

4 Jan 2011

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To: Sean Tackley

From: Christopher C. Caudill and George P. Naughton

RE: Testing of juvenile salmon acoustic tags (JSAT) in the Washington shore fishway at Bonneville Dam.

Background

Acoustic tags have not been used in fishways historically because acoustic signals are attenuated by entrained bubbles and high background noise, both of which can limit detectability of the acoustic signal. However, it is possible that transmitters will have reasonable performance because the detection range needed within fishways is relatively low (meters to tens of meters) compared to the range of tags under typical field conditions (hundreds of meters). Acoustic telemetry has several advantages over radiotelemetry (RT) and Passive Integrated Transponder (PIT) tag technologies, including the ability to detect signals in deep water (>10 m). Acoustic transmitters also do not require a trailing antenna which may affect fish behavior and survival.

During 2010, we used JSATS tags to successfully tag, release and track 30 adult Pacific lampreys as part of a study to determine migration fate and behavior in the Bonneville Reservoir. We would like to evaluate the potential for using similarly tagged fish to estimate dam passage metrics in future study years. Results from RT and PIT tag studies have indicated that Pacific lampreys do not readily pass dams and their poor passage performance likely represents a critical limitation to their migration success. Specifically, research has shown that that fishway entrances, collection channel/transition pool areas, count stations, diffuser gratings, and serpentine weirs impeded adult Pacific lamprey dam passage at lower Columbia River dams. Ideally, we could use JSATS tags to simultaneously estimate dam passage and movement in reservoirs.

We propose to evaluate the detection efficiency of the new JSAT system within the Washington Shore, Bradford and Cascades Island fishways at Bonneville Dam during winter 2011. Testing would occur during early-January to late-February. Testing would begin at Bradford Island/PH1 fishways during the in-water work period and testing at the Washington Shore fishway would occur as soon as possible after the fishway is rewatered. Pending results, we also propose to test JSATS at the Cascades Island entrance during the week of April 18 or 25, 2011, depending on the start of spill. Ten year average daily passage at Bonneville Dam during this period has been 3,042 – 5,458 adult Chinook salmon, 39-184 jack Chinook salmon, and 8-19 adult steelhead. No coho salmon or steelhead were recorded during the period. Results from this evaluation will be used to determine the feasibility of using the JSAT system to monitor adult lamprey passage in fishways at this location and other Columbia and Snake river dams and would allow refinement of the 2011 study design for adult lamprey. The trials will be conducted collaboratively with Mark Weiland (PNNL).

Methods

We will attempt to estimate maximum detection distances and detection efficiencies at typically monitored locations:

- approach (outside of fishways)
- inside fishway entrances
- transition pools
- near count stations
- fishway exits

At each location, we will deploy a cabled hydrophone attached (Figure 1) into the fishway on existing structures (trolley on Acoustic Deterrent Device [ADD] i-beams in as many locations as possible; a beam supported by picketed lead gates near count stations and the AFF), or weighted cable (50-80 lb weights; relatively low flow locations, e.g., exits, UMT junction). After the hydrophone is deployed, we will lower a weighted test tag (on a weighted rope or using a fishing rod) into the fishway at varying distances from the node. We expect each deployment and testing at each site to take approximately one hour. The testing will likely be conducted over 2-3 days with total in-water time of approximately 12 hours. We also request permission to test

other locations that may be suitable for detection of acoustic tags, including auxiliary water supply (AWS) channels, UMT channel, turn pools, etc. after consultation with COE Biologists (see Figures 2-4 for the maximum number of potential locations). The aim throughout will be to assess locations that are low noise, have low potential impact on fishes, and/or are important passage locations.

We anticipate the testing will have no or minimal effects on the passage of adult salmonids for the following reasons:

- the in-water equipment is relatively small and should have minimum effects on hydraulic conditions.
- the equipment does not create noise detectable by adults.
- adult passage numbers are relatively low during this period.
- the in-water work period will be brief at each location (< ~ 1 hour).
- the in-water work can be conducted after nightfall to minimize interactions with adult salmonids.

Please let us know if you have questions or suggestions.



Figure 1. Photo of JSAT hydrophone and cable similar to those proposed for deployment in Bonneville Dam fishways. The hydrophone is approximately 10 inches long and 2 inches in diameter (left photo). The hydrophone will be secured to an Acoustic Deterent Device (ADD) trolley (right photo) and lowered via the ADD i-beams to 1-2 feet below the water surface.

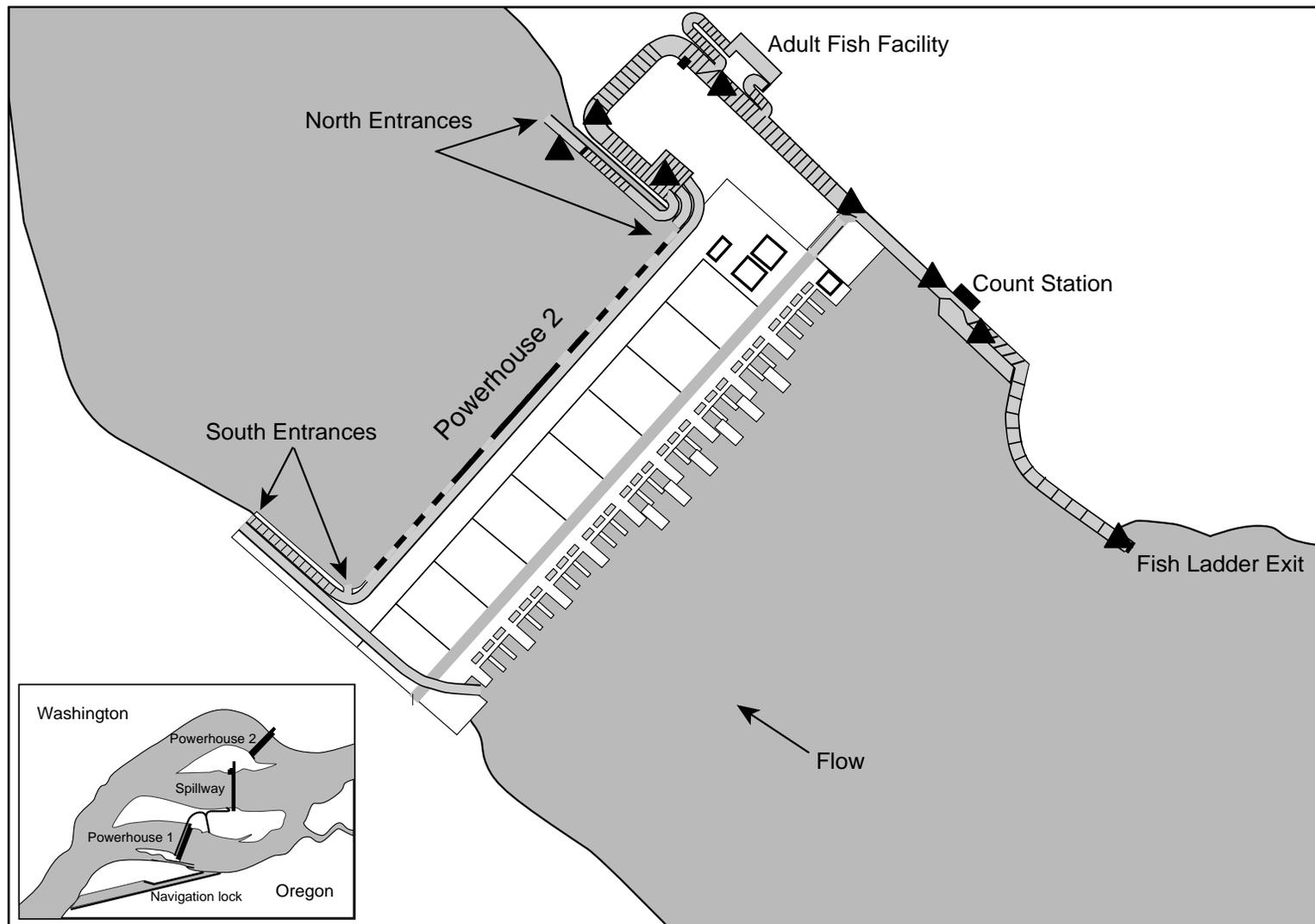


Figure 2. Bonneville Dam second powerhouse and Washington (north) shore fish ladder. Black triangles indicate possible sites for JSAT testing.

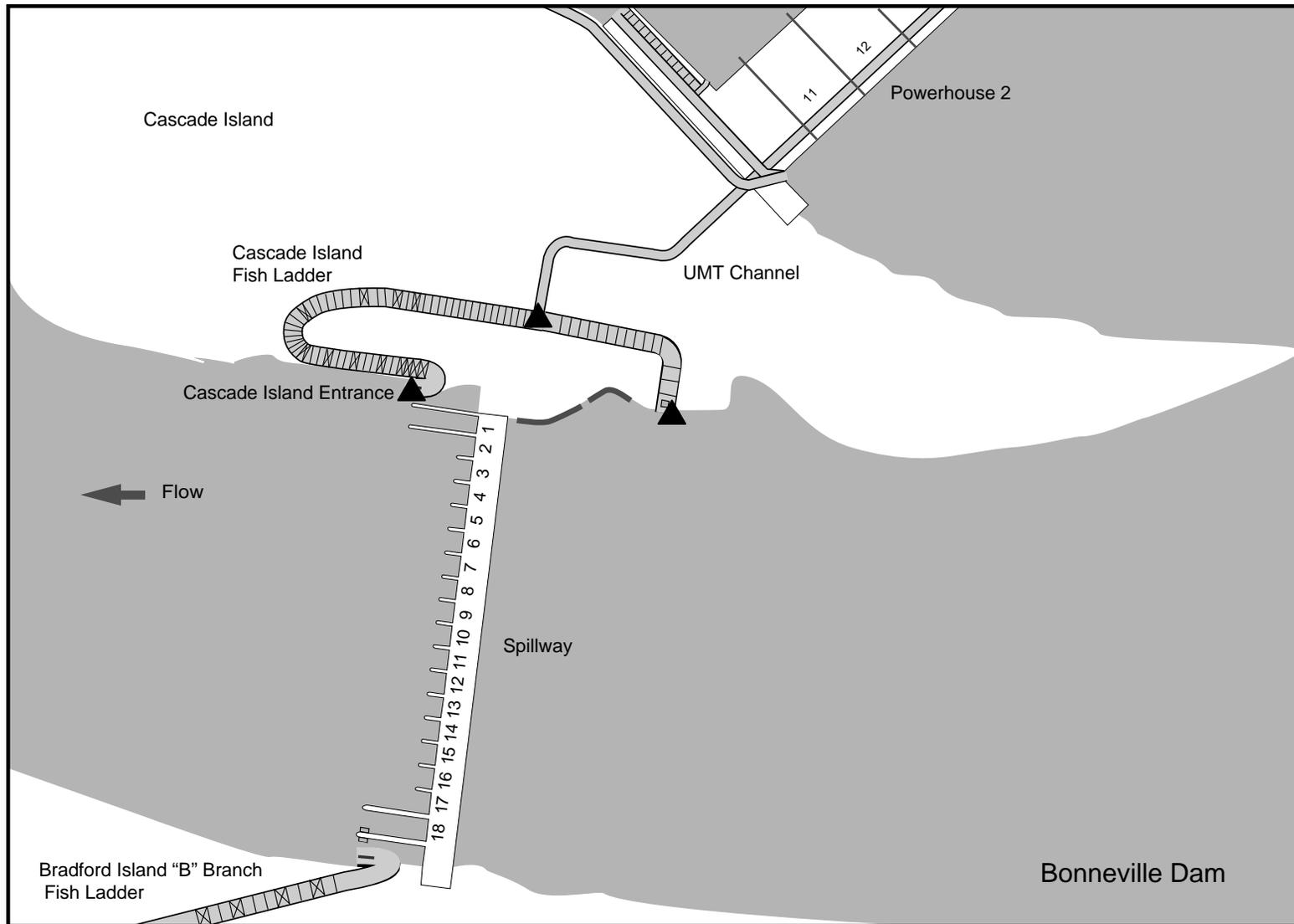


Figure 3. Bonneville Dam Cascade Island fish ladder and upstream migrant transportation. Black triangles indicate possible sites for JSAT testing.

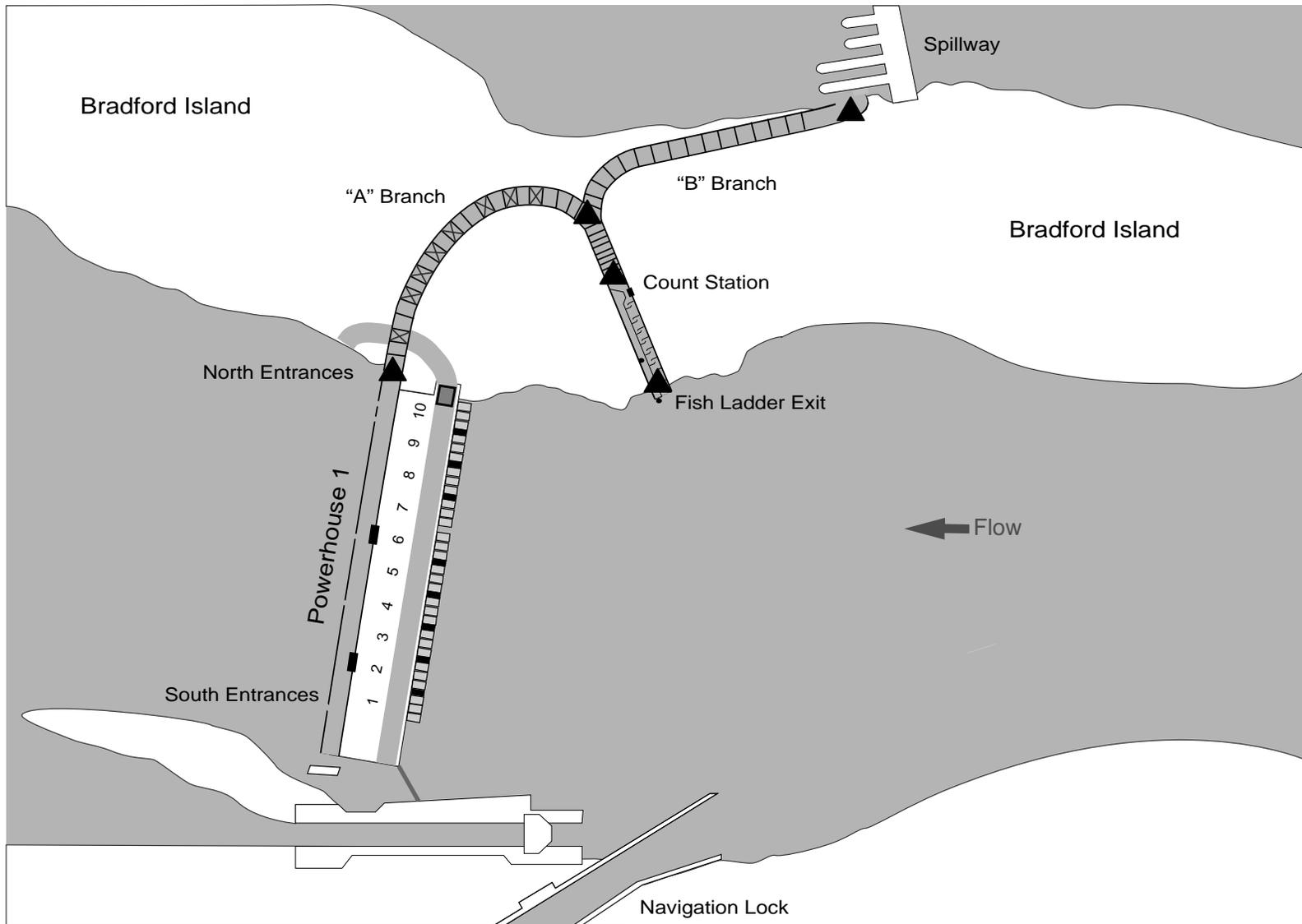


Figure 4. Bonneville Dam first powerhouse and Bradford Island fish ladder. Black triangles indicate possible sites for JSAT testing.