Study 2.6

# WATER TEMPERATURE MODEL

November 2010

## 1.0 Project Nexus

Yuba County Water Agency's (YCWA or Licensee) continued operation and maintenance (O&M) of the Yuba River Development Project (Project) has a potential to affect water temperature.

## 2.0 Resource Management Goals of Agencies with Jurisdiction over the Resource to Be Studied

[Relicensing Participants - This section is a placeholder in the Pre-Application Document (PAD). Section 5.11(d)(2) of 18 CFR states that an applicant for a new license must in its proposed study *"Address any known resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied."* During 2010 study proposal development meetings, agencies advised License that they would provide a brief written description of their jurisdiction over the resource to be addressed in this study. If provided before Licensee files its Proposed Study Plan and Licensee agrees with the description, Licensee will insert the brief description here stating the description was provided by that agency. If not, prior to issuing the Proposed Study Plan, Licensee will describe to the best of its knowledge and understanding the management goals of agencies that have jurisdiction over the resource addressed in this study. Licensee]

## 3.0 Study Goals and Objectives

The goal of the study is to develop a water temperature model that could be used by all Relicensing Participants during relicensing to simulate current and potential future water temperature conditions.

The objective of the study is to develop a water temperature model that all interested Relicensing Participants agree is reasonably reliable for the purposes of Relicensing, and also agree to use this single water temperature model to make Relicensing recommendations. The model should accomplish the following:

- Simulate reservoir and stream water temperatures resulting from Project O&M.
- Include both Project and non-Project reservoirs and stream reaches below the Project for a period of analysis that covers the range of normal variations in hydrology of the Yuba River.
- Accurately reproduce observed reservoir and stream water temperatures, within acceptable calibration standards over a range of hydrologic conditions.
- Be sensitive to both flow and meteorological conditions

Development of protection, mitigation, and enhancement (PM&E) measures is not part of this study.

# 4.0 Existing Information and Need for Additional Information

Licensee believes adequate information exists to develop a water temperature model that meets the above study goal. Available water temperature data are described in detail in Section 7.2.9 of the Preliminary Information Package (YCWA 2009), and as described in Licensee's Water Temperature Monitoring Study, Licensee proposes to continued collection of water temperature data through Calendar Year 2013.

Previous modeling efforts have resulted in several different modeling approaches, as described below:

- In 1991, a water temperature model, the Yuba River Temperature Model (YRTM) (YCWA 1992), was developed by YCWA in response to California Department of Fish and Game (DFG) proposed flow requirements on the lower Yuba River. This model consisted of the following:
  - A CE-QUAL-R1 1-dimensional model of New Bullards Bar Reservoir.
  - A series of linear regressions to simulate water temperatures in the Colgate Penstock as a function of water temperature from New Bullards Bar Reservoir, flow through the penstock, and Marysville air temperature.
  - A series of linear regressions to simulate water temperatures in Englebright Reservoir as functions of Colgate Penstock temperatures, flows through the Colgate penstock, and Marysville air temperatures.
  - A HEC-5Q 1-dimensional model of the lower Yuba River.

  This model operated on a daily basis, and was calibrated for water years 1974, 1976, and 1977, and a portion of June 1991. The model was verified by simulating water temperatures in 1975 and 1978.

  While the regression coefficients for the Colgate Penstock and Englebright Reservoir components and the HEC-5Q model for the lower Yuba River are available, the CE-QUAL-R1 model of New Bullards Bar Reservoir is not available.

- In 2001, a water temperature model of the lower Yuba River was developed by YCWA to support testimony before the California State Water Resources Control Board (SWRCB) (YCWA 2001). This water temperature model consisted of three linear regressions for the following:
  - Narrows 2 Powerhouse temperatures as a function of Colgate Powerhouse release temperature and Marysville air temperature.
  - Yuba River flow temperature at the Marysville gage as a function of Narrows 2 Powerhouse release temperature, Yuba River flow at Marysville, and Marysville air temperature.

- Yuba River flow temperature at Daguerre Point Dam as a function of Marysville flow temperature, Yuba River flow at Marysville, and Marysville air temperature.

The model relied on historical average monthly release temperatures from Colgate Powerhouse rather than simulating New Bullards Bar Reservoir water temperatures. The model operated on a monthly basis, and the regressions were computed based on historical water temperatures from 1989 through 2001.

- In 2006, an expanded regression-based water temperature model was developed by YCWA to support the Yuba River Accord Environmental Impact Report/Environmental Impact Statement (EIR/EIS) (YCWA 2007). This water temperature model included regressions for the following:
  - Colgate Powerhouse release temperature as a function of month and New Bullards Bar Reservoir storage.
  - Narrows 2 Powerhouse release temperature as a function of Colgate Powerhouse release temperature, inflow to Englebright Reservoir, and Marysville air temperature.
  - Daguerre Point Dam flow temperature as a function of Narrows 2 Powerhouse release temperature, Yuba River flow at Smartville, and Marysville air temperature.
  - Marysville flow temperature as a function of Narrows 2 Powerhouse release temperature, Yuba River flow at Smartville, Yuba River flow at Marysville, and Marysville air temperature.

  These regressions were developed using historical data from 2000 through 2006, and were validated against historical data from 1990 through 2000. The model operated on a monthly time step.

None of these models, as currently developed, adequately addresses the range of operations and geography required as part of Relicensing. Therefore, a new water temperature model is needed for Relicensing.

# 5.0 Study Methods and Analysis

## 5.1 Study Area

For the purpose of this study, the study area includes 1) the Middle Yuba River from and including Our House Diversion Dam Impoundment to the confluence with the North Yuba River, 2) Oregon Creek from and including the Log Cabin Diversion Dam Impoundment to the confluence with the Middle Yuba River, 3) the North Yuba River from and including New Bullards Bar Dam Reservoir to the confluence with the Middle Yuba River, 4) and the portion of the Yuba River from the confluence of the North and Middle Yuba rivers to the Feather River, including the U.S. Army Corps of Engineers' (USACE) Englebright Reservoir.

If YCWA proposes an addition to the Project, the study area will be expanded, if necessary, to include areas potentially affected by the addition.

## 5.2 General Concepts and Procedures

The following general concepts and practices apply to the study:

- Personal safety is the most important consideration of each fieldwork team.
- Licensee will make a good faith effort to obtain permission to access private property where needed well in advance of entering the property.
- Field crews may make minor variances to the FERC-approved study in the field to accommodate actual field conditions and unforeseen problems. When minor variances are made, Licensee's field crew will follow the protocols in the FERC-approved study.
- When Licensee becomes aware of major variances to the FERC-approved study, Licensee will issue an e-mail to the Relicensing Contact List describing the variance and reason for the variance. Licensee will contact by phone the Forest Service (if the variance is on National Forest System land), USFWS, SWRCB and CDFG to provide an opportunity for input regarding how to address the variance. Licensee will issue an e-mail to the Relicensing Contact List advising them of the resolution of the variance. Licensee will summarize in the final study report all variances and resolutions.
- Licensee's performance of the study does not presume that Licensee is responsible in whole or in part for measures that may arise from the study.
- Global Positioning System (GPS) data will be collected using either a Map Grade Trimble GPS (sub-meter data collection accuracy under ideal conditions), a Recreation Grade Garmin GPS unit (3 meter data collection accuracy under ideal conditions), or similar units. GPS data will be post-processed and exported from the GPS unit into Geographic Information System (GIS) compatible file format in an appropriate coordinate system using desktop software. The resulting GIS file will then be reviewed by both field staff and Licensee's relicensing GIS analyst. Metadata will be developed for deliverable GIS data sets.
- Licensee's field crews will record incidental observations of aquatic and wildlife species observed during the performance of this study. All incidental observations will be reported in the appropriate Licensee report (e.g., incidental observations of special-status fish recorded during fieldwork for the Special-Status Turtles – Western Pond Turtle Study will be reported in Licensee's Stream Fish Populations Study report). The purpose of this effort is not to conduct a focus study (i.e., no effort in addition the specific field tasks identified for the specific study) or to make all field crews experts in identifying all species, but only to opportunistically gather data during the performance of the study.
- Field crews will be trained on and provided with materials (e.g., Quat) for decontaminating their boots, waders, and other equipment between study sites. Major concerns are amphibian chytrid fungus, and invasive invertebrates (e.g., zebra mussel, *Dreissena polymorpha*). This is of primary importance when moving: 1) between tributaries and mainstem reaches; 2) between basins (e.g., Middle Yuba River, Yuba River, and North Yuba River); and 3) between isolated wetlands or ponds and river or stream environments.

## 5.3 Study Methods

The study will consist of six steps, each of which is described below.

### 5.3.1 Step 1— Select Modeling Platform

The first step will be to select a modeling platform based on its adequacy in meeting specific criteria. After meeting with the Relicensing Participants to discuss specific issues to be addressed through results from the water temperature model, Licensee will develop a matrix of required model attributes, including a relative weight for each capability and a mechanism for scoring the model's ability to meet the criteria. After identifying a range of modeling platforms previously used in other FERC relicensing processes or other similar studies, Licensee will evaluate each platform based on its capabilities relative to the selection criteria. The model platform best meeting those criteria will be selected for use in modeling water temperature related to the Project.

During this step, Licensee will meet with Relicensing Participants about progress on the following issues:

- Water temperature model output requirements
- Model selection criteria definition
- Potential model platform list
- Potential model scoring against criteria
- Ultimate model platform selection

The water temperature model must reasonably simulate water temperatures of the stream reaches affected by the Project using hydrology from the water balance/operations model and meteorological data. The model platform must accomplish the following:

- Produce results such that Relicensing Participants agree on the validity of the results
- Simulate water temperatures on at least a 6-hour time step to capture diurnal fluctuations of water temperatures
- Simulate water temperatures over the full range of hydrology and meteorology of the Project-affected streams

### 5.3.2 Step 2— Develop and Calibrate the Model

After selecting a modeling platform, Licensee will develop and calibrate the water temperature model so that inputs, assumptions, operations, and calibration are consistent with operations and factors governing water temperature in Project reservoirs and the Yuba River.

The model will include representations of the North Yuba River between Goodyears Bar and New Bullards Bar Reservoir, New Bullards Bar Reservoir, Our House Diversion Dam, Log Cabin Diversion Dam, the Middle Yuba River below Our House Diversion Dam, Oregon Creek

below Log Cabin Diversion Dam, Englebright Reservoir, and the Yuba River,. The model will operate on at least a 6 hour time step to capture diurnal fluctuations in water temperatures.

The North Yuba River between Goodyears Bar and the upper extent of New Bullards Bar Reservoir will be simulated as a longitudinally segmented river, and will incorporate inflows from Slate and Canyon creeks.

New Bullards Bar Reservoir will be simulated as a single-dimensional vertically segmented profile located near the New Colgate Powerhouse intake tower. This will allow the water temperature model to capture the variability of release water temperature associated with changing water levels. Hydrologic and water temperature inputs to New Bullards Bar Reservoir will include the Camptonville Tunnel and North Yuba River. Releases from the reservoir will be made through either the New Colgate Powerhouse, the Fish Hydro, or from the spillway. The model will incorporate the ability to represent operation of the existing New Bullards Bar Dam outlet shutter system and the ability to selectively release through both powerhouse outlet tunnels. The reservoir water temperature model for New Bullards Bar Reservoir will be calibrated for the water temperature profile at the New Colgate Powerhouse Intake.

Since neither Our House nor Log Cabin diversion dams on the Middle Yuba River and Oregon Creek, respectively, are deep or large enough to develop vertical temperature stratification, they will be treated as diversion points, directing flows into the Lohman Ridge and Camptonville tunnels, respectively. Water temperatures in the tunnels and in the Middle Yuba River and Oregon Creek will be simulated as longitudinally stratified rivers to their downstream extents. Simulated water temperatures for two reaches will be calibrated for water temperatures upstream from the Middle Yuba River confluence with the North Yuba River.

The Yuba River between New Bullards Bar Dam and the upstream extent of Englebright Reservoir will similarly be simulated as a longitudinally stratified river. In addition to inflows from New Bullards Bar Reservoir and the Middle Yuba River, releases from the New Colgate Powerhouse will be the primary water temperature input for this reach.

To capture travel time for water temperatures across Englebright Reservoir, the reservoir may be simulated as either a two-dimensional, vertically and longitudinally stratified reservoir, or as a one-dimensional, vertically stratified reservoir with an inflow-dependant lag-time capturing travel time for flows across the reservoir. In either case, the model will be calibrated to compute the water temperature profile at the Narrows 2 Powerhouse intake. In addition to inflow from the Yuba River, the South Yuba River will be included as an input to Englebright Reservoir. The reservoir water temperature model for Englebright Reservoir will be calibrated for the water temperature profile at the Narrows 2 Powerhouse Intake. The Narrows 1 and Narrows 2 powerhouses will be included as outlets; the outflow temperatures from these two powerhouses will be calibrated at the U.S. Geologic Survey's (USGS) Smartville[1] gage.

[1] In 2008, the people of this community petitioned to have the name changed to Smartsville, with an "s". However, the USGS gage refers to the former spelling of the community name. Therefore, in this document, the community is referred to as such.

The lower Yuba River below Englebright Reservoir will be simulated as a longitudinally stratified river, with inputs from Deer Creek and Dry Creek in addition to releases from Englebright Reservoir, and diversions at Daguerre Point Dam. The lower Yuba River water temperature model will be calibrated to compute water temperatures at the USGS Marysville gage.

Available meteorological data, including air temperature, atmospheric pressure, humidity, precipitation, solar radiation, and wind speed, and physical parameters such as reservoir area-storage relationships, river channel geometry, and water turbidity, will be used for water temperature model calibration. Accretions at multiple locations throughout the study area will be included to preserve mass balance throughout the system. Model calibration will use available historical hydrology corresponding to the period of record for meteorological data. A portion of the historical data set will be set aside for model validation.

In addition to previously described output, the model will provide output for the locations listed in Table 5.3.2-1.

**Table 5.3.2-1. Water Temperature Model Output Locations.**

| Node (River Mile) | Location | Hydrologic Reach or Data Source (as listed in Water Balance/Operations Model Study Plan) |
|---|---|---|
| **MIDDLE YUBA RIVER- OUR HOUSE DIVERSION DAM REACH[1]** | | |
| ----- | Inflow into Our House Diversion Dam Impoundment | Input Timeseries |
| ----- | Lohman Ridge Tunnel Intake | Lohman Ridge Tunnel Intake |
| 11.9 | Our House Diversion Dam Release to Middle Yuba River | Total Flow Downstream from Our House Diversion Dam |
| 4.6 | Middle Yuba River Upstream from Oregon Creek Confluence | Middle Yuba River Upstream from Oregon Creek Confluence |
| 4.6 | Middle Yuba River Downstream from Oregon Creek Confluence | Middle Yuba River Downstream from Oregon Creek Confluence |
| 0.0 | Middle Yuba River Upstream from North Yuba River Confluence | Middle Yuba River Upstream from North Yuba River Confluence |
| **ORGON CREEK- LOG CABIN DIVERSION DAM REACH[2]** | | |
| ----- | Upstream Inflow into Log Cabin Diversion Dam Impoundment | Input Timeseries |
| ----- | Camptonville Tunnel Intake | Camptonville Tunnel Intake |
| 4.1 | Log Cabin Diversion Dam Release to Oregon Creek | Total Flow Downstream from Log Cabin Diversion Dam |
| 0.0 | Oregon Creek Upstream from Middle Yuba River Confluence | Oregon Creek Upstream from Middle Yuba River Confluence |
| **NORTH YUBA RIVER NEW BULLARDS BAR DAM REACH[3]** | | |
| ----- | Upstream Inflow into New Bullards Bar Reservoir | Input Timeseries |
| ----- | New Bullards Bar Reservoir Profile at the New Colgate Powerhouse Intake | Reservoir Simulation |
| ----- | Colgate Powerhouse | Colgate Powerhouse |
| 2.4 | New Bullards Bar Dam Instream Release (Fish Flow Powerhouse) | New Bullards Bar Dam Instream Release (Fish Flow Powerhouse) |
| 2.4 | New Bullards Bar Dam Spill | New Bullards Bar Dam Spill |
| 2.4 | Total Flow Downstream from New Bullards Bar Dam | North Yuba River Upstream from Middle Yuba River Confluence |
| 0.0 | North Yuba River Upstream from Middle Yuba River Confluence | North Yuba River Upstream from Middle Yuba River Confluence |

**Table 5.3.2-1. (continued)**

| Node (River Mile) | Location | Hydrologic Reach or Data Source (as listed in Water Balance/Operations Model Study Plan) |
|---|---|---|
| **YUBA RIVER- NORTH/MIDDLE YUBA REACH[4]** | | |
| 39.5 | Yuba River at North and Middle Yuba River Confluence | Yuba River at North and Middle Yuba River Confluence |
| 34.0 | Yuba River to New Colgate Powerhouse | Yuba River to New Colgate Powerhouse |
| **YUBA RIVER- NEW COLGATE POWERHOUSE REACH[5]** | | |
| 34.0 | Yuba River Downstream from New Colgate Powerhouse | Yuba River Downstream from New Colgate Powerhouse |
| 33.6 | Yuba River Downstream from Dobbins Creek | Yuba River Downstream from New Colgate Powerhouse |
| 32.8 | Inflow into Englebright Reservoir from Middle Yuba River | Yuba River Downstream from New Colgate Powerhouse |
| **YUBA RIVER- ENGLEBRIGHT DAM REACH[6]** | | |
| ----- | Inflow into Englebright Reservoir from South Yuba River | Input Timeseries |
| ----- | Englebright Reservoir Profile at Narrows 2 Intake | Reservoir Simulation |
| 24.0 | Englebright Dam Spill | Englebright Dam Spill |
| 23.9 | Narrows Powerhouse 2 Release | Narrows Powerhouse 2 Release |
| 23.8 | Narrows Powerhouse 1 Release | Narrows Powerhouse 1 Release |
| 23.6 | Yuba River Near Smartville | Yuba River Near Smartville |
| 23.0 | Yuba River Upstream from Deer Creek | Yuba River Near Smartville |
| 23.0 | Deer Creek Inflow | Input Timeseries |
| 23.0 | Yuba River Downstream from Deer Creek Confluence | Yuba River Upstream from Dry Creek |
| 17.4 | Yuba River at Parks Bar | Yuba River Upstream from Dry Creek |
| 16.0 | Yuba River at Longs Bar | Yuba River Upstream from Dry Creek |
| 13.3 | Yuba River Upstream from Dry Creek | Yuba River Upstream from Dry Creek |
| 13.3 | Dry Creek Inflow | Input Timeseries |
| 13.3 | Yuba River Downstream from Dry Creek | Yuba River Downstream of Dry Creek |
| 12.4 | Yuba River Upstream from Browns Valley Irrigation District's John L. Nelson Fish Screen Facility | Yuba River Downstream of Dry Creek |
| 12.4 | John L. Nelson Fish Screen Facility | Yuba River Downstream from Dry Creek |
| 12.4 | Yuba River Downstream from Browns Valley Irrigation District's John L. Nelson Fish Screen Facility | Yuba River Downstream from Dry Creek |
| **YUBA RIVER- DAGUERRE POINT DAM REACH[7]** | | |
| 11.4 | Yuba River Upstream from Daguerre Point Dam | Yuba River Downstream of Dry Creek |
| 11.4 | At Daguerre Point Dam | Yuba River below Daguerre Point Dam |
| 11.4 | North Canal Diversions | Daguerre Point Dam Diversions |
| 11.4 | South Canal Diversions | Daguerre Point Dam Diversions |
| 11.4 | Yuba River below Daguerre Point Dam | Yuba River below Daguerre Point Dam |
| 8.1 | Yuba River at Walnut Ave (Near Western Extent of Goldfields) | Yuba River below Daguerre Point Dam |
| 6.0 | Yuba River near Marysville | Yuba River near Marysville |
| 4.8 | Yuba River at Simpson Lane (Between Goldfields and Marysville) | Yuba River near Marysville |
| 0.7 | Yuba River at Marysville | Yuba River near Marysville |
| 0.0 | Yuba River Upstream from Feather River | Yuba River near Marysville |

[1] Our House Diversion Dam Reach - Middle Yuba River from Our House Diversion Dam to immediately upstream from the confluence with the North Yuba River.

[2] Log Cabin Diversion Dam Reach - Oregon Creek from Log Cabin Diversion Dam to immediately upstream from the confluence with the Middle Yuba River.

[3] New Bullards Bar Dam Reach - North Yuba River from New Bullards Bar Dam to immediately upstream from the confluence with the Middle Yuba River.

[4] North and Middle Yuba Rivers Confluence Reach - Yuba River from the confluence of the North Yuba River and the Middle Yuba River to upstream from Colgate Powerhouse.

[5] Colgate Powerhouse Reach - Yuba River from the Colgate Powerhouse to the normal maximum water surface elevation of Englebright Reservoir.
[6] Englebright Dam Reach - Yuba River from and including Englebright Reservoir to Daguerre Point Diversion Dam.
[7] Daguerre Point Diversion Dam Reach - Yuba River from the Daguerre Point Diversion Dam to the Feather River.

### 5.3.3 Step 3—Develop Input Data Set

Concurrent with calibration of the model, Licensee will develop both a meteorological and an input-water-temperature data set. Hydrologic input data are expected to come from Licensee's Water Balance/Operations Model.

A complete set of meteorological data corresponding to the full hydrologic period of record is unavailable. Therefore, available full-period-of-record historical meteorology, including air temperature and precipitation, may be used, along with available short-period-of-record meteorological data, to attempt to statistically synthesize a full period of record of hourly or 6-hour meteorological input data, if it is determined that the full period of record is needed to represent the water temperature regime of the Yuba River. If it is not possible to synthesize a full period of record input data set, available data from a reduced period of record will be used.

Daily input water temperatures will be determined for the North Yuba River, Slate Creek, the South Yuba River, and Oregon, Deer, and Dry creeks. To capture hourly variability in the Middle Yuba River below Our House Dam resulting from Project operations, hourly input water temperatures will be determined for the Middle Yuba River. Since limited historical water temperature data are available for study area tributaries for the full period of record, it will be necessary to synthesize input water temperatures. These input water temperatures will be synthesized by identifying statistical relationships between available historical water temperature data and meteorology and hydrology. Since flow from accretions is typically very small relative to the aforementioned tributaries, accretion water temperatures will only incorporate seasonal variation in water temperature rather than daily values for the full period of record. While New Bullards Bar and Englebright reservoirs are expected to partially buffer uncertainties in input water temperatures, a reasonable attempt to capture the full range of conditions will be made.

Upstream from the Project, the Nevada Irrigation District (NID) is undergoing a FERC Relicensing of its Yuba-Bear Project (FERC 2266), the Pacific Gas and Electric Company (PG&E) is undergoing a FERC Relicensing of its Drum-Spaulding Project (FERC 2310), and South Feather Water and Power (SFWP) is undergoing a FERC Relicensing of its South Feather Power Project (FERC 2088). Proposed alternative operating criteria for each of these projects has the potential to affect inflow water temperatures to the Project from the respective streams. To address these potential changes in inflow water temperature, Licensee will compare the proposed alternative against the basis of comparison for each of the upstream projects to compute the change in water temperature resulting from the proposed alternative. Changes in upstream Project water temperatures will be applied to respective Project tributaries' inflow water temperatures to compute an alternative Project inflow water temperature. If differing periods of records make it impossible to compute a full period of record of alternative Project inflow water temperatures, the longest period of record available will be used to evaluate

changes in upstream project operations using sensitivity studies to characterize changes resulting from upstream project alternatives on Project inflow water temperatures.

### 5.3.4 Step 4—Validate the Model

Model validation will occur as three tasks. In the first task, Licensee will evaluate the model by comparing model output to the historical record. Significant differences between historical conditions and model runs will be examined, and the causes identified and documented. Where substantial differences cannot be explained, the model will be recalibrated. Key validation points will be at the following locations:

- Vertical profile in New Bullards Bar Reservoir at New Colgate Powerhouse intake
- Vertical profile in Englebright Reservoir at Narrows 2 Powerhouse intake
- River temperature in the Middle Yuba River upstream from its confluence with the North Yuba River
- River temperature at USGS Smartville gage (immediately below Narrows 1 and 2 powerhouses)
- River temperature at USGS Marysville gage

In the second task, Licensee will meet with interested Relicensing Participants to review the model. This will include a meeting to generally introduce the Relicensing Participants to the model. At that meeting, Relicensing Participants will be given a compact disc (CD) with the model, a Model Development Report that describes model inputs and logic and general information on running the model, and the Licensee's Draft Model Validation Report. After a reasonable time for review, Licensee will hold a series of workshops with interested Relicensing Participants to collaboratively review the model and make modifications, as appropriate.

In the last task, Licensee will finalize the model, and the Model Development and Validation reports, and provide these to Relicensing Participants.

### 5.3.5 Step 5—Develop Base Case

The base case for the water temperature model will simulate reservoir and stream temperature for the same reservoir operations, releases, and diversions as simulated in the Licensee's Water Balance/Operations Model base case. Licensee will configure the model to represent how Licensee currently operates the Project, including all physical, regulatory, and contractual constraints. The underlying assumption is that this base case represents the "No-Action Alternative." A full description of the base case setting will be prepared and distributed as part of the final report. Licensee intends that all subsequent model runs be compared to the base case run.

### 5.3.6 Step 6 – Prepare Model and Model Development and Validation Report

In the last step, Licensee will finalize the model, and the Model Development and Validation reports, including a report describing development and rationale for the base case, and provide these to Relicensing Participants along with the model (on CD) configured to the base case.

Making runs of the model once the model has been fully calibrated and validated is not part of this study.

## 6.0 Study-Specific Consultation

The study includes the following study-specific consultation:

- Licensee will brief Relicensing Participants about progress towards the following stages of model development: 1) model selection criteria definition; 2) potential model platform list; 3) potential model scoring against criteria; and 4) ultimate model platform selection. (Step 1.)

- Licensee will meet with interested Relicensing Participants to review the model. This will include a meeting to generally introduce the Relicensing Participants to the model and providing Relicensing Participants with the model on CD, a Model Development Report, and a Model Validation Report. After a reasonable time for review, Licensee will hold a series of workshops with interested Relicensing Participants to collaboratively review the model and make modifications, as appropriate. (Step 4.)

## 7.0 Schedule

Licensee anticipates the schedule to complete the study proposal as follows assuming the PAD is filed on November 1, 2010, and FERC issues its Study Determination by October 4, 2011:

Select Model Platform (Step 1)..... October 2011—December 2011
Calibrate Model (Step 2).....December 2011—March 2012
Develop Input Data Set (Step 3).....December 2011—March 2012
Validate Model (Step 4).....March 2012—April 2012
Develop Base Case (Step 5)..... April 2012—October 2012
Prepare Model and Reports (Step 6).....October 2011—October 2012

## 8.0 Consistency of Methodology with Generally Accepted Scientific Practices

The model platform used in support of the Project Relicensing will be selected from a list of model platforms used in other Relicensing processes. Model development, including calibration, verification, and model application will be conducted in accordance with generally accepted scientific practices.

# 9.0 Level of Effort and Cost

[Relicensing Participants – Licensee will include a cost range estimate for this study in its Proposed Study Plan. Licensee]

# 10.0 References Cited

Yuba County Water Agency (YCWA). 1992. Report on Water Temperature Modeling on the Yuba River. January.

_____. 2001. Lower Yuba River: Assessment of Proposed Water Temperature Requirements. October.

_____. 2007. Draft Proposed Lower Yuba River Accord EIR/EIS. June.