random aliquots of the same sample within a short time period.

68. **Reporting Limit (RL) -** the quantitation level required by the Irrigated Lands Program for reporting purposes. The RL is typically set at a laboratory quantitation level, but consideration may be made for lowering the level to the detection limit, if information about presence or absence of a contaminant is necessary. Similarly, if levels that are protective of water quality prove to be lower than the routine quantitation limit at a given laboratory, then the CVRWQCB may require an RL that is lower than the PQL, providing achieving that limit is economically feasible. The RL can sometimes be

raised to some default value above the PQL, if the PQL is much lower than necessary to protect water quality, and if it is approved by the CVRWQCB.

69. **Representativeness -** A measure of the degree to which data accurately and precisely represent characteristics of a population, parameter variations at a sampling point, a process condition, or an environmental condition.
70. **Rinse Blank -** A dilute acid solution used to flush an instrument between samples in order to reduce memory interferences.
71. **Sample Batch -** A group of samples collected during a sampling event and, if required, preserved or extracted together.
72. **Sampling Event -** A group of samples collected by the same entity in a day or within a multi-day consecutive collection period.
73. **Sensitivity -** The capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest.
74. **Spike -** A known quantity of an analyte added to a sample for the purpose of determining recovery or efficiency (analyst spikes), or for quality control (blind spikes).
75. **Split -** Two or more representative portions taken from one specimen in the field or in the laboratory and analyzed by different analysts, methods, or laboratories.
76. **Standard Deviation -** The measure of the dispersion or imprecision of a series of accepted results around the average, equal to the square root of the variance.
77. **Standard Operating Procedure -** A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and that is officially approved as the method for performing certain routine or repetitive tasks.
78. **Surrogate --** A pure substance with properties that mimics the analyte of interest (organics only) and which is unlikely to be found in environmental samples. It is added into a sample before sample preparation.
79. **Travel Blank --** Analyte-free water placed in the same type of container as its associated field samples. It may be pre-preserved prior to shipment, but is not opened during the sample collection. Consequently, it helps isolate contamination associated with sample transport.

Acronyms

The following acronyms apply to the Monitoring and Reporting Program as related to discharges from irrigated lands as described in this Order and all attached documents.

AMR	Annual Monitoring Report
CAL-EPA	California Environmental Protection Agency
CCR	California Code of Regulations
CEDEN	California Environmental Data Exchange Network
CFR	Code of Federal Regulations
COC	Chain of Custody
DPH	Department of Public Health
DO	Dissolved Oxygen

DOC	Dissolved Organic Carbon
DQO	Data Quality Objective
GC/MS	Gas chromatography/mass spectrometry
GIS	Geographic Information System
IDL	Instrument Detection Limit
ILRP	Irrigated Lands Regulatory Program
LCS	Laboratory Control Spike
LCSD	Laboratory Control Spike Duplicate
ML	Minimum Level
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MRP	Monitoring and Reporting Program
MS	Matrix Spike
MSD	Matrix Spike Duplicate
N/A	Not Applicable
ppm	Parts per million (mg/kg sediment and tissue; mg/l water)
ppb	Parts per billion (ug/kg or ng/g sediment and tissue; ug/l water)
PQL	Practical Quantitation Limit
QAPP	Quality Assurance Project (or Program) Plan
QA/QC	Quality Assurance/Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference
SOP	Standard Operating Procedure
SQMP	Surface Water Quality Management Plan
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
TIE	Toxicity Identification Evaluation
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compounds

APPENDIX MRP-1A: Analytical Requirements

Constituents, Parameters, and Tests	Analytical Methods	Reporting Limit	Reporting Unit
General Parameters - Water			
Flow	USGS (R2Cross Streamflow Method)	1	cfs
pH	SM 4500 H+B, EPA 150.1	0.1	pH units
Specific Conductivity	EPA 9050A or EPA 120.1	100	µS/cm
Dissolved Oxygen	SM 4500-O G	0.1	mg/L
Temperature	SM 2550 B	0.1	° Celsius
Turbidity	SM 2130 B or EPA 180.1	1	NTU
Total Dissolved Solids	SM 2540 C or EPA 160.1	10	mg/L
Total Suspended Solids	SM 2540 D or EPA 160.2	10	mg/L
Hardness (as $CaCO_3$)	EPA 200.7, 130.1, 130.2, SM 2340 C	10	mg/L
Total Organic Carbon	SM 5310 C, EPA 415.1, 415.2	0.5	mg/L
Fecal coliform	SM 9221 B/E or 9223	2	MPN/100ml
E. coli	SM 9221 B/E or 9223	2	MPN/100ml
Toxicity Testing - Water			
Algae -*Selenastrum capricornutum*	EPA/821/R-02/013	NA	Cell/ml, % Growth
Water Flea – *Ceriodaphnia dubia*	EPA/821/R-02/012 (Acute) EPA/821/R-02/013 (Chronic)	NA	% Survival Reproduction
Fathead Minnow – *Pimephales promelas*	EPA/821/R-02/012 (Acute) EPA/821/R-02/013 (Chronic)	NA	% Survival Biomass
Toxicity Identification Evaluation (TIE)	EPA/600/3-88/034, EPA/600/3-88/035	NA	Stressor Type
Carbamate Pesticides - Water	EPA 8321 or 632		
Aldicarb	"	0.5	µg/L
Carbaryl	"	0.5	µg/L
Carbofuran	"	0.5	µg/L
Methiocarb	"	0.5	µg/L
Methomyl	"	0.5	µg/L
Oxamyl	"	0.5	µg/L
Organochlorines Pesticides - Water	EPA 608, 8081A,B, 8272, or 8081		
DDD	"	0.02	µg/L
DDE	"	0.01	µg/L
DDT	"	0.01	µg/L
Dicofol	"	0.1	µg/L
Dieldrin	"	0.01	µg/L
Endrin	"	0.01	µg/L
Methoxychlor	"	0.01	µg/L
Organophosphorus Pesticides - Water	EPA 8141A, 614, 8321, 625m, or 8270		
Azinphos methyl	"	0.1	µg/L
Chlorpyrifos	"	0.015	µg/L
Diazinon	"	0.02	µg/L
Dichlorvos	"	0.1	µg/L
Dimethoate	"	0.1	µg/L
Demeton-s	"	0.1	µg/L
Disulfoton	"	0.05	µg/L
Malathion	"	0.1	µg/L

Constituents, Parameters, and Tests	Analytical Methods	Reporting Limit	Reporting Unit
Methamidophos	"	0.2	µg/L
Methidathion	"	0.1	µg/L
Parathion, Methyl	"	0.1	µg/L
Phorate	"	0.2	µg/L
Phosmet	"	0.2	µg/L
Group A Pesticides - Water	EPA 3510C, 8081A, 625m, 8270CM		
Aldrin	"	0.01	µg/L
Chlordane, Total	"	0.01	µg/L
Heptachlor	"	0.005	µg/L
Heptachlor epoxide	"	0.005	µg/L
HCH, Total (in. Lindane)	"	0.005	µg/L
Endosulfan (I & II)	"	0.005	µg/L
Toxaphene	EPA 8081A, 8270M_NCI	0.5 / 0.05	µg/L
Herbicides - Water			
Atrazine	EPA 619 or 507	0.5	µg/L
Cyanazine	EPA 619 or 507	0.5	µg/L
Diuron	EPA 8321 or 632	0.5	µg/L
Glyphosate	EPA 547	5	µg/L
Linuron	EPA 8321 or 632	0.5	µg/L
Molinate	EPA 8141A or EPA 507	0.5	µg/L
Paraquat dichloride	EPA 549.1	0.5	µg/L
Simazine	EPA 619, 8141, 625, 8270C, or 507	0.5	µg/L
Thiobencarb	EPA 619 or 507	0.05	µg/L
Triflularin	EPA 8141	0.05	µg/L
Metals - Water			
Arsenic	EPA 200.7, 200.8, 6020, 1639 or 206.3	1	µg/L
Boron	EPA 200.7 or 200.8	10	µg/L
Cadmium (total and dissolved)	EPA 200.7, 200.8, 213.2, 6020, SM 3113, 3113B	0.1	µg/L
Copper (total and dissolved)	EPA 200.7, 200.8, 213.2, 6020, SM 3113, 3113B	0.5	µg/L
Lead (total and dissolved)	EPA 200.7, 200.8, 239.2, 6020, 1639, SM 3111B, 3113	0.5	µg/L
Molybdenum	EPA 200.7, 200.8, 6010, 6020, 3015A	1	µg/L
Nickel (total and dissolved)	EPA 200.7, 200.8, 249.2, 6020, 1639	1	µg/L
Selenium	EPA 200.7, 200.8, 6020, 270.3	1	µg/L
Zinc (total and dissolved)	EPA 200.7, 200.8, 289.2, 6020, 1639, SM3113B	1	µg/L
Mercury (total)	EPA 1631	0.01	µg/L
Methylmercury	EPA 1630	0.01	µg/L
Nutrients - Water			
Nitrogen, Total Kjeldahl	EPA 351 or SM 4500-NH_3	0.1	mg/L
Nitrate + Nitrite (as N)	EPA 300, 300.1 351.3, 353.2, or SM 4500	0.05	mg/L
Total Ammonia (as N)	EPA 350 or SM4500 NH_3	0.1	mg/L
Unionized Ammonia	Calculation	NA	mg/L
Total Phosphorous (as P)	EPA 365.1, 365.4, or SM 4500-P	0.01	mg/L
Soluble Orthophosphate	EPA 300.1, 365.1, or SM 4500-P	0.01	mg/L
Toxicity Testing - Sediment			
Hyalella azteca	EPA/600/R-99/064	NA	% Survival

Constituents, Parameters, and Tests	Analytical Methods	Reporting Limit	Reporting Unit
Pesticides - Sediment	EPA 1660, 8081 8081A or 8270		
Bifenthrin	"	1.0	ng/g dw
Cyfluthrin	"	1.0	ng/g dw
Cypermethrin	"	1.0	ng/g dw
Deltamethrin	"	1.0	ng/g dw
Esfenvalerate/Fenvalerate	"	1.0	ng/g dw
Cyhalothrin, lambda	"	1.0	ng/g dw
Permethrin	"	1.0	ng/g dw
Piperonyl butoxide (PBO)	EPA 8270C EI-GCMS	2.0	ng/g dw
Fenpropathrin	"	1.0	ng/g dw
Chlorpyrifos	EPA 8141A, 614, 8321, 625m, or 8270	3.0	ng/g dw
General Parameters - Sediment			
Total Organic Carbon	EPA 415.1, EPA 9060, or Walkley-Black	200	mg/kg dw
Grain Size	SM2560 D	1	%sand, %silt, %clay, %gravel

APPENDIX MRP-1B: Measurement Quality Objectives

Group	Parameter	Requirements				
		Accuracy	**Precision**	**Bias**	**Contamination**	**Completeness**
Field Testing	Dissolved Oxygen	± 0.2 mg/L	± 0.2 or 10%	NA	NA	90%
	Temperature	± 0.1 °C	± 0.1 or 5%	NA	NA	90%
	Specific Conductivity	± 2 µS/cm	± 5%	NA	NA	90%
	pH by Meter	± 0.2 units	± 0.2 or 5%	NA	NA	90%
	Turbidity	± 1 NTU	± 10% or 0.1 %, whichever is greater	NA	NA	90%
Laboratory Analyses	Conventional constituents in water	Standard Reference Materials or LCS: 80% to 120% recovery	Laboratory duplicate, Field duplicate, and MS/MSD: RPD<25% (n/a if native concentration of either sample<RL)	Matrix spike 80% - 120% recovery	<RL for target analyte	90%
	Synthetic organic constituents, semi-volatiles & volatiles, in water and sediment	Standard Reference Materials: 70% to 130% recovery. LCS: 50% to 150% recovery	Laboratory duplicate, Field duplicate, and MS/MSD: RPD<25% (n/a if native concentration of either sample<RL)	Matrix spike 50% - 150% or control limits at ± 3 standard deviations based on actual lab data	<RL for target analyte	90%
	Trace metals in water and sediment	Standard Reference Materials or LCS: 75% to 125% recovery	Laboratory duplicate, Field duplicate, and MS/MSD: RPD<25% (n/a if native concentration of either sample<RL)	Matrix spike 75% - 125% recovery	<RL for target analyte	90%
	Total organic carbon in sediment	Standard Reference Materials: 80% to 120% recovery	Laboratory duplicate, field duplicate: RPD<25% (n/a if native concentration of either sample<RL)	NA	<RL or <30% lowest sample	90%
	Bacteria/ Pathogens	Positive control 80% to 120% recovery	Laboratory duplicate: RPD<25% (n/a if native concentration of either sample<RL)	NA	No growth	90%
	Toxicity testing	Meet all performance criteria in method relative to reference toxicant	Meet all performance criteria in method relative to sample replication	Meet all performance criteria in method relative to water quality parameters	Meet all performance criteria in method relative to negative controls	90%
	Methylmercury in water	Tissue SRM DORM-2: 70% to 130% recovery	Laboratory duplicate, Field duplicate, and MS/MSD: RPD<25% (n/a if native concentration of either sample<RL)	Matrix spike 75% - 130% recovery	<RL for target analyte	90%

APPENDIX MRP-1C: Form Templates

EXAMPLE FORM I (a): Field Data Sheet Form for surface water sampling including all the minimum items required

Surface Water Field Data Sheet
Irrigated Lands Regulatory Program

Coalition:_____

Page___of
Date _____

Site Name _____
Site Code _____
Sampling Crew
(first and last name) _____

Wadeability YES/NO

Time First Sample taken _____
Monitoring Event _____

Comments _____

Section A

GPS Position	Lat. (dd.ddddd)	Long. (dd.ddddd)
Target		
Actual		
Datum		

FIELD OBSERVATION	**CIRCLE YOUR OBSERVATION**
Dominant Substrate	Concrete, Cobble, Gravel, Sand, Mud, Other
Site Odor	None, Sulfides, Sewage, Petroleum, Mixed, Other
Other Presence	Vascular, Nonvascular, Oily sheen, Foam, Trash, Other
Water Odor	None, Sulfides, Sewage, Petroleum, Mixed, Other
Water Clarity	Clear (see bottom), Cloudy (>4" vis.), Murky (<4" vis.)
Water Color	Clear, Brown, Green, Grey
Sky Code	Clear, Partly Cloudy, Overcast, Fog, Hazy
Precipitation	None, Foggy, Drizzle, Rain
Precipitation (last 24 hrs)	Unknown, <1", >1", None
Observed Flow	NA, Dry Waterbody Bed, No Observed Flow, Isolated Pool, 0.1-1 cfs, 1-5 cfs, 5-20 cfs, 20-50 cfs, 50-200 cfs, >200 cfs

Section B

PROBE MEASUREMENTS **Section C**

	Flow (cfs)	pH	Specific Conductivity (µS/cm)	DO (mg/L)	Water Temp (°C)	Turbidity (NTU)	
Measurement							
Instrument							
Calibration Date							

SAMPLES TAKEN (# of containers filled) **Section D**

	Physical Parameters (Inorganics)	Total Organic Carbon (TOC)	Nutrients (Inorganics)	Metals (Inorganics)	Toxicity	Hardness	Pesticides Collected (1 L amber bottles)				
Samples											
Duplicate											
Blank											
Matrix Spike											
Total # Containers											

Preserved Time and Conditions:

EXAMPLE FORM I (b): Field Data Sheet Form for sediment sampling including all the minimum items required

Sediment Field Data Sheet
Irrigated Lands Regulatory Program

Coalition: _____

Page___of
Date _____

Site Name _____
Site Code _____
Sampling Crew
(first and last name) _____

Time First Sample taken _____
Monitoring Event _____

Comments _____

Section A

Wadeability YES/NO

GPS Position	Lat. (dd.ddddd)	Long. (dd.ddddd)
Target		
Actual		
Datum		

FIELD OBSERVATION **CIRCLE YOUR OBSERVATION** **Section B**

Dominant Substrate	Concrete, Cobble, Gravel, Sand, Mud, Other
Site Odor	None, Sulfides, Sewage, Petroleum, Mixed, Other
Other Presence	Vascular, Nonvascular, Oily sheen, Foam, Trash, Other
Water Odor	None, Sulfides, Sewage, Petroleum, Mixed, Other
Water Clarity	Clear (see bottom), Cloudy (>4" vis.), Murky (<4" vis.)
Water Color	Clear, Brown, Green, Grey
Sky Code	Clear, Partly Cloudy, Overcast, Fog, Hazy
Precipitation	None, Foggy, Drizzle, Rain
Precipitation (last 24 hrs)	Unknown, <1", >1", None
Observed Flow	NA, Dry Waterbody Bed, No Observed Flow, Isolated Pool, 0.1-1 cfs, 1-5 cfs, 5-20 cfs, 20-50 cfs, 50-200 cfs, >200 cfs

SAMPLES TAKEN (# of containers filled) **Section C**

	Toxicity	Pyrethroids	Chlorpyrifos	TOC	Grain Size		
Samples							
Duplicate							
Matrix Spike	Non Applicable			Non Applicable	Non Applicable		
Total # Containers							

Preserved Time and Conditions:

EXAMPLE FORM II: Discharge Field Data Sheet for obtaining surface flow measurements

Discharge Field Sheet
Irrigated Lands Regulatory Program

Coalition: _____

Date _____
Sampling Crew _____
Site Code _____
Site Name _____
Method (Circle one) wading/ other (specify) _____
Record units of the meter on sheet _____
Comments _____

Right Edge Water (REW) _____
Left Edge Water (LEW) _____
Total Width _____
Start Time (24 hr) _____
Ending Time (24 hr) _____
Spin Test (# Sec) _____

Number of Measurements	Angle (if taken from bridge)	Numbers on measuring tape (in meters/feet)	Observation depth from water surface (0.2, 0.6, 0.8)	Revolutions/ Velocity

EXAMPLE FORM III: Field Data Sheet Form for groundwater sampling

Groundwater Sampling Event Field Data Sheet **Page_____ of_____**

Irrigated Lands Regulatory Program **Coalition: _____** **Sample Date_____** **Sample Time_____**

Section A

Site Name:_____
Site Code:_____
Sampling Crew Names
(first and last):_____
_____

Well ID:_____
Well Type (circle one): Monitoring, Domestic, Ag Supply

Weather conditions (circle one or more): Sunny, Cloudy, Rainy, Windy

GPS Position	Lat. (dd.ddddd)	Long. (ddd.ddddd)
Actual		
Datum		

WELL, WATER LEVEL, AND PURGE INFORMATION — Section B

Well diameter (inside casing), inches:_____
Total casing length, ft:_____
Distance to top of casing (above ground), ft: _____
Screen interval, ft: _____
Depth measurement equipment (circle one): electric sounder, chalked tape, other:
Depth to water before purge (from top of casing), ft: _____
Depth to water at sample collection (from top of casing), ft: _____
Well recharge rate, gal/min: _____
Casing volume, gal: _____

Well pump active upon arrival (Y/N):_____
Purge equipment (circle one): Existing well pump, bailer, bladder pump, submersible pump, other
Purge port location:_____
Micropurge/Low-flow techniques used (Y/N):_____
Casing volumes purged: _____
Time period purged, min: _____
Purge rate, gal/min: _____
Storage/Pressure tank volume, gal: _____

Observations:

Water present in recharge sources near well? (e.g. dairy pond, unlined canal, etc):

Condition of well (cracked pad, flooded, odor, etc.):

FIELD MEASUREMENTS — Section C

Time Start	Time Stop	Total Volume Purged	Water Level (feet)	Specific Conductance (µS/cm)	pH	DO (mg/L)	Water Temp (°C)	Turbidity (NTU)	ORP (mV)	Did well dry out?	Notes
Purge Events Data											
Post-purge Data (after readings stabilize)											

SAMPLE INFORMATION — Section D

Sample ID	Analyte(s)	Field Filtered (Y/N)	Preservative (Y/N)

NOTES — Section E

EXAMPLE FORM IV: Chain of Custody Form and the minimum items needed

REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY RECORD

Page___ of_____

Name (Customer)	Send Results To																		Batch ID			
Address (Customer)																			Lab Storage (Refrigerator or freezer number)			
City	Phone Number																					
Ice Chest Temperature at Log-In	Analysis Requested		Physical Parameters	Nutrients	Pathogens	THM's	Trace Elements	Hardness	Water Column Toxicity	Sediment Toxicity	TOC	Others (specify)	OCH Pesticides	OP Pesticides	Pyrethroids	Carbamates	Herbicides (specify)	Others (specify)	Number of Containers			
Sample Identification	Collection																		Plastic	Glass	Vial	Whirlpak
	Date	Time																				
Comments/Special Instructions																						

Samples Relinquished By (signature)	Print Name	Date	Received By (signature)	Print Name	Date

APPENDIX MRP-1D: Summary of Sampling Container Volume, Initial Preservation and Holding Time Recommendations for Water Samples

Parameters for Analysis in WATER Samples	Recommended Containers (all containers pre-cleaned)	Typical Sample Volume (ml)	Preservation	Maximum Holding Time (analysis must start by end of max)
Conventional Constituents in Water				
Alkalinity	Polyethylene bottles (see **NOTE**(1) below)	300 ml	Cool to 6°C and store in the dark	14 days at 6°C, dark
Chloride (Cl), Sulfate (SO_4), and Fluoride (F)	"	300 ml	"	28 days at 6°C, dark
Ortho-phosphate (OPO_4)	"	150 ml	"	48 hours at 6° C, dark
Nitrate + Nitrite ($NO_3 + NO_2$)	"	150 ml	Cool to 6°C and store in the dark. Acidify with H_2SO_4 to pH<2	48 hours at 6°C, dark or 28 days if acidified
Total Kjeldahl Nitrogen (TKN)	"	600 ml	Cool to 6°C and store in the dark. Acidify with H_2SO_4 to pH<2	Recommended: 7 days Maximum: 28 days Either one at 6°C, dark
Total Dissolved Solids (TDS)	"	1000 ml	"	7 days at 6°C, dark
Ammonia (NH_3)	"	500 ml	Cool to 6°C and store in the dark. May acidify with H_2SO_4 to pH<2	48 hours at 4°C and in the dark or if acidified 28 days at 6°C and in the dark
Total Phosphorous (TPO_4)	"	300 ml	"	28 days at 6°C, dark
Total Organic Carbon (TOC), Dissolved Organic Carbon (DOC)	"	40 ml (one vial)	Cool to 6°C and store in the dark. TOC: If analysis is to occur more than two hours after sampling, acidify with HCl or H_2SO_4 to pH<2.	28 days at 6°C, dark
Total Suspended Solids (TSS)	"	1000 ml (two jars)	"	7 days at 6°C, dark
Trace Metals in Water				
Metals (Total) (except Total Mercury)	60 ml polyethylene bottle, pre cleaned in lab using HNO_3	60 ml (one bottle) if salinity<0.5 ppt 180 ml (three bottles) if salinity >0.5 ppt	Cool to 6°C, dark. Acidify in lab within 48 hours with pre-acidified container (ultra-pure HNO_3 for pH<2)	Acidified samples can store up to 6 months at room temperature
Metals (Dissolved) (except Dissolved Mercury)	60 ml polyethylene bottle, pre-cleaned in lab using HNO_3	60 ml (one bottle) if salinity <0.5 ppt 180 ml (three bottles) if salinity >0.5 ppt	Filter at sample site using 0.45 µm in-line filter, or syringe filter. Cool to 6°, dark. Acidify in lab within 24 hrs using pre-acidified container (ultra-pure HNO_3 for pH<2)	Filtered and acidified samples can store up to 6 months at room temperature
Mercury (Total)	250 ml glass or Teflon bottle, pre-cleaned in lab using HNO_3	250 ml (one bottle)	Cool to 6°C, dark. Acidify in lab within 48 hrs with pre-tested HCl to 0.5%	Acidified samples can store up to 6 months at room temperature
Mercury (Dissolved)	250 ml glass or Teflon bottle, pre-cleaned in lab using HNO_3	250 ml (one bottle)	Cool to 6°C, dark. Filter in lab within 48 hours using bench top Hg filtration apparatus. Acidify in lab within 48 hours with pre-tested HCl to 0.5%	Filtered and acidified samples can store up to 6 months at room temperature
Methylmercury (Total)	250 ml glass or Teflon bottle, pre-cleaned in lab using HCl	250 ml (one bottle)	Cool to 6°C, dark. Filter in lab within 48 hours, with pre-tested HCl to 0.5%	Filtered and acidified samples can store up to 6 months at room temperature
Methylmercury (Dissolved)	250 ml glass or Teflon bottle, pre-cleaned in lab using HCl	250 ml (one bottle)	Cool to 6°C, dark. Filter in lab within 48 hours using bench top Hg filtration apparatus. Acidify in lab within 48 hours with pre-tested HCl to 0.5%	Filtered and acidified samples can store up to 6 months at room temperature
Hardness	200 ml polyethylene or glass bottle	200 ml (one bottle)	Cool to 6°C, dark OR filter and add 2 ml conc. H_2SO_4 or HNO_3 to pH<2; Cool to 4°C, dark	48 hours dark at 6°C, dark 6 months at 6°C, dark

(1) NOTE:

The volume of water necessary to collect in order to analyze for the above mentioned constituents is typically combined in four 1-liter polyethylene bottles, which also allows enough volume for possible re-analysis and for conducting lab spike duplicates. This is possible if the same laboratory is conducting all the above analyses; otherwise, individual volumes apply.

APPENDIX MRP–1D: Summary of Sampling Container Volume, Initial Preservation and Holding Time Recommendations for Water Samples (continued)

Parameters for Analysis in WATER Samples	Recommended Containers (all containers pre-cleaned)	Typical Sample Volume (ml)	Initial Field Preservation	Maximum Holding Time (analysis must start by end of max)
Synthetic Organic Compounds in Water Samples				
PESTICIDES & HERBICIDES* □ Organophosphate Pesticides □ Organochlorine Pesticides □ Chlorinated Herbicides	1-liter amber glass bottle with Teflon lid-liner (per each sample type)	1000 ml (one container)	Cool to 6° C, dark pH 5-9	Keep at 6°C dark, up to 7 days. Extraction must be performed within the 7 days; analysis must be performed within 40 days of extraction
Toxicity Testing Water Samples				
Toxicity in Water	Amber glass bottles (recommended volume 5 gallons)	20,000 ml	Cool to 6° C, dark	36 hours at 6°C, dark
Pathogen Testing Water Samples				
E. coli	Factory-sealed, pre sterilized, disposable Whirl-pak® bags or 125 ml sterile plastic (high density polyethylene or polypropylene) container	100 ml volume sufficient for both *E. coli* and fecal coliform analyses	Sodium thiosulfate is pre-added to the containers in the laboratory (chlorine elimination). Cool to 6°C, dark.	STAT: 24 hours at 6°C, dark lab must be notified well in advance
Fecal Coliform	Factory-sealed, pre sterilized, disposable Whirl-pak® bags or 125 ml sterile plastic (high density polyethylene or polypropylene) container	100 ml volume sufficient for both *E. coli* and fecal coliform analyses	Sodium thiosulfate is pre-added to the containers in the laboratory (chlorine elimination). Cool to 6°C, dark.	STAT: 24 hours at 6°C, dark lab must be notified well in advance

*Each sample type requires 1000 ml in a separate container.

APPENDIX MRP-1E: Summary of Sampling Container Volume, Initial Preservation and Holding Time Recommendations for Sediment Samples

Parameters for Analysis in SEDIMENT Samples	Recommended Containers	Typical Sample Volume (ml)	Initial Field Preservation	Maximum Holding Time
Bed Sediment Samples				
Synthetic Organic Compounds	250 ml amber glass jar with Teflon lid-liner, pre-cleaned	500 ml (two jars)	Cool to 6° C, dark, up to 48 hours	12 months(1) (-20°C)
Sediment TOC	125 ml(2) clear glass jar, pre-cleaned	125 ml (one jar)	Cool to 6° C, dark, up to 48 hours	12 months(1) (-20°C)
Sediment Grain Size	125 ml(2) clear glass jar, pre-cleaned	125 ml (one jar)	Cool to 6° C, dark, up to 28 days	28 days at (4°C) Do not freeze
Sediment Toxicity Testing	1-liter wide-mouth Polyethylene jar with Teflon lid-liner, pre-cleaned	2000 ml (two jars filled completely)	Cool to 6° C, dark, up to 14 days	14 days at (4°C) Do not freeze

(1) Sediment samples for Synthetic Organic Compounds and Sediment TOC analysis must be frozen at minus (-) 20°C within the initial 48 hours of sample collection. During the initial 48 hours, samples must be kept at 6°C until they are frozen. Once frozen, samples may be stored for a maximum time period of 12 months at minus (-) 20°C. After thawing, the samples must be extracted within 48 hours and must be analyzed within 40 days

(2) Sediment samples for TOC and Grain Size analysis can be combined in one 250 ml clear glass jar, and sub-sampled at the laboratory in order to utilize holding time differences for the two analyses. If this is done, the 250 ml combined sediment samples must be refrigerated only (not frozen) at 6°C for up to 28 days, during which time the sub-samples must be aliquoted in order to comply with separate storage requirements (as shown above).

APPENDIX MRP-1F: Corrective Actions

ILRP CONTROL SAMPLES –CONVENTIONAL CONSTITUENTS, ORGANIC COMPOUNDS, AND TRACE METALS	
Laboratory Quality Control	**Required Corrective Actions for Failures**
Calibration Standard	Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Continuing Calibration Verification	The analysis must be halted, the problem investigated, and the instrument recalibrated. All samples after the last acceptable continuing calibration verification must be reanalyzed.
Laboratory Blank	If any analyte concentration in the method blank is above the RL, all samples associated with that method blank must be re-extracted and re-analyzed for that analyte.
Standard Reference Material/LCS	Affected samples and associated quality control must be reanalyzed if acceptance criteria are exceeded.
Matrix Spike	Results should be reviewed to evaluate matrix interference. If matrix interference is suspected, and reference material recoveries are acceptable, the matrix spike and the matrix spike duplicate result must be qualified.
Matrix Spike Duplicate	Appropriately spiked results should be compared to the matrix spike and evaluated for matrix interference. If matrix interference is suspected and reference material recoveries are acceptable, the matrix spike duplicate result must be qualified.
Laboratory Duplicate	For duplicates with a heterogeneous matrix and/or ambient concentrations below the reporting limit, failed results may be qualified. Other failures should be reanalyzed as sample volume allows.
Internal Standard	The instrument must be flushed with rinse blank. If, after flushing, the responses of the internal standards remain unacceptable, the analysis must be halted and the cause of drift investigated.
Surrogate	If holding times prevent reanalysis, affected results should be qualified. The analytical method or quality assurance project plan must detail procedures for updating surrogate measurement quality objectives.
Field Quality Control	**Required Corrective Actions for Failures**
Field Duplicate	For duplicates with a heterogeneous matrix and/or ambient concentrations below the reporting limit, failed results may be qualified. All failures should be communicated to the sampling team so that the source of error can be identified and corrective measures taken before the next sampling event.
Field Blank, Travel Blank, Equipment Blank	If contamination of the field blanks and associated samples is known or suspected, the laboratory should qualify the affected data, and notify the sampling team so that the source of contamination can be identified and corrective measures taken prior to the next sampling event.
Periodic Quality Control	**Required Corrective Actions for Failures**
Method Detection Limit Study	If results do not meet analytical method requirements and the requirements of 40 CFR Part 136 Appendix B, a new MDL study must be performed before sample analysis begins. Participants wishing to exceed mandated method detection limits or reporting limits must obtain written approval prior to sample analysis.
Proficiency Test, Intercomparison	Results should be subjected to troubleshooting and/or reanalysis. If allowed by the vendor or referee, results may be resubmitted. To further examine the analytical failure, a follow-up proficiency test or intercomparison study should be completed as soon as possible.

APPENDIX MRP-1F: Corrective Actions (Continued)

ILRP CONTROL SAMPLES – FIELD PARAMETERS	
Field Measurement	**Required Corrective Actions for Failures**
Depth, Dissolved Oxygen, pH, Specific Conductivity, Temperature, Turbidity, Velocity	The instrument should be recalibrated following its manufacturer's cleaning and maintenance procedures. If measurements continue to fail measurement quality objectives, affected data should not be reported and the instrument should be returned to the manufacturer for maintenance. All troubleshooting and corrective actions should be recorded in the calibration and field data logbooks.
ILRP CONTROL SAMPLES – TOXICITY TESTING	
Negative Controls	**Required Corrective Actions for Failures**
Laboratory Control Water	Flag the data for samples affected or compared to the failed control water. Follow Test Acceptability Criteria decision steps in section 5.7 of QAPP.
Specific Conductivity Control Water	If Specific Conductivity is outside the species tolerance range, flag all samples affected and associated control samples.
Additional Control Water (Method Blank)	Flag the data for samples affected or compared to the failed method blanks.
Positive Controls	**Required Corrective Actions for Failures**
Reference Toxicant Tests	Immediately re-set up within 48 hours of failure and investigate source of failure.
Field Quality Control	**Required Corrective Actions for Failures**
Field Duplicate	Flag the data for samples affected and the source of the failure should be identified to prevent future failures. All QC failures should be reported to the Central Valley Water Board.

APPENDIX MRP-1G: Toxicity Identification Evaluation Procedures

Phase I Procedures	*Ceriodaphnia*	*Selenastrum*	*Pimephales*	Purpose of Procedure
Addition of piperonylbutoxide (PBO)	X	NA	NA	Inactivates metabolically active organophosphorous compounds Increases toxicity of pyrethroids insecticides.
Aeration	X	X	X	Removes volatile chemicals, surfactants and sublatable compounds.
AG2-X8 Solid Phase Extraction (SPE)	X	X	X	Removes multivalent anions.
Antibiotic Amendment	X	Unknown	X	Reduces pathogen infections.
C8 (C18) Solid Phase Extraction (SPE)	X	X	X	Removes non-polar organic chemicals and particulate-bound chemicals.
SPE eluate add-back	X	X	X	Confirms presence of non-polar organic compound(s).
Centrifugation	X	X	X	Removes particle-bound chemical and biological contaminants.
Chelation (addition of EDTA)	X	X	X	Inactivates cationic metals.
Chelex SPE	X	X	X	Removes mulitvalent cations.
Filtration	X	NA	X	Removes particle-bound chemicals and biological contaminants.
Graduated pH adjustment	X	NA	X	Increases pH; increases ammonia toxicity.
Hardness manipulation	X	Unknown	X	Decreases solubility /speciation of metals (bioavailability).
Addition of sodium thiosulfate (STS)	X	Unknown	X	Inactivates cations, and detects oxidative compounds.
Temporary pH shift to 3	X	Unknown	X	Breaks down hydrolizable organic compounds, may increase metal solubility(bioavailability).
Temporary pH shift to 11	X	X	X	Precipitates metals (may decrease metal bioavailability). Breaks down hydrolizable organic compounds.
Ultraviolet Light	X	Unknown	X	Activates polyaromatic hydrocarbons, inactivates biological contaminants.
Zeolite	Unknown	X	X	Removes unionized ammonia.
Phase II Procedures	*Ceriodaphnia*	*Selenastrum*	*Pimephales*	Purpose of Procedure
Solvent fractionation of SPE eluate	X	X	X	Identifies specific non-polar organic compounds causing toxicity.
Phase III Procedures	*Ceriodaphnia*	*Selenastrum*	*Pimephales*	Purpose of Procedure
Side-by-side dilution series	X	X	X	Determines the contribution of suspected chemical(s) to toxicity.
Hardness manipulation	X	Unknown	X	Decreases solubility /speciation of metals (bioavailability).

NA = Manipulation not compatible for series
X = manipulation compatible for series

APPENDIX MRP-1H: Online Resources

Hosted by the State Water Resources Control Board

SWAMP Quality Assurance Management Plan:
http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/qapp/qaprp082209.pdf
This QAMP and associated appendices in Adobe PDF and Microsoft Word formats

SWAMP Quality Assurance Project Plan Template:
http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa
Template for SWAMP-comparable QAPP creation

SWAMP Quality Assurance and Quality Control:
http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml
SWAMP quality assurance homepage and links

Hosted by the Moss Landing Marine Laboratories

SWAMP Standard Operating Procedures:
http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/standard-operating-procedures
SWAMP data management and quality assurance SOPs

SWAMP Quality Assurance Comparability:
http://swamp.mpsl.mlml.calstate.edu/swamp-comparability/quality-assurance-comparability
Guidelines and links pertaining to SWAMP quality assurance comparability

SWAMP Data Management Comparability:
http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/database-management-systems/swamp-25-database
Guidelines and links pertaining to SWAMP data management comparability