# State Water Resources Control Board

July 14, 2025

Adam Laputz
Assistant Executive Officer
Central Valley Regional Water Quality Control Board

**SUBJECT: Final Response to the Request for External Scientific Peer Review of the Scientific Basis of the Proposed Amendment to the Water Quality Control Plan for the Central Valley Regional Water Quality Control Board Tulare Lake Basin (Tulare Lake Basin Plan) to Remove (De-designate) the Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) Beneficial Uses from Groundwater Within a Designated Horizontal and Vertical Area Within and Surrounding the Administrative Boundaries of the South Belridge, Monument Junction and Cymric Oil Fields in Kern County**

Dear Adam,

This letter is in response to the attached, revised 08 November 2024 request for external scientific peer review for the subject noted above. The review process is described below. All steps were conducted in confidence. Reviewers' identities were not disclosed.

To begin the process for selecting reviewers, I contacted the University of California, Berkeley (University) and requested recommendations for candidates considered qualified to perform the assignment. This service is supported through an Interagency Agreement co-signed by CalEPA and the University. The University was provided with the request letter and attachments. The University interviews each promising candidate.

Each candidate who was both qualified and available for the review period was asked to complete a Conflict of Interest (COI) Disclosure form and submit to the CalEPA Peer Review Program for review, with their Curriculum Vitae. The cover letter for the COI form describes the context for COI concerns that must be taken into consideration when completing the form: "As noted, staff will use this information to evaluate whether a reasonable member of the public would have a serious concern about [the candidate's] ability to provide a neutral and objective review of the work product."

For each candidate judged to be free of conflict, I approved that person as reviewer, affirmed by an approval letter to initiate the review. These letters provided access instructions to a secure FTP site where all material to be reviewed was placed. Each

reviewer was asked to address each conclusion for which they had previously agreed, as outlined in my initiation letters. Thirty days were provided for the review, unless a reviewer requested additional time. Guidance was provided to ensure confidentiality through the review process.

Reviewers' names, affiliations, curriculum vitae, initiating letters and reviews are being sent to you now with this letter. This information can be accessed easily through the bookmarks provided in this file.

The review commenced on 25 March 2025 and all draft review reports were received by the first week of May 2025. Upon receipt of the draft review reports, Central Valley Regional Water Quality Control Board (RB5) staff conducted a sufficiency review of each report and found the reviewers independently and collectively addressed all assumptions, conclusions, and findings under review. Clarification was sought from reviewers as outlined in the *Memo to ESPR Program Regarding Reviewer Clarification*. The review reports have since been brought into compliance with web accessibility standards. This letter includes those reports and concludes this peer review request.

Approved reviewers:

1. Alberto Bellin, Ph.D.
   Professor, Hydraulic and Marine Constructions and Hydrology
   Department of Civil, Environmental and Mechanical Engineering Center
   Agriculture Food Environment – C3A
   University of Trento, Italy

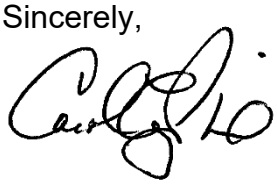
2. J. Jaime Gómez-Hernández, Ph.D.
   Full Professor, Instituto de Ingeniería del Agua y Medio Ambiente
   Universitat Politècnica de València
   Camino de Vera s/n, 46020 Valencia, Spain

3. Isaya Kisekka, Ph.D.
   Professor, Hydrology and Agricultural Water Management
   Depts., Land, Air, and Water Resources and Biological and Agricultural Engineering
   Director, Agricultural Water Center of Excellence
   University of California Davis
   One Shields Avenue, PES 1110 Davis, CA 95616

4. Lee Allen Pettey, Ph.D.
   Associate Professor of Teaching in Animal Science
   Department of Animal Science
   University of California, Davis
   One Shields Avenue, Davis, CA 95616

If you have any questions, please contact me directly.

Sincerely,



Carol Perkins, Environmental Scientist
CalEPA External Scientific Peer Review Program Lead
Office of Research, Planning, and Performance
State Water Resources Control Board

Attachments:

(1) Revised 08 November 2024 Request by Adam Laputz for Scientific Peer Review

(2) Letters to Reviewers Initiating the Review
   i. Alberto Bellin, Ph.D.
   ii. J. Jaime Gómez-Hernández, Ph.D.
   iii. Isaya Kisekka, Ph.D.
   iv. Lee Allen Pettey, Ph.D.

(3) *Guidance to Reviewers*, posted at FTP site

(4) Curriculum Vitae
   i. Alberto Bellin, Ph.D.
   ii. J. Jaime Gómez-Hernández, Ph.D.
   iii. Isaya Kisekka, Ph.D.
   iv. Lee Allen Pettey, Ph.D.

(5) *Memo to ESPR Program Regarding Reviewer Clarification*

(6) Web Accessible Reviews
   i. Alberto Bellin, Ph.D.
   ii. J. Jaime Gómez-Hernández, Ph.D.
   iii. Isaya Kisekka, Ph.D.
   iv. Lee Allen Pettey, Ph.D.

cc: Jennifer Fuller
Senior Environmental Scientist, Specialist; Basin Planning Section
Central Valley Regional Water Quality Control Board

Alex Olsen
Supervising Engineering Geologist, Oil Field Program
Central Valley Regional Water Quality Control Board

Meredith Howard
Environmental Program Manager, Basin Planning Section
Central Valley Regional Water Quality Control Board

Christina Shupe
Assistant Executive Officer
Central Valley Regional Water Quality Control Board

Jessica Jahr
Attorney, Office of Chief Counsel California
State Water Resources Control Board

# Central Valley Regional Water Quality Control Board

Revisions (dated November 8, 2024) have been made to the original Cover Memorandum and to Attachments 1, 2 and 3 (originally dated September 27, 2024) for clarity.

TO: Carol Perkins
Environmental Scientist .
Manager, CalEPA Scientific Peer Review Program
Office of Research, Planning, and Performance
California State Water Resources Control Board

FROM: Adam Laputz
Assistant Executive Officer
Central Valley Regional Water Quality Control Board

CC: Jennifer Fuller
Senior Environmental Scientist, Specialist; Basin Planning Section
Central Valley Regional Water Quality Control Board

Alex Olsen
Supervising Engineering Geologist, Oil Field Program
Central Valley Regional Water Quality Control Board

Meredith Howard
Environmental Program Manager, Basin Planning Section
Central Valley Regional Water Quality Control Board

Christina Shupe
Assistant Executive Officer
Central Valley Regional Water Quality Control Board

Jessica Jahr
Attorney, Office of Chief Counsel California State Water Resources Control Board

DATE: September 27, 2024 (Revised November 8, 2024)

SUBJECT: Request for External Scientific Peer Review of the Scientific Basis of a Proposed Amendment to the Water Quality Control Plan for the Central Valley Regional Water Quality Control Board Tulare Lake Basin (Tulare Lake Basin Plan) to Remove (De-designate) the Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) Beneficial Uses from Groundwater Within a Designated Horizontal and Vertical Area Within and Surrounding the Administrative Boundaries of the South Belridge, Monument Junction and Cymric Oil Fields in Kern County

## McKittrick Area Oil Fields Groundwater Beneficial Use Evaluation

This request is regarding an external scientific peer review of the scientific basis of a proposed amendment to the Tulare Lake Basin Water Quality Control Plan to remove Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) as beneficial uses of groundwater within an area that includes portions of an area within and surrounding the administrative boundaries of the South Belridge, Monument Junction and Cymric Oil Fields in Kern County (Proposed Basin Plan Amendment).
The scientific basis for the Proposed Basin Plan Amendment is included in the associated draft Staff Report, titled *Draft Staff Report, Amendment to the Water Quality Control Plan for the Tulare Lake Basin to Remove Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) as Beneficial Uses of Groundwater Within an Area that Includes Portions of an Area within and Surrounding the Administrative Boundaries of the South Belridge, Monument Junction, and Cymric Oil Fields in Kern County* (Draft Staff Report), and dated September 2024, which is the primary scientific document requested for external peer review. This Draft Staff Report was developed by staff at the Central Valley Regional Water Quality Control Board (Central Valley Water Board).

Regional Water Quality Control Board Basin Plans developed, adopted, and amended through the State Water Boards are rules, as defined in Health and Safety Code section 57004, subdivision (a)(1), for water quality control pursuant to the Porter-Cologne Water Quality Control Act. Central Valley Water Board staff requests that you initiate the process to identify external scientific peer reviewers as soon as possible for the Proposed Rule (Central Valley Water Board Proposed Basin Plan Amendment), per the requirements of California Health and Safety Code section 57004.

This Proposed Basin Plan Amendment project has a series of strict deadlines, as it is mandated under a judge's order (described below). Therefore, to keep on schedule with the mandated project requirements, this Draft Staff Report needs to have an External Peer Review completed by approximately the end of 2024.

## Purpose of Review

The Central Valley Water Board staff proposes to amend the Tulare Lake Basin Plan to de-designate MUN and AGR beneficial uses of groundwater within a horizontally and vertically delineated zone within and near the South Belridge, Monument Junction, and Cymric Oil Fields in Kern County near the town of McKittrick. The scientific basis for this

Proposed Basin Plan Amendment is detailed in the associated September 2024 Draft Staff Report developed by Central Valley Water Board staff. This External Peer Review request concerns the scientific conclusions of the Draft Staff Report, as detailed in Attachment 2 of this External Peer Review Request Letter.

The Draft Staff Report includes an evaluation of a three-dimensional area (called the Project Zone) for potential de-designation of MUN and AGR beneficial uses of groundwater. This de-designation evaluation was mandated by a judge's order pursuant to legal proceedings regarding unlined oil field produced wastewater disposal facilities (McKittrick 1-1 and McKittrick 1 & 1-3 Facilities) operated by Valley Water Management Company (Valley Water) within the Project Zone. The judge's order also mandates, pursuant to those same legal proceedings, that a Basin Plan Amendment regarding the findings of the mandated evaluation be proposed for adoption by the Central Valley Water Board where appropriate.

The mandated evaluation of the beneficial uses of MUN and AGR in the groundwater in the Project Zone has been completed by Central Valley Water Board staff and is detailed in the Draft Staff Report. Central Valley Water Board staff is requesting that the Draft Staff Report be externally peer reviewed. An external peer review of the Draft Staff Report is not mandated by the judge's order for the Proposed Basin Plan Amendment. However, the review is being requested because the State Water Resources Control Board requires an external peer review of the scientific basis (e.g. Draft Staff Report) for Proposed Basin Plan Amendments be performed before approving Basin Plan Amendments. A Proposed Basin Plan Amendment requires approval from the State Water Resources Control Board in order to become effective in the Tulare Lake Basin Plan.

The groundwater in the Project Zone is currently designated for MUN and AGR beneficial uses by the Tulare Lake Basin Plan. Additionally, the Tulare Lake Basin Plan provides criteria for determining exceptions to MUN and AGR beneficial use designations.

Based on the mandated evaluation that Central Valley Water Board staff performed, and the exceptions criteria listed in the Tulare Lake Basin Plan, the available data supports de-designating groundwater for MUN and AGR beneficial uses in only an approximately 6-square-mile portion of the Project Zone. Additionally, the available data supports de-designating groundwater for only the MUN beneficial use (not the AGR beneficial use) in an additional approximately half-square-mile portion of the Project Zone. The reduced de-designation areas of the approximately 6-square-mile portion of the Project Zone and the approximately half-square-mile portion of the Project Zone together are named the Revised Project Zone. The Revised Project Zone only includes groundwater located in sediments that extend to the base of the alluvium, approximately 200 to 400 feet below ground surface (ft bgs), and does not extend into the Tulare Formation.

The Revised Project Zone is a horizontally and vertically delineated portion of the Project Zone that is proposed for de-designation of groundwater for MUN and AGR beneficial uses, and only the MUN beneficial use, in respective areas, in the Proposed Basin Plan Amendment. The Proposed Basin Plan Amendment de-designates MUN and AGR beneficial uses from the groundwater in areas in the Revised Project Zone respective of each beneficial use. The locations of the Project Zone and Revised Project Zone de-designations for MUN and AGR beneficial uses, and only the MUN beneficial use, are detailed in the Draft Staff Report.

The Draft Staff Report contains the scientific basis for the Proposed Basin Plan Amendment that Central Valley Water Board staff request to be external peer reviewed.

### When All Supporting Documents and References will be Available at the FTP Site

All supporting documents and references are currently available on the FTP site.

### Requested Review Period

We request that scientific peer review be accomplished within 30 days.

### Necessary Areas of Expertise for Reviewers

To review the scientific conclusions outlined in Attachment 2: Scientific Assumptions, Findings, and Conclusions to Review, reviewers should have expertise in (1) geology, (2) hydrogeology, and/or (3) agronomy. Refer to Attachment 2 for more details on the scientific assumptions, findings, and conclusions to be reviewed.

### Subsurface Geology

One to two reviewers with expertise in subsurface geology. Reviewers need to be familiar with geology of California's southwestern San Joaquin Valley and eastern Coast Range, with an emphasis the formations that are hydrocarbon producing or contain aquifers, and those that overlie them. Specifically, the reviewer should be familiar with the placement and stratigraphy of the Quaternary Alluvium, Corcoran Clay or Corcoran Clay Equivalent, and Tulare Formation.

<u>Corresponding conclusions in Attachment 2:</u>

Conclusion #1

Conclusion #2

Conclusion #3

Conclusion #5

Conclusion #6

### Subsurface Hydrogeology

One to two reviewers with expertise in subsurface hydrogeology. Reviewers need to be familiar with the hydrogeology of California's southwestern San Joaquin Valley and eastern Coast Range. Specifically, the reviewer should be familiar with the aquifers within the Quaternary Alluvium, the Tulare Formation, and corresponding confining layers (i.e., Basal Alluvial Clay, Corcoran Clay and Corcoran Clay Equivalent) and confining structures (i.e., Belridge Anticline).

Corresponding conclusions in Attachment 2:

Conclusion #1

Conclusion #2

Conclusion #3

Conclusion #5

Conclusion #6

### Agronomy

One reviewer with expertise in agronomy. Reviewers need to be familiar with salinity effects on crops, salt sensitive crops, salinity thresholds for salt sensitive crops, and leaching fractions. The reviewer specifically should be familiar with the salt tolerance of crops grown in the southwestern San Joaquin Valley such as pistachios, cotton, and almonds.

Corresponding conclusions in Attachment 2:

Conclusion #4

Conclusion #6

### Livestock/Animal Scientist

One reviewer with expertise in animal science, particularly domestic livestock. Reviewers need to be familiar with salinity thresholds acceptable for domestic livestock health, and salt salinity effects off elevated levels of salinity in drinking water. Specifically, the reviewer needs to be familiar with the salt tolerance of sheep, goats, and cattle.

Corresponding conclusions in Attachment 2:

Conclusion #4

Conclusion #6

## Contact Information

Jennifer Fuller is the project manager: Jennifer.Fuller@Waterboards.ca.gov, 916-464-4646

## Attachments

Attached please find:

1. Attachment 1: Plain English Summary
2. Attachment 2: Scientific Assumptions, Findings, and Conclusions to Review
3. Attachment 3: Individuals who Participated in the Development of the Proposal
4. Attachment 4: References Cited

## Attachment 1: Plain English Summary

The purpose of the Proposed Basin Plan Amendment is to de-designate Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) beneficial uses of groundwater within a horizontally and vertically delineated zone within and near the South Belridge, Monument Junction, and Cymric Oil Fields in Kern County near the town of McKittrick.

### Draft Staff Report for the Proposed Basin Plan Amendment

The Draft Staff Report for the Proposed Basin Plan Amendment provides technical information detailing the Central Valley Water Board staff evaluation of the potential de-designation of MUN and AGR beneficial uses of groundwater located in the Project Zone (described below).

### Draft Staff Report Project Zone

The Project Zone is a horizontally and vertically delineated three-dimensional area detailed in the Draft Staff Report that is within and near the South Belridge, Monument Junction, and Cymric Oil Fields in Kern County near the town of McKittrick.

The Project Zone is situated beneath and adjacent to a disposal facility operated by Clean Harbors Buttonwillow, LLC (Clean Harbors) and unlined oil field produced wastewater disposal facilities (McKittrick 1-1 and McKittrick 1 & 1-3 Facilities) operated by Valley Water Management Company (Valley Water).

### Judge's Order Mandate for the Draft Staff Report and Proposed Basin Plan Amendment

The Proposed Basin Plan Amendment and associated Draft Staff Report were developed by Central Valley Water Board staff due to a mandate from a judge's order. The judge's order was made pursuant to legal proceedings regarding the beneficial uses of the Tulare Lake Basin Plan.

The judge's order mandates that Central Valley Water Board staff review the scope and extent of beneficial uses in the Project Zone, develop a Proposed Basin Plan Amendment regarding the results of the mandated beneficial use evaluation, and present the Proposed Basin Plan Amendment to the Central Valley Water Board for potential adoption.

The mandated evaluation of the beneficial uses of MUN and AGR in the groundwater in the Project Zone has been completed by Central Valley Water Board staff and is detailed in the Draft Staff Report. Central Valley Water Board staff is requesting that the Draft Staff Report be externally peer reviewed. An external peer review of the Draft Staff Report is not mandated by the judge's order for the Proposed Basin Plan Amendment. However, the review is being requested because the State Water Resources Control Board requires an external peer review of the scientific basis (e.g. Draft Staff Report) for Proposed Basin Plan Amendments be performed before approving Proposed Basin Plan Amendments. A Proposed Basin Plan Amendment requires approval from the

State Water Resources Control Board in order to become effective in the Tulare Lake Basin Plan.

### MUN and AGR Beneficial Uses in Project Zone

The groundwater in the Project Zone is currently designated for MUN and AGR beneficial uses by the Tulare Lake Basin Plan.

The Tulare Lake Basin Plan provides criteria for determining exceptions to the MUN beneficial use designation,[1] including Criterion (1) which applies to water bodies where the concentration of total dissolved solids (TDS) exceeds 3,000 mg/L.[2]

The Tulare Lake Basin Plan also provides criteria for determining exceptions to the AGR beneficial use designation. One of those criteria is the presence of pollution that cannot reasonably be treated for agricultural use. In the absence of an established salinity water quality objective for the protection of the AGR beneficial use, the Central Valley Water Board relied upon scientific literature to provide salinity threshold concentrations that are generally considered to be protective of the AGR beneficial use. The literature supports a salinity threshold of 5,000 mg/L TDS.

### Evaluation of MUN and AGR Beneficial Uses in Project Zone

Available data shows that groundwater in the alluvium of the Project Zone has concentrations of TDS ranging from approximately 1,700 to 16,000 milligrams per liter (mg/L). Groundwater data from the Tulare Formation is limited, but available data shows that the TDS is generally less than 5,000 mg/L. Therefore, the Project Zone includes some groundwater that exceeds the MUN TDS threshold of 3,000 mg/L and thus may be considered for de-designation of the MUN beneficial use. Additionally, the Project Zone includes some groundwater that exceeds the AGR TDS threshold of 5,000 mg/L and thus may be considered for de-designation of the AGR beneficial use, as well as MUN de-designation.

The available data supports de-designating groundwater for MUN and AGR beneficial uses in only an approximately 6-square-mile portion of the Project Zone. Additionally, the available data supports de-designating groundwater for only the MUN beneficial use (not the AGR beneficial use) in an additional approximately half-square-mile portion of the Project Zone. The reduced de-designation areas of the approximately 6-square-mile portion of the Project Zone and the approximately half-square-mile portion of the Project Zone together are named the Revised Project Zone. The Revised Project Zone only

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[1] These criteria mirror the State Water Resources Control Board's *Sources of Drinking Water Policy's* criteria for determining that groundwater is not suitable for the MUN beneficial use designation.

[2] This criterion is often referred to as *Exemption 1a* under the *Sources of Drinking Water Policy*.

includes groundwater located in sediments that extend to the base of the alluvium, approximately 200 to 400 feet below ground surface (ft bgs), and does not extend into the Tulare Formation. The Revised Project Zone is a horizontally and vertically delineated portion of the Project Zone that is proposed for de-designation of groundwater for MUN and AGR beneficial uses in the Proposed Basin Plan Amendment, with a respective area for de-designation of both MUN and AGR beneficial uses, and a respective area for de-designation of only the MUN beneficial use (not the AGR beneficial use). The locations of the Project Zone and Revised Project Zone are detailed in the Draft Staff Report. If adopted by the Central Valley Water Board, the Proposed Basin Plan Amendment will use Tulare Lake Basin Plan de-designation criteria to de-designate MUN and AGR beneficial uses in a horizontally and vertically defined area of groundwater within the Project Zone (the Revised Project Zone).

De-designation of MUN and AGR beneficial uses in groundwater within the Revised Project Zone is not anticipated to result in significant groundwater quality impacts. This de-designation is consistent with current water quality conditions in the Project Zone.

## Proposed Basin Plan Amendment Language

The specific language of the Proposed Basin Plan Amendment is as follows:
Modify Chapter 2 of the Basin Plan, adding a new row to the bottom of Table 2-3 (p. 2-9), thereby establishing an Exception Area 6 (column 1) with the following Area Description (column 2), which shall be applicable to Detailed Analysis Unit (DAU) #259 (column 3):

> Groundwater contained within the Holocene Alluvium (alluvium), from ground surface to the base of the Corcoran Clay Equivalent (CCE), within the approximately 6.0 square mile two-dimensional surface area composed of: the east quarter of Section 13, the southeast quarter of Section 23, the east half of the southwest quarter of Section 23, the south half and the east quarter of Section 24, the north quarter of Section 25, the north half of the northeast quarter of Section 26, and the northeast quarter of the northwest quarter of Section 26, of T29S/R21E[3], MDBM[4], and Sections 17, 18, and 19, the west quarter of Section 16, the west and north quarters of Section 20, the northwest quarter of the northwest quarter of Section 21, the northwest quarter of the northwest quarter of Section 29, and the north quarter of Section 30, of T29S/R22E[5], MDBM[6] is not suitable, or potentially suitable, for municipal or domestic supply (MUN) or agricultural supply

[3] Township 29 South, Range 21 East

[4] Mount Diablo Base and Meridian

[5] Township 29 South, Range 22 East

[6] Mount Diablo Base and Meridian

(AGR), including, but not limited to, AGR applications for irrigation, stock watering and support of vegetation for range grazing. Additionally, a half square mile two-dimensional area composed of: the north half of the northeast quarter of Section 16, the east half of the west half of Section 16, the southwest quarter of the southeast quarter of Section 16, the northeast quarter of the northwest quarter of Section 21, and the northwest quarter of the northeast quarter of Section 21, of T29S/R22E[7], MDBM[8] is not suitable, or potentially suitable, for municipal or domestic supply (MUN).

[7] Township 29 South, Range 22 East

[8] Mount Diablo Base and Meridian

## Attachment 2: Scientific Assumptions, Findings, and Conclusions to Review

1. **Conclusion #1: Based on the available data, the scientific assumptions, findings, and conclusions regarding the subsurface hydrology, geology, and Corcoran Clay Equivalent in the Project Zone are scientifically reasonable and defensible.**

   The Project Zone includes Quaternary Alluvium and the Tulare Formation. A confining clay layer, the Corcoran Clay Equivalent, is a thick clay that provides a vertical barrier between the Quaternary Alluvium and Tulare Formation and inhibits groundwater in the Quaternary Alluvium from reaching the underlying Tulare Formation. The Revised Project Zone, which incorporates a portion of Quaternary Alluvium sediments within the Project Zone, and does not extend into the Tulare Formation, has water quality as such that it is appropriate for de-designation of MUN and AGR beneficial uses. The Corcoran Clay Equivalent acts as the confining layer that separates the Revised Project Zone from the underlying Tulare Formation. Due to this confining layer, oil field produced wastewater discharged to the surface of the Revised Project Area is not expected to migrate into the Tulare Formation, as the Corcoran Clay Equivalent provides a vertical barrier.

   Key References:
   1. Croft, 1972
   2. Gillespie et al., 2019
   3. Page, 1983

   Draft Staff Report Locations:
   1. Executive Summary
   2. Section 1: Introduction and Existing Conditions
   3. Section 1.2: Background
   4. Subsection 1.2.1: Regional Subsurface Geology
   5. Subsection 1.2.3: Groundwater
   6. Subsection 3.1: Characteristics of the Project Zone
   7. Figure 4: Type Log of the Tulare Formation within the Project Area

2. **Conclusion #2: Based on the available data, the scientific assumptions, findings, and conclusions regarding the quality of the groundwater in the Project Zone are scientifically reasonable and defensible.**

   As observed in samples taken from monitoring wells within the Revised Project Zone, groundwater exceeds 5,000 mg/L total dissolved solids (TDS). A small portion of the Revised Project Zone contains groundwater that ranges between 3,000 to 5,000 mg/L TDS. This is the basis for the de-designation of MUN and AGR beneficial uses within the Revised Project Zone. Available water quality data does not support de-designation outside of the Revised Project Zone.

Key References:

1. GeoTracker: Monitoring well data/Self-Monitoring Report (SMR) data from:
    a. Clean Harbors Buttonwillow, Inc. GeoTracker Case File Documents for Clean Harbors Buttonwillow, Inc.
    b. California Regional Water Quality Control Board Central Valley Region, April 2018 (Monitoring and Reporting Program R5-2018-0808 for Valley Water Management Company McKittrick 1 & 1-3 Facility Kern County)
    c. California Regional Water Quality Control Board Central Valley Region, June 2019 (Water Code Section 13301 Cease and Desist Order No. R5-2019-0045 for Valley Water Management Company McKittrick 1 & 1-3 Facility Kern County)
    d. California Regional Water Quality Control Board Central Valley Region, July 2019 (Water Code Section 13267 Monitoring Program R5-2019-0896 for Valley Water Management Company McKittrick 1-1 Facility Kern County)
    e. Kennedy Jenks, March 2020 (General Order Three Notice of Intent Technical Report, McKittrick 1 & 1-3 Facility, Kern County, California)
    f. Valley Water Management Company GeoTracker Case File Documents for McKittrick 1-1 Facility
    g. Valley Water Management Company GeoTracker Case File Documents for McKittrick 1 & 1-3 Facility

Draft Staff Report Locations:

1. Executive Summary
2. Subsection 3.3: Proposed De-Designation Boundary
3. Section 4: Project Alternatives
4. Figure 2: Project Area TDS concentrations of the groundwater in the alluvium
5. Figure 3: Project Area TDS concentrations of the groundwater in the Tulare Formation

3. **Conclusion #3: Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the MUN beneficial use of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the MUN de-designation determination is scientifically reasonable and defensible.**

De-designation of the MUN beneficial use is based on groundwater in the Revised Project Zone meeting one of the MUN de-designation criteria in the

Tulare Lake Basin Plan (levels of TDS exceed 3,000 mg/L). Available groundwater data and geologic site information indicate that the groundwater exceeds 3,000 mg/L TDS in the MUN de-designation portion of the Revised Project Zone.

Key References:

1. Tulare Lake Basin Plan, 2018
2. GeoTracker: Monitoring well data/Self-Monitoring Report (SMR) data from:
    a. Clean Harbors Buttonwillow, Inc. GeoTracker Case File Documents for Clean Harbors Buttonwillow, Inc.
    b. California Regional Water Quality Control Board Central Valley Region, April 2018 (Monitoring and Reporting Program R5-2018-0808 for Valley Water Management Company McKittrick 1 & 1-3 Facility Kern County)
    c. California Regional Water Quality Control Board Central Valley Region, June 2019 (Water Code Section 13301 Cease and Desist Order No. R5-2019-0045 for Valley Water Management Company McKittrick 1 & 1-3 Facility Kern County)
    d. California Regional Water Quality Control Board Central Valley Region, July 2019 (Water Code Section 13267 Monitoring Program R5-2019-0896 for Valley Water Management Company McKittrick 1-1 Facility Kern County)
    e. Kennedy Jenks, March 2020 (General Order Three Notice of Intent Technical Report, McKittrick 1 & 1-3 Facility, Kern County, California)
    f. Valley Water Management Company GeoTracker Case File Documents for McKittrick 1-1 Facility
    g. Valley Water Management Company GeoTracker Case File Documents for McKittrick 1 & 1-3 Facility

Draft Staff Report Locations:

1. Executive Summary
2. Section 1: Introduction and Existing Conditions
3. Subsection 1.1.1: Current Application of the MUN Beneficial Use
4. Subsection 1.1.3: History of Evaluating Beneficial Uses in Groundwater
5. Section 1.2: Background
6. Subsection 1.2.1: Regional Subsurface Geology
7. Subsection 1.2.3: Groundwater
8. Subsection 2.1.1 Federal Regulations and Guidance
9. Subsection 2.1.2: State Regulations and Guidance
10. Subsection 2.2: Sources of Drinking Water Policy, State Water Board Resolution 88-63
11. Subsection 3.1: Characteristics of the Project Zone
12. Subsection 3.3: Proposed De-Designation Boundary

13. Subsection 4.1: MUN Beneficial Use Alternatives, Evaluation and Recommendation
14. Subsection 4.1.6: Staff Recommendation: MUN Alternative 3
15. Figure 2: Project Area TDS concentrations of the groundwater in the alluvium
16. Figure 3: Project Area TDS concentrations of the groundwater in the Tulare Formation
17. Figure 4: Type Log of the Tulare Formation within the Project Area

4. **Conclusion #4: Based on the available data, the scientific assumptions, findings, and conclusions regarding the determination to use 5,000 mg/L TDS as a salinity threshold concentration to evaluate AGR de-designation in the groundwater of the Project Zone is scientifically reasonable and defensible.**

De-designation of the AGR beneficial use is based on groundwater in the Revised Project Zone meeting one of the AGR de-designation criteria in the Tulare Lake Basin Plan. This criterion is the presence of pollution, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for agricultural use using either Best Management Practices or best economically achievable treatment practices. Unlike the MUN beneficial use, there is no numeric criterion in the Tulare Lake Basin Plan for determining when TDS levels are high enough to be considered pollution that does not support the AGR beneficial use. For salinity, the Central Valley Water Board must determine what numeric levels of salinity (e.g. TDS levels) are not protective and do not support the use of groundwater for irrigation, livestock watering, and support of vegetation for range grazing.

A literature review [CV-SALTS, 2012] regarding salinity impacts on both irrigation and stock watering was conducted and showed that the literature concurred with the Ayers and Westcot finding [Ayers and Westcot, 1985] that only the most salt tolerant crops may be sustainably irrigated with water exceeding 2,000 mg/L TDS. In addition. Sharif et al., [2019] classify cotton as moderately salt tolerant with a salinity threshold level of 7,700 µS/cm EC (TDS of approximately 5,159 mg/L). As part of a stock watering literature review [CV-SALTS, 2013], CV-SALTS also identified a range of acceptable salt levels for livestock watering, ranging from 3,000 mg/L TDS [CCME, 2013] to 5,000 mg/L TDS [NRC, 1974]. For purposes of this Proposed Basin Plan Amendment, based on the scientific literature reviews conducted and the references discussed above, the Central Valley Water Board will utilize the salinity threshold value of 5,000 mg/L TDS as the upper limit for groundwater quality capable of supporting AGR beneficial use. Therefore, groundwater with greater than 5,000 mg/L TDS is eligible for de-designation under the pollution criterion.

Key References:

1. Ayers and Westcot, 1985

2. CCME, 2013
3. CV-SALTS, 2012
4. CV-SALTS, 2013
5. NRC, 1974
6. Sharif et al., 2019
7. Tulare Lake Basin Plan, 2018
8. GeoTracker: Monitoring well data/Self-Monitoring Report (SMR) data from:
    a. Clean Harbors Buttonwillow, Inc. GeoTracker Case File Documents for Clean Harbors Buttonwillow, Inc.
    b. California Regional Water Quality Control Board Central Valley Region, April 2018 (Monitoring and Reporting Program R5-2018-0808 for Valley Water Management Company McKittrick 1 & 1-3 Facility Kern County)
    c. California Regional Water Quality Control Board Central Valley Region, June 2019 (Water Code Section 13301 Cease and Desist Order No. R5-2019-0045 for Valley Water Management Company McKittrick 1 & 1-3 Facility Kern County)
    d. California Regional Water Quality Control Board Central Valley Region, July 2019 (Water Code Section 13267 Monitoring Program R5-2019-0896 for Valley Water Management Company McKittrick 1-1 Facility Kern County)
    e. Kennedy Jenks, March 2020 (General Order Three Notice of Intent Technical Report, McKittrick 1 & 1-3 Facility, Kern County, California)
    f. Valley Water Management Company GeoTracker Case File Documents for McKittrick 1-1 Facility
    g. Valley Water Management Company GeoTracker Case File Documents for McKittrick 1 & 1-3 Facility

<u>Draft Staff Report Locations:</u>

1. Executive Summary
2. Section 1: Introduction and Existing Conditions
3. Subsection 1.1.2: Current Application of the AGR Beneficial Use
4. Subsection 1.1.3: History of Evaluating Beneficial Uses in Groundwater
5. Subsection 4.2: AGR Beneficial Use Alternatives, Evaluation and Recommendation
6. Subsection 4.2.6: Staff Recommendation: AGR Alternative 3

5. **Conclusion #5: Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the AGR beneficial uses of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and**

**therefore the AGR de-designation determination is scientifically reasonable and defensible.**

De-designation of the AGR beneficial use is based on groundwater in the Revised Project Zone meeting one of the AGR de-designation criteria in the Tulare Lake Basin Plan (the presence of pollution that cannot reasonably be treated for agricultural use). In the absence of an established salinity water quality objective for the protection of the AGR beneficial use, the Central Valley Water Board relied upon scientific literature to provide salinity threshold concentrations that are generally considered to be protective of AGR. The literature supports a salinity threshold of 5,000 mg/L TDS (please see discussion of this in Conclusion #4 above).

Available groundwater data and geologic site information indicate that the groundwater exceeds 5,000 mg/L TDS in the AGR de-designation portion of the Revised Project Zone.

Key References:

1. Ayers and Westcot, 1985
2. CV-SALTS, 2013
3. Tulare Lake Basin Plan, 2018
3. GeoTracker: Monitoring well data/Self-Monitoring Report (SMR) data from:
    h. Clean Harbors Buttonwillow, Inc. GeoTracker Case File Documents for Clean Harbors Buttonwillow, Inc.
    i. California Regional Water Quality Control Board Central Valley Region, April 2018 (Monitoring and Reporting Program R5-2018-0808 for Valley Water Management Company McKittrick 1 & 1-3 Facility Kern County)
    j. California Regional Water Quality Control Board Central Valley Region, June 2019 (Water Code Section 13301 Cease and Desist Order No. R5-2019-0045 for Valley Water Management Company McKittrick 1 & 1-3 Facility Kern County)
    k. California Regional Water Quality Control Board Central Valley Region, July 2019 (Water Code Section 13267 Monitoring Program R5-2019-0896 for Valley Water Management Company McKittrick 1-1 Facility Kern County)
    l. Kennedy Jenks, March 2020 (General Order Three Notice of Intent Technical Report, McKittrick 1 & 1-3 Facility, Kern County, California)
    m. Valley Water Management Company GeoTracker Case File Documents for McKittrick 1-1 Facility
    n. Valley Water Management Company GeoTracker Case File Documents for McKittrick 1 & 1-3 Facility

Draft Staff Report Locations:

1. Executive Summary
2. Section 1: Introduction and Existing Conditions
3. Subsection 1.1.2: Current Application of the AGR Beneficial Use
4. Subsection 1.1.3: History of Evaluating Beneficial Uses in Groundwater
5. Section 1.2: Background
6. Subsection 1.2.1: Regional Subsurface Geology
7. Subsection 1.2.3: Groundwater
8. Subsection 3.1: Characteristics of the Project Zone
9. Subsection 3.3: Proposed De-Designation Boundary
10. Subsection 4.2: AGR Beneficial Use Alternatives, Evaluation and Recommendation
11. Subsection 4.2.6: Staff Recommendation: AGR Alternative 3
12. Figure 2: Project Area TDS concentrations of the groundwater in the alluvium
13. Figure 3: Project Area TDS concentrations of the groundwater in the Tulare Formation
14. Figure 4: Type Log of the Tulare Formation within the Project Area

6. **Conclusion #6: Based on the available data, and taken as a whole, the scientific assumptions, findings, and conclusions in regard to the scientific portions of the Proposed Basin Plan Amendment are based upon sound scientific knowledge, methods, and practices.**

Draft Staff Report Locations:

1. Executive Summary
2. Section 1: Introduction and Existing Conditions
3. Section 3: Evaluation of the Project Zone
4. Section 4: Project Alternatives
5. Section 7: Environmental Review
6. Section 9: References
7. Figure 1: Project Area
8. Figure 2: Project Area TDS concentrations of the groundwater in the alluvium
9. Figure 3: Project Area TDS concentrations of the groundwater in the Tulare Formation
10. Figure 4: Type Log of the Tulare Formation within the Project Area

## Attachment 3: Known Individuals or Entities who Participated in the Development of the Proposed Basin Plan Amendment, or Entities with Facilities Located Within the Draft Staff Report Project Zone

### CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD

Patrick Pulupa, Executive Officer
Adam Laputz, Assistant Executive Officer
Christina Shupe, Assistant Executive Officer
Meredith Howard, Environmental Program Manager
Alex Olsen, Supervising Engineering Geologist
Rebecca Asami, Senior Engineering Geologist (Supervisory)
Alejandra Lopez, Engineering Geologist
Sara Maloney, Engineering Geologist
Mariana Estrada, Water Resource Control Engineer (WRCE)
Glenn Meeks, Senior Engineering Geologist (Retired)
Jennifer Fuller, Senior Environmental Scientist (Specialist)

### STATE WATER RESOURCES CONTROL BOARD, OFFICE OF CHIEF COUNSEL

Jessica Jahr, Attorney IV

### ENTITIES WITH FACILITIES LOCATED WITHIN THE DRAFT STAFF REPORT PROJECT ZONE

Clean Harbors Buttonwillow, LLC
Valley Water Management Company
Starrh & Starrh Cotton Growers LP (Starrh Farms)

### COMMENTERS IN CEQA PROCESS

Rock Zierman, Chief Executive Officer, California Independent Petroleum Association
Melissa Thorme, Downey Brand LLP
Jason Meadors, General Manager, Valley Water Management Company
Richard Garcia, President of the Kern County League of United Latin American Citizens (LULAC), Council 3272

## Attachment 4: References Cited

**(KEY REFERENCES THAT ARE INCLUDED IN ATTACHMENT 2 ARE BOLDED)**

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**Ayers, R.S. and D.W. Westcot. 1985. *Water Quality for Agriculture.* Food and Agriculture Organization of the United Nations, Irrigation and Drainage Paper 29, Rev. 1, Rome.**

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**California Regional Water Quality Control Board Central Valley Region. June 17, 2019. Water Code Section 13301 Cease and Desist Order No. R5-2019-0045 for Valley Water Management Company McKittrick 1 & 1-3 Facility Kern County. http://geotracker.waterboards.ca.gov/?gid=L10007494132.**

**California Regional Water Quality Control Board Central Valley Region. July 3, 2019. Water Code Section 13267 Monitoring Program R5-2019-0896 for Valley Water Management Company McKittrick 1-1 Facility Kern County. http://geotracker.waterboards.ca.gov/?gid=L10004955136.**

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# State Water Resources Control Board

March 25, 2025

Alberto Bellin, Ph.D.
Professor, Hydraulic and Marine Constructions and Hydrology
Department of Civil, Environmental and Mechanical Engineering
Center Agriculture Food Environment – C3A
University of Trento, Italy

Sent via email

SUBJECT: Peer Review Commencement Regarding the Scientific Basis of a Proposed Amendment to the Water Quality Control Plan for the Central Valley Regional Water Quality Control Board Tulare Lake Basin (Tulare Lake Basin Plan) to Remove (De-designate) the Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) Beneficial Uses from Groundwater Within a Designated Horizontal and Vertical Area Within and Surrounding the Administrative Boundaries of the South Belridge, Monument Junction and Cymric Oil Fields in Kern County

Dear Professor Bellin,

Thank you for accepting the role as an external scientific peer reviewer of subject request. The purpose of this letter is to initiate the external peer review.

**Components of the review:**

1. Request for External Scientific Peer Review, with the following attachments:
    a. Attachment 1: Plain English Summary.
    b. Attachment 2: Scientific Assumptions, Findings, and Conclusions to Review.
    c. Attachment 3: Individuals who Participated in the Development of the Proposal.
    d. Attachment 4: References Cited.
2. Proposed rule or related documents:
    a. Draft Staff Report.
    b. Draft Staff Report, Appendix D.
3. Electronic copies of references cited.
4. *Guidance for Reviewers*.

All components of the review are posted at a secure FTP site:

Site: https://ftp.waterboards.ca.gov
- Username: gbowes-ftp53
- Password: rUCUR8ERpBXFa9VBWg6tDdKW

The findings, assumptions, and conclusions that need review are listed in Attachment 2 of the review request. I ask that you review those findings, assumptions, and conclusions which you previously stated, in communications with me dated 25 March 2025, that you could address with confidence, based on your expertise and experience. These are the following conclusions:

*Conclusion* # 1:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the subsurface hydrology, geology, and Corcoran Clay Equivalent in the Project Zone are scientifically reasonable and defensible.*

*Conclusion* # 2:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the quality of the groundwater in the Project Zone are scientifically reasonable and defensible.*

*Conclusion* # 3:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the MUN beneficial use of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the MUN de-designation determination is scientifically reasonable and defensible.*

*Conclusion* # 6:
*Based on the available data, and taken as a whole, the scientific assumptions, findings, and conclusions in regard to the scientific portions of the Proposed Basin Plan Amendment are based upon sound scientific knowledge, methods, and practices.*

If you decide to address other assumptions, findings, or conclusions identify the expertise and experience you are relying on to do so. Please refer to *Guidance for Reviewers* for more information about your review and subsequent report, including formatting and web accessibility guidelines.

I will help provide support for any questions you have. To ensure a clear record of our communication, all communications should be in writing (email is preferred). My email address below should prepopulate an email.

Please email your review to me no later than **25 April 2025**. I will forward all reviews and the curricula vitae of all reviewers to the requesting organization. All information may be posted on their website.

The organization requesting the review may require clarification or additional information on a specific subject. If this occurs, I will ask you to supplement your review to address those comments.

Your participation in this review assignment is most appreciated.

Sincerely,

Carol Perkins
Environmental Scientist
CalEPA External Scientific Peer Review Program Lead
Office of Research, Planning, and Performance
State Water Resources Control Board
1001 “I” Street, 13th Floor Sacramento, California 95814
Carol.Perkins@waterboards.ca.gov

# State Water Resources Control Board

March 25, 2025

J. Jaime Gómez-Hernández, Ph.D.
Full Professor, Instituto de Ingeniería del Agua y Medio Ambiente
Universitat Politècnica de València
Camino de Vera s/n, 46020 Valencia, Spain

Sent via email

SUBJECT: Peer Review Commencement Regarding the Scientific Basis of a Proposed Amendment to the Water Quality Control Plan for the Central Valley Regional Water Quality Control Board Tulare Lake Basin (Tulare Lake Basin Plan) to Remove (De-designate) the Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) Beneficial Uses from Groundwater Within a Designated Horizontal and Vertical Area Within and Surrounding the Administrative Boundaries of the South Belridge, Monument Junction and Cymric Oil Fields in Kern County

Dear Professor Gómez-Hernández,

Thank you for accepting the role as an external scientific peer reviewer of subject request. The purpose of this letter is to initiate the external peer review.

**Components of the review:**

1. Request for External Scientific Peer Review, with the following attachments:
   a. Attachment 1: Plain English Summary.
   b. Attachment 2: Scientific Assumptions, Findings, and Conclusions to Review.
   c. Attachment 3: Individuals who Participated in the Development of the Proposal.
   d. Attachment 4: References Cited.
2. Proposed rule or related documents:
   a. Draft Staff Report.
   b. Draft Staff Report, Appendix D.
3. Electronic copies of references cited.
4. *Guidance for Reviewers*.

All components of the review are posted at a secure FTP site:

Site: https://ftp.waterboards.ca.gov
- Username: gbowes-ftp53
- Password: rUCUR8ERpBXFa9VBWg6tDdKW

The findings, assumptions, and conclusions that need review are listed in Attachment 2 of the review request. I ask that you review those findings, assumptions, and conclusions which you previously stated, in communications with me dated 20 February 2025, that you could address with confidence, based on your expertise and experience. These are the following conclusions:

*Conclusion* # 1:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the subsurface hydrology, geology, and Corcoran Clay Equivalent in the Project Zone are scientifically reasonable and defensible.*

*Conclusion* # 2:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the quality of the groundwater in the Project Zone are scientifically reasonable and defensible.*

*Conclusion* # 3:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the MUN beneficial use of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the MUN de-designation determination is scientifically reasonable and defensible.*

*Conclusion* # 4:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the determination to use 5,000 mg/L TDS as a salinity threshold concentration to evaluate AGR de-designation in the groundwater of the Project Zone is scientifically reasonable and defensible.*

*Conclusion* # 5:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the AGR beneficial uses of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the AGR de-designation determination is scientifically reasonable and defensible.*

*Conclusion* # 6:
*Based on the available data, and taken as a whole, the scientific assumptions, findings, and conclusions in regard to the scientific portions of the Proposed Basin Plan Amendment are based upon sound scientific knowledge, methods, and practices.*

If you decide to address other assumptions, findings, or conclusions identify the expertise and experience you are relying on to do so. Please refer to *Guidance for Reviewers* for more information about your review and subsequent report, including formatting and web accessibility guidelines.

I will help provide support for any questions you have. To ensure a clear record of our communication, all communications should be in writing (email is preferred). My email address below should prepopulate an email.

Please email your review to me no later than **25 April 2025**. I will forward all reviews and the curricula vitae of all reviewers to the requesting organization. All information may be posted on their website.

The organization requesting the review may require clarification or additional information on a specific subject. If this occurs, I will ask you to supplement your review to address those comments.

Your participation in this review assignment is most appreciated.

Sincerely,

Carol Perkins
Environmental Scientist
CalEPA External Scientific Peer Review Program Lead
Office of Research, Planning, and Performance
State Water Resources Control Board
1001 “I” Street, 13th Floor Sacramento, California 95814
Carol.Perkins@waterboards.ca.gov

# State Water Resources Control Board

March 25, 2025

Isaya Kisekka, Ph.D.
Professor, Hydrology and Agricultural Water Management
Depts., Land, Air, and Water Resources and Biological and Agricultural Engineering
Director, Agricultural Water Center of Excellence
University of California Davis
One Shields Avenue, PES 1110 Davis, CA 95616

Sent via email

SUBJECT: Peer Review Commencement Regarding the Scientific Basis of a Proposed Amendment to the Water Quality Control Plan for the Central Valley Regional Water Quality Control Board Tulare Lake Basin (Tulare Lake Basin Plan) to Remove (De-designate) the Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) Beneficial Uses from Groundwater Within a Designated Horizontal and Vertical Area Within and Surrounding the Administrative Boundaries of the South Belridge, Monument Junction and Cymric Oil Fields in Kern County

Dear Professor Kisekka,

Thank you for accepting the role as an external scientific peer reviewer of subject request. The purpose of this letter is to initiate the external peer review.

**Components of the review:**

1. Request for External Scientific Peer Review, with the following attachments:
    a. Attachment 1: Plain English Summary.
    b. Attachment 2: Scientific Assumptions, Findings, and Conclusions to Review.
    c. Attachment 3: Individuals who Participated in the Development of the Proposal.
    d. Attachment 4: References Cited.
2. Proposed rule or related documents:
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All components of the review are posted at a secure FTP site:

Site: https://ftp.waterboards.ca.gov
- Username: gbowes-ftp53
- Password: rUCUR8ERpBXFa9VBWg6tDdKW

The findings, assumptions, and conclusions that need review are listed in Attachment 2 of the review request. I ask that you review those findings, assumptions, and conclusions which you previously stated, in communications with me dated 07 January 2025, that you could address with confidence, based on your expertise and experience. These are the following conclusions:

*Conclusion* # 1:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the subsurface hydrology, geology, and Corcoran Clay Equivalent in the Project Zone are scientifically reasonable and defensible.*

*Conclusion* # 2:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the quality of the groundwater in the Project Zone are scientifically reasonable and defensible.*

*Conclusion* # 4:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the determination to use 5,000 mg/L TDS as a salinity threshold concentration to evaluate AGR de-designation in the groundwater of the Project Zone is scientifically reasonable and defensible.*

*Conclusion* # 5:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the AGR beneficial uses of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the AGR de-designation determination is scientifically reasonable and defensible.*

*Conclusion* # 6:
*Based on the available data, and taken as a whole, the scientific assumptions, findings, and conclusions in regard to the scientific portions of the Proposed Basin Plan Amendment are based upon sound scientific knowledge, methods, and practices.*

If you decide to address other assumptions, findings, or conclusions identify the expertise and experience you are relying on to do so. Please refer to *Guidance for*

*Reviewers* for more information about your review and subsequent report, including formatting and web accessibility guidelines.

I will help provide support for any questions you have. To ensure a clear record of our communication, all communications should be in writing (email is preferred). My email address below should prepopulate an email.

Please email your review to me no later than **25 April 2025**. I will forward all reviews and the curricula vitae of all reviewers to the requesting organization. All information may be posted on their website.

The organization requesting the review may require clarification or additional information on a specific subject. If this occurs, I will ask you to supplement your review to address those comments.

Your participation in this review assignment is most appreciated.

Sincerely,

Carol Perkins
Environmental Scientist
CalEPA External Scientific Peer Review Program Lead
Office of Research, Planning, and Performance
State Water Resources Control Board
1001 “I” Street, 13th Floor Sacramento, California 95814
Carol.Perkins@waterboards.ca.gov

# State Water Resources Control Board

March 25, 2025

Lee Allen Pettey, Ph.D.
Associate Professor of Teaching in Animal Science
Department of Animal Science
University of California, Davis
One Shields Avenue, Davis, CA 95616

Sent via email

SUBJECT: Peer Review Commencement Regarding the Scientific Basis of a Proposed Amendment to the Water Quality Control Plan for the Central Valley Regional Water Quality Control Board Tulare Lake Basin (Tulare Lake Basin Plan) to Remove (De-designate) the Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) Beneficial Uses from Groundwater Within a Designated Horizontal and Vertical Area Within and Surrounding the Administrative Boundaries of the South Belridge, Monument Junction and Cymric Oil Fields in Kern County

Dear Professor Petty,

Thank you for accepting the role as an external scientific peer reviewer of subject request. The purpose of this letter is to initiate the external peer review.

**Components of the review:**

1. Request for External Scientific Peer Review, with the following attachments:
   a. Attachment 1: Plain English Summary.
   b. Attachment 2: Scientific Assumptions, Findings, and Conclusions to Review.
   c. Attachment 3: Individuals who Participated in the Development of the Proposal.
   d. Attachment 4: References Cited.
2. Proposed rule or related documents:
   a. Draft Staff Report.
   b. Draft Staff Report, Appendix D.
3. Electronic copies of references cited.
4. *Guidance for Reviewers*.

All components of the review are posted at a secure FTP site:

Site: https://ftp.waterboards.ca.gov
- Username: gbowes-ftp53
- Password: rUCUR8ERpBXFa9VBWg6tDdKW

The findings, assumptions, and conclusions that need review are listed in Attachment 2 of the review request. I ask that you review those findings, assumptions, and conclusions which you previously stated, in communications with me dated 07 January 2025, that you could address with confidence, based on your expertise and experience. These are the following conclusions:

*Conclusion* # 2:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the quality of the groundwater in the Project Zone are scientifically reasonable and defensible.*

*Conclusion* # 4:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the determination to use 5,000 mg/L TDS as a salinity threshold concentration to evaluate AGR de-designation in the groundwater of the Project Zone is scientifically reasonable and defensible.*

*Conclusion* # 5:
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the AGR beneficial uses of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the AGR de-designation determination is scientifically reasonable and defensible.*

*Conclusion* # 6:
*Based on the available data, and taken as a whole, the scientific assumptions, findings, and conclusions in regard to the scientific portions of the Proposed Basin Plan Amendment are based upon sound scientific knowledge, methods, and practices.*

If you decide to address other assumptions, findings, or conclusions identify the expertise and experience you are relying on to do so. Please refer to *Guidance for Reviewers* for more information about your review and subsequent report, including formatting and web accessibility guidelines.

I will help provide support for any questions you have. To ensure a clear record of our communication, all communications should be in writing (email is preferred). My email address below should prepopulate an email.

Please email your review to me no later than **25 April 2025**. I will forward all reviews and the curricula vitae of all reviewers to the requesting organization. All information may be posted on their website.

The organization requesting the review may require clarification or additional information on a specific subject. If this occurs, I will ask you to supplement your review to address those comments.

Your participation in this review assignment is most appreciated.

Sincerely,

Carol Perkins
Environmental Scientist
CalEPA External Scientific Peer Review Program Lead
Office of Research, Planning, and Performance
State Water Resources Control Board
1001 “I” Street, 13th Floor Sacramento, California 95814
Carol.Perkins@waterboards.ca.gov

# CalEPA Peer Review Program
# Guidance for Reviewers

*Updated June 2023*

**Communication with the CalEPA Peer Review Program.** To ensure a clear record of our communication, all our communications should be in writing (email is preferred).

**Confidentiality.** You are required to help maintain the confidentiality of this review process.

- Confidentiality began at the point you were contacted by the University of California, Berkeley (UC).
- You should not inform others about your role as reviewer.
- You will not know the names of other reviewers until all reviews are complete and the requesting organization decides to release reviews.
- You are not allowed to discuss the proposal with employees of the requesting organization or individuals who participated in development of the proposal. The individuals who participated in development are listed in Attachment 3 of the review request. Please let the CalEPA Program know if you have a question, and we will provide the support between you and the requesting organization.

**Independence.** If you learn what you are reviewing was developed by someone with whom you share a common supervisor or have or had a working relationship, you must let us know so that we can determine whether to seek another peer reviewer. For example, if the CalEPA organization asking for the review contracted with someone in your department or organization to help develop the material you were asked to review, you have a potential conflict of interest.

**Your review.** The statutory mandate for external scientific peer review (California Health and Safety Code Section 57004) states that the reviewer's responsibility is to determine whether "the scientific portion of the proposed rule is based upon sound scientific knowledge, methods, and practices." Your review should take into account both the scientific basis for the proposed rule and the intended application or implementation of that science in the context of the proposed rule.

Note: you are also invited to identify and address additional subjects that should be considered as part of the scientific basis of the proposed rule, and to consider, whether you conclude the proposed rule, taken as a whole, is based on sound scientific knowledge, methods, and practices.

**You may have been asked to review the implementation or application of science that has previously been peer reviewed.** In some cases, there is a clear, previously reviewed scientific basis for what you are reviewing but the scientific basis of a new

implementation of the science still must be reviewed. For example, the scientific foundation for a drinking water standard may have been reviewed when the drinking water standard was adopted, but you might determine that the same scientific foundation does not support the use of the same standard to protect aquatic life in a river.

**You may ask for clarification or for additional specific supporting documents.** We will provide what we can to you and all reviewers. Send clarification questions to the CalEPA Program.

**Text to include in your review.**

- Your name, professional affiliation, and the date.
- The name of the item you are reviewing.
- Begin your review with, “Based on my expertise and experience, I am reviewing the findings, assumptions, or conclusions I agreed I could review with confidence:” and list them by number, as they are referred to in Attachment 2 of the review request.

**Formatting your review.** To ensure all people can perceive, understand, navigate, and interact with the materials posted on CalEPA websites, files posted on these websites must meet accessibility criteria. Your peer review may be posted on a CalEPA website so you must submit your review in an accessible format. The recommended way to make your file accessible is to use Microsoft Word to write your review and to use only basic text and headings during document creation. Then, run the built-in Word Accessibility Checker and resolve any accessibility issues.

Making your review accessible is your responsibility but staff at the UC may be able to assist you by suggesting changes for your approval.

General accessibility criteria include:

- Text. Text should be black, in Arial, size 12 points or larger.
- Non-text elements. If you use them, equations, graphs, figures, images, charts, or tables must follow accessibility criteria regarding meaningful captions and alternative text.
- Layout. Avoid complex document layouts, such as having text in more than one column, use of text boxes, use of color, and applying different font styles (i.e., bolding, underlining, etc.). It’s best to avoid letterhead, signatures, headers, and footers, aside from page numbers.
- Other requirements. There are also additional accessibility formatting requirements, including meaningful hyperlink text and appropriate use of styles for headings and lists.

The links below provide some information on accessible online content:

- Resources for Creating Accessible Content (created by the California Department of Rehabilitation).
- Video lessons for accessible Word documents (created by Microsoft).
- State, Federal, and Other Related Laws & Regulations on Digital Accessibility (created by the California Department of Rehabilitation).

**You may be asked to supplement your review.** The organization requesting the review may require clarification or additional information on a specific subject. If this occurs, the CalEPA Program will contact you to revise your review to address those comments.

**If you are asked to discuss your comments.** After you have submitted your review, you may be approached by third parties, the press, or by colleagues. You are under no obligation to discuss your comments with them and we recommend that you do not. Outside parties are provided an opportunity to address a proposed regulatory action during the public comment period. Discussions outside the provided avenues for comment could seriously impede the established process for vetting the proposal under consideration. Please direct third parties to the CalEPA Program.

# Alberto Bellin

*Curriculum Vitae*

*via Mesiano 77*
*38123 Trento, Italy*
*+39 0461 282620*
*alberto.bellin@unitn.it*

## Personal Information

Birth **03 August 1962**, *Borgo Valsugana (TN)*, Italy
Citizenship **Italian**

## Education

1989–1992 **PhD**, *Hydrodynamics*, University of Padua, Italy
1982–1987 **M.Sc.**, *Civil Engineering*, University of Padua, Italy
Summa Cum Laude

## Research Interests

My research embraces flow and transport processes in heterogeneous environments, along the following main lines: 1) transport processes in heterogeneous formations at both local and catchment scale, including the impact of local dispersion on mixing and geochemical reactions. This research resulted in innovative tools for risk assessment studies and the development of methodologies for addressing the impact of the data support volume in groundwater modeling; 2) inversion of tomographic data for characterizing hydraulic property variations in heterogeneous aquifers. This research provided novel approaches for inference of hydraulic properties variations in heterogeneous aquifers by using hydraulic (i.e. hydraulic tomography) and concentration data; 3) Modeling of surface/subsurface exchange processes and their implication on the nitrogen cycle. This research unveiled the importance of advection in hyporheic exchange, which before was modeled as a purely diffusive exchange. The coupling of this model with a geochemical model of the nitrogen cycle resulted in an upscaling technique able to predict $N_2O$ emissions from rivers; 4) water resources management in the Alpine catchments. This research analyzed the combined impact of water uses and climate change on mesoscale hydrological fluxes. The main contribution in this field is a tool for modeling hydrological processes in catchments altered by climate change and water uses, and disentangle their effect.

## Publications

### Links

ISI Web of Knowledge profile
ORCID profile
Research Gate

### Bibliometry (updated on November 17, 2024)

Google Scholar

- h=53
- citations=7553

ISI Web of Knowledge

- h=45
- citations=5244

SCOPUS

- h=45
- citations=5443

## Current position

**Professor of Hydraulic and Marine Constructions and Hydrology**, *Department of Civil, Environmental and Mechanical Engineering, and C3A - Center Agriculture Food Environment*, University of Trento (Italy)

## Academic Employment

Nov. 1998 - Oct. 2000 **Associate professor of Hydraulic and Marine Constructions and Hydrology**, *Department of Civil and Environmental Engineering*, University of Trento (Italy)

Nov. 1990 - Oct. 1998 **Assistant professor of Hydraulic and Marine Constructions and Hydrology**, *Department of Civil and Environmental Engineering*, University of Trento (Italy)

## Professional experience and service (since 2001)

2006 - present Associated Editor of Water Resources Research

2024 - present Associate Editor of ARC Geophysical Research

2013-present Member of the doctoral school committee, program in Civil, Environmental and Mechanical Engineering, University of Trento

2021 - present Member of the Academic Senate of the University of Trento.

May 2016-2018 Member of the Committee for the institution of the research Center on Agriculture Food and Environment of the University of Trento in collaboration with the Fondazione Edmund Mach

Sept. 2015 - 2019 Member of the Committee for recruitment and career development, University of Trento (Italy)

Nov. 2016 - 2018 Member of the national committee for the National habilitation to the role of University professor (sector 08/A1)

Nov. 2014 - Oct. 2016 Member of the Board of Discipline of the University of Trento

Nov. 2012 - Oct. 2015 Member of the Steering Committee of the Department of Civil, Environmental and Mechanical Engineering

2010-2018 member of the Trentino climate observatory as representative of the University of Trento

Nov. 2007 - Feb. 2013 Member of the Teaching committee of the School of Engineering, University of Trento

Nov. 2007 - Feb. 2013 Head of the PhD School in Environmental Engineering, University of Trento (Italy)

2004 - 2006 Vice president of the International Commission on Ground Water (ICGW), International Association of Hydrological Sciences (IAHS)

Nov. 2001 - Oct. 2007 Head of the Department of Civil and Environmental Engineering University of Trento (Italy)

## Sabbatical and short visits

Aug. 2016 **Visiting Research fellow** at the Dept. of Civil and Environmental Engineering, University of Southern California, Los Angeles USA

Jun. 1992 - Jul. 1993 **Visiting Research fellow** at the Dept. of Civil Engineering, University of California at Berkeley (USA) (sabbatical year under the Fulbright program `https://fulbrightscholars.org/grantee/alberto-bellin`)

Jun. 1994 - Jul 1994 **Visiting Research fellow** at the Dept. of Civil Engineering, University of California at Berkeley (USA)

## Advise of PhD students and Post Docs

PhD students: Silvia Barbieri (current), Venkatesh Panchariya (current), Manikandan Shanmugarajasekara (current), Prasanjaya Ekanayake (current), Maria Grazia Zanoni (2023), Andrea Galletti (2020), Elena Diamantini (2018), Stefano Mallucci (2018), Elisa Stella (2018), Maria Ines di Dato (2017), Karina Cano Paoli (2016), Cagri Gokdemir (2015), Diego Avesani (2014) , Francesca Boso (2012), Simonetta Rubol (2010), Mauricio Zambrano Bigiarini (2010), Alessandra Marzadri (2009), Oscar Cainelli (2007), Marta Castagna (2006), Bruno Majone (2004)

Post docs: Andrea Betterle (catchment hydrology), Mariaines di Dato (current - stochastic groundwater), Stefano Mallucci (transport at the catchment scale), Sebastiano Piccolroaz (catchment hydrology), Maria Grazia Zanoni (current - transport at the catchment scale and Machine Learning applications in hydrology).

## Main Fundings (since 2004)

### European Union

2024-2027 **Investigator in the project:** Energy-oriented Centre of Excellence for Exascale HPC applications (EoCoE-III) co-funded by the European Union and the Ministry of Research and University under the European High-Performance ComputingJoint Undertaking, EuroHPC JU

2022 - 2025 **Spoke coordinator of the project:** Interconnected Nord-Est Innovation Ecosystem (iNEST) spoke 8 (Maritime, marine, and inland water technologies: towards the digital twin of the upper Adriatic), funded by the European Union within the program Next Generation EU (project reference ECS00000043, CUP E63C22001030007)

2022 - 2025 **Investigator in the project:** National Centre for HPC, Big Data and Quantum Computing (HPC) spoke 4, funded by the European Union within the program Next Generation EU (project reference CN00000013, CUP E63C22000970007)

2015 - 2018 **Member of the steering committee of the project:** Energy oriented Centre of Excellence for computer applications (EoCoE) funded by the European Commission within the Horizon 2020 program (project reference 676629)

2014 - 2019 **WP leader and member of the steering committee of the project:** Managing The Effects Of Multiple Stressors On Aquatic Ecosystems Under Water Scarcity (GLOBAQUA) funded by the European Commission within the VII framework program (Grant Agreement No. 603629-ENV-2013-6.2.1)

2010 - 2013 **WP leader and member of the steering committee of the project:** Climate Induced Changes on the Hydrology of Mediterranean Basins (CLIMB) funded by the European Commission within the VII framework program (Grant Agreement No. 244151)

2010 - 2018 Partner in the Erasmus program project Science for MAnagement of Rivers and their Tidal systems (SMART) funded by the Erasmus Mundus Joint Doctoral Programme

2004 - 2009 **PI and member of the steering committee of the sub-project:** COMPUTE in the integrated project: Integrated modeling of the river-sediment-soil-groundwater system; advanced tools for the management of catchment areas and river basins in the context of global change (AQUATERRA) funded by the European Commission within the VI framework program. Member of the steering committee

### Italian Ministry of Research and University

2024 - **Investigator in the project (extended partnership):** Space it Up spoke 7, funded by Agenzia Spaziale Italiana (ASI) (project reference N. 2024-5-E.0 - CUP (master) I53D24000060005 – CUP di progetto E63C24000530003)

2013 - 2016 **PI of the interuniversity project:** innovative methods for water resources management under hydro-climatic uncertainty scenarios funded by the Italian University and Research Ministry (MURST) within the PRIN2010-2011 program (prot. 2010JHF437)

2008 - 2009 **PI of the interuniversity project:** Transport phenomena at the catchment scale, funded by the Italian University and Research Ministry (MURST) within the PRIN program

2004 - 2006 **PI of the interuniversity project:** Nutrient and contaminant transport at the catchment scale: models for the management and the protection of water resources, funded by the Italian University and Research Ministry (MURST) within the PRIN program

### Local Agencies

Dec. 2011 - Nov. 2013 Computer simulation of blood flow in the intra/extra cranial venous system in humans with multiple sclerosis and the CCSVI condition (Founded by: Fondazione Caritro)

2006-2010 **PI of the project:** Hydrological cycle of the Cadses regions (Hydrocare), funded by the Autonomous Province of Trento in the framework of the EU program Interreg III B Cadses

## Intramural Water Engineering Research since 2005

PI in the following applied research projects (selection)

2005 Realization of a field site for monitoring soil moisture in an apple orchard, funded by the Autonomous Province of Trento;

2005-2006 Real time model for flood prediction in the province of Trento, funded by the Autonomous Province of Trento;

2005 Hydrological and hydraulic study of the S. Massenza hydropower system, funded by the Autonomous Province of Trento;

2006-2007 Study of the impact of a underground mineral exploitation on the groundwater system, funded by Tassullo;

2007-2009 Water budget study of catchments within the Province of Trento to support the water resource plan of water authority in the province of Trento, phase I: analysis of the time series, funded by the Autonomous Province of Trento;

2008-2009 Development of a groundwater model of the regional aquifer of the ceramic district of Modena and Reggio Emilia, funded by the Regional Environmental Protection Agency, Emilia Romagna region;

2009-2011 Water budget study of catchments within the Province of Trento to support the water resource plan of water authority in the province of Trento, phase II: reconstruction of natural flows, funded by the Autonomous Province of Trento;

2011-2013 Study on the water budget and the nutrients load of the Ledro lake, funded by the Autonomous Province of Trento;

2013-2014 Homogenization of snow depth data time series of the Province of Trento, funded by the Autonomous Province of Trento;

2020 - 2023 A large scale model of groundwater resources in the Trentino region, funded by the Agenzia Provinciale per Le Risorse Idriche e l'Energia (APRIE)

2021-2024 Modelli di flusso e trasporto di PFOS nell'acquifero del Basso Chiese, funded by the Agenzia Provinciale per la Protezione dell'Ambiente (APPA)

## Referral activities

### Journals

Advances in Water Resources; Biomechanics and Modeling in Mechanobiology; Frontiers; Geophysical Research Letters; Geoscientific Model Development; Hydrology and Earth System Sciences Journal of Contaminant Hydrology; Journal of Glaciology; Journal of Hydrology; Mathematical Geology; Microporous and Mesoporous Materials; Plos One; Science of the Total Environment; Stochastic Environmental Research and Risk Assessment; Stochastic Hydrology and Hydraulics; Transport in Porous Media; Water Resources Research; Water; Physical Review Fluids

### Funding Agencies

Research projects National Science Fundation (USA) sectors: Earth Sciences and Hydrological Sciences; Commission of the European Community (V framework, Energy Environment and Sustainable Development); PRIN, Progetti di Ricerca di Interesse Nazionale, Italy; DFG, German Research Foundation, Germany; SNF, Swiss National Science Foundation, Switzerland; Austrian Academy of Sciences, research program Earth System Sciences (ESS), Austria; Evaluation Committee of the Helmholtz Centre for Environmental Research (UFZ), Germany; California Environmental Protection Agency (CalEPA)

## Memberships

since 1991 American Geophysical Union (AGU)
since 2000 European Geosciences Union (EGU)
since 1990 Gruppo Italiano di Idraulica (GII)
since 2009 Società Idrologica Italiana (SII)

Trento, March 22, 2025

J. JAIME GÓMEZ-HERNÁNDEZ
Full Professor, Instituto de Ingeniería del Agua y Medio Ambiente
Universitat Politècnica de València, Camino de Vera s/n, 46020 Valencia, Spain
+34 629 354 478 | jgomez.webs.upv.es | jgomez@upv.es | @jaumegomez

**Education**

| | | | |
|---|---|---|---|
| Ph.D. | Geostatistics for Natural Resources Characterization | 1987-1990 | Stanford University |
| M.Sc. | Applied Hydrogeology | 1985-1987 | Stanford University |
| B.S. | Civil Engineering | 1977-1983 | Tech. U. Valencia |

**Appointments**

| | |
|---|---|
| 2000-present | Full Prof., Dep. of Hydraulic Eng. and Environment, Tech. U. Valencia (TUV) |
| 2007-present | Head, Hydrogeology Group, Institute for Water and Environmental Eng., TUV |
| 2018-2025 | Visiting Prof. (one- to three-month terms per year), U. of Parma (Italy) |
| 2017 | Visiting Prof. (three months), Kansas Geological Survey, USA |
| 2015-2018 | Visiting Prof. (one- to three-month terms per year), U. of São Paulo (Brazil) |
| 2005-2007 | Director General, Department of Enterprise, University and Science, Regional Government of Valencia |
| 2000-2005 | Vice-rector, Technical University of Valencia |
| 1999-2000 | Cox Visiting Professor, Dep. of Geol. and Environ. Sci., Stanford University |
| 1994-2000 | Associate Prof., Dep. of Hydraulic Eng. and Environment, TUV |
| 1990-1994 | Engineering consulting for various global companies |

**Professional Affiliations**

| | |
|---|---|
| 1984-present | Spanish Professional Association of Civil Engineers |
| 1986-present | American Geophysical Union |
| 1986-present | International Association of Mathematical Geosciences (IAMG) |
| 2016-2019 | Elected Council member |
| 2019-present | International Society for Porous Media (InterPore) |
| 2012-present | International Association of Hydrogeologists (IAH) |
| 2012-2015, 2015-2021, 2021-present | President of the Spanish Chapter, then Vice President |
| 2002-present | International Association of Environmental Geostatistics (geoENVia) |
| 2002-2006, 2016-2022 | geoENVia Founder and then President |
| 1994-1996 | Secretary for the Hydrogeology Division of the European Geophysical Society |

**Service to Professional Organizations**

| | |
|---|---|
| 2023-present | Groundwater Action Plan Comm. of the Spanish Ministry of Ecologic Transition |
| 2010-present | Advisory Board for the Center de Recursos Naturais e Ambiente (U. Lisboa) |
| 2024-2026 | InterPore Annual Conference Program Committee Chairman |
| 2009-2024 | Actively involved in IAMG Comm. (Meetings, Pubs., Lecture and Strategic Plan) |
| 2020 | Panel member for the Fundação para a Ciência e a Tecnologia, Portugal |
| 2017, 2019 | European Research Council Starting Grant Panel “Earth Systems Sci.” member |
| 2003-2005 | Manager of the Water Resources Program of the Spanish National Plan for R+D |

**Selected Honors and Awards**

| | |
|---|---|
| 2024 | Technical U. of Valencia Research Career Award in Civil Engineering |
| 2022 | EWRI American Society of Civil Engineers Pioneers in Groundwater Award |
| 2021 | Forbes list of 50 most internationally awarded Spaniards |
| 2021 | International Association of Mathematical Geosciences Distinguished Lecturer |
| 2020 | International Association of Mathematical Geosciences Krumbein Medal |

2020 Prince Sultan bin Abdulaziz International Prize of Water · Hydrogeology
2020 Technical U. of Valencia Social Council Outreach Award
2019 InterPore Rosette
1999 Valencian Community Prize for Research on Waste Disposal
1990 Stanford University Centennial Teaching Assistant
1983 National Prize for Best Civil Engineer Graduate

**Scientific Leadership**

Chairman, SustainValencia2022 Conf. Organizing Committee (Valencia, 2022)
Chairman, InterPore Annual Meeting Local Org. Comm. (Valencia, 2019)
Chairman, geoENV2012 Conference Organizing Committee (Valencia, 2012)
Chairman, IAHR Groundwater Symposium Organizing Committee (Valencia, 2010)
Chairman, geoENV98 Conference Organizing Committee (Valencia, 1998)
Founder, geoENV Conference Series (1996)

**Training and Mentoring: Selected Ph.D. Students / Current Position**

| | | |
|---|---|---|
| Daniele Secci | (2024) | Postdoctoral fellow, University of Parma (Italy) |
| Valeria Todaro | (2021) | Tenure track Professor, University of Parma (Italy) |
| Teng Xu | (2014) | Full Professor, Hohai University (China) |
| Liangping Li | (2011) | Assoc. Prof., South Dakota School of Mines and Technology |
| Peter Salamon | (2006) | Sci. Project Manager, EC Joint Research Centre (Italy) |
| Carolina Guardiola | (2004) | Tenured Researcher, Spanish National Geological Survey |
| Harrie-Jan Hendricks | (2001) | Head of research group, Jülich UFZ (Germany) |
| Eduardo Cassiraga | (1999) | Associate Professor, Technical University of Valencia |
| Xian-Huan Wen | (1996) | Chevron Fellow, Chapter Manager, Reservoir Simulation Research & Optimization at Chevron Technical Center |

**AGU Service**

Chapman Conference, Co-chair, The Quest for Sustainability of Heavily Stressed Aquifers at Regional to Global Scales (Valencia, 2019)
Chapman Conference, Chairman, The MADE Challenge for Groundwater Transport in Highly Heterogeneous Aquifers (Valencia, 2015)
Water Resources Research Special Sections after the 2019 and 2015 Valencia Chapman Conf.

**Selected Editorial Activities**

| **Editorial Boards** | | **Guest Editor** |
|---|---|---|
| Advances in Water Resources | (1997-present) | Journal of Hydrogeology (2023) |
| Mathematical Geosciences | (2012-present) | Journal of Contaminant Hydrology (2022) |
| Water | (2018-2020) | Math. Geosc. (2021, 2016, 2013, 2012, 1999) |
| Journal of Hydrogeology | (2006-2010) | Spatial Statistics (2013) |
| Journal of Hydrology | (1997-2008) | Journal of Hydrology (2003, 1986) |

**Grants**

Numerous Spanish and European Grants, such as OurMED (Principal Investigator, 2023-26) or InTheMED (Project Coordinator, 2020-23), both financed by the PRIMA Foundation with 4092 k€ and 1589 k€, respectively.

**Invited Lecturer**

Of the more than 400 presentations at congresses, workshops, and seminars presented worldwide, **75** of them were by invitation.

**Isaya Kisekka – Abridged CV**
University of California Davis, One Shields Avenue, PES 1110 Davis, CA 95616, Office: Veihmeyer Hall Room 119, ikisekka@ucdavis.edu, http://kisekka.ucdavis.edu/

## ACADEMIC DEGREES

2013 – Ph.D. Agricultural and Biological Engineering, University of Florida, USA.
2009 – M.Sc. Agricultural and Biological Engineering, University of Florida, USA.
2003 – BSc. Agricultural Engineering Makerere University-. Kampala, Uganda.

## ACADEMIC APPOINTMENTS

| | |
|---|---|
| 2021-present | Director UC Davis Agricultural Water Center |
| 2023-Present | Full Professor, University of California, Davis |
| 2018-2023 | Associate Professor, University of California, Davis |
| 2017-2018 | Assistant Professor, University of California, Davis |
| 2013-2017 | Assistant Professor, Kansas State University, Manhattan |
| 2007-2013 | Research Assistant, University of Florida |
| 2004-2007 | Research Engineer, National Agricultural Research Organization, UG |
| 2002-2004 | Irrigation Engineer, Balton (U) Ltd Kampala, UG |

## AWARDS AND HONORS

2022 ASABE Netafim Award for Advancements in Microirrigation Award
2020 Irrigation Association Excellence in Education Award
2018-ASABE award in recognition of excellence as an Associate Editor
2016-New Innovator Award from Foundation for Food and Agricultural Research
2015-ASABE Educational Aids Blue Ribbon Award
2014- Member of Gamma Sigma Delta- The Honor Society of Agriculture
2014- The Scarborough-Maud Fraser Scholarship University of Florida international center award for outstanding service record and academic Excellency
2009-Recipient of the University of Florida/IFAS Best Thesis Award
2008- Charlie Burr Memorial Scholarship Award supporting tropical fruit and vegetable research in Miami-Dade County, Florida

## PROFESSIONAL SERVICE

Associate Editor ASCE Journal of Irrigation and Drainage Engineering
Associate Editor Irrigation Science
Associate Editor Journal of ASABE
Chair Natural Resources and Environmental Systems Community of ASABE
Visiting Professor Land and Water Management CIHEAM IAMB Italy.

## SELECTED JOURNAL PUBLICATIONS

1. Raij-Hoffman, I., Dahan, O., Dahlke, H. E., Harter, T., & **Kisekka**, I. (2024). Assessing Nitrate Leaching During Drought and Extreme Precipitation: Exploring Deep Vadose-Zone Monitoring, Groundwater Observations, and Field Mass Balance. Water Resources Research, 60(11), Article e2024WR037973. https://doi.org/10.1029/2024WR037973
2. Lazarovitch, N., **I. Kisekka**, T. E. Oker, G. Brunetti, T. Wöhling, X. Li, Y. Li, T. H. Skaggs, A. Furman, S. Sasidharan, I. Raij-Hoffman, and J. Šimunek. 2023. Modeling of irrigation and related processes with HYDRUS. *Advances in Agronomy*, https://doi.org/10.1016/bs.agron.2023.05.002
3. **Kisekka, I**, S. Grattan, F. P. Salcedo, J. Gan, M. L. Partyka, R. F. Bond, N. Bernstein6, J. Radcliffe, and A. Adin. 2024. Assessing the State of Knowledge and Impacts of Recycled Water Irrigation on Agricultural Crops and Soils. UC Davis. http://dx.doi.org/10.34951/E2WC7K Retrieved from https://escholarship.org/uc/item/1m32x544
4. **Kisekka,** I., U. Al-Dughaishi, B. Platts, M. Cahn, F. Pedrero, and S. R. Grattan. 2024. Developing a New Foundational Understanding of SAR-Soil Structure Interactions for Improved Management of Agricultural Recycled Water Use
5. **Kisekka I**., Peddinti S. R., Vanella D., Andrews E. M., Brown P., Khalsa S. D. S. Organic soil amendment effects on soil hydrology in an almond orchard evaluated using time-lapse

electrical resistivity tomography. Agricultural Water Management. 2024. Vol. 302. p. 108979.

6. Aldughaishi, U., S. R Grattan, F. Nicolas, S. R. Peddinti, C. Bonfil, F. Ogunmokun, M. Abou Najm, M. Nocco, I. Kisekka. 2024. Assessing the impact of recycled water reuse on infiltration and soil structure. Geoderma. 452. 117103.
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NAME: Lee Allen Pettey

POSITION TITLE & INSTITUTION: Associate Professor of Teaching; University of California, Davis

**A. PROFESSIONAL PREPARATION - (see PAPPG Chapter II.C.2.f.(i)(a))**

| INSTITUTION | LOCATION | MAJOR/AREA OF STUDY | DEGREE (if applicable) | YEAR (YYYY) |
|---|---|---|---|---|
| California Polytechnic State University | San Luis Obispo | Animal Science | B.S. | 1998 |
| Oklahoma State University | Stillwater | Animal Science/Swine Nutrition | M.S. | 2000 |
| University of Kentucky | Lexington | Animal Science/Swine Nutrition | Ph.D. | 2004 |

**B. APPOINTMENTS - (see PAPPG Chapter II.C.2.f.(i)(b))**

| From - To | Position Title, Organization and Location |
|---|---|
| 2023-current | Associate Professor of Teaching, University of California, Davis |
| 2015-2023 | Assistant Professor of Teaching, University of California, Davis |
| 2015-2015 | Associate Professor, California State Polytechnic University, Pomona |
| 2010-2015 | Assistant Professor, California State Polytechnic University, Pomona |
| 2006-2010 | Assistant Professor, California Polytechnic State University, San Luis Obispo |
| 2004-2006 | Lecturer, California Polytechnic State University, San Luis Obispo |

**C. PRODUCTS - (see PAPPG Chapter II.C.2.f.(i)(c)) Products Most Closely Related to the Proposed Project**

H.C. Dougherty, J.W. Oltjen, F. M. Mitloehner, E. J. DePeters, L. A. Pettey, D. Macon, J. Finzel, K. Rodrigues, and E. Kebreab. 2018. Carbon and blue water footprints of California sheep production. J. Anim. Sci. 97:945-961.

Pettey, L.A., G.L. Cromwell, Y.D. Lang, M.D. Lindemann. 2015. Estimation of calcium and phosphorus content in growing and finishing pigs: whole empty body components and relative accretion rates. J. Anim. Sci. 93:158-167.

Pettey, L.A., G.L. Cromwell, and M.D. Lindemann. 2006. Estimation of endogenous phosphorus excretion in growing and finishing pigs. J. Anim. Sci. 84:223-231.

**Other Significant Products, Whether or Not Related to the Proposed Project**

Rincker, M.J., S.D. Carter, D.E. Real, J.L. Nelssen, M.D. Tokach, R.D. Goodband, S.S. Dritz, B.W. Senne, R.W. Fent, L.A. Pettey, and K.Q. Owen. 2003. Effects of increasing dietary L-carnitine on growth performance of weanling pigs. J. Anim. Sci. 81:2259-2269.

Shriver, J.A, S.D. Carter, A.L. Sutton, B.T. Richert, B.W. Senne, and L.A. Pettey. 2003. Effects of adding fiber sources to reduced-crude protein, amino acid-supplemented diets on nitrogen excretion, growth performance, and carcass traits of finishing pigs. J. Anim. Sci. 81(2):492.

Pettey, L.A., S.D. Carter, B.W. Senne, and J.A. Shriver. 2002. Effects of -mannanase addition to corn-soybean meal diets on growth performance, carcass traits, and nutrient digestibility of weanling and growing-finishing pigs. J. Anim. Sci. 80(4):1012.

Pettey, L.A. 2005. Modeling Calcium and Phosphorus Requirements for Growing and Finishing Pigs. Midwest Swine Nutrition Conference, Indianapolis, IN. September 15, 2005.

Pettey, L.A. 2004. Modeling Phosphorus Requirements for Growing and Finishing Pigs. Carolina Swine Nutrition Conference, Raleigh, NC. October 27, 2004.

Pettey, L.A. 2004. Phosphorus Balance in Practical Swine Diets: Assessing P Requirements for Growing and Finishing Swine Using Factorial Techniques. Minnesota Swine Nutrition Conference, St. Paul, MN. September 22, 2004.

Carter, S.D., G.L. Cromwell, P.W. Westerman, J.S. Park, and L.A. Pettey. 2003. Prediction of nitrogen, phosphorus, and dry matter excretion by swine based on diet chemical composition, feed intake, and nutrient retention. Proc. 9th International Symposium on Animal, Agricultural and Food Processing Wastes, Durham, NC, Oct. 12-15, 2003.

**D. SYNERGISTIC ACTIVITIES - (see PAPPG Chapter II.C.2.f.(i)(d))**

Undergraduate Research Mentor (2004-Present) – faculty mentor and research advisor to undergraduate students conducting research for completion of their senior projects or Honors Projects. Supervised a total of 68 students in projects in a variety of discipline areas including behavior, nutrition, business planning, and student education.

Program-level Assessment Capacity Enrichment for Equity (PACE4E) 2021-2022. Yearlong workshop in developing program/student learning outcomes and interpreting assessment data.

Completed 'Stanford Summer 2017 Department Education Specialist Training Workshop' hosted by Dr. Carl Weiman (Nobel Laureate) . A focused 6-day workshop on incorporating research-based teaching techniques in science courses to improve student learning.
Provost's Teacher-Scholar Program – Invited Member (2013-2014)
I was selected in a cohort of 10 faculty members from across campus in 2013 to receive support and guidance as part of a program to enhance professional development activities at Cal Poly Pomona.
Lead Faculty Advisor, Animal Science and Management major – provide curricular and advising leadership for all students in the major (approx. 120). Guided the 7-year program review in 2022.

TO: Carol Perkins
Environmental Scientist
CalEPA Scientific Peer Review Program, Lead
Office of Research, Planning, and Performance
California State Water Resources Control Board

FROM: Jennifer Fuller
Senior Environmental Scientist (Specialist), Basin Planning
Central Valley Regional Water Quality Control Board

DATE: May 15, 2025 [content found in this memo received via email]

SUBJECT: Request for clarification from Peer Reviewers regarding reports submitted for the McKittrick Area Oil Fields Groundwater Beneficial Use Evaluation BPA

Hello Carol!

I have good news! We have completed our assessment of all the Peer Review reports submitted for the McKittrick Area Oil Fields Groundwater Beneficial Use Evaluation BPA and are able to tell you at this time what we need further.

Here are our report assessments:

1. Reviewer #1 [Dr. Gómez-Hernández]: Report found to be complete, with one clarification request.

    a. On page 4 of their report, please ask Reviewer #1 to clarify the following text that seems to contradict itself: “It (the proposed salinity threshold of 5,000 mg/L) should be considered as an upper bound, above which both crop yield and soil health increase significantly.” (I believe the reviewer meant crop yield and soil health decrease significantly.)

2. Reviewer #2 [Dr. Bellin]: Report found to be complete, with a request to include with the final report the informational text provided to you by Reviewer #2 in an email (that you emailed me about 5/7/2025).

    a. Text to be included from Reviewer #2 email to you: “Please find attached my review of the Sta Draft. As requested, I commented on the issues I felt comfortable. My comments refer exclusively to the scientific aspects controlling the migration of the contaminants, i.e., the wastewater discharged into the McKittrick facilities, in the formations underlying the ponds. I did not comment on the choice of 5000 mg/l as the upper limit for the AGR beneficial use, because I am not an

expert in agronomy and livestock breeding. Also, I did not comment on legal and regulatory aspects, and much less on their interpretation, related to the decisions taken in the Draft Sta Report because I am not familiar with the regulations in force in California.)"

3. Reviewer #3 [Dr. Pettey]: Report found to be incomplete, additional information needed.

   a. Please ask Reviewer #3 to list each conclusion separately that they agreed they could review with confidence and respond to (Conclusions #2,4,5,6).

   b. Please ask Reviewer #3 to indicate, for each conclusion they agreed they could respond to, if they do or don't believe that each of those conclusions (conclusions #2,4,5,6) is scientifically supported. This is especially important as they are our only livestock/animal scientist expert for this Peer Review.

4. Reviewer #4 [Dr. Kisekka]: Report found to be complete. Nothing further needed.

# Reviewer: Alberto Bellin, professor at the University of Trento, Italy, Department of Civil, Environmental and Mechanical Engineering, via Mesiano 77, I-38123 Trento (Italy)

## Review of the document: “Draft Staff Report, Amendment to the Water Quality Control Plan for the Tulare Lake Basin to Remove Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) as Beneficial Uses of Groundwater Within an Area that Includes Portions of an Area within and Surrounding the Administrative Boundaries of the South Belridge, Monument Junction, and Cymric Oil Fields in Kern County (Draft Staff Report)”, dated September 2024, and the additional documents included in the review package downloaded by ftp the website: https://ftp.waterboards.ca.gov

Based on my expertise and experience, I am reviewing the findings, assumptions, or conclusions I agreed I could review with confidence. In particular, below I commented on conclusions 1, 2, 3, 6, as indicated in the review request letter. In the following, the conclusions for which my review has been requested are followed by my comments, which focus on the scientific aspects concerning the propagation of contaminants, namely the high salinity water discharged into the ponds, from the ponds to the underlying aquifers.

I commented on the issues I felt comfortable. My comments refer exclusively to the scientific aspects controlling the migration of the contaminants, i.e., the wastewater discharged into the McKittrick facilities, in the formations underlying the ponds. I did not

comment on the choice of 5000 mg/l as the upper limit for the AGR beneficial use, because I am not an expert in agronomy and livestock breeding. Also, I did not comment on legal and regulatory aspects, and much less on their interpretation, related to the decisions taken in the Draft Staff Report, because I am not familiar with the regulations in force in California.

## Conclusion #1: Based on the available data, the scientific assumptions, findings, and conclusions regarding the subsurface hydrology, geology, and Corcoran Clay Equivalent in the Project Zone are scientifically reasonable and defensible.

The Project Zone includes Quaternary Alluvium and the Tulare Formation. A confining clay layer, the Corcoran Clay Equivalent, is a thick clay that provides a vertical barrier between the Quaternary Alluvium and Tulare Formation and inhibits groundwater in the Quaternary Alluvium from reaching the underlying Tulare Formation. The Revised Project Zone, which incorporates a portion of Quaternary Alluvium sediments within the Project Zone, and does not extend into the Tulare Formation, has water quality as such that it is appropriate for de-designation of MUN and AGR beneficial uses. The Corcoran Clay Equivalent acts as the confining layer that separates the Revised Project Zone from the underlying Tulare Formation. Due to this confining layer, oil field produced wastewater discharged to the surface of the Revised Project Area is not expected to migrate into the Tulare Formation, as the Corcoran Clay Equivalent provides a vertical barrier.

Comments.

The depositional characteristics of the area from the Lost Hills and Southern Belridge oil field, including the Northern Belridge oil field, are described in the work by Gillespie et al. (2019). This work identifies a surficial alluvium, overlying the Tulare formation, which hosts the main aquifer of the central valley. The Tulare formation overlies the May formation and deepens eastward from the Kettleman Hills, near Kettleman City, where it crops out (Page, 1983), reaching depths larger than 4,000 ft (1219 m) just east of the hills. About the Tulare formation and the overlying alluvium Gillespie et al. (2019) say:

"*The Tulare Formation and overlying alluvium have similar lithologic compositions and were deposited in fluvial and lacustrine environments; therefore, they are not readily distinguishable, especially in the subsurface. Maps of the water-level contours in the Tulare and alluvial aquifer by Wood and Davis (1959) indicate eastward gradients in the aquifer. In the study area, the lower Tulare Formation consists of lacustrine and deltaic sands and the upper Tulare contains alluvial fan, meandering channels, and floodplain facies (Kiser et al., 1988; Miller et al., 1990). The Tulare Formation and overlying alluvium also include lacustrine clays, which form confining beds. Several distinct regional clay units within the Tulare Formation are present in the study area. Some of these clays are not present throughout the study area but, when present, act as local confining layers. The three main clays mapped using borehole geophysical logs in this study are the Amnicola, the Middle Tulare, and the Corcoran Clay Equivalent (CCE) (Figure 2)*". Notice that the term Equivalent was used because the Corcoran Clay formation is of difficult identification, particularly south of the Southern Belridge oil field (Gillespie et al., 2019, pg. 78). Two observations are relevant for Conclusion #1 as stated above. First, the alluvium and the underlying upper Tulare formation were formed in the Quaternary and the Pleistocene in similar depositional environments characterized by the presence of fluvial and lacustrine environments. This is a common situation, which generates heterogeneous formations characterized by coarse and conductive sediments, deposited by the fluvial regime, with interbedded low to poorly conductive facies of fine sediments deposited during lacustrine phases. The thickness of the low-conductive facies varies through the formation, such as its spatial extent and continuity. This is recognized by Gillespie et al. (2019) when they say: "*The Tulare Formation and overlying alluvium also include lacustrine clays, which form confining beds. Several distinct regional clay units within the Tulare Formation are present in the study area. Some of these clays are not present throughout the study area but, when present, act as local confining layer".* The conclusion #1 assumes that the Corcoran Clay Equivalent (CCE) layer is continuous in the project area and with a hydraulic conductivity sufficiently low to separate the unit called alluvium from the Tulare aquifer, which are therefore assumed to behave as two separate hydrogeological units. This cannot be given for granted based on the information that can be extracted from Gillespie's and previous works. In particular, Gillespie et al.

(2019) state that the clay layers are local and, in addition, their analysis is limited to the Southern Oil field, which is located North of the Project Area. In other words, given that the confining capability of the clay layers varies in space as their continuity, an analysis conducted North of the Project area cannot be used to safely conclude that the CCE layer separates the two hydrogeological units. Therefore, the claim tha*t "The Corcoran Clay Equivalent acts as the confining layer that separates the Revised Project Zone from the underlying Tulare Formation. Due to this confining layer, oil field produced wastewater discharged to the surface of the Revised Project Area is not expected to migrate into the Tulare Formation, as the Corcoran Clay Equivalent provides a vertical barrier."* is not supported by convincing evidence. There is evidence, in the work of Gillespie et al. (2019), that the CCE layer is discontinuous at the Southern Bielridge Oil field and that the hydrogeological unit called alluvium is in connection with the Tulare formation. The geological and stratigraphy analysis proposed in Gillespie et al. (2019) concurs with previous geological studies of the central valley geology. A further confirmation of the connection between the alluvium and the Tulare formation can be drawn from sections titled "Salinity analysis" and "Effects of Oil Field Activities on Water Salinity" of Gillespie et al. (2019), which elaborates the available information on concentration measurements, Spontaneous Potential (SP) and Resistivity (R) logs. Figure 10 of Gillespie et al. (2019), for example, shows that after the year 1970 the resistivity in a well located in proximity of an infiltration pond in the Southern Belridge oil field, north of the project area, and logged in the Tulare formation, reduced significantly, particularly in the upper Tulare formation. This suggests the penetration of the more conductive (less resistive) water from the pond into the Tulare formation, which mixed with the natural water, thereby causing the reduction of the overall conductivity with respect to the discharged wastewater. Similar conclusions can be drawn from the analysis of Figure 11 of Gillespie et al. (2019, showing a reduction of the resistivity in the Tulare formation in an area containing infiltration wells. Similar conclusions can be drawn from the inspection of the TDS concentration at observation wells drilled downstream the McKittrick 1 & 1-3 pond, some of them screened in the Upper Tulare formation and other in the Lower Tulare formation, and available in the GeoTracker database, as discussed below in the comments to the conclusion #2. To summarize, Gillespie et al. (2019) evidenced that the alluvium and the underlying Tulare

formation developed in similar depositional environments alternating fluvial and lacustrine deposition, which generated discontinuous low-conductivity facies that potentially may promote the development of local confined aquifers. In particular, the facies called Carcoran Clay Equivalent, to which the report attributes confining capacity in the Project Area, is of difficult identification, and at least in the Southern Oil field area, does not protect the underlying upper Tulare formation from infiltration from the alluvium. This connection is confirmed by the reduction of the resistivity with time observed in the Tulare formation underneath an infiltration pond (Figure 10 of Gillespie et al. (2019)) located in the Southern Belridge oil field and in infiltration wells located in the east flank of the South Belridge (Figure 11). The area of the central valley investigated by Gillespie et al. (2019), which results are utilized in the report under review, is north of the project area, and considering the discontinuous nature of the fine low-conductivity facies, I cannot support the conclusion that the Carcoran Clay Equivalent layer "*acts as a confining layer*" and that "*due to this confining layer, oil field produced wastewater discharged to the surface of the Revised Project Area is not expected to migrate into the Tulare Formation, as the Corcoran Clay Equivalent provides a vertical barrier*". Concentration measurements from wells screened in the Upper and Lower Tulare formations downstream of the McKittrick 1 & 1-3 infiltration ponds, available in the GeoTracker database, confirm the presence of wastewater discharged in the infiltration ponds, as discussed in the comments to Conclusion #2.

## Conclusion #2: Based on the available data, the scientific assumptions, findings, and conclusions regarding the quality of the groundwater in the Project Zone are scientifically reasonable and defensible.

As observed in samples taken from monitoring wells within the Revised Project Zone, groundwater exceeds 5,000 mg/L total dissolved solids (TDS). A small portion of the Revised Project Zone contains groundwater that ranges between 3,000 to 5,000 mg/L TDS. This is the basis for the de-designation of MUN and AGR beneficial uses within the Revised Project Zone. Available water quality data does not support de-designation outside of the Revised Project Zone.

Comments

In the following comments, I assume 3000 mg/l (milligrams per liter) and 5000 mg/l as a reference TDS concentration for MUN and AGR de-designation, respectively. The value of 3000 mg/l for MUN uses de-designation is fixed by state regulations, while I cannot comment on the value assumed for AGR de-designation, because my expertise does not include agronomy and livestock breeding. I reviewed all the available TDS concentrations of the investigated area included in the documents submitted for review, and I also consulted the GeoTracker site containing concentration data downstream the McKittrick 1 & 1-3 pond, and also at two wells upstream the facility: wells CYM-24R2D, screened in the Lower Tulare formation, and CYM24R1S screened in the Upper Tulare formation. Wells' location is shown in the attached Figure (attachment 1) produced by Golder I downloaded from the GeoTracker. The concentration data at the wells showed in the attached Figure support the conclusion that the high salinity water discharged into the McKittrick 1 &1-3 pond reached both the Upper and Lower Tulare formation downstream the McKittrick 1 & 1-3 facility. The wells located downstream of the facility and screened in the upper Tulare formation show TDS concentrations larger than 10000 mg/l, variable in time with maximum values between 12000 mg/l (well CYM-17J1D) and 18000 mg/l (wells CYM-17K1 and CYM-19H1). These values are lower, but comparable with the TDS concentration of the discharge's wastewater, which was observed in the following range: 11000-26000 mg/l. The TDS concentration at the well CYM24R1S, located upstream but at a relatively small distance from the facility, shows comparable TDS concentrations. Although upstream, with respect to the regional flow, this well may receive the discharged water because of the mound caused by the injection, and it may be influenced by the operation of the upstream facility, the McKittrick 1. Wells screened in the Lower Tulare formation showed smaller TDS concentrations, but significantly higher than the limit of 3000 mg/l, and most of them also than the AGR limit of 5000 mg/l. The situation is different upstream of the McKittrick 1 & 1-3 facility with the well CYM-24R2D screened in the Lower Tulare formation and close to the well CYM-24R1S (screened in the upper Tulare) that shows concentrations in the range of 2500-3400 mg/l, thereby supporting the

hypothesis that the TDS concentration higher than 11000 mg/l observed at the well CYM-24R1S receives water infiltrated in the pond McKittrick 1 & 1-3. There is therefore clear evidence that the high salinity water discharged into the McKittrick 1 & 1-3 facility reached both the Upper and the Lower Tulare formations in all the monitoring wells, whose location is shown in the attached figure. The TDS concentration at the largest distance from the McKittrick 1 & 1-3 facility in the Lower Tulare formation (CYM-17A1D) varied between 4900 mg/l and 6000 mg/l in the period February 2020 and October 2024. In the absence of wells at larger distances from the facility in the regional flow direction, the California Regional Water Quality Board suggested limiting the area of de-definition with reference to the measured TDS concentrations without considering that groundwater may also be affected downstream of the wells CYM-24R1S and CYM-24R2D. This is possible given that at the external border of this area the TDS concentrations are higher than 3000 mg/l.

The data I commented above, viewed in the GeoTracker dataset and in part contained in the documents included in the reviewer package, are in agreement with Figures 2 and 3 of the Draft Staff report, but with the important difference that in this report the concentrations measured at the more surficial wells are attributed to the alluvium (Figure 2) instead of the Upper Tulare formation (see the attached figure), and the deeper wells to the Upper Tulare Formation (Figure 3) instead of the lower Tulare formation. This is important because the alluvium is supposed to be separated from the Upper Tulare formation by the CCE layer. I could not find in the documents submitted for review or on the GeoTracker site suitable information to resolve this inconsistency, which does not reflect directly in the conclusion #2, which is written in terms of TDS concentrations and not in terms of depth, while Figures 2 shows only the horizontal extension of the de-definition zone. However, it affects the Conclusion #1, which states that the CCE layer between the Alluvium and the Upper Tulare formation provides a barrier to the propagation of the discharged water into the Tulare formation. Based on the information contained in the attached figure, this is not the case because the Upper Tulare formation appears contaminated by the discharged water. A more detailed discussion of the recorded TDS concentrations, in line with the description I provided above, and based on the data available in the GeoTracker database, is provided in the document titled: CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD CENTRAL VALLEY

REGION; WATER CODE SECTION 13301 CEASE AND DESIST ORDER NO. R5-2019-0045 FOR VALLEY WATER MANAGEMENT COMPANY MCKITTRICK 1 & 1-3 FACILITY KERN COUNTY, (file 10_CDO R5-2019-0045.pdf in the material provided for the review). The authors of this document notice that the water sampled from the above shallow wells screened in the Upper Tulare formation shows an isotopic signature that is closer to the water discharged to the McKittrick 1 &1-3 pond than the natural groundwater. In addition, the isotopic signature of the water sampled from the wells screened in the Lower Tulare formation is intermediate because of mixing with the natural groundwater. Similar conclusions are drawn from the concentrations of Sodium, Calcium Sulfate, and Chloride. While natural groundwater is rich in Sodium, Calcium, and Sulfate, the sampled water is richer in Sodium and Chloride as the discharged wastewater in the infiltration ponds. Similarly to the isotopic signature, the differences between the two waters are higher in the shallower wells, thereby providing further evidence that the origin is the discharged water.

Notice that this report refers to the same wells I indicated above, whose location is reported in the attached figure, and locate them in the Upper and Lower Tulare formations and not in the Alluvium and the Upper Tulare formation as in the Staff report under review.

## Conclusion #3: Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the MUN beneficial use of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the MUN de-designation determination is scientifically reasonable and defensible.

De-designation of the MUN beneficial use is based on groundwater in the Tulare Lake Basin Plan (levels of TDS exceed 3,000 mg/L). Available groundwater data and geologic

site information indicate that the groundwater exceeds 3,000 mg/L TDS in the MUN de-designation portion of the Revised Project Zone.

Comments

I already commented on this in the comments of the first two conclusions. To summarize, the criterion adopted in the Staff Report is to delineate the de-designation zone based on available data. However, all the observation wells show the presence of the wastewater discharged into the McKittrick 1 & 1-3 ponds, which is mixed in different proportions with natural groundwater. In the Upper Tulare formation (indicated as alluvium in the Staff Report), the TDS concentration is close to that of the discharged water, and similar to it in terms of hydrogeochemical and isotopic characteristics. The TDS concentration of the discharged water varies between 11000 mg/l and 26000 mg/l (see Table 1 in the file 10_CDO R5-2019-0045.pdf), while GeoTracker reports TDS concentrations in the range 11000 -18000 mg/l in the wells screened in the Upper Tulare formations. In the Lower Tulare formation, the TDS concentration is as large as about half of the concentration in the Upper Tulare formation and declines slightly with the distance from the infiltration facility. Despite this reduction, the concentration at the northwest limit of the area (close to the Clean Harbors facility) is higher than the limit of 3000 mg/l. Consequently, it remains uncertain if the “plume” extends outside the area identified for de-designation of the MUN protected uses. The conclusion #2 indicates that the de-designation zone should extend vertically down to the limit of 3000 mg/l. This is sound, provided that the inconsistency described in my comments on conclusion #2 is resolved. The extension of the monitoring northwest of the Clean Harbors facility is recommended to gain more insight about the propagation of the contamination. At the same time, the development of a groundwater model could be helpful in assessing future scenarios of the area, including the estimation of the possible extension of the contamination outside the monitored area.

## Conclusion #5: Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the AGR beneficial uses of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the AGR de-designation determination is scientifically reasonable and defensible.

De-designation of the AGR beneficial use is based on groundwater in the Revised Project Zone meeting one of the AGR de-designation criteria in the Tulare Lake Basin Plan (the presence of pollution that cannot reasonably be treated for agricultural use). In the absence of an established salinity water quality objective for the protection of the AGR beneficial use, the Central Valley Water Board relied upon scientific literature to provide salinity threshold concentrations that are generally considered to be protective of AGR. The literature supports a salinity threshold of 5,000 mg/L TDS (please see discussion of this in Conclusion #4 above). Available groundwater data and geologic site information indicate that the groundwater exceeds 5,000 mg/L TDS in the AGR de-designation portion of the Revised Project Zone.

Comments

As I said before, I cannot comment on the adopted limit of 5000 mg/l for the AGR beneficial uses. Concerning the reduction of the de-designation zone for this use, I notice that the zone that remains protected for AGR beneficial uses (but not for MUN beneficial uses) includes the Clean Harbors facility and an area external to it without observation wells. The closest wells, included in the red area for the designation of both MUN and AGR beneficial uses, show TDS concentrations larger than 5000 mg/l. This limit is also exceeded in the well MW-148I, located at the upper left corner of the Clean Harbors facility, between February 6, 2019, and August 4, 2021. In the following period, TDS concentrations were below the threshold except in the last sampling on May 31, 2022,

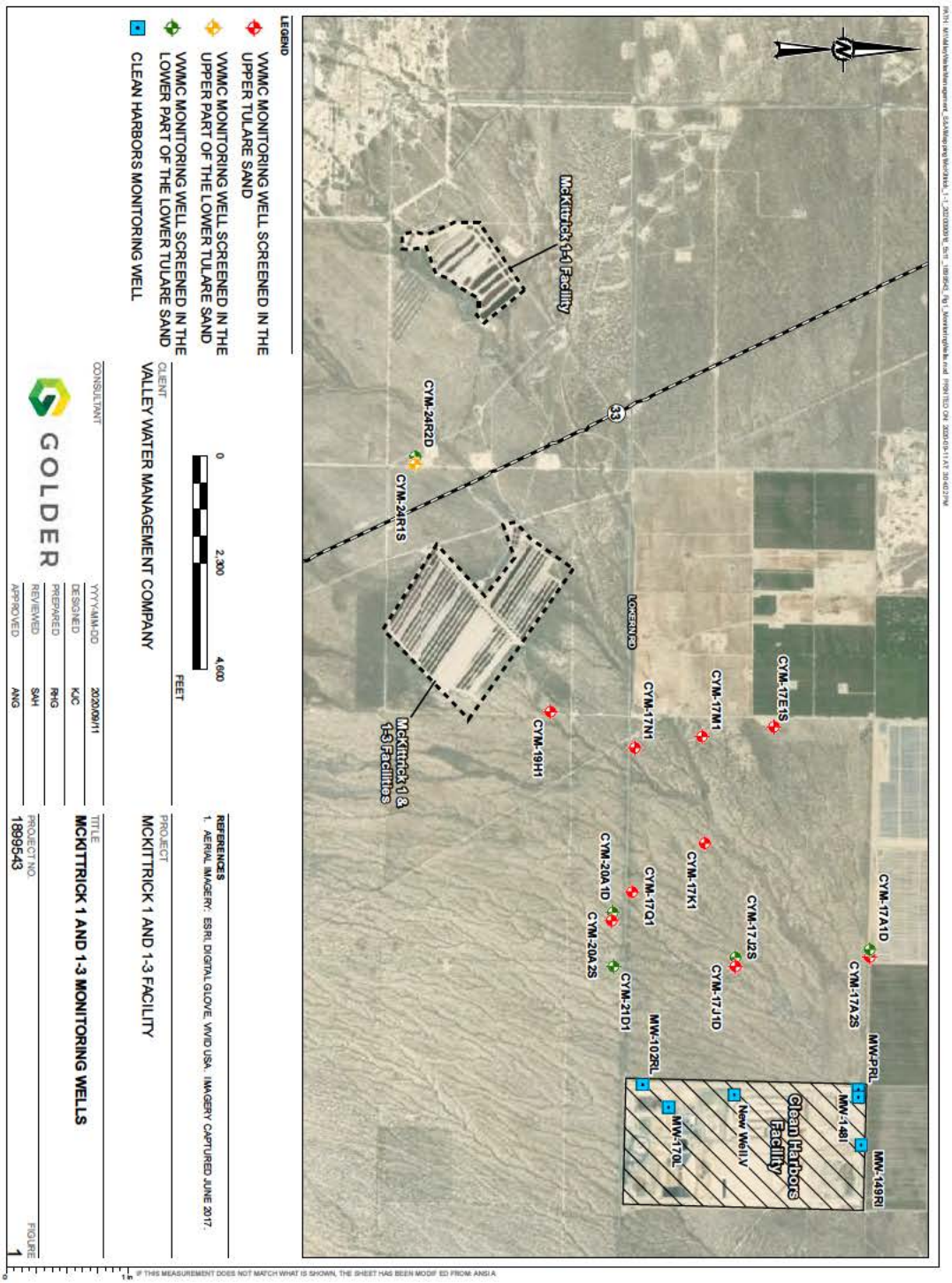
when the TDS concentration was 5200 mg/l (see the graph in the attachment 2, which I downloaded from the GeoTracker database). Based on the data, and assuming that the limit of 500 mg/l is a proper choice (as I said, I do not comment on this), I consider the restriction of the de-designation zone for AGR beneficial uses a scientifically reasonable and defensible interpretation of the available data and geological information. The recommended extension of the monitoring zone and the development of a groundwater model could also provide important insights for the AGR beneficial uses.

## Conclusion #6: Based on the available data, and taken as a whole, the scientific assumptions, findings, and conclusions in regard to the scientific portions of the Proposed Basin Plan Amendment are based upon sound scientific knowledge, methods, and practices.

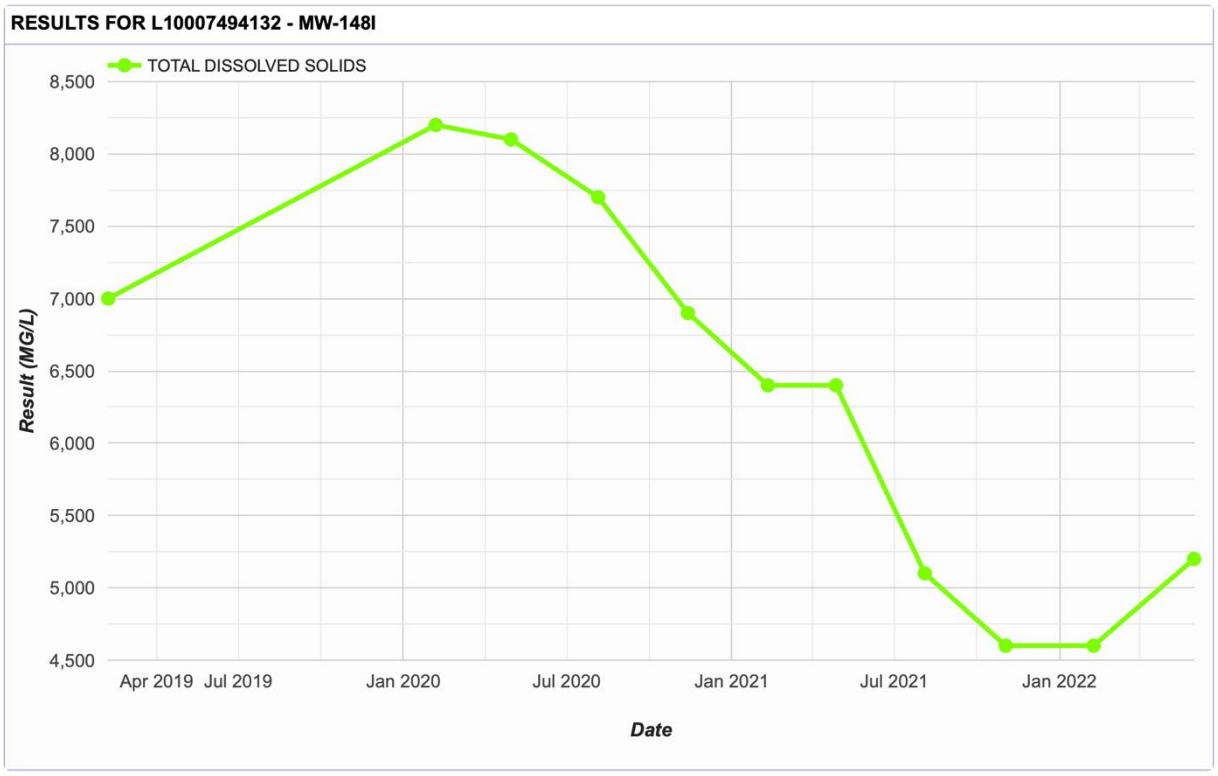
Comments

Mostly yes, with the exceptions described in the comments to the previous conclusions.

## Attachments




Attachment 1: map of the monitoring wells downstream the McKittrick 1 & 1-3 facility downloaded from the GeoTracker database




Attachment 2: Plot of the TDS concentration at the well NW-148I extracted from the GeoTracker database

# Review of the scientific basis Regarding the Scientific Basis of a Proposed Amendment to the Water Quality Control Plan for the Central Valley Regional Water Quality Control Board Tulare Lake Basin (Tulare Lake Basin Plan) to Remove (De-designate) the Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) Beneficial Uses from Groundwater Within a Designated Horizontal and Vertical Area Within and Surrounding the Administrative Boundaries of the South Belridge, Monument Junction and Cymric Oil Fields in Kern County

J. Jaime Gómez-Hernández, Ph. D.
Professor, Technical University of Valencia, Spain
Institute of Water and Environmental Engineering

17 April 2025

Based on my expertise and experience, I am reviewing the findings, assumptions, or conclusions I agreed I could review with confidence. Specifically, I am reviewing the document with respect to the following conclusions as stated in the March 25, Commence Letter from the State Water Resources Control Board:

*Conclusion # 1:*
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the subsurface hydrology, geology, and Corcoran Clay Equivalent in the Project Zone are scientifically reasonable and defensible.*

*Conclusion # 2:*
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the quality of the groundwater in the Project Zone are scientifically reasonable and defensible.*

*Conclusion # 3:*
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the MUN beneficial use of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the MUN de-designation determination is scientifically reasonable and defensible.*

*Conclusion # 4:*
*Based on the available data, the scientific assumptions, findings, and conclusions regarding the determination to use 5,000 mg/L TDS as a salinity threshold concentration to evaluate AGR de-designation in the groundwater of the Project Zone is scientifically reasonable and defensible.*

*Conclusion # 5:*

*Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the AGR beneficial uses of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the AGR de-designation determination is scientifically reasonable and defensible.*

*Conclusion # 6:*
*Based on the available data, and taken as a whole, the scientific assumptions, findings, and conclusions in regard to the scientific portions of the Proposed Basin Plan Amendment are based upon sound scientific knowledge, methods, and practices.*

## Conclusion #1: Based on the available data, the scientific assumptions, findings, and conclusions regarding the subsurface hydrology, geology, and Corcoran Clay Equivalent in the Project Zone are scientifically reasonable and defensible.

My assessment is that, no, the conclusion that the Corcoran Clay Equivalent (CCE) in the Project Zone can act as a barrier to prevent water migration from the alluvium into the Upper Tulare Formation is not fully supported either by the reports or by the available data.

It is well known that in a fluvial depositional environment, heterogeneity in the sediments may be present, cutting across the CCE and providing preferential pathways for water migration from the alluvium downwards [1]. This migration might have occurred already: according to Valley Water's hydrogeologic reports (as cited in [2]), implying that the CCE in the vicinity of the facility does not act as a significant barrier to the downward migration of produced wastewater, and a wastewater plume has migrated directly from beneath the ponds below the CCE and into the Upper Tulare Formation sediments. This potential lack of contention of the CCE may explain the high values of total dissolved solids (TDS) observed in the Upper Tulare Formation and shown in Figure 2 of the Draft Staff Report [3]. It is not enough to say that there are not enough samples in the Tulare Formation to justify its inclusion in the de-designated area. Groundwater migrates, and there seems to be evidence that such migration has already occurred, producing a wastewater plume in the Tulare Formation.

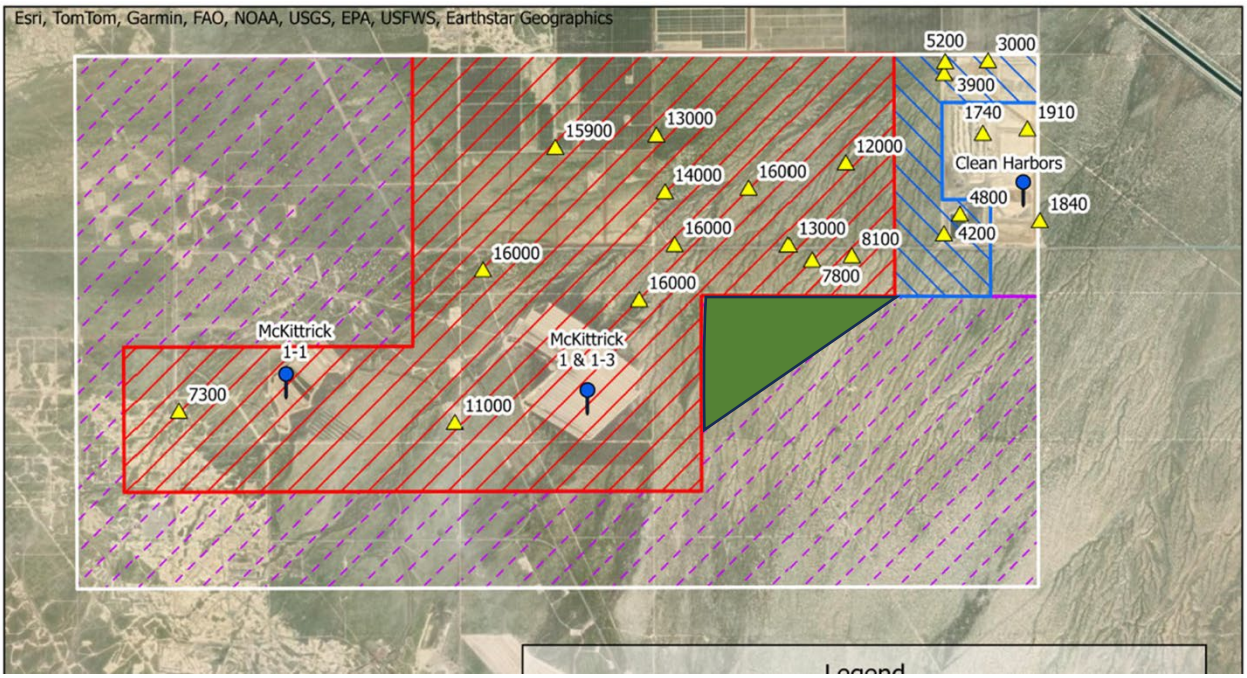
## Conclusion #2: Based on the available data, the scientific assumptions, findings, and conclusions regarding the quality of the groundwater in the Project Zone are scientifically reasonable and defensible

Following up on my assessment in the previous conclusion, the decision to exclude the Tulare Formation from the Revised Project Zone because the quality of the water in the formation cannot be assessed, given the small number of samples, is not defensible. There are two main reasons against this decision. The first one is that, even though there are few measurements, out of the seven measurements, all but one are above or

very close to the 3,000 mg/L threshold; this exceedance occurring in most wells should raise the concern that maybe the Tulare Formation is also affected by high TDS concentrations. The second one is that there seems to be evidence of wastewater downward migration beyond the CCE formation.

## Conclusion # 3: Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the MUN beneficial use of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the MUN de-designation determination is scientifically reasonable and defensible.

To base the vertical boundary on the containment characteristics of the CCE formation is not defensible. As mentioned above, the CCE may be a low-permeable zone acting as a barrier at some locations. Still, its continuity across the entire project zone is debatable. In line with my previous conclusions, it seems that it is not continuous below the facilities, given that a waste plume has been observed already below the CCE. My recommendation would be the CCE not to be used as a vertical boundary. Regarding the horizontal boundaries, I assume that the description of the Revised Project Zone corresponds to the shaded blue and red areas in Figure 2 of the Draft Staff Report [3]. (It would have been convenient if a reference to these shaded areas in Figure 2 had been included in the lengthy description of the revised project zone in the main text.) Considering that the groundwater moves from the McKittrick facilities 1 & 1-3 towards the northeast [2], the shape of the red-shaded area in Figure 2 seems to be a little bit artificial. I would argue that there is a very high chance of having high TDS concentrations to the east of the facility, in the green-shaded area in the figure below. (And probably, a similar area could be drawn north of McKittrick 1-1.)




I would venture myself to say that to the north of the Project Area, there will still be very high TDS concentrations as well, although this is not part of the analysis in this report. My statements could be better supported with a local numerical model that could evaluate the extent of the plume and its migration speed.

## Conclusion # 4: Based on the available data, the scientific assumptions, findings, and conclusions regarding the determination to use 5,000 mg/L TDS as a salinity threshold concentration to evaluate AGR de-designation in the groundwater of the Project Zone is scientifically reasonable and defensible.

My assessment is that, yes, 5,000 mg/L is the correct salinity threshold to classify water as not suitable for irrigation. While 5,000 mg/L of total dissolved solids is not a strict regulatory limit, there is enough evidence that irrigation beyond this threshold becomes severely limited (i.e., [4]). At that concentration, only salt-tolerant crops can be grown, and even then, only under carefully controlled conditions. It should be considered as an upper bound, above which both crop yield and soil health decrease significantly. In fact, most agricultural guidelines point out that adverse effects on many crops appear well below this concentration (i.e., 2,000 mg/L) [5].

## Conclusion # 5: Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the AGR beneficial uses of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and

## therefore the AGR de-designation determination is scientifically reasonable and defensible.

In line with my statement regarding conclusion #1, I don't think it is scientifically reasonable to exclude the area below the CCE from the de-designated zone. I also believe the area to the east of the McKittrick 1 & 1-3, highlighted in the figure above, should be included since it is very likely to have high TDS concentrations considering the groundwater flow direction in the alluvium.

## Conclusion # 6: Based on the available data, and taken as a whole, the scientific assumptions, findings, and conclusions in regard to the scientific portions of the Proposed Basin Plan Amendment are based upon sound scientific knowledge, methods, and practices.

I don't believe that the proposed basic plan amendment is based on sound scientific knowledge methods and practices for the reasons stated above.

## References


[1] Staff Report, Valley Water Management Company, McKittrick 1 &1-3 Facility, Kern County (in key document 26_K Jenks-2020-GO3-NOI.pdf)

[2] Cease And Desist Order No. R5-2019-0045 Valley Water Management Company Mckittrick 1 & 1-3 Facility Kern County (in key document 10_CDO R5-2019-0045.pdf)

[3] Amendment to the Water Quality Control Plan for the Tulare Lake Basin To Remove theMunicipal and Domestic Supply (MUN) and Agricultural Supply (AGR) Beneficial Uses from Groundwater Within a Designated Horizontal and Vertical Area Within and Surrounding the Administrative Boundaries of the South Belridge, Monument Junction and Cymric Oil Fields in Kern County DRAFT STAFF REPORT, 2024

[4] Salinity Effects on Agricultural Irrigation-Related Uses of Water White Paper Executive Summary. 2012 (key document 15_CV_SALTS_2012.pdf)

[5] Ayers, R. S., & Westcot, D. W. *Water quality for agriculture* (Vol. 29, p. 174). Rome: Food and agriculture organization of the United Nations, 1985 (key document 2_Ayers_Westcot_1985.pdf)

# Peer Review Report

**Reviewer:**
Dr. Isaya Kisekka
Professor of Hydrology and Agricultural Water Management
Department of Land, Air, and Water Resources
Department of Biological and Agricultural Engineering
University of California, Davis

**Date:** April 14, 2025

**Document Reviewed:**
*Scientific Basis of a Proposed Amendment to the Water Quality Control Plan for the Central Valley Regional Water Quality Control Board Tulare Lake Basin (Tulare Lake Basin Plan) to Remove (De-designate) the Municipal and Domestic Supply (MUN) and Agricultural Supply (AGR) Beneficial Uses from Groundwater Within a Designated Horizontal and Vertical Area Within and Surrounding the Administrative Boundaries of the South Belridge, Monument Junction and Cymric Oil Fields in Kern County*

Based on my expertise and experience in hydrology, agricultural water quality, and agricultural water management, I am reviewing the findings, assumptions, or conclusions I agreed I could review with confidence.

Conclusion #1
Conclusion #2
Conclusion #3
Conclusion #4
Conclusion #5
Conclusion #6

## Conclusion #1:

**Based on the available data, the scientific assumptions, findings, and conclusions regarding the subsurface hydrology, geology, and Corcoran Clay Equivalent in the Project Zone are scientifically reasonable and defensible.**

The *Staff Report* presents a scientifically sound and well-supported interpretation of the subsurface conditions within the Project Zone, particularly regarding the regional geologic framework, hydrostratigraphy, and the function of the Corcoran Clay Equivalent. These elements are fundamental to understanding the behavior of groundwater and the justification for beneficial use de-designation in the Revised Project Zone.

As stated in the Executive Summary and further detailed in Section 1, the Project Zone lies within the Tulare Lake Bed area of the southern San Joaquin Valley and is underlain by Quaternary Alluvium and the Tulare Formation. Section 1.2 and Subsection 1.2.1 describe the stratigraphic composition of this region, highlighting the Corcoran Clay Equivalent, a regionally extensive, low-permeability confining layer, as a critical hydrogeologic feature. This thick clay acts as a vertical barrier, separating the overlying Quaternary Alluvium from the underlying Tulare Formation.

Subsection 1.2.3 further confirms that the Corcoran Clay Equivalent plays a dominant role in limiting vertical groundwater movement. Specifically, it prevents groundwater and any constituents introduced through surface discharges in the Revised Project Zone from migrating into the deeper Tulare Formation aquifer. This hydrologic separation is essential for the defensibility of beneficial use de-designation because it confirms the hydrologic isolation of impaired shallow zones from potentially higher-quality deeper zones.

In Section 3.1, the report characterizes the Revised Project Zone as comprising sediments within the Quaternary Alluvium only, with elevated salinity levels that do not support MUN and AGR beneficial uses. The Tulare Formation is excluded from the Revised Project Zone. This boundary is scientifically justified due to the Corcoran Clay Equivalent's role as a confining layer that impedes the vertical transmission of water and solutes.

Figure 4, a type log of the Tulare Formation, visually supports this stratigraphic interpretation by showing the distribution of sand, silt, and clay in the formation, confirming the presence of thick clay units consistent with the Corcoran Clay Equivalent. These geologic observations validate the vertical zoning of water quality conditions and support the delineation of areas proposed for de-designation.

The available geologic and hydrogeologic data support the conclusion that the Revised Project Zone's impaired groundwater does not pose a risk to deeper water-bearing units due to the integrity of the Corcoran Clay Equivalent. This interpretation is grounded in standard hydrogeologic principles and is consistent with best practices in groundwater basin evaluation (Freeze and Cherry, 1979).

Therefore, the delineation and interpretation of the subsurface geology and hydrology, including the critical role of the Corcoran Clay Equivalent, are scientifically reasonable and defensible.

### Conclusion #2:

Based on the available data, the scientific assumptions, findings, and conclusions regarding the quality of the groundwater in the Project Zone are scientifically reasonable and defensible.

The staff report presents a scientifically sound and defensible assessment of groundwater quality in the Revised Project Zone. Based on an evaluation of empirical monitoring data, hydrogeologic mapping, and regulatory thresholds for beneficial use, the report supports the conclusion that the groundwater within this zone does not and is not expected to support the Municipal and Domestic Supply (MUN) and Agricultural Supply beneficial uses.

As documented in the Executive Summary and Subsection 3.3, water quality samples from monitoring wells within the Revised Project Zone show that groundwater exceeds 5,000 mg/L total dissolved solids (TDS) in most of the area. A smaller portion of the zone contains groundwater with TDS concentrations between 3,000 and 5,000 mg/L. These levels far exceed the Secondary Maximum Contaminant Levels (SMCLs) for drinking water established by the State Water Resources Control Board: 500 mg/L (recommended), 1,000 mg/L (upper), and 1,500 mg/L (short-term). TDS concentrations above 3,000–5,000 mg/L render groundwater unsuitable for municipal use without extensive and economically infeasible treatment.

Figure 2 in the staff report visually reinforces these findings. It delineates several important boundaries:

- The white box indicates the entire area originally considered for de-designation.
- The red box shows the revised project area where alluvial groundwater exceeds 5,000 mg/L TDS.
- The blue box identifies areas where TDS is between 3,000 and 5,000 mg/L.
- The purple box denotes regions where there are missing or no available data for groundwater quality to objectively evaluate of MUN or ARG supply can be de-designated.

These clearly defined zones ensure that the de-designation boundary is based on robust empirical data and that the MUN and AGR beneficial use are proposed for removal only where groundwater quality fails to meet even minimum potable standards or be protective of ARG. Subsection 3.3 explicitly notes that available water quality data do not support de-designation outside the Revised Project Zone, demonstrating scientific restraint and adherence to a data-driven approach.

Figure 3 complements the analysis by presenting TDS concentrations in the Tulare Formation. It confirms similarly elevated salinity levels in the upper member of the formation, with many values exceeding 2,000 mg/L, and in some areas, reaching or exceeding 5,000 mg/L. The report also notes that there is insufficient groundwater quality data in the Tulare formation beyond 490 ft bgs to objectively evaluate if MUN or AGR  beneficial uses can be de-designated beyond 490 ft.

Finally, Section 4 examines alternatives for both MUN and AGR, including de-designation, leaving the designation in place or implementing localized treatment options. Most of the alternatives were deemed impractical due to the widespread and persistent nature of the water quality impairment, particularly in the alluvium, and the infeasibility of treatment at the scale required. Leaving the de-designation in the revised project areas as the most scientifically defensible option.

In conclusion, the staff report provides comprehensive and well-documented evidence that groundwater in the Revised Project Zone does not and will not support the MUN AGR beneficial uses. The spatially detailed and conservative delineation of the de-designation area, coupled with robust water quality data and clear regulatory benchmarks, make the report's findings and assumptions scientifically reasonable and defensible.

### Conclusion #3:

**Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the MUN beneficial use of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the MUN de-designation determination is scientifically reasonable and defensible.**

The proposed de-designation of the Municipal and Domestic Supply (MUN) beneficial use in the Revised Project Zone is supported by analysis of groundwater quality (TDS), regional hydrogeology, and applicable regulatory policy. The horizontal (approximately 6 sq miles) and vertical (200 to 400 ft below ground surface) boundaries delineated in the staff report are based on scientifically sound interpretations of subsurface conditions and empirical groundwater quality data.

As stated in the Executive Summary and detailed in Subsection 3.3, de-designation of the MUN beneficial use is based on groundwater in the Revised Project Zone meeting one of the MUN de-designation criteria outlined in the Tulare Lake Basin Plan: total dissolved solids (TDS) exceeding 3,000 mg/L. Groundwater data and site-specific geologic information confirm that TDS concentrations consistently exceed this threshold

within the de-designation area. Figures 2 and 3 further substantiate these findings by illustrating widespread exceedances of 3,000 mg/L TDS in both the alluvium and the upper member of Tulare Formation within the Revised Project Zone.

The project area reflects the potential impact of land management activities, such as the disposal of produced wastewater in unlined ponds dating back to the 1960s, with TDS concentrations that can range from 8,400 to 56,000 mg/L. Flood irrigation in the past might also have contributed to elevated TDS levels in the alluvium part of the aquifer. As described in Section 1.2 and Subsection 3.1, this area is geologically and hydrologically distinct, with little recharge and limited potential for water quality improvement. The staff report justifiably excludes areas with insufficient data or where TDS concentrations remain below 3,000 mg/L, ensuring that the horizontal boundary is both conservative and data-driven.

Vertically, the de-designation is proposed to a depth of the top of the Tulare Formation or the depth of the alluvium. As described in Subsection 1.2.1 and illustrated in Figure 4, this formation consists predominantly of low-permeability clays with limited and discontinuous sand lenses. Subsection 1.2.3 notes that there is insufficient groundwater data to evaluate de-designation for the Upper member of the Tulare Formation.

The staff's selection of MUN Alternative 3 (Subsection 4.1.6) reflects a thorough evaluation of regulatory options and is consistent with State Water Board Resolution 88-63 and applicable federal and state guidance (Sections 2.1.1 and 2.1.2). The alternative appropriately applies the MUN exemption where groundwater is not reasonably expected to serve as a source of drinking water due to quality limitations, specifically TDS levels exceeding 3,000 mg/L.

In conclusion, the proposed horizontal and vertical boundaries for MUN de-designation are well-supported by empirical groundwater quality data (TDS), a clear understanding of the regional geology and hydrology, and compliance with regulatory criteria. The delineation is conservative, scientifically reasoned, and represents a defensible interpretation of site conditions within the Revised Project Zone.

### Conclusion #4:

**Based on the available data, the scientific assumptions, findings, and conclusions regarding the determination to use 5,000 mg/L TDS as a salinity threshold concentration to evaluate AGR de-designation in the groundwater of the Project Zone is scientifically reasonable and defensible.**

The use of 5,000 mg/L total dissolved solids (TDS) as a salinity threshold for evaluating the de-designation of the Agricultural Supply (AGR) beneficial use within the Revised Project Zone is supported by scientifically grounded assumptions, regulatory guidance,

and empirical evidence. This threshold is based on a defensible interpretation of groundwater conditions and salinity tolerance for both crops and livestock, as outlined in the *Staff Report* and in accordance with the Tulare Lake Basin Plan.

As explained in Section 1.1.2, the AGR beneficial use supports a wide range of agricultural activities including irrigation, livestock watering, and vegetation for range grazing. Unlike the Municipal and Domestic Supply (MUN) beneficial use, the Tulare Lake Basin Plan does not specify a numeric threshold for TDS beyond which groundwater is considered unsuitable for agricultural use. Therefore, the Central Valley Water Board, as described in Section 4.2 and Subsection 4.2.6, appropriately turned to the best available scientific literature to establish a salinity limit that is protective of agricultural uses.

The literature review, including work by CV-SALTS (2012, 2013), referenced in Subsection 4.2.6, identifies consensus in the scientific community that only salt-tolerant crops can be reliably irrigated with water exceeding 2,000 mg/L TDS, as originally documented by Ayers and Westcot (1985). Furthermore, research by Sharif et al. (2019) is cited to demonstrate that even moderately salt-tolerant crops like cotton have an upper threshold of approximately 5,159 mg/L TDS. This conclusion could be supported with more recent literature on crop response to salinity that supports the assumption that most crops will experience reduced productivity at salinity levels exceeding 1400 to 2800 mg/L (Nicolas et al., 2023; Kisekka et al., 2024). With regard to livestock watering, the literature supports a maximum tolerable TDS range between 3,000 and 5,000 mg/L, with the latter value cited from NRC (1974) and adopted as the high-end threshold.

Given these findings, the Central Valley Water Board's use of 5,000 mg/L TDS as the salinity threshold for AGR de-designation is both conservative and scientifically justified. It establishes a clear and protective boundary for determining when groundwater is no longer capable of supporting agricultural uses, in alignment with the Basin Plan criterion of "pollution that cannot reasonably be treated using Best Management Practices or best economically achievable treatment practices." This threshold ensures that only groundwater truly unsuitable for AGR uses is de-designated.

Moreover, the geographic and geologic context presented in the Executive Summary and Section 1 demonstrates that in the Revised Project Zone, groundwater frequently exceeds this 5,000 mg/L TDS threshold. The Type Log of the Tulare Formation (Figure 4) reinforces the understanding that the subsurface environment in this area is composed of clay-rich, low-permeability materials, which are not conducive to natural attenuation or improvement in water quality.

In summary, the use of a 5,000 mg/L TDS threshold for evaluating AGR de-designation in the Revised Project Zone is a scientifically reasonable and defensible interpretation of

the available hydrogeologic data, groundwater quality data and crop response to salinity impact. It reflects both a sound application of regulatory principles and a careful consideration of agricultural and livestock water use needs.

### Conclusion #5:

**Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the AGR beneficial uses of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the AGR de-designation determination is scientifically reasonable and defensible.**

The Staff Report presents a scientifically sound and well-documented basis for the proposed horizontal and vertical boundaries of the AGR beneficial use de-designation within the Revised Project Zone. These boundaries reflect the hydrogeologic characteristics and salinity conditions of the subsurface environment and align with the de-designation criteria established in the Tulare Lake Basin Plan, specifically the presence of pollution that cannot reasonably be treated for agricultural use.

As outlined in the Executive Summary and detailed in Sections 1.2.1 and 1.2.3, the regional geology is characterized by a Corcoran Clay Equivalent, a regionally extensive, low permeability confining layer which has limits capacity for natural flushing or recharge. This stratigraphy contributes to persistently elevated salinity levels in the groundwater. The Type Log of the Tulare Formation (Figure 4) further illustrates these clay-dominated lithologies, confirming the minimal likelihood of natural improvements in groundwater quality.

Available groundwater data demonstrate that TDS concentrations in much of the Revised Project Zone exceed 5,000 mg/L, a rather conservative threshold supported by scientific literature and adopted by the Central Valley Water Board as appropriate for assessing the protectiveness of AGR uses (Section 4.2 and Subsection 4.2.6). Specifically, Figures 2 and 3 provide clear spatial representations of TDS levels in the alluvium and Tulare Formation, showing large areas where concentrations exceed this salinity threshold. These figures directly support the delineation of the horizontal boundary for de-designation.

The vertical extent of the de-designation, as described in Subsection 3.3, is limited to the alluvial aquifer zones (to the top of the Tulare formation) within the Revised Project Zone that meet the pollution criterion. This includes areas where elevated TDS levels are consistent throughout the saturated zone and where the geology inhibits the

potential for mixing with fresher groundwater. Additionally, Subsection 3.1 confirms that in the Project Area, the alluvium varies in thickness but can be as thick as 400 feet, and the alluvium is separated from the underlying Tulare Formation by the Corcoran Clay Equivalent, reinforcing the rationale for limited vertical boundaries.

The regulatory context outlined in Subsections 1.1.2, 1.1.3, and Section 4.2 underscores that in the absence of a numeric water quality objective for AGR, the Central Valley Water Board's reliance on a scientifically supported threshold (5,000 mg/L TDS) is reasonable. This value was selected following a literature review on crop and livestock salinity tolerance and is consistent with Basin Plan criteria regarding the presence of untreatable pollution.

In conclusion, the proposed horizontal and vertical boundaries for AGR de-designation are well-supported by empirical water quality data (TDS), robust geological and hydrological analysis, and established regulatory criteria. The scientific assumptions and interpretations presented in the Staff Report are reasonable and defensible, and the AGR de-designation determination is appropriately justified.

### Conclusion #6:

**Based on the available data, and taken as a whole, the scientific assumptions, findings, and conclusions in regard to the scientific portions of the Proposed Basin Plan Amendment are based upon sound scientific knowledge, methods, and practices.**

The scientific foundation of the Proposed Basin Plan Amendment is comprehensive, well-reasoned, and grounded in accepted methods of hydrogeologic investigation, environmental assessment, agronomic literature review, and water quality policy interpretation. The *Staff Report* documents the technical rationale for de-designating the MUN and AGR beneficial uses within the Revised Project Zone through a rigorous evaluation of groundwater salinity conditions, hydrostratigraphy, agronomic analysis of crop response to salinity and regulatory context, and applicable scientific literature.

The Executive Summary concisely outlines the purpose of the amendment, the basis for the de-designation of beneficial uses, and the supporting scientific and regulatory framework. This framing is expanded upon in Section 1, which provides an overview of the existing conditions in the Tulare Lake Bed area, including the extensive history of groundwater salinity impairment.

In Section 3, the evaluation of the Project Zone includes a thorough analysis of groundwater quality data, in particular TDS concentrations in both the alluvium and the upper member of the Tulare Formation. Figures 2 and 3 clearly show that the Revised Project Zone contains extensive areas where groundwater TDS exceeds 5,000 mg/L,

the scientifically supported threshold for de-designating the AGR beneficial use. In addition, the secondary maximum contaminant level (SMCL) ranges from 500 to 1,000 mg/L for MUN and is substantially exceeded. These data are paired with detailed hydrogeologic interpretations that inform the proposed vertical and horizontal boundaries of the de-designation. Figure 4, a type log of the Tulare Formation, supports the identification of low-permeability, clay-rich deposits that restrict natural groundwater flushing and limit prospects for water quality improvement.

The de-designation of the AGR beneficial use is based on the presence of salinity pollution that cannot reasonably be treated for agricultural use. In the absence of a Basin Plan numeric objective for salinity protective of AGR, Section 4 explains that the Central Valley Water Board relied on peer-reviewed scientific literature, including thresholds for salt tolerance in crops and livestock. The report adopts a 5,000 mg/L TDS threshold based on CV-SALTS evaluations and studies by Ayers and Westcot (1985), Sharif et al. (2019), and others, providing a scientifically defensible standard for evaluating AGR support. I also provided additional references to more recent literature on crop salinity response that confirms that the adopted 5,000 mg/L TDS threshold is scientifically supported and rather conservative.

Section 7, the environmental review, appropriately considers potential environmental consequences of the proposed amendment under California Environmental Quality Act (CEQA) and concludes that no significant adverse environmental impacts would result. This section demonstrates that the amendment was developed with environmental protection principles in mind and in accordance with applicable procedural standards.

Additionally, the analysis complies with the requirements of the State Water Resources Control Board’s sources of drinking water policy (Resolution 88-63) and Basin Plan procedures for beneficial use de-designation. The staff's attention to ensuring consistency with prior Basin Plan Amendments and similar decisions across the Tulare Lake Basin further enhances the defensibility of the conclusions.

Finally, Section 9: References demonstrates the reliance on peer-reviewed scientific literature, state and federal guidance, and technical reports, further confirming that the scientific assumptions and conclusions in the amendment are consistent with standard practices in groundwater quality evaluation, agronomic science, and regulatory practices.

Taken together, the data, methods, and interpretations presented in the *Staff Report* are well-documented, technically sound, and reflective of scientific best practices. The Proposed Basin Plan Amendment is therefore supported by credible scientific knowledge and appropriately applied methodologies.

## References

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Based on my expertise and experience as an animal nutritionist, I am reviewing the findings, assumptions, or conclusions I agreed I could review with confidence:

The primary focus of this review pertains to the quality of water and water testing parameters as they relate to the de-designation of AGR use of water in this zone – specifically with a focus on water use for livestock raising purposes. The only measurement discussed here in terms of water quality is Total Dissolved Solids (TDS). Other measurements of water quality (sulfates, nitrates, alkalinity) would also provide a means to assess the adequacy of a water source for livestock use but have not been provided for review.

Different species of livestock animals – specifically, animals raised for food or fiber production (including horses for the purposes of this review, can tolerate different levels of water salinity as measured by Total Dissolved Solids (mg TDS/L). General recommendations for maximal tolerance of livestock to water salinity have been reviewed by many people in the livestock industry and commonly include ranges of tolerance due to a lack of specific research that focuses on specific effects of high salinity water which would lead to more precise recommendations in livestock animals. A commonly cited source of water quality guidelines comes from the Australian and New Zealand Environment and Conservation Council document (ANZECC, 2000) that provides guidelines for many animal species. The tolerance for high TDS in water for poultry species is regarded as 3000-4000 mg TDS/L to maintain adequate health and growth. Poultry species (ducks, turkeys, chickens) do have the physiological capacity to tolerate high salinity water by increasing total water intake and/or increasing the use of body water to remove salts from the body via the kidneys. For livestock species which are larger and considered grazing species, the recommended tolerance levels are higher. For cattle, salinity levels from 4000-5000 mg/L are considered maximal to maintain adequate growth and body composition in cattle over extended periods of time, with horses being able to tolerate levels up to 6000 mg/L. Many grazing animals in production systems may be at full body size when grazing specific areas, therefore maximal levels of salinity would consider potential adverse health conditions and reproductive physiology and not focus only on growth. This same publication provides a range of 5000-10,000 mg/L of TDS that could be consumed by cattle and still be in the limits of safety for the animals. This fits the results of

a recent study (Mohamed et al., 2024) that measured adverse effects on sperm production traits in sheep when provided water at close to 9000 mg TDS/L, with no adverse effects on reproductive ability of rams provided water at close to 5000 mg TDS/L. Maximal tolerance for grazing horses is considered to be 7000 mg/l, with very little data in the published literature to clarify. For all animal species, it is recognized that tolerance of higher TDS concentrations must include a gradual transition from lower salinity to higher salinity. Rapid transition to consuming high TDS water could cause reduced water and feed intake, diarrhea, dehydration, and death.

A recent study looking directly at high salinity water consumption of health and growth effects in small ruminants (sheep and goats) that were being fed for meat production indicated that levels of TDS can reach as high as 15,900 mg/L TDS before any changes in growth rate, carcass weight, and other meat quality traits are affected (Abera et al., 2024). The same research group published a second paper measuring health parameters in sheep and goats consuming the same high salinity water levels and it wasn't until water concentrations of TDS reached approximately 11,900 mg/L that reductions in packed cell volume (red blood cell count) and hemoglobin levels were measurably reduced. In these studies, sheep and goats consumed more water when salinity levels were increased, and it appeared that goats had an increased ability to tolerate higher TDS than sheep which may be due to the sheep's reduced heat tolerance and need to pant to maintain body temperature.

The previous studies mentioned were conducted over a 75 day time period, which would correlate to the use of land as a source of grazing in a short plant/forage growing period. Extended consumption of high saline water and its effects on livestock has been less extensively studied. One publication (Ghanem et al., 2017) conducted a study which provided increased salinity water (<5000 mg/L) to sheep over a 9 month period and measured reduced body weight and indications of inflammation to kidneys and liver at those levels. These longer-term effects of consuming high salinity water are likely the key influencers of reviewed recommendations that tend to discourage providing water with a TDS of greater than 5000 mg/L to livestock animals.

Overall, the designation of threshold levels of Total Dissolved Solids (TDS) levels for livestock use is variable based on species, time period of an animal consuming the increased salinity water, and other environmental factors that could influence the water requirements of an animal including temperature, humidity, and feed/forage availability. Many grazing species of livestock can adapt to high levels of water salinity (>7000-9000 mg/L) and utilize that water source for short periods of time. Other water quality measurements (nitrate, sulfate, alkalinity) are potentially more important to livestock

health and could also influence the suitability of a water source for livestock production purposes.

**Conclusion # 2: Based on the available data, the scientific assumptions, findings, and conclusions regarding the quality of the groundwater in the Project Zone are scientifically reasonable and defensible.**

This statement is true, but the data needed to fully assess the quality of the groundwater may be incomplete. As discussed in the first paragraph above, Total Dissolvable Solids (TDS) is a common measurement of water quality used to determine its ability to support livestock animals, but there are further qualities (nitrates, sulfates, alkalinity) that can also further confirm the suitability of a water source to support livestock health and production.

**Conclusion # 4: Based on the available data, the scientific assumptions, findings, and conclusions regarding the determination to use 5,000 mg/L TDS as a salinity threshold concentration to evaluate AGR de-designation in the groundwater of the Project Zone is scientifically reasonable and defensible.**

For specific species or production stages of livestock, the level of 5000 mg/L TDS as a threshold is reasonable. As discussed above, most non-ruminant species of livestock (poultry, swine) can not tolerate TDS higher than 5000 mg/L, yet grazing species (goats, cattle, sheep) have been known to maintain health and production when drinking from a water source with much higher TDS levels (up to 9,000 mg/L) for a relatively short period of time which could include animals managed at the site for seasonal grazing. The level of 5000 mg/L is reasonable as a threshold for long-term housing of all types of animals that may be reproducing which would have extended consumption of water at these levels of TDS.

**Conclusion # 5: Based on the available data, the scientific assumptions, findings, and conclusions regarding the proposed horizontal and vertical boundaries for de-designating the AGR beneficial uses of groundwater in the Proposed Basin Plan Amendment Revised Project Zone are scientifically reasonable and defensible interpretations of the subsurface geology, hydrology, and water quality conditions in the Project Zone, and therefore the AGR de-designation determination is scientifically reasonable and defensible.**

Yes, the measurements taken and provided here are reasonable and represent the best indicators currently available of the quality of water that would be consumed by

animals kept at the site. Again, published data supports short-term consumption of water at TDS levels beyond the threshold for some grazing species of livestock.

**Conclusion # 6: Based on the available data, and taken as a whole, the scientific assumptions, findings, and conclusions in regard to the scientific portions of the Proposed Basin Plan Amendment are based upon sound scientific knowledge, methods, and practices.**

Yes, the data referenced regarding the quality of water (TDS) for livestock are from reputable sources that provide a general guideline as the suitability for maintaining animal health and production. Further information has been provided above that details the specific types of livestock under specific conditions that may tolerate and thrive consuming water above the threshold established in the current plan.

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