ADDENDUM TO TECHNICAL MEMORANDUM 6-1

Riparian Habitat Upstream of Englebright Reservoir

Additional Analysis

Yuba River Development Project
FERC Project No. 2246

January 2014

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TECHNICAL MEMORANDUM 6-1

ADDENDUM TO RIPARIAN HABITAT UPSTREAM OF ENGLEBRIGHT RESERVOIR

1.0 Introduction

On September 30, 2011, the Federal Energy Regulatory Commission (FERC) issued a Study Plan Determination for the Yuba County Water Agency's (YCWA) relicensing of its Yuba River Development Project, FERC Project Number 2246 (Project). The Determination included Study 6.1, *Riparian Habitat Upstream of Englebright Reservoir* (Study). The study, which was modified by FERC on December 8, 2011 and May 14, 2012, provided that:

> YCWA will provide germination and recruitment data to Relicensing Participants 1 month prior to the issuance of the Initial Study Report for consultation regarding the need for additional riparian seed germination studies. If, based on the results of the information, YCWA and Relicensing Participants collaboratively agree that seed germination or recruitment, including the need for modeling the relationship between flows and germination, should be studied in the second year, YCWA and Relicensing Participants will collaborate regarding the study and YCWA will propose the study in its Initial Study Report.

YCWA completed the Study and on May 31, 2013, provided to Relicensing Participants Technical Memorandum 6-1, *Riparian Habitat Upstream of Englebright Reservoir,* which provided the results of the Study 6.1, including germination and recruitment data.

Subsequently, YCWA and Relicensing Participants collaboratively agreed that YCWA would provide additional analysis of the Study 6.1 data in an addendum to the Technical Memorandum 6-1.

On July 26, YCWA filed with FERC a letter that advised FERC YCWA and Relicensing Participants consulted on Study 6.1 and collaboratively agreed on additional analysis. The Relicensing Participants agreed that the additional analysis would be provided in an addendum to Technical Memorandum 6-1, and that it adequately addresses the Relicensing Participants' need for additional information from YCWA regarding Study 6.1 seed germination and recruitment.

This addendum provides the additional analysis.[1]

[1] This addendum in no way modifies Technical Memorandum 6-1, *Riparian Habitat Upstream of Englebright Reservoir*, which was posted to the Relicensing Website on May 31, 2013.

2.0 Methods

The additional analysis focuses on Fremont's cottonwood (*Populus fremontii*); assumes seed dispersal for Fremont's cottonwood is from April 1 through July 15; and that the maximum stage change per day for Fremont's cottonwood seedling germination, establishment and survival is 2.5 centimeters per day (cm/day). Such a rate is faster than maximum root follow rates (1 to 1.5 cm/day), but potentially allows for capillary action to provide water to root tips. Actual maximum recession rate for viable seed germination may be much less (Stella et al. 2010).

YCWA and Relicensing Participants jointly selected two existing Study 6.1 transects[2] in each of three reaches for a total of six transects. The reaches and transects were:

- Our House Diversion Dam Reach (Middle Yuba River between Our House Diversion Dam and Oregon Creek) – Transect 7 and Transect 12
- Log Cabin Diversion Dam Reach, Celestial Valley Sub-reach (Oregon Creek between Log Cabin Diversion Dam and the Middle Yuba River) – Transect 10 and Transect 12
- Middle/North Yuba River Reach (Yuba River between the confluence of the Middle and North Yuba rivers and New Colgate Powerhouse) – Transect 11 and Transect 15

At each of these six selected transects, YCWA and Relicensing Participants agreed to perform additional analysis of the stage discharge relationship using available hydrology data and modeling as appropriate. YCWA developed a tool in Microsoft™ Excel that shows the elevation of water along each transect at different flows. Using the tool, for each of the six transects and for the period between April 1 and July 15 in each of the 41 years in the relicensing hydrology period of record (Water Year 1970 through Water Year 2010), YCWA created Microsoft™ Excel tables with the following columns of output data:

- Date
- mean daily flow (cfs) With-Project Hydrology
- daily recession rate (%) With-Project Hydrology
- mean daily stage (cm) With-Project Hydrology
- daily stage change (cm) With-Project Hydrology
- mean daily flow (cfs) Without-Project Hydrology
- daily recession rate (%) Without-Project Hydrology
- mean daily stage (cm) Without-Project Hydrology
- daily stage change (cm) Without-Project Hydrology

[2] Each of the Study 6.1 trasnsects was collocated with transects for Study 1.1, *Channel Morphology Upstream of Englebright Reservoir*, and Study 3.10, *Instream Flow Upstream of Englebright Reservoir*.

The With-Project and Without-Project hydrologies used to develop the tables were obtained from the relicensing Water Balance/Operations Model. YCWA highlighted table cells with a stage change of 2.5 cm or less. In addition, YCWA created 'spaghetti hydrographs' using stage in cm by water year type for With- and Without-Project hydrologies, and by five water year types (i.e., 10 charts per transect). These tables and hydrographs, as well as the tool used to develop them are included in the attachments to this addendum.

YCWA developed summary tables of information from each of the 41 years of hydrologic record at each of the selected transects to describe:

- The number of years and percent of years for which stage recession was 2.5 cm or less than 2.5 cm/day for the entire analysis period.
- A summary table with the average, maximum, and minimum by water year type, of the number of consecutive days with a recession rate of 2.5 cm/day or less.
- Two frequency distributions, one based on With-Project and one based on Without-Project hydrologies, for stage increments (e.g., 3 or 5 cm) where recession did not exceed 2.5 cm/day, and no recession rate in excess of 2.5 cm/day followed in a given year**.**

YCWA and Relicensing Participants agreed to jointly review the completed tool and tables, and to discuss areas of interest for limited additional analysis regarding specific areas of the selected transects and specific flows.

After reviewing the results provided directly to the Relicensing Participants and included in the YCWA's Draft License Application, Relicensing Participants requested slight modifications to the tools and tables. These modifications were agreed upon and are attached. The modifications included:

- Refine analysis to filter out flows less than base flow.
- Filter spaghetti hydrograph to be consecutive days with stage change between 0 cm and 2.5 cm.
- The cumulative frequency distribution of daily stage change on filtered data for all stages (not just categories of stage change).

3.0 Results

The results presented in this section include a summary of the Microsoft™ Excel tables. More detailed tables with information from each water year, spaghetti hydrographs, and a spreadsheet tool for various water elevations is included in the attachments. All analysis is limited to the period of the year when the majority of cottonwood seed distribution and germination is anticipated, between April 1 and July 15. All analysis is based on the recession rate (i.e., decreasing stage) of 2.5 cm or less, the rate at which germinating cottonwood seedlings are anticipated to be able achieve root-follow for down drawing water levels using capillary action.

4.0 List of Attachments to this Addendum

- Attachment A Spreadsheet Models [6 Microsoft Excel files: 37 MB]
- Attachment B Cross Section Tool [1 compressed folder containing an executable file: 122 MB]

5.0 References Cited

Stella, J.C.; J.J. Battles; J.R. McBride; and B.K. Orr. 2010. Riparian seedling mortality from simulated water table recession, and the design of sustainable flow regimes on regulated rivers. Restoration Ecology 18:284-294.

Addendum to
Technical Memorandum 6-1

Riparian Habitat Upstream of Englebright Reservoir

Attachment B

Cross Section Tool

Yuba River Development Project
FERC Project No. 2246

January 2014

Attachment B of Technical Memorandum 6-1 – Addendum to *Riparian Habitat Upstream of Englebright Reservoir*, consists of a compressed folder with an executable file of the Cross Section Tool. Due to the file type and file size, the file cannot be uploaded to FERC's e-Library system. YCWA will file a copy of the file on compact disc with FERC.

A copy of the CD can be obtained by contacting:

Curt Aikens
General Manager
Yuba County Water Agency
Office 530-741.5015
caikens@ycwa.com
www.ycwa.com

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