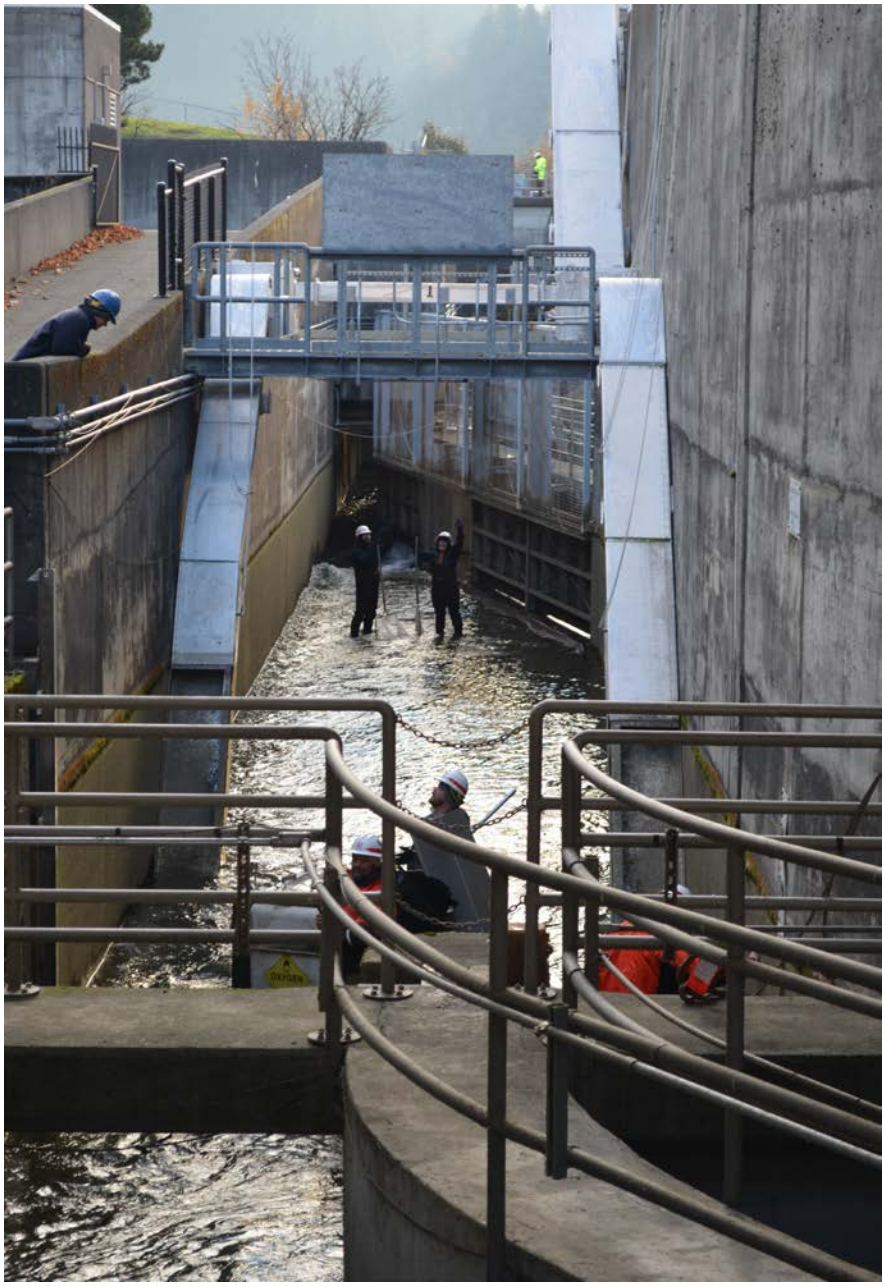
2018 Annual Fishway Status Report for Bonneville Project



Ben Hausmann, Brian Bissell,
Andrew Derugin, and Leif Halvorson

U. S. Army Corps of Engineers
Bonneville Lock & Dam
Cascade Locks, OR 97014
(541) 374-4598

Table of Contents

Glossary

AFF ---------- Adult Fish Facility. Research lab associated with the Washington Shore ladder.
AWS ---------- Auxiliary Water Supply.
B2CC ---------- Powerhouse Two Corner Collector. A surface bypass system located in the southern corner of the Bonneville Second Powerhouse forebay.
BI--- ---------- Bradford Island Fishway.
BIWW ---------- Bradford Island Wetted Wall.
BiOp ---------- Biological Opinion.
BPA ---------- Bonneville Power Association.
CI ---------- Cascades Island Fishway.
CC ---------- Collection Channel - Part of the adult fishway spanning the length of the downstream side of each powerhouse.
DSM2---------- Downstream Migrant transportation channel (PH2). Transport channel for juvenile fish from gatewell orifices to the juvenile transport pipe.
FDX---------- Full-duplex Pit detection; smaller and faster tag that can receive and transmit simultaneously.
FG ---------- Fish diffusion gate.
FGE ---------- Fish Guidance Efficiency.
FOG---------- Floating Orifice Gate.
Forebay---------- That area of a reservoir immediately upstream of a dam.
FPOM---------- Fish Passage Operations and Maintenance Coordination Team
FPP---------- Fish Passage Plan.
FU ---------- Fish Unit. Provides auxiliary water to PH2 entrance diffusers.
FV ---------- Fish Valve.
HDX ---------- Half-duplex Pit detection; larger & slower tag that transmits then receives.
ITS ---------- Ice and Trash Sluiceway.
IWW ---------- In water work period (01-December through 28-February).
JBS ---------- Juvenile Bypass System.
JMF ---------- Juvenile Monitoring Facility. Lab associated with the PH2 JBS.
LFS---------- Lamprey Flume System.
MU ---------- Main Unit. PH1 turbine units 1-10, PH2 units 11-18.
MUB ---------- Main Unit Breaker
NDE----- ---------- North Downstream Entrance. Overflow weir adult fishway entrances at PH2.
NUE---------- North Upstream Entrance. See NDE.
NOAA ---------- National Oceanic and Atmospheric Administration.
OOS---------- Out of Service.
PH1---------- Bonneville Powerhouse One.
PH2---------- Bonneville Powerhouse Two.
PIT ------ ---------- Passive Integrated Transponder. A tag inserted into juvenile and adult fish. Detectors are installed at all fish passage systems.
Project ---------- Bonneville Lock & Dam.
ROV ---------- Remotely Operated Vehicle.
SDE ---------- South Downstream Entrance. See NDE.
SLED ---------- Sea Lion Exclusion Device
SUE ---------- South Upstream Entrance. See NDE.
STS---------- Submersible Traveling Screen.
Tailrace---------- The portion of a river immediately downstream of a dam or powerhouse.
TDG---------- Total dissolved gas.
UMT----- ---------- Upstream Migrant Transportation channel. This channel connects Cascades Island ladder to Washington Shore ladder through PH2.
VBS ---------- Vertical Barrier Screen.
WDFW ---------- Washington Department of Fish & Wildlife.

1. INTRODUCTION

1.1 Introduction

This **2018** Project Fisheries Annual Report for Bonneville Project summarizes activities occurring from **01 December 2017 through 30 November 2018** and is required by the Fish Passage Plan (FPP), per section 3.3.4.

The Project includes two powerhouses, a spillway and one operating navigation lock. There are four adult fish ladders, located at each powerhouse and the north and south ends of the spillway for upstream migration. There are three Juvenile Bypass Systems (JBS) for downstream migration: an Ice and Trash Sluiceway (ITS) at Powerhouse 1 (PH1), a downstream migration transportation channel (DSM) at Powerhouse Two (PH2), and the corner collector at PH2 (B2CC).

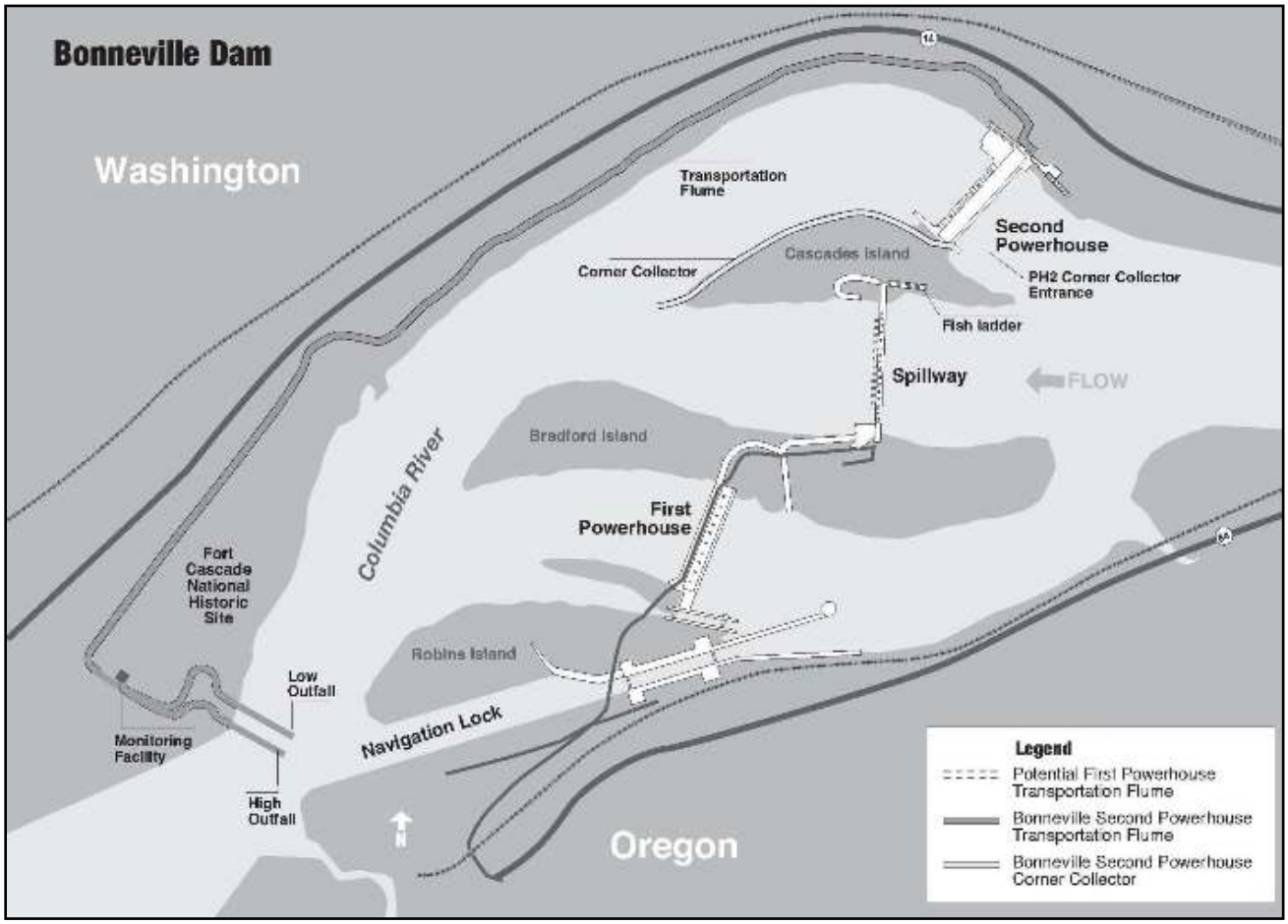


Figure 1. Bonneville Lock and Dam.

2. OPERATIONS

2.1 Fish Facility Outages

Table 1 shows the outage dates for Bonneville fishways, fish facilities, and lamprey passage structures.

Table 1. Seasonal fish facility outages.

Fish Facility	OOS Date 2017	In Service Date 2018	OOS Date 2018	Reason for Outage
BI Ladder	24-Nov	27-Feb	NA	2017-18 IWW period
A-branch	24-Nov	27-Feb	NA	2017-18 IWW period
B-branch	24-Nov	27-Feb	NA	2017-18 IWW period
CI Ladder	NA	NA	NA	No outage due to CI subsidence/bridge de-rating
WA Shore Ladder	NA	NA	1-Dec	2018-19 IWW period
UMT	NA	NA	1-Dec	2018-19 IWW period
BI LPS	31-Oct	6-Mar	31-Oct	End of Season / Maintenance
CI LPS	31-Oct	16-Apr	31-Oct	End of Season / Maintenance
WA AWS LPS	31-Oct	24-Apr	31-Oct	End of Season / Maintenance
NDE LFS/LPS	24-Aug	*4/10/2019	14-Sep	Low number of fish collected
BI Wetted Wall	NA	17-Mar		Operation Issues, low usage
B2CC	1-Sep	7-Apr	1-Sep	Opens with kelt trigger / closes with spill
DSM	27-Oct	20-Feb	19-Dec	Winter maintenance
AFF	15-Nov	24-Apr	7-Nov	End of Season / Maintenance
SMF	31-Oct	2-Mar	31-Oct	End of Season / Maintenance

*The NDE LFS/LPS was only operational M-Th until 20-May.

2.2 Turbine Outages

Table 2 shows turbine outages that lasted 24 hours or longer. Note that turbine outages lasting less than 24 hours did occur but are not included for the sake of brevity. Lengthier unit outages at PH1 were due to main unit breaker replacements.

Table 2. Turbine outages lasting greater than 24 hours.

Unit	Reason for Outage	Start Date	End Date	Duration
18	Exciter Issues	8/21/17 9:30	1/31/18 16:29	163 D, 6 H, 59 M
1	Bus Insp.	12/4/17 0:01	12/26/17 13:38	22 D, 13 H, 37 M
2	Bus Insp.	12/4/17 0:01	12/16/17 11:02	12 D, 11 H, 1 M
15	Annual Maint.	12/4/17 6:59	12/14/17 13:45	10 D, 6 H, 46 M
13	FGE / Thrust Collar Insp.	12/6/17 7:37	12/9/17 14:06	3 D, 6 H, 29 M
14	FGE / Thrust Collar Insp.	12/13/17 0:02	12/16/17 13:19	3 D, 13 H, 17 M
10	5 Year Overhaul	12/18/17 10:40	3/1/18 11:43	73 D, 1 H, 3 M
11	4 Year Overhaul	1/8/18 7:36	3/20/18 8:24	71 D, 48 M
16	Thrust Bearing Insp.	2/7/18 2:06	2/9/18 16:13	2 D, 14 H, 7 M
17	Forebay Dredging	2/7/18 9:27	2/9/18 16:19	2 D, 8 H, 52 M
18	Forebay Dredging	2/7/18 9:27	2/9/18 16:22	2 D, 8 H, 55 M

12	FGE / Thrust Collar Insp.	2/28/18 0:02	3/3/18 13:40	3 D, 13 H, 38 M
14	Governor Oil Issues	3/2/18 21:45	3/5/18 20:55	2 D, 23 H, 10 M
16	Annual / FGE / Thrust Collar Insp.	3/19/18 0:19	3/28/18 15:41	9 D, 15 H, 22 M
4	5 Year Overhaul	4/2/18 8:22	6/7/18 16:57	66 D, 8 H, 35 M
8	Disconnect / Annual	4/6/18 9:21	8/23/18 16:13	139 D, 6 H, 52 M
7	Disconnect / Annual	4/6/18 9:22	8/23/18 16:12	139 D, 6 H, 50 M
15	FGE Insp.	4/16/18 0:35	5/8/18 18:08	22 D, 17 H, 33 M
15	FGE Insp.	4/16/18 0:35	5/8/18 18:08	22 D, 17 H, 33 M
12	Annual Maint.	4/23/18 0:01	5/3/18 11:53	10 D, 11 H, 52 M
3	Annual Maint.	4/23/18 0:02	5/3/18 14:15	10 D, 14 H, 13 M
13	Annual Maint.	5/14/18 0:03	5/24/18 14:22	10 D, 14 H, 19 M
2	Annual Maint.	5/29/18 0:17	6/7/18 12:46	9 D, 12 H, 29 M
9	Annual Maint.	6/11/18 0:00	6/14/18 12:52	3 D, 12 H, 52 M
14	Annual Maint.	6/11/18 0:01	6/14/18 20:35	3 D, 20 H, 34 M
11	FGE Insp.	6/25/18 0:02	6/30/18 11:33	5 D, 11 H, 31 M
1	Wire Mods MU Breaker Upgrades	7/11/18 19:00	7/26/18 10:06	14 D, 15 H, 6 M
2	Wire Mods MU Breaker Upgrades	7/11/18 19:00	7/26/18 10:06	14 D, 15 H, 6 M
13	FGE / Thrust Collar Insp.	7/16/18 0:01	7/20/18 14:40	4 D, 14 H, 39 M
16	FGE Mods	7/23/18 0:01	7/29/18 9:00	6 D, 8 H, 59 M
17	Annual Maint.	7/23/18 0:01	7/29/18 9:00	6 D, 8 H, 59 M
15	Terminal Clearance	7/23/18 5:50	7/29/18 9:00	6 D, 3 H, 10 M
18	Terminal Clearance	7/23/18 5:50	7/29/18 9:00	6 D, 3 H, 10 M
5	North Main Bus Outage	7/23/18 16:54	8/23/18 16:13	30 D, 23 H, 19 M
6	North Main Bus Outage	7/23/18 16:54	8/23/18 16:13	30 D, 23 H, 19 M
11	BPA Relay Maint.	8/6/18 7:30	8/13/18 9:16	7 D, 1 H, 46 M
12	BPA Relay Maint.	8/6/18 7:30	8/9/18 16:10	3 D, 8 H, 40 M
9	North Main Bus Outage	8/20/18 0:02	8/22/18 17:22	2 D, 17 H, 20 M
10	North Main Bus Outage	8/20/18 0:02	8/22/18 17:22	2 D, 17 H, 20 M
1	Turbine Bearing Oil Pump Failure	8/20/18 11:30	8/21/18 14:10	1 D, 2 H, 40 M
12	FGE Mods	9/10/18 0:07	9/15/18 15:26	5 D, 15 H, 19 M
7	Bus Insp.	9/21/18 0:01	10/4/18 19:09	13 D, 19 H, 8 M
8	Bus Insp.	9/21/18 0:01	10/4/18 19:09	13 D, 19 H, 8 M
9	Bus Insp.	9/21/18 0:01	10/4/18 17:00	13 D, 16 H, 59 M
10	Bus Insp.	9/21/18 0:01	10/4/18 17:00	13 D, 16 H, 59 M
13	4 Year Overhaul	10/1/18 7:02	11/26/18 9:23	56 D, 2 H, 21 M
6	Exciter Issues	11/26/18 7:18	11/28/18 14:18	2 D, 7 H

2.3 Fish Removal

Fish passage facilities and turbine units are taken out of service and dewatered to allow for inspection, preventative maintenance, repairs, and modifications. As facilities and turbine units are dewatered, project biologists follow procedures outlined in the FPP and detailed in the Fish Salvage Plan to minimize impacts on fish. Adult salmonids and adult lamprey are generally released into the forebay above the new navigation lock. Juvenile salmonids, juvenile lamprey, and sturgeon are generally released below the dam at the Hamilton Island boat launch. The following is a summary of the number of fish that were removed during facility and turbine unit dewaterings. All fish were recovered in good condition unless otherwise noted.

Table 3. Fish salvages at Bonneville December 2017 – November 2018

Date	Location	Fish Salvaged	Release Site
12-Dec	A-Branch Diffuser Pits	~20 adult Pacific Lamprey, 4 juvenile lamprey, 9 juvenile salmonids, ~40 juvenile suckers, catfish, Centrarchids, and Cyprinids.	Forebay
14-Dec	MU 15 Tail Logs	5 sculpin & 1 juvenile lamprey.	Tailrace
19-Dec	MU 10 Scroll Case	~120 American Shad, ~80 juvenile salmonids, 1 sculpin, & 3 juvenile Centrarchids.	Tailrace
19-Dec	MU 10 Draft Tube	1 sculpin, & ~15 juvenile salmonids.	Tailrace
9-Jan	MU 11 Scroll Case	7 juvenile salmonids, & 1 Cyprinid.	Tailrace
9-Jan	MU 11 Draft Tube	1 sculpin, & ~15 juvenile salmonids.	Tailrace
25-Jan	MU 18 Tail Logs	1 sculpin, & 4 juvenile lamprey.	Tailrace
28-Feb	MU 10 Tail Logs	~20 sculpin, ~15 juvenile lamprey, & 1 Centrarchid.	Tailrace
6-Mar	Nav Lock Sill Basin	2 sculpins, 2 crayfish, & 1 Centrarchid.	Forebay
3-Apr	MU 4 Scroll Case	~24 juvenile salmonids.	Tailrace
3-Apr	MU 4 Draft Tube	2 juvenile salmonids.	Tailrace
5-Jun	CI LPS	10 adult Pacific Lamprey.	Forebay
5-Jun	MU 4 Tail Logs	1 White Sturgeon, 1 adult Pacific Lamprey, ~15 juvenile lamprey, & 7 sculpin.	Tailrace
17-Jul	MU 8 Tail Logs	2 sculpins.	Tailrace
2-Oct	MU 13 Draft Tube	10 White Sturgeon.	Forebay
7-Nov	AFF	1 juvenile salmonid, ~10 juvenile lamprey, ~500 American Shad, & ~100 sucker & Cyprinids.	Tailrace

2.4 Fish Unit Outages

A list identifying every closure for fish units 1 and 2 is shown in Table 4. Throughout the year, the fish units are cleaned using a crane-operated trash rake during working hours. On weekends when personnel are unavailable to operate the trash rake, debris accumulation may occur to the point of causing excessive drawdowns, requiring the units to be floated to prevent potential trash rack or unit damage. During high debris loading, this may also occur overnight between daytime trash raking. When floating, the units may be placed in standby between the hours of 2200 and 0400 to minimize impact on adult fish passage. An adjacent unit is then operated to pull trash away from the fish unit trashracks. Lamprey Operations June 1–August 31: Reduce fish unit output to operate all north (NUE, NDE) and south (SUE, SDE) entrances at 0.5' of entrance head. To ensure proper function of fish units, B2 fish unit output can be further reduced or placed on standby to float debris as necessary from 2200-0400 hours.

Table 4. List of fish unit outages.

				Duration		
Unit	**Reason**	**OOS**	**RTS**	**RS**	**Lamprey Ops**	**Total**
F1	Reserved Service	12/3/17 18:52	12/3/17 19:15	0:23		23 minutes
F1	Annual Maint.	12/3/17 19:15	12/8/17 4:36	4:09		4 days, 9 hours, 21 minutes
F2	Reserved Service	12/6/17 18:27	12/6/17 22:08	3:41		3 hours, 41 minutes
F2	Reserved Service	12/7/17 19:29	12/7/17 21:53	2:24		2 hours, 24 minutes
F2	Reserved Service	12/8/17 0:07	12/8/17 6:22	6:15		6 hours, 15 minutes
F1	Reserved Service	12/8/17 6:31	12/8/17 7:13	0:42		42 minutes
F1	Reserved Service	12/10/17 19:33	12/11/17 0:14	4:41		4 hours, 41 minutes
F2	Reserved Service	12/10/17 19:33	12/11/17 0:01	4:28		4 hours, 28 minutes
F2	2 Year Overhaul	12/11/17 0:01	2/22/18 16:51	1:16		73 days, 16 hours, 50 minutes
F1	Reserved Service	12/11/17 20:21	12/12/17 1:14	4:53		4 hours, 53 minutes
F1	Excessive Drawdown	12/13/17 19:04	12/13/17 20:23	1:19		1 hours, 19 minutes
F1	Excessive Drawdown	12/24/17 19:53	12/25/17 0:01	4:08		4 hours, 8 minutes
F1	Excessive Drawdown	1/1/18 15:45	1/1/18 16:46	1:01		1 hours, 1 minutes
F1	Reserved Service	1/2/18 11:08	1/2/18 11:17	0:09		9 minutes
F1	Reserved Service	1/2/18 12:42	1/2/18 12:49	0:07		7 minutes
F1	Reserved Service	1/3/18 18:19	1/3/18 22:40	4:21		4 hours, 21 minutes
F1	Reserved Service	1/14/18 20:51	1/15/18 1:47	4:56		4 hours, 56 minutes
F1	Excessive Drawdown	1/17/18 8:47	1/17/18 10:49	2:02		2 hours, 2 minutes
F1	Dredging Forebay	2/7/18 9:28	2/9/18 16:44	2:07		2 days, 7 hours, 16 minutes
F1	Reserved Service	2/20/18 19:18	2/20/18 21:12	1:54		1 hours, 54 minutes

F2	Reserved Service	2/26/18 10:49	2/26/18 14:45	3:56		3 hours, 56 minutes
F1	Reserved Service	2/26/18 10:49	2/26/18 14:45	3:56		3 hours, 56 minutes
F1	U11 Tail Log Recovery	3/16/18 9:37	3/16/18 12:25	2:48		2 hours, 48 minutes
F2	U11 Tail Log Recovery	3/16/18 9:37	3/16/18 12:25	2:48		2 hours, 48 minutes
F2	Reserved Service	5/12/18 21:59	5/13/18 3:01	5:02		5 hours, 2 minutes
F1	Reserved Service	5/13/18 0:09	5/13/18 2:51	2:42		2 hours, 42 minutes
F2	Reserved Service	5/13/18 21:22	5/14/18 0:39	3:17		3 hours, 17 minutes
F1	Reserved Service	5/13/18 22:46	5/14/18 0:38	1:52		1 hours, 52 minutes
F2	Reserved Service	5/14/18 21:19	5/15/18 0:20	3:01		3 hours, 1 minutes
F1	Reserved Service	5/14/18 22:33	5/15/18 0:20	1:47		1 hours, 47 minutes
F2	Reserved Service	5/15/18 21:25	5/16/18 0:20	2:55		2 hours, 55 minutes
F2	Reserved Service	5/16/18 18:55	5/16/18 19:47	0:52		52 minutes
F1	Reserved Service	5/16/18 19:51	5/16/18 20:31	0:40		40 minutes
F2	Reserved Service	5/17/18 19:35	5/17/18 20:17	0:42		42 minutes
F2	Reserved Service	5/18/18 18:46	5/18/18 20:01	1:15		1 hours, 15 minutes
F1	Reserved Service	5/18/18 20:04	5/18/18 21:42	1:38		1 hours, 38 minutes
F2	Reserved Service	5/18/18 22:41	5/19/18 0:14	1:33		1 hours, 33 minutes
F2	Reserved Service	5/20/18 4:34	5/20/18 5:00	0:26		26 minutes
F2	Reserved Service	5/20/18 22:36	5/20/18 23:47	1:11		1 hours, 11 minutes
F1	Reserved Service	5/20/18 23:15	5/20/18 23:48	0:33		33 minutes
F2	Reserved Service	5/22/18 18:13	5/22/18 19:09	0:56		56 minutes
F2	Reserved Service	5/24/18 16:23	5/24/18 16:45	0:22		22 minutes
F1	Reserved Service	5/24/18 16:24	5/24/18 16:40	0:16		16 minutes
F2	Reserved Service	5/25/18 16:31	5/25/18 21:09	4:38		4 hours, 38 minutes
F1	Reserved Service	5/25/18 17:44	5/25/18 20:42	2:58		2 hours, 58 minutes
F2	Reserved Service	5/27/18 19:04	5/27/18 22:40	3:36		3 hours, 36 minutes
F2	Reserved Service	5/29/18 1:14	5/29/18 4:34	3:20		3 hours, 20 minutes
F1	Reserved Service	5/29/18 1:14	5/29/18 4:32	3:18		3 hours, 18 minutes

F2	RS / Lamprey Ops	6/1/18 0:07	6/1/18 4:20		4:13	4 hours, 13 minutes
F2	RS / Lamprey Ops	6/1/18 22:05	6/2/18 4:34	0:34	5:55	6 hours, 29 minutes
F2	RS / Lamprey Ops	6/2/18 22:01	6/3/18 4:33	0:33	5:59	6 hours, 32 minutes
F2	RS / Lamprey Ops	6/3/18 21:49	6/3/18 21:54	0:05		5 minutes
F1	RS / Lamprey Ops	6/3/18 21:54	6/4/18 1:48	0:06	3:48	3 hours, 54 minutes
F2	RS / Lamprey Ops	6/4/18 1:49	6/4/18 4:31	0:31	2:11	2 hours, 42 minutes
F2	RS / Lamprey Ops	6/4/18 22:00	6/5/18 4:32	0:32	6:00	6 hours, 32 minutes
F2	RS / Lamprey Ops	6/5/18 22:01	6/6/18 4:31	0:31	5:59	6 hours, 30 minutes
F1	RS / Lamprey Ops	6/6/18 21:59	6/7/18 4:27	0:28	6:00	6 hours, 28 minutes
F2	RS / Lamprey Ops	6/7/18 22:00	6/8/18 4:00	0:00	6:00	6 hours
F2	RS / Lamprey Ops	6/8/18 22:00	6/9/18 4:27	0:27	6:00	6 hours, 27 minutes
F2	RS / Lamprey Ops	6/9/18 22:02	6/10/18 4:29	0:29	5:58	6 hours, 27 minutes
F2	RS / Lamprey Ops	6/10/18 22:29	6/11/18 4:39	0:39	5:31	6 hours, 10 minutes
F2	RS / Lamprey Ops	6/11/18 22:01	6/12/18 4:28	0:28	5:59	6 hours, 27 minutes
F2	RS / Lamprey Ops	6/12/18 21:58	6/13/18 4:44	0:46	6:00	6 hours, 46 minutes
F2	RS / Lamprey Ops	6/14/18 21:57	6/15/18 2:57	0:03	4:57	5 hours
F1	RS / Lamprey Ops	6/15/18 3:01	6/15/18 4:20	0:20	0:59	1 hours, 19 minutes
F2	RS / Lamprey Ops	6/15/18 21:57	6/16/18 4:03	0:06	6:00	6 hours, 6 minutes
F2	RS / Lamprey Ops	6/16/18 22:52	6/17/18 4:02	0:02	5:08	5 hours, 10 minutes
F2	RS / Lamprey Ops	6/17/18 21:31	6/18/18 4:29	0:58	6:00	6 hours, 58 minutes
F2	RS / Lamprey Ops	6/18/18 21:31	6/19/18 4:31	1:00	6:00	7 hours
F2	RS / Lamprey Ops	6/19/18 21:31	6/20/18 4:36	1:05	6:00	7 hours, 5 minutes
F2	RS / Lamprey Ops	6/20/18 21:35	6/21/18 4:30	0:55	6:00	6 hours, 55 minutes
F1	RS / Lamprey Ops	6/21/18 23:12	6/22/18 1:57		2:45	2 hours, 45 minutes
F2	RS / Lamprey Ops	6/22/18 1:58	6/22/18 4:30	0:30	2:02	2 hours, 32 minutes
F2	RS / Lamprey Ops	6/22/18 21:31	6/23/18 4:35	1:04	6:00	7 hours, 4 minutes
F2	RS / Lamprey Ops	6/26/18 22:00	6/27/18 4:02	0:02	6:00	6 hours, 2 minutes
F1	RS / Lamprey Ops	6/27/18 21:26	6/28/18 4:18	0:52	6:00	6 hours, 52 minutes
F2	RS / Lamprey Ops	6/28/18 21:26	6/29/18 4:31	1:05	6:00	7 hours, 5 minutes
F2	RS / Lamprey Ops	6/29/18 21:29	6/30/18 4:27	0:58	6:00	6 hours, 58 minutes
F2	RS / Lamprey Ops	6/30/18 21:29	7/1/18 4:31	1:02	6:00	7 hours, 2 minutes
F2	RS / Lamprey Ops	7/1/18 21:58	7/2/18 4:30	0:32	6:00	6 hours, 32 minutes
F2	RS / Lamprey Ops	7/2/18 22:00	7/3/18 4:30	0:30	6:00	6 hours, 30 minutes
F2	RS / Lamprey Ops	7/3/18 22:01	7/4/18 4:34	0:34	5:59	6 hours, 33 minutes

F2	RS / Lamprey Ops	7/4/18 21:58	7/5/18 4:25	0:27	6:00	6 hours, 27 minutes
F2	RS / Lamprey Ops	7/5/18 21:56	7/6/18 4:29	0:33	6:00	6 hours, 33 minutes
F2	RS / Lamprey Ops	7/6/18 22:01	7/7/18 4:39	0:39	5:59	6 hours, 38 minutes
F1	RS / Lamprey Ops	7/7/18 22:00	7/8/18 4:31	0:31	6:00	6 hours, 31 minutes
F2	RS / Lamprey Ops	7/8/18 22:00	7/9/18 4:29	0:29	6:00	6 hours, 29 minutes
F1	RS / Lamprey Ops	7/9/18 22:00	7/10/18 4:30	0:30	6:00	6 hours, 30 minutes
F2	RS / Lamprey Ops	7/10/18 22:00	7/11/18 4:29	0:29	6:00	6 hours, 29 minutes
F2	RS / Lamprey Ops	7/11/18 22:02	7/12/18 4:32	0:32	5:58	6 hours, 30 minutes
F1	RS / Lamprey Ops	7/12/18 13:32	7/12/18 13:44	0:12		12 minutes
F2	RS / Lamprey Ops	7/12/18 13:48	7/12/18 13:57	0:09		9 minutes
F2	RS / Lamprey Ops	7/12/18 22:01	7/13/18 4:30	0:30	5:59	6 hours, 29 minutes
F2	RS / Lamprey Ops	7/13/18 22:02	7/14/18 4:36	0:36	5:58	6 hours, 34 minutes
F2	RS / Lamprey Ops	7/14/18 22:36	7/15/18 4:32	0:32	5:24	5 hours, 56 minutes
F2	RS / Lamprey Ops	7/15/18 21:57	7/16/18 4:33	0:36	6:00	6 hours, 36 minutes
F2	RS / Lamprey Ops	7/16/18 21:59	7/17/18 5:07	1:08	6:00	7 hours, 8 minutes
F2	RS / Lamprey Ops	7/17/18 21:56	7/18/18 4:49	0:53	6:00	6 hours, 53 minutes
F2	RS / Lamprey Ops	7/18/18 22:05	7/19/18 4:30	0:30	5:55	6 hours, 25 minutes
F2	RS / Lamprey Ops	7/19/18 22:03	7/20/18 4:30	0:30	5:57	6 hours, 27 minutes
F2	RS / Lamprey Ops	7/20/18 21:59	7/21/18 4:30	0:31	6:00	6 hours, 31 minutes
F1	RS / Lamprey Ops	7/21/18 22:00	7/22/18 4:23	0:23	6:00	6 hours, 23 minutes
F2	RS / Lamprey Ops	7/22/18 22:24	7/23/18 4:28	0:28	5:36	6 hours, 4 minutes
F2	RS / Lamprey Ops	7/23/18 22:01	7/24/18 4:31	0:31	5:59	6 hours, 30 minutes
F1	RS / Lamprey Ops	7/24/18 22:03	7/25/18 4:34	0:34	5:57	6 hours, 31 minutes
F2	RS / Lamprey Ops	7/25/18 22:00	7/26/18 4:30	0:30	6:00	6 hours, 30 minutes
F1	RS / Lamprey Ops	7/26/18 22:01	7/27/18 4:29	0:29	5:59	6 hours, 28 minutes
F2	RS / Lamprey Ops	7/27/18 22:01	7/28/18 4:30	0:30	5:59	6 hours, 29 minutes
F2	RS / Lamprey Ops	7/28/18 22:00	7/29/18 4:31	0:31	6:00	6 hours, 31 minutes
F2	RS / Lamprey Ops	7/29/18 22:00	7/30/18 4:31	0:31	6:00	6 hours, 31 minutes
F1	RS / Lamprey Ops	7/30/18 22:07	7/31/18 4:35	0:35	5:53	6 hours, 28 minutes

F2	RS / Lamprey Ops	7/31/18 22:09	8/1/18 5:00	1:00	5:51	6 hours, 51 minutes
F2	RS / Lamprey Ops	8/1/18 22:00	8/2/18 5:00	1:00	6:00	7 hours
F1	RS / Lamprey Ops	8/2/18 21:46	8/3/18 4:59	1:13	6:00	7 hours, 13 minutes
F2	RS / Lamprey Ops	8/3/18 21:45	8/4/18 5:00	1:15	6:00	7 hours, 15 minutes
F1	RS / Lamprey Ops	8/4/18 21:45	8/5/18 5:01	1:16	6:00	7 hours, 16 minutes
F2	RS / Lamprey Ops	8/5/18 21:45	8/5/18 22:08	0:15	0:08	23 minutes
F2	RS / Lamprey Ops	8/5/18 22:18	8/6/18 7:30	3:30	5:42	9 hours, 12 minutes
F1	RS / Lamprey Ops	8/6/18 6:11	8/6/18 7:30	1:19		1 hours, 19 minutes
F1	BPA Relay Maint.	8/6/18 7:30	8/9/18 14:27	3:06		3 days, 6 hours, 57 minutes
F2	BPA Relay Maint.	8/6/18 7:30	8/9/18 15:04	3:07		3 days, 7 hours, 34 minutes
F2	BPA Relay Maint.	8/9/18 15:56	8/13/18 7:47	3:15		3 days, 15 hours, 51 minutes
F2	RS / Lamprey Ops	8/13/18 22:09	8/14/18 4:29	0:29	5:51	6 hours, 20 minutes
F1	RS / Lamprey Ops	8/14/18 21:45	8/15/18 5:01	1:16	6:00	7 hours, 16 minutes
F2	RS / Lamprey Ops	8/15/18 21:45	8/16/18 5:00	1:15	6:00	7 hours, 15 minutes
F2	RS / Lamprey Ops	8/16/18 20:52	8/17/18 5:03	2:11	6:00	8 hours, 11 minutes
F2	RS / Lamprey Ops	8/17/18 20:44	8/18/18 4:57	2:13	6:00	8 hours, 13 minutes
F1	RS / Lamprey Ops	8/18/18 20:27	8/19/18 4:55	2:28	6:00	8 hours, 28 minutes
F2	RS / Lamprey Ops	8/19/18 20:37	8/20/18 4:57	2:02	6:00	8 hours, 20 minutes
F2	RS / Lamprey Ops	8/20/18 20:27	8/21/18 4:55	2:28	6:00	8 hours, 28 minutes
F1	RS / Lamprey Ops	8/21/18 20:30	8/22/18 5:01	2:31	6:00	8 hours, 31 minutes
F2	RS / Lamprey Ops	8/22/18 20:30	8/23/18 5:00	2:03	6:00	8 hours, 30 minutes
F1	RS / Lamprey Ops	8/23/18 20:30	8/24/18 4:59	2:29	6:00	8 hours, 29 minutes
F2	RS / Lamprey Ops	8/24/18 20:31	8/25/18 5:00	2:29	6:00	8 hours, 29 minutes
F2	RS / Lamprey Ops	8/25/18 20:30	8/26/18 5:02	2:32	6:00	8 hours, 32 minutes
F2	RS / Lamprey Ops	8/26/18 20:30	8/26/18 23:10	1:30	1:10	2 hours, 40 minutes
F1	RS / Lamprey Ops	8/26/18 23:11	8/27/18 2:00		2:49	2 hours, 49 minutes
F2	RS / Lamprey Ops	8/27/18 2:01	8/27/18 4:59	0:59	1:59	2 hours, 58 minutes
F2	RS / Lamprey Ops	8/27/18 20:30	8/28/18 5:02	2:32	6:00	8 hours, 32 minutes
F1	RS / Lamprey Ops	8/28/18 20:30	8/28/18 23:31	1:30	1:31	3 hours, 1 minutes
F2	RS / Lamprey Ops	8/28/18 23:33	8/29/18 5:00	1:00	4:27	5 hours, 27 minutes
F2	RS / Lamprey Ops	8/29/18 20:37	8/30/18 5:02	2:25	6:00	8 hours, 25 minutes

F2	RS / Lamprey Ops	8/30/18 20:27	8/31/18 4:58	2:31	6:00	8 hours, 31 minutes
F2	RS / Lamprey Ops	8/31/18 20:30	9/1/18 4:04	1:34	6:00	7 hours, 34 minutes
F1	Reserved Service	9/2/18 20:27	9/3/18 13:29	17:02		17 hours, 2 minutes
F2	Reserved Service	9/7/18 0:05	9/7/18 3:41	3:36		3 hours, 36 minutes
F2	Reserved Service	9/20/18 12:38	9/21/18 16:04	1:03		1 days, 3 hours, 26 minutes
F1	Reserved Service	9/22/18 1:56	9/24/18 10:01	2:08		2 days, 8 hours, 5 minutes
F2	Reserved Service	9/26/18 20:14	9/27/18 15:03	18:49		18 hours, 49 minutes
F1	Reserved Service	9/27/18 15:12	9/27/18 15:23	0:11		11 minutes
F2	Reserved Service	9/28/18 4:30	9/28/18 16:36	12:06		12 hours, 6 minutes
F2	Reserved Service	9/28/18 23:59	9/30/18 18:07	1:18		1 days, 18 hours, 8 minutes
F1	Reserved Service	10/1/18 4:57	10/1/18 14:37	9:40		9 hours, 40 minutes
F2	Reserved Service	10/1/18 21:08	10/3/18 16:48	1:19		1 days, 19 hours, 40 minutes
F2	Reserved Service	10/3/18 23:52	10/4/18 5:39	5:47		5 hours, 47 minutes
F2	Reserved Service	10/4/18 10:25	10/5/18 7:00	20:35		20 hours, 35 minutes
F1	Reserved Service	10/6/18 15:54	10/7/18 6:02	14:08		14 hours, 8 minutes
F2	Reserved Service	10/7/18 15:02	10/9/18 13:46	1:22		1 days, 22 hours, 44 minutes
F2	Reserved Service	10/21/18 9:49	10/22/18 7:44	21:55		21 hours, 55 minutes
F2	Reserved Service	10/23/18 1:58	10/23/18 2:05	0:07		7 minutes
F2	Reserved Service	10/31/18 11:32	10/31/18 14:27	2:55		2 hours, 55 minutes
F2	Reserved Service	11/11/18 2:16	11/11/18 4:45	2:29		2 hours, 29 minutes
F1	Reserved Service	11/11/18 18:00	11/11/18 20:11	2:11		2 hours, 11 minutes
F2	Reserved Service	11/12/18 4:38	11/12/18 5:04	0:26		26 minutes
F1	Reserved Service	11/12/18 4:52	11/12/18 5:06	0:14		14 minutes
F2	Reserved Service	11/12/18 14:50	11/12/18 15:43	0:53		53 minutes
F1	Reserved Service	11/12/18 15:45	11/12/18 16:45	1:00		1 hour
F2	Reserved Service	11/12/18 18:10	11/12/18 21:32	3:22		3 hours, 22 minutes
F1	Reserved Service	11/12/18 19:46	11/12/18 21:27	1:41		1 hours, 41 minutes

F2	Reserved Service	11/13/18 22:08	11/14/18 2:20	4:12		4 hours, 12 minutes
F1	Reserved Service	11/13/18 22:59	11/14/18 2:16	3:17		3 hours, 17 minutes
F2	Reserved Service	11/18/18 19:19	11/19/18 0:00	4:41		4 hours, 41 minutes
F1	Reserved Service	11/18/18 21:54	11/19/18 0:00	2:06		2 hours, 6 minutes
F2	Reserved Service	11/25/18 0:01	11/25/18 4:48	4:47		4 hours, 47 minutes
F1	Reserved Service	11/26/18 15:52	11/26/18 16:42	0:50		50 minutes
F2	Reserved Service	11/26/18 15:55	11/26/18 16:34	0:39		39 minutes
F2	Reserved Service	11/28/18 13:41	11/28/18 14:14	0:33		33 minutes

3. FISH PASSAGE PLAN COMPLIANCE

3.1 Fish Passage Plan Violations

Project Fisheries and the control room operators conduct inspections each day during fish passage season, and at least 3 days per week during winter maintenance. Project Biologists conducted 295 daily fishway inspections. Listed below are the FPP violations and the percentage of days the item was in criteria based on Project Biologist's inspections only (Table 4). Items in criteria 100% of the time are not listed. Explanations for items that were in criteria less than 90% of the reporting year, or having unusual circumstances, are given below.

Table 5. Fish Passage Plan violations and percent in criteria.

Violation	Occurrences	In Criteria (%)
Missed inspections by Project Biologists	19	94%
Calibration Occurred	22	58%
Avian Arrays	295	0%
PH1 Violations		
Sub/Diff: PH1 S	28	91%
Sub/Diff: PH1 N	21	93%
Depth over weir: A-branch	95	68%
A-branch diffusers: FG3−3-8	6	98%
B-Branch diffusers: FG3−18-33	15	95%
B-branch entrance differential	37	87%
B-branch telescopic gates	34	88%
PH2 Violations		
Cascades Island diffusers: FG6−5-20	210	29%
Cascades Island entrance differential	15	95%
Depth over weir at UMT	14	95%
Sub/Diff: PH2 NUE	7	98%
Sub/Diff: PH2 NDE	89	70%
Sub/Diff: PH2 SUE	27	91%

Sub/Diff: PH2 SDE	79	73%
PH2 diffusers:	80	73%
Depth over weir 37	9	97%
Depth over weir 38	35	88%

*Calibrations did not occur during the IWW period. Regrettably due to staffing and equipment issues in 2018 a number of additional spillway calibrations did not occur.

*Bonneville had the majority of its avian lines broken due to ice storms during the 2016/17 winter and PH2 lines are still awaiting reinstallation.

*The FV3-7 conduit "A-branch leak" has been a known issue for some years now. Slightly higher than normal depth at the staff gauge (1.2' vs the targeted 0.9-1.1') has typically been observed.

*Due to both B-branch diffuser and telescopic gate issues a number of slightly higher or lower entrance differentials were observed.

*B-branch has two telescopic sluice gates located on the south partition of the fishway entrance. These mechanical gates open and close at lower tailwater levels to achieve optimal hydraulic attractions at the fishway entrance. Historically both of these gates (SW-SG-4N and 4S) have had mechanical and electrical issues.

*On 01 May 2018, Cascades Island FG6-11 was found broken partially open. The diffuser shaft had broken away from the motor. Due to the subsidence issues at Cascades Island, repairs cannot occur until crane support is allowed in the vicinity.

*On 18 August 2018, Cascades Island FG6-12 was found to be mechanically bound in the open position. FG6-12 should only be open with tailwaters ranging from 11.0'-33.0'. Due to the subsidence issues at Cascades Island, repairs cannot occur until crane support is allowed in the vicinity.

*On 13 September 2018, Cascades Island FG6-14 was manually closed, due to issues surrounding FG6-11 and FG6-12 (see above). Through trial and error this was found to help facilitate FPP entrance differential criteria and alleviate "boiling" from adjacent diffusers within the Cascades Island fishway. FG6-14 should be open during tailwaters of 9.0'-28.0'.

*The North Downstream Entrance (NDE) and the South Downstream Entrance (SDE) gates would not lower past 6' and 4', respectively at lower tailwaters. It was believed the gate pits were obstructed with sediment. They will be addressed during the winter maintenance period.

*PH2 diffuser B4 was discovered to have its stem bent on 24 May 2017. This likely occurred while trying to close and the valve is believed to be open. It should be open at tailwaters of 11.0' – 31.0' msl.

*Weir 38 water depths are heavily influenced by AFF operations as well as the adjacent bleed-off valve located in the main ladder. A number of operational changes to valve positions in the AFF have had to occur in recent years due to what is believed to be sediment buildup. Additionally a number of maintenance has had to occur on the bleed off valve all influencing weir 38 to occasionally be out of criteria.

3.2 STS / VBS Inspections

Submersible traveling screens (STS) and vertical barrier screens (VBS) are typically inspected once a month. Each STS has a timer that automatically shows elapsed time of operation, with one month of continuous operation equaling 720 hours. Bonneville uses an underwater video camera to inspect STSs and VBSs, allowing inspection of the screens while they are installed and while the unit is running. PH2 STSs are generally installed in operational units from the end of February until December 15 for juvenile fish passage and for adult fallbacks. PH1 screens have been permanently removed.

Table 6. 2018 STS / VBS inspections.

		Run Hours Between Inspections								
Unit	**Install Dates & Run Hours Upon Installation**	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	**Removal Dates & Run Hours**
11	22-Feb									17-Dec
	36472	315	1044	622	567	756	498	650	836	42789
12	23-Feb									17-Dec
	26641	671	797	623	679	636	231	508	837	32701
13	21-Feb									17-Dec
	97913	672	993	430	585	290	108	646	OOS	2345
14	20-Feb									18-Dec
	20	664	1050	616	449	290	88	517	840	5453
15	23-Feb									18-Dec
	12674	660	503	624	426	44	66	335	598	16798
16	20-Feb									18-Dec
	24457	444	1049	625	483	76	17	219	453	28758
17	23-Feb									19-Dec
	16080	676	1030	624	627	298	114	651	839	22090
18	20-Feb									19-Dec
	54473	675	1019	615	696	487	422	649	839	61210

3.3 Avian Abatement Measures

USDA Wildlife Service's avian hazing occurred from April through July 2018. This was done from the tailrace side of the powerhouses, the spillway, and the shoreline.

3.4 Fish Counts

The Corps of Engineers contracted with Normandeau Associates, Inc. for all fish counting during the 2018 fish passage season. The fish count season is year round with visual counts from March until December and video counts during the rest of the year. All fish count numbers may be found at the Fish Passage Center.

4. WATER QUALITY MONITORING

4.1 Zebra/Quagga Mussels

Through monthly inspections of the monitoring station at PH1 and of all dewatered fishways, no indication of zebra or quagga mussel colonization was found. The Project stays involved in regional preparation for zebra/quagga mussel arrival by sending project personnel to training and seminars to stay abreast of the latest information concerning these invasive species. Monitoring will continue with hopes that control programs can be initiated at the first indication of the mussel's arrival in the Pacific Northwest.

4.2 Fishway Temperature Monitoring

Project biologists monitor fishway temperatures throughout the fish passage season, from 01 March through 30 November. Temperature probes are installed at the following locations: A-Branch entrance, B-Branch entrance, Bradford Island exit, Bradford Island downstream of the picket leads, WA Shore upstream of the UMT, AFF, SMF, BI LPS, CI LPS, WA AWS LPS, and the LFS. Additionally, the Technical Management Team (TMT) tracks BON forebay temperature on their website. The TMT temperature is publically accessible real-time, and is the standard utilized per the FPP to determine when high-temperature fish sampling restrictions are operative in BON facilities. In 2018, these temperatures were available from 05 March - 27 September. Detailed daily temperatures can be found in the weekly reports and are available upon request.

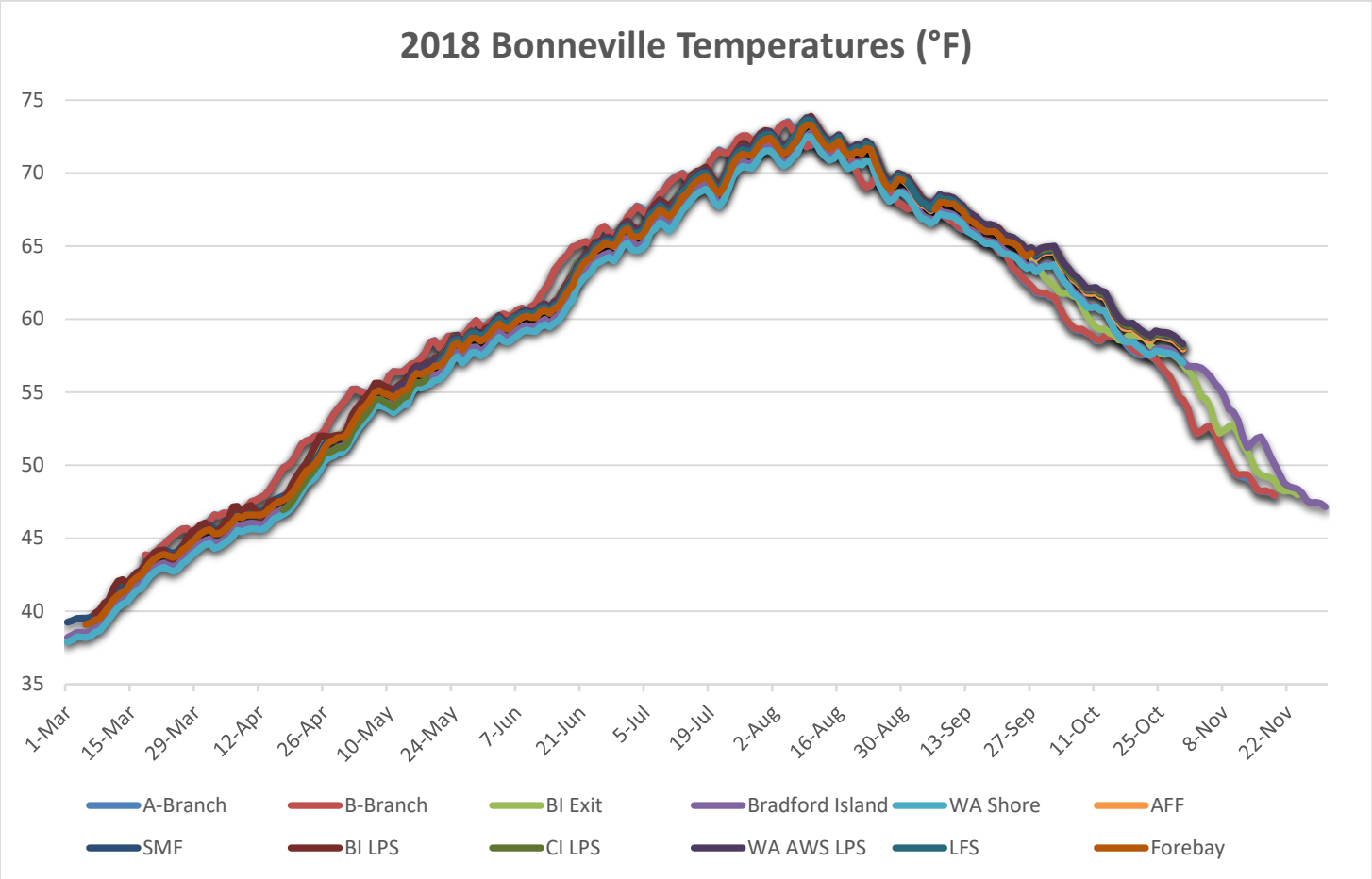


Figure 2. 2018 Bonneville temperatures.

5. FISHWAY MODIFICATIONS (1996 - present)

POWERHOUSE ONE ADULT

2018. Installed HOBO temperature monitors.
2012. Replaced PIT tag antenna in Bradford Island serpentine section.
2012. Dredged along the exit channel for the Bradford Island fish ladder.
2011. Repaired erosion cavities under the B-branch ladder of Bradford Island.
2006-present. Sea lion exclusion devices (SLEDs) are installed at the fishway entrances to prevent sea lion access to the fish ladder.
2005/06. Bulkheads were installed in the orifice gate and telescoping gate slots. Gates were removed along with the associated electronic and mechanical equipment.
2005/06. Passive Integrated Transponder (PIT) tag detectors installed in four serpentine weirs in the Bradford Island fishway.
2004-present.Utilize ROVs for fishway inspections instead of divers.
2003/04. Installed new electronic velocity meter at the north end of the PH1CC. No longer used.
2002/03. PH1CC orifice gates and telescoping gates are closed and disabled. Studies indicated more fish exited these gates than entered. Weir gates were left in service.
2001/02. Extra orifices in the overflow weirs were filled with concrete.
2000/01. PIT tag detectors installed in four orifice weirs in A-branch and four orifice weirs in B-branch.
1998/99. FG3-10 through 17 disabled and filled with concrete. FG3-14 (at the junction pool) covered with metal plates instead of concrete.

POWERHOUSE ONE JUVENILE

2013/14. ITS gate removed for repairs, gate slot plated for fish passage during removal.
2012/13. Spillway erosion hole and ogee repair.
2010/11. Welded elevation indicators on chain gates 3B, 6C, and 10B.
2010. PH1 JBS outfall pipe removed.
2009/10. Removal of the wall separating the Powerhouse 1 downstream migrant channel (DSM1) from the ITS completed to improve surface passage at PH1. The floor was raised and sloped.
2009. All remaining PH1 screens scrapped.
2008/09. ITS automated chaingates installed in 3B, 6C, and 10B.
2004-2007. The Powerhouse 1 downstream migrant channel (DSM1) is disabled as a juvenile bypass route. Screens are not installed during fish passage season except from 15 September until 15 December for adult fallback. DSM1 runs south during this time.
2001-2003. Unit 8 extended submerged bar screens were deemed undesirable and replaced with standard STSs.
2001-present. The 2000 Biological Opinion (BiOp) required the removal of impediments to fish passage from the turbine environments. Removal and replacement of excess metal, with fish friendly alternatives, occurs as units go out of service for rehab.
2000-2010. Turbine rehab involves installing minimum gap runners on all PH1 main units.

POWERHOUSE ONE LAMPREY

2018. Tested reduced nighttime entrance velocities at PH1 and B-branch entrances.
2018. Field tested the Bradford Is. Wetted Wall (BIWW).
2018. Installed HOBO temperature monitors.
2017/18. Modified the Bradford Is. LPS exit. Objective was to allow for adjustable slope and to release lamprey further from the adult ladder exit thus reducing fallback.
2017/18. Orifice slots drilled in lower serpentine weir walls (weirs 1, 3, and 5); trial rest boxes installed.
2015/16. Modified Bradford crowder station to reduce lamprey mortality due to crowder run-over and those dying in area behind crowder. Perf plate in count slot, skirt in bottom of crowder, plating on sides of crowder.
2013/14. Lamprey passage structure pumps relocated from forebay location to within the AWS to minimize debris buildup. Fry criteria screens placed on lamprey pumps.
2012. Picket lead modifications to insure one inch spacing between leads and sill plate and prevent lead bending. Spacers installed.
2011. Lamprey count improvements including video verification network at exit flume.
2011. Picket lead spacers for lamprey passage removed on 29 June.
2011. One inch picket lead spacers installed on 24 May to allow lamprey passage under leads.
2005/06. PIT tag detection and expanded lamprey ramp installed in the Bradford Island FV3-9 AWS channel.
2003/04. Lamprey ramp installed in the Bradford Island FV3-9 AWS channel.

CASCADES ISLAND FISHWAY/ UMT

2004-present. Utilize ROVs for fishway inspections instead of divers.
2004/05. UMT fish count window crowder and window cleaner removed.
2001/02. New diffuser covers built and installed.
2000/01. More PIT tag detectors installed in four orifice weirs.
1999/00. FG6-1 through 4 filled in with concrete.
1998/99. PIT tag detectors installed in four orifice weirs.
1996-2000. The UMT drain is blind flanged and no longer used.

CASCADES ISLAND LAMPREY

2018. Installed HOBO temperature monitors.
2017/18. FDX PIT systems installed.
2016. Gaps in picket leads fixed with addition of new pickets to reduce lamprey incursion into AWS.
2014/15. Picket lead spacing reduced and side gaps amended to block lamprey access to the AWS and ladder exit area above the lower pickets.
2012/13. Lamprey passage system extension into the forebay and conversion to volitional passage system.
2008/09. Lamprey ramp and bollards installed in CI entrance pool. Variable width entrance weir installed in May.
2005/06. HDX PIT tag detectors were installed along the picket leads to track lamprey.

POWERHOUSE TWO ADULT

2017. Removal of Collection Channel velocity meter.
2017. Permanent SLIBs (Sea Lion Incursion Devices) were fabricated and installed on top of FOGs to prevent Sea Lions from entering the fishway.
2017. Four floating orifice gates (FOGs) were removed and replaced with bulkheads to minimize locations for potential sea lion entry. This reduced the number of FOGs from 12 to 8.
2017. An opening in the wall separating the crowder area of the main ladder from the AWS was covered with screen to prevent possible Sockeye incursion into the AWS.
2017. Installed ID plates at bases of "C" diffusers in the collection channel for ROV inspections.
2017. The base of the AWS picket leads was modified to reduce possible Sockeye incursion into the AWS.
2013-2015. Modifications to the AFF to improve water velocity and sampling conditions.
2013. Replaced PIT antenna in WA Shore ladder serpentine section.
2013. Forebay dredging in front of the Fish Unit intakes.
2012/13. Repairs to the gates and guides on B-valves 3 and 4.
2012. Debris removal from the AWS and accompanying diffusers.
2011. SA-24 board replaced with new PH2 Collection Channel Fishway PLC.
2011. Reattached blown off diffuser grating in ladder at North Monolith and debris removal from AWS and accompanying diffusers.
2010/11. AFF sample flume modified to accommodate an auxiliary sample tank used by WDFW. CRITFC obtained and installed a new, larger sample tank complete with a PIT tag detector at the entrance to the tank.
2008/09. Picket leads installed perpendicular to existing AFF picket leads. Not used after 2009 sample season.
2007/08. Manufactured new FOG SLEDs.
2006/07. Installed new staff gauges in the monoliths.
2006/07. AFF lamprey orifice gate removed due to pulley failure resulting in salmon passage blockage and dewatering difficulties.
2005-present. SLEDs installed at fishway entrances to prevent sea lion access to the fish ladders.
2005/06. AFF count window crowder removed due to structural failure.
2004-present. Utilize ROVs for fishway inspections instead of divers.
2004/05. Repaired the AWS conduit.
2004/05. Installed new velocity meter at South Upstream Entrance (SUE).
2004/05. PIT tag detectors installed in four serpentine weirs.
2004/05. AFF brail pool modifications made. The brail pool is now the primary recovery pool.
2003/04. AFF electrical upgrades complete.
2003/04. Picket leads for the triangle section were removed.
2002/03. Removed old metal staff gauge frames from monolith entrances.
2001/02. PIT tag detectors installed in eight orifice weirs, four upstream and four downstream of the AFF.
1999/00. AFF exit ladder equipped with orifice PIT tag detectors.

POWERHOUSE TWO JUVENILE

2018. Removal of FGE flow control plates from all units.
2018. Installed HOBO temperature monitors.
2018. Major electrical upgrades to the SMF PLC.
2016/17. LED lighting improvements to DSM.
2016/17. Flow control plates installed in 'A' & 'B' gatewells of all PH2 units, plating on upper sections of VBSs.
2014. Testing of a flow control plate in Unit 15 "A" slot.
2013. Gantry 7 rehabilitation.
2013. Turbulence Reduction Device (TRD) testing in Unit 14 "A" slot.
2013. Alarm installed on the 2-way rotating gate at the SMF.
2012. B2CC bulkhead converted to permanent hoist with automatic control.
2012. B2CC joint repair to fix spalling and decrease channel roughness.
2008/09. Release pipe attached to JMF outfall pipe for juveniles trucked from Walla Walla District.
2007/08. Behavioral Guidance Structure (BGS) installed in PH2 forebay. Removed in December 2010.
2007/08. PH2 Downstream Migrant transportation channel (DSM2) LED lights returned to halogen lights due to the unknown effects of LEDs.
2007/08. Units 14 and 18 are modified for new VBSs and improved FGE.
2006/07. New LED lights replace the halogen lights. The LED lights are cooler and will last years longer than the halogens. These lights were salvaged from DSM1.
2006/07. Units 11, 15, 16 are modified for new VBSs and improved FGE.
2005/06. B2CC PIT tag antenna installed.
2005/06. SMF full flow PIT tag antenna installed.
2005/06. Units 12 and 13 modified for new VBSs and improved Fish Guidance Efficiency (FGE).
2004/05. VBS modifications for Unit 17 result in screen failure. The design for the new VBSs is re-examined and redrawn.
2004/05. SMF Outfall hydro-cannon piping is replaced.
2004/05. B2CC complete and online.
2003/04. Unit 17 VBSs and gatewells are modified to improve FGE. Modifications include gap closure devices on the STSs and modified VBSs.
2002/03. NOAA Fisheries fyke net frame is removed from the tailrace.
2002/03. Unit 15 gatewells are partially modified to improve FGE. Modifications include gap closure devices on the STSs.
2002/03. Biologists noticed places of ovality while inspecting the two mile pipe. The pipe has been monitored regularly to document potential changes.
2002-present. The 2000 BiOp required the removal of impediments to fish passage from the turbine environments. Removal and replacement of excess metal, with fish friendly alternatives, occurs as units come out of service for maintenance.
2001/02. Raised the DSM2 walkway grating to prevent fish from impacting it.
2001/02. Modified the DSM2 add-in screen to vertical bars to allow juveniles to move out of the add-in water and into the channel. The bars didn't reach the walkway so a perforated plate was added later in the season to prevent adults from jumping into the add-in section.
2001/02. Flume covers were added over the switch gates. This was to encourage fish to stay in the main channel and not seek shade by swimming under the switch gates.
2000/01. Saltwater rearing moved into the SMF.
2000/01. Modifications were made to the primary dewatering structure drain pipe to divert more water into the wetlands. This reduced the flow fluctuations and air bubbles under the perforated plate in the primary dewatering structure.
1998-2000. SMF construction completed. The facility goes online.

POWERHOUSE TWO LAMPREY

2018. Replaced the two winch deployed AFF lamprey traps for a permanently installed single ramp trap.
2018. Installed HOBO temperature monitors.
2018. WA AWS LPS exit "plunge box" installed.
2017. Blackout blinds were installed over visitor center viewing windows in order to reduce in-ladder nighttime light pollution.
2017. The count station crowder was modified with perf plating and a rubber "skirt" to reduce incidences of lamprey being run over. Grating was installed on the downstream side of the crowder to reduce fish incursion into the area behind the crowder.
2016/17. Lamprey weir caps installed on SDE and SUE.
2016/17. Orifice slots drilled in lower serpentine weir walls (weirs 1, 3, and 5); trial rest boxes installed.
2016/17. FLS velocity barrier plate installed to reduce areas of high velocity.
2016/17. Removed lamprey plating in N entrance area, replaced with orifice plates. AWS LPS extensions and new pump system.
2016. LFS repairs. Divers replaced missing hatch, hydraulic air entrainment 'dampener' installed.
2013. Lamprey refuge boxes installed in the WA Shore ladder, near the UMT confluence.
2012/13. Construction of Lamprey Flume System and associated LPS at NDE on the north monolith.
2012/13. Picket lead modifications to insure 1 ½ inch spacing between leads and sill plate and prevent lead bending. Spacers installed.
2011. Picket lead spacers for lamprey passage removed on 29 June.
2010/11. NOAA installed a picket lead sill ramp to ease the transition from the ladder into the AWS. NOAA also installed ¾ inch crowder picket leads at the count station.
2010. One inch picket lead spacers installed on 25 May for lamprey passage under leads.
2007/08. Lamprey ramp installed in the Washington Shore FV6-9 AWS channel.
2004/05. Lamprey ramp installed at North Downstream Entrance (NDE).
2000/01. Lamprey plates are installed over the Washington Shore diffuser grates.

BASS LAKE

2006. The leaking drain is repaired. The lake holds water and Coho are seen spawning in the outlet (Moffett Creek) of Bass Lake. The salvaged logs create log jams over the sink hole.
2004. Salvaged logs are placed in Bass Lake to provide habitat.

REFERENCES

2017-2018. Daily fishway inspections for Bonneville Dam.

2018. Fish Passage Plan for Corps of Engineers Projects. U. S. Army Corps of Engineers, Northwestern Division, Portland, Oregon.

2017-2018. Weekly reports for Bonneville Dam. U.S. Army Corps of Engineers, Portland District. Bonneville Lock and Dam.