Draft-Final Memorandum for the Record Sept 11, 2007

Subject- New Lamprey ¾" Grating Criteria Implementation Recommendation
Purpose- In July of 2007, new NMFS lamprey criteria was provided for diffuser gratings requiring ¾". Up until that point, there were no criteria available. This change affects gratings with associated trash racks on ladders on the Columbia River.
Background-

- Lamprey numbers at BONN were very low this year, specifically 19,135 as of September 10. The worse recent year was 2000 when 19,002 were counted.
- In the Executive Summary provided below, the 2007 NMFS lamprey grating criteria is provided. To summarize, no lamprey passed through diffuser grating with 1.9 cm bar spacing, while 86% were able to pass through grating with 2.5 cm bar spacing.
- Listed below are the gratings and associated trash rack replacements priorities for BONN, JDA and TDA, which have documented cases of lamprey mortality or stranding issues. (x% out of the total number of gratings)
- JDANFL team will address these needs during the Alternatives Evaluation and DDR process.
- If the existing trash racks are left in place, debris blockage may occur at the ¾" gratings. However, trash racks may be in good shape and do not need to be replaced due to lack deterioration and the fish turbine trash racks are very large and expensive to replace.
- From discussions with The Dalles Dam Project Personnel, some gratings are deteriorating and the dam received O&M replacement funding in 2006. Gratings were replaced "in-kind" with 1" before the new ¾" criteria came into affect.

Recommendation-

- The replacement of gratings is a relatively inexpensive way to help the lamprey species, which may prevent them from being listed under the Threaten and Endanger Species Act.
- For the gratings that have not been replaced in the lists below, provide a team approach from CENWP-Hydraulics, Structures in conjunction with PPMD Environmental and the Project Personnel. This group can complete analyses and make a recommendation, which could range from an "off the shelf" grating products to a special design.
- Modify existing trash racks which are in good shape and the existing fish turbine trash racks if this is cost effective and meets the needs.
- Salvage or trade in the recently purchased 1" for 3/4" gratings which have not been installed yet if this can be done in a cost effective manner.
- Funding-The team analysis approach be funded with CRFM, which is estimated to cost $XXXX. The ballpark estimated material replacement cost for the priority list, excluding JDANFL, is approximately $XXXX. The precedence set by The Dalles Dam in 2006 using O&M funding to replace deteriorated gratings with 1" new gratings complicates matter; however, the replacement need was great, O&M funding was provided and the criteria was not been finalized when this purchase was made.

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EXECUTIVE SUMMARY

At hydropower projects in the lower Columbia River Basin, migrating adult Pacific lamprey *Lampetra tridentata* routinely pass through picket leads and diffuser gratings into areas where they can be delayed, injured, or killed. The objective of this project was to determine the gap sizes needed to exclude adult lamprey.

We conducted lamprey passage evaluations in the Adult Fish Facility at Bonneville Dam. We evaluated the ability of adult lamprey to pass through vertical gaps of 2.5, 2.2, 1.9, 1.6, or 1.3 cm in height. Vertical gaps were produced by placing a perforated divider in a large (1.8-m × 0.9-m × 0.6-m) flow-through tank and then raising the divider from the tank floor by placing appropriately sized spacers under its bottom edge. Mean length of the 242 lamprey used in these evaluations was 67.5 cm (SD = 4.2, range 53.0-79.0), mean weight was 494 g (SD = 85, range 282-800), and mean girth was 11.3 cm (SD = 0.8, range 9.2-13.7). All lamprey were able to volitionally pass through a 2.5-cm vertical gap, 47% passed through a 2.2-cm gap, and no lamprey passed through gap sizes of 1.9 cm or less.

We also conducted dewatering simulations using 50 additional lamprey. For these tests, a diffuser grating partition was positioned horizontally in the tank at a depth of 15 cm; completely separating the tank into upper and lower compartments. Ten lamprey were released in the upper part of the tank and the water was then lowered 30 cm in 3 min, stranding the lamprey on the grating and inducing them to pass through into the lower compartment. The groups of lamprey were tested with two grating sizes: 2.5 or 1.9 cm. The lamprey used in these experiments were comparable in size to those used in the vertical gap experiments: mean length was 67.5 cm (SD = 4.7, range 56.0-77.0), mean weight 481 g (SD = 88, range 284-684), and mean girth 11.0 cm (SD = 0.9, range 8.9-12.9). No lamprey passed through diffuser grating with 1.9-cm bar spacing, while 86% were able to pass through grating with 2.5-cm bar spacing.

Based on these results, and on comparisons to size ranges of lamprey collected after a year of freshwater residence, we concluded that a gap or bar spacing of 1.9 cm (3/4 in) is needed to exclude most adult Pacific lamprey in the Columbia River drainage. Using this information, the U.S. Army Corps of Engineers conducted a field test of the 1.9-cm grating at John Day Dam. No lamprey passed through the 1.9-cm grating they installed, further confirming our findings.

Bonneville Dam Prioritization for Diffuser Grating Replacement

If ¾ inch gap grating is determined to be acceptable for use as diffuser grating, the project would like to replace all diffuser grating in the following order of importance:

1. WA shore ladder between weirs 33 and 19. We have observed lamprey caught under gratings in this section after dewatering.
2. The entrance of Cascades Island ladder. Lamprey observed under grating during ROV inspection. FG 6-16 through FG 6-20. Many tagged lamprey observed in this ladder according to NOAA lamprey researchers.
3. The entrance of B-Branch ladder. FG 3-29 through FG 3-33
4. Cascades Island diffusers FG 6-5 through FG 6-15.
5. B-Branch diffusers FG 3-18 through FG 3-28.
6. A-branch diffusers FG 3-3 through FG 3-9.
7. Downstream of weir 19 and triangle section at WA shore.
8. Powerhouse 2 collection channel.
9. Powerhouse 1 collection channel.

Minimizing the gaps between any structure such as diffuser shafts and grating should be a priority when designing new grating. Lamprey traveling along walls could enter below grating at the existing gaps as water levels drop during dewatering.

Proposed Lamprey Passage Improvement List for The Dalles and John Day

The Dalles East

Per discussion with Bob Cordie, 9/13/2007 concerning TDA, all gratings have been purchased and are out at the Project, except for the west and south gratings
May be side grating can be replaced to ¾" and the bottom 1" grating will not have to be replaced?

1) Grating – All 1" gap. New grating also 1" gap. Need to determine if ¾' can be used effectively against wall where lamprey travels. New 1" gap grating on site to be installed in junction pool and east entrance. Reducing gap requires hydraulic analysis (velocity and volume), structural analysis and risk analysis in the event of zebra/quagga mussels.
   Prioritization for ¾ installation;
   A) Lower east#L6 thru L15 and north #N5 thru N15 ladder grating exposed during dewatering
   B) Junction pool #J1thruJ8 and L1thruL5
   C) East #E1-1 thru E1-6, West #E2-1 thru E2-4, South #E3-1thru E3-8 and North #1-A thru1-H and #N-1 thru N-5 entrance equal priority value.
2) Junction pool bulkhead stub walls – Used to prevent debris accumulation under bulkhead slot. Lamprey commonly found in this area during dewatering. Bulkheads not used here

for at least 15 years. Picture below. Options; ramp or removal.

3) Step up on first ladder weir – Needs a ramp. Will be a challenge due to grating. Could be chamfered. Picture below.

4) Step up on 180 bend upstream weir – Needs ramp. Can be done by project during winter outage. No Picture.
5) Weirs 154-147 – orifices raised various distance from floor. Options; new design or modify with ramp. Worn seals to be replaced to prevent lamprey entry into guide and potential crushing. Picture below.

6) Entrance and exit weir guides – Provide hiding place for lamprey. Potential crushing when weir makes adjustments. Lamprey observed pinched by lift beam extension. Option; install brush to deter lamprey entry. No picture.
7) South entrance depression – 3’ floor depression immediately upstream of weirs. Option; ramp upstream edge of pool. Picture below.

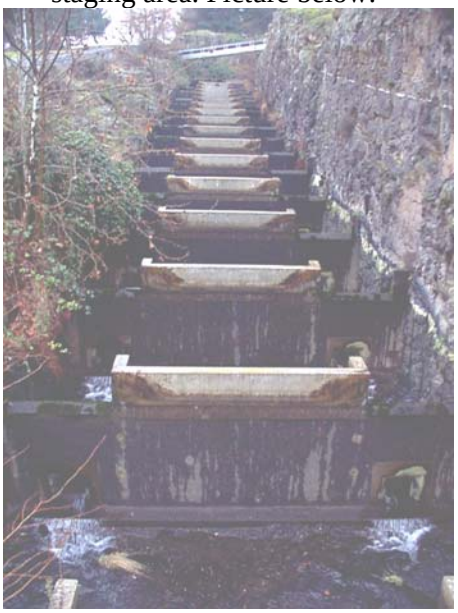
8) Collection channel depressions - Approx 20, 3’ deep floor depressions in channels. Even floor along sides may allow easier lamprey passage by these areas.

The Dalles North

1) Grating – Same as above.
2) Lower weir pools with rock pools – Floor raise up to 3’ to weir orifice. Option; ramp. Would require additional pumping for remove water from pool. Picture below.

3) North entrance depression – Same and south entrance depression above.

4) Rock channel in ladder – Not smooth, but may not be detrimental to lamprey passage. Routinely find lamprey in these areas during dewatering. May also be beneficial lamprey staging area. Picture below.



5) Count station diffuser grating – Due for replacement. No evidence of lamprey trapping during dewaterings. Option; install design change along wall.
6) Entrance weir guides – same as above.

John Day South

1) Grating – Same as above. *Prioritization for ¾" grating;*
A) South ladder upper diffuser #17 (Per discussions with BC 9/13/2007, the gratings were slated for replacement during this in-water-work period Dec , 2007 to Feb 18, 2008 but there are trash rack issues and the Project is on hold.

The following grates have not been purchased yet.
B) South ladder dewater exposed grating #9-#16
C) North ladder dewater exposed grating #7-#15
D) South entrance and south collection channel grating
E) Remainder of collection channel
F) Remainder of north fishway.

2) South entrance depression – Immediately upstream of SE1 weir. Approx 12' depression. Option; round upper edge. Ramp not feasible due to grating and distance.
3) Wall Diffuser – Chain link grating. No longer used. Should be plated over. Picture below.

4) Upper diffuser grating – 1” gap. Known lamprey trapping area. Change to ¾ same as north.
5) New exit flow control weirs hydraulic sills – Option; design change.

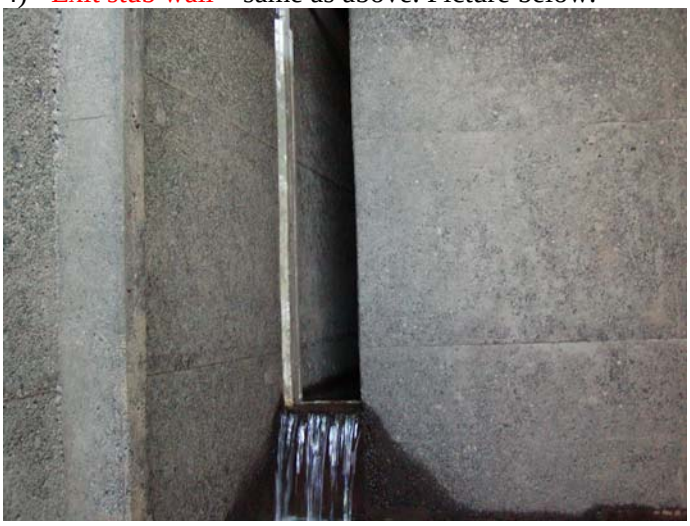
6) Exit stub wall – 6” raise in floor under road deck located at half duplex antennae. Option; ramp. Picture below.

7) Entrance weir guides – same as above.

John Day North-

Under the JDANFL project, the grating and respective trash racks are going to be replaced and this work will not need to be covered under this funding.

1) Grating - same as above.
2) Upper diffuser grating – Changed to ¾'. Seemed to be effective preventing entrapment. Floor raise approx 1' still exists at first upstream weir. Grating for the south upper diffuser is comparable to the north and will be replaced with ¾".
3) Exit hydraulic sills – Option; design change. Picture shows sills open. Normally operate with sills closed.
4) Exit stub wall – same as above. Picture below.



5) Orifice raised upstream of count station – Option; chamfer orifice floor. Pictured below.