US Army Corps
of Engineers®
Portland District

Bonneville Lock and Dam
Columbia River Basin, Washington - Oregon

Bonneville Entrance Improvements

Cascades Island Adult Fishway

Letter Report

July 2008

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EXECUTIVE SUMMARY

This Letter Report covers the alternatives evaluation and the selected plan for the Bonneville Cascades Island Entrance Improvements. This report describes the project background and outlines technical aspects of the selected plan.

The Bonneville Second Powerhouse fish ladders have very low lamprey passage rates. It was determined that the Cascades Island entrance would be modified to improve lamprey passage because it is one of the easier entrances to modify. The entrance improvements will be made during the FY09 in water work period. If the Cascades Island Entrance Improvements project is found to be successful at increasing lamprey passage, it will be used as a prototype for entrance improvements on other ladder on the Columbia River, including the FY10/11 John Day North Fish Ladder Auxiliary Water Supply and Entrance Improvement project.

The entrance improvements will be beneficial to both lamprey and salmon. The improvements for lamprey include rounded corners on the fixed entrance weir, the invert is flush with the ladder floor, and a slot filler will be inserted in the stop log slots when the Sea Lion Exclusion Device (SLED) is not in use. The improvements for salmon include lowering the weir invert 4 feet and the entrance head and channel velocity criteria will be met at a larger range of tailwater elevations than the existing weir.

A CFD model of the proposed entrance improvements is currently being built by the Environmental Services Corporation (ENSR). ENSR will submit a draft report to the Portland District at the end of August 2008. The information contained in the draft report will be used to update the fixed weir 90% plans and specifications.

The bottom rock structures are currently being studied by the University of Idaho. The rock structure information will be added to this letter report when the University of Idaho has progressed further along in their study. The preliminary size and spacing assumed in this report will be used in the CFD analysis by ENSR.

Total Project Cost for the selected plan in this report is estimated at $1,479,000.

1. PURPOSE AND SCOPE – Fish ladder entrances on the Lower Columbia River are known to cause difficulty for lamprey trying to migrate up the Columbia River to reproduce. This project incorporates recent Bonneville flume study data (see Appendix E) to improve the Cascades Island fish ladder entrance which will be monitored to evaluate fish passage and may be utilized throughout the Columbia River Ladder Systems. Changes to the entrance will come in two forms: 1) The entrance shape will accommodate many different tailrace elevations with variable width and rounded edges in order to facilitate lamprey movement and 2) Structural elements will be added to the invert to simulate a rock bottom that reduces velocities and provide crevices for lamprey to hide in and move through.

2. PROJECT AUTHORIZATION – Bonneville Dam was authorized in 1933. The multi-purpose project is part of the Columbia River navigation system and provides recreational and hydropower benefits.

3. PROJECT LOCATION – Bonneville Dam is located 40 miles east of Portland, Oregon, in the Columbia River Gorge. The Cascades Island fish ladder entrance, located at Bonneville Dam, is being investigated in this letter report.

4. BIOLOGICAL NEED AND FUNCTION – The proposed project is an evaluation of a modified fixed-weir entrance at Cascades Island ladder at Bonneville Dam as a prototype of an adult salmon entrance redesign being planned for the John Day North Ladder modifications in 2010-11.

The current Cascades Island entrance has a submerged, uniform-width, fixed shape entrance with an opening raised slightly off the floor of the ladder. A prototype variable-width, fixed shape weir similar to those at Wanapum and Priest Rapids salmon fish ladders can easily be fitted into the existing slot to test its effectiveness. An alternative design for a new variable-width, non-mechanical, entrance gate presently in use at the salmon fish ladders of large PUD hydroelectric dams on the Columbia River (Priest Rapids and Wanapum Dams) would maintain or increase the attraction for salmon approaching the dam, and allow easier ingress for adult lamprey (Figure 1). These entrances present an equal or larger opening to the fish ladder. With the proposed design, the deeper, more consolidated shape of the fixed weir entrance will cast a more hydraulically efficient jet into tailrace. (Jets dissipate along the periphery of the jet, so more oblong or eccentric shapes dissipate faster.) The jet from the new weir will allow attraction flows to be detected by salmonids further downstream than the existing modulating entrance weirs. Adult salmon and Pacific lamprey use of this entrance will be monitored by comparing PIT tagged fish use of Cascades Island entrance over time.

The invert of the new weir will match the invert of the concrete approach channel—the minimum possible invert for the weir. Thus the new weir will always provide maximum entrance opening depth for any given tailwater elevation. This is particularly important during times of high spill (for juvenile salmon passage): the deeper ladder opening of the new weir will allow the adult salmon to more easily depth compensate when approaching the entrance opening and avoid the adverse effects of total dissolved gas (TDG).

Figure 1: Variable-width, fixed shape salmon ladder Entrance Weir at Wanapum Dam

If any unexpected problems should occur, the prototype weir can be quickly removed and replaced with the currently used weir. In conjunction with the weir modification, rounded 8 inch by 8 inch simulated rock structures are planned to be placed at 24 inches apart on the floor of the ladder just inside the entrance weir in a pattern to help reduce bottom velocities to aid lamprey entrance into the ladders.

5. **DESCRIPTION OF CURRENT PROJECT FEATURES** – The Cascades Island fish ladder entrance currently has a constant width, fixed weir at the entrance. The weir consists of painted carbon steel and has a 7.3-foot constant width opening at the center of the weir. The 7.3-foot opening does not extend all the way down to the ladder floor because there is a 4 foot high beam at the bottom of the weir. The existing weir structure is 15'-11 ½" wide and is 40'-2" tall. The existing weir is inserted in slots measuring 5' 13/16" by 11' 1/8". The fish ladder floor invert is at elevation +2.0 and the ladder floor is made of reinforced concrete.

The entrance approach channel is 35 feet wide and is separated by a 5-foot wide center pier into two 15-foot wide channels. The fixed weir is located in the channel on the northside. In the south channel, there are two 6 x 10-foot sluice gates, side-by side. These sluice gates are currently operated open or closed as a function of tailwater elevation: both are open for tailwater levels below 10 feet; one sluice gate is open for tailwater levels between 10 -19 feet; and both are closed when tailwater levels are above 19 feet. The invert for the sluice gates is +3.0 feet, whereas the invert for the fixed weir is +6.0 feet. Consequently the sluice gates are essential for existing operations at low tailwater elevations.

There is also a side entrance opening to spillbay 1, the side entrance has been permanently closed for several years.

6. **PROBLEM AND CRITERIA** – The issue to resolve is defining a variable width weir and a bottom rock configuration that will reduce the velocities and provide resting places along the bottom of the entrance to the Cascades Island fish ladder to satisfy lamprey criteria. The variable width weir and bottom rock configuration will also satisfy the salmon criteria described below.

6.1 Adult Salmon Criteria:

Standard Adult Criteria

- Elevation entrance weir crest or sluice opening invert ≥ 8 feet below tailrace level (or entrance submergence ≥ 8 feet)[1];
- Head difference across entrances should be between 1 – 2 feet, 1.5 feet optimum;
- Channel velocities approaching entrance should be between 1.5 - 4 feet per second (ft/s), 2 ft/s optimum[2];

Project Specific Design Criteria

- New entrance bulkhead shall not cause a reduction in total entrance discharge rate compared to the existing Cascades Island operation as shown for the following range of tailwater levels:

Tailrace Elev. (ft)	Total Entrance Discharge Rate for Existing Operation (cfs)
7	610
10	630
15	920
20	845
25	1080
30	1455
35	1725

Table 1 - Project Specific Design Criteria

[1] Existing system does not meet submergence criteria at Tailwater levels below elevation 11 feet. This limit will be lowered to 10 feet with the new entrance as the channel invert is elevation 2.0 feet.
[2] Existing operation does not meet minimum velocity criteria for Tailwater levels above 16 feet.

6.2 Lamprey Criteria:

Standard Lamprey Criteria

- 4–inches minimum radius rounding on all outside corners (> 180 degree in change in bearing in any surface) of fish passage openings—wherever weir opening is not flush with sidewall or orifice opening is not flush with floor.

Project Specific Design Criteria

- Bottom structures shall improve means of Lamprey passage through high velocity zone of entrance by reducing velocities near invert and providing adequately spaced structures for leverage.
- Bottom structures will be fish friendly with no sharp edges.

7. **ALTERNATIVES EVALUATION** –

7.1 Variable Width Weir - Four general alternatives were developed for the prototype entrance weir shape. In addition to criteria guidance, the intent of the prototype weir was to test an alternative design concept that might see future use at other ladders to improve both Lamprey and salmon passage. The risk is minimal since the existing fixed weir can always be dropped back in if the biological assessors find the performance of the new weir unacceptable.

The alternatives were developed around degrees of sluice gate (SG) operation (See Table 2). No change in SG operation was assumed for Alternative A—which was simply a deeper version of the existing fixed weir. Variable width shapes were explored with the B & C alternatives based on a reduced the operation of the Sluice Gates. The B Alternatives are based on an operation where the maximum number of open sluice gates dropped from 2 to 1. Alternative B-2 was a more assertive alternative than B in terms of reducing sluice gate operation and difference in bottom and top widths. Alternative C was the most assertive alternative as it eliminates the use of the sluice gates altogether and had the largest difference between bottom and top widths.

Alternative C was selected for primarily because it could eliminate the SG operation. If one or more SG were open, then the lamprey would have to cross a risky second high velocity flow field in order to reach the north wall of the main approach channel, where a lamprey passage system (LPS) is planned to be ultimately deployed. Alternative C will provide an average or 45% more discharge than the existing operation, but it fails to match the existing operation at tailwater elevations below 10 feet (exceeded 94% of time).

There is a more complicated option that would offer a similar safe route for lamprey, and meet or exceed existing discharge rates at all tailwater levels: use Alternative B-2 and switch the sluice gate assembly and fixed weir locations. However, this would require considerably extra time & cost, and could not be done within the project schedule.

A more detailed and illustrative documentation of the alternatives elevation is provided in item 3 of Appendix C (Alternatives Evaluation Memo), where the comparative hydraulic performance for each alternative is provided.

FIXED WEIR ALTERNATIVE	Sluice Gate Operation			Configuration Geometry		
	Max No Open	Minimum TW (ft) 2 closed	1 Closed	Invert (ft)	Bottom width (ft)	Top width (ft)
Same Sluice Gate operation:						
Existing Configuration	2	17	10	6	7.3	7.3
Alternative A	2	17	10	2	7.3	7.3
Reduced SG Operation:						
Alternative B	1	15	15	2	9	7
Alternative B-2	1	10	10	2	11	6
No Sluice Gate Operation:						
Alternative C	0	7	7	2	14	5

Table 2– List of Fixed Weir Alternatives Considered

7.2 Bottom Rock Structures – The materials considered for the bottom rock structures include concrete, painted steel, and stainless steel. Concrete requires a long lead time because a large number of forms would first need to be made, the concrete would be poured, and then the rocks would need time to cure. The number of forms required would also increase the cost of using concrete for artificial rocks. Painted steel also requires a long lead time because the bottom rock structure would first be assembled and then time to paint and paint cure time would be required. Painted steel is also a maintenance issue because it may crack during installation and would start rusting as soon as the ladder entrance was watered back up. Stainless steel was considered as an alternative for bottom rock structure material and it requires the shortest lead time of the materials considered. Stainless steel is also maintenance free and will not rust. Stainless steel is the chosen alternative because this project has a very tight schedule and quick fabrication is necessary to meet the schedule. Also stainless steel is a maintenance free alternative that is desirable because of the short maintenance periods available for fish ladders.

8. SELECTED PLAN

8.1 DESCRIPTION OF PLAN FEATURES –

8.1.1 General – The selected plan includes a fixed, variable width weir at the entrance to the Cascades Island Fish Ladder. A new variable width weir will be inserted in the slots that currently hold the existing constant width weir. A slot filler will be inserted into the stop log/SLED slots when the SLEDs are not in use. The slots immediately upstream of the fixed weir will be plated over. Also, a rock structure will be installed on the ladder floor.

8.1.2 Variable Width Weir – The width of the proposed weir will be varied as a function of height above invert, or elevation. Unlike the current operation (which employs the two sluice gates in the adjacent south channel), the new weir is intended to operate without sluice gate augmentation over the full range of tailwater elevations. The bottom width of the new weir must effectively make up for the lost capacity of the sluice gates at the low tailwater elevations, so that the weir discharge rates are equal or more than the total entrance discharge rates in the current operation at equivalent tailwater elevations. With the weir invert being fixed at the bottom, maintaining the wide bottom for the full height of the weir opening (or range of tailwater elevations) is infeasible, and the system auxiliary water supply could not provide enough flow to maintain entrance head criteria (1 - 2 feet). Consequently, the width is made much narrower at the top. There is a transition section between the wide bottom and narrow top sections.

- Elevation 2 – 10 feet Width = 14 feet
- Elevation 10 – 18 feet Width tapers uniformly from 14 to 5 feet
- Elevation 18 – 40 feet Width = 5 feet

8.1.3 Bottom Rock Structure – The University of Idaho will perform testing on sizes and spacing of bottom rocks. The results from the U of I study will be used to determine the rock size and configuration used for the Cascades Island entrance improvements. The bottom rocks size will preliminarily be 8 inches wide and 8 inches tall. The preliminary rock spacing will be 2 feet on center. The rocks will be constructed of stainless steel. The rock size and spacing will be verified by the University of Idaho study and the CFD model currently being accomplished by hydraulic design.

8.2 HYDRAULIC DESIGN – The proposed design configuration will meet the standard adult salmon hydraulic criteria and lamprey criteria for the full range of tailwater elevations. A summary comparison of the performance of the proposed design with the existing operation is provided in Table 3. The proposed operation is located under the yellow cell and the existing is under the green cell.

The new design does not entirely meet the project specific criteria: it will not provide sufficient discharge to match the total discharge rates from the existing configuration and operation for tailwater elevations below 10 feet (which is exceeded 94% of the time on average during the calendar year). Under current operations, both 6-foot-wide sluice gates are open at tailwater elevations lower than 10 feet. However, the new design will meet or exceed existing discharge rates for tailwater elevations above 10 feet. The time-weighted averaged discharge rate (interval of % exceedance x average entrance discharge) will be 1270 cfs, a 45% increase over the time weighted average combined discharge rate of 875 cfs for the existing operation.

The discharge coefficient used in the analyses and design of the new weir was estimated from the flow measurement taken at the existing 7.3-foot wide entrance weir on June 4, 2008. The measured discharge rate was approximately 1570 cfs at tailwater 28.9 feet with an entrance head of 2.4 feet. The effect of the bottom rock was incorporated into the estimate for the discharge coefficient and entrance flow rates. The methods used to estimate the discharge rates and discharge coefficients are documented in the first two items in Appendix C (Data Trip Report & Discharge Coefficient Memo).

Tailrace Elev. (ft)	Annual Percent Exceedance (daily stage)	Total Entrance Discharge (cfs) for Existing & Alternative Operations		Entrance Head for New Weir	Approach Channel Velocity (ft/s)
		Current Operation	14' Fixed Weir		
7	100%	610	465	1.5	2.0
10	94%	630	830	1.5	2.5
15	54%	920	1275	1.5	2.5
20	23%	845	1415	1.5	2.1
25	7%	1080	1605	1.5	1.9
30	1.1%	1455	1755	1.4	1.7
35	0.1%	1725	1890	1.4	1.6

Large Variable width Fixed Weir from 5 - 14 feet, No Sluice gate and increased diffuser
Sluice Gate: No Sluice Gate Operation

Total Entrance Discharge is less than Existing Operation
Total Entrance Discharge provides less than 1.5 ft/s average approach channel velocity (per criteria)

Table 3 – Summary Comparison Table of Performance of Current Operation and Proposed Design

The proposed shape was selected from a number of alternatives. (The alternatives evaluation is provided in the item 3 of Appendix C --Alternatives Memo). The design objective was to avoid any operation of the adjacent sluice gates so that lamprey could safely cross the channel to reach the north sidewall where a future lamprey passage system (LPS) will be deployed. The proposed alternative was the only one that could meet this objective. The 14-foot bottom width is the maximum structurally feasible that would go into the existing guides of the existing 15-foot wide channel. The weir width was narrowed to 5-feet above elevation 18 feet to meet entrance head criteria without requiring discharge rates that would exceed maximum system capacity. The maximum system capacity for a given tailwater elevation is based on the number of available diffuser (for that tailwater) that can be operated without exceeding 6 psi head differential between either auxiliary water conduit and the water level in lower ladder channel[3]. At tailwater elevations above 25 feet, the new system will be operating near these limits.

Computational Fluid Dynamics (CFD) are currently being performed on the proposed entrance design by ENSR. The accuracy of the model will be verified by a comparison run

[3] The maximum discharge limits were estimated in the Hydraulic Evaluation of the Lower Columbia River Adult Salmon Bypass Systems (HELCRABS) for the Cascades Island Fishladder, CENWP-EC-HD, 2003.

of the existing weir under conditions equivalent to the flow measurements taken in June 2008. The bottom rock shapes will be included in the model. The CFD analyses will verify that the new entrance will not adversely affect the SLED[4], refine discharge coefficients and check on the possibility or degree of vortices that may develop at higher tailwater conditions. The model will be run at three different tailwater elevations for the proposed design with and without the SLED in place. The ENSR CFD results will become available before 60% Plans & Specifications.

8.3 STRUCTURAL DESIGN – The entrance weir is designed for a 3-foot head differential. The entrance weir is designed to be inserted into the existing slots at the Cascades Island fish ladder entrance. See Appendix A - Plates for drawings of the entrance weir. Hydraulic design is currently preparing a CFD model for the entrance weir and any additional loads resulting from this model will be included in the structural design of the weir during plans and specifications.

At the end of the sea lion season, when the SLEDs are removed from the Cascades Island entrance, a slot filler will be lowered into the stop log slots. See Appendix A - Plates for drawings of the stop log slot insert. The slot insert will have artificial rocks attached to the bottom plate. The purpose of this insert is to fill the slots to facilitate faster lamprey passage.

The artificial rocks will be welded to a stainless steel plate and the plate will be anchored to the ladder floor with epoxy anchors.

8.4 **CONSTRUCTION METHODS AND MATERIALS** -

8.4.1 Variable Width Weir – The existing Cascades Island entrance weir will be removed from its slots and stored near the Cascades Island ladder. The new variable width weir will be installed in the existing slots. The existing entrance weir will be removed and the new variable width weir will be installed with the Bonneville Project 65-ton crane. The removal and installation of the entrance weir will take place outside of the in water work period. The flow in the fish ladder will be stopped during the removal and installation of the weirs.

8.4.2 Bottom Rock Structure – The bottom rock structures will be installed when the entrance is dewatered during the December 2008 to February 2009 in water work period. The rock structure assemblies will be lowered into the ladder using a crane. The contractor will be required to determine how to pick the plate and attached rock structures without bending the plate. The rock structure assemblies will be anchored to the existing ladder floor using epoxy anchors.

9. **COST ESTIMATE** – The cost estimate is based on the recommendations of this Letter Report. A site visit was performed on January 14, 2008. Quantities and information were provided by the designers. Preliminary price quotes for the "rocks" were obtained from a manufacturer. Fabrication costs, production rates, construction effort, and contractor markups are based on engineering judgment and recent bids and work in the Portland

[4] The SLED was evaluated for the existing operation with CFD analyses from CENWP-EC-HD in 2005. The new flow conditions are changed, and verification is required that there is no impact to the SLED.

District. The 8a program to develop small and disadvantaged contractors will be used to complete this project.

The Engineering and the Construction Management costs are from the detailed budgets in the Baseline Scope of Work. Costs include developing a letter report and development of plans and specifications, Engineering During Construction, Supervision and Administration and closeout costs.

See Table 4, TOTAL PROJECT COST SUMMARY for the estimated costs of $1,478,800.

***** TOTAL PROJECT COST SUMMARY ***** PAGE 1 OF 1

THIS COST IS BASED ON THE LETTER REPORT DATED JULY 2008

PROJECT: BONNEVILLE CASCADES ISLAND ENTRANCE IMPROVEMENTS DISTRICT: PORTLAND DATE: 11 JULY-2008

LOCATION: BONNEVILLE POWERHOUSE 2 P.O.C.: PAT JONES, CHIEF, CONSTRUCTION AND COST ENGINEERING

CURRENT COST ESTIMATE PREPARED: Jul-08						AUTHORIZ./BUDGET YEAR: 2008								
EFFECTIVE PRICING LEVEL: Jul-08														
ACCOUNT NUMBER	FEATURE DESCRIPTION	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	OMB (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	FEATURE MID PT	OMB (%)	COST ($K)	CNTG ($K)	FULL ($K)
05---	B2 WEIR Cascade Island Fishladder Entrance	206.0	61.8	30%	267.8	0%	206.0	61.8	267.8	Nov-08	0.6%	207.2	62.2	269.3
05---	Stainless Steel "Rocks" at Entrance Floor	495.0	148.5	30%	643.5	0%	495.0	148.5	643.5	Mar-09	1.2%	500.8	150.2	651.0
	TOTAL CONSTRUCTION COSTS ===>	701.0	210.3	30%	911.3	0%	701.0	210.3	911.3			707.9	212.4	920.3
30---	PLANNING, ENG. AND DESIGN	377.0	113.1	30%	490.1	0%	377.0	113.1	490.1	Sep-08	0.0%	377.0	113.1	490.1
30---	PLANNING, ENGI. AND DESIGN (EDC)	42.0	12.6	30%	54.6	0%	42.0	12.6	54.6	Jan-09	1.2%	42.5	12.7	55.2
31---	CONSTRUCTION MANAGEMENT	10.0	3.0	30%	13.0	0%	10.0	3.0	13.0	Jan-09	1.2%	10.1	3.0	13.2
	TOTAL PROJECT COSTS ======>	1,130.0	339.0	30%	1,469.0		1,130.0	339.0	1,469.0			1,137.6	341.3	1,478.8

Note: Planning, Engineering and Design cost includes, preliminary work, Project Managment, Letter report, and P&S as shown in the Baseline Scope of Work

Table 4 – Total Project Cost Summary

10. **BENEFIT ANALYSIS –** A benefit analysis is not required.

11. CULTURAL/ENVIRONMENTAL REQUIREMENTS – It is anticipated that this project will have no negative effects on the Cascades Island fish ladder. A Categorical Exclusion will be prepared for this project.

12. **SCHEDULE** – See Figure 2 and Appendix F for the project schedule. The bottom rock structure will be constructed during the December 2008 through February 2009 in water work period. The fixed weir insert will be installed prior to the arrival of lamprey in June 2009. Once the weir is installed, intense biological evaluation of fish passage will occur for one year. If this biological evaluation determines that there are no effects on salmon, it is likely that evaluation of the entrance will no longer be necessary. If it is not clear that salmon are not effected during the first year of biological evaluations, either additional evaluation will be necessary for a second year or evaluation of an additional species will need to occur during the second year.

ID	Task Name	Duration	Start	Finish
1	**Bonneville Lamprey Entrance**	**343 days**	**Mon 1/14/08**	**Wed 5/6/09**
2	**Bottom Rock Structure**	**280 days**	**Mon 2/4/08**	**Fri 2/27/09**
3	Use Input from Previous Flume Report for Preliminary Design	150 days	Mon 2/4/08	Fri 8/29/08
4	Bottom Rock Study (by others)	65 days	Mon 6/2/08	Fri 8/29/08
5	Feasibility Study/Letter Report	115 days	Mon 2/4/08	Fri 7/11/08
6	ITR	10 days	Mon 7/14/08	Fri 7/25/08
7	90% Design	30 days	Mon 7/28/08	Fri 9/5/08
8	90% Review	10 days	Mon 9/8/08	Fri 9/19/08
9	Final Design	5 days	Mon 9/22/08	Fri 9/26/08
10	BCOE/ITR/Incorporate BCOE Comments/Check off Sheet	15 days	Mon 9/29/08	Fri 10/17/08
11	Prepare Final Solicitation	5 days	Mon 10/20/08	Fri 10/24/08
12	Contract Advertisement (Prepare Bid/Proposal/Negotiate)	15 days	Mon 10/27/08	Fri 11/14/08
13	Award 8-A Contract/NTP	15 days	Mon 11/17/08	Fri 12/5/08
14	Construct and Install Bottom Structure	60 days	Mon 12/8/08	Fri 2/27/09
15	Cascades Island Fish Ladder Dewatered	65 days	Mon 12/1/08	Fri 2/27/09
16	**Insert Structure**	**343 days**	**Mon 1/14/08**	**Wed 5/6/09**
17	Site Visit to BONN	1 day	Mon 1/14/08	Mon 1/14/08
18	Feasibility Study/Letter Report	115 days	Mon 2/4/08	Fri 7/11/08
19	ITR	10 days	Mon 7/14/08	Fri 7/25/08
20	**Prepare Plans and Specs**	**108 days**	**Mon 7/28/08**	**Wed 12/24/08**
21	60% Design	26 days	Mon 7/28/08	Mon 9/1/08
22	60% Review	14 days	Tue 9/2/08	Fri 9/19/08
23	90% Design	20 days	Mon 9/22/08	Fri 10/17/08
24	90% Review	14 days	Mon 10/20/08	Thu 11/6/08
25	Final Design	14 days	Fri 11/7/08	Wed 11/26/08
26	BCOE / ITR/Incorporate BCOE Comments/Check off Sheet	20 days	Thu 11/27/08	Wed 12/24/08
27	Prepare Final Solicitation	5 days	Thu 12/25/08	Wed 12/31/08
28	Contract Advertisement (Prepare Bid/Proposal/Negotiate)	15 days	Thu 1/1/09	Wed 1/21/09
29	Award 8A Contract/NTP	15 days	Thu 1/22/09	Wed 2/11/09
30	Fabricate and Install Fixed Weir and Stop Log Insert	60 days	Thu 2/12/09	Wed 5/6/09

Figure 2: Bonneville Entrance Improvements Schedule

13. **LOCAL COOPERATION REQUIREMENTS** – There are no local cooperation requirements.

14. **FUNDING** – Funds for Plans and Specifications, Construction, Engineering During Construction, and Supervision and Administration are required for completion of this project. Columbia River Fish Mitigation (CRFM) funds will be used for this project.

15. **REAL ESTATE REQUIREMENTS** – No real estate is required because the entrance improvements are within the Bonneville Cascades Island fish ladder.

16. **RECOMMENDATION** – It is recommended that the proposed entrance improvements to the Bonneville Cascades Island fish ladder as described in this report, be approved.