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Attorneys for Cross-Defendant
CASITAS MUNICIPAL WATER DISTRICT a California special district

SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF LOS ANGELES, COMPLEX

SANTA BARBARA CHANNELKEEPER, a California non-profit corporation, Petitioner, vs. STATE WATER RESOURCES CONTROL BOARD, a California State Agency; CITY OF SAN BUENA VENTURA, a California municipal corporation, incorrectly named as CITY OF BUENA VENTURA, Respondents.	Case No. 19STCP01176 *Judge: Hon. William F. Highberger* *Dept: 10* **CASITAS MUNICIPAL WATER DISTRICT'S C.C.P § 843 SUPPLEMENTAL EXPERT WITNESS DESIGNATION AND DISCLOSURE; DECLARATION OF JEREMY N. JUNGREIS IN SUPPORT THEREOF**
CITY OF SAN BUENA VENTURA, a California municipal corporation, Cross-Complainant, vs. DUNCAN ABBOTT, et al., Cross-Defendant.	Date Action Filed: September 19, 2014 Phase 1 Trial Date: February 14, 2022

Pursuant to Code of Civil Procedure ("C.C.P.") Sections 843, as well as the Court's July 23, and November 23, 2021 Orders,[1] Cross-Defendant Casitas Municipal Water District ("Casitas") hereby discloses its retained supplemental expert witness for the Phase 1 trial[2] scheduled to commence on February 14, 2022. In providing this disclosure, Casitas reserves the right to ask opinion questions, or expert witness questions, of any and all witnesses who, although experts, are also percipient witnesses to issues or facts raised in this case. Subject to C.C.P Section 843, and the deadline imposed by the Court for Casitas to disclose supplemental experts by December 3, 2021, Casitas anticipates calling the following supplemental expert to testify at trial:

Dr. Jim McCord, Ph.D., P.E.
Groundwater Lead /Water Resources Engineer
Lynker-Intel, LLC
5445 Conestoga Court, Suite 100
Boulder, CO 80301

The qualifications and expected testimony of this expert are set forth in the Supplemental Expert Witness Report that is being produced to all parties concurrently herewith. Casitas reserves the right, per the Court's November 23, 2021 order, to call additional rebuttal or impeachment expert witnesses to provide opinion and non-opinion testimony, once all expert and supplemental expert witnesses of all other parties have been designated. Further, Casitas reserves the right to supplement this disclosure, and to designate and call at the time of trial, such other expert witnesses as may be appropriate and authorized by the Court.

Dated: December 3, 2021

Respectfully submitted

By: _____

Jeremy N. Jungreis
Douglas J. Dennington
Attorneys for Cross-Defendant
CASITAS MUNICIPAL WATER DISTRICT

[1] At the Court's November 23, 2021 hearing, the Court granted Casitas' motion to designate expert witnesses in Phase 1 of the Litigation, and the Court's order of November 23 also included authorization for Casitas to designate supplemental experts on or before December 3, 2021. (Jungreis Decl.: ¶2, Ex. 1.)

[2] The scope of the Phase 1 trial has not, as of yet, been definitively determined by the Court.

DECLARATION OF JEREMY N. JUNGREIS

I, Jeremy N. Jungreis, declare:

1. I am a partner in the law firm of Rutan & Tucker, LLP, the attorneys of record for Cross-Defendant Casitas Municipal Water District ("Casitas"). I am licensed to practice law before all courts in the State of California. Unless otherwise stated, I have personal knowledge of the facts set forth herein and if called and sworn as a witness, could and would testify competently thereto.

2. Casitas designates as a supplemental expert witness at the Phase 1 trial of this matter the following retained expert: Dr. Jim McCord, Ph.D., P.E. Dr. McCord's Supplemental Expert Designation is in addition to Casitas' prior designation of Mr. Jordan Kear as an expert, both of which were authorized by the Court's order of November 23, 2021. A true and correct copy of the minute order issued by the Court after the November 23, 2021 hearing is attached hereto as Exhibit 1.

3. I am informed and believe that Dr. McCord is an expert in hydrogeology and the modeling of surface and groundwater interface with extensive experience reviewing and commenting upon surface and groundwater models. A copy of his Supplemental Expert Witness Report for Phase 1 of this adjudication, which contains his opinions and the bases for those opinions, is enclosed with this Supplemental Expert Disclosure as Exhibit "2." Although this Supplemental Report is intended, among other things, to contain Dr. McCord's affirmative opinions regarding the unsuitability of the State Water Resources Control Board's Groundwater-Surface Water Model of the Ventura River Watershed ("SWRCB Model") for use in quantification of surface water – groundwater interactions in the Ventura River Watershed, it does not foreclose opinions that may be formed by Dr. McCord in rebuttal or otherwise supplemented.

4. A copy of Dr. McCord's CV is enclosed as Exhibit "A" to his Supplemental Expert Witness Report. Dr. McCord's CV and Supplemental Expert Witness Report include statements reflecting his background, qualifications and experience, and rates as required by C.C.P. 843. Dr. McCord has agreed to testify at trial, and he will be sufficiently familiar with the pending action to submit to a meaningful oral deposition concerning the specific testimony, including the opinions

and bases for the opinions, that he is expected to give at trial.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Dated: December 3, 2021

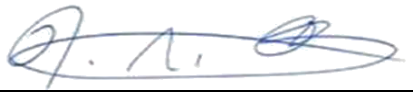
By: 
Jeremy N. Jungreis

Exhibit “1”

EXHIBIT 1

SUPERIOR COURT OF CALIFORNIA, COUNTY OF LOS ANGELES
Civil Division
Central District, Spring Street Courthouse, Department 10

19STCP01176 November 23, 2021
SANTA BARBARA CHANNELKEEPER vs STATE WATER RESOURCES CONTROL BOARD, et al. 9:00 AM

Judge: Honorable William F. Highberger
Judicial Assistant: P. Martinez
Courtroom Assistant: R. Sanchez

CSR: Tracy Dyrness, CSR# 12323
ERM: None
Deputy Sheriff: None

APPEARANCES:

For Plaintiff(s): No Appearances

For Respondent(s): Jeremy N. Jungreis for Douglas J. Dennington; Shawn David Hagerty

NATURE OF PROCEEDINGS: Hearing on Motion - Other Late Designation of Experts; Hearing on Motion - Other Late Designation of Experts by Loa Bliss; Further Status Conference

Pursuant to Government Code sections 68086, 70044, and California Rules of Court, rule 2.956, Tracy Dyrness, CSR# 12323 , certified shorthand reporter is appointed as an official Court reporter pro tempore in these proceedings, and is ordered to comply with the terms of the Court Reporter Agreement. The Order is signed and filed this date.

The matters are called for hearing.

The parties have been previously provided with the Court's tentative ruling.

Motion of Loa Bliss, As Trustee, Etc., For Extension Of Time Re Disclosure Of Experts: Granted

After hearing oral argument, The Court rules as follows:

Motion of Casitas Municipal Water District (“Casitas MWD”) Motion To Serve Untimely Expert Witness Disclosures: Granted

The deadline for presentation of Supplemental Reports by Kear and any other disclosed expert remains December 3, 2021.

The Court sets the deadline for Rebuttal Experts for January 7, 2022. The Upper Ojai Basin rebuttal expert deadline is 2/01/22.

Discovery cut-off is modified to 02/10/22.

19STCP01176 November 23, 2021
SANTA BARBARA CHANNELKEEPER vs STATE WATER RESOURCES CONTROL BOARD, et al. 9:00 AM

Judge: Honorable William F. Highberger
Judicial Assistant: P. Martinez
Courtroom Assistant: R. Sanchez

CSR: Tracy Dyrness, CSR# 12323
ERM: None
Deputy Sheriff: None

City of Ventura is to give notice.

Order to Show Cause Re: Why The Court Shouldn't Determine Certain Watershed Boundaries According To The Terms Of Notice Of Hearing Filed By City Of Ventura is scheduled for 12/09/21 at 02:30 PM in Department 10 at Spring Street Courthouse.

Hearing on Motion for Judgment on the Pleadings (City of Ojai) is scheduled for 01/18/22 at 01:30 PM in Department 10 at Spring Street Courthouse.

City of Ventura is to file brief regarding the Antelope Evaluations case by 11/30/21.

City of Ojai is to file a response by 12/07/21.

Deadline for objections to Judicial Notice is 12/08/21.

City of Ojai to give notice.

On 12/06/21 the Court will post the structure for the 12/09/21 hearing.

City of Ventura is to give notice.

** Additional Appearances**

(telephonic)
Peter Duchesneau for Aera Energy, LLC
Gina Angiolillo for AGR Breeding, Inc.
Brian E. Moskal for Baldwin Ranch, LLC
Noah Golden-Krasner for California Department of Fish & Wildlife
Christopher Pisano for City of Buenaventura
Holly Jacobson for City of Ojai
Claude R. Baggerly for Claude R. Baggerly
Ryan Blatz for Erica J. Abrams
Laura R. Schreiner
Loa E. Bliss (Roe 27)
Neal Maguire for Rancho Matilija Mutual Water Company
Gregg Garrison for Rosanna Garrison

SUPERIOR COURT OF CALIFORNIA, COUNTY OF LOS ANGELES

Civil Division

Central District, Spring Street Courthouse, Department 10

19STCP01176 November 23, 2021
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Judge: Honorable William F. Highberger
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Courtroom Assistant: R. Sanchez

CSR: Tracy Dyrness, CSR# 12323
ERM: None
Deputy Sheriff: None

Daniel Cooper for Santa Barbara Channelkeeper
Scott Slater for Santa Barbara Channelkeeper
Adam Kear for Senior Canyon Mutual Water Company
Marc N. Melnick for State Water Resources Control Board
William Carter for The Thacher School
Nathan Metcalf for Ventura County Watershed Protection District
Jeanne M. Zolezzi for Ventura River County Water District
Brad Herrema for Wood-Claeyssens Foundation

Exhibit “2”

Prepared for: Rutan and Tucker, LLP, Counsel for Casitas Municipal Water District

Supplemental Expert Report on the California State Water Resources Control Board's *Groundwater-Surface Water Model of the Ventura River Watershed*

December 2021

Prepared by:
One-Water Hydrologic, LLC, San Diego, California
Lynker-Intel LLC, Boulder, Colorado and **GSI Water Solutions Inc.**, Santa Barbara, California

ONE WATER

Lynker INTEL

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Abbreviations and Acronyms

AF	acre-feet
AFY	acre-feet per year
CalPIP	California Pesticide Information Portal
CDFW	California Department of Fish and Wildlife
cfs	cubic feet per second
CMWD	Casitas Municipal Water District
CWRP	Comprehensive Water Resources Plan
DBS&A	Daniel B. Stephens and Associates
DWR	California Department of Water Resources
ET	Evapotranspiration
Flood MAR	Floodwater Managed Aquifer Recharge
ft amsl	feet above mean sea level
Geosyntec	Geosyntec Consultants
GHB	General-Head Boundary Package
GSA	Groundwater Sustainability Agency
GSFLOW	Groundwater Surface-water Flow Model
GSI	GSI Water Solutions, Inc.
GSP	Groundwater Sustainability Plan
GW-SW	Groundwater-Surface Water
IHM	Integrated Hydrologic Model
HFB	Horizontal flow barrier
LiDAR	Light Detection and Ranging
MNW2	Multi-aquifer (Well Package)
MODFLOW-NWT	Newton Formulation for Modflow-2005
NMFS	National Marine Fisheries Service
OBGM	Ojai Valley Basin Groundwater Model
PDO	Pacific Decadal Oscillation
POR	Period-of-Record
PRMS	Precipitation-Runoff Modeling System
PMAs	projects and management actions
SFR2	Streamflow Routing (Package version 2)
SGMA	Sustainable Groundwater Management Act
Study Plan Review	*Review of the California State Water Resources Control Board's December 2019 Final Study Plan for the Development of Groundwater-Surface Water and Nutrient Transport Models of the Ventura River Watershed*
SWRCB	State Water Resources Control Board
TMDL	total maximum daily load
VRW	Ventura River Watershed
VSWHM	Ventura Surface Water Hydrology Model
WY	Water Year

SECTION 1: INTRODUCTION

At the request of Rutan and Tucker LLP and Casitas Municipal Water District ("Casitas" or "CMWD"), a team of water resources/hydrogeology experts assembled by GSI Water Solutions, Inc. (GSI), has been closely tracking the development and application of the three-dimensional (3D) integrated hydrologic model and nutrient transport model for the Ventura River watershed. The Ventura River Watershed Groundwater-Surface Water Model (VRW GW-SW Model) is being developed under the auspices of the State Water Resources Control Board and Los Angeles Regional Water Quality Review Board (collectively referred to below as "Water Boards").

The expert hydrogeologic modeling team reviewing the development and application of the VRW-SW-GW model is comprised of specialists from One-Water Hydrologic LLC, Lynker-Intel LLC, and GSI. The qualifications of the testifying expert is provided in **Section 8**.

Specific tasks undertaken by Casitas' review team since early 2021 have included:

1. A detailed technical review of the *Final Study Plan for the Development of Groundwater-Surface Water and Nutrient Transport Models of the Ventura River Watershed* (Study Plan or Plan; Geosyntec and DBS&A, 2019). The results of this review were formally submitted to the water boards in July 2021, and no response has been received as of this date,
2. Attendance at model development webinars sponsored by the Water Boards, specifically a series of three webinars on model develop in May and June 2021, as well as the model scenario development webinar held in November 2021,
3. Downloading model files, and preliminary evaluation of selected the model inputs and outputs for the baseline calibration and "unimpaired flow" scenario models as posted on the Water Boards model website (October 2021). As part of the process model review process, the Casitas expert reviewers noted that some key model files were missing, and a formal request for those files was made to the Water Boards for those files. Thus, the review to date should be considered preliminary until the additional files are obtained to support model testing.

This technical memo provides a summary of key findings and opinions developed based on all of these model review activities which have been underway for most of 2021. To facilitate the court consideration of the review findings, a summary of findings and opinions is provided next in **Section 2**. The summary of findings is followed by more detailed data and information that support those opinions. The details are summarized in separate **Sections 3, 4,** and **5** related to task items 1 through 3 above, respectively.

SECTION 2: SUMMARY OF OPINIONS

Based on the detailed review effort as introduced above, the Casitas hydrogeologic modeling expert team has developed the following overarching opinion:

- The Ventura River Basin Integrated Watershed model has a number of outstanding issues and uncertainties that render the current model unsuitable for use in quantification of surface water – groundwater interactions.

This overarching opinion arises from a synthesis of several other findings from this initial review, specifically:

1. Based on selected hydrologic properties and flow features, the model appears to be "too leaky;" specifically, the (i) interlayer flow may be overestimated due to high vertical conductivity for model layers, (ii) the stream leakage may be overestimated due to high streambed conductance, and (iii) wellbore flows larger than expected;
2. The apparent overestimation of stream leakage may be related to interlayer flows as well as potentially unrealistic wellbore flow parameters used to represent multi-aquifer wells (MNW) in the model;
3. The model appears to underestimate runoff during wet years, and overestimate runoff during dry years, this was inferred by comparing model results to Lake Casitas stage data and to estimates of ungaged tributary inflows to the reservoir;
4. The model does not accurately simulate streamflow, Robles diversion, or reservoir flows based on initial comparisons with the Foster Park gage (VC 608), Robles Diversion, and Lake Casitas Reservoir stage;
5. The geologic data compilation, mapping, and synthesis conducted early in the project (DBS&A, 2018) revealed numerous faults and steeply dipping layers in the bedrock formations, potentially leading to large gradients across faults, and/or extreme Kv:Kh hydraulic conductivity anisotropy ratios. The VRW SW-GW model, however, does not employ HFB (Horizontal Flow Boundary) package nor any other special treatment for simulating these other geological structures.

SECTION 3: REVIEW OF MODEL DEVELOPMENT PLAN

As noted in the Introduction, the first step for the expert team was a detailed technical review of the *Final Study Plan for the Development of Groundwater-Surface Water and Nutrient Transport Models of the Ventura River Watershed* (Study Plan or Plan; Geosyntec and DBS&A, 2019). A formal report documenting that review and associated findings was submitted to the Water Boards by Casitas in July 2021. That review is briefly summarized here, but the reader is referred to the original report for details. It has been attached as .

This Study Plan review remains relevant, as many of the issues identified in Casita's expert review were unresolved through the Water Boards webinars conducted to date, and through review of uploaded model files. Those two topics are covered below in **Section 4** and **Section 5**, respectively.

Section 1. Introduction of the Study Plan provides a high-level background and summary of objectives. It is noted by reviewers that the background summary is provided at such a high level that it fails to mention several important ongoing activities that may share both overlapping and diverging goals and objectives, such as the Sustainable Groundwater Management Act (SGMA) and the Ventura River Basin groundwater adjudication process. Similarly, other relevant completed and ongoing projects in other parts of the state of California that could have provided lessons learned and guidance for the project were not cited.

The Study Plan states that the model will meet the following seven objectives:

1. *Estimate existing instream flows at multiple points of interest (POI) throughout the entire Ventura River Watershed;*
2. *Predict unimpaired flow at each POI that would occur with no water diversions, pumping, or storage;*
3. *Evaluate how water use affects the water balance and instream flows;*
4. *Simulate groundwater pumping and groundwater-surface water interactions to understand groundwater effects on instream flows;*
5. *Ensure that the model simulation period is long enough to reasonably capture the variability of the full range of water year types from drought to flood years;*
6. *Create a nutrient transport model to inform nitrogen source assessment in the Ventura River Watershed; and*
7. *Simulate the effects of the December 2017-January 2018 Thomas Fire on hydrology, nitrogen transport, groundwater levels, and instream flows.* (Geosyntec and DBS&A, 2019)

Again, this review found the goal statements overly general and imprecise. It remains unclear as to how the goals would be approached in the models, and, in some cases (e.g., Objective 1) the Study Plan fails to evaluate the feasibility of meeting the goals as stated. As noted below in Sections 3 and 4, most of the key questions explicitly pointed out in this review have not been resolved in the current model, including how the existing streamflow network is insufficient to support Goal #1, lack of well-by-well pumping data, together with GSFLOW's limitation related to internal supply and demand calculations, will make some of the analyses required for Goal #4 difficult to complete, and there is a general lack of available information and relevant studies in other basins related to the required climate series discussion for Goal #5.

Section 2. Model Methodology Selection provides a summary of existing models and a detailed discussion of the comparative analysis of different codes considered as the framework codes for development of this model. Related to the selection of which modeling tool to use for this project, the Study Plan first defines the model selection criteria:

1. Capability to accurately model essential groundwater-surface water functions

2. Perceived credibility, for instance as demonstrated by citation in peer-reviewed literature
3. Ability to model nitrogen fate and transport in groundwater and track sources back through groundwater to surface-water and landscape sources
4. Meets California Department of Water Resources (DWR) SGMA public domain requirements (DWR, 2016)
5. Ability to model recharge from irrigation and septic systems
6. Ability to meet project requirements within the defined scope and budget
7. Longevity of model, availability of support/updates
8. Transparency
9. Degree of leveraging previous models OBGM and VSWHM
10. Proven use for similar applications

While generally concurring that these are good criteria, the Casitas' review identifies a variety of potential concerns. Those concerns especially relate to meeting the SGMA requirements for properly documented public domain code, transparency, and longevity of model, and availability of support and updates in relation to the suite of codes finally selected. Technical challenges related to the ability of the model to meet project requirements are raised, as well as the capability of the model to accurately simulate all key hydrologic and hydrogeologic functions.

After defining the model selection criteria, the Study Plan lists the various codes and combinations of codes considered. The Study Plan then provides a qualitative evaluation of each against the criteria, to finally arrive at the selection of the GSFLOW – MT3D-USGS code combination. The Casitas' technical review provides an evaluation and comments on each of the codes evaluate, in all cases supporting the points raised with citations to relevant studies which had employed the model tools under consideration. The review cites several inconsistencies and potential issues in the evaluations.

Section 3. Overview of GSFLOW and Modeling Approach is a broad overview of the modeling approach to be taken, beginning with a general overview of GSFLOW and the underlying component models (Precipitation-Runoff Modeling System [PRMS] and Newton Formulation for Modflow-2005 [MODFLOW-NWT]), and then summarizing a seven-step model development process. Casitas' technical review found this overall approach generally reasonable, but noted several omissions that should be clarified, specifically:

- For the dry-season only MODFLOW-NWT and wet-season only PRMS calibration, further clarification would be helpful for those definitions and which model parameters (for each model) will be well calibrated under those conditions and which parameter will be difficult to calibrate for those conditions.
- No time period was designated for the historical period of simulation used for calibration.
- No summary of model packages was provided, and features being simulated by these packages/processes were not enumerated that would represent all the components of a conceptual model of the climate, land system, surface-water, and groundwater use and movement of water.
- Overall, the historical periods chosen for calibration may not be consistent with the climate cycles observed in the precipitation and surface-water time series and does not include the period after the Thomas Fire.

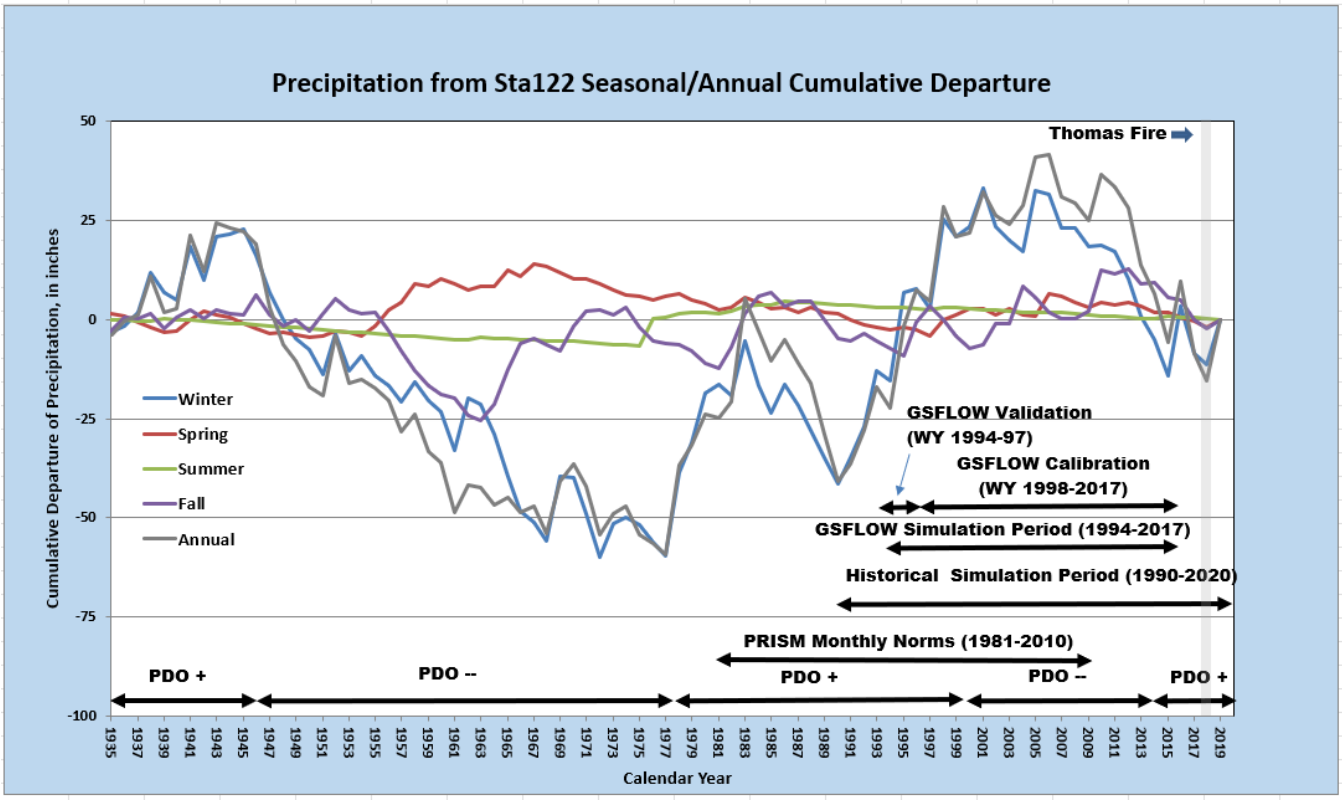
Section 4. Surface Water Model Development presents the detailed approach for the development of the PRMS-only surface water model, and how that model development will attempt to leverage knowledge and experience gained for the development and application of the existing VSWHM (previously developed for stormwater management). A summary of model domain and grid cell sizes and set up is followed by a

detailed tabulation of input data sources, including land surface hydrologic parameters, precipitation, and evapotranspiration (ET) datasets.

This review identifies several points that should have been considered in the PRMS-only model development, including:

- There is no clear justification for the selected model grid cell size related to physical characteristics of the basin. For example, it would be helpful to know how many 330-foot model cells will occupy the 2,900 acres of active wash deposit in the Ventura River floodplain.
- While the use of some parameters from the VSWHM may make sense for wet-season high flows, the climate for the Ventura River Basin is dominated by long dry periods punctuated by occasional very wet season. For example, 53 of 85 years (62 percent) are dry years with less than average precipitation (1935–2019). Similarly, on a seasonal basis, during the fish migration season of January to June, 62 percent of the winters and 65 percent of the spring seasons are dry. This suggests that dry-year and dry-season climate will largely influence the fit of any watershed models, and the wet-season only calibration approach for the PRMS-only model will require significant revision during subsequent linking to the groundwater model owing to this potential inherent bias. Figures 1, 2, and 3 below illustrate each of these issues.

Figure 1. Cumulative Departure of Annual and Seasonal Precipitation from Kingston Reservoir, Ventura, Station 122, 1935–2019 (PDO: Pacific Decadal Oscillation climate index)



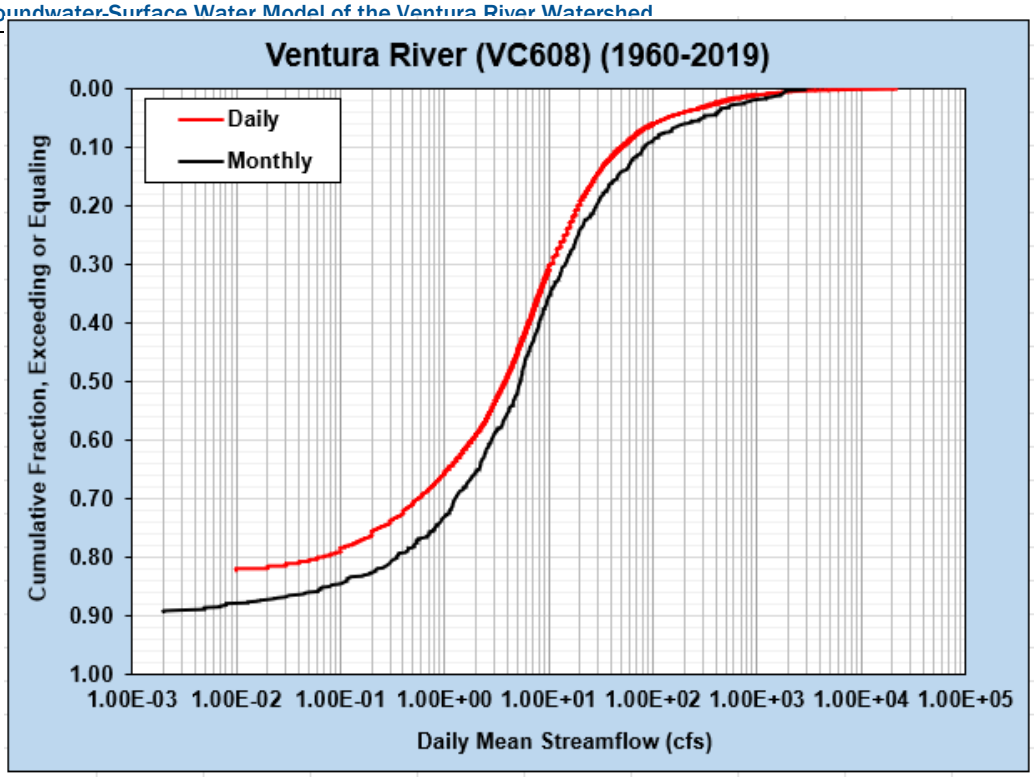


Figure 2. Streamflow Duration for Daily and Monthly Flows for Ventura River near Ventura (VC 608).

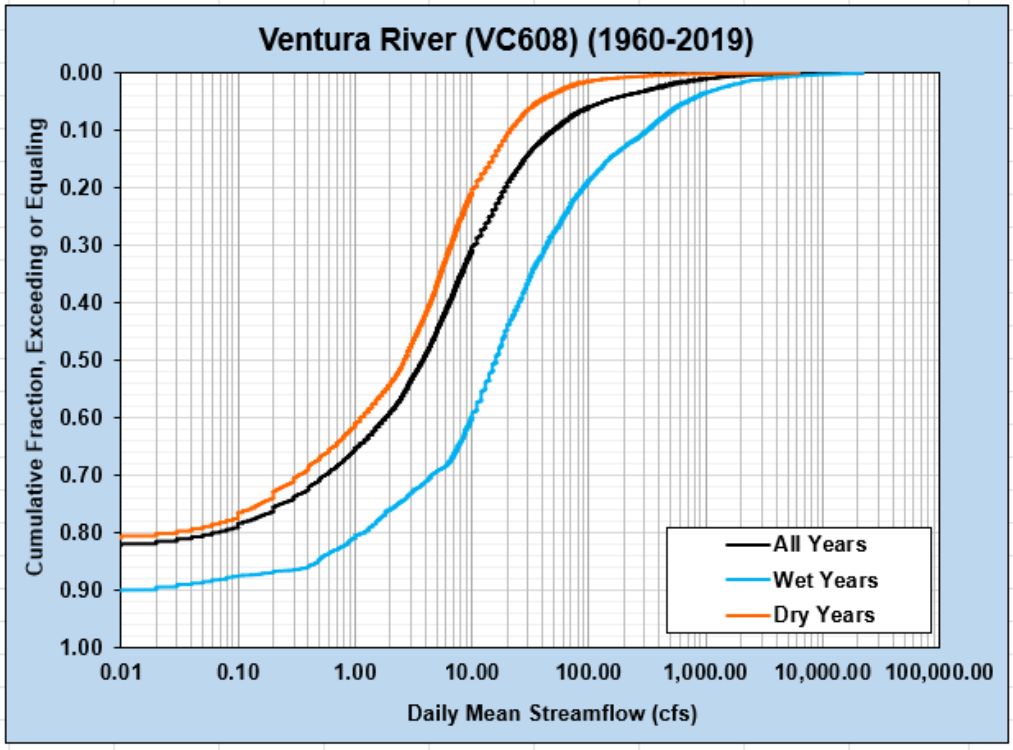


Figure 3. Streamflow Duration for Wet and Dry-Year Daily Flows for Ventura River near Ventura (VC 608).

- The lack of specificity in type of observational data to be used in calibration. For instance, there is no discussion of second order observations such as groundwater drawdowns, vertical groundwater head differences, and streamflow gains and losses, as well as higher order observations such as streamflow duration distributions at gages and climate cycles percentages. All these types of measures should be looked at as part of the model calibration process and will affect the skill needed to address the modeling objectives.

The review identified nine additional points needing clarification, including clarifying which data sets are being used to define the land surface and surface drainage network, no mention of extensive network of urban storm drains in the lower part of the basin, how land use evolution over time is being treated, and how the models with treat operations of Robles Diversion and Lake Casitas. The last two are issues of key concern for CMWD.

Section 5. Groundwater Model Development summarizes the development of the groundwater model, including the goals of the model development and a summary of comments for selected the elements of development in the following sections. The reviewers support the modest goals of ensuring that the model runs without error and is consistent with the conceptual model of the features within the Ventura River Watershed, although they suggest additional important goals for the groundwater-only MODFLOW-NWT model. Specifically, the groundwater model should also:

- Replicate the important parts of the geologic framework,
- Include all the uses and sources of water (supply and demand components),
- Cover a reasonable period of historical calibration that captures climate variability,
- Use a complete set of observations that constrain as many of the features of an integrated model as possible, and
- Yield a reasonable mass balance for the groundwater and surface-water systems.

The Casitas reviewers also support the notion of extending the model domain to the limits of the surface water hydrographic basins the contribution of surface flows into the surface water network. The selection of monthly stress periods and daily timesteps makes sense and doing so will deliver easy linkage to the daily stress period structure of the PRMS model. While the overall approach makes sense, the Study Plan discussion of these data/parameter classes appears to overlook some key factors, for example:

- Fixing the geometric configuration (areal extents, top and bottom surfaces, and thicknesses) of the underlying hydrogeologic units makes sense, but there is no description of how the layering will be constructed, what units are represented, or any additional features that may be derived from the geologic model such as natural faults (considered to act as horizontal flow barriers [HFBs]) or man-made subsurface flow barriers (e.g., Ventura River subsurface barriers at Foster Park).
- Identifying the agricultural pumpage as a fixed parameter fails to recognize the dynamic feedback between surface-water availability, groundwater recharge patterns, stream-aquifer interactions, and groundwater pumping.
- The provided list of parameters coming from the PRMS model does not include any surface-water flows, runoff (native, agricultural, or urban), storm drain networks, or spatially varying ET from agriculture, which can be major components of the overall groundwater model.
- Parameters for the Multi-aquifer (MNW2) Well Package are not cited, but likely will need to be considered in calibration of the integrated model.
- The treatment of the coastal boundary, and parameters used to define that boundary (for example, the conductance for the General-Head Boundary [GHB]) and a time-varying ocean boundary head.

- The treatment of fractured bedrock using discrete features versus equivalent porous media may be important if there are points of discrete inflows associated with discrete features.
- Additional transient features, such as the buried timber-pile dam installed at the Robles Diversion, which may be treated using the Horizontal Flow Barrier Package.

The Study Plan identifies and discusses data gaps for development of the groundwater-only model, specifically: media properties/hydraulic parameters (e.g., hydraulic conductivity and storativity), the subsurface geology, and the groundwater extraction rates. The reviewers found this list generally correct but lacking. Related to subsurface geology, it should have also included faults and any man-made features that could represent groundwater flow barriers for selected layers. Other gaps could be the estimation of gains and losses along specific parts of the surface-water network under different wet and dry conditions, identification, and measurement of surface-water diversions.

Related to estimating agricultural pumpage, the Study Plan lays out a three-step approach. While that approach makes sense and is commonly applied, it is a "one-way" calculation that leads to a fixed specified pumping which fails to account for potential feedbacks between the particular hydrologic condition (surface and groundwater) and pumping demand. For future forecast or alternate adaptation/mitigation-scenario simulations, such dynamic linkages can affect groundwater extraction rates, and an internal supply-demand framework (such as that implemented in MODFLOW-OWHM) provides a better approach for estimating groundwater extraction rates for meeting agricultural irrigation demands.

Additional comments on development of the groundwater-only model raised by the technical reviewers include:

- Related to the model domain and discretization, the Study Plan does not describe any model grid orientation that may be needed to align with any structural aspects of the watershed, nor does it describe the model extent and boundary condition treatment at the coast but based on the figures presented appears to stop at the coast and does not include any offshore regions.
- The specific layering in the alluvium is not described in any detail outside of probably including 10 layers that include aquifer and aquiclude layers and enough bedrock to cover the partial penetration of the wells and does not address any potential perched groundwater zones.
- The geologic analysis referred to in the Plan appears to not describe any texture or facies analysis of the recent or older alluvium, as is commonly done in most other modern models.
- Based on the Study Plan's geologic structural map (see Figure 5-2 in the Plan), there appear to be several faults that may serve as potential barriers to groundwater flow. Some of the more extreme deformation in the bedrock units includes tight anticlines also may serve as potential flow barriers or enhanced vertical anisotropy, which should be evaluated during model development.
- The section on preliminary groundwater model simulation summarizes the strategy to model build, debugging and analysis. It appears that the use of specific years to test the model will preclude the effects of antecedent conditions. The overall simulation of the period WY1994–2017 is different than what was described before for the PRMS model (i.e., WY1990–2020).
- One major item that is missing from this section of the Study Plan is a summary of observation types and locations. While the potential groundwater observation wells are shown in Figure 5-3 of the Plan, there is no description of how these could be used with the Head Observation Package. As noted above, types of observations needed for IHM calibration should include first-order observations (e.g., water levels, streamflows, and diversions) as well as second-order observations (e.g., vertical head differences, streamflow gains and losses, and streamflow seepage). These are not discussed in the Study Plan.

Section 6. GSFLOW Model Development, Calibration, and Validation describes how the GSFLOW model is developed by integrating the PRMS surface water model with the MODFLOW groundwater model. The overall

description indicates that groundwater levels along with surface-water flows will be used to assess the fit of the calibrated model to historic period of 24 years (WY1994–2017). In addition, the Study Plan indicates a constraint of a cumulative mass balance error of 0.5 percent (Reilly and Harbaugh, 2004) will be used to assure that the model has reasonable mass balance. In addition to these calibration objectives, the Casitas' review recommends that mass balance criteria be assessed, such as Actual ET.

Related to the simulation period for the integrated model, the review notes that the selected period is not consistent with the wet and dry-year variations in streamflow cycles (see Figure 6-1 in the attached Casitas' review report) that comprise 6 wet years and 18 dry years with multi-year recession occurring since 2006.

The Study Plan describes in more detail the model calibration approach and related data sources for each component model, with more detail than summarized previously in Section 3 of the Plan. The major modeling issues include:

- For the PRMS surface-water model, the calibration strategy is to focus on "wet-weather flows." However, the meaning or criteria for delineating wet-weather periods is not clear. Could such "wet-weather flows" occur only in overall wet years, or could it be a wet season in an average or dry year, or simply be synoptic storm events that could occur in any climate setting?
- The use of flow observations from streamflow gages, manual streamflow measurements and wet-dry maps is a good subset of observations. Additional observations that should be considered include stage at the streamflow gaging stations, surface-water diversions at the Robles Diversion and any other irrigation diversions, and block flows at the ocean boundary for periods when the river outlet is open.
- The use of stream stage observations will be especially relevant because California Department of Fish and Wildlife (CDFW) flow targets for fish migration include a flow and a stage requirement.
- As noted previously, other higher-order observations could be employed such as wet and dry-year/season daily streamflow duration, residuals of observed and simulated cumulative departure of monthly flows, and climate-cycle frequency analysis to help explore the continuity of transition between wet and dry-climate flows.
- Calibration goals for the PRMS surface water model should extend beyond average error metrics for streamflows because the streamflows tend to be lognormally distributed. In addition, RMSE or Nash-Sutcliffe error of log streamflows binned into selected ranges of flow regimes may also be better to address the skill of the model for its ultimate purposes. The review team also recommend use of weighted residual error, with weights based on the uncertainty of gaging data (higher uncertainty, lower weight). The evaluation of low-flow periods as well as wet-season periods is a good idea.
- Related to groundwater model calibration, the Study Plan only discussed fitting to observed groundwater levels. Additional important considerations include evaluating water level fluctuations (drawdowns) from a defined baseline, obtaining data from sufficiently outside the stream channel (to avoid confusing hyporheic surface water -groundwater interactions from transfers between the stream and the regional groundwater system), and evaluating vertical gradients (if multi-depth monitoring data is available).
- The Casitas review team recommends splitting groundwater level data into different groups that represent different parts of the watershed and different sets of model layers.
- The Study Plan stated groundwater model calibration measures should be assessed with respect to groundwater-level residuals, drawdown residuals, and vertical head difference residuals.
- The sensitivity analysis approach described in the Study Plan is rather vague, and it is recommended that the models be set up in the PEST or UCODE framework and then perform trial-and-error analysis in this framework using simple forward runs.

Finally, the Study Plan notes that there will be eight scenarios simulated with the integrated GSFLOW model, with four generally defined, but with the remaining four to be defined in detail at a later date. The Casitas reviewers recommend that all the climate-change scenarios should include sea-level rise. Climate variability scenarios also should be considered to assess the common Pacific Decadal Oscillation (PDO) cycles in local climate and streamflow data (see Figures 4-1 and 6-3 in the attached review report). For example, some climate studies are suggesting that we are in the worst mega-drought since the late 1500s (Williams et al., 2020), so prolonged a decadal drought may need to be assessed and available for other analyses, such as flow thresholds for fish migration by CDFW and National Marine Fisheries Service (NMFS).

Section 7. Nitrogen Transport Model Development describes how the nitrate transport model will be developed in MT3D-USGS from the flow quantities simulated by the GSFLOW model, including identifying datasets and sources for model inputs and calibration, and the calibration process and goals. The modeling calibration and validation periods will be the same as used for the GSFLOW model described above, and the review concerns raised previously related to the selected time Period-of-Record (POR) remain.

The Study Plan states they will be explicitly accounting for (1) On-site Water Treatment System (OWTS; in the past commonly known as septic tank disposal systems), (2) livestock ranching, and (3) leaching of agricultural fertilizers to groundwater under irrigated lands. They will employ a nitrogen mass balance approach as developed and described by Viers et al. (2012), accounting for the three sources described above plus atmospheric deposition, atmospheric nitrogen-fixing legume crops (e.g., alfalfa, clover), and losses due to crop uptake and release to the atmosphere.

The Study Plan covers two types of input data needed for the nitrogen transport model: (a) data on the soil zone model nitrogen mass balance model inflows and outflows, and (b) water quality data for the surface water that recharges the groundwater along losing stream reaches. Notably, the Casitas reviewers note that five out of these seven will be obtained from "literature values" and "published values," without clarification as to the relation to the study area. The same is true for two out of the three components of surface water loading to groundwater. The review team recommends that the California Pesticide Information Portal (CalPIP) database be ued as a potential data source.

This review notes that the calibration target dataset is expected to be limited and less than ideal, due to the lack of long-term regular synoptic water-quality sampling. However, the recent nitrogen loading / algae study by Geosyntec provides excellent recent data from surface water and groundwater samples collected in three events over an 8-month period in 2017–2018. The related calibration goals for the targets are similarly undefined in the Study Plan. One exception is the definition of a preliminary threshold for the normalized RMSE of nitrate concentration is less than 20 percent; the calibration will be considered adequate. However, this goal does not appear to be tied to any specific total maximum daily load (TMDL) regulatory criteria or uncertainty of physical samples or physical processes, which presumably would be important from a regulatory compliance perspective.

Finally, potential nitrogen transport model scenarios are covered in Section 7.7 of the Study Plan. The section notes that four mass loading scenarios will be investigated with the MT3D-USGS model, but no details are provided and instead it is stated that those scenarios will be defined later in the project. The Plan does not discuss how scenarios may, or may not, be shuffled with the integrated PRMS–GSFLOW model scenarios. The transport or limitations of salinity loading are also not addressed even though they were the focus of TMDL analysis for the adjacent Santa Clara River.

SECTION 4: ISSUES UNRESOLVED BY WEBINARS

As noted in the Introduction, the expert review team attended the three (3) model development webinars held in May and Jun 2021, as well as the November 2021 webinar on model scenario development. The following issues remained unresolved based on these presentations and related Q/A during the Model training webinar.

(1) Rate of ET and distribution of ET from Arundo along river channels did not reflect the clearance program that had already eliminated much of the Arundo for the calibration period. This may result in overestimation of riparian ET and potential changes in channel geometry, streamflow, and manning roughness coefficients for these river segments, along with any potential changes in percent of impervious area for PRMS model input.

(2) The recent 2018, post-Thomas Fire LIDAR survey was not going to be used for the post-2017 model update to adjust the surface-water network attributes such as segment elevations, slopes, and streambed conductivities for post fire conditions. The Consultants claimed this would be too much work.

(3) Evaluation of the skill of the model to simulate flow and stage as proposed in the CDFW flow targets for wet and dry seasons. The model developers claimed that the model will not be used to assess fish passage attributes of flow and stage and that a "hydraulic model" would be needed and used for such an evaluation and not this regional model. This is despite the fact that the Model Study Plan specifically lists "estimate existing instream flows at multiple points of interest (POI) throughout the entire Ventura River Watershed" as a model-use objective.

(4) Several other model attributes were not considered such as calibration of the model to Robles Diversion flows or to Lake Casitas reservoir stage

(5) The Unimpaired Flow scenario does not change land use (and related impervious area distributions for agriculture and urban regions), yet the delivery of water to the urban areas (along with the two reservoirs and Robles Diversion and all pumping wells) are no longer in this model. This scenario appears to be a mismatch between potential supply and demand components of the model framework and it also removes some of the features that were contributing to vertical flows in the baseline model, which in turn may also impact streamflows.

(6) While the stream package uses ICALC=4 for 58 selected river channel segments (of 791 segments), the locations of those segments are not easily discernable for analysis[1] the rating table of flow versus head does not fall below flows of 0.5 cfs at Foster Park (VC 608) and other locations. This assumes that these segments are virtually perennial and never have flows below 0.5 cfs. While the model did extrapolate smaller non-zero flows below 0.5 cfs, they did not match the no-flow conditions observed in the gaged data.

(7) Casitas reviewer questions related to the storm drain networks were not answered in the webinars. Specifically, were they added to the surface-water network, or is the network adjusted in some other way to reflect the additional runoff and reduced infiltration in the lower part of the Lower Ventura Watershed?

[1] the GWV MAP files requested by Casitas in October 2021 would have greatly facilitate this analysis for the reviewers

SECTION 5: ACQUISITION, REVIEW, AND TESTING OF MODEL FILES

As noted in the Introduction, the expert review team has downloaded, reviewed and evaluated selected model files that were made available for public review in late September 2021. The review has evaluation of the model input, model structure and hydrologic budgets, but still needs to include running and testing model the baseline calibration and "no diversion" (unimpaired flow) models, and extracting results from those models and comparing those results to relevant data. Due to some key model files missing that allow for this assessment, the review to date should be considered preliminary until the additional files are obtained to support model testing and more complete evaluation. The following preliminary observations are centered on the Modflow-NWT model within GSFLOW and the PRMS model attributes and results will still need to be evaluated. However, our findings to date include:

(1) Selected hydrologic properties in the Modflow model seem relatively large for selected attributes and locations where they are used. This may collectively result in a model that potentially has a lot of vertical flow between layers and between the groundwater and surface-water flow systems.

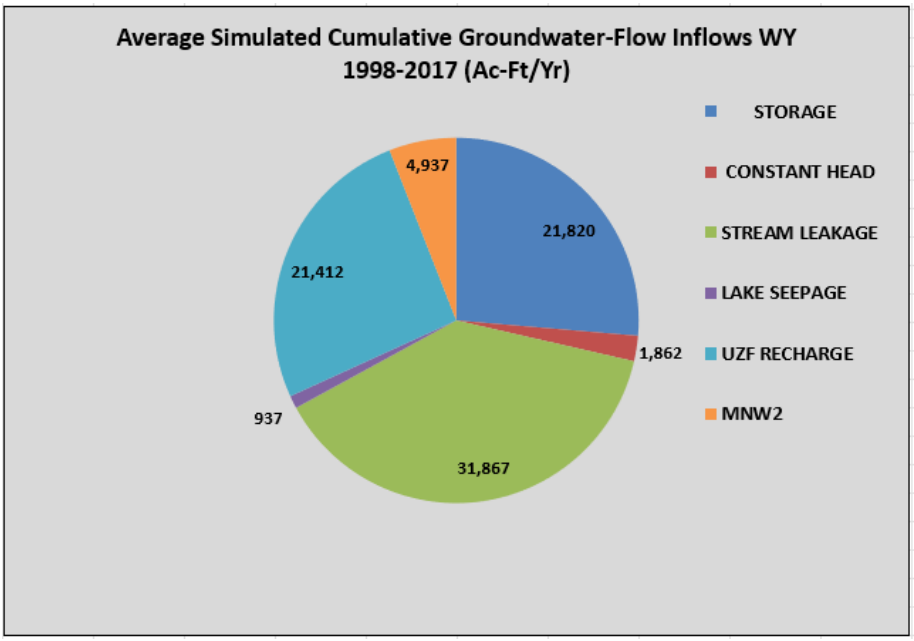
(2) Hydrologic-Flow Budget shows the largest changes in flow occur from groundwater storage and stream leakage (inflows and outflows), with only small amounts of groundwater ET and surface leakage (rejected infiltration plus groundwater outflow). Multi-aquifer wells show a relatively large percentage (25%) of wellbore inflow relative to pumpage, which combined with oversized well diameter of 2 ft, suggests that these wells may be too leaky and are facilitating additional vertical flow between model layers and may also enhance streamflow infiltration. Overall the historical period calibrated hydrologic budget indicates a small groundwater storage depletion of about 705 ac-ft/yr (**Table 1, Fig. 4**).

__Table 1.__ Summary of average annual cumulative hydrologic budget groundwater-flow components from MF-NWT calibrated model in ac-ft/yr for 24-year historical simulation period (WY1998-2017).

Groundwater Flow Component	Average Inflow (Percent of Total Inflows)	Average Outflow (Percent of Total Outflows)	Net Flow (In-Out)[1] (Percent of Total In or Out)
Groundwater Storage	21,820 (26)	21,115 (25)	705 (2.7)
Constant Head	1,862 (2)	4,521 (5)	-2,659 (10.3)
Stream Leakage	31,867 (38)	28,302 (34)	3,565 (13.9)
Lake Seepage	937 (1)	1,120 (1)	-183 (0.7)
UZF Recharge	21,412 (26)	=====	21,412 (83.4)
Groundwater ET	=====	5,959 (7)	-5,959 (23.2)
Surface Leakage	=====	2,060 (2)	-2,060 (8.0)
Well Pumpage	4,937 (6)	19,759 (24)	-14,822 (57.7)
Total Flows	82,835	82,836	0

[1]Net positive number represents inflow to groundwater flow and net negative number represents outflow from groundwater flow. Total net inflow is 25,682 and total net outflow is 25, 683 ac-ft/yr.

(A)



(B)

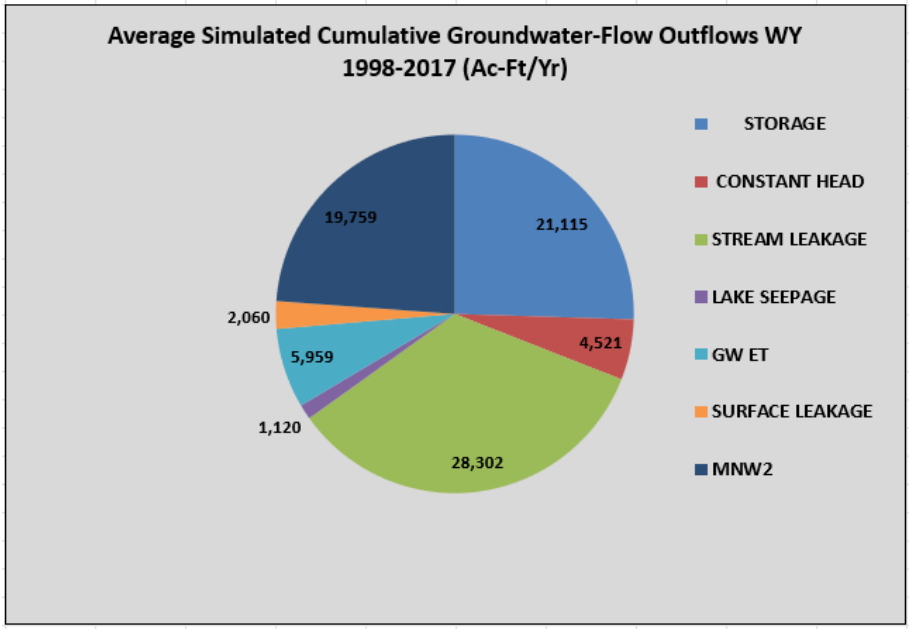


Figure 4. -- Summary of average annual historical simulated groundwater-flow (A) inflows and (B) outflows.

(3) The Robles diversion and other surface-water flows in general don't appear to be used as formal calibration targets. The evaluation of the Robles Diversion indicated an underestimation of simulated diversions during the peak flow events (fig.5). This may suggest that the simulation of runoff is underestimated for peak events and/or that the streambeds are too leaky and would not convey the larger flows that were reported to occur at to the Robles diversion. The total error of flows at the diversion was about 26,400 ac-ft, which is comparable to about 1.6 years of average surface-water deliveries from Lake Casitas. This also represented about 19 percent of the total diversions at the Robles Diversion, which may be too large of an error.

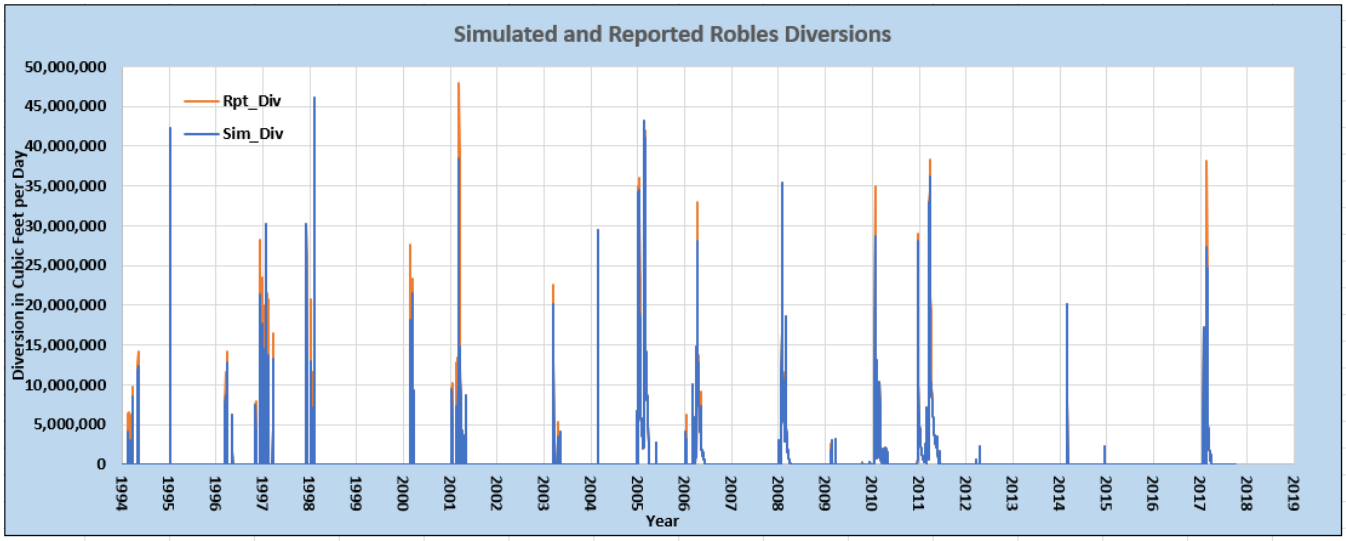
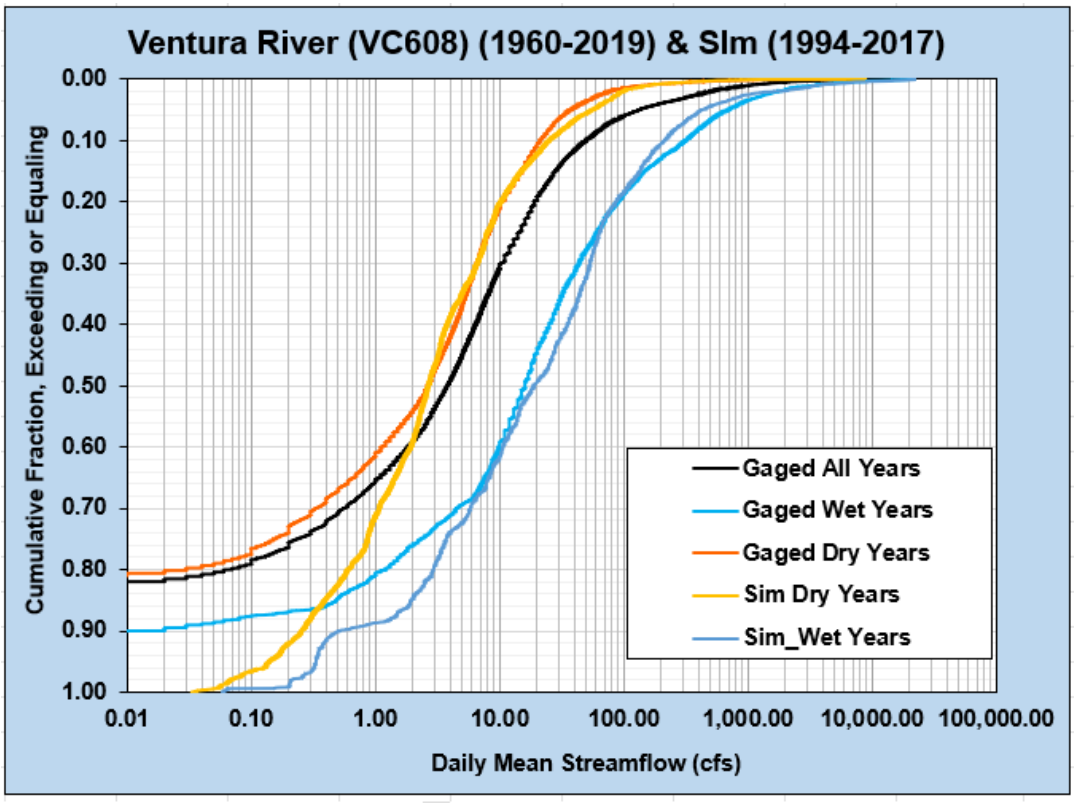


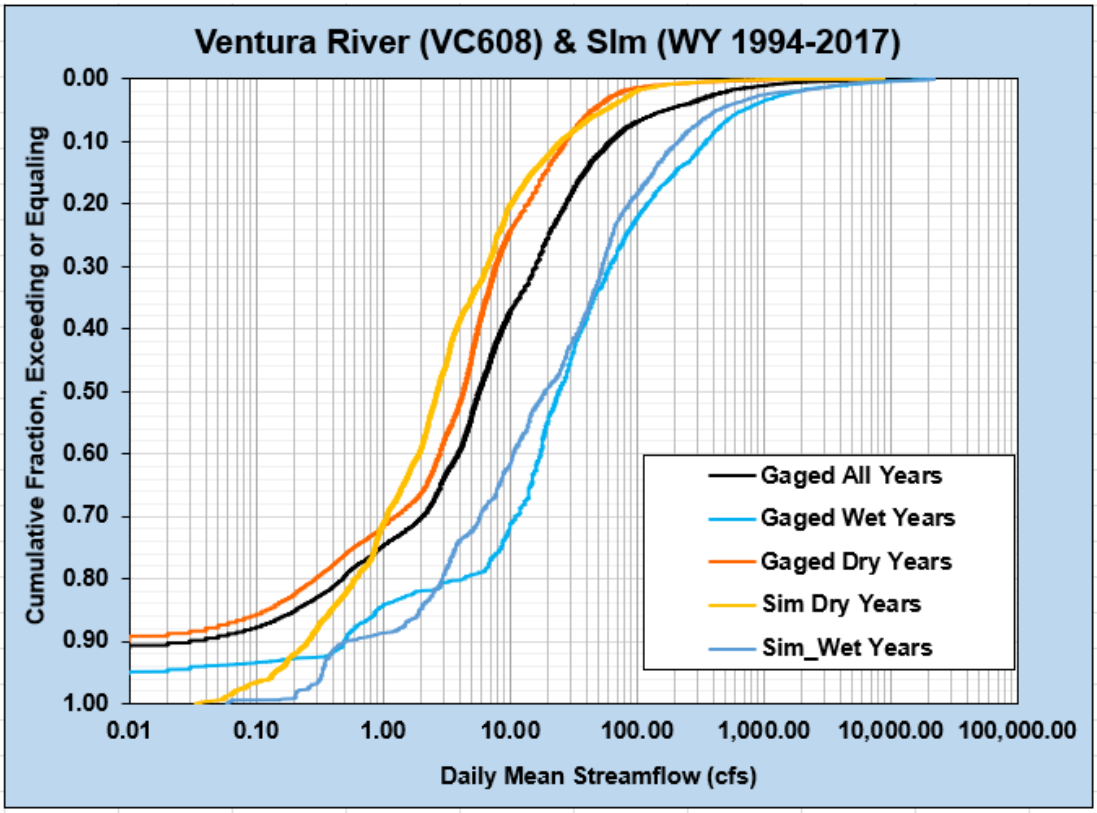
Figure 5. -- Comparison of reported and simulated surface-water flows at the Robles Diversion.

The analysis of streamflow exceedance at the Foster Park gaging station (VC 608) indicates that the distribution of flows and especially low flows is not consistent with wet and dry-year distributions from the gaging data (fig. 6a). These exceedance plots are also different than similar analysis for the longer period of water years 1960-2019, suggesting that climate variability has a major factor on the distribution of flows and especially low flows, as was also demonstrated for the selected tributaries of the nearby Santa Clara River (Hanson et al., 2003). The unimpaired flow scenario shows even larger perennial flows (fig. 6b).

(A)



(B)



(C)

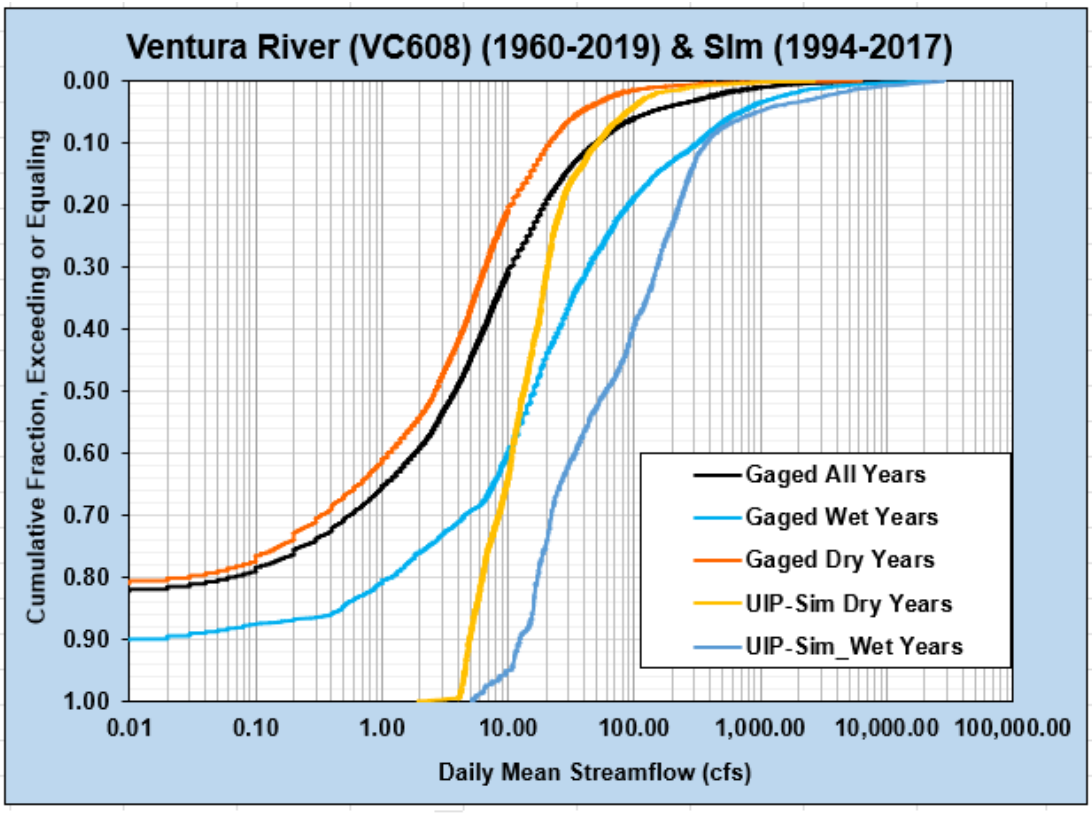


Figure 6. -- Streamflow exceedance probabilities distributions on Ventura River at Foster Park (VC 608) with (A) of gaged flows (1960-2019) with simulated streamflows (WY 1994-2017)), (B) gaged and simulated streamflows (WT 1994-2017), and (C) of gaged flows (1960-2019) with unimpaired streamflows (WY1994-2017).

In addition, stage was not compared with gaging-station stages, so the skill of the model to replicate actual changes in stage remains uncertain. Selected river segments used a flow-stage-width relation of a 24-value "look-up table" (ICALC=4 in SFR2 Package), but the minimum values of stage and flow did not include no-flow conditions. This resulted in the model having perennial flow at Foster Park gage when the stage at the gage did occasionally go to zero. The difference between the calibrated model and the unimpaired flow model also indicates a minimal improvement in stage that averaged about 0.2 ft over the simulation period (fig. 7).

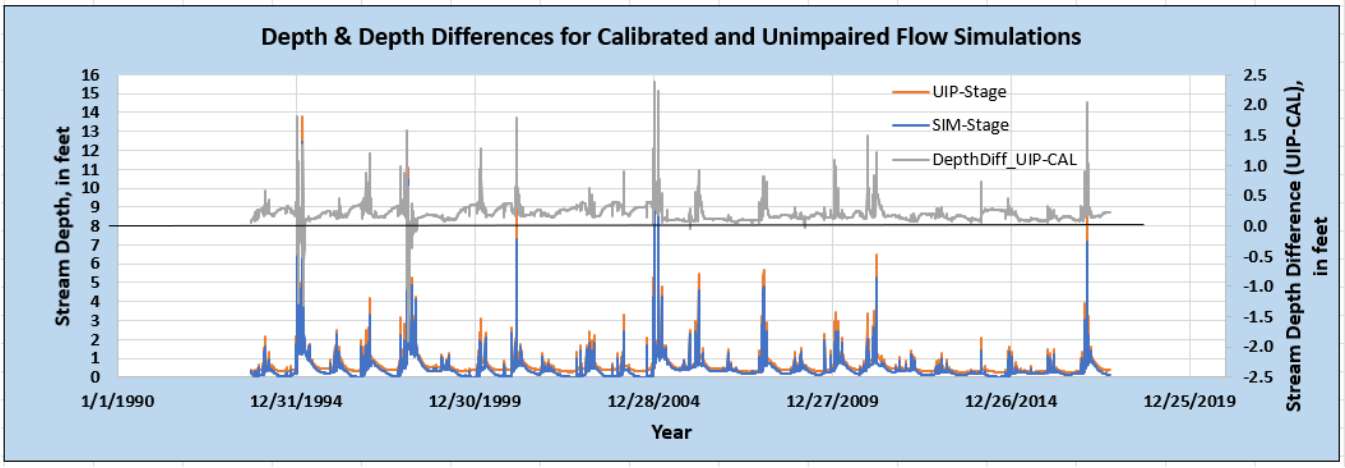


Figure 7. -- Comparison of stage on Ventura River at gage VC 608 for calibrated (CAL) and unimpaired (UIP) flow simulations, and difference (UIP-CAL) in stage elevations between simulations.

(4) Stage and runoff into the reservoir at Lake Casitas and performance of the Reservoir was not part of the formal calibration process. There are substantial underestimation and overestimation errors in stage with an average error in stage of 8.7 ft that represents a daily volumetric error of about 18,010 ac-ft, which is about a year's delivery of water from Lake Casitas (fig. 8). This graph suggests that runoff and related reservoir stage are overestimated in drier years and underestimated in wetter years. This is consistent with Lake Casitas cumulative inflow and outflow data (**Fig. 9**), which shows that runoff from ungaged tributaries into the reservoir represents the single largest inflow component to the reservoir. Notably, the large jump in stage in 2005 shown in **Figure 8** corresponds with the large tributaries inflows in that year (**Fig. 9**), yet this is not reflected in the VRW GW-SW model results.

(5) This simulation also does not include loss of storage from reservoir sedimentation. Reservoir leakage to groundwater system is not described but small inflows and outflows of leakage were simulated.

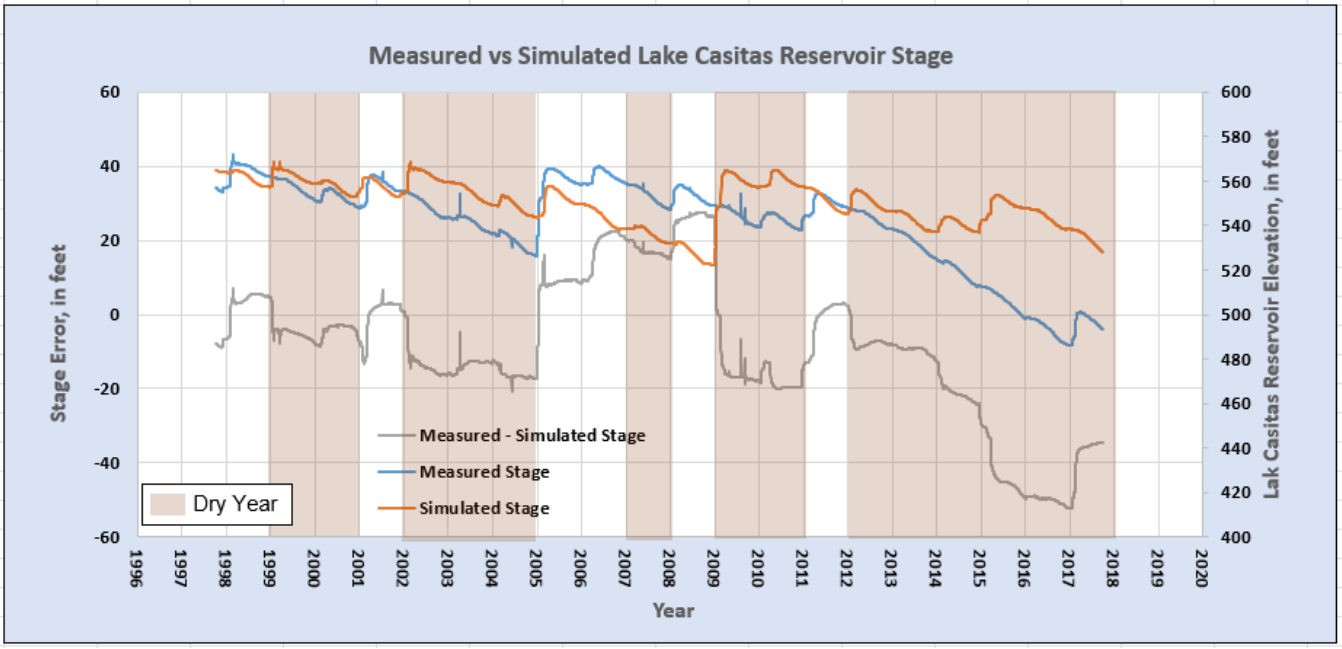


Figure 8. -- Comparison of measured and simulated Lake Casitas Reservoir stage and related simulation error.

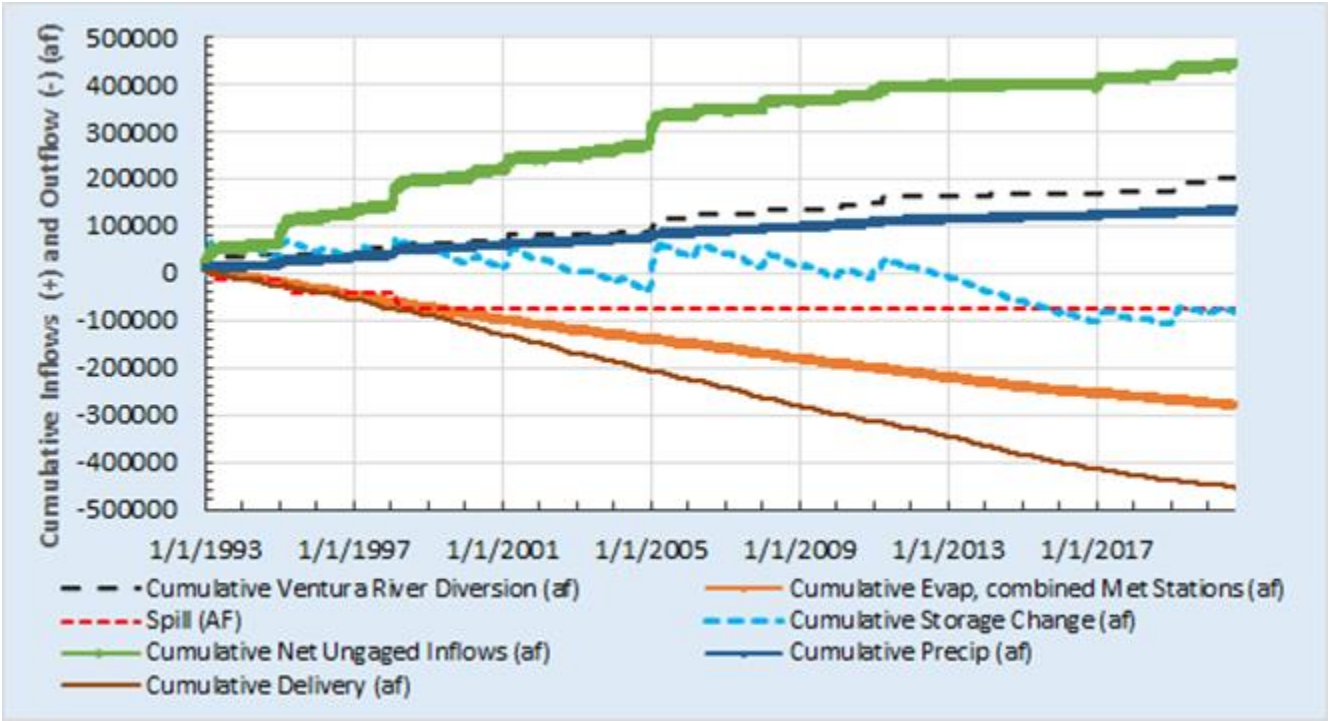


Figure 9. Lake Casitas cumulative water balance from 1993 to 2021, by inflow and outflow components

(6) The geologic data compilation, mapping, and synthesis conducted early in the project (DBS&A, 2018) revealed numerous faults and steeply dipping layers in the bedrock formations, potentially leading to large gradients across faults, and/or extreme Kv:Kh hydraulic conductivity anisotropy ratios. The VRW SW-GW model, however, does not employ HFB (Horizontal Flow Boundary) package nor any other special treatment for simulating these geological structures.

(7) The Horizontal Flow barriers were only used to represent one fault in some uppermost layers and the subsurface dam at Foster Park in the uppermost layer for 4 model cells. No HFB was used for other faults or for the dam foundation for Matillija Dam.

(8) The unimpaired flow scenario model resulted in larger streamflow inflows and outflows and an average increase in streamflow at Foster Park gage of 32 cfs. The average increase in streamflow was 48 percent at Foster Park and the increase in simulated stage was increased by 0.2 ft over average stage of calibrated model.

(9) The difference between the calibrated model and the Unimpaired flow scenario model resulted in a reduction of overall groundwater flow of about 9,000 ac-ft/yr, which is about 11 percent decrease in groundwater inflows and outflows and an increase in the average net exfiltration of about 8,300 ac-ft/yr (11.4 cfs).

(10) It is not clear how agricultural and urban water supply are compensated in the unimpaired flow scenario. If agricultural land was retained, then are these farms and orchards now dry-land farming? What happened to the urban supply from Lake Casitas and related sewage effluent?

SECTION 6: SUMMARY

On behalf of CMWD, a team of hydrogeologic modeling experts have been tracking the development of the Water Boards' VRW SW-GW model. That effort has included:

(1) A detailed technical review of the *Final Study Plan for the model development and application (*Study Plan or Plan; Geosyntec and DBS&A, 2019);

(2) Attendance at model development webinars sponsored by the Water Boards, specifically a series of three webinars on model develop in May and June 2021, as well as the model scenario development webinar held in November 2021; and

(3) Downloading model files, and then running and testing model the baseline calibration and "unimpaired flow" models as posted on the Water Boards model website.

This report was prepared to document these activities, specifically a high-level summary of the findings and resulting expert opinions. Section 2 provides the summary of opinions, with the overarching opinion from this work to date is that VRW SW-GW model has a number of outstanding issues related the model structure and parameters that render the current model unsuitable for use in quantification of surface water – groundwater interactions. In addition, a number of additional key findings are listed in Section 2.

Sections 3, 4, and 5 provide details backing up the findings and opinions.

Due to some key model files missing, the model files review to date should be considered preliminary. Should new data, files, or information become available, additional findings may be presented, and the opinions stated in Section 2 above may be updated and/or modified.

SECTION 7: REFERENCES

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SECTION 8: QUALIFICATIONS AND PROFESSIONAL FEES OF EXPERT

Dr. James T. "Jim" McCord has more than 32 years of experience in hydrology, hydrogeology, and water resource investigations, with emphasis on characterization of groundwater and surface water systems, numerical modeling of hydrologic systems, river basin planning and management, water supply and availability analysis, vadose zone hydrology, contaminant hydrology, surface water and groundwater interaction, water rights, and stochastic hydrology and geostatistics. He is a court-recognized expert in many of these topics.

Prior to embarking on his water resources consulting career nearly 25 years ago, Dr. McCord was employed as:

- Assistant Professor of Civil Engineering and Geology at Washington State University (1988 – 1990), and
- Senior Member of the Technical Staff at Sandia National Laboratories (1990 – 1997), where he worked on radioactive waste management issues.

Since then, Dr. McCord has been a private consultant, applying his broad expertise to help solve water resource problems for a broad range of clients, from local, state, tribal, and federal governments, to private industry (mining, oil and gas, and responsible parties in groundwater contamination cases), both in the US and internationally.

One of Dr. McCord's core skills is in groundwater flow and transport modeling. Since beginning at Sandia National Laboratories over 30 years ago, Dr. McCord consistently has been involved with (and most typically leading) projects that involve the development and application of groundwater models, from models for the Waste Isolation Pilot Project (WIPP, the nation's only licensed high-level radioactive waste facility) back in the 1990s, to regional models for water rights proceedings in Colorado and New Mexico in the 2000s, to regional models in California, Peru, and Chile in last decade. He is currently an expert on multiple water cases across the world, and all of these involve the development and application of groundwater modeling tools or are focused on detailed critiquing of models developed by others.

Dr. McCord's CV provides details on numerous projects that he has been involved with over the past 30 years, including his expert testimony experience and partial list of publications. See attached Exhibit A for Dr. McCord's full CV.

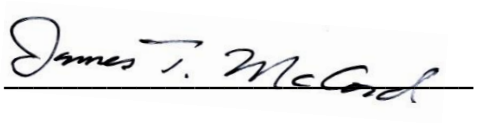
Dr. McCord's professional fees are as follows:

- Office and Field Work, Base Rate: $200/hour (base rate increases to $220/hour Jan. 1, 2022)
- Exhibit, Deposition, and Testimony Preparation: $250/hour (25% mark-up on base rate, escalates 2022)
- Deposition and Trial Testimony: $300/hour (50% mark-up over base rate, which escalates Jan. 1, 2022)

SECTION 9: **Affirmation of Expert**

I, Dr. James. T. McCord, affirm that the opinions expressed herein are mine, based on the information cited in the attached documents in the references section above and in the attached exhibits, analysis using the available data provided by the State Water Boards, and hydrogeologic brainstorming discussion among experts on the Casitas team.

Signed:



James T. McCord, PhD, PE

Exhibit A- CV of Dr. James T. McCord

Jim McCord, Ph.D., P.E.

Principal Hydrogeologist / Water Resources Engineer

Education

Ph.D., Geoscience, Dissertation in Hydrogeology, New Mexico Institute of Mining and Technology, 1989

M.S., Hydrology, New Mexico Institute of Mining and Technology, 1986

B.S., Civil Engineering, Virginia Polytechnic Institute and State University, 1981

Memberships/Affiliations

Professional Engineer (New Mexico #15568, in process for California)

Member, California Groundwater Resources Assoc.

Member, New Mexico Geological Society

Languages

English, Mother Tongue

Spanish, DELE (Diploma in Spanish as Foreign Tongue) Level 2, Fluent spoken and written

Consulting Employment History

Lynker Technologies, LLC, Principal Hydrogeologist / Water Resources Engineer, 2021 – Present

IRP Water Resources Consulting
Principal Consultant, 2020 – 2021

Geosystems Analysis, Inc.
Principal Hydrogeologist, 2018 – 2020

Amec Foster Wheeler
Principal Water Resources Engineer 2007-2018

Hydrosphere Resource Consultants, Principal Hydrologist, 1999 – 2007 (acquired by Amec)

Daniel B. Stephens & Associates, Hydrology Group Leader, 1997-1999.

Summary

Dr. McCord has more than 32 years of experience in hydrology, hydrogeology, and water resource investigations, with emphasis on characterization of groundwater and surface water systems, numerical modeling of hydrologic systems, river basin planning and management, water supply and availability analysis, vadose zone hydrology, contaminant hydrology, surface water and groundwater interaction, water rights, and stochastic hydrology and geostatistics. Prior to embarking on his water resources consulting career, Dr. McCord was employed as Assistant Professor of Civil Engineering and Geology at Washington State University (1988 – 1990) and as Senior Member of the Technical Staff at Sandia National Laboratories (1990 – 1997), where he worked on radioactive waste management issues. Over his nearly 20 years with Hydrosphere and Amec Foster Wheeler (who acquired Hydrosphere in 2007), Dr. McCord served as New Mexico manager (1999 – 2007), Water Resources Technical Director for Texas – New Mexico (2007-2011), and Water Resources Technical Director for South America (2011 – 2016). He is a recognized expert in Vadose Zone Hydrology, has authored numerous consulting reports and technical peer-reviewed papers, and co-authored the textbook, *Vadose Zone Processes* (CRC Press, 1999). Following a listing of core skills is a listing of representative projects in sustainable groundwater management and water rights* in which Dr. McCord played an important role:

Core Skills

- Hydrogeology and Vadose Zone Hydrology
- Groundwater flow and transport modeling, from site- to basin-scale
- Unsaturated flow and contaminant transport
- Groundwater recharge processes
- Surface water/groundwater interactions
- Hydrologic analyses in Water Rights
- Crop Water Use / Irrigation Hydrology
- Mine water management
- Heap leach optimization studies

Project Experience

Sustainable Water Resources Management and Water Rights

GSP Groundwater Model Development, Santa Ynez River Basin Eastern Management Area

Santa Barbara County Water Agency, California, 2020 - current

Working under subcontract to GSI Water Solutions (GSI) for Santa Barbara County Water Agency, Dr. McCord led the development of a groundwater flow model of the Santa Ynez River Basin Eastern Management Area (EMA), in support of GSI's effort to develop the Groundwater Sustainability Plan (GSP) for the EMA. The EMA has been identified as a Medium Priority basin, with the GSP to be submitted at the end of 2021. As part of this effort, Dr. McCord worked closely with the GSI team on construction of the hydrogeologic

conceptual model (HCM) and a, annual timestep water budget, utilizing best available historical data and DWR requirements related to GSP development.

Development of Spatially Distributed Recharge Estimates and Surface Water-Groundwater Interactions for Aquifers in Central and West Texas.

Texas Water Development Board, 2020 - current

Teamed with WSP, LRE Water Consultants, and Dr. Raghavan Srinivasan (Texas A&M University), Dr. McCord is supporting a contract to Texas Water Development Board (TWDB) for Development of Recharge Estimates and Surface Water-Groundwater Interactions for Aquifers in Central and West Texas. The team is employing a variety of water budget and hydrologic modeling tools to obtain detailed rasterized estimates of recharge and surface water gains and losses for key stream reaches across the study area. Dr. McCord is leading the effort to evaluate the use of satellite-based tools such as GRACE and MODIS to compare to and in some cases help constrain the estimates.

Hydrology and Hydrogeology Expert Consultant, Casitas Municipal Water District

Casitas Municipal Water District, Ventura County, California, 2020 - current

For Casitas Municipal Water District (Ventura County, California), Dr. McCord is serving as a hydrogeology and hydrologic modeling expert in support of the District's TAC (Technical Advisory Committee) involvement and review of the integrated hydrologic – hydrogeologic – water quality model being developed by the State Water Boards for evaluation of fish flows for the Ventura River, review of models developed to support to GSPs in the Ojai and Upper Ventura River Subbasins, and for potential use of model in the ongoing groundwater adjudication for the basin.

Hydrology Expert, Navajo Nation, Zuni River Basin and Little Colorado River Adjudications

Navajo Nation Department of Justice, Arizona and New Mexico, 2007 - 2019

For the Navajo Nation DOJ, Dr. McCord served as the hydrology expert on two water rights adjudications (Little Colorado River Basin, Arizona, and Zuni River Basin, New Mexico). Tasks include evaluating water claims and demands (including agricultural, M&I, and domestic) by other water users in the basin, developing Navajo claims, evaluating surface water and groundwater supplies and availability in the basins, development of a three-dimensional groundwater flow model for the Zuni River Basin, evaluation and application of a unique surface water model (based on PRMS) to estimate surface water diversions - depletions associated with Hopi agricultural systems, development of expert reports, and expert testimony.

Water Supply and Water Rights Due Diligence for Vineyard Acquisition, Aconcagua River Valley, Chile

Confidential Client, California, 2018

For a confidential client, Dr. McCord led a due diligence assessment of the irrigation water supply reliability and sustainability for a 540-hectare vineyard property in the Aconcagua River Valley of Chile; currently only 105 hectares are being cultivated (1 hectare = 2.47 acres). The assessment included an evaluation of existing water rights (both surface water and groundwater) held by the farm, the historical yield of the surface rights, hydrogeologic analyses to identify preferred areas to install wells and thus perfect existing groundwater rights, and evaluation of various approaches (including groundwater banking) to increase the sustainability of the farm water supply.

GSP Groundwater Model Development, Santa Ynez River Basin Eastern Management Area

San Antonio Creek Basin Groundwater Sustainability Agency, Los Alamos, California, 2020 - current

Working under subcontract to GSI Water Solutions (GSI), Dr. McCord supported development of an annual and monthly timestep water budget tool, utilizing best available historical data and DWR requirements related to GSP development. He led the effort in bringing in gridded hydrologic data (recharge, ETo, ETa, and runoff) from the USGS Basin Characterization Model (BCM), adjusting the gridded data to honor local weather station monthly precipitation, and filtering and processing the data to develop future climate series that met SGMA requirements and incorporated climate change factors per DWR.

Groundwater Sustainability Plan Groundwater Model Development, Tulare Lake Subbasin, San Joaquin Valley

Tulare Lake Subbasin Groundwater Sustainability Agency, San Joaquin Valley, California, 2016 - 2020

Supported the development of the 3D groundwater flow model that will be used as the quantitative basis for development of a Groundwater Sustainability Plan (GSP) for the Tulare Lake subbasin in Kings County, California. The GSP for the Tulare Lake subbasin must be completed and delivered to DWR by 2020 per the requirements of the Sustainable Groundwater Management Act (SGMA). The preliminary model was delivered in March 2018, and the updated GSP model was delivered in December 2019.

Groundwater Hydrology Expert, Surface Water – Groundwater Interactions Along South Platte River

City of Boulder, South Platte Basin, Colorado, 2005-2011

Retained by the City of Boulder, CO as groundwater hydrology expert, Dr. McCord evaluated and critiqued numerous water supply augmentation plans submitted by alluvial aquifer water users / irrigators in the Lower South Platte River, Colorado. The evaluations focused on assessing the quantity and timing of depletions to South Platte flows caused by groundwater pumping. Most of the cases involved development and application of site-specific 3D numerical models of groundwater flow, and preparation of expert reports, as well as depositions and testimony in Colorado Water Court.

Hydrologic Impacts of Water Rights Acquisitions and Transfers, Middle Rio Grande Basin, New Mexico

Middle Rio Grande ESA Collaborative Program, NM ISC, 2004 - 2005

The Water Acquisition and Management Subcommittee (WAMS) of the Middle Rio Grande Endangered Species Act Collaborative Program made preliminary estimates of the volume of water required to meet the flow targets of the 2003 Biological Opinion regarding the silvery minnow. This study addresses how a water rights acquisition program in the Middle Rio Grande Basin might work, how water rights transfers might be affected, recommended terms and conditions for to be placed on transfers to avoid increased depletions in the basin, and the likely magnitude of the acquisitions.

Hydrogeology, Hydrochemistry, and Groundwater Transport Studies, Wadi Ibrahim, Saudi Arabia

Saudi Geological Survey, Mecca Valley, Saudi Arabia 2010 - 2012

On contract to the Saudi Geological Survey, Dr. McCord served as project manager and principal hydrogeologist for a study of Wadi Ibrahim hydrogeochemistry and isotope hydrology Study. Specific tasks included evaluation of aquifer hydrochemistry and geochemistry include isotope chemistry, recharge sources and rates, hydraulic properties, flow path characterization, and design and execution of single- and multi-well tracer tests for aquifer transport characteristics.

Hydrology and Water Resources of Lower Pecos River Basin, New Mexico

New Mexico Interstate Stream Commission, 2000- 2008

Served as Project Manager and lead hydrologist for several New Mexico Interstate Stream Commission (ISC) studies related to water management issues on the lower Pecos River. Tasks included: Representing ISC on the NEPA team Hydrology Work Group for developing an EIS for re-operations of Pecos River projects; develop and apply linked surface water – groundwater hydrologic model to support adjudication settlement discussions for the lower Pecos River; analysis of seepage losses from Carlsbad Irrigation District main canal; disaggregated unidentified losses from Brantley Reservoir into three components: seepage/bank storage, submerged spring inflow, and ungaged tributary inflows.

Impacts of Coalbed Methane Development on Connected Groundwater Systems, Southern Colorado

Public Counsel of the Rockies, Huerfano and Archuleta Counties, Colorado, 2008-2011

Assessed impairment to existing water rights due to Coal-bed Methane (CBM) development in northern San Juan Basin, La Plata and Archuleta counties, and northern Raton Basin, Huerfano County, Colorado. Performed hydrogeologic evaluations and submitted expert witness documents (including affidavits in Colorado District Court, Water Division 7 and Colorado Supreme Court, Vance vs Wolfe, SEO). Included in project tasks was development of a groundwater flow model for the northern Raton Basin in Colorado and critical evaluation of groundwater models developed by energy production companies in San Juan Basin in southwest Colorado. Provided testimony in hearing before Colorado State Engineer on potential impacts of CBM development on connected surface water rights.

Isleta Pueblo Water Resources and Hydrology Expert, New Mexico

Isleta Pueblo, New Mexico, 2007 - 2011

Dr. McCord served as hydrology expert for the Pueblo of Isleta (New Mexico) addressed a variety of technical tasks including surface water and groundwater interactions in support of Rio Grande riverine habitat restoration, and evaluation of injury to Pueblo water rights due to ag to municipal transfers.

Stream – Aquifer Interactions along San Acacia – San Marcial Reach of the Middle Rio Grande

US Bureau of Reclamation, Socorro County, New Mexico, 2000-2001

Project Manager for study funded by US Bureau of Reclamation looking at surface water – groundwater interaction along the San Acacia to San Marcial Reach of Rio Grande, New Mexico. Utilizing a variety of historical data collected as early as the 1960s, Dr. McCord's analysis supported refinement of the hydrogeologic conceptual model for the reach, identified losing and gaining sub-reaches, and quantified the gains and losses (and their variability). This understanding is critical for evaluating management alternatives for this reach of the Rio Grande.

Mining Projects

Analysis of Seepage, Las Bambas Mine Waste Rock Facilities, Apurimac, Peru

Working with DHI under contract to Mining & Minerals Group (MMG), Dr. McCord is leading the effort in detailed seepage analysis. Tasks undertaken in this effort include review and compilation of waste rock materials properties, climate data analysis, and development and application of a numerical model of long-term seepage (including matrix and macropore flow) for the waste rock facility. Dr. McCord's waste rock facility seepage analyses modeling results will be used as input for the regional groundwater flow model developed in FEFLOW.

Peer Review of Hydrogeologic Flow Model, Vega Sapunta, Pampa Puno Mine, Chile

Under contract to CODELCO and working with Ausenco hydrogeologists, Dr. McCord served as senior consultant and reviewer of detailed 3D regional hydrogeologic flow model (developed in MODFLOW-USG) of the Cerro Leon and Quebrada Yocas basins that converge and feed the Vega Sapunta wetlands, a protected ecological zone. The model had been developed specific ally to evaluate impacts of well fields located upgradient of the wetlands that supply water for the Pampa Puno mine.

Analysis of Seepage, Zafranal Waste Rock and Tailings Management Facilities, Arequipa, Peru

Under contract to Teck, Dr. McCord led the effort in detailed seepage analysis. Tasks undertaken in this effort included development of a TMF conceptual model for seepage development, and development and application of a numerical model of draindown seepage from the TMF and another for long-term seepage (including matrix and macropore flow) for the waste rock facility. Dr. McCord's TMF and Waste Rock Dump modeling results were used as input for the regional model developed in FEFLOW.

Analysis of Waste Rock Seepage, Antapaccay – Tintaya Mines, Cusco, Peru

Under contract to DHI, Dr. McCord led the effort in detailed seepage analysis. Tasks undertaken in this effort included development and application of a hybrid analytical - numerical model for long-term seepage (including matrix and macropore flow) for the waste rock facility and working closely with regional modeling team (FEFLOW) to ensure consistency between the two modeling efforts.

Analysis of Seepage, Antamina Waste Rock Dump, Ancash, Peru

Working with GeoSystems Analysis scientists under contract to Antamina, Dr. McCord led the effort in detailed seepage analysis for the East Waste Rock Dump. The effort included compilation and integration of more than a decade's worth of monitoring and experimental data generated by the client since 2009, and synthesized the data to support development and application of a transient water balance model for the waste rock facility. The results of this model will be used to support mine closure engineering and water management.

Analysis of Seepage, Candelaria Mine, Chile

For an EIA in support of expansion of the Candelaria project, Dr. McCord performed detailed seepage analysis, which included development and application of a numerical model for long-term seepage for the waste rock facility. For the tailings management facility, Dr. McCord supported the FEFLOW team in the development and application of post-operations draindown modeling embedded within the regional model.

Analysis of Seepage, Drystack Tailings Facility, Rosemont Mine, Arizona

In support of mine planning for the planned Hudbay drystack tailings facility (DTF) at the Rosemont Mine in Arizona, Dr. McCord played a senior consultant role in the development of a hydrologic conceptual model for seepage development in the DTF, design and execution of a laboratory characterization program for the drystack tailing materials, analysis of geotechnical and soil-physical properties from the laboratory test results, and development and application of a numerical model of seepage and subsurface flow, with the objective to project long-term seepage rates from the facility.

Lagunas Norte Project (Barrick Gold), Water Resources Lead for Modification to EIA, Peru

Under contract to Barrick Gold, Dr. McCord led the water resources effort for the EIA study for the Lagunas Norte project expansion, and supported the mine operations team by evaluating the ability of the pit dewatering activity to provide the supply required for the mine expansion. For the water resource activity, particular tasks performed by AMEC included: compilation of historical hydrology and hydrogeology data, and development of a GoldSim water balance and water quality model, and a three-dimensional numerical model of groundwater flow for the mine area.

Stage 2 Investigation and Contaminated Groundwater Abatement Plan, Tyrone Mine, New Mexico, USA

Under contract to Freeport McMoran Tyrone mine, Dr. McCord served as a senior consultant on a Stage 2 investigation and detailed design for perched groundwater in Oak Grove Wash / Brick Kiln Gulch (OGW/BKG), which has been contaminated by acid drainage associated with the mine operations. As part of implementing these measures, site investigation and conceptual design activities in OGW/BKG had previously been completed, and the objective of this project was to conduct site investigation services to support design and construction of a keyed-in, low-permeability barrier and alluvial (perched) groundwater collection system to collect impacted water which flows to and through OGW/BKG and will accumulate up-gradient of the proposed low-permeability barrier. Data from this site investigation is beinge used to design the Stage 2 abatement measures for perched groundwater in OGW/BKG.

Fruta del Norte Project Water Resources Coordinator for Feasibility Study, Ecuador

Under contract to Lundin Gold, Dr. McCord supported the feasibility study for this gold mine, in the “ceja de selva” (edge of the jungle) in southeast Ecuador. For this project, he led the water resource studies for the project, coordinating activities among AMEC staff and subcontractors who performed the hydrogeologic and surface hydrology characterization and modeling efforts, and played a key role in development of mine water management strategies.

Pampa de Pongo Project Water Resources Lead for EIA, Peru

Under contract to Jinzhao Mining Company, AMEC performed the EIA study for the Pampa de Pongo Project, located near the coast in the Department of Arequipa in southern Peru. For this project, Dr. McCord led the water resource studies for the project, and supported the geotechnical analysis of the of pit wall stability for the feasibility study. For the water resource activity, particular tasks performed by AMEC included hydrology and hydrogeology field characterization, core drilling, and borehole hydraulic testing; site surface hydrology, meteorology, and project area water balance; and estimation of open pit water inflows using analytical and numerical models.

Analysis of Seepage, San Nicolas Waste Rock and Tailings Management Facilities, Zacatecas, Mexico

Under contract to Teck, Dr. McCord led the effort in detailed seepage analysis, which included development and application of a numerical model of draindown seepage from the TMF and another for long-term seepage (including matrix and macropore flow) for the waste rock facility. The results of these models were used as part of the upper boundary condition for the regional flow model developed in FEFLOW.

Studies and Engineering, Sustainable Management of Tailings, Minera Doña Inés de Collahuasi, Chile

Provided services in disciplines of hydrogeology and acid drainage. Preparation Analysis of Relevance and PAS 135, 137 and 155. Oversight Activities of soil sampling, QA/QC control of soil analysis, and acid mine drainage determination, updated hydrogeologic conceptual and numerical model of seepage and contaminant transport.

Analysis of Seepage and Acid Drainage, Quillayes –El Chinche Tailings Facility, Los Pelambres Mine

In support of closure planning for this tailings facility, AMEC is performing a detailed hydrogeological study, tasks have include sampling activities of tailings and water, QA/QC control of analysis of tailings and water samples, water quality assessment and geochemical modeling of water quality, installation of piezoemters, development of a hydrogeological conceptual model, and development and application of a numerical model of seepage, subsurface flow, and contaminant transport.

Antamina Mine Project Regional Hydrogeologic Integration and Hydrogeologic Geodatabase

Under contract to Antamina, Dr. McCord served as project manager for AMEC team charged with integrating all hydrogeologic data collected since site inception into an ArcGIS geodatabase, and compiling a hydrogeologic integration report, as well as developing three- and four-dimensional data visualizations. The hydrogeologic integration report involved summarizing all past work, with a particular focus on site studies undertaken since 2008, identifying important data gaps, and developing a site-wide integrated hydrogeologic conceptual model that could be used to provide a framework for interpreting existing and newly acquired site data.

La Granja Project Water Resources Lead for Prefeasibility Study, Peru

Under contract to Rio Tinto Mining Company, AMEC performed the prefeasibility study for the”starter case” for the La Granja Mine Project, located in the Department of Cajamarca in northern Peru. For this project, Dr. McCord led the water resource studies for the project, and supported the analysis of the heapleach planning task. For the water resource task, Dr. McCord coordinated activities among AMEC staff and subcontractors who performed the hydrogeologic and surface

hydrology characterization and modeling efforts, and played a key role in development of mine water management strategies.

Carmen de Andacollo Project – Hydrogeologic Analyses in Support of Tailings Facility Expansion, Chile

On contract to Compania Minera TECK, AMEC is providing hydrogeological characterization and analyses in support of expansion of the mine tailing facilities. As part of this effort Dr. McCord is providing senior review and consulting to the AMEC E&I team in Santiago involved in data analysis, field characterization, and hydrogeological modeling.

Mina Huaron and Mina Morococha, Water Resources Management and Compliance with LMP and ECA Water Quality Standards

Under contract to Pan American Silver Corporation, AMEC led efforts to characterize mining project water management and discharges to evaluate current conditions and develop water management and treatment plans to ensure compliance with the new Peruvian LMP (Limitacion Maximum Permisible, basically end-of-pipe discharge) and ECA (Estandard de Calidad Ambiental, basically river standards at locations downstream from end-of-pipe discharges) for the Huaron and Morococha mines in the Peruvian Andes. Dr. McCord led the water management team, involved in analysis of existing data and development of water management models for evaluation of alternatives to ensure compliance with new standards. Treatment alternatives considered included standard mine water treatment plants, innovative water recycling and management schemes, and constructed wetlands and permeable reactive barriers.

Ollachea Mine Project Hydrology and Hydrogeology for Prefeasibility and Feasibility Studies, Peru

Under contract to IRL / Compania Minera Kuri Kullu, Dr. McCord performed project management, model development, and senior review tasks for the hydrology and hydrogeology activities for the project pre-feasibility study. Particular tasks performed by AMEC hydrology and hydrogeology team included: field characterization, core drilling, and borehole hydraulic testing; site surface hydrology, meteorology, and project area water balance; and estimation of underground mine tunnel inflows using analytical and numerical models (MODFLOW-USG).

Hydrogeological Modeling of the Limestone Quarries, Toromocho Project, Peru

As part of mine development studies for Minera Chinalco Perú S.A., AMEC constructed a groundwater flow model to evaluate likely timing that seepage from the tailings facility would begin flowing into the limestone quarry. Dr McCord served a project manager of this effort which involved staff from US and Peru office. The project was performed on a very accelerated schedule to address concerns that arose during the facility permitting process, and utilized the limited available data from the quarry area to generate a numerical model suitable for addressing questions raised by government regulators.

Quechua Mine Water Balance, Peru

For Compañía Minera Quechua performed senior review for the development of a comprehensive water balance of the Proyecto Minero Quechua mine during the operating phase. Water balances for the construction and closure phases are currently under development.

Tyrone Mine Pit Lake Model for Closure Plan, New Mexico

Senior reviewer for hydrogeology team in development of pit lake model to address a variety of issues, including estimating the post-closure recovery period of water levels in the mine pits and surrounding aquifers, and project the post-closure steady-state pit lake(s) surface elevation(s), examining the potential for pit lake outflows, and evaluating the potential interactions of pit lake(s) with other mine facilities, hydrologic features, and geologic structures.

Radionuclide Transport Modeling, Uranium Milling Facility, Western US

Groundwater expert responsible for the development and application of flow and transport models to evaluate historical radionuclide concentrations in groundwater. The results of our analysis were used for exposure assessments for off-site individuals via the drinking water and foodchain pathways as part of a toxic tort suit.

Corani Mine, Water Resources Lead for EIA, Peru

Under contract to Bear Creek Mining Company, Dr. McCord performed project management, oversaw model development, and senior review tasks for the hydrology and hydrogeology, and water resource management tasks for the project EIA study. Utilizing existing data supplemented by AMEC-collected data on site hydrology, hydrogeologic measurements and mapping, and water quality sampling team, developed linked surface water and regional groundwater models, and project area water balance to provide EIA impact analysis for water resources.

Unsaturated Flow and Transport Analysis of Heap Leach Operations

Developed a conceptual model for heterogeneous distribution of hydraulic properties within a heapleach pad for the Tyrone Mine in southwest New Mexico. Based on the conceptual model, constructed and applied a variability saturated flow and transport model to evaluate the potential for channeling and flow bypass at various surface application rates, and leaching efficiency as a function of application rates.

Environmental Contamination / Remediation Projects

Tuba City Landfill Contamination Site, Tuba City, Arizona

Under contract to the US Bureau of Indian affairs, Dr. McCord served as senior reviewer and consultant for the Tuba City Landfill Remediation Feasibility Study, AZ to develop groundwater flow and transport models to evaluate sources of uranium contamination and potential remediation alternatives.

CSX Railroad, Papa John's Stadium Contamination Plume Remediation, Louisville, Kentucky

Senior reviewer and consultant for development of models to estimate the total, mobile, and recoverable volumes and natural source zone depletion of a 20+ acre LNAPL plume in Louisville, KY. MODFLOW-SURFACT was employed to simulate reactive transport in an active water phase (both saturated and unsaturated flow) with interaction and interphase transfer with a static separate LNAPL phase. Developed remedial strategies to pinpoint locations of the project site amenable to recovery; as well as to define the areas of the site where recovery is technically impractical with use of more innovative enhanced bioremediation approaches to effective management of the LNAPL plume.

Williams Air Force Base LNAPL Plume Remediation, Arizona

Senior reviewer and consultant for development of models to estimate the natural and enhanced bioremediation depletion of a jet fuel and aviation gas release at Williams Air Force Base, AZ. The water table at this site has risen some 90 feet creating an uncharacteristically deep LNAPL residual in the site aquifers. MODFLOW-SURFACT was used to predict the fate of residual LNAPL and dissolved phase contamination following aggressive, steam-flushing recovery operations at the site.

Redlands Toxic Tort Litigation, California,

Served as methodology expert in evaluation of contaminant transport through the vadose zone. Contaminants included organic solvents disposed of from industrial and manufacturing facilities.

Rocky Mountain Arsenal, Natural Resources Damage Claim by State of Colorado

As the groundwater expert to the Colorado Office of Attorney General, Dr. McCord worked with interdisciplinary team to assess and quantify injury to groundwater resources and water supply impairment due to historical site operations at the Rocky Mountain Arsenal, CO, as part of a Natural Resources Damage Claim by the state. Tasks involved review and analysis of historical site data, as well as development and application of a regional groundwater flow model.

Spartan Site, DNAPL Contamination Plume, Albuquerque West Mesa, New Mexico

Project Manager and groundwater expert on a case which involved subsurface contamination by DNAPL at an industrial site on Albuquerque's west mesa, NM. Evaluated observed contaminant plumes (water and gas phases) for current and historical conditions in both the vadose and saturated zones. Considered impacts of municipal well pumping and a nearby irrigation ditch system on the dynamics of the fate and transport processes. Prepared expert report and was involved in technical aspects of the settlement negotiations.

Site Wide Hydrogeological Characterization Project, Sandia National Laboratories, New Mexico

Project Manager for Sandia National Laboratory (SNL) Site Wide Hydrogeologic Characterization Project. Development and testing of surface and subsurface hydrologic conceptual models for environmental restoration sites at the 200 square mile SNL region. Annual reports, regional groundwater characterization and monitoring wells, definition and characterization of representative vadose zone settings across the region, and characterization and monitoring of the site-wide surface water system.

Evaluation of Greater Confinement Disposal of Radioactive Water, Dept of Energy, Nevada

Development and application of vadose zone hydrologic models to project radionuclide migration rates associated with disposal of low-level and "orphan waste" to be disposed of in the Greater Confinement Disposal Test located on the Nevada Test Site in southern Nevada.

International Paper Groundwater Contamination Insurance Recovery

Project Manager and groundwater expert in major insurance recovery case involving five separate wood treating plant facilities across the country (LA. TX, MO, CA and WA). Development of contaminant histories based on plant records (going back to the early 20th century), site specific data and contaminant fate and transport modeling.

Waste Isolation Pilot Plant, Southeast New Mexico

Supported the development of a regional MODFLOW model used to define groundwater in the vicinity of the Waste Isolation Pilot Plant (WIPP), NM site, and application of the SECO performance assessment model to evaluate potential radionuclide releases over a 10,000-year performance period. Provided written and oral rationales for groundwater transport parameters to EPA and National Academy of Science technical review panels, and developed QA records for the WIPP license application.

Expert Witness

- 2019, General Adjudication of All Rights to Use Water in the Little Colorado River System, Civil Case No. 6417-203, Apache County Superior Court, The State Of Arizona. *Trial testimony* on behalf of the Navajo Nation, as expert in trial Phase II, Hopi Water Claims, focus on historical water resource availability, surface water modeling, and water use and depletion for agricultural and irrigation purposes. Phase II court ruling in 2019 favorable to Navajo
- 2018, General Adjudication of All Rights to Use Water in the Little Colorado River System, Civil Case No. 6417-203, Apache County Superior Court, The State Of Arizona. Filing of expert report and subsequent *deposition testimony* on contract to the Navajo Nation Department of Justice. Court-accepted expert in historical water resource availability, surface water model and water depletion analysis, and water use for agricultural irrigation purposes.
- 2012, Steadfast Insurance Company et al. vs. Terracon, Inc., et al., Colorado. Retained as plaintiffs groundwater hydrology expert, Dr. McCord served on a multidisciplinary team of hydrologists, geologists, and civil and geotechnical engineers for a large construction defects insurance recovery case. Contributed expert reports, technical exhibits to support mediation efforts, and *deposition testimony*. Case settled in August 2012 (Client: Zurich Insurance).
- 2009, Colorado State Engineer, CBM Produced Water Nontributary Rulemaking Hearing, Groundwater expert for Public Counsel of the Rockies, *testified at SEO rule-making hearing* on technical review of northern San Juan Basin groundwater model produced by CBM industry consultants (Client: Public Counsel of the Rockies).
- 2009, Isleta Pueblo vs Santa Fe Water Resource Alliance, NEW MEXICO Office of the State Engineer File No. SD-04729 & RG-74141 into SP-4842, Hearing No. 07-059. Expert reports filed and hearing testimony related to hydrologic impact of surface water transfers that moved point of diversion (and depletion) along the Rio Grande from south of Isleta Pueblo to north of Isleta Pueblo, cases settle (Client: Pueblo of Isleta).
- 2007, Vance et al vs Wolfe (Colorado State Engineer) et al. Colorado Water Court Division 7, Case No. 05CW63. Plaintiffs' hydrology expert in case to determine jurisdiction of Colorado State Engineer to adopt permitting requirements for coalbed methane wells that may be impacting plaintiffs' decreed water rights. Plaintiffs prevailed in Water Court, and case was appealed to the Colorado Supreme Court, which in 2009 affirmed the lower court ruling (see http://www.westernwaterlaw.com/articles/Vance_v_Wolfe.html).
- 2007, Sierra Club and Mineral Policy Center vs. El Paso Gold Mine, Civil Action 01-PC-2163, Federal District Court of Colorado. *Trial testimony* as groundwater flow and transport methodology expert. (Client: John Barth, Attorney-at-Law)
- 2006, Low Line Ditch Well Users, An Application For Water Rights And Approval Of Plan For Augmentation, Colorado District Court, Water Division No. 1 Case NO. 2003CW094. *Deposition testimony* in October 2006 on impacts of groundwater pumping aspects of water rights application on senior water rights holder, case settled. (client: City of Boulder, CO; Moses, Wittemyer, Harrison, and Woodruff, P.C.)
- 2006, Dinsdale Brothers, Inc Well Users, An Application For Water Rights And Approval Of Plan For Augmentation, Colorado District Court Case Nos. 2001CW061 and 2003CW194:, Water Division No. 1. Deposition testimony in

September 2006 on impacts of groundwater pumping aspects of water rights application on senior water rights holder, case settled. (client: City of Boulder, CO; Moses, Wittemyer, Harrison, and Woodruff, P.C.)

- 2006, Allen et al. vs. Aerojet General et al., Superior Court of the State of California, County of Sacramento, Consolidated Case No. RCV 31496. *Jury trial testimony* in March 2006 regarding the evaluation of historical groundwater contamination at Aerojet Rancho Cordova Plant. Case Phase I (defendant negligence) ruled in client favor, Phase 2 (damages) settled for undisclosed sum (client: Engstrom, Lipscomb & Lack)
- 2006, Well Augmentation Subdistrict of Central Colorado Water Conservancy District, Water Rights Application and Augmentation Plan, Colorado District Court, Water Division No. 1. Deposition testimony in March 2006 on impacts of groundwater pumping aspects of water rights application on senior water rights holder, case settled. (client: City of Boulder, CO; Moses, Wittemyer, Harrison, and Woodruff, P.C.)

Reports & Publications

Textbooks

Selker, J.S., C.K. Keller, and J.T. McCord, 1999. Vadose Zone Processes, Lewis / CRC Press, Boca Raton, FLA, 339 pp.

McCord, J.T., and J.S. Selker, 2003. Transport Phenomena and Vulnerability of the Unsaturated Zone, in Encyclopedia of Life Support Systems, UNESCO, www.eolss.net.

Refereed Journal Articles

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Goodrich, M.T. and J.T. McCord. 1995. Quantification of uncertainty in exposure assessments of hazardous waste sites. Ground Water, 33(5):727-732.

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Dr. McCord has more than 75 additional conference presentations and publications on a range of water resource topics dating back to 1985, and a list of those can be provided upon request.

Exhibit B – Full Review of Model Development Plan

"Review of the California State Water Resources Control Board's December 2019 Final Study Plan for the Development of Groundwater-Surface Water and Nutrient Transport Models of the Ventura River Watershed" available online at https://www.casitaswater.org/your-water/california-instream-flow-studies

Prepared by GSI Water Solutions, One-Water Hydrologic, and IRP Water Resources Consulting

For Casitas Municipal Water District

PROOF OF SERVICE

Santa Barbara Channelkeeper v. State Water Resources Control Board, et al.
and related cross-action
Los Angeles County Superior Court
Case No. 19STCP01176

STATE OF CALIFORNIA, COUNTY OF ORANGE

I am employed by the law office of Rutan & Tucker, LLP in the County of Orange, State of California. I am over the age of 18 and not a party to the within action. My business address is 18575 Jamboree Road, 9th Floor, Irvine, California 92612. My electronic notification address is mmartinez@rutan.com.

On December 3, 2021, I served on the interested parties in said action the within:

CASITAS MUNICIPAL WATER DISTRICT'S C.C.P § 843 EXPERT WITNESS DISCLOSURE; DECLARATION OF JEREMY N. JUNGREIS

as stated below:

☒ (Via E-Service to **File & ServeXpress**) I affected electronic service by submitting an electronic version of the document(s) to **File & ServeXpress, LLC**, through the user interface at https://secure.fileandservexpress.com, which caused the document(s) to be sent by electronic transmission to the person(s) at the electronic service address(es) listed.

Executed on December 3, 2021, at Irvine, California.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Marisol Martinez	/s/ *Marisol Martinez*
(Type or print name)	(Signature)