Appendix 5.A, CalSim II Modeling and Results

EXHIBIT BKS-101

STAFF EXHIBIT SWRCB-104
BIOLOGICAL ASSESSMENT FOR THE CALIFORNIA WATERFIX
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Delta exports in CalSim II are a function of many factors including physical pumping capacities, health and safety pumping requirements, south-of-Delta allocations, monthly demand patterns, available export capacities considering regulatory and operational constraints, and the assumed San Luis rule curve. San Luis rule curve is an input to CalSim II which provides a target storage each month that is dependent on the South-of-Delta allocation and upstream reservoir storage. The rule curve allows CalSim II to emulate judgement of the operators in balancing the north-of-Delta and south-of-Delta storage conditions. Assumed San Luis rule curve could differ depending on the available export capacity during winter and spring months, and the need to protect upstream carryover storage in the fall months. In the absence of any other operating criteria controlling the upstream reservoir releases or the Delta exports, different San Luis rule curves can result in differences in upstream reservoir release patterns, and Delta exports.

Under stressed water supply conditions, given the generalized nature of specified operations rules, CalSim II model results should only be considered an indicator of stressed water supply conditions, and should not necessarily be understood to reflect literally what would occur in the future under a given scenario. For example, CalSim II model can result in instances where the required minimum instream flows, or regulatory flow/salinity requirements cannot be achieved, or deliveries to senior water rights holders could be shorted due to extreme water supply conditions in the reservoirs. CalSim II does not currently reflect potential relaxations of standards that the State Water Resources Control Board in coordination with other regulatory agencies might invoke under such dry circumstances. As a result, CalSim II may tend to underestimate reservoir storages and overestimate flows during the most severe droughts. CalSim II also does not account for the compromises and temporary arrangements that are made among stakeholders during such dry circumstances. In reality the operations are managed in close coordination with various regulatory agencies and stakeholders under such extreme circumstances. In actual future operations, the project operators would continue to work in real time to satisfy legal and contractual obligations based on the water supply conditions and other information available at the time.

Appropriate use of model results is important. While there are certain components in the model that are downscaled to daily time step (simulated or approximated hydrology) such as an air-temperature based trigger for a fisheries action, the results of those daily conditions are always averaged to a monthly time step (for example, a certain number of days with and without the action is calculated and the monthly result is calculated using a day-weighted average based on the total number of days in that month); and model operational decisions based on those components are again made on a monthly basis. Therefore reporting sub-monthly results from CalSim II or from any other subsequent model that uses monthly CalSim results as an input is tenuous at best.

Because it is simulating hypothetical conditions, CalSim II is not calibrated and cannot be used in a real-time predictive manner. CalSim II results are intended to be used in a comparative manner, which allows for assessing the changes in the CVP/SWP system operations and resulting incremental effects between two scenarios. The model should be used with caution where absolute results are needed in instances such as determining effects based on a threshold, prescribing seasonal or to guide real-time operations, predicting flows or water deliveries for any real-time operations etc.

5.A.5.1 CalSim II Assumptions for the No Action Alternative

The assumptions for the NAA are consistent, where appropriate, with the 2015 LTO EIS NAA assumptions (Reclamation 2015). The NAA was developed assuming projected Year 2030 conditions. The NAA includes projected climate change and sea level rise assumptions corresponding to the Year 2030. Change in climate results in the changes in the reservoir and tributary inflows included in CalSim II. The changes associated with the assumed 15 cm sea level rise result in modified flow-salinity relationships in the Delta. The climate change and sea level rise assumptions at Year 2030 are described in detail in Appendix 5A - Attachment 1. The CalSim II simulation for the NAA does not consider any adaptation measures that would result in managing the CVP/SWP system in a different manner than today to reduce climate impacts. For example, future changes in reservoir flood control reservation to better accommodate a seasonally changing hydrograph may be considered under future programs, but are not considered under the CWF BA.

5.A.5.1.1 Hydrology

5.A.5.1.1.1 Inflows/Supplies

CalSim II model for the NAA includes the historical hydrology projected to Year 2030 considering the climate change effects.

5.A.5.1.1.2 Level of Development

CalSim II uses a hydrology which is the result of an analysis of agricultural and urban land use and population estimates. The assumptions used for Sacramento Valley land use result from an aggregation of historical survey and projected data developed for the California Water Plan Update (Bulletin 160-98). Generally, land use projections are based on Year 2020 estimates (hydrology serial number 2020D09E), however the San Joaquin Valley hydrology reflects draft 2030 land use assumptions developed by Reclamation. Where appropriate Year 2020 projections of demands associated with water rights and CVP/SWP water service contracts have been included. Specifically, projections of full build out are used to describe the American River region demands for water rights and CVP contract supplies, and California Aqueduct and the Delta Mendota Canal CVP/SWP contractor demands are set to full contract amounts.

5.A.5.1.1.3 Demands, Water Rights, CVP/SWP Contracts

CalSim II demand inputs are preprocessed monthly time series for a specified level of development (e.g. 2020) and according to hydrologic conditions. Demands are classified as CVP project, SWP project, local project or non-project. CVP/SWP demands are separated into different classes based on the contract type. A description of various demands and classifications included in CalSim II is provided in the 2008 LTO BA Appendix D (Reclamation 2008a).

Table 5.A-2 below includes the summary of the CVP/SWP project demands in thousand acre-feet (TAF) included under NAA. Detailed description of American River demands assumed under the NAA is provided in Appendix 5A - Attachment 5. For SWP contractors, full Table A demands are assumed every year. Under Article 21 of the Monterey Agreement, SWP contractors may request more than their Table A entitlements under certain water-availability conditions. Article 21 deliveries require that San Luis Reservoir be at capacity and that Banks PP

remain open and the Delta exports are limited to 2,000 cfs for each day in question. Specifically, if the Rock Slough salinity standard in not met, then the gates are operated per D-1641 criteria.

The gates are also closed in any month if the monthly average Sacramento River flow upstream of the DCC is greater than 25,000 cfs.

5.A.5.1.5.3 Allocation Decisions

CalSim II includes allocation logic for determining deliveries to north-of-Delta and south-of-Delta CVP/SWP contractors. The delivery logic for both the CVP and the SWP starts by computing their respective water supplies index for the contract year. This uses runoff forecast information, which incorporates uncertainty in the hydrology. Each project then uses its own Water Supply Index versus Demand Index Curveto relate forecasted water supplies to deliverable "demand." The deliverable "demand" is then related to delivery levels, given inputted general balancing between water available for delivery and carryover storage for each Demand Index Level. Updates of delivery levels occur monthly from January 1 through May 1 for the SWP and March 1 through May 1 for the CVP as runoff forecasts become more certain. The south-of-Delta SWP delivery is determined based on water supply parameters and operational constraints. The CVP system wide delivery and south-of-Delta delivery are determined similarly upon water supply parameters and operational constraints with specific consideration for export constraints.

5.A.5.1.5.4 San Luis Operations

CalSim II sets targets for San Luis storage each month that are dependent on the current South-of-Delta allocation and upstream reservoir storage (San Lusis rule curve). When upstream reservoir storage is high, allocations and San Luis fill targets are increased. During a prolonged drought when upstream storage is low, allocations and fill targets are correspondingly low. For the NAA simulation, the San Luis rule curve is managed to maximize filling during summer and fall months when the Delta export pumping is less constrained to minimize situations in which south-of-Delta shortages may occur due to lack of storage or exports.

5.A.5.1.5.5 New Melones Operations

In addition to flood control, New Melones is operated for four different purposes: fishery flows, water quality, Bay-Delta flow, and water supply.

5.A.5.1.5.5.1 Fishery Flows

In the NAA simulation, fishery flows refer to flow requirements of the 2009 NMFS BiOp Action III.1.3 (NMFS 2009). These flows are patterned to provide fall attraction flows in October and outmigration pulse flows in spring months (April 15 through May 15 in all years) and total up to 98.9 TAF to 589.5 TAF annually depending on the hydrological conditions based on the New Melones water supply forecast (the end-of-February New Melones Storage, plus the March - September forecast of inflow to the reservoir) (Tables 5.A-3 through 5.A-5).

5.A.5.1.5.5.2 Water Quality

Water quality releases include releases to meet the State Water Resources Control Board (SWRCB) Decision 1641 (D-1641) salinity objectives at Vernalis and the Decision 1422 (D-1422) dissolved oxygen objectives at Ripon.

The Vernalis water quality requirement (SWRCB D-1641) is an electrical conductivity (EC) requirement of 700 and 1000 micromhos/cm for the irrigation (Apr-Aug) and non-irrigation (Sep-Mar) seasons, respectively.

Additional releases are made to the Stanislaus River below Goodwin Dam if necessary, to meet the D-1422 dissolved oxygen content objective. Surrogate flows representing releases for DO requirement in CalSim II are presented in Table 5.A-6. The surrogate flows are reduced for critical years where New Melones water supply forecast (the end-of-February New Melones Storage, plus the March - September forecast of inflow to the reservoir) is less than 940 TAF. These flows are met through releases from New Melones without any annual volumetric limit.

5.A.5.1.5.5.3 Bay-Delta Flows

Bay-Delta flow requirements are defined by D-1641 flow requirements at Vernalis (not including pulse flows during the April 15 - May 16 period). These flows are met through releases from New Melones without any annual volumetric limit.

D-1641 requires the flow at Vernalis to be maintained during the February through June period. The flow requirement is based on the required location of "X2" and the San Joaquin Valley water year hydrologic classification (60-20-20 Index) as summarized in Table 5.A-7.

5.A.5.1.5.5.4 Water Supply

Water supply refers to deliveries from New Melones to water rights holders (Oakdale Irrigation District and South San Joaquin Irrigation District) and CVP eastside contractors (Stockton East Water District and Central San Joaquin Water Control District).

Water is provided to Oakdale ID and South San Joaquin ID in accordance with their 1988 Settlement Agreement with Reclamation (up to 600 TAF based on hydrologic conditions), limited by consumptive use. The conservation account of up to 200 TAF storage capacity defined under this agreement is not modeled in CalSim II.

5.A.5.1.5.5.5 Water Supply-CVP Eastside Contractors

Annual allocations are determined using New Melones water supply forecast (the end-of-February New Melones Storage, plus the March - September forecast of inflow to the reservoir) for Stockton East WD and Central San Joaquin WCD (Table 5.A-8) and are distributed throughout a year using monthly patterns.

5.A.5.2 CalSim II Assumptions for the Proposed Action

The PA is a dual conveyance alternative with three proposed intakes in the north Delta with 9,000 cfs total pumping capacity (3,000 cfs at each intake). As mentioned previously, the PA assumptions are consistent with the NAA assumptions except for a few operational changes in the Delta and the additional operations associated with the new facilities including north Delta diversion bypass flows, South Delta export operations, Head of Old River barrier operations, Spring Delta outflow and Rio Vista miminum flow requirements. CalSim II assumptions for the PA that are different from the NAA are described below.

During the initial pulse protection period low level pumping is maintained until the pulse period has ended. For modeling purposes, the initiation of the pulse is defined by the following criteria: (1) Wilkins Slough flow changing by more than 45% within a five day period and (2) Wilkins Slough flow becomes greater than 12,000 cfs. The pulse protection and the low level pumping continues until (1) Wilkins Slough returns to pre-pulse flows (flow on first day of the within-5 day increase), (2) Wilkins Slough flows decrease for five consecutive days, or (3) Wilkins Slough flows are greater than 20,000 cfs for 10 consecutive days. If the initial pulse begins and ends before December 1, the May Level 1 post-pulse criteria will go into effect after the pulse until December 1. On December 1, the post-pulse rules defined below for December through April, starting with Level 1 apply. If the initial pulse begins and ends before December 1st, a second pulse period will be afforded the same protective operation.

After the pulse period has ended, the bypass flows noted in the Table 5.A-13 are maintained. After the initial pulse(s), Level I post-pulse bypass rules are applied until 15 days of bypass flows above 20,000 cfs have accrued since the pulse ended. Then Level II post-pulse bypass rules are applied until 30 days of bypass flows above 20,000 cfs have accrued since the pulse ended. Then Level III post-pulse bypass rules are applied. The bypass rules were applied on the mean daily river flows in the CalSim II model. Under the post-pulse operations allowable diversion will be greater of the low-level pumping or the diversion allowed by the following post-pulse bypass flow rules. In actual operations these criteria as well as fishery conditions are expected to guide allowable north Delta intake diversions as described in Section 3.3.3.1 of the BA.

In addition to the bypass flow criteria described above, a linear constraint was applied in the CalSim II PA simulation on the potential diversion at the north Delta intakes, to account for the fish screen sweeping velocity criteria of 0.4 fps based on diversion limitations from DSM2 modeling.

5.A.5.2.5 Operations Criteria

5.A.5.2.5.1 Fremont Weir Operations
Consistent with the NAA assumptions.

5.A.5.2.5.2 Delta Cross Channel Gate Operations
Consistent with the NAA assumptions.

5.A.5.2.5.3 Allocation Decisions
Consistent with the NAA assumptions.

5.A.5.2.5.4 San Luis Operations
Under the PA, the CalSim II San Luis rule curve is modified in expectation that the new north Delta diversion facility would allow capturing winter and spring excess flows and filling of the San Luis Reservoir to a greater extent than the NAA. Additional modifications to the rule curve were included to preserve upstream carryover storage conditions while minimizing south-of-Delta shortages in the fall months. Sensitivity analyses indicated that using the NAA's more aggressive rule to move water south earlier in the water year than in the PA would yield a little more delivery, but would be at the expense of upstream storage.