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Date: March 24, 2026
To: Mr. Zachary Zwahlen, Instream Flow Unit-Supervisor, State Water Board
From: Al Preston, Ph.D., P.E. (CA), Geosyntec Consultants and
Gregory Schnaar, Ph.D., P.G. (VA, WY, AR), Geo-Logic Associates¹
Subject: **Response to Jawitz Comments - Report: “Review of revisions to Model Documentation Report for Groundwater-Surface Water Model for the Ventura River Watershed” from Professor James W. Jawitz, August 2025**

Mr. Zwahlen,

Please see responses including a summary of changes to the model documentation report in response to the second round of peer review comments provided by Professor James W. Jawitz of the University of Florida in August 2025.

Summary of Changes in the Revised Report:

We have revised portions of Sections 2, 5 and 7 of the report to address comments on Findings 1a, 1c, 5b, 7a and 7b. Additionally, formatting issues in Section 7 have been corrected.

Response to Reviewers’ Comments-Reviewer 2: Prof. James W. Jawitz

- **Reviewer’s Comments on Findings 1.a and 1.c:** “The new text in Section 2.7 clarifies that the pumping estimates affected only 29% of the total pumping volume. This was a valuable addition to the report.

The following three comments relate to measured vs estimated pumping rates.

1. The revised text on p. 24 reports that pumping rates for many wells are measured and therefore wells with unknown pumping rates in which estimates are needed are primarily “outside of the OBGJMA [sic] area”. Figure 2.1 shows a map of the wells with measured vs estimated pumping. From that figure, it looks like the number of

¹ Geo-Logic Associates acquired Daniel B. Stephens & Associates, Inc. (DBS&A) in 2016
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wells requiring estimates is larger than the number of wells with measured pumping rates.

Recommendation: I suggest including in Section 2.1 a clear statement of the total number of wells with measured vs estimated pumping rates.

2. A simple method is described on p. 24 for estimating pumping rates for domestic wells “outside of the OBGMA”. But there is a different description on p.28 of how residential demands were estimated. It is not clear which wells this applies to compared to the description on p.24, nor is it clear how these two reported methods are reconciled.

Recommendation: I suggest adding some text to better describe the relationship between these two methods.

3. In part because of the uncertainty of what method is being applied where, the usage of the regressions in Figure 2.3 is not totally clear. Currently p. 29 says “Regressions of per capita use with delivery volume were developed... and used to extrapolate to years with no information.” But this does not describe exactly what information was being extracted from the regression. Table 2.3 lists gpcd [gallons per capita per day] for all years, so my best guess is that the annual deliveries are not known for each year and the regression used these reported gpcd values to estimate the unknown annual deliveries.

Recommendation: My suggestion is to make a more explicit statement such as “The regressions of Figure 2.3 were used to estimate annual deliveries in years with no data based on that year’s reported gpcd.” (Subject to whether I have interpreted the point of this figure correctly). Finally, if that is correct, then note that it is also standard practice to put the independent variable on the x-axis and the dependent variable on the y-axis. So, if the variable to be estimated is indeed annual deliveries, then standard practice suggests this should be on the y-axis.”

- **Response to Comment 1:** There are 231 wells with measurements or self-reported volumes (i.e., reported pumping information), compared to 407 wells that are estimated. The 407 wells that required estimates represent 64% of the total number of wells. However, as stated in the report, the volume of well pumping that required estimates is 29% of the total volume. This additional context has been added in Section 2.1 of the newly revised report, as suggested by the reviewer.
- **Response to Comment 2:** The two methods are used for different purposes. The “simple method” (p. 24 of the April 2025 report) is used to estimate

supplies from non-reported domestic wells, whereas the other method (p.28 of the April 2025 report) is used to estimate overall residential demands (that are supplied by both domestic wells and other sources). The order that these methods were presented led to confusion in the April 2025 report. Specifically, the April 2025 report discussed the simple approach for assigning pumping rates for the domestic wells (Section 2.1) on p.24, before describing the details of the demands (Section 2.3) and supplies (Section 2.4). This created confusion for the reader, and in the revised report (March 2026) the discussion of domestic well pumping volumes has been removed from Section 2.1 and is now entirely discussed in Section 2.4.1, which discusses groundwater supplies. Section 2.4.1 presents an estimate of the supply of water from the non-reported domestic wells that was used as part of the supply side of the analyses. In the revised report (March 2026) this discussion of the non-reported domestic wells occurs after the residential demands are discussed in Section 2.3.1. The residential demands include the entire residential population, and not just domestic wells. The residential demand calculations are independent of the domestic well pumping supply estimates, but both inform the supply and demand analysis. The removal of discussion of domestic well pumping volumes from Section 2.1 in the revised report (March 2026) provides more clarity to the reader.

- **Response to Comment 3:** The gpcd were not used to estimate the unknown deliveries. The gpcd were used to estimate residential demands within each region by multiplying by the applicable population numbers from the United States Census Bureau (2010). The Casitas Municipal Water District (CMWD) delivery volumes were available in all model years and are detailed in Table 2.6. The gpcd data were not available in all model years as noted in Table 2.3, and the missing years were filled by using the regressions developed with the CMWD deliveries as indicated by the ‘Regression’ line in Figure 2.4. Additional clarifications were added in Section 2.3.1 of the revised report (March 2026) to clarify that the gpcd were not available in all model years and that the regressions with CMWD delivery volumes (that were available in all model years) were used to estimate gpcd to fill in the missing years. It is also noted that with this clarification, Figure 2.3 does provide the independent variable (CMWD Total Annual Deliveries) on the x-axis, and the dependent variable (per capita use (gpcd)) on the y-axis, following the standard practice suggested by the reviewer.
- **Reviewer’s Comments on Finding 1.d:** “The new section 2.8 is a valuable addition to the report. For example it is now clear that one-third of the demand is residential and that CMWD deliveries are approximately equal to groundwater pumping.”

- **No response required.**
- **Reviewer’s Comments on Findings 2.a and 2.b:** “The new R2 values in the figures of Appendix B are valuable additions to the report.”
 - **No response required.**
- **Reviewer’s Comments on Finding 5.a:** “The new Table 5.1 with rainfall statistics is a valuable addition to the report, showing similarity between the modeling period and the full record.”
 - **No response required.**
- **Reviewer’s Comments on Finding 5.b:** “Regarding different metrics for groundwater and surface water modeling, this is not a critical issue and is unlikely to affect the important work in this report.

[First] Recommendation: I do not see a need to change this part of the report. The authors are correct that these disciplines were long considered separate enough to develop different standards. However, for future work the authors should recognize that current best practice does not support separate metrics even if relatively obscure regional reports can be found that continue to do this. For example, KGE [Kling Gupta Efficiency] is widely recognized as the most informative all-around metric for any type of modeling, surpassing NSE [Nash- Sutcliffe Efficiency] in popularity in modern use.

Regarding low-flow importance, I agree that somehow transforming the flows with exponents is a dark path best avoided. However, it is important to maintain a clear focus on the main questions of the work. Based on p. 234, I interpreted low flow periods to be important (from p. 234, “Here, the focus is primarily on low-flow periods”). So, it is concerning when (relative) errors in predicting low flows are concluded (p. 204) as “misleadingly high” as a justification for switching to absolute errors in order to enable concluding that errors are low. The model results are largely very good. The text mostly also says this. But are the errors in low flow periods important? If an important model goal is to predict low flows, then what accuracy is needed in those periods for the model to be considered successful? It seems these questions are somewhat sidestepped by instead focusing on the overall good performance during higher flow periods.

[Second] Recommendation: I am not suggesting a new method to transform the flows but rather being specific about the importance of low-flow accuracy during the interpretations in Section 5.4. How accurate is good enough during the low-flow periods?

[Third] Recommendation: Figure 5.30 is revised, but check if it is presented twice? (pp. 221 and 226)”

- **Response to First Recommendation:** We agree with the reviewer that “Regarding different metrics for groundwater and surface water modeling, this is not a critical issue and is unlikely to affect the important work in this report”. Our approach followed standard and long-accepted methods for hydrologic modeling; for example, the same approach was used by the United States Geological Survey, the developers of GSFLOW, in its Santa Rosa Plain study (Woolfenden & Nishikawa, 2014).

More specifically we note that the NSE coefficient used in the VRWM calibration (Nash & Sutcliffe 1970) has widely been applied in hydrologic modeling for 50 years. The KGE metric recommended by the commenter (Gupta et al., 2009) and its variant (Kling et al., 2012) have become more prevalent in the last decade. The relative merits of NSE and KGE continue to be an area of active research (e.g., Williams 2025; Clark et al., 2026)). In our work, NSE (referred to in the report as NSME) is used as one line of evidence, together with other standard calibration statistics (i.e., RMSE, scaled RMSE, correlation coefficient and mean error for groundwater elevations, and PAEE, AAEE, NSME, seasonal volume errors, summer RMSE and summer mean error for streamflow)² and plots (i.e., 1:1 line chart and hydrograph timeseries for groundwater, and timeseries plots and exceedance curves for surface water), as well as comparisons to wet-dry mapping to demonstrate overall model calibration.

The modeling report presents both relative (Tables 5.5 and 5.6) and absolute (Table 5.7) errors for the summer (low) streamflow. We did not “switch” statistical metrics, but rather, we present both sets of statistical metrics, as each offers useful context. Absolute errors are particularly informative for lower flows. Table 5.7 specifically reports calibration statistics for summer flows after removing wet years with higher summer flows, and thus directly demonstrates the accuracy of the low flow calibration. For these reasons, we do not agree with the reviewer’s suggestion that the analysis emphasized higher-flow periods at the expense of low-flow calibration.

- **Response to Second Recommendation:** The documentation of model errors in the report, and specifically Table 5.7, enables model users to consider the errors and make allowances in their specific application, including for applications evaluating low flow. For example, one application for the VRWM is to evaluate flows for fish passage, with flow requirements being a function

² RMSE = root-mean-square error, PAEE = percent average estimation error, AAEE = absolute average estimation error, NSME = Nash-Sutcliffe model efficiency.

of fish biology and channel hydraulics (e.g., flow, depth, and velocity). The provision of model errors in the VRWM documentation enables uncertainty to be considered (e.g., by including a statistical error bar or buffer on the modeled flows).

- **Response to Third Recommendation:** The track changes in the Word document (p.221 of the April 2025 report) included two instances of the same figure and in the revised report (March 2026) the extra figure was removed. The same issue in Section 7 was also corrected in the revised report (March 2026).
- **Reviewer’s Comments on Findings 7.a and 7.b:** “The additional text on p. 268 is a valuable addition, explaining the role of groundwater in increasing streamflow in the ‘unimpaired’ scenario at two gages (604 and 605A/605) of the four gages discussed in this section.

However, regarding the other two gages, the data in Figures 7.5 and 7.6 clearly show no difference (overlapping IQRs [inter-quartile ranges] in the seasonal box plots) between the unimpaired scenario and the calibration/validation period. The authors declined a t-test because it will also show no difference.

Recommendation: Instead of seasonal box plots, consider box plots based on flow quartiles. For example, in Figure 7.2 the unimpaired flow scenario and the baseline results are exactly the same under both high- and low-flow conditions. However, at intermediate flows the unimpaired scenario indeed does have systematically higher flows. The seasonal box plots do not capture this systematic difference because intermediate flows are not restricted to individual seasons. In Figure 7.1 the range of flows where the unimpaired scenario predictions are higher is even narrower (only at the lowest flows), but there appears to be a systematic difference in that interval.

Finally, of the two gages where the unimpaired scenario does not significantly affect streamflow (Figures 7.1 and 7.2), at one of them the model does not describe the measured low flow conditions (Figure 7.2), which occur more than 30% of the time. This discrepancy is far larger than between the calibration and unimpaired scenario and is perhaps worthy of further elaboration. Are the data reliable here at low flows? If so, then why is the behavior so different here compared to the other locations?

In conclusion, because the whole report is leading up to these scenarios, it seems important that the conclusions from the scenarios should be well supported by data analysis.”

- **Response to Comments 7a and 7b:** There are differences between the calibration/validation (existing condition Water Year [WY] 1994-WY2017) simulation and the unimpaired flow scenario simulation results in Figures 7.1,

7.2, 7.5, and 7.6. The differences in the model outputs are due to removal of surface water diversions and removal of groundwater pumping upstream and upgradient of the gages in the unimpaired flow scenario. The differences are distinguishable in the time series and exceedance curves of Figures 7.1 and 7.2, as well as the box and whisker plots in Figures 7.5 and 7.6.

The seasonal box plots (Figures 7.5, 7.6, 7.7, and 7.8) show the difference in flow quartiles in each season. These plots have been updated to include box plots across all seasons (flow quartiles), as suggested by the reviewer.

The reviewer correctly notes that the measured flow at Gage 607 is zero more than 30% of the time. Gage 607 is located at the Robles diversion structure at the upstream end of the intermittent reach as classified by USGS (USGS 2017). Gage 607 measures flow that continues downstream past the diversion structure. Zero flow may occur naturally at this location (i.e., in the intermittent reach), but may also be the result of the Robles diversion structure blocking surface flows upstream during low flow conditions, which results in surface water going underground. Neither the model calibration/validation, nor the unimpaired flow scenario replicate this condition in part due to the hydraulics of the Robles diversion structure not being represented in the model. This is explained in Section 5.4.1.1 of the April 2025 report with reference to Figure 5.16. Additional explanation and context have been provided in Section 5.4.1.1 of the revised report (March 2026), including reference to the wet/dry maps and flow rates downstream at Gage 608 that support the modeling approach.

In summary, the revised report (March 2026) provides additional information and data analyses that support the conclusions from the unimpaired flow scenario.

Thank you for the opportunity to respond to the peer review comments.



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References

Clark, M.P., Knoben, W.J.M., Spieler, D., Grundemann, G.J., Thebault, C., Vasquez, N.A., Wood, A.W., Song, Y., Shen, C., Carney, S., van Werkhoven, K., 2026. Comment on Williams (2025): “Friends don't let friends use NSE or KGE for hydrologic model accuracy evaluation: A rant with data and suggestions for better practice”. *Env. Modelling and Software* 197 (2026) 106869.

Gupta, H.V., Kling, H., Yilmaz, K.K., Martinez, G.F., 2009. Decomposition of the mean squared error and NSE performance criteria: implications for improving hydrological modelling. *J. Hydrol.* 377 (1–2), 80–91.

Kling, H., Fuchs, M., Paulin, M., 2012. Runoff conditions in the upper Danube basin under an ensemble of climate change scenarios. *J. Hydrol.* 424, 264–277.

Nash, J.E., Sutcliffe, J.V., 1970. River flow forecasting through conceptual models part I—A discussion of principles. *J. Hydrol.* 10 (3), 282–290.

U.S. Census Bureau (USCB). 2010. Block Maps – 2010 Census. United States: Department of Commerce: Bureau of the Census. Accessed March 2020. URL: <https://www.census.gov/geographies/reference-maps/2010/geo/2010-census-block-maps.html>

U.S. Geological Survey (USGS). 2017. National Hydrography Dataset Plus High Resolution - USGS National Map Downloadable Data Collection. United States: Department of the Interior: Geologic Survey. Accessed August 2017.

Williams, G.P., 2025. Friends don't let friends use Nash-Sutcliffe Efficiency (NSE) or KGE for hydrologic model accuracy evaluation: A rant with data and suggestions for better practice. *Env. Modelling and Software* 194 (2025) 106665.

Woolfenden, L.R., and T. Nishikawa, eds. 2014. Simulation of groundwater and surface-water resources of the Santa Rosa Plain watershed, Sonoma County, California. U.S. Geological Survey Scientific Investigations Report 2014–5052 258 pp. Prepared in cooperation with California: Sonoma County Water Agency, City of Santa Rosa, City of Sebastopol, City of Rohnert Park, City of Cotati, Town of Windsor, County of Sonoma, and California American Water. URL: <http://dx.doi.org/10.3133/sir20145052>