STATE WATER RESOURCES CONTROL BOARD
PUBLIC WORKSHOPS AND REQUEST FOR INFORMATION: COMPREHENSIVE (PHASE 2) REVIEW AND UPDATE TO THE BAYDELTA PLAN

Workshop 3: Analytical Tools for Evaluating Water Supply, Hydrodynamic and Hydropower Effects

Written Submittal of Daniel B. Steiner on behalf of San Joaquin Tributaries Authority

1. I, Daniel B. Steiner, declare that the facts set forth below are true and correct based on my own personal knowledge and I could and would testify to them if called to do so.

2. I am a registered Civil Engineer in the State of California, Certificate No. 32226. I received a B.S. in Engineering from the University of California, Davis, in 1977. I am currently self-employed and conduct business as Daniel B. Steiner – Consulting Engineer. I have over 35 years of experience in water resources planning, development and management, including the planning and implementation of operations for multipurpose water systems that have water and power supply, flood control, recreation, fishery and wildlife enhancement and water quality objectives. I also have experience in evaluation of water rights, contracted and court decreed entitlements, and water use.

3. My professional experience began with employment with the United States Bureau of Reclamation (USBR), including direction of the operation of Central Valley Project (CVP) facilities in California, including Trinity, Shasta, Folsom, New Melones, Millerton and San Luis Reservoirs and associated water conveyance facilities. I also coordinated CVP operations within the Sacramento-San Joaquin Delta. As a consultant, my experience includes participation in several regulatory proceedings including the development of the 1995 State Water Resources Control Board Water Quality Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary and Decision 1641, the technical and policy development of the San Joaquin River Agreement and its environmental documentation and the development of the New Melones Interim Plan of Operations.

4. I am a co-developer of the San Joaquin River Basin representation within the

peer-reviewed joint Department of Water Resources/USBR CalSim II model, with responsibility for the depiction of San Joaquin River hydrology and operations from Friant to the Sacramento-San Joaquin Delta. I have participated in or have been directly responsible for several hydrologic analyses concerning flow and quality of the San Joaquin River over the course of my career. I have also developed companion worksheet modeling tools for the depiction of New Melones, Friant, and Tuolumne River operations.

5. I am currently assisting the members of the San Joaquin Tributary Authority with planning analysis of future operations of the San Joaquin River, which is utilizing the CalSim II operations simulation model and other separate or companion modeling tools. I have reviewed and performed operation studies concerning the June 2009 Biological Opinion. Also included in the assistance is review and development of operation studies concerning the State Water Resources Control Board (SWRCB) potential changes to the San Joaquin River Flow and Southern Delta water quality objectives, and have reviewed and commented on the SWRCB Staff analysis and tools for the Substitute Environmental Document.

6. The SWRCB noticed public workshops concerning the comprehensive (Phase 2) review and update to the Bay-Delta Plan. Workshop 3 concerns the analytical tools used for evaluating the water supply, hydrodynamic and hydropower effects of the Bay-Delta Plan. The SWRCB has posed the following questions concerning the tools and modeling:

> *What types of analyses should be completed to estimate the water supply, hydrodynamic, and hydropower effects of potential changes to the Bay-Delta Plan?*
>
> *What analytic tools should be used to evaluate these effects? What are the advantages, disadvantages and limitations of these tools?*

7. Concerning the analyses, sequential period operation studies must be performed to simulate and evaluate projected system operations during numerous hydrologic sequences. Such analyses should be done for the historically experienced 1922-2003 period of record, and additionally through more recent periods if the hydrology is available. The analyses must evaluate not only the long-term average or year type effect of alternative objectives, but must also evaluate and specifically address interspersed, specific shorter-duration periods of

operations associated with drought, such as the 1928-1935, 1976-1977, and 1987-1992.

8. The best available tool for analyzing the water supply effects to the San Joaquin River Basin tributary systems and the subsequent Bay-Delta system reaction to San Joaquin River operations is the CalSim II model. The current peer-reviewed model provides the structure and logic to adequately provide a depiction of individual San Joaquin River tributary operations based on local and certain basin-wide operation objectives. The structure and logic of the model currently allows the evaluation of a range of alternative potential changes to the Bay-Delta Plan, and with modification, the model would depict proposed constraints or objectives. The CalSim II platform allows a combined operation of San Joaquin River Basin facilities to be depicted, with hydrology projected for the Delta input at Vernalis. Other, commonly applied hydrodynamic, hydropower and water temperature models derive their inputs from CalSim II results.

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

Executed this 15 of October, 2012 in Sacramento, California.

DANIEL B. STEINER

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Written Submittal of Avry Dotan, AD Consultants
on behalf of San Joaquin Tributaries Authority

The development of the San Joaquin River (SJR) Basin-wide Water Temperature Model (Model) started as a grass-roots project in December 1999 when a group of Stanislaus stakeholders decided to analyze the relationship between operational alternatives, water temperature regimes and fish mortality in the Stanislaus River. These stakeholders included the U.S. Bureau of Reclamation (USBR), U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), Oakdale Irrigation District (OID), South San Joaquin Irrigation District (SSJID), and Stockton East Water District (SEWD). The group decided to join resources and fund the development of a high resolution reservoir operation water temperature computer model built on the Army Corps of Engineers' HEC-5Q platform. The Model covered the Stanislaus River from New Melones Reservoir to its confluence with the San Joaquin River.

The Model has enabled the stakeholders to evaluate water temperature objectives at critical points in the river system that would enhance habitat conditions for fall-run Chinook salmon and Steelhead rainbow trout under various river operation scenarios. The Model also allowed examination of the thermal benefits that might be obtained from physical changes to existing facilities (e.g., removal or breaching the original Melones Dam which is still in place in New Melones Reservoir) or from new facilities (e.g., selective withdrawal structure at New Melones Reservoir or retrofitting Goodwin Dam).

The success of the Stanislaus work and the interest in this Model expressed by stakeholders from adjacent tributaries to the San Joaquin River (e.g., Tuolumne and Merced rivers), prompted CALFED to fund the expansion of the Model. This was done in two phases: 1) extending the Model to include the Lower San Joaquin River in the reach between the Stanislaus River and Mossdale, and 2) extending the Model to include the mainstem SJR between the Stanislaus River and Stevinson (upstream of the Merced confluence).

A working version of the Model was released to the SJR stakeholders in November 2008 and the final version of the model was submitted to CALFED and released to the public in December 2009. The model has been peer reviewed by a group of scientists selected by CALFED.

In its current setting, the Model is designed to simulate reservoir operation and resulting flow regime in the river system using daily time steps and then compute the water temperature response at any given location downstream of the reservoirs on a sub-daily basis (6-hour intervals). Reservoirs represented in the Model include McClure, McSwain, Merced Falls, and Crocker Huffman on the Merced River; Don Pedro and La Grange on the Tuolumne River; and New Melones, Tulloch, and Goodwin on the Stanislaus River.

The Model can perform two modes of simulations: The first mode uses the "top-down" approach. In this mode, the Model computes the temperature response downstream to the reservoirs given a prescribed release schedule. The second mode uses the "bottom-up" approach. In this mode, target temperatures at compliance points are identified (could be at multiple locations and times in the year) and the Model computes the quantity and timing of water releases from reservoirs (taking into account travel time), in an attempt to meet the target temperatures. Special constraints are imposed to ensure that the Model's proposed release is compatible with the physical system as well as with the operator's ability to manage this release (e.g., ramping rates, channel capacity, maximum volume of water available to managers to mitigate temperature violations, etc.).

Concurrent with the efforts of Model development described above, the USBR, as part of the 2006 Friant Litigation Settlement Agreement, funded Model extensions, to include: 1) the San Joaquin River flood and bypass systems from Millerton Lake/Friant Dam downstream to Stevinson, to evaluate thermal impacts of Friant restoration alternatives, and 2) the SWP and CVP system components (canals and storage facilities between the Bay-Delta and Mendota Pool). More recently, the USBR also funded a study to assess the viability (proof of concept) of expanding the Model to simulate salinity (Electrical Conductivity, or EC) conditions at key locations within the San Joaquin River system.

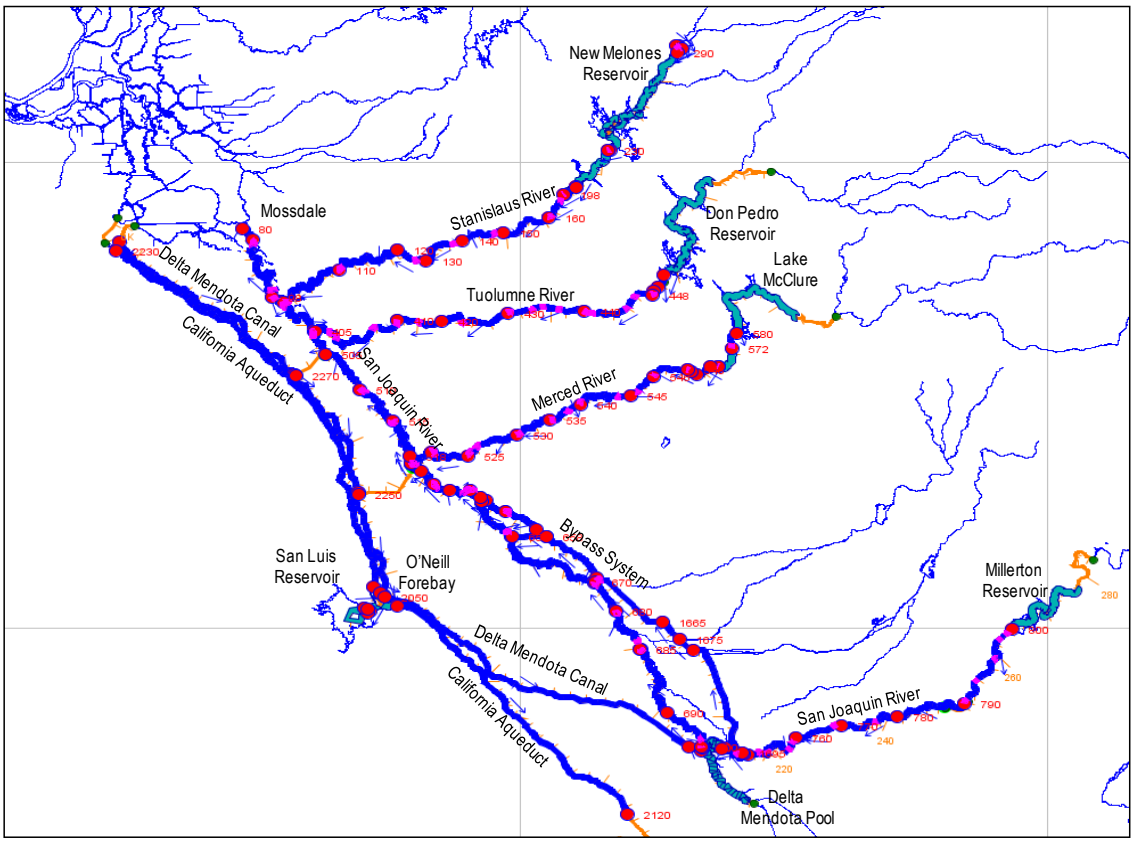
Given the promising results of this study, new data collected since the Model was released in 2009, and feedback and suggestions provided by various users of the Model, the CDFG decided in 2011 to embark on and fund an expansion and enhancement of the Model.

The newly expanded/enhanced Model provides a complete geographical coverage of the SJR basin stretching from the SJR Basin rim reservoirs (New Melones, New Don Pedro, McClure, and Millerton) to the Bay-Delta, including representation of the SWP and CVP components, as illustrated in the figure below.

The Model also includes representation of hydropower facilities at the main dams in the SJR basin. EC representation in the Model has been refined and calibrated and the hydrological period was extended through December 2010. The newly collected water temperature and EC data were used for both Model validation and recalibration.

One of the important features in the expanded/enhanced Model is the interface with CALSIM II. A special routine was added to allow importing CALSIM II output as Model input. This routine serves two purposes: 1) to allow the Model perform a long-term simulation compatible with the period used in CALSIM II, and 2) to disaggregate monthly output from CALSIM II to daily values in the Model. The latter feature is coupled with new optimization routine where by the Model disaggregates the monthly release from reservoirs to daily flow and reallocates the water in way that maximizes the thermal benefits downstream, while maintaining the same volume of water released, either on an annual or monthly basis (two options).

The expanded/enhanced Model is due for release to the public by the end of 2012.



Representation of the SJR Basin-wide Water Temperature Model

In conclusion, the SJR Basin-wide Water Temperature Model is a powerful basin-scale tool to assess a wide range of hydrological, meteorological, and operational conditions in support of balancing multiple beneficial uses in the basin. This Model includes extended time series allowing assessment of assumed or proposed conditions through a variety of year-types (e.g., wet, dry, extended drought), while yielding results on a sub-daily time step (daily flow and 6-hour time interval temperature response). The EC representation (currently a weekly time step) provides a new insight regarding salinity conditions at key locations, with emphasis on the confluences of the tributaries with the main-stem SJR and at Vernalis, resulting from various water management scenarios. The hydropower representation (treated in the Model as by-product of system operation), provides useful information about the ramification of water management scenarios on power generation.

Finally, the acceptance of this Model as the tool of choice for SJR Basin-wide modeling by most of the SJR stakeholders helps focus the discussion amongst the stakeholders on the merit of proposed water management scenarios rather than on the "war of the models".

INDEX TO DOCUMENTS SUBMITTED
SAN JOAQUIN TRIBUTARIES AUTHORITY
STATE WATER RESOURCES CONTROL BOARD- WORKSHOP 3
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dotans_submittal_re_workshop_3.pdf	**Title**: Written Submittal of Avry Dotan, AD Consultants on behalf of the San Joaquin Tributaries Authority **Prepared for**: State Water Resources Control Board-Phase II Comprehensive Review Workshops, Workshop 3, "Analytical Tools for Evaluating the Water Supply, Hydrodynamic, and Hydropower Effects of the Bay-Delta Plan" to be held November 13-14, 2012 **Prepared by**: Avry Dotan, AD Consultants **On behalf of**: The San Joaquin Tributaries Authority	October 23, 2012
steiners_submittal_re_workshop_3.pdf	**Title**: Written Submittal of Daniel B. Steiner on behalf of the San Joaquin Tributaries Authority **Prepared for**: State Water Resources Control Board-Phase II Comprehensive Review Workshops, Workshop 3, "Analytical Tools for Evaluating the Water Supply, Hydrodynamic, and Hydropower Effects of the Bay-Delta Plan" to be held November 13-14, 2012 **Prepared by**: Daniel B. Steiner **On behalf of**: The San Joaquin Tributaries Authority	October 15, 2012