UNITED STATES OF AMERICA 131 FERC ¶ 62,110
FEDERAL ENERGY REGULATORY COMMISSION

MODESTO IRRIGATION DISTRICT PROJECT NO. 2299 – 072
TURLOCK IRRIGATION DISTRICT

ORDER MODIFYING AND APPROVING INSTREAM FLOW AND WATER TEMPERATURE MODEL STUDY PLANS

(Issued May 12, 2010)

1. On October 14, 2009, the Modesto Irrigation District and the Turlock Irrigation District (Districts), licensees for the Don Pedro Project, filed their Instream Flow and Water Temperature Model Study Plans pursuant to ordering paragraph (F) of the Order on Rehearing, Amending License, Denying Late Intervention, Denying Petition, and Directing Appointment of a Presiding Judge for a Proceeding on Interim Conditions, issued July 16, 2009. [1] The project is located on the Tuolumne River, in Stanislaus and Tuolumne Counties, California.

BACKGROUND

2. The Commission issued an original license to the Districts for the 161-megawatt Don Pedro Project in 1964. Project facilities consist of a 580-foot-high dam, a powerhouse, and a reservoir with an active storage capacity of 1,721,000 acre feet. The project is located on the mainstem of the Tuolumne River, in the Central Valley of California, about 115 miles east of San Francisco. It began commercial operation in 1971, and is operated to provide irrigation storage, hydroelectric power, flood control storage, recreational benefits, fish and wildlife conservation, and municipal water supply. The current license expires in 2016, and the process for relicensing would begin in 2011.

3. The Districts also own La Grange Dam (river mile (RM) 52.2), a non-project diversion dam built in 1893 and located on the Tuolumne River 2.3 miles downstream of Don Pedro Dam. It is 130 feet high and impounds approximately 500 acre feet. The Districts use La Grange Dam to divert water into their canal systems for upstream consumptive purposes.

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[1] 128 FERC ¶ 61,035 (2009)

4. The project is hydrologically linked with the City and County of San Francisco's upstream Hetch Hetchy System which regulates inflow to the Don Pedro Project and includes a series of reservoirs, diversion conduits, and powerhouses located on the Upper Tuolumne River.[2] San Francisco agreed to help finance construction of the Don Pedro Project in return for storage rights in the project reservoir, from which it could provide the Districts with the irrigation water to which their senior water rights entitle them. This allows San Francisco to use a greater portion of its upstream storage reservoirs for municipal water supply.

5. On March 19, 1998, the National Marine Fisheries Service (NMFS) listed the evolutionary significant unit (ESU) of California Central Valley steelhead (*Oncorhynchus mykiss* or *O. mykiss*) [3] under the Endangered Species Act. On July 10, 2000, NMFS issued protective regulations under Section 4(d) of the ESA, which prohibit taking of listed steelhead without authorization. On September 2, 2005, NMFS designated critical habitat for the California Central Valley steelhead ESU, including stream reaches in the Tuolumne River. On January 5, 2006, after the initial listing was declared invalid, NMFS issued a final rule reaffirming the listing for the California Central Valley distinct population segment of steelhead as threatened under the ESA. At that time, NMFS also determined that there was no need to revise its September 2, 2005 designation of critical habitat for Central Valley steelhead, which included the Tuolumne River from its confluence with the San Joaquin River upstream to La Grange Dam.

6. On September 16, 1999, the California Central Valley fall- and late-fall run Chinook salmon ESU listing was found not to be warranted under the ESA; however, the species was made a Candidate Species due to specific risk factors. On April 15, 2004, it was transferred to the new Species of Concern list and remains a species of concern today. This ESU includes fall and late-fall Chinook salmon spawning in the Sacramento and San Joaquin Rivers and their tributaries.

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[2] The Hetch Hetchy System in not a part of the licensed project. The System is owned and operated by San Francisco pursuant to authority conferred in the Raker Act. 38 Stat. 242 (1913). The Raker Act requires the Hetch Hetchy System to release a specified amount of water to the Districts. Section 29 of the Federal Power Act, 16 U.S.C. § 823 (2006), prohibits the Commission from modifying or repealing any provisions of the Raker Act.

[3] Steelhead is the anadromous form of *O. mykiss*; the resident form of *O. mykiss* is commonly known as rainbow trout. The ESA listing includes only the anadromous form of the species.

7. Article 37 of the Don Pedro Project license requires the Districts to maintain minimum flow releases from the Don Pedro Project into the Tuolumne River, as measured at La Grange Bridge (RM 50.5). The flows are based on the Water Year classification,[4] as determined by forecasts of the San Joaquin River Basin run-off. As amended in 1996,[5] Article 37 minimum flow releases were revised to benefit fishery resources in the Tuolumne River in accordance with the table and schedules set-forth below or with such schedules as may be agreed to among the Districts, California Department of Fish and Game (CDFG), and the U.S. Fish and Wildlife Service (FWS), and the National Marine Fisheries Service (NMFS). In accordance with the July 16, 2009 order[6] Article 37 was further amended to add the National Marine Fisheries Service (NMFS) as an agency to be consulted on any changes to the minimum flow release schedule for the project.

ARTICLE 37 FLOW SCHEDULE

Schedule	Days	Critical & below	Median Critical	Interm. Critical Dry	Median Dry	Interm. Dry-Below Normal	Median Below Normal	Interm. Below Normal -Above Normal	Median Above Normal	Interim Above Normal-Wet	Median Wet/Max
Occurrence		6.4%	8.0%	6.1%	10.8%	9.1%	10.3%	15.5%	5.1%	15.4%	13.3%
October 1-15	15	100 cfs 2,975 ac-ft	100 cfs 2,975 ac-ft	150 cfs 4,463 ac-ft	150 cfs 4,463 ac-ft	180 cfs 5,355 ac-ft	200 cfs 5,950 ac-ft	300 cfs 8,926 ac-ft	300 cfs 8,926 ac-ft	300 cfs 8,926 ac-ft	300 cfs 8,926 ac-ft
Attraction Pulse		none	none	none	none	1,676 ac-ft	1,736 ac-ft	5,950 ac-ft	5,950 ac-ft	5,950 ac-ft	5,950 ac-ft

[4] A Water Year begins on October 1 and ends September 30.

[5] 76 FERC ¶ 61,117 (1996)

[6] 128 FERC ¶ 61,035 at 61,159 (2009) (ordering paragraph G)

October 16-May 31	**228**	**150 cfs 67,835 ac-ft**	**150 cfs 67,835 ac-ft**	**150 cfs 67,835 ac-ft**	**150 cfs 67,835 ac-ft**	**180 cfs 81,402 ac-ft**	**175 cfs 79,140 ac-ft**	**300 cfs 135,669 ac-ft**	**300 cfs 135,669 ac-ft**	**300 cfs 135,669 ac-ft**	**300 cfs 135,669 ac-ft**
Out-migration Pulse Flow		**11,091 ac-ft**	**20,091 ac-ft**	**32,619 ac-ft**	**37,060 ac-ft**	**35,920 ac-ft**	**60,027 ac-ft**	**89,882 ac-ft**	**89,882 ac-ft**	**89,882 ac-ft**	**89,882 ac-ft**
June 1 - Sept. 30	**122**	**50 cfs 12,099 ac-ft**	**50 cfs 12,099 ac-ft**	**50 cfs 12,099 ac-ft**	**75 cfs 18,149 ac-ft**	**75 cfs 18,149 ac-ft**	**75 cfs 18,149 ac-ft**	**250 cfs 60,496 ac-ft**	**250 cfs 60,496 ac-ft**	**250 cfs 60,496 ac-ft**	**250 cfs 60,496 ac-ft**
Volume (ac-ft.)	**365**	**94,000**	**103,000**	**117,016**	**127,507**	**142,502**	**165,002**	**300,923**	**300,923**	**300,923**	**300,923**

8. Ordering paragraph (F) of the July 16, 2009 order states:

> The Districts shall develop and implement an Instream Flow Incremental Methodology (IFIM)/Physical Habitat Simulation (PHABSIM) study plan to determine instream flows necessary to maximize fall-run Chinook salmon and *O. mykiss* production and survival throughout their various life stages. The PHABSIM flow models under the IFIM should evaluate base flows, to include, but not be limited to, 150 cubic feet per second (cfs), 200 cfs, 250 cfs, 300 cfs, and at least 400 cfs. The instream flow study shall also evaluate spring pulse flows of 1,000 to 5,000 cfs and fall pulse flows of up to 1,500 cfs from La Grange Dam. In general, the instream flow study shall include the following steps, unless agreed upon otherwise in consultation with the resource agencies: (1) selection of target species or guild, selection or development of appropriate micro- and/or macro-habitat suitability criteria; (2) study area segmentation and study site selection; (3) cross section placement and field data collection; (4) hydraulic modeling; (5) habitat modeling; (6) derivation of total habitat time series, micro- and macro-habitat; (7) determination of habitat bottlenecks; and (8) evaluation of management alternatives and problem resolution. In connection with the IFIM study, the Districts shall also develop a water temperature model to determine the downstream extent of thermally suitable habitat to protect summer juvenile *O. mykiss* rearing under various flow conditions and to determine flows necessary to maintain water temperatures at or below 68 degrees Fahrenheit from La Grange Dam to Robert's Ferry Bridge.
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> The Districts shall file for Commission approval, within 90 days from the date of

this order, their instream flow study plan, to include provisions for developing and completing a water temperature model. The study plan shall include the following: (a) a detailed description of the study and methodologies to be used; (b) a schedule for conducting the IFIM study and water temperature model; and (c) a provision for filing periodic progress reports with the Commission. The Districts shall design and prepare their study plan in consultation with the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game prior to filing their plan and schedule with the Commission. The Districts shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. The Districts shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments and recommendations are accommodated by the plan. If the Districts do not adopt a recommendation, the filing shall include the District's reasons, based on project-specific information.

DISTRICTS IFIM/PHABSIM STUDY PLAN

9. The purpose of the District's IFIM/PHABSIM[7] instream flow study is to determine instream flows necessary to maximize *O. mykiss* and fall-run Chinook salmon production and survival throughout their various life stages. The Districts state that two prior

[7] The IFIM and one-dimensional PHABSIM modeling are standard approaches to assessing instream flow needs for aquatic species. The first step is to perform a detailed stream or aerial survey, or map habitats, in the study area to determine the extent and distribution of habitat types. Following habitat mapping, individual study reaches and instream flow transect locations are established. Hydraulic and habitat data are collected at each transect using standard techniques employed in instream flow studies. The transect data are then processed through hydraulic simulation submodels within the PHABSIM model, generating simulations of depth and velocity distributions over a broad range of flows. Literature-derived or site-specific habitat suitability criteria are applied to the predicted hydraulic parameters to produce functional relationships between flow and aquatic habitat (expressed as weighted usable area). Lastly, a habitat time series analysis is performed to integrate weighted usable area results across spatial (reach-long) and temporal (over the hydrologic period of record) scales.

PHABSIM studies on the lower Tuolumne River were conducted in 1981 and 1992. The 1981 study, which was reanalyzed by the Districts in 1991, was focused within a nine-mile reach (RM 50.5-42.0) with simulated flows from 20 cfs to 600 cfs. The 1992 study was conducted by the FWS and included the entire lower Tuolumne River from La Grange Dam downstream to the confluence with the San Joaquin River with simulated flows from 25 cfs to 1,000 cfs.

10. The Districts plan to conduct their instream flow study using a one-dimensional (1-D) PHABSIM model with flows ranging from 150 cfs to at least 400 cfs and a 2-D PHABSIM model to evaluate spring pulse flows of 1,000 cfs to 5,000 cfs and fall pulse flows of up to 1,500 cfs. The 1-D model would estimate habitat availability for various lifestages of *O. mykiss* and Chinook salmon over a range of simulated flow releases, as well as in-channel flows up to 1,200 cfs, in accordance with the July 16, 2009 Commission order. The Districts would use the Riverine Habitat Simulation Model (RHABSIM) software, which is an adaptation of the PHABSIM software.

11. The flow study would examine potential responses of salmonid and predator species to spatial variations in inundation area, velocities, and depths in relation to the proposed pulse flows within both in-channel as well as temporarily inundated portions of the Tuolumne River floodplain. The proposed study reach would extend from the La Grange Dam streamflow gage at RM 51.7 downstream to the lower end of the Gravel Mining Reach at RM 34.2. The Gravel Mining Reach includes the downstream extent of summer *O. mykiss* observations in past snorkel surveys as well as the large majority of the spawning reach for Chinook salmon. As a secondary option, the Districts state that the California Department of Fish and Game (CDFG) has recommended that the downstream boundary for the study extend to RM 24 to the downstream end of the In-Channel Gravel Mining Reach. Within the proposed study reach, the river would be divided into segments of similar habitat, geomorphic, and hydrologic characters and analyzed independently. The Districts state that the final study reach determination and number/location of segments would be determined as part of the study's scoping process with the resource agencies.

12. The Districts state that within the proposed study reach, existing habitat mapping has been completed down to RM 29.0 as part of *O. mykiss* population estimate surveys conducted in conjunction with snorkel surveys during 2008 and 2009 and in accordance with the Commission's Order on Ten-Year Summary Report Under Article 58, issued April 3, 2008.[8] Data from this current habitat mapping would provide the basis for

[8] 123 FERC ¶ 62,012 (2008)

habitat composition and delineation for the following three mesohabitat types: (1) riffle; (2) run/glide; and (3) pool. The Districts state that additional habitat mapping below RM 29.0 would need to be conducted if it determined that areas further downstream are to be included in the hydraulic simulations as recommended by CDFG.

13. To identify study sites for instream flow data collection, the Districts plan to review the proposed study area for segmentation into reaches. Reach segments would be based primarily on changes in stream gradient and/or hydrology that may cause habitat types in one reach to display significant hydraulic differences from the same habitat type in another reach. Stream gradient would be determined using existing topographic data and displayed as a longitudinal profile of elevation versus river mile within the study area. Once study sites are identified, sites would be established via consensus with the resource agencies. Transects would be distributed in run, riffle, and pool habitat types. Within each study site, transects would be placed in each habitat unit to be sampled either by professional judgment and concurrence of the transect selection team, or based on a stratified random sampling protocol. A sufficient number of transects would be established to model approximately three replicates of each major habitat unit type, with the number of replicates dependent on the relative proportions of the major habitat unit types.

14. Target calibration flows would be relatively evenly spaced and selected to allow the models to simulate in-channel flows over a range covering the current minimum flow (50 cfs) up to approximately 1,000 cfs, with a target of having the lowest simulated flow at no less than 0.4 of the lowest calibration flow and the highest simulated flow at most 2.5 times the highest calibration flow. The Districts proposed target calibration flow ranges for low, middle, and high flow calibration would be 100 cfs, 250 cfs, and 600 cfs, respectively. Velocity data sets would be collected at all transects at the middle calibration flow, and water surface elevation (WSE) would be collected along each transect at all calibration flows.

15. Hydraulic data collection and recording would use standard procedures and guidelines for PHABSIM field studies and include establishing independent elevation reference benchmarks for level control, as well as semi-permanent headpins and tailpins at each transect. The WSEs would be measured using an auto-level and stadia rod along each transect at each calibration flow; WSE would be measured near each bank, and in mid-channel areas where a significant difference between the near-bank WSE exists. A level loop survey tied to the local benchmark would be conducted at each calibration flow to ensure accuracy of each survey. Channel cross section profiles above the highest measured calibration flow would also be surveyed with a stadia rod and auto-level or total

station to establish the overbank channel profile up to or beyond the water's edge at the highest flow to be modeled, with sufficiently close spacing of verticals to document changes in slope. In-channel profiles would be calculated by subtracting the depth of water measured during the velocity measurements from the average WSE. Additional topographic data collection for each transect would include stage-of-zero flow elevation.[9]

16. Depths and mean column water velocities would be measured across each transect at the middle calibration flow with a goal of retaining a minimum of 20-25 stations that would remain in-water at the low calibration flow. Discharge measurements would be collected at each calibration flow and be made at each grouping of transects in hydrologically distinct areas using either an existing habitat transect or at some other suitable transect established solely for measuring discharge. These discharge measurements would be used in conjunction with data from the La Grange gaging station (U.S. Geological Survey (USGS) Gage No. 11289650) to determine more precisely the calibration flow and account for accretion, if any, within the study reach.

17. Velocity measurements would be measured at six-tenths of the depth (0.6 depth) when depths are less than 2.5 feet, and at two-tenths (0.2 depth) and eight-tenths (0.8 depth) of the depth when depths equal or exceed 2.5 feet or when the expected velocity profile is altered by an obstruction immediately upstream. In instances of increased turbulence or obstructions, measurements would be taken at all three depths and a weighted average calculated. Where transects have a series of water depths greater than approximately 3.5 feet, depth and velocity would be measured using an Acoustic Doppler Current Profiler whereas a pressure transducer-type velocity meter would be used for depths less than 3.5 feet.

18. Data collection at each transect would include substrate and/or cover codes compatible with proposed species Habitat Suitability Criteria (HSC). Substrate composition and cover types would be recorded in the field at each cross section location where channel geometry data are collected. Substrate coding, as applicable and feasible, would be adapted to the FWS and CDFG coding systems and/or from prior mapping of the lower Tuolumne River under the Districts' Coarse Sediment Management Plan.

19. Proposed HSC for the instream flow study would consider the adult, spawning, fry, and juvenile life stages of *O. mykiss*, and spawning, fry, and juvenile life stages of fall-

[9] Stage-of-zero flow elevation is the controlling elevation within or downstream of the transect line below which flow ceases.

run Chinook salmon. Existing HSC data would be compiled for the target species and life stages, in consultation with the resource agencies, to create a database of curves that can be reviewed for applicability to the proposed study. Habitat suitability criteria from prior lower Tuolumne River studies would also be included in the HSC database for consideration. The proposed screening criteria would include the following, although no single criterion would be used to qualify or disqualify a curve from further consideration: (1) minimum of 150 observations; (2) clear identification of fish size classes; (3) depth and velocity HSC; (4) category II or III data; (5) comparable stream size and morphology; (6) source data from the lower Tuolumne River; (7) habitat availability data; (8) data collected at high enough flow that depths and velocities are not biased by flow availability; and (9) availability of presence/absence data. The Districts state that existing curves may be selected and/or modified for use on the proposed study, or site-specific HSC curves may be developed as deemed appropriate.

20. Habitat would be modeled using the Habitat Simulation submodel provided in the RHABSIM software. The Districts state that the habitat model combines the hydraulic and HSC components to generate the weighted usable area (WUA)[10] of the stream for each species and life stage at each simulated flow. The standard option of multiplying individual variable suitabilities for cell centroids would be used to calculate WUA. This output would then be proportioned over all habitat types to obtain the reach-wide estimate of WUA by life stage. Finally, WUA versus flow curves would be developed to aid in the interpretation of the habitat flow relationships.

21. A habitat time series (HTS) analysis would be used for flows up to a maximum of approximately 1,000 cfs. The Districts state that the HTS analysis uses the WUA versus flow relationship and combines it with current or alternative hydrologic conditions to generate WUA by day under selected flow regimes for different water-year types. Daily flow values for the study reach under varying water-year types would be obtained from USGS gage records and used for the HTS analysis. The total HTS results would be used as the first step in calculation of an Effective Habitat Time Series. In addition to the standard WUA results, a secondary analysis showing the 'effective' WUA (eWUA) would be conducted. The eWUA analysis relates to summertime water temperature suitability for *O. mykiss*, and integrates both micro- and macro-habitat considerations. The results from the Districts' water temperature model over a range of flows would be

[10] WUA is the index of the capacity of a stream reach to support the species and life stage(s) being considered. WUA is also the physical habitat component of the habitat-versus-streamflow function under the PHABSIM.

combined with the summer WUA results so that areas with unsuitable water temperatures are excluded from the total WUA sum.

DISTRICTS PULSE FLOW STUDY PLAN

22. The pulse flow assessment would evaluate spring pulse flows of 1,000 to 5,000 cfs and fall pulse flows of up to 1,500 cfs. The Districts plan to use and expand upon existing topographic maps of the lower Tuolumne River floodplain (RM52 to RM29), combined with the development of a high flow stage-discharge relationship for these same areas as inputs to the River2D hydraulic model[11] or similar 2-D modeling software. The objectives of the assessment would be to: (1) gather empirical data on the relationship between water temperature and flow during pulse flow events; and (2) assess habitat usability and habitat segmentation for the lower Tuolumne River fish species during pulse flow conditions.

23. Study sites for the pulse flow assessment would include up to four locations upstream of RM 29 (including the gravel-bedded portion of the river used most extensively by salmonids between RM 34.2 to RM 51.7), in addition to other restoration sites where there is existing 2-D modeling data. Study site selection would include areas where significant floodplain inundation is expected at flow ranges up to 5,000 cfs. Existing coverage data of the lower Tuolumne River floodplain, originally developed from aerial surveys in September 2005 at river flows of 321 cfs, would be used for development of the model cross sections and topography. A digital elevation model would be used within GIS to develop hydraulic model cross sections; with bathymetric data below the 321 cfs water surface developed using standard survey methods.

24. Stage discharge relationships at high flows would be developed at each pulse flow study site within the lower Tuolumne River using either standard survey techniques (where timing and flow conditions allow) or pressure transducers mounted along the active river channel. The stage recorders would be set at 15-minute intervals and would record corresponding stages to lower Tuolumne River flows of up to 5,000 cfs. Test flows for the pulse flow assessment would include 2,000 cfs, 3,000 cfs, and 5,000 cfs to develop the high flow stage discharge relationship. The Districts state that in the event

[11] Steffler, P. and J. Blackburn. 2002. River2D, Two-Dimensional Depth Averaged Model of River Hydrodynamics and Fish Habitat. University of Alberta. September. http://betram.civil.ualberta.ca/. 120pp.

that the following hydrology conditions are met in the first year of study, tests would occur during the March-May period:

a. The estimated 60-20-20 Water Year Hydrological Classification Index[12] (Index, using 50% exceedance probability) for the then current water-year based upon the California Department of Water Resources within-month March runoff forecast update following March 15 is at least 4.2 (rather than 4.5 as provided in footnote 11), provided that (1) daily computed natural flows for both the Tuolumne and San Joaquin Rivers in excess of 50,000 cfs are excluded and (2) the Tuolumne River comprises at least 31% of the Index.
b. The 60-20-20 Index for the immediately preceding water-year was at least 4.2.
c. The target flow shall be subject to any flow and/or timing limitation required by the Vernalis Adaptive Management Program[13] study.
d. The target flow shall be subject to any flow and/or timing limitation required by the Corps of Engineers.

25. The River2D model input would include: (1) topography of the river channel; (2) roughness of the channel expressed as a roughness height; (3) discharge; and (4) downstream water surface elevation. As an additional calibration, model outputs would be compared to existing flood area inundation maps previously developed at a range of flows of 100, 230, 620, 1,100, 3,100, 5,300, and 8,400 cfs. The calibrated 2-D model would be used to simulate flow routing and velocity vectors in both the in-channel areas at pulse flows of 1,000 cfs and 1,500 cfs. Additionally, the model would be used to simulate intermediate high flows of 2,500 cfs up to 5,000 cfs. The results of the pulse

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[12] The Index is equal to 0.6 x current April to July unimpaired runoff +0.2 x current October to March unimpaired runoff +0.2 x previous year's index (if the previous year's index exceeds 4.5, then 4.5 is used). The San Joaquin River unimpaired runoff is the sum of Stanislaus River inflow to New Melones Lake, Tuolumne River inflow to New Don Pedro Reservoir, Merced River inflow to Lake McClure, and San Joaquin River inflow to Millerton Lake.

[13] The Vernalis Adaptive Management Plan is a large-scale, long-term experimental/management program designed to: (1) determine how salmon survival rates change in response to alterations in San Joaquin River flows and State Water Project/ Central Valley Water Project exports with the installation of the Head of Old River Barrier; and (2) to protect juvenile Chinook salmon migrating from the San Joaquin River through the Sacramento-San Joaquin Delta.

flow assessment would be used to examine habitat suitability for migratory life stages of lower Tuolumne River salmonids as well as habitat preferences of predators such as largemouth and smallmouth bass. Finally, the pulse flow study would be coordinated with any test flows that examine movement patterns of juvenile Chinook salmon in ongoing rotary screw trap monitoring, or high flows that are released in relation to fall-spawner attraction flows.

DISTRICTS WATER TEMPERATURE MODEL STUDY PLAN

26. The Districts state that a HEC-5Q model[14] was developed for the Tuolumne River and other tributaries of the San Joaquin River in 2008 as part of a CALFED[15]-funded temperature model. The model was calibrated using updated water temperature and meteorological data collected from 1996-2006 and reproduces this historical temperature record to within 1-2ºF (0.6-1.1ºC) depending upon river location and time of year. Considering the HEC-5Q model is more precise than previous water temperature models, the Districts plan to use the existing HEC-5Q model to simulate water temperatures at various flows and times of year. The Districts state that their study approach is to first validate the existing water temperature model against water temperature data not used in the initial model calibration. Second, the validated HEC-5Q model would be used to test a series of flow scenarios to determine the flows needed to maintain specified water temperatures at particular river locations at various times of the year. The water temperature model predictions developed would be used in conjunction with the IFIM predictions of WUA developed under the Districts' respective IFIM study plan.

27. The study area would extend from La Grange Dam downstream to the San Joaquin River confluence (RM 0.0). The Districts state that the upper reach from La Grange Dam to Robert's Ferry Bridge (RM 39.5) represents the downstream extent of most summer *O. mykiss* observations in past snorkel surveys and includes the Dominant Spawning (down to RM 46.6) and Dredger Tailing Reaches (down to RM 40.3) which typically have the majority of Chinook salmon spawning activity.

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[14] The HEC-5Q is a water temperature model used to obtain a desirable water quality condition for a given set of flow conditions.

[15] The CALFED is a department within the government of California that acts as consortium, coordinating the activities and interests of the state government of California and the U.S. federal government to focus on the interrelated problems in the state's Sacramento-San Joaquin River Delta.

28. The Districts state that water temperatures have been recorded continuously by the Districts at various locations in the lower Tuolumne River since 1986. The HEC-5Q model would be validated against 1996-2009 thermograph data not used in the original model calibration. Data used in the original model calibration may be used if no data independent of the model are available. Because no documentation of the original model calibration was provided in the final CALFED summary report, the Districts would request documentation of thermograph locations, temperature data, and periods of record used in the model calibration so that unbiased goodness-of-fit statistics can be developed and model uncertainties can be identified; however, they state that delays in collection of the final HEC-5Q calibration data may result in changes to their proposed schedule. The Districts state that if the goodness-of-fit results from the resource agency recommended goodness-of-fit metrics indicate large errors between observed and predicted temperatures, updated model uncertainty estimates would be developed for particular locations or times of year.

29. In addition to an evaluation of the current license flow schedules and the actual flow releases during the 1996-2009 periods as part of the model validation exercise, the initial scenario would use the validated HEC-5Q model to determine the summer flows necessary to maintain a maximum summer water temperatures of 68ºF downstream to Robert's Ferry Bridge. As recommended by the resource agencies, the Districts would also evaluate the following four additional scenarios for the protection of various life stages of *O. mykiss* and fall-run Chinook salmon: (1) flows required to maintain a maximum summer water temperature of 64.4ºF downstream of La Grange Dam to Robert's Ferry Bridge; (2) flows required to maintain a maximum water temperature of 64.4ºF downstream of La Grange Dam to the confluence with the San Joaquin River from October 15 to December 1; (3) flows required to maintain a maximum water temperature of 55.4ºF downstream of La Grange Dam to Robert's Ferry Bridge from October 15 to February 15; and (4) flows required to maintain a maximum water temperature of 59.0ºF downstream of La Grange Dam to the confluence with the San Joaquin River from March 20 to May 15. The Districts state that alternative scenarios may also be evaluated that draw upon findings from the literature or field observations.

30. The HEC-5Q model would be used to determine the downstream extent of suitable water temperatures for key *O. mykiss* and Chinook salmon life stages under normal and extreme meteorology. Additionally, various reservoir operation and release scenarios may be simulated against the period-of-record meteorology to generate a range of predicted temperatures for various locations in the river under varying meteorologic conditions.

SCHEDULE AND REPORTING

31. The Districts state that management alternatives for the lower Tuolumne River would be considered following completion of the IFIM study and pulse flow assessment, as well as the water temperature study. Results of these investigations would be evaluated in the context of available information from other studies of the lower Tuolumne River and consideration of other beneficial uses of the Tuolumne River, including: agricultural water supply, cold freshwater habitat, fish migration, municipal and domestic water supply, water contact recreation, non-contact recreation, fish spawning, warm freshwater habitat, and wildlife.

32. The Districts state that a major factor in their proposed IFIM study plan schedule is the development of HSC. They state that although existing HSC are proposed for the lower Tuolumne River, their proposed schedule assumes that site-specific HSC could be necessary for one or more species or life stages, and analytical and reporting tasks are scheduled accordingly. Additionally, for the pulse flow assessment, stage data collection for the highest flow ranges (up to 5,000 cfs) may be delayed from 2010 until appropriate wet-year hydrology occurs (flood releases in excess of the 301,000 acre-feet annual flow requirement under the project license). Furthermore, the Districts' schedule assumed a Commission approval of their study plan by January 12, 2010.

DISTRICTS' IFIM STUDY PLAN PROPOSED IMPLEMENTAITON SCHEDULE

TASK	Dates (duration in days)
Study Planning and Site Selection	January 13 to March 13, 2010 (60d)
HSC Consultation	March 13 to September 9, 2010 (150d)
Cross Section Placement	March 14 to April 27, 2010 (45d)
Field Data Collection (Hydraulic)	April 28 to September 24, 2010 (150d)
HSC Field Data Collection (if necessary)	April 1, 2010 to March 31, 2011 (365d)
Data Analysis (presuming HSC field data collection or 2011 high flow data collection	April 1 to July 29, 2011 (120d)
High Flow Stage Discharge Data Collection	March 31 to June 1, 2010 (62d) January 15 to June 1, 2011 (137d)
Pulse Flow Study Data Analysis and Modeling	June 1, 2010 to June 30, 2010 (394d)

Progress Reporting	July 1, 2010 and July 1, 2011
Draft Report	October 27, 2011 (90d)
Resource Agency Review	November 26, 2011 (30d)
Final Report to Commission	January 25, 2012 (60d)

33. An IFIM study progress report for the Year 1 and Year 2 data collection efforts, including any changes to the proposed study plan, would be filed with the Commission by July in each of the first two years (2010 and 2011). Following completion of the field studies and analysis, a draft report would be prepared detailing the study methods and results. The draft report would be provided to the resource agencies for a 30-day review and comment period and a final report filed with the Commission within 60 days from the end of the 30-day review period.

34. The Districts state that their water temperature model study plan schedule assumes timely response by the model developer and CDFG in providing requested calibration data and documentation. In the event that these responses are not received in a timely manner, or in the event that the validation of the existing model reveals major inconsistencies with observed temperatures in the lower Tuolumne River, the Districts state that their proposed schedule may be adjusted in consultation with the resource agencies and the Commission. Consistent with their IFIM study plan schedule, the Districts assumed a Commission approval of their study plan by January 12, 2010.

DISTRICTS' WATER TEMPERATURE MODELING STUDY PLAN
PROPOSED IMPLEMENTATION SCHEDULE

TASK	Dates (duration in days)
Validate Existing Water Temp. Model	January 13 to April 12, 2010 (90d)
Scenario Development	January 13 to May 31, 2010 (139d)
Model Simulations and Analysis	June 1 to July 30, 2010 (60d)
Progress Report	July 30, 2010
Draft Report	October 28, 2010 (90d)
Instream Flow and Effective Habitat Evaluations	September 27, 2011 (180d)

35. The Districts plan to prepare a report summarizing the results of the temperature model study, describing the HEC-5Q modeling background, validation, scenario development, model simulations, and analysis. The report would include graphics

depicting the longitudinal flow versus water temperature relationship under varying meteorologic conditions in order to allow a thermal analysis of various flow regimes. The draft report would be provided to the resource agencies for a 30-day review and comment period and a final report would be filed with the Commission within 60 days from the end of the 30-day resource agency review period.

RESOURCE AGENCY CONSULTATION

36. The Commission's July 16, 2009 order required the Districts to design and prepare their study plans in consultation with the NMFS, FWS, and CDFG. On September 3, 2009, the Districts provided their draft study plans to the resource agencies for a 30-day review and comment period. By letters dated October 5, 2009, FWS and CDFG provided comments on the Districts' plans. By letter dated October 14, 2009, NMFS provided comments on the Districts' plans, and by letter dated November 5, 2009, FWS provided additional comments on the Districts' plans. The Districts, as required by the July 2009 order, included their responses to the October 5, 2009 FWS and CDFG comments in their October 14, 2009 filing. By letter dated December 18, 2009, the Districts filed their responses to NMFS' October 14 and FWS' November 5 comment letters. The Districts incorporated many of the resource agencies' comments and recommendations into their final plan filed with the Commission and included explanations for those comments and recommendations that were not incorporated into their final plan.

37. In general, the resource agencies question the usefulness of conducting another IFIM/PHABSIM study for the Tuolumne River. Specifically, NMFS and FWS comment that the Commission's July 16, 2009 order is unclear regarding the need for the instream flow study, how the study results would be used in decision-making, and why the PHABSIM methodology was chosen for the study. The FWS also expresses concern that the results of the PHABSIM study would be used unilaterally to make decisions regarding interim flows when there are many other factors (habitat-related and otherwise) that are not included in a PHABSIM study but should be included in any comprehensive analysis. In light of the resource agencies' (and Districts') concerns regarding the utility of an IFIM/PHABSIM model, our objective is to keep the effort as straightforward and efficient as possible. As discussed below, concerns and limitations should be addressed with mutually agreed-upon complementary studies that are planned and performed by the Districts and resource agencies.

FWS AND CDFG IFIM/PHABSIM STUDY PLAN COMMENTS AND RECOMMENDATIONS, DISTRICTS' RESPONSE, AND COMMISSION STAFF'S RECOMMENDATIONS

1. FWS: The PHABSIM model does not address all of the essential habitat needs of the migratory phases of anadromous species, does not address the indirect effects of flow on potential biotic and abiotic limiting factors, and should not be used by itself to develop an instream flow schedule.

   Districts' Response: Generally agree with this statement; however, assert that their plan is consistent with the Commission's July 16, 2009 order.

   Commission Staff's Recommendation: The Districts should include a complementary analysis, developed in consultation with the resource agencies, to address these other factors and to keep the results of the PHABSIM study in perspective with the other limiting factors.

2. FWS: Recommends a mapping system that includes 12 mesohabitat types instead of the three proposed by the Districts.

   Districts' Response: Prefer to use three mesohabitat types as proposed in their plan and that were used in the lower reaches of the Tuolumne River in previous studies considering habitat complexity is reduced in the lower river reaches.

   Commission Staff's Recommendation: More detailed mapping should provide a better representation of the river habitat, and considering the Districts previously mapped the upper 16 river miles similar to that recommended by the resource agencies, the Districts should use the 12 mesohabitat types as recommended. Based on the Districts' assertion that habitat complexity is reduced in the lower reaches anyway, using the recommended 12 types should not require an excessive amount of additional time and effort.

3. FWS: Recommends at least five spawning sites per study segment.

   Districts' Response: Assert that it is too early to make this determination.

Commission Staff's Recommendation: Preliminary study data should first be evaluated to determine the number of spawning study sites per segment. Therefore, the number of spawning sites should be determined in consultation with the resource agencies following review of preliminary study data.

4. FWS: In-channel habitat modeling should be conducted with a 2-D model instead of the 1-D PHABSIM model.

   Districts' Response: Argue that the 1-D approach is more widely accepted as the standard, is more easily replicated and extrapolated to other reaches, and requires less field measurements per reach modeled.

   Commission Staff's Recommendation: Although we recognize that both methods have disadvantages, the IFIM and 1-D PHABSIM modeling are standard approaches to assessing instream flow needs for aquatic species. The 1-D approach applies average conditions to similar habitats and can thus be applied to a larger reach of river more easily. It does not provide as realistic a representation of the hydraulics of a stream as does a 2-D model; however, it is not clear that this necessarily means a poorer quantification of fish habitat. The 2-D approach requires more detailed data and a greater effort for model development than 1-D, and data from one reach are not transferable or extrapolatable to another reach. To assess a long river reach using the 2-D approach would require a much greater effort to gather stream bathymetry data. Translating output from physical habitat models like these into some meaningful measure of habitat quality or quantity has been difficult and debatable. Given that neither method is universally accepted, it is possible that neither captures the parameters or proper scale by which fish make habitat choices. Given that the Districts are being required to model such a large portion of the river, the data-intensive 2-D approach is likely less practical in this case and less cost-effective. Therefore, we agree with the Districts and support the use of the 1-D model approach.

5. FWS: Recommends that the range of simulated flows include 8,400 cfs.

   Districts' Response: They do not specifically address the recommended 8,400 cfs, but rather state that they plan to test a range of flows from 50-1,000 cfs.

   Commission Staff's Recommendation: Although they do not specifically provide a justification for the 8,400 cfs, it is unclear what would be gained from extending the PHABSIM analysis to such high flows, whose purpose is something other than meeting normal fish habitat requirements. The 2-D floodplain model being developed by the Districts would be used to evaluate overbanking during flood flows. Although we recognize that the Districts should consider slightly higher flows for evaluation (beyond 1,000 cfs if possible), this is partly limited by the extent to which validation flows can be extrapolated. The rule of thumb is that the highest simulated flow should not be more than 2.5 times the highest calibration flow. To simulate flows beyond 1,000 cfs would require a higher maximum calibration flow than the proposed 400 cfs and obtaining field measurements becomes increasingly difficult as flows increase. Therefore, we agree with the Districts' proposal of evaluating flows up to 1,000 cfs, which would also avoid additional delay in collecting additional flow measurement data.

6. FWS: Suggests using cover and adjacent velocity for HSC curves. They recommend developing curves specifically for the Tuolumne River or using curves recently developed by the FWS with more advanced methods.

   Districts' Response: Intend to select HSC curves from those previously developed for the Tuolumne River (in 1995) and elsewhere. They do not plan to collect additional habitat data from known fish locations in the Tuolumne River and therefore would not add new parameters like cover and adjacent velocity.

   Commission Staff's Recommendation: In order to obtain and utilize the most up-to-date information and validate existing data, the Districts should conduct the field work necessary to develop specific HSC curves for the project.

Additionally, the Districts should include measures of cover and adjacent velocity with the other more standard habitat metrics (i.e., velocity, depth, and substrate) if additional habitat information is collected.

7. FWS: Recommends using the depth correction method of Gard (1998) for developing HSC.

   Districts' Response: They assert that this method is not a standard or widely accepted methodology and provide several reasons why they are opposed to this method.

   Commission Staff's Recommendation: Although it seems apparent that this method has not effectively been proven and therefore should not be applied here, the Districts should further consult with the resource agencies and other technical experts to determine its applicability as it relates to the Tuolumne River.

8. FWS: Recommends using a logistic regression method to develop HSC.

   Districts' Response: They assert their opposition to using logistic regression for the same reasons identified for not using the depth correction method by Gard, and cite two not-peer reviewed reports that state the technique is not standard methodology.

   Commission Staff's Recommendation: One of the most recognized problems with IFIM/PHABSIM methodology is that it takes a univariate approach to defining habitat preference. The logistic regression method analyzes fish habitat by examining habitat characteristics in combination for both occupied and unoccupied habitat, and has been successfully used by several investigators (Guay et al. 2000).[16] Therefore, the Districts should utilize a logistic regression

[16] Guay, J.C. et al. 2000. Development and validation of numerical habitat models for juvenile Atlantic salmon (*Salmo salar*). Can. J. Fish. Aquat. Sci. 57: 2065-2075.

method as well as the standard PHABSIM approach for comparison from their habitat data collection. Additionally, this methodology may be able to be applied to data from previous Tuolumne River studies.

9. FWS: Biological verification data should be collected to test the PHABSIM model predictions of habitat suitability by comparing the observed presence and absence of salmonid redds, fry, and juveniles to habitat suitability predictions.

   Districts' Response: Since the recommendation refers to 2-D modeling, which is not part of the Districts' proposed plan, they believe the comment is not pertinent.

   Commission Staff's Recommendation: Although the FWS comment appears to refer to 2-D modeling, which is not the Districts' proposed method, the Districts should verify the HSC curves since they propose to use HSC curves from previous studies.

10. FWS: The amount of floodplain habitat inundated during releases of 1,000-5,000 cfs throughout the river should be determined. They also make recommendations for incorporating existing bathymetry and GIS data into the Districts' analysis.

    Districts' Response: Since the Tuolumne River predominantly confines to its channel at flows below 9,000 cfs, they propose to focus their study on those areas where floodplain inundation is most likely, instead of on the entire river and at test flows of 2,000, 3,000, and 5,000 cfs.

    Commission Staff's Recommendation: We believe that the Districts' approach to focus on specific areas of likely floodplain inundation during test pulses between 2,000 and 5,000 cfs is sufficient to calibrate their pulse flow model which can then be used to simulate inundation at other flows. However, the Districts should incorporate additional bathymetry and GIS data into their

analysis of specific floodplain areas as recommended if it does not result in additional study delay.

11. FWS: Recommends omitting the use of eWUA to identify habitat bottlenecks.

    Districts' Response: Agree that this analysis is overly simplistic and not the appropriate approach, and therefore should be omitted from their plan.

    Commission Staff's Recommendation: Considering this element was required by the Commission's July 2009 order, the Districts should, at a minimum, include a discussion in their final report to be filed with the Commission that describes potential habitat bottlenecks and which of the bottlenecks may be addressed by management of instream flows.

12. FWS/CDFG: Encourage the Districts to make every effort to deliver the high calibration flows as soon as possible to conduct the study.

    Districts' Response: Re-emphasize that they fully intend to deliver the high flows of greater than 4,000 cfs at least once in next four years, but state that it is also based on water availability considering they have other water delivery requirements.

    Commission Staff's Recommendation: We recommend that the Districts better define the conditions under which they will be able to provide the required flows under their plan as soon as possible. For example, we would foresee the Districts having the ability to determine 2010 study flows by April 1, 2010, based on snowpack and forecasted water-year type.

13. CDFG: Recommends using MANSQ and WSP programs for stage-discharge calibration instead of the Districts' proposed IFG-4 program.

    Districts' Response: Prefer to use the IFG-4 program as long as it meets the agreed-upon performance standards; however, would develop the stage-

discharge relationship using either MANSQ or WSP programs as necessary to meet performance standards.

Commission Staff's Recommendation: Other than asserting that the MANSQ and WSP programs are the most accurate methods, CDFG does not provide any further evidence discounting the accuracy or reliability of the Districts' use of the IFG-4 program. Therefore, we believe the Districts' approach is reasonable, considering they agree to use the MANSQ or WSP programs as necessary.

14. CDFG: Recommends that juvenile HSC curves also consider smolt outmigration.

Districts' Response: Question the clarity of this recommendation considering HSC are typically applied to resident life stages; however, would discuss further in consultation with the resource agencies.

Commission Staff's Recommendation: As suggested by the Districts, this recommendation should be addressed in consultation with the resource agencies during the development of HSC when their study plan is implemented.

15. CDFG: Recommends that all cross sections in similar mesohabitat unit types within a study reach be given equal weight.

Districts' Response: Provide a sound explanation of the relationship between proper representation of each reach through the correct transect weighting method. They indicate their willingness to weight transects in similar mesohabitat unit types equally, but state that it would require placing a similar number of transects in each unit of the same type in order to maintain proper statistical extrapolation of the results.

Commission Staff's Recommendation: As recommended by the Districts, determine whether transects are weighted equally and determine a statistically appropriate approach in consultation with the resource agencies.

16. CDFG: Recommends that predator habitat conditions not be evaluated.

    Districts' Response: Believe that an important part of improving salmon production is reducing predation of smolts, which is related to flow-related habitat production for both. Additionally, they state that past rotary screw trap studies indicate a significant loss of juvenile salmon in the predator-rich gravel mining reach.

    Commission Staff's Recommendation: Considering the Districts have historical data indicating juvenile salmon loss due to predation and this evaluation would simply provide additional data and analysis to their study, the Districts should evaluate predator habitat conditions as proposed.

17. CDFG: Recommends a more aggressive implementation schedule.

    Districts' Response: Identify several interdependent scheduling factors beyond their control but indicate their interest in accelerating the study schedule if possible.

    Commission Staff's Recommendation: We find that the schedule proposed by the Districts is reasonable and reflects their readiness to implement and complete the study schedule as soon as possible.

FWS, CDFG AND NMFS' WATER TEMPERATURE MODEL STUDY PLAN COMMENTS AND RECOMMENDATIONS, DISTRICTS' RESPONSE, AND COMMISSION STAFF'S RECOMMENDATIONS

1. FWS: The existing HEC-5Q water temperature model for the Tuolumne River has been sufficiently validated and should not be revised by the Districts without approval from the resource agencies.

   Districts' Response: Considering there is no disagreement over the applicability and plan to use the existing model, they emphasize that they do not plan to revise the model but rather validate it as a standard practice prior to using the model for predictive purposes. They believe validation should not necessitate resource agency approval.

   Commission Staff's Recommendation: The Districts' plan states that their study approach is to first validate the existing water temperature model against water temperature data not used in the initial model calibration. Second, the validated HEC-5Q model would be used to test a series of flow scenarios to determine the flows needed to maintain specified water temperatures at particular river locations at various times of the year. Considering the Districts do not plan to revise or modify the existing model but rather validate the model against water temperature data not used in the initial model calibration, we agree with the Districts that validation of the model does not necessitate resource agencies' approval. However, if this validation process reveals discrepancies in the existing model or results in any modification or revision of the existing model, the Districts should consult with the resource agencies prior to making any such changes to the existing model.

2. FWS: The results of the temperature model should not be combined with the PHABSIM results to develop WUA estimates as the ultimate measure of habitat availability.

   Districts' Response: Agree that the combined WUA/temperature model results should not be the sole assessment for flow needs, but rather than identifying alternate approaches, state that a variety of data presentations and consideration of other study data are likely necessary to develop a more complete understanding of the issues.

Commission Staff's Recommendation: The Districts should provide an approach or framework for incorporating other data and analyses into a broader assessment along with the results of the present study for assessing instream flow needs. This does not mean that more studies should be added or that a new assessment method would need to be developed, but rather the Districts should work with the resource agencies to develop a framework for considering other factors in conjunction with the study results.

3. FWS/NMFS: Recommend that the questions being addressed by the Districts' temperature modeling be expanded beyond the two posed in their plan.[17] They pose six questions instead; the first four refer to specific temperature maxima for specific river reaches during specific time periods and the last two refer to conditions and operations of Don Pedro Reservoir.[18]

Districts' Response: The first four questions were incorporated into the scenarios being modeled (see paragraph 29), but did not include additional analyses to address the last two questions since they are beyond the scope of the study plan requested in the Commission's July 2009 order. Instead, they anticipate that these questions would be addressed at a later time if new thermal criteria are considered for adoption as interim measures.

Commission Staff's Recommendation: We agree that the Don Pedro Reservoir operational questions are important questions; however, they are beyond the

[17] The Districts' water temperature model study plan identified the following two overall study questions to be examined: (1) what flows are required to maintain summer water temperature of 68ºF or less downstream to Robert's Ferry Bridge; and (2) what is the relationship between flow and water temperature at various time periods during the year in specified reaches of the lower Tuolumne River.

[18] The following two questions regarding Don Pedro Reservoir operations were raised by FWS and NMFS: (1) what is the minimum pool for Don Pedro Reservoir that is needed to achieve the above in-river temperature objectives; and (2) are there modifications to Don Pedro Reservoir that would allow a smaller minimum pool and still meet the above in-river temperature objectives.

scope of the intended study and not part of the information requested in the Commission's order. Therefore, we agree with the Districts that these questions could be addressed following determination of the primary objective of the Districts' plan regarding flows and temperature maintenance.

4. FWS: Recommends that if substantial discrepancies are found as a result of the Districts' model verification, that they be required to prove verification validity before modifying the model.

   Districts' Response: Agree to provide their model validation data and procedures to the resource agencies, but do not agree to only modify the model after resource agency approval.

   Commission Staff's Recommendation: See Commission staff's recommendation under #1 above.

5. FWS/CDFG: Suggest that the metric for evaluating exceedance of the target temperature of 68°F should be an instantaneous measure for which the model would be a 6-hour average since that is the minimal model time-step. Also, that the model should be for the entire summer period, not just select days or weeks.

   Districts' Response: In addition to an evaluation using MWAT (as originally proposed) as the temperature metric, they would also include scenarios that evaluate daily averages and daily maximums as the metric for comparison to the target exceedance level.

   Commission Staff's Recommendation: Since the Commission's July 2009 order does not specify the exact metric, the use of the weekly average maximum, the daily maximum, and the daily average is a reasonable approach. Model results should be presented for the entire summer period or at least for periods when the highest water temperatures are expected to occur due to high air temperature forecasts.

6. FWS/CDFG: Recommend using goodness-of-fit criteria recommended by USGS staff since the Districts do not identify specific criteria.

   Districts' Response: Their goodness-of-fit assessment would incorporate the intent of the resource agencies' comments and although their recommended criteria are stated as data acceptance standards rather than goodness-of-fit statistics, the Districts would calculate actual exceedance statistics at the identified temperature thresholds to provide an assessment of model performance.

   Commission Staff's Recommendation: The goodness-of-fit criteria as recommended by the resource agencies should be considered and incorporated, as appropriate, into the existing HEC-5Q temperature model.

7. FWS/CDFG: Recommend a more aggressive implementation schedule.

   Districts' Response: Assert that their proposed schedule is appropriate and consistent with the intent of the Commission's July 2009 order, and emphasize that the time spent in validating the HEC-5Q model would be far less than that required for new data collection, development of a new model, and subsequent calibration and validation. Additionally, their draft report would be completed by October 28, 2010, which would allow adequate time for resource agency review and comment prior to filing their final report with the Commission. The Districts' proposed schedule identifies a 90-day period from October 28, 2010 to provide their report to the resource agencies for review and comment, and file their final report with the Commission.

   Commission Staff's Recommendation: As with the Districts' IFIM proposed study schedule, we find that the schedule proposed here by the Districts is reasonable and reflects their readiness to implement and complete the studies as soon as possible. Although the Districts' proposed schedule does not specifically identify the dates for the resource agency review and comment period or the date in which their final report would be filed with the

Commission, we assume their dates would be consistent with their 90-day reporting schedule under their IFIM study plan schedule. Their schedule does however identify a 90-day period from October 28, 2010, for providing their report to the resource agencies for review and comment, and filing their final report with the Commission. Based on a 30-day resource agency review and comment period, and a 60-day period to file their final report with the Commission, as proposed under their IFIM study plan schedule, the Districts should provide their draft report to the resource agencies by October 28, 2010, and file their final report with the Commission by January 26, 2011.

8. NMFS: Recommends that additional studies be conducted to determine the location of any thermal refugia downstream of LaGrange Dam.

   Districts' Response: Did not specifically address this comment.

   Commission Staff's Recommendation: Although the location of significant hyperreal and lateral inflows is important for accurate stream temperature modeling, a separate study on thermal refugia, is beyond the scope of the Commission's July 2009 order and would require additional time and resource commitment likely resulting in study and schedule delays.

DISCUSSION AND CONCLUSIONS

38. The Districts identify their rationale for using the 1-D and 2-D models for the instream flow and pulse flow elements of the study, respectively, as threefold. First, extension of the IFIM analysis to flows exceeding the bankfull channel width, in the range of 1,500-2,500 cfs in some locations, would cause a significant shift in the stage-discharge relationship for the channel. Thus, it would require a separate modeling analysis in order to develop a reliably predictive estimate of stage. Second, patchy distribution of floodplain areas makes their treatment as separate, discrete areas more precise, since the conditions at these locations cannot be as reliably extrapolated to other areas of the river. Third, pulse flows are typically of shorter duration and intended for either the attraction/migration of fall spawners or to facilitate outmigration of juvenile fish. The Districts state that detailed evaluation of such pulse flows in a PHABSIM study in order to assess and generalize their microhabitat suitability for spawning, adult holding,

or rearing is of limited use in refining potential flow recommendations.

39. The resource agencies raise various concerns and provide study recommendations for inclusion into the Districts' IFIM/PHABSIM and water temperature model study plans, and the Districts incorporated many of the resource agencies' comments and recommendations into their final study plans. We understand that due to the contentious nature of this proceeding, it becomes difficult at times to reach consensus amongst all parties. However, the techniques and methods described by the Districts to design and perform the 1-D IFIM/PHABSIM and water temperature model studies are thorough and sound. With regard to the Districts' IFIM/PHABSIM study plan, the primary concern raised by the resource agencies is the utility of an IFIM/PHABSIM model and more specifically, the use of a 1-D model rather than a 2-D model, which we address under #4 of paragraph 37 above. We also provide the following reference, which identifies the advantages and disadvantages of the two methods: http://www.hydroreform.org/hydroguide/science/4-1-instream-flows.

40. The Districts state that the final number of transects proposed for a respective reach under their IFIM study plan would depend on habitat complexity as well as target resource values in the reach, and determined during a field site visit with concurrence of resource agency representatives. The Districts also state that following a review and discussion of applicable HSC curves, existing curves may be selected and/or modified for use on the proposed study, or site-specific HSC curves may be developed as deemed appropriate in consultation with technical experts from the resource agencies. The Districts state that if agreement on the appropriate number of transects to use or which HSC curves to use can not be reached with the resource agencies, the issue would be referred to the Commission for final determination. Although we understand the complexity of the Districts' IFIM study plan and the challenges of reaching consensus, the Districts should determine the number of transects and which HSC curves to use in the event that consensus cannot be reached with the resource agencies and include this information with justification in the reports required to be filed with the Commission.

41. The Districts state that, in the event that their proposed high flow conditions under the IFIM study plan are not necessitated by naturally occurring wetter hydrologic conditions (resulting in flood releases of the 301,000 acre-feet annual flow requirement under the project license), the Districts would delay data collection for up to 2 years or may alter their proposed intermediate test flows. The Districts should alter their proposed intermediate test flows to maximize data collection up to the highest possible flow condition based on water year type, in consultation with the resource agencies.

42. The Districts state that delays in collection of the final HEC-5Q calibration data under their water temperature model study plan may result in changes to their proposed schedule. Furthermore, their schedule assumes timely response by the model developer and CDFG in providing requested calibration data and documentation. If these responses are not received in a timely manner, or validation of the existing model reveals major inconsistencies with observed temperatures in the lower Tuolumne River, the Districts state that their proposed schedule may be adjusted in consultation with the resource agencies and the Commission. In response, FWS states that the Commission's July 16, 2009 order does not imply that the existing HEC-5Q model cannot be used to assess flow releases needed to meet water temperature standards. Therefore, FWS states that, in the event of any such delay, the Districts should use the existing model to provide results as soon as possible. We agree. The existing HEC-5Q model should be utilized in the event of any such delay in obtaining calibration data to minimize any potential study delay.

43. The Districts' proposed water temperature model study implementation schedule does not identify the resource agency review and comment period or the date by which their final report would be filed with the Commission. Their report does, however, identify a 90-day period from October 28, 2010 for providing their report to the resource agencies for review and comment, and filing their final report with the Commission. Based on a 30-day resource agency review and comment period, and a 60-day period to file their final report with the Commission, and as proposed under their IFIM study plan schedule, the Districts should provide their draft report to the resource agencies by October 28, 2010, and file their final report with the Commission by January 26, 2011.

44. The resource agencies provided comments and recommendations related to the inclusion of additional data and information into the Districts' proposed study plans, some of which were not incorporated into the Districts' final study plans. Although we recognize the interest and importance of these additional study elements, we have determined that their study plans should be limited to the scope of the Commission's July 2009 order to avoid any further potential delay of study implementation. However, in light of the resource agencies' comments, we are requiring that the Districts incorporate Commission Staff's recommendations as identified in this order.

45. The Districts' IFIM and Water Temperature Model Study Plans would provide the data and information necessary to assist in determining potential interim and long-term instream flows, pulse flows, and flows necessary to maintain thermal criteria in the Tuolumne River below La Grange Dam for the protection and enhancement of *O. mykiss* and fall-run Chinook salmon life-stages. Inclusion of Commission Staff's recommendations into the Districts' study plans will provide more complete and thorough

studies while addressing resource agency recommendations and minimizing any potential delays under the Districts' proposed study schedules.

46. The Districts' plans, with Commission Staff's recommendations, satisfies the requirements of the Commission's July 16, 2009 Order. Therefore, I am approving the Districts' plans, as modified.

The Director orders:

(A) The Districts' Instream Flow Incremental Methodology and Water Temperature Model Study Plans, filed October 14, 2009, pursuant to the Commission's July 16, 2009 Order on Rehearing, Amending License, Denying Late Intervention, Denying Petition, and Directing Appointment of a Presiding Judge for a Proceeding on Interim Conditions for the Don Pedro Project, as modified by paragraphs (B) through (E), are approved.

(B) The Districts shall incorporate Commission Staff's recommendations identified in paragraph 37 of this order into their proposed Instream Flow Incremental Methodology and Water Temperature Model Study Plans.

(C) In the event that the Districts' proposed high flow conditions under their Instream Flow Incremental Methodology Study Plan are not necessitated by naturally occurring wetter hydrologic conditions (resulting in flood releases of the 301,000 acre-feet annual flow requirement under the project license), the Districts shall alter their proposed intermediate test flows to maximize data collection up to the highest possible flow condition based on water year type, in consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Game.

(D) The Districts shall file their Instream Flow Incremental Methodology Study Plan progress reports with the Commission by July 1, 2010 and July 2011, and their Water Temperature Model Study Plan progress report with the Commission by July 30, 2010. The Districts shall file their final Water Temperature Model and Instream Flow Incremental Methodology Study Plan reports by January 26, 2011, and January 25, 2012, respectively. The Districts shall prepare their final reports in consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Game and allow the resource agencies 30 days to review and comment on the reports prior to filing them with the Commission. The Districts' reports shall include any resource agency comments and the licensee's response to any comments. If the Districts' proposed study or reporting schedules require modification as a result of the timing of the

issuance of this subject order, or for any other reason, the Districts shall file, for Commission approval, a request for extension of time. Any such extension of time requests shall include documentation of resource agency consultation and any comments received from the agencies on the proposed schedule modification.

(E) Based on the final results of the Instream Flow Incremental Methodology and Water Temperature Model Study Plans, the Commission reserves its authority to require changes to project structures and operations to protect fishery resources of the Tuolumne River, after notice and opportunity for hearing.

(F) The licensee shall file an original and seven copies of any filing required by this order with:

The Secretary
Federal Energy Regulatory Commission
Mail Code: DHAC, PJ-12.3
888 First Street, NE
Washington, DC 20426

(G) This order constitutes final agency action. Requests for rehearing by the Commission may be filed within 30 days from the date of issuance of this order, pursuant to 18 CFR § 385.713.

Edward A. Abrams
Director
Division of Hydropower Administration
and Compliance

Document Content(s)