Recommendations for Variance for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of Total Dissolved Solids, Methods of Calculation, and Supporting Data Requirements

WUES-DWR-2021-09

A Report to the State Water Resources Control Board Prepared Pursuant to California Water Code Section 10609.14

September 2022

California Department of Water Resources
Water Use Efficiency Branch

Note: This report is part of the package of reports developed by the California Department of Water Resources to meet the requirements of Senate Bill 606 and Assembly Bill 1668 of 2018 for urban water use efficiency.

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Abbreviations and Acronyms

2018 Legislation	2018 Legislation on Water Conservation and Drought Planning (Senate Bill 606 [Hertzberg] and Assembly Bill 1668 [Friedman], as amended)
CCR	California Code of Regulations
CII	commercial, industrial, and institutional
CII-DIM	commercial, industrial, and institutional dedicated irrigation meter
CII-DIMWUS	Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard
CIMIS	California Irrigation Management Information System
DIM	dedicated irrigation meter
DM	dedicated meter
dS/m	decisiemens per meter
DWR	California Department of Water Resources
EC	electrical conductivity (Note: Acronym as used in WUES-DWR-2021-09)
ECe	plant threshold salinity
ECiw	salinity of the irrigation (recycled) water
ETAF	evapotranspiration factor in Model Water Efficient Landscape Ordinance design standard (on parcel level)
ETF	evapotranspiration factor (on urban retail water supplier level)
ETF_SLA	evapotranspiration factor for special landscape areas' irrigation with recycled water per Model Water Efficient Landscape Ordinance, as amended
ETo	reference evapotranspiration
IRWUS	Indoor Residential Water Use Efficiency Standard
LA	landscape area
LR	leaching requirement
MAWA	maximum applied water allowance

MCL	maximum contaminant level
mg/L	milligrams per liter
MWELO	Model Water Efficient Landscape Ordinance
ORWUS	Outdoor Residential Water Use Efficiency Standard
PF	plant factor
Recommendation Package	Urban Water Use Efficiency Recommendation Package
SB	Senate Bill
SLA	Special Landscape Area
SLA_htds	total special landscape area irrigated with high total dissolved solids recycled water
SMCL	secondary maximum contaminant level
SNMP	Salt and Nutrient Management Plan
State	State of California
State Water Board	State Water Resources Control Board
TDS	total dissolved solids
UCANR	University of California, Division of Agriculture and Natural Resources
UWUO	urban water use objective
WC	California Water Code
WDR	waste discharge requirement
WELO	Water Efficient Landscape Ordinance
WLS	Water Loss Standard

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Executive Summary

The California State Legislature passed the 2018 Legislation on Water Conservation and Drought Planning (Senate Bill 606 [Hertzberg] and Assembly Bill 1668 [Friedman], as amended; hereinafter referred to as the "2018 Legislation"), which included provisions for advancing urban water use efficiency through developing and implementing various water use efficiency standards, variances, and performance measures. This report provides the purpose and details of review and development, and the recommendations for a variance for "significant landscaped areas irrigated with recycled water having high levels of total dissolved solids" consistent with the directives under California Water Code (WC) Section 10609.14.

WC Section 10609.14 directs the California Department of Water Resources (DWR), in coordination with the State Water Resources Control Board (State Water Board), to conduct necessary studies to recommend appropriate variances for unique uses of water that could have a material effect on an urban retail water supplier's urban water use objective (UWUO). A variance for "significant landscaped areas irrigated with recycled water having high levels of total dissolved solids" is one of the eight potential variances identified in the legislation. For each variance, the recommendations include a threshold of significance and guidelines and methodologies for calculating efficient water use allowable under the variance.

DWR conducted topic-specific research and investigations to answer three critical questions prior to developing recommendations for a variance for significant landscaped areas irrigated with recycled water having high levels of total dissolved solids (TDS):

1. Is this water use outside of the scope of the UWUO? In other words, is this water for non-urban use or part of the commercial, industrial, and institutional water uses other than irrigating landscape with dedicated irrigation meters? If so, the water use is either not subject to the provisions of urban water use efficiency in the 2018 Legislation or excluded from the UWUO and, thus, there is no need for a variance.

2. Is this water use unique within the context of the UWUO? If no, it is not eligible. If yes, the water use is potentially eligible for a variance, and the following two questions need to be answered "yes" to be determined eligible.

    a. Is this water use shared by only some urban retail water suppliers or needed in unusual circumstances, but not commonly used enough to be included in one of the standards?

    b. Is this water use excluded from all urban water use efficiency standards and other variances?

3. Could this unique water use have a material effect on the UWUO of some urban retail water suppliers? If so, the water use is warranted for variance development.

After confirming the above in collaboration with stakeholders and the State Water Board, DWR proceeded with variance development with a clarified scope, whereby use of water for significant landscaped areas irrigated with recycled water having high levels of TDS can be appropriately estimated and incorporated in an urban retail water supplier's UWUO.

Consistent with the legislative directive, DWR used a public process involving a diverse group of stakeholders in the review and development of the variance for significant landscaped areas irrigated with recycled water having high levels of TDS. The Water Use Studies Working Group and the Standards, Methods, and Performance Measures Working Group that DWR established to assist in implementing the 2018 Legislation were the primary stakeholders involved in the variance development process. Additional stakeholders included State of California agencies, cities, counties, urban retail water suppliers, environmental organizations, and other interested parties. Working group members and stakeholders were provided with many opportunities to comment on and inform the appropriateness of recommending a variance for significant landscaped areas irrigated with recycled water having high levels of TDS. Additionally, they were able to comment on, and inform the development and refinements for, the applicable scope, specifications, and methodologies for estimating the efficient water use volume for such a purpose. The resource requirements for administering the variance and associated supporting data requirements, accessibility, and quality were considered in the evaluation.

Through investigation of available data and stakeholder input, DWR concluded that establishing a variance to accommodate the efficient water use for "significant landscaped areas irrigated with recycled water having high levels of total dissolved solids" is appropriate as that water use is unique, excluded from other standards and variances, and can have a material effect on an urban retail water supplier's UWUO. In this recommended variance, DWR focused on addressing the additional water requirements to wash out the salt built up in plant root zones due to irrigation with recycled water having high levels of TDS. Implementation considerations, including the need for technical assistance, are included with the recommendations.

The recommendations for a variance for significant landscaped areas irrigated with recycled water having high levels of TDS are part of the *Recommendations for Urban Water Use Efficiency Standards, Variances, Performance Measures, and Annual Water Use Reporting* (WUES-DWR-2021-01A). The recommendations were prepared per the requirements of the 2018 Legislation and are to be transmitted to the State Water Board for adoption.

1.0 Introduction

Senate Bill (SB) 606 (Hertzberg) and Assembly Bill 1668 (Friedman) of 2018, as amended (hereinafter referred to as the "2018 Legislation"), established a new foundation for long-term improvements in water conservation and drought planning to adapt to climate change and the resulting longer and more intense droughts in the State of California (State). These two bills provide expanded and new authorities and requirements to enable permanent changes and actions for those purposes, thereby improving the State's water future for generations to come. Details of these provisions are summarized in *Making Water Conservation a California Way of Life: Primer of 2018 Legislation on Water Conservation and Drought Planning, Senate Bill 606 (Hertzberg) and Assembly Bill 1668 (Friedman)* (DWR and State Water Board, 2018).

1.1 New Approach to Urban Water Use Efficiency

Among other things, the 2018 Legislation contains provisions for advancing urban water use efficiency through developing and implementing various water use efficiency standards, variances, and performance measures per California Water Code (WC) Section 10609. The new water conservation framework is different than SB X7-7, which was established in 2009. The focus of SB X7-7 was to reduce statewide urban water use by 20 percent in 2020 compared to baseline calculated in 2010. The 2018 Legislation requires a bottom-up estimate from urban retail water suppliers of the urban water use objective (UWUO) based on the aggregated efficient water use volume by considering four urban water use efficiency standards and appropriate variances. The four standards are:

- Indoor Residential Water Use Efficiency Standard (IRWUS).
- Outdoor Residential Water Use Efficiency Standard (ORWUS).
- Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard (CII-DIMWUS).
- Water Loss Standard (WLS).

Commercial, industrial, and institutional (CII) water use not associated with dedicated irrigation meters (DIM) (or equivalent technologies) for outdoor irrigation of landscape areas is excluded from the UWUO.

Each of the procedural requirements to formalize these four standards for implementation is different. The 2018 Legislation includes a default progressively reduced IRWUS (WC Section 10609.4(a)). In November 2021, in collaboration with the

State Water Resources Control Board (State Water Board), the California Department of Water Resources (DWR) submitted the joint recommendations for IRWUS to the California State Legislature for further consideration per WC Section 10609.4(b). Separately, the State Water Board is currently conducting a rulemaking process to adopt the proposed WLS, which was originally authorized by SB 555 of 2015. For ORWUS and CII-DIMWUS, the 2018 Legislation requires DWR, in coordination with the State Water Board, to conduct necessary studies and investigations and develop recommendations to the State Water Board by October 1, 2021 (WC Sections 10609.6 and 10609.8).

Another major difference between the SB X7-7 requirements and those of the 2018 Legislation is that the anticipated outcome was measured on a statewide level per SB X7-7 and on an individual urban retail water supplier level per the 2018 Legislation. Recognizing the diversity of water use to support local economic, social, and environmental needs and varying climate conditions in the State, the 2018 Legislation requires DWR, in coordination with the State Water Board, to conduct necessary studies and investigations. It also requires DWR to develop recommendations for adoption by the State Water Board by October 1, 2021, for appropriate variances for unique uses that can have a material effect on an urban retail water supplier's UWUO and the corresponding thresholds of significance (WC Section 10609.14). In this context, DWR interpreted that a material effect means that this unique water use, although used in an efficient manner, could unfairly jeopardize an urban retail water supplier's ability to meet the UWUO when not explicitly addressed and calculated separately from the volume based on the four water use efficiency standards.

As a supporting recommendation, the 2018 Legislation requires DWR to develop accompanying guidelines and methodologies for calculating the UWUO (WC Section 10609.16) and provide the recommendation to the State Water Board for adoption, along with DWR's recommendations on ORWUS, CII-DIMWUS, and appropriate variances by June 30, 2022 (WC Section 10609.2). The 2018 Legislation further requires DWR and the State Water Board to solicit broad public participation throughout the development and adoption processes (WC Section 10609(b)(3)).

1.2 Appropriate Variances

Per the 2018 Legislation, appropriate variances **may include, but are not limited to,** the following eight identified in WC Section 10609.14(b):

1. Significant use of evaporative coolers.
2. Significant populations of horses and other livestock.
3. Significant fluctuations in seasonal populations.

4. Significant landscaped areas irrigated with recycled water having high levels of total dissolved solids.
5. Significant use of water for soil compaction and dust control.
6. Significant use of water to supplement ponds and lakes to sustain wildlife.
7. Significant use of water to irrigate vegetation for fire protection.
8. Significant use of water for commercial or noncommercial agricultural use.

The eight identified potential variances were subject to further review to affirm the unique use and the likelihood of a material effect on an urban retail water supplier's UWUO before DWR engaged in additional efforts in variance development. Through stakeholder engagement, additional potential variances could also be identified. Additional potential variances may emerge in the future due to changes in water use to meet economic, social, and environmental needs.

When a recommended variance is adopted by the State Water Board, the variance becomes available to urban retail water suppliers. However, before a variance can be included in an urban retail water supplier's UWUO, the urban retail water supplier is required to request, with supporting data, and receive approval from the State Water Board (WC Section 10609.14(d)). This procedural requirement is urban retail water supplier–specific and variance-specific. The State Water Board is required to post on its website a list of approved variances, the specific variances approved for each urban retail water supplier, and the data requirement supporting the approval of each variance for individual urban retail water suppliers (WC Section 10609.14(e)).

1.3 Purpose of the Report

Per legislative requirements, DWR conducted studies and investigations to determine if the legislatively identified potential variances and others suggested by stakeholders should be developed and recommended for adoption. This report is one of the variance-specific reports that focuses on the potential variance for "significant landscaped areas irrigated with recycled water having high levels of total dissolved solids" identified in the legislation.

Water Use to Irrigate Landscape Areas with Recycled Water Having High Levels of Total Dissolved Solids

Recycled water is currently an inseparable part of many urban retail water suppliers' water supply portfolios, especially for the outdoor landscape irrigation. Use of recycled water needs to meet all of the related criteria and regulations. With the perspective of increasing drought intensity and duration as a result of climate change, further expansion of recycled water use is considered as a regional strategy for improving

water resiliency. One significant use of recycled water is for landscape irrigation. Urban landscaped areas irrigated with recycled water may include parks, athletic fields, golf courses, and residential and commercial landscaping (common areas). However, irrigation with recycled water that has a high total dissolved solids (TDS) level would require using additional water, beyond the normal irrigation requirements for plant needs, in order to flush out excess salts that accumulate in the plant root zone (i.e., leaching requirements [*LR*]). The amount of additional water to meet *LR*s depends on the recycled water TDS level. Therefore, a properly defined scope and criteria for application of this water use are critically important for the considerations of this potential variance.

Relationship to California Department of Water Resources' Urban Water Use Efficiency Recommendation Package

DWR has completed a significant body of work to meet the requirements of the 2018 Legislation and provide recommendations on different topics to the State Water Board for adoption. To streamline document development and recognize the inherent interrelationship among different topics and the need for overall consistency, DWR organized the various reports into an Urban Water Use Efficiency Recommendation Package (Recommendation Package) that allows mutual referencing and incorporates content by reference. All reports in this Recommendation Package are given a serial number in the form of "WUES-DWR-2021-xx." For each report, Appendix A includes the list of documents within the Recommendation Package that are incorporated by reference.

Specifically, this report, *Recommendations for Variance for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of Total Dissolved Solids, Methods of Calculation, and Supporting Data Requirements* (WUES-DWR-2021-09), provides the detailed documentation for the review and subsequent variance development for specifications, guidelines, and methodologies for the potential variance for significant landscaped areas irrigated with recycled water having high levels of TDS. The recommendations for this variance were summarized in the report, *Summary of Recommendations for Variances* (WUES-DWR-2021-04), and the corresponding guidelines and methodologies for calculating efficient water use for this variance were summarized in *Recommendations for Guidelines and Methodologies for Calculating Urban Water Use Objective* (WUES-DWR-2021-01B). The additional context, variance development process and approach, evaluation of options, and stakeholder input included in this document are incorporated by reference. Key terms and their definitions used in this report, along with abbreviations and acronyms, are included in *Urban Water Use Efficiency Recommendation Package: Glossary and Abbreviations and Acronyms* (WUES-DWR-2021-21).

Effects on Existing Law and Regulations

DWR developed this variance per legislative directive. The resulting variance, when adopted, does not set, rescind, or modify existing or future water quality limitations for recycled water use.

This variance will only be applicable where use of high TDS recycled water is allowed for irrigation per current regulations and requirements.

1.4 Report Organization

This report is organized into six sections:

- **Section 1 – Introduction** provides the background and purpose of this document.
- **Section 2 – Scope Definition** provides the process and rationales in confirming the scope for this potential variance that reflects unique water use with potential material effects on an urban retail water supplier's UWUO.
- **Section 3 – Approach to Variance Design** describes the technical approach and stakeholder engagement that DWR conducted to support the variance development. Options for different coverages and methods for calculating efficient water use for this variance are discussed and evaluated for technical feasibility, reasonableness, and ability to be implemented.
- **Section 4 – Recommendations** provides DWR's recommendations on this variance, including the specifications, guidelines, and methodologies for calculating efficient water use for this variance and supporting data and information requirements.
- **Section 5 – Glossary** provides a list of key terms and their definitions used in this document.
- **Section 6 – References** provides a list of references that are used in this document.

This report includes two appendices:

- **Appendix A** provides the list of documents in DWR's Recommendation Package that are incorporated by reference.
- **Appendix B** provides a template for calculating the efficient water use to irrigate landscaped areas with recycled water having high levels of TDS. This template is

provided for illustrative purposes and is subject to revision after the State Water Board's adoption.

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2.0 Scope Definition

In accordance with the legislative directive, DWR conducted studies and investigations to develop the information necessary to determine if a variance for significant landscaped areas irrigated with recycled water having high levels of TDS was needed and, if so, to support any recommendation made to the State Water Board on the guidelines and methodologies pertaining to the calculation of an urban retail water supplier's UWUO.

The goals of these studies and investigations were to achieve the following:

- Confirm whether significant use of water, due to significant landscaped areas irrigated with recycled water having high levels of total dissolved solids, is a unique use that could have a material effect on the UWUO of urban retail water suppliers.
- Inform the recommendations for variance specifications, including the threshold of significance.
- Provide the basis for developing guidelines and methodologies for urban retail water suppliers to use in calculating the aggregated efficient water use allowable under this variance.

The first study goal provided a clarified scope for variance development, which was to be accomplished by addressing the remaining two study goals. The process and findings for scope definition are provided in Section 2. Section 3 contains additional variance development and option evaluation to inform the recommendations in Section 4.

2.1 Interpretation of Recycled Water Having High Levels of Total Dissolved Solids Nexus

Using recycled water instead of potable water for irrigation purposes is a viable approach for sustainable management of water resources by urban retail water suppliers. If specific water needs, including irrigation, can be met using recycled water, potable water can be directed for other purposes where recycled water use may be limited or prohibited. However, when used for landscape irrigation, the presence of TDS in recycled water can lead to salt build up in soil, which can affect plant growth and soil health. The level of potential impacts depends on the level of TDS in recycled water along with other factors such as plant tolerance, soil drainage, and climate. Therefore, irrigation with recycled water may require additional water compared to irrigation with

potable water in order to effectively us high TDS recycled water without negatively impacting plant growth and soil health.

As discussed in Section 1.3, *LR* is the amount of water required to bring the soil salinity from a high value down to an acceptable value. The amount of water needed for *LR* depends on salt tolerance of plants (i.e., plant threshold salinity [ECe]) and TDS levels in the recycled water. While the legislative directive emphasizes irrigation of landscaped areas with recycled water having high levels of TDS in this variance consideration, WC does not define what range of TDS concentration is considered “high” for recycled water that is used for landscape irrigation purposes. Therefore, DWR must first define what constitutes “high” TDS that should be warranted a variance beyond what is allowed for ‘normal’ recycled water TDS. While practicing water use efficiency strategies, it is equally important to define an upper bound for recycled water TDS levels in order to limit the adverse consequence of using recycled water with TDS that may be detrimental to plant growth.

2.2 Process for Scope Refinement

In the context of the 2018 Legislation, the four water use efficiency standards cover types of water use commonly shared by most, if not all, urban retail water suppliers. The variances are effectively the less common uses that may be important for only some urban retail water suppliers due to geographic location, local climate, and other local conditions. In concept, the scopes of standards and those of variances are mutually exclusive. However, local water use, facility connections, and account management can be complex due to years of development and implementation of practices without the structure suggested in the 2018 Legislation. Therefore, DWR needed to examine different scenarios associated with water use on landscaped areas irrigated with recycled water having high levels of TDS against three questions in sequence prior to developing variance recommendations:

1. Is this water use out of the scope of the UWUO? In other words, is this water for non-urban use or part of the CII water uses other than irrigating landscape with DIMs? If so, the water use is either not subject to the provisions of urban water use efficiency in the 2018 Legislation or excluded from the UWUO and, thus, there is no need for a variance.

2. Is this water use unique in the context of the UWUO? If no, it is not eligible. If yes, the water use is potentially eligible for a variance, and the following two questions need to be answered “yes” to be determined eligible.

    a. Is this water use shared by only some urban retail water suppliers or needed in unusual circumstances, but not commonly used enough to be included in one of the standards?

   b. Is this water use excluded from all urban water use efficiency standards and other variances?

3. Could this unique water use have a material effect on the UWUO of some urban retail water suppliers? If so, the water use is warranted for variance development.

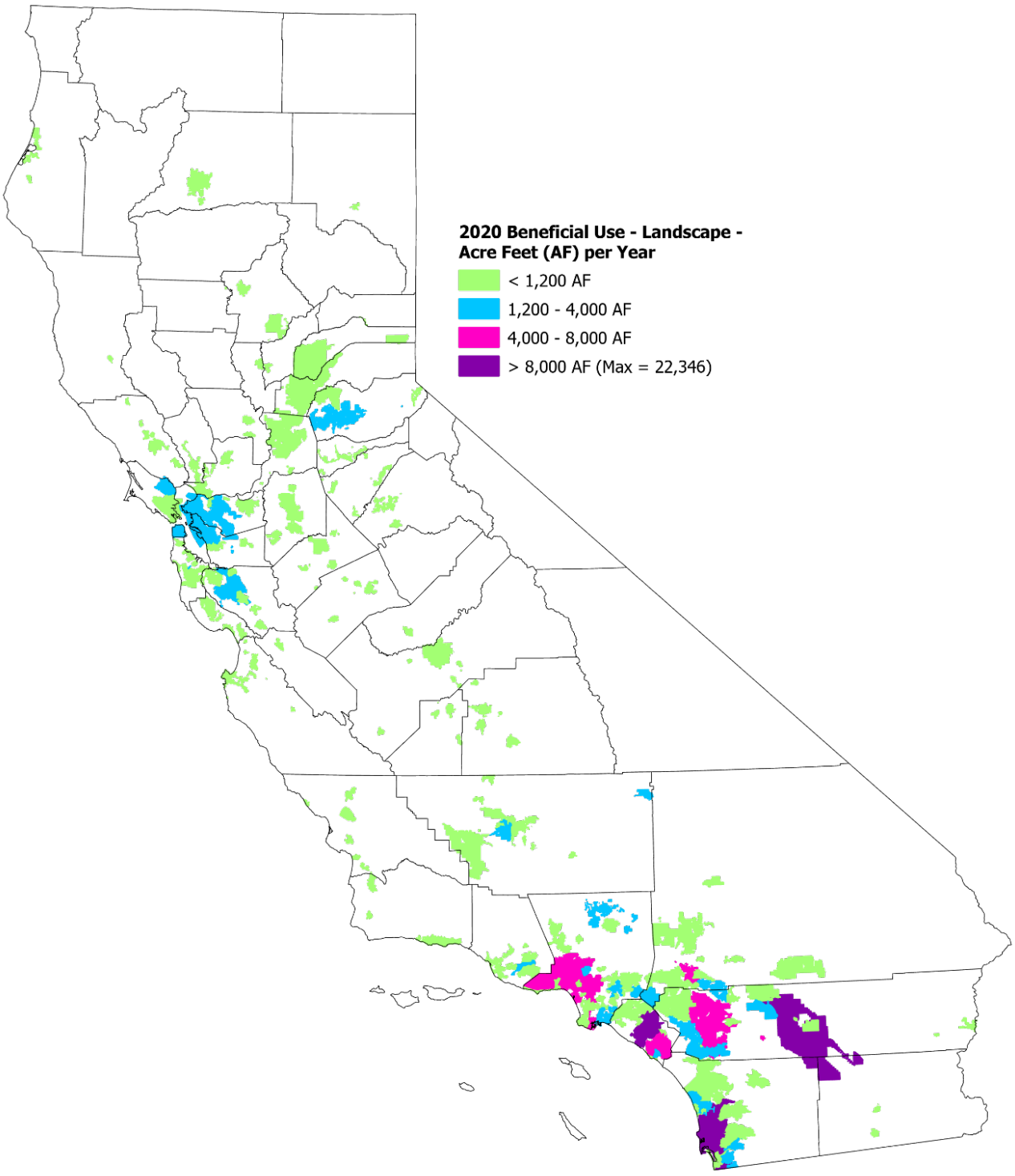
The following summarizes the results of the above process of elimination for clarifying the scope of the variance.

Unique Use

The unique use for variance consideration was established by addressing the first two questions listed above. Statewide recycled water use and quality in terms of TDS levels was explored in order to characterize if a high TDS variance might be applicable and to inform the potential magnitude of effects. Recycled water quality varies across the State and is based on the composition of the initial municipal wastewater, which is a function of the potable water supply quality and end use. The locations and approximate annual use of recycled water for landscape irrigation throughout the State is provided in Figure 2-1. This figure shows that only a few areas use a substantial amount of recycled water. While recycled water use is likely to increase in the future, not all recycled water has higher levels of TDS, and its use may remain concentrated in limited areas.

In April 2021, DWR conducted a survey regarding potential concerns over significant use of water for irrigation with recycled water having high levels of TDS. The survey was completed by 68 urban retail water suppliers in the State. About 12 percent of the participants mentioned that using recycled water with high TDS for irrigation purposes might be significant in their service areas. Urban retail water suppliers located in the South Coast, Colorado River, and San Francisco Bay expected that this specific use would be more than 15 percent of their total water use.

Data on recycled water TDS is less accessible than total quantities of recycled water used. However, available data from a sample of State wastewater agencies producing recycled water indicated that TDS ranges on average from 300 to 2,000 milligrams per liter (mg/L), with a median of 1,200 mg/L (Olivenhain Water District, 2020). This information indicates that potential substantial irrigation using recycled water with higher levels of TDS is not expected to be common in urban retail water supplier service areas.



Data Source: California Department of Water Resources, Water Use Efficiency data (https://wuedata.water.ca.gov/); 2015 and 2020 Urban Water Management Plans

Figure 2-1 Annual Recycled Water Use for Landscape Irrigation

DWR examined multiple scenarios in determining the status of a unique water use, as summarized below. Note that the conditions described below illustrate the filtering process for variance applicability. In practice, an urban retail water supplier would need to assess its actual conditions for variance applicability.

- Conditions that are categorically excluded for variance considerations due to the water use not being part of the UWUO:
  - Water use from mixed-use meters that are partially used for CII landscape irrigation are excluded from the UWUO. However, mixed-use meters with a landscape area that is greater than the conversion threshold specified in CII water use performance measure need to either be converted to a separate commercial, industrial, and institutional dedicated irrigation meter (CII-DIM) or implement in-lieu technology (see *Recommendations for Performance Measures for Commercial, Industrial, and Institutional Water Use* [WUES-DWR-2021-15]).
  - Recycled water used for any purposes other than landscape irrigation with a residential dedicated meter (DM) or a CII-DIM is excluded from the UWUO (e.g., industrial water use).
- Conditions where water use is within the scope of UWUO:
  - Landscape irrigation with normal (not high) TDS recycled water using CII-DIMs or DMs on residential or CII parcels that are reported as CII-DIMs for the purposes of calculating the UWUO are not included in the scope of this variance because this use is covered under CII-DIMWUS through the Special Landscape Area (SLA) provision (see Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard [WUES-DWR-2021-03]). Note that non-potable recycled water use on residential parcels is required to have DMs and, per ORWUS, can be reported under CII-DIMWUS to make use of the SLA provision (see Recommendations for Residential Outdoor Water Use Efficiency Standard [WUES-DWR-2021-02]).
  - Additional water required for leaching when recycled water with higher levels of TDS is used for landscape irrigation to prevent salt buildup in the root zone of plants and soil health issues on residential or CII parcels. As for all non-potable recycled water, this water is provided through a residential DM or a CII-DIM, but the LR is not covered under any water use efficiency standards or other variances under consideration. Therefore, the additional LR associated with use of recycled water with higher levels of TDS may warrant a variance. Note that the non-potable recycled water use on residential parcels is required to have dedicated meters, and per ORWUS, can be

reported under CII-DIMWUS to make use of the SLA provision (see Recommendations for Residential Outdoor Water Use Efficiency Standard [WUES-DWR-2021-02]). Therefore, the variance, if warranted, will be against CII-DIMWUS.

In the above analyses, the unique use of water for landscape irrigation using recycled water having higher levels of TDS by some urban retail water suppliers was confirmed. The consideration of a variance will be against CII-DIMWUS, if warranted. Therefore, it was reasonable for DWR to proceed with evaluating the potential for a material effect on urban retail water suppliers' UWUOs.

Potential for a Material Effect

The potential use of recycled water will be restricted by existing applicable laws and regulations. A number of major regulations in California that must be followed when producing, distributing, and using recycled water are identified in this report. The California Department of Public Health has adopted strict public health and safety requirements and guidelines, which help protect the public from any potential risk associated with recycled water use. These requirements are described in Titles 17 and 22 of the California Code of Regulations (CCR). Permits to oversee the production, conveyance, and use of recycled water are granted by the State Water Board and the corresponding Regional Water Quality Control Board(s). Local Departments of Public Health or Environmental Health may also have guidelines and inspection requirements for recycled water use. Additionally, local and regional utilities may adopt and implement their own ordinances or requirements pertaining to recycled water use. Other legislative and state requirements that are pertinent to the use of this variance include, but are not limited to, the following:

- Salt and Nutrient Management Plans (SNMP) – In 2009, the State Water Board adopted the Recycled Water Policy (Resolution No. 2009-0011), which aims to encourage the use of recycled water while protecting groundwater quality. Use of recycled water may contribute to excess salt and nutrient loading in groundwater basins that exceed basin water quality objectives. SNMPs help manage basin-wide sources of salts and nutrients to protect water quality and beneficial uses of groundwater. Those groundwater basins that have been evaluated as vulnerable to degradation by salts and nutrients must have an associated SNMP that use of recycled water will have to comply with. However, not all groundwater basins have been evaluated as vulnerable, so all may not have SNMPs. Regardless, the recycled water supplier would have to ensure that its use would not contribute to groundwater or surface water quality degradation consistent with the Antidegradation Policy described below. This condition could significantly limit the use of recycled water with high TDS.

- Antidegradation Policy – The State Water Board adopted the Antidegradation Policy (Resolution 68-16) to protect surface water and groundwater from degradation. This policy requires that existing high-quality waters be maintained to the extent possible. Recycled water project proponents (recycled water suppliers) seeking to enroll under the statewide water reclamation requirements must demonstrate compliance with the Antidegradation Policy by showing that they are in compliance with an accepted SNMP or that they are participating in an existing salt and nutrient management planning effort.

- CCR, Title 22 – This regulation establishes State guidelines for water quality and recycled water treatment requirements. It also establishes how recycled water can be discharged and used.

- Waste Discharge Requirement (WDR) – All discharges of municipal, commercial, or industrial waste that may affect surface water or groundwater quality are regulated by WDRs. WDRs are issued by associated Regional Water Quality Control Boards and regulate the type of treatment, volume of discharge, and types of application for municipal wastewater effluent, including treated recycled water uses.

- Recycled Water Policy – The State Water Board adopted the Recycled Water Policy to encourage the use of recycled water by setting goals for the volume of recycled water treated and used and for encouraging recycled water use where groundwater supplies are over drafted.

- Water Reclamation Requirements for Recycled Water Use – The State Water Board's Water Quality Control Policy for Recycled Water and General Order WQ 2016-0068-DDW governs the reclamation of water for reuse. This General Order requires that recycled water use shall not cause unacceptable groundwater and/or surface water degradation. Additionally, the amount of recycled water applied is limited to agronomic rates (what the plants need) that limits the potential for significant amounts of recycled water to impact groundwater quality and allows for plants to take up some of the nutrients from wastewater.

Based on data from Urban Water Management Plans[2] submitted to DWR, recycled water for landscape irrigation comprises approximately 36 percent, or approximately 205,000 acre-feet per year, of all recycled water used throughout the State and is currently used by over 150 urban retail water suppliers for this purpose.[3] As previously discussed, recycled water use is an important strategy for improving the State's

[2] Data from all urban retail water suppliers' 2020 Urban Water Management Plans are pending and not fully accessible.
[3] Data Source: California Department of Water Resources, Water Use Efficiency data (https://wuedata.water.ca.gov/); 2015 and 2020 Urban Water Management Plans.

resiliency against drought. Accordingly, there is a push to expand recycled water use in the State and these values are expected to continue increasing.

Although recycled water use might remain limited only to those urban retail water suppliers who have access to the recycled water source and meet all the regulatory requirements, as well as anything else that might be missed in the list, those suppliers might increase their use of recycled water.

Data from the *2020 Volumetric Reporting of Wastewater and Recycled Water* report to the State Water Board showed that there was a 6 percent increase in recycled water use from 2019 to 2020.[4]

Irrigation with Recycled Water and Leaching Requirements

An important factor in using recycled water for landscape irrigation that could significantly increase water consumption is the *LR*. While it is not always possible, in general, salt intolerant plants should not be used for landscapes where recycled water is applied. If recycled water with high TDS is used for irrigation, additional water would be needed to push the excess salt from soil and the plant root zone to keep the plants healthy. The *LR*s often vary by the types of plants, the amount and quality of recycled water used, and site-specific soil drainage conditions.

There are multiple types of recycled water used for landscape irrigation. However, most of this recycled water is tertiary treated, which is a higher level of treatment than conventional wastewater treatment, and is considered safe for public exposure but not for public consumption. The significant salts remaining after treatment are sodium and chloride, which are soluble salts contributing to recycled water salinity. Salinity that can be expressed as electrical conductivity (EC), typically in units of decisiemens per meter (dS/m) or by the amount of TDS, which are the inorganics salts, metals, and minerals in the water. TDS is usually expressed in parts per million or mg/L. TDS is highly correlated to EC and EC is often used to describe salinity because it is much simpler to measure. While treated recycled water is not intended for potable use, it can be considered for a number of other uses, primarily landscape irrigation and certain CII process operations.

Plant Soil Salt Tolerance and Leaching Requirements

Since plant species vary widely in their tolerance to salinity (Table 2-1), plants with moderate to high soil salt tolerance (i.e., *ECe* greater than 6 dS/m, or 4,800 mg/L), such as drought tolerant or native species, can survive in sites that contain high concentrations of salts that would not be suitable for plants with low tolerance to salty soil. In most cases, the salt concentration in areas landscaped with moderate and high salt tolerant plants can be managed with rainfall and leaching. Some landscapes,

[4] https://www.waterboards.ca.gov/water_issues/programs/recycled_water/docs/2021/2020_var_infographic.pdf

however, are composed of a variety of plants having a range of salt tolerance and soil types that require different irrigation management strategies.

Table 2-1 Relative Tolerances of California Turfgrass Species to Soil Salinity

Sensitive (*ECe* < 3 dS/m)	Moderately Sensitive (3 < *ECe* < 6 dS/m)	Moderately Tolerant (6 < *ECe* < 10 dS/m)	Tolerant (*ECe* >10 dS/m)
Annual bluegrass Colonial bentgrass Kentucky bluegrass Rough bluegrass	Annual ryegrass Creeping bentgrass Fine-leaf fescues Buffalograss	Perennial ryegrass Tall fescue Zoysiagrasses	Alkaligrass Bermudagrasses Seashore paspalum St. Augustinegrass

Source: Harivandi, M.A. et al., 1992
Key:
< = less than
> = greater than
dS/m = decisiemens per meter
ECe = plant threshold salinity

Due to the wide variability of landscape plant types and associated soil salt tolerances, the salt concentration (or TDS) in recycled water must be acceptable for a wide range of plant species in a single landscape setting.

The *LR* for controlling salinity buildup in soils can be calculated as follows:

$$LR = ECiw / [5 \times (ECe - ECiw)]$$

where,

- *ECe* is the plant threshold salinity.
- *ECiw* is the salinity of the irrigation (recycled) water.
- *LR* is the leaching requirement (unitless).

California Turfgrass Leaching Requirements Analysis

The most common application for landscape irrigation with recycled water is on large landscapes such as parks, athletic fields, and golf courses. These areas are typically planted with turfgrass, which is one of the most common groundcovers throughout the nation. There are various species of turfgrass, which can be categorized as either cool season (stays active all year long) or warm season (winter dormant). Cool season grasses commonly found in the State include Kentucky bluegrass and Fescue. Warm season grasses commonly found in the State include Bermudagrass and Buffalograss. Turfgrass species also vary in qualities related to upkeep including mowing, fertilizing, and watering. Specifically, when irrigating turfgrass with recycled water, the salt tolerance of different turfgrass species will affect the amount of water needing to be

applied during irrigation to assist with leaching. Turfgrass can range in relative tolerances to soil salinity from highly sensitive (Kentucky bluegrass) to tolerant (Bermudagrass).

Due to the popularity and availability within the State of the four turfgrasses discussed above, a literature review was performed to determine the relative *LR*s of these turfgrasses based on their general characteristics. It should be noted that *LR*s for the same species of grass will vary across climate zones, soil conditions, irrigation frequency and method, and water quality. A range of values for TDS were included as part of the analysis to determine the sensitivity of the turfgrass to the TDS values of recycled water currently seen throughout the State. The results from this analysis, presented in Table 2-2, indicated that various turfgrass species found throughout the State may have *LR*s ranging between 0.00 and 0.26, meaning up to 40 percent more water would be needed to meet *LR*s when irrigating using recycled water with TDS greater than 500 mg/L.

Table 2-2 California Turfgrass Leaching Requirements

Plant Type	Tall Fescue	Kentucky Bluegrass	Bermudagrass	Buffalograss
Category	Cool Season, tolerant turfgrass	Cool Season, sensitive turfgrass	Warm Season, tolerant turfgrass	Warm Season, sensitive turfgrass
Plant Factor	0.8	0.8	0.6	0.6
Salinity Tolerance (dS/m)	7	3	10	4
TDS (mg/L)	**Leaching Requirement**			
500	0.02	0.05	0.02	0.04
600	0.03	0.07	0.02	0.05
700	0.03	0.08	0.02	0.06
800	0.04	0.09	0.03	0.07
900	0.04	0.10	0.03	0.08
1,000	0.05	0.12	0.03	0.08
1,100	0.05	0.13	0.04	0.09
1,200	0.06	0.14	0.04	0.10
1,300	0.06	0.16	0.04	0.11
1,400	0.07	0.17	0.05	0.12
1,500	0.07	0.19	0.05	0.13
1,600	0.08	0.20	0.05	0.14
1,700	0.08	0.22	0.06	0.15
1,800	0.09	0.23	0.06	0.16
1,900	0.09	0.25	0.06	0.17
2,000	0.10	0.26	0.07	0.19

Key:
dS/m = decisiemens per meter; mg/L = milligrams per liter; TDS = total dissolved solids

Given that some urban retail water suppliers use considerable amounts of recycled water for landscape irrigation, if recycled water has high TDS, the need for additional water to meet *LR*s could have a material effect on the urban retail water supplier's UWUO.

2.3 Clarified Scope for Variance Development

Based on the analysis, the variance for landscape irrigation using recycled water with high TDS applies only to those water uses in landscape irrigation on residential or CII parcels that are in compliance with all applicable laws, regulations, and ordinances for recycled water use. The current regulations require the recycled water use for irrigation purposes to be delivered through a DM. Per recommendations in ORWUS, recycled water use from residential DMs needs to be reported under CII-DIMWUS. Therefore, the resulting variance will be against only CII-DIMWUS (see *Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard* [WUES-DWR-2021-03]) and *Recommendations for Outdoor Residential Water Use Efficiency Standard* [WUES-DWR-2021-02]).

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3.0 Approach to Variance Design

DWR's approach to variance design was an iterative process in collaboration with stakeholders and the State Water Board to assist DWR in refining options and associated specifications and data needs. Taking into consideration findings from the studies, research, and input and feedback from the collaborative process, DWR formulated the recommendations.

3.1 Stakeholder Process

Consistent with the legislative directive, DWR used a public process involving diverse stakeholders in the review and development of the variance for significant use of water to supplement ponds and lakes to sustain wildlife. The stakeholder process was part of the larger engagement process to implement the provisions of urban water use efficiency in the 2018 Legislation (see *Stakeholder Outreach Summary for Developing Urban Water Use Efficiency Standards, Variances, and Performance Measures* [WUES-DWR-2021-20]). More focused stakeholder engagements specifically for variances started in November 2020, with periodic meetings and workshops held through early 2022.

DWR established two working groups to assist in implementing the 2018 Legislation, and these groups formed the base of the stakeholder involvement process that included State agencies, cities, counties, urban retail water suppliers, environmental organizations, professionals, and other stakeholders and interested parties. The Water Use Studies Working Group was established in July 2019 to inform DWR in developing water use studies for setting up standards, variances, and performance measures. Concurrently, the Standards, Methods, and Performance Measures Working Group was also established to provide input to DWR on developing the structure and specifications of water use efficiency standards, variances, methodologies, and performance measures. However, due to the close relationship between research and variance design, members of both working groups were invited to participate in the same stakeholder meetings and workshops. DWR opened working group meetings and workshops to the public to allow for broader participation in and input from other stakeholders, interested parties, and individuals.

Working group members and other participants had ample opportunities to learn about the variance design process and provide feedback on the appropriateness of this specific variance being developed and the scope, specifications, and methodologies for estimating efficient water use. They provided input on variance implementation, such as resource needs (staff), supporting data requirements, and accessibility considerations.

DWR also conducted and responded to requests for additional meetings and public outreach and engagement activities with both individuals and groups of stakeholders to

learn from their experiences, understand their specific concerns, and receive other feedback. For this variance, there were no specific studies using data from urban retail water suppliers.

3.2 Considerations for Variance Design

As stated in Section 2.3, the clarified scope for the variance for landscape irrigation with high TDS recycled water applies only to landscape areas on residential or CII parcels irrigated with recycled water that satisfies the applicable laws, regulations, and ordinances. Also, the recycled water use for irrigation must be delivered through a DM to a residential parcel or through a CII-DIM. Per ORWUS, recycled water use from residential DMs needs to be reported under CII-DIMWUS. Therefore, the resulting variance would be against CII-DIMWUS only. DWR proceeded with variance development after confirming this clarified scope with stakeholders and working group members.

In variance design, DWR needed to determine what would constitute efficient water use for landscape irrigation using recycled water with high TDS, what level of estimated water use (i.e., significance threshold) should be achieved before an urban retail water supplier could claim the variance in its UWUO, and how to calculate the aggregated water use under the variance with credible data and supporting information. Based on the research and stakeholder input, DWR considered the following factors.

- This variance will only be applicable where use of recycled water is allowed under all existing regulations and requirements. Therefore, this variance does not set water quality limitations for recycled water use on a statewide, regional, or local level.
  - In certain locations, these requirements may significantly limit, if not prohibit, use of recycled water with high TDS for landscape irrigation.
- WC does not define what range of TDS concentration is considered “high” for recycled water that is used for landscape irrigation purposes. Therefore, DWR considered it necessary to provide a range for what constitutes “high” TDS that should be warranted a variance.
- Landscape irrigation using recycled water with high TDS needs water in addition to what is required for irrigation for *LR*s. Consistent with established practices under the existing water use efficiency regulatory framework, landscape irrigation with recycled water receives SLA provisions based on CII-DIMWUS (see *Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard* [WUES-DWR-2021-03]). Therefore, the variance for landscape

irrigation using recycled water with high TDS focuses only on the additional water needs for *LR*s.

- Although using salt tolerant plants is advised, where using recycled water with high TDS for irrigation purposes is allowed, DWR acknowledged that certain functions of irrigated landscapes such as soccer fields cannot be served with salt tolerance plant variants.

- DWR considered that, where possible, consistency with existing regulations and established practices could potentially streamline the design and implementation of this variance. Therefore, DWR considered the Model Water Efficient Landscape Ordinance (MWELO) (CCR, Title 23, Sections 490 through 495) as a solid foundation for the variance design and associated methodologies for calculating water use volume allowable under this variance. It is also important to include considerations for variance specifications and methodologies to be adaptive to future amendments of MWELO.

- DWR recognized that specific data are needed in order to follow the calculation of water use for this variance. Many urban retail water suppliers expressed concerns over the potential burden and costs to pursue a variance in addition to compliance with many other requirements under the provisions of urban water use efficiency in the 2018 Legislation. Therefore, DWR considered the following to be reasonable:

  - The methodology for calculating aggregated water use under this variance should, to the extent reasonable, stay consistent with existing water use efficiency laws and regulations or build on existing methodologies used by urban retail water suppliers in SB X7-7 compliance.

  - The data and information required to support a variance and calculated amount need to be credible, reasonably accessible to urban retail water suppliers or reasonably obtainable by urban retail water suppliers, or separately provided by DWR to the extent possible.

  - Necessary technical assistance from DWR related to implementation should be also incorporated into the variance development process.

Defining High Total Dissolved Solids

Before exploring whether use of high TDS recycled water warrants a variance, what is meant by ‘high TDS’ needs to be defined. One of the most challenging aspects for the design of this variance was to define high TDS range with a proper context. Recycled water is currently being used for landscape irrigation with a high potential for future expansion. The existing MWELO and DWR recommended CII-DIMWUS recognize the State policy for promoting recycled water use while encouraging for water use efficiency

by providing an SLA provision for landscape areas irrigated with recycled water. Without any direct references in existing law and regulations, DWR used available data and other relevant information to develop a reasonable definition for high TDS. The resulting definition should not interfere with current regulations governing recycled water use for landscape irrigation.

First, DWR considered the water management aspect of using recycled water. Recycled water is used to promote a more robust water supply portfolio for urban retail water suppliers by replacing portable water use with recycled water for landscaped area irrigation. Water quality considerations for recycled water use are often based on the water quality of available potable water because TDS values of recycled water are usually proportionate to the potable water TDS seen in the same area. Data from recycled water and wastewater treatment facilities across the State indicated that the median TDS observed would be approximately 1,200 mg/L with a maximum TDS of approximately 2,000 mg/L. From the viewpoint of creating a robust water supply portfolio, it is also reasonable to consider deploying recycled water for use when lower water quality is required, thereby saving limited potable water for essential purposes, such as for drinking.

Comparison to Potable Water Quality Criteria

Recognizing that there are many other quality requirements for potable water, CCR, Title 22, Division 4, Chapter 15, Article 16, recommends 500 mg/L as the maximum contaminant level for TDS for drinking water. This regulation also includes a secondary maximum contaminant level (SMCL) of 1,000 mg/L that are considered to not present a risk to human health. The SMCL is not usually used for drinking water and is mainly established as a guideline to assist public water systems in managing their drinking water for aesthetic considerations such as taste, color, and odor. While it does not provide specific directions for DWR to determine how high is high for TDS of recycled water that is used for irrigation purposes, it suggested that an acceptable threshold for TDS level could be approximately 1,000 mg/L.

The input from working group members and stakeholders recognized the referenced SMCL may not be directly applicable to set the threshold for using this variance, but they confirmed that it could be a starting point to discuss the appropriate levels of TDS or, specifically, the appropriate range of high TDS for irrigation with recycled water. More details are presented below.

DWR has not received specific input from the stakeholders regarding current examples where recycled water use for landscape irrigation was prohibited or discouraged due to the concerns over high TDS. The stakeholders considered the variance, if approved, an opportunity that could provide additional incentives to expand the use of recycled water.

Acceptable Range of TDS for Landscape Irrigation

Available research and literature suggest that irrigation water with TDS of 525 to 1,400 mg/L is "permissible" for landscape irrigation with potential *LR*s. University of California, Division of Agriculture and Natural Resources studied salt tolerance of common forage and grass types across the State where recycled water is used for irrigation. The classification showed a range from moderately sensitive to TDS (960 mg/L) to tolerant to TDS (up to 5,520 mg/L) (UCANR, n.d.). Fipps (2003) also suggested that using recycled water with TDS above 1,400 mg/L requires specific considerations, including good drainage, and TDS above 2,000 mg/L is not suitable due to potential high risks to plant health.

- **Upper bound**: Research of available studies and data suggested that additional *LR*s may be required for the use of recycled water with TDS concentration above 1,400 mg/L and that increasing TDS levels result in higher LRs. In addition to higher water requirements, additional costs associated with using different drainage infrastructure and compliance with regulatory requirements should be also considered. Note that specific limitations on recycled water use are often determined based on plant characteristics, local soil and groundwater conditions, and applicable regulatory requirements. However, for the purpose of this variance, DWR considered that the reasonable upper bound for TDS should be set at some level between 1,400 and 2,000 mg/L, leaning toward the lower spectrum of this range to avoid undesirable adverse impacts on plant growth and soil health while allowing for leaching to safely mitigate salt buildup in the plant root zone due to irrigation using recycled water with high TDS.

  Through discussions with stakeholders, DWR has determined that 1,600 mg/L is a reasonable upper bound for the TDS to be considered for this variance to balance the State water use efficiency practices and promotion of recycled water use without negatively impacting plant growth and soil health. Urban retail water supplies could use recycled water with higher TDS levels than 1,600 mg/L; however, DWR does not endorse using recycled water with TDS levels above 1,600 mg/L based on currently available studies and, thus, will not grant additional water use needed for *LR*s for irrigation using recycled water with TDS greater than 1,600 mg/L.

- **Lower bound**: On the lower end of high TDS for the variance application, DWR reviewed the available research and literature and concluded that the different between *LR*s for 900 through 1,000 mg/L would not be considerable. Therefore, based on stakeholder input, DWR followed a conservative approach and proposed to use 900 mg/L as the lower bound of TDS applicable for this variance.

Recommended High TDS Definition

In summary, through literature reviews and stakeholder discussions, DWR concluded that using recycled water with TDS levels between 900 mg/L and 1,600 mg/L for this variance would balance the State policies regarding drought resiliency improvement, water conservation and water use efficiency, as well as safe applications of recycled water for landscape irrigation purposes.

3.3 Variance Options

The variance efficient water use calculation was designed following MWELO principles and considering the precision of data that urban retail water suppliers would rely upon to calculate their water use for landscape irrigation using recycled water with high TDS. All options were discussed with stakeholders in working group meetings on May 13 and July 21, 2021. DWR also engaged stakeholders for additional topic specific discussions throughout the process.

The purposes of designing different options with various considerations were to explore pros and cons for different settings and solicit input from stakeholders regarding their corresponding reasonableness and ability to implement them. Based on the resulting findings and insights, DWR then developed the recommendations (Section 4). The following section first provides discussions of DWR's considerations for critical elements of the variance. Subsequently, variance options with different combinations of specifications for comparison are provided and finally stakeholder input are discussed.

Calculating the Variance Efficient Water Use

As previously mentioned in Section 3.2, DWR considered that, where possible, consistency with existing regulations and established practices for water use volume calculation could potentially streamline the implementation of this variance. In general, stakeholders agreed with DWR on this premise.

Consistency with Existing Regulations and Established Practices for Irrigation Water Use Efficiency

DWR considered that MWELO has provided a good basis for calculating the efficient water use under this variance. MWELO is a State regulation (CCR, Title 23, Sections 490 through 495) that was updated last in 2015. It is for the purpose of requiring water-efficient landscapes in new developments that are equal to or greater than 500 square feet and rehabilitated landscapes that are equal to or greater than 2,500 square feet requiring a permit. The MWELO is also referenced by CCR, Title 24, Part 11 CalGreen Building Code. All local agencies must adopt, implement, and enforce the MWELO or a local Water Efficient Landscape Ordinance (WELO) that is at least as effective as the MWELO. Usually, local agencies adopt WELOs to create a more stringent ordinance than MWELO. However, any existing regulations are subject to amendments. Thus, it is

also important to consider the longevity of this variance in design and in its recommended methodologies for calculating the variance allowable water use volume.

This variance is against CII-DIMWUS, which includes SLA provisions for landscape irrigation using recycled water that are consistent with current MWELO specifications. The current MWELO includes an additional water allowance for SLAs including recycled water irrigated landscapes. This adjustment factor allowed is not solely based on physical needs of plants, but it also considers the State policy for encouraging recycled water use. On the other hand, in order to avoid adverse impacts on plant growth or soil health, the total volume of recycled water with high TDS that is needed for landscape irrigation should cover both the volume for efficient water use for landscape irrigation (as considered under CII-DIMWUS) and the additional volume needed for *LR*s. As a result, the allowable water use volume under this variance should cover the difference between the total volume of recycled water with high TDS needed for proper application of landscape irrigation and the water use volume allowed for in existing applicable regulations or standards (in the current context, the volume based on SLA provisions under CII-DIMWUS).

DWR also recognized that MWELO is subject to future amendments and the current allowance for SLAs under CII-DIMWUS, which is based off MWELO, may not remain indefinitely. From the viewpoint of longevity for regulations, DWR considered that it is important to design a methodology for calculating the water use volume under this variance in a manner that is adaptable to future changes of SLA provisions in MWELO, and always resulting in the same total volume of water required to properly apply recycled water with high TDS for landscape irrigation. This consideration was reflected in all options.

MWELO Principles in Calculating Water Use Volume

MWELO relies on a quantitative approach to determine efficient water use by setting a Maximum Applied Water Allowance (MAWA) as an upper limit of water that can be applied annually for an irrigated landscape (CCR, Title 23, Section 491(tt)).

$$MAWA = ETo \times 0.62 \times ETAF \times LA$$

where,

- *ETo* is the reference evapotranspiration in inches.
- 0.62 is a unit conversion factor in gallons per square feet.
- *ETAF* is the evapotranspiration factor in MWELO design standard (on parcel level) based on the plant factors (*PF*) and irrigation methods selected standard for individual landscapes.
- *LA* is total landscape area in square feet.

MWELO defines an SLA as an area of the landscape dedicated solely to edible plants, recreational areas, areas irrigated with recycled water, or water features using recycled water (CCR, Title 23, Section 491(ttt)). These SLAs are allowed to use an *ETAF* of 1.0 in the MAWA calculation (CCR, Title 23, Section 491(s)).

It is worth noting that MWELO is a design standard and, thus, the *ETAF* is applied on a parcel or landscape level. Additional treatments are applied for variance design to use an evapotranspiration factor on an urban retail water supplier level (*ETF*) to be consistent with the legislative directive for implementing the provisions of urban water use efficiency in 2018 Legislation.

DWR considers MWELO specifications as a solid building block for the methodology to calculate efficient water use under this variance. As previously discussed in Section 2, the MWELO allowance may not be enough to protect plant and soil health if high TDS recycled water is used for irrigation. Therefore, an *ETF* adjustment needs to be incorporated into the equation to calculate the additional efficient water use volume allowed under this variance. DWR established three options for calculating efficient water use based on different approaches for *ETF* adjustment for landscape irrigation with high TDS recycled water and discussed with stakeholders in working group meetings on May 13 and July 21, 2021.

Different designed options to calculate the efficient water use for this variance include two common parameters:

- **Total Landscape Area in Service Area Irrigated Using Recycled Water with High TDS Irrigated Landscape Area**. To avoid confusion with SLA irrigated using recycled water with normal (not high) TDS levels, another class of SLA area measurement is defined for the purpose of this variance, which is total SLA irrigated with high TDS recycled water (*SLA_htds*).

- **Reference Evapotranspiration (*ETo*)**. Reference evapotranspiration is determined on an urban retail water supplier level based on the hydrological condition of each urban retail water supplier using data provided by DWR and available at California Irrigation Management Information System (CIMIS).

Seasonal variations in weather conditions, plant characteristics, and water management strategies and irrigation efficiency, among many other factors, all affect how much water is necessary for irrigation. The *ETF* is used to adjust the reference evapotranspiration based on these controlling factors. As a result, the variance efficient water use calculation focuses on *ETF* determination. In the case of irrigation using recycled water with high TDS, *ETF* needs to be further adjusted to accommodate the necessary *LR*s. *LR*, itself, depends on the *ECiw* and *ECe*. *Adjusted ETF* for using high TDS water is determined as follows:

$$Adjusted\ ETF = PF\ /\ [\text{irrigation efficiency} \times (1 - LR)]$$

where,

- *PF* is plant factor (unitless).
- Irrigation efficiency depends on the irrigation system percentage, which is 0.75 for sprinklers and 0.81 for drip or micro-spray systems under the 2015 MWELO.
- *LR* is the leaching requirement (unitless).

Depending on data availability, two main approaches were followed to calculate the efficient water use under this variance that lead to three option designs: an aggregate approach with two levels of data availability and a detailed approach.

Complexity of the Methodology, Associated Data Needs, and Significance Thresholds

Landscape plant choices are not controlled by urban retail water suppliers, and they can change from time to time as well. Landscape area plant mixes can be uniform or very diverse. DWR considered the importance of keeping the methodology for calculating water use volume for this variance simple to the extent practicable, recognizing that there may be limitations for urban retail water suppliers in acquiring and maintaining detailed data for every landscape area. At the same time, DWR also considered that many urban retail water suppliers have access to detailed data due to years of effort in using and managing recycled water in their service areas. Under this condition, DWR recognized that the variance methodology should accommodate the intent of active management by these urban retail water suppliers with the associated significance threshold for using this variance adjusted accordingly. The variance options presented below incorporate these considerations in specifications.

Options for Calculating *Adjusted Evapotranspiration Factor*

Based on the above considerations, DWR developed three options with different combinations of specifications. These options were constructed for contrasting the effects of different specifications for discussion purposes. DWR extracted beneficial elements from different options to inform the recommendations in Section 4.

- **Option 1 – Aggregate Approach Using Dominant Plant Types Across the State to Estimate a Service Area Constant *Adjusted ETF***. The dominant applications of recycled water used for landscape irrigation is for turfgrass. Therefore, there are benefits in developing the variance water use volume calculation using these dominant plant types to simplify the process.

Based on the California Turfgrass *LR* analysis provided in Section 2.2 of this report, corresponding *ETF*s for irrigation of the most common turfgrass across the State using high TDS recycled water was calculated. This analysis resulted in a range of *ETF* between 0.82 and 1.33, as presented in Table 3-1. The 90th percentile of the *ETF* values provided is 1.26 and was considered a reasonable constant *ETF* for the variance design.

The MWELO and CII-DIMWUS already allow for a higher *ETF* for SLAs, including landscapes irrigated with recycled water. Therefore, an irrigation budget using an *ETF* of 1.26 should consider the existing irrigation allotment for recycled water in calculating efficient water use, meaning that additional water allowed for under this variance would be 0.26 greater than the currently allowed for recycled water efficient irrigation *ETF* of 1.0 (2015 MWELO). To account for potential changes in a future MWELO, the *Adjusted ETF* was designed as follows:

$$Adjusted\ ETF = 0.26 + [1 - ETF\_SLA]$$

where,

- *ETF*_SLA is the evapotranspiration factor for special landscape areas' irrigation with recycled water per MWELO, as amended.

The *Adjusted ETF* should be greater than 0. This would be the simplest calculation option and subsequently the most conservative option due to the limited availability of detailed data to calculate the *ETF*. Urban retail water suppliers would be required to report *SLA_htds*, *ETo*, and recycled water TDS, to calculate efficient water use under this variance option. The significance of threshold for this option was set at 10 percent of the total aggregated water use based on the four urban water use efficiency standards.

Table 3-1 California Turfgrass Evapotranspiration Factors

TDS (mg/L)	Tall Fescue	Kentucky Bluegrass	Bermudagrass	Buffalograss
900	1.11	1.19	0.82	0.87
1,000	1.12	1.21	0.83	0.87
1,100	1.12	1.23	0.83	0.88
1,200	1.13	1.24	0.83	0.89
1,300	1.14	1.26	0.84	0.90
1,400	1.14	1.29	0.84	0.91
1,500	1.15	1.31	0.84	0.92
1,600	1.16	1.33	0.84	0.93

Key:
mg/L = milligrams per liter
TDS = total dissolved solids

- **Option 2 – Aggregate Approach to Estimate an *ETF* based on the TDS Concentration of Recycled Water**. In this option, DWR recognized that the generalization in Option 1 may not be adequate to represent the needs of urban retail water suppliers or to provide fair calculation of resulting efficient water use volume. Therefore, a more refined approach based on local conditions would be required.

  Understanding that TDS concentrations of recycled water vary across regions, this option provided a sliding-scale *ETF* adjustment for *LR*, depending on the recycled water salinity. The sliding scale (see Figure 3-1) represents a linear increase in *ETF* from 0 to 0.26 above the *ETF_SLA* of 1.0 (allowed for recycled water irrigation under 2015 MWELO) to accomodate actual needs for leaching using high TDS recycled water used for irrigation. As shown in Figure 3-1, if TDS of recycled water is 900 mg/L, no *ETF* adjustment above 1.0 would be allowed, and if TDS is greater than 1,600 mg/L, an *ETF* adjustment is capped at 0.26 above 1.0.

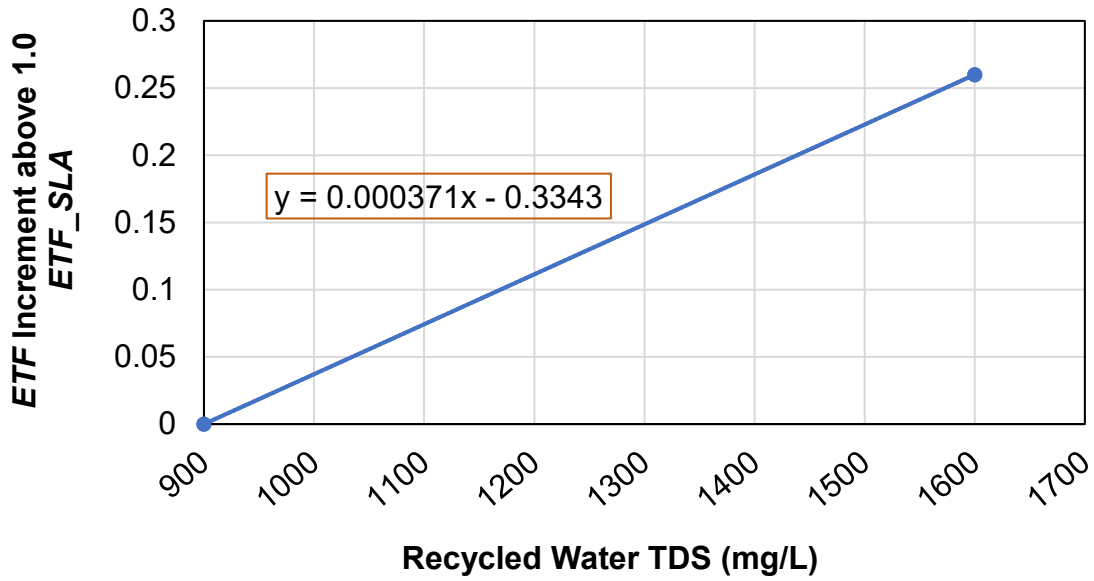

Figure 3-1 Evapotranspiration Factor Increment Relationship to Total Dissolved Solids in Option 2

Similar to Option 1, the *Adjusted ETF* for this variance needs to compensate for the volume of water that is needed for *LR*s regardless of the *ETF_SLA* in effect at the time. Therefore, Option 2 was also designed to cover the water requirement if the *ETF_SLA* is changed in future when MWELO is amended.

- For 900 mg/L < TDS ≤ 1,600 mg/L:

$$Adjusted\ ETF = [0.000371 \times (TDS - 900\ mg/L)] + (1 - ETF\_SLA)$$

- For TDS > 1,600 mg/L:

$$Adjusted\ ETF = 0.26 + (1 - ETF\_SLA)$$

where,

- ETF_*SLA* is the evapotranspiration factor for Special Landscape Areas' irrigation with recycled water per MWELO, as amended.

The *Adjusted ETF* should be greater than 0. Urban retail water suppliers would be required to report *SLA_htds*, *ETo*, *Adjusted ETF,* and recycled water *TDS*, to calculate efficient water use under this variance option. The significance of threshold for this option was set at 5 percent of total aggregated water use based on the four urban water use efficiency standards.

- **Option 3 – Detailed Approach Using Site-Specific Representative Plant Types and Irrigation Efficiencies to Estimate a Variable *Adjusted ETF***. The consideration of Option 3 is similar to that of Option 2, but with additional refinements when landscape owners incorporate considerations of salt tolerance in their plant mix choice. This option could have a positvie reflection on the outreach and education efforts by urban retail water suppliers and others.

  Salt tolerance of landscape plants differs across climates and regions. Therefore, where available, specific values of saturated soil thresholds can be used for representative plants in a landscaped area to customize the *LR* calculations per local conditions. A plant is considered representative if more than 30 percent of the landscaped area is covered by that plant.

  PF can be determined using one of the following classifications:

  - 0.0 to 0.1 (for very low water use plants)
  - 0.2 to 0.3 (for low water use plants)
  - 0.4 to 0.6 (for moderate water use plants)
  - 0.7 to 1.0 (for high water use plants)

  LR is calculated as follows:

$$LR = ECiw\ /\ [5 \times (ECe - ECiw)]$$

where,

- ECiw is the salinity of the irrigation (recycled) water.
- *ECe* is the plant threshold salinity.

Adjusted ETF is calculated based on *LR* and *PF*.

Similar to Option 2, the scenario for potential changes in future MWELO and *EFT_SLA* was incorporated into the calculation of *Adjusted ETF*.

For sprinkler:

$$Adjusted\ ETF = \left(\frac{PF}{0.75 \times (1-LR)} - ETF\_SLA\right)$$

For drip or micro-spray:

$$Adjusted\ ETF = \left(\frac{PF}{0.81 \times (1-LR)} - ETF\_SLA\right)$$

where,

- *PF* is the plant factor.
- *LR* is the leaching requirement (unitless).
- *ETF_*SLA is the evapotranspiration factor for Special Landscape Areas' irrigation with recycled water per MWELO, as amended.

And, the *Adjusted ETF* should be greater than 0. This option was the most data intensive and required the most robust analysis. Under this option, urban retail water suppliers would have to calculate aggregate landscape area factors and use the leaching factor equations to calculate their *ETF* adjustments.

Urban retail water suppliers would be required to report *SLA_htds*, *ETo*, recycled water *TDS*, *Adjusted ETF*, and representative plant type, *plant threshold salinity*, and *PF*, and calculate the efficient water use under this variance option. Irrigation efficiency was defined as 0.75 when using sprinklers and 0.81 for drip irrigation. Since Option 3 was the most specific calculation for LRs, there was no limit set on the *ETF* that could be used. The threshold of significance for using Option 3 was set at 3 percent of total aggregated water use based on the four urban water use efficiency standards.

A summary of different options and source of data for each option are provided in Table 3-2. Each option along with important characteristics, including data requirements, data source, and threshold of significance, are shown in the table. This comparison was presented to the stakeholders during the workshop held on July 21, 2021, and the feedback received is summarized below.

Adjusted ETF = *PF* / [irrigation efficiency x (1 - *LR*)]

Table 3-2 Summary of the Options for Variance for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of Total Dissolved Solids

Option	Option 1	Option 2	Option 3
Threshold of significance	More than 10 percent of the total aggregated water use by the four established standards.	More than 5 percent of the total aggregated water use by the four established standards.	More than 3 percent of the total aggregated water use by the four established standards.
Equation	Variance Efficient Water Use Volume (gallons) = *Adjusted ETF* x *ETo* (inches) x *SLA_htds* (square feet) x 0.62		
Type of equation	Constant	Variable	Variable
Adjusted evapotranspiration factor	*Adjusted ETF* = 0.26 + [1 - *ETF_SLA*]	• Maximum TDS suitable for irrigation is 1,600 mg/L. • Recycled water with TDS of 900 mg/L will receive 0.0 increment above *ETF_SLA* provided under MWELO, as amended, for landscapes irrigated with recycled water. • Recycled water with TDS between 900 and 1,600 mg/L will be provided a linear increment between 0.0 and 0.26. ***Adjusted ETF*** = 0.000371 x (*TDS* mg/L - 900) + (1 - *ETF_SLA*) • Recycled water with TDS greater than 1,600 mg/L will receive 0.26 increment above *ETF_SLA* provided under MWELO, as amended, for landscapes irrigated with recycled water. *Adjusted ETF* = 0.26 + [1 - *ETF_SLA*] **Note that the *Adjusted ETF* should be greater than 0.**	• Based on representative plant (>30 percent of landscaped area). • Information to calculate adjusted *ETF:* – *ECe*. – *ECiw*. – Maximum TDS suitable for irrigation is 1,600 mg/L. – *PF* (https://ucanr.edu/sites/WUCOLS/). ▪ 0.0 to 0.1 (for very low water use plants). ▪ 0.2 to 0.3 (for low water use plants). ▪ 0.4 to 0.6 (for moderate water use plants). ▪ 0.7 to 1.0 (for high water use plants). *LR = ECiw* / [5 x *(ECe - ECiw)*] *Adjusted ETF = PF* / [irrigation efficiency x (1 - *LR*)] where, • Irrigation efficiency: For sprinkler = 0.75 For drip or micro-spray = 0.81 and **the *Adjusted ETF* should be greater than 0**.

Key:
ECe = plant threshold salinity
ECiw = salinity of the irrigation (recycled) water
ETF = evapotranspiration factor
ETF_SLA = evapotranspiration factor for Special Landscape Areas' irrigation with recycled water per Model Water Efficient Landscape Ordinance, as amended
ETo = reference evapotranspiration
LR = leaching requirement
MWELO = Model Water Efficient Landscape Ordinance
PF = plant factor
SLA_htds = total Special Landscape Area irrigated with high total dissolved solids recycled water
TDS = total dissolved solids

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Stakeholders and working group members appreciated that different scenarios regarding data availability were considered through different specifications of Options 1, 2, and 3. While the intention of Option 1 was appreciated, the represenation of local conditions may be questionable. Options 2 and 3 provided more tangible and solid foundations for calculating efficient water use volume.

Stakeholders and working group members supported setting different significance thresholds for Options 2 and 3. It was agreed that the more specific and detailed calculation option (Option 3) should have a lower threshold than its counterpart. As such, considering 3 percent threshold of significance in Option 3 was not supported, because the stakholders believed Option 3 covers high resolution data and the threshold should be lower; stakeholders and working group members felt that the relative difference in significance thresholds in Options 2 and 3 was not reflective of the difference in investment and efforts required to implement Option 3. They recommended an even lower threshold to be considered equitable.

Stakeholders supported the idea that the definition of high TDS in the context of this variance and that the subsequent increment change to *ETF* was based on the horticultural salt tolerance levels of landscape plants commonly found throughout the State.

Stakeholders also discussed the value of this variance considering a yearly adjustment for urban retail water suppliers given that water sources and quality can change on an annual or more often basis and would subsequently change the components defined in this variance. They suggested that design and assumptions of this variance should be revisited every few years to review the status and impacts of this variance, and adjustments should be made to the variance design as needed.

3.4 Summary of Findings

Based on research and input from working group members and stakeholders, DWR concluded that necessary additional water use to irrigate landscaped areas using recycled water with high TDS should be recognized and provided through a variance. The allowable water use should be for offsetting the *LR*s to adjust *ETF* above what is allowed under MWELO, as amended. Through stakeholder input, TDS from 900 to 1,600 mg/L is considered the operable range for this variance to ensure safe application of recycled water for landscape irrigation. In addition, DWR was in agreement with stakeholders for allowing different calculation options with different threshold of significance to accommodate varying levels of active management in landscape irrigation by urban retail water suppliers and corresponding investments and efforts.

Per ORWUS, residential landscape irrigated by recycled water through a DM should report that water use under CII-DIMWUS, for the purposes of the UWUO and Annual Water Use Report filing, in order to make use of the higher water allowance accorded

for SLAs (see *Recommendations for Residential Outdoor Efficient Water Use Efficiency Standard* [WUE-DWR-2021-02]). Urban retail water suppliers can use SLA provisoins for using recycled water for landscape irrigation under CII-DIMWUS to include this water use in UWUO calculation (see *Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard* [WUE-DWR-2021-03]). The water use volume allowed under this variance is additive to that of CII-DIMWUS.

4.0 Recommendations

This section provides DWR's recommendations for the variance for significant landscaped areas irrigated with recycled water having high levels of TDS, including guidelines and methodologies, reporting requirements, and implementation considerations.

These recommendations and the resulting varaince adopted by the State Water Board do not set, rescind, or modify existing or future requirements for significant landscaped areas irrigated with recycled water having high levels of TDS.

4.1 Summary of Recommendations

Based on the analysis and stakeholder input, DWR recommendations include two parts. **This recommendation is contingent upon the DWR's recommended CII-DIMWUS and its adoption by the State Water Board**.

Recommendations for the Variance for Landscaped Irrigation Using Recycled Water Having High Levels of Total Dissolved Solids

DWR recommends that a variance should be established for landscaped areas irrigated using recycled water having high levels of TDS in order to maintain or improve plant and soil health without requiring additional desalination treatment of the recycled water. The recommended variance against CII-DIMWUS should have the specifications detailed in Section 4.2. The calculation of aggregated efficient water use for significant landscaped areas irrigated with recycled water having high levels of TDS (Variance Efficient Water Use Volume) as part of an urban retail water supplier's UWUO should be subject to the guidelines and methodologies detailed in Section 4.3.

Coordinated Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard

Certain urban retail water suppliers use recycled water on residential parcels with meters that may be classified as residential DIMs. An urban retail water supplier may formally (by changing the meter classification) or informally (for UWUO reporting purposes) re-classify residential or uncategorized DIMs serving non-CII landscapes as a CII-DIM to use the provisions for SLAs associated with CII-DIMWUS. Both the water use and irrigated landscape area associated with these DIMs must be reported under CII-DIMWUS for UWUO calculation and reporting purposes.

4.2 Specifications

DWR recommends that a variance be established for "significant landscaped areas irrigated with recycled water having high levels of TDS" with the following specifications:

- Under this variance, only the required water for leaching due to irrigation with high TDS recycled water that is in addition to the volume allowed for by MWELO, as amended, for recycled water use is allowed.
- The water use under this variance is allowed only when TDS concentration of irrigating recycled water is above 900 mg/L.
- The maximum allowable water use under this variance is capped at a TDS concentration of 1,600 mg/L.
  - An urban retail water supplier can use recycled water with a TDS concentration of more than 1,600 mg/L if all applicable law and regulations are satisfied; however, no additional water use allowance will be granted beyond the cap.
- Consistent with MWELO, the Variance Efficient Water Use Volume should be expressed using reference evapotranspiration and *Adjusted ETF* for *LR*s in relation *SLA_htds* on the urban retail water supplier level.

  Variance Efficient Water Use Volume (gallons) = *Adjusted ETF* x *ETo* (inches) x *SLA_htds* (square feet) x 0.62

- The Variance Efficient Water Use Volume can be calculated using a Standard Method (the minimum requirement) and a Detailed Method to determine the adjusted *ETF*.
  - The Variance Efficient Water Use Volume is calculated based on the *ETF* increments above current MWELO, which allows *ETF_SLA* of 1.0 for landscape irrigation with recycled water. Should the specifications change in a future MWELO, only the *ETF_SLA* needs to be updated accordingly and other parameters of these two methods remain unchanged.
- Standard Method for *ETF* determination: To align the variance with MWELO and any future amendments, the variance for recycled water with high TDS is calculated based on the *ETF_SLA* in MWELO, as amended, plus an incremental *ETF* allowance that increases from 0.0 to 0.26 *ETF* in a linear relationship above 1.0 with an increase in recycled water TDS concentration from 900 mg/L to 1,600 mg/L.

- Detailed Method for *ETF* determination: The Variance Efficient Water Use Volume is calculated using the TDS of recycled water for individual *SLA_htds* using plant-based *LR*s for the representative plant that is present in at least 30 percent of the service area aggregate landscaped area. The *Adjusted ETF* is still used on the water supplier level, not on individual landscape area level.
  - There is no limit on the *ETF* adjustment above *ETF_SLA* that can be used in this method. However, the recycled water TDS is still capped at 1,600 mg/L.
  - Consistent with MWELO, irrigation efficiency will be 0.75 for sprinkler systems and 0.81 for drip or micro-spray systems.
- The estimated efficient water use for landscape irrigation with high TDS recycled water should be greater than the significant thresholds associated with the two calculation methods.
  - The estimated water use in the Standard Method should be greater than 5 percent of the sum of the aggregated estimates of efficient water use based on four established standards, namely IRWUS, ORWUS, CII-DIMWUS, and WLS.
  - The estimated water use in the Detailed Method should be greater than 1 percent of the sum of the aggregated estimates of efficient water use based on four established standards, namely IRWUS, ORWUS, CII-DIMWUS, and WLS.
  - The allowable lower threshold for the Detailed Method is to recognize the use of high-resolution data, detailed methodology, and advanced technologies by the urban retail water supplier. Implementation of this variance should not force them to use only the lesser detailed data or methods for compliance purposes.
- The calculation of estimated water use under this variance should follow the guidelines and methodologies provided by DWR (see Section 4.3).

4.3 Guidelines and Methodologies to Calculate the Variance Efficient Water Use Volume

DWR recommends the following guidelines and methodologies for a variance for "significant landscaped areas irrigated with recycled water having high levels of TDS."

- An urban retail water supplier will be allowed to include the variance for landscape irrigation using recycled water with high TDS in calculating its UWUO **when all the following conditions are satisfied**:

1. The use of this variance by the urban retail water supplier is previously approved by the State Water Board. (Note that the State Water Board's approval is for using the variance but not for the quality, which varies every year.)

2. The determination of significant water use based on the appropriate threshold should be evaluated annually for eligibility to apply the variance.

3. The urban retail water supplier demonstrates compliance with all existing laws and regulations regarding recycled water use, including the protection of surface water and groundwater quality.

- The Variance Efficient Water Use Volume should be calculated based on data applicable to the conditions of the previous year.

- DWR, in coordination with the State Water Board, may recommend revisions of the guidelines and methodologies in the future, as needed.

- Use of alternative data is allowed if the urban retail water supplier can provide evidence that the alternative data is equal to or superior to DWR-provided data or DWR-suggested referenced data. Refer to "Use of Alternative Data" in the following sections.

- Urban retail water suppliers should provide all necessary data and information to support the use of this variance and associated calculated amount of estimate water use to be included in UWUO. The data and information should be made publicly available. Where applicable, DWR will specify validation and certification requirements for certain data use.

For general guidelines and methodologies for using variances for calculating UWUO, refer to *Guidelines and Methodologies for Calculating Urban Water Use Objective* (WUES-DWR-2021-01B, Section 6.2).

Methodology to Estimate the Variance Efficient Water Use Volume on Urban Retail Water Supplier Level

The recommendation for this variance allows for calculation of the water use following one of two options: a simple calculation with a higher threshold of significance (Standard Method), and a more detailed calculation with a lower threshold of significance (Detailed Method). These options provide urban retail water suppliers with flexibility in how eligibility for the variance is achieved, depending on data availability.

Appendix B provides a template for calculating the efficient water use for significant landscaped areas irrigated with recycled water having high TDS. This template is

provided for illustrative purposes and is subject to revision after the State Water Board's adoption.

An urban retail water supplier with a significant water use that is within the scope of this variance must follow the explained development steps to apply for the variance using one of the two calculation options, provided they meet the requirements and threshold.

Data Needed for Calculation

- Common data needed for Standard Method and Detailed Method:
  - *ETo* in inches.
  - *SLA_htds* in square feet.
  - Allowable *ETF* under MWELO for landscape irrigation with recycled water *(ETF_SLA)*.
  - Recycled water salinity (*TDS*).
- Additional Data needed for Detailed Method:
  - Salinity of the irrigation (recycled) water (*ECiw*) in dS/m.
  - *ECe* in dS/m.
  - *PF* for representative plant (unitless).
  - *LR* (unitless).
  - Irrigation system for representative plant (sprinkler systems, or drip or micro-spray systems).

Variance Efficient Water Use Volume

The Variance Efficient Water Use Volume for the recommended variance, in gallons, is the product of the *Adjusted ETF*, *ETo*, *SLA_htds*, and 0.62 (a unit conversion factor). The calculation for recycled water irrigated landscapes is:

> Variance Efficient Water Use Volume (gallons) = *Adjusted ETF* x *ETo* (inches) x *SLA_htds* (square feet) x 0.62

- Standard Method:
  - For TDS less than or equal to 900 mg/L, there is no additional allowance.
  - For TDS 900 to 1,600 mg/L, additional allowance is:

$$Variance\ Efficient\ Water\ Use\ Volume\ (gallons) = [(0.000371 \times (TDS\ (\text{mg/L}) - 900)) + (1 - ETF\_SLA)] \times ETo\ (\text{inches}) \times SLA\_htds\ (\text{square feet}) \times 0.62$$

where,

- *Adjusted ETF* term should be greater than 0.
- For TDS greater than 1,600 mg/L, additional allowance is:

  Variance Efficient Water Use Volume (gallons) = [0.26 + (1 – *ETF_SLA*)] x *ETo* (inches) x *SLA_htds* (square feet) x 0.62

- Detailed Method:
  - For TDS less than or equal to 900 mg/L, there is no additional allowance.
  - For TDS 900 to 1,600 mg/L, additional allowance is calculated following these steps:

    1. Urban retail water suppliers must identify a representative plant and type of irrigation system used for that plant and calculated variance *LR* as follows:

       a. Representative plant is the plant type occupying 30 percent or more of the service area *SLA_htds* landscapes.

       b. *PF* is for representative plant.

       c. Irrigation type is sprinkler systems, or drip or micro-spray systems.

    2. *LR* is calculated by:

       Leaching requirement = irrigation water salinity (*ECiw*) / [5 x Plant Threshold Salinity (*ECe*) – irrigation water salinity (*ECiw*)]

       where,

       A range of salinity tolerance is provided for the representative plant, use the range average.

    3. Simple relationships can be used to convert *TDS* (mg/L) to *EC* (dS/m) or vice versa (as referenced at Salinity measurement and unit conversion - Salinity Management (ucanr.edu)):

       a. For *EC* from 0.1 to 5 (dS/m):

EC (dS/m) = *TDS* (mg/L or parts per million [ppm]) / 640

b. For *EC* greater than (5 dS/m):

EC (dS/m) = *TDS* (mg/L or ppm) / 800

4. *Adjusted ETF* should be greater than zero and is calculated by:

   For sprinkler irrigation systems:

$$Adjusted\ ETF = \left(\frac{PF}{0.75 \times (1-LR)} - ETF\_SLA\right)$$

   For drip or micro-spray systems:

$$Adjusted\ ETF = \left(\frac{PF}{0.81 \times (1-LR)} - ETF\_SLA\right)$$

5. For sprinkler systems, the additional allowance is:

$$Variance\ Efficient\ Water\ Use\ Volume\ (gallons) = \left(\frac{PF}{0.75 \times (1-LR)} - ETF\_SLA\right) \times ETo \times SLA\_htds \times 0.62$$

6. For drip or micro-spray systems, the additional allowance is:

$$Variance\ Efficient\ Water\ Use\ Volume\ (gallons) = \left(\frac{PF}{0.81 \times (1-LR)} - ETF\_SLA\right) \times ETo \times SLA\_htds \times 0.62$$

   - For *TDS* greater than 1,600 mg/L, additional allowance is capped at a *TDS* of 1,600 mg/L.

Significance Test

For this variance, the Variance Efficient Water Use Volume must be equal to or greater than the minimum volume established below.

- Standard Method Minimum Variance Volume (gallons) = 5% x UWUO_SB
- Detailed Method Minimum Variance Volume (gallons) = 1% x UWUO_SB

Data Provided or Referenced by California Department of Water Resources

Standard and Detailed Method

- *ETo* (inches) from CIMIS.
- *ETF_SLA.*

Detailed Method

- *ECe* ranges as referenced by WateReuse (WateReuse, 2007)
- *ETF_SLA.*
- *PF:*
  - 0 to 0.1 (for very low water use plants).
  - 0.2 to 0.3 (for low water use plants).
  - 0.4 to 0.6 (for moderate water use plants).
  - 0.7 to 1.0 (for high water use plants).

Data Provided or Obtained by Urban Retail Water Supplier

Standard Method

- *SLA_htds*.
- *ETF_SLA* based on urban retail water supplier information.

Detailed Method

- *ECiw.*
- Plant type.
- *LR* (unitless).
- *SLA_htds*.
- *Adjusted ETF* based on urban retail water supplier information.
- Irrigation system for representative plant (sprinkler systems, or drip or micro-spray systems).

A summary of guidelines and methodologies to calculate water use for significant landscaped areas irrigated with recycled water having high levels of TDS is provided in Table 4-1.

Table 4-1 Summary of Guidelines and Methodologies for Efficient Water Use for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of Total Dissolved Solids

Guidelines and Methodologies	Standard Method for 5 Percent Significance Threshold	Detailed Method for 3 Percent Significance Threshold
Data needed for calculation	• *ETo.* • Evapotranspiration factor for SLA irrigation with recycled water as amended by MWELO *(ETF_SLA).* • *Adjusted ETF.* • *SLA_htds*.	• *ETo.* • Adjusted *ETF.* • Evapotranspiration factor for SLA irrigation with recycled water as amended by MWLO (*ETF_SLA*). • *SLA_htds*. • *ECiw.* • *ECe.* • *PF.* • *LR.* • Irrigation efficiency.
Adjusted evapotranspiration factor	• Recycled water with TDS of 900 mg/L will receive 0.0 increment above *ETF_SLA* provide under MWELO for landscapes irrigated with recycled water. • Recycled water with TDS of 1,600 mg/L and greater will receive 0.26 increment above *ETF* provided under MWELO for landscapes irrigated with recycled water. • Recycled water with TDS between 900 and 1,600 mg/L will be provided a linear increment between 0.0 and 0.26 (a variable *ETF* that averages plant-specific leaching requirements).	• Based on representative plant (>30 percent of landscaped area) information adjusted *ETF* is determined using: – *ECiw*. – *ECe*. – *PF*: 0 to 0.1 (for very low water use plants). ▪ 0.2 to 0.3 (for low water use plants). ▪ 0.4 to 0.6 (for moderate water use plants). ▪ 0.7 to 1.0 (for high water use plants). – *LR = ECiw* / [5 x (*ECe - ECiw*)]. • Irrigation efficiency (0.75 for sprinkler systems and 0.81 for drip or micro-spray systems). • For sprinkler irrigation systems: $Adjusted\ ETF = \left(\frac{PF}{0.75 \times (1-LR)} - ETF\_SLA\right)$ • For drip or micro-spray systems: $Adjusted\ ETF = \left(\frac{PF}{0.81 \times (1-LR)} - ETF\_SLA\right)$
Equation	Variance Efficient Water Use Volume (gallons) = *Adjusted ETF* x *ETo* (inches) x *SLA_htds* (square feet) x 0.62	Variance Efficient Water Use Volume (gallons) = *Adjusted ETF* x *ETo* (inches) x *SLA_htds* (square feet) x 0.62
Allowable variance volume	**For 900 < TDS ≤ 1,600 mg/L:** $Variance\ Efficient\ Water\ Use\ Volume\ (gallons) = [(0.000371 \times (TDS\ (\text{mg/L}) - 900)) + (1 - ETF\_SLA)] \times ETo\ (\text{inches}) \times SLA\_htds\ (\text{square feet}) \times 0.62$ **For TDS > 1,600 mg/L:** Variance Efficient Water Use Volume (gallons) = [0.26 + (1 – *ETF_SLA*)] x *ETo* (inches) x *SLA_htds* (square feet) x 0.62 where, *Adjusted ETF* > 0.	**For sprinkler systems:** $Variance\ Efficient\ Water\ Use\ Volume\ (gallons) = \left(\frac{PF}{0.75 \times (1-LR)} - ETF\_SLA\right) \times ETo \times SLA\_htds \times 0.62$ **For drip or micro-spray systems:** $Variance\ Efficient\ Water\ Use\ Volume\ (gallons) = \left(\frac{PF}{0.81 \times (1-LR)} - ETF\_SLA\right) \times ETo \times SLA\_htds \times 0.62$

Table 4-1 Summary of Guidelines and Methodologies for Efficient Water Use for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of Total Dissolved Solids (contd.)

Guidelines and Methodologies	Standard Method for 5 Percent Significance Threshold	Detailed Method for 3 Percent Significance Threshold
Source(s) of data	**Provided by DWR:** • *ETo.* **To be obtained/developed by urban retail water supplier:** • *SLA_htds.* • *ETF_SLA* based on urban retail water supplier information. • Recycled water TDS.	**Provided by DWR:** • *ETo.* • *ECe.* • *PF.* **To be obtained/developed by urban retail water supplier:** • *ECiw.* • *SLA_htds*. • *ETF_SLA* based on urban retail water supplier info • *Adjusted ETF.* • Representative plant type. • Irrigation system type.

Key:
dS/m = decisiemens per meter
DWR = California Department of Water Resources
ECe = plant threshold salinity
ECiw = salinity of irrigation (recycled) water
ETF = evapotranspiration factor
ETF_SLA = evapotranspiration factor for Special Landscape Areas' irrigation with recycled water per Model Water Efficient Landscape Ordinance, as amended
ETo = reference evapotranspiration
LR = leaching requirement
mg/L = milligrams per liter
MWELO = Model Water Efficient Landscape Ordinance
PF = plant factor
SLA_htds = total Special Landscape Area irrigated with high total dissolved solids recycled water
SNMP = Salt and Nutrient Management Plan
TDS = total dissolved solids
WDR = waste discharge requirement

Data Accuracy – Both Methods

Urban retail water suppliers choosing to use this variance will need to measure *SLA_htds*.

- Identification and measurement of *SLA_htds* must conform to the data accuracy requirements for identification and measurement of SLAs in Section 5.2 of *Recommendations for Guidelines and Methodologies for Calculating Urban Water Use Objective* (WUES-DWR-2021-01B), Estimated Commercial, Industrial, and Institutional SLA Irrigated with a Dedicated Irrigation Meter.

- Map(s), satellite image(s), or aerial image(s) showing the location of designated *SLA_htds* and other documentation should be maintained by the urban retail water supplier and available upon request for the duration of its applicability and at least three years following.

Data Accuracy – Detailed Method

- **Representative Plant**. Urban retail water suppliers must document the process and measurements for identification of the representative plant occupying 30 percent or more of the urban retail water supplier's *SLA_htds*.

- **Irrigation System Type**. Urban retail water suppliers must document the process for identifying the representative plant irrigation system type (sprinkler systems, or drip or micro-spray systems).

- Urban retail water suppliers must include the following in their application to the State Water Board:

    1. A description of the method(s) used to estimate representative plant and type of irrigation system (e.g., field measurement, analysis of satellite or aerial imagery, and others).

    2. Calculated *LR*.

Use of Alternative Data

If an urban retail water supplier chooses to use alternative data, they must receive approval from DWR and demonstrate that their data meets or exceeds the quality and accuracy of data and methodology provided by DWR. Urban retail water suppliers requesting more than one type of alternative data may submit separate applications for each data type or a combined application for all data types so long as the required information is included in the combined package.

Alternative ETo Data

To demonstrate that alternative *ETo* data meet or exceed the quality and accuracy of the *ETo* data that DWR provides, a water supplier must submit a package containing the following:

1. Description of why the alternative data meets or exceeds the quality and accuracy of the DWR data.
2. Description of the methodology used to estimate *ETo*.
3. Indication of the source of data used to estimate *ETo* (e.g., whether it is from a weather station or remote sensing).
4. If *ETo* is calculated using station data:
    a. Description of the siting condition of the weather station.
    b. List of all sensors used.
    c. Description of maintenance procedures and schedules.
    d. Description of the quality assurance/quality control procedures.
    e. Detailed description of the equation used to estimate *ETo*.
5. If *ETo* is estimated using remote sensing data:
    a. The specific input data source (satellite, airborne, etc.) and image resolution.
    b. Detailed description of the methodology for deriving ETo from remotely sensed data.
    c. Description of how the method and data was validated and documentation of validation.
6. Description of why the alternative *ETo* data quality and accuracy is equivalent to or better than that of DWR.
7. Certification of the alternative data by the entity that produced it.
8. A public process to provide the public an opportunity to review the alternative data and understand the purpose of the request to use alternative data.
9. Submit a request signed by the General Manager of the water supplier to DWR.

Alternative Leaching Requirement and Salinity Data

To request the use of alternative data to determine the *LR* (*ECe*, *ECiw*), the urban retail water supplier must demonstrate that the alternative data or method meet or exceed the quality and accuracy of the data and method DWR provides or references by submitting a package containing the following:

1. Description of why the alternative data or method meets or exceeds the quality and accuracy of the DWR data or referenced data.
2. Description of the methodology and data used, including data sources and any locally applicable research and literature.
3. Credentials (such as licenses, certifications, education, training, or professional background of staff) for the entity/party that conducted the research or analysis and verification.
4. Affidavit or certification of the alternative data by a qualified urban retail water supplier staff member responsible for data quality.
    a. Certification of the alternative data by the entity/party that produced it if not produced by the urban retail water supplier's staff.
    b. Referenced, published research reports do not require certification but must be cited.
5. A public process that provides the public an opportunity to review the alternative data or methodology and understand the purpose of the request to use alternative data.
6. A request submitted to DWR signed by the General Manager of the urban retail water supplier.

Calculation of the leaching fraction requires an irrigation efficiency. The irrigation efficiency for sprinkler systems is 0.81 and for drip or micro-spray systems it is 0.75. These are part of the variance for efficient high TDS recycled water irrigation and are not subject to alternative data requests.

4.4 Implementation Considerations

Where possible, salt tolerant plants should be considered for landscape areas where recycled water is applied.

Some urban retail water suppliers may receive recycled water from different sources with their unique water quality and apply it to different landscape areas with potential

different plant mixes. The water use volume calculation should be calculated by landscape area with different source of water or plant mix as *LR*s are based on the physical needs of plants and safe application of recycled water with high TDS.

4.5 Reporting Requirements

Official documentation to verify the accuracy of the data must be submitted with the package. All data used by an urban retail water suppliers in its calculation(s), regardless of whether they were obtained by the water supplier or provided by DWR, must be reported with the variance application as listed below. Urban retail water suppliers will need to report their variance water use each year in their Annual Water Use Report. Each year, the urban retail water supplier will have to calculate their UWUO based on the efficient water use standards and conduct the threshold test in order to allow for addition of the approved Variance volume in their UWUO.

Reporting Requirements for Standard Calculation Method

Urban retail water supplier seeking to receive this variance must report:

1. *SLA_htds* measurement in acres.
2. Annual average recycled water *TDS* (mg/L) applied to *SLA_htds* from recycled water purveyor.
3. *ETo* in inches.
4. *ETF* for SLA, as amended by MWLO (*ETF_SLA*).
5. *Adjusted ETF* in inches calculated based on the guidelines and methodologies.
6. Variance Efficient Water Volume in gallons per year.
7. Standards-based UWUO (sum of IRWUS, ORWUS, CII-DIMWUS, and WLS).

Reporting Requirements for Detailed Calculation Method

Urban retail water supplier seeking to receive this variance must also report

1. *ECiw* in dS/m.
2. *ECe* in dS/m.
3. *PF* for representative plant (unitless).
4. *LR* (unitless).

5. Irrigation system for representative plant (sprinkler systems, or drip or micro-spray systems).

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5.0 Glossary

The following key terms are listed below for easy reference. Where applicable, existing definitions from statutes and regulations are provided.

commercial, industrial, and institutional water use. Water used by commercial water users, industrial water users, institutional water users, and large landscape water users, as defined in California Water Code Section 10608.12(d).

dedicated irrigation meter. A meter used only for irrigation of outdoor landscape areas. However, a mixed-use meter with no more than five percent of total delivered water serving non-landscape irrigation purposes can also be considered a dedicated irrigation meter for the purpose of the urban water use objective and actual water use calculations and reporting.

dedicated meter. A meter used for outdoor water use purposes.

evapotranspiration. The amount of water transpired by plants, retained in plant tissues, and evaporated from plant tissues and surrounding soil surfaces.

evapotranspiration factor. An adjustment factor when applied to reference evapotranspiration that adjusts for plant factors and irrigation efficiency which are two major influences upon the amount of water that needs to be applied to the landscape.

high levels of total dissolved solids. For the purposes of variance development, high levels of total dissolved solids in recycled water were defined as between 900 and 1,600 milligrams per liter.

irrigation efficiency. The efficiency of water application and use, calculated by dividing a portion of applied water that is beneficially used by the total applied water, expressed as a percentage. The two main beneficial uses are crop water use (evapotranspiration) and leaching to maintain a salt balance.

leaching requirement. Leaching is the basic means for controlling salinity. The leaching requirement is the extra amount of water applied to percolate (or move) salts below the plant root zone. Also known as the “leaching fraction.”

material effect. Having real importance or great consequences. In the context of California Department of Water Resources’ recommendations regarding the urban water use objective and variances, a material effect is an effect on the urban water use objective that could influence the compliance status of an urban retail water supplier.

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, as defined in California Water Code Section 13050(n), as defined in California Water Code Section 10608.12(q).

reference evapotranspiration. The evapotranspiration rate from an extended surface of 3- to 6-inch-tall (8- to 15-centimeter-tall) green grass cover of uniform height, actively growing, completely shading the ground, and not short on water (the reference evapotranspiration rate reported by the California Irrigation Management Information System).

Special Landscape Area. An area of the landscape dedicated solely to edible plants, areas irrigated with recycled water, water features using recycled water and areas dedicated to active play such as parks, sports fields, golf courses, and where turf provides a playing surface, as defined in California Code of Regulations, Title 23, Section 491(iii).

threshold of significance. A minimum volume of unique water use in an urban retail water supplier’s service area that could have a material effect on that urban retail water supplier’s urban water use objective.

total dissolved solids. The inorganic salts, metals, and minerals present in water. This term is usually expressed in parts per million or milligrams per liter.

urban retail water supplier. A water supplier, either publicly or privately owned, that directly provides potable municipal water to more than 3,000 end users or that supplies more than 3,000 acre-feet of potable water annually at retail for municipal purposes, as defined in California Water Code Section 10608.12(t).

urban water use efficiency standards. The standards effective through California Water Code Section 10609.4 (indoor residential use) or adopted by the State Water Resources Control Board (outdoor residential, water loss, and commercial, industrial, and institutional outdoor irrigation of landscape areas with dedicated meters) pursuant to California Water Code Section 10609.2.

urban water use objective. An estimate of aggregate efficient water use for the previous year based on adopted water use efficiency standards and local service area characteristics for that year, as described in California Water Code Section 10609.20, as defined in California Water Code Section 10608.12(u).

water loss. The total of apparent loss and real loss (California Code of Regulations, Title 23, Section 638.1(a) and Section 638.1(k), respectively) in an urban retail water supplier's system. Apparent loss means loss due to unauthorized consumption and/or nonphysical (paper) loss attributed to inaccuracies associated with customer metering or systematic handling errors. Real loss means the physical water loss from the pressurized potable water system and the urban retail water supplier's potable water storage tanks, up to the point of customer consumption.

water salinity. Salinity can be described in terms of soluble salts, or in terms of total dissolved solids.

6.0 References

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Appendix A – Urban Water Use Efficiency Recommendation Package Reports Incorporated by Reference

DWR (California Department of Water Resources). September 2022. Recommendations for Urban Water Use Efficiency Standards, Variances, Performance Measures, and Annual Water Use Reporting. DWR Report Number: WUES-DWR-2021-01A.

DWR (California Department of Water Resources). September 2022. Recommendations for Guidelines and Methodologies for Calculating Urban Water Use Objective. DWR Report Number: WUES-DWR-2021-01B.

DWR (California Department of Water Resources). September 2022. Recommendations for Outdoor Residential Water Use Efficiency Standard. DWR Report Number: WUES-DWR-2021-02.

DWR (California Department of Water Resources). September 2022. Recommendations for Commercial, Industrial, and Institutional Outdoor Irrigation of Landscape Areas with Dedicated Irrigation Meters Water Use Efficiency Standard. DWR Report Number: WUES-DWR-2021-03.

DWR (California Department of Water Resources). September 2022. Summary of Recommendations for Variances. DWR Report Number: WUES-DWR-2021-04.

DWR (California Department of Water Resources). September 2022. Recommendations for Performance Measures for Commercial, Industrial, and Institutional Water Use. DWR Report Number: WUES-DWR-2021-15.

DWR (California Department of Water Resources). September 2022. Stakeholder Outreach Summary for Developing Urban Water Use Efficiency Standards, Variances, and Performance Measures. DWR Report Number: WUES-DWR-2021-20.

DWR (California Department of Water Resources). September 2022. Urban Water Use Efficiency Recommendation Package: Glossary and Abbreviations and Acronyms. DWR Report Number: WUES-DWR-2021-21.

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Appendix B – Template for Calculating the Efficient Water Use for Variance for Significant Landscaped Areas Irrigated with Recycled Water Having High Levels of Total Dissolved Solids

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Variance: Significant Landscaped Areas Irrigated with Recycled Water having High Levels of Total Dissolved Solids (TDS) - Standard Method

*Fill in the grey rows to determine: 1. water use under this variance, and 2. whether you (urban retail water supplier) are qualified to apply for this variance.

Parameter	Value
Recycled Water TDS (mg/L) [a]	
Reference Evapotranspiration (*ETo*) [b] (inch)	
Total qualified landscape area (*SLA_htds*) [c] (square-feet)	
ETF_SLA **provided under MWELO** [d]	
Adjusted Evapotranspiration Factor (*Adjusted ETF*) [e] (Calculated)	FALSE
Variance Efficient Water Use Volume (gallons) [f] (Calculated)	-
What is your aggregated estimates of efficient water use based on four established standards?	
Are you qualified to apply for this variance? (Calculated)	NO

Only irrigation with recycled water with TDS above 900 mg/L is elligible to use this variance.

a. Recycled water should be reported an annual average basis. For most recycled water, total dissolved solids (TDS) can be converted from electrical conductivity (*EC*) by: *TDS* (mg/L) = 640 x *EC* (dS/m)

b. *SLA_htds* is the total qualified landscape area irrigated with recycled water having high TDS.

c. Reference evapotranspiration (*ETo*) in your service area which will be provided by DWR.

d. Landscapes irrigated with recycled water receive *ETF* for Special Landscape Area under MWELO (*ETF_SLA*). Currently the *ETF_SLA* is equal to 1. This value may be subject to change in the future.

e. Recycled water with TDS in between 900-1,600 mg/L will be provided a linear increment between +0.0 and +0.26 for the reference evapotranspriation adjustment factor above the *ETF_SLA*, as noted in (c).

f. **Variance Efficient Water Use Volume (gallons)** = 0.62 x *Adjusted ETF* x *ETo* x *SLA_htds*

where

0.62 is a conversion factor that converts acre□inches per acre per year to gallons per square foot per year

Adjusted ETF is evapotranspiration factor adjusted for leaching requirements

ETo is reference evapotranspiration

SLA_htds is the total qualified landscape area irrigated with recycled water having high TDS

Variance: Significant Landscaped Areas Irrigated with Recycled Water having High Levels of Total Dissolved Solids (TDS) - Detailed Method

*Fill in the grey rows to determine: 1. water use under this variance, and 2. whether your agency is qualified to apply for this variance.

Parameter	Value
Recycled Water TDS (mg/L) [a]	
Reference Evapotranspiration (*ETo*) [b]	
Total qualified landscape area (*SLA_htds*) [c] (square-feet)	
***ETF_SLA* provided under MWELO** [d]	
Representative Plant Type [e]	
Plant Threshold Salinity (*EC_iw*) [f]	
Recycled Water Salinity (*EC_e*) [g] **(Calculated)**	0.0
Plant Factor (*PF*) [h]	
Irrigation Method [i]	
Leaching Requirement (*LR*) [j] **(Calculated)**	#DIV/0!
Adjusted Evapotranspiration Factor (*Adjusted ETF*) [k] **(Calculated)**	FALSE
Variance Efficient Water Use Volume (gallons) [l] **(Calculated)**	-
What is your aggregated estimates of efficient water use based on four established standards?	
Are you qualified to apply for this variance? (Calculated)	NO

Only irrigation with recycled water with TDS above 900 mg/L is elligible to use this variance.

a. Recycled water should be reported an annual average basis. For most recycled water, total dissolved solids (TDS) can be converted from electrical conductivity (EC) by: *TDS* (mg/L) = 640 x EC (dS/m)
b. Reference evapotranspiration (*ETo*) in your service area is provided by DWR.
c. *SLA_htds* is the total qualified landscape area irrigated with recycled water having high TDS.
d. Landscapes irrigated with recycled water receive *ETF* for Special Landscape Area under MWELO *(ETF_SLA).* Currently the *ETF_SLA* is equal to 1. This value may be subject to change in the future.
e. Representative plant type is definedbased on a plantoccupying 30 percent or more of the urban retail water suppliers *SLA_htds* area.

f. Plant threshold salinity (*EC_iw*) is available at http://www.fao.org/3/y4263e/y4263e0e.htm, or as approved by DWR.
g. For most recycled water, total dissolved solids (TDS) can be converted from electrical conductivity (*EC_e*) by: *TDS* (mg/L) = 640 x EC_e (dS/m)
h. Plant factor (*PF*) can be obtained from WUCOLS database at http://ucanr.edu/sites/WUCOLS/ and from horticultural researchers at academic institutions and/or professional associations, as approved by DWR.
i. Irrigation method could be one of the two options including sprinkler or drip and micro-spray irrigation.
j. Leaching requirement (*LR*) is the amount of water needed to flush out excessive salt bulit up from the plant root zome which is calculated using this equation: leaching requirement = *EC_iw* / (5 x *EC_e* -*EC_iw*)
k. Adjusted evapotranspiration factor is calculated using the following formula: *Adjusted ETF* = (*PF* / (0.75 x (1- *LR*)) - *ETF_SLA*) for sprinkler irrigated landscapes and *Adjusted ETF* = (*PF* / (0.81 x (1- *LR*)) - *ETF_SLA*) for drip or micro-spray irrigation
l. **Variance Efficient Water Use Volume (gallons)** = 0.62 x *Adjusted ETF* x *ETo* x (*SLA_htds*)
where
0.62 is a conversion factor that converts acre□inches per acre per year to gallons per square foot per year
Adjusted ETF is adjusted evapotranspiration factor for leaching requirements
ETo is reference evapotranspiration