

POTENTIAL RESOURCE ISSUE:

Macroinvertebrate community distribution and abundance.

PROJECT NEXUS:

Project operations and Project betterments modify or could potentially modify flow regimes and water quality (including water temperature) in the bypass reaches and the peaking reach, altering the macroinvertebrate community and food availability for fish.

POTENTIAL LICENSE CONDITION:

- Instream flow releases.
- Site-specific water quality measures.

STUDY OBJECTIVE(S):

- Document the ~~spring/summer/fall~~ seasonal density and size distribution of drifting macroinvertebrates in ~~the selected~~ bypass reaches and the peaking reach for input to bioenergetics growth and habitat modeling.
- Document the benthic macroinvertebrate community in the peaking reach and compare to adjacent bypass and comparison reaches to assess general habitat conditions.
- Sample the benthic macroinvertebrate community at long-term agency sampling sites to supplement existing data sets.
- Document the benthic macroinvertebrate community in areas with known water quality issues as determined during the Water Quality Technical Study.

EXTENT OF STUDY AREA:

The study area includes accessible bypass reaches, the peaking reach, and potential comparison reaches identified in Table AQ3-1.

STUDY APPROACH:

Macroinvertebrate Drift Sampling

- Collect drift samples at select Instream Flow Technical Study sites (Table AQ3-1). Identify two representative riffles and sample drift at the downstream end of each riffle. Collect three drift samples at each riffle using the sampling methodology in Hayes et al. 2000.
- Collect drift density samples three different times (June, August, October). Process samples based on average drift density (number/m<sup>3</sup>) at each site by 2 mm prey size classes (e.g., lengths 1-3 mm, 3-5 mm, 5-7 mm, etc.). Use general aquatic invertebrate length versus weight relationships to convert macroinvertebrate drift to energy equivalents (joules/m<sup>3</sup>/size class) for bioenergetics modeling.
- Compare/contrast drift density and size between the study reaches and with the literature.

- Use [the](#) drift density information as [an](#) input to bioenergetics models to assist in the identification of limiting factors related to fish growth (food, water temperature, habitat) (see Bioenergetics Technical Study Plan).

### Benthic Macroinvertebrate Sampling

- Select critical bypass, peaking, and comparison reaches to collect benthic samples and inventory data following the California Stream Bioassessment Procedure (CSBP) (CDFG 2003). The purpose of these surveys is to compare and contrast the macroinvertebrate community in the peaking reach to adjacent bypass and comparison reaches. Proposed sampling sites for benthic macroinvertebrates are identified in Table AQ3-1.
- Conduct CSBP sampling at long-term agency sampling sites.
- To ensure comparability, select sample locations in the peaking reach and in the comparison reaches that are similar in substrate and hydraulic characteristics.
- In ~~August–October~~, collect ~~CSPB–CSBP~~ composite riffle samples at each site and process benthic macroinvertebrate samples according to the CSBP protocols (CDFG 2003). Characterize habitat conditions at each of the sampling locations (i.e., mesohabitat substrate, percent cover, water velocity, water temperature).
- In the peaking reach and in the associated comparison reaches, also collect benthic macroinvertebrate samples in June and compare to the October sampling to assess the change in seasonal macroinvertebrate abundance.
- Coordinate with the Water Quality Technical Study to identify any additional CSBP sampling locations based on water quality results.
- Statistically compare/contrast CSBP sampling results between reaches and with literature values.

### Sample Analysis

- BMI samples collected using the CSBP method will be identified to CSBP Level 1. The taxonomic identification of the BMI samples will be performed by a laboratory that will analyze samples in accordance with the California State Bioassessment Procedures.

### SCHEDULE:

To be developed in early 2007.

### REFERENCES:

California Department of Fish and Game (CDFG). 2003. California stream bioassessment procedure (Protocol brief for biological and physical/habitat assessment in wadeable streams).

Hayes, J.W., J.D. Stark, K.A. Shearer. 2000. Development and test of a whole-lifetime foraging and bioenergetics growth model for drift-feeding brown trout. Trans. Am. Fish. Soc. 129:315-332.

**Table AQ3-1. Macroinvertebrate Sampling Reaches.**

Study Reach	Bypass Reaches	Peaking Reach	Reservoir	Comparison Reach	Long-Term Agency Sampling Sites	Number of Benthic Macroinvertebrate Sample Locations	Number of Drift Macroinvertebrate Sample Locations
<b>Duncan Creek</b>							
Duncan Creek upstream of Diversion					●	1	--
Duncan Creek from Diversion to confluence with Middle Fork American River	●				●	1	--
<b>Middle Fork American River</b>							
Middle Fork American River from Middle Fork Interbay to Ralston Afterbay	●					1 <sup>a</sup>	1
<b>Ralston Afterbay Downstream</b>							
Middle Fork American River from Ralston Afterbay to confluence with Canyon Creek		●				2 <sup>a</sup>	1
Middle Fork American River from confluence of Canyon Creek to confluence with North Fork American River		●				2 <sup>a</sup>	1
<b>Rubicon River</b>							
Rubicon River from Hell Hole Reservoir to confluence with South Fork Rubicon River	●					-1	1
Rubicon River from confluence with South Fork Rubicon River to Ralston Afterbay	●					42 <sup>a</sup>	2
<b>Long Canyon Creek</b>							
South Fork Long Canyon Creek upstream of Diversion					●	1	--
South Fork Long Canyon Creek from Diversion to confluence with Long Canyon Creek	●				●	1	--
<b>Other Tributaries</b>							
North Fork Middle Fork American River				●		1 <sup>a</sup>	--
North Fork American River				●		1 <sup>a</sup>	--

<sup>a</sup> = [Benthic samples will also be collected in June](#)

**Placeholder for Figure AQ3-1**

**Macroinvertebrate Study Reaches**

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