ADULT AND JUVENILE FISH FACILITIES MONITORING REPORT
LITTLE GOOSE DAM – 2010

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Introduction

This report summarizes the operation and maintenance of the adult fish passage facility at Little Goose Dam (LGS) from March 1, 2010 to February 28, 2011. The report also summarizes activities and results associated with the collection, transportation, and bypass of migrating juvenile salmon and steelhead at Little Goose Dam in 2010. A more detailed annual report on juvenile fish is available upon request.

River Condition

A dry winter, with snowpack at 53% of average as of March, was redeemed by a cold rainy spring creating high elevation spring snowpack and a late spring freshet for the Snake River Basin. The final 2010 water year was predicted to be about 95% of average for the lower Snake River. Flows for April and May were below the five year average. Most of the spring freshet occurred throughout the month of June and into July. Flows during the remainder of the season were similar to the five year average.

During the 2010 season, April 2 through October 31, average daily flow past LGO was 50.0 kcfs with a peak daily flow of 199.3 kcfs on June 6 and a minimum daily flow of 12.6 kcfs on October 17. The major components of total flow at LGO were discharge through turbine units (powerhouse flow) and discharge over spillways. Minor sources of discharge were the fish passage structures and the navigation lock.

Spill designed to improve fish passage and survival rates occurred from April 3 to August 31, 2010, in accordance with the 2010 Fish Passage Plan (FPP). The 2010 FPP specified that spill at Little Goose was to be kept at a constant 30% of outflow. This discharge pattern produces tailrace conditions better suitable for upstream migrating adults. The 70% powerhouse discharge overpowers the counter-clockwise current created by spill improving adult fish guidance into the fishway. In addition turbine units were operated in priority order 1 through 6 to improve adult fish guidance.

Other factors that affected spill management were high and low runoff conditions, total dissolved gas (TDG) levels, generation unit outages that reduce powerhouse discharges, low power demand, research, and adult fish passage. Changes to spill as a result of these factors were coordinated through the Technical Management Team (TMT). The daily average percentage of discharge from spring and summer spill was 30.2%.

Adult Fish Facility

Facility Description

The adult fish facility is located on the downstream side of the dam and functions to attract and pass adult migrating fish upstream over the dam. The facility consists of a fish ladder and a collection channel. The collection channel acts to both attract and route fish from across the tailrace to the fish ladder. Components of the collection channel system include two south shore entrances (SSE), four floating orifice gates, three north powerhouse entrances (NPE), three north shore entrances (NSE), the collection channel itself, a fallout fence, a auxiliary water supply system, and an electronic monitoring and control system.

The pool-and-weir fish passage ladder is located on the south shore. It is approximately 1,000 feet long and rises a vertical distance of about 100 feet. The ladder begins at the junction pool near the SSE and leads upstream westward approximately 400 feet and switches backed with a curve south and then east. It continues another 550 feet to the east where it passes under the dam's intake deck and exits into the forebay.

The viewing room and fish counting windows are located approximately 300 feet from the start of the ladder at the junction pool. The fish counting slot is approximately 18" wide by 36" high. Underwater vertical fences called "picketed leads" guide and confine fish to pass through the counting slot.

The two SSE (SSE1 and 2) have overflow weirs that were normally open. Two of the NPE (NPE1 and 2) have overflow weirs and were normally open. NPE3, a lift gate entrance, was permanently closed with a concrete bulkhead. Two of the north shore entrances (NSE1 and 2) are also overflow weirs and were normally open. NSE3, a lift gate entrance, was also permanently closed with a concrete bulkhead.

Additionally, ten floating orifice gates located in front of the powerhouse have been removed and permanently sealed with bulkheads. Floating orifice gates 1, 4, 6, and 10 have been closed since the 2000 fish passage season and floating orifice gates 2, 3, 5, 7, 8, and 9 have been closed since January 1996. Research has proved that adult fish attraction into the adult fish channel improved with these ten gates closed.

The adult collection channel begins at the NSE, passes under the spillway, past the NPE and continues along the base of the powerhouse, and terminates in the junction pool near the base of the ladder. A short channel connects the SSE to the junction pool and ladder. The fallout fence, consisting of a pipe framework and chain link fencing, is located in the channel near NPE1 and 2. It functions to prevent fish in the channel from re-entering the tailrace at the NPE.

The collection channel water is supplied from three sources. First, the fish ladder coupled with a diffuser (diffuser 13) supplies approximately 75 CFS of water and flows via gravity into the channel. Second, three turbine-driven pumps (fish pumps) supply approximately 1,700-2,000 CFS of auxiliary water. The fish pumps move water from the tailrace to floor diffusers located on the bottom of the collection channel in front of the

powerhouse, near the junction pool and lower end of the ladder. Third, 175-230 CFS of excess water from the primary dewater unit of the juvenile fish collection system also flows into the floor diffusers.

An electronic computer interface system, the fishway system control (FSC), operates and monitors the fishway. The FSC includes water elevation sensors for the fishway channel and for the tailrace near each major entrance (six sensors total). All six-overflow weirs also have elevation sensors and controls. An electronic water velocity meter (flowmeter) was added to the collection channel near the SSE in November 1997.

Facility Modifications

1) Inspections and repair maintenance was performed to the collection channel fall-out fence and diffuser gratings during January-February 2011 maintenance period.
2) Annual inspections and routine maintenance was performed to the adult fish ladder during the winter adult fish ladder outage in January and February 2011.
3) Adult fish collection entrances North Shore Entrance 3 and North Powerhouse Entrance 3 were permanently closed off in February 2011. Both these entrances faced inward perpendicular to tailrace spill bays #1 and #8. The permanent closure consisted of removing the recessed bulkheads and filling the entrances with concrete with a flush finished to match the existing concrete walls. The flush finish removes the recessed rectangular opening thus making safer passage for adult fish migrating in the channel and juvenile fish migrating downstream in-river through spill bays 1 and 8.
4) New overhead lamps and circuits were installed in the spillway section of the collection channel in February 2011. The new metal-halide lamps replaced the old and deteriorating incandescent lamps. The new lamps provide a significant increase in lumens.
5) New electronics components were installed in the fish system control panel and south shore fish entrance hoists
6) Two lamprey landing apron plates were installed over the diffuser 13 grating just upstream of each fish passage orifice. The apron plates provide a place of attachment for lamprey to aid in swimming over the diffuser grating.
7) Picketed Leads were modified to allow 1.5 inches of clearance at the bottom to allow adult lamprey passage. Pickets in series of 3 were trimmed 1.5 inches from the bottom allowing space for adult lamprey to migrate through.

Fish Passage and Fishway Activities

In 2010 a total of 387,007 salmonids were visually counted passing upstream through the adult fish ladder. The species counts were 168,539 Chinook adults, 20,912 Chinook jacks, 193,890 steelhead, 1658 sockeye, 1,721 coho, and 281 coho jacks.

Additionally, 29 adult lampreys were counted migrating upstream through the adult fishway system.

Several monitoring activities involving the use of the adult fishway were in progress in 2010. These included:

1) An ongoing radio-tracking study of adult Chinook and steelhead past the dam conducted by the University of Idaho.
2) Water temperature monitoring within the adult passage system. This activity started in 1999 and will help determine if thermal barriers exist and to take corrective action if needed.
3) The Walla Walla District continued a hydraulic evaluation of the adult fishway. The purpose was to analyze existing operating conditions and investigate alternatives to improve fish passage.

Operations and Maintenance

The adult fish passage facility was in service from March 1, 2010 to January 3, 2011. The adult fish ladder performed satisfactorily throughout the season. The collection channel incurred several failed components. These included NSE1, NSE2 weir gate hoists, NSE3 concrete bulkhead and the fall-out fence. The failure of the NSEs made it difficult to keep the channel within criteria and often the channel functioned marginally out of criteria.

Scheduled winter maintenance included dewatering the fish ladder from January 3 to February 28, 2011 and the adult collection channel from February 14 through February 28, 2011. During winter maintenance both NSE 3 and NPE 3 concrete bulkheads that were deteriorating over the past several years were permanently sealed with concrete. New metal halide lamps were installed in the spillway section of the collection channel and the fall-out fence underwent major repairs.

Adult Fish Ladder

The fish ladder was in service throughout 2010 and performed satisfactorily.

Dewatering of the fish ladder to tailrace level occurred January 3, 2011 for winter maintenance. Ladder maintenance included; repairing the fish counting backboard, re-surfacing the window pool picketed lead holding channels, sealing two expansion joints, inspecting weirs, removing debris, cleaning the picketed leads, servicing the window brush cleaning motors, replacing light bulbs, cleaning lamp lenses and cleaning the viewing windows. The picketed leads were modified for lamprey passage. Pickets in series of 3 were trimmed 1.5 inches above the ladder floor to allow room for lamprey to pass through. Two lamprey attachment plates were installed on diffuser 13. These plates cover a small section of the diffuser and extend approximately 1.7 feet on the

upstream side of the fish passage orifice allowing adult lamprey an area to attach to when entering the diffuser area.

Collection Channel

The collection channel was also in service throughout 2010. However some components failed which often made it difficult to keep the channel within required operating criteria.

To start the season, NSE1 was manually positioned at 530.1 feet. The gate operator had failed in November 2009. On April 5, NSE1 was lowered to sill elevation at 529.1 feet to verify position but due to mechanical problems with the chain hoist lift, the weir was not able to be raised and it remained on-sill elevation for the remainder of the season. On November 28, NSE2 weir hoist operator also failed and this weir also lowered to sill elevation. Throughout the season, the concrete bulkhead closing off NSE3 deteriorated significantly and developed a large hole (4 feet in diameter) and allowed water to pass unrestricted through the opening. With both NSE 1 and 2 gates on sill elevation and the large hole in NSE 3 created an excess loss of water that reduced channel elevations below criteria (1.0 – 2.0 feet). To compensate for the additional water loss, NPE 2 weir gate was raised and closed on November 29. Closing NPE2 improved channel water elevations however it often remained out of criteria by 0.1 to 0.2 feet through the remainder of the season.

In February 2007 the collection channel was inspected by District Structural Design Engineers. The inspection confirmed that NSE3 and NPE3 concrete bulkheads were damaged creating excessive leaking and required replacing or repair. NSE3 was observed to have structural cracks possibly making it a life safety issue for personnel working in the channel while dewatered.

Temporary repairs to NPE3 were made for the 2010 fish passage season. Permanent repairs to both NPE 3 and NSE 3 that completely closed off the entrances using concrete, was complete in February of 2011.

Repairs to the fall-out fence were made in January 2006, 2007, February 2008, 2010 and 2011. The chain-link fabric continues to corrode at points of contact with the structural supports with dissimilar metal fasteners. New stainless steel welded mesh is scheduled for installation during January and February 2012.

In February 2011, all lamps and the three circuits were replaced. The new lamps are metal halide and provide significant more light.

Auxiliary Fish Pumps

Fish pump performance in 2010 continued to improve. There were a total of three pump outages during the fish passage season. The three outages were the fewest recorded in the past 4 years. For comparison there were 10 outages in 2009, 16 in 2008 and 33 in 2007. Of the three outages, one was scheduled for preventive maintenance and the remaining two incurred to fish pump 3 and were caused by high bearing temperature that automatically shut down the pump.

Water Velocities

Surface water velocities were measured near the SSE and the NSE. These velocities were calculated by recording the time of travel of sticks or bubbles over a known distance. In addition, a flowmeter positioned near the junction pool electronically measures water velocity using a formula calculated from the average water speed from three sections of the channel; near the surface, mid depth and near the bottom. As determined by the 2001 hydraulic evaluation, water velocities near the SSE will more often not meet criteria due to upwelling flows from diffuser 2 that interfere with the laminar flows.

Adult Fishway Inspections

Adult fishway inspections during the 2010 fish passage season were conducted by Corps fishery biologists and/or technicians and by natural resources specialists with the Oregon Department of Fish and Wildlife (ODFW). Inspections by the ODFW were done twice a week from April through October, generally on designated days. Inspections by the Corps were conducted weekly but on different days and at different times each week through October and conducted two to three times each week during November and December. Problems observed during an inspection were reported to the Project Biologist and/or the Dam Operator for appropriate action. Chronic problems with no immediate fix (e.g. inadequate weir depth at the NPE) were simply recorded. The more important problems are detailed below in the results section.

All inspection data were entered into a computer spreadsheet that provided an indication as to whether operating criteria were met (Appendix 1). Spreadsheet outputs includes: “yes” (meets criteria), “no” (does not meet criteria), “NA” (no reading taken), “closed” (entrance closed due to weir failure or for two-pump operation), and “sill” (overflow weir bottomed out on its sill, due to minimum operating pool (MOP) conditions). The two criteria used to determine “sill” are listed below. In all cases when both criteria were met, then a weir was judged to be on sill. Criteria were:

1) Weir elevation was less than or equal to 532.20’ for NPE and less than or equal to 529.20’ for SSE and NSE.
2) Weir depth was less than 8.00’ for SSE, less than 7.00’ for NPE and less than 6.00’ for NSE. (Minimum required depths in accordance with the 2009 Fish Passage Plan.)

Inspection Results

The adult fish ladder (ladder exit, ladder weirs and counting station) met criteria for all inspections; 100 % (Table 1). The ladder exit trash rack and picketed leads remained relatively clean throughout the season. The air bubbler at the ladder exit was in service during the season and keep debris from collecting at the ladder exit area.

In 2010 most adult fishway components met criteria at least 97.6% of the time. The notable exceptions being NPE1 and 2 weir depths, channel to head differential at the NSE and surface water velocities measured near the SSE (Table 1). NPE1 and 2 weir depths met criteria 33.6% and 28.0% respectively. This was in part due to low tailwater elevations that caused the weirs to rest on sill at 532.20 feet. Combined (met criteria and sill elevation) were 100% for NPE 1 and 89.6% for NPE 2. NPE 2 was raised and closed beginning November 29 through the end of the season to compensate for excess water loss through the damaged NSEs. This accounted for 14 inspections out of criteria.

Due to NSE1 and 2 gate hoists failures, the weirs were inoperable and rested on sill elevations averaging three to four feet below the normal setting of six feet below tailwater surface elevations. The lower depths made is difficult to maintain the channel to tailwater head differential criteria of 1 to 2 feet.

Surface water velocities measured near the SSE and NSE met criteria (1.5 – 4.0 fps) 83.2% and 99.1% respectively (Tables 1 and 2). Water velocities measured near the SSE that met criteria were substantially lower than the previous four years. Inspections of diffuser gratings and gate openings will be made to determine if improvement in velocities can be attained.

Table 1. Summary of adult fishway inspections at Little Goose Dam, 2010. [1]

LITTLE GOOSE			----Not Enough Depth---			---Too Much Depth---		
Criteria and	**No. in**	**% In**	**No./%**	**No./%**	**No./%**	**No./%**	**No./%**	**No./%**
Locations	**Criteria/**	**Criteria/**	**Within**	**Within**	**>0.2**	**Within**	**Within**	**>0.2**
	No. on Sill/	% On	0.01-0.1	0.11-0.2	Foot	0.01-0.1	0.11-0.2	Foot
	No. of	**Sill**	**Foot**	**Foot**		**Foot**	**Foot**	
	Inspections							
Channel Velocities (S)	104	83.2	***	***	***	***	***	***
	***	***	***	***	***	***	***	***
	125							
Channel Velocities (N)	114	99.1	***	***	***	***	***	***
	***	***	***	***	***	***	***	***
	115							
Differentials								
Ladder Exit (staff)	125	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	125							
Ladder Weirs (staff)	125	100.0	0	0	0	0	0	0
	***	***	0.0	0.0	0.0	0.0	0.0	0.0
	125							
Counting Station (staff)	120	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	120							
South Shore (FSC)	122	97.6	1	0	0	2	0	0
	***	***	0.8	0.0	0.0	1.6	0.0	0.0
	125							
North Pwrhse (FSC)	122	97.6	1	0	0	1	0	1
	***	***	0.8	0.0	0.0	0.8	0.0	0.8
	125							
North Shore (FSC)	102	81.6	20	2	0	0	0	0
	***	***	16.0	1.6	0.0	0.0	0.0	0.0
	125							
Weir Depths								
SSE-1 (FSC)	124	99.2	1	0	0	***	***	***
	Not Applic.	***	0.8	0.0	0.0	***	***	***
	125							
SSE-2 (FSC)	123	98.4	2	0	0	***	***	***
	Not Applic.	***	1.6	0.0	0.0	***	***	***
	125							
NPE-1 (FSC)	42	33.6	0	0	0	***	***	***
	83	66.4	0.0	0.0	0.0	***	***	***
	125							
NPE-2 (FSC)	35	28.0	0	0	0	***	***	***
	77	61.6	0.0	0.0	0.0	***	***	***
	125							
NSE-1 (FSC)	124	99.2	1	0	0	***	***	***
	Not Applic.	***	0.8	0.0	0.0	***	***	***
	125							
NSE-2 (FSC)	123	98.4	0	0	2	***	***	***
	Not Applic.	***	0.0	0.0	1.6	***	***	***
	125							

[1] Data are from Appendix 1.

[2] "On sill" means the weir gate was bottomed out on its sill and within criteria at this location.

Table 2. Inspection in-criteria success rates for adult collection channel components at Little Goose Dam, 2006-2010.

Location	Collection Channel Success Rates - Annual Comparison				
	2006	2007	2008	2009	2010
Channel Surface Water Velocities					
Near SSE	100%	98.6%	100%	98.4%	83.2%
Near NSE	99.3%	88.8%	99.1%	74.3%	99.1%
Channel Head Differentials					
SSE	98.6%	96.4%	99.2%	98.4%	97.6%
NPE	98.6%	97.1%	97.5%	93.5%	97.6%
NSE	96.4%	95.7%	96.7%	90.3%	81.6%
Channel Weir Depths					
SSE1	96.4%	94.2%	100%	98.4%	99.2%
SSE2	97.1%	92.8%	100%	98.4%	98.4%
NPE1 without on-sill criteria	52.5%	31.9%	43.4%	49.2%	33.6%
NPE1 with on-sill criteria	85.6%	97.1%	98.3%	100%	100%
NPE2 without on-sill criteria	43.9%	31.2%	44.3%	49.2%	28.0%
NPE2 with on-sill criteria	96.4%	98.6%	98.4%	100%	89.6%
NSE1	81.3%	90.6%	100%	90.3%	99.2%
NSE2	92.1%	85.5%	98.4%	48.4%	98.4%

[1] Data compiled from Appendix 1, previous monitoring report appendixes and inspection forms for the years 2006-2009.

Average tailrace elevations in 2010 were similar to those recorded in 2006 - 2009 (Table 3). To enhance lotic conditions supporting juvenile fish out-migration, reservoirs were drafted down to minimum operating pool (MOP) elevations from April though September. During MOP, Lake Herbert G. West is operated between 537.0 and 538.0 as measured at Lower Monumental Dam. At Little Goose Dam, during the spring freshet tailrace elevations range one to four feet higher. After the freshet the tailrace elevations subsided to range from one to four tenths of a foot higher as measured at LMO.

Tailrace water elevations when simultaneously collected at the FSC for the SSE, NPE and NSE locations. These readings usually varied from 0 to 3 tenths of a foot. The variations are caused by the upwelling of water being released from the turbine draft tube and the number of and/or sequence of turbine units operating. In general, over the course of the season, water elevations are generally higher at the SSE and lowest at the NSE with the NPE ranging in-between. Table 3 doesn't reflect this observation at the NSE location. The FSC electronically measures the water surface using a transducer but debris collects and holds fast throughout the season at the location of the transducer. Water elevations were often exaggerated because woody debris floating on the surface of the water was measured in place of the actual water surface. However, manual observations and reading of staff gauges this general trend.

Table 3. Average tailrace water elevations at Little Goose Dam, 2006-2010.

Location	Average Tailrace Water Elevations Per FSC					
	2006	2007	2008	2009	2010	2006 – 2010 Average
SSE	538.82	538.16	538.38	538.60	538.82	538.56
NPE	538.84	537.94	538.38	538.65	538.84	538.53
NSE	538.91	538.02	538.44	538.68	538.91	538.99

Overall, average channel to tailwater head differentials in 2010 were most similar to those recorded in 2008 and 2009 (Table 4). NSE1 weir depth was significantly lower due to the weir sitting on sill for most of the season. NSE2 was also lower due to the hoist failure on November 25 and the weir lowering to sill over the last 14 inspections. Average weir depths for SSE and NPE were similar to those observed in 2008 – 2009.

Table 4. Average channel/tailwater differentials and weir depths for the adult fishway at Little Goose Dam, 2006-2010.[1]

Location	Average Differential or Depth in Feet Per FSC					
Head Differential	2006	2007	2008	2009	2010	2006 – 2010 Average
SSE	1.44	1.45	1.49	1.49	1.57	1.49
NPE	1.29	1.31	1.34	1.28	1.52	1.35
NSE	1.28	1.26	1.23	1.18	1.14	1.22
Weir Depth						
SSE-1	8.18	8.25	8.33	8.29	8.29	8.27
SSE-2	8.18	8.21	8.31	8.27	8.29	8.25
NPE-1	6.46	6.18	6.44	6.47	6.34	6.38
NPE-2	6.53	6.15	6.46	6.47	6.23	6.37
NSE-1	6.03	6.10	6.21	6.61	9.10	6.81
NSE-2	6.07	6.00	6.22	4.99[2]	6.61	5.98

[1] Data compiled from Appendix 1 and previous monitoring report appendixes for the years 2006-2009.

[2] Data does include weir gate in the raised position but not in the closed position.

Juvenile Fish Facility

Facility Description

The Little Goose Juvenile Fish Facility was designed to bypass juvenile salmon and steelhead to the tailrace, or transport them by truck and barge below Bonneville Dam. The bypass system includes extended length submersible bar screens in the turbine intakes, vertical barrier screens, 12-inch diameter gatewell orifices, a 14-inch diameter gatewell orifice, a collection channel running the length of the powerhouse, a dewatering structure, two emergency bypass routes, and a corrugated metal flume/outfall pipe.

The transport system includes a fish separator, fish distribution system, raceways, a sampling and marking building, truck and barge loading areas, and a passive integrated transponder (PIT) tag detection and diversion / bypass system. Untagged fish (without PIT tags) may also be bypassed from the transport system.

Facility Modifications

Several modifications were made prior to, during, and after the 2010 season. The more important modifications include:

Several modifications was made prior to, during, and after the 2010 season.

1. The bypass outfall flume was reconstructed and relocated. The new outfall was extended an additional 400 feet and constructed of 36" corrugated steel pipe. The extension of the outfall allows bypassed fish to re-enter mid- river in better downstream flow conditions ultimately improving downstream migration.

2. Upgrades to ESBS include new control systems for the cleaning brushes. The new controls consist of new proximity switches located on the screen and new PLC's located in the orifice gallery, a switch to change the brush cycle between 2 or 4 hours, an emergency stop switch, and a new touch screen computer interface to control ESBS functions by the dam operator.

3. In March of 2011, all pneumatic hoses and fittings were replaced on all 36 orifice air cylinders and valves.

4. Raceway tail screens were replaced in March of 2011. The new screens are 12.2 mm in width as measured from corner to corner. The old screen was 7.2 mm. The larger opening will allow juvenile lamprey to pass through without getting entangled.

5. A new underwater video camera, new monitor and new DVD recorder was purchased in 2010 to be used in underwater inspections of ESBS and VBS.

6. Pacific States Marine Fisheries Counsel installed a new PLC and Interface controller to operate the PIT-tag and sample gate system. The new components are an upgrade to improve sample and PIT-tag gate system performance.

Juvenile Fish Collection

In 2010, ESBS were lowered into operating position beginning on March 22 and ending on April 5. The juvenile fish passage channel was watered up on March 24 and the system was placed in primary bypass mode. Primary bypass operations occurred throughout April except for fish condition sampling and GBT monitoring.

Beginning May 1, at 0700 hours and continuing to October 31 at 0700 hours juvenile fish were collected for transportation. The 2010 collection total was the second lowest in recent years. An estimated total of 2,870,791 juvenile steelhead and salmon were collected. This includes fish estimates from condition sampling conducted in April. Composition by species and clip type was: clipped yearling Chinook *O. Tshawytscha* 22.4%, unclipped yearling Chinook 8.0%, clipped sub-yearling Chinook 10.0%, unclipped sub-yearling Chinook 20.2%, clipped steelhead 28.1%, unclipped steelhead 9.7%, clipped sockeye *O. nerka* <0.1%, unclipped sockeye 0.3%, and Coho *O. kisutch* 1.3%.

Barge transportation began May 1, at 0700 hours and ended August 16, at 0700 hours. A total of 2,718,936 smolts were collected during this time of which 2,712,735 (99.8%) fish were transported 6, 357 were mortalities and 68 Chinook fry were bypassed for continued growth.

Truck transportation began on August 16 at 0700 hours and ended at 0700 on October 31. A total of 11,224 fish were collected during this time of which 10,667 were transported, 297 were mortalities, and 260 were bypassed.

The maximum daily collection of 222,600 smolts occurred on May 20, representing 8.2% of the total collection for the season. This date was later than in previous years and coincided with the release of water from Dworshak Reservoir to assist juvenile fish migration, with flows increasing from 74.3 kcfs on May 19 to 96.4 kcfs on May 20. The peak collection dates for Chinook salmon, Coho, and unclipped sockeye were similar to recent years. The peak collection dates for steelhead and clipped sockeye were later than observed in recent years.

Bypass

In 2010 primary bypass began on March 23 and ended when collection for barge transportation began on May 1 at 0700 hours. There is no estimate of the number of fish that passed while the facility was in primary bypass mode. The facility performed

several abbreviated collections during April for SMP condition monitoring, and for WDFW GBT sampling. All fish were again bypassed back to the river.

Bypass totals during collection for transportation from May 1 at 0700 hours until October 31 at 0700 hours included 328 smolts, 260 of which were given to researchers from the USGS. The remaining 68 were salmonid fry under 60 mm in fork length which were bypassed back to the river for continued growth.

The facility was also placed into primary bypass on one occasion in 2010 for separator debris removal. This occurred on June 30 from 1400-1500 hours. During this time an unknown number of fish were bypassed back to the river.

Beginning April 1 and ending October 31 a total of 171,029 PIT tagged salmonids were detected within the juvenile collection/bypass system. Of this total, 22,969 PIT tag detections were recorded with unknown distribution. Detections of PIT tagged fish at exits leading to transport areas totaled 56,120 smolts. PIT tagged fish detected at river exits totaled 89,539 smolts. PIT tagged salmonids recorded entering the smolt monitoring subsample totaled 2,401. All PIT tagged live smolts in the subsample were either routed back to the river if the facility was operating in secondary bypass mode, or were transported during collection for transportation.

Primary bypass resumed October 31 and continued to December 16 when the juvenile fish collection channel was removed from service for the season. Again, the numbers of fish bypassed during this time are unknown.

Transportation

Juvenile salmonids collected for transport by barge were held in raceways or directly loaded into barges. Juveniles awaiting transportation by truck were held in tanks or loaded directly into the transport truck. Maximum fish holding time prior to transport varied from 24 to 48 hours depending on the transportation schedule. Transport time from Little Goose to the approved release point was approximately 2 days by barge or 6 hours by truck. Fish that were transported by truck were transported in a mild saline solution of 1mg/L to reduce stress and treat columnaris disease. In 2010, daily barging and direct loading operations occurred from May 2 to May 28, alternate day barging occurred from May 30 to August 16 and alternate day trucking occurred from August 18 to October 31. There were no incidents which resulted in transportation related mortalities during the 2010 season.

A total of 2,723,402 juvenile salmonids were transported from Little Goose in 2010, 99.6% by barge and 0.4% by truck/midi tank (Table 2). Salmonids transported by truck in 2010 were primarily (98.6%), unclipped subyearling Chinook salmon.

Adult Fallbacks

Fallbacks are adult Salmonids that have passed the dam and have entered the juvenile collection and bypass system. These adult sized fish were usually too large to pass between the separator bars. Fallback adults were identified by species and fin clip and assessed for condition prior to being released to the river.

A total of 5,426 adult fallbacks were removed from the sample or separator in 2010. Composition by species and clip type included 568 clipped and 408 unclipped adult Chinook salmon, 408 clipped and 372 unclipped jack or mini jack Chinook salmon, 1,755 clipped and 1,884 unclipped steelhead, 15 clipped and 7 unclipped sockeye, and 9 Coho. Many of the steelhead observed in April, May, and June were kelts. Of the 5,426 total fallbacks, 7 clipped and 2 unclipped mini-jacks occurred in the SMP sample after August 9. Mini-jacks are maturing salmon with a fork length of less than 300 mm.

In addition to adult salmon and steelhead, there were 11 white sturgeon, 9 bull trout, 10 adult Lamprey and numerous other adult incidental fish removed from the separator or sample. All fallback fish were released to the river.

Operations and Maintenance

Turbine Operation

Efforts were made to operate all turbine units within 1% limitation of best efficiency from April 1 to October 31. Best efficiency operations provide greatest fish passage survival through operating turbines. Reportable deviations consist of operations outside the 1% criteria for more than 15 minutes in duration and/or 5 or more periods of at least 5 minutes during a single calendar day. In 2010, all units were operated within the best efficiency range. There were no reportable deviations.

Drawdown inspections across trashracks and ESBS/VBS were performed according to the FPP. Heavy debris loading occurred with the high flows in June however the debris did not interfere with turbine operations. All drawdown inspection measurements were within criteria throughout the season. Debris removal using the trash rack rake occurred in 2010 but at a reduced rate due to mechanical problems.

In recent years, it has become evident that juvenile fish were being trapped in cooling water strainers. Beginning in March 2010, turbine unit cooling water strainers were checked weekly for juvenile fish entrapment. The cooling water originates from an inlet located in the scrollcase. The grating covering the inlet has open spaces large enough to allow small fish to pass through and thus getting trapped into the cooling water

system and strainer. In 2010 there were a total of 212 juvenile lamprey and 4 salmonid smolts, all mortalities collected from the strainers. Most of the fish, 171 or 80.7% were collected in the month of June simultaneously with the spring freshet.

Forebay Debris/Trashracks

Estimates of debris volume and location in the forebay were recorded daily during JFF inspections. Large accumulations of woody debris were present in the Little Goose forebay beginning June 7 and extending until mid July. The maximum debris estimate was reported on June 14 and consisted of 32,500 square feet of debris in the forebay.

As in past years, debris caused the majority of smolt injury and mortality. The debris was removed by spill, trash rack raking, gatewell debris dipping, separator debris cleanouts, and increased orifice rotations.

At the conclusion of MOP when forebay elevations were increased, debris floated from the banks and accumulated in the forebay. No blockages were reported during this latter time.

Temporary Spillway Weir

The SW was used in spillway one in 2010 and placed into operation on April 3 in the high crest position. The weir height was changed on May 13 to the low crest position. The SW was removed from operations May 18 at 0800 hours to May 20 at 1120 hours due to low numbers of adult fish moving upstream in the adult fish ladder. The idea was that the SW spill was producing adverse tailrace water conditions that reduced adult fish guidance into the adult fishway. Upon closure, an increase in adult fish numbers was immediately observed. On May 25 at 0800 hours, the SW was again removed from service to allow improved tailrace conditions for adult fish passage into the collection system and ladder fishway. Again, an observed increase in adult fish passage was immediately observed. The SW was returned to service on May 27 at 1520 hours in the high crest mode and continued to operate until August 5 at 0822 hours when it was removed from service for the remainder of the year.

Extended-Length Submersible Bar Screens

There was one ESBS failure that required forced turbine unit 3 out of service from April 23 to 27. There were several other ESBS outages due to tripped circuit breakers. All were short in duration and required resetting the breakers.

Underwater camera inspections were performed on ESBS 1A – 4C on April 26 - 28. The underwater camera failed on April 28. Using a borrowed camera from Ice Harbor video inspections of ESBS 2A – 6C were performed on June 29 – 30. This

camera also failed on June 30 preventing the inspection of ESBS 1A – 1C. During the video inspections ESBS were observed to be in good operating condition and clear of debris. The malfunctioning of the camera prevented video inspections for the remainder of the fish passage season. To compensate for the lack of video inspections, ESBS brush motors were manually operated using the PLC. All indicators (amperage, brush travel distance) were observed to verify proper operation.

ESBS cleaning brushes were programmed to automatically operate at two hour intervals in 2010. This frequency of cleaning brush operations reduced the amount of debris collected on the screens between brush cycles. This in turn, reduced debris swept up into the gatewell during each brush cycle and thereby helped to reduce orifices blockages.

Drawdown measurements were conducted on April 4, and weekly thereafter through June, every two weeks from July through October. All drawdown measurements met criteria.

Vertical Barrier Screens (VBS)

VBS were in good operating condition throughout the season. Scheduled inspections of the VBS were performed by underwater video camera concurrently with ESBS inspections. Thorough VBS inspections of screens 1A -1C, 4A- 4C and 6A- 6C were performed on December 13. All inspections showed VBS in good operating condition.

Gatewells

Scheduled inspections of the VBS were performed by underwater video camera concurrently with ESBS inspections. Thorough VBS inspections of screens 1A -1C, 4A- 4C and 6A- 6C were performed on December 13. All inspections showed VBS in good operating condition.

Orifices and Collection Channel

The juvenile collection channel and flume were placed into service March 24. Open orifices were increased from 18 to 21 on March 30. The collection channel was operated throughout the season with 20 to 23 open orifices depending on forebay elevations. Minimum operating pool (633.0 feet msl) plus 1’ elevation (MOP +1) occurred from April 1 through September 3.

Orifices were inspected and/or back-flushed at least once per shift from April 1 through May 22. Beginning May 23 and continuing through June 29 orifices inspections and back-flushing were increased in frequency in response to debris loading. Full-time

night shifts were added to the schedule solely to operate and back-flush orifices to clear and prevent debris blockages.

All orifice operations (opening, closing, backflushing) were manually performed throughout the year. The orifices, collection channel, dewatering structure and flume were taken out of service for winter maintenance on December 16.

Primary Dewatering Structure

Overall, the primary dewatering structure functioned adequately throughout the season. In January through March 2010 contractors completed improvements which included a new excess water downwell, underground plumbing to the pump chamber and tailrace, two new 42" valves and valve operators, and an access platform to service valves. All components operated satisfactorily throughout the season. Excess water was diverted to the adult fish channel pump chamber the entire season to help supplement flows for adult fish migration.

Flume

The primary bypass flume functioned satisfactorily in 2010. During winter maintenance 2010, the primary bypass outfall flume was relocated from near shore to mid channel. The relocation extended the release site approximately 400 feet towards the mid-channel. This new section of outfall is made of 36 inch corrugated metal pipe. The new point of release will allow bypassed fish to migrate downstream with less delay. The old point of release was located close to shore and further upstream where bypassed smolts were likely to be entrained into a back current eddy slowing downriver out migration. The flume was inspected during the winter maintenance period 2011 and observed in good condition and found free of obstructions and rough edges.

Separator

The separator was operated in a similar fashion as previous years. The water level was kept about 1 to 2 inches above the downstream ends of the A-side separator bars. At times the water level was lowered to force fish to pass through the bars. Heavy accumulations of debris occurred in the separator in June which prompted the facility to clean the separator on June 30. The facility was switched to primary bypass operations for 1 hour to clean debris from the separator. During debris removal, large numbers of ammocoete lamprey were salvaged and released to the river. During the winter maintenance period, the interior and exterior surfaces of the separator were cleaned and/or refurbished.

Sample System/PIT Tag System

The PIT tag detection and diversion systems at the lower Snake and Columbia River dams are maintained and operated by the Pacific States Marine Fisheries Commission. PIT tagged salmonids have been monitored for movement and behavior in the Columbia and Snake Rivers since 1987. At Little Goose Dam, there are 11 PIT tag monitors located throughout the JFF. A new "full flow" unit that monitors the juvenile flume upstream from the JFF was added in 2009.

In 2010, the PIT tag system at Little Goose performed satisfactorily. There were several scheduled power outages at the JFF which temporarily disabled the PIT tag interrogation equipment.

Truck/Barge Loading Operations

In 2010, daily barging and direct loading operations occurred on May 1 - 2 and May 3 through May 28, alternate day barging occurred from May 30 to August 16 and alternate day trucking occurred from August 16 to October 31. The loading boom and fish routing pipes and flumes performed satisfactorily. Barged fish were transported to a release point at mid-channel below Bonneville Dam.

The 3,500 gallon tanker semi-tractor combination assigned to LGO was not used in 2010. All truck transportation was performed using the one ton truck and 300-gallon midi-tank except on October 3 and 5 when fish collection exceeded the 300 gallon limit. On October 3, LGR trucked a portion of the fish collected and on October 5, LGR trucked all the fish collected using their 3,500 gallon tanker. Salt in small concentrations of approximately 1 g/L was added to the midi-tank water to treat potential Columnaris disease and reduce stress. In 2010 trucked fish were again released into the outfall fish flume located at the juvenile fish facility downstream of Bonneville dam. A total of 10,667 fish were trucked from LGO. Of these, there were 10 fish (sub-yearling Chinook) that resulted in mortalities. All the mortalities were the result of disease (presumed Columnaris).

Avian Predation

In 2010, contracted bird hazing activities at Little Goose took place from April 11 through June 19. Gulls (*Larus spp.*) were observed throughout the entire year with the peak period recorded between April 30 and May 24. This peak period occurred similar to 2009. During the peak period, daily observations ranged between 25 and 150 gulls. Beginning in late September and continuing through November in response to juvenile shad out migration, gull populations again increased with a maximum 50 gulls observed

on October 27. On average gull numbers were lower than that observed in previous years during this time of year.

Double Crested Cormorants (*Phalacrocorax auritus)* numbers continued to be lower in 2010 similar to 2009 and much lower than that observed in previous years. Cormorants were observed throughout the early juvenile fish migration season but their numbers were usually less than 10. The peak period for Cormorants occurred September through November also in response to juvenile shad out migration. During the peak period, up to 30 Cormorants were observed during a single sighting (October 27). The majority of the birds were counted within the area one half mile upstream and downstream of the dam. These numbers are far less than the 100 to 200 observed during the previous years (2005-2008) during the same period. The decline in 2009 and 2010 may be the result of lethal take for research purposes. Approximately 45 Cormorants were taken in the fall/winter of 2007-08 and 2008-09.

American White Pelicans (*Pelecanus erythrorhynchos*) sighting and numbers have increased over 2007 – 2009. In 2010, Pelican observations and numbers were less than that observed in 2009. One to six pelicans were observed in single sightings in the tailrace area in early May through early June.

Other piscivorous bird species observed during the 2010 season include Western Grebes (*Aechmophorus occidentalis*) and Caspian Terns (*Sterna caspia*).

Acronyms

APHIS – Animal and Plant Health Inspection Service.
BPA – Bonneville Power Administration
CRITFC – Columbia River Inter-Tribal Fish Commission
DDS – Diversion During Sample
ESBS – Extended Submersible Bar Screen
F – Fahrenheit (temperature scale)
FGE – Fish Guidance Efficiency
FPC – Fish Passage Commission
GBT – Gas Bubble Trauma
NMFS – National Marine Fisheries Service (Now known as NOAA Fisheries)
NOAA – National Oceanic and Atmospheric Administration
ODFW – Oregon Department of Fish Wildlife
PIT – Passive Integrated Transponder (tag)
PSMFC – Pacific States Marine Fisheries Commission
PTAGIS – PIT Tag Information System
RSW – Removable Spillway Weir
SW – Spillway Weir
USGS – United States Geological Service