

**POTENTIAL RESOURCE ISSUE:**

- Fish passage/migration.

**PROJECT NEXUS:**

- Project facilities and operations may affect fish passage/migration.

**POTENTIAL LICENSE CONDITIONS:**

- Instream flow releases.
- Facility modifications.

**STUDY OBJECTIVES:**

- Document the location, nature, and characteristics of fish barriers in bypass river reaches.
- Identify Project facilities and operations (e.g., diversion structures, instream flow releases) that may affect fish passage.

**EXTENT OF STUDY AREA:**

- The study area includes the bypass river reaches and Project diversion dams and pools.

**STUDY APPROACH:**

- Identify and classify potential fish passage barriers in bypass river reaches.
  - Use the AQ 1 – Instream Flow Technical Study Plan (TSP) mesohabitat mapping to identify the location and nature (natural or Project-related) of potential barriers (e.g., natural falls, tributary junctions, road crossings, shallow riffles, and diversion or dam structures) in the bypass river reaches.
  - Classify each potential barrier identified in the field mapping into the falls, chute, and cascade types defined by Powers and Orsborn (1985) or as critical riffles (Thompson 1972).
  - For stream crossings, use a classification approach consistent with Flosi, et al. (2010).
  - Summarize fish passage data collected at the barriers during field mapping (e.g., fall height, plunge pool depth, photographs, and field biologist observations).
- Evaluate fish passage at the potential Project-related fish barriers during the base-flow (low-flow) period using the following information:
  - Leaping and swimming capabilities of the fish based on the literature (Powers and Orsborn 1985; Hoar et al. 1978) and fish size and water temperature information from the AQ 2 – Fish Population TSP and the AQ 4 – Water Temperature Modeling TSP;
  - Physical and hydraulic characterization of potential barriers based on measurements from the field and/or Project engineering drawings;
  - The fish passage assessment methodology outlined in Powers and Orsborn (1985) and Thompson (1972) modified, where necessary, for the specific species (e.g., rainbow trout, brown trout, and hardhead) and barriers within the study area; and
  - For stream crossings, evaluate fish passage consistent with Flosi, et al. (2010).

- In collaboration with resource agencies, identify Project-related barriers, if any, which require hydrodynamics modeling to assess fish passage over a range of flows. Only barriers that prevent access to sections of river with important spawning or rearing habitat (as determined in collaboration with the resource agencies) would be considered for modeling. If there are barriers that require hydrodynamics modeling:
  - Characterize the seasonality, magnitude, and frequency of flows at the barrier over a range of water year types using the existing and unimpaired flow information; and
  - Coordinate with the AQ 1 – Instream Flow TSP to provide hydrodynamics data and modeling to estimate fish passage over the range of flows determined by the interested resource agencies.

**SCHEDULE:**

Date	Activity
March–October 2018	Conduct field surveys
November 2018–February 2019	Analyze data and prepare draft report
March 2019	Distribute draft report to the stakeholders
April–June 2019	Stakeholders review and provide comments on draft report (90 days)
June 2019	Meet with resource agencies to determine if there are any Project-related barriers that require hydrodynamics modeling
July–October 2019	Collect hydrodynamics data, if necessary, and resolve comments and prepare final report
December 2019	Distribute final report in Final License Application

**REFERENCES:**

Flosi, G., S. Downi, J. Hopelain, M. Bird, R. Coey, and B. Collins. 2010. California Salmonid Stream Habitat Restoration Manual Vol. II, Part IX, Fish Passage Evaluation at Stream Crossings. California Department of Fish and Game.

Hoar, W. S. and D. J. Randall (ed). 1978. Fish Physiology. Academic Press New York.

Powers, P. D. and J. F. Orsborn. 1985. Analysis of Barriers to Upstream Migration: An Investigation of the Physical and Biological Conditions Affecting Fish Passage Success at Culverts and Waterfalls. BPA Report No. DOE/BP-36523-1.

Thompson, K. 1972. Determining Stream Flows for Fish Life in Pacific Northwest River Basins Commission Instream Flow Requirement Workshop, March 15-16, 1972.