

# WATER QUALITY CONTROL POLICY FOR RECYCLED WATER



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**STATE WATER RESOURCES CONTROL BOARD**  
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY



DIVISION OF WATER QUALITY  
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# Water Quality Control Policy for Recycled Water

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<b><u>Acronym</u></b>	<b><u>Definition</u></b>
af	Acre feet
AhR	Aryl hydrocarbon receptor
AOP	Advanced oxidation process
Basin plan	Water quality control plan
BEQ	Bioanalytical equivalent concentration
CEC	Constituent of emerging concern
CEQA	California Environmental Quality Act
DOC	Dissolved organic carbon
ELAP	Environmental Laboratory Accreditation Program
ER- $\alpha$	Estrogen receptor - alpha
GAMA	Groundwater Ambient Monitoring and Assessment
GSP	Groundwater sustainability plan
MEC	Measured environmental concentration
MTL	Monitoring trigger level
NDMA	N-nitrosodimethylamine
NMOR	N-Nitrosomorpholine
Order WQ 2016-0068-DDW	Order WQ 2016-0068-DDW, Water Reclamation Requirements for Recycled Water Use
PFOS	Perfluorooctane sulfonate
PFOA	Perfluorooctanoic acid
Policy	Water Quality Control Policy for Recycled Water
Regional water board	Regional water quality control board
RO	Reverse osmosis
State Water Board	State Water Resources Control Board
STORMS	Strategy to Optimize Resource Management of Stormwater
Uniform Statewide Recycling Criteria	California Code of Regulations, title 22, division 4, chapter 3
U.S. EPA	U.S. Environmental Protection Agency
UV	Ultraviolet
Water Code	California Water Code

## Definitions

The following are definitions of terms used in the Policy.

**Basin Plan amendment:** An amendment to a water quality control plan that has been adopted by the regional water board and approved by the State Water Board and Office of Administrative Law.

**Bioanalytical equivalent concentration (BEQ):** The output from bioanalytical screening tools are referenced to a substance that initiates a physiological response from the receptor (strong agonist) to generate BEQs. A BEQ is generated from a standard curve of a strong agonist for the receptor and is expressed in mass (ng/L) or molar concentration units. A BEQ is typically derived by comparing the 50<sup>th</sup> percentile effect concentration (EC50) or 10<sup>th</sup> percentile effect concentration (EC10) responses of the test sample with the same effect concentration (EC) level of the standard curve. The BEQ is compared to the Monitoring Trigger Level in water for the strong agonist for the receptor used to generate the BEQ. In the event the sample BEQ result is at or below the Reporting Limit in Table 3 of Attachment A, the Reporting Limit shall be used to generate the BEQ.

**Bioanalytical screening:** The use of *in vitro* (cell or protein-based) assays to screen for CECs and measure potential adverse effects of CECs on living cells or tissues. These assays are also known as bioanalytical screening tools.

**Constituents of emerging concern (CECs):** For purposes of this Policy, CECs are defined to be constituents in personal care products; pharmaceuticals; antimicrobials; industrial, agricultural, and household chemicals; naturally-occurring hormones; food additives; transformation products; inorganic constituents; microplastics; and nanomaterials.

**Desalination facility:** An industrial facility that processes water to remove salts and other components from the source water to produce water that is less saline than the source water.

**Enclosed bays:** Enclosed bays are indentations along the coast which enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. This definition includes but is not limited to: Humboldt Bay, Bodega Harbor, Tomales Bay, Drakes Estero, San Francisco Bay, Morro Bay, Los Angeles Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay.

**Estuaries and coastal lagoons:** Estuaries and coastal lagoons are waters at the mouths of streams that serve as mixing zones for fresh and ocean waters during a major portion of the year. Mouths of streams that are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters will generally be considered to extend from a bay or the open ocean to the upstream limit of tidal action but may be considered to extend seaward if significant mixing of fresh and salt water occurs in the open coastal waters. The waters described by this definition include but are not limited to the Sacramento-San Joaquin Delta as defined by section 12220 of the Water Code, Suisun Bay, Carquinez Strait downstream to Carquinez Bridge, and appropriate areas of the Smith, Klamath, Mad, Eel, Noyo, and Russian Rivers.

Groundwater recharge: Indirect potable reuse for groundwater recharge is defined in Water Code section 13561(c), as the planned use of recycled water for replenishment of a groundwater basin or an aquifer that has been designated as a source of water supply for a public water system. Groundwater recharge by surface application is the controlled application of water to a spreading area for infiltration resulting in the recharge of a groundwater basin or an aquifer. Subsurface application is the controlled application of water to a groundwater basin or aquifer by a means other than surface application, such as direct injection through a well.

Health-based CECs: CECs that have toxicological relevance to human health. Some health-based CECs may also serve as performance indicator CECs.

Incidental runoff: Unintended small amounts (volume) of runoff from recycled water use areas, such as unintended, minimal over-spray from sprinklers that escapes the recycled water use area. Water leaving a recycled water use area is not considered incidental if it is due to the facility design, excessive application, intentional overflow or application, or negligence.

Measured environmental concentration (MEC): Concentration measured at the monitoring locations specified in Attachment A.

Method detection limit: The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix.

Monitoring trigger level (MTL): CEC concentrations above which response actions may be required. MTLs were established by the Science Advisory Panel for CECs in Recycled Water in their final report "[Monitoring Strategies for Constituents of Emerging Concern \(CECs\) in Recycled Water – Recommendations of a Science Advisory Panel](#)," dated April 2018.

Non-potable recycled water: Recycled water that is treated for non-potable use pursuant to the uniform statewide recycling criteria in California Code of Regulations, title 22. Non-potable recycled water uses include but are not limited to irrigation, industrial or commercial cooling, supply for recreational impoundment, toilet flushing, and dust control.

Notification level: Health-based advisory levels established by the State Water Board's Division of Drinking Water for chemicals in drinking water that lack maximum contaminant levels. When chemicals are found at concentrations greater than their notification levels, certain requirements and recommendations apply.

Ocean waters: The territorial marine waters of the State as defined by California law to the extent these waters are outside of enclosed bays, estuaries, and coastal lagoons.

Quality assurance project plan (QAPP): A document describing in comprehensive detail the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria.

Performance indicator CECs: CECs that do not have human health relevance but can be used to monitor the efficacy of recycled water treatment processes.

**Permit:** For purposes of this Policy, the term “permit” means an order adopted by a regional water board or the State Water Board prescribing requirements for a recycled water project, including but not limited to water recycling requirements pursuant to Water Code section 13523, master recycling permits pursuant to Water Code section 13523.1, National Pollutant Discharge Elimination System permits pursuant to the Federal Water Pollution Control Act and Water Code section 13377, waste discharge requirements pursuant to Water Code section 13263, and waivers of waste discharge requirements pursuant to Water Code section 13269.

**Raw water augmentation:** The planned placement of recycled water into a system of pipelines or aqueducts that deliver raw water to a drinking water treatment plant that provides water to a public water system as defined in section 116275 of the Health and Safety Code (Water Code § 13561).

**Recycled water:** Water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource (Water Code §13050(n)).

**Recycled water producer:** An entity that is permitted to produce recycled water consistent with California Code of Regulations, title 22 at a wastewater treatment plant or water recycling treatment plant.

**Recycled water project proponent:** An entity seeking permit coverage for a planned recycled water project.

**Regional water board:** A regional water quality control board. All references to regional water board include the executive officer or his/her designee, who may act for the regional water board in carrying out the provisions of this Policy consistent with Water Code section 13223.

**Reporting Limit:** The measured value of an analyte that can be reliably detected and quantified within acceptable limits of precision and bias for a given method. This value is further defined as no lower than the lowest calibration standard performed within the calibration process. Reporting limits are the minimum value below which data are documented as non-detects.

**Reservoir water augmentation:** The planned placement of recycled water into a raw surface water reservoir used as a source of domestic drinking water supply for a public water system or into a constructed system conveying water to such a reservoir (Wat. Code § 13561; also referred to as surface water augmentation in Wat. Code § 13562).

**State Water Board:** The State Water Resources Control Board. All references to the State Water Board include the executive director or his/her designee.

**Surrogate:** A measurable physical or chemical property that can be used to measure the effectiveness of trace organic compound removal by a treatment process and/or provide an indication of a treatment process failure.

**Treated drinking water augmentation:** The planned placement of recycled water into the water distribution system of a public water system, as defined in section 116275 of the Health and Safety Code.

**Water purveyor:** An entity that supplies water.

Wastewater treatment plant: Any of the following, as defined in Water Code section 13625(d):

- (A) Any facility owned by a state, local, or federal agency and used in the treatment or reclamation of sewage and industrial wastes.
- (B) Any privately-owned facility used in the treatment or reclamation of sewage and industrial wastes and regulated by the Public Utilities Commission pursuant to sections 216 and 230.6 of, and Chapter 4 (commencing with Section 701) of Part 1 of Division 1, of the Public Utilities Code.
- (C) Any privately-owned facility used primarily in the treatment or reclamation of sewage for which the state board or a regional board has issued waste discharge requirements.

Consistent with California Code of Regulations, title 23, section 3671, the term “wastewater treatment plant” does not include onsite sewage treatment systems as defined in Water Code section 13290.

Water recycling treatment plant: A wastewater treatment plant that further treats secondary or tertiary effluent, or both, for the purpose of meeting the uniform statewide recycling criteria established pursuant to Water Code section 13521 for the use of recycled water, as defined in Water Code section 13625(g).



## 1. Purpose

- 1.1. The purpose of the Policy for Water Quality Control for Recycled Water (Recycled Water Policy, hereafter Policy) is to encourage the safe use of recycled water from wastewater sources that meets the definition in California Water Code (Water Code) section 13050(n), in a manner that implements state and federal water quality laws and protects public health and the environment.
- 1.2. This Policy provides direction to the regional water quality control boards (regional water boards), proponents of recycled water projects, and the public regarding the methodology and appropriate criteria for the State Water Resources Control Board (State Water Board) and the regional water boards to use when issuing permits for recycled water projects.
- 1.3. All elements of this Policy are to be interpreted in a manner that fully implements state and federal water quality laws and regulations to enhance the environment and put the waters of the state to the fullest use of which they are capable.
- 1.4. This Policy describes the circumstances under which permittees may enroll under statewide water reclamation requirements for recycled water use (e.g., State Water Board [Order WQ 2016-0068-DDW](#)) or choose an alternate permitting mechanism, such as a master recycling permit. The intent of statewide water reclamation requirements for recycled water use is to expedite the permitting of recycled water projects in a manner that implements state and federal water quality laws while allowing the regional water boards to focus their limited resources on projects that require substantial regulatory review due to unique site-specific conditions.
- 1.5. It is the State Water Board's intent to maximize consistency in the permitting of recycled water projects while also preserving sufficient authority and flexibility for the regional water boards to address site-specific conditions.

## 2. Benefits of recycled water

- 2.1. When used in compliance with this Policy, California Code of Regulations, title 22 and all applicable state and federal water quality laws, the State Water Board finds that recycled water is safe for approved uses, and strongly supports recycled water as a safe alternative to fresh water or potable water for such approved uses.
- 2.2. Recycled water is presumed to have a beneficial impact when used in accordance with this Policy and all applicable regulations, that is, when supporting the sustainable use of groundwater and surface water with the intent of substituting for use of fresh water or potable water. Other public agencies are encouraged to use this presumption in evaluating the impacts of recycled water projects on the environment as required by the California Environmental Quality Act (CEQA).
- 2.3. The State Water Board supports the use of recycled water to diversify community water supplies and mitigate the impacts of climate change.

### 3. Goals and reporting requirements to track recycled water

3.1. *Goals.* To support water supply diversity and sustainability and to encourage the increased use of recycled water in California, the State Water Board adopts the following goals:

3.1.1. Increase the use of recycled water from 714,000 acre-feet per year (afy) in 2015 to 1.5 million afy by 2020 and to 2.5 million afy by 2030.

3.1.2. Reuse all dry weather direct discharges of treated wastewater to enclosed bays, estuaries and coastal lagoons, and ocean waters that can be viably put to a beneficial use. For the purpose of this goal, treated wastewater does not include discharges necessary to maintain beneficial uses and brine discharges from recycled water facilities or desalination facilities.

3.1.3. Maximize the use of recycled water in areas where groundwater supplies are in a state of overdraft, to the extent that downstream water rights, instream flow requirements, and public trust resources are protected.

3.2. *Annual reporting requirements.* The State Water Board will evaluate progress toward these goals and revise the goals as necessary. To support this evaluation, the Executive Director will issue an order consistent with Water Code section 13267 and Water Code section 13383 to require wastewater treatment plants and recycled water producers to annually report the information listed in this section. The Executive Director may modify the reporting requirements of this section, as needed, to effectively evaluate progress toward the goals. All volumetric data shall be reported on an annual basis as acre-feet (af) to a database identified by the State Water Board.

3.2.1. *Influent.* Monthly total volume of wastewater collected and treated by the wastewater treatment plant.

3.2.2. *Production.* Monthly volume of wastewater treated, specifying level of treatment.

3.2.3. *Discharge.* Monthly volume of treated wastewater discharged to each of the following, specifying level of treatment:

- Inland surface waters, specifying volume required to maintain minimum instream flow.
- Enclosed bays, estuaries and coastal lagoons, and ocean waters.
- Natural systems, such as wetlands, wildlife habitats, and duck clubs, where augmentation or restoration has occurred, and that are not part of a wastewater treatment plant or water recycling water treatment plant.
- Underground injection wells, such as those classified by U.S. EPA's Underground Injection Control Program, excluding groundwater recharge via subsurface application intended to reduce seawater intrusion into a coastal aquifer with a seawater interface.

- Land, where beneficial use is not taking place, including evaporation or percolation ponds, overland flow, or spray irrigation disposal, excluding pasture or fields with harvested crops.

### 3.2.4. *Reuse.*

#### 3.2.4.1. Monthly volume of recycled water distributed.

#### 3.2.4.2. Annual volume of treated wastewater distributed for beneficial use in compliance with California Code of Regulations, title 22 in each of the use categories listed below.

- Agricultural irrigation: pasture or crop irrigation.
- Landscape irrigation: irrigation of parks, greenbelts, and playgrounds; school yards; athletic fields; cemeteries; residential landscaping, common areas; commercial landscaping; industrial landscaping; and freeway, highway, and street landscaping.
- Golf course irrigation: irrigation of golf courses, including water used to maintain aesthetic impoundments within golf courses.
- Commercial application: commercial facilities, business use (such as laundries and office buildings), car washes, retail nurseries, and appurtenant landscaping that is not separately metered.
- Industrial application: manufacturing facilities, cooling towers, process water, and appurtenant landscaping that is not separately metered.
- Geothermal energy production: augmentation of geothermal fields.
- Other non-potable uses: including but not limited to dust control, flushing sewers, fire protection, fill stations, snow making, and recreational impoundments.
- Groundwater recharge: surface or subsurface application, except for seawater intrusion barrier use.
- Seawater intrusion barrier: groundwater recharge via subsurface application intended to reduce seawater intrusion into a coastal aquifer with a seawater interface.
- Reservoir water augmentation: the planned placement of recycled water into a raw surface water reservoir used as a source of domestic drinking water supply for a public water system, as defined in section 116275 of the Health and Safety Code, or into a constructed system conveying water to such a reservoir (Water Code § 13561).

- Raw water augmentation: the planned placement of recycled water into a system of pipelines or aqueducts that deliver raw water to a drinking water treatment plant that provides water to a public water system as defined in section 116275 of the Health and Safety Code (Water Code § 13561).
- Other potable uses: both indirect and direct potable reuse other than for groundwater recharge, seawater intrusion barrier, reservoir water augmentation, or raw water augmentation.

3.3. The State Water Board and regional water boards will exercise the authority granted to them by the Legislature to the fullest extent possible to encourage the use of recycled water, consistent with state and federal water quality laws and with state and federal laws to protect public health.

3.3.1. Agencies producing recycled water that is available for reuse and not being put to beneficial use shall make that recycled water available to water purveyors for reuse on reasonable terms and conditions. Such terms and conditions may include payment by the water purveyor of a fair and reasonable share of the cost of the recycled water supply and facilities.

3.3.2. It is a waste and unreasonable use of water for water agencies not to use recycled water when recycled water of adequate quality is available and is not being put to beneficial use, pursuant to the conditions established in Water Code sections 13550 *et seq.* The State Water Board shall exercise its authority pursuant to Water Code section 275, as appropriate, to enforce these requirements.

3.4. The State Water Board requests the Public Utilities Commission, Department of Water Resources, State Lands Commission, and Coastal Commission to use their respective authorities to the fullest extent possible to promote and streamline permitting and funding of recycled water projects to assist the State Water Board and the regional water boards in increasing the use of recycled water in California to make progress toward achieving the recycled water goals set forth in 3.1.

#### **4. State agency roles**

The State Water Board recognizes that it shares jurisdiction over regulating the uses of recycled water with the regional water boards. In addition, the State Water Board recognizes several agencies have roles in encouraging the use of recycled water.

4.1. The State Water Board establishes general policies governing the permitting of recycled water projects, develops uniform water recycling criteria appropriate to particular uses of water, processes and approves wastewater change petitions filed by wastewater dischargers for recycled water projects that have the potential to decrease the flow in any portion of a watercourse such as a river or stream, adopts statewide orders for the permitting of recycled water projects, reviews and approves Title 22 engineering reports for recycled water use, and allocates and disperses funding for recycled water projects consistent with its roles of protecting water quality, public health, and sustaining water supplies. The State Water Board exercises general oversight over recycled water projects, including review of regional water board permitting practices,

and leads the effort to meet the recycled water use goals set forth in 3.1. The State Water Board is also responsible for implementing portions of the Sustainable Groundwater Management Act. The State Water Board's responsibilities under the Sustainable Groundwater Management Act are specific to state intervention, which is the process of managing a basin's groundwater resources if local efforts fail.

- 4.2. The regional water boards issue permits that include requirements needed to protect water quality, human health, and the environment consistent with the State and Regional Water Quality Control Plans, Policies, and applicable law. The regional water boards will, pursuant to 3.3, use their authority to the fullest extent possible to encourage the use of recycled water and to streamline permitting of recycled water projects.
- 4.3. The Department of Water Resources is charged with reviewing urban water management plans and, every five years, updating the California Water Plan, including evaluating the quantity of recycled water presently being used, planning for the potential future uses of recycled water, and updating statewide targets for recycled water use, consistent with Water Code section 10608.50(b). Pursuant to Water Code section 13577, the Department of Water Resources is also charged with adopting regulations in the California Plumbing Code to provide design standards to safely plumb buildings with both potable and recycled water systems. The State Water Board and Department of Water Resources work in collaboration to track recycled water volume and use in California. In undertaking these tasks, the Department of Water Resources may rely on annual recycled water production and use data collected by the State Water Board as well as urban water management plans. The Department of Water Resources may share the data from those plans with the State Water Board and the regional water boards. The Department of Water Resources shares with the State Water Board the authority to allocate and distribute bond funding, which can provide incentives for the use of recycled water. The Department of Water Resources is charged with implementing elements of the Sustainable Groundwater Management Act and provides technical and financial assistance to the groundwater sustainability agencies as they develop groundwater sustainability plans (GSPs). The Department of Water Resources also developed GSP regulations and is responsible for reviewing and approving GSPs and with GSP implementation pursuant to Water Code sections 10733, 10733.2, and 10733.8. The Department of Water Resources is charged with reviewing agricultural water management plans every five years and submitting a report to the California Legislature summarizing the status of the plans, pursuant to Water Code section 10845.
- 4.4. The Public Utilities Commission is charged with approving rates and terms of service for the use of recycled water by investor-owned utilities.
- 4.5. The Department of Food and Agriculture is charged with promoting California agriculture and food products and ensuring the safety and quality of these products for the consumer, including products irrigated with recycled water. The State Water Board and Department of Food and Agriculture will work in collaboration to support agricultural diversity and sustainability by working with grower coalitions, third-party technical service providers, public and private agricultural entities, and academia.

## 5. Wastewater change petitions

In many cases, recycled water project proponents will be required to obtain approvals from several regulatory agencies prior to implementing their project. If the proposed recycled water project will result in reduced stream flows, an approved wastewater change petition may be required pursuant to Water Code section 1211 as described below. For this reason, the State Water Board encourages early coordination by the recycled water project proponent with the State Water Board's Division of Water Rights and Division of Financial Assistance, the regional water boards, Department of Water Resources, and Department of Fish and Wildlife in the process of funding and permitting recycled water projects to ensure compliance with Water Code section 1211.

- 5.1. Prior to changing the point of discharge, place of use, or purpose of use of treated wastewater that will decrease the flow in any portion of a watercourse, or receiving state funding for the treatment or use of recycled water, the recycled water project proponent must receive (1) concurrence from the State Water Board's Division of Water Rights that an order approving the change is not required; or (2) State Water Board approval of the proposed change pursuant to Water Code section 1211. The recycled water project proponent shall notify the applicable regional water board and any applicable state funding agency (such as the Division of Financial Assistance of the State Water Board or the Department of Water Resources) of the concurrence or approval.
- 5.2. To approve a wastewater change petition, the State Water Board must determine that the proposed change will not injure any other legal user of the water involved, will not unreasonably affect instream uses including fish and wildlife, and is in the public interest. In addition, the State Water Board must find that the requirements of CEQA, including, where applicable, an analysis of cumulative impacts, have been met. The State Water Board also has an independent obligation to consider the effect of the proposed change and the cumulative impacts of water projects (including the proposed recycled water project and other projects that may affect the watercourse) on public trust resources and to protect those resources where feasible. (*National Audubon Society v. Superior Court* (1983) 33 Cal.3d 419 [189 Cal. Rptr. 346, 658 P.2d 709].)
- 5.3. The use of recycled water may only occur if all requirements prescribed by the State Water Board pursuant to Water Code section 1211 are being met. Furthermore, compliance with Water Code section 1211 shall not be construed to release any recycled water project proponent from the obligation to comply with any additional regional water board or State Water Board requirements applicable to the recycled water project.

## 6. Salt and nutrient management plans

### 6.1. Introduction

- 6.1.1. Some groundwater basins in the state contain salts and nutrients that exceed or threaten to exceed water quality objectives established in the applicable regional water board Water Quality Control Plans (basin plans). Not all basin plans include adequate implementation procedures for achieving or ensuring compliance with the water quality objectives for salts or nutrients. These

conditions can be caused by naturally-occurring sources of salinity, discharges of agricultural, domestic, industrial, and municipal wastewater; fertilizers; and residual solids (including on-site wastewater treatment systems). In addition, irrigation using imported water, diverted water, surface water, groundwater, or recycled water, and indirect potable reuse for groundwater recharge (groundwater recharge) can contribute to increased salt and nutrient loading. Regulation of recycled water alone will not fully address these conditions.

6.1.2. Salts and nutrients from all sources must be managed on a basin-wide or watershed-wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses. The most effective way to address salt and nutrient loading is typically through the development of regional or subregional salt and nutrient management plans rather than imposing requirements solely on individual recycled water projects or other individual sources of salts and nutrients.

6.1.3. *Basin evaluation.* To sustain the ongoing development of salt and nutrient management plans in basins where plans are needed and to clarify where salt and nutrient management planning is not needed, each regional water board shall evaluate each basin or subbasin in its region before April 8, 2021 and identify basins through a resolution or executive officer determination where salts and/or nutrients are a threat to water quality and therefore need salt and nutrient management planning to achieve water quality objectives in the long term. Each regional water board shall review and update this evaluation every five years to consider any changes in these factors that have occurred that would change the findings from the initial evaluation. Basin evaluations completed prior to April 8, 2019 can be used to satisfy this requirement if the prior evaluation clearly identifies whether the basin requires salt and nutrient management planning to achieve water quality objectives in the long term. Regional water boards shall consider the following factors in this determination, as well as any additional region-specific factors:

- Magnitude of and trends in the concentrations of salts and nutrients in groundwater
- Contribution of imported water and recycled water to the basin water supply
- Reliance on groundwater to supply the basin or subbasin
- Population
- Number and density of on-site wastewater treatment systems
- Other sources of salts and nutrients, including irrigated agriculture and confined animal facilities
- Hydrogeologic factors, such as regional aquitards, depth to water, and other basin- or subbasin-specific factors

## 6.2. *Development and adoption of salt and nutrient management plans*

6.2.1. The State Water Board encourages collaborative work among salt and nutrient management planning groups, the agricultural community, the regional water boards, Integrated Regional Water Management groups, and groundwater sustainability agencies formed under the Sustainable Groundwater Management Act to achieve the goals of groundwater sustainability, recycled water use, and water quality protection. For basins identified pursuant to 6.1.3, the State Water Board encourages local water suppliers, wastewater treatment agencies, and recycled water producers, together with local salt and nutrient contributing stakeholders, to continue locally driven and controlled, collaborative processes open to all stakeholders and the regional water board that will result in the development of salt and nutrient management plans for groundwater basins and the management of salts and nutrients on a basin-wide basis. The State Water Board also encourages stakeholders to incorporate the basin evaluation information developed by each regional water board, pursuant to 6.1.3, into the salt and nutrient management planning efforts.

6.2.1.1. Every groundwater basin and subbasin identified pursuant to 6.1.3 shall have a salt and nutrient management plan or a plan that is functionally equivalent pursuant to 6.2.1.4. Salt and nutrient management plans shall be tailored to address the water quality concerns of the basin and subbasin. Such plans shall include implementation measures, as appropriate, to address all sources of salt and/or nutrients to groundwater basins, including projects using recycled water for irrigation and groundwater recharge. The salt and nutrient management plans may address constituents other than salts and nutrients that adversely affect groundwater quality.

6.2.1.2. The State Water Board recognizes that because stormwater is typically lower in nutrients and salts and can augment local water supplies, inclusion of a significant stormwater use and recharge component within salt and nutrient management plans can play a vital role in the long-term sustainable use of water in California. Inclusion of stormwater recharge is consistent with the California Water Plan and the State Water Board Strategy to Optimize Resource Management of Stormwater (STORMS) vision, as adopted in State Water Board [Resolution No. 2016-0003](#), that stormwater be managed as a resource, wherein water quality improvement and water supply enhancement are complementary goals.

6.2.1.3. Salt and nutrient management plans adopted as a Basin Plan amendment or accepted by the regional water board prior to April 8, 2019 shall be evaluated pursuant to 6.2.6 and 6.2.7 by April 8, 2024.

6.2.1.4. The regional water board may determine pursuant to 6.2.3 that a groundwater management plan for a basin, subbasin, or other regional planning area is functionally equivalent to a salt and nutrient management plan. For example, the regional water board may find that groundwater sustainability plans developed pursuant to the Sustainable Groundwater Management Act include water quality components that sufficiently address



the components of 6.2.4 and therefore are functionally equivalent to a salt and nutrient management plan.

- 6.2.1.5. The provisions in 6.2 are not intended to limit regional water board authority pursuant to Water Code section 13242 to adopt plans and programs of implementation for the protection of beneficial uses.
- 6.2.2. Implementation of salt and nutrient management plans may require a regional water board to amend its basin plan. The regional water board shall consider for adoption a basin plan amendment when implementation of a salt and nutrient management plan involves adoption and/or modification of water quality objectives, beneficial uses, or programs of implementation consistent with Water Code sections 13240, 13241, and 13242. In other cases where a regional water board determines a basin plan amendment is not required, the accepted salt and nutrient management plan serves as a technical document to support future regional water board decisions.
- 6.2.3. *Regional water board review and acceptance of salt and nutrient management plans.* Proposed salt and nutrient management plans shall be submitted to the regional water board for review. The regional water board shall evaluate the salt and nutrient management plan in accordance with the provisions of 6.2.4. Following review, the regional water board shall make one of the following determinations through a resolution. This determination shall be made within six months of receipt of a proposed salt and nutrient management plan, unless compliance with CEQA is required and the regional water board notifies the public of this within the six-month period.
- 6.2.3.1. The proposed salt and nutrient management plan does not satisfy the requirements of 6.2.4. In this case, the regional water board shall provide specific findings regarding which components in 6.2.4 are not adequately addressed and recommendations for what may need to be included or modified in the proposed salt and nutrient management plan for the regional water board to accept the plan.
- 6.2.3.2. The proposed salt and nutrient management plan satisfies the requirements of 6.2.4, a basin plan amendment is not needed to implement the plan, and the regional water board will accept the plan. In this case, the accepted salt and nutrient management plan will serve as a technical document to support future regional water board decisions.
- 6.2.3.3. The proposed salt and nutrient management plan satisfies the requirements of 6.2.4 and a basin plan amendment will be needed to implement the plan. In this case, the regional water board shall initiate a process to amend the basin plan based on the accepted salt and nutrient management plan and associated documentation.
- 6.2.4. *Required components of salt and nutrient management plans.* The degree of specificity within salt and nutrient management plans and the length of the plans will be dependent on a variety of site-specific factors, including but not limited to, size and complexity of a basin, source water quality, stormwater recharge,

hydrogeology, and aquifer water quality. Each salt and nutrient management plan shall include the following components:

- 6.2.4.1. A basin- or subbasin-wide monitoring plan that includes an appropriate network of monitoring locations to provide a reasonable, cost effective means of determining whether the concentrations of salts, nutrients, and other constituents of concern as identified in the salt and nutrient management plans are consistent with applicable water quality objectives. The number, type, and density of monitoring locations to be sampled and other aspects of the monitoring program shall be dependent upon basin-specific conditions and input from the regional water board. Salts, nutrients, and the constituents identified in 6.2.1.1 shall be monitored. The frequency of monitoring shall be proposed in the salt and nutrient management plan for review by the regional water board pursuant to 6.2.3.
  - 6.2.4.1.1. The monitoring plan must be designed to effectively evaluate water quality in the basin. The monitoring plan must focus on water supply wells, areas proximate to large water recycling projects, particularly groundwater recharge projects, and other potential sources of salt and nutrients identified in the salt and nutrient management plan. Also, monitoring locations shall, where appropriate, target groundwater and surface waters where groundwater has connectivity with adjacent surface waters.
  - 6.2.4.1.2. The monitoring plan may include water quality data from existing wells where the wells are located and screened appropriately to determine water quality throughout the most critical areas of the basin. The State Water Board supports monitoring approaches that leverage the use of groundwater monitoring wells from other regulatory programs, such as the Irrigated Lands Regulatory Program and the Sustainable Groundwater Management Act.
  - 6.2.4.1.3. The monitoring plan shall identify those stakeholders responsible for conducting, compiling, and reporting the monitoring data. Where applicable, the regional water board will assist by encouraging other dischargers in the basin or subbasin to participate in the monitoring program. The data shall be electronically reported annually in a format that is compatible with a Groundwater Ambient Monitoring & Assessment (GAMA) information system and must be integrated into the GAMA information system or its successor.
- 6.2.4.2. Water recycling use goals and objectives.
- 6.2.4.3. Salt and nutrient source identification, basin or subbasin assimilative capacity and loading estimates, together with fate and transport of salts and nutrients.
- 6.2.4.4. Implementation measures to manage or reduce the salt and nutrient loading in the basin on a sustainable basis and the intended outcome of each measure.

6.2.4.5. An antidegradation analysis demonstrating that the existing projects, reasonably foreseeable future projects, and other sources of loading to the basin included within the plan will, cumulatively, satisfy the requirements of State Water Board [Resolution No. 68-16](#), Statement of Policy with Respect to Maintaining High Quality of Waters in California (Antidegradation Policy).

6.2.5. Nothing in this Policy shall prevent stakeholders from developing a plan that is more protective of water quality than applicable standards in the basin plan. No regional water board, however, shall seek to modify basin plan objectives without compliance with Water Code section 13241.

6.2.6. *Data assessment.* The regional water boards, in consultation with stakeholders, shall assess and review monitoring data generated from these plans every five years, unless an alternate timeline has been established in a basin plan amendment. This assessment shall include an evaluation of:

- observed trends in water quality data as compared with trends predicted in the salt and nutrient management plan;
- the ability of the monitoring network to adequately characterize groundwater quality in the basin;
- potential new data gaps;
- groundwater quality impacts predicted in the salt and nutrient management plan based on most recent trends and any relied-upon models, including an evaluation of the ability of the model to simulate groundwater quality;
- available assimilative capacity based on observed trends and most recent water quality data; and
- projects that are reasonably foreseeable at the time of this data assessment but may not have been when the salt and nutrient management was prepared or last updated.

6.2.7. The regional water boards, in consultation with stakeholders, shall use the results of these periodic assessments to update basin evaluations of available assimilative capacity, projected trends, and concentrations of salts and nutrients in groundwater, and then determine whether potential updates or revisions to the salt and nutrient management plan may be warranted as a result of the data assessment or to make the plan consistent with the Policy.

## **7. Permitting and antidegradation analysis for non-potable recycled water projects**

The purpose of this section is to describe permitting options and antidegradation analysis for non-potable recycled water projects when issuing a new or revised permit. Recycled water project proponents must also comply with related statutes and regulations, such as those contained in Water Code sections 13263, 13267, 13377, 13523, 13523.1, and California Code of Regulations, title 17 and title 22.

### *7.1. Use of statewide water reclamation requirements*

The State Water Board has adopted statewide water reclamation requirements (e.g., Order WQ 2016-0068-DDW) to streamline permitting of recycled water projects where recycled water is used for non-potable uses.

7.1.1. To achieve the goals of statewide consistency, streamlined permitting, and efficiency of resource management, all appropriate and eligible projects with the capability of taking on the responsibility of administering water recycling programs shall enroll under statewide water reclamation requirements.

7.1.2. *Antidegradation analysis.* Recycled water project proponents seeking to enroll under statewide water reclamation requirements can demonstrate compliance with the Antidegradation Policy by demonstrating that the project complies with the conditions of the order, which includes compliance with an accepted salt and nutrient management plan or participation in an existing salt and nutrient management planning effort, if directed by the State Water Board or applicable regional water board.

### *7.2. Site-specific permitting for non-potable recycled water projects*

7.2.1. If a project is not appropriate or eligible to enroll under statewide water reclamation requirements, the regional water board shall consider a site-specific order for adoption or consider the project for enrollment under an existing order (e.g., a master recycling permit).

7.2.2. *Antidegradation analysis.* For non-potable recycled water projects ineligible or inappropriate for enrollment under statewide water reclamation requirements, project proponents must submit an antidegradation analysis to the regional water board with the report of waste discharge to demonstrate compliance with the Antidegradation Policy.

### *7.3. Salt and nutrient management plans and antidegradation analysis for non-potable recycled water projects*

7.3.1. Irrigation and other non-potable uses of recycled water in accordance with this Policy is to the benefit of the people of the State of California. Nonetheless, the use of water for irrigation may, regardless of its source, affect groundwater quality.

7.3.2. *Basin plan amendment.* For non-potable recycled water project proponents within a basin with a basin plan amendment based on an accepted salt and nutrient

management plan, compliance with the Antidegradation Policy may be based, in part, on the technical findings of the salt and nutrient management plan or basin plan amendment, as applicable.

7.3.3. *Accepted but no basin plan amendment.* For non-potable recycled water project proponents within a basin with an accepted salt and nutrient management plan without an associated basin plan amendment, the antidegradation analysis may be based, in part, on the technical findings of the accepted salt and nutrient management plan as described in 6.2.2.

7.3.4. *No salt and nutrient management plan.* For non-potable recycled water project proponents within a basin where no salt and nutrient management plan is needed pursuant to 6.1.3 or where a salt and nutrient management plan has not yet been accepted by the regional water board, an antidegradation analysis shall be consistent with the permitting option selected by the regional water board as described in 7.1. and 7.2. If the proposed project is in a basin identified pursuant to 6.1.3. as needing a salt and nutrient management plan and if directed by a regional water board pursuant to Water Code section 13267, the recycled water project proponent may be required to develop or participate in developing a salt and nutrient management plan.

7.4. *Site-specific monitoring.* For non-potable recycled water projects, project-specific groundwater monitoring shall not be required if the criteria below are met, unless the regional water board determines there are unique site-specific conditions, or unless such project-specific monitoring is required under the accepted salt and nutrient management plan, applicable basin plan, or other Water Board program such as the Irrigated Lands Regulatory Program. Unique site-specific conditions include but are not limited to areas where recycled water is proposed to be used for irrigation over high transmissivity soils over a shallow (5' or less) high quality groundwater aquifer or proposed to be stored in unlined ponds where the regional water board determines that it will result in an unacceptable threat to groundwater quality. The criteria are:

7.4.1. For irrigation projects, application of recycled water at rates that minimize percolation of recycled water below the plants' root zone, i.e., in a manner (1) necessary to satisfy the plants' evapotranspiration requirements; (2) that considers allowances for supplemental water, irrigation distribution uniformity, leaching, and climate; and (3) when the soil is not saturated.

7.4.2. Appropriate use of fertilizers that accounts for the nutrient levels in the recycled water and nutrient demand by plants.

7.5. *Incidental runoff of recycled water for irrigation*

The incidental runoff of recycled water shall not result in water quality less than that prescribed in water quality control plans or policies, unless authorized through time schedule provisions in waste discharge requirements, waivers of waste discharge requirements, or conditional prohibitions (e.g., agricultural discharges from irrigated lands).

## **8. Permitting and antidegradation analysis for groundwater recharge projects**

### *8.1. Permitting for groundwater recharge projects*

8.1.1. All recycled water groundwater recharge projects must be reviewed and permitted on a site-specific basis.

8.1.2. Approved groundwater recharge projects shall meet the following criteria:

8.1.2.1. Compliance with regulations related to recycled water for groundwater recharge projects, including monitoring requirements for priority pollutants contained in California Code of Regulations, title 17 and California Code of Regulations, title 22 (including subsequent revisions), and recommendations by the State Water Board for the protection of public health pursuant to Water Code section 13523.

8.1.2.2. Implementation of a monitoring program for constituents of emerging concern (CECs) that is consistent with Attachment A and any recommendations from the State Water Board.

8.1.3. Nothing in this section shall be construed to limit the authority of a regional water board to protect designated beneficial uses, provided that any proposed limitations for the protection of public health may only be imposed following regular consultation by the regional water board with the State Water Board, consistent with the precedent established in State Water Board [Orders WQ 2005-0007](#) and [WQ 2006-0001](#).

8.1.4. Nothing in this Policy shall be construed to prevent a regional water board from imposing additional requirements for a proposed recharge project that has a substantial adverse effect on the fate and transport of a contaminant plume or changes the geochemistry of an aquifer thereby causing the dissolution of constituents, such as arsenic, from the geologic formation into groundwater.

8.1.5. Projects that utilize surface spreading to recharge groundwater with recycled water treated by reverse osmosis shall be permitted by a regional water board within one year of receipt of an approved Title 22 engineering report, provided that the project proposes a brine disposal method to the satisfaction of the regional water board. Furthermore, the regional water board shall give a high priority to review and approval of such projects.

### *8.2. Antidegradation analysis for groundwater recharge projects*

8.2.1. Groundwater recharge with recycled water for later extraction and use in accordance with this Policy and state and federal water quality law is to the benefit of the people of the state of California. Nonetheless, groundwater recharge projects using recycled water have the potential to degrade water quality within a basin. To ensure a project does not degrade water quality within a basin, the proponent of a groundwater recharge project must submit an antidegradation analysis to the regional water board with the report of waste discharge to demonstrate compliance with the Antidegradation Policy.

- 8.2.2. For groundwater recharge projects within a basin with a basin plan amendment based on an accepted salt and nutrient management plan pursuant to 6.2.3.3, the antidegradation analysis may be based, in part, on the technical findings of the basin plan amendment.
- 8.2.3. For groundwater recharge projects within a basin with a salt and nutrient management plan accepted by the regional water board pursuant to 6.2.3.2 (i.e., without an associated basin plan amendment), the antidegradation analysis may be based, in part, on the technical findings of the accepted salt and nutrient management plan as described in 6.2.2.
- 8.2.4. If a groundwater recharge project proponent is actively participating in the development of a salt and nutrient management plan for the basin or subbasin to the satisfaction of the applicable regional water board, then compliance with the Antidegradation Policy may be demonstrated as follows:
- 8.2.4.1. If a groundwater recharge project proposes to utilize less than 10 percent of the available assimilative capacity in a basin or subbasin (or multiple projects to utilize less than 20 percent of the available assimilative capacity in a basin or subbasin), the antidegradation analysis need only demonstrate that the project will use less than 10 percent (or multiple projects will use less than 20 percent) of the available assimilative capacity. For those basins or subbasins where the regional water boards have not determined the baseline assimilative capacity, the baseline assimilative capacity shall be calculated by the initial project proponent, with review and approval by the regional water board, until the salt and nutrient management plan is accepted by the regional water board consistent with 6.2. For compliance with this subparagraph, the available assimilative capacity shall be calculated by comparing the mineral water quality objective with the representative concentration of the basin or subbasin as determined by the regional water board, either over the most recent five years of data available or using a data set approved by the regional water board. In determining whether the available assimilative capacity will be exceeded by the project or projects, the regional water board shall calculate the impacts of the project or projects over at least a ten-year time frame.
- 8.2.4.2. In the event a project or multiple projects utilize more than the fraction of the assimilative capacity designated in 8.2.4.1, then a more detailed antidegradation analysis shall be performed to comply with the Antidegradation Policy. The project proponent shall provide sufficient information for the regional water board to make this determination. An example of an approved method is the method used in State Water Board [Resolution No. 2004-0060](#) and the regional water board in California Regional Water Quality Control Board, Santa Ana Region Resolution No. R8-2004-0001. An integrated approach (using surface water, groundwater, recycled water, stormwater, pollution prevention, water conservation, etc.) to the implementation of the Antidegradation Policy is encouraged.

8.2.5. For groundwater recharge projects within a basin without a salt and nutrient management plan accepted by the regional water board pursuant to 6.2.3, or any applicable basin plan amendment based on an accepted salt and nutrient management plan, or within a basin where no salt and nutrient management plan is needed pursuant to 6.1.3, a more detailed antidegradation analysis, as described in 8.2.4.2 shall be performed to comply with the Antidegradation Policy.

## **9. Permitting for reservoir water augmentation**

9.1. All recycled water reservoir water augmentation projects must be reviewed and permitted on a site-specific basis.

9.2. Approved reservoir water augmentation projects shall meet the following criteria:

9.2.1. Compliance with regulations related to recycled water for reservoir water augmentation projects, including monitoring requirements for priority pollutants contained in California Code of Regulations, title 17 and California Code of Regulations, title 22 (including subsequent revisions); and

9.2.2. Implementation of a monitoring program for CECs that is consistent with Attachment A and recommendations by the State Water Board for the protection of public health pursuant to Water Code section 13523.

9.3. Nothing in this section shall be construed to limit the authority of a regional water board to protect designated beneficial uses, provided that any proposed limitations for the protection of public health may only be imposed following regular consultation by the regional water board with the State Water Board, consistent with the precedent established in State Water Board Orders WQ 2005-0007 and WQ 2006-0001.

## **10. Constituents of emerging concern**

### *10.1. Introduction and need for research*

10.1.1. The presence, variety, and concentration of CECs in water may vary over time. In addition, the state of knowledge regarding CECs is inherently incomplete and will change over time based on scientific developments. Continuing research is needed to support understanding of which CECs present a risk to public health and the environment.

10.1.2. Agencies shall employ source control and/or pollution prevention programs to minimize the likelihood of CECs impacting human health and the environment.

10.1.3. There is a need for additional research to: improve analytical methods and screening tools, increase the availability of toxicological studies, and improve our understanding of prevalence and persistence of CECs in water. This research will assist the State Water Board in identifying CECs with the greatest potential to be of toxicological relevance to human health and the environment.



## 10.2. Science Advisory Panel

- 10.2.1. The State Water Board will convene a Science Advisory Panel every five years to guide future actions relating to CECs.
- 10.2.2. The Panel shall be composed of members representing the following areas of expertise: human health toxicology, environmental toxicology, epidemiology, biochemistry, civil engineering (particularly the design and construction of water recycling treatment plants), analytical chemistry (particularly the design and operation of advanced laboratory methods for the detection of CECs), CEC sources and discharge pathways, and human health pathology (particularly antibiotic resistant bacteria and antibiotic resistance genes). Each panelist shall have extensive experience as a principal investigator in their respective area of expertise.
- 10.2.3. The Panel will review the scientific literature and submit a report to the State Water Board that describes the current state of scientific knowledge regarding the risks of CECs to public health and the environment.
- 10.2.4. Each report shall recommend actions that the State of California should take to improve our understanding of CECs and, as may be appropriate, to protect human health and the environment.
- 10.2.5. Each report shall at a minimum address the following topics:
  - 10.2.5.1. The appropriate constituents to be monitored in recycled water, including analytical methods and reporting limits.
  - 10.2.5.2. The known toxicological information for the above constituents and persistence through treatment systems.
  - 10.2.5.3. Any change to the above constituents based on level of treatment and uses specified in Title 22 and for reservoir water augmentation.
  - 10.2.5.4. The indicators or surrogates that can be used to represent a suite of CECs.
  - 10.2.5.5. The concentrations of CECs that should trigger enhanced monitoring.
  - 10.2.5.6. Recommendations regarding antibiotic resistant bacteria and antibiotic resistance genes.
- 10.2.6. Within six months from receipt of a report, the State Water Board will hold a hearing to consider recommendations from staff and will endorse the recommendations, as appropriate, after making any necessary modifications.

## **11. Maximizing consistency in permitting recycled water projects**

### *11.1. CEC permit provisions*

Permits for recycled water projects shall be consistent with any applicable monitoring requirements prescribed in Attachment A.

### *11.2. Regional water board general orders*

To ensure consistent regulation of recycled water statewide,

- 11.2.1. On or after April 8, 2019, a regional water board may not enroll a recycled water project proponent under a regional water board general order for non-potable uses of recycled water issued prior to April 8, 2019.
- 11.2.2. If an enrollee under an existing regional water board general order for non-potable uses of recycled water has a Title 22 engineering report approved after January 1, 2001, the regional water board shall transition the enrollee to Order WQ 2016-0068-DDW or its successor, unless a site-specific order is more appropriate, before April 8, 2020.
- 11.2.3. Regional water boards shall transition all other enrollees from these orders to Order WQ 2016-0068-DDW or its successor, or a site-specific order as appropriate, before April 8, 2022.
- 11.2.4. Coverage under existing regional water board general orders for non-potable uses of recycled water will terminate on April 8, 2022 and, except for enforcement purposes, these orders will have no further force and effect.

### *11.3. Permit review*

By April 8, 2022,

- 11.3.1. The State Water Board will review Title 22 engineering reports for recycled water permits issued prior to January 1, 2001 for consistency with all applicable regulations, including those related to recycled water contained in California Code of Regulations, title 17 and California Code of Regulations, title 22. If the Title 22 engineering report was never prepared or is inconsistent with applicable regulations, the State Water Board may require a new or updated Title 22 engineering report to be submitted for review and approval.
- 11.3.2. The regional water boards shall review all recycled water permits and shall update any recycled water permits and/or monitoring and reporting programs that are (1) inconsistent with this Policy; (2) inconsistent with an approved Title 22 engineering report pursuant to 11.3.1; or (3) inconsistent with the applicable regional water board basin plan. Regional water boards shall enroll permittees in Order WQ 2016-0068-DDW or its successor if appropriate.

- 11.3.3. The regional water boards shall prioritize updating orders, permits and/or monitoring and reporting programs that were issued prior to January 1, 2001 or are located in basins identified pursuant to 6.1.3.
- 11.3.4. The regional water boards shall periodically update permits for groundwater recharge and reservoir water augmentation consistent with the requirements for update of Title 22 engineering reports in California Code of Regulations, title 22.
- 11.3.5. Timelines consistent with a prioritized approach identified in a basin plan amendment based on an accepted salt and nutrient management plan pursuant to 6.2.3.3 will supersede the three-year timeline identified above in sections 11.3.1 through 11.3.3.

**ATTACHMENT A**

**MONITORING REQUIREMENTS FOR  
CONSTITUENTS OF EMERGING CONCERN IN  
RECYCLED WATER USED FOR GROUNDWATER RECHARGE AND  
RESERVOIR WATER AUGMENTATION**

The purpose of this attachment to the Policy is to provide direction to the regional water boards on monitoring requirements for constituents of emerging concern (CECs) in recycled water when permitting recycled water projects. The State Water Board developed the monitoring requirements and criteria for evaluating monitoring results considering recommendations from a Science Advisory Panel<sup>1</sup> and stakeholders.

The monitoring requirements in this attachment pertain only to the production and use of recycled water for groundwater recharge and reservoir water augmentation. CEC monitoring is not required for recycled water used for non-potable applications. The regional water boards shall issue permits consistent with this attachment except for water recycling treatment plants where the State Water Board has established site-specific CEC monitoring requirements such as:

- Groundwater recharge projects implementing treatment processes that provide control of CECs by processes other than soil aquifer treatment or reverse osmosis/advanced oxidation processes (RO/AOPs),
- Reservoir water augmentation projects implementing treatment processes that provide control of CECs by processes other than RO/AOPs.

The regional water boards shall not issue requirements for monitoring of additional CECs or bioanalytical screening in recycled water beyond the requirements provided in this Policy except when recommended by the State Water Board following the review of the Title 22 engineering report or when requested by the recycled water producer. However, the regional water boards can require other monitoring requirements consistent with their authorities.

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<sup>1</sup> The Science Advisory Panel was convened in accordance with provision 10.2 of the Policy. The Panel's recommendations were presented in the report [\*Monitoring Strategies for Constituents of Emerging Concern \(CECs\) in Recycled Water – Recommendations of a Science Advisory Panel\*](#), dated April 2018

## **1 QUALITY ASSURANCE PROJECT PLAN**

The recycled water producer shall develop and maintain a quality assurance project plan (QAPP) for monitoring CECs to ensure the project data are of known, consistent, and documented quality and that the monitoring is consistent with this Policy. The QAPP shall be developed using the Guidance for Quality Assurance Project Plans, EPA QA/G-5 (EPA/240/R-2/009, 2002). The QAPP shall be submitted to the regional water board and approved by the regional water board or State Water Board prior to beginning any sampling and analysis. The QAPP shall be updated and re-submitted to the regional water board for approval when significant changes are made that would affect the overall data quality and use (e.g., using a new analytical chemistry laboratory) or at least annually if any changes are made. This attachment provides additional direction regarding specific components that must be considered when developing the QAPP.

### **1.1 Selection of Analytical Methods**

Laboratories shall use analytical methods that have been validated and approved for the analytes in the applicable matrix and can achieve the reporting limits in Table 1 and Table 3. This includes methods that have been approved by U.S. EPA, the Standards Methods Committee, the American Society for Testing and Materials International, or other methods that have been validated and approved by the regional water boards or State Water Board for the analytes in the applicable matrix. The QAPP shall include minimum method validation requirements developed by the regional water board in consultation with the State Water Board if proposing to (1) use a method that has not been validated and approved, (2) use a validated and approved method that has been modified, or (3) use a method for an application that is outside the intended use of the method (e.g., different matrix, new analyte). The State Water Board and regional water board shall review the method validation package and must approve the method prior to use.

### **1.2 Laboratory Selection and Demonstrations of Competency**

The regional water board in consultation with the State Water Board shall review the QAPP and determine if the selected laboratory(ies) has the competency to provide analytical testing for the project and can meet the performance criteria established in the QAPP. The regional water board in consultation with the State Water Board shall review the method detection limit studies and reporting limit verification data to ensure that the data meets the required reporting limits in Table 1 and Table 3.

A laboratory providing analyses of CECs and bioanalytical screening must hold a valid certificate of accreditation from the State of California Environmental Laboratory Accreditation Program (ELAP) for the analytical test methods or analytes selected, if such methods or analytes are accredited by ELAP at the time that monitoring is required to begin. If ELAP accreditation for analytical test methods or an analyte becomes available after monitoring is initiated, then the laboratory providing analysis of CECs shall be accredited by ELAP for those methods or analytes within one year of such accreditation becoming available. If ELAP accreditation is unavailable for a method or an analyte, the recycled water producer shall use a laboratory that has been accredited for a similar analytical method, instrumentation, or analyte

until ELAP accreditation becomes available, unless otherwise approved by the regional water board or State Water Board for bioanalytical screening tools.

### **1.3 Data Submission**

Monitoring results required by this Policy shall be electronically reported to a database identified by the State Water Board.

The recycled water producer shall submit the quality assurance data specified in the QAPP, including percent recoveries and acceptable recovery ranges for each analyte, to the regional water board with each data set. The regional water board will review the data quality and may require additional actions if data quality objectives are not met.

## **2 CEC MONITORING PARAMETERS**

The recycled water producer shall monitor for the constituents and parameters in this section (health-based CECs, performance indicator CECs, surrogates, and bioanalytical screening tools, collectively referred to as the CEC Monitoring Parameters) as listed in Table 1, Table 2, and Table 3 at monitoring locations specified in section 3 of Attachment A, and at a frequency specified in section 4 of Attachment A. Sections 5.2 and 5.3 of Attachment A include a method for evaluating monitoring results for health-based CECs and bioanalytical screening tools and the associated response actions.

### **2.1 Health-based CECs and Performance Indicator CECs**

[See next page for *Table 1. Health-based and performance indicator CECs with the required reporting limits.*]

Table 1: Health-based and performance indicator CECs and required reporting limits.

Constituent	Constituent Group	Relevance/Indicator Type	Reporting Limit <sup>1</sup> (µg/L)
<b>GROUNDWATER RECHARGE - SURFACE APPLICATION</b>			
1,4-Dioxane	Industrial chemical	Health	0.1
N-Nitrosodimethylamine (NDMA)	Disinfection byproduct	Health	0.002
N-Nitrosomorpholine (NMOR)	Industrial chemical	Health	0.002
Perfluorooctane sulfonate (PFOS)	Consumer/industrial chemical	Health	0.0065
Perfluorooctanoic acid (PFOA)	Consumer/industrial chemical	Health	0.007
Gemfibrozil	Pharmaceutical	Performance	0.01
Iohexol	Pharmaceutical	Performance	0.05
Sucralose	Food additive	Performance	0.1
Sulfamethoxazole	Antibiotic	Performance	0.01
<b>RESERVOIR WATER AUGMENTATION AND GROUNDWATER RECHARGE - SUBSURFACE APPLICATION</b>			
1,4-Dioxane	Industrial chemical	Health	0.1
NDMA	Disinfection byproduct	Health & Performance	0.002
NMOR	Industrial chemical	Health	0.002
PFOS	Consumer/industrial chemical	Health	0.0065
PFOA	Consumer/industrial chemical	Health	0.007
Sucralose	Food additive	Performance	0.1
Sulfamethoxazole	Antibiotic	Performance	0.01

<sup>1</sup> The regional water board may approve higher reporting limits if it determines these reporting limits cannot be practically met in recycled water sample matrices using existing methods, as long as the ratio between the reporting limit and the monitoring trigger limit (see Table 7) is no less than 2. µg/L – micrograms per liter.

## 2.2 Surrogates for CECs

Table 2 presents a list of surrogates that shall be considered for monitoring treatment efficacy of recycled water used for groundwater recharge and reservoir water augmentation. Other surrogates not listed in

Table 2 may also be considered. The recycled water producer shall identify surrogates to monitor that are indicative of removal of CECs through individual unit processes or combinations of unit processes at the water recycling treatment plant. The regional water board in consultation with the State Water Board shall review and approve the selected surrogates for each water recycling treatment plant. The list of surrogates may be revised throughout the phased monitoring approach described in section 4 of Attachment A.

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

Table 2: Surrogates for CECs

GROUNDWATER RECHARGE - SURFACE APPLICATION
Ammonia
Dissolved Organic Carbon (DOC)
Nitrate
Total fluorescence
Ultraviolet (UV) Light Absorbance
RESERVOIR WATER AUGMENTATION AND GROUNDWATER RECHARGE - SUBSURFACE APPLICATION
Electrical Conductivity
DOC
UV Light Absorbance

### 2.3 Bioanalytical Screening Tools for CECs

Table 3: Bioanalytical screening tools for CECs and required reporting limits

Endpoint Activity	Example Relevant CECs	Adverse effect	Reporting Limit (ng/L)
RESERVOIR WATER AUGMENTATION AND GROUNDWATER RECHARGE – SURFACE AND SUBSURFACE APPLICATION			
Estrogen receptor- $\alpha$ (ER- $\alpha$ )	Estradiol, bisphenol A, nonylphenol	Feminization, impaired reproduction, cancer	0.5
Aryl hydrocarbon receptor (AhR)	Dioxin-like chemicals, polycyclic aromatic hydrocarbons, pesticides	Cancer, impaired reproduction	0.5



### **3 MONITORING LOCATIONS**

The recycled water producer shall monitor for the CEC Monitoring Parameters in section 2 of Attachment A at the monitoring locations specified in this section.

#### **3.1 Groundwater Recharge - Surface Application**

For groundwater recharge projects implementing surface application of recycled water, bioanalytical screening and monitoring for health-based CECs, performance indicator CECs, and surrogates shall be performed at these locations:

- (1) Following tertiary treatment<sup>2</sup> prior to application to the surface spreading area; and
- (2) At monitoring well locations designated in consultation with the State Water Board within the distance groundwater travels downgradient from the application site in 30 days.

#### **3.2 Groundwater Recharge - Subsurface Application**

##### **3.2.1 *Monitoring Locations for Health-Based CECs and Bioanalytical Screening***

For groundwater recharge projects implementing subsurface application of recycled water, bioanalytical screening and monitoring for health-based CECs shall be performed at a location following treatment prior to release into the aquifer.

##### **3.2.2 *Monitoring Locations for Performance Indicator CECs and Surrogates***

For groundwater recharge projects using subsurface application of recycled water, performance indicator CECs shall be monitored in recycled water at these locations:

- (1) Prior to treatment by RO; and
- (2) Following treatment prior to release into the aquifer.

If the recycled water producer can demonstrate that the RO unit will not substantially remove a CEC, the regional water board may allow monitoring for that CEC prior to the AOPs, instead of prior to the RO unit.

For groundwater recharge projects using subsurface application of recycled water, surrogates shall be monitored at locations proposed by the recycled water producer and approved by the regional water board in consultation with the State Water Board.

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<sup>2</sup> Standards for disinfected tertiary recycled water presented in California Code of Regulations, title 22, section 60301.230 and 60301.320.

### **3.3 Reservoir Water Augmentation**

#### **3.3.1 *Monitoring Locations for Health-Based CECs and Bioanalytical Screening***

For reservoir water augmentation projects, bioanalytical screening and monitoring for health-based CECs shall be performed at a location following treatment prior to release into the surface water reservoir.

#### **3.3.2 *Monitoring Locations for Performance Indicator CECs and Surrogates***

For reservoir water augmentation projects, performance indicator CECs shall be monitored in recycled water at these locations:

- (1) Prior to treatment by RO; and
- (2) Following treatment prior to release into the surface water reservoir.

If the recycled water producer can demonstrate that the RO unit will not substantially remove a CEC, the regional water board may allow monitoring for that CEC prior to the AOPs, instead of prior to the RO unit. For reservoir water augmentation projects, surrogates shall be monitored at locations proposed by the recycled water producer and approved by the regional water board in consultation with the State Water Board.

## **4 PHASED MONITORING REQUIREMENTS**

For each water recycling treatment plant, the recycled water producer shall conduct a three-phased monitoring approach for the CEC Monitoring Parameters, which includes an initial assessment monitoring phase, followed by a baseline monitoring phase, and then a standard operation monitoring phase. Additional details of the three-phased monitoring approach are provided below. The purpose of phased monitoring is to allow the regional water board to review the monitoring results for the CEC Monitoring Parameters at the various phases and refine the specific monitoring requirements based on the monitoring results and findings of the previous phase.

A recycled water producer may submit existing CEC monitoring data for the health-based CECs and performance indicator CECs, surrogates for CECs, and bioanalytical screening tools from a water recycling treatment plant with a State Water Board-approved Title 22 engineering report to the regional water board to satisfy the requirements in the initial assessment or baseline monitoring phase. If the regional water board, in consultation with the State Water Board, determines the existing CEC monitoring data meet the intent of the initial assessment phase (section 4.1 below), it may allow a recycled water producer to initiate the baseline monitoring phase (section 4.2 below). If the regional water board, in consultation with the State Water Board, determines the existing CEC monitoring data meet the intent of the baseline monitoring phases, the recycled water producer can initiate the standard operation monitoring phase. All facilities must conduct the standard operation monitoring phase.

#### **4.1 Initial Assessment Monitoring Phase**

The monitoring requirements for the initial assessment monitoring phase shall apply to the start-up of new water recycling treatment plants, piloting of new unit processes at existing facilities, and existing facilities where the regional water board, in consultation with the State Water Board, determines that CECs, surrogates, and bioanalytical screening tools have not been assessed consistent with the requirements of this attachment.

The purpose of the initial assessment phase is to: (1) identify the occurrence of health-based CECs, performance indicator CECs, and surrogates in recycled water for groundwater recharge or reservoir water augmentation; (2) determine treatment effectiveness; (3) define the project-specific performance indicator CECs and surrogates to monitor during the baseline monitoring phase; (4) specify the expected removal percentages for performance indicator CECs and surrogates; and (5) gather bioactivity data for ER- $\alpha$  and AhR bioanalytical screening tools to determine the range of responses for the bioassays for standardized water quality monitoring. The Initial Assessment Phase shall be conducted after the water recycling treatment plant has received approval from the State Water Board for the facility's Title 22 engineering report.

The recycled water producer shall monitor for the constituents in section 2 of Attachment A consistent with the initial assessment phase requirements. Following completion of the initial assessment monitoring phase for each water recycling treatment plant, the regional water board, in consultation with the State Water Board, shall evaluate the data from the initial assessment monitoring phase and determine the appropriate monitoring requirements for the baseline monitoring phase.

##### **4.1.1 *Initial Assessment Monitoring for Health-Based CECs, Performance Indicator CECs, and Surrogates***

- 4.1.1.1 The recycled water producer shall conduct an initial assessment monitoring phase consistent with Table 4 for a period of one year for each of the health-based CECs and performance indicator CECs listed in Table 1 and project-specific surrogates identified per section 2.2 of Attachment A.
- 4.1.1.2 The recycled water producer shall evaluate data from performance indicator CECs and surrogates and prepare an updated Table 7 with the expected (rather than example) removal percentages for the water recycling treatment plant and submit to the regional water board with the initial assessment monitoring data.
- 4.1.1.3 Following each sampling event, the recycled water producer shall evaluate monitoring results for health-based CECs using the direction in section 5.2 of Attachment A and implement appropriate response actions. The recycled water producer shall also evaluate monitoring results for surrogates and evaluate the suitability of the surrogates.

#### **4.1.2 Initial Assessment Monitoring for Bioanalytical Screening Tools**

- 4.1.2.1 The recycled water producer shall initiate the initial assessment phase by April 8, 2020. The recycled water producer shall conduct an initial assessment monitoring phase consistent with Table 4 for a period of three years for each of the bioanalytical screening tools listed in Table 3 (i.e., ER- $\alpha$  and AhR).
- 4.1.2.2 Following each sampling event, the recycled water producer shall evaluate monitoring results for bioanalytical screening tools. The recycled water producer may elect to follow the response actions for bioanalytical screening tools using the direction in section 5.2 of Attachment A, but implementation of the response actions during the initial assessment monitoring phase is not required.

[See next page for *Table 4. Initial Assessment Monitoring Phase Requirements*]

Table 4: Initial Assessment Monitoring Phase Requirements

Recycled Water Use	Constituent	Frequency	Monitoring Point
Groundwater Recharge - Surface Application	Health-Based CECs and Performance Indicator CECs: All listed in Table 1.	Quarterly <sup>1</sup>	- Following tertiary treatment prior to application to surface spreading area. - At monitoring well locations designated in consultation with the State Water Board. <sup>2</sup>
	Surrogates: To be selected on a project-specific basis (see 2.2), considering those listed in Table 2.	1 <sup>st</sup> 3 months: To be determined on a project-specific basis. <sup>3</sup>	- Following tertiary treatment prior to application to the surface spreading area. - At monitoring well locations designated in consultation with the State Water Board. <sup>2</sup>
		3-12 months: To be determined on a project- specific basis. <sup>3</sup>	- Following tertiary treatment prior to application to the surface spreading area. - At monitoring well locations designated in consultation with the State Water Board. <sup>2</sup>
	Bioanalytical Screening Tools: All listed in Table 3.	Quarterly <sup>1</sup>	- Following tertiary treatment prior to application to surface spreading area. - At monitoring well locations designated in consultation with the State Water Board. <sup>2</sup>
Reservoir Water Augmentation and Groundwater Recharge - Subsurface Application	Health-Based CECs: All listed in Table 1.	Quarterly <sup>1</sup>	Following treatment prior to release to the aquifer or surface water reservoir.
	Performance Indicator CECs: All listed in Table 1.	Quarterly <sup>1</sup>	- Prior to RO treatment. <sup>4</sup> - Following treatment prior to release to the aquifer or surface water reservoir.
	Surrogates: To be selected on a project-specific basis (see 2.2), considering those listed in Table 2.	To be determined on a project-specific basis.	At locations approved by the regional water board. <sup>5</sup>
	Bioanalytical Screening Tools: All listed in Table 3.	Quarterly <sup>1</sup>	Following treatment prior to release to the aquifer or surface water reservoir.

<sup>1</sup> This is the initial monitoring frequency for the monitoring and reporting program. The regional water board may require additional monitoring to respond to a concern as stated in 4.1 of Attachment A.

<sup>2</sup> Groundwater within the distance groundwater travels downgradient from the application site in 30-days.

<sup>3</sup> The monitoring frequency shall be determined by the regional water board in consultation with the State Water Board. The intent is to have an increased monitoring frequency during the first three months and a decreased monitoring frequency after three months.

<sup>4</sup> If the recycled water producer can demonstrate that the RO unit will not substantially remove a CEC, the regional water board may allow monitoring for that CEC prior to the AOP, instead of prior to the RO unit.

<sup>5</sup> See 3.2.2 of Attachment A for information on surrogate monitoring locations for subsurface application and 3.3.2 of Attachment A for reservoir water augmentation.

## **4.2 Baseline Monitoring Phase**

A recycled water producer shall initiate the baseline monitoring phase upon completion of the initial assessment phase or upon receiving approval from the regional water board to proceed with this phase given the existing data for the water recycling treatment plant meet the intent of the initial assessment phase.

The purpose of the baseline monitoring phase is to: (1) gather occurrence data for health-based CECs; (2) evaluate performance indicator CECs and surrogates and determine treatment effectiveness; (3) gather bioactivity data for ER- $\alpha$  and AhR bioanalytical screening tools and pilot test the framework for response actions; and (4) assess the list of health-based CECs, performance indicator CECs, surrogates, and bioanalytical screening tools and identify an appropriate list of constituents to monitor the removal of CECs and treatment system performance in the standard operation monitoring phase of a water recycling treatment plant.

### **4.2.1 *Baseline Monitoring for Health-Based CECs, Performance Indicator CECs, and Surrogates***

4.2.1.1 The recycled water producer shall conduct a baseline monitoring phase consistent with Table 5 for a period of three years for each of the health-based CECs in Table 1, and performance-based CECs and surrogates identified by the regional water board in consultation with the State Water Board.

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

4.2.1.3 If a performance indicator CEC listed in Table 1 is not a good indicator of CEC removal, the recycled water producer shall propose an alternative performance indicator CEC to monitor that is representative of the constituent group. This performance indicator CEC shall be subject to approval by the regional water board in consultation with the State Water Board.

4.2.1.4 The recycled water producer shall evaluate data from performance indicator CECs and surrogates and prepare an updated Table 7 with the expected (rather than example) removal percentages for the water recycling treatment plant and submit to the regional water board with the baseline monitoring data.

4.2.1.5 Following each sampling event, the recycled water producer shall evaluate monitoring results for health-based CECs using the direction in section 5.2 of Attachment A and implement appropriate response actions.

**4.2.2 *Baseline Monitoring for Bioanalytical Screening Tools***

4.2.2.1 The recycled water producer shall conduct a baseline monitoring phase consistent with Table 5 for a period of one year for each of the bioanalytical screening tools listed in Table 3.

4.2.2.2 Following each sampling event, the recycled water producer shall evaluate monitoring results for bioanalytical screening tools using the direction in section 5.3 of Attachment A and implement appropriate response actions.

[See next page for *Table 5: Baseline Phase Monitoring Requirements*]

Table 5: Baseline Monitoring Phase Requirements

Recycled Water Use	Constituent	Frequency	Monitoring Point
Groundwater Recharge – Surface Application	Health-Based CECs: All listed in Table 1.	Semi-Annually <sup>1</sup>	- Following tertiary treatment prior to application to the surface spreading area.
	Performance Indicator CECs: Selected based on the findings of the initial assessment phase.		- At monitoring well locations designated in consultation with the State Water Board. <sup>2</sup>
	Surrogates: Selected based on the findings of the initial assessment phase.	Based on findings of the initial assessment phase.	- Following tertiary treatment prior to application to the surface spreading area.  - At monitoring well locations designated in consultation with the State Water Board. <sup>2</sup>
	Bioanalytical Screening Tools: All listed in Table 3.	Quarterly <sup>1</sup>	- Following tertiary treatment prior to application to the surface spreading area.  - At monitoring well locations designated in consultation with the State Water Board. <sup>2</sup>
Reservoir Water Augmentation and Groundwater Recharge – Subsurface Application	Health-Based CECs: All listed in Table 1.	Semi-Annually <sup>1</sup>	Following treatment prior to release to the aquifer or surface water reservoir.
	Performance Indicator CECs: Selected based on the findings of the initial assessment phase.	Semi-Annually <sup>1</sup>	- Prior to RO treatment. <sup>3</sup>  - Following treatment prior to release to the aquifer or surface water reservoir.
	Surrogates: Selected based on the findings of the initial assessment phase.	Based on findings of the initial assessment phase.	- At locations approved by the regional water board. <sup>4</sup>
	Bioanalytical Screening Tools: All listed in Table 3.	Quarterly <sup>1</sup>	Following treatment prior to release to the aquifer or surface water reservoir.

<sup>1</sup> More frequent monitoring may be required to respond to a concern as stated in 4.2 of Attachment A.

<sup>2</sup> Groundwater within the distance groundwater travels downgradient from the application site in 30-days.

<sup>3</sup> If the recycled water producer can demonstrate that the RO unit will not substantially remove a CEC, the regional water board may allow monitoring for that CEC prior to the AOP, instead of prior to the RO unit.

<sup>4</sup> See 3.2.2 of Attachment A for information on surrogate monitoring locations for subsurface application and 3.3.2 of Attachment A for reservoir water augmentation.



### **4.3 Standard Operation Monitoring Phase**

A recycled water producer shall initiate the standard operation monitoring phase upon completion of the baseline monitoring phase or upon receiving approval from the regional water board to proceed with this phase given the existing data for the water recycling treatment plant.

The purpose of the standard operation monitoring phase is to monitor CECs under standard operating conditions at a water recycling treatment plant. In this phase, the regional water board in consultation with the State Water Board will identify a list of health-based CECs, performance-based CECs, surrogates, and bioanalytical screening tools to monitor based on the water recycling treatment plant's data from the first two monitoring phases.

#### **4.3.1 *Standard Operation Monitoring for Health-Based CECs, Performance Indicator CECs, and Surrogates***

- 4.3.1.1 For the standard operation monitoring phase, the recycled water producer shall conduct the monitoring requirements in Table 6 while the facility is operating.
- 4.3.1.2 The regional water board, in consultation with the State Water Board, may remove a health-based CEC from the required monitoring list if the monitoring results meet the conditions of the minimum threshold level presented in Table 8.
- 4.3.1.3 Performance indicator CECs and surrogates that exhibited reduction by a unit process and/or provided an indication of operational performance shall be selected for monitoring of standard operations. If a performance indicator CEC is not a good indicator, the recycled water producer shall propose an alternative performance indicator CEC representative of the constituent group to monitor. This performance indicator CEC shall be subject to approval by the regional water board in consultation with the State Water Board.
- 4.3.1.4 Monitoring for health-based CECs and performance indicator CECs shall be conducted on a semi-annual basis, unless the project demonstrates consistency in treatment effectiveness in removal of CECs, treatment operational performance, and appropriate recycled water quality. These projects may be monitored for health-based CECs and performance indicator CECs on an annual basis.
- 4.3.1.5 Following each sampling event, the recycled water producer shall evaluate monitoring results for health-based CECs using the direction in section 5.2 of Attachment A and implement appropriate response actions.

4.3.1.6 If evaluation of monitoring results indicates a concern, such as finding a health-based CEC above the thresholds described in Table 7 or a decline in removal of a performance indicator CEC from the performance levels established during the initial and baseline monitoring phases, the regional water board in consultation with the State Water Board may require more frequent monitoring to further evaluate the effectiveness of the treatment process. Additional actions may also be warranted, which may include, but are not limited to, resampling to confirm a result, additional monitoring, implementation of a source identification program, toxicological studies, engineering removal studies, and/or modification of facility operation. If additional monitoring is required, the regional water board shall consult with the State Water Board and revise the Monitoring and Reporting Program as appropriate.

#### **4.3.2 *Standard Operation Monitoring for Bioanalytical Screening Tools***

4.3.2.1 The regional water board, in consultation with the State Water Board, may remove a bioanalytical screening tool from the required monitoring list if monitoring results meet the conditions of the minimum threshold level presented in Table 10.

4.3.2.2 Following each sampling event where bioassay monitoring is required, the recycled water producer shall evaluate monitoring results for bioanalytical screening tools using the direction in section 5.2 of Attachment A and implement appropriate response actions.

4.3.2.3 Monitoring for bioanalytical screening tools shall be conducted on a semi-annual basis, unless the project demonstrates consistency in treatment effectiveness in removal of CECs, treatment operational performance, and appropriate recycled water quality. These projects may be monitored for CECs and with bioanalytical screening tools on an annual basis. Monitoring frequencies for CECs and surrogates for standard operation monitoring are specified in Table 6.

Table 6: Standard Operation Monitoring Requirements

Recycled Water Use	Constituent	Frequency	Monitoring Point
Groundwater Recharge - Surface Application	Health-Based CECs: Selected based on the findings of the baseline phase.	Semi-Annually or Annually <sup>1</sup>	- Following tertiary treatment prior to application to the surface spreading area.
	Performance Indicator CECs: Selected based on the findings of the baseline phase.		- At monitoring well locations designated in consultation with the State Water Board. <sup>2</sup>
	Surrogates: Selected based on the findings of the baseline phase.	Based on findings of the baseline phase.	- Following tertiary treatment prior to application to the surface spreading area. - At monitoring well locations designated in consultation with the State Water Board. <sup>2</sup>
	Bioanalytical Screening Tools: Selected based on the findings of the baseline phase.	Semi-Annually or Annually <sup>1</sup>	- Following tertiary treatment prior to application to the surface spreading area. - At monitoring well locations designated in consultation with the State Water Board. <sup>2</sup>
Reservoir Water Augmentation and Groundwater Recharge - Subsurface Application	Health-Based CECs: Selected based on the findings of the baseline phase.	Semi-Annually or Annually <sup>1</sup>	-Following RO/AOPs treatment prior to release to the aquifer or surface water reservoir.
	Performance Indicator CECs: Selected based on the findings of the baseline phase.	Semi-Annually or Annually <sup>1</sup>	- Prior to RO treatment. <sup>3</sup> - Following treatment prior to release to the aquifer or surface water reservoir.
	Surrogates: Selected based on the findings of the baseline phase.	Based on findings of the baseline phase.	At locations approved by the regional water board. <sup>4</sup>
	Bioanalytical Screening Tools: Selected based on the findings of the baseline phase.	Semi-Annually or Annually <sup>1</sup>	Following treatment prior to release to the aquifer or surface water reservoir.

<sup>1</sup> More frequent monitoring may be required to respond to a concern as stated in 4.3 of Attachment A.

<sup>2</sup> Groundwater within the distance groundwater travels downgradient from the application site in 30-days.

<sup>3</sup> If the recycled water producer can demonstrate that the RO unit will not substantially remove a CEC, the regional water board may allow monitoring for that CEC prior to the AOP, instead of prior to the RO unit.

<sup>4</sup> See 3.2.2 of Attachment A for information on surrogate monitoring locations for subsurface application and 3.3.2 of Attachment A for reservoir water augmentation.

## **5 EVALUATION OF CECs, SURROGATES, AND BIOANALYTICAL SCREENING TOOL MONITORING RESULTS**

This section describes the approaches for evaluating treatment process performance and health-based CEC and bioanalytical screening tool monitoring results. Monitoring results for performance indicator CECs and surrogates shall be used to evaluate the operational performance of a treatment process and the effectiveness of a treatment process in removing CECs. For evaluation of health-based CEC and bioanalytical screening tool monitoring results, a multi-tiered approach of thresholds and corresponding response actions is specified in 5.2 and 5.3 of Attachment A, respectively. The evaluation of monitoring results shall be included in monitoring reports submitted to the regional water board.

### **5.1 Evaluation of Performance Indicator CEC and Surrogate Results**

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

$$\text{Removal Percentage} = ([X_{\text{in}} - X_{\text{out}}]/X_{\text{in}}) (100)$$

$X_{\text{in}}$  - Concentration in recycled water prior to a treatment process

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

During the initial assessment, the recycled water producer shall monitor performance to determine removal percentages for performance indicator CECs and surrogates. The removal percentages shall be confirmed during the baseline monitoring phase. One example of removal percentages for each application scenario and their associated processes (i.e., soil aquifer treatment or RO/AOPs) is presented in Table 7. The established removal percentages for each project shall be used to evaluate treatment effectiveness and operational performance.

#### **5.1.1 Groundwater Recharge – Surface Application**

For groundwater recharge by surface application, the removal percentage shall be determined by comparing the quality of the recycled water applied to a surface spreading area to the quality of groundwater at monitoring wells. The distance between the application site and the monitoring wells shall be no more than the distance the groundwater travels in 30 days downgradient from the application site. The location of the monitoring wells shall be designated by the regional water board in consultation with the State Water Board. The removal percentage shall be adjusted to account for differences in concentrations due to dilution from potable water applied to the application site, stormwater applied to the application site, and native groundwater. The removal percentage shall also be adjusted to account for CECs in these waters. The recycled water producer shall submit a proposal to the regional water board and the State Water Board as part of its operation plan describing how it will perform this accounting.

### **5.1.2 Groundwater Recharge – Subsurface Application**

For groundwater recharge using subsurface application, the removal percentage shall be determined by comparing the CEC Monitoring Parameters before treatment by RO/AOPs and after treatment prior to release into the aquifer.

### **5.1.3 Reservoir Water Augmentation**

For reservoir water augmentation, the removal percentage shall be determined by comparing the CEC Monitoring Parameters before treatment by RO/AOPs and after treatment prior to release into the surface water reservoir.

## **5.2 Evaluation of Health-Based CEC Results**

The recycled water producer shall evaluate health-based CEC monitoring results. To determine the appropriate response actions, the recycled water producer shall compare measured environmental concentrations (MECs) to their respective monitoring trigger levels<sup>3</sup> (MTLs) listed in Table 7 to determine MEC/MTL ratios. The recycled water producer shall compare the calculated MEC/MTL ratios to the thresholds specified in Table 8 and implement the response actions corresponding to the threshold.

For surface application, the recycled water producer shall evaluate the health-based CEC results for samples collected from the groundwater monitoring wells. For subsurface application and reservoir water augmentation projects, the recycled water producer shall evaluate the health-based CEC results for the recycled water following treatment prior to release into the aquifer or surface water reservoir.

[See next page for *Table 7. Monitoring Trigger Levels and Example Removal Percentages*]

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<sup>3</sup> Recommended MTLs were established in [Monitoring Strategies for Constituents of Emerging Concern \(CECs\) in Recycled Water – Recommendations of a Science Advisory Panel](#), dated April 2018.

Table 7: Monitoring Trigger Levels and Example Removal Percentages

Constituent/ Parameter	Relevance/Indicator Type/Surrogate	Monitoring Trigger Level (micrograms/liter) <sup>1</sup>	Example Removal Percentages (%) <sup>2</sup>
GROUNDWATER RECHARGE - SURFACE APPLICATION <sup>3</sup>			
1,4-Dioxane	Health	1	-- <sup>4</sup>
NDMA	Health	0.010	--
NMOR	Health	0.012	--
PFOS	Health	0.013	--
PFOA	Health	0.014	--
Gemfibrozil	Performance	--	>90
Iohexol	Performance	--	>90
Sucralose	Performance	--	<25 <sup>5</sup>
Sulfamethoxazole	Performance	--	>30
Ammonia	Surrogate	--	>90
DOC	Surrogate	--	>30
Nitrate	Surrogate	--	>30
Total fluorescence	Surrogate	--	>30
UV Absorbance	Surrogate	--	>30
RESERVOIR WATER AUGMENTATION AND GROUNDWATER RECHARGE - SUBSURFACE APPLICATION <sup>6</sup>			
1,4-Dioxane	Health	1	--
NDMA	Health & Performance	0.010	25-50, >80 <sup>7</sup>
NMOR	Health	0.012	--
PFOS	Health	0.013	--
PFOA	Health	0.014	--
Sucralose	Performance	--	>90
Sulfamethoxazole	Performance	--	>90
Electrical Conductivity	Surrogate	--	>90
DOC	Surrogate	--	>90
UV Absorbance	Surrogate	--	>50

<sup>1</sup> Recommended monitoring trigger levels for groundwater recharge and reservoir water augmentation applications were established in [Monitoring Strategies for Constituents of Emerging Concern \(CECs\) in Recycled Water – Recommendations of a Science Advisory Panel](#), dated April 2018.

<sup>2</sup> The removal percentages are from Drewes et al. (2008) and provide an example of performance for that specific research. Project-specific removal percentages will be developed for each project during the initial and baseline monitoring phases.

<sup>3</sup> Treatment process: Soil aquifer treatment. The stated removal percentages are examples and need to be finalized during the initial and baseline monitoring phases for a given site.

<sup>4</sup> Not applicable

<sup>5</sup> Sucralose degrades poorly during soil aquifer treatment. It is included here mainly as a tracer. <sup>6</sup>

Treatment process: RO/AOP.

<sup>7</sup> For treatment using RO, removal percentage is between 25 and 50 percent. For treatment using RO/AOP, removal percentage is greater than 80 percent.

Table 8: MEC/MTL Thresholds and Response Actions for Health-based CECs

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

<sup>1</sup> If a CEC also has a notification level, additional follow-up monitoring may be required by the State Water Board or regional water board per requirements in California Code of Regulations, title 22.

### 5.3 Evaluation of Bioanalytical Screening Tool Results

The recycled water producer shall evaluate bioanalytical assay monitoring results. During the baseline monitoring phase and standard operation monitoring phase, the recycled water producer shall determine the appropriate response actions. The recycled water producer shall compare bioanalytical equivalent concentrations (BEQs) to their respective MTLs listed in Table 9 to determine BEQ/MTL ratios. The recycled water producer shall compare the calculated BEQ/MTL ratios to the thresholds presented in Table 10 and implement the response actions corresponding to the threshold.

For groundwater recharge - surface application, the recycled water producer shall evaluate the bioanalytical screening results for samples collected from the groundwater monitoring wells. For groundwater recharge - subsurface application and reservoir water augmentation projects, the recycled water producer shall evaluate the bioanalytical screening results for the recycled water following treatment prior to release to the aquifer or surface water reservoir.

*Table 9: Required Equivalency Agonists and Monitoring Trigger Levels for Bioanalytical Screening Tools*

Constituent/ Parameter	Equivalency Agonist	Monitoring Trigger Level (nanograms/liter) <sup>1</sup>
Estrogen receptor- $\alpha$ (ER- $\alpha$ )	17-beta-estradiol	3.5
Aryl hydrocarbon receptor (AhR)	2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	0.5

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<sup>1</sup> The MTL for ER- $\alpha$  represents a health-based MTL. The MTL for AhR represents a level which may or may not be indicative of a health-based effect due to the wide variation in health-based predicted no-effect concentrations of agonists.



Table 10: BEQ/MTL Thresholds and Response Actions for Bioanalytical Screening Tools

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