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Transmittal Letter

Date:	3/23/07	**Job#:**	29075
		Transmittal#:	003
To:	COE, Randall Lee	**From:**	WGI, Doug Hartsock
Address:		**Address:**	Bellevue

Re: EFL Final Trip Report

Comments:
Hereby transmitted is the EFL Final Trip Report from Washington Group International dated 3/23/07.

If there are any questions, please contact Doug Hartsock at 425-451-4658

Cc: WGI, Edwina Singal Document Control

Washington Group International
Integrated Engineering, Construction, and Management Solutions

March 23, 2007

U.S. Army Corps of Engineers
Hydroelectric Design Section
Attention: Randy Lee, USACE
P.O. Box 2946
Portland, OR 97208-29746

Subject: The Dalles East Fish Ladder Inspection
Contract No. W9127N-06-D-0009, Task Order No. 0004
FINAL Trip Report

Dear Randy:

The Dalles East Fish Ladder was inspected by the USACE, Washington Group International (WGI), and ENSR on February 7 and 8, 2007. The purpose of the inspection was to establish baseline conditions of the ladder to support future reliability studies. The attached trip report summarizes the observations of the inspection participants.

We appreciate the opportunity to have participated in this inspection. Please contact me if you have any questions.

Sincerely,

Doug Hartsock, P.E.
Project Manager

Attachment: Report

cc: File

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Washington Group International
Integrated Engineering, Construction, and Management Solutions

THE DALLES DAM

COLUMBIA RIVER BASIN, WASHINGTON - OREGON

The Dalles Dam East Fish Ladder Inspection Report

MARCH 2007

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INTRODUCTION

The Dalles East Fish Ladder (EFL) was inspected by the USACE, Washington Group International (WGI), and ENSR on February 7 and 8, 2007. The purpose of the inspection was to establish baseline conditions of the ladder to support future reliability studies. This trip report summarizes the observations of the inspection participants.

INSPECTION PARTICIPANTS

The follow individuals participated in the inspection:

Randy Lee	COE	503.808.4876	randall.t.lee@usace.army.mil
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BACKGROUND AND PURPOSE

The Dalles EFL currently passes between 70 and 90 percent of upstream migrating adult fish (the North Fish Ladder on the opposite bank passes the remainder). The continuous availability of the EFL is therefore crucial to the overall adult fish passage success at The Dalles Dam.

The purpose of the EFL inspection was to observe and document the current civil/structural, mechanical, hydraulic, electrical, and geotechnical conditions of the overall facility. The observations will be used to support future EFL reliability studies.

METHODOLOGY

The following methodology was adopted for this task:

1. Review EFL drawings and reports
2. Conduct site inspection
3. Prepare draft trip report
4. Review draft trip report with USACE
5. Finalize trip report

INSPECTION CHRONOLOGY

The following represents an approximate chronology of the inspection. See Figure 1 for area descriptions.

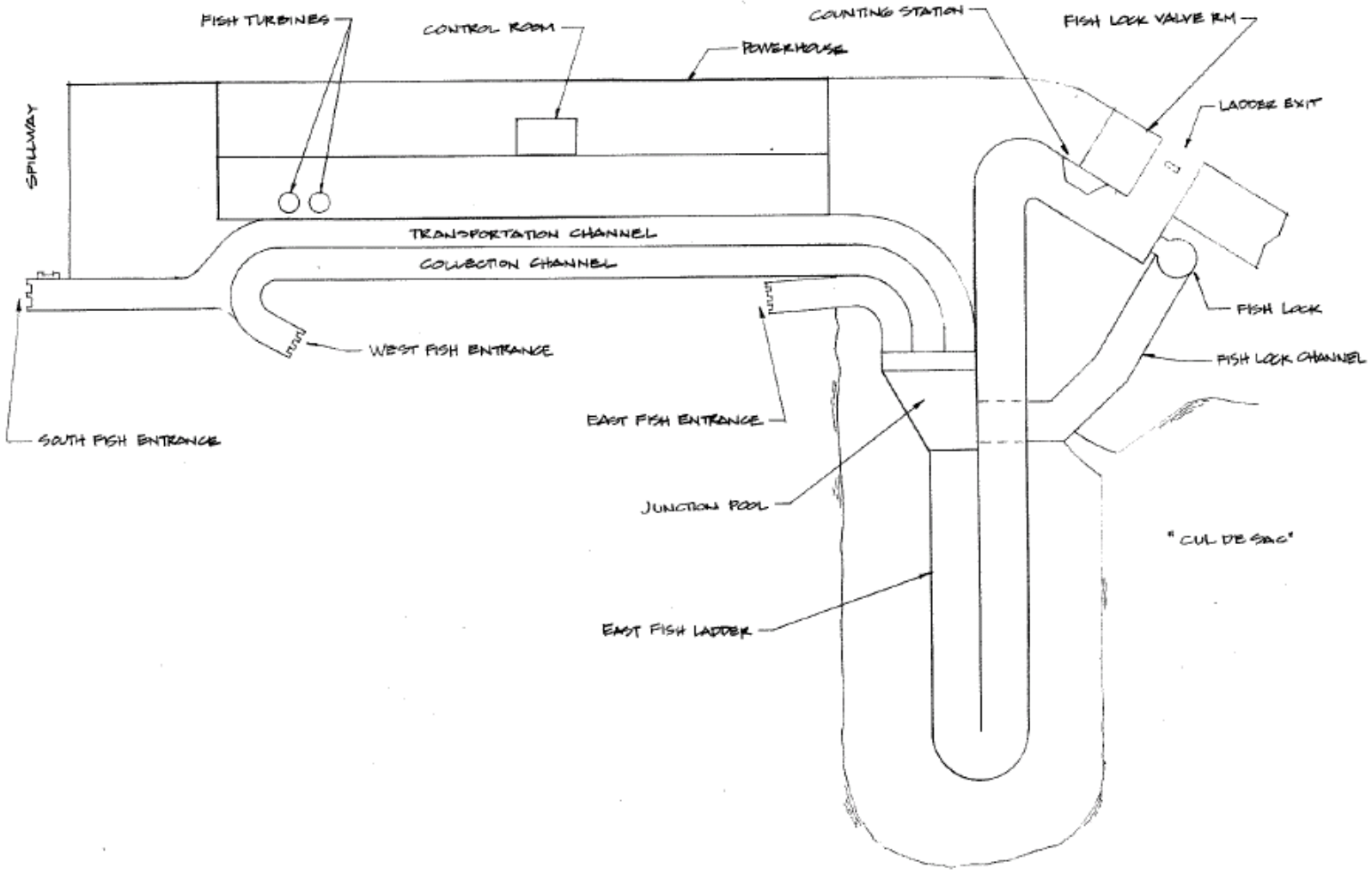
1. Met at The Dalles Fisheries Office at 9:00 a.m. Introduced participants, reviewed project history and objectives, safety, and agenda.
2. Drove to east end of The Dalles powerhouse. Lowered by manbasket into East Fish Entrance. Observed East Fish Entrance telescoping weirs, Junction Pool, and Fish Lock bulkhead.
3. Geotechnical participants proceeded south along Transportation Channel. The remaining participants proceeded south along the Collection Channel. Observed Collection Channel structure, gates, bulkheads, orifices, dewatering equipment, and diffuser grating.
4. Geotechnical participants continued south in Transportation Channel until reaching the concrete-to-rock transition point. Continued south, observing the rock portion of the channel until access blocked by deep ponded water.
5. Collection Channel participants reached the West Fish Entrance and observed the telescoping weirs, diffuser grating, and gates.
6. Both participant groups were lifted from their respective channels and broke for lunch.
7. Following lunch, the participants met at the South Fish Entrance. Select participants were lowered by manbasket into the entrance to observe the structure, telescoping weirs, diffuser grating, and gates.
8. Following removal from the South Entrance, participants observed the south weir hoists and rigging. The group then drove to the East Fish Ladder and observed the Junction Pool from above. Observations were also made of the lower half of the ladder structure and weirs.
9. The participants entered the Fish Lock Valve Room to observe the various large valves used to supply forebay water to the Fish Lock and other areas.
10. Leaving the valve room, participants entered and observed the Fish Counting Station. Exiting the Fish Counting Station, participants observed the Fish Lock silo, Ladder Exit weirs, and various hoists and electrical controls before quitting for the day.

11. Day Two began at the Fisheries Office at 8:30 a.m. Participants walked to the North Fish ladder to observe it in operation. The group then drove to the west end of The Dalles powerhouse and entered the powerhouse to observe the Fish Turbines and associated electrical controls.
12. Participants then proceeded to the Powerhouse Control Room to observe the fish turbine control panel.
13. The group then drove to the site conference center where a wrap up meeting was held and attended by operations personnel.
14. The meeting adjourned and all participants departed at 3:00 p.m.

INSPECTION RESULTS

The following sections provide a description of the areas that were inspected (Figure 1), followed by discipline specific observations.

FIGURE 1: THE DALLES EAST FISH LADDER
AREAS INSPECTED FEBRUARY 7-8, 2007



East Fish Entrance

Civil/Structural Observations

The East Entrance is separated into two parts by a divider wall, and thus requires two bulkheads for dewatering. Only one telescoping weir was observed, installed in the south opening immediately behind the bulkhead. The bulkheads leaked slightly. We were told that the seals on the bulkheads were new and therefore there was much less leakage now than previously.

Concrete work appeared to be intact and unweathered with little joint leakage, only a few places showing dampness. Diffuser grillages are in good condition with light corrosion.

Mechanical/Electrical Observations

Bulkheads were observed to be installed in the three east fish entrance gate openings. (Photo ME-1) A telescoping gate was suspended by wire rope in the center opening. Gate slots and seals appeared to be in good condition. Three pairs of telescoping weirs (called out as junction pool weirs on drawings) were observed between the east entrance and the junction pool. The two northernmost weirs were suspended in what appeared to be the full up position; the southernmost weir was dropped to the floor in what appeared to be a full down position. Leaf seals on the southernmost weir were observed to be in good condition. (Photo ME-2) Crustacean shell fragments were observed to be piled against the sill of the weirs at the bottom of the gate slots.

Hydraulic Observations

The east entrance gates appear to be in satisfactory condition, except the center gate is under repair as shown in Photo H-1. The east entrance gates operate with the same lifting beam mechanism used for the North Fish Ladder. The diffuser grating in the east entrance appears to be in satisfactory condition and the diffuser panels in the entrance area operate as part of the auxiliary water supply.

Junction Pool

Civil/Structural Observations

There are low concrete sills, about 3 feet high, between the junction pool and the east entrance, collection channel, and transportation channel. The collection and transportation channels have telescoping weirs stored in a raised position out of water as shown in Photo CS-1.

Concrete work appeared to be intact and unweathered with no joint leakage except for one damp (but not leaking) joint in the right wall of the transportation channel entrance. Diffuser grillages are in good condition with light corrosion. The fishlock bulkhead has a small leak.

Hydraulic Observations

The junction pool was observed as shown in Photo H-2. USACE staff noted that the junction pool 3-leaf weirs are open to the collection and transportation channels and operated at 7 feet below tailwater in the east entrance channel. The 1" by ~ 4 in" floor diffuser grating appeared to be in satisfactory condition. The diffuser panels in the junction pool are normally in operation for the auxiliary water supply.

The lower weirs for the East Fish Ladder are shown in Photo H-3. Some debris was caught in the gap between the grating and the orifice floor at each orifice opening as shown in Photo H-4. We also observed the bulkhead for the fish lock channel entrance to the junction pool. The fish lock is not operated at this time.

We were advised that there was a distribution problem in the junction pool, whereby an excessive amount of water was lost out the east entrance. Due to this loss, in order to furnish sufficient water to the collection and transportation channels a total of about 4,500 cfs of auxiliary water was needed. Both fish water turbines were therefore required to operate near rated capacity at all times. It was believed that the auxiliary water flow could be much reduced, perhaps by as much as 1,000 cfs, if the excessive east entrance outflow could be controlled. At present it cannot be controlled because the differential head criterion for the telescoping weirs would be violated if they were raised further.

Collection Channel

Civil/Structural Observations

The only major leak observed on the inspection tour was found at one of the floating orifices. All the floating orifices were closed, and only the one exhibited significant leakage (Photo CS-2). The concrete bulkheads exhibited very small leakage in varying amounts. We were advised that the seals were new. The dewatering pumps were also new. These items were part of the "Adult Fishway Dewatering Improvements" undertaken since the Inca condition inspection report recommended them ten years ago. Only a few of the joints in the concrete walls showed dampness. Structural condition of the concrete work appeared excellent.

The auxiliary water system (AWS) tunnel under the collection channel floor was at least partially dewatered, which revealed that several of the diffuser gates were leaking. The water level beneath the diffuser grills was drawn down by varying amounts despite the constant inflow from collection channel leakage. Where the drawdown was large enough we could observe that there were piles of bivalve shells, stones and muck on the floor of the diffuser chambers, which probably interfered with the closure of the diffuser gates and caused the leakage into the AWS from the collection channel.

The diffuser grills were considerably more corroded than were the similar grills in the junction pool. Nevertheless, they were all intact, well fastened down, and had no holes or missing bars.

Hydraulic Observations

We walked the entire length of the collection channel as shown in Photo H-5. The gate housing for the diffuser gates are visible in the channel as shown in Photo H-6. The diffuser gates are closed during current operations. The floating orifices in the collection channel are closed during normal operation as well (Photo H-7). We were advised that the floating orifices in the collection channel were no longer used, since they had not been effective for fish attraction. With the orifices closed, the diffuser gates were also closed; thus no attraction water from the AWS entered the collection channel along its length, only at the junction pool and the west powerhouse entrance.

During the site visit some of the diffuser gate wells were drained below the floor level. This was likely due to some leakage through the diffuser gates in these wells. In the gate wells with lower water levels, sedimentation and growth of mussels or other bivalve populations were observed. It is possible that the

sediment prevents full closure and sealing of the diffuser gates. Photo H-8 shows one of the diffuser wells that was partially drained. The diffuser grating appeared to be in satisfactory condition but showed signs of sedimentation.

Mechanical/Electrical Observations

A series of diffuser gates were observed at regular intervals along the upstream wall of the fish collection channel. (Photo ME-3) District staff advised that the gates were fully closed and were maintained in the fully closed position. A few gates appeared to be partially open, allowing water to enter the collection channel through the diffuser gratings. Six dewatering pump casings were observed at regular intervals along the upstream side of the channel. (Photo ME-4) The pumps were operating and removing water that was leaking into the channel past bulkheads or the partially open diffuser gates. Floating orifices were abandoned in place along the downstream wall of the channel. Water was observed to be leaking past the downstream bulkheads in a few locations. (Photo ME-5)

West Fish Entrance

Civil/Structural Observations

There is a telescoping weir between the collection channel and the transportation channel which closes the west powerhouse bypass opening. According to the drawings it is always closed.

The west entrance has three openings. Three telescoping weirs were present, stored in a raised position behind the bulkheads. The concrete floor exhibited some laitance which was flaking off; this is of no structural significance, although it may indicate that part of the floor has been replaced or patched recently. Small amounts of seepage were present at several locations on the concrete walls, particularly at one horizontal lift joint near the normal water level. The diffuser grills appeared to be new. There were shells and stones lying atop the diffuser grills. It is not obvious how the stones were transported to this location, since they were too large to come up through the diffuser grills. In the entire inspection we never observed any missing diffuser grills, although we did observe grills being replaced in the fish ladder itself.

Mechanical/Electrical Observations

Bulkheads were installed in all three west fish entrance openings. (Photo ME-6) Telescoping weirs were suspended in each opening. Gates, slots, and seals appeared to be in good condition. A fourth telescoping “bypass” gate was

observed between the collection channel and the transportation channel. (Photo ME-7) All four gates appeared to be in good condition.

Hydraulic Observations

The West Entrance gates were observed and appear to be in satisfactory condition as shown in Photo H-9. The diffusers in the west entrance operate during normal operations and the grating appeared to be in satisfactory condition.

Transportation Channel

Civil/Structural Observations

As viewed from grade, the open-cut concrete walled portion of the transportation channel appeared to be in good condition. There was approximately one-inch of water in the Transportation Channel. Locally, there were pieces of spalled concrete on the floor of the channel. There was also some miscellaneous debris that had fallen from the grating above, i.e., keys, coins, bolts, etc. At one location near the entrance of the transportation channel near the junction pool, an area of sand approximately 1 to 2-feet in dimension was present at the floor of the channel near a construction joint as shown in Photo CS-3.

Nearer to the rock-lined channel, a piece of formed concrete was found on the floor of the channel. The inspection team could not find where the concrete had dislodged, as the walls appeared to be intact, but the piece of concrete had fresh sharp corners and appeared to be a recent addition to the transportation channel debris.

Geotechnical/Geologic Observations

From conversations with Corps of Engineers personnel, it is our understanding that the rock-lined portion of the EFL had been cleaned of loose rock debris approximately 2 years prior to our inspection. This was the only time it had been cleaned since the construction of the channel. COE site personnel who were there at the time of the cleaning mentioned that there was quite a bit of rock removed, which had accumulated over the 50-year time period. At the time of our inspection, only small pieces of rock were present on the floor of the channel.

The rock in the channel is part of the Columbia River Basalt Group. Two flows were noted during the inspection and are separated by a thin layer of material that supports growth of a moss layer with minor vegetation. The lower layer had a closer spaced joint pattern and the upper layer tended to be more massive. The rock required blasting to be constructed and the blast holes are still evident in the rock slopes (Photo G-1). The rock maintains vertical slopes. The basalt is

fresh to slightly weathered. Although it is jointed, due to cooling, no pervasive joint pattern was noted that was deleterious to the stability of the slope. Most rock fall that has occurred is likely the result of loosening of individual basalt rocks (Photo G-2). A few areas of large blocks that have been loosened from the slope are also shown in this photograph.

In areas where fill has been placed, the area was stabilized with concrete wall and cross struts (Photo G-3).

Hydraulic Observations

Significant rock-fall in the rock-lined portion of the transportation channel may change the effective roughness coefficient of this portion of the channel and impact head loss through the channel. This can be minimized by periodic channel maintenance.

South Fish Entrance

Civil/Structural Observations

The south entrance has two openings. The two bulkheads appeared to be leak free, although the sills could not be observed due to being submerged. The structural concrete appeared sound. The diffuser grills were somewhat corroded but were intact and well secured. The rocks and shells which were found lying on the grills at the west powerhouse entrance were not observed here.

Mechanical/Electrical Observations

Bulkheads were installed in both south fish entrance openings. (Photo ME-8) A telescoping weir was suspended in the south opening; the north opening weir was missing and reported to be installed in the North Fish Ladder Entrance. A dual sheaved lifting beam used to raise and lower the telescoping weirs was observed. (Photo ME-9) The beam is a relatively recent addition designed to improve the reliability of the gate by removing the wire ropes from the flow stream. Hoists used to raise and lower the telescoping gates were observed to be in good condition. (Photo ME-10) Gate slots also appeared to be in good condition. Hoist electrical controls appeared to be somewhat weathered and old but no reports of malfunction were reported. (Photo ME-11)

Hydraulic Observations

The South Entrance gates and diffusers were observed as shown in Photo H-10 and appeared to be in satisfactory condition. The diffusers in the South Entrance operate during normal operations as part of the auxiliary water supply.

East Fish Ladder

Civil/Structural Observations

The exterior of the concrete of the ladder shows considerable efflorescence, especially at the horizontal joint between floor and walls. This is probably a sign of historical leakage at the joint, likely long since stopped by autogenous healing. The diffuser grills were being replaced and the expansion joints in the concrete walls recaulked. It was noted that some of the concrete weirs in the lower part of the ladder, such as Weir 72 (second weir from end of ladder) were supported by steel angle clips; no one in the party was able to supply any information what had happened that resulted in the installation of the clips (Photo CS-4). Some concrete had been cut off from the base of the buttress walls of other weirs, and the pieces were lying in the fishway; it was unclear what motivated their removal.

The upper ladder weirs were modifications made to the original ladder. They were steel bulkheads, rather than concrete, and were adjustable. The fish exit weirs were also modifications, as was the fish counting station near the ladder exit. PIT tag detectors had been recently installed on the weirs and orifices at one location downstream of the counting station. All of the modifications appeared to be in good condition.

Mechanical/Electrical Observations

A hoist control station appeared to be somewhat weathered and old, but no reports of malfunction were reported. (Photo ME-12) Hoists and rigging appeared to be in good condition. Evidence of regular changing of hoist gearbox oil was noted on several gearbox housings. (Photo ME-13) District staff pointed out that the gearboxes were located over water.

Hydraulic Observations

The East Ladder appeared to be in good condition, with the weirs and orifices appearing in satisfactory condition. On the lower approach to the junction pool, several weir pools contained chunks of concrete as shown in Photo H-11. It appears that the concrete may have come from under the upstream weir approach wall. Several of the diffuser sections have new grating.

The upper section of ladder weirs upstream of the 180° bend was observed to have significantly greater algal growth as shown in Photo H-12.

We were advised that the AWS could only supply water to the ladder diffusers when the river water level was high.

Fish Lock

Mechanical/Electrical Observations

The original east fish ladder construction included a fish lock designed to lift fish from the junction pool to the ladder exit. (Photo ME-14)The fish lock had not been used in several years; District staff reported that 1) fish were not inclined to enter it, and 2) fish that did enter it experienced descaling during the lifting operation. A valve room used to supply forebay water to the fish lock and other areas was entered and observed. (Photo ME-15) The valves, actuators, and controls appeared to be in good condition. District staff shared that operation of the valves had been considered to supply additional attraction flow to the east fish ladder via the fish lock.

Hydraulic Observations

We were told that the fish lock has not been used since early in the operation of the project because it descaled the fish. There are no plans to use it for fish passage. However, it is of interest as an alternative source of attraction water, possibly requiring modifications to obtain water delivery in the right quantity, head and location.

We found that on Drawing DDF-1-0-5/3, “East Fish Ladder and East Non-Overflow Dam General Plan,” a tunnel was shown from the fish lock under the ladder to the AWS conduit. No one present had ever seen the tunnel, so it could not be confirmed if it actually exists.

Fish Turbines

Mechanical/ Electrical Observations

The two fish turbine transformers (one per unit) were observed and appeared to be in good condition. (Photo ME-16) The fish turbine units and controls were observed and appeared to be well-maintained. (Photo ME-17, ME-18)

The condition of the fish turbines was discussed. Although they have been very reliable, they are showing signs of age. New windings have been installed. The

original 50-year-old bearings are “sagging.” The carbon packing would be the first item to fail and would take 3 weeks to replace. If replacing the packing only was not sufficient, it would then take 3 months to replace the bearings.

It was confirmed that a low side bus had been installed so that the fish turbines could feed the Turbine 1 transformer in event of failure of their own transformer. Both fish turbines are on that same bus, however.

Counting Station

Mechanical/Electrical Observations

The counting station was entered and observed. District staff reported no problems with the operation of the crowder or window cleaning mechanisms. The counting room ventilation and cooling system was reported to need improving.

Hydraulic Observations

The picket gates, counting station, crowder and water level measurement station all appeared to be in satisfactory condition. The water level measurement station is located just downstream of the count station.

Fish Ladder Exit Section

Mechanical/Electrical Observations

Several adjustable weirs were observed in the ladder exit section. (Photo ME-19) The weirs were in various positions. District staff reported that the number of adjustable weirs added complexity and maintenance to the operation of the ladder, and questioned whether they were needed. The ladder exit consists of two smaller adjustable weirs that appear to have been fabricated from a former single weir. (Photo ME-20) Bulkheads were observed on the upstream side of the weirs. The various adjustable weirs are controlled by a motor control center and PLC located in a room adjacent to the gates. (Photo ME-21) No electrical or control problems were reported.

Hydraulic Observations

Photo H-13 shows the four adjustable exit section weirs. Each of the adjustable weirs has a slightly different geometry. Typical operation is that the downstream-most weir is in place, the next two upstream alternate operating, and the upstream-most is almost always out of the ladder. Staff reported occasional

automation problems with the system. The orifice openings on the adjustable weirs are not flush with the ladder floor as in the permanent ladder weirs. The removable weirs are a retrofit and are not part of the original design. Water levels are monitored in the ladder just downstream of the counting station.

The exit weirs are shown in Photo H-14. The pair of weirs are automatically operated based on forebay elevation. The downstream weir tracks at 1 foot below the upstream (weir 159) weir elevation. The weirs appear to be in satisfactory condition.

Control Room

Mechanical/Electrical Observations

The fish turbine control panels located in the powerhouse control room were observed. Operators reported no problems with their operation. (Photo ME-22, ME-23)

APPENDIX

SITE PHOTOS

Photo CS-1 Overall view of the East Entrance, Collection Channel and Transportation Channel

Photo CS- 2 Collection Channel. Note leakage at one floating orifice.

Photo CS-3 Sand accumulated from seepage at joint between concrete sections in Transportation Channel

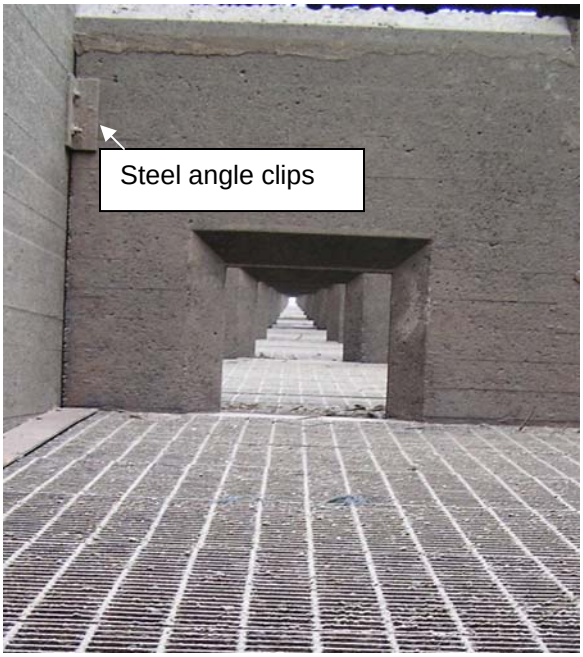


Photo CS-4 – East Fish Ladder Concrete Weir supported by steel angle clips

Photo ME-1 Bulkheads present in the three east fish entrance gate openings

Photo ME-2 Leaf seals on the southernmost weir at East Entrance

Photo ME-3 Diffuser gates along upstream wall of fish collection channel

Photo ME-4 Dewatering pump casings along upstream side of collection channel

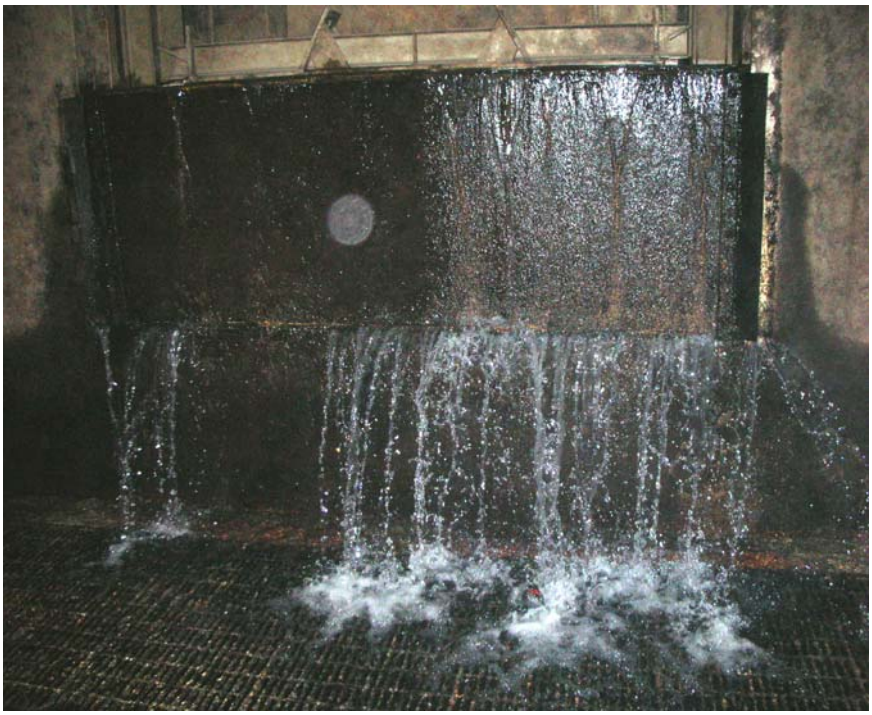


Photo ME-5 Water leaking past downstream bulkhead in collection channel

Photo ME-6 Bulkheads at west fish entrance openings

Photo ME-7 Telescoping “bypass” gate between collection and transportation channels

Photo ME-8 South fish entrance bulkheads

Photo ME-9 Dual sheaved lifting beam for raising and lowering telescoping weirs

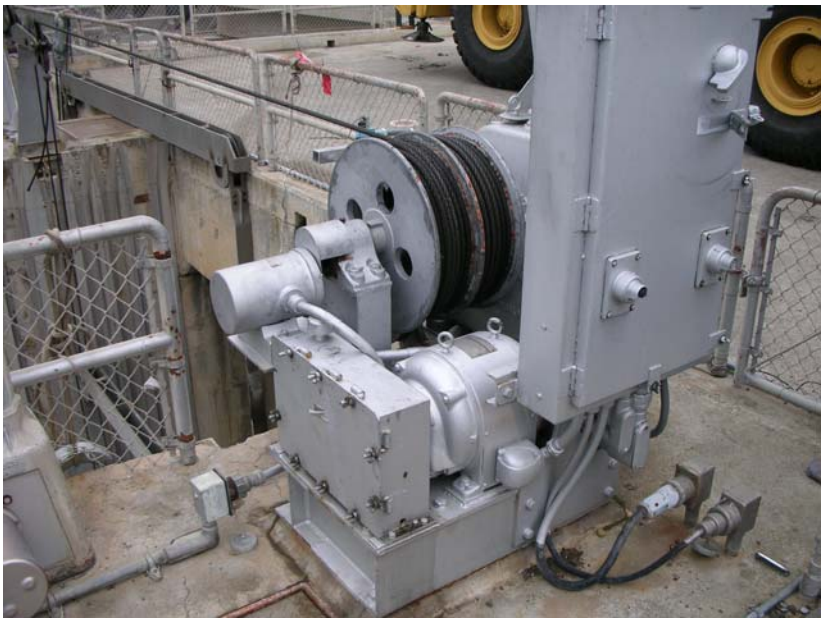


Photo ME-10 Hoists for raising and lowering telescopic gate at south fish entrance

Photo ME-11 Hoist electrical controls at South Entrance showing older condition

Photo ME-12 Hoist Control Station at Junction Pool

Photo ME-13 Gearbox Housing

Photo ME-14 Fish Lock – View from top

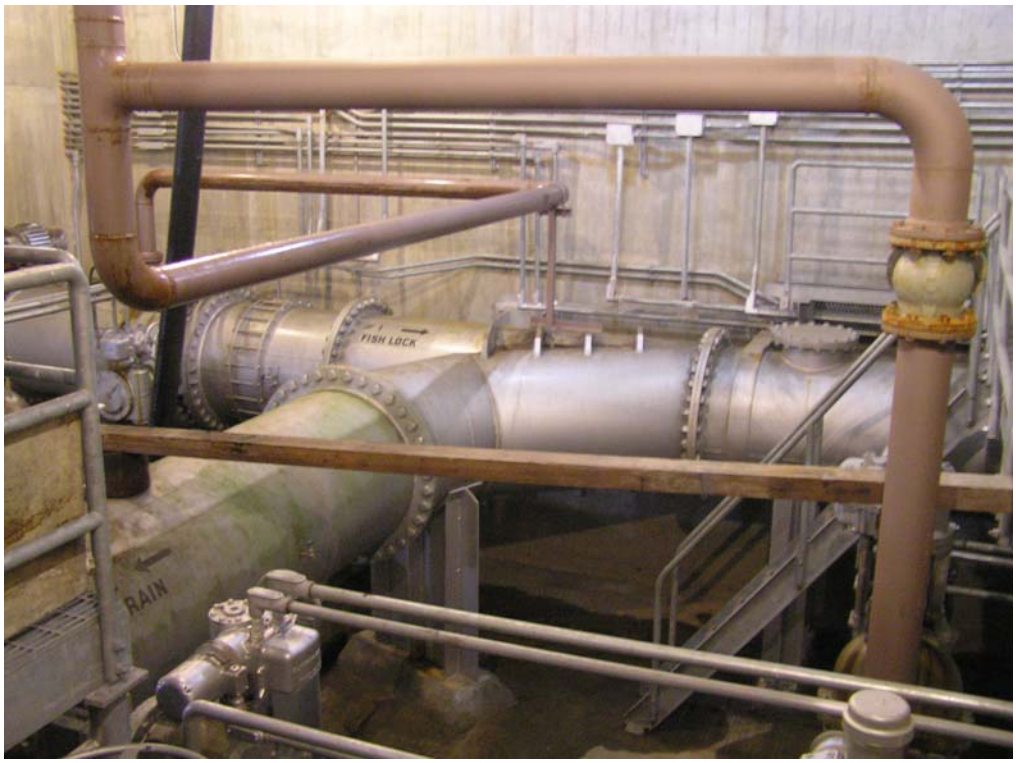


Photo ME-15 Fish Lock Valve Room

Photo ME-16 Fish Turbine Transformer

Photo ME-17 Fish Turbine Units

Photo ME-18 Fish Turbine Controls

Photo ME-19 Adjustable weirs in fish ladder exit section

Photo ME-20 Weirs fabricated from a former single weir

Photo ME-21 Motor Control Center and PLC

Photo ME-22 Fish Turbine Control Panels

Photo ME-23 Fish Turbine Control Panels

Photo H-1 EFL East Entrance

Photo H-2 EFL Junction Pool

Photo H-3 Junction Pool

Photo H-4 Debris between diffuser grating and orifice

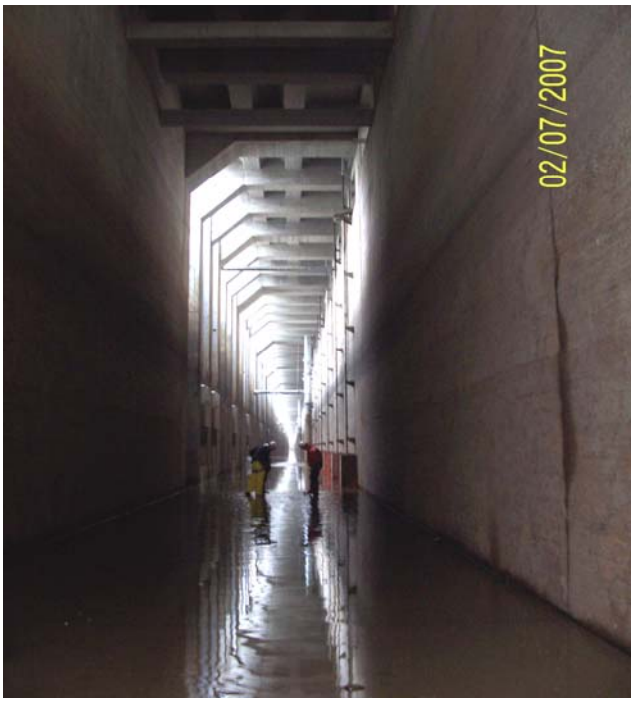


Photo H-5 Collection Channel

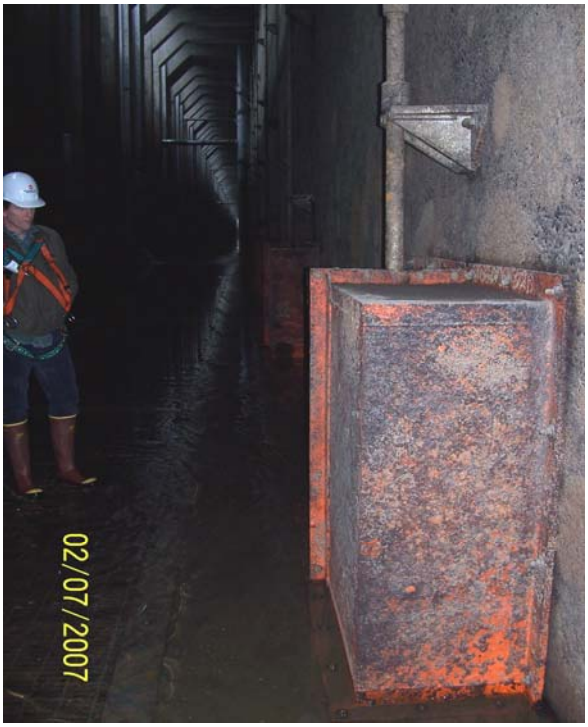


Photo H-6 Diffuser Gate Housing

Photo H-7 Floating Orifice

Photo H-8 Sediment on diffuser grating

Photo H-9 West Entrance

Photo H-10 South Entrance

Photo H-11 Typical East Ladder Weir

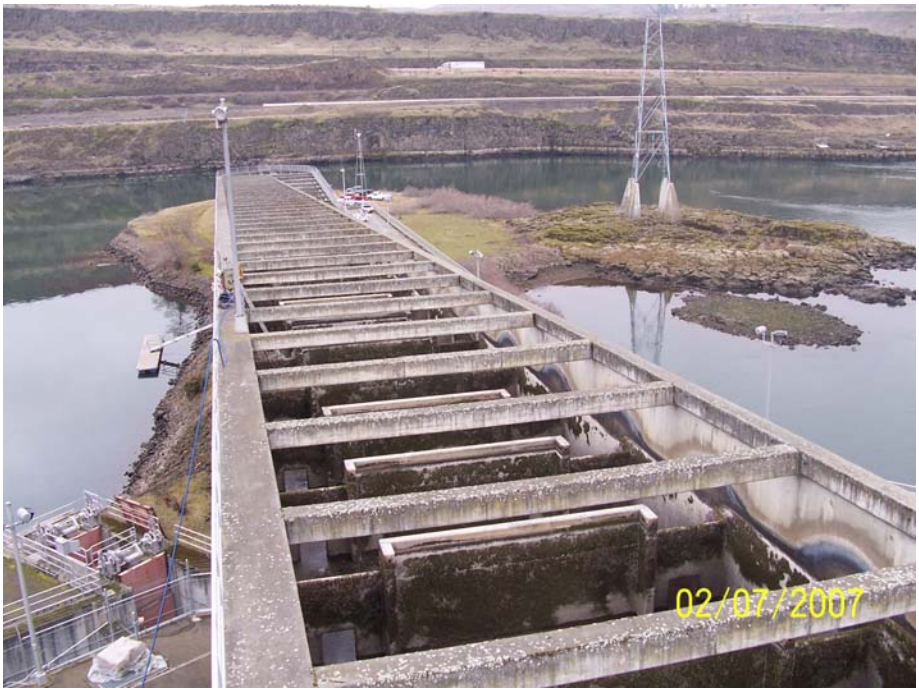


Photo H-12 Upper EFL

Photo H-13 Exit Section

Photo H-14 Exit Weirs

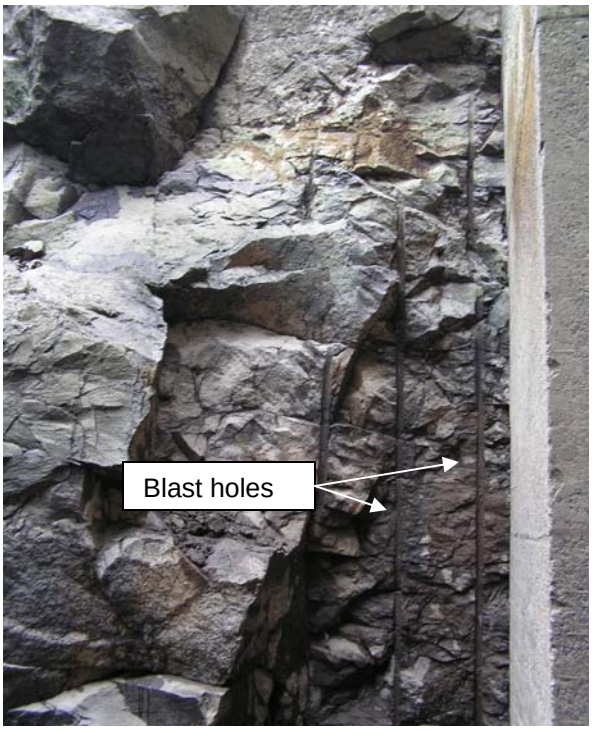


Photo G-1 Blast holes drilled for the construction of the channel

Photo G-2 Vertical slopes in the rock-lined channel. Notice zones where larger rocks have been displaced into channel. Only minor amount or rock debris on floor of the channel.

Photo G-3 – Area of rock-lined channel that is stabilized with concrete and cross struts.