State Water Resources Control Board

April 19, 2021

Jayne Joy
Assistant Executive Officer
Santa Ana Regional Water Quality Control Board
Riverside, California

SUBJECT: INTERIM RESPONSE TO REQUEST FOR AN EXTERNAL PEER REVIEW OF THE DRAFT BASIN PLAN AMENDMENT TO INCORPORATE A MAXIMUM BENEFIT SALT AND NUTRIENT MANAGEMENT PLAN FOR THE ELSINORE GROUNDWATER MANAGEMENT ZONE, RIVERSIDE COUNTY, CALIFORNIA

Dear Ms. Joy,

This letter responds to the attached December 16, 2020 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. No additional material was asked for, nor provided. 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 send it to me for review, with 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. Reference was made to specific parts of the completed COI form and CV. The approval letter also asked the approved candidate which of the conclusions that person would be able to address “with confidence, based on expertise and experience”.

Later, I sent letters to reviewers to initiate the review. These letters provided access instructions to a secure FTP site where all material to be reviewed was placed. Confirmation was requested that the reviewer could access the site and all documents that had been uploaded to it. Each reviewer was asked to address each conclusion for which he or she had previously agreed, and these were identified in the letter. Thirty days were provided for the review, unless a reviewer requested additional time. I also asked reviewers to direct enquiring third parties to me after they have submitted their reviews.

Following my signature on the initiating letter, guidance was provided a) to ensure confidentiality through the review process; and b) for format presentation to meet “accessibility” requirements.

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 listed on the left of the screen, or by scrolling down.

Approved reviewers:

1. Gretchen R. Miller, Ph.D., Associate Professor
   Zachry Department of Civil & Environmental Engineering
   Texas A&M University
   402D Dwight Look Engineering Building
   3136 TAMU
   College Station, TX 77843

2. Kimberly Rollins, Ph.D.
   Professor of Resource and Environmental Economics
   University of Connecticut – Department of Agriculture and Resource Economics
   1376 Storrs Road Unit 4021
   Storrs, CT 06269-401
3. Sally Thompson, Ph.D., Associate Professor  
   Civil, Environmental, and Mining Engineering  
   Faculty of Engineering and Mathematical Sciences  
   University of Western Australia (M051)  
   35 Stirling Highway  
   6009 Perth, Australia

4. Alexandra D. Lutz, Ph.D.  
   Associate Research Professor  
   Affiliated with Division of Hydrological Sciences  
   Desert Research Institute  
   Nevada System of Higher Education  
   2215 Raggio Parkway  
   Reno, NV 89512

If you have any questions, or require clarification from the reviewers, please contact me directly.

Sincerely,

Gerald W. Bowes, Ph.D.  
Manager, CalEPA External Scientific Peer Review Program  
Office of Research, Planning, and Performance  
State Water Resources Control Board  
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Gerald.Bowes@waterboards.ca.gov

Attachments:
(1) December 16, 2020 Request by Jayne Joy, for Scientific Peer Review  
(2) Letters to Reviewers Initiating the Review  
   (1) Gretchen R. Miller, Ph.D.  
   (2) Kimberly Rollins, Ph.D.  
   (3) Sally Thompson, Ph.D.  
   (4) Alexandra D. Lutz, Ph.D.  
(3) Curriculum Vitae  
   (1) Gretchen R. Miller, Ph.D.  
   (2) Kimberly Rollins, Ph.D.  
   (3) Sally Thompson, Ph.D.  
   (4) Alexandra D. Lutz, Ph.D.  
(4) Reviews  
   (1) Gretchen R. Miller, Ph.D.  
   (2) Kimberly Rollins, Ph.D.  
   (3) Sally Thompson, Ph.D.  
   (4) Alexandra D. Lutz, Ph.D.
cc: John Wheeler
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TO: Gerald Bowes  
Manager, Cal/EPA Scientific Peer Review Program  
Office of Research, Planning and Performance  
STATE WATER RESOURCES CONTROL BOARD  
Sacramento, CA

FROM: Jayne Joy  
Assistant Executive Officer  
SANTA ANA REGIONAL WATER QUALITY CONTROL BOARD  
Riverside, CA

DATE: December 16, 2020

SUBJECT: REQUEST FOR PEER REVIEW OF DRAFT BASIN PLAN AMENDMENT TO INCORPORATE A MAXIMUM BENEFIT SALT AND NUTRIENT MANAGEMENT PLAN FOR THE ELSINORE GROUNDWATER MANAGEMENT ZONE, RIVERSIDE COUNTY, CALIFORNIA

The Santa Ana Regional Water Quality Control Board (Santa Ana Water Board) staff hereby request initiation of the peer review process pursuant to the requirements of the Health and Safety Code section 57004 for scientific portions of the proposed Basin Plan amendment (BPA) to incorporate a maximum benefit salt and nutrient management plan (SNMP) for the Elsinore Groundwater Management Zone (GMZ). The proposed BPA intends to: 1) establish maximum benefit water quality objectives¹ for total dissolved solids (TDS) and nitrate-nitrogen for the Elsinore GMZ, and 2) incorporate the maximum benefit commitments for the responsible agency, Elsinore Valley Municipal Water District, to ensure that beneficial uses of the Elsinore GMZ are protected. Specifically, the Santa Ana Water Board request review of the scientific components

¹ In accordance with the State’s Antidegradation Policy (Executive Order 68-16) and California Water Code 13241, the Santa Ana Board can set a less stringent, numerically higher maximum-benefit-based water quality objective compared to an existing water quality objective for a GMZ if it can be demonstrated that beneficial uses are protected and allowing degradation is to the maximum benefit of the people of California.
employed in the maximum benefit SNMP proposal package\(^2\) that justify the proposed BPA.

The Santa Ana Water Board plans to consider the proposed BPA at a regularly scheduled meeting in March 2021. The Santa Ana Water Board staff anticipates submittal of the peer review package to CalEPA staff by December 18, 2020.

Attachment 2 provides detailed descriptions of the scientific conclusions used in the development of the maximum benefit SNMP for the Elsinore GMZ. The critical component of the maximum benefit SNMP proposal package that requires the independent review is the method that was implemented to derive the maximum benefit TDS and nitrate objectives for the Elsinore GMZ. With that said, the Santa Ana Water Board staff asks that the State Water Board staff solicit three peer reviewers with expertise in one or more of the following areas which covers the conclusions described in Attachment 2:

- A hydrologist, hydrogeologist, geologist, groundwater modeler, or geotechnical/civil engineer familiar with groundwater modeling. This expertise is needed for Conclusion 1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 6f, 7, 8, 10a, 10c, and 11.

- A civil engineer or water resources manager familiar with the impacts of climate and land uses on salt and nutrient buildup in the arid west and treatment technology and management practices to sustainably manage groundwater resource. This expertise is needed for Conclusions 3, 4, 5, 6b, 6d, 6e, 7, 8, 10b, 10c, 10d, 10e, 10f, and 11.

- A water resources manager familiar with monetary and environmental costs associated with increasing energy and imported water uses in the arid west. This expertise is needed for Conclusion 9.

The Santa Ana Water Board also requests that the selected peer reviewers provide comments on the Staff Report and the maximum benefit SNMP proposal package within 30 days or less of the receipt of these documents.

The following summarizes the enclosed attachments to this request:

- Attachment 1 – A summary of the proposed action;
- Attachment 2 – A list of descriptions of the scientific conclusions identified by the Santa Ana Water Board staff as requiring review;
- Attachment 3 – A list of participants who assisted in the development of the maximum benefit SNMP for the Elsinore GMZ; and

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\(^2\) Refers to the Elsinore Valley Municipal Water District Proposal to Amend the Basin Plan to Incorporate a Maximum-Benefit-Based Salt and Nutrient Management Plan for the Elsinore Groundwater Management Zone prepared by Wildermuth Environmental, Inc. in 2020 as referenced in Attachment 4 of this peer review package.
Attachment 4 – A list of key references for the draft Staff report and planning documentations that support this proposed BPA.

This BPA package includes an electronic copy of the draft Staff Report, the Substitute Environmental Document, the propose maximum benefit SNMP package, and all references and appendices for the draft Staff Report. The Santa Ana Water Board understands that the State Board staff has set up a secure File Transfer Protocol (ftp) site for posting documents for the peer reviewers. The Santa Ana Water Board will upload all the necessary documents for this review to an FTP site.

While the reviewers are not prevented from commenting on other portions of the referenced documents, the Santa Ana Water Board would like to emphasize to potential reviewers the need to provide a concise evaluation of the conclusions, findings, and conclusions in the proposed maximum benefit SNMP package that have been identified by the Santa Ana Board staff in Attachment 2.

Should you have questions, please contact Cindy Li at Cindy.Li@waterboards.ca.gov, (951) 782-4906.

Attachments 1, 2, 3, and 4

cc:

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Keith Person, RWQCB, keith.person@waterboards.ca.gov
Xinyu “Cindy” Li, RWQCB, cindy.li@waterboards.ca.gov
Attachment 1 – The Proposed Action

Draft Basin Plan Amendment to Adopt the Maximum Benefit Salt and Nutrient Management Plan for the Elsinore Groundwater Management Zone

Summary of Basin Plan Amendment

The proposed Basin Plan amendment (BPA) would update Chapters 4 and 5 of the Santa Ana Water Board Basin Plan. Chapter 4 includes the water quality objectives to protect beneficial uses. Chapter 5 includes the implementation programs to achieve the water quality objectives established in Chapter 4. The proposed action is to incorporate the maximum benefit salt and nutrient management plan for the Elsinore GMZ. Specifically, the proposed BPA intends to: 1) establish maximum benefit-based water quality objectives for total dissolved solids (TDS) and nitrate-nitrogen (nitrate) for the Elsinore GMZ, and 2) incorporate the maximum benefit commitments for the responsible agency (Elsinore Valley Municipal Water District) to ensure that beneficial uses of the Elsinore GMZ are protected.

The proposed amendment is supported by a technical report prepared by the staff of the Santa Ana Water Board (draft Staff Report). The Staff Report also references technical reports prepared to support the BPA, including a Substitute Environmental Document and the maximum benefit SNMP proposal package submitted by the project proponent, the Elsinore Valley Municipal Water District. The draft Staff Report and the supporting documents provide the detailed basis and scientific and economic analyses supporting the proposed BPA.
Attachment 2 – Scientific Conclusions

Draft Basin Plan Amendment to Adopt the Maximum Benefit Salt and Nutrient Management Plan for the Elsinore Groundwater Management Zone (GMZ)

Descriptions of the Scientific Conclusions to be addressed by Peer Reviewers

The statutory mandate for external scientific peer review (Health and Safety Code Section 57004) states that the reviewer’s responsibility is to determine whether the scientific portions of the proposed rule is based upon sound scientific knowledge, methods, and practices. We request that the reviewers make this determination for each of the following conclusions that constitute the scientific portion of the proposed regulatory action.

To help with the review, an explanatory statement has been provided for each conclusion. Conclusions are supported by the literature references cited in the draft Staff Report, Substitute Environmental Document, and the maximum benefit SNMP proposal package¹.² Majority of the references for the Conclusions listed below are from the maximum benefit SNMP proposal package.

Conclusion 1 – The hydrogeologic conceptual model of the Elsinore GMZ used in the analysis is based on accepted and published seminal documents and models that detail the hydrogeology of the GMZ (Section 4.1 of Attachment B in the maximum benefit SNMP proposal package)

Based on published documents on the Elsinore groundwater basin, this analysis characterized the GMZ as hydrologically closed, meaning that groundwater outflow from the GMZ only occurs through groundwater pumping. This means that salts added through natural and artificial recharge processes accumulate in the GMZ unless they are exported.

The Elsinore GMZ has five-layer aquifer system that consists younger alluvium (layer 1), older alluvium (layer 2), an aquitard (layer 3), the Fernando Group (layer 4), and the Bedford Canyon Formation (layer 5). Most of the District groundwater pumping occurs in layers 4 and 5 with some occurring in layer 2.

¹ Refers to the Elsinore Valley Municipal Water District Proposal to Amend the Basin Plan to Incorporate a Maximum-Benefit-Based Salt and Nutrient Management Plan for the Elsinore Groundwater Management Zone prepared by Wildermuth Environmental, Inc. in 2020 as referenced in Attachment 4. This package includes Attachment A, Attachment B, and Attachment C.

² The references of the Staff Report, Substitute Environmental Document, and the maximum benefit SNMP proposal package are provided in Attachment 4 of this peer review package.
References of the published documents that detail the hydrogeology of the Elsinore GMZ are included in page 17, Section 4 of Attachment B in the maximum benefit SNMP proposal package.

**Conclusion 2 – The coupling of the HYDRUS-2D, MODFLOW, and MT3D models to project future TDS and nitrate concentrations in the groundwater of the Elsinore GMZ is appropriate (Sections 2.2, 2.3 and 2.5 of Attachment B in the maximum benefit SNMP proposal package)**

HYDRUS-2D was used in the analysis to estimate the hydraulic travel times of applied water for irrigation from the root zone of plants to the water table (e.g. through the vadose zone). HYDRUS-2D is an industry standard tool that models water flow and solute and heat transport in variably saturated porous media. This program solves the Richards equation for saturated to unsaturated flow and the Fickian-based advection-dispersion equations for heat and solute transport. This program analyzes water and solute movement in unsaturated, partially saturated, or fully saturated porous media like soil. The version of HYDRUS used in this investigation is Version 2.0.

MODFLOW-2005 was used in the investigation to predict the hydraulic response of the Elsinore Basin to future water resources management decisions of the District. MODFLOW is considered an international standard for simulating and predicting groundwater conditions and groundwater-surface water interactions. Flow from external stresses such as flow to wells, areal recharge, evapotranspiration, flow to drains, and flow through riverbeds can be simulated using MODFLOW. Specified head and specified flux boundaries can be simulated as can a head dependent flux across the model's outer boundary that allows water to be supplied to a boundary block in the modeled area at a rate proportional to the current head difference between a "source" of water outside the modeled area and the boundary block.

The MT3D model was used to predict the TDS and nitrate concentration response of the Elsinore Basin to future water resources management decisions of the District. MT3D is a model that simulates advection, dispersion, and chemical reactions of contaminants in groundwater flow systems in 2- or 3-dimensions. The model uses a mixed Eulerian-Lagrangian approach to solve the advection-dispersion-reactive equation, based on combination of the method characteristics and the modified method of characteristics.

The coupling of the three models is appropriate in projecting future changes in groundwater flow conditions and TDS and nitrate concentrations in the Elsinore GMZ.
Conclusion 3 – The initial conditions for groundwater TDS and nitrate concentrations in the analysis are based on observed measurements and are scientifically appropriate in characterizing the initial conditions of the GMZ for the planning scenario analysis (Sections 2.4 and 4.4.2 of Attachment B in the maximum benefit SNMP proposal package).

The initial TDS and nitrate concentrations are based on groundwater quality sampling results collected at wells between 2015 and 2017. For wells that couldn’t be sampled, the constituent concentration can be assumed to equal the last measured concentration value, if the data were collected after 2000. Average TDS and nitrate concentrations were calculated, and aquifer layer codes were assigned to each well for estimating spatial and vertical distribution of TDS and nitrate concentrations in the Basin. A weighted interpolation scheme was used to estimate the spatial distribution of TDS and nitrate concentrations in layer 1 through layer 5.

Conclusion 4 – The selection of the six planning scenarios for the projections of potential future water quality outcomes is appropriately based on projected cultural conditions in the Elsinore GMZ (Section 3.3 of Attachment B in the maximum benefit SNMP proposal package).

Information on the spatial and temporal changes in cultural conditions can be used to describe how water and wastes are managed and their subsequent impact on surface and groundwater. Land use is a key component of the cultural conditions and can be used to understand where water is being used outdoors for irrigation, a portion of which will return to the groundwater basin through deep infiltration past the root zone. The historic and future projected water supply plan, and its estimated associated water quality, is necessary to develop a time-history of the TDS concentration of the composite outdoor water supply, which can subsequently be used to compute the TDS concentration of the deep infiltration of applied water entering the vadose zone and discharging to the water table. The TDS concentration in recycled water served over the Elsinore Valley Municipal Water District (MWD)’s service area impacts TDS and nitrate concentrations of the Elsinore GMZ.

The analysis selected six planning scenarios to characterize and quantify the impacts of recycled water reuse in the Elsinore Basin Watershed to the TDS and nitrate concentration of the Elsinore GMZ for a planning period of 2017 through 2050. Descriptions of the six planning scenarios are include on page 15, Section 3.3 of Attachment B in the maximum benefit SNMP proposal package. Each planning scenario is comprised of recycled water discharge compliance plan and a variation on water supply sources that are used over the Elsinore Basin Watershed.
Conclusion 5 – The hydraulic loading rates and travel time applied inside and outside the model domain to simulate the movement of water and TDS and nitrate in the Elsinore Basin Watershed for all planning scenarios are based on scientific data and standard modeling practices (Section 4.2 of Attachment B in the maximum benefit SNMP proposal package).

Figure B-7 in Attachment B of the maximum benefit SNMP proposal package shows the surface geology of the Elsinore Basin Watershed and illustrates that the geology of the watershed outside of the model domain is predominantly non-water bearing sediments. Thus, there is no vadose zone and the recharges in these areas will either discharge to streams or become subsurface inflow to the Basin. To simulate movement of water throughout the whole Elsinore Basin Watershed, this analysis used a science-based method to divide the watershed into two sub-watersheds: 1) Canyon Hills sub-watershed (upstream) and 2) Elsinore sub-watershed (downstream). The model boundary covers the majority of the downstream portion of the Elsinore Basin Watershed.

The Canyon Hills sub-watershed lies outside of the model boundary and the recharges (deep infiltration of precipitation and water applied) in this area will become rising groundwater and discharges to the San Jacinto River or its tributaries which flow (volume and associated TDS and nitrate concentrations) into the Elsinore sub-watershed. In the Elsinore sub-watershed, the deep infiltration of precipitation and applied water that occurs outside the groundwater model domain becomes a subsurface boundary inflow to the uppermost active layer of the model. For this analysis, it is assumed that the hydraulic lag time of the deep infiltration of applied water in the sub-watershed downstream of USGS Gage 11070500 is less than one year, meaning that the precipitation and applied water are tributary to the basin in the same year they are applied at the ground surface.

In the Elsinore sub-watershed within the model boundary, HDYRUS-2D was used to simulate hydraulic travel time of deep infiltration of applied water through the vadose zone based on lithology logs of six boreholes located across the Elsinore sub-watershed. The hydraulic loading rates for streambed recharge and septic tanks are significantly higher than for the deep infiltration of precipitation and applied water because the vadose zone underlying these recharge sources is completely saturated or nearly so. The hydraulic loading rates and lag time were set based on a range of reasonable and commonly observed infiltration rates and vadose zone thicknesses.

Conclusion 6 – Calculations of the recharge and discharge model inputs for the planning scenarios are based on historical data and science-based projections of changes in recharges and discharges and are appropriate for the analysis (Section 4.3 of Attachment B in the maximum benefit SNMP proposal package)

Sources of recharge include streambed infiltration of the San Jacinto River, the deep infiltration of precipitation and outdoor applied water, and discharges from septic tanks. The only
discharge term is groundwater discharge through groundwater pumping by the Elsinore Valley MWD. The methods to calculate the values for recharge and discharge model inputs for all planning scenarios for the planning period of 2017 to 2050 are scientifically appropriate and are detailed below:

a. Estimates of deep infiltration of precipitation are based on the expected long-term average of historical estimates of deep infiltration of precipitation developed in the model calibration. Annual estimates of the deep infiltration of precipitation were prepared by Elsinore Valley MWD’s staff for the period of 1990 through 2013. These annual deep infiltration of precipitation values were compared to the annual precipitation at the Riverside County Flood Control and Water Conservation District (RCFCWCD) gage number 67 located downstream of the Canyon Lake Dam where flow from the San Jacinto River enter the model boundary. A regression analysis was developed to predict the annual deep infiltration of precipitation to annual precipitation. The regression equation is provided in Section 4.3.1.1 of Attachment B in the maximum benefit SNMP proposal package.

The TDS concentration of natural precipitation is approximately 15 milligrams per liter (mgl), with a low pH level. Due to the low pH, infiltrating precipitation causes dissolution of minerals increasing the TDS concentration as it transits the vadose zone. For this analysis, the TDS concentration of deep infiltration of precipitation was assumed to equal to the lowest TDS concentration observed in the Basin historically (220 mgl). The nitrate concentration of deep infiltration of precipitation was assumed to be 1 mgl.

b. Estimates of deep infiltration of applied water are based on water supplies that are used for outdoor irrigation, the fraction of potable water used outdoors, and irrigation efficiency. The volumes of water supplies (potable) and recycled water are based on the Elsinore Valley MWD’s historical and projected water supply plans. The fraction of potable water used outdoors is 0.56 for the historical period and 0.5 for the future projections. The equation used to compute the deep infiltration of applied water to the water table within the model boundary is provided in Section 4.3.1.2 of Attachment B in the maximum benefit SNMP proposal package.

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4 The fraction of outdoor water use is reduced in the future due to water conservation and the Elsinore Valley MWD’s recently enacted landscape irrigation ordinances for new development.
Deep infiltration of applied water in the model boundary varies depending on land use data. Outside of the model boundary, deep infiltration of applied water becomes rising groundwater discharge in the San Jacinto River.

The TDS and nitrate concentration of deep infiltration of applied water at the root zone are based on the average TDS concentration in the irrigation supply, the TDS concentration added through application of fertilization which was assumed to be 159 mg/l, and the irrigation efficiency. The nitrate concentration of deep infiltration of applied water was based on the literature review which is 3.3 mg/l.

c. The estimates of streambed infiltration of the San Jacinto River to the model boundary are based on stream gage measurements at USGS gage 11070500 located downstream of the Canyon Lake Dam where the San Jacinto River enters the model boundary and the land use of the watershed upstream of the gage (Canyon Hills sub-watershed). A double mass curve of precipitation and daily stream flow measurements was analyzed to determine the period of record that is considered representative of current watershed land use conditions: 1978 to 2017. To estimate future streambed infiltration, the average annual streambed infiltration for the historical period was adjusted to account for future changes in land use that will increase streamflow. This was accomplished by assuming that 100 percent of the deep infiltration of applied water attributable to the new developments in this sub-watershed will discharge into the San Jacinto River.

The TDS and nitrate sample results collected from the San Jacinto River by RCFCWCD from 1995 to 2005 were used to estimate TDS and nitrate concentration of the streambed infiltration. A regression analysis of the TDS concentration and average daily stream flow measurements corresponding to the sample data was developed to project the TDS concentrations of San Jacinto River in the future. This regression equation is provided in Section 4.3.2 of Attachment B in the maximum benefit SNMP proposal package.

A regression equation for nitrate was not possible due to the lack of relationship between nitrate and flow data. Further inspection of the available data demonstrated that, in general, when the daily flow is less than 80 cfs, the nitrate concentration averaged about 1.5 mg/l and when the daily flow is greater than 80 cfs,

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5 Description of land use data is provided in Section 3.1 of Attachment B in the maximum benefit SNMP proposal package.
6 Based on the discussion on page 5 in Appendix B-1 of Attachment B in the maximum benefit SNMP proposal package.
the nitrate concentration averaged about 0.6 mgl. This algorithm was used to calculate the expected nitrate concentration of the San Jacinto River.

d. Estimates of septic tanks recharges are based on the published septic tank study\(^7\) and the Elsinore Valley MWD’s 2016 Sewer System Master Plan\(^8\) which identified a plan to convert the septic tanks to the sewer system.

It was assumed that the TDS concentration of the septic tank discharges is equal to the wastewater TDS concentration of the Elsinore Valley MWD’s Regional Water Reclamation Facility which treats wastewater generated in the area. The nitrate concentration of the septic tank discharges was assumed to be 30 mgl consistent with the modeling work performed for the septic tank study.

e. Supplemental water recharge is based on the District’s plans to implement an indirect potable reuse (IPR) project in the Elsinore GMZ to meet the increasing water demands of its growing service area. Based on an initial feasibility study, the optimal strategy for IPR is injection of advanced treated recycled water and the project could be sized up to 6,750 afy. The analysis evaluated the future TDS and nitrate concentrations with and without the IPR program. In the scenario that assumes the IPR program is operated (Scenario E), the project is operated beginning in 2030.

The TDS and nitrate concentrations of the injected water were estimated to be 100 mgl and non-detect, respectively, based on the anticipated treatment level (reverse osmosis/micro filtration) and blending assumed in the feasibility study.

f. Estimates of groundwater pumping from the Elsinore GMZ are based on the Elsinore Valley MWD’s pumping activities.\(^9\) The pumping schedule is discussed in Section 4.3.5 of Attachment B.

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\(^9\) There are unquantified number of private wells owners pumping from the GMZ. Additionally, field research efforts by the Elsinore Valley MWD and Bedford-Coldwater and Elsinore Groundwater Sustainability Agencies did not identify relevant private pumping activities in the GMZ. Therefore, the private pumping is assumed to be negligible.
Conclusion 7 – The conclusion that all of the management and facilities options for complying with the existing Basin Plan antidegradation objective of 480 mgl for the Elsinore GMZ (Scenarios B, C, and D) provide no TDS water quality benefit to the groundwater basin, the water supply, or the volume-weighted recharge are reasonable based on the scientific conclusions presented in Conclusions 1 through 7 (Sections 5 and 6 of Attachment B in the maximum benefit SNMP proposal package).

For many hydrologically closed groundwater basins in the Santa Ana Watershed, and other regions, the TDS concentrations of groundwater will increase over time due to agricultural operations (irrigation and animal waste management) and urban landscape irrigation. And, that the amount and rate of TDS concentration increases are not sensitive to the TDS concentration in the water supplies available in the watershed, including recycled water. The TDS concentration projections produced using the models shows that complying with the 480 mgl antidegradation-based TDS objective through the direct treatment of recycled water or groundwater, or by discontinuing the reuse of recycled water will not stop the TDS degradation in the Elsinore GMZ.

Conclusion 8 – The groundwater quality model projections shown in Scenario E demonstrate that the alternative maximum benefit regulatory compliance strategy to amend the Basin Plan to change the Basin Plan TDS and nitrate objectives and require implementation of the maximum benefit commitments can provide significant water quality benefits to the Elsinore GMZ (Section 5 of Attachment B, and Result Section of Attachment A of the maximum benefit SNMP proposal package – pages 21-24).

The analysis results demonstrate that the alternative maximum benefit regulatory compliance strategy improves the TDS concentration of the groundwater supply, the total water supply, the combined recharge quality and ultimately the groundwater basin. Part of this compliance strategy includes IPR which has a positive impact in reducing the TDS and nitrate concentrations of the GMZ. In contrast, constructing and operating desalter(s) to reduce the TDS concentration in recycled water used for irrigation and or desalting groundwater for the same purpose will not stop TDS degradation from occurring.

Conclusion 9 – Economic considerations for alternatives in the proposed Basin Plan amendment are appropriate (Attachment C in the maximum benefit SNMP proposal package, Section 4d in the Staff Report, and Section H in the Substitute Environmental Document).

The supporting documents and evidence for the maximum benefit objective for TDS and nitrate concentrations include an economic assessment of the proposed Basin Plan amendment and alternative regulatory compliance plans that do not establish maximum benefit objectives for the Elsinore GMZ. For each scenario, the costs evaluated include:

- The annual amortization cost of new capital facilities
- The annual operations and maintenance cost of facilities
• The cost associated with required increases in imported water demand
• The “cost” of contributing to climate change, as measured by the increase in energy usage and GHG emissions

The economic assessment provides a sound and supportable evaluation of the potential environmental and financial costs of alternative compliance strategies.

**Conclusion 10 – The proposed maximum benefit TDS objective for the Elsinore GMZ of 530 mgl is appropriate based on hydrologic considerations (Attachment A to the maximum benefit SNMP proposal package – pages 26-27)**

The hydrologic rationale for this objective is as follows:

a. The Elsinore GMZ is a closed groundwater basin and the only way salt can leave the basin is through groundwater pumping. This means that the TDS concentrations in groundwater will increase over time and eventually approach the volume-weighted TDS concentration of the recharge to the basin.

b. For the planning scenarios that excluded the IPR project during the planning period (A/F, B/D and C), the volume-weighted TDS concentration of the combined recharge to the GMZ for the period 2017 through 2050 is about 620 mgl and thus, the groundwater quality of the basin will continue to degrade relative to the current volume-weighted TDS concentration of 520 mgl. By 2050, the TDS concentration of the Elsinore GMZ is projected to be 530 mgl for these salinity management scenarios.

c. The TDS concentration projections demonstrated that even if the controllable factor that contributes to the TDS concentration of recharge to the basin (e.g. TDS concentration of outdoor water supplies) is managed through treatment of the supply sources (recycled water or groundwater) or substitute supply (Scenarios B/D and C), there is no distinguishable improvement in the TDS concentration in the Elsinore GMZ through 2050 relative to a scenario where no salt mitigation is performed (Scenario A/F).

d. A maximum benefit objective of 530 mgl is consistent with the water quality conditions that could reasonably be achieved over a 30-year planning period through the coordinated control of all factors with affect water quality in the basin.

e. A maximum benefit objective of 530 mgl is consistent with previously approved maximum benefit proposals that based the maximum benefit TDS objective concentrations on 30-year planning projections.
f. Downstream beneficial uses will not be impacted because the Elsinore GMZ is operated as a closed basin and has negligible groundwater outflow.

**Conclusion 11 – The proposed maximum benefit nitrate objective for the Elsinore GMZ of 5 mgl is appropriate (Attachment A to the maximum benefit SNMP proposal package – page 27)**

The objective is based on Table A in the Santa Ana Regional Water Quality Control Board’s Resolution 2010-0012, the Declaration of Conformance with the State Recycled Water Policy, which states that this concentration is fully protective of municipal beneficial use. This objective is also consistent with previously approved maximum benefit proposals that have generally limited the objective to one-half of the primary California Maximum Contaminant Level.

**The Big Picture**

Reviewers are not limited to addressing the specific conclusions presented above. Reviewers are also asked to contemplate the following questions:

1. In reading the technical reports and proposed implementation language, are there additional scientific components of the proposed action not described above? If so, please comment with respect to those components.
2. Taken as a whole, is the scientific portion of the proposed action based upon sound scientific knowledge, methods, and practices?

Reviewers should also note that some proposed actions may rely significantly on professional judgement where available scientific data are not as extensive as desired to support the statute requirement for absolute scientific rigor. In these situations, the proposed action is favored over no action.

The preceding guidance will ensure that reviewers have an opportunity to comment on all aspects of the scientific basis of the proposed action. At the same time, reviewers should also recognize that the Santa Ana Regional Water Quality Control Board has a legal obligation to consider and respond to all feedback on the scientific portions of the proposed action. Thus, reviewers are encouraged to focus on the scientific issues that are relevant to the central elements being proposed.
Attachment 3 – List of Participants

Draft Basin Plan Amendment to Adopt the Maximum Benefit Salt and Nutrient Management Plan for the Elsinore Groundwater Management Zone

The maximum benefit salt and nutrient management plan project proponent is the Elsinore Valley Municipal Water District (Elsinore Valley MWD). The Elsinore Valley MWD administered to development of the project proposal, including the supporting technical, economic, and environmental analyses. The Santa Ana Regional Water Quality Control Board (Santa Ana Water Board) worked collaboratively with the Elsinore Valley MWD to initiate and finalize the project from 2015 to 2020.

Elsinore Valley MWD

- Margie Armstrong – Director of Strategic Initiatives
- Parag Kalaria – Water Resources Manager
- Jesus Gastelum – Senior Water Resources Planner/Engineer
- Shane Sibbett – Civil Engineer
- Ganesh Krishnamurthy – former Water Resources Manager
- Norris Brandt – former Assistant General Manager

Santa Ana Water Board

- Hope Smythe
- Jayne Joy
- Cindy Li
- Keith Person
- Ann Sturdivant

The maximum benefit SNMP proposal package was prepared by the Elsinore Valley MWD’s consultant, Wildermuth Environmental, Inc. The following participants provided technical reviews, regulatory interpretation, data acquisition, scientific expertise, and on-the-ground experience working in the watershed.

Wildermuth Environmental, Inc.¹

- Mark Wildermuth*, PE – Principal Engineer, Senior Technical Reviewer
- Samantha Adams*, MESM – Project Manager and Principal Scientist
- Eric Chiang*, PhD – Principal Engineer and Groundwater Modeler
- Veva Weamer*, MS – Supervising Scientist

¹ Note that as of November 9, 2020, Wildermuth Environmental Inc. was acquired by West Yost Associates. All employees marked with a * are now employees of West Yost Associates.
Attachment 3, List of Participants

Gerald Bowes, Ph.D. SWRCB

Peer Review Request of the Draft Basin Plan Amendment to Adopt the Maximum Benefit salt and Nutrient Management Plan for the Elsinore Groundwater Management Zone

- Carolina Sanchez*, PE – Senior Engineer
- Sodavy Ou*, MESM – Staff Scientist
- Leah Gonzalez, MESM – Former Staff Scientist
Attachment 4 – References

Draft Basin Plan Amendment to Adopt the Maximum Benefit Salt and Nutrient Management Plan for the Elsinore Groundwater Management Zone

All available on ftp

References for the Staff Report and key planning documentations:


State Water Resources Control Board

March 9, 2021

Gretchen R. Miller, Ph.D., Associate Professor
Zachry Department of Civil & Environmental Engineering
Texas A&M University
402D Dwight Look Engineering Bldg.
3136 TAMU
College Station, TX 77843

SUBJECT: INITIATION OF REVIEW OF THE DRAFT BASIN PLAN AMENDMENT TO INCORPORATE A MAXIMUM BENEFIT SALT AND NUTRIENT MANAGEMENT PLAN FOR THE ELSINORE GROUNDWATER MANAGEMENT ZONE, RIVERSIDE COUNTY, CALIFORNIA

Dear Professor Miller,

I recently approved you to be a peer reviewer. 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:
   • Attachment 1: Plain English Summary.
   • Attachment 2: Scientific Assumptions, Findings, and Conclusions to Review.
   • Attachment 3: Individuals who Participated in the Development of the Proposal.
   • Attachment 4: References Cited.

2. Document(s) for review.

3. Electronic copies of references cited.

4. Guidance for reviewers, as described after my signature. (Please pay particular attention to the section titled, “The review.”)

All components of the review are posted at a secure FTP site, or addressed in this letter:

- [https://ftp.waterboards.ca.gov](https://ftp.waterboards.ca.gov)
- username: gbowes-ftp26
- password: dTN3q9

E. Joaquin Esquivel, Chair | Eileen Sobek, Executive Director
The findings, assumptions, and conclusions that need review are listed in Attachment 2 of the review request. Please address the subjects you noted you would cover with confidence, in your February 9, 2021 email to me: You will address Conclusions 1, 2, 3, 6a, 6b, 6c, 6d, 6e, 6f, 7, 8, 10a, 10b, 10c, 10d, 10e, 10f, with confidence, and Conclusions 5 and 11 to the extent possible.

I will help with any questions you have. To ensure a clear record of our communication, all of our communications should be in writing (email is preferred).

Please email your reviews to me by Thursday April 8, 2021. I will subsequently forward all reviews and the curricula vitae of all reviewers to the Santa Ana Regional-Water Quality Control Board. All of this information will be posted at the State and Regional Water Boards' Scientific Peer Review web site.

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

Your acceptance of this review assignment is most appreciated.

Sincerely,

Gerald W. Bowes, Ph.D.
Manager, CalEPA External Scientific Peer Review Program
Office of Research, Planning, and Performance
State Water Resources Control Board
1001 “I” Street, 13th Floor Sacramento, California 95814
Gerald.Bowes@waterboards.ca.gov

**Guidance for Reviewers**

**Communication with the Peer Review Program.** As noted above, to ensure a clear record of our communication, all of 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.
- 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 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.

**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.

**The 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 task is to make this determination for the assumptions, findings, or conclusions that the CalEPA External Scientific Peer Review Program has determined you can address with confidence, based on expertise and experience. (If you decide to address other assumptions, findings, or conclusions, identify the expertise and experience you are relying on to do so.) We also invite you to address these questions:

• Are there any scientific subjects that are part of the scientific basis of the proposal that are not described above?
• Taken as a whole, is the proposal based upon sound scientific knowledge, methods, and practices?

**You may have been asked to review the implementation or application of established work.** In some cases, there is a clear, previously-reviewed scientific basis for what you are reviewing but the scientific basis of the specific implementation of it still must be reviewed. For example, a United States Environmental Protection Agency criterion may have a solid peer review record, but you might determine that the proposed implementation or application of the criterion is not based upon sound scientific knowledge, methods, or practices.

**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 Dr. Yoram Rubin (rubin@ce.berkeley.edu).
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 should 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. We want to avoid, as much as possible, CalEPA staff making any kind of modification to your final peer review after you submit it. If your document does not meet accessibility requirements, we may send it back to you to fix and resubmit.

General accessibility criteria include:

- Text. Text should be black, in Arial, size 12 points or larger.
- Non-text elements. If you use them, 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, 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)](link)
- [Microsoft video lessons for accessible Word documents (created by Microsoft)](link)
- [State, Federal, and Other Related Laws & Regulations on Digital Accessibility (created by the California Department of Rehabilitation)](link)

**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, I 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 us.
State Water Resources Control Board

March 11, 2021

Kimberly Rollins, Ph.D.
Professor of Resource and Environmental Economics
University of Connecticut – Department of Agriculture and Resource Economics
1376 Storrs Road Unit 4021
Storrs, CT 06269-401

SUBJECT: INITIATION OF REVIEW OF THE DRAFT BASIN PLAN AMENDMENT TO INCORPORATE A MAXIMUM BENEFIT SALT AND NUTRIENT MANAGEMENT PLAN FOR THE ELSINORE GROUNDWATER MANAGEMENT ZONE, RIVERSIDE COUNTY, CALIFORNIA

Dear Professor Rollins,

I recently approved you to be a peer reviewer. 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:
   - Attachment 1: Plain English Summary.
   - Attachment 2: Scientific Assumptions, Findings, and Conclusions to Review.
   - Attachment 4: References Cited.

2. Document(s) for review.

3. Electronic copies of references cited.

4. Guidance for reviewers, as described after my signature. (Please pay particular attention to the section titled, “The review.”)

All components of the review are posted at a secure FTP site, or addressed in this letter:

- username: gbowes-ftp26
- password: dTN3q9
The findings, assumptions, and conclusions that need review are listed in Attachment 2 of the review request. Please address the subjects you noted you would cover with confidence, in your March 10, 2021 email to me: You will address Conclusion 9.

I will help with any questions you have. To ensure a clear record of our communication, all of our communications should be in writing (email is preferred).

Please email your reviews to me by Thursday April 8, 2021. I will subsequently forward all reviews and the curricula vitae of all reviewers to the Santa Ana Regional Water Quality Control Board. All of this information will be posted at the State and Regional Water Boards’ Scientific Peer Review web site.

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

Your acceptance of this review assignment is most appreciated.

Sincerely,

Gerald W. Bowes, Ph.D.
Manager, CalEPA External Scientific Peer Review Program
Office of Research, Planning, and Performance
State Water Resources Control Board
1001 "I" Street, 13th Floor Sacramento, California 95814
Gerald.Bowes@waterboards.ca.gov

Guidance for Reviewers

Communication with the Peer Review Program. As noted above, to ensure a clear record of our communication, all of 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.
- 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 organization decides to release reviews.
- You 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.

**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.

**The 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 task is to make this determination for the assumptions, findings, or conclusions that the CalEPA External Scientific Peer Review Program has determined you can address with confidence, based on expertise and experience. (If you decide to address other assumptions, findings, or conclusions, identify the expertise and experience you are relying on to do so.) We also invite you to address these questions:

- Are there any scientific subjects that are part of the scientific basis of the proposal that are not described above?
- Taken as a whole, is the proposal based upon sound scientific knowledge, methods, and practices?

**You may have been asked to review the implementation or application of established work.** In some cases, there is a clear, previously-reviewed scientific basis for what you are reviewing but the scientific basis of the specific implementation of it still must be reviewed. For example, a United States Environmental Protection Agency criterion may have a solid peer review record, but you might determine that the proposed implementation or application of the criterion is not based upon sound scientific knowledge, methods, or practices.

**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 Dr. Yoram Rubin (rubin@ce.berkeley.edu).
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 should 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. We want to avoid, as much as possible, CalEPA staff making any kind of modification to your final peer review after you submit it. If your document does not meet accessibility requirements, we may send it back to you to fix and resubmit.

General accessibility criteria include:

- **Text.** Text should be black, in Arial, size 12 points or larger.
- **Non-text elements.** If you use them, 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, 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.
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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, I 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 us.
Sally Thompson, Ph.D., Associate Professor
Civil, Environmental, and Mining Engineering
Faculty of Engineering and Mathematical Sciences
University of Western Australia (M051)
35 Stirling Highway
6009 Perth, Australia

SUBJECT: INITIATION OF REVIEW OF THE DRAFT BASIN PLAN
AMENDMENT TO INCORPORATE A MAXIMUM BENEFIT SALT AND
NUTRIENT MANAGEMENT PLAN FOR THE ELsinore GROUNDWATER
MANAGEMENT ZONE, RIVERSIDE COUNTY, CALIFORNIA

Dear Professor Thompson,

I recently approved you to be a peer reviewer. 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:
   - Attachment 1: Plain English Summary.
   - Attachment 2: Scientific Assumptions, Findings, and Conclusions to Review.
   - Attachment 4: References Cited.

2. Document(s) for review.
3. Electronic copies of references cited.
4. Guidance for reviewers, as described after my signature. (Please pay particular attention to the section titled, “The review.”)

All components of the review are posted at a secure FTP site, or addressed in this letter:

- [https://ftp.waterboards.ca.gov](https://ftp.waterboards.ca.gov)
- username: gbowes-ftp26
- password: dTN3q9
The findings, assumptions, and conclusions that need review are listed in Attachment 2 of the review request. Please address the subjects you noted you would cover with confidence, in your February 8, 2021 email to me: You will address Conclusions 1, 2, 3, 5, 7, 8, 10 and 11, with confidence.

I will help with any questions you have. To ensure a clear record of our communication, all of our communications should be in writing (email is preferred).

Please email your reviews to me by Thursday April 8, 2021. I will subsequently forward all reviews and the curricula vitae of all reviewers to the Santa Ana Regional Water Quality Control Board. All of this information will be posted at the State and Regional Water Boards' Scientific Peer Review web site.

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

Your acceptance of this review assignment is most appreciated.

Sincerely,

Gerald W. Bowes, Ph.D.
Manager, CalEPA External Scientific Peer Review Program
Office of Research, Planning, and Performance
State Water Resources Control Board
1001 “I” Street, 13th Floor Sacramento, California 95814
Gerald.Bowes@waterboards.ca.gov

**Guidance for Reviewers**

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

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

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**The 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 task is to make this determination for the assumptions, findings, or conclusions that the CalEPA External Scientific Peer Review Program has determined you can address with confidence, based on expertise and experience. (If you decide to address other assumptions, findings, or conclusions, identify the expertise and experience you are relying on to do so.) We also invite you to address these questions:

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- Taken as a whole, is the proposal based upon sound scientific knowledge, methods, and practices?

**You may have been asked to review the implementation or application of established work.** In some cases, there is a clear, previously-reviewed scientific basis for what you are reviewing but the scientific basis of the specific implementation of it still must be reviewed. For example, a United States Environmental Protection Agency criterion may have a solid peer review record, but you might determine that the proposed implementation or application of the criterion is not based upon sound scientific knowledge, methods, or practices.

**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 Dr. Yoram Rubin (rubin@ce.berkeley.edu).
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 should 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.

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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 us.
SUBJECT: INITIATION OF REVIEW OF THE DRAFT BASIN PLAN AMENDMENT TO INCORPORATE A MAXIMUM BENEFIT SALT AND NUTRIENT MANAGEMENT PLAN FOR THE ELSINORE GROUNDWATER MANAGEMENT ZONE, RIVERSIDE COUNTY, CALIFORNIA

Dear Professor Lutz,

I recently approved you to be a peer reviewer. 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:
   - Attachment 1: Plain English Summary.
   - Attachment 2: Scientific Assumptions, Findings, and Conclusions to Review.
   - Attachment 4: References Cited.
2. Document(s) for review.
3. Electronic copies of references cited.
4. Guidance for reviewers, as described after my signature. (Please pay particular attention to the section titled, “The review.”)

All components of the review are posted at a secure FTP site, or addressed in this letter:

- [https://ftp.waterboards.ca.gov](https://ftp.waterboards.ca.gov)
- username: gbowes-ftp26
- password: dTN3q9
The findings, assumptions, and conclusions that need review are listed in Attachment 2 of the review request. Please address the subjects you noted you would cover with confidence, in your March 3, 2021 email to me: You will address Conclusion 4 with confidence.

I will help with any questions you have. To ensure a clear record of our communication, all of our communications should be in writing (email is preferred).

Please email your reviews to me by Thursday April 8, 2021. I will subsequently forward all reviews and the curricula vitae of all reviewers to the Santa Ana Regional Water Quality Control Board. All of this information will be posted at the State and Regional Water Boards' Scientific Peer Review web site.

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

Your acceptance of this review assignment is most appreciated.

Sincerely,

Gerald W. Bowes, Ph.D.
Manager, CalEPA External Scientific Peer Review Program
Office of Research, Planning, and Performance
State Water Resources Control Board
1001 “I” Street, 13th Floor Sacramento, California 95814
Gerald.Bowes@waterboards.ca.gov

Guidance for Reviewers

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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.

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CURRICULUM VITAE
GRETCHEN R. MILLER, PH.D., P.E.
Associate Professor, Department of Civil & Environmental Engineering, Texas A&M University
Phone: (979) 862-2581, Email: gmiller@tamu.edu

PROFESSIONAL PREPARATION
University of Missouri, Rolla Geological Engineering B.Sc. 2002
University of Missouri, Rolla Geological Engineering M.Sc. 2003
University of California, Berkeley Environmental Engineering Ph.D. 2009

APPOINTMENTS
Associate Professor Texas A&M University 2016- present
Assistant Professor Texas A&M University 2009 - 2016
Graduate Student Instructor Univ. of California, Berkeley 2008 - 2009
Research Engineer Hydrogeophysics, Inc. 2006 - 2007
Graduate Student Researcher Univ. of California, Berkeley 2005
Project Engineer Shaw Environmental 2004
Graduate Student Researcher Univ. of Missouri, Rolla 2003

RECENT AWARDS
Dean of Engineering Excellence Award, TAMU 2016
Editors’ Citation for Excellence in Refereeing - Water Resour. Res. 2015
Montague Scholar, Center for Teaching Excellence, TAMU 2015
National Science Foundation CAREER Award 2014

REFERRED PUBLICATIONS (SELECTED)
CONSULTING REPORTS


PROFESSIONAL SERVICE

- Board of Directors, Consortium of Universities for the Advancement of Hydrologic Science, Inc (CUAHSI); Chair, 2021, Chair-Elect 2020, Director 2019 – present
- Associate Editor, Hydrological Processes, 2016 – present
- Chair, Interdisciplinary Council, Environmental and Water Resources Institute of the American Society of Civil Engineers, officer from 2014 – present
- Peer reviewer for grant proposals (NSF, NASA, and DOE) and 70+ journal articles
Kimberly Rollins, Ph. D.
Professor of Resource and Environmental Economics
University of Connecticut – Department of Agricultural and Resource Economics
1376 Storrs Road Unit 4021 – Storrs, CT 06269-4021
Tel: (860) 486-4394; E-mail: Kimberly.Rollins@UConn.edu
Mobile: (775) 813-4182

(a) Education and Training

<table>
<thead>
<tr>
<th>Institution</th>
<th>Location</th>
<th>Major</th>
<th>Degree</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Maine</td>
<td>Orono, ME</td>
<td>Zoology</td>
<td>BA</td>
<td>1982</td>
</tr>
<tr>
<td>University of Wisconsin</td>
<td>Madison, WI</td>
<td>Applied Economics</td>
<td>PhD</td>
<td>1990</td>
</tr>
<tr>
<td>Postdoctoral Research Associate:</td>
<td>Joint with University of Wisconsin, Madison and Tropical Agricultural Research and Higher Education Center (CATIE), Turrialba, Costa Rica, 1990-91</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

(b) Professional Experience

- Director, Zwick Center for Food and Resource Policy, 2019 - Current
- Professor and Department Head, Department of Agricultural and Resource Economics, University of Connecticut, Storrs CT, 2019 – current.
- Professor Emeritus, University of Nevada, Reno, August 2019 to current
- Visiting Scholar/Economic Advisor, Environment Canada, a branch of the Government of Canada, Ottawa, Canada, 2014-15
- Professor, Department of Economics, University of Nevada, Reno, 2014-2019.
- Associate Professor, Department of Economics, University of Nevada, Reno, 2011-14.
- Associate Professor, Department of Resource Economics, University of Nevada, 2002-11.
- Visiting Associate Professor, Nicholas School of the Environment, Duke University, Durham, North Carolina, 1998-99.
- Associate Professor, Department of Agricultural Economics and Business, University of Guelph, Guelph, Ontario, Canada, 1998-02.
- Assistant Professor, Department of Agricultural Economics and Business, University of Guelph, Guelph, Ontario, Canada, 1992-98.

(c) Publications from last 4 years


### (d) Current Research Contracts and Grants

<table>
<thead>
<tr>
<th>Year</th>
<th>Title and Source</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020-21</td>
<td>Cost of Dairy Production Survey, State of Connecticut Department of Agriculture</td>
<td>$56,068</td>
</tr>
<tr>
<td>2020-23</td>
<td>Integrated economic assessment of nutrient loadings in watersheds, best practice agricultural management, and environmental policies in the North East. NIFA/CAHNR Capacity Grant award</td>
<td>$90,000</td>
</tr>
</tbody>
</table>
Curriculum Vitae: Assoc. Prof. Dr. Sally Thompson

Personal Details
Full Name: Sally Elizabeth Thompson
Present Position: Associate Professor Environmental Engineering (Hydrology)
Associate Editor, Water Resources Research
Associate Editor, Journal of Hydrology
School of Civil, Environmental and Mining Engineering
The University of Western Australia, Crawley, WA 6009.
Tel: (61) 459959489  Fax (61 8) 6488 1015
Email: sally.thompson@uwa.edu.au
Website: https://research-repository.uwa.edu.au/en/persons/sally-thompson/

Research Interests
Ecohydrology, Hydrology, Climate Change, Complex Systems Science and Nonlinear Dynamics.

Professional History (since 1997)
Since 2019  Associate Professor Environmental Engineering, The University of Western Australia.
Since 2019  Adjunct Associate Professor, Environmental Engineering, The University of California, Berkeley
Since 2017  Clare and Hsieh-Wen Shen Distinguished Research Chair, The University of California, Berkeley
2017-2018  Associate Professor Civil and Environmental Engineering, The University of California, Berkeley.
2011-2017  Assistant Professor Civil and Environmental Engineering, The University of California, Berkeley.
2010-2011  Visiting Assistant Professor Civil and Environmental Engineering, Purdue University

Qualifications
2010  Doctor of Philosophy, Duke University, NC, USA.
2003  Bachelor of Science (hons) and Bachelor of Engineering (hons) University of Western Australia

Selected grants and awards (values in US dollars unless specified)
• 2018 Effects of long-term fire regime on post-fire erosion, NSF, $49,999 (USD)
• 2016 Water balance and Plant Ecophysiology in Coastal California: Linking Models and Mechanisms to project under future climate scenarios. NSF, $726,511
• 2016 Assessing controls on hydrologic connectivity, plant water availability and degradation risk in drylands with isotope tracers and Lagrangian modeling, National Science Foundation – Israeli National Science Foundation, $282,543
• 2016 Jim Dooge Award, best paper in Hydrology and Earth System Science Journal
• 2016 Editor’s Citation for Excellence in Reviewing, Water Resources Research
• 2015 Shifting Baselines in the San Francisco Bay-Delta Watershed: Reconstructing 165 years of Change Through Data Synthesis and Modeling, LA Metropolitan Water District. $117,924
• 2015 CAREER: Fire management effects on Sierra Nevada ecohydrology – a dynamical systems approach, National Science Foundation, $586,987
• 2014 Hydrology and Fire in the Sierra Nevada: A Possible Win-Win, Joint Fire Sciences Program, $395,107
• 2014 The Eel River Critical Zone Observatory: Exploring How the Critical Zone Mediate Watershed Currencies and Ecosystems in a Changing Environment, NSF. $4,899,996
• 2014 US-India Collaborative Research Linking Remote Sensing, Citizen Science and Robotics to Address Critical Environmental Problems in Data Sparse Regions, NSF CNIC. $38,746
• 2014 RAPID: The Endless Summer: Implications of a 100-year drought for the Functional Biology of Native Californian Plants and Ecosystems, NSF. **$180,411**

• 2014 Co-Aerial Ecologist: Robotic Water Sampling and Sensing in the Wild. USDA/National Robotics Initiative. **$142,857**

• 2013 American Geophysical Union Early Career Award in Hydrology

**Professional Service (since 1990)**

Reviewer for over 20 international journals and National and International Research Funding Bodies including The National Science Foundation (U.S), the US Department of Energy and several private foundations.

- Associate Editor, Journal of Hydrology 2019-Present
- Associate Editor, Water Resources Research 2018-Present
- NSF Review Panelist “Hydrology” 2018
- AGU Early Career Hydrology Award Selection Committee, Chair. 2017–2017
- ... Member. 2015–2017
- AGU Horton Award Selection Committee. 2015–2017
- General Sir John Monash Scholarship Application Reviewer. 2014–present
- Handling Editor, Hydrology and Earth Systems Science. 2011–present
- Editorial board member, Advances in Water Resources. 2012–present
- Editorial board member, Ecohydrology. 2015–present
- Editorial board member, Australasian Journal of Water Resources. 2016–present
- NSF Review Panelist “Geoscience Graduate Research Fellowships” 2016
- Department of Energy Earth Sciences Program Reviewer 2012-present
- NSF Hydrological Sciences Program Reviewer 2012-present
- National Geographic Society Grant Reviewer 2014

**Recent Scientific Publications (2020 publications shown here only)**

105 refereed publications & 3 book contributions totalling 3740 citations, h-index 31 & i10-index 67


Alexandra Denise Lutz  
Division of Hydrologic Sciences  
Desert Research Institute  
2215 Raggio Parkway, Reno NV 89512  
alex@dri.edu · ph 775.673.7418 · fax 775.673.7363

Education  

2007  
University of Nevada, Reno Ph.D.  
Graduate Program of Hydrologic Sciences  
Field: Hydrogeology/Water Resources  

2006  
Fulbright Scholarship  
Mali Rural Water Project  
Field: Sustainability of Groundwater  

2002  
University of Nevada, Reno M.S.  
Department of Civil Engineering  
Field: Water Treatment  

2002  
University of Nevada, Reno M.A.  
Department of Literature and Foreign Languages  
Field: German Literature  

1994  
University of Vermont, B.A.  
School of Arts  
Field: Economics/German Literature

Experience  

Work and Research  

2015-Present  
Desert Research Institute (DRI)  
Associate Research Professor  
Division of Hydrologic Sciences (DHS)  
Water Resources, Climate Change, Water Treatment  

2019-Present  
Associate Director  
University of Nevada Reno (UNR)  
Graduate Program of Hydrologic Sciences

2010-2015  
DRI, DHS Assistant Research Professor  
Reno, NV

2008-Present  
UNR, GPHS  
Faculty

2009-Present  
UNR Adjunct Professor  
Department of Geography  
Water Resources, Climate Change, Impact of Development Work

2007-2010  
DRI Post-Doctoral Fellow  
Division of Hydrologic Sciences  

1999-2002  
UNR Graduate Research Assistant  
Department of Civil Engineering  

Lutz CV, Page 1 of 7
1998-1999  **UNR Graduate Teaching Assistant**  
Department of Foreign Languages and Literatures  
**Reno, NV**

1999-2002  **California Water Quality Control Board Engineering Intern**  
Northern Watersheds / Leviathan Mine  
**South Lake Tahoe, CA**

**Teaching/Advising: DRI and UNR**

  UNR / Dept. of Geography / “Water Issues and Development” (GEOG 701n)  
  **Reno, NV**

- 2011-2018  
  **Advisor** to Student Association for International Water Issues (SAIWI)  
  **Reno, NV**

- 2009-present  
  **Major Professor** of Master students (S. Holt, D. Saftner); advisor to Ph.D. student (L. Craig) and Master’s students (B. Anderson, Z. Arno, H. Diehl, H. Fillmore, K. Gastineau, L. Gilbertson, E. Mlawsky, M. Reed, S. Thomas)  
  **Reno, NV**

- 2001-2003  
  **Volunteer/Mentor** in “Get SET” – (Get Science, Engineering and Technology Program) to engage at-risk high school girls to these fields.  
  **Washoe County, NV**

- 1998-1999  
  UNR / Dept. of Foreign Languages and Literature  
  **Graduate teaching Assistant** German 101  
  **Reno, NV**

**Teaching: International Workshops**

- 2019  
  Navajo Nation, STAR school  
  Accredited, two-day teacher professional development workshop on water quality lessons for local classrooms.  
  **Navajo Nation**

- 2018  
  Ministry of Water and Water For People, Kyenjojo, Uganda  
  Hardware/software for monitoring groundwater levels and data management.  
  **Uganda**

- 2011  
  University of Urgench, Uzbekistan  
  Hardware/software for monitoring groundwater levels and calculating water loss from irrigation canals  
  **Uzbekistan**

- 2011, 2013  
  Ghana Rural Water Project, Tamale, Ghana  
  Using Geographic Information Systems (GIS) and associated tools; Res2-D (geophysical software).  
  **Ghana**

- 2009  
  Niger Rural Water Project, Zinder, Niger  
  Mali Rural Water Project, Bla, Mali  
  Advanced MS Office, testing water quality  
  **Niger, Mali**

- 2008  
  Church of Christ, Yendi, Ghana  
  Introduction to GIS and associated tools, MS Office  
  **Ghana**
<table>
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<tr>
<th>Year</th>
<th>Agency</th>
<th>Project Description</th>
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<tbody>
<tr>
<td>2015-2020</td>
<td>USDA</td>
<td>“Native Waters on Arid Lands,” understand the impacts of climate change, and to evaluate adaptation options for sustaining water resources and agriculture, participant.</td>
</tr>
<tr>
<td>2018</td>
<td>Conrad N. Hilton Foundation</td>
<td>“Water Resources Assistance to Water For People and Water4,” find sources of water and monitor their long-term sustainability, PI.</td>
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<tr>
<td>2017</td>
<td>White Pine County, NV</td>
<td>“Data Gather and Assimilation Services” for update to White Pine County Water Resources Plan, PI.</td>
</tr>
<tr>
<td>2015-2017</td>
<td>USGS / Dept. of Interior Southwest Climate Science Center</td>
<td>“Climatic, hydrological, and ecological changes at intermediate timescales in a Great Basin Watershed”, PI.</td>
</tr>
<tr>
<td>2011-2014</td>
<td>World Vision</td>
<td>“Water Projects Regional-Scale Hydrogeologic Mapping and Sustainability of Groundwater” Co-PI.</td>
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<td>2011-2013</td>
<td>US Civilian Research and Development Foundation</td>
<td>“Canal Lining and Afforestation to Prevent Raised Groundwater Tables in Khorezm, Uzbekistan” PI.</td>
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<tr>
<td>2010-2012</td>
<td>Carson Water Sub-Conservancy District / Bureau of Reclamation</td>
<td>“Development of a Regional Water Management Plan for the Carson River Watershed – Analysis of Historical Streamflow Patterns” PI.</td>
</tr>
<tr>
<td>2010-2012</td>
<td>Carson Water Sub-Conservancy District / Bureau of Reclamation</td>
<td>“Development of a Regional Water Management Plan for the Carson River Watershed – Analysis of Historical Streamflow Patterns” PI.</td>
</tr>
</tbody>
</table>

**Synergistic Activities**

**Professional Organizations** Fulbright Association; Nevada Water Resources Association; Registered Engineering Intern, State of Nevada OT4153

**Community Organizations** Board Member, Northern Nevada Math Club

Multi-cultural and multi-faith experience working long-term abroad in developmental and applied science in emerging regions;

Languages: German, French/Spanish, Bambara

Lutz CV, Page 3 of 7
Professional Service  
**Reviewing Responsibilities**


Grant Reviewer for: New Jersey Water Resources Research Institute; Civilian Resources Defense Foundation; National Environment Research Council, UK.

Panel Participant for: National Science Foundation, International Research Experiences for Students (IRES)

Publications and Presentations  
**Referred Publications**


Tang, G., Carroll, R. W., Lutz, A. D., 2016: Regulation of precipitation-associated vegetation dynamics on catchment water balance in a semiarid and arid mountainous watershed., Ecohydrology, DOI: 10.1002/eco.1723


Jabbarov, K., Eschanov, R, Matniyazova, G., Lutz, A., Shanafiend, M., Lamers, J. 2013, Canal Lining to Increase Water Use Efficiency and Remediate

Lutz CV, Page 4 of 7


*Project Reports (locally peer-reviewed)*


Lutz CV, Page 5 of 7


Presentations at Scientific Meetings


Lutz, A., Thomas, J. Engaging students in water resources issues in developing countries. American Geophysical Union Fall Meeting, December 13-17, San Francisco, CA.


*Invited Speaker
Overview

Based on my expertise and experience, I am reviewing the findings, assumptions, or conclusions I agreed I could review with confidence: 1, 2, 3, 6a, 6b, 6c, 6d, 6e, 6f, 7, 8, 10a, 10b, 10c, 10d, 10e, and 10f. After reviewing the materials, I also have confidence that I can comment on Conclusion 11. In this review, I focus on the technical aspects of the Staff Report and the Salt and Nutrient Management Plan as they relate to my primary areas of expertise: groundwater engineering and hydrogeology, evapotranspiration, plant uptake of water and nutrients, and hydrologic modeling.

In general, I find that the proposed action is supported by the best available science and sound modeling practices. I do, however, note and discuss some potentially significant scientific unknowns within the context of the conclusions: 1) the potential for subsurface transfers of water to the Murrieta basin in the southeast (Conclusion 1) and 2) the assumption that Lake Elsinore does not contribute recharge to the basin (Conclusion 6). While these are open scientific questions, I do not disagree with the professional judgement that they would have limited impacts on the results. From a hydrogeological perspective, the analysis makes a strong case for the implementation of the Integrated Resources Plan with the inclusion of indirect potable reuse.

Conclusion #1: The hydrogeologic conceptual model of the Elsinore GMZ used in the analysis is based on accepted and published seminal documents and models that detail the hydrogeology of the GMZ

The hydrogeologic conceptual model used in this analysis follows those previously articulated in the background materials (MWH, 2005; MWH, 2010; Kennedy/Jenks, 2013). The geologic faulting and layering appear to be consistent with these, and the model has been updated appropriately over time. Although the impacts of heterogeneity and faulting on this system are not fully understood, the numerical model represents a reasonable approach based on existing best practices.

However, the description of the Elsinore GMZ as a “hydrologically closed” basin is also important to this analysis, and as such deserves additional scrutiny. Starting from the original GMP document, it is clear that such a statement is an oversimplification. The geometry of the basin is such that it has a physical, subsurface connection with the
Murieta groundwater basin to the southeast (MWH, 2005, pg. 2-35). However, the executive summary makes a more general statement about it being “bounded by either bedrock or faults (pg. ES-5).” According to cross-section presented in this document (Figure 2-6), the two basins are connected via a layer of Fernando Group sediments that extends from an elevation of approximately 1000 ft msl to the ground surface. Thus, the basin is only closed if the water level in the vicinity of this border remains below 1000 ft, or 1100 ft as stated in the accompanying text.

Is this condition met? Based on the available data, it appears that is currently the case. The nearest, regularly monitored well appears to be the Corydon St. Production Well, although MW-2 Deep Monitoring Well is also within this formation and on the southern side of the fault. Based on Figure 2-9 and Table B-1, the Corydon Well typically shows a groundwater elevation of 650 – 750 ft, with the only two historical values (from 1996) exceeding 1000 ft msl (MWH, 2010). Of some additional concern is the failure of the intermediate numerical model to accurately reflect the observed water levels at this well (MWH, 2010, pg. 3-13). In general, it seems possible that pumping in this vicinity is a cause of the disconnection of the two basins. The latest numerical model seems to support this idea as well, as it shows the flow direction in the southeast basin opposite the underlying trend and inward toward the Back Basin area (Kennedy/Jenks, 2013, Figure 4-1).

It should also be noted that Kennedy/Jenks (2013) directly contradicts the idea that the basin is closed, stating: “Minor amounts of outflow occurs from…subsurface outflow from the basin to the Murrieta Basin along the southeastern basin margin.” This newer version of the model prescribes a general head boundary at the basin border to allow for these exchanges, which were previously assumed to be low volume but were “included here because of their potential influence on nitrate concentrations (Kennedy/Jenks, 2013, A-2).”

I do find it plausible that the impact of including these subsurface exchanges would be trivial, or even positively impact the results, such that the proposed action is more strongly supported. However, further analysis or data is needed to support such a statement.

**Conclusion #2: The coupling of the HYDRUS-2D, MODFLOW, and MT3D models to project future TDS and nitrate concentrations in the groundwater of the Elsinore GMZ is appropriate.**

These three software packages were appropriate to use in this analysis and are considered industry standard. They have been used in the manner intended by their original developers and which is consistent with other accepted applications.

The process for “coupling” these codes is harder to follow in the documentation, as they are not coupled in the common scientific use of the term. To my understanding, HYDRUS was run separately from MODFLOW/MT3D in order to develop a set of travel-time based transfer functions. Then these functions, along with a set of empirical
equations, were used to determine the flow and concentration boundary conditions necessary in MODFLOW and MT3D. While codes that more truly couple the processes of relevance are available (e.g., PFLOTRAN), these are typically considered research codes and must be implemented on supercomputing infrastructure. Thus, although the approach taken was not state-of-the-art from a scientific perspective, it is reasonable within the context of this effort.

Conclusion #3: The initial conditions for groundwater TDS and nitrate concentrations in the analysis are based on observed measurements and are scientifically appropriate in characterizing the initial conditions of the GMZ.

The initial concentrations used in the analysis were developed based on a reasonable, recent snapshot of basin conditions. In some key instances, older data were used to develop the plots, and these data may be locally skewing the results. For example, the elevated TDS and nitrate concentrations in the northern area of layer 1 appear to be based on a single monitoring well. This choice could introduce significant error, but given the interpolation method used, I believe it should be limited in its spatial effects. However, it also suggests that hotspots in the basin may need to be monitored more closely in the future.

Conclusion #6: Calculations of the recharge and discharge model inputs for the planning scenarios are based on historical data and science-based projections of changes in recharges and discharges and are appropriate.

The inputs to the hydrogeological model are generally sound and based on available science, although in the future, additional monitoring could improve them. Each of the points are addressed below. I do note a potential issue about inputs not covered at the end.

a) The use of a regression equation relating deep infiltration to annual precipitation is a reasonable simplification, and one that is frequently used in similar efforts (i.e., the Texas Groundwater Availability Modeling program). An r² of 0.76 should be considered satisfactory to very good for this type of relationship, especially when used for a 30-year planning horizon.

b) An outdoor use fraction of 0.56 is consistent with that found in similar arid and semi-arid areas. Further projecting a modest decrease in lawn and garden watering based on conservation efforts seems appropriate.

c) The use of a logarithmic regression equation relating TDS concentrations to river flow rates is a reasonable simplification in the absence of other data. Again, an r² of 0.72 is good. Modeling nitrate as a step function based on flow rate is not as defensible, but in the absence of an alternative, it is acceptable.

d) The septic tank study cited here was quite comprehensive; relying on its data for modeling inputs here is justified.
e) A 10-year construction horizon for the IPR facility seems short but possible. The concentrations and flow rates anticipated, and used as model inputs, are reasonable. The TDS concentration depends entirely on blending practices, but a 100 mg/L is consistent with industry practices.

f) The assumption of a 10-year put/hold/take cycle is necessary in the absence of more detailed climatological predictions.

Aside from these points, I am concerned about the lack of recharge inputs from Lake Elsinore. In the model documentation, I could find little addressing the potential for leakage from the lake. The original conceptual model simply states “Because of the predominance of clay beneath Lake Elsinore, it is assumed that Lake Elsinore itself does not contribute significant recharge to the groundwater basin and the net inflow from the lake is zero (MWH, 2005).” I do not find this argument, which is presented without evidence, compelling. The lake is situated in direct contact with the Recent alluvium (Qal) which consists of “interfingering gravels, sands, silts and clays resulting from streams originating in the surrounding highland areas.” This type of depositional environment is prone to having areas of high permeability sands immediately adjacent to low permeability clays. Given that it covers a large areal proportion of the groundwater basin, even small discharges to the subsurface could be significant. The assumption that no discharge occurs ideally should be revisited or better defended.

Conclusion #7: The conclusion that all of the management and facilities options for complying with the existing Basin Plan antidegradation objective of 480 mg/l for the Elsinore GMZ (Scenarios B, C, and D) provide no TDS water quality benefit to the groundwater basin, the water supply, or the volume-weighted recharge are reasonable based on the scientific conclusions presented in Conclusions 1 through 7.

Based on the science discussed in the previous conclusions, Scenarios B, C, and D would provide only marginal benefits and would not ultimately stop TDS degradation, as assessed by the three metrics described above.

Conclusion #8: The groundwater quality model projections shown in Scenario E demonstrate that the alternative maximum benefit regulatory compliance strategy can provide significant water quality benefits.

Yes, the conclusion that Scenario E would provide significant water quality benefits appears to be well supported by the modeling effort. The main additional component in this scenario is Indirect Potable Reuse, and it is logical that this would be one of the few mechanisms/strategies for long term sustainability in this basin. Since water is essentially circulated through the basin and is subjected to mainly evaporative losses, the only method of improving TDS concentrations in the long-term would be to directly remove salt mass. Scenario E does this via the inclusion of IPR and its use of advanced treatment technology (i.e., reverse osmosis) for significant water volumes.
Scenarios B/C also reduce mass via a proposed groundwater desalter, but they are only required to treat the recycled water and to treat it to a TDS concertation of 480 mg/L. As such, they do not remove the (larger) salt mass needed to improve overall water quality.

**Conclusion #10:** The proposed maximum benefit TDS objective for the Elsinore GMZ of 530 mg/L is appropriate based on hydrologic considerations [as articulated in points a – f.]

The hydrologic rationale for the proposed objective is generally sound. While several potential issues are noted above, in my judgment, these would only create modest errors in the final model outputs. Based on this modeling effort, achieving the 530 mg/L TDS objective should be possible and would be the best possible outcome given the alternatives presented.

**Conclusion #11:** The proposed maximum benefit nitrate objective for the Elsinore GMZ of 5 mg/L is appropriate.

The California and US MCLs for nitrate, which limit its concentration in drinking water to 10 mg/L, have been determined based upon risk assessment practices targeted at protecting the most sensitive populations. A target concentration of 5 mg/L for this basin should preserve its use as drinking water without the need for pretreatment, making it an appropriate objective for the GMZ.

**References**


This peer review addresses: Conclusion 9: Economic considerations

Peer Reviewer: Dr. Kimberly Rollins, Phd  
Professor of Economics and Department Head  
Department of Agricultural and Resource Economics  
University of Connecticut  
Kimberly.Rollins@uconn.edu  
April 17, 2021

Based on my expertise and experience, I am reviewing the findings, assumptions and conclusions I agreed I could review with confidence. This review addresses Conclusion 9, Economic Considerations.

From Page 26, of the Draft Report: “The economic considerations evaluated herein include 1) the net present value of the capital and operating costs of the facilities; (2) the environmental cost of increasing dependence on exports from the Sacramento-San Joaquin Delta, as measured by the increased use of imported water; and (3) the cost of contributing to climate change, as measured by increased energy usage and greenhouse gas (GHG) emissions associated with facilities operations and increased use of imported SWP water.” The supporting documents and evidence for the maximum benefit objective for TDS and nitrate concentrations include an economic assessment of the proposed Basin Plan amendment and alternative regulatory compliance plans. Costs evaluated include the annual amortization cost of new capital facilities, annual operations and maintenance cost of facilities, costs associated with required increases in imported water demand, and “cost” of contributing to climate change, as measured by the increase in energy usage and GHG emissions.

This reviewer finds that the economic assessment is based on sound methods and practices for evaluation of potential environmental and financial costs of alternative compliance strategies.

Peer Review Notes: This review considers the methods as described in Attachment C, and conclusions based on these methods.

The methods are sound and are well-described with transparent assumptions. The analysis demonstrates not only cost savings, but also the environmental costs savings, both locally (water quality) and globally (GHG emissions). Costs are calculated as the differences in costs, by category, between a baseline (Scenario A) and alternative scenarios (these vary by mass removal associated with varying levels of TDS concentrations, water imports to balance discharged recycled water, capital and operating and maintenance costs, energy used, and associated GHG emissions). Costs occur over time, with different components hitting at different times, depending on scenario. As is standard practice, the differences in timing are effectively standardized by representing monetary values in present valued terms. Costs considered are amortized annual costs of capital facilities, and annual operations and maintenance. Present values and amortization allow costs per category and scenario that occur over time to be summed over time into single estimates, as has been done in this assessment.

Environmental costs are represented as net differences in water quantity treated and differences in CO2/GHG emissions among scenarios. The assessment does not convert
environmental costs averted in monetary terms, nor is it necessary in this case, given that these are consistently represented for all scenarios as differences in emissions levels / water quantities. However, for future reference, this reviewer points out that the incremental costs of CO2/GHG emissions are likely to be of increasing importance, as these are not solely local in nature, and are the focus of current and future policy targets. Relevant to the State of California. California is unique among the US states in its progress in CO2 emissions policy (see https://ww2.arb.ca.gov/our-work/programs/cap-and-trade-program). Auctions for permits provide short-term monetary values for GHG emissions averted, with values of these permits likely increasing over the 30-year timeline that this analysis considers. While not necessary for this review economic analysis, this reviewer notes that the auction values for CO2 are valid measures of the economic value of GHG emissions averted. Further, inclusion of these costs demonstrates connections between water policy and CO2 policy. This reviewer (an environmental and natural resource economist) is so very happy to see this component for the precedent that it sets related to water quality policy and GHG emissions/air quality goals for the State. This would also be a solid example, should other states consider similar cap and trade policy options for GHG (and potentially water quality).

Other details: Assumptions are clearly stated and reasonable. Definitions of the baseline scenario and deviations from this baseline are clearly stated. In comparing differences with the baseline (Scenario A), Scenario E shows a Net Present valued benefits (negative cost), with all others resulting in present valued net costs ranging between $29.4 and $79.5 million, demonstrating that of the 4 scenarios, E clearly is the most beneficial. Table C-2 summarizes costs savings, including reduction in energy and GHGs as differences between the Scenario with max benefits to achieve the TDS objective with indirect potable reuse (scenario E) and all others. It is not difficult to follow the logic through to the stated conclusions, that Scenario E clearly represents the alternative with maximum societal net benefits.
March 20th, 2021

Review of: Draft Basin Plan Amendment to Adopt the Maximum Benefit Salt and Nutrient Management Plan for the Elsinore Groundwater Management Zone

Based on my expertise and experience, I am reviewing the findings, assumptions, or conclusions I agreed I could review with confidence, namely: conclusions 1, 2, 3, 5, 7, 8, 10 and 11.

Conclusion 1: The hydrogeologic conceptual model of the Elsinore GMZ used in the analysis is based on accepted and published seminal documents and models that detail the hydrogeology of the GMZ (Section 4.1 of Attachment B in the maximum benefit SNMP proposal package).

This conclusion is supported, with some semantic caveats.

The hydrogeological conceptual model of the Elsinore GMZ is equivalent to that described in the 2005 Groundwater Management Plan and used subsequently. To the extent that this GMP and references therein are “accepted”, “published” and “seminal” this conclusion is indisputable. I would suggest that perhaps “seminal” and “published” are not the correct adjectives to use to describe all documents. Not all are peer reviewed, and I doubt any would be considered “seminal” in the field. It is correct to say that the software used is industry standard. All documents appear to be widely accepted in terms of regional water management and all models are certainly accepted in the field. It may be advisable to limit the conclusion to the statement that the “analysis is based on accepted documents and models”.

I find it hard to imagine, however, that the conclusion as written conveys the most important point for a reviewer to address in considering the subject of the hydrogeological conceptual model. Surely the key issue is whether or not the conceptual model used – regardless of its provenance from past work – provides fidelity to the conditions in the Elsinore GMZ (as described in past studies). Surely this is the most important point to consider, rather than the status of the documents on which the model is based?

Because of this, I will briefly outline why there is good reason to consider that the conceptual model proposed is a valid way to describe the Elsinore GMZ.
Hydrogeological study of the Elsinore GMZ has taken place since the 1950s. The subsurface of the basin is densely sampled – for example the 2005 Groundwater Management Plan references bore logs from ~150 wells, and water level data from ~250 wells. Lithological information from these wells, along with additional geophysical investigations, is sufficient to understand the vertical profile of the subsurface. It is clear that the water bearing formations only occur within the faults which bound the graben in which the GMZ is located.

The extensive faulting in the aquifer has created a very complex subsurface geology, so that even the location of faults is inferred rather than confirmed. However, this uncertainty does not significantly impact the key conclusions for the conceptual model, because key faults forming the boundaries of the basin in the north-east and south-west (the Glen Ivy and Rome Hill Faults) are well mapped and restrict flow; the flow direction within the basin is parallel to the faults that do occur (so that uncertainty around specific fault locations is unlikely to greatly impact predictions of groundwater flow behavior), groundwater levels within the basin are significantly lower than the level of surface water bodies in the area (Lake Elsinore and the San Jacinto River), and the bedrock elevation in the south east (forming the “downgradient end” of the basin) is approximately 1000 feet above the level of groundwater (reflecting the tectonic origins of the basin).

Thus, I would conclude that:
(i) there is ample physical evidence on which to base a conceptual groundwater model for the basin;
(ii) the conceptual groundwater model developed is consistent with past studies, and
(iii) the conceptual groundwater model developed is consistent with the physical evidence from the basin.

Conclusion 2 – The coupling of the Hydrus 2D – Modflow – and MT3D models to project future TDS and nitrate concentrations in the groundwater of the Elsinore GMZ is appropriate.

This conclusion is not well supported.

Again, I take some issue with the precise phrasing of this question and have chosen to interpret it more broadly than it is phrased. There seem to be three issues at play:
(i) Has appropriate modeling software been used for the problem at hand?
(ii) Have the three different models used been appropriately interfaced (“coupled”) to produce reliable and meaningful outcomes?
(iii) Does the resulting model system provide a valid representation of hydrogeology and mass transport in the Elsinore Basin?

I address each of these separately.

Has appropriate modeling software been used for the problem at hand? Yes.
Hydrus represents an industry standard for vadose zone transport, Modflow is the industry standard model for groundwater flow, and MT3D is an appropriate reactive transport model. I do not believe any controversy attaches itself to this part of the conclusion.

Have the three different models used been appropriately interfaced (“coupled”) to produce reliable and meaningful outcomes? Unclear and perhaps not.

This conclusion referred specifically to the coupling of the models. The “coupling” of the models – a term which I interpret to specifically mean “how inputs/outputs from each model are linked together” - is not clearly elucidated in the supporting material.

MT3D can run dynamically within Modflow. I assume that this was what was done in the present study.

The use of Hydrus 2D is less clear. I understand that it has been used primarily to estimate a travel time needed for recharge to pass through the unsaturated zone to the groundwater.

I understand that Hydrus 2D has not been used to estimate the volume of water passing through the unsaturated zone, which instead has been estimated using regression equations of the form: 
\[ D_{IP} = 2.2965 \times P - 2.619 \] for precipitation, where \( P \) is a benchmark measured rainfall volume, and 
\[ D_{AW} = \frac{Q_{aw}}{(1.0 - IE)} \] where \( Q_{aw} \) is the applied water and \( IE \) is the infiltration efficiency.

Similarly, Hydrus 2D has not been used to estimate the concentration of dissolved solids or the concentration of nitrogen species in the recharge.

Given that Hydrus 2D can itself estimate recharge volumes and the associated mass fluxes, I find it unclear that the choice to confine the use of Hydrus to estimating a transport timescale is appropriate and valid.

Does the resulting model system provide a valid representation of hydrogeology and mass transport in the Elsinore Basin? Unclear, and validity is unsupported.

Presumably within the purview of this conclusion is the question of whether the models used produce a valid representation of the way the groundwater system behaves.

I was unable to find any reference to testing/validation of Hydrus 2D, MODFLOW or MT3D in the material presented.

Such a test is usually considered essential to have confidence in the models used.

In the absence of a validation exercise of any description, it is unclear that the resulting model system is a valid representation of the functioning of the Elsinore Basin in terms of water flow or mass transport of solutes.

Conclusion 3 – the initial conditions for groundwater TDS and nitrate concentrations in the analysis are based on observed measurements and are scientifically appropriate in characterizing the initial conditions of the GMZ for the planning scenario analysis.
This conclusion is not adequately supported.

In making this statement I do not want to criticize the specific development of the initial conditions. The decision to treat 2015-2016 as representing initial conditions and to draw on as much data as possible is logical and laudable. The difficulties then encountered, namely the limited number of wells screened solely within each aquifer unit, means that the initial conditions developed for the analysis are an appropriate way to work with the data that are present. The less obvious question is whether this necessary “compromise” in the vertical resolution of the initial condition used has implications for the remainder of the study. It is not clear if this is the case.

That is – it is possible to say that the choice of initial conditions is pragmatic and reasonable. It is not possible to say that it has not impacted the validity of the model findings.

I would strongly suggest that the sensitivity of the modeling to its initial conditions could be undertaken to enable this conclusion to be made more strongly. For example, given the observed TDS and N concentrations, several “extreme” cases of different vertical distributions could be generated and run through the model. If the management objectives are insensitive to these different possible initial conditions, then this conclusion would be supported. However, if the management solutions are sensitive to different plausible vertical distributions of the solute ICs, it would suggest that constructing additional wells allowing multi-level sampling would be important.

In the absence of testing whether the results are sensitive to the imposed ICs, it is not possible to claim that the IC choice is appropriate – even if it is pragmatic, logical and on the face of it reasonable.

**Conclusion 5 – The hydraulic loading rates and travel time applied inside and outside the model domain to simulate the movement of water and TDS and nitrate in the Elsinore Basin Watershed for all planning scenarios are based on scientific data and standard modeling practices.**

This conclusion is only partly supported.

The subdivision of the project area into the Canyon Hills and Elsinore Basin domains is supported based on the conceptual hydrogeological model of the area.

If I understand the treatment of Canyon Hills correctly, the argument is that groundwater is not connected between Canyon Hills and the Elsinore Basin. Connection of the basins is argued to only occur via the San Jacinto Creek, and therefore provided flow in the creek & recharge from the streambed is accounted for, Canyon Hills can be broadly neglected for the purposes of the management plan. This approach is supported in principle. However, there is distinct lack of clarity regarding how this approach was implemented.
Tables B-5 and B6 in Attachment B appear to be missing, and these Tables were meant to detail the hydraulic loading rates from streambed and leach fields.

It is unclear if the rate of flow in San Jacinto Creek is relevant to the streambed leaching that was assumed.

It is unclear if the approach is to model contributions from Canyon Hills via the San Jacinto Creek, and lag them by 1 year (which seems to be indicated by the mention of the 1 year time lag?), or if the approach is to measure flow at the gauge and monitor its concentrations.

Given the potential for significant dilution of groundwater discharge within the stream system by surface flows, it would seem problematic to neglect these potential interactions of the discharged groundwater (and its solutes) with variable volumes of surface flow.

At any rate, more precision regarding the modeling assumptions is necessary. However, I would recommend that before investing effort into rectifying any issues raised here, the sensitivity of the management plan design to possible improvements in methodology in this area should be assessed. That is – simulating some order of magnitude variations in the creek loading and asking if the decisions taken would change – could inform whether it is worth refining the methodology in this area.

Within the model domain, I am not able to support the conclusions with regards to the use of Hydrus 2D, because I have been left with many questions about its use. I will simply list the issues below.

(a) Hydrus 2D is a 2D model. As far as I can tell it has been used for a 1D problem here. Why not use Hydrus1D? What value is added through the 2D capability of the model? Where did 2D flow come into the analysis? This is utterly unclear. Quite possibly a 1D model could be used instead, which may speed up the computation and enable more detailed use of Hydrus’ capabilities.

(b) Hydrus (1D or 2D) is a completely appropriate model to use to infer the flux of water leaving the root zone / unsaturated zone. Firstly, I find it surprising that there has been no intercomparison of the predictions of the regression equations for DIP and DIAW with the predictions of deep boundary fluxes in Hydrus. There is a real risk that the models might disagree on the transport in the vadose zone – in which case the “sense” of merging them would be highly questionable. Conversely, agreement between the models would give confidence in the use of the regression equations. Secondly, Hydrus is an efficient model to run. I do not understand the argument for relying on regression equations rather than directly using recharge output from Hydrus for the purposes of estimating DIAW and DIP.

(c) I have equivalent comments to (b) regarding solute transport, which can also be simulated by Hydrus.
(d) The lack of any validation of Hydrus against observations of water content against depth is problematic. For instance, even in very arid situations, much more rapid infiltration of water than predicted via the matrix flow which is all Hydrus can simulate, is possible (see works by Nimmo regarding e.g. fracture flow paths). Even if matrix flow is the dominant transport mechanism, transport is likely to be highly sensitive to the water retention curve used for the purposes of modeling and it is not at all clear how these retention curves were related to the well lithological properties. There is not a one to one correspondence between soil texture and knowing immediately a correct water retention curve.

Thus, overall, my assessment is that the use of Hydrus 2D is (i) unclear in terms of the dimension of the problem analyzed, (ii) under-utilised as a potential source of information regarding recharge volumes and water quality, (iii) untested, and (iv) the calibration of Hydrus based on well data is unclear. It is possible that this assessment mostly reflects missing information or lack of clarity in the reports provided.

Again, however, I would recommend that before investing effort into rectifying these issues, the sensitivity of the management plan design to possible improvements in methodology in this area should be assessed. Once again I would recommend sensitivity analysis be used to ask how variations in the recharge flux might impact the decisions taken and recommendations made.

Conclusion 7 – The conclusion that all of the management and facilities options for complying with the existing Basin Plan antidegradation objective of 480 mg/L for the Elsinore GMZ provide no TDS water quality benefit to the groundwater basin, the water supply or the volume weighted recharge are reasonable based on the scientific conclusions presented in Conclusions 1-7.

This conclusion – in spite of the concerns raised about methodology earlier in the review – is largely supported. While there is scope to raise concern about some methodological aspects, these aspects largely do not influence the specific management scenarios tested in developing conclusion 7. The finding that management is not sensitive as a determinant of groundwater quality is likely to remain robust regardless of any improvements to the modeling that could be argued for. However, specific predictions of concentrations, their distributions through space or through the vertical profile of the aquifers, and the timing of changes in these spatial distributions should be approached with caution – as these more specifically quantitative measures may be more likely to be influenced by the specific choices made in developing the model.

Please note that this assessment is subject to the correctness of Conclusion 4 and 6 which I have not separately reviewed.
Conclusion 8 – The groundwater quality model projections shown in Scenario E demonstrate that the alternative maximum benefit regulatory compliance strategy to amend the Basin Plan to change the basin Plan TDS and nitrate objectives and require implementation of the maximum benefit commitments can provide significant water quality benefits to the Elsinore GMZ.

It is not clear that this conclusion can be supported.

In particular, the term “significant” is very hard to support in this context. The reason for this is that at this stage there is no assessment that can be made of the uncertainty in the predictions of the model. It is well known that all models contain uncertainty – they are not “right”. What is not well known about any given model is just what that uncertainty looks like – how big it is.

What is clear is that the quantities of change in the TDS concentrations are proportionally small. The 2030 values across the 3 categories considered: – Volume-Weighted TDS of Elsinore GMZ, Volume-Weighted TDS of District-Produced Groundwater Supply and Volume-Weighted TDS of Water Supply Served in the Area Tributary to Elsinore GMZ, show that Scenario E provides effectively no benefit; but by 2050 the benefits are on the order of 5%, 8% and 6% reductions in TDS respectively.

The relevant question is not “is this a good thing?” (clearly any reduction is a good thing, and where a reduction could mean that a water supply stays on the “right” side of a water quality criterion, that will be particularly true). The relevant question is whether we trust the model sufficiently that we believe that changes on the order of 5% are robust and realistic in the face of the considerable uncertainties associated with the model inputs.

No uncertainty estimation, and no sensitivity analyses have been performed, which makes it very difficult to know if these kinds of changes are likely to be robustly predicted by the model. (If the model uncertainty is ~0.5% then we’re in great shape here…). However, based on experience with complex hydrological models in general, errors in a model of ~5% would often be considered quite normal and acceptable. My best estimate is that the predicted changes are not likely to be very different to the uncertainty in the model. This means that it is not necessarily true that they represent significant water quality benefits.

What could be said with more confidence is that there is no evidence that the management proposed in Scenario E would be harmful to the basin. If there are other reasons than water quality improvements that would support the use of these management proposals, then there is no reason to think that water quality should create an impediment to them. However if the reason to adopt Scenario E is 100% motivated by the potential to improve water quality, then the results would not provide a convincing basis on which to proceed – certainly not until uncertainty estimates were made.
Conclusion 10 – The proposed maximum benefit TDS objective for the Elsinore GMZ of 530 mg/L is appropriate based on hydrologic considerations.

The hydrological arguments presented regarding the closed nature of the Elsinore Basin are supported. The overall rationale that relaxing the TDS objective to enable IPR is unlikely to cause harm is supported.

However, as noted above, it is not clear what uncertainties are attached to the concentration predictions associated with the modeling – uncertainties that might impinge upon the suitability of 530 mg/L specifically as a target. Provided uncertainties are on the order of +/-10 mg/L, however, 530 mg/L is appropriate.

Conclusion 11 – The proposed maximum benefit nitrate objective for the Elsinore GMZ of 5 mg/L is appropriate

As this proposal is based on existing guidelines for municipal water use, this is supported.

The Big Picture

The efforts made to understand and model the behavior of the Elsinore GMZ are considerable and represent a laudable effort in the face of a well characterized hydrogeological system, with poorly characterized vertical water quality profiles and poorly characterized vadose zone properties. The modeling effort undertaken provides a good platform by which to compare scenarios and their likely effects on water yield and water quality.

Broadly, the modeling effort appears to have:

(i) Missed some opportunities to make full use of the tools available – specifically Hydrus 2D
(ii) Not considered the importance of sensitivity analysis and uncertainty characterization for the interpretation of model findings.
(iii) Not been documented fully such that complete interpretation of the modeling undertaken was challenging from a reviewer perspective.

Of these points, it is (ii) that is most concerning. If the differences in water quality scenarios were very large then it might be reasonable to expect the differences would be robust to model uncertainties. But the differences are relatively small. And the model uncertainty is not characterized. Basing a decision upon such relatively small changes in model output in the absence of knowing if these small changes are large or small relative to expected errors in model parameters or model performance is risky. In the present case, where the important argument – it seems to me – is less about whether IRP will improve water quality than whether it would harm water quality – the risks may not be so large as in a situation where the decision was hinging on a water quality improvement.
Throughout the study, taking opportunities to validate and test models and to check their sensitivity to errors or changes in the assumptions about inputs could have strengthened this work and would be recommended if similar future studies are to be undertaken. I would also caution against future work repurposing the existing model without carefully considering whether the assumptions made are fit for purpose – particularly with regards to the vadose zone elements.

Allowing for and measuring model uncertainty is not an admission of “failure” to model well. It is a necessary measure to enable end users to understand the risks entailed when relying on a model for decision-making. I would urge the State of California and consultants to the State to embrace and demand a transparent characterization of model uncertainty.

References cited:


CONCLUSION 4: The selection of the six planning scenarios for the projections of potential future water quality outcomes is appropriately based on projected cultural conditions in the Elsinore GMZ.

Section 3.3 Attachment B in the maximum benefit SNMP proposal package describes an approach for six planning scenarios defined for characterizing and quantifying the TDS and nitrate concentration impacts to the Elsinore GMZ resulting from recycled water reuse for a planning period of 2017 through 2050. Land use and water management activities are presented as both cultural conditions and a regulatory paradigm. Difficulties are caused by recycled water exceeding permitted discharge limitations and/or antidegradation objectives.

The Integrated Resources Plan (IRP) identifies a portfolio of nine new or expanded local water supply projects to satisfy more than 22,000 afy of future demands by various means (p 14 Attachment B). All six scenarios assume all nine IRPs to be 100% successful. The timeline is 20 years, so this may be a reasonable assumption. Perhaps at least one scenario should consider less than 100% success of all nine projects during 20 years. A sentence or two explaining why are all likely to be successful and lack of a scenario considering otherwise should be provided.

The “cornerstone” of the IRP is an indirect potable reuse program to recycle wastewater via advanced treatment methods. Only Scenarios E and F consider implementation of indirect potable reuse. Scenario F is considered to be similar to Scenario A, which is identified as “not realistic.” So, only Scenario E considers implementation of indirect potable reuse. If reuse is a cornerstone, it is not clear as to why it is not considered in more than one scenario. A sentence or two explanation should be provided.

Summary: Selection of the six planning scenarios for the projections of potential future water quality outcomes is appropriately based on projected cultural conditions in the Elsinore GMZ.