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June 9, 2016

Hearing Chair Tam Doduc

Hearing Officer Felicia Marcus

State Water Resources Control Board

Sacramento, CA 95812-0100

**Subject:** Incomplete or missing information on CALSIM II modeling in submitted evidence

Dear Hearing Officers,

I support the request by Pacific Coast Federation of Fishermen's Association for an extension to 60 days of the time to review the evidence submitted by the Petitioners. In addition, a preliminary examination of the modelling evidence submitted shows major omissions that make it difficult even to prepare objections. These omissions need to be rectified. It is the Petitioners who have the burden of proof, not the Protestants.

For the CALSIM II modelling, information on the following appears to be incomplete or missing from the evidence submitted for the Case in Chief.

1. Peer review of modelling
2. Technical Review of modelling
3. Documentation of hydrologic inputs and embedded parameters
4. Documentation of code and modelling assumptions, and any calibration
5. Version control: maintaining a version history
6. Quality control: model version testing and error checking
7. Model and data testing and quality improvement

These processes are an integral part of the development of a large and complex computational simulation. They document the assumptions and testing done in development of the different

components, the revision and technical review status, and the quality control that insures the integrity of each version of the simulation.

Information from each of the processes needs to be made available to all hearing participants, prior to any required response to the submission of the modelling evidence. This includes objections to the evidence submitted.

The Department of Water Resources and US Bureau of Reclamation appear to have assumed that disclosure of the raw modelling data is sufficient for review by stakeholders. But more complete information is required for any informed review by a technical expert.

The following questions request information about the current status of each of these core model development processes. They request relevant information be disclosed to the hearing participants, or an explanation of why it is not available. I hereby request that the State Water Board require the Petitioners to answer these questions, at least 30 days prior to the deadline for submission of objections to the evidence.

Mr. Mizell, the attorney for the Department of Water Resources has indicated that the Department has provided "all data reasonably in its possession" responsive to my prior requests. It is unclear what is meant by "all data reasonably in its possession," so another, more detailed request is in order.

In case DWR and USBR have forgotten about the core model development processes enumerated above, I am including documentation that they were recommended as an essential part of CALSIM model development in the December 2003 Strategic Review of CALSIM. This review, prominently featured on DWR's website, was done under the auspices of the CALFED Science Program, and is titled, "A Strategic Review of CALSIM II and its Use for Water Planning, Management, and Operations in Central California." The review was performed by Drs. A. Close (Murray Darling Basin Commission), W.M. Haneman (University of California, Berkeley), J.W. Labadie (Colorado State University), J.R. Lund (University of California, Davis), D.C. McKinney (University of Texas, Austin), J.R. Stedinger (Cornell University) and Dr. Pete Loucks (Cornell University, Chair.)<sup>1</sup>

In addition, in case DWR and the US Bureau of Reclamation have forgotten, I am including documentation that the agencies made specific, concrete commitments to implement and maintain these processes. The documentation is from the 2004 response to the strategic review, which is also prominently featured on DWR's website. It is titled, "Peer Review Response: A Report by DWR/Reclamation in Reply to the Peer Review of the CalSim-II Model Sponsored by the CALFED Science Program in December 2003, August 2004."<sup>2</sup>

It is possible that Petitioners failed to maintain the modelling development process commitments in the Peer Review Response. This is a major material fact that should be known prior to submission of objections to the modelling evidence. Protestants need to have this information, at least 30 days prior to the deadline for submission of objections.

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<sup>1</sup> Available on the Department of Water Resources' website at <http://baydeltaoffice.water.ca.gov/modeling/hydrology/CalSimII/>

<sup>2</sup> Also available on the Department of Water Resources' website at <http://baydeltaoffice.water.ca.gov/modeling/hydrology/CalSimII/>

To: Mr. Mizell and Ms. Aufdemberge

Representing: California Department of Water Resources and US Bureau of Reclamation

Please have your agencies answer the following questions about the CALSIM II modelling evidence that was submitted as part of the Case in Chief.

### **1. Peer Review of modelling and accreditation for proposed use**

No peer reviews of CALSIM II modelling appear to have been submitted with the modelling evidence. This is an essential step in validating the model for any specific use. The 2003 Strategic Review of CALSIM II proposed a “model toolbox” for California, and an interagency process for validating the models. It stated in part (p. 3):

*New models proposed for use in California should be peer reviewed with respect to their suitability, and for their strengths and limitations, before being placed in the toolbox. The review should be of the theory underlying the model, the model’s software, the documentation of the model as well as of its software, the model’s functions and capabilities including those pertaining to model data input and output, the input data themselves, model calibration and verification, capabilities for sensitivity and uncertainty analyses, user control of all model operations including pre and post analyses (GUIs), spatial and temporal resolutions, and its limiting assumptions.*

Please answer the following questions:

- a) What efforts have been made to do an in-depth peer review of the current CALSIM II model submitted in support of the petition? Or any of the BDCP / Waterfix modelling?
- b) What CALSIM II components (besides the San Joaquin River module in 2006) have ever had such an in-depth peer review?
- c) Can you make both the report and information submitted to the panel available to the hearing participants?
- d) Can you provide information on the changes made to any peer-reviewed components of the model to hearing participants?

### **2. Technical Review of modelling**

Information about the technical review of the components of the CALSIM II model also appears to be incomplete or missing: The 2003 CALSIM Strategic Review stated the following (p. 3):

*The information we received and the shortness of our meetings with modeling staff precluded a thorough technical analysis of CALSIM II. We believe such a technical review should be carried out. Only then will users of CALSIM II have some assurance as to the appropriateness of its assumptions and to the quality (accuracy) of its results. By necessity our review is more strategic. It offers some*

*suggestions for establishing a more complete technical peer review, for managing the CALSIM II applications and for ensuring greater quality control over the model and its input data, and for increasing the quality of the model, the precision of its results, and their documentation.*

Questions:

- a) For what components of CALSIM II was this thorough technical analysis done? In what year and for what version of the CALSIM II model?
- b) For each of the technical analyses, was it internal or external?
- c) For each component, what information about the most recent technical analysis is available? Can you provide this information to all parties in the hearing?
- d) For each technical analysis, have the inputs, embedded parameters, or code changed for those components changed since that time? Can you provide this information to all parties in the hearing?

### **3. Documentation of hydrologic inputs and embedded parameters**

Documentation of hydrologic inputs and embedded parameters in the CALSIM II modelling also appears to be incomplete or missing. The 2003 CALSIM II Strategic Review stated the following (p. 20):

*“There has not been sufficiently systematic, transparent, and accessible approach to the development and use of hydrologic, water demand, capacity and operational data. The administration of data development is fragmented, disintegrated, and lacks a coherent technical or administrative framework.”*

The response by DWR and USBR stated in part (4.3.2. Data, p. 17),

*The validity of data inputs impacts both model results and model credibility. The greatest concern is the validity of the hydrologic inputs and parameters. Concern is compounded by the current lack of complete documentation. Over the last two years DWR and Reclamation have attempted to document model inputs. Reclamation is currently documenting the current CalSim-II hydrology procedures. This effort needs to be extended and updated.*

Please answer the following questions:

- a) For what hydrologic, water demand, capacity and operational data was this documentation completed?
- b) In each case, was this documented for the current version of the model?
- c) If not, was it documented for prior versions?
- d) In each case, can you make the most recent version of the documentation available to all parties to the hearing, with a summary and guide to the information?

#### **4. Documentation of code and modelling assumptions, and any calibration**

The 2003 Strategic Review of CALSIM II (p. 37) indicated that DWR and USBR needed to maintain model and data documentation as part of a quality control program for the software. The response to the 2003 Strategic Review proposed the implementation of a documentation management system. The response stated (Appendix D p. D-1),

*“Therefore, a documentation management system is proposed that utilizes a database to organize and maintain the information. The system will be used as a “central-file” for all model documentation. The new system will track and maintain a documentation history similar to features in the next version of CalSim (v2.0) data management system. Existing documentation will also be rolled into the new management system. [...]*

*It is anticipated that the organized and centralized documentation management system will be the new standard for CalSim documentation procedures. Linkages between the documentation and the code will eliminate undocumented or overlooked topics. New documentation coverage will address deficiencies and multi levels of detail will support both the novice and expert. The document management system is also expected to be an integral and priority component of the CalSim work effort.”*

Please answer the following questions:

- a) Was this documentation management system or something similar implemented?
- b) If so, is it still being maintained?
- c) If so, can you provide a list of the documentation in the documentation management system, along with the most recent documentation of all model components, to the parties in the WaterFix hearing?
- d) If not, why has it not been implemented or maintained?

#### **5. Version control: maintaining a version history**

Version history and version control information for the the CALSIM II code, inputs, and embedded parameters in the model version submitted for the Case in Chief also appears to be incomplete or missing. The 2003 Strategic Review identified version control as essential to quality control of the software (p. 37 & 58).

In the response to the review, DWR and USBR stated that they had implemented a version control system (Appendix B. Current CalSim / CalSim-II Development Projects, p. B-1):

*A web-based version control software (Perforce) is used by DWR modelers for managing the text-file input files of the current version of CalSim (v1.2). Adoption of a public domain relational database management system is under development for the next version of CalSim (v2.0). This database will provide a central repository that will contain documentation in addition to the model input/output data (time series data may continue to be stored in HECDSS). This will provide a full-featured client/server database*

*including version control, integrity of data, documentation (including metadata), and ease of dissemination.*

Please answer the following questions:

- a) Is this version control system still being maintained?
- b) Was it maintained for the BDCP / WaterFix code versions?
- c) If so, can you make the complete version history of the BDCP / WaterFix model and any DRR versions they are derived from available to stakeholders, including all parties in the hearing?
- d) Was it maintained for the code version submitted for the WaterFix hearing?
- e) If so, can you make the complete version history of the BDCP / WaterFix model and any DRR versions they are derived from available to stakeholders, including all parties in the hearing?
- f) If not, why has it not been maintained?

## **6. Quality control: model version testing and error checking**

The 2003 CALSIM Strategic Review also identified model testing as essential to quality control of the software. Since the system is large and complex, the panel identified automated error and input/output checking as important.

In the response, DWR and USBR stated (Section 4.3.4.2, Error Checking, p. 18):

*Staff from DWR, Reclamation, and other agencies or consultants has [sic] developed several spreadsheets for such purposes. A short-term goal of DWR is to collect, refine, and develop such spreadsheets into a series of standard pre and post processors that become a standardized set of tools.*

Please answer the following questions:

- a) Are these quality control spreadsheets still being maintained?
- b) If so, have they been run on any of the BDCP/Waterfix CALSIM II model versions?
- c) If so, can you provide the information to the WaterFix hearing parties?
- d) If so, have they been run on the version submitted in support of the hearing?
- e) If so, can you provide the information to the WaterFix hearing parties?

## **7. Model and data testing and quality improvement**

The 2003 Peer review recommended that the CALSIM II model be “subject to a systematic model and data testing regime and continuous quality improvement program,” and further elaborated (Some Prominent Weaknesses, p. 21):

*As the problems of California water change, different and greater demands will be placed on analytical capability, requiring an essentially continuous testing, re-testing,*

*and improvement of data and models. This might parallel a continuous review of local representations and data involving local agency and consulting experts.*

It also suggested review by stakeholders (Executive Summary, p. 2):

*To increase the public's confidence in the many components and features of CALSIM II, we suggest that these components of CALSIM be subjected to careful technical peer review by appropriate experts and stakeholders.*

However, there were significant concerns expressed by stakeholders that the BDCP / WaterFix modelling development was done almost entirely in coordination with the BDCP Steering Committee, and the only information available to many local agencies or stakeholders was the raw modelling data.

Please answer the following questions:

- a) Besides Contra Costa County, what efforts were made to involve local water agency and consulting experts in review of local representations and data?
- b) If so, who was involved, what was the year, and what modules were revised?
- c) What CALSIM II modules or embedded parameters were revised and tested in coordination with the BDCP Steering Committee?
- d) Can you make a list of the information from these reviews and revisions available to the hearing participants?