QUALITY ASSURANCE PROJECT PLAN
For Monitoring for CECs in Recycled Water for Groundwater Recharge or Reservoir Augmentation Pursuant to the Water Quality Control Policy for Recycled Water

Prepared for:
[INSERT REGIONAL WATER BOARD]

Submitted by:

[Insert project sponsor name here]

[MONTH], [YEAR]

[This document has been developed to assist the project sponsor in completing a Quality Assurance Project Plan, and the project sponsor is not required to use this template. The project sponsor must ensure that the submitted plan is complete and accurately represents the project.]

A: Project Management

A.1 TITLE AND APPROVAL SHEET

Quality Assurance Project Plan

For Monitoring Pursuant to the Water Quality Control Policy for Recycled Water

Lead Organization: [Address]

[Address]

[Address]

[Address]

[XXX], Project Manager

[XXX], Regional Coordinator

Primary Contact: [Name]

[Address]

[Address]

Effective Date: This Quality Assurance Project Plan (QAPP) is effective from [XXX] to [XXX] unless otherwise revised, approved and distributed accordingly at an earlier date.

Revision: 1.0

A.2 APPROVAL

This QAPP is being submitted to the [State Water Resources Control Board (State Water Board) or [NAME] Regional Water Board] on [ENTER DATE HERE]. If necessary, the document must be revised in accordance with the [State Water Resources Control Board (State Water Board) or [NAME] Regional Water Board] requests and then resubmitted. The QAPP must be updated and re-submitted to the [NAME] Regional Water Board] for approval when significant changes are made that would affect the overall data quality and use (e.g. using a new analytical chemistry laboratory) or at least annually if any changes are made. A final approved QAPP consists of a final document containing dated and signed authorization of the signatory approval page.

[XXX]
Regional Coordinator

_____Date_____

[XXX]
Project Manager

_____Date_____

[XXX]
Field Lead

_____Date_____

[XXX]
Laboratory Quality Assurance Officer

_____Date_____

[XXX]
Regional Water Board Project Manager

_____Date_____

Tricia Lee
State Water Board Quality Assurance Officer for the Recycled Water Policy

_____Date_____

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Table 1. List of Acronyms and Abbreviations	
Term	Acronym/Abbreviation
Aryl Hydrocarbon Receptor	AhR
Advanced Oxidation Processes	AOPs
Constituents of Emerging Concern	CECs
Data Quality Indicator	DQI
Data Quality Objective	DQO
Department of Defense Quality Systems Manual Version 5.1	DoD QSM 5.1
California Environmental Laboratory Accreditation Program	ELAP
Estrogen Receptor-alpha	ER-α
High-density Polyethylene	HDPE
Measured Environmental Concentration	MEC
Measurement Quality Objective	MQO
Monitoring Trigger Levels	MTL
N-Nitrosodimethylamine	NDMA
N-Nitrosomorpholine	NMOR
Polyvinyl chloride	PVC
Per- and Polyfluoroalkyl Substances	PFAS
Perfluorooctanoic acid	PFOA
Perfluorooctane sulfonate	PFOS
Personal Protective Equipment	PPE
Quality Assurance	QA
Quality Assurance Officer	QAO
Quality Control	QC
Quality Assurance Project Plan	QAPP
Water Quality Control Policy for Recycled Water	Recycled Water Policy
[NAME] Regional Water Quality Control Board	Regional Water Board
Reverse Osmosis	RO
Relative Percent Difference	RPD
Standard Operating Procedure	SOP
State Water Resources Control Board	State Water Board
California Code of Regulations, title 22	Title 22
U.S. Environmental Protection Agency	U.S. EPA
Ultraviolet	UV

A.6 DISTRIBUTION LIST

Table 2. Distribution List			
Name	Organizational Affiliation	Title	**Contact Information** (Telephone number, email and physical address)
	[Project Sponsor]	**Project Manager**	
	[Project Sponsor]	**Project Logistics Coordinator**	
	[Project Sponsor]	**Project Quality Assurance Officer (QAO)**	
	[Project Sponsor]	**Field Coordinator**	
Tricia Lee	State Water Board	**State Water Board QAO for the Recycled Water Policy**	(916) 323-0875 tricia.lee@waterboards.ca.gov, 1001 I Street, Sacramento, CA 95814
	[Regional Water Board]	**Regional Water Board Project Manager**	
	[Laboratory Name]	**Laboratory QAO**	
	[Laboratory Name]	**Laboratory Director**	

A.7 PROJECT ORGANIZATION AND SCHEDULE

A.7.1 PURPOSE

Constituents of emerging concern (CECs) are a large group of constituents that may or may not pose a risk to human health and aquatic species. There is no single definition of the term, but generally they are constituents that are typically not well-monitored and may not be regulated for water quality purposes, that is, chemicals for which there are no water quality standards or regulatory thresholds. CECs include many varied classes of constituents, such as chemicals in personal care products; pharmaceuticals; industrial, agricultural and household chemicals; hormones; antibiotic resistant bacteria, antibiotic resistance genes; and others. The amount of information available on an individual CEC (e.g., environmental concentrations, fate and transport, pharmacokinetics, toxicity-particularly from long-term, low-level exposure) depends on how well it has been investigated. As new information regarding CECs becomes available, additional chemicals may be added to or removed from the required monitoring list.

This document is the Quality Assurance Project Plan (QAPP) designed to ensure requirements are met for potable reuse projects pursuant to the Water Quality Control Policy for Recycled Water (Recycled Water Policy). The Recycled Water Policy was developed by stakeholders and adopted by the State Water Resources Control Board (State Water Board) in 2009 to streamline permitting for recycled water projects and to encourage the use of recycled water from wastewater sources that meets the definition in California Water Code section 13050(n). In July 2017, a Science Advisory Panel convened and provided recommendations to the State Water Board for CECs in recycled water[1]. In December 2018, the State Water Board adopted an amendment to the Recycled Water Policy, which includes updated CEC monitoring requirements for groundwater recharge and reservoir water augmentation recycled water projects based on recommendations from the Science Advisory Panel. The Recycled Water Policy does not require monitoring of CECs for recycled water used for non-potable applications.

The 2018 Recycled Water Policy includes CEC monitoring requirements for the production and use of recycled water for groundwater recharge and reservoir water augmentation. Responsible project sponsors must develop a QAPP to ensure CEC monitoring data quality are of known, consistent, and documented quality and to verify that the laboratory can meet the required reporting limits for the targeted CECs and bioanalytical results. This QAPP describes in comprehensive detail the necessary quality assurance, quality control, and other technical activities that must be implemented by the [Project Sponsor] to ensure that the results of the CEC monitoring satisfy stated performance criteria[2]. The QAPP is developed using the Guidance for Quality Assurance Project Plans, U.S. EPA QA/G-5 (EPA/240/R-2/009, 2002).

A.7.2 Involved Parties and Roles

The QAPP will be submitted to and approved by the [INSERT NAME Regional Water Quality Control Board](Regional Water Board) or State Water Board prior to beginning any sampling and analysis. The QAPP must be updated and re-submitted to the

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[1]The Science Advisory Panel convened in accordance with section 10.2 of the Recycled Water Policy. The Panel's recommendations were presented in the report Monitoring Strategies for Constituents of Emerging Concern (CECs) in Recycled Water – Recommendations of a Science Advisory Panel, dated April 2018.
[2]Described in detail in Tables 1 and 3 of Attachment A of the 2018 Recycled Water Policy Amendment.

Regional Water Board or State Water Board for approval when significant changes are made that would affect the overall data quality and use (e.g., using a new analytical chemistry laboratory) or at least annually if any changes are made.

The Regional Water Board Project Manager is [INSERT REGIONAL WATER BOARD PROJECT MANAGER NAME] and serves as the primary contact for the recycled water facilities as well as provides review and approval of the QAPP in consultation with the State Water Board Quality Assurance Officer (QAO) for the Recycled Water Policy.

The State Water Board QAO for the Recycled Water Policy is Tricia Lee. She is the primary contact for QAPP development for the Recycled Water Policy and leads the review of project plans, assists in project plan preparation, as well as provides initial review and final approval of the QAPP in collaboration with the Regional Water Board Project Manager.

The Facility Project Manager for [PROJECT SPONSOR NAME] is [INSERT NAME] and is responsible for completion of all project components, and the content and accuracy of reports, invoices, and other deliverables to the State Water Board.

The Laboratory team includes [NAMES OF LAB STAFF]. Training for lab staff is detailed below.

The Laboratory QAO is [INSERT NAME] and is responsible for reviewing data prior to submission of each batch to the Project Manager or Geotracker Database, discussing quality control (QC) discrepancies with responsible parties and, when necessary, issuing stops to data collection or reporting.

The Laboratory Director is responsible for resolving issues related to Data Quality Objectives (DQOs), chain of custody, and other related laboratory matters. The Regional Water Board Project Manager and State Water Board QAO may act as points of contact in the resolution of these issues.

The Sampling Team includes [NAMES OF FIELD STAFF]. Training for sampling procedure is detailed below.

The Field Coordinator is [INSERT NAME] responsible for ensuring training for field staff is current and for resolving issues related to quality control in the field.

[OTHER PARTIES WHO MAY BE RESPONSIBLE; contractors, etc.]

Personnel responsibilites and contact information may be found in Table 2.

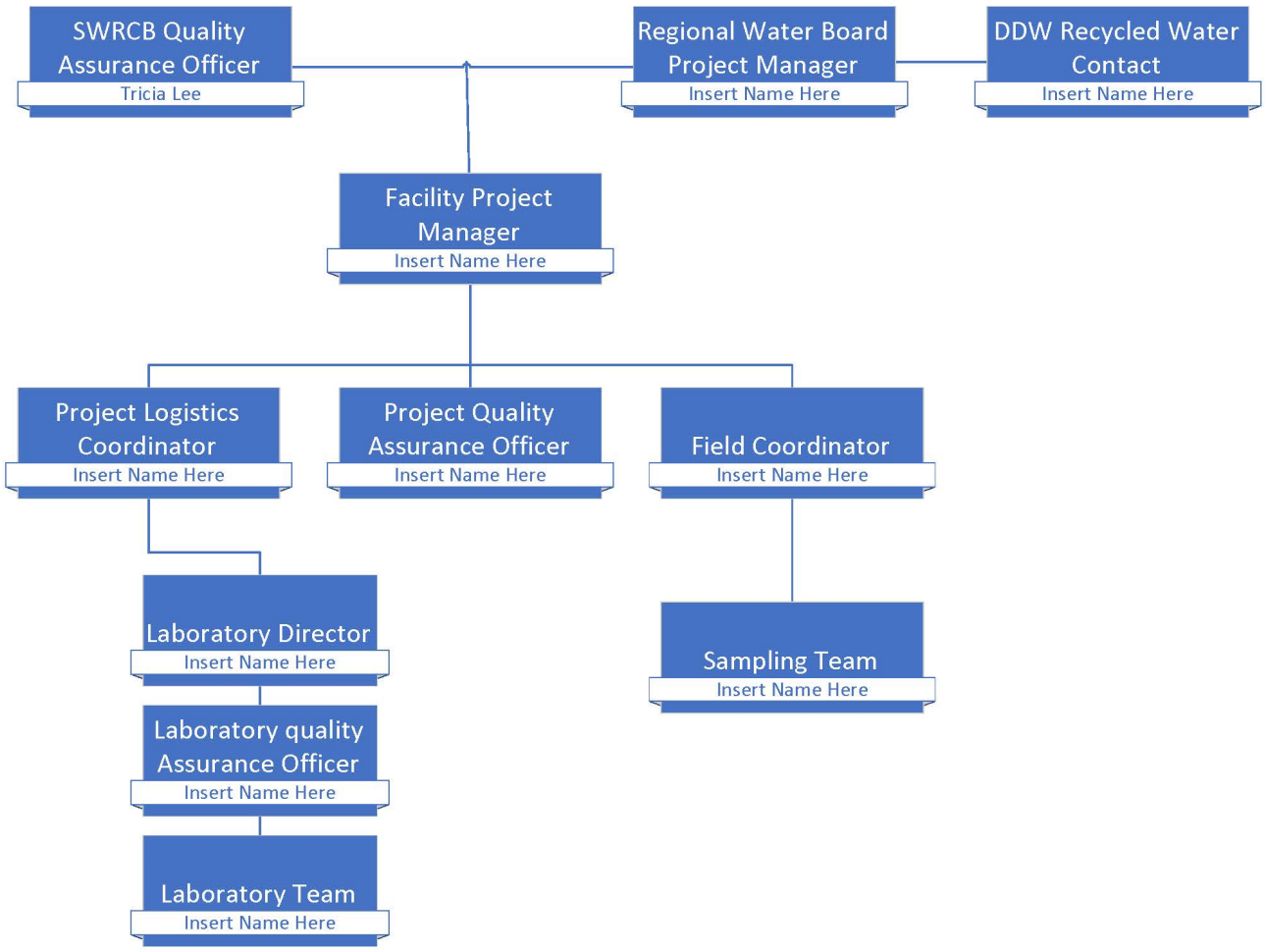
The Contractor Project QAO is responsible for the overall quality of the effectiveness assessment data produced and reported. Specific duties of the Contractor Project QAO include:

- Conducting audits of ongoing tests, data packages, and completed reports.
- Conducting audits of the routine quality control documentation of laboratory procedures.
- Communicating potential quality control problems to the staff and ensuring that problems are resolved.
- Issuing Quality Assurance Reports to management.
- Maintaining a current Quality Assurance Manual.
- Issuing Quality Assurance Project Plans as required.

The Project QAO also ensures that data reported are in compliance with the Quality Assurance Manual and appropriate protocols.

The Project QAO is responsible for the quality assurance/quality control (QA/QC) procedures in this QAPP as part of the sampling and field analysis. The Project QAO must report any data quality issues to the Project Manager, who must report these issues to the appropriate personnel as they pertain to the water quality testing.

A.7.3 Organizational Chart



[REPLACE SAMPLE DIAGRAM]

Figure 1. Organizational Chart

[NOTE TO AUTHORS: TABLE 3 IS A LIST OF SUGGESTED POSSIBLE COMMUNICATION ITEMS. THERE MAY BE OTHERS THAT ARE GOOD TO CONSIDER AND/OR IT MAY BE TOO LONG A LIST. THE TABLE WAS POPULATED WITH EXAMPLES FOR EASE BUT IT IS OPEN TO EDIT AND REVISION AS AUTHORS SEE FIT FOR PROJECT.]

Table 3. Project Communication Roles and Responsibilities

Role	Organization	Name [PROVIDE NAME OF RESPONSIBLE INDIVIDUAL]	Contact Information	Responsibility (e.g. timing, pathway, documentation, etc.)
Technical decisions and QAPP modifications	[PROJECT SPONSOR or CONTRACTOR IF CONTRACTED OUT]	e.g.,PROJECT LOGISTICS COORDINATOR, LABORATORY DIRECTOR, PROJECT QAO, FIELD COORDINATOR		Communicate technical decisions and modifications to sampling plan to FACILITY PROJECT MANAGER, Regional Water Board Project Manager, and State Water Board QAO, as necessary. All approved modifications must be included in amendments to the QAPP, uploaded to GeoTracker, and reviewed by the State and Regional Water Board within 20 working days.

Role	Organization	Name [PROVIDE NAME OF RESPONSIBLE INDIVIDUAL]	Contact Information	Responsibility (e.g. timing, pathway, documentation, etc.)
Plant operation and sample collection coordination	[PROJECT SPONSOR]	e.g., FIELD COORDINATOR		Communicate sampling schedule with appropriate operations staff [FACILITY PROJECT MANAGER] and confirm representative water samples are collected.
Field sampling modifications affecting data usability or quality	[PROJECT SPONSOR]	e.g., FIELD COORDINATOR		Provide same-day verbal notification to [e.g. LABORATORY DIRECTOR, PROJECT MANAGER] for approval to proceed. Project Manager will secure approval for modifications to the QAPP as necessary from the Regional Water Board Project Manager and State Water Board QAO. All approved modifications will be included in the amendments to the QAPP and signed by Regional Water Board Project Manager, State Water Board QAO, and Facility Project Manager.

Role	Organization	Name [PROVIDE NAME OF RESPONSIBLE INDIVIDUAL]	Contact Information	Responsibility (e.g. timing, pathway, documentation, etc.)
Minor field sampling modifications not affecting data usability or quality	[PROJECT SPONSOR]	e.g. SAMPLING TEAM OR FIELD COORDINATOR		Provide same-day verbal notification to [e.g. LABORATORY DIRECTOR] for approval to proceed. Document communication exchange in field notes.
Sample receipt variances	LAB PERSONNEL OR? CONTRACT LAB PERSONNEL	NEED NAME OF PERSON NEED NAME OF PERSON		Report all project field sample variance issues to the [e.g. LABORATORY DIRECTOR] within two business days of identification of the technical concern.

Role	Organization	Name [PROVIDE NAME OF RESPONSIBLE INDIVIDUAL]	Contact Information	Responsibility (e.g. timing, pathway, documentation, etc.)
Laboratory QC variances	LAB PERSONNEL CONTRACT LAB PERSONNEL	NEED NAME OF PERSON NEED NAME OF PERSON		Report QA/QC issues with project field samples to the [e.g. LABORATORY DIRECTOR] within two business days of identification of the technical concern.
Analytical corrective actions	LAB PERSONNEL CONTRACT LAB PERSONNEL	NEED NAME OF PERSON NEED NAME OF PERSON		The need for laboratory corrective actions is determined by the [e.g. LABORATORY DIRECTOR], as appropriate, and will be documented in a memorandum to the Facility Project Manager. The Regional Water Board will be notified if the corrective actions impact reports/data that have already been submitted. Otherwise, the memorandum will be included with the validated data.

Role	Organization	Name [PROVIDE NAME OF RESPONSIBLE INDIVIDUAL]	Contact Information	Responsibility (e.g. timing, pathway, documentation, etc.)
Data verification issues, e.g., incomplete records	LAB PERSONNEL CONTRACT LAB PERSONNEL	NEED NAME OF PERSON NEED NAME OF PERSON		All verification issues will be reported by the laboratory to the [e.g. LABORATORY DIRECTOR, FACILITY PROJECT MANAGER] via email within 24 hours of identification of the technical concern. The Facility Project Manager will take appropriate action, if necessary.
Data validation issues, e.g., non-compliance with procedures	LAB PERSONNEL CONTRACT LAB PERSONNEL	NEED NAME OF PERSON NEED NAME OF PERSON		All validation issues will be reported by the [e.g. LABORATORY QUALITY ASSURANCE OFFICER] to the [e.g. LABORATORY SUPERVISOR, FACILITY PROJECT MANAGER], via email within 24 hours of identification of the technical concern. The Facility Project Manager will take appropriate action, if necessary.

Role	Organization	Name [PROVIDE NAME OF RESPONSIBLE INDIVIDUAL]	Contact Information	Responsibility (e.g. timing, pathway, documentation, etc.)
Data review corrective actions	[PROJECT SPONSOR]	IDEALLY PROJECT MANAGER		The need for data review corrective actions will be determined by the [e.g. LABORATORY QUALITY ASSURANCE OFFICER, LABORATORY DIRECTOR, FACILITY PROJECT MANAGER] and will be documented in a memorandum to the Regional Water Board Project Manager and State Water Board QAO. Corrective actions will be taken, as appropriate, and documented in the QAPP Addendum.

A.7.4 Project Oversight and Decisions

The Project Manager, under the direction, supervision, and review of the State Water Board QAO, is responsible for making the changes, submitting drafts for review, preparing final copy, and submitting the final copy for signature. The Project Manager shall coordinate and consolidate changes to the QAPP in consultation with the Project and Laboratory QAO. Proposed changes to the QAPP must not be implemented unless authorized by the State Water Board QAO. Causes for revision may include, but are not limited to, updates in sampling locations, methods, personnel, or re-consideration of DQOs based on feasibility and applicability.

Data must be reviewed by each Laboratory QAO prior to submission of each batch to the Project Manager or Geotracker Database. Field crew audits must be conducted once per sampling season, and a review of sampling procedures shall be made by the Field Lead and the Project Manager should problems arise. As SOPs are updated and refined, additional reviews shall be made. Each data technician is responsible for flagging data that does not meet established QA/QC criteria.

If a reviewer discovers any discrepancy, the Laboratory QAO must discuss it with the personnel responsible for the activity. The discussion should include the accuracy of the information, potential factors leading to the deviation, how the deviation might impact data quality, and the corrective actions that might be considered. If the discrepancy is not resolved, the Laboratory QAO must issue a stop work order until the problem is fixed.

Assessments by the Laboratory QAO may be oral; if no discrepancies are noted and corrective action is not required, additional records are not required. If discrepancies are observed, analytical equipment fails, or quality check samples fall outside of acceptability limits, personnel are to record the problem according to their documentation protocols and take necessary corrective actions to correct and resolve the issue. Corrective actions must be documented and provided in a Corrective Action Report at the request of the Project Manager or State Water Boards QAO. The State Water Boards QAO will review the report and may request additional information or actions to be taken. The laboratory shall respond with an amended Corrective Action Report within the timeframes agreed upon in the current contract. The laboratory must notify the Project Manager, State Water Board QAO, and Contract Manager before proceeding with an analysis that results in a hold time violation and shall seek permission from the Project Manager before proceeding with the analysis. Associated

data resulting from a corrective action shall be flagged accordingly by the Laboratory QAO.

[FILL IN ADDITIONAL DETAILS HERE REGARDING SOPs FOR PROJECT AUDITS AND REVIEW]

A.7.5 Deviations and Corrective Actions

Analyses are conducted according to procedures and conditions recommended by the U.S. EPA, and described in laboratory SOPs, with the exception of those reported herein. Beyond those identified, deviations from these recommended conditions must be reported to the Laboratory QAO. The Project Manager and Project QAO must also be notified within 48 hours of a deviation.

In the event of an SOP/QAPP deviation or corrective action, a Corrective Action Report must be prepared, completed, and signed, and the Project Manager and Project QAO shall both be notified. Best professional judgment should be used in interpretation of results obtained when deviations in the test conditions have occurred. All deviations and associated interpretations must be reported in interim and final reports. Protocol amendments shall be submitted to the Laboratory QAO, Project QAO, and Project Manager. Upon approval, protocol amendments must be employed.

Copies of this QAPP must be distributed to the parties identified in Table 2. Updates to this QAPP must be distributed in like manner, and previous versions must be discarded from the project file. The Project QAO or Project Manager, under the direction, supervision, and review of State Water Board QAO, is responsible for distributing an updated version of the QAPP. The QAPP must be reviewed annually for any changes that need to be made before the start of the sampling period.

A.8 PROJECT INTENT OVERVIEW AND INTENDED USE OF DATA

A.8.1 Project Intent

CEC monitoring for the Recycled Water Policy is intended to be investigatory and not for regulatory compliance with a specific limit such as a maximum contaminant level (MCL) or water quality objective (WQO). For both targeted chemical analyses and bioanalytical screening tools, the response actions for exceeding the monitoring trigger

levels (MTL) are to further investigate the exceedance if the magnitude of the exceedance is greater than a factor of 10 higher than the monitoring trigger level[3].

A.8.2 Facility Location

[INSERT SPECIFIC LOCATION INFORMATION OF WATER RECYCLING FACILITY HERE]

A.8.3 Project Overview

CEC monitoring for the Recycled Water Policy must be conducted based in a three-phased approach—initial assessment, baseline, and standard operation monitoring phases—with different requirements for each phase (e.g., constituents, frequency, surrogate assessment). The purpose of phased monitoring is to allow the Regional Water Board, in consultation with the State Water Board, to review the monitoring results for the CEC monitoring parameters at the various phases and refine the specific monitoring requirements based on the monitoring results and findings of the previous phase.

[Note to Author: [PROJECT SPONSOR NAME] may submit existing CEC monitoring data for the health-based CECs and performance indicator CECs, surrogates for CECs, and bioanalytical screening tools from a water recycling treatment plant with a State Water Board-approved Title 22 Engineering Report[4] to the Regional Water Board to satisfy the requirements in the initial assessment or baseline monitoring phase. If the Regional Water Board, in consultation with the State Water Board determines the existing CEC monitoring data meet the intent of the initial assessment phase, the Regional Water Board may allow a recycled water producer to initiate the baseline monitoring phase. If the Regional Water Board, in consultation with the State Water Board, determines the existing CEC monitoring data meet the intent of the baseline monitoring phase, [PROJECT SPONSOR NAME] may initiate the standard operation monitoring phase for that specific analyte or endpoint. All facilities must conduct the standard operation monitoring phase.]

A.8.3.1 Initial Assessment Monitoring Phase

[3] More details on response actions can be found in Tables 8 and 10 of Appendix A to the Recycled Water Policy.

[4] Additional details may be found in the 2018 Amendment to the Recycled Water Policy.

The monitoring requirements for the initial assessment monitoring phase apply to the start-up of new water recycling treatment plants, piloting of new unit processes at existing facilities, and existing facilities where the Regional Water Board, in consultation with the State Water Board, determines that CECs, surrogates, and bioanalytical screening tools have not been assessed consistent with the requirements outlined in Attachment A of the 2018 Amendment to the Recycled Water Policy[2]. The initial assessment monitoring phase is conducted after [PROJECT SPONSOR NAME] has received approval from the State Water Board for the facility's Title 22 Engineering Report.

A principal purpose of the initial assessment monitoring phase is to identify the occurrence of CECs in recycled water for groundwater recharge or reservoir water augmentation; determine treatment effectiveness; and define the facility-specific performance indicator CECs and surrogates to monitor during the baseline monitoring phase.

[PROJECT SPONSOR NAME] will monitor for constituents consistent with the initial assessment phase requirements. Following completion of the initial assessment monitoring phase for each water recycling treatment plant, [PROJECT SPONSOR NAME] must request that the Regional Water Board, in consultation with the State Water Board, evaluate the data from the initial assessment monitoring phase and determine the appropriate monitoring requirements for the baseline monitoring phase.

Following each sampling event, [PROJECT SPONSOR NAME] must evaluate monitoring results for health-based CECs based on the Measured Environmental Concentration/Monitoring Trigger Level (MEC/MTL) guidelines in Section C.1 Reports to Management And Response Actions and implement appropriate response actions. During the initial assessment monitoring phase, no response actions are required if the magnitude of an exceedance is less than a factor of 10 greater than the monitoring trigger limits, except in the case of CECs that are required for monitoring as priority pollutants in accordance with Title 22[5], in which response actions that are already established (notification levels or maximum contaminant levels) will take precedent. CECs with Notification Levels that are required for monitoring in accordance with Title

22[5] must also be monitored at locations, frequencies, methods, reporting limits, and action levels that are in compliance with existing regulations.

A.8.3.1.1 Health-based CECs, Performance indicator CECs and Surrogates

[PROJECT SPONSOR NAME] conducts an initial assessment monitoring phase of targeted analytes (including health-based CECs, performance indicator CECs and surrogates) for a period of one year for each of the analytes and surrogates listed in Table 9 and according to the reporting frequency as described in Table 4.

Following each sampling event, [PROJECT SPONSOR NAME] will evaluate monitoring results for health-based CECs and implement appropriate response actions as outlined in Section C.1 Reports to Management And Response Actions. [PROJECT SPONSOR NAME] must also evaluate monitoring results for surrogates and evaluate the suitability of the performance indicator CECs and surrogates, which include specifying expected removal percentages.

A.8.3.1.2 Bioanalytical Screening Tools

[PROJECT SPONSOR NAME] conducts an initial assessment monitoring phase using two bioanalytical screening tools (estrogen receptor-alpha [ER-α] and aryl hydrocarbon receptor [AhR]) for a period of three years and according to the reporting frequency as described in Table 4.

Following each sampling event [PROJECT SPONSOR NAME] will evaluate monitoring results for bioanalytical screening tools and may elect to follow the response action using the direction in section C.1 Reports to Management And Response Actions, but implementation of the response actions during the initial assessment monitoring phase is not required.

A.8.3.2 Baseline Monitoring Phase

[5] As of August 12th, 2019, CECs occur in this QAPP that also have notification levels are: NDMA, 1,4-dioxane, PFOS and PFOA. Note that this list is subject to change and it is the facility Project Manager's responsibility to make sure that this QAPP is up-to-date with current regulations. An up-to-date list of chemicals which have notification levels may be found at https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/NotificationLevels.html

[PROJECT SPONSOR NAME] initiates the baseline monitoring phase upon completion of the initial assessment monitoring phase or upon receiving approval from the Regional Water Board to proceed with this phase provided the existing data for the water recycling treatment plant meet the intent of the initial assessment monitoring phase.

Principal purposes of the baseline monitoring phase include: gathering occurrence data for health-based CECs; evaluating performance indicator CECs and surrogates; determining treatment effectiveness; assessing the list of health-based CECs, performance indicator CECs, surrogates, and bioanalytical screening tools; and identifying an appropriate list of constituents to monitor for the removal of CECs and treatment system performance in the standard operation monitoring phase of [PROJECT SPONSOR NAME].

Following each sampling event, [PROJECT SPONSOR NAME] will evaluate monitoring results for health-based CECs and bioanalytical screening tools and implement appropriate response actions as outlined in Section C.1 Reports to Management And Response Actions. [PROJECT SPONSOR NAME] will also evaluate monitoring results for surrogates and evaluate the suitability of the performance indicator CECs and surrogates, which include specifying expected removal percentages

A.8.3.2.1 Health-based CECs, Performance indicator CECs and Surrogates

The Regional Water Board will evaluate the performance indicator CEC and surrogate data from the initial assessment monitoring phase. Performance indicator CECs and surrogates that exhibited reduction by unit processes and/or provided an indication of operational performance will be selected for monitoring in the baseline monitoring phase. Surrogates not reduced through a unit process are not good indicators of the unit's intended performance. *[For example, soil aquifer treatment may not effectively lower electrical conductivity. Therefore, electrical conductivity may not be a good surrogate for soil aquifer treatment.]*

If a performance indicator CEC listed in Table 9 is not a good indicator of CEC removal, [PROJECT SPONSOR NAME] must propose an alternative performance indicator CEC to monitor that is representative of the constituent group. The applicability of a performance indicator's ability to represent a constituent group may be demonstrated using statistical justifications such as principal component analysis, correlation coefficients, or other applicable statistical methods. This performance indicator CEC is subject to approval by the Regional Water Board in consultation with the State Water Board.

[PROJECT SPONSOR NAME] conducts a baseline monitoring phase of targeted analytes (including health-based CECs, performance indicator CECs and surrogates) for a period of three years for each of the analytes and surrogates listed in Table 9as well as performance-based CECs and surrogates identified by the Regional Water Board in consultation with the State Water Board as outlined in Table 4.

[PROJECT SPONSOR NAME] must evaluate data from performance indicator CECs and surrogates and prepare an updated Table 9 with the expected (rather than example) removal percentages for the water recycling treatment plant and submit to the Regional Water Board with the baseline monitoring data. Following each sampling event, [PROJECT SPONSOR NAME] must evaluate monitoring results for health-based CECs and implement appropriate response actions as outlined in Section C.1 Reports to Management And Response Actions. [PROJECT SPONSOR NAME] must also evaluate monitoring results for surrogates and evaluate the suitability of the surrogates.

A.8.3.2.2 Bioanalytical Screening Tools

[PROJECT SPONSOR NAME] will conduct a baseline monitoring phase with use of two bioanalytical screening tools (estrogen receptor-alpha [ER-α] and aryl hydrocarbon receptor [AhR]) for a period of one year as outlined in Table 4.

Following each sampling event, [PROJECT SPONSOR NAME] will evaluate monitoring results for bioanalytical screening tools using the direction in section C.1 Reports to Management And Response Actions and implement appropriate response actions.

A.8.3.3 Standard Operation Monitoring Phase

The purpose of the standard operation monitoring phase is to monitor CECs under standard operating conditions for [PROJECT SPONSOR NAME]. In this phase the Regional Water Board, in consultation with the State Water Board, will identify a list of health-based CECs, performance-based CECs, surrogates, and bioanalytical screening tools to monitor based on [PROJECT SPONSOR NAME]'s data from the first two monitoring phases. [PROJECT SPONSOR NAME] will initiate the standard operation monitoring phase upon completion of the baseline monitoring phase and upon receiving approval from the Regional Water Board to proceed with this phase given the existing data for the water recycling treatment plant.

Following each sampling event, [PROJECT SPONSOR NAME] will evaluate monitoring results for health-based CECs and bioanalytical screening tools and implement appropriate response actions as outlined in Section C.1 Reports to Management And

Response Actions. [PROJECT SPONSOR NAME] will also evaluate monitoring results for surrogates and evaluate the suitability of the performance indicator CECs and surrogates, which include specifying expected removal percentages

A.8.3.3.1 Health-based CECs, Performance indicator CECs and Surrogates

[PROJECT SPONSOR NAME] will conduct monitoring requirements for performance indicator CECs and surrogates as outlined in Table 4 while the facility is operating. The Regional Water Board, in consultation with the State Water Board, may remove a health-based CEC from the required monitoring list if the monitoring results meet the conditions of the minimum threshold level presented in Table 13.

A.8.3.3.2 Bioanalytical Screening Tools

[PROJECT SPONSOR NAME] will conduct monitoring requirements with use of bioanalytical screening tools as outlined in Table 4 while the facility is operating.

Table 4. Project Schedule			
Activity	Anticipated Date of Initiation (MM/DD/YYYY)	Anticipated Date of Completion (MM/DD/YYYY)	Deliverable[6] Frequency
Health-based CECs, Performance Indicator CECs and Surrogates[7]			
Initial Assessment Phase	[start date of monitoring]	[one year from start date of monitoring]	Quarterly[8]
Baseline Monitoring Phase	[one year from start date of monitoring]	[four years from start date of monitoring]	Semi-Annually

[6] Deliverable is electronic data report to State Water Board through GeoTracker.
[7] CECs which are required for monitoring by as priority pollutants in accordance with title 22, may need to be monitored and reported at a higher frequency in accordance with regulations.
[8] For health-based CECs and Performance Indicator CECs. Surrogates will be monitored and reported on a project-specific basis as determined by the [INSERT NAME Regional Water Board] in consultation with the State Water Board. More frequent monitoring may be required to respond to a concern

Table 4. Project Schedule			
Activity	Anticipated Date of Initiation (MM/DD/YYYY)	Anticipated Date of Completion (MM/DD/YYYY)	Deliverable[6] Frequency
Standard Operation Monitoring Phase	[four years from start date of monitoring]	Ongoing	Semi-Annually or Annually
Bioanalytical Screening Tools			
Initial Assessment Phase	[start date of monitoring]	[three years from start date of monitoring]	Quarterly[9]
Baseline Monitoring Phase	[three years from start date of monitoring]	[four years from start date of monitoring]	Quarterly
Standard Operation Monitoring Phase	[four years from start date of monitoring]	Ongoing	Semi-Annually or Annually

A.8.4 Project Constituents

A.8.4.1 Targeted Analytical Chemistry

Analytical methods for all health-based and performance CECs are included in Table 9. [NOTE TO AUTHOR: ONLY LIST THE METHOD INTENDED TO USE FOR THE ANALYTE]

A.8.4.2 Surrogates

For potable reuse applications, consistent monitoring of specific surrogate parameters (i.e., ultraviolet (UV) absorbance, dissolved organic carbon, etc.) that correlate with the removal of CECs during advanced water treatment processes are invaluable indicators of water quality. Surrogates for this project and methods are found in Table 9.

A.8.4.3 Bioanalytical Screening Tools

Monitoring with bioanalytical screening tools is intended to capture a wider array of CECs than is possible with targeted analytical chemistry monitoring.

[9] More frequent monitoring may be required to respond to a concern.

In-vitro bioassay monitoring is conducted using standardized sampling, handling, extraction, and analysis methods detailed in the SOP in Appendix XX.

A.8.5 Monitoring Locations

[INSERT APPROVED SPECIFIC LOCATION INFORMATION (lat/long coordinates) OF DESIGNATED PRIMARY AND SECONDARY MONITORING LOCATIONS HERE AS SPECIFIED IN SECTION B.3.1. NOTE THAT BOTH PRIMARY AND SECONDARY LOCATIONS MUST BE APPROVED BY THE REGIONAL WATER BOARD IN CONSULTATION WITH THE STATE WATER BOARD. NOTE: A DETAILED MAP MAY BE USEFUL]

(e.g. following tertiary treatment prior to application to surface spreading area, prior to treatment by RO, groundwater monitoring well 30 days downgradient from the application site, following treatment prior to release into the aquifer)

A.9 DATA QUALITY OBJECTIVES, DATA QUALITY INDICATORS, AND MEASUREMENT QUALITY OBJECTIVES

Data quality objectives are established through a process that establishes performance and acceptance criteria for designing a plan for collecting data of sufficient quality and quantity to support the goals of the study. There are seven iterative steps that are followed to clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions (USEPA 2006). Various aspects of the DQO process are described in Section A.6. Project Overview and Intended Use of Data. Those elements are also summarized in Table 8, below.

Table 5 – Data Quality Objectives [NOTE TO AUTHOR: CHECK ALL CITED TABLES AND APPENDICES]

Initial Monitoring Phase

Data Quality Objective	Metric	Data	Field	Method	Response Actions
(1) Identify the occurrence of health-based CECs, performance indicator CECs, and surrogates in recycled water for groundwater recharge or reservoir water augmentation.	Evaluate data from performance indicator CECs and surrogates from monitoring locations in A.8.5 Monitoring Locations. Evaluate monitoring results for health-based CECs from monitoring locations in A.8.5 Monitoring Locations.	Performance Indicator and Health-Based CECs and surrogates in Table 9	Use of sampling protocol as listed in Appendix B	Analyze according to lab methods in Table 9	Inform (2) for health-based CECs and (4) for performance indicator CECs and Surrogates.
(2) Determine treatment effectiveness	Compare health-based CECs from monitoring locations in A.8.5 Monitoring Locations.	Health-based CECs in Table 9.	Use of sampling protocol as listed in Appendix B	Analyze according to lab methods in Table 9. Obtain a measured environmental	Compare MECs to their respective monitoring trigger levels (MTLs) listed in Table 9 and implement appropriate

Data Quality Objective	Metric	Data	Field	Method	Response Actions
				concentration (MEC).	response actions.
(4) Specify the expected removal percentages for performance indicator CECs and surrogates	Determine the removal percentages for performance indicator CECs and surrogates.	Performance indicator CECs and surrogates in Table 9	Use of sampling protocol as listed in Appendix B	Analyze according to lab methods in Table 9. Calculate removal percentage by use Equation 3	Prepare an updated Table 9 with the expected removal percentages for performance indicator CECs and surrogates and submit to the Regional Water Board. Evaluate suitability of surrogates.
(3) Gather bioactivity data for ER-α and AhR bioanalytical screening tools and pilot	Evaluate monitoring results for bioanalytical screening tools from monitoring	Bioanalytical screening tools in Table 11**Error! Not a valid bookmark**	Use of sampling protocol as listed in Appendix B	Analyze according to lab methods in Table 11 to obtain bioanalytic	Compare BEQs to their respective MTLs listed inTable 14, if desired.

Data Quality Objective	Metric	Data	Field	Method	Response Actions
test the framework for response actions (5) Gather bioactivity data for ER-α and AhR bioanalytical screening tools to determine the range of responses for the bioassays for standardized water quality monitoring	locations in A.8.5 Monitoring Locations.	**self-reference.**.		al equivalent concentrations (BEQ).	

Baseline Monitoring Phase

Data Quality Objective	Metric	Data	Field	Method	Response Actions
(1) Gather occurrence data for health-based CECs	Compare health-based CECs from monitoring locations in A.8.5 Monitoring Locations.	Health-based CECs in Table 9.	Use of sampling protocol as listed in Appendix B	Analyze according to lab methods in Table 9. Obtain a measured environme	Compare MECs to their respective monitoring trigger levels (MTLs) listed in Table 12 and

Data Quality Objective	Metric	Data	Field	Method	Response Actions
				ntal concentrati on (MEC).	implement appropriate response actions.
(2) Evaluate performance indicator CECs and surrogates and determine treatment effectiveness	Performance indicator CECs and surrogates that exhibited reduction by unit processes and/or provided an indication of operational performance will be selected for monitoring in the baseline monitoring phase. Surrogates not reduced through a unit process are not good indicators of the unit's intended performance.	Performance indicator CECs and surrogates in Table 9	Use of sampling protocol as listed in Appendix B	Analyze according to lab methods in Table 9. Calculate removal percentage by use of Equation 3	The removal percentages will be confirmed during the baseline monitoring phase. Prepare an updated Table 9 with the expected removal percentages for performance indicator CECs and surrogates and submit to the Regional Water Board.

Data Quality Objective	Metric	Data	Field	Method	Response Actions
(3) Gather bioactivity data for ER-α and AhR bioanalytical screening tools and pilot test the framework for response actions	Evaluate monitoring results for bioanalytical screening tools from monitoring locations in A.8.5 Monitoring Locations.	Bioanalytical screening tools in Table 11	Use of sampling protocol as listed in Appendix B	Analyze according to lab methods in Table 11 to obtain bioanalytical equivalent concentrations (BEQ).	Compare BEQs to their respective MTLs listed in Table 14 and implement appropriate response actions.
(4) Assess the list of health-based CECs, performance indicator CECs, surrogates, and bioanalytical screening tools,	Identify an appropriate list of constituents to monitor the removal of CECs and treatment system performance in the standard operation monitoring phase	All data collected in initial and baseline monitoring phases.			Identify an appropriate list of constituents to monitor the removal of CECs and treatment system performance in the standard operation monitoring phase

Standard Operating Phase

Data Quality Objective	Metric	Data	Field	Method	Response Actions
Monitor performance indicator CECs and surrogates under standard operating conditions	Determine the removal percentages for performance indicator CECs and surrogates from monitoring locations in A.8.5 Monitoring Locations.	CECs and surrogates in Table 9.	Use of sampling protocol as listed in Appendix B	Analyze according to lab methods in Table 9 and Appendix B. Calculate removal percentage by use of Equation 3.	The established removal percentages for each project will be used to evaluate treatment effectiveness and operational performance.
Monitor occurrence data of health-based CECs	Compare health-based CECs from monitoring locations in A.8.5 Monitoring Locations.	Health-based CECs in Table 9.	Use of sampling protocol as listed in Appendix B	Analyze according to lab methods in Table 9. Obtain a measured environmental concentration (MEC).	Compare MECs to their respective monitoring trigger levels (MTLs) listed in Table 12 and implement appropriate response actions.
Monitor bioactivity data for ER-α and AhR bioanalytical	Evaluate monitoring results for bioanalytical screening	Bioanalytical screening tools in Table 11.	Use of sampling protocol as listed in	Analyze according to lab methods in Table 11 to	Compare BEQs to their respective MTLs listed in Table 14 and

screening tools and pilot test the framework for response actions	tools from monitoring locations in A.8.5 Monitoring Locations.		Appendix B	obtain bioanalytical equivalent concentrations (BEQ).	implement appropriate response actions.

Data collected as part of this process will meet minimum acceptance criteria. Acceptance criteria is based on the implementation of acceptable and recognized QA/QC procedures, such as proper sample collection and handling methods, sample preparation and analytical procedures, holding times, and QA protocols.

DQOs are used to define performance and acceptance criteria to document decision making processes. DQOs will define tolerable levels of potential decision error used to establish the quantity and quality of data required to support the project objectives.

A.9.1 Data Quality Indicators

Data Quality Indicators (DQI) are the quantitative measures and qualitative descriptors used to set limits of acceptable levels of data error. The principal DQIs are precision, bias/accuracy, representativeness, completeness, and sensitivity. *[NOTE TO AUTHOR: the following are descriptions of DQIs, include as needed for utility of QAPP.]*

A.9.1.1 Precision

Precision is defined as the measure of agreement among repeated measurements of the same property under identical or substantially similar conditions, calculated as either the range or the standard deviation. The precision of instrument-related field measurements must be controlled using the same analytical instrument in the field to replicate each field measurement of each water sample three times. The replicated field measurements must be reported as the mean, and the precision must be calculated as the standard deviation of the measurements. The precision of chemistry laboratory measurements must be controlled by comparison of the sample to a laboratory matrix spike/matrix spike duplicate (MS/MSD). Precision must be measured by the degree of agreement between the sample and MS/MSD results. Only samples with a ±25% relative percent difference (RPD) will be accepted.

A.9.1.2 Bias/Accuracy

Accuracy is a qualitative term referring to whether there is agreement between a measurement made on an object and its true (target or reference) value. Bias is a systematic error that consistently results in a high or low measurement of a constituent from its true value.. An applicable method of measuring bias/accuracy of measurements of Health-based CECs and Performance CECs applies to laboratory control standards and matrix spike samples, which is quantified as percent recovery (Equation 1).

Equation 1

$$Percent\ Recovery\ (\%) = \frac{Mass\ of\ substance\ recovered}{Mass\ of\ Substance\ spiked}\ x\ 100$$

Please note that percent recovery may not be appropriate as a metric for accuracy for all potential surrogates listed in this QAPP due to the lack of reference standards, so refer to Table 9 for specific guidance. For some surrogates, an instrument performance check must be used for quality control, which is generally a blank fortified with a reference control that is used to verify instrument performance and calibration.

Bias can be reduced or eliminated through the calibration of instruments and/or use of standards.

A.9.1.3 REPRESENTATIVENESS

Representativeness is a qualitative term that expresses the degree to which the sample represents characteristics of the body from which it was sampled. Sampling from approved locations using documented sample types (grab, continuous, composite, etc.) and frequency of sample collection, as well as employing best measures to reduce contamination may improve the representativeness of a sample (see section B.3.2.1 for details). Including appropriate laboratory and field replicates, reference standard curves, and proper maintenance and calibration of instruments to meet performance standards may improve the representativeness of a sample. In addition, professional judgement should be exercised in the field to evaluate whether measurements and physical samples are collected in such a manner that the resulting data appropriately reflect the sampled water. Sample selection and use of approved/documented analytical methods will control to the best extent possible that the measurement data represent the conditions at the investigation site.

A.9.1.4 COMPLETENESS

Completeness describes the success of sample collection and laboratory analysis, which should be sufficient to fulfill the statistical criteria of the project. Completeness is measured as the fraction of samples collected and/or analyzed relative to the quantity targeted in the monitoring design (Equation 2). While no specific statistical criteria have been established for this monitoring, it is expected that 90% of all measurements can be taken when anticipated. This accounts for adverse weather conditions, safety concerns, and equipment problems. A loss of 10% of the samples during a monitoring period would represent a minimal loss in statistical power to address the monitoring objectives.

Equation 2

$$Completeness = (100\%)\ x\ \frac{T-(I+NC)}{T}$$

Where *T* is the total number of expected sample measurements, *I* is the number of invalid sample measured results, and *NC* is the number of sample measurements not produced (e.g. spilled sample, etc).

A.9.1.5 SENSITIVITY

Sensitivity is the ability of a method to detect an analyte at a concentration at which the mean response is statistically beyond the noise limits of the method at zero concentration of that analyte.

A.9.2 MEASUREMENT QUALITY OBJECTIVES

MQOs are the individual performance criteria or acceptance goals that correspond to each of the DQIs. The MQOs for targeted analytical chemistry are summarized in Table 6. [Note that distinct MQOs were developed for Perfluorooctane sulfonate (PFOS) and Perfluorooctanoic acid (PFOA) in non-drinking water matrices in accordance with the performance criteria in Department of Defense Quality Systems Manual (DoD QSM 5.1 or higher).]

Table 6. Measurement Quality Objectives for Targeted Analytical Chemistry and Surrogates					
Parameter	Precision	Bias/Accuracy	Representativeness	Sensitivity	Completeness
Health and performance indicator CECs	*Lab Replicate:* RPD≤25% *Matrix Spike Replicate:* RPD≤25%	*Reference Standard Curve:* correlation coefficient (R) ≥0.995 *Instrument Performance Check*: 70-130% recovery if certified. *Matrix Spikes*: 50-150% recovery, or based on 3x the standard deviation of lab's actual method recoveries	*Reference Standard Curve:* Once per batch. *Instrument Performance Check:* One after every 10 samples, and at end of batch. *Lab Replicate:* One lab duplicate per method. *Field Replicate:* one field duplicate 5% of total project sample count.	Verify reporting limits and method detection levels	90%
Surrogates					
Dissolved Organic Carbon (DOC)	*Lab Replicate:* RPD≤15%	*Reference Standard Curve:* correlation coefficient (R) ≥0.995 *Instrument Performance Check* (2.0 mg/L	*Reference Standard Curve:* Once per batch. *Instrument Performance Check:* One after every 10	*Blank* ≤ method detection limit (~0.1 mg/L)	90%

Table 6. Measurement Quality Objectives for Targeted Analytical Chemistry and Surrogates					
Parameter	Precision	Bias/Accuracy	Representativeness	Sensitivity	Completeness
	Matrix Spike Replicate: RPD≤10%	standard in milli-Q water and 10 mg/L): 90-110% of theoretical value. *Laboratory Fortified Blank:* (mid-level standard in milli-Q water): 90-110% recovery *Matrix Spike*: 80-120% recovery	samples, and at end of batch. *Lab Replicate:* One lab sample replicate per 10 samples or analytical batch (whichever is more frequent). *Laboratory Fortified Blank:* Once per every 15 samples. *Field Replicate:* Field duplicate 5% of total project sample count. *Blank:* once every 10 samples and at end of run.		
Nitrate	*Lab Replicate:* RPD≤10%	*Reference Standard Curve*: correlation coefficient (R) ≥0.99950. *Instrument Performance Check* (5.0 mg/L NO_3 in	*Reference Standard Curve*: Once per batch. *Instrument Performance Check:* Once daily following calibration, after every 10	*Blank* ≤ method detection limit (~0.1 mg/L)	90%

Table 6. Measurement Quality Objectives for Targeted Analytical Chemistry and Surrogates					
Parameter	Precision	Bias/Accuracy	Representativeness	Sensitivity	Completeness
	Matrix Spike Replicate: RPD≤10%	milli-Q water): 90-110% of theoretical value. *Laboratory Fortified Blank* (2.0 mg/L NO_3 in milli-Q water): 90-110% recovery *Matrix Spike* (2.0 mg/L NO_3 spiked in matrix): 90-110% recovery	samples, and at end of batch. *Laboratory Fortified Blank:* once per batch or every 10 samples (whichever is more frequent). *Matrix Spike:* once per batch or every 10 samples (whichever is more frequent). *Lab Replicate:* One lab sample replicate per 10 samples or analytical batch (whichever is more frequent). *Field Replicate:* Field duplicate 5% of total project sample count. *Blank:* once per batch or every 10 samples		

Table 6. Measurement Quality Objectives for Targeted Analytical Chemistry and Surrogates					
Parameter	Precision	Bias/Accuracy	Representativeness	Sensitivity	Completeness
			(whichever is more frequent).		
Fluorescence	*Lab Replicate:* RPD≤10%[10]	*Instrument Performance Check: (*quinine sulfate in 0.1 N H_2SO_4)	*Instrument Performance Check:* once per batch or every 10 samples (whichever is more frequent). *Lab Replicate:* One lab sample replicate per 20 samples or analytical batch (whichever is more frequent). *Field Replicate:* Field duplicate 5% of total project sample count.		90%

[10] Based on findings of low coefficient of variance (<4%) in Chen et al. (2003).

Table 6. Measurement Quality Objectives for Targeted Analytical Chemistry and Surrogates					
Parameter	Precision	Bias/Accuracy	Representativeness	Sensitivity	Completeness
UV Light Absorbance[11]	For UV values >0.045 cm^{-1}, the RPD limit is ≤10%. For UV values 0.045cm > 1, the RPD limit is ≤20%	*Reference Standard Curve (KHP)*: correlation coefficient (R) ≥0.995. *Instrument Performance Check (*1.0 mg/L and 5.0 mg/ KHP reference standard) 70-130%.	*Reference Standard Curve:* every 3 months or less. *Instrument Performance Check:* Once per batch. *Replicate:* once per batch or every 10 samples (whichever is more frequent). *Blank*: One at the beginning of each batch, after every 10 samples, and at the end of each batch.	*Blank* ≤ 0.010 cm^{-1}	90%
Ammonia	*Lab Replicate:* RPD≤10%	*Reference Standard Curve*: correlation coefficient (R) ≥0.99950. *Instrument Performance Check* (1.0 mg/L NH_3-N	*Reference Standard Curve*: Once per batch. *Instrument Performance Check:* Once daily following calibration, after every 10	*Blank* ≤ method detection limit (~0.003 mg/L)	90%

[11] DQOs from SM5910(B).

Table 6. Measurement Quality Objectives for Targeted Analytical Chemistry and Surrogates					
Parameter	Precision	Bias/Accuracy	Representativeness	Sensitivity	Completeness
	Matrix Spike Replicate: RPD≤10%	in milli-Q water): 90-110% of theoretical value. *Laboratory Fortified Blank* (1.0 mg/L NH_3-N in milli-Q water): 90-110% recovery. *Matrix Spike* (1.0 mg/L NH_3-N spiked in matrix): 90-110% recovery.	samples, and at end of batch. *Laboratory Fortified Blank:* once per batch or every 10 samples (whichever is more frequent). *Matrix Spike:* once per batch or every 10 samples (whichever is more frequent). *Lab Replicate:* One lab sample replicate per 10 samples or analytical batch (whichever is more frequent). *Field Replicate:* Field duplicate 5% of total project sample count. *Blank:* one per batch.		

Table 6. Measurement Quality Objectives for Targeted Analytical Chemistry and Surrogates					
Parameter	Precision	Bias/Accuracy	Representativeness	Sensitivity	Completeness
Electrical Conductivity[12]	*Lab Replicate:* RPD≤10%	*Calibration:* 1 certified low-level standard at 25˚ or determine cell constant using certified low-level standard at 25˚. If at different temperature, using temperature compensation. *Instrument Performance Check:* certified reference standard (20 µS/cm): 85-115% of theoretical value. *Control Chart Standard:* 90-110% of theoretical value.	*Calibration*: monthly. *Instrument Performance Check:* one per batch. *Lab Replicate*: one lab sample duplicate per 10 samples or analytical batch (whichever is more frequent). *Field Replicate:* Field duplicate 5% of total project sample count. *Control Chart Standard:* Analyze 2 control chart standards at the beginning and end of each batch.	N/A	90%

[12] Data quality objectives based on SM2510(B).

A.10 SPECIAL TRAINING AND ORGANIZATION

A.10.1 SPECIALIZED TRAINING

[INSERT specialized training information here. Include Staff training, for sampling, and if applicable, analytical, as well as California Environmental Laboratory Accreditation Program (ELAP) certificates of accreditation number for each laboratory and other relevant training, e.g. text: "All field staff shall be trained on sampling for CECs by project QA Officer. A folder documenting this training and who attended shall be maintained at [PROJECT SPONSOR NAME]'s office." Please also include links to the analytical laboratories' quality assurance manuals, if available. If links are unavailable, reference the labs' quality assurance manuals when discussing the analytical training for laboratory personnel.]

A.10.2 METHOD SOPS AND ELAP ACCREDITATION

[NOTE TO AUTHOR: According to the amended Recycled Water Policy ELAP accreditation is required if accreditation for the analytical test methods or analytes is offered by ELAP at the time that monitoring is required to begin. If ELAP accreditation for analytical test methods or analytes in the Recycled Water Policy become available after monitoring is initiated, the laboratory providing analysis of CECs is required to be accredited by ELAP for those methods or analytes within one year of such accreditation becoming available. If ELAP accreditation is unavailable for a method or an analyte, [PROJECT SPONSOR NAME] is required to use a laboratory that has been accredited for a similar analytical method, instrumentation, or analyte until ELAP accreditation becomes available, unless otherwise approved by the Regional Water Board or State Water Board for bioanalytical screening tools.

If the [PROJECT SPONSOR] proposes to (1) use a method that has not been validated and approved, (2) use a validated an approved method that has been modified, or (3) use a method for an application that is outside the intended use of the method (e.g., different matrix, new analyte) minimum method validation requirements must be developed by the regional water board in consutlation with the State Water Board for the analytes. The State Water Board and regional water board will review the method validation package and must approve the method prior to use.]

[FOR ALL ANALYTES/TECHNOLOGIES (SURROGATES, BIOANALYTICAL SCREENING TOOLS), INCLUDE A LINK/REFERENCE TO THE SOP FOR THE

METHOD USED, AS WELL THE ELAP ACCREDITATION (IF AVAILABLE) DETAILS BELOW. A TABLE MAY BE HELPFUL].

[INSERT LAB NAME] accredited by the California Environmental Laboratory Accreditation Program (ELAP) for the analyses of [ANALYTE/TECHNOLOGY] by [METHOD] in [MATRIX].

[Include ELAP certificates of accreditation number for each laboratory for the analysis of analytes using specified methods.]

A.10.3 Training Safety and Certification Documentation

[INSERT TRAINING SAFETY AND CERTIFICATION DOCUMENTATION].

A.10.4 Personnel Certification Documentation

All personnel are responsible for complying with all QA/QC requirements that pertain to their organizational/technical function. Each technical staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their function and a general knowledge of sample collection, laboratory operations, test methods, QA/QC procedures, and records management, which are determined and organized by the organization and will be made available to Water Boards' staff upon request.

[INSERT APPLICABLE PERSONNEL CERTIFICATION DOCUMENTATION AND FACILITY-SPECIFIC REQUIREMENTS FOR EQUIPMENT TRAINING, LABORATORY OPERATIONS, ETC.].

A.11 DOCUMENTATION AND RECORDS REQUIREMENTS

A.11.1 Sample Documentation and Handling Records

Sampling staff from [INSERT LABORATORY, FACILITY OR CONSULTANT] are responsible for custody of the samples from the time they are taken until they are delivered to [LABORATORY NAME(S) INCLUDING IN-HOUSE LABORATORY].

Sample collection crews must record the following information for each sampling event in the applicable chain of custody form:

1. Date, time and exact location of sample collection

2. Sample matrix
3. Name(s) and signatures of individual(s) who performed the sampling
4. Sample identification number
5. Qualitative description of relevant water flow and weather conditions at the time of sample collection
6. A description of any unusual occurrences associated with the sampling event (especially those that could affect sample or data quality)
7. Temperature of the sample at time of collection
8. Preservatives in or added to sample bottles

Following receipt by the laboratory, the following information will be recorded on the chain of custody form:

1. Time of arrival to the lab
2. Chemical preservatives added in lab
3. Temperature of sample
4. Condition of sample

A sample chain-of-custody form may be found in Appendix xx.

A.11.2 Equipment Calibration Documentation

Calibration of analytical instrumentation must be documented regularly and in accordance with the lab's SOPs. Equipment calibration documentation should be available to the Project QAO, State Water Board QAO and Laboratory QAO upon request.

B. Sample Handling and Analysis

This section of the QAPP outlines specific QA/QC procedures related to field sampling, laboratory analysis, as well as the generation, compliation, reporting and archiving of data.

B.1 EXPERIMENTAL DESIGN

B.1.1 Sampling and Monitoring Design

Sampling design criteria are specific to each phase in which [PROJECT SPONSOR NAME] is currently operating under, as outlined in the project schedule (Table 4). [INSERT ADDITIONAL DETAILS HERE AS NEEDED]

B.2 SAMPLING LOCATIONS, SAMPLE COLLECTION, HANDLING, CUSTODY PROCEDURES, AND DOCUMENTATION

B.2.1 Sample Collection Monitoring Points

[DELETE SECTION THAT DOES NOT APPLY TO YOUR FACILITY]

B.2.1.1 Groundwater Recharge- Surface Application

Samples to be analyzed for **health-based and performance indicator CECs**, **bioanalytical screening tools**, and **surrogates** (listed in Table 9) will be collected:

1. Following tertiary treatment prior to application to surface spreading area and.[INSERT EXACT LOCATION DETAILS FOR PRIMARY LOCATION (LAT, LONG) HERE].

   [INSERT EXACT LOCATION DETAILS FOR SECONDARY LOCATION (LAT, LONG) HERE]
2. At groundwater monitoring wells designated in consultation with the State Water Board within the distance groundwater travels downgradient from the application site in 30 days.[INSERT EXACT LOCATION DETAILS FOR PRIMARY LOCATION (LAT, LONG) HERE]

[INSERT EXACT LOCATION DETAILS FOR SECONDARY LOCATION (LAT, LONG) HERE]

B.2.1.2 Groundwater Recharge- Subsurface Application and Reservoir Water Augmentation

Samples to be analyzed for **health-based CECs** (listed in Table 9) and **bioanalytical screening** tools (not listed in this QAPP version) will be collected:

1. At a location following treatment prior to release into the aquifer or surface water reservoir.[INSERT EXACT LOCATION DETAILS FOR PRIMARY LOCATION (LAT, LONG) HERE]

   [INSERT EXACT LOCATION DETAILS FOR SECONDARY LOCATION (LAT, LONG) HERE]

Samples collected for **perfomance indicator CECs** (listed in Table 9) will be collected:

1. Prior to RO treatment[13]; and [INSERT EXACT LOCATION DETAILS FOR PRIMARY LOCATION (LAT, LONG) HERE].

   [INSERT EXACT LOCATION DETAILS FOR SECONDARY LOCATION (LAT, LONG) HERE]

2. Following treatment prior to release into the aquifer or surface water reservoir.[INSERT EXACT LOCATION DETAILS FOR PRIMARY LOCATION (LAT, LONG) HERE]

   [INSERT EXACT LOCATION DETAILS FOR SECONDARY LOCATION (LAT, LONG) HERE]

Samples collected for **surrogates** (listed in Table 9) will be collected at locations proposed by [PROJECT SPONSOR NAME] and approved by the Regional Water Board in consultation with the State Water Board.

[13]If the recycled water producer can demonstrate that the RO unit does not substantially remove a CEC, the [INSERT NAME Regional Water Board]may allow monitoring for that CEC prior to the AOP, instead of prior to the RO unit.

B.2.2 Water Sample and Field Blank Collection, Handling, and Disposal Requirements

B.2.2.1 General Practices for Water Sample Collection

Best practices for sample collection for wastewater is detailed in USEPA (2017). The following criteria should be followed when sampling all CECs and surrogates to ensure samples are representative unless otherwise specified in CEC-specific sampling guidelines in B.3.2.2.

1. A clean pair of new, non-powdered, disposable gloves must be worn at each sampling location. Gloves should be put on immediately prior to sampling and must not come in contact with the media being sampled. If at any time during sample collection, cleanliness is suspected to be compromised, gloves must be changed.
2. Store samples suspected of containing high concentrations of contaminants separately.
3. Collect samples with the least suspected contamination before collecting from the most suspected contamination.
4. When possible, one member of the field sampling team must be responsible for taking notes and photographs, fill out tags, etc., while the other members collect samples.
5. Field investigators must use new, verified, certified-clean disposable or nondisposable equipment cleaned according to procedures contained in SESD Operating Procedure for Field Equipment Cleaning and Decontamination (SESDPROC-205) for collection of samples for organic compound analyses.
6. The sample must be collected where the water is well mixed. Therefore, the sample must be collected near the center of the flow channel, at approximately 40 to 60 percent of the water depth, where the turbulence is at a maximum and the possibility of solids settling is minimized. Skimming the water surface or dragging the channel bottom must be avoided. However, allowances should be made for fluctuations in water depth due to flow variations.
7. In sampling from wide conduits, cross-sectional sampling should be considered. Rhodamine WT dye may be used as an aid in determining the most representative sampling locations. (It should be noted that the selection of a sampling location must be approved by the State or Regional Water Board).
8. If manual compositing is employed, the individual sample portions must be thoroughly mixed before pouring the individual aliquots into the composite

container. For manual composite sampling, the individual sample aliquots should be preserved at the time of sample collection.

9. Water samples will be collected: by directly filling the sample container, by using an automatic sampler, or by use of another device to be specified in advance of collection. [SPECIFY IF DIFFERENT SAMPLING EQUIPMENT IS USED].
10. During sample collection, if transferring the sample from a collection device, the device must not come in contact with the sample containers.
11. Place the sample into appropriate, pre-labeled containers as detailed in Table 10. Targeted Analytes with Sample Volume, Container Type and Preservation . Sample container caps and lids must be checked for tightness and clearly labeled with an indelible marker.
12. No CECs listed in Table 8 are volatile, therefore non-volatile sampling procedures should be followed. In particular, sample containers must be filled with an allowance for ullage.
13. Specific guidance for ensuring representativeness of grab or composite samples is detailed below in B.3.2.1.1 and B.3.2.1.2, respectively.

B.3.2.1.1 Grab Samples

Grab samples consist of either a single discrete sample or individual samples collected over a period of time not to exceed 15 minutes. The grab sample should be representative of the water conditions at the time of sample collection. The sample volume depends on the type and number of analyses to be performed (see Table 10. Targeted Analytes with Sample Volume, Container Type and Preservation [UPDATE TABLE TO REFLECT CHOSEN SAMPLE TYPES FOR EACH ANALYTE]).

B.2.2.1.2 Composite Samples

The following guidance is an excerpt from USEPA (2017). [IF AVAILABLE, INSERT FACILITY-SPECIFIC SOPs AND GUIDANCE AND DELETE THE FOLLOWING TEXT]:

Composite samples are collected over time, either by continuous sampling or by mixing discrete samples. A composite sample represents the average water characteristics during the compositing period. Various methods for compositing are available and are based on either time or flow proportioning. The choice of a flow proportional or time composite sampling scheme depends on the permit requirements, variability of the wastewater flow or concentration of pollutants, equipment availability and sampling location. The investigator must know each of these criteria before a sampling program can be initiated. Generally, a time composite is acceptable. However, in enforcement

cases where strict adherence to permit requirements are necessary, a flow proportional sample is preferable, if possible.

A time composite sample consists of equal volume discrete sample aliquots collected at constant time intervals into one container. A time composite sample can be collected either manually or with an automatic sampler.

A flow proportional composite sample can be collected using one of two methods. One method consists of collecting a constant sample volume at varying time intervals proportional to the wastewater flow. For the other method, the sample is collected by varying the volume of each individual aliquot proportional to the flow, while maintaining a constant time interval between the aliquots.

Flow proportional samples can be collected directly with an automatic sampler that is connected to a compatible flow measuring device. An automatic sampler can also be used to collect discrete samples. At the end of the compositing period, the discrete samples are composited by volume versus flow chart readings. Field personnel can use the facility's primary flow device and flow measurement system when such equipment's accuracy can be verified. Prior to collecting flow proportional samples, the facility's flow measuring system should be examined for proper installation and accuracy according to SESD Operating Procedure for Wastewater Flow Measurement (SESDPROC-109). If the facility's primary flow measuring device does not meet standard conditions specified in SESDPROC-109 (Most Recent Version), or is in an unsafe or inaccessible location, then the investigator may choose to collect time composite samples or install a portable primary flow device. If the flow measurement system is acceptable, samples should be collected using the appropriate flow proportioning methods.

B.2.2.2 General Practices for Water Sample Handling

1. Samples must be stored and transported on ice, maintaining 4°C, until processed.
2. Samples must be delivered to the laboratory, and analyses initiated within specified holding times, as outlined in Table 10. Targeted Analytes with Sample Volume, Container Type and Preservation [UPDATE TABLE WITH METHOD AND SOP-REQUIRED HOLDING TIMES].
3. All samples requiring preservation must be preserved as soon as practically possible, ideally immediately at the time of sample collection. It is suggested to use chemical preservatives stored in an individual single-use vial as described in the SESD Operating Procedure for Field Sampling Quality Control (SESDPROC-011).

4. When possible, the adequacy of sample preservation should be checked after the addition of the preservative for all samples. If it is determined that a sample is not adequately preserved, additional preservative should be added to achieve adequate preservation. For example, all samples preserved using a pH adjustment must be checked, using pH strips, to ensure that they were adequately preserved. This is done by pouring a small volume of sample over the strip. Do not place the strip in the sample.
5. All samples will be handled, prepared, transported, and stored in a manner so as to minimize bulk loss, analyte loss, contamination, or biological degradation, according to the applicable DQOs (Table 6) and SOPs (Appendix B).
6. Samples should be placed in an insulated cooler with enough dry or wet ice to completely fill the space and sealed with tape before shipping. Forms are either placed in an envelope and taped to the top of the cooler or placed in a Ziploc plastic bag and taped to the inside of the lid. It is assumed that samples in tape-sealed coolers are secure whether being transported by staff vehicle, by common carrier, or by commercial package deliver.

B.2.2.3 CEC-Specific Water Sample Collection and Handling Requirements

B.2.2.3.1 Surrogates and Targeted CEC Analytes Excluding PFOS and PFOA

Field staff wearing clean, disposable gloves will collect water samples in containers as specified in Table 10. Targeted Analytes with Sample Volume, Container Type and Preservation [UPDATE TABLE WITH PPE AND CONTAINER REQUIREMENTS PER METHODS AND SOPs]. Care must be taken to avoid contaminating the sample with debris. All samples must be stored on ice in a covered cooler during pick-up and delivery to the [laboratory name]. A thermometer must be included in the ice chest so appropriate temperature can be maintained and verified. Chain-of-custody forms for samples must be submitted to the laboratory. Sample volume, sample container, and preservation requirements for chemistry analyses are presented in Table 10. Targeted Analytes with Sample Volume, Container Type and Preservation [UPDATE TABLE WITH REQUIRED PARAMETERS PER METHODS AND SOPs]. Due to the potential for contamination from materials used during sampling, collection of additional or more frequent equipment blanks than the required amounts listed in Table 6 is recommended prior to and during sampling to ensure no residual compound remains on the sampling equipment [SPECIFY IF ADDITIONAL BLANKS ARE REQUIRED].

B.2.2.3.2 Targeted Analytes: PFOS and PFOA

Due to the widespread occurrence of PFOS and PFOA in everyday items, including industrial, commercial and consumer products, the probability of detecting false positives is high. As such, extensive care must be taken in the design and implementation of sampling for PFOS and PFOA. Sample guidance described below has been prepared by the State Water Board[14] for non-drinking water. This guidance is subject to change, so please refer to the most updated guidelines from the State Water Board for sampling[15].

All bottles used for PFOS and PFOA sampling should come from the laboratory that performs the Per- and Polyfluoroalkyl Substances (PFAS) analysis. For all environmental media, hands should be well washed before sampling. Clean powderless nitrile gloves must be put on before collecting samples, handling sample containers, and handling sampling equipment. The sample container must be kept sealed and only open during the sample collection. The sampling container cap or lid should never be placed on the ground, or on any other surface unless it is PFOS/PFOA-free.
The following additional considerations should be taken during sample collection to prevent
contamination:

- Regular/thick size markers (Sharpie® or otherwise) are to be avoided; as they may contain PFOS/PFOA.
- Do not use sticky notes (e.g. Post-it Notes®), plastic clipboards, or waterproof paper and notebooks in the sampling area. Rite in the Rain® notebooks are acceptable to use in the staging area provided gloves are changed after note taking.
- Fine and Ultra-Fine point Sharpie® markers are acceptable to label the empty sample bottle while in the staging area provided the lid is on the sample bottle and gloves are changed following sample bottle labeling.
- Ballpoint pens may be used when labeling sample containers. If ballpoint pens do not write on the sample container labels, preprinted labels from the laboratory may be used.

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[14]California State Water Quality Control Board, Division of Water Quality. (2019) “Per- and Polyfluoroalkyl Substances (PFAS) Sampling Guidelines” obtained from https://www.waterboards.ca.gov/pfas/docs/march_pfas_sampling_guidelines.pdf.

[15] Updated guidelines for sampling for PFOA and PFOS may be found on the State Water Board webpage at https://www.waterboards.ca.gov/pfas/.

- Use HDPE or polypropylene sample bottles with Teflon®-free caps, provided by the laboratory.
- Chemical or blue ice should not be used.
- Samples and ice should be double-bagged using LDPE bags (e.g. Ziploc®). Care should be taken to ensure that samples and ice are kept in the staging area, do not come into direct contact with the sample media, and gloves are changed after handling.
- Samples must be chilled during storage and shipment and must not exceed 50°F (10°C) during the first 48 hours after collection.

B.2.2.3.2.1 Personal Protective Equipment

Personal protective equipment (PPE) that is free of PFOS- and PFOA materials should be used avoid cross-contamination. PFOS and PFOA are used to coat various clothing and leather products to repel water, oil, and dirt. While preparing for sampling, attention should be paid on clothing that is advertised as having waterproof, water-repellant, or dirt and/or stain resistant characteristics. These types of clothing are most likely to have had PFOS and PFOA used in their manufacturing.

The safety of staff should not be compromised by fear of PFOS- and PFOA-containing materials without any scientific basis. Personal safety is paramount. Any deviation from this guidance, including those necessary to ensure the health and safety of field staff, should be recorded in field notes and discussed in reports.

Table 7. Allowable and Prohibited Materials for sampling PFOS and PFOA

Allowable materials	Staging area materials	Prohibited materials
• Well-laundered synthetic or 100% cotton clothing (with most recent launderings not using fabric softeners) • Powderless nitrile gloves • Waterproof clothing made of or with polyurethane, polyvinyl chloride (PVC), wax-coated fabrics, rubber, neoprene • Boots made of polyurethane and/or PVC	•If a specific type of boot is required (such as steeltoed), and PFOS- and PFOA-free boots cannot be purchased, PFOS- and PFOA- free over-boots may be worn.The over-boots must be put on, and hands washed after donning the over-boots before the beginning of sampling activities. Overboots may only be removed in the staging area and after the sampling activities are completed. • Application of approved sunscreens and insect repellants (see below).	• Water/stain/dirt-resistant treated clothes (including but not limited to Gore-Tex™, Scotchgard™, RUCO®, etc.) • New unwashed clothing • Clothes recently washed with fabric softeners • Clothes chemically treated for insect resistance and ultraviolet protection • Coated Tyvek® • Latex gloves

There are many often-used and industry standard PPE items that may be required to be used during sampling events that have not been completely evaluated, including hard hats, safety glasses, and Tyvek®. If use of these items is required, they should be screened by reviewing the safety data sheets (if available) and/or collecting an equipment blank prior to use.

B.2.2.3.2.2 Sun and Biological Protection

Because biological hazards (sunburn, mosquitos, ticks, etc.) may be encountered during sampling, the elimination of specific clothing materials or PPE (sunscreens and insect repellants) could pose a health and safety hazard to staff.

Prolonged sun exposure may require sunscreens and protection against insects may require the use of insect repellant, many of which may include PFOS and PFOA. The words “natural” and/or “organic” in a product name or used to describe it does not mean that it is PFOS- and PFOA-free. Below is a detailed list of sunscreens and insect repellants that have been analyzed and found to be PFOS- and PFOA-free. Note that this is not a comprehensive list of allowable insect repellants or sunscreens; other products may meet the requirements for use. Listing or omission of any product does not imply endorsement or disapproval Also, there is no guarantee that these products will always remain PFOS- and PFOA-free.

- Allowable Insect Repellants:
  - OFF Deep Woods
  - Sawyer Permethrin
  - Jason Natural Quit Bugging Me
  - Repel Lemon Eucalyptus Insect repellant
  - Herbal Armor or California Baby Natural Bug Spray
- Allowable Sunscreens:
  - Banana Boat Sport Performance Sunscreen Lotion Broad Spectrum SPF 30.
  - Meijer Sunscreen Lotion Broad Spectrum SPF 30.
  - Neutrogena Ultra-Sheer Dry-Touch Sunscreen Broad Spectrum SPF 30.
  - Banana Boat for Men Triple Defense Continuous Spray Sunscreen SPF 30
  - Banana Boat Sport Performance Coolzone Broad Spectrum SPF 30
  - Banana Boat Sport Performance Sunscreen Lotion Broad Spectrum SPF 30
  - Banana Boat Sport Performance Sunscreen Stick SPF 50

- Coppertone Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50
- Coppertone Sport High-Performance AccuSpray Sunscreen SPF 30
- Coppertone Sunscreen Stick Kids SPF 55
- L'Oréal Silky Sheer Face Lotion 50+
- Meijer Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50
- Meijer Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70
- Neutrogena Beach Defense Water + Sun Barrier Lotion SPF 70
- Neutrogena Beach Defense Water + Sun Barrier Spray Broad Spectrum SPF 30
- Neutrogena Pure & Free Baby Sunscreen Broad Spectrum SPF 60+

If none of the above sunscreens or insect repellents are available, equipment blank sample must be collected from the product according to B.3.5.2 below to verify that it is PFOS- and PFOA-free.

B.2.2.3.2.3 Food Packaging

PFOS and PFOA are known to be prevalent in food packaging, including paper plates, food containers, bags, and wraps. Food packaging must not be in the sampling and staging areas during sampling due to the potential for PFOS and PFOA cross-contamination. When staff requires a break to eat or drink, they should remove their gloves, coveralls, and any other appropriate PPE, if worn, in the staging area and move to the designated area for food and beverage consumption. When finished, staff should wash their hands and put on a fresh pair of powderless nitrile gloves at the staging area, before returning to the sampling area.

B.2.3 Field Quality Control Samples

Blank sample information, including how to collect and handle blanks and frequency of collection, for each method is specified below according to the requirements listed within validated methods. If blank sample information is not required for a validated method, or no validated method exists for an analyte, include draft blank sampling information for the approval of the State and Regional Water Boards with the approval of this QAPP.

B.2.3.1 Surrogates and Targeted Analytes Excluding PFOS and PFOA

[INSERT METHOD-SPECIFIC FIELD QUALITY CONTROL SAMPLES FOR SELECTED METHODS HERE]

B.2.3.2 TARGETED ANALYTES: PFOS AND PFOA

Sampling materials and field supplies like plastic bags and sample containers, as well as, waterproof pens and paper, personal protective Equipment, clothing, food packaging, and personal care products all have been known to contain PFOA or PFOS. Since PFOA and PFOS are used in many traditional sampling equipment, materials, or products, and can be sources of contamination, caution must be exercised for all steps of sampling. As such, collection of field quality control samples to evaluate if cross-contamination has occurred must be collected. Reference the State Water Board's "Per- and Polyfluoroalkyl Substances (PFAS) Sampling Guidelines for Non-Drinking Water" for more information.

[Specify type and frequency of field control samples that will be collected].

B.3 LABORATORY AND FIELD EQUIPMENT AND INSTRUMENTATION

TARGETED ANALYTES: PFOS AND PFOA

Sampling and laboratory equipment used for sampling PFOS and PFOA must be made from acceptable materials, which include high-density polyethylene (HDPE), polypropylene, silicone, stainless steel, nylon, polyvinyl chloride (PVC), acetate, and cottonSampling equipment that containe PFOA- or PFOS-based parts that would be in direct contact with the sample or sampling environment are prohibited. These include, but are not limited to:

- Polytetrafluoroethylene (PTFE), including the trademark Teflon® and Hostaflon®, which can be found in many items, including but not limited to ball check-valves on certain bailers, the lining of some hoses and tubing, some wiring, certain kinds of gears, lubricant, and some objects that require the sliding action of parts.
- Polyvinylidene fluoride (PVDF), including the trademark Kynar®, which can be found in many items, including but not limited to tubing, films/coatings on aluminum, galvanized or aluminized steel, wire insulators, and lithium-ion batteries.
- Polychlorotrifluoroethylene (PCTFE), including the trademark Neoflon®, which can be found in many items, including but not limited to valves, seals, gaskets, and food packaging.

- Ethylene-tetrafluoro-ethylene (ETFE), including the trademark Tefzel®, which can be found in many items, including but not limited to wire and cable insulation and covers, films for roofing and siding, liners in pipes, and some cable tie wraps.
- Fluorinated ethylene propylene (FEP), including the trademarks Teflon® FEP and Hostaflon® FEP, and may also include Neoflon®, which can be found in many items, including but not limited to wire and cable insulation and covers, pipe linings, and some labware.
- Low density polyethylene (LDPE) should not be used for any items that may come into direct contact with the sample media. LDPE can be found in many items, including but not limited to containers and bottles, plastic bags, and tubing.

Instruments that contains PFOS and PFOA materials such as Teflon coated parts can be used if the PFAS is internal to the instrument and does not contact the external environment. If in doubt about a product, collect and analyze an laboratory blank sample.

Sampling equipment used for grab sampling, including cable ties, extension rods, and couplings, should be made of materials that are known to be PFAS-free

Additional considerations should be taken when labelling samples and documenting field activities to prevent contamination including the following:

- Regular/thick size markers (Sharpie® or otherwise) should be avoided as they may contain PFAS.
- Fine and Ultra-Fine point Sharpie® markers are acceptable to label the empty sample bottle while in the staging area provided the lid is on the sample bottle and gloves are changed following sample bottle labeling.
- Ballpoint pens may be used when labeling sample containers. If ballpoint pens do not write on the sample container labels, preprinted labels from the laboratory may be used.
- Do not use sticky notes (e.g. Post-it Notes®), plastic clipboards, or waterproof paper and notebooks in the sampling area.
- Rite in the Rain® notebooks are acceptable to use in the staging area provided gloves are changed after note taking.

B.3.1 Field Equipment

[INSERT FIELD EQUIPMENT INFORMATION HERE BASED ON SELECTED METHODS; I.E. CORE TUBES, SCOOPS; REFERENCE STATE WATER BOARD

"PFAS SAMPLING GUIDELINES FOR NON-DRINKING WATER" FOR APPROPRIATE DETAILS]

B.3.2 Laboratory Equipment

[INSERT LABORATORY EQUIPMENT INFORMATION HERE BASED ON SELECTED METHODS; I.E. WATERBATHS, FRIDGES, INCUBATORS, BALANCES, ETC.; REFERENCE STATE WATER BOARD "PFAS SAMPLING GUIDELINES FOR NON-DRINKING WATER" FOR APPROPRIATE DETAILS]

B.3.3 Laboratory Instrumentation

Analytical instruments must be maintained in accordance with the lab's SOPs. This includes procedures specified by the manufacturer and procedures specified in the analytical methods used. Maintenance logs are kept and each instrument has its own log that documents the dates and description of any problems, the action(s) taken to correct problem(s), maintenance procedures, system checks, follow-up maintenance dates, and the person responsible for maintaining the instruments.

[INSERT EQUIPMENT-SPECIFIC INFORMATION: FIELD INSTRUMENTS, CALIBRATION FREQUENCIES, CHAIN-OF-CUSTODY FOR CALIBRATION LOCATION; REFERENCE STATE WATER BOARD "PFAS SAMPLING GUIDELINES FOR NON-DRINKING WATER" FOR APPROPRIATE DETAILS]

Table 8. Project Inspection/Acceptance Requirements for Supplies and Consumables

Project	Instrument Name/Model	Date Purchased	Inspection / Calibration Specifications	Acceptance Criteria	Frequency	Responsible Individual

B.3.4 Instrument/Equipment Testing, Calibration, and Maintenance Requirements, Supplies and Consumables

[Please include a narrative describing the process that the facilities and labs employ to test, calibrate and maintain equipment, supplies and consumables. In addition to the information inTable 8. Project Inspection/Acceptance Requirements for Supplies and ConsumablesTable 8, please describe how samples are handled after analysis.]

B.3.5 Cleaning/Decontamination

B.3.5.1 Targeted Analytes: PFOS and PFOA

Sampling equipment must be cleaned and decontaminated prior to use. Conventional procedures for cleaning and decontaminating sampling quipment can be used but must include a triple rinsing with PFAS-free water and adhere to the following decontamination guidance:

- Use of laboratory supplied PFAS-free deionized water is preferred for cleaning and decontamination.
- Commercially available deionized water may be used for cleaning and decontamination if the water is verified to be PFAS-free.
- Do not use Decon 90®.
- Alconox®, Liquinox®, and Citranox® can be used for equipment cleaning and decontamination.
- Sampling equipment can be scrubbed using a polyethylene or PVC brush to remove particulates.
- It should be noted that detergents used to decontaminate equipment may be a source of contamination for 1,4-Dioxane.

[INSERT CLEANING/DECONTAMINATION INFORMATION BASED ON LAB STANDARD OPERATING PROCEDURES, FIELD STANDARD OPERATING PROCEDURES AND SELECTED METHODS; REFERENCE STATE WATER BOARD "PFAS SAMPLING GUIDELINES FOR NON-DRINKING WATER" FOR APPROPRIATE DETAILS]

B.4 SAMPLE DOCUMENTATION

The analytical laboratory must maintain custody logs sufficient to track each sample submitted and to analyze or preserve each sample within specified holding times.

Analytical water quality samples must be labeled with the project name, primary and secondary site locations (latitude/longitude), date and time collected, analyses to be performed, and sample preservatives, if any. Secondary locations will be used in the event that the primary sampling locations are not accessible. Secondary sampling locations should be approved by the Regional Water Board in consultation with the State Water Board. Please include information that may make sampling untenable at the sites (such as weather, construction, etc.).

B.4.1 Sample Chain of Custody

Project chain of custody procedures require that possession of samples be traceable from the time they are collected until completion and submittal of analytical results. Therefore, a complete chain of custody form must accompany the transfer of samples to each analyzing laboratory and must be forwarded to Geotracker with the data reporting package (see sample in Appendix xx) A sample chain of custody form may be found in Appendix xx. The chain of custody form must be attached to the laboratory report.

All samples must be handled, prepared, transported, and stored in a manner so as to minimize bulk loss, analyte loss, contamination, or biological degradation, according to the applicable MQOs (Table 6) and the SOPs in Appendix xx. Sample container caps and lids must be checked for tightness and clearly labeled with an indelible marker. Samples are then placed in an insulated cooler with enough dry or wet ice to completely fill the space and sealed with tape before shipping. Forms are either placed in an envelope and taped to the top of the cooler or placed in a Ziploc plastic bag and taped to the inside of the lid. It is assumed that samples in tape-sealed coolers are secure whether being transported by staff vehicle, by common carrier, or by commercial package delivery. The receiving laboratory has a sample custodian who examines the samples for proper documentation, preservation, and holding times.

[Detail facility-specific QA if different from above.]

B.4.2 Sample Retention and Disposal

Proper disposal of all waste is an important component of laboratory activities. Upon completion of analyses, any remaining samples analyzed for water chemistry should be disposed of as per the laboratory-specific documentation. [Include link to laboratory specific documentation here]

B.5 ANALYTICAL METHOD REQUIREMENTS

B.5.1 Targeted CEC Analytes

Standardized, validated and approved analytical methods are available for all CECs included on the targeted chemistry monitoring list (Table 9) with the exception of Sucralose and Iohexol, which may be monitored using listed methods. Table 9 lists validated methods for the targeted analytical chemistry analysis of CECs currently required for monitoring along with reporting limits, notification levels (if applicable), monitoring trigger levels, relevance/indicator type, and sample type (grab, composite, etc.). It should be noted that Sucralose and Iohexol are not included in the analyte lists for the methods listed in Table 9 (EPA 1694 and Standard Method 6810). However, the Science Advisory Panel determined that EPA 1694 and Standard Method 6810 could be used for these analytes, and several laboratories have previously demonstrated that these CECs can be reliably detected using the standardized methods listed for those analytes.

B.5.2 CEC Surrogates

Surrogate parameters serve as the core means to demonstrate process reliability. Monitoring results for surrogates are used to evaluate the operational performance of a treatment process and the effectiveness of a treatment process in removing CECs. Surrogates considered for monitoring treatment efficacy of recycled water used for groundwater recharge and reservoir water augmentation are listed in Table 8. The Recycled Water Policy allows other surrogates not listed in Table 8 to be used[16]. [PROJECT SPONSOR NAME] must identify surrogates to monitor that are indicative of removal of CECs through individual unit processes or combinations of unit processes at the water recycling treatment plant. The Regional Water Board in consultation with the State Water Board will review and approve the selected surrogates for each water recycling treatment plant. The list of surrogates may be revised throughout the phased monitoring approach described in Section A.8.3 upon consultation with the Regional Water Board.

Where applicable, surrogates may be measured using on-line or hand-held instruments provided instrument calibration procedures are implemented in accordance with the manufacturer's specifications and that calibration is documented.

[16]For instance, facilities may monitor for total organic carbon to satisfy both the Recycled Water Policy and Title 22 monitoring requirements, granted they monitor at frequencies and locations and submit data in accordance with both policies.

B.5.2.1 Guidance for Use of Total Fluorescence as a Surrogate

Similar to UV absorbance, reductions in fluorescence may be indicative of improvements in water quality. Total fluorescence has been demonstrated to be a reliable, real-time online indicator of changes in water quality due to reverse osmosis (RO) membrane fouling and breaches in several municipal advanced water recycling plants in Australia (Singh 2015). Similar to dissolved organic carbon (DOC), total fluorescence characterizes dissolved organic matter, with the added benefit of being able to qualitatively differentiate between organic matter fractions based on EEM wavelength pairs, thus allowing recycled water plant operators to more effectively respond to changes in water quality (Singh 2015).

B.4.2.1.1 A Standardized Method for Monitoring and Reporting Total Fluorescence

ELAP does not offer accreditation for the measurement of Total Fluorescence in any matrix. Until a method has been approved by the US EPA, The Standard Methods Committee, the American Society for Testing and Materials International, or the regional water boards or State Water Board for Total Fluorescence in an applicable matrix, facilities wishing to measure Total Fluorescence should supply an SOP with this QAPP for verification and approval. To generate consistent data between indirect potable recycled water producers throughout California, the State Water Board advises the use of the in-house method, which was adapted from Gerrity et al. (2011), Park and Snyder (2018) and Chen et al. (2003).

[METHOD AVAILABLE UPON REQUEST TO STATE WATER BOARD QAO FOR RECYCLED WATER. BE SURE TO SPECIFY IF MODIFICATIONS ARE MADE TO THE METHOD IF USED. ADDITIONALLY, INSERT APPROPRIATE INFORMATION AS APPLICABLE, SUCH AS INSTRUMENT MAKE/MODEL, MONITORING LOCATIONS, ETC.]

B.5.3 Evaluation of Performance Indicator CEC and Surrogate Results

The effectiveness of a treatment process to remove CECs is evaluated by determining the removal percentages for performance indicator CECs and surrogates. The removal percentage is the difference in the concentration of a compound in recycled water prior to and after a treatment process (e.g., soil aquifer treatment or RO followed by advanced oxidation processes (AOPs)), divided by the concentration prior to the treatment process and multiplied by 100 (

Equation 3).

Equation 3

$$Removal\ Percentage = \frac{(X_{in} - X_{out})}{X_{in}}\ x\ 100$$

Where,
X_{in} - Concentration in recycled water prior to a treatment process

X_{out} - Concentration in recycled water after a treatment process

During the initial assessment, [PROJECT SPONSOR NAME] must monitor performance to determine removal percentages for performance indicator CECs and surrogates. The removal percentages must be confirmed during the baseline monitoring phase. The established removal percentages for each project will be used to evaluate treatment effectiveness and operational performance. Expected removal percentages for performance indicator CECs and surrogates are listed in Table 9.

B.5.4 Analytical Methods

[NOTE TO AUTHOR: This QAPP template includes a number of standardized methods that were available at the time of writing. Several methods for the detection of CECs listed in Table 9 *are available for ELAP accreditation at the time of writing and are annotated as such in their corresponding footnotes. Note that in some cases, a method may be accredited by ELAP, however the specific analyte/applicable matrix is not offered for accreditation. Additionally, some methods in Table 8 are marked as preferred (see asterisk*), meaning that they either are already accredited by ELAP, are robust methods in which multiple laboratores have demonstrated that they can meet the required reporting limits, or have been recommended for use by the Science Advisory Panel. Note that laboratories are not obligated to use methods marked as "preferred," and that they should be viewed as suggestions only. ONLY LIST METHOD INTENDED TO USE FOR ANALYTE]*

[Table 8 should be updated to reflect chosen methods with sample type (grab or 24-hour composite) and appropriate project type (i.e. groundwater recharge surface/subsurface or reservoir water augmentation)]

Table 9. Health-based CECs, Performance Indicator CECs and Surrogates Analytical Methods							
Analyte/Surrogate	Standardized Methods (applicable matrices in parentheses[17]; *preferred method)	Reporting Limit[18] (µg/L)	MTL (µg/L)	NL (µg/L)[19]	Removal Percentage (%)	Indicator Type	Sample Type
Groundwater Recharge - Surface Application							
1,4-Dioxane	*EPA SW-846 Method 8270E (WW, GW) *EPA 522[20] (DW), EPA SW-846 Method 8260D[21] (WW, GW)	0.1	1	1	Not applicable (NA)	Health	[Grab or 24 hr composite] choose

[17] WW= wastewater, DW= drinking water, GW=groundwater.
[18] The Regional Water Board may approve higher reporting limits (RL) if it determines these RLs cannot be practicably met in recycled water sample matrices using existing methods, as long as the MTL/RL (see Table 13) is no less than 2.
[19] If a CEC is also listed as a priority toxic pollutant in Title 22, a Notification Level (NL) is listed here, thus monitoring frequency, reporting limits, methods, removal, sampling type and action levels should follow requirements in Title 22. If a notification level is not listed in Title 22 regulations, "NA" (not applicable) is listed and monitoring requirements for this constituent should be followed in compliance with the Recycled Water Policy. Notification levels in this QAPP were updated as of June 20, 2019, and are subject to change. Refer to the most updated list of priority toxic pollutants to ensure compliance with Title 22.
[20] Munch and Grimmett 2008. Currently ELAP accredited for drinking water as of 07/12/2019.
[21] USEPA 2006.

Table 9. Health-based CECs, Performance Indicator CECs and Surrogates Analytical Methods							
Analyte/Surrogate	Standardized Methods (applicable matrices in parentheses[17]; *preferred method)	Reporting Limit[18] (µg/L)	MTL (µg/L)	NL (µg/L)[19]	Removal Percentage (%)	Indicator Type	Sample Type
N-Nitrosodimethylamine (NDMA)	*EPA 1625B[22] (WW, GW, DW), EPA 521[23] (DW), EPA 8270E (DW, GW, WW), EPA 607 (DW, GW, WW)[24], EPA 625.1 (DW, GW, WW)[25]	0.002	0.01	0.01	NA	Health	[Grab or 24 hr composite] choose
N-Nitrosomorpholine (NMOR)	*EPA 1625C[26] (DW, GW, WW), EPA 8270E (DW, GW, WW), EPA 625.1 (DW, GW, WW)	0.002	0.012	NA	NA	Health	[Grab or 24 hr composite] choose
Perfluorooctane sulfonate (PFOS)	*EPA Method 537.1[27] (DW), *LC-MS/MS with accreditation from	0.0065	0.013	0.0065	NA	Health	[Grab or 24 hr compos

[22] USEPA 1984. Currently accredited by ELAP for non-drinking water matrices as of 07/12/2019.
[23] Munch and Bassett 2004.
[24] Currently accredited by ELAP for non-drinking water matrices as of 07/12/2019.
[25] Currently accredited by ELAP for non-drinking water matrices as of 07/12/2019.
[26] USEPA 1984. Currently accredited by ELAP for drinking water matrices as of 07/12/2019.
[27] Shoemaker et al. 2018. Currently accredited by ELAP for drinking water matrices as of 07/12/2019.

Table 9. Health-based CECs, Performance Indicator CECs and Surrogates Analytical Methods							
Analyte/Surrogate	Standardized Methods (applicable matrices in parentheses[17]; *preferred method)	Reporting Limit[18] (µg/L)	MTL (µg/L)	NL (µg/L)[19]	Removal Percentage (%)	Indicator Type	Sample Type
	DoD QSM 5.1 (Table B-15)[28] (GW, WW), EPA Method 537 Rev 1.1[29] (DW)						ite] choose
Perfluorooctanoic acid (PFOA)	*EPA Method 537.1[27] (DW), *LC-MS/MS with accreditation from DoD QSM 5.1 (Table B-15)[28] (GW, WW), EPA Method 537 Rev 1.1[29] (DW)	0.007	0.014	0.0051	NA	Health	[Grab or 24 hr compos ite] choose
Gemfibrozil	*EPA 1694 (DW, GW, WW), *Standard Method 6810 (DW, GW, WW), EPA Method 542 (DW)	0.01	-	NA	>90	Perform ance	[Grab or 24 hr compos ite] choose
Iohexol	*EPA 1694[30] (DW, GW, WW),	0.05	-	NA	>90	Perform ance	[Grab or 24 hr

[28] Currently accredited by ELAP for non-drinking water matrices.
[29] Shoemaker et al. 2009. Currently accredited by ELAP for drinking water matrices as of 07/12/2019.
[30] Method does not include analyte in list, however laboratories have demonstrated reliability of method for detection of CEC.

Table 9. Health-based CECs, Performance Indicator CECs and Surrogates Analytical Methods							
Analyte/Surrogate	Standardized Methods (applicable matrices in parentheses[17]; *preferred method)	Reporting Limit[18] (µg/L)	MTL (µg/L)	NL (µg/L)[19]	Removal Percentage (%)	Indicator Type	Sample Type
	*Standard Method 6810[31] (DW, GW, WW)						composite] choose
Sucralose	*EPA 1694[30] (DW, GW, WW), *Standard Method 6810[31] (DW, GW, WW)	0.1	-	NA	<25	Performance	[Grab or 24 hr composite] choose
Sulfamethoxazole	*EPA 1694 (DW, GW, WW), *Standard Method 6810 (DW, GW, WW)	0.01	-	NA	>30	Performance	[Grab or 24 hr composite] choose
Ammonia	*SM4500NH3[(C,D,E,G,H)]	0.1 mg/L	-	NA	>90	Surrogate	[Grab or 24 hr compos

[31] Method does not include analyte in list; however, method allows for additional analytes and provides quality control guidelines for such additions as specified within Section 6020 of the 23rd Edition of the Standard Methods for the Examination of Water and Wastewater.

Table 9. Health-based CECs, Performance Indicator CECs and Surrogates Analytical Methods							
Analyte/Surrogate	Standardized Methods (applicable matrices in parentheses[17]; *preferred method)	Reporting Limit[18] (µg/L)	MTL (µg/L)	NL (µg/L)[19]	Removal Percentage (%)	Indicator Type	Sample Type
							ite] choose
Dissolved Organic Carbon (DOC)[32]	*EPA Methods for Analysis of Water and Wastes #415.1 and 415.3		-	NA	>30	Surrogate	[Grab or 24 hr composite] choose
Nitrate	*USEPA Method 353.2, *Standard Methods 22nd Ed. #4500NO_3-F	0.0086 mg/L	-	10,000.[33]	>30	Surrogate	[Grab or 24 hr composite] choose
Total fluorescence	Work with Water Boards	NA	NA	NA	>30	Surrogate	[Grab or 24 hr

[32] Total organic carbon (TOC) is listed as a monitoring requirement in Title 22. DOC can not be used to satisfy Title 22 requirements. While DOC was suggested as a possible surrogate by the Science Advisory Panel, facilities may request to use other surrogates such as TOC.
[33] Nitrate has a maximum contaminant level of 10,000 µg/L and must be monitored quarterly pursuant to section 60320.126 of Title 22.

Table 9. Health-based CECs, Performance Indicator CECs and Surrogates Analytical Methods							
Analyte/Surrogate	Standardized Methods (applicable matrices in parentheses[17]; *preferred method)	Reporting Limit[18] (µg/L)	MTL (µg/L)	NL (µg/L)[19]	Removal Percentage (%)	Indicator Type	Sample Type
							composite] choose
UV Light Absorbance (253.7nm)	*Standard Methods for the Examination of Water and Wastewater*, 22nd Ed., Method 5910	0.009 cm^{-1}	-	NA	>30	Surrogate	[Grab or 24 hr composite] choose
Reservoir Water Augmentation and Groundwater Recharge- Subsurface Application							
1,4-Dioxane	*EPA SW-846 Method 8270E (WW, GW), *EPA 522[34] (DW), EPA SW-846 Method 8260D[35] (WW, GW)	0.1	1	1	NA	Health	[Grab or 24 hr composite] choose

[34] Munch and Grimmett 2008. Currently ELAP accredited for drinking water as of 07/12/2019..
[35] USEPA 2006.

Table 9. Health-based CECs, Performance Indicator CECs and Surrogates Analytical Methods							
Analyte/Surrogate	Standardized Methods (applicable matrices in parentheses[17]; *preferred method)	Reporting Limit[18] (µg/L)	MTL (µg/L)	NL (µg/L)[19]	Removal Percentage (%)	Indicator Type	Sample Type
NDMA	*EPA 1625B[36] (WW, GW, DW), EPA 521[37] (DW), EPA 8270E (DW, GW, WW), EPA 607 (DW, GW, WW)[38], EPA 625.1 (DW, GW, WW)[39]	0.002	0.01	0.01	25-50, >80[40]	Health & performance	[Grab or 24 hr composite] choose
NMOR	*EPA 1625C[41] (DW, GW, WW), EPA 8270E (DW, GW, WW), EPA 625.1 (DW, GW, WW)	0.002	0.012	NA	NA	Health	[Grab or 24 hr composite] choose
PFOS	*EPA Method 537.1[42] (DW), *LC-MS/MS with accreditation from	0.0065	0.013	0.013	NA	Health	[Grab or 24 hr

[36] USEPA 1984. Currently accredited by ELAP for non-drinking water matrices as of 07/12/2019.
[37] Munch and Bassett 2004.
[38] Currently accredited by ELAP for non-drinking water matrices as of 07/12/2019.
[39] Currently accredited by ELAP for non-drinking water matrices as of 07/12/2019.
[40] For treatment using RO, removal percentage is between 25 and 50 percent. For treatment using RO/AOP, removal percentage is greater than 80 percent.
[41] USEPA 1984. Currently accredited by ELAP for drinking water matrices as of 07/12/2019.
[42] Shoemaker et al. 2018. Currently accredited by ELAP for drinking water matrices as of 07/12/2019.

Table 9. Health-based CECs, Performance Indicator CECs and Surrogates Analytical Methods							
Analyte/Surrogate	Standardized Methods (applicable matrices in parentheses[17]; *preferred method)	Reporting Limit[18] (µg/L)	MTL (µg/L)	NL (µg/L)[19]	Removal Percentage (%)	Indicator Type	Sample Type
	DoD QSM 5.1 (Table B-15)[28] (GW, WW), EPA Method 537 Rev 1.1[43] (DW)						composite] choose
PFOA	*EPA Method 537.1[27] (DW), *LC-MS/MS with accreditation from DoD QSM 5.1 (Table B-15)[28] (GW, WW), EPA Method 537 Rev 1.1[29] (DW)	0.007	0.014		NA	Health	[Grab or 24 hr composite] choose
Sucralose	*EPA 1694[30] (DW, GW, WW), *Standard Method 6810[31] (DW, GW, WW)	0.1	-	NA	>90	Performance	[Grab or 24 hr composite] choose
Sulfamethoxazole	*EPA 1694 (DW, GW, WW), *Standard Method 6810 (DW, GW, WW)	0.01	-	NA	>90	Performance	[Grab or 24 hr compos

[43] Shoemaker et al. 2009. Currently accredited by ELAP for drinking water matrices as of 07/12/2019.

Table 9. Health-based CECs, Performance Indicator CECs and Surrogates Analytical Methods							
Analyte/Surrogate	Standardized Methods (applicable matrices in parentheses[17]; *preferred method)	Reporting Limit[18] (µg/L)	MTL (µg/L)	NL (µg/L)[19]	Removal Percentage (%)	Indicator Type	Sample Type
							ite] choose
Electrical Conductivity	*Standard Methods* 22nd Ed. #2510 B EPA *Methods for Analysis of Water and Waste, #120.1*	-	-	NA	>90	Surrogate	[Grab or 24 hr composite] choose
Dissolved Organic Carbon (DOC)[32]	*Standard Methods*, 20th, 21st, and 22nd Eds. #5310C	-	-	NA	>90	Surrogate	[Grab or 24 hr composite] choose
UV Light Absorbance (253.7nm)	*Standard Methods for the Examination of Water and Wastewater*, 22nd Ed., Method 5910	-	-	NA	>50	Surrogate	[Grab or 24 hr composite] choose

Table 10. Targeted Analytes with Sample Volume, Container Type and Preservation				
Analyte/Analysis	Methods	Volume/Container	Preservation	Holding Time
Targeted Chemistry Analysis				
1,4-Dioxane	EPA 522[44], EPA SW-846 Method 8260D[45], EPA SW-846 Method 8270E	500 mL, glass bottle fitted with polytetrafluoroethylene lined screw caps	pH<4 (sodium bisulfate) sodium sulfate (50 mg/L), -5°C, protect from light	28 days
NDMA	EPA 521[46], EPA 1625[47], EPA SW-846 Method 8070[48]	1-L amber glass bottle	4˚C	7 days to extraction; 40 days to extract analysis
NMOR	Standard Method 6450B, Standard Method 6450C	1-L amber glass bottle	4˚C, 1g/L ascorbic acid	7 days to extraction; 40 days to extract analysis

[44] Munch and Grimmett 2008.
[45] USEPA 2006. bluet
[46] Munch and Bassett 2004.
[47] USEPA 1984.
[48] USEPA 2014b.

Table 10. Targeted Analytes with Sample Volume, Container Type and Preservation				
Analyte/Analysis	Methods	Volume/Container	Preservation	Holding Time
PFOS	EPA Method 537 Rev 1.1[49], EPA Method 537.1[50], LC-MS/MS with accreditation from DoD QSM 5.1 (Table B-15) [28]	250 mL polypropylene botte fitted with polypropylene screw caps (bottle must be discarded after use)	Aqueous samples: ≤6 °C until extraction, but should not be frozen Extract: room temperature	14 days to extraction, analyzed 28 days following extraction
PFOA	EPA Method 537 Rev 1.1, EPA Method 537.1, LC-MS/MS with accreditation from DoD QSM 5.1 (Table B-15) [28]	250 mL polypropylene botte fitted with polypropylene screw caps (bottle must be discarded after use)	Aqueous samples: ≤6 °C until extraction, but should not be frozen Extract: room temperature	14 days to extraction, analyzed 28 days following extraction
Gemfibrozil	EPA Method 542, EPA 1694	1-L amber glass bottle (x2- one for acid and base fractions, each)	Aqueous: 80 mg/L sodium thiosulfate (chlorinated water), <6 ˚C protect from light	Extract samples within 7 days of collection (48 hours

[49] Shoemaker et al. 2009.
[50] Shoemaker et al. 2018.

Table 10. Targeted Analytes with Sample Volume, Container Type and Preservation				
Analyte/Analysis	Methods	Volume/Container	Preservation	Holding Time
			Extract: <-10 ˚C, protection from light	suggested). Store samples <40 days
Iohexol	EPA 1694[51]	1-L amber glass bottle (x2- one for acid and base fractions, each)	Aqueous: 80 mg/L sodium thiosulfate (chlorinated water), <6 ˚C protect from light Extract: <-10 ˚C, protection form light	Extract samples within 7 days of collection (48 hours suggested). Store samples <40 days
Sucralose	EPA 1694[30]	1-L amber glass bottle (x2- one for acid and base fractions, each)	Aqueous: 80 mg/L sodium thiosulfate (chlorinated water), <6 ˚C protect from light Extract: <-10 ˚C, protection form light	Extract samples within 7 days of collection (48 hours suggested). Store samples <40 days
Sulfamethoxazole	EPA Method 542, EPA 1694	1-L amber glass bottle (x2- one for acid and base fractions, each)	Aqueous: 80 mg/L sodium thiosulfate (chlorinated water), <6 ˚C protect from light	Extract samples within 7 days of collection (48 hours

[51] Method does not include analyte in list, however laboratories have demonstrated reliability of method for detection of CEC according to the Science Advisory Panel Final Report (Drewes et al. 2018).

Table 10. Targeted Analytes with Sample Volume, Container Type and Preservation				
Analyte/Analysis	Methods	Volume/Container	Preservation	Holding Time
			Extract: <-10 ˚C, protection form light	suggested). Store samples <40 days
Surrogates Analysis				
Ammonia	USEPA Method 415.3 Standard Methods 20th – 22nd Eds. #4500NH3-H EPA Methods for Analysis of Water and Waste, #350.1	500 mL polyethylene bottle	≤6˚C, pH<2 (H_2SO_4), 4˚C	28 Days
DOC	Standard Methods, 20th, 21st, and 22nd Eds. #5310C EPA Methods for Analysis of Water and Wastes #415.1 and 415.3	250 mL amber glass bottle or 250 mL bottles specially cleaned for trace organics[52]	pH<2 (H_3PO_4), 4˚C Filter prior to storing using 0.45 µm Nylon, 50 mm diameter, 150 mL capacity	28 days (best if analyzed within 3 days)
Nitrate	USEPA Method 353.2, Standard Methods 22nd Ed. #4500NO_3-F	500 mL glass bottle	DW (non-chlorinated), wastewater: pH<2 (H_2SO_4), 4˚C DW (chlorinated): 4˚C	non-chlorinated DW: 14 days chlorinated DW, wastewater: 28 days

[52] See Standard Methods #5310B 1.d for details

Table 10. Targeted Analytes with Sample Volume, Container Type and Preservation				
Analyte/Analysis	Methods	Volume/Container	Preservation	Holding Time
Total fluorescence	Work with Water Boards	Amber glass bottle	Sodium bisulfite (1:1 stoichiometric with O_3 and HOCl)	28 days
UV Light Absorbance (253.7nm)	*Standard Methods for the Examination of Water and Wastewater*, 22nd Ed., Method 5910	Amber glass bottle (washed, thoroughly rinsed with organic-free water, baked at 400°C ≥1hr	4 °C, seal with TFE-lined cap	48 hours (best if analyzed immediately)
Electrical Conductivity	Standard Methods 22nd Ed. #2510 B EPA *Methods for Analysis of Water and Waste, #120.1*	glass-stoppered borosilicate glass bottle	4˚C	28 days (filtered through 0.45µmfilter)

B.5.5 Bioanalytical Screening Tools

Monitoring with bioanalytical screening tools is intended to capture a wider array of CECs than is possible with targeted analytical chemistry monitoring. The two bioassays required in this project, ER-α and AhR, have been determined to be at a stage of development that can provide robust and reliable results for recycled water and the adverse outcome pathways have been identified and linked to acitivation of their respective receptors.

The 2018 Science Advisory Panel Report recommended that a bioanalytical implementation adviosry group (BIAG) be convened to guide the implementation of the bioanalytical screening tools. The BIAG developed a report "Bioanalytical Tools for Detection and Quantification of Estrogenic and Dioxin-Like Chemicals in Water Recycling and Reuse – Guidance Document for Developing a Standard Operating Procedure". *[NOTE: This guidance document will be used by the State Water Board to validate laboratories and approve the submitted SOPs for use in this project. Complete Tables 11 and 12 with information from submitted SOP.]*

Table 11. Bioassay Methods				
Bioassay	SOP and Validated Laboratory	Reporting Limit[53] (ng/L)	MTL (ng/L)	Sample Type
Estrogen receptor-α		0.5	3.5	[Grab or 24 hr composite] choose
Aryl hydrocarbon receptor		0.5	0.5	[Grab or 24 hr composite] choose

Table 12. Bioassays with Sample Volume, Container Type and Preservation				
Bioassay	SOP and Validated Laboratory	Volume/Container	Preservation	Holding Time
Estrogen receptor-α				
Aryl hydrocarbon receptor				

[53] The Regional Water Board may approve higher reporting limits (RL) if it determines these RLs cannot be practicably met in recycled water sample matrices using existing methods, as long as the MTL/RL (see Table 13) is no less than 2.

C. Data Validation and Management

C.1 REPORTS TO MANAGEMENT AND RESPONSE ACTIONS

C.1.1 Health and Performance Based CECs

To determine the appropriate response actions for results obtained for health and performance-based CECs that do not already have notification levels or maximum contaminant levels, the Laboratory QAO will calculate a ratio of the measured concentration (MECs) of the analyte relative to its respective monitoring trigger levels[54] (MTLs) as listed in Table 13. [PROJECT SPONSOR NAME] will compare the calculated MEC/MTL ratios to the thresholds specified in Table 13 and implement the response actions corresponding to the threshold. For CECs that are required for monitoring as priority pollutants in accordance with Title 22[5], refer to the according reponse actions specified in Title 22.

[KEEP THE FOLLOWING TEXT THAT IS APPLICABLE TO YOUR FACILITY: For groundwater recharge via surface application, [PROJECT SPONSOR NAME] will evaluate the health-based CEC results for samples collected from the groundwater monitoring wells. For groundwater recharge via subsurface application and reservoir water augmentation projects, [PROJECT SPONSOR NAME] will evaluate the health-based CEC results for the recycled water following treatment prior to release into the aquifer or surface water reservoir.]

Performance indicator CECs and surrogate data must be prepared in a report detailing the expected (rather than example) removal percentages for [PROJECT SPONSOR NAME] and submit to the Regional Water Board with the initial assessment monitoring data.

[54] Recommended MTLs were established in the Science Advisory Panel Final Report (Drewes et al. 2018).

Table 13. MEC/MTL Thresholds and Response Actions for Health-based CECs

MEC/MTL Threshold	Response Action[55]
If greater than 75 percent of the MEC/MTL ratio results for a CEC are less than or equal to 0.1 during the baseline monitoring phase and/or subsequent monitoring	After completion of the baseline monitoring phase, consider requesting removal of the CEC from the monitoring program.
If MEC/MTL ratio is greater than 0.1 and less than or equal to 1	Continue to monitor.
If MEC/MTL ratio is greater than 1 and less than or equal to 10	Check the data. Continue to monitor.
If MEC/MTL ratio is greater than 10 and less than or equal to 100	Check the data, resample within 72 hours of notification of the result and analyze to confirm CEC result. Continue to monitor. Additional investigation to be determined with Regional Water Board.
If MEC/MTL ratio is greater than 100	Check the data, resample within 72 hours of notification of the result and analyze to confirm CEC result. Continue to monitor. Contact the Regional Water Board and the State Water Board to discuss additional actions. (Additional actions may include, but are not limited to, additional monitoring, toxicological studies, engineering removal studies, modification of facility operation, implementation of a source identification program, and monitoring at additional locations.)

C.1.2 Bioanalytical Screening Tools

[55] If a CEC also has a notification level or maximum contaminant level, additional follow-up monitoring and actions may be required by the State Water Board or Regional Water Board per requirements in California Code of Regulations, Title 22 sections 60320.120, 60320.220, and 60320.320.

Similarly, to determine the appropriate response actions for results obtained for bioanalytical screening tools, the Laboratory QAO will calculate a ratio of the bioanalytical equivalent concentrations (BEQs) of the bioassay relative to its respective MTLs as listed in Table 14. [PROJECT SPONSOR NAME] will compare the calculated BEQ/MTL ratios to the thresholds specified in Table 14 and implement the response actions corresponding to the threshold.

Table 14: BEQ/MTL Thresholds and Response Actions for Bioanalytical Screening Tools

BEQ/MTL Threshold	Response Action
If BEQ/MTL ratio is consistently less than or equal to 0.15 for ER-α or 1.0 for AhR	A) After completion of the baseline monitoring phase, consider decreasing monitoring frequency or requesting removal of the endpoint from the monitoring program.
If BEQ/MTL ratio is greater than 0.15 and less than or equal to 10 for ER-α or greater than 1.0 and less than or equal to 10 for AhR	B) Continue to monitor.
If BEQ/MTL ratio is greater than 10 and less than or equal to 1000	C) Check the data, resample within 72 hours of notification of the result and analyze to confirm bioassay result. Continue to monitor. Contact the Regional Water Board and State the Water Board to discuss additional actions, which may include, but are not limited to, targeted analytical chemistry monitoring, increased frequency of bioassay monitoring, and implementation of a source identification program.
If BEQ/MTL ratio is greater than 1000	D) Check the data, resample within 72 hours of notification of the result and analyze to confirm bioassay result. Continue to monitor. Contact the Regional Water Board and the State Water Board to discuss additional actions, which may include, but are not limited to, targeted and/or non-targeted analytical chemistry monitoring, increased frequency of bioassay monitoring, toxicological studies, engineering removal studies, modification of facility operation, implementation of a source identification program, and monitoring at additional locations.

C.2 DATA REVIEW, VERIFICATION, AND VALIDATION

C.2.1 LABORATORY REPORTS

Monitoring reports should include the following:

I. Sample collection records, including location of each sampling station where representative samples are obtained.
II. Date, exact place and time of laboratory analyses
III. Analytical test methods used and the corresponding minimum detection, quantification and reporting levels for each analyte endpoint.
IV. Chain of custody;
V. Name(s) of the laboratory, which conducted the analyses.
VI. Analytical results.
VII. Certification numbers of applicable laboratory certifications by the Environmental Laboratory Accreditation Program (ELAP) (if available),
VIII. Summary of quality control results,
IX. Results of the removal percentage calculations for performance indicator CECs and surrogates.
X. Summary of compliance exceedances during the monitoring period.
XI. Results of the MEC/MTL ratio calculations and any actions taken.
XII. Results of the BEQ/MTL ratio calculations and any actions taken.

For the purpose of reporting compliance with numerical limitations, analytical data must be reported using the following reporting protocols:

- Sample results greater than or equal to the reporting limit should be reported "as measured" by the laboratory (i.e., the measured chemical concentration in the sample).
- Sample results less than the reporting limit, but greater than or equal to the laboratory's minimum detection limit, must be reported as "Detected, Not Quantified" (DNQ). The laboratory will write the estimated chemical concentration of the sample next to "DNQ."
- Sample results less than the laboratory's minimum detection limit will be reported as "Not Detected," or ND.

C.2.1.1 CECS REQUIRED FOR MONITORING BY TITLE 22

For CECs that are required for monitoring in Title 22, [PROJECT SPONSOR NAME] may use data to satisfy Title 22 requirements, granted they submit data pursuant to existing reporting requirements and frequencies, including electronic reporting requirements, associated with Title 22. To satisfy requirements specified in the Recycled Water Policy, recycled water producers must follow the reporting

requirements specified in the Recycled Water Policy and described in D.1.2. In order to satisfy both Title 22 and Recycled Water Policy requirements, [PROJECT SPONSOR NAME] must submit data both to the Safe Drinking Water Information System (SDWIS) database and Geotracker database.

C.3 VERIFICATION AND VALIDATION METHODS

Discrepancies in flagged data, noted during the data verification process, must be communicated to the Project QAO, Laboratory QAO, and Project Manager prior to loading. Excessive amounts of data discrepancies may warrant corrective action.

C.3.1 DATA VALIDATION

[BRIEFLY PROVIDE AN OVERVIEW OF THE METHODS FOR HOW DATA WILL BE VALIDATED, INCLUDING ANY VALIDATION SOFTWARE USED, PROCESSES FOR HOW ERRORS WILL BE HANDLED AND APPROPRIATE PERSONNEL AS WELL AS DATA TRANSFORMATIONS USED (I.E. LOG VALUES, REDUCED VALUES FROM PEAK AREAS, ETC.]

[FOR A MORE DETAILED DESCRIPTION OF THE DATA VERIFICATION AND VALIDATION PROCESS, REFER TO GUIDANCE ON ENVIRONMENTAL DATA VERIFICATION AND DATA VALIDATION (EPA QA/G-8)).]

C.3.1.1 DATA VALIDATION SOFTWARE

The analytical laboratory is responsible for maintaining a data validation system (either digital or otherwise) that tracks each sample and records associated QA/QC information and sample holding and collection information, including chemicals used to preserve each sample, temperature of samples when received, extraction and analysis during specified holding times, etc. [IF DATA VALIDATION SOFTWARE IS USED (SUCH AS LIMS), PLEASE DESCRIBE THIS PROCESS, INCLUDING REFERENCES OR LINKS TO APPLICABLE SOPS, SOFTWARE MANUALS, ETC.]

C.3.1.2 DATA TRANSFORMATION

[DESCRIBE, IN AS MUCH DETAIL AS NECESSARY, HOW DATA WILL BE TRANSFORMED PRIOR TO REPORTING THE FINAL VALUE IN GEOTRACKER OR SDWIS. FOR INSTANCE, RECOVERY MAY BE DETERMINED USING ISOTOPICALLY LABELED STANDARDS, OR VALUES MAY BE DETERMINED FROM PEAK AREA THEN INTERPOLATED FROM A STANDARD CURVE. SPECIFIC PROTOCOL SHOULD BE SPECIFIED FOR HOW/WHEN TO WEIGHT STANDARD

CURVES OR USE NON-LINEAR STANDARD CURVES, HOW TO ANALYZE OUTLIERS, LOG-TRANSFORM DATA, ETC.]

C.3.1.3 PERSONNEL

[DESCRIBE WHICH PERSONNEL WILL BE RESPONSIBLE FOR DATA VERIFICATION AND VALIDATION PRIOR TO DATA SUBMISSION. A FLOWCHART MAY BE USEFUL.]

C.4 Reconciliation with User Requirements

In addition to submitting monitoring data to the Water Boards to be used for compliance with the Recycled Water Policy, CEC data collected as specified in this QAPP may be used to make informed decisions regarding treatment processes that may prove useful to the Project Manager, Regional Water Board, State Water Board, other water treatment facilities, greater scientific community, and more. Data may be displayed and communicated to these parties in a substantially different manner than how it would be prepared for submission to a regulatory database. For instance, data may be displayed in charts or tables, with statistical analyses of trends, relationships, and anomalies. Error may be displayed using standard deviation or confidence intervals. Such formal scientific preparation of data may be particularly useful when justifying the use of a new surrogate (or removal of a surrogate) for approval from the Regional Water Board, or at the end of a monitoring phase to justify the reduced monitoring frequency for a particular analyte. [If desired, describe in detail how data should be represented to evaluate the validated data and answer specific questions, for instance, how a surrogate may be evaluated for suitability for evaluating a specific treatment process, or how analyte monitoring frequency should be reduced based on findings from a previous phase].

C.5 DATA MANAGEMENT REQUIREMENTS

C.5.1 FACILITIES' DATA MANAGEMENT PROCESSES

Copies of Chain of Custody forms must be kept by each receiving laboratory. An electronic copy of the Chain of Custody must be provided to the Regional Water Board Project Manager and State Water Board QAO upon request. Original copies of field sheets, lab logs, and data generated must be stored on a local server for 3 years. Lab data will be entered into the applicable Geotracker template by laboratory staff and submitted to Geotracker.

All raw and statistically analyzed data are subject to a 100% check for accuracy by Laboratory QAO, the Regional Water Board Project Manager and the State Water Board QAO. Data are reviewed for accuracy and checked against the QAPP and applicable MQOs before being uploaded into the Geotracker database at http://geotracker.waterboards.ca.gov/. Data must be submitted to the GeoTracker database under a site-specific global identification number through a reporting module.

Hardware and software must be updated as recommended by the manufacturer or as needed. Testing of each component is not required on a regular basis, aside from day to day functionality. Each entity is responsible for the necessary updates or upgrades, whether provided regularly through an Information Technology department or otherwise.

C.5.2 Electronic Data Deliverables

The final report must be formatted as a PDF file and be uploaded electronically to the State Water Board's Geotracker site. If the file exceeds 10 megabytes, then the report can be uploaded in multiple parts. [PROJECT SPONSOR NAME] must submit the sample results and associated quality control data specified in this QAPP, including percent recoveries and acceptable recovery ranges for each analyte, with each data set on a quarterly, semi-annual or annual basis according to phase as described in Table 4. Guidelines for submission of electronic data in Geotracker are available on https://www.waterboards.ca.gov/ust/electronic_submittal/docs/edf_gr_v1_2i.pdf. Upon request by Water Board staff data may be provided in tabular (i.e. Excel) format.

Error! Not a valid bookmark self-reference. contains valid value codes for Recycled Water Policy analytes. Note that surrogates must be reported to Geotracker for each monitoring location in actual values (i.e. total Nitrate or UV absorbance, etc.).

Table 15. Electronic Data Format Valid Value Codes for Geotracker

Parameter	Field Name	Valid Value
1,4-Dioxane	PARLABEL	DIOXANE14
N-Nitrosodimethylamine (NDMA)	PARLABEL	NNSM
N-Nitrosomorpholine (NMOR)	PARLABEL	NNSMRPH
Perfluorooctane sulfonate (PFOS)	PARLABEL	PFOS
Perfluorooctanoic acid (PFOA)	PARLABEL	PFOA
Gemfibrozil	PARLABEL	GEMFIBROZIL

Table 15. Electronic Data Format Valid Value Codes for Geotracker		
Parameter	Field Name	Valid Value
Iohexol	PARLABEL	IOHEXOL
Sucralose	PARLABEL	SUCRALOSE
Sulfamethoxazole	PARLABEL	SULFAMETH
Ammonia	PARLABEL	NH3N
Dissolved Organic Carbon (DOC)	PARLABEL	DOC
Nitrate	PARLABEL	NO3
Total fluorescence	PARLABEL	TOTALFLUOR
UV Light Absorbance (253.7nm)	PARLABEL	UV-254
ER-α (bioanalytical equivalent)	PARLABEL	ERALPHABEQ
AhR (bioanalytical equivalent)	PARLABEL	AHRBEQ

The Regional Water Board will review the data quality and Water Board staff may require additional actions if DQOs are not met. If sample analysis is performed more frequently than required using approved analytical methods, then the results of those analyses must be included in the report.

C.5.3 Document/Data Retention

All records of QA/QC procedures, laboratory method SOPs, QA/QC issue resolution documentation, personnel, chain-of-custody forms, equipment calibration, analytical records, lab reports, all original strip chart recordings for continuous monitoring instrumentation, copies of all reports discussed in this QAPP, and data deliverables must be securely stored on a server and be available upon request of the State Water Board QAO. Documents must be retained for a minimum of three years from the date of sample, measurement, report, or application. This period may be extended during the course of any unresolved litigation regarding this discharge or when requested by the Water Boards.

D. References

[NOTE TO AUTHOR: UPDATE REFERENCES AS THEY ARE ADDED/DELETED FROM THE QAPP]

Arnold, M.; Batista, J.; Dickenson, E.; Gerrity, D. Use of Ozone-Biofiltration for Bulk Organic Removal and Disinfection Byproduct Mitigation in Potable Reuse Applications. Chemosphere 2018, 202, 228–237. https://doi.org/10.1016/j.chemosphere.2018.03.085.

Anderson P, Denslow N, Drewes JE, Olivieri A, Schlenk D, Snyder S. 2010. Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water – Recommendations of a Science Advisory Panel. Final Report. Convened by the State Water Resources Control Board. Available at: https://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/docs/cec_monitoring_rpt.pdf. [Access date 11/5/18]

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E. Appendix A – Sample Chain of Custody Form

[INSERT SAMPLE CHAIN OF CUSTODY FORM HERE, which should include sample name, sample ID, date, analysis, quantity, names of people handling samples with signatures, dates, times and locations.]

F. Appendix B – Standard Operating Procedures

[INSERT SOPs FOR EACH ANALYTICAL METHOD]