

Study 2.5¹

WATER TEMPERATURE MONITORING²

December 2011

1.0 Project Nexus

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

2.0 Resource Management Goals of Agencies and Indian Tribes with Jurisdiction Over the Resource Studied

YCWA believes that five agencies have jurisdiction over water quality, including water temperature, and the resources that could be potentially affected in the geographic area included in this study proposal: 1) the United States Department of Agriculture, Forest Service (Forest Service) on National Forest System (NFS) land; 2) United States Department of Interior, Fish and Wildlife Service (USFWS); 3) United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); 4) California Department of Fish and Game (CDFG); and 5) State Water Resources Control Board, Division of Water Rights (SWRCB). Each of these agencies and their jurisdiction and management direction, as understood by YCWA at this time, is discussed below.

Forest Service

The Forest Service's jurisdiction and applicable management goals are described by the Forest Service from page 59 to 76 in the Forest Service's March 2, 2011 letter to FERC providing the Forest Service's comments on YCWA's Pre-Application Document, or PAD (YCWA 2010). The Forest Service's jurisdiction and management goals are not repeated here.

USFWS

USFWS's jurisdiction and goals and objectives are described by USFWS on pages 1 through 3 of USFWS's March 7, 2011 letter to FERC that provided USFWS's comments on YCWA's Pre-Application Document (PAD). USFWS's jurisdiction, goals and objectives are not repeated here.

NMFS

NMFS's statutory authorities and responsibilities are described by NMFS in Section 2.0 of Enclosure A in NMFS's March 7, 2011 letter to FERC providing NMFS's comments on YCWA's PAD. NMFS's jurisdiction and responsibilities are not repeated here.

¹ After consultation with Relicensing Participants, YCWA, at its own risk, agreed to begin this study in 2011 prior to FERC's Study Determination. If FERC includes this study in its Determination, YCWA will consider the study ahead of schedule.

² YCWA's included a Water Temperature Monitoring Study in its August 2011 Revised Study Plan. FERC's December 28, 2011 Resolution of Study Disputes Determination required modifications to the study. Those modifications have been made in this study plan.

CDFG

CDFG's jurisdiction is described by CDFG on page 1 of CDFG's March 2, 2011 letter to FERC providing CDFG's comments on YCWA's PAD. CDFG's goal, as described on page 2 of CDFG's letter is to preserve, protect, and as needed, to restore habitat necessary to support native fish, wildlife and plant species.

SWRCB

SWRCB has authority under the federal Clean Water Act (33 U.S.C. §11251-1357) to restore and maintain the chemical, physical and biological integrity of the Nation's waters. Throughout the relicensing process the SWRCB maintains independent regulatory authority to condition the operation of the Project to protect water quality and the beneficial uses of stream reaches consistent with Section 401 of the federal Clean Water Act, the Regional Water Quality Control Board Basin Plans, State Water Board regulations, CEQA, and any other applicable state law.

3.0 Existing Information and Need for Additional Information

YCWA is actively collecting stream water temperature data upstream, within and downstream of the Project, and is also collecting reservoir water temperature data in New Bullards Bar Reservoir and in the United States Army Corps of Engineer's (USACE) Englebright Reservoir. Table 5.3.1-1 lists YCWA's stream temperature data collection network and the period of record for each site as of July 2009. Data have been collected at several locations in the Yuba River below USACE's Englebright Dam since 2003; at other locations, data collection began in summer 2008. Reservoir temperature data have been recorded twice per month by YCWA since 1990 at a single point near the upstream face of New Bullards Bar Dam and at a single point near the upstream face of USACE's Englebright Dam. Normally, reservoir data have been collected at 10-foot intervals, along with *in situ* air temperature. Data collected during these efforts is available in the Preliminary Information Package (YCWA 2009) in section 7.2.9, Existing Water Quality Information.

4.0 Study Goals and Objectives

The goals of this Water Temperature Monitoring Study are: 1) to characterize water temperature conditions in reservoirs and river reaches potentially affected by continued Project O&M; and 2) to facilitate development of a water temperature model or models, as may be necessary, to provide useful tools in the Project relicensing.

The objective of the study is to collect water temperature and meteorological data adequate to meet the study goals.

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 North 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 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. Upon request, GIS maps will be provided to agencies in a form, such as ESRI Shapefiles, GeoDatabases, or Coverage with appropriate metadata, that is useful for interactive data

analysis and interpretation. Metadata will be Federal Geographic Data Committee (FGDC) compliant.³

- 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 be completed in the five steps: 1) identify monitoring sites; 2) install and maintain recorders and download data; 3) perform additional temperature profiling in New Bullards Bar Reservoir;⁴ 4) perform quality assurance/quality control (QA/QC) of data; and 5) prepare report. Step 1 and Step 2 each has three components: 1) stream water temperature monitoring; 2) reservoir water temperature monitoring; and 3) meteorological monitoring. Each step is described below.

5.3.1 Step 1 - Identify Monitoring Sites

The locations at stream and reservoir water temperatures and meteorological data will be collected are described below.

5.3.1.1 Stream Water Temperature

Table 5.3.1-1 below provides a list of 38 locations at which YCWA will maintain continuous water temperature recorders in streams. Many of these are locations where data have been collected previously, to maintain continuous data records. To the extent possible, continuous water temperature recorders will be co-located with existing United States Geological Survey (USGS) or YCWA stream flow gages.

³ The Forest Service and CDFG each have requested that a copy of the GIS maps be provided to them when the maps are available.

⁴ This step was added in accordance with FERC's December 28, 2011 Resolution of Study Disputes Determination.

Table 5.3.1-1. Locations at which continuous water temperature data will be collected, including current data availability.

Project Reach	Location	Designation for Recorders ¹	River Mile	Latitude	Longitude	Data Available (as of 1/10/11)	Streamflow Gage, if Co-Located ³
MIDDLE YUBA RIVER							
--	Upstream of Our House Diversion Dam Impoundment	T10a T10b	MYR 12.2	39.413015	-120.994590	3/28/09-2/7/11	--
Our House Diversion Dam Reach	At Intake to Lohman Ridge Diversion Tunnel	T20	MYR 12.0	39.411910	-120.997427	7/3/08-11/3/10	USGS 11408870 (PG&E NY17)
	Downstream of Our House Diversion Dam	T30	MYR 11.9	39.410661	-120.998604	10/24/08-11/3/10	USGS 11408880 (PG&E NY18)
Oregon Creek Reach	Upstream of North Yuba River	T90a T90b	MYR 0.0	39.368639	-121.135658	8/19/08-12/18/08, 3/28/09-3/7/11	--
OREGON CREEK							
--	Upstream of Log Cabin Diversion Dam Impoundment	T40	OC 4.3	39.440146	-121.056149	7/8/08-11/2/10	USGS 11409300 (PG&E NY19)
Log Cabin Diversion Dam Reach	At Intake to Camptonville Diversion Tunnel	T50	OC 4.1	39.440491	-121.058746	7/8/08-11/3/10	USGS 11409350 (PG&E NY30)
	Downstream of Log Cabin Diversion Dam	T60	OC 4.0	39.439455	-121.059264	8/30/08-11/3/10	USGS 11409400 (PG&E NY20)
	Upstream of confluence with Middle Yuba River	TBC	OC 0.1	TBD	TBD	To Be Installed Upon Study Proposal Approval	--
NORTH YUBA RIVER							
--	Upstream of New Bullards Bar Reservoir	T65a T65b	NYR 16.0	39.523728	-121.090972	1/1/08-8/11/10	--
New Bullards Bar Dam Reach	At Low Flow Releases from New Bullards Bar Dam	T70a T70b	NYR 2.3	39.392348	-121.141584	7/18/08-11/3/10	USGS 11413517 (PG&E NY23)
	Upstream of Middle Yuba River	T80a T80b	NYR 0.0	39.368694	-121.136793	8/19/08-12/18/08, 3/28/09-11/9/10	--
SOUTH YUBA RIVER							
--	At Jones Bar (data collected on 1-hr interval, rather than every 15 min)	Jones Bar a Jones Bar b Jones Bar c	SYR 6.2	39.292222	-121.103610	5/16/08 – 11/3/10	USGS 11417500 (PG&E NY29)
DOBBINS CREEK							
--	At Lake Francis Outlet ²	T140a T140b	DC 2.4	39.359171	-121.205168	4/2/09-11/9/10	--
--	Upstream of Yuba River	T145a T145b	DC 0.1	39.329735	-121.197641	4/2/09-11/9/10	--
DRY CREEK							
--	Upstream of Yuba River	T185a T185b	DryC 0.7	39.228930	-121.402270	4/1/09-2/14/10	--
DEER CREEK							
--	Upstream of Yuba River	T175a T175b	DeerC 0.9	39.224091	-121.269866	2/3/09-11/3/10	--

Table 5.3.1-1. (continued)

Project Reach	Location	Designation for Recorders ¹	River Mile	Latitude	Longitude	Data Available (as of 1/10/11)	Streamflow Gage, if Co-Located ³
YUBA RIVER							
Middle/ North Yuba River Reach	Downstream of Confluence of North Yuba River and Middle Yuba River	T100a T100b	YR 39.7	39.367839	-121.136655	8/19/08-12/18/08, 3/28/09-11/9/10	--
	Upstream of New Colgate Powerhouse	T110a T110b	YR 34.1	39.330602	-121.187675	8/19/08-12/18/08, 3/28/09-3/8/11	--
New Colgate Powerhouse Reach	In Colgate Powerhouse Penstock	T120	YR 33.9	39.330824	-121.191565	1/1/08-3/31/11	--
	Downstream of New Colgate Powerhouse	T130a T130b	YR 33.8	39.330260	-121.193169	8/19/08-12/18/08, 3/28/09-3/8/11	--
	Downstream of Dobbins Creek	T150a T150b	YR 33.6	39.328398	-121.196162	3/28/09-11/9/10	--
	In Narrows #2 Powerhouse Penstock	T160a T160b	YR 23.9	39.238911	-121.270034	5/5/09-3/31/11	(PG&E NY24)
	Downstream of Narrows #2 Powerhouse at Smartville	T170	YR 23.6	39.235799	-121.272688	4/15/09-2/14/11	USGS 11419000 (PG&E NY28)
	Downstream of Narrows #2 Powerhouse at Smartville (data collected on 1-hr interval, rather than every 15 min)	Smartville a Smartville b Smartville c	YR 23.6	39.235799	-121.272688	WY2003 - 2007	USGS 11419000 (PG&E NY28)
	Downstream of Deer Creek	T180a T180b	YR 22.7	39.230047	-121.285165	11/8/08-2/14/11	--
	Downstream of Dry Creek	T190a T190b	YR 13.3	39.219611	-121.415128	11/8/08-3/9/09	--
	At Parks Bar (data collected on 1-hr interval, rather than every 15 min)	Parks Bar a Parks Bar b Parks Bar c	YR 17.4	39.219612	-121.346980	6/14/04 – 10/25/10	--
	At Long Bar (data collected on 1-hr interval, rather than every 15 min)	Longs Bar a Longs Bar b Longs Bar c	YR 16.0	39.218503	-121.369961	4/8/04 – 12/9/10	--
Upstream of USACE's Daguerre Point Dam	T200a Y200b	YR 11.5	39.208009	-121.443116	11/8/08-2/15/11	--	
USACE's Daguerre Point Dam Reach	At USACE's Daguerre Point Dam Fish Ladder	T210a T210b	YR 11.4	39.207853	-121.443529	11/18/08-11/14/10	--
	At USACE's Daguerre Point Dam Fish Ladder (data collected on 1-hr interval, rather than every 15 min)	Daguerre a Daguerre b Daguerre c	YR 11.4	39.208009	-121.443116	WY2003 – 2007	--
	At Walnut Avenue (Near Western Extent of Yuba Goldfields)	T220a T220b	YR 8.1	39.188220	-121.495307	8/28/08-2/7/11	--
	At Marysville Gage (data collected on 1-hr interval, rather than every 15 min)	Marysville a Marysville b Marysville c	YR 6.0	39.176164	-121.524386	WY2003 – 2007, 1/1/08 – 4/1/11	USGS 11421000
	Upstream of Simpson Lane (Between Yuba Goldfields and Marysville)	T230a T230b	YR 4.8	39.165328	-121.541350	8/28/08-2/7/11	--
	At Marysville (Downstream of Highway 70 Bridge)	T240a T240b	YR 0.7	39.134510	-121.590720	8/21/08-3/2/11	--

Table 5.3.1-1. (continued)

Project Reach	Location	Designation for Recorders ¹	River Mile	Latitude	Longitude	Data Available (as of 1/10/11)	Streamflow Gage, if Co-Located ³
FEATHER RIVER							
--	Upstream of Yuba River	T250a T250b	--	39.139425	-121.607282	8/15/08-3/2/11	--
--	Downstream of Yuba River on Right Bank	T260a T260b	--	39.108603	-121.603149	8/15/08-3/2/11	--
--	Downstream of Yuba River on Left Bank	T270a T270b	--	39.108594	-121.604663	8/19/08-3/2/11	--

¹ YCWA has installed redundant water temperature recorders at all locations except locations that are co-located with secure USGS stream flow gages or secure penstock sites.

² Water temperature data collected only when Lake Francis releases water.

³ Co-located means that a flow gage may be in the vicinity of the water temperature recorder, but possibly not at the exact location.

5.3.1.2 Reservoir Water Temperature

Table 5.3.1-2 provides a list of locations where routine reservoir profiling will occur.

Table 5.3.1-2. Locations where routine reservoir profiling will occur by reservoir. Profiles taken about every 2 weeks from March through November, unless otherwise stated.

Reservoir	Location	Designation for Site	River Mile	Latitude	Longitude	Period of Record
NORTH YUBA RIVER						
New Bullards Bar Reservoir	Approximately 100-200 feet upstream of center point of main dam	NY2.T455	NYR 2.3	39.397148	-121.135863	About Every 2 Weeks from March through November from 08/25/89 to 5/2010
YUBA RIVER						
USACE's Englebright Reservoir	Approximately 100-200 feet upstream of center point of main dam	NY14.T455	YR 24.0	39.240959	-121.268811	About Every 2 weeks from March through November from 01/24/90 to 5/2010
USACE's Englebright Reservoir	Approximately 3.3miles upstream of center point of main dam	--	YR 27.2	39.276111	-121.259497	About Every 2 weeks from March through November 1990 to present

5.3.1.3 Meteorological Data

Table 5.4.1-3 identifies locations where YCWA or another party has installed and maintains a meteorological station in the immediate vicinity of the Project.

Table 5.3.1-3. Metrological stations by Project facility.

Project Facility	Location	Designation for Site	Elevation ¹	Latitude	Longitude	Parameter	Date Installed
MIDDLE YUBA RIVER							
Our House Diversion Dam	On Right Abutment of Dam	OHD ²	1,960 ft	39.4120°N	120.9964°W	Min, Max and Mean Daily Air Temp ²	12/19/06 to Present
						Precipitation ²	12/19/06 to Present
NORTH YUBA RIVER							
New Bullards Bar Reservoir	On north bank about 0.25 ft Upstream of Dam	BUD ³	2,100 ft	39.3963°N	121.1439°W	Min, Max and Mean Daily Air Temp ³	11/16/09 to Present
						Humidity ³	11/16/09 to Present
						Wind Speed and Direction ³	11/16/09 to Present
						Solar Radiation ³	11/16/09 to Present
						Precipitation ³	11/16/09 to Present
YUBA RIVER							
New Colgate Powerhouse	On Deck of Powerhouse	CGT ⁴	600 ft	39.3308°N	121.1900°W	Min, Max and Mean Daily Air Temp ⁴	10/1/05 to Present
						Precipitation ⁴	11/14/05 to Present

¹ National Geodetic Vertical Datum of 1928.

² These data are available on the California Data Exchange Center (CDEC) under the Station ID name of "OHD" (Our House Dam).

³ These data are available on the California Data Exchange Center (CDEC) under the Station ID name of "BUD" (Bullards Bar).

⁴ These data are available on the California Data Exchange Center (CDEC) under the Station ID name of "CGT" (Colgate Powerhouse).

5.3.2 Step 2 – Install and Maintain Recorders and Download Data

Methods that will be used to install and maintain recorders, and collect data are described below. In general, anecdotal information that will be collected during each field visit to collect water temperature data will include: 1) general description of the weather; 2) start and end time of data collection; 3) air temperature at the start and end time of data collection; 4) maximum water depth where the observation is recorded; and 5) additional general comments regarding the data collection process. In addition, during initial installation of each recorder, YCWA will prepare a narrative description of each site, including the specific locations of recorders, and has taken photographs of each location.

At this time, YCWA intends to remove all water temperature recorders above Englebright Reservoir in late October 2012. Prior to removing the recorders, License will consult with Relicensing Participants regarding the need to maintain any gages for the purpose of water temperature modeling (See the Water Temperature Modeling Study).

5.3.2.1 Stream Water Temperature

Continuous water temperature will be recorded every 15 minutes at the 33 sites listed in Table 5.4-1: 22 are located within the active streams; 9 of these are co-located and are installed within USGS steam flow gaging structures; and two are located in powerhouse penstocks. In addition, YCWA will collect continuous water temperature on one-hour intervals at five locations, two of which are co-located with a USGS gage.

Water Temperature Recorders in the Active Channel

The stream water temperature recorders in the active flow channel will have 12-bit resolution with a minimum accuracy of $\pm 0.2^{\circ}\text{C}$ (i.e., Onset or equivalent). Each stream recorder will be contained in a durable protective housing that permits the active flow of water in and around the unit. Each stream recorder will be secured by a cable to a stable root mass, tree trunk or man-made structure, or secured using embedded rebar where necessary such that the recorder will be secured in the channel during high flow periods. The stream recorders will be installed in the channel thalweg, and the housing and cable will be disguised as much as possible while ensuring the ability to retrieve the unit for future downloads. A GPS coordinate will be taken and recorded at each installation point, along with any waypoints that may prove valuable for future retrieval, especially where there is not a defined trail leading to the access point. Photographs of the recorder site, including installation configuration, will be taken. Each recorder will be set to record water temperature at 15 minute intervals. YCWA will visit each recorder and download data at least monthly.

Prior to installation, each recorder will be numbered and calibrated to manufacturer's recommended specifications. YCWA will install a redundant water temperature recorder at each site. Redundant recorders will be located as close as possible to the primary recorders. Where a redundant recorder occurs, the primary recorder will be labeled with the recorder number for the site (e.g., "T100") with the suffix "a" and the redundant recorder with the number for the site with the suffix "b". Data from both recorders will be downloaded during each scheduled visit.

Data from higher elevation recorders subject to being snowbound or inaccessible due to high spring flows or requiring difficult access will be downloaded as soon as possible each spring and again prior to winter storms.

During each visit, YCWA will download data into an optic shuttle or directly to a personal computer. Immediately after the data are safely downloaded, back-ups will be recorded on compact disc (CD) or other suitable medium. Only after the raw water temperature data are safely backed-up will the optic shuttle be cleared or the data manipulated.

Prior to each download of data, a National Institute of Standards and Technology (NIST) traceable digital thermometer will be used to determine the water temperature at the recorder. The water temperature reading from the NIST-traceable thermometer will be compared to the last logger reading to check for accuracy drift of the recorder.

In addition, during each site visit, YCWA will be prepared to replace or fix a recorder installation. Should a recorder need to be replaced because it is missing or has failed, YCWA will be able to do so immediately to reduce the potential for additional data loss. Any recorder or optic shuttle that fails to download will be returned to the manufacturer for possible data recovery.

During each visit besides downloading data from the recorder, YCWA will also check equipment operation/calibration, battery life, and calibrate the instrument to manufacturer's specifications. After the recorder is removed from the water, it will be cleaned and visually inspected.

YCWA will maintain a record of all recorder installations and data downloads for a comparison between the NIST-traceable thermometer and recorder water temperature readings, and a record of any problems that were encountered in the field.

Water Temperature Recorders in Stream Margins

After the first Special-Status Amphibians – Foothill Yellow-Legged Frog (FYLF) Study (Study 3.4) survey effort (e.g., for egg masses), YCWA will install three to four continuous water temperature recorders at each of up to four locations upstream of Englebright Reservoir. YCWA and Relicensing Participants will collaboratively agree on each specific location and the siting of the specific recorders, with a goal that each location is: 1) in the margin of the stream channel (e.g., edge of runs, pool tailouts, and backwater pools/eddies at the top or bottom of lateral and median cobble bars); 2) in potential or known occupied FYLF habitats; and 3) if possible, near an existing water temperature recorder (Table 5.3.1-1). If possible, the recorders will also be located where a Channel Morphology Study (Study 1.1) cross-section is located.

The recorders will be installed in series at each location with one recorder near the water's edge (shallow) one in somewhat deeper (mid depth), and one in deeper water (deep). YCWA will install a pressure transducer at the deep water recorder. It is the intent that at least the shallow and mid depth recorder are in locations that represent FYLF egg laying habitat. YCWA will establish a benchmark at water's edge when the recorders are first installed, and the location and

depth of each recorder in relation to the benchmark and water's edge will be recorded. The target depth of the shallow recorder is 12 to 44 cm.

The recorders will be maintained as described above for Water Temperature Recorders in the Active Channel.

Water Temperature Recorders at USGS Streamflow Gage Sites

As shown in Table 5.4-1, YCWA will maintain 11 continuous water temperature recorders at USGS stream flow gaging sites. Data will be collected hourly by means of a Waterlog H-350 XL Instrument. Gages will be maintained by YCWA through a contractor. Data is stored in a data logger and downloaded monthly.

Water Temperature Recorders in Powerhouse Penstocks

YCWA will maintain two continuous water temperature recorders in powerhouse penstocks: one at the New Colgate Powerhouse and one at the Narrows 2 Powerhouse. Hourly temperature data will be collected by means of Honeywell Truline device, which trends the data on a chart-recorder and also transmits the data to the YCWA's Supervisory Control and Data Acquisition (SCADA) system.

5.3.2.2 Reservoir Water Temperature

Reservoir profiles will be taken at New Bullards Bar and USACE's Englebright reservoir at a target frequency of about every 2 weeks year round. Sampling will occur at one location near the dam in New Bullards Bar and in Englebright Reservoir, at one location near the dam and one location approximately 3.3 miles upstream of the dam. A GPS receiver will be used during each successive sampling occasion to locate the geographical coordinates of each sample site. Care will be taken to identify the same site for successive profiles where water conditions and GPS accuracy allow.

Prior to mid 2010, YCWA measured reservoir water temperature by use of a Fluke 50S K/J thermometer. The device was lowered in 10-ft intervals, allowed to stabilize, and then a recording was made. The maximum depth sampled in New Bullards Bar Reservoir was 300 ft or the bottom, whichever was less, and the maximum depth sampled in USACE's Englebright Reservoir was 100 ft or the bottom, whichever was less.

Beginning in mid 2010, YCWA will use a Hydrolab[®] DataSonde 5[®] multi-parameter water quality monitoring system (or equivalent) to measure water temperature ($\pm 0.2^{\circ}$ C) and dissolved oxygen (± 0.2 milligrams per liter (mg/l) at each of the reservoir sampling sites). Dissolved oxygen (DO) will be calibrated at each reservoir following the manufacturer's calibration protocols. Generally, measurements will be taken at 10-foot vertical increments where the change in temperature with respect to depth is low. Where the temperature gradient is higher or where measuring an interflow or an underflow, 5-foot or smaller vertical increments will be used. At each sample depth, the parameter readings will be allowed to stabilize before water temperature and DO will be recorded on the data sheet. When possible, profiling will occur up

to a depth of about 300 feet or the bottom, whichever is less, in New Bullards Bar Reservoir, and 120 feet or the bottom, whichever is less, in USACE's Engelbright Reservoir.

Also beginning in mid 2010, YCWA will collect with each reservoir water temperature profile a Secchi disk depth reading as an indicator of water clarity and photic zone. Secchi depth readings will be taken by lowering a Secchi disc over the shaded side of the boat until the disc is no longer visible from the boat. The disk will then be raised until visible, at which location the depth of the disc will be recorded in tenths of a foot, and the average of the two readings will be used as the water clarity reading for that location.

5.3.2.3 Meteorological Data

The stations at Our House Diversion Dam, New Colgate Powerhouse and New Bullards Bar Dam are operated and maintained by the California Department of Water Resources (CDWR) with data collected by satellite. Hourly data is available on the CDEC website under OHD (Our House Dam), CGT (Colgate Powerhouse), and BUD (New Bullards Bar Dam).

5.3.3 Step 3 - Perform Additional Temperature Profiling in New Bullards Bar Reservoir⁵

Once, on a date not sooner than August 15 and not later than September 1, Merced ID will collect a reservoir vertical profile of water temperature at three sites in New Bullards Bar Reservoir. The sites will be located at:

- The northwest arm of New Bullards Bar Reservoir
- The central arm of the New Bullards Bar Reservoir
- Approximately 100-200 feet upstream of center point of main dam (i.e., same location as described in Table 5.3.1-2)

YCWA will use a Hydrolab[®] DataSonde 5[®] multi-parameter water quality monitoring system (or equivalent) to measure water temperature ($\pm 0.2^{\circ}$ C) at each of the three sites. Measurements will be taken at 10-foot vertical increments where the change in temperature with respect to depth is low. Where the temperature gradient is higher or where measuring an interflow or an underflow, 5-foot or smaller vertical increments will be used. At each sample depth, the parameter reading will be allowed to stabilize before water temperature will be recorded on the data sheet. Profiling will occur at each site up to a depth adequate to identify the thermocline at that site.

The purpose of the sampling is to verify the assumption that stratification in New Bullards Bar Reservoir is relatively uniform in a longitudinal direction.

⁵ YCWA's Water Temperature Monitoring Study in its August 2011 Revised Study Plan did not include this Step 3. The Step was added to satisfy the requirements of FERC's December 28, 2011 Resolution of Study Disputes Determination in which FERC directed YCWA to modify the study to "add one temperature profile station in the northwest arm of New Bullards Bar reservoir and one temperature profile station in the central arm of the New Bullards Bar reservoir at a location deep enough to capture the level of the thermocline; monitor the temperature profile at the above station, once, on a date not sooner than August 15, and not later than September 1; and on the day that the reservoir stations are monitored, simultaneously monitor the temperature profile at the New Bullards Bar dam temperature profile station." (Page XX of Appendix B to FERC's December 28, 2011 letter).

5.3.4 Step 4 – Perform QA/QC Review of Data

Following data collection, YCWA will subject all data to a quality assurance/quality control (QA/QC) procedures including, but not limited to: 1) checking field data sheets (*e.g.*, comparison of NIST-traceable thermometers and recorder readings) to be sure no corrections are needed; 2) spot-checking data; and 3) reviewing recorder readings and electronic data for completeness. The datasets will also be reviewed graphically to check for errors. If any datum seems inconsistent during the QA/QC procedure, YCWA will investigate the problem. Values that are determined to be anomalous will be removed from the database if the reason for the reading cannot be identified.

If data are unavailable for brief periods of the record, the missing data will be synthesized into the record using a straight line interpolation method, and the data will be indicated as “synthesized” in the record and all subsequent summaries.

The raw data files will be retained in their unaltered state for future QA/QC reference. And data modified in the final record will be so indicated in the record.

5.3.5 Step 5 – Prepare Report

At the conclusion of the study, YCWA will prepare a report that includes the following sections: 1) Study Goals and Objectives; 2) Methods; 3) Results; 4) Discussion; and 5) Description of Variances from the FERC-approved study proposal, if any. The report will include, in Microsoft Excel and DSD format, on compact disc (CD) all data in mean daily increments except for reservoir profile data that will be in instantaneous readings. The final report will also include plots of stream water temperature showing mean daily water temperatures over time with mean daily stream flow at a site nearby the monitoring site, if available. Plots of water temperature and DO reservoir profiles will also be included in the report.

6.0 Study-Specific Consultation

This study includes one study-specific consultation.

- Prior to removing all water temperature recorders above Englebright Reservoir in late October 2012, YCWA will consult with Relicensing Participants regarding the need to maintain any gages for the purpose of water temperature modeling (See Water Temperature Modeling Study) (Step 2).

7.0 Schedule

YCWA anticipates the schedule to complete the study as follows:

Identify Sites and Install Recorders (Steps 1 & 2)October 2011
Maintain Recorders and Download Data (Step 2) November 2011 - Late October 2012
Additional Profiling (Step 3) August 2012

Data QA/QC (Step 4)..... November & December 2012
Prepare Report (Step 5)..... January & February 2013

8.0 Consistency of Methodology with Generally Accepted Scientific Practices

The methodologies described above for water temperature monitoring, reservoir profiling, and meteorological data collection are typical of recent relicensings in California.

9.0 Level of Effort and Cost

YCWA estimates the cost to complete this study in 2011 dollars is between \$160,000 and \$210,000.⁶

10.0 References Cited

California Department of Fish and Game. 2011. Yuba River Hydroelectric Project (Project No. 2246-058) Comments on the Pre-Application Document, Scoping Document 1, and Additional Resource Study Requests. March 2

Office of Environmental Health Hazard Assessment (OEHHA). 2003. Draft Report and Health Advisory for Fish from Selected Water Bodies in the Bear River, South Yuba River, and Deer Creek Watersheds (Nevada, Placer, and Yuba Counties) a fact sheet by Office of Environmental Health Hazard Assessment - California Environmental Protection Agency. February http://www.oehha.ca.gov/public_info/facts/fishfacts.html

State Water Resources Control Board (SWRCB). 2011. Comments on Pre-Application Document, Study Plan Proposals and Scoping Document 1 for the Yuba River Development Project, Federal Energy Regulatory Commission (FERC) Project No. 2246. March 7

State Water Resources Control Board (SWRCB). 2006. 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments. Central Valley Regional Water Quality Control Board. Approved by the SWRCB: October 25, 2006. http://www.swrcb.ca.gov/tmdl/303d_lists2006.html

Yuba County Water Agency (YCWA). 2010. Yuba River Development Project Relicensing Pre-Application Document. Yuba County Water Agency, Marysville, CA. <http://www.ycwa-relicensing.com>.

⁶ YCWA's Water Temperature Monitoring Study in its August 2011 Revised Study Plan had an estimate cost range of between \$150,000 and \$200,000. With the modifications required by FERC in its December 28, 2011 Resolution of Study Disputes Determination, the estimated cost range is between \$160,000 and \$210,000.