



PROPOSITION 1 WATER RECYCLING RESEARCH

THE WATER RESEARCH FOUNDATION

AND

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD



RESEARCH GRANT

RESEARCH TO ADVANCE POTABLE AND NON-POTABLE REUSE IN CALIFORNIA

CALSTARS AGREEMENT NO. D1705003

FISCAL AGREEMENT NO. SWRCB0000000000D1705003

AMENDMENT 2

GRANT FUNDS: \$3,114,100

ELIGIBLE START DATE: MARCH 1, 2018

RESEARCH COMPLETION DATE: FEBRUARY 28, 2024

FINAL DISBURSEMENT REQUEST DATE: MARCH 31, 2024

RECORDS RETENTION TERM END DATE: FEBRUARY 28, 2060

This Grant Agreement executed by the State Water Board on March 30, 2018, and subsequently amended on January 14, 2020, is hereby amended as of March 20, 2020, to revise Exhibits A and B. Except as noted herein all other terms and conditions shall remain the same.

WHEREAS,

1. The State Water Board is authorized to provide funding under this Agreement pursuant to Article 4 of Chapter 7 of Division 26 of the Water Code (Prop 13) and sections 79765 - 79768 of the Water Code (Prop 1).
2. The State Water Board determines eligibility for financial assistance, determines a reasonable schedule for providing financial assistance, establishes compliance with Prop 13 and Prop 1, and establishes the terms and conditions of the funding agreement.
3. The State Water Board adopted Resolution No. 2017-0034, which authorizes the Deputy Director of the Division and their designee to award and execute Proposition 13 and Proposition 1 grant agreements and amendments for recycled water research and development included on the Water Recycling Research and Development Funding List. On the Water Recycling Research and Development Funding List, the State Water Board awarded funding to the Recipient to conduct the research described in Exhibit A of this agreement.
4. The State Water Board proposes to provide financial assistance for eligible costs of the Research, and the Recipient desires to participate as a recipient of financial assistance from the State Water Board, upon the terms and conditions set forth in this Agreement, all pursuant to Prop 13 and Prop 1.
5. This grant is for the benefit of the Recipient to advance water recycling research and development and is not for the planning or construction of a water recycling project as defined in section 79135 of the Water Code.

NOW, THEREFORE, in consideration of the premises and of the mutual representations, covenants and agreements herein set forth, the State Water Board and the Recipient, each binding itself, its successors and assigns, do mutually promise, covenant, and agree as follows:

1. Definitions

Unless otherwise specified, each capitalized term used in this Agreement has the following meaning:

"Agreement" means this research grant, including all exhibits and attachments hereto.

"Authorized Representative" means the duly appointed representative of the Recipient as set forth in the certified original of the Recipient's authorizing resolution that designates the Authorized Representative by title.

"Days" means calendar days unless otherwise expressly indicated.

"Deputy Director" means the Deputy Director of the Division.

"Disbursement Period" means the period during which Grant Funds may be disbursed.

"Disbursement Request" means the form used by the Recipient to document and request reimbursement of Research Costs.

"Division" means the Division of Financial Assistance of the State Water Board or any other segment of the State Water Board authorized to administer this Agreement.

"Division of Water Quality (DWQ) Technical Coordinator" is a senior in DWQ who will oversee the research portfolio in the Water Recycling Research and Development Funding List in Resolution No.

2017-0034 and will ensure that the research is consistent with the statutory requirements of Proposition 13 and Proposition 1 and the Water Recycling Funding Program guidelines. The DWQ Technical Coordinator may participate in Research-related meetings and conference calls as an observer.

“Eligible Start Date” means the date set forth in Exhibit B, establishing the date on or after which reimbursable costs may be incurred and eligible for reimbursement hereunder.

“Event of Default” means the occurrence of any of the following events: (a) any representation or warranty made by the Recipient under this Agreement proves to be incorrect in any material respect, (b) the Recipient’s failure to observe or perform any covenant, condition, or provision contained in Exhibit B of this Agreement, (c) the failure of the Recipient to perform any covenant or condition under this Agreement and such failure shall remain unremedied for a period of 30 days, unless expressly waived by the Division, (d) the failure of the Recipient to keep in full force and effect its legal existence and any rights, licenses, permit, or privileges to conduct its business, or the occurrence of any material restraint on Recipient’s business by a government agency or by court order (e) initiations of proceedings seeking liquidation, reorganization, or other relief with respect to the Recipient or its debts, or for the appointment of a receiver, trustee, custodian or conservator with respect to the Recipient or any part of its assets, or similar event, (f) a material adverse change in the business, operations, or condition (financial or otherwise) of Recipient.

“Final Disbursement Request Date” means the date established in Exhibit A, after which date, no further Grant Funds disbursements may be requested.

“Force Account” means the use of the Recipient’s own employees or equipment.

“Generally accepted accounting principles (GAAP)” means the uniform accounting and reporting procedures set forth in publications of the American Institute of Certified Public Accountants or its successor, or by any other generally accepted authority on such procedures, and includes, as applicable, the standards set forth by the Governmental Accounting Standards Board or its successor.

“Grant Contact” means the employee of the Recipient who has been delegated by the Project Director to oversee the day-to-day activities of the Research.

“Grant Funds” means funds provided by the State Water Board towards eligible reimbursable Research Costs.

“Grant Manager” means the person designated by the State Water Board to manage performance of this Agreement.

“Guidelines” means the Water Recycling Funding Program Guidelines, as amended by the State Water Board on June 16, 2015.

“Indirect Costs” means those costs that are incurred for a common or joint purpose benefiting more than one cost objective and are not readily assignable to the Research (i.e., costs that are not directly related to the Research). Examples of Indirect Costs include, but are not limited to: central service costs; general administration of the Recipient; non-research specific accounting and personnel services performed within the Recipient’s organization; depreciation or use allowances on buildings and equipment; the costs of operating and maintaining non-research specific facilities; tuition and conference fees; generic overhead or markup; and taxes.

“Advisory Committee (AC)” means a group of scientists, engineers, and other subject matter experts selected by the Recipient with the responsibility of developing a program of research, which consists of the highest priority research needs in their assigned subject-matter area, on an annual basis. Individuals on an AC are responsible for monitoring research needs in their areas of expertise and work as a team to

develop the research approach and tasks for each research project description, review and/or draft the schedules and budgets based on the scopes of work, and recommend potential Project Advisory Committee members to the Recipient. The AC will review all of the research project descriptions, identify the highest priority research, and make recommendations for a program of research to the Research Advisory Council for review. The Recipient currently has three subgroups of the Water Reuse and Desalination AC relevant to this Research: Potable Reuse, Agricultural Reuse, Industrial Reuse and Produced Water. The State Water Board has two technical liaisons on the Potable Reuse AC subgroup, and one technical liaison on the Agricultural Reuse and Industrial Reuse and Produced Water AC subgroups.

“Match Funds” means non-obligatory funds provided by the Recipient towards the Research Costs.

“Material Event” means the failure of the Recipient to observe or perform any covenant in this Agreement, including any of the following: a) revenue shortfalls; (b) adverse findings by the Regional Water Quality Control Board or DDW; (c) any false warranty or representation made by the Recipient relevant to this Agreement.

“Party Contact” means, for the Recipient, the Authorized Representative of the Recipient or any designee of the Authorized Representative, and, for the State Water Board, the Grant Manager or the Program Analyst.

“Project Advisory Committee” means a group of scientists, engineers, and other relevant backgrounds selected by the Recipient to provide expert scientific review and technical oversight for each Research component. The Project Advisory Committee reviews Research objectives, request for proposals, and proposals and makes recommendations for Research awards, as well as providing technical oversight and objective feedback to the Research Teams through the Recipient.

“Project Director” means an employee of the Recipient designated by the Authorized Representative to be responsible for the overall management of the administrative and technical aspects of the executed Agreement. The Project Director is set forth in Section 2 of this Agreement.

“Recipient” means The Water Research Foundation.

“Regional Water Quality Control Board” or “Regional Water Board” means the appropriate Regional Water Quality Control Board.

“Research” means the Research funded pursuant to this Agreement and as described in Exhibit A and in the documents incorporated by reference herein.

“Research Advisory Council” means individuals selected by the Recipient with specific areas of expertise and experience from water and wastewater utilities, engineering and consulting firms, manufacturers and suppliers, academia, and federal and state agencies. The Research Advisory Council reviews research descriptions developed by the AC. The Research Advisory Council is responsible for reviewing a list of research projects for the year that meets the budget allocations set by the Recipient and then submits the list to the Recipient for approval. The State Water Board has one technical liaison on the Research Advisory Council.

“Research Completion” means the Recipient’s submittal of all work set forth under Exhibit A for review and approval by the Division and as determined by the Division, and that the Research is complete to the reasonable satisfaction of the Division. The Division may require corrective work to be performed. Any work occurring after the Research Completion Date will not be reimbursed under this Agreement.

“Research Completion Date” means the date set forth in Exhibit A that is the last date on which Research Costs may be incurred under this Agreement.

"Research Costs" means the incurred costs of the Recipient which are: (a) eligible under this Agreement, (b) allowable costs as defined under the Guidelines, and (c) reasonable, necessary and allocable by the Recipient to the Research under GAAP.

"Research Manager" means an employee of the Recipient designated to fulfill the requirements of the grant and the Research components and is assigned to manage at least one of the components. The Research Manager will coordinate with the Project Advisory Committees, Research Teams, and Project Director for their assigned Research components.

"Research Team" means a group responsible for the fulfillment of the research objectives for each component and which will interact with the Project Advisory Committee through the Research Manager.

"State" means State of California.

"State Water Board" means the California State Water Resources Control Board.

"Year" means calendar year unless otherwise expressly indicated.

2. Party Contacts

The Party Contacts during the term of this Agreement are:

State Water Board	The Water Research Foundation
Section: Division of Financial Assistance	
Name: Sandeep Kals, Grant Manager	Name: Julie Minton, Project Director
Address: 1001 I Street, 16 th Floor	Address: 1199 N. Fairfax St., Suite 900
City, State, Zip: Sacramento, CA 95814	City, State, Zip: Alexandria, VA 22314
Phone: (916) 341-5415	Phone: (571) 699-0023
Fax: (916) 341-5707	Fax:
Email: Sandeep.Kals@waterboards.ca.gov	Email: jminton@waterrf.org

Direct inquiries to:

State Water Board	The Water Research Foundation
Section: Division of Financial Assistance	
Name: Kari Holzgang, Program Analyst	Name: Kim Van Eyzeren, Grant Contact
Address: 1001 I Street, 17 th Floor	Address: 6666 W. Quincy Avenue
City, State, Zip: Sacramento, CA 95814	City, State, Zip: Denver, CO 80235
Phone: (916) 341-5461	Phone: (303) 347-6113
Fax: (916) 341-5296	Fax: (303) 730-0851
Email: Kari.Holzgang@waterboards.ca.gov	Email: kvaneyzeren@waterrf.org

The Recipient may change its Project Director upon written notice to the Grant Manager, which notice shall be accompanied by authorization from the Recipient's Authorized Representative. The State Water Board will notify the Project Director of any changes to its Party Contacts.

3. Exhibits and Appendices Incorporated

The following exhibits and appendices to this Agreement, including any amendments and supplements hereto, are hereby incorporated herein and made a part of this Agreement:

EXHIBIT A - SCOPE OF WORK & INCORPORATED DOCUMENTS
EXHIBIT B - FUNDING TERMS
EXHIBIT C - GENERAL TERMS AND CONDITIONS
EXHIBIT D - SPECIAL CONDITIONS

4. Representations, Warranties, and Commitments

The Recipient represents, warrants, and commits to the following as of the Eligible Start Date set forth in Exhibit B and continuing thereafter for the term of this Agreement.

- (a) General Recipient Commitments. The Recipient shall comply with all terms, provisions, conditions, and commitments of this Agreement, including all incorporated documents, and to fulfill all assurances, declarations, representations, and commitments in its application, accompanying documents, and communications filed in support of its request for financial assistance.
- (b) Authorization and Validity. The execution and delivery of this Agreement, including all incorporated documents, has been duly authorized by the Recipient. This Agreement constitutes a valid and binding obligation of the Recipient, enforceable in accordance with its terms, except as such enforcement may be limited by law.
- (c) No Violations. The execution, delivery, and performance by Recipient of this Agreement, including all incorporated documents, do not violate any provision of any law or regulation in effect as of the date set forth on the first page hereof, or result in any breach or default under any contract, obligation, indenture, or other instrument to which Recipient is a party or by which Recipient is bound as of the date set forth on the first page hereof.
- (d) No Litigation. There are no pending or, to Recipient's knowledge, threatened actions, claims, investigations, suits, or proceedings before any governmental authority, court, or administrative agency which materially affect the financial condition or operations of the Recipient.
- (e) Solvency. None of the transactions contemplated by this Agreement will be or have been made with an actual intent to hinder, delay, or defraud any present or future creditors of Recipient. As of the date set forth on the first page hereof, Recipient is solvent and will not be rendered insolvent by the transactions contemplated by this Agreement. Recipient is able to pay its debts as they become due.
- (f) Legal Status and Eligibility. Recipient is duly organized and existing and in good standing under the laws of the State of California, and will remain so during the term of this Agreement. Recipient shall at all times maintain its current legal existence and preserve and keep in full force and effect its legal rights and authority. Recipient independently represents its eligibility and covenants to maintain its eligibility for funding under this Agreement through Research Completion.
- (g) Good Standing. The Recipient is currently in compliance with the state requirements set forth in Exhibit C. Within the preceding ten years, the Recipient has not failed to demonstrate compliance with previous state audit disallowances.
- (h) Insurance. Recipient maintains sufficient insurance coverage considering the scope of this Agreement, including, for example, but not necessarily limited to, General Liability, Automobile Liability, Worker's Compensation and Employer's Liability, and Professional Liability insurance.

5. Research Completion

The Recipient shall expeditiously proceed with and complete the work under this Agreement.

6. Notice

- (a) The Recipient shall notify the Division within ten (10) working days of the occurrence of any of the following:
 - (1) Bankruptcy, insolvency, receivership or similar event of the Recipient;
 - (2) Actions taken pursuant to state law in anticipation of filing for bankruptcy;
 - (3) Material Events; or
 - (4) Any litigation pending or threatened against the Recipient regarding its continued existence, consideration of dissolution, or disincorporation.
- (b) The Recipient shall notify the Division within ten (10) working days of any litigation pending or threatened against the Recipient regarding its continued existence, consideration of dissolution, or disincorporation.
- (c) The Recipient shall notify the Division promptly of the following:
 - (1) Any proposed change in the scope of the Research. Under no circumstances may the Recipient make changes to the scope of the Research without receiving prior review and approval by the Division. Most changes will require an amendment to this Agreement;
 - (2) Cessation of all major work on the Research where such cessation of work is expected to or does extend for a period of thirty (30) days or more;
 - (3) Any circumstance, combination of circumstances, or condition, which is expected to or does delay Research Completion;
 - (4) Any Research monitoring, demonstration, or other implementation activities such that the State Water Board Division of Drinking Water and/or Regional Water Quality Control Board staff may observe and document such activities;
 - (5) Any public or media event publicizing the accomplishments and/or results of this Agreement and provide the opportunity for attendance and participation by state representatives with at least ten (10) working days' notice to the Division; or
 - (6) Research Completion.

IN WITNESS WHEREOF, this Agreement has been executed by the parties hereto.

THE WATER RESEARCH FOUNDATION:

By: _____

Name: Peter Grevatt

Title: Chief Executive Officer

Date: _____

STATE WATER RESOURCES CONTROL BOARD:

By: _____

Name: Leslie S. Laudon

Title: Deputy Director
Division of Financial Assistance

Date: _____

EXHIBIT A – SCOPE OF WORK

A-1. Completion Date

The Research Completion Date is established as FEBRUARY 28, 2024. Work occurring after the Research Completion Date, including corrective actions, is not eligible for reimbursement with Grant Funds.

A-2. Background

The State Water Board adopted the Policy for Water Quality Control for Recycled Water (Recycled Water Policy) on February 3, 2009, and amended it on December 11, 2018. The Recycled Water Policy includes goals to increase the use of recycled water over 2002 volumes by at least one million acre-feet per year by 2020 and by at least two million acre-feet per year by 2030. The State Water Board also included goals to reuse all dry weather direct discharge of treated wastewater to enclosed bays, estuaries and coastal lagoons, and ocean waters that can be viably put to a beneficial use, and to maximize the use of recycled water in areas where groundwater supplies are in a state of overdraft. To achieve these goals, additional research is needed to enhance the scientific understanding of non-potable and potable water reuse in California. In December 2016, the State Water Board passed Resolution No. 2016-0061, stating it supports and encourages the use of recycled water by providing funding support for research that will fill critical knowledge gaps.

A-3. Purpose

This grant is for the benefit of the Recipient. The purpose of this grant is to enhance the understanding of potable and non-potable water reuse applications in California. The Recipient will on an annual basis develop, prioritize, and identify potable and non-potable recycled water research using their long-standing multi-phased process. Each year, the Recipient convenes multiple subject-specific Advisory Committees (AC) (e.g., Water Reuse and Desalination AC, Intelligent Water Systems AC, Sustainable Integrated Water Management AC, which are allocated a budget for their research area for the year. The AC will develop and identify the highest priority research within their area of expertise and budget and recommend a list of research projects to the Research Advisory Council (RAC). The RAC will review the proposed research recommendations from all of the ACs and develop a program of research within the allocated budget for the year that is reviewed and approved by the Recipient's Board.

For this agreement, the Recipient will utilize the Water Reuse and Desalination AC to develop and prioritize a list of potable and non-potable recycled water research needs in 2018 and in 2019. The Research in Phase 1 of this Agreement was selected using the 2017 iteration of the process described above. The Research in Phase 2 of this Agreement was selected using the 2018 iteration of the process described above. The Research in Phase 3 of this Agreement was selected using the 2019 iteration of the process described above. This phased approach ensures that as the scientific information in this field rapidly progresses, that the highest research priorities are identified and funded on an annual basis.

The Recipient's receipt of funding under this Agreement is not a commitment to and does not obligate the State Water Board to provide funding to develop or support a "water recycling project" as defined in Water Code section 79135.

A-4. Scope of Work

The Recipient agrees to do the following:

1. Grant Administration

- 1.1 Provide all technical and administrative services needed for Research Completion; monitor, supervise, and review all work performed; and coordinate budgeting and scheduling to ensure the Research is completed within budget, on schedule, and in accordance with approved procedures, applicable laws, and regulations.
 - 1.2 Notify the Grant Manager at least fifteen (15) working days in advance of upcoming meetings, workshops, webinars, and trainings.
 - 1.3 Conduct Research status review meetings as requested by the Grant Manager and DWQ Technical Coordinator.
 - 1.4 Submit a summary of total Research Costs including any Match Funds to the Grant Manager and DWQ Technical Coordinator.
 - 1.5 Conduct meetings related to the Research in such a way to ensure that such meetings are not held in states that are identified by the Attorney General pursuant to Government Code section 11139.8, subd.(e), unless otherwise approved by the Grant Manager. The list of states identified by the Attorney General can be found here: <https://oag.ca.gov/ab1887> (or other web address in effect at the time). The Grant Manager and DWQ Technical Coordinator may be required to travel to attend meetings related to the Research in order to manage performance of this Agreement but shall not travel to meetings held in states that are identified by the Attorney General pursuant to Government Code section 11139.8 subd.(e).
 - 1.6 Submit any documents developed to disseminate findings from this Research to the Grant Manager and DWQ Technical Coordinator.
2. Research Implementation

Phase 1: Research Identified in 2017

- 2.1 Evaluation of Constituents of Emerging Concern Removal by Ozone/Biologically Activated Filtration Treatment (Component 1A)

Objectives: Analyze the efficiency of removing constituents of emerging concern (CECs) using ozone/biologically activated filtration (BAF) treatment compared to reverse osmosis (RO) treatment considering variations in water quality, treatment train design, and operations. Develop design and operational guidelines for the potable reuse industry to use ozone/BAF treatment systems.

- 2.1.1 Establish and oversee an ozone/BAF Project Advisory Committee (ozone/BAF PAC) of ozone/BAF experts. Submit all *curricula vitae* for members of the ozone/BAF PAC to the Grant Manager and DWQ Technical Coordinator. The ozone/BAF PAC shall:
 - 2.1.1.1 Develop and solicit a request for proposals to meet the research objectives of Component 1A and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.1.1.2 Review and rank proposals based on criteria provided by the Recipient and select and oversee an ozone/BAF Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the ozone/BAF Research Team to the

Grant Manager and DWQ Technical Coordinator. The ozone/BAF Research Team shall:

- 2.1.1.2.1 Conduct a literature review from peer-reviewed literature, published and unpublished data from related Recipient-funded research, and past and existing treatment facilities to compile data to quantify CEC removal and correlate removal efficiency with treatment train design, operations, and water quality parameters.
 - 2.1.1.2.2 Analyze the data compiled in 2.1.1.2.1 to identify critical variables affecting CEC and total organic carbon (TOC) removal, compare CEC and TOC removal performance of ozone/BAF and RO treatment systems, evaluate the role of low-pressure membranes in ozone/BAF systems, characterize failure frequency and post-treatment needs of ozone/BAF systems, and characterize public health implications of ozone/BAF effluent.
 - 2.1.1.2.3 Identify CECs (or groups of CECs) that may persist through ozone/BAF systems but are typically removed by RO-based treatment trains and evaluate the need for post-treatment of ozone/BAF effluent.
 - 2.1.1.2.4 Develop recommendations for future research to facilitate the implementation of ozone/BAF in potable reuse applications.
 - 2.1.1.2.5 Develop a draft guidance document for use by the potable reuse industry that contains design and operational guidelines to optimize ozone/BAF treatment systems for CEC removal and submit to the ozone/BAF PAC, Grant Manager, and DWQ Technical Coordinator for comment.
 - 2.1.1.2.6 Complete a final guidance document incorporating any comments received in Item 2.1.1.2.5 and submit to the ozone/BAF PAC, Grant Manager, and DWQ Technical Coordinator.
 - 2.1.1.2.7 Develop a draft report summarizing the work completed in items 2.1.1.2.1 through 2.1.1.2.4 and submit to the ozone/BAF PAC, Grant Manager, and DWQ Technical Coordinator for comment.
 - 2.1.1.2.8 Complete a final report incorporating any comments received in Item 2.1.1.2.7 and submit it to the ozone/BAF PAC, Grant Manager, and DWQ Technical Coordinator.
 - 2.1.1.3 Provide recommendations, technical oversight, and objective feedback to the ozone/BAF Research Team.
 - 2.1.1.4 Oversee the ozone/BAF Research Team efforts, and review reports, interim information, and draft submittals.
- 2.2 Understand Wastewater Treatment Performance on Advanced Water Treatment Processes and Finished Water Quality (Component 2A)

Objective: Investigate the impact of the quality of primary, secondary, and tertiary wastewater treatment (WWT) on advanced water treatment (AWT) feed and finished water quality, including economic and performance tradeoffs.

- 2.2.1 Establish and oversee a WWT PAC. Submit *curricula vitae* for members of the WWT PAC to the Grant Manager and DWQ Technical Coordinator. The WWT PAC shall:
 - 2.1.1.5 Develop and solicit a request for proposals to meet the research objective for Component 2A, and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.1.1.6 Review and rank proposals based on criteria provided by the Recipient and select a WWT Research Team. Submit the completed selection criteria, winning proposal, research timeline and *curricula vitae* for members of the WWT Research Team to the Grant Manager and DWQ Technical Coordinator. The WWT Research Team shall:
 - 2.2.1.1.1 Collect and collate existing water quality data (both influent and effluent) from a minimum of six (6) pilot or full-scale WWT and AWT facilities, including ozone/biologically active filtration-based systems and reverse osmosis-based systems. Selected AWT facilities must receive feedwater from a range of primary, secondary, and tertiary treatment processes, and feedwater quality must represent a range of possible water qualities.
 - 2.2.1.1.2 Document changes in primary, secondary, and tertiary treatment performance using the data collected in item 2.2.1.2.1, and identify impacts on AWT system operation and water quality. Define all side streams and return flows and their associated impacts on system operations and water quality. Evaluate potential impacts of primary, secondary, and tertiary treatment processes on subsequent AWT processes.
 - 2.2.1.1.3 Evaluate the potential for improvements in AWT efficiency and performance through primary, secondary, and tertiary treatment process modifications for each AWT facility identified in 2.2.1.2.1.
 - 2.2.1.1.4 Evaluate the capital, operations, and maintenance costs of primary, secondary, tertiary treatment and AWT facilities. Evaluate economic and performance tradeoffs between levels of conventional wastewater treatment and the corresponding levels of AWT needed to meet direct potable water quality that is protective of public health and meets regulatory requirements.
 - 2.2.1.1.5 Identify any additional treatment needed to meet direct potable water quality that is protective of public health and meets regulatory requirements and make recommendations for future research.
 - 2.2.1.1.6 Develop a draft report describing the work completed in items 2.2.1.2.1 through 2.2.1.2.5 and submit it to the WWT PAC, Grant Manager, and DWQ Technical Coordinator for comment.

2.2.1.1.7 **Complete** a final report incorporating any comments received in Item 2.2.1.2.6, and submit it to the WWT PAC, Grant Manager, and DWQ Technical Coordinator.

2.1.1.7 Provide recommendations, technical oversight, and objective feedback to the WWT Research Team.

2.1.1.8 Oversee the WWT Research Team efforts, and review reports, interim information, and draft submittals.

2.3 Potable and Non-Potable Water Reuse Research Projects for 2018

Objective: Using the Recipient's established research process in collaboration with the Grant Manager and DWQ Technical Coordinator, the Recipient will identify and fund the highest priority potable and non-potable (including urban, agricultural, industrial, and produced water) reuse Research for 2018 that will expand the scientific understanding of recycled water in California, including advances in fields such as source control, treatment technologies; monitoring of treatment system performance; water quality monitoring including pathogens, constituents of emerging concern, surrogates, and indicator compounds; data collection, integration, management, and interpretation for advanced water treatment systems; operations and operators; antibiotic resistant bacteria, antibiotic resistance genes, and mobile genetic elements; concentrate treatment and management.

2.3.1 In 2018, convene at least the following subgroups of the Water Reuse and Desalination AC: Potable Reuse, Agricultural Reuse, and Industrial and Produced Water Reuse, and submit a list of AC members and their affiliations to the Grant Manager and DWQ Technical Coordinator. Each AC subgroup shall:

2.3.1.1 Develop the research approach and tasks for each research project description, draft the schedules and budgets, and recommend potential Project Advisory Committee members to the Recipient.

2.3.1.2 Review and refine the research project descriptions.

2.3.1.3 Prioritize the research project descriptions based on their potential to expand reuse in the State, and submit a prioritized list of research project descriptions to the Recipient that is within the budget allocated to the AC for the year by the Recipient.

2.3.2 Review the research priorities of the AC subgroups and submit a prioritized list of research projects (Proposed 2018 Research List) to the Grant Manager and DWQ Technical Coordinator for approval and research selection (Approved 2018 Research List). The Proposed 2018 Research List shall include research descriptions and estimated budgets for each research priority.

2.3.3 Develop the research objective(s), scope of work, budget, submittals, and submittal schedule for each research project on the Approved 2018 Research List, which will be provided by the Grant Manager, and submit this information to the Grant Manager and DWQ Technical Coordinator.

Phase 2: Research Identified in 2018

2.4 Integration of High-Frequency Performance Data for Microbial and Chemical Compounds Control in Potable Reuse Treatment Systems (Component 1B)

Objectives: Expand the understanding of how high-frequency data monitoring and analytics can best be leveraged to improve the accuracy, efficiency, and safety of monitoring and control strategies in potable reuse systems, including a literature review and surveys, a monitoring/control system, challenge testing of the system, evaluation and analysis of trends, and development of a framework to use monitoring data to optimize process performance and prevent failures.

2.4.1 Establish and oversee a Project Monitoring/Control Project Advisory Committee (PAC) including experts on treatment operations and design, system monitoring, water quality surveillance and monitoring. Submit *curricula vitae* for members of the Project Monitoring/Control PAC to the Grant Manager and DWQ Technical Coordinator. The Monitoring/Control PAC shall:

2.4.1.1 Develop and solicit a request for proposals to meet the research objective of Component 1B and submit to the Grant Manager and DWQ Technical Coordinator.

2.4.1.2 Review and rank proposals based on criteria provided by the Recipient and select a Monitoring/Control Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the Monitoring/Control Research Team to the Grant Manager and DWQ Technical Coordinator. The Monitoring/Control Research Team shall:

2.4.1.2.1 Evaluate existing potable reuse treatment schemes for statistical control of processes (e.g., control charts, advanced data analytics), focusing on current monitoring strategies used for process control of potable reuse facilities and the unit processes that make up common potable reuse treatment trains.

2.4.1.2.1.1 Conduct a review of relevant literature and data to evaluate existing potable reuse treatment schemes for statistical control processes.

2.4.1.2.1.2 Conduct case studies of operating potable reuse facilities to understand existing monitoring and control systems, data management strategies and operationalization of monitoring data.

2.4.1.2.1.3 Document regulatory requirements and voluntary monitoring approaches beyond regulatory requirements for treatment train unit process monitoring of potable reuse facilities.

2.4.1.2.2 Develop a monitoring/control system for a potable reuse treatment train that will integrate monitoring data collected to assess unit process performance and overall treatment train performance in removing chemical and microbial contaminants to target levels.

- 2.4.1.2.3 Develop performance-based requirements for the design of a monitoring/control system for monitoring a potable reuse facility, based on the work completed in Items 2.4.1.2.1 through 2.4.1.2.2.
 - 2.4.1.2.4 Integrate the monitoring/control system into an existing treatment train (treatment system) and operate the treatment system for a minimum of six (6) months.
 - 2.4.1.2.5 Integrate challenge testing during treatment system operation in Item 2.4.1.2.4 to demonstrate the responsiveness of the monitoring and control system to off-specification performance or sub-optimal trends in water quality.
 - 2.4.1.2.5.1 Evaluate the use of monitoring data to develop mitigation techniques that bring treatment train processes back into specification.
 - 2.4.1.2.6 Use data analytics and supplemental information to identify water quality excursions or undesirable performance trends during treatment system operation in Item 2.4.1.2.4.
 - 2.4.1.2.7 Develop a framework to use monitoring data to optimize treatment train process performance and prevent failures.
 - 2.4.1.2.8 Prepare a draft Component 1B Research Report on the work completed in Items 2.4.1.2.1 through 2.4.1.2.7. Submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.4.1.2.9 Complete a final Component 1B Research Report incorporating any comments received in Item 2.4.1.2.8 and submit it to the Grant Manager and DWQ Technical Coordinator.
 - 2.4.1.3 Provide recommendations, technical oversight, and objective feedback to the Monitoring/Control Research Team.
 - 2.4.1.4 Oversee the Monitoring/Control Research Team efforts, and review reports, interim information, and draft and final submittals.
- 2.5 Compile Evidence of Pathogen Reduction through Managed Aquifer Recharge (MAR) and Recovery (Component 2B)
- Objectives: Document and quantify performance of pathogen reduction through MAR based on residence time, aquifer characteristics, temperature, source water quality, and comparing methods of introduction, such as surface spreading and direct injection. Develop recommendations to optimize pathogen reduction through MAR.
- 2.5.1 Establish and oversee an MAR Project Advisory Committee (MAR PAC) of experts. Submit *curricula vitae* for members of the MAR PAC to the Grant Manager and DWQ Technical Coordinator. The MAR PAC shall:

- 2.5.1.1 Develop and solicit a request for proposals to meet the research objective of Component 2B and submit to the Grant Manager and DWQ Technical Coordinator.
- 2.5.1.2 Review and rank proposals based on criteria provided by the Recipient and select an MAR Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the MAR Research Team to the Grant Manager and DWQ Technical Coordinator. The MAR Research Team shall:
 - 2.5.1.2.1 Review literature and data to compile evidence of fate and transport of pathogens through MAR.
 - 2.5.1.2.1.1 Summarize the background of groundwater storage credits for viruses, bacteria, and protozoa for both recycled water used for groundwater recharge and groundwater under the direct influence of surface water (GUDI), including bank filtration.
 - 2.5.1.2.2 Plan and facilitate a workshop including experts in wastewater, analytical microbiology, and pathogen detection methods to develop a Workshop Report that would summarize:
 - 2.5.1.2.2.1 State of knowledge of MAR and identify research needed to provide regulators **with** rationale for setting log reduction credits for MAR.
 - 2.5.1.2.2.2 State of knowledge of pathogen reduction through MAR processes to provide planners and regulators a more nuanced understanding of necessary travel times for pathogen reduction.
 - 2.5.1.2.3 Prepare a draft Component 2B Research Report on the work completed in Items 2.5.1.2.1 through 2.5.1.2.2.2 and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.5.1.2.4 Complete a final Component 2B Research Report incorporating any comments received in Item 2.5.1.2.3 and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.5.1.3 Provide recommendations, technical oversight, and objective feedback to the MAR Research Team.
 - 2.5.1.4 Oversee the MAR Research Team efforts, and review draft and final reports, interim information, and draft and final submittals.
- 2.6 New Techniques, Tools, and Validation Protocols for Achieving Log Removal Credit across Nanofiltration (NF) and RO Membranes (Component 3B)

Objectives: Identify methods and procedures for validation of NF and RO membrane integrity that will provide regulators with confidence to award appropriate Log Removal Values (LRV) for the technology. Perform extensive challenge testing of high-pressure

membranes under a variety of conditions (e.g. oxidized membrane, chemically clean membrane, new membrane) to determine and verify pathogen log removal efficiencies. Evaluate chemicals, particles, or other indicators (e.g., electrical conductivity) to assess the possible relationships in monitoring and removal efficiency.

- 2.6.1 Establish and oversee an NF/RO Project Advisory Committee (NF/RO PAC) of experts. Submit *curricula vitae* for members of the NF/RO PAC to the Grant Manager and DWQ Technical Coordinator. The NF/RO PAC shall:
 - 2.6.1.1 Develop and solicit a request for proposals to meet the research objective of Component 3B and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.6.1.2 Review and rank proposals based on criteria provided by the Recipient and select an NF/RO Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the NF/RO Research Team to the Grant Manager and DWQ Technical Coordinator. The NF/RO Research Team shall:
 - 2.6.1.2.1 Review accepted methods and procedures for demonstrating log reductions in NF and RO membrane systems used by existing potable reuse facilities. Evaluate the advantages, disadvantages, and future needs of less mature validation methods.
 - 2.6.1.2.1.1 Document accepted methods and procedures for process monitoring of NF and RO membranes, noting the role of regulatory requirements such as the USEPA Membrane Filtration Guidance Manual.
 - 2.6.1.2.2 Identify surrogate chemicals and detection methods that can verify log removal efficiencies in high-pressure membrane treatment.
 - 2.6.1.2.3 Evaluate impacts of fouling states, membrane age, and resolution and sensitivity of methods selected in Item 2.6.1.2.2 by testing the methods at RO facilities with differing water quality and membrane conditions.
 - 2.6.1.2.4 Evaluate each detection method selected in Item 2.6.1.2.2 for its applicability to potable reuse, including pros and cons, costs and benefits based on financial cost, required skills for operations, and potential log removal credit awarded.
 - 2.6.1.2.5 Develop recommendations for:
 - 2.6.1.2.5.1 Applications of the research results by regulatory bodies.
 - 2.6.1.2.5.2 Implementing detection methods to receive log removal credit.
 - 2.6.1.2.6 Prepare a draft Component 3B Research Report on the work completed in Items 2.6.1.2.1 through 2.6.1.2.5 and submit to the Grant Manager and DWQ Technical Coordinator for comment.

- 2.6.1.2.7 Complete a final Component 3B Research Report incorporating the comments received in Item 2.6.1.2.6 and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.6.1.3 Provide recommendations, technical oversight, and objective feedback to the NF/RO Research Team.
 - 2.6.1.4 Oversee the NF/RO Research Team efforts, and review draft and final reports, interim information, and draft and final submittals.
- 2.7 Evaluation of a Validation Protocol for Membrane Bioreactors Based on a Correlated Surrogate to Achieve Pathogen Credit for Potable Reuse (Component 4B)
- Objectives: Investigate whether the proposed Tier 3 validation protocol for pathogen removal from membrane bioreactors (MBR) is feasible and adaptable for potable reuse applications in the United States, including recommendations for testing and verifying the protocol.
- 2.7.1 Establish and oversee an MBR Project Advisory Committee (MBR PAC) of experts. Submit *curricula vitae* for members of the MBR PAC to the Grant Manager and DWQ Technical Coordinator. The MBR PAC shall:
 - 2.7.1.1 Develop and solicit a request for proposals to meet the research objective of Component 4B and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.7.1.2 Review and rank proposals based on criteria provided by the Recipient and select an MBR Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the MBR Research Team to the Grant Manager and DWQ Technical Coordinator. The MBR Research Team shall:
 - 2.7.1.2.1 Evaluate the proposed WaterVal Tier 3 validation protocol for MBRs. The evaluation should include a gap analysis of the proposed protocol, strengths and limitations of the proposed protocol; a plan for implementation of the proposed protocol by utilities; and potential log removal credits that may be awarded.
 - 2.7.1.2.2 Determine what modifications are needed to adapt the proposed WaterVal Tier 3 validation protocol for application in the United States based on the findings from Item 2.7.1.2.1 and collaborate with utilities that are using or considering the use of MBRs in potable reuse treatment trains.
 - 2.7.1.2.3 Develop recommendations for implementing a Tier 3 protocol for MBRs including operational parameters to be monitored in real time, testing methods, sampling protocols and frequency, and monitoring instrument calibration frequency and protocols, considering the financial and technical burden on utilities.
 - 2.7.1.2.4 Prepare a draft Component 4B Research Report on the work completed in Items 2.7.1.2.1 through 2.7.1.2.3 and submit to the Grant Manager and DWQ Technical Coordinator for comment.

- 2.7.1.2.5 Complete a final Component 4B Research Report incorporating any comments received in Item 2.7.1.2.4 and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.7.1.3 Provide recommendations, technical oversight, and objective feedback to the MBR Research Team.
 - 2.7.1.4 Oversee the MBR Research Team efforts, and review draft and reports, interim information, developed recommendations, and draft and final submittals.
- 2.8 Indicator Viruses to Confirm Performance of Advanced Physical Treatment (Component 5B)
- Objectives: Identify and evaluate potential viral indicator(s) for assessing the performance of physical treatment processes during advanced water treatment for potable reuse, including a literature review, identification of viral indicators, monitoring evaluation, and final recommendations.
- 2.8.1 Establish and oversee a Treatment Performance Project Advisory Committee (Treatment Performance PAC) of experts. Submit *curricula vitae* for members of the Treatment Performance PAC to the Grant Manager and DWQ Technical Coordinator. The Treatment Performance PAC shall:
 - 2.8.1.1 Develop and solicit a request for proposals to meet the research objective of Component 5B and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.8.1.2 Review and rank proposals based on criteria provided by the Recipient and select a Treatment Performance Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the Treatment Performance Research Team to the Grant Manager and DWQ Technical Coordinator. The Treatment Performance Research Team shall:
 - 2.8.1.2.1 Conduct a literature review to evaluate and summarize concentration and removal of viruses by advanced water treatment processes.
 - 2.8.1.2.1.1 Investigate expected virus concentrations in raw wastewater, secondary effluent, and biofilm in media filtration, microfiltration (MF), and RO.
 - 2.8.1.2.1.2 Evaluate physical advanced treatment processes including quantification and discussion of effects of soil types, aquifer characteristics, and travel time for soil aquifer treatment (SAT).
 - 2.8.1.2.1.3 Review studies which evaluate biological biomass by measuring adenosine triphosphate (ATP) concentrations.
 - 2.8.1.2.1.4 Summarize traditional and advanced analytical methods for measuring and concentrating viruses.

- 2.8.1.2.1.5 Identify knowledge gaps in the field of viral indicator assessment.
 - 2.8.1.2.1.6 Ensure the integrity of each literature source by verifying that quantitative polymerase chain reaction (qPCR) and digital polymerase chain reaction (dPCR) data meet the Minimum Information for Publication of Quantitative Real-Time PCR Experiments (MIQE) guidelines.
 - 2.8.1.2.2 Select viruses that represent pathogens of concern, that can measure treatment performance without requiring seeding studies. Provide justification to support the selection.
 - 2.8.1.2.3 Select a detection technique for quantifying the selected viruses in Item 2.8.1.2.2, considering cost-effectiveness. Determine appropriate quality assurance/quality control (QA/QC) methods to understand recovery efficiency and matrix effects.
 - 2.8.1.2.4 Collect sampling data from advanced water treatment systems and aquifer recharge projects to determine concentrations and log removal values of viruses selected in Item 2.8.1.2.2.
 - 2.8.1.2.5 Recommend potential online surrogate(s) that may correlate with full-scale virus data, considering data interpretation, statistical design, cost considerations.
 - 2.8.1.2.6 Prepare a draft Component 5B Research Report on the work completed in Items 2.8.1.2.1 through 2.8.1.2.5 and submit to the Grant Manager and DWQ Technical Coordinator for review and comment.
 - 2.8.1.2.7 Complete a final Component 5B Research Report incorporating any comments received in Item 2.8.1.2.6 and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.8.1.3 Provide recommendations, technical oversight, and objective feedback to the Treatment Performance Research Team.
 - 2.8.1.4 Oversee the Treatment Performance Research Team efforts, and review draft and final reports, interim information, and draft and final submittals.
- 2.9 Review of Industrial Contaminants Associated with Water Quality or Adverse Performance Impacts for Potable Reuse Treatment (Component 6B)

Objectives: Identify contaminants or families of compounds related to industry or manufacturing (e.g., low molecular weight compounds, pharmaceuticals, CECs) and the industries that may discharge these compounds. Group the listed contaminants in terms of risk to water quality and impact to advanced treatment performance (e.g., loss of throughput, impact to treatment). Develop mitigation strategies to improve source control of industrial contaminants, such as treatment, inspection frequency and methodology, and monitoring requirements.

- 2.9.1 Establish and oversee an Industrial Project Advisory Committee (Industrial PAC) of experts. Submit *curricula vitae* for members of the Industrial PAC to the Grant Manager and DWQ Technical Coordinator. The Industrial PAC shall:
 - 2.9.1.1 Develop and solicit a request for proposals to meet the research objective of Component 6B and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.9.1.2 Review and rank proposals based on criteria provided by the Recipient and select an Industrial Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the Industrial Research Team to the Grant Manager and DWQ Technical Coordinator. The Industrial Research Team shall:
 - 2.9.1.2.1 Review literature and data to identify contaminants or compound groups related to industry or manufacturing that may impact advanced water treatment performance.
 - 2.9.1.2.1.1 Identify the industries that may discharge these compounds.
 - 2.9.1.2.1.2 Analyze existing data on the identified contaminants or compound groups to understand impacts to advanced water treatment performance.
 - 2.9.1.2.1.3 Categorize the identified contaminants or compound groups in Item 2.9.1.2.1 based on the potential risk to water quality.
 - 2.9.1.2.2 Conduct a survey to identify wastewater treatment plants receiving significant industrial inputs and group those wastewater treatment plants based on the type of industrial wastewater dischargers.
 - 2.9.1.2.3 Review the requirements and practices of the National Pretreatment Program and conduct case studies to understand source water management program implementation at a minimum of six (6) operating advanced water treatment systems that were selected based on the results of Item 2.9.1.2.2.
 - 2.9.1.2.4 Prepare a draft Source Water Guidance Document for strategies to mitigate industrially influenced source water impacts on advanced water treatment performance, including treatment, inspection frequency and methodology, and monitoring requirements. Submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.9.1.2.4.1 Identify design and operational strategies to best manage key industrial sourced chemicals of concern, including operational response/control methodologies.
 - 2.9.1.2.4.2 Recommend additional practices to improve source control programs and program revisions to improve

monitoring/control and operational responses at advanced treatment facilities.

- 2.9.1.2.5 Complete a final Source Water Guidance Document, incorporating any comments received in Item 2.9.1.2.4, and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.9.1.2.6 Prepare a draft Component 6B Research Report on the work completed in Items 2.9.1.2.1 through 2.9.1.2.5 and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.9.1.2.7 Complete a final Component 6B Research Report incorporating any comments received in Item 2.9.1.2.6 and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.9.1.3 Provide recommendations, technical oversight, and objective feedback to the Industrial Research Team.
 - 2.9.1.4 Oversee the Industrial Research Team efforts, and review draft and final reports, interim information, and draft and final submittals.
- 2.10 Considerations and Blending Strategies for Drinking Water System Integration with Alternative Water Supplies (Component 7B)
- Objectives: Identify and evaluate impacts of alternative water supplies, such as potable reuse, on the water quality of the end users' existing drinking water systems that have known issues with tuberculation (e.g., corrosion, biological regrowth, Legionella, aesthetics, biofilm). Understand impacts of blending ratios of alternative water supplies, including potable reuse, at a full-scale system into existing treated water on a variety of issues (e.g., nitrification, total chlorine residual, ammonia, nitrite, nitrate). Develop management strategies and options to mitigate adverse impacts.
- 2.10.1 Establish and oversee a Blending Project Advisory Committee (Blending PAC) of experts. Submit *curricula vitae* for members of the Blending PAC to the Grant Manager and DWQ Technical Coordinator. The Blending PAC shall:
 - 2.10.1.1 Develop and solicit a request for proposals to meet the research objective of Component 7B and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.10.1.2 Review and rank proposals based on criteria provided by the Recipient and select a Blending Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the Blending Research Team to the Grant Manager and DWQ Technical Coordinator. The Blending Research Team shall:
 - 2.10.1.2.1 Develop a research plan to evaluate a drinking water distribution system conveying potable reuse or other alternative water supplies based on a literature review.
 - 2.10.1.2.2 Identify an existing drinking water distribution system impacted by tuberculation and a premise plumbing system with lead and

copper piping materials. Harvest a portion of pipe from each system, maintaining the existing biofilms and water quality.

- 2.10.1.2.3 Conduct studies to investigate the role of biological corrosion on water quality in distribution systems impacted by potable reuse or alternative water supply blending, particularly when chloramines are used for disinfection. Test different blending water combinations to examine the impact of biological corrosion on water quality in these distribution systems.
 - 2.10.1.2.4 Conduct further study on the indicators of pipe material leaching in premise plumbing systems impacted by potable reuse or alternative water supplies. Test different blending water combinations to examine the impact on leaching in these premise plumbing systems.
 - 2.10.1.2.5 Prepare a draft Component 7B Research Report on the work completed in Items 2.10.1.2.1 through 2.10.1.2.4 and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.10.1.2.6 Complete a final Component 7B Research Report incorporating any comments received in Item 2.10.1.2.5 and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.10.1.3 Provide recommendations, technical oversight, and objective feedback to the Blending Research Team.
 - 2.10.1.4 Oversee the Blending Research Team efforts, and review draft and final reports, interim information, and draft and final submittals.
- 2.11 The Use of Next Generation Sequencing Technologies and Metagenomics Approaches to Evaluate Water and Wastewater Quality Monitoring and Treatment Technologies (Component 8B)
- Objective: Identify applications for Next Generation Sequencing (NGS) and metagenomics tools that have the most potential for use in a utility monitoring program through the use of a literature survey to document existing approaches and case studies to demonstrate applicability and usefulness of the technologies.
- 2.11.1 Establish and oversee an NGS Project Advisory Committee (NGS PAC) of experts. Submit *curricula vitae* for members of the NGS PAC to the Grant Manager and DWQ Technical Coordinator. The NGS PAC shall:
 - 2.11.1.1 Develop and solicit a request for proposals to meet the research objective of Component 8B and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.11.1.2 Review and rank proposals based on criteria provided by the Recipient and select an NGS Research Team. Submit the completed selection criteria, winning proposal, research timeline and *curricula vitae* for members of the NGS Research Team to the Grant Manager and DWQ Technical Coordinator. The NGS Research Team shall:

- 2.11.1.2.1 Perform a literature survey to identify and document existing and emerging NGS and metagenomics approaches and their insights to date, including identifying and documenting QA/QC standards and standard operating procedures (SOPs).
 - 2.11.1.2.2 Identify applications for NGS and metagenomics tools that have the most potential for use at a utility.
 - 2.11.1.2.3 Design and conduct case studies to test the readiness and benefits to utilities of applying NGS and metagenomics tools as identified in Item 2.11.1.2.2. Identify research needs for these applications.
 - 2.11.1.2.4 Prepare a guidance report on the case studies completed in Item 2.11.1.2.3, including an overview of the case studies, guidance for using NGS and metagenomics tools and recommendations for tool application and viability at potable reuse facilities.
 - 2.11.1.2.5 Prepare a draft Component 8B Research Report on the work completed pursuant to Items 2.11.1.2.1 through 2.11.1.2.4 and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.11.1.2.6 Complete a final Component 8B Research Report incorporating any comments received in Item 2.11.1.2.5 and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.11.1.3 Provide recommendations, technical oversight, and objective feedback to the NGS Research Team.
 - 2.11.1.4 Oversee the NGS Research Team efforts, and review draft and final reports, interim information, and draft and final submittals.
- 2.12 Identify the Amount of Wastewater that is Available and Feasible to Recycle in California (Component 9B)
- Objectives: Identify the amount of treated municipal wastewater that is currently available for recycled water production in California and projected to be available in the future. Determine how much of the available treated municipal wastewater is feasible to produce for reuse, considering minimum instream flows, water quality, proximity to potential recycle water users, and cost.
- 2.12.1 Establish and oversee a Recycled Water Project Advisory Committee (RW PAC) of experts. Submit *curricula vitae* for members of the RW PAC to the Grant Manager and DWQ Technical Coordinator. The RW PAC shall:
 - 2.12.1.1 Develop and solicit a request for proposals to meet the research objective of Component 9B and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.12.1.2 Review and rank proposals based on criteria provided by the Recipient and select an RW Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for

members of the RW Research Team to the Grant Manager and DWQ Technical Coordinator. The RW Research Team shall:

- 2.12.1.2.1 Identify the amount of treated municipal wastewater currently available for recycled water production in California and project the amount expected to be available by researching the State Water Board and Regional Water Boards' records of volumes of wastewater discharges and associated treatment levels, considering any required minimum instream flows.
 - 2.12.1.2.2 Estimate the amount of available municipal wastewater identified in Item 2.12.1.2.1 that could be used if treated to California Code of Regulations, Title 22 recycled water treatment standards, by evaluating potential users and uses of the recycled water estimated at a planning level.
 - 2.12.1.2.3 Analyze the cost of treating the available municipal wastewater to the following recycled water treatment standards as defined under California Code of Regulations, Title 22, Division 4: undisinfected secondary, disinfected secondary-23, disinfected secondary-2.2, disinfected tertiary, full advanced treatment.
 - 2.12.1.2.4 Summarize the data and findings from Items 2.12.1.2.1 through 2.12.1.2.3 on the amount of treated municipal wastewater available and foreseeably available that is feasible to produce and reuse, including the associated costs.
 - 2.12.1.2.5 Prepare a draft Component 9B Research Report on the work completed in Items 2.12.1.2.1 through 2.12.1.2.4 and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.12.1.2.6 Complete a final Component 9B Research Report incorporating any comments received in Item 2.12.1.2.5 and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.12.1.2.7 Host a webinar on Research Component 9B findings following submission of the final report. Submit webinar agenda and presentation materials to the Grant Manager and DWQ Technical Coordinator.
 - 2.12.1.3 Provide recommendations, technical oversight, and objective feedback to the RW Research Team.
 - 2.12.1.4 Oversee the RW Research Team efforts, and review draft and final reports, interim information, and draft and final submittals.
- 2.13 Develop a New Foundational Understanding of SAR-Soil Structure Interactions to Provide Management Options for Recycled Water Use in Agriculture (Component 10B)
- Objectives: Understand how recycled water used for agriculture irrigation affects plant and soil interactions by investigating sodium absorption ratio (SAR)/electro-conductivity (EC) interactions between recycled water and soil parameters (e.g., textural classes, mineralogy, soil organic matter content).

- 2.13.1 Establish and oversee a SAR-Soil Project Advisory Committee (SAR-Soil PAC) of experts. Submit *curricula vitae* for members of the SAR-Soil PAC to the Grant Manager and DWQ Technical Coordinator. The SAR-Soil PAC shall:
 - 2.13.1.1 Develop and solicit a request for proposals to meet the research objective of Component 10B and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.13.1.2 Review and rank proposals based on criteria provided by the Recipient and select an SAR-Soil Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the SAR-Soil Research Team to the Grant Manager and DWQ Technical Coordinator. The SAR-Soil Research Team shall:
 - 2.13.1.2.1 Conduct a literature review to document SAR/EC interactions between recycled water and soil parameters, and plant-soil interactions affected by recycled water used for irrigation.
 - 2.13.1.2.2 Evaluate water quality requirements for recycled water used for agricultural irrigation that minimize impacts to soil structure and crop fertility.
 - 2.13.1.2.3 Conduct experiments to investigate interactions between crops, soil and recycled water, crop yield responses, and impacts to soil structure, including comparative field plots to demonstrate sustainability of using recycled water for agricultural irrigation.
 - 2.13.1.2.4 Investigate remediation options for sodium affected soils.
 - 2.13.1.2.5 Develop guidance for selecting plant and soil combinations when recycled water or brine from advanced water treatment is used for irrigation.
 - 2.13.1.2.6 Prepare a draft Component 10B Research Report on the work completed pursuant to Items 2.13.1.2.1 through 2.13.1.2.5 and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.13.1.2.7 Complete a final Component 10B Research Report incorporating any comments received in Item 2.13.1.2.6 and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.13.1.3 Provide recommendations, technical oversight, and objective feedback to the SAR-Soil Research Team.
 - 2.13.1.4 Oversee the SAR-Soil Research Team efforts, and review draft and final reports, interim information, and draft and final submittals.
- 2.14 Assess the State of Knowledge and Impacts of Recycled Water Irrigation on Agricultural Crops (Component 11B)

Objectives: Investigate how and to what degree the impacts of salinity, sodium, and chloride affect the growth and production of different crops (e.g., grain crops, vegetables, fruits, and other specialty crops); how recycled water used for agricultural irrigation affects the growth and productivity of crops, including investigating the association between soil health and recycled water properties such as total dissolved salts (TDS), sodium absorption ratio (SAR), sodium and chloride concentrations; and provide management guidelines for sustainable application of recycled water with different crops and systems.

- 2.14.1 Establish and oversee a Crops Project Advisory Committee (Crops PAC) of experts. Submit *curricula vitae* for members of the Crops PAC to the Grant Manager and DWQ Technical Coordinator. The Crops PAC shall:
 - 2.14.1.1 Develop and solicit a request for proposals to meet the research objective of Component 11B and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.14.1.2 Review and rank proposals based on criteria provided by the Recipient and select a Crops Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the Crops Research Team to the Grant Manager and DWQ Technical Coordinator. The Crops Research Team shall:
 - 2.14.1.2.1 Conduct a literature review to understand the impacts of recycled water on agriculture production and growth, and the level of treatment required for various crops. Identify knowledge gaps and future research needs for this field.
 - 2.14.1.2.1.1 Evaluate case studies where reuse for agricultural purposes has been implemented.
 - 2.14.1.2.2 Investigate risk concerns, such as TDS, Na, Cl, B, and other constituents associated with recycled water for agricultural irrigation and identify what research or data is needed to address the risk.
 - 2.14.1.2.3 Evaluate the impacts recycled water characteristics have on soil health and farming sustainability in areas irrigated by recycled water.
 - 2.14.1.2.4 Develop a quantitative risk assessment framework and management guidelines for agriculture farmers using recycled water for irrigation.
 - 2.14.1.2.5 Evaluate different strategies for sustainable application of recycled water with different cropping systems.
 - 2.14.1.2.6 Prepare a draft Component 11B Research Report on the work completed in Items 2.14.1.2.1 through 2.14.1.2.5 and submit to the Grant Manager and DWQ Technical Coordinator for comment.

- 2.14.1.2.7 Complete the final Component 11B Research Report incorporating any comments received in Item 2.14.1.2.6 and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.14.1.3 Provide recommendations, technical oversight, and objective feedback to the Crops Research Team.
 - 2.14.1.4 Oversee the Crops Research Team efforts, and review draft and final reports, interim information, and draft and final submittals.
- 2.15 Potential of Oilfield Produced Water for Irrigation in California (Component 12B)
- Objectives: Compare the scientific and policy history of California Code of Regulations, Title 22 recycled water regulations to past and current practice of oilfield produced water (OPW) reuse to make recommendations on the future directions for OPW reuse. Identify the quality of OPW reused for irrigation and understand the limitations of using OPW for agriculture irrigation and develop a Fit-For-Purpose solution framework that can make OPW reuse more approachable. Identify the feasibility and availability of OPW for reuse to develop an interactive map.
- 2.15.1 Establish and oversee an OPW Project Advisory Committee (OPW PAC) consisting of industry and academic experts. Submit *curricula vitae* for members of the OPW PAC to the Grant Manager and DWQ Technical Coordinator. The OPW PAC shall:
 - 2.15.1.1 Develop and solicit a request for proposals to meet the research objective of Component 12B and submit to the Grant Manager and DWQ Technical Coordinator.
 - 2.15.1.2 Review and rank proposals based on criteria provided by the Recipient and select and oversee a winning OPW Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the OPW Research Team to the Grant Manager and DWQ Technical Coordinator. The OPW Research Team shall:
 - 2.15.1.2.1 Conduct a literature review to identify the current state (e.g., amount, uses, and locations) of OPW currently used for irrigation in California and data gaps, understand the procedural and scientific history for developing California Code of Regulations, Title 22 recycled water regulations, and prioritize data needed to support a Fit-For-Purpose classification framework.
 - 2.15.1.2.2 Develop a framework for increasing the use of OPW for agriculture by researching and emulating the scientific and procedural history of California Code of Regulations, Title 22 recycled water regulations.
 - 2.15.1.2.3 Develop a Fit-For-Purpose classification framework for OPW for irrigation.
 - 2.15.1.2.4 Quantify the potential for expanding OPW reuse by collecting and analyzing datasets on the quality of OPW before treatment; state, crop, and soil types by parcel; volume and disposition of OPW

from oil fields in California; cost of water for irrigation by irrigation district; and indicators of current and future water scarcity such as groundwater basins in a state of overdraft, and where fields were fallowed in the 2012-2016 drought.

- 2.15.1.2.4.1 Identify key barriers if the result of this analysis indicates little opportunity for OPW reuse expansion.
- 2.15.1.2.5 Develop an interactive web-based geospatial map that identifies the potential, safety, and cost-effectiveness of OPW reuse expansion by location based on Item 2.15.1.2.4. Submit screenshots to the Grant Manager and DWQ Technical Coordinator.
- 2.15.1.2.6 Prepare a draft OPW Guidance Document on the developed frameworks and the outputs of the geospatial model and submit to the Grant Manager and DWQ Technical Coordinator for comment.
- 2.15.1.2.7 Complete a final OPW Guidance Document incorporating any comments received in Item 2.15.1.2.6 and submit to the Grant Manager and DWQ Technical Coordinator.
- 2.15.1.2.8 Prepare a draft Component 12B Research Report on the work completed pursuant to Items 2.15.1.2.1 through 2.15.1.2.7 and submit to the Grant Manager and DWQ Technical Coordinator for comment.
- 2.15.1.2.9 Complete a final Component 12B Research Report incorporating any comments received in Item 2.15.1.2.8 and submit to the Grant Manager and DWQ Technical Coordinator.
- 2.15.1.3 Provide recommendations, technical oversight, and objective feedback to the OPW Research Team.
- 2.15.1.4 Oversee the OPW Research Team efforts, and review draft and final reports, interim information, and draft and final submittals.

Phase 3: Research Identified in 2019

2.16 Potable and Non-Potable Water Reuse Research Projects for 2019

Objective: Using the Recipient's established research process in collaboration with the Grant Manager and DWQ Technical Coordinator, the Recipient will identify and fund the highest priority potable and non-potable (including urban, agricultural, industrial, and produced water) reuse Research for 2019 that will expand the scientific understanding of recycled water in California, including advances in fields such as source control, treatment technologies; monitoring of treatment system performance; water quality monitoring including pathogens, constituents of emerging concern, surrogates, and indicator compounds; data collection, integration, management, and interpretation for advanced water treatment systems; operations and operators; antibiotic resistant bacteria, antibiotic resistance genes, and mobile genetic elements; concentrate treatment and management.

- 2.16.1 In 2019, convene at least the following subgroups of the Water Reuse and Desalination AC: Potable Reuse, Agricultural Reuse, and Industrial and Produced Water Reuse, and submit a list of AC members and their affiliations to the Grant Manager and DWQ Technical Coordinator. Each AC subgroup shall:
 - 2.16.1.1 Develop the research approach and tasks for each research project description, draft the schedules and budgets, and recommend potential Project Advisory Committee members to the Recipient.
 - 2.16.1.2 Review and refine the research project descriptions.
 - 2.16.1.3 Prioritize the research project descriptions based on their potential to expand reuse in the State, and submit a prioritized list of research project descriptions to the Recipient that is within the budget allocated to each AC subgroup for the year by the Recipient.
 - 2.16.2 Review the research priorities of the AC subgroups and submit a prioritized list of research projects list (Proposed 2019 Research List) to the Grant Manager and DWQ Technical Coordinator for approval and research selection (Approved 2019 Research List). The Proposed 2019 Research List shall include research descriptions and estimated budgets for each research priority.
 - 2.16.3 Develop the research objective(s), scope of work, budget, submittals, and submittal schedule for each research project on the Approved 2019 Research List, which will be provided by the Grant Manager, and submit this information to the Grant Manager and DWQ Technical Coordinator.
 - 2.16.4 The Recipient shall not commence work on the Approved 2019 Research List until (1) the Grant Manager has reviewed the information submitted by the Recipient in Item 4.2.16.3 and the Division has determined which research priorities to fund, and (2) this Agreement is amended in writing and executed by the Recipient and the State Water Board to incorporate a detailed scope of work, budget, and any other terms that the State Water Board determines is necessary or desirable for funding the Approved 2019 Research List.
- 2.17 Guidelines for the Demonstration of Pathogen Log Removal Credits in Wastewater Treatment (Component 1C)
- Objectives: Develop guidance for crediting water resource recovery facilities (WRRF) with pathogen log reduction values.
- 2.17.1 Establish and oversee a pathogen Project Advisory Committee (Pathogen PAC) of experts in pathogen log removal credits in wastewater treatment. Submit all *curricula vitae* for members of the Pathogen PAC to the Grant Manager and DWQ Technical Coordinator. The Pathogen PAC shall:
 - 2.17.1.1 Develop and solicit a request for proposals to meet the research objective of Component 1C and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.17.1.2 Review and rank proposals based on criteria provided by the Recipient and select and oversee a Pathogen Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the Pathogen Research Team to the

Grant Manager and DWQ Technical Coordinator. The Pathogen Research Team shall:

- 2.17.1.2.1 Conduct a literature review from peer-reviewed literature, published and unpublished data from related Recipient-funded research, and past and existing treatment facilities to compile data on pathogen log removal credits in wastewater treatment.
 - 2.17.1.2.2 Develop evidence-based guidance for determining pathogen reduction from raw wastewater through secondary treatment and tertiary-level treatments.
 - 2.17.1.2.3 Provide recommendations for use of pathogen log removals in developing Title-22 engineering reports.
 - 2.17.1.2.4 Develop a draft guidance document summarizing the work completed in Items 2.17.1.2.1 through 2.17.1.2.3 and submit it to the Pathogen PAC, Grant Manager, and DWQ Technical Coordinator.
 - 2.17.1.2.5 Complete a final guidance document incorporating any comments received in Item 2.17.1.2.4 and submit it to the Pathogen PAC, Grant Manager, and DWQ Technical Coordinator.
 - 2.17.1.3 Provide recommendations, technical oversight, and objective feedback to the Pathogen Research Team.
 - 2.17.1.4 Oversee the Pathogen Research Team efforts, and review reports, interim information, and draft submittals.
- 2.18 Integrate Real-Time Collection (RTC) System Monitoring Approaches into Enhanced Source Control Programs for Potable Reuse (Component 2C)
- Objectives: Determine what level of real-time collection system monitoring is feasible, appropriate, and/or necessary for protection of downstream potable reuse. Develop a framework for integrating real-time monitoring (RTM) into existing pretreatment program requirements (permits, local limits, etc.), including data management and security considerations.
- 2.18.1 Establish and oversee an Intelligent Water Systems/Real Time Control (IWS/RTC) Project Advisory Committee (IWS/RTC PAC) of experts. Submit all *curricula vitae* for members of the IWS/RTC PAC to the Grant Manager and DWQ Technical Coordinator. The IWS/RTC PAC shall:
 - 2.18.1.1 Develop and solicit a request for proposals to meet the research objective of Component 2C and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.18.1.2 Review and rank proposals based on criteria provided by the Recipient and select and oversee a qualified RTC Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the winning RTC Research Team to the Grant Manager and DWQ Technical Coordinator. The selected RTC Research Team shall:

- 2.18.1.2.1 Review currently available real-time collection system monitoring tools (water quality and flow sensing tools) for feasibility of deployment upstream in the collection system. Consider the market-readiness, existing distribution, and practicality of deploying both technologies upstream in the collection system.
- 2.18.1.2.2 Review current practices in enhanced source control for potable reuse, including existing utility experience with real-time monitoring, and the benefits observed from those projects.
- 2.18.1.2.3 Develop a framework that defines how real-time monitoring can integrate with pretreatment permitting, monitoring, and enforcement activities. Identify potential challenges with that integration (for example, data control and security) and possible solutions to those challenges.
- 2.18.1.2.4 Prepare a draft literature/technology review document for use by the potable reuse industry and submit it to the IWS/RTC PAC, Grant Manager, and DWQ Technical Coordinator for comment.
- 2.18.1.2.5 Complete a final literature/technology review document incorporating any comments received in Item 2.18.1.2.4 and submit it to the IWS/RTC PAC, Grant Manager, and DWQ Technical Coordinator.
- 2.18.1.2.6 Develop a draft guidance document for integration of real-time data into a utility's existing pretreatment program for use by the potable reuse industry and by facilities with pretreatment programs and submit it to the IWS/RTC PAC, Grant Manager, and DWQ Technical Coordinator for comment.
- 2.18.1.2.7 Complete a final guidance document for integration of real-time data into a utility's existing pretreatment program incorporating any comments received in Item 2.18.1.2.6 and submit it to the IWS/RTC PAC, Grant Manager, and DWQ Technical Coordinator.
- 2.18.1.2.8 Develop a draft report summarizing the work completed in Items 2.18.1.2.1 through 2.18.1.2.7 and submit it to the IWS/RTC PAC, Grant Manager, and DWQ Technical Coordinator for comment.
- 2.18.1.2.9 Complete a final report incorporating any comments received in Item 2.18.1.2.8 and submit it to the IWS/RTC PAC, Grant Manager, and DWQ Technical Coordinator.
- 2.18.1.2.10 Conduct a webinar, hosted by the Recipient and collaborating organizations, on the overall findings of Component 2C and facilitate discussion among collaborators.
 - 2.18.1.2.10.1 Submit the webinar agenda and presentation materials to the Grant Manager.

- 2.18.1.3 Provide recommendations, technical oversight, and objective feedback to the selected RTC Research Team.
 - 2.18.1.4 Oversee the selected RTC Research Team efforts, and review reports, interim information, and draft submittals.
- 2.19 Benefits and Challenges in Pathogen Removal for Blending Advanced Treated Water with Raw Water Upstream of a Surface Water Treatment Plant in Direct Potable Reuse (DPR) (Component 3C)
- Objectives: Define the benefits and challenges of conventional drinking water treatment processes following advanced water treatment for DPR and their influence on pathogen removal and public health protection. Provide guidance on how to optimize conventional treatment after blending advanced treated water and raw water supplies. Explore pathogen credit validation approaches for conventional processes (i.e., coagulation, flocculation, sedimentation, and media filtration) when advanced treated water is added prior to conventional processes. Enhance the knowledge of the potential benefits and challenges of blending advanced treated water at surface water treatment plants (SWTP) after filtration and prior to disinfection.
- 2.19.1 Establish and oversee a blending Project Advisory Committee (Blending PAC) of ozone/BAF experts. Submit all *curricula vitae* for members of the Blending PAC to the Grant Manager and DWQ Technical Coordinator. The Blending PAC shall:
 - 2.19.1.1 Develop and solicit a request for proposals to meet the research objectives of Component 3C and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.19.1.2 Review and rank proposals based on criteria provided by the Recipient and select and oversee a Blending Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the Blending Research Team to the Grant Manager and DWQ Technical Coordinator. The Blending Research Team shall:
 - 2.19.1.2.1 Review existing literature on water quality impacts from raw water augmentation on conventional drinking water treatment processes, including review and discussion of pathogen removal in the context of direct potable reuse and a clear identification of downstream surface water treatment processes.
 - 2.19.1.2.2 Conduct water quality and process modeling for raw water augmentation based on water quality from potential raw water augmentation sites including estimated impacts on pathogen removal by conventional treatment processes. Consider the impact of stabilization measures after advanced treatment (e.g., corrosion control) on conventional treatment processes where appropriate.
 - 2.19.1.2.3 Conduct jar testing to validate water quality modeling of the impact of advanced treated water on raw water sources and conventional treatment processes and pathogen removal through

turbidity and other relevant surrogate parameters. Include recommendations for additional testing where appropriate.

- 2.19.1.2.4 Develop recommendations on the benefits and challenges associated with blending advanced treated water with raw water prior to a surface water treatment plant and the impacts on treated water quality and pathogen removal credits.
 - 2.19.1.2.5 Develop a draft report summarizing the work completed in Items 2.19.1.2.1 through 2.19.1.2.4 and submit it to the Blending PAC, Grant Manager, and DWQ Technical Coordinator for comment.
 - 2.19.1.2.6 Complete a final report incorporating any comments received in Item 2.19.1.2.5 and submit it to the Blending PAC, Grant Manager, and DWQ Technical Coordinator.
 - 2.19.1.3 Provide recommendations, technical oversight, and objective feedback to the Blending Research Team.
 - 2.19.1.4 Oversee the Blending Research Team efforts, and review reports, interim information, and draft submittals.
- 2.20 The UV/Chlorine (UV/Cl₂) Advanced Oxidation Process (AOP) in Potable Reuse: Assessment of Applicability, Operational Issues, and Potential By-Products (Component 4C)

Objectives: Understand the current state of the science of UV/Cl₂ AOPs and provide a framework for assisting utilities decide which AOP is most suitable for their treatment application. Develop a report that provides guidance for the potable reuse industry to use UV/Cl₂ AOP technology.

- 2.20.1 Establish and oversee an UV/Cl₂ AOP Project Advisory Committee (UV/Cl₂ PAC) of UV/Cl₂ AOP experts. Submit all *curricula vitae* for members of the UV/Cl₂ AOP PAC to the Grant Manager and DWQ Technical Coordinator. The UV/Cl₂ AOP PAC shall:
 - 2.20.1.1 Develop and solicit a request for proposals to meet the research objective of Component 4C and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.20.1.2 Review and rank proposals based on criteria provided by the Recipient and select and oversee an UV/Cl₂ AOP Research Team. Submit the completed selection criteria, winning proposal, research timeline, and *curricula vitae* for members of the UV/Cl₂ AOP Research Team to the Grant Manager and DWQ Technical Coordinator. The UV/Cl₂ AOP Research Team shall:
 - 2.20.1.2.1 Conduct a literature review from peer-reviewed literature, published and unpublished data from related Recipient-funded research, and past and existing treatment facilities to compile data to develop a current state of the science for UV/Cl₂ AOPs.
 - 2.20.1.2.2 Conduct an in-depth analysis documenting all the collected and sampled data, and the findings regarding UV/Cl₂ as well as a

thorough comparative study with UV/H₂O₂ including a benchmarking study to identify and evaluate the effectiveness of this process.

- 2.20.1.2.3 Identify data gaps, develop a work plan for additional data collection, and conduct sampling and testing of operating UV/Cl₂ facilities including pilot scale facilities to fill data gaps.
 - 2.20.1.2.4 Develop a guidance document that summarizes the significant findings and specify how the UV/Cl₂ AOP technology is being utilized to serve as a reference for utilities implementing this technology.
 - 2.20.1.2.5 Develop recommendations for future research to facilitate the implementation of UV/Cl₂ AOP in potable reuse applications.
 - 2.20.1.2.6 Develop a draft report summarizing the work completed in Items 2.20.1.2.1 through 2.20.1.2.5 and submit it to the UV/Cl₂ AOP PAC, Grant Manager, and DWQ Technical Coordinator for comment.
 - 2.20.1.2.7 Complete a final report incorporating any comments received in Item 2.20.1.2.6 and submit it to the UV/Cl₂ AOP PAC, Grant Manager, and DWQ Technical Coordinator.
 - 2.20.1.3 Provide recommendations, technical oversight, and objective feedback to the UV/Cl₂ AOP Research Team.
 - 2.20.1.4 Oversee the UV/Cl₂ AOP Research Team efforts, and review reports, interim information, and draft submittals.
- 2.21 Geochemical Considerations for Managed Aquifer Recharge (MAR) Implementation in Potable Reuse (Component 5C)
- Objectives: Estimate the influence of geochemical conditions on the fate of regulated and unregulated contaminants during MAR. Identify AWT effluent water quality parameters of interest (e.g., oxygen reduction potential, TDS, pH, and alkalinity) for aquifer compatibility, including the impact of disinfection on geochemistry. Develop direction for stabilizing AWT effluent to mitigate mobilization of aquifer geochemistry (e.g., arsenic, chromium) prior to recharge. Provide guidance to utilities considering MAR that includes potential application point impacts (e.g., shallow vs. deep well), water quality compatibility considerations, and monitoring techniques for risk mitigation.
- 2.21.1 Establish and oversee a Project Advisory Committee (Geochemical MAR PAC) of MAR experts. Submit all *curricula vitae* for members of the Geochemical MAR PAC to the Grant Manager and DWQ Technical Coordinator. The Geochemical MAR PAC shall:
 - 2.21.1.1 Develop and solicit a request for proposals to meet the research objective of Component 5C and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.21.1.2 Review and rank proposals based on criteria provided by the Recipient and select and oversee a Geochemical MAR Research Team. Submit

the completed selection criteria, winning proposal, research timeline, and curricula vitae for members of the Geochemical MAR Research Team to the Grant Manager and DWQ Technical Coordinator. The Geochemical MAR Research Team shall:

- 2.21.1.2.1 Provide a literature review that includes analysis of drinking water and recycled water ASR geochemical evaluations, range of AWT effluent water quality conditions, important geochemical water quality monitoring parameters, and other factors that characterize the materials in the aquifer itself.
 - 2.21.1.2.2 Provide a review of current potable reuse MAR case studies that describes geochemical compatibility approaches across geographic regions.
 - 2.21.1.2.3 Propose water quality conditioning options to stabilize AWT effluent with aquifer geochemistry (e.g., chemical addition, quenching agents) focusing on, but not limited to, preventing the leaching of existing contaminants within an aquifer.
 - 2.21.1.2.4 Develop a decision support framework for a MAR geochemical assessment to guide project planning and implementation.
 - 2.21.1.2.5 Develop a draft report summarizing the work completed in Items 2.21.1.2.1 through 2.21.1.2.4 and submit it to the Geochemical MAR PAC, Grant Manager, and DWQ Technical Coordinator for comment.
 - 2.21.1.2.6 Complete a final report incorporating any comments received in Item 2.21.1.2.5 and submit it to the Geochemical MAR PAC, Grant Manager, and DWQ Technical Coordinator.
 - 2.21.1.2.7 Conduct a webinar, hosted by the Recipient and collaborating organizations, on the overall findings of Component 5C and facilitate discussion among collaborators.
 - 2.21.1.2.7.1 Submit the webinar agenda and presentation materials to the Grant Manager.
 - 2.21.1.3 Provide recommendations, technical oversight, and objective feedback to the Geochemical MAR Research Team.
 - 2.21.1.4 Oversee the Geochemical MAR Research Team efforts, and review reports, interim information, and draft submittals.
- 2.22 Standardize Methods with QA/QC Standards for Investigating the Occurrence and Removal of Antibiotic-Resistant Bacteria/Antibiotic Resistance Genes (ARB/ARG) in Surface Water, Wastewater, and Recycled Water (Component 6C)

Objective: Develop a consensus for a standardized approach to profile ARB and ARG that can be used to generate comparable data to be used in future research to validate the analytical methods and identify QA/QC components and data quality objectives.

- 2.22.1 Establish and oversee an ARB/ARG PAC. Submit *curricula vitae* for members of the ARB/ARG PAC to the Grant Manager and DWQ Technical Coordinator. The ARB/ARG PAC shall:
- 2.22.1.1 Develop and solicit a request for proposals to meet the research objective for Component 6C and submit to the Grant Manager and DWQ Technical Coordinator for comment.
 - 2.22.1.2 Review and rank proposals based on criteria provided by the Recipient and select an ARB/ARG Research Team. Submit the completed selection criteria, winning proposal, research timeline and *curricula vitae* for members of the ARB/ARG Research Team to the Grant Manager and DWQ Technical Coordinator. The ARB/ARG Research Team shall:
 - 2.22.1.2.1 Review literature and data to compile evidence on the state of the science of the occurrence and removal of ARB/ARG.
 - 2.22.1.2.2 Identify ARB/ARGs with molecular analytical methods that could be used in routine monitoring of surface water, wastewater, and recycled water.
 - 2.22.1.2.3 Assess the utility of selected ARB/ARGs to recommend the most effective candidates to monitor.
 - 2.22.1.2.4 Conduct a minimum of one (1) workshop to bring researchers from academia, industry, and consulting firms to achieve a consensus on the SOP and Quality Assurance Project Plan (QAPP) components.
 - 2.22.1.2.5 Develop the SOP and QAPP components to conduct laboratory-based testing of the methods selected in Items 2.22.1.2.2 and 2.22.1.2.3.
 - 2.22.1.2.6 Conduct laboratory-based testing of the method(s) selected in Items 2.22.1.2.2 and 2.22.1.2.3.
 - 2.22.1.2.7 Develop a draft report describing the work completed in items 2.22.1.2.1 through 2.22.1.2.6 and submit it to the ARB/ARG PAC, Grant Manager, and DWQ Technical Coordinator for comment.
 - 2.22.1.2.8 Complete a final report incorporating any comments received in Item 2.22.1.2.6 and submit it to the ARB/ARG PAC, Grant Manager, and DWQ Technical Coordinator.
 - 2.22.1.3 Provide recommendations, technical oversight, and objective feedback to the ARB/ARG Research Team.
 - 2.22.1.4 Oversee the ARB/ARG Research Team efforts, and review reports, interim information, and draft submittals.

A-5. Disclosure

The Recipient shall include the following disclosure statement in any document, written report, or brochure prepared in whole or in part pursuant to this Agreement:

"Funding has been provided in full or in part through an agreement with the State Water Resources Control Board using funds from Proposition 1. The contents of this document do not necessarily reflect the views and policies of the foregoing, nor does mention of trade names or commercial products constitute endorsement or recommendation for use."

A-6. Reporting

- (a) Progress Reports. The Recipient shall submit quarterly progress reports, using a format provided by the Grant Manager, within forty-five (45) days following the end of the calendar quarter (March, June, September, and December) to the Grant Manager. Progress reports shall provide a brief description of activities that have occurred, milestones achieved, monitoring results (if applicable), and any problems encountered in the performance of the work under this Agreement during the applicable reporting period. Reporting shall be required even if no grant-related activities occurred during the reporting period. The Recipient shall document all activities and expenditures in progress reports, including work performed by contractors.
- (b) As Needed Information or Reports. The Recipient agrees to provide expeditiously, during the term of this Agreement, such reports, data, and information as may be reasonably required by the Division including, but not limited to, material necessary or appropriate for evaluation of the funding program or to fulfill any reporting requirements of the state or federal government.
- (c) Annual Progress Summaries. The Recipient shall prepare and submit an Annual Progress Summary, using a format provided by the Grant Manager, annually by November 15 that covers the time period from October 1 of the previous year through September 30 of the current year to the Grant Manager. The summary must be no more than five (5) pages, and shall include pictures as appropriate. The summary shall include, at a minimum, the following:
 - (1) A summary of the conditions the Research is meant to alleviate, the Research objective, the scope of the Research, and a description of the approach used to achieve the Research objective.
 - (2) A summary of the progress made to date, significant milestones achieved, and the current schedule of completing the Research.
- (d) Final Reports. At the conclusion of the Research, the Recipient must submit the following to the Grant Manager:
 - (1) Draft Final Research Report. Prepare and submit to the Grant Manager, for review and comment, a draft Final Research Report in a format provided by the Grant Manager.
 - (2) Final Research Report. Prepare a Final Research Report that addresses, to the extent feasible, comments made by the Grant Manager on the draft Final Research Report. Submit one (1) reproducible master copy and an electronic copy of the final.
 - (3) Final Research Summary. Prepare a brief summary of the information contained in the Final Research Report, using a format provided by the Grant Manager, and include accomplishments, recommendations, and lessons learned, as appropriate.

A-7. Submittal Schedule

Failure to provide items by the due dates indicated in the Submittal Schedule below may constitute a material violation of this Agreement. However, the dates in the “Estimated Due Date” column of this Submittal Schedule may be adjusted as necessary during the Disbursement Period with Grant Manager approval. All work or submittals must be achieved with relevant submittals approved by the Division prior to the Research Completion Date, and the final Disbursement Request submitted prior to the Final Disbursement Request Date set forth in Exhibit B.

ITEM	DESCRIPTION OF SUBMITTAL	CRITICAL DUE DATE	ESTIMATED DUE DATE
EXHIBIT A-4 RESEARCH-SPECIFIC SCOPE OF WORK			
1.	Grant Administration		
1.2	Notification of meetings, workshops, webinars, and trainings		15 Working Days Prior
1.3	Status Review Meetings		As Needed
1.4	Summary of Total Research Cost with Match Funds	Complete	
1.6	Documents Developed to Disseminate Findings from this Research		Ongoing
2.	Research Implementation		
Phase 1: Research Identified in 2017			
2.1	Evaluation of Constituents of Emerging Concern Removal by Ozone/Biological Activated Filtration Treatment (Component 1A)		
2.1.1	<i>Curricula Vitae</i> for Members of the Ozone/BAF PAC		Complete
2.1.1.1	Request for Proposals		Complete
2.1.1.2	Completed Selection Criteria, Winning Proposal, Research Timeline, and <i>Curricula Vitae</i> for Members of the Ozone/BAF Research Team		Complete
2.1.1.2.5	Draft Guidance Document from Ozone/BAF Research Team	October 31, 2023	
2.1.1.2.6	Final Guidance Document from Ozone/BAF Research Team	December 31, 2023	
2.1.1.2.7	Draft Report from Ozone/BAF Research Team	October 31, 2023	
2.1.1.2.8	Final Report from Ozone/BAF Research Team	December 31, 2023	
2.2	Understand Wastewater Treatment Performance on Advanced Water Treatment Processes and Finished Water Quality (Component 2A)		
2.2.1	<i>Curricula Vitae</i> for Members of the WWT PAC		
2.2.1.1	Request for Proposals		Complete
2.2.1.2	Completed Selection Criteria, Winning Proposal, Research Timeline, and <i>Curricula Vitae</i> for Members of the WWT Research Team		Complete

ITEM	DESCRIPTION OF SUBMITTAL	CRITICAL DUE DATE	ESTIMATED DUE DATE
EXHIBIT A-4 RESEARCH-SPECIFIC SCOPE OF WORK			
2.2.1.2.6	Draft Report from WWT Research Team	October 31, 2023	
2.2.1.2.7	Final Report from WWT Research Team	December 31, 2023	
2.3	Potable and Non-Potable Water Reuse Research Projects for 2018		
2.3.1	List of 2018 AC Members and their Affiliation for the AC Relevant to the Research		Complete
2.3.2	Proposed 2018 Research List	Complete	
2.3.3	Research Objective(s), Scope of Work, Budget, Submittals, and Submittal Schedule for Each Research Project on Approved 2018 Research List	Complete	
Phase 2: Research Identified in 2018			
2.4	Integration of High-Frequency Performance Data for Microbial and Chemical Compounds Control in Potable Reuse Treatment Systems (Component 1B)		
2.4.1	Monitoring/Control PAC <i>Curricula Vitae</i>		Complete
2.4.1.1	Component 1B Request for Proposals		Complete
2.4.1.2	Monitoring/Control Research Team completed selection criteria, winning proposal, research timeline, and <i>Curricula Vitae</i>		Complete
2.4.1.2.8	Draft Component 1B Research Report	October 31, 2023	
2.4.1.2.9	Final Component 1B Research Report	December 31, 2023	
2.5	Compile Evidence of Pathogen Reduction through Managed Aquifer Recharge (MAR) and Recovery (Component 2B)		
2.5.1	MAR PAC <i>Curricula Vitae</i>		Complete
2.5.1.1	Component 2B Request for Proposals		Complete
2.5.1.2	MAR Research Team completed selection criteria, winning proposal, research timeline, and <i>Curricula Vitae</i>		Complete
2.5.1.2.3	Draft Component 2B Research Report	October 31, 2023	
2.5.1.2.4	Final Component 2B Research Report	December 31, 2023	
2.6	New Techniques, Tools, and Validation Protocols for Achieving Log Removal Credit across NF and RO Membranes (Component 3B)		
2.6.1	NF/RO PAC <i>Curricula Vitae</i>		Complete
2.6.1.1	Component 3B Request for Proposal		Complete
2.6.1.2	NF/RO Research Team completed selection criteria, winning proposal, research timeline, and <i>Curricula Vitae</i>		Complete
2.6.1.2.6	Draft Component 3B Research Report	October 31, 2023	

ITEM	DESCRIPTION OF SUBMITTAL	CRITICAL DUE DATE	ESTIMATED DUE DATE
EXHIBIT A-4 RESEARCH-SPECIFIC SCOPE OF WORK			
2.6.1.2.7	Final Component 3B Research Report	December 31, 2023	
2.7	Evaluation of a Validation protocol for Membrane Bioreactors Based on a Correlated Surrogate to Achieve Pathogen Credit for Potable Reuse (Component 4B)		
2.7.1	MBR PAC <i>Curricula Vitae</i>		Complete
2.7.1.1	Component 4B Request for Proposal		Complete
2.7.1.2	MBR Research Team completed selection criteria, winning proposal, research timeline, and <i>Curricula Vitae</i>		Complete
2.7.1.2.4	Draft Component 4B Research Report	October 31, 2023	
2.7.1.2.5	Final Component 4B Research Report	December 31, 2023	
2.8	Indicator Viruses to Confirm Performance of Advanced Physical Treatment (Component 5B)		
2.8.1	Treatment Performance PAC <i>Curricula Vitae</i>		Complete
2.8.1.1	Component 5B Request for Proposal		Complete
2.8.1.2	Treatment Performance Research Team completed selection criteria, winning proposal, research timeline, and <i>Curricula Vitae</i>		Complete
2.8.1.2.6	Draft Component 5B Research Report	October 31, 2023	
2.8.1.2.7	Final Component 5B Research Report	December 31, 2023	
2.9	Review of Industrial Contaminants Associated with Water Quality or Adverse Performance Impacts for Potable Reuse Treatment (Component 6B)		
2.9.1	Industrial PAC <i>Curricula Vitae</i>		Complete
2.9.1.1	Component 6B Request for Proposal		Complete
2.9.1.2	Industrial Research Team completed selection criteria, winning proposal, research timeline, and <i>Curricula Vitae</i>		Complete
2.9.1.2.4	Draft Source Water Guidance Document		October 2023
2.9.1.2.5	Final Source Water Guidance Document		December 2023
2.9.1.2.6	Draft Component 6B Report	October 31, 2023	
2.9.1.2.7	Final Component 6B Report	December 31, 2023	
2.10	Considerations and Blending Strategies for Drinking Water System Integration with Alternative Water Supplies (Component 7B)		
2.10.1	Blending PAC <i>Curricula Vitae</i>		Complete
2.10.1.1	Component 7B Request for Proposals		Complete
2.10.1.2	Blending Research Team completed selection criteria, winning proposal, research timeline, and <i>Curricula Vitae</i>		Complete

ITEM	DESCRIPTION OF SUBMITTAL	CRITICAL DUE DATE	ESTIMATED DUE DATE
EXHIBIT A-4 RESEARCH-SPECIFIC SCOPE OF WORK			
2.10.1.2.5	Draft Component 7B Research Report	October 31, 2023	
2.10.1.2.6	Final Component 7B Research Report	December 31, 2023	
2.11	The Use of Next Generation Sequencing (NGS) Technologies and Metagenomics Approaches for Water Monitoring (Component 8B)		
2.11.1	NGS PAC <i>Curricula Vitae</i>	Complete	
2.11.1.1	Component 8B Request for Proposals	Complete	
2.11.1.2	NGS Research Team completed selection criteria, winning proposal, research timeline, and <i>Curricula Vitae</i>	Complete	
2.11.1.2.5	Draft Component 8B Research Report	October 31, 2023	
2.11.1.2.6	Final Component 8B Research Report	December 31, 2023	
2.12	Identify the Amount of Wastewater that is Available and Feasible to Recycle in California (Component 9B)		
2.12.1	RW PAC <i>Curricula Vitae</i>		Complete
2.12.1.1	Component 9B Request for Proposals		Complete
2.12.1.2	RW Research Team completed selection criteria, winning proposal, research timeline, and <i>Curricula Vitae</i>		Complete
2.12.1.2.5	Draft Component 9B Research Report	October 31, 2023	
2.12.1.2.6	Final Component 9B Research Report	December 31, 2023	
2.12.1.2.7	Webinar Agenda and Presentation Materials		December 2023
2.13	Develop a New Foundational Understanding of SAR-Soil Structure Interactions to Provide Management Options for Recycled Water Use in Agriculture (Component 10B)		
2.13.1	SAR-Soil PAC <i>Curricula Vitae</i>		Complete
2.13.1.1	Component 10B Request for Proposals		Complete
2.13.1.2	SAR-Soil Research Team completed selection criteria, winning proposal, research timeline, and <i>Curricula Vitae</i>		Complete
2.13.1.2.6	Draft Component 10B Research Report	October 31, 2023	
2.13.1.2.7	Final Component 10B Research Report	December 31, 2023	
2.14	Assess the State of Knowledge and Impacts of Recycled Water Irrigation on Agricultural Crops (Component 11B)		
2.14.1	Crops PAC <i>Curricula Vitae</i>		Complete
2.14.1.1	Component 11B Request for Proposals		Complete

ITEM	DESCRIPTION OF SUBMITTAL	CRITICAL DUE DATE	ESTIMATED DUE DATE
EXHIBIT A-4 RESEARCH-SPECIFIC SCOPE OF WORK			
2.14.1.2	Crops Research Team completed selection criteria, winning proposal, research timeline, and <i>Curricula Vitae</i>		Complete
2.14.1.2.6	Draft Component 11B Research Report	October 31, 2023	
2.14.1.2.7	Final Component 11B Research Report	December 31, 2023	
2.15	Identifying the Potential of Oilfield Produced Water for Irrigation in California (Component 12B)		
2.15.1	OPW PAC <i>Curricula Vitae</i>		Complete
2.15.1.1	Component 12B Request for Proposals		Complete
2.15.1.2	Research Team completed selection criteria, winning proposal, research timeline, and <i>Curricula Vitae</i>		Complete
2.15.1.2.5	Web-based Geospatial Map		November 2022
2.15.1.2.6	Draft OPW Guidance Document		October 2023
2.15.1.2.7	Final OPW Guidance Document		December 2023
2.15.1.2.8	Draft Component 12B Research Report	October 31, 2023	
2.15.1.2.9	Final Component 12B Research Report	December 31, 2023	
Phase 3: Research Identified in 2019			
2.16	Potable and Non-Potable Water Reuse Research Projects for 2019		
2.16.1	List of 2019 AC Members and their Affiliation for the AC Relevant to the Research		Complete
2.16.2	Proposed 2019 Research List	Complete	
2.16.3	Research Objective(s), Scope of Work, Budget, Submittals, and Submittal Schedule for each Research Project on Approved 2019 Research List	Complete	
2.17	Guidelines for the Demonstration of Pathogen Log Removal Credits in Wastewater Treatment (Component 1C)		
2.17.1	Pathogen PAC <i>Curricula Vitae</i>		Complete
2.17.1.1	Component 1C Request for Proposals		Complete
2.17.1.2	Selection Criteria, Winning Proposal, Research Timeline, and <i>Curricula Vitae</i> from Members of the Pathogen Research Team		October 2020
2.17.1.2.4	Draft Guidance Document from Pathogen Research Team	October 31, 2023	
2.17.1.2.5	Final Guidance Document from Pathogen Research Team	December 31, 2023	

ITEM	DESCRIPTION OF SUBMITTAL	CRITICAL DUE DATE	ESTIMATED DUE DATE
EXHIBIT A-4 RESEARCH-SPECIFIC SCOPE OF WORK			
2.18	Integrate Real-Time Collection System Monitoring Approaches into Enhanced Source Control Programs for Potable Reuse (Component 2C)		
2.18.1	IWS/RTC PAC <i>Curricula Vitae</i>		Complete
2.18.1.1	Component 2C Request for Proposals		Complete
2.18.1.2	Selection Criteria, Winning Proposal, Research Timeline, and <i>Curricula Vitae</i> from Members of the IWS/RTC Research Team		Complete
2.18.1.2.4	Draft Literature/Technology Review		April 2021
2.18.1.2.5	Final Literature/Technology Review		July 2021
2.18.1.2.6	Draft Guidance Document from IWS/RTC Research Team		April 2021
2.18.1.2.7	Final Guidance Document from IWS/RTC Research Team		July 2021
2.18.1.2.8	Draft Report from IWS/RTC Research Team	October 31, 2023	
2.18.1.2.9	Final Report from IWS/RTC Research Team	December 31, 2023	
2.18.1.2.10.1	Webinar Agenda and Presentation Materials		December 2021
2.19	Benefits and Challenges in Pathogen Removal for Blending Advanced Treated Water with Raw Water Upstream of a Surface Water Treatment Plant in DPR (Component 3C)		
2.19.1	Blending PAC <i>Curricula Vitae</i>		Complete
2.19.1,1	Component 3C Request for Proposals		Complete
2.19.1.2	Selection Criteria, Winning Proposal, Research Timeline, and <i>Curricula Vitae</i> from Members of the Blending Research Team		October 2020
2.19.1.2.5	Draft Report from Blending Research Team	October 31, 2023	
2.19.1.2.6	Final Report from Blending Research Team	December 31, 2023	
2.20	The UV/Chlorine AOP in Potable Reuse: Assessment of Applicability, Operational Issues, and Potential By-Products (Component 4C)		
2.20.1	UV/Cl ₂ AOP PAC <i>Curricula Vitae</i>		Complete
2.20.1.1	Component 4C Request for Proposals		Complete
2.20.1.2	Selection Criteria, Winning Proposal, Research Timeline, and <i>Curricula Vitae</i> from members of the UV/Cl ₂ AOP Research Team		Complete
2.20.1.2.6	Draft Report from UV/Cl ₂ AOP Research Team	October 31, 2023	
2.20.1.2.7	Final Report from UV/Cl ₂ AOP Research Team	December 31, 2023	
2.21	Geochemical Considerations for MAR Implementation in Potable Reuse (Component 5C)		
2.21.1	Geochemical MAR PAC <i>Curricula Vitae</i>		Complete

ITEM	DESCRIPTION OF SUBMITTAL	CRITICAL DUE DATE	ESTIMATED DUE DATE
EXHIBIT A-4 RESEARCH-SPECIFIC SCOPE OF WORK			
2.21.1.1	Component 5C Request for Proposals		Complete
2.21.1.2	Selection Criteria, Winning Proposal, Research Timeline, and <i>Curricula Vitae</i> from Members of the Geochemical MAR Research Team		Complete
2.21.1.2.5	Draft Report from Geochemical MAR Research Team	October 31, 2023	
2.21.1.2.6	Final Report from Geochemical MAR Research Team	December 31, 2023	
2.21.1.2.7.1	Webinar Agenda and Presentation Materials		October 31, 2021
2.22	Standardize Methods with QA/QC Standards for Investigating the Occurrence and Removal of ARB/ARGS in Surface Water, Wastewater, and Recycled Water (Component 6C)		
2.22.1	ARB/ARG PAC <i>Curricula Vitae</i>		Complete
2.22.1.1	Component 6C Request for Proposals		Complete
2.22.1.2	Selection Criteria, Winning Proposal, Research Timeline, and <i>Curricula Vitae</i> for Members of the ARB/ARG Research Team		Complete
2.22.1.2.7	Draft Report from ARB/ARG Research Team	October 31, 2023	
2.22.1.2.8	Final Report from ARB/ARG Research Team	December 31, 2023	
EXHIBIT A-5 REPORTING			
(a)	Progress Reports	Quarterly	
(b)	As Needed Information or Reports		As Needed
(c)	Annual Progress Summaries	Annually by November 15	
(d)	Final Reports		
(d)(1)	Draft Final Research Report	December 31, 2023	
(d)(2)	Final Research Report	January 31, 2024	
(d)(3)	Final Research Summary	Before Research Completion Date	
EXHIBIT B – FUNDING PROVISIONS			
3(b)	Final Disbursement Request	March 31, 2024	
8(b)(4)	Disbursement Requests	Quarterly	

EXHIBIT B – FUNDING TERMS

B-1. Research Funding

The maximum amount of Grant Funds that may be available under this agreement is THREE MILLION ONE HUNDRED FOURTEEN THOUSAND ONE HUNDRED DOLLARS (\$3,114,100).

Subject to the terms of this Agreement, the State Water Board agrees to provide Grant Funds in the amount not to exceed FIVE HUNDRED TWENTY-TWO THOUSAND EIGHT HUNDRED THIRTY-FIVE DOLLARS (\$522,835) for Direct Research Administration Costs upon the Recipient's submittal of eligible items for Exhibit A-4 "Scope of Work."

Subject to the terms of this Agreement, the State Water Board agrees to provide Grant Funds in the amount not to exceed FOUR HUNDRED THOUSAND DOLLARS (\$400,000) for Research Costs for Phase 1 of A-4 "Scope of Work" upon receipt of the submittals in Phase 1 (Components 1A and 2A) per Section A-7 of Exhibit A.

Subject to the terms of this Agreement, the State Water Board may provide Grant Funds in an amount not to exceed ONE MILLION FIVE HUNDRED SIXTY-SIX THOUSAND EIGHT HUNDRED NINETY-SEVEN DOLLARS (\$1,566,897) for Research Costs for Phase 2 of A-4 "Scope of Work" upon the Recipient's submittal of items for Phase 2 (Components 1B through 12B) per section A-7 of Exhibit A.

Subject to the terms of this Agreement, the State Water Board may provide Grant Funds in an amount not to exceed SIX HUNDRED TWENTY-FOUR THOUSAND THREE HUNDRED SIXTY-EIGHT DOLLARS (\$624,368) for Research Costs for Phase 3 of A-4 "Scope of Work" upon the Recipient's submittal of items for Phase 3 (Components 1C through 6C) per Section A-7 of Exhibit A.

B-2. Estimated Reasonable Total Research Cost

The estimated reasonable cost of the total Research is THREE MILLION ONE HUNDRED FOURTEEN THOUSAND ONE HUNDRED DOLLARS (\$3,114,100).

B-3. Funding Dates

- (a) The Eligible Start Date is MARCH 1, 2018. Otherwise eligible costs incurred prior to this date will not be reimbursed.
- (b) The Final Disbursement Request Date is MARCH 31, 2024. The Deputy Director of the Division may extend this date for good cause. Extensions may require an amendment to this Agreement. All Disbursement Requests must be submitted to the Division such that they are received prior to this date. Late Disbursement Requests will not be honored, and remaining amounts will be deobligated.

B-4. Funding Conditions and Exclusions

The State Water Board's disbursement of funds hereunder is contingent on the Recipient's compliance with the terms and conditions of this Agreement.

Grant Funds may not be used for any Indirect Costs. Any Disbursement Request submitted including Indirect Costs will cause that Disbursement Request, in its entirety, to be disputed and will not be paid until the dispute is resolved. This prohibition applies to the Recipient and any subcontract or sub-agreement for work on the Research that will be reimbursed with Grant Funds pursuant to this Agreement. (Gov. Code, § 16727.)

B-5. Budget Summary

LINE ITEM	GRANT FUNDS	TOTAL RESEARCH COSTS
Direct Research Administration Costs	\$522,835	\$522,835
Research		
Phase 1 Research	\$400,000	\$400,000
Phase 2 Research	\$1,566,897	\$1,566,897
Phase 3 Research	\$624,368	\$624,368
Equipment	\$0	\$0
Monitoring/Performance	\$0	\$0
Education/Outreach	\$0	\$0
TOTAL	\$3,114,100	\$3,114,100

B-6. Budget Flexibility

- (a) Subject to the prior review and approval of the Grant Manager, adjustments between existing line items may be used to defray allowable direct costs up to fifteen percent (15%) of the Grant Funds amount, including any amendment(s) thereto. Line item adjustments in excess of fifteen percent (15%) require an Agreement amendment. If the detailed budget includes an amount for the Recipient's personnel costs, that amount is based on the hours, classifications, and rates submitted by the Recipient in its application. Any changes to the hours, classifications, and rates must be approved, in advance and in writing, by the Grant Manager.
- (b) The Recipient may submit a request for an adjustment in writing to the Grant Manager. Such adjustment may not increase or decrease the total grant amount. The Recipient shall submit a copy of the original Agreement budget sheet reflecting the requested changes and shall note proposed changes by striking out the original amount(s) followed with proposed change(s) in bold and underlined. Budget adjustments deleting a budget line item or adding a new budget line item shall require a formal amendment. The Division may also propose budget adjustments.
- (c) The sum of adjusted line items shall not exceed the total budget amount.

B-7. Amounts Payable by the Recipient

The Recipient agrees to pay any and all costs connected with the Research including, without limitation, any and all Research Costs. If the Grant Funds are not sufficient to pay the Research Costs in full, the Recipient shall nonetheless complete the Research and pay that portion of the Research Costs in excess of available Grant Funds, and shall not be entitled to any reimbursement therefor from the State Water Board.

B-8. Disbursement of Grant Funds; Availability of Grant Funds

- (a) The State Water Board's obligation to disburse Grant Funds is contingent upon the availability of sufficient funds to permit the disbursements provided for herein. If sufficient funds are not available for any reason including, but not limited to, failure of the State government to appropriate funds necessary for disbursement of Grant Funds, the State Water Board shall not be obligated to make any disbursements to the Recipient under this Agreement. This provision shall

be construed as a condition precedent to the obligation of the State Water Board to make any disbursements under this Agreement. Nothing in this Agreement shall be construed to provide the Recipient with a right of priority for disbursement over any other recipient. If any disbursements due the Recipient under this Agreement are deferred because sufficient funds are unavailable, it is the intention of the State Water Board that such disbursement will be made to the Recipient when sufficient funds do become available, but this intention is not binding. If this Agreement's funding for any Fiscal Year expires due to reversion or is reduced, substantially delayed, or deleted by the Budget Act, by Executive Order, or by order or action of the Department of Finance, the State shall have the option to either cancel this Agreement with no liability accruing to the State, or offer an amendment to the Recipient to reflect the reduced amount.

- (b) Except as may be otherwise provided in this Agreement, disbursement of Grant Funds will be made as follows:
- (1) Upon execution and delivery of this Agreement, the Recipient may submit a Disbursement Request for eligible Research Costs to the State Water Board using the Disbursement Request form and the Reimbursement Request form provided by the Grant Manager.
 - (2) Disbursement Requests shall contain the following information:
 - a. The date of the request;
 - b. The time period covered by the request, i.e., the term "from" and "to";
 - c. The total amount requested;
 - d. Original signature and date (in ink) of Recipient's Project Director or their designee; and
 - e. The Final Disbursement Request shall be clearly marked "FINAL DISBURSEMENT REQUEST" and shall be submitted NO LATER THAN MARCH 31, 2024.
 - (3) Disbursement Requests must be itemized based on the line items specified in the budget in this Exhibit. Disbursement Requests must be signed by the Project Director or their designee and must be addressed to the Grant Manager as set forth in the Party Contacts section of this Agreement. Requests for disbursement submitted in any other format than the one provided by the State Water Board will cause a Disbursement Request to be disputed. In the event of such a dispute, the Grant Manager will notify the Recipient. Payment will not be made until the dispute is resolved and a corrected Disbursement Request submitted. The Grant Manager has the responsibility for approving Disbursement Requests. Disbursement Requests must be complete and signed by the Recipient's Project Director or their designee. Research Costs incurred prior to the Eligible Start Date of this Agreement will not be reimbursed.
 - (4) Grant Funds must be requested quarterly via Disbursement Request for eligible costs incurred during the reporting period of the corresponding Progress Report, describing the activities and expenditures for which the disbursement is being requested. Each Disbursement Request must be accompanied by a Progress Report. Failure to provide timely Disbursement Requests may result in such requests not being honored.
 - (5) The Recipient agrees that it will not submit any Disbursement Requests that include any Research Costs until such costs have been incurred and are currently due and payable by the Recipient; although, the actual payment of such costs by the Recipient is not required as a condition of the Disbursement Request. Supporting documentation (e.g., receipts)

must be submitted with each Disbursement Request. The amount requested for administration costs must include a calculation formula (i.e., hours or days worked times the hourly or daily rate = total amount claimed). Disbursement of Grant Funds will be made only after receipt of a complete, adequately supported, properly documented and accurately addressed Disbursement Request.

- (6) The Recipient will not seek reimbursement of any Research Costs that have been reimbursed from other funding sources.
- (7) The Recipient shall use Grant Funds within thirty (30) days of receipt to reimburse contractors, vendors, and other Research Costs. Any interest earned on Grant Funds shall be reported to the State Water Board and will either be required to be returned to the State Water Board or deducted from future disbursements. In the event that the Recipient fails to disburse Grant Funds to contractors or vendors within thirty (30) days from receipt of the Grant Funds, the Recipient shall immediately return such Grant Funds to the State Water Board. Interest shall accrue on such Grant Funds from the date of disbursement through the date of mailing of Grant Funds to the State Water Board. If the Recipient held such Grant Funds in interest-bearing accounts, any interest earned on the Grant Funds shall also be due to the State Water Board.
- (8) The Recipient shall submit its final Disbursement Request no later than the Final Disbursement Request Date specified herein unless prior approval is granted by the Division. If the Recipient fails to do so, then the undisbursed balance of this Agreement will be deobligated.
- (9) The Recipient agrees that it will not request a disbursement unless that cost is allowable, reasonable, and allocable.
- (10) Notwithstanding any other provision of this Agreement, no disbursement shall be required at any time or in any manner that is in violation of or in conflict with federal or state laws, policies, or regulations.
- (11) The Recipient agrees that it shall not be entitled to interest earned on undisbursed Grant Funds.
- (12) Any reimbursement for necessary travel and per diem shall be at rates not to exceed those set by the California Department of Human Resources. These rates may be found at <http://www.calhr.ca.gov/employees/Pages/travel-reimbursements.aspx>. Reimbursement will be at the State travel and per diem amounts that are current as of the date costs are incurred by the Recipient. No travel outside the State of California shall be reimbursed unless prior written authorization is obtained from the Grant Manager.
- (13) The Recipient must include any other documents or requests required or allowed under this Agreement.

B-9. Withholding of Disbursements and Material Violations

- (a) Notwithstanding any other provision of this Agreement, the Recipient agrees that the State Water Board may retain an amount equal to ten percent (10%) of the Grant Funds until Research Completion. Any retained amounts due to the Recipient will be promptly disbursed to the Recipient, without interest, upon Research Completion.
- (b) The State Water Board may withhold all or any portion of the funds provided for by this Agreement in the event that:

- (1) The Recipient has materially violated, or threatens to materially violate, any term, provision, condition, or commitment of this Agreement; or
- (2) The Recipient fails to maintain reasonable progress toward Research Completion.

B-10. Remaining Balance

In the event the Recipient does not request all of the Grant Funds encumbered under this Agreement, any remaining Grant Funds revert to the State.

B-11. Fraud and Misuse of Public Funds

All Disbursement Requests submitted shall be accurate and signed under penalty of perjury. Any and all costs submitted pursuant to this Agreement shall only be for the tasks set forth herein. The Recipient shall not submit any Disbursement Request containing costs that are ineligible or have been reimbursed from other funding sources unless required and specifically noted as such. Any eligible costs for which the Recipient is seeking reimbursement shall not be reimbursed from any other source. Double or multiple billing for time, services, or any other eligible cost is illegal and constitutes fraud. Any suspected occurrences of fraud, forgery, embezzlement, theft, or any other misuse of public funds may result in suspension of disbursements of Grant Funds and/or termination of this Agreement requiring the repayment of all funds disbursed hereunder. Additionally, the Deputy Director of the Division may request an audit and refer the matter to the Attorney General's Office or the appropriate district attorney's office for criminal prosecution or the imposition of civil liability. (Civ. Code, §§ 1572-1573; Pen. Code, §§ 470, 489-490.)

EXHIBIT C – GENERAL TERMS AND CONDITIONS

C-1. Access and Public Records

The Recipient shall ensure that the State Water Board, the Governor of the State, or any authorized representative of the foregoing, will have safe and suitable access to the Research site at all reasonable times during Research work. The Recipient acknowledges that, except for a subset of information regarding archaeological records, the Research records and locations are public records including, but not limited to, all of the submissions accompanying the application, all of the documents incorporated by Exhibit A, and all reports, Disbursement Requests, and supporting documentation submitted hereunder.

C-2. Amendment

No amendment or variation of the terms of this Agreement shall be valid unless made in writing and signed by both the Recipient and the Deputy Director or designee. Requests for amendments shall be made in writing and directed to the Grant Manager and Deputy Director. No oral understanding or agreement not incorporated in this Agreement is binding on any of the parties.

C-3. Assignability

This Agreement is not assignable by the Recipient, either in whole or in part, without the consent of the State Water Board in the form of a formal written amendment to this Agreement.

C-4. Audits and Accounting Standards

- (a) The Division may call for an audit of financial information relative to the Research if the Division determines that an audit is desirable to assure program integrity or if an audit becomes necessary because of state or federal requirements. If an audit is called for, the audit shall be performed by a Certified Public Accountant independent of the Recipient and at the cost of the Recipient. The audit shall be in the form required by the Division.
- (b) Audit disallowances will be returned to the State Water Board. Failure to comply with audit disallowance provisions shall disqualify the Recipient from participating in State Water Board funding programs.
- (c) The Recipient shall maintain accounts in accordance with GAAP as issued by the Governmental Accounting Standards Board or its successor. The Recipient agrees that, at a minimum, its fiscal control and accounting procedures will be sufficient to permit preparation of reports for the tracking of Grant Funds to a level of expenditure adequate to establish that such funds have not been used in violation of state law or the terms of this Agreement.

C-5. Claims

Any claim of the Recipient is limited to the rights, remedies, and claims procedures provided to the Recipient under this Agreement.

C-6. Competitive Bidding

The Recipient shall adhere to any applicable state or local ordinance for competitive bidding and applicable labor laws. If the Recipient is a private entity, any construction contracts related in any way to the Research shall be led by competitive bid procedures that ensure award of such contracts to the lowest responsible bidders. The Recipient shall not award a construction contract until a summary of bids and identification of the selected lowest responsible bidder is submitted to and approved in writing by the

Division. The Recipient must provide a full explanation if the Recipient is proposing to award a construction contract to anyone other than the lowest responsible bidder.

C-7. Compliance with Law

The Recipient shall, at all times, comply with and require its contractors and subcontractors to comply with all applicable federal and state laws, rules, guidelines, regulations, and requirements.

C-8. Conflict of Interest

The Recipient certifies that its owners, officers, directors, agents, representatives, and employees are in compliance with applicable state and federal conflict of interest laws.

C-9. Damages for Breach Affecting Tax-Exempt Status or Federal Compliance

In the event that any breach of any of the provisions of this Agreement by the Recipient shall result in the loss of tax-exempt status for any bonds of the State or any subdivision or agency thereof, including bonds issued on behalf of the State Water Board, or if such breach shall result in an obligation on the part of the State or any subdivision or agency thereof to reimburse the federal government by reason of any arbitrage profits, the Recipient shall immediately reimburse the State or any subdivision or agency thereof in an amount equal to any damages paid by or loss incurred by the State or any subdivision or agency thereof due to such breach. In the event that any breach of any of the provisions of this Agreement by the Recipient shall result in the failure of Grant Funds to be used pursuant to the provisions of this Agreement, or if such breach shall result in an obligation on the part of the State or any subdivision or agency thereof to reimburse the federal government, the Recipient shall immediately reimburse the State or any subdivision or agency thereof in an amount equal to any damages paid by or loss incurred by the State or any subdivision or agency thereof due to such breach.

C-10. Disputes

- (a) The Recipient may appeal a staff decision within 30 days to the Deputy Director of the Division or designee, for a final Division decision. The Recipient may appeal a final Division decision to the State Water Board within 30 days. The Office of the Chief Counsel of the State Water Board will prepare a summary of the dispute and make recommendations relative to its final resolution, which will be provided to the State Water Board's Executive Director and each State Water Board Member. Upon the motion of any State Water Board Member, the State Water Board will review and resolve the dispute in the manner determined by the State Water Board. Should the State Water Board determine not to review the final Division decision, this decision will represent a final agency action on the dispute.
- (b) This clause does not preclude consideration of legal questions, provided that nothing herein shall be construed to make final the decision of the State Water Board, or any official or representative thereof, on any question of law.
- (c) The Recipient shall continue with the responsibilities under this Agreement during any dispute.
- (d) This Section 6 relating to disputes does not establish an exclusive procedure for resolving claims within the meaning of Government Code sections 930 and 930.4.

C-11. Governing Law

This Agreement is governed by and shall be interpreted in accordance with the laws of the State of California.

C-12. Income Restrictions

The Recipient agrees that any refunds, rebates, credits, or other amounts (including any interest thereon) accruing to or received by the Recipient under this Agreement shall be paid by the Recipient to the State Water Board, to the extent that they are properly allocable to costs for which the Recipient has been reimbursed by the State Water Board under this Agreement.

C-13. Indemnification and State Reviews

The parties agree that review or approval of Research plans and specifications by the State Water Board is for administrative purposes only, including conformity with application and eligibility criteria, and expressly not for the purposes of design defect review or construction feasibility, and does not relieve the Recipient of its responsibility to properly plan, design, construct, operate, and maintain the Research. To the extent permitted by law, the Recipient agrees to indemnify, defend, and hold harmless the State Water Board, and any trustee, and their officers, employees, and agents, if any (collectively, "Indemnified Persons"), against any loss or liability arising out of any claim or action brought against any Indemnified Persons from and against any and all losses, claims, damages, liabilities, or expenses, of every conceivable kind, character, and nature whatsoever arising out of, resulting from, or in any way connected with (1) the Research or the conditions, use, possession, conduct, or management of, work done in or about, or the planning, design, acquisition, installation, or construction, of the Research or any part thereof; (2) the carrying out of any of the transactions contemplated by this Agreement or any related document; (3) any violation of any applicable law, rule or regulation, any environmental law (including, without limitation, the Federal Comprehensive Environmental Response, Compensation and Liability Act, the Resource Conservation and Recovery Act, the California Hazardous Substance Account Act, the Federal Water Pollution Control Act, the Clean Air Act, the Toxic Substances Control Act, the Occupational Safety and Health Act, the Safe Drinking Water Act, the California Hazardous Waste Control Law, and California Water Code Section 13304, and any successors to said laws), rule or regulation or the release of any toxic substance on or near the Research; or (4) any untrue statement or alleged untrue statement of any material fact or omission or alleged omission to state a material fact necessary to make the statements required to be stated therein, in light of the circumstances under which they were made, not misleading with respect to any information provided by the Recipient for use in any disclosure document utilized in connection with any of the transactions contemplated by this Agreement. The Recipient shall also provide for the defense and indemnification of the Indemnified Parties in any contractual provision extending indemnity to the Recipient in any contract let for the performance of any work under this Agreement, and shall cause the Indemnified Parties to be included within the scope of any provision for the indemnification and defense of the Recipient in any contract or subcontract. To the fullest extent permitted by law, the Recipient agrees to pay and discharge any judgment or award entered or made against Indemnified Persons with respect to any such claim or action, and any settlement, compromise or other voluntary resolution. The provisions of this section shall survive the term of this Agreement and the discharge of the Recipient's obligation hereunder.

C-14. Independent Actor

The Recipient, and its agents and employees, if any, in the performance of this Agreement, shall act in an independent capacity and not as officers, employees, or agents of the State Water Board.

C-15. Insurance

The Recipient shall maintain any insurance necessary to protect against losses that might disrupt or delay the Research or otherwise cause a material violation of this Agreement.

C-16. Integration

This Agreement is the complete and final Agreement between the parties.

C-17. Non-Discrimination Clause

- (a) The Recipient shall not travel to, or hold any meetings in, states that are identified by the Attorney General pursuant to Government Code section 11139.8 and listed at <https://oag.ca.gov/ab1887> (or other web address in effect at the time) in connection with the Research. No work or travel outside the State of California is permitted in connection with the Research unless the Division provides prior written authorization.
- (b) The Recipient shall comply with Government Code section 11135 and the implementing regulations (Cal. Code Regs, tit. 2, § 11140 et seq.), including, but not limited to, ensuring that no person is unlawfully denied full and equal access to the benefits of, or unlawfully subjected to discrimination in the operation of, the Research on the basis of sex, race, color, religion, ancestry, national origin, ethnic group identification, age, mental disability, physical disability, medical condition, genetic information, marital status, or sexual orientation as such terms are defined under California law.
- (c) If Grant Funds are used to acquire or improve real property, the Recipient shall include a covenant of nondiscrimination running with the land in the instrument effecting or recording the transfer of such real property.
- (d) The Recipient shall comply with the federal American with Disabilities Act of 1990 and implementing regulations as required by Government Code section 11135(b).
- (e) The Recipient's obligations under this section shall survive the term of this Agreement.
- (f) During the performance of this Agreement, Recipient and its contractors and subcontractors shall not unlawfully discriminate, harass, or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, sexual orientation, physical disability (including HIV and AIDS), mental disability, medical condition (cancer), age (over 40), marital status, denial of family care leave, or genetic information, gender, gender identity, gender expression, or military and veteran status.
- (g) The Recipient, its contractors, and subcontractors shall ensure that the evaluation and treatment of their employees and applicants for employment are free from such discrimination and harassment.
- (h) The Recipient, its contractors, and subcontractors shall comply with the provisions of the Fair Employment and Housing Act and the applicable regulations promulgated thereunder. (Gov. Code, §12990, subs. (a)-(f) et seq.; Cal. Code Regs., tit. 2, § 7285 et seq.) Such regulations are incorporated into this Agreement by reference and made a part hereof as if set forth in full.
- (i) The Recipient, its contractors, and subcontractors shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement.
- (j) The Recipient shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under this Agreement.

C-18. No Obligation of the State

Any obligation of the State Water Board herein contained shall not be an obligation, debt, or liability of the State and any such obligation shall be payable solely out of the monies encumbered pursuant to this Agreement.

C-19. No Third Party Rights

The parties to this Agreement do not create rights in, or grant remedies to, any third party as a beneficiary of this Agreement, or of any duty, covenant, obligation, or undertaking established herein.

C-20. Other Assistance

If funding for Research Costs is made available to the Recipient from sources other than this Agreement, the Recipient shall notify the Division. The Recipient may retain such funding up to an amount which equals the Recipient's local share of Research Costs. To the extent allowed by requirements of other funding sources, excess funding shall be remitted to the State Water Board.

C-21. Permits, Subcontracting, and Remedies

The Recipient shall comply in all material respects with all applicable federal, state and local laws, rules and regulations. Recipient shall procure all permits, licenses and other authorizations necessary to accomplish the work contemplated in this Agreement, pay all charges and fees, and give all notices necessary and incidental to the due and lawful prosecution of the work. Signed copies of any such permits or licenses shall be submitted to the Division before the Research begins.

The Recipient shall not contract or allow subcontracting with excluded parties. The Recipient shall not contract with any party who is debarred or suspended or otherwise excluded from or ineligible for participation in any work overseen, directed, funded, or administered by the State Water Board program for which this funding is authorized. For any work related to this Agreement, the Recipient shall not contract with any individual or organization on the State Water Board's List of Disqualified Businesses and Persons that is identified as debarred or suspended or otherwise excluded from or ineligible for participation in any work overseen, directed, funded, or administered by the State Water Board program for which funding under this Agreement is authorized. The State Water Board's List of Disqualified Businesses and Persons is located at

http://www.waterboards.ca.gov/water_issues/programs/enforcement/fwa/dbp.shtml

C-22. Prevailing Wages

The Recipient agrees to be bound by all applicable provisions of the State Labor Code regarding prevailing wages. The Recipient shall monitor all agreements subject to reimbursement from this Agreement to ensure that the prevailing wage provisions of the State Labor Code are being met.

C-23. Professionals

The Recipient agrees that only professionals with valid licenses in the State of California will be used to perform services under this Agreement where such services are called for. All technical reports required pursuant to this Agreement that involve planning, investigation, evaluation, design, or other work requiring interpretation and proper application of engineering, architecture, or geologic sciences shall be prepared by or under the direction of persons registered to practice in California. All technical reports must contain the statement of the qualifications of the responsible registered professional(s). Technical reports must bear the signature(s) and seal(s) of the registered professional(s) in a manner such that all work can be clearly attributed to the professional responsible for the work.

C-24. Public Funding

This Research is publicly funded. Any service provider or contractor with which the Recipient contracts must not have any role or relationship with the Recipient, that, in effect, substantially limits the Recipient's

ability to exercise its rights, including cancellation rights, under the contract, based on all the facts and circumstances.

C-25. Recipient's Responsibility for Work

The Recipient shall be responsible for all work and for persons or entities engaged in work performed pursuant to this Agreement including, but not limited to, contractors, subcontractors, suppliers, and providers of services. The Recipient shall be responsible for responding to any and all disputes arising out of its contracts for work on the Research. The State Water Board will not mediate disputes between the Recipient and any other entity concerning responsibility for performance of work.

C-26. Records

- (a) Without limitation of the requirement to maintain Research accounts in accordance with GAAP, the Recipient shall:
- (1) Establish an official file for the Research which adequately documents all significant actions relative to the Research;
 - (2) Establish separate accounts which will adequately and accurately depict all amounts received and expended on the Research, including all assistance funds received under this Agreement;
 - (3) Establish separate accounts which will adequately depict all income received which is attributable to the Research, specifically including any income attributable to assistance funds disbursed under this Agreement;
 - (4) Establish an accounting system which will accurately depict final total costs of the Research, including both direct and indirect costs;
 - (5) Establish such accounts and maintain such records as may be necessary for the State to fulfill federal reporting requirements, including any and all reporting requirements under federal tax statutes or regulations; and
 - (6) If Force Account is used by the Recipient for any phase of the Research, other than for planning, design, and construction engineering and administration provided for by allowance, accounts will be established which reasonably document all employee hours charged to the Research and the associated tasks performed by each employee. Indirect Force Account costs are not eligible for funding.
- (b) The Recipient shall maintain separate books, records and other material relative to the Research. The Recipient shall also retain such books, records, and other material for itself and for each contractor or subcontractor who performed or performs work on this research for a minimum of thirty-six (36) years after Research Completion. The Recipient shall require that such books, records, and other material are subject at all reasonable times (at a minimum during normal business hours) to inspection, copying, and audit by the State Water Board, the Bureau of State Audits, or any authorized representatives of the aforementioned. The Recipient shall allow and shall require its contractors to allow interviews during normal business hours of any employees who might reasonably have information related to such records. The Recipient agrees to include a similar duty regarding audit, interviews, and records retention in any contract or subcontract related to the performance of this Agreement. The provisions of this section shall survive the term of this Agreement.

C-27. Related Litigation

Under no circumstances may the Recipient use Grant Funds from any disbursement under this Agreement to pay costs associated with any litigation the Recipient pursues against the State Water Board or any Regional Water Quality Control Board. Regardless of the outcome of any such litigation, and notwithstanding any conflicting language in this Agreement, the Recipient agrees to repay all of the disbursed Grant Funds plus interest in the event that Recipient does not complete the Research.

C-28. Reports

The Recipient shall provide expeditiously, during the term of this Agreement, any reports, data, and information reasonably required by the Division including, but not limited to, material necessary or appropriate for evaluation of the funding program or to fulfill any reporting requirements of the state or federal government.

C-29. Rights in Data

The Recipient agrees that all data, plans, drawings, specifications, reports, computer programs, operating manuals, notes, and other written or graphic work produced in the performance of this Agreement are subject to the rights of the State as set forth in this section. The State shall have the right to reproduce, publish, and use all such work, or any part thereof, in any manner and for any purposes whatsoever and to authorize others to do so. If any such work is copyrightable, the Recipient may copyright the same, except that, as to any work which is copyrighted by the Recipient, the State reserves a royalty-free, nonexclusive, and irrevocable license to reproduce, publish, and use such work, or any part thereof, and to authorize others to do so, and to receive electronic copies from the Recipient upon request.

The Recipient shall comply with the California Taxpayer Access to Publicly Funded Research Act (Gov. Code section 13989 et seq). As a condition of receiving disbursements under this Agreement, the Recipient shall (1) ensure that any publishing or copyright agreement concerning peer-reviewed manuscripts comply with Government Code section 13989.6; and (2) report to the State Water Board on the final disposition of a peer-reviewed manuscript, including, but not limited to, if it was published, when it was published, where it was published, and, when the 12-month time period expires pursuant to subdivision (b) of Government Code section 13989.6 expires, where the peer-reviewed manuscript will be available for open access.

C-30. State Cross-Cutters

Recipient represents that is in in compliance with the following conditions precedent and agrees that it will continue to maintain compliance during the term of this Agreement:

- (a) If Recipient is a water diverter, Recipient must maintain compliance with Water Code section 5103, subdivision (e)(2)(A) by submitting monthly diversion reports to the Division of Water Rights of the State Water Board.
- (b) If Recipient is an “urban water supplier” as defined by Water Code section 10617, Recipient must charge each customer for actual water volume measured by water meter according to the requirements of Water Code sections 526 and 527. Section 527 further requires that such suppliers not subject to section 526 install water meters on all municipal and industrial service connections within their service area by 2025.
- (c) If Recipient is a state or local public agency and the proposed action is covered by the Delta Plan, Recipient must submit certification of research consistency with the Delta Plan to the Delta Stewardship Council according to the requirements of Water Code section 85225 and California Code of Regulations, title 23, section 5002.

- (d) California Environmental Quality Act (CEQA). Implementation and construction activities must comply with CEQA and potentially other environmental review requirements, including the National Environmental Policy Act (NEPA). Proceeding with work subject to CEQA and/or NEPA without environmental clearance by the State Water Board shall constitute a breach of a material provision of this Agreement.

C-31. State Water Board Action; Costs and Attorney Fees

Any remedy provided in this Agreement is in addition to and not in derogation of any other legal or equitable remedy available to the State Water Board as a result of breach of this Agreement by the Recipient, whether such breach occurs before or after completion of the Research, and exercise of any remedy provided by this Agreement by the State Water Board shall not preclude the State Water Board from pursuing any legal remedy or right which would otherwise be available. In the event of litigation between the parties hereto arising from this Agreement, it is agreed that each party shall bear its own costs and attorney fees.

C-32. Termination; Immediate Repayment; Interest

- (a) This Agreement may be terminated by written notice at any time, at the option of the State Water Board, upon an Event of Default, or upon violation by the Recipient of any material provision of this Agreement after such violation has been called to the attention of the Recipient and after failure of the Recipient to bring itself into compliance with the provisions of this Agreement within a reasonable time as established by the Division.
- (b) In the event of such termination, the Recipient agrees, upon demand, to immediately repay to the State Water Board an amount equal to Grant Funds disbursed hereunder, accrued interest, penalty assessments, and additional payments. In the event of termination, interest shall accrue on all amounts due at the highest legal rate of interest from the date that notice of termination is mailed to the Recipient to the date all monies due have been received by the State Water Board.

C-33. Timeliness

Time is of the essence in this Agreement.

C-34. Unenforceable Provision

In the event that any provision of this Agreement is unenforceable or held to be unenforceable, then the parties agree that all other provisions of this Agreement have force and effect and shall not be affected thereby.

C-35. Venue

Any action arising out of this Agreement shall be filed and maintained in the Superior Court in and for the County of Sacramento, California.

C-36. Waiver and Rights of the State Water Board

Any waiver of rights by the State Water Board with respect to a default or other matter arising under this Agreement at any time shall not be considered a waiver of rights with respect to any other default or matter. Any rights and remedies of the State Water Board provided for in this Agreement are in addition to any other rights and remedies provided by law.

EXHIBIT D – SPECIAL CONDITIONS

1. If Recipient is an “urban water supplier” as defined by Water Code section 10617, the Recipient certifies that the Recipient and this Research complies with the Urban Water Management Planning Act (Water Code, § 10610 et seq.). This shall constitute a condition precedent to this Agreement.
2. If Recipient is an agricultural water supplier as defined by Water Code section 10608.12, Recipient must comply with Agricultural Water Management Planning requirements as mandated by Water Code section 10852.
3. If Recipient is an “urban water supplier” as defined by Water Code section 10617 or an “agricultural water supplier” as defined by Water Code section 10608.12, Recipient must comply with water conservation measures established by SBx7-7. (Water Code, Sec. 10608.56.).