Study 2.2

WATER BALANCE/OPERATIONS MODEL

November 2010

1.0 Project Nexus

Yuba County Water Agency's (Licensee or YCWA) continued operation and maintenance (O&M) of the Yuba River Development Project (YRDP or Project) affects storage in reservoirs and stream flow.

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 balance/operations model that can be used by all Relicensing Participants during the Relicensing to simulate current and potential future operations of the Project.

The objective of the study is to develop the model in a fashion that results in all interested Relicensing Participants agreeing the model is reasonably reliable for the purposes of Relicensing, and agreeing to use this single Water Balance/Operations Model to make Relicensing recommendations.

Study primary objectives include developing a model that simulates Project O&M for a period of analysis that covers a range of hydrologic conditions. The model should:

- Address operational decisions made during Project O&M including: flood control; water supply; recreation; stream flows; and hydropower generation

- Accurately reproducing observed reservoir levels, reservoir releases, and hydropower generation, within acceptable calibration standards over a range of hydrologic conditions

- Providing output to inform other studies, analyses, and models

- Allowing simulation of changes in Project O&M to determine effects on reservoir levels, reservoir releases and hydropower generation

Development of PM&E measures is not part of the study

4.0 Existing Information and Need for Additional Information

Licensee believes adequate information exists to develop a Water Balance/Operations Model that meets the above study goal. These data are located in Appendix G, Hydrology Data, of Licensee's Preliminary Information Package (YCWA 2009). The data include area-storage-elevation information for each Project reservoir, historical operations data on reservoir storage, release, power generation, and observed flows downstream of the Project. The existing Federal Energy Regulatory Commission (FERC) license, 1965 Agreement with the California Department of Fish and Game (CDFG), State Water Resources Control Board (SWRCB) Revised Decision 1644 (RD-1644) and the Lower Yuba River Accord agreement specify historical and existing flow requirements throughout the lower Yuba River and Project area. The United States Army Corps of Engineer's (USACE) Water Control Manual for New Bullards Bar Reservoir specifies flood control requirements and operations. Information on physical capacities of the reservoirs, outlets, and powerhouses is known by Licensee.

In 2001, YCWA developed an operations model of the Project to support water management and operational decisions. The model was subsequently improved for use by the participants of the Lower Yuba River Accord process, was reviewed by several of the participating party's experts, and was used to evaluate alternative hydrology scenarios for the Lower Yuba River Accord Environmental Impact Report (EIR). The model used for the Lower Yuba River Accord will not meet the goals of this relicensing study because 1) it uses a monthly timestep; 2) it does not simulate fluctuations in USACE's Englebright Reservoir, and 3) does not simulate operations at the Log Cabin and Hour House diversions dams.

5.0 Study Methods and Analysis

This study includes the development of a Water Balance/Operations Model (model) for use in simulating Project operations and determining flows resulting from both current Project operations and alternative Project operations.

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, and 4) and the portion of the Yuba River from the confluence of the North and Middle Yuba rivers to the Feather River, including USACE's 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

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 methods will consist of five steps: 1) model development; 2) model validation; 3) base case development; 4) model documentation; and 5) final report. Each step is described below.

5.3.1 Step 1 – Develop Model

The model will simulate Project operations for a 39-year Relicensing hydrology period of record, which extends from Water Year (WY) 1970 through WY 2008. This period of record was chosen due to the availability of daily flow data for all major Project tributaries from United States Geological Survey (USGS) gages. This period of record includes the driest year on record (1977), an extended drought (1987 through 1992), and the wettest year on record (1983). The model will include hydrologic inputs from the following locations:

- North Yuba River above Goodyears Bar
- Slate Creek below South Feather Water and Power Agency's South Feather Power Project's Slate Creek Diversion Dam
- Oregon Creek above Log Cabin Diversion Dam
- Middle Yuba River above Our House Diversion Dam
- South Yuba River above Jones Bar
- Deer Creek below Nevada Irrigation District's Lake Wildwood Dam
- Dry Creek near its confluence with the Yuba River
- Accretions from ungaged tributaries below gaged locations to New Bullards Bar Reservoir, USACE's Englebright Reservoir, and the lower Yuba River

Development of the inflow hydrology is described in the Appendix G, Hydrology Data, of Licensee's Preliminary Information Package (YCWA 2009).

The model will include simulation of the following Yuba River Development Project facilities:

- New Bullards Bar Reservoir
- New Colgate Powerhouse
- Log Cabin Diversion Dam
- Our House Diversion Dam
- Camptonville Diversion Tunnel
- Lohman Ridge Diversion Tunnel
- Narrows 2 Powerhouse

Additionally, the model will simulate USACE's Englebright Reservoir and Pacific Gas and Electric Company's (PG&E) Narrows 1 Powerhouse operations and of diversions at USACE's Daguerre Point Dam. While these facilities are not a part of the Yuba River Development Project, they play a major role in determining operations of Yuba River Development Project facilities.

As the primary facility of Project, operations of New Bullards Bar Reservoir will be the focal point of the model. Simulation of New Bullards Bar Reservoir operations will include the following considerations:

- Flood management operations at New Bullards Bar Reservoir
- Flood management operations at USACE's Englebright Reservoir
- Seasonal reservoir storage management at New Bullards Bar Reservoir
- Weekly and daily reservoir storage management at USACE's Englebright Reservoir
- Yuba River flow requirements
- Agricultural diversions to YCWA Member Units (MU) at USACE's Daguerre Point Dam
- Power Generation at the New Colgate Powerhouse

The model will include the capability of operating for an end-of-September carryover-storage target in New Bullards Bar Reservoir by managing reservoir releases and by applying deficiencies to agricultural deliveries at USACE's Daguerre Point Dam.

In addition to being able to simulate operations for flow requirements from any of the various controlling documents, the model will include both the Yuba River Index (YRI) and North Yuba Index (NYI) since these are the two primary hydrologic indices used by RD-1644 and the Yuba River Accord for determining their respective water year types and for in-stream flow schedules. The YRI is solely based on the computed unimpaired flow of the Yuba River, but the NYI is dependent on end-of-September New Bullards Bar Reservoir storage, so reservoir operations of any year could affect the NYI for the following year and beyond.

The model will also be able to compute power generation at the New Colgate, Narrows 2 and Narrows 1 powerhouses resulting from Project operations. The model will include the capability

of reflecting operations to shape power generation to meet energy demands. If needed, post-processing of daily model output could be developed to simulate hourly operations of the New Colgate and Narrows 2 powerhouse to simulate inter-day variations in releases from these powerhouse.

Licensee intends to collaborate with Relicensing Participants on certain aspects of model development and to consult/advise Relicensing Participants of the more basic elements of the model. Much of the work to prepare a basic model platform has been completed, and Licensee intends to provide interested Relicensing Participants with detail information about these effort, model basics, and justification for model representation of physical and operational aspects of the Project. These early effort are intended to complete the foundational platform for the model to accurately represent the current physical configuration of the Project, Yuba River hydrology, and existing operational conditions. Concurrent with this work, Licensee intends to collaborate with Relicensing Participants on the more variable, discretionary elements of project operations, model output and additional post-processing needs for refined analysis and information.

Approach to Modeling Critical Project Elements

To accurately simulate operations of the Project, several critical elements of project operations outlined above require special consideration. The proposed approaches to representing these elements in the model are described as follows;

Carryover Storage In New Bullards Bar Reservoir

Stored water in New Bullards Bar Reservoir must be preserved for subsequent year drought protection to ensure sufficient water to meet instream flows and local irrigation deliveries. Licensee's approach to carryover storage determination, and operations to preserve stored water for carryover are based on a shortage risk policy that uses exceedance probability of drought conditions.

To protect against multi-year droughts, simulation of New Bullards Bar Reservoir will include a Carryover Storage target for the end of September each year. If simulated end-of-September (EOS) New Bullards Bar reservoir storage falls below the Carryover Storage target, Daguerre Point Dam diversions would be reduced. To achieve the desired Carryover Storage the model will iterate, cutting Daguerre Point Dam diversions, until the Carryover Storage target is met, as long as Daguerre Point Dam diversions do not drop to less than 50% of demand.

The Carryover Storage target volume is computed to ensure the subsequent year will have sufficient water supply to meet Yuba Accord flow requirements and 50% of Daguerre Point Dam diversion demands, assuming the volume of inflow to the Project are greater than or equal to inflows corresponding to a 1 in 100 occurrence drought.

Yuba Accord Index and Schedule Determination

The Yuba Accord includes a determination of the North Yuba Index, which includes the amount of active stored water at the beginning of a water year (amount of stored water above the License minimum storage on September 30th). Because the amount of water stored in New Bullards Bar Reservoir at the beginning of a water year is affected by the previous year(s) operations, a series

of historical indices and year types cannot be predetermined for modeling purposes, and must instead be calculated based on the simulation result of the preceding water year.

The model will use the previous year's New Bullards Bar Reservoir EOS storage with the current year's New Bullards Bar Reservoir inflows to compute the North Yuba Index and the corresponding flow schedule. While the Yuba Accord describes a methodology for forecasting inflows, the model will include perfect foresight of reservoir inflows for the water year. The computed North Yuba Index and flow schedule will be used from April 1 of the current water year through March 30 of the following water year.

Systematic Changes to Inflow Hydrology due to Upstream Project Operations

Project inflow hydrology is significantly affected by the upstream facilities of the South Feather Power Project, the Yuba-Bear Project and the Drum-Spaulding Project. These projects all divert substantial amounts of water from the Yuba River watershed. All of these diversions are upstream of all Yuba River Development Project facilities and almost none of the water that is diverted by these projects ever flows back into the Yuba River. These diversions therefore will significantly impact the amounts of water that will be available to meet minimum instream-flow requirements in the Yuba River downstream of USACE's Englebright Dam.

These upstream projects have operated on continuous and consistent bases during the entire Yuba River Development Project period of record. Because of these continuous and consistent historical operations, the historical hydrology for inflows into the Yuba River Development Project area accurately represents the effects of these upstream projects' operations under current conditions.

For this Study 2.2, Licensee will utilize results from the modelings of the upstream projects' operations that have been done for these projects' FERC relicensings. Outputs from these modelings provide the amounts of water that flow into the Yuba River Development Project area from each of these projects under the projects' current operations. The amounts of water that would flow from the area of each of these projects into the Yuba River Development Project area under natural conditions also were calculated by these modelings, and can be used to quantify these projects' impacts on Yuba River Development Project hydrology.

The FERC relicensing processes for these upstream projects may, through new license conditions, result in changes in these projects' operations or releases. To model the effects of potential changes in operations of these upstream projects on Yuba River Development Project operations, Licensee will use a modeling method that will apply the resulting changes in flows due to upstream project operational changes to the historical inflow time series at the appropriate gage locations.

Licensee's modeling also will be able to analyze the impacts of these upstream projects on Licensee's ability to implement potential new minimum instream-flow requirements in the Yuba River downstream of USACE's Englebright Dam.

After the impacts of the upstream projects and proposed changes in their future operations on Yuba River Development Project hydrology have been quantified, these hydrological changes

may be further analyzed to determine these projects' impacts on specific resources such as fish habitat, water quality, and stream morphology.

Intra-day Peaking Operations of Colgate Powerhouse

Historically Colgate Powerhouse has operated on both a weekday peaking schedule and an hourly peaking schedule, as well as concurrently providing ancillary services, which can affect releases and generation on a time period as short as a ten minutes. Under non-flood conditions, water management is generally done on a weekly basis. Through weekly power generation factors, the model will skew the daily power generation pattern while maintaining the weekly release volume. This would allow the model to simulate a weekday-weekend power generation cycle, where weekday generation was emphasized over weekend generation.

The water balance/operations model runs on a daily time step and cannot directly simulate shorter time period power operations. To simulate the range, rate of change and occurrence of flows within a day post-processing of the water balance/operations model output will be accomplished using Excel spreadsheets to apply hourly or 15 minute patterns to the daily flows for a representative period of interest.

Englebright Coordinated Operations

Englebright Reservoir and New Bullards Bar Reservoir are operated conjunctively to meet YCWA and PG&E regulatory instream flow requirements, flood management, irrigation deliveries and power demands.

As previously mentioned, weekly power generation factors will be used to weight generation on certain weekdays over others. Since Englebright Reservoir is operated to maintain relatively consistent flows on the lower Yuba River below Englebright Dam, variations in power generating flows from Colgate Powerhouse would be reflected as changes in storage at Englebright Reservoir. As such, the model will operate Colgate Powerhouse to maintain Englebright Reservoir storage within a defined, limited range. The model will adjust Colgate Powerhouse releases as necessary to begin and end each week at the same Englebright Reservoir storage.

Power generation releases from Englebright Reservoir can be made through either the Narrows 1 or Narrows 2 powerhouses or both. The model will have three simulation modes for splitting Englebright Reservoir releases between the two powerhouses: No Split, Current Contract, and Post Relicensing.

Under the No Split mode, all available Narrows 2 Powerhouse capacity would be used before releases were made through the Narrows 1 Powerhouse. Under the Current Contract mode, the order is reversed, and all Narrows 1 Powerhouse capacity would be used before any releases were made through the Narrows 2 Powerhouse. Under the Post-Relicensing mode, natural inflows to Englebright Reservoir would be released through the Narrows 2 Powerhouse up Licensee's water rights. Releases above Licensee's water rights would be made through the Narrows 1 Powerhouse. If needed, any additional releases could be made through the remaining capacity of Narrows 2 Powerhouse.

In addition to previously-described output, the model will provide output for the locations listed in Table 5.3.1-1.

Table 5.3.1-1. Water Balance/Operations Model output locations.

River Mile	Location	Units	Source of Data
MIDDLE YUBA RIVER – OUR HOUSE DIVERSION DAM REACH[1]			
--	Upstream Inflow into Our House Diversion Dam Impoundment	Mean Daily Flow	Synthetic and Historical Flows from USGS Gages
--	Lohman Ridge Tunnel Intake	Mean Daily Flow	Model Output
11.9	Total Flow Downstream of Our House Diversion Dam	Mean Daily Flow	Model Output
4.6	Middle Yuba River Upstream of Oregon Creek Confluence	Mean Daily Flow	Model Output
4.6	Middle Yuba River Downstream of Oregon Creek Confluence	Mean Daily Flow	Model Output
0.0	Middle Yuba River Upstream of North Yuba River Confluence	Mean Daily Flow	Model Output
ORGON CREEK – LOG CABIN DIVERSION DAM REACH[2]			
--	Upstream Inflow into Log Cabin Diversion Dam Impoundment	Mean Daily Flow	Synthetic and Historical Flows from USGS Gages
--	Camptonville Tunnel Intake (USGS Gage 11409350)	Mean Daily Flow	Model Output
4.1	Total Flow Downstream of Log Cabin Diversion Dam	Mean Daily Flow	Model Output
0.0	Oregon Creek Upstream of Middle Yuba River Confluence	Mean Daily Flow	Model Output
NORTH YUBA RIVER - NEW BULLARDS BAR DAM REACH[3]			
--	Upstream Inflow into New Bullards Bar Reservoir	Mean Daily Flow	Synthetic and Historical Flows from USGS Gages
--	New Bullards Bar Reservoir	Mean Daily Reservoir Elevation	Model Output
--	Colgate Power Tunnel Intake	Mean Daily Flow	Model Output
2.4	New Bullards Bar Dam Instream Release (Min Flow Powerhouse)	Mean Daily Flow	Model Output
2.4	New Bullards Bar Dam Spill	Mean Daily Flow	Model Output
2.4	Total Flow Downstream of New Bullards Bar Dam	Mean Daily Flow	Model Output
0.0	North Yuba River Upstream of Middle Yuba River Confluence	Mean Daily Flow	Model Output
YUBA RIVER - NORTH AND MIDDLE YUBA RIVER CONFLUENCE REACH[4]			
39.5	Yuba River at North and Middle Yuba River Confluence	Mean Daily Flow	Model Output
34.0	Yuba River to New Colgate Powerhouse	Mean Daily Flow	Model Output
YUBA RIVER - NEW COLGATE POWERHOUSE REACH[5]			
34.0	Yuba River Downstream of New Colgate Powerhouse	Mean Daily Flow	Model Output
32.8	Inflow into Englebright Reservoir from Middle Yuba River	Mean Daily Flow	Model Output
YUBA RIVER - ENGLEBRIGHT DAM REACH[6]			
--	Inflow into Englebright Reservoir from South Yuba River	Mean Daily Flow	Synthetic and Historical Flows from USGS Gages
--	Englebright Reservoir	Mean Daily Reservoir Elevation	Model Output
24.0	Englebright Dam Spill	Mean Daily Flow	Model Output
23.9	Narrows 2 Powerhouse Release	Mean Daily Flow	Model Output
23.8	Narrows 1 Powerhouse Release	Mean Daily Flow	Model Output
23.6	Yuba River Near Smartville	Mean Daily Flow	Model Output

Table 5.3.1-1. Water Balance/Operations Model output locations.

River Mile	Location	Units	Source of Data
YUBA RIVER - ENGLEBRIGHT DAM REACH[6] (continued)			
23.0	Yuba River Upstream of Deer Creek	Mean Daily Flow	Model Output
23.0	Deer Creek Inflow	Mean Daily Flow	Synthetic and Historical Flows from USGS Gages
13.3	Yuba River Upstream of Dry Creek	Mean Daily Flow	Model Output
13.3	Dry Creek Inflow	Mean Daily Flow	Synthetic and Historical Flows from USGS Gages
13.3	Yuba River Downstream of Dry Creek	Mean Daily Flow	Model Output
11.4	North Canal Diversions	Mean Daily Flow	Model Output
11.4	South Canal Diversions	Mean Daily Flow	Model Output
11.4	Yuba River below Daguerre Point Dam	Mean Daily Flow	Model Output
6.0	Yuba River near Marysville	Mean Daily Flow	Model Output
0.0	Yuba River Upstream of Feather River	Mean Daily Flow	Model Output

[1] Our House Diversion Dam Reach - Middle Yuba River from Our House Diversion Dam to immediately upstream of the confluence with the North Yuba River.
[2] Log Cabin Diversion Dam Reach - Oregon Creek from Log Cabin Diversion Dam to immediately upstream of the confluence with the Middle Yuba River.
[3] New Bullards Bar Dam Reach - North Yuba River upstream of the confluence with the Middle Yuba River
[4] North and Middle Confluence Reach - Yuba River from the confluence of the North Yuba River and the Middle Yuba River to upstream of 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 Dam.
[7] Daguerre Point Diversion Dam Reach - Yuba River from the Daguerre Point Dam to the Feather River.

The model will incorporate storage targets for New Bullards Bar and USACE's Englebright reservoirs to simulate the decision process used to manage storage at times when the facilities are not operating to meet regulatory flow requirements.

The Model will also require the ability to simulate stored water transfers from New Bullards Bar Reserovir through an increase in flow at USGS's Marysville gage and a decrease in New Bullards Bar Reservoir storage on a user-defined schedule as water transfers have historically had a significant effect on Project operations.

5.3.2 Step 2 – Validate Model

A simulation of multiple water years will be executed in the model using flow requirements, diversion demands, starting reservoir storage, and hydrologic conditions corresponding to those years. Licensee will evaluate the model by comparing the simulation output to the historical record for the corresponding years. Significant differences between historical conditions and model runs will be examined, and the causes of any differences will be identified and documented. Key locations for validation of the model will be as follows:

- End-of-Day New Bullards Bar Reservoir storage
- Daily average releases from the New Colgate Powerhouse
- Daily average Middle Yuba River flow below Our House Dam
- Daily average Yuba River flow at Smartville
- Daily average Yuba River flow at Marysville

The validation simulations will be reviewed by YCWA staff and consultants with historical experience in operating the Project to ensure consistency and reasonableness of simulation logic with Project operations. Any unexplainable variations will result in an examination and revision of model logic or input.

5.3.3 Step 3 – Develop Base Case Simulation

Using current regulatory requirements and agreements, diversion demands, and historical storage at the start of the simulation period of record, a base case simulation for project operations will be developed. Flows resulting from upper watershed projects to the Project area will be historical flows for the period of record as reflected in the Project inflow hydrology.

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. Licensee intends that all subsequent model runs be compared to the Base Case run.

5.3.4 Step 4– Develop Draft Model Development Report

Concurrent with model development, Licensee will develop a Model Development Report describing the basic logic and major assumptions associated with the model. While the Model Development Report does not need to describe every decision made in developing the model, it will be complete enough so that a user unfamiliar with the Project, but relatively familiar with operations modeling, could review model output and understand the logic behind most Project operations decisions. Discussion of model assumptions will include facility capacities and other physical Project constraints.

After completing a draft of the Validation and Model Development Report, Licensee will meet with interested Relicensing Participants to review the model. This will include a meeting to generally introduce Relicensing Participants to the model. At that meeting, Relicensing Participants will be given a CD with an executable version of the model, the Model Development Report that describing all model input and logic including priorities, and the 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.

5.3.5 Step 5 – Prepare Final Model and Model Development and Validation Report

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

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 meet with interested Relicensing Participants to review the model. This will include a meeting to generally introduce Relicensing Participants to the model. At that meeting, Relicensing Participants will be given a CD with an executable version of the model, the Model Development Report that describing all model input and logic including priorities, and the 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. (Step 4.)

7.0 Schedule

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

Develop Model (Step 1).....October 2011
Validate Model (Step 2).....October 2011 - May 2012
Develop Base Case (Step 3)..... May 2012 - July 2012
Develop Draft Model Development Report (Step 4).....October 2011 - August 2012
Prepare Reports (Step 5)..... 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 validation 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

State Water Resources Control Board (SWRCB). 2003. Revised Water Right Decision 1644 in the Matter of Fishery Resources and Water Right Issues of the Lower Yuba River.

United States Army Corps of Engineers (USACE). June 1972. New Bullards Bar Reservoir Regulation for Flood Control, Appendix V to Master Manual of Reservoir Regulation Sacramento River Basin, California.

United States Federal Power Commission (FPC). 1963. Order Issuing License and Accepting Surrender of License for Project No. 2246

Yuba County Water Agency and California Department of Fish and Game (YCWA – CDFG). 1965. Agreement

_____, Department of Water Resources and the Bureau of Reclamation. 2007. Draft Environmental Impact Report/ Environmental Impact Statement for the Proposed Lower Yuba River Accord.

Page Left Blank