Fish Passage at Bumping Dam
Technical Memorandum

U.S. Bureau of Reclamation
Contract No. 08CA10677A ID/IQ, Task 4.1

Prepared by

Reclamation

HDR Engineering, Inc.

U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Columbia-Cascades Area Office

State of Washington
Department of Ecology
Office of Columbia River

March 2011

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1.0 Introduction

This technical memorandum summarizes proposed fish passage facilities at the existing Bumping Dam, a Bureau of Reclamation (Reclamation) water storage dam in the Yakima River Basin, southwest Washington. Key elements for the storage facility are listed below (Reclamation 2008).

Table 1. Proposed Elements of Fish Passage Facility

Downstream Passage	Bypass Q = 100 to 300 cfs over 30 feet w/s pool range
Upstream Passage/Adult Collection	6 cfs ladder with spillway flows as attraction flows
Barrier Dam	5-foot-high picket barrier
Fish Ladder – Pool/Weir	Not Applicable
Fish Conduit	230-foot-long, 7-foot-diameter (18-inch wall thickness)
Auxiliary System	6 to 15 cfs (16-inch supply pipe)

This memorandum summarizes a fish passage document prepared by Reclamation. The document is as follows:

- Cle Elum and Bumping Lake Dams Fish Passage Facilities Planning Report – Draft, September 2008

Technical content and conceptual design approach have not been altered. Some of the text has been modified for clarity.

The proposed Integrated Plan for Water Resource Management includes a proposal to replace the existing Bumping Dam with a new dam at a downstream location. This technical memorandum solely addresses fish passage at the existing dam, and does not address the proposed new dam. For information on the proposed new dam and fish passage, see the Volume 2 technical memorandum *Bumping Lake Enlargement Dam Planning Design Summary Update*.

1.1 Background

Bumping Dam is one of five major water storage dams in the Yakima Project that were not equipped with fish passage facilities when constructed (see Figure 1). The storage dam was a natural lake turned to a reservoir by construction of the dam. Lack of fish passage at the dam blocked access to the lake and upstream habitat for anadromous salmonids, which eliminated one of the largest sockeye salmon runs in the Columbia River Basin from the Yakima River Basin. Lack of passage also prevents fish such as bull trout from moving throughout the basin.

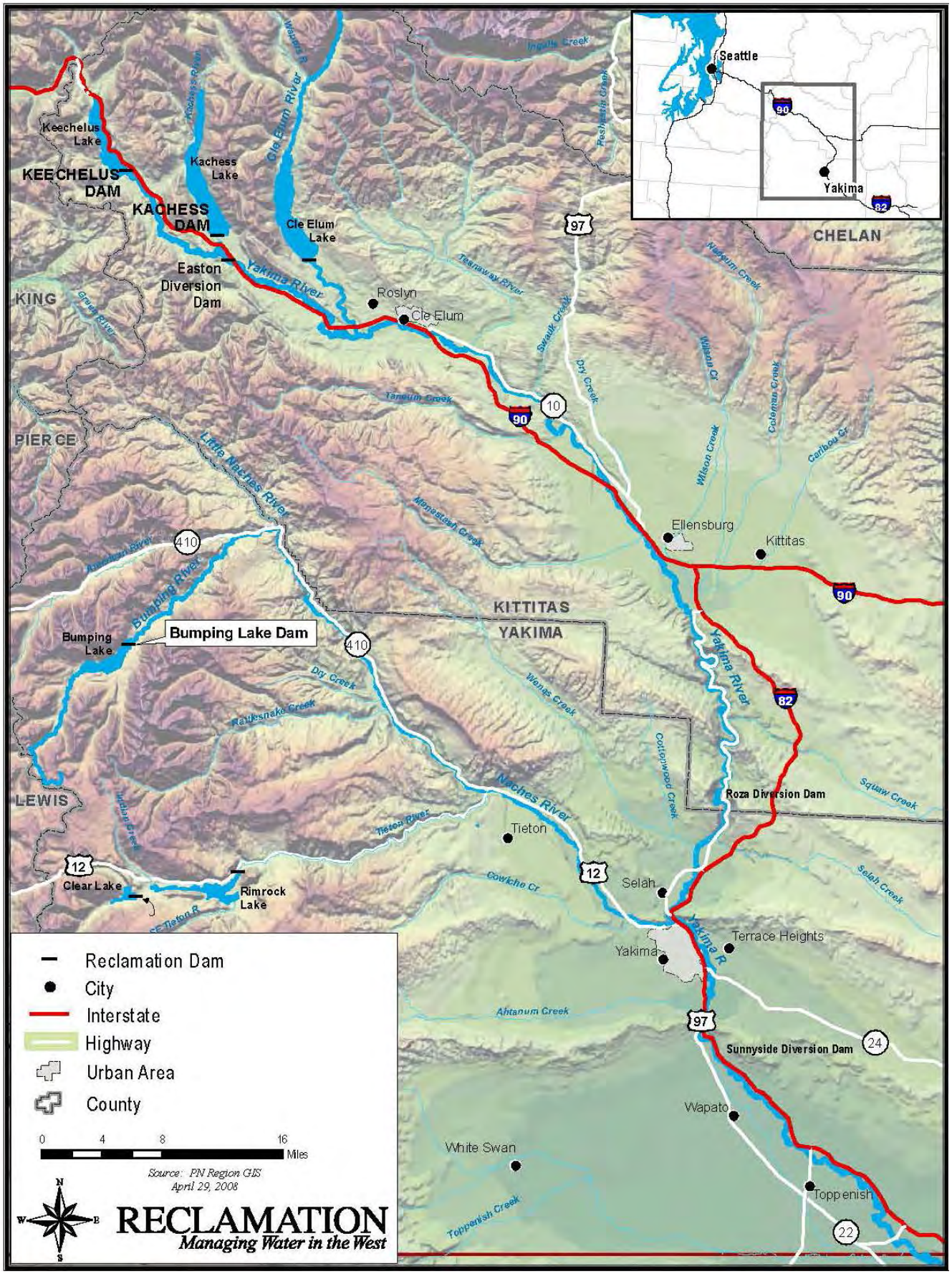

Figure 1. Bumping Dam Location

2.0 Fish Passage Facilities

Bumping Dam is located at the lower end of a natural lake at river mile (RM) 17 on the Bumping River, about 29 miles northwest of the town of Naches, Washington. The earthfill dam was completed in 1910 and forms a reservoir with a total capacity of 33,970 acre-feet, with 31,220 acre-feet available for use. The dam has a maximum structural height of 61 feet and a crest length of 2,925 feet. The average annual runoff at Bumping Lake is much more than the reservoir's capacity, which allows the reservoir to fill every year.

The spillway consists of an uncontrolled concrete ogee crest (elevation 3,426.20) and concrete-lined channel connected to a timber chute that discharges spillway flows to the river. The spillway is capable of passing 3,400 cfs at a reservoir water level of 3,429 feet. The outlet works consist of a gate tower and concrete conduit at the base of the dam.

During the early-September to late-October spawning period, the reservoir's outflows are kept under 200 cfs to minimize required releases from storage for the winter incubation and rearing (I&R) period when natural inflow to Bumping Lake often drops below 35 cfs. During the winter I&R period (and depending on earlier instream spawning flows), flows downstream from Bumping Lake Dam are kept within a target range of 200 cfs to the minimum natural inflow. The instream flows during this period vary depending on results of redd surveys. The reservoir typically reaches its lowest elevation after the end of the irrigation season and can remain low from October through December.

Bumping Lake is not used as a carryover facility, but is operated to provide 10,000 acre-feet of end-of-season storage (3,403.55) needed to maintain winter incubation flows. In extreme water-short years, the end-of-season storage target is reduced to a range of 6,000 to 9,000 acre-feet (3,398.16 to 3,402.27 feet). In winter, water is released to meet downstream targets and maintain flood-control space. In the spring, water is stored in the reservoir to regulate downstream flows for flood control and store water for irrigation demands later in the year. The highest reservoir elevations generally occur from May to August depending on the annual water supply.

Proposed fish passage facilities for Bumping Lake Dam include both downstream juvenile passage and upstream adult passage as shown in Figure 2 (Reclamation 2008).

2.1 Downstream Fish Passage

The downstream fish passage concept is similar to that proposed at Cle Elum Dam (see Volume 2 technical memorandum: *Fish Passage at Cle Elum Dam*). The proposed downstream passage facility would include a reinforced concrete intake structure and a conduit through the dam embankment. The intake structure would include two multilevel overshot, or tilting weir, gates set at different elevations to control passage of release flows. The gates would be raised or lowered as needed to match desired outflow and reservoir levels. Fish would pass over the gates into a 20-foot-long, 20-foot-wide stilling pool that would vary from 5 to 10 feet deep and then into a conduit. The reinforced, cast in-place concrete conduit, 230 feet long and 7 feet in diameter, would carry fish from the upstream intake structure and discharge them downstream into the river near the dam outlet works. The downstream fish passage facilities would generally be operated from early April to late June.

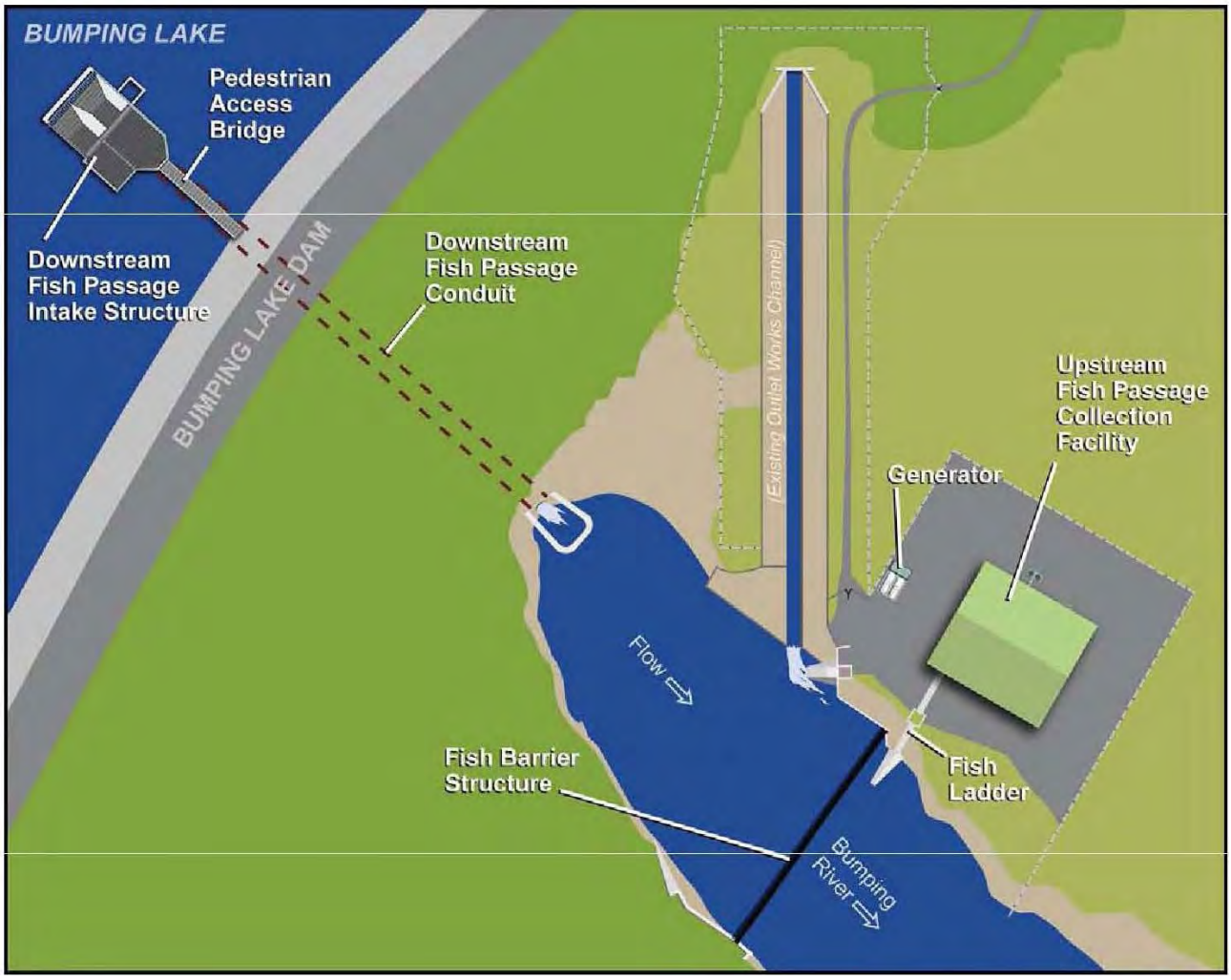

Figure 2. Bumping Dam Upstream and Downstream Fish Passage Facilities

2.2 Intake Structure

The reinforced concrete intake structure would include two overshot or tilting weir gates set at different elevations to control passage release flows. The gates would be raised or lowered as needed to match desired outflow and reservoir levels. Each gate would be 10 feet wide and 12 feet high. Flow over the gate would pass into a 20-foot-long, 20-foot-wide stilling pool section that would reduce energy to acceptable levels for juvenile fish. Water depth in the stilling pool would vary from 5 to 10 feet for flows from 100 to 300 cfs.

When the reservoir pool elevation is at the spillway crest, the maximum hydraulic drop over the fish passage gate to the stilling pool water surface would be 10 feet or less. Passage releases of 300 cfs could be made at reservoir pool elevation 3,411 or higher. The intake structure would butt up to the existing embankment with the structure deck at elevation 3,430. The structure includes a trashrack with 12-inch bar spacing that would be cleaned manually by raking from the top of the deck or from a trolley-mounted access platform on the front of the trashrack. A short pedestrian access bridge would connect the structure deck to the crest of the dam.

2.3 Fish Passage Conduit

A reinforced, cast in-place concrete conduit would carry passage flows from the upstream intake structure to be discharged downstream into the dam outlet works. The 230-foot-long conduit would have an inside diameter of 7 feet, a minimum wall thickness of 18 inches, and would be formed in a horseshoe shape with a rounded top and open flume transition on the downstream end. The maximum open channel flow capacity would be 400 cfs, but normal releases would be from 100 to 300 cfs. The normal depth of flow in the conduit at a discharge of 300 cfs would be 4.5 feet with a velocity of about 12 fps.

A 10-foot transition would connect the conduit to a 5-foot-wide chute that would drop 7.7 feet in a distance of 20 feet and discharge to the receiving pool. The maximum velocity down the chute and discharging into the pool would vary between 24 and 21 fps and would be discharged horizontally just above the receiving pool tailwater elevation. A 6-foot-deep plunge pool would be excavated at the outfall structure.

An open cut with 3:1 side slopes and bottom width of about 18 feet would be excavated through the existing dam embankment. This would result in a temporary breach of the existing embankment 260 feet wide at the top of the dam. Proper backfill with appropriate filter zones and materials would minimize the potential for seepage or piping. The excavated dam embankment would be replaced with a new zoned embankment that includes a 20-foot-wide impervious core section. Much of the excavated material from the dam would be reused. The existing seepage stability berms would be replaced to eliminate any piping or seepage concerns.

2.4 Upstream Fish Passage/Adult Collection Facility

A trap and haul system is proposed to provide adult upstream passage at Bumping Lake Dam in lieu of a fish ladder. This system would be long enough to accommodate reservoir fluctuations exceeding 30 feet. A barrier structure angled at 35 degrees to the outlet works channel would be constructed across the river to guide fish to the fish ladder entrance and into the collection facility. From there, fish would swim up the ladder into a holding pool. When adequate numbers of fish were collected in the facility, they would be placed into a transport truck to be hauled upstream for release into the reservoir and upstream tributaries. The barrier and adult collection facility would generally be operated from early April to late November.

Water to supply the adult collection facility would be delivered by a 16-inch-diameter pipeline from the reservoir at the downstream passage intake structure to the flume and holding pond at the adult collection facility. This pipe would be encased in the juvenile downstream passage conduit. A reservoir water surface elevation of approximately 3,419 or above would be needed to deliver water by gravity flow to the flume, and elevation 3,412 or above for gravity delivery to the holding pool at the adult collection facility. The reservoir pool is typically in this elevation range or higher from about May through August in an average water year. The collection facility water supply would need to be pumped when the reservoir was below these elevations, typically in April and from September through November in an average water year.

2.5 Barrier Structure

The barrier structure would have a series of 13 picketed vertical panels to effectively block adult fish while having minimal backwatering effects on the outlet works channel. The panels would be removable if necessary to meet freezing conditions or for maintenance of the facility. Each panel would be about 10 feet wide and 5 feet high. An operating deck at elevation 3,396 would provide access to the picket panels. The barrier would be constructed at about a 35-degree angle to the outlet works channel.

The outlet works flow would attract adult fish, which would be directed by the barrier toward the ladder entrance immediately adjacent to the left end of the barrier. Approach velocity at the picketed barrier would be less than 1 foot per second at a flow of 400 cfs. The barrier pickets would extend 2 feet above the maximum design water surface. Two V-shaped openings would be provided in the picket panels on the right side of the barrier to allow downstream passage of adult fish if necessary. The V-shaped opening would prevent upstream movement of adults.

3.0 References

Reclamation. 2008, Cle Elum and Bumping Lake Dams Fish Passage Facilities Planning Report – Draft. September 2008. U.S. Department of Interior, Bureau of Reclamation.

4.0 List of Preparers

NAME	BACKGROUND	RESPONSIBILITY
HDR Engineering, Inc.		
John Nelson	Fisheries Engineer	Fish Screening and Passage Designer