Enclosure F
FWS-4
Benthic Macroinvertebrate Study
Submitted by U.S. Fish and Wildlife Service
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Introduction

The Service is requesting that the Licensee conduct a benthic macroinvertebrate (BMI) study on the lower Bear River from Camp Far West Dam to the confluence with the Feather River.

Study Goals and Objectives

The goals of this study plan are to: 1) assess the BMI community structure to evaluate overall stream health in the lower Bear River; and 2) determine whether Project operations and maintenance adversely affects BMI community structure in the lower Bear River. Resource agencies can use this information to develop license recommendations. The objective of the study is to identify existing BMI community structure and habitat in the lower Bear River.

Resource Agency Management Goals

BMI are indicators of water quality and overall stream health. BMI are an important part of freshwater food webs as they: increase the rate at which organic matter is decomposed; release nutrients into the stream while feeding, excreting, and burrowing into sediments; control the numbers, locations, and sizes of their prey (e.g., BMI and algae); and provide a food source for fish, turtles, birds, and other aquatic and terrestrial organisms (Covich, Palmer, and Crowl 1999). The purpose of this study is to characterize existing BMI assemblages (including community structure and habitat) within Project-affected reaches in the Bear River and to evaluate Project effects on BMI community composition and distribution of BMIs downstream of Camp Far West Dam on the lower Bear River. Using the SWAMP protocol, current conditions of stream health in the lower Bear River will be assessed and a baseline condition will be established which will serve as a tool for use in monitoring status and trends of BMIs over time.

The specific information obtained during this study will provide information to the Service, Licensee, and other Project relicensing participants needed to understand the BMI community structure and overall stream health in the lower Bear River. This information will assist the Service, Licensee, and other Project relicensing participants in determining how Project operations and maintenance activities affect BMI in the lower Bear River. The results of this study and other Project relicensing studies will assist the Service, Licensee, and other Project relicensing participants in the collaborative development of Project Mitigation & Enhancement measures (PM&Es) for BMIs for the new FERC license.

Among others, the Service's resource objectives as related to BMI communities for this Project are:

1. Avoid and minimize existing and future Project impacts to fish and wildlife species and the habitats they depend on.
2. Protect, strengthen, and rely more on natural processes for the production and sustainability of fish and wildlife species and the habitats they depend on.
3. Implement adaptive management of resource actions so as to maximize benefits for fish and wildlife species.
4. Improve conditions for fish, wildlife, and their habitats and improve habitat availability.

5. Design and implement instream flow regimes below Project facilities that are sufficient to keep aquatic resources, including native fish, in good condition (see also Fish and Game Code §5937).
6. Ensure fish and wildlife species fully utilize available habitat in a manner that benefits all life stages, thereby maximizing natural production and full use of the ecosystem's carrying capacity.

Relevant Public Interest Considerations
The Service is a resource agency.

Existing Information and Need for Additional Information
The PAD provides very limited information regarding the BMI community in the lower Bear River. The BMI study conducted in 2014 referenced in the PAD was not a complete study following standard State protocols and did not include an analysis of stream health utilizing BMI metrics. The 2013 BMI sample was collected in the Bear River upstream of the Project. Thus, the Service does not have enough information from the 2014 BMI study and 2013 BMI sample to determine the current BMI community structure in the lower Bear River downstream of the Project and determine how Project operations and maintenance activities affect this BMI community.

Project Nexus
The primary Project facilities include the: (1) Camp Far West Dam and spillway; (2) Camp Far West Reservoir (impoundment); (3) 6.8 MW capacity Camp Far West powerhouse; and (4) powerhouse afterbay.

The Project contributes to Direct, Indirect, and Cumulative effects on the quantity of water in the lower Bear River. The Project directly impacts the community structure and habitat of BMI assemblages through operations and maintenance of the Project.

Scientific studies evaluating the relationship between flows and Project operation effects to BMI community structure and habitat in the lower Bear River must be conducted to provide federal and state resource agencies necessary information to develop license conditions, protection, mitigation, and enhancement measures that will protect the BMI resources of this watershed and that are consistent with federal and state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by a project (§10(a)(2) of the Federal Power Act, 16 U.S.C. section 803(a)(2)(A)). Information from this specific new study would inform all parties of the Project's particular effects on BMI assemblages and if beneficial uses of the lower Bear River are being protected (CVRWQCB 1998). The study results will inform the development of license requirements such as water operation modifications to provide instream flow downstream of Camp Far West Dam to support BMI resources in the lower Bear River.

Description of Study Methods and Analysis

Study Area
The study area includes the Bear River between water diversion pool/Project afterbay and the confluence with the Feather River. Sample sites for this study should be collocated with sampling sites for Study 3.2 – Stream Fish Populations Study. Specifically, four total sample sites should be included in this study at Reach 1 (Camp Far West Dam downstream to the non-Project diversion dam, Reach 2 (within one mile downstream of the diversion dam), Reach 3 (within 0.5 miles of the

Highway 65 Bridge), and Reach 4 (within 0.5-mile of the Highway 70 Bridge). The BMI study sampling site in Reach 1 should be located in the stream portion of the Bear River immediately downstream of Camp Far West Dam and not in the pool located directly upstream of the non-Project diversion dam.

General Concepts

The following general concepts apply to this study:

- Personal safety is an important consideration of each fieldwork team. If Licensees determine the information cannot be collected in a safe manner, Licensees will notify FERC and USFWS as soon as possible via email to discuss alternative approaches to perform the study.

- Licensee shall make a good faith effort to obtain permission to access private property where needed well in advance of performance of the study. If access is not granted or river access is not feasible or safe, Licensees will notify FERC and USFWS as soon as possible via email to determine if USFWS can assist in gaining access or to discuss alternative approaches to perform the study.

- Licensees' performance of the study does not presume Licensees are responsible in whole or in part for resource management measures that may arise from that study.

- All special-status species observations will be submitted to the California Natural Diversity Database.

Study Methods

BMI sampling for this study plan should be conducted using the reach-wide benthos (RWB) method for documenting and describing benthic macroinvertebrate assemblages and physical habitat described by the State Water Resources Control Board Surface Water Ambient Monitoring Program's (SWAMP) Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California (Ode 2007).

Physical habitat and water quality should be characterized at each BMI sampling site utilizing methods described by SWAMP (Ode 2007).

The following list of quantitative measures of chemical and physical/habitat characteristics should be collected at each site:

- Reach-Wide Parameters
    - GPS coordinates at each site
    - Water temperature, specific conductance, pH, and dissolved oxygen using approved standardized procedures and instruments.
- Transect-Specific Parameters
    - Aquatic habitat characterization including average depth, wetted width, bankfull dimensions, percent slope, sinuosity, and average canopy cover.

- A pebble count using the approach described by Wolman (1954) as adapted for use in the SWAMP protocol (Ode 2007).
- Evaluation of embeddedness and course particulate organic matter evaluation. Estimates should be obtained while collecting BMI samples by noting whether substrate is loosely, moderately, or tightly cemented and whether substrate is lightly, moderately, or heavily surrounded by fine sediment.
- If field or analytical methods deviate from SWAMP protocols, reasons for the deviation and alternate methods will be explained and documented.

Data collected during the study should be scored utilizing the California Stream Condition Index (CSCI) to translate BMI metric data into a measure of overall stream health (see Rehn, Mazor, and Ode 2015).

The Licensee will summarize and distribute results from this survey to the Service and other interested Project relicensing participants no later than 3 months from the end of the data collection. Licensee will discuss the results from the survey at a Relicensing Project meeting within one month of issuance of the study report.

Consistency of Methodology with Generally Accepted Scientific Practices

The methodology recommended by the Service for this study, Ode (2007), is the State standard protocol for conducting BMI assessments for California streams. This protocol has been utilized for other FERC Project relicensing studies (see Study 3.1 – Aquatic Macroinvertebrates Upstream of Englebright Reservoir and Study 3.2 – Aquatic Macroinvertebrates Downstream of Englebright Reservoir for the relicensing of the Yuba River Development Project (FERC No. 2246) and Study Description FA-S3 – Benthic Macroinvertebrate Study.

Considerations of Level of Effort

As addressed above, existing information is not sufficient for developing protection, mitigation, and enhancement measures because the existing information does not specifically evaluate BMI community structure, health, and how the Project may affect the BMI assemblages.

References Cited

Covich, A.P., Palmer, M.A., and T.A. Crowl. 1999. The role of benthic macroinvertebrate species in freshwater ecosystems, zoobenthic species influence energy flows and nutrient cycling. Bioscience 49:119-126.

Central Valley Regional Water Quality Control Board. 1998. The Water Quality Control Plan (Basin Plan) for the Sacramento River Basin and the San Joaquin River Basin. 4th ed. California Regional Water Quality Control Board, Central Valley Region, Sacramento, California.

Ode, P.R. 2007. Standard operating procedures for collecting benthic macroinvertebrate samples and associated physical and chemical data for ambient bioassessments in California. California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 001.

Rehn, A.C., Mazor, R.D., and P. Ode. 2015. The California Stream Condition Index (CSCI): a new statewide biological scoring tool for assessing the health of freshwater streams. SWAMP Technical Memorandum, SWAMP-TM-2015-0002.

Wolman, M.G. 1954. A method of sampling coarse riverbed material. Transactions of the American Geophysical Union 35(6): 951–956.