2022 Annual Fishway Status Report for Bonneville Project

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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.
CPUE ----------Catch Per Unit Effort. Also known as catch rate.
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.
FO ----------Forced Outage not planned or coordinated with the FPP.
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
NA ----------Not available
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.
OWS ----------Oil Water Separator.
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.
PO ---------- Planned Outage
ROV---------- Remotely Operated Vehicle.
RS ----------Reserve Status; A unit in reserve status is available and running, but not currently generating power.
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 **2022** Project Fisheries Annual Report for Bonneville Project summarizes activities occurring from **01 December 2021 through 30 November 2022** and is required by the Fish Passage Plan (FPP), per **FPP Section 2.5.2.3.**

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**).

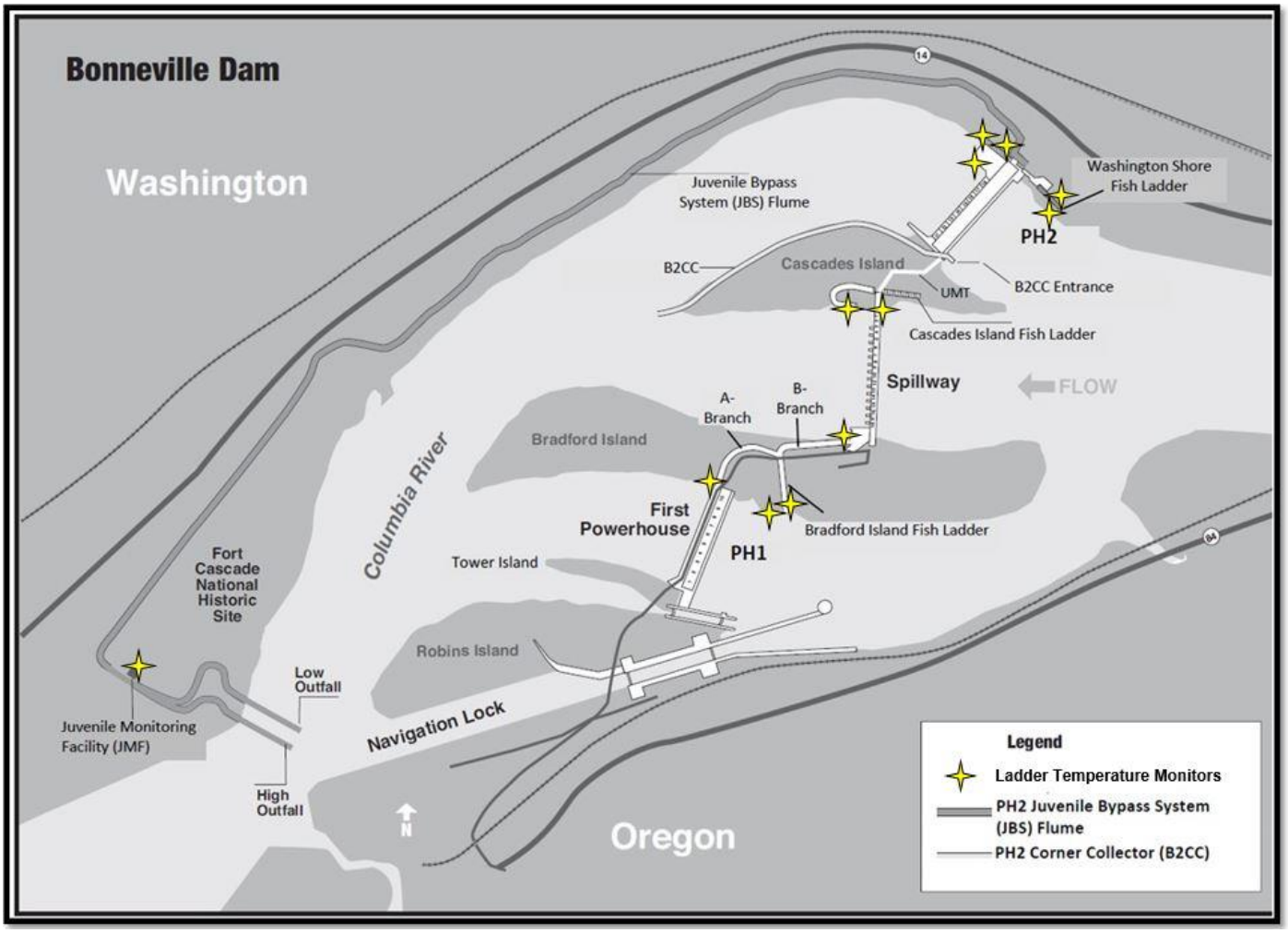

Figure 1. Bonneville Lock and Dam. Image obtained from FPP (2022).

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 2021	IN SERVICE DATE 2022	OOS DATE 2022	REASON FOR OUTAGE
BI LADDER	06-Dec	25-Feb	NA	NA
A-BRANCH	06-Dec	25-Feb	NA	NA
B-BRANCH	06-Dec	25-Feb	NA	NA
CI LADDER	NA	NA	6-Dec	Winter Maintenance
WA SHORE LADDER	NA	NA	5-Dec	Winter Maintenance
UMT	NA	NA	5-Dec	Winter Maintenance
BI LPS	01-Nov	18-Apr	01-Nov	Winter Maintenance
CI LPS	01-Nov	18-Apr	01-Nov	Winter Maintenance
WA AWS LPS	01-Nov	18-Apr	01-Nov	Winter Maintenance
NDE LFS/LPS	09-Sept	09-May	16-June	Mechanical Malfunction
AFF LAMPREY TRAP	09-Sept	07-June	07-Sept	Low CPUE (seasonal)
CI LAMPREY TRAP	09-Sept	07-June	07-Sept	Low CPUE (seasonal)
BI WETTED WALL	NA	NA	NA	NA
B2CC	1-Sept	13-Mar	1-Sept	Winter Maintenance
DSM	20-Dec	25-Feb	21-Dec	Winter Maintenance
AFF	21-Dec	14-Mar	21-Nov	Winter Maintenance
SMF	31-Oct	02-Mar	31-Oct	Winter Maintenance

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.

Table 2. Turbine Outages Lasting Greater Than 24 Hours.

UNIT	OOS DATE	RTS DATE	DURATION	REASON
11	0713 on 06 Dec	1456 on 03 Feb	59 days, 7 hours, 43 mins	P.O., 4 Yr Overhaul
14	0802 on 08 Dec	1230 on 17 Dec	9 days, 4 hours, 28 mins	P.O., BPA Work
13	0804 on 08 Dec	1254 on 17 Dec	9 days, 4 hours, 50 mins	P.O., BPA Work
12	0808 on 08 Dec	1406 on 17 Dec	9 days, 5 hours, 58 mins	P.O., BPA Work
10	0001 on 03 Jan	1757 on 07 Jan	4 days, 17 hours, 56 mins	P.O., Annual Overhaul
1	0001 on 10 Jan	1139 on 03 Feb	24 days, 23 hours, 38 mins	P.O., Annual Overhaul/PT Replacement
2	0001 on 10 Jan	1140 on 03 Feb	24 days, 23 hours, 39 mins	P.O., PT Replacement
16	0756 on 24 Jan	1648 on 28 Jan	4 days, 8 hours, 52 mins	P.O., BPA Work - Install Metering CTs
15	0802 on 24 Jan	1649 on 28 Jan	4 days, 8 hours, 47 mins	P.O., BPA Work - Install Metering CTs
17	0806 on 24 Jan	1653 on 28 Jan	4 days, 8 hours, 47 mins	P.O., BPA Work - Install Metering CTs
18	0811 on 24 Jan	1656 on 28 Jan	4 days, 8 hours, 45 mins	P.O., BPA Work - Install Metering CTs
18	0002 on 31 Jan	1417 on 03 Feb	3 days, 14 hours, 15 mins	P.O., Annual Overhaul
11	1424 on 16 Feb	1110 on 18 Feb	1 day, 20 hours, 46 mins	F.O., For 125v DC Ground
13	1628 on 18 Feb			F.O., Generator Ground
16	0802 on 28 Feb	1928 on 17 Mar	17 days, 11 hours, 26 mins	P.O., BPA Work, RC #4 Relay Replacement
15	0802 on 28 Feb	1927 on 17 Mar	17 days, 11 hours, 26 mins	P.O., BPA Work, RC #4 Relay Replacement
17	0803 on 28 Feb	1937 on 17 Mar	17 days, 11 hours, 34 mins	P.O., BPA Work, RC #4 Relay Replacement
18	0803 on 28 Feb	1921 on 17 Mar	17 days, 11 hours, 18 mins	P.O., BPA Work, RC #4 Relay Replacement
8	1355 on 10 Mar	1554 on 14 Mar	4 days, 1 hour, 59 mins	F.O., High EMI Reading/Bus Inspections
3	0920 on 04 Apr	1326 on 24 May	50 days, 4 hours, 6 mins	P.O., 5-Yr Overhaul
17	0719 on 18 Apr	1440 on 14 July	87 day, 7 hours, 21 mins	P.O., 4-Yr Overhaul
9	1425 on 10 May	1643 on 11 May	1 day, 2 hours, 18 mins	F.O., Transformer DC Ground
10	1425 on 10 May	1643 on 11 May	1 day, 2 hours, 18 mins	F.O., Transformer DC Ground
14	0702 on 16 May	0844 on 19 May	3 days, 1 hour, 42 mins	P.O., FGE Work

15	0702 on 23 May	1752 on 25 May	2 days, 10 hours, 50 mins	P.O., FGE Work
2	0000 on 06 June	1702 on 09 June	3 days, 17 hours, 2 mins	P.O., Annual Overhaul
12	0702 on 05 July	1708 on 10 Aug	36 days, 10 hours, 6 mins	P.O., SU Panel Upgrade/Installation and Annual Overhaul
7	0857 on 11 July	1350 on 20 Oct	101 days, 4 hours, 53 mins	P.O., 5-Yr Overhaul
5	0001 on 18 July	1508 on 21 July	3 days, 15 hours, 7 mins	P.O., Annual Overhaul
11	0802 on 18 July	1624 on 10 Aug	23 days, 8 hours, 22 mins	P.O., BPA Work - Grounded Clearance and SU Panel Upgrade/Installation
14	0804 on 18 July	1714 on 10 Aug	23 days, 9 hours, 10 mins	P.O., BPA Work – Grounded Clearance
6	0002 on 25 July	1254 on 28 July	3 days, 12 hours, 52 mins	P.O., Annual Overhaul
8	0002 on 25 July	1706 on 19 Oct	86 days, 17 hours, 4 mins	P.O., Annual Overhaul
4	0000 on 01 Aug	1559 on 03 Aug	2 days, 15 hours, 59 mins	P.O., Annual Overhaul
9	0000 on 15 Aug	1422 on 25 Aug	10 days, 14 hours, 22 mins	P.O., Annual Overhaul
16	0729 on 22 Aug	1416 on 21 Sept	30 days, 6 hours, 47 mins	P.O., Annual Overhaul/Shaft Sleeve Repair
15	0001 on 29 Aug	1509 on 15 Sept	17 days, 15 hours, 8 mins	P.O., T12 Maintenance
17	0001 on 29 Aug	1432 on 15 Sept	17 days, 14 hours, 31 mins	P.O., T12 Maintenance
18	0002 on 29 Aug	1531 on 15 Sept	17 days, 15 hours, 29 mins	P.O., T12 Maintenance
14	0915 on 20 Sept	1645 on 28 Sept	8 days, 7 hours, 30 mins	P.O., SU Panel Upgrade/Installation
3	1335 on 27 Sept	1635 on 06 Oct	9 days, 3 hours	F.O., Exciter Controller - Bad Circuit Board
5	1330 on 28 Sept	1635 on 06 Oct	8 days, 3 hours, 5 mins	F.O., 230kV limit of 350 MW, xfer bus split to max 115kV
15	1810 on 28 Sept	1023 on 12 Oct	13 days, 16 hours, 13 mins	P.O., SU Panel Replacement
17	1024 on 12 Oct	1712 on 24 Oct	12 days, 6 hours, 48 mins	P.O., SU Replacement
10	0700 on 24 Oct	1600 on 27 Oct	3 days, 9 hours	P.O., ROV Inspection/ Trash Rack Debris Excavation
3	0620 on 01 Nov	0646 on 03 Nov	2 days, 0 hours, 26 mins	P.O., Generation Lineup
5	0623 on 01 Nov	1217 on 23 Nov	22 days, 5 hours, 54 mins	P.O., Generation Lineup
4	0646 on 03 Nov	1216 on 23 Nov	20 days, 5 hours, 30 mins	P.O., Generation Lineup
9	0700 on 12 Nov	1511 on 14 Nov	2 days, 8 hours, 11 mins	F.O., U1 MLDT Failure
3	1419 on 15 Nov	0714 on 17 Nov	1 day, 16 hours, 55 mins	F.O., Troubleshooting XJ 2.1

6	1120 on 23 Nov	1330 on 28 Nov	5 days, 2 hours, 10 mins	F.O., Oil Sheen Investigation
9	0214 on 24 Nov	1404 on 29 Nov	5 days. 11 hours, 50 mins	F.O., Gate Feedback/Position Indication

Definitions: Planned Outage (P.O.) and Forced Outage (F.O.)

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 ramp. **Table 3** is a summary of the number of fish that were removed during facility and turbine unit dewatering's. All fish were recovered in good condition unless otherwise noted.

Table 3. Fish Salvages at Bonneville December 2021 – November 2022.

DATE	LOCATION	FISH SALVAGED	RELEASE SITE
2/2/2022	U11 Tail Logs	42 sculpin	Downstream
2/14/2022	Nav Lock - Upper Sill	1 smallmouth bass	Upstream of Nav Lock
2/16/2022	Nav Lock - Main Floor and Some Below	101 juvenile lamprey, 42 juvenile salmonids, 20 salmonid fry, 57 sculpin, 50 crawdad, 14 bass, 1 crappie, 1 peamouth, 6 stickleback	Downstream
2/17/2022	Nav Lock - Lower Portions	9 juvenile salmonids, 1 salmonid fry, 1 juvenile lamprey, 5 smallmouth bass, 1 starry flounder, 5 sculpin, and 3 crawdads	Downstream
3/1/2022	U13 Scroll Case and Draft Tube	No fish	NA
4/5/2022	U3 Scroll Case & Draft Tube	SC: 40 juvenile salmonids, 1 stickleback, 1 sculpin; DT: 2 juvenile salmonids, 3 sculpin	Downstream
4/18/2022	U17 Scroll Case	0 Fish	NA
4/19/2022	U17 Draft Tube	1 adult lamprey, 1 adult Chinook	Upstream of Nav Lock
5/18/2022	U3 Tail Logs	2 juvenile salmonids, 17 sculpin	Downstream
5/18/2022	U14 Tail Logs	6 sculpin, 1 smallmouth bass	Downstream
5/25/2022	U15 Tail logs	5 sculpin, 1 catfish, 1 suckermouth minnow	Downstream
5/25/2022	U15A Intake Bulkhead	7 juvenile salmonids recovered, 2 morts in gatewell	Downstream
6/1/2022	BI LPS	0 Fish	NA
6/2/2022	WA LPS	1 lamprey	Bradford Island Service Building (BISB) Boat Launch
6/16/2022	LFS Trap	0 Fish	NA
7/11/2022	U7 Scroll Case	~300 juvenile salmonids, 70 adult shad, 3 smallmouth bass, 1 juvenile carp, 2 sculpin, 1 stickleback	Nav Lock
7/12/2022	U7 Draft Tube	~250 pacific lamprey	BISB Boat Launch
7/12/2022	U17 Tail Logs - Day 1	1 smallmouth bass, 13 sculpin	Downstream

7/13/2022	U17 Tail Logs - Day 2	14 sculpin, 11 adult lamprey, and 76 ammocoete lamprey	BISB Boat Launch (adults), downstream for sculpin and ammocoetes
8/22/2022	U16 Scroll Case	No fish	NA
8/23/2022	U16 Draft Tube	7 adult white sturgeon, 1 juvenile white sturgeon, 1 catfish, 1 carp	Downstream
9/12/2022	U16 Tail Logs	8 sculpin	Downstream
10/19/2022	U7 Tail Logs	30 sculpin, 2 bass, 11 crappie	Downstream
11/21/2022	AFF	1 rainbow trout, 1 juvenile salmonid, mixture of 7500, shad, peamouth, sucker, walleye, carp, sunfish	Downstream
11/30/2022	U11 Scroll Case	1 juvenile salmonid	Downstream
12/1/2022	U11 Draft Tube	1 juvenile salmonid, 3 bluegill	Downstream
12/5/2022	Washington Shore Ladder to TW and UMT	5 steelhead, 10 juvenile salmonids, mix of >500 peamouth, pikeminnow, shad, suckers, sculpin	Upstream of Nav Lock
12/6/2022	UMT and Cascades Island to TW	mixture of 700 peamouth, pikeminnow, shad, suckers, sculpin, 15 lamprey, 1 steelhead,	Upstream of Nav Lock

2.4 Fish Unit Outages

A list identifying every closure for Fish Unit 1 and Fish Unit 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.

UNIT	OOS	RTS	DURATION	REASON
F2	1110 on 02 Dec	1120 on 02 Dec	10 mins	Check Exciter Brushes
F2	2106 on 08 Dec	2237 on 08 Dec	1 hour, 31 mins	R.S., Float Trash
F2	1621 on 09 Dec	1633 on 22 Mar	99 days, 16 hours, 23 mins	P.O., Bi-Annual Maintenance/Extended Outage
F1	2021 on 15 Dec	2225 on 15 Dec	2 hours, 4 mins	R.S., Float Trash
F1	1009 on 20 Dec	1131 on 20 Dec	1 hour, 22 mins	R.S., Repair HC#1 BKR
F1	0003 on 01 Jan	0044 on 01 Jan	41 mins	R.S., Float Trash
F1	0002 on 04 Jan	0101 on 04 Jan	59 mins	R.S., Float Trash
F1	1732 on 09 Jan	1834 on 09 Jan	1 hour, 2 mins	R.S., Float Trash
F1	0315 on 17 Jan	0402 on 09 Jan	47 mins	R.S., Float Trash
F1	1747 on 18 Jan	2202 on 18 Jan	4 hours, 15 mins	R.S., Float Trash
F1	2001 on 26 Jan	2041 on 26 Jan	40 mins	R.S., Float Trash
F1	2215 on 28 Jan	2254 on 28 Jan	39 mins	R.S., Float Trash
F1	1900 on 01 Feb	1959 on 01 Feb	59 mins	R.S., Float Trash
F1	0204 on 15 Mar	0217 on 15 Mar	13 mins	R.S., Testing UF1 Emergency Headgate Closure
F2	1038 on 04 Apr	1051 on 04 Apr	13 mins	R.S., Elec adjusting blade MLDT
F1	0707 on 05 May	0826 on 05 May	1 hour, 19 mins	R.S., Trash Raking
F2	0835 on 05 May	1018 on 05 May	1 hour, 43 mins	R.S., Trash Raking
F2	0140 on 01 June	0545 on 01 June	4 hours, 5 mins	R.S., Nighttime Lamprey Ops
F2	2232 on 01 June	0533 on 02 June	7 hours, 1 min	R.S., Nighttime Lamprey Ops
F1	2235 on 02 June	0535 on 03 June	7 hours, 0 mins	R.S., Nighttime Lamprey Ops
F2	2230 on 03 June	0529 on 04 June	6 hours, 59 mins	R.S., Nighttime Lamprey Ops
F1	2252 on 04 June	0532 on 05 June	6 hours, 40 mins	R.S., Nighttime Lamprey Ops
F2	2230 on 05 June	0533 on 06 June	7 hours, 3 mins	R.S., Nighttime Lamprey Ops
F1	2231 on 06 June	0528 on 07 June	6 hours, 57 mins	R.S., Nighttime Lamprey Ops
F2	2230 on 07 June	0530 on 08 June	7 hours	R.S., Nighttime Lamprey Ops
F1	2232 on 08 June	0535 on 09 June	7 hours, 3 mins	R.S., Nighttime Lamprey Ops
F2	1814 on 09 June	2038 on 09 June	2 hours, 24 mins	R.S., Float Trash
F2	2230 on 09 June	0532 on 10 June	7 hours, 2 mins	R.S., Nighttime Lamprey Ops
F1	1759 on 10 June	1958 on 10 June	1 hour, 59 mins	R.S., Float Trash
F1	2232 on 10 June	0533 on 11 June	7 hours, 1 min	R.S., Nighttime Lamprey Ops
F2	2150 on 11 June	0529 on 12 June	7 hours, 40 mins	R.S., Nighttime Lamprey Ops

F1	2232 on 12 June	0254 on 13 June	4 hours, 22 mins	R.S., Nighttime Lamprey Ops/Float Trash
F2	0255 on 13 June	0530 on 13 June	2 hours, 35 mins	R.S., Nighttime Lamprey Ops/Float Trash
F2	2230 on 13 June	0529 on 14 June	6 hours, 59 mins	R.S., Nighttime Lamprey Ops
F2	2229 on 14 June	0532 on 15 June	7 hours, 3 mins	R.S., Nighttime Lamprey Ops
F1	1813 on 15 June	1921 on 15 June	1 hour, 8 mins	R.S., Float Trash
F2	2230 on 15 June	0534 on 16 June	7 hours, 4 mins	R.S., Nighttime Lamprey Ops
F1	2230 on 16 June	0531 on 17 June	7 hours, 1 min	R.S., Nighttime Lamprey Ops
F2	1739 on 17 June	2000 on 17 June	2 hours, 21 mins	R.S., Float Trash
F1	2234 on 17 June	0535 on 18 June	7 hours, 1 min	R.S., Nighttime Lamprey Ops
F2	1902 on 18 June	2002 on 18 June	1 hour, 0 mins	R.S., Float Trash
F1	2229 on 18 June	0533 on 19 June	7 hours, 4 mins	R.S., Nighttime Lamprey Ops
F2	1818 on 19 June	1921 on 19 June	1 hour, 3 mins	R.S., Float Trash
F1	2230 on 19 June	0539 on 20 June	7 hours, 9 mins	R.S., Nighttime Lamprey Ops
F2	0654 on 20 June	0811 on 20 June	1 hour, 17 mins	R.S., Float Trash
F2	2229 on 20 June	0729 on 21 June	9 hours	R.S., Nighttime Lamprey Ops
F1	2229 on 21 June	0530 on 22 June	7 hours, 1 min	R.S., Nighttime Lamprey Ops
F2	1816 on 22 June	1901 on 22 June	45 mins	R.S., Float Trash
F2	2228 on 22 June	0530 on 23 June	7 hours, 2 mins	R.S., Nighttime Lamprey Ops
F1	2229 on 23 June	0529 on 24 June	7 hours	R.S., Nighttime Lamprey Ops
F2	1827 on 24 June	1943 on 24 June	1 hour, 16 mins	R.S., Float Trash
F1	2229 on 24 June	0531 on 25 June	7 hours, 2 mins	R.S., Nighttime Lamprey Ops
F2	2229 on 25 June	0530 on 26 June	7 hours, 1 min	R.S., Nighttime Lamprey Ops
F1	2230 on 26 June	0530 on 27 June	7 hours	R.S., Nighttime Lamprey Ops
F2	1243 on 27 June	1251 on 27 June	8 mins	R.S., Float Trash
F2	2229 on 27 June	0528 on 28 June	6 hours, 59 mins	R.S., Nighttime Lamprey Ops
F2	1142 on 28 June	1620 on 02 Aug	35 days, 4 hours, 38 mins	F.O., Water in Hub
F1	2046 on 30 June	2218 on 30 June	1 hour, 32 mins	R.S., Float Trash
F1	1901 on 31 July	2004 on 31 July	1 hour, 3 mins	R.S., Float Trash
F2	2239 on 02 Aug	0542 on 03 Aug	7 hours, 4 mins	R.S., Nighttime Lamprey Ops
F1	1805 on 03 Aug	2040 on 03 Aug	2 hours, 35 mins	R.S., Float Trash
F2	2247 on 03 Aug	0604 on 04 Aug	7 hours, 17 mins	R.S., Nighttime Lamprey Ops
F1	1056 on 04 Aug	1125 on 04 Aug	29 mins	OOS, Switching
F2	2247 on 04 Aug	0604 on 05 Aug	7 hours, 17 mins	R.S., Nighttime Lamprey Ops
F1	2244 on 05 Aug	0559 on 06 Aug	7 hours, 15 mins	R.S., Nighttime Lamprey Ops
F2	2247 on 06 Aug	0600 on 07 Aug	7 hours, 13 mins	R.S., Nighttime Lamprey Ops
F1	2247 on 07 Aug	0559 on 08 Aug	7 hours, 12 mins	R.S., Nighttime Lamprey Ops
F2	2248 on 08 Aug	0557 on 09 Aug	7 hours, 9 mins	R.S., Nighttime Lamprey Ops
F1	2247 on 09 Aug	0604 on 10 Aug	7 hours, 17 mins	R.S., Nighttime Lamprey Ops
F1	1144 on 10 Aug	1304 on 10 Aug	1 hour, 20 mins	R.S., BPA Work
F1	1326 on 10 Aug	1354 on 10 Aug	28 mins	R.S., BPA Work
F1	1400 on 10 Aug	1415 on 10 Aug	15 mins	R.S., BPA Work
F1	1426 on 10 Aug	1455 on 10 Aug	29 mins	R.S., BPA Work
F2	1524 on 10 Aug	1540 on 10 Aug	16 mins	R.S., BPA Work
F2	2256 on 10 Aug	0558 on 11 Aug	7 hours, 2 mins	R.S., Nighttime Lamprey Ops
F1	2245 on 11 Aug	0601 on 12 Aug	7 hours, 16 mins	R.S., Nighttime Lamprey Ops

F2	2245 on 12 Aug	0615 on 13 Aug	7 hours, 30 mins	R.S., Nighttime Lamprey Ops
F2	2245 on 13 Aug	0602 on 14 Aug	7 hours, 17 mins	R.S., Nighttime Lamprey Ops
F1	2244 on 14 Aug	0601 on 15 Aug	7 hours, 17 mins	R.S., Nighttime Lamprey Ops
F2	1807 on 15 Aug	2008 on 15 Aug	2 hours, 1 min	R.S., Float Trash
F2	2244 on 15 Aug	0603 on 16 Aug	7 hours, 19 mins	R.S., Nighttime Lamprey Ops
F1	1233 on 16 Aug	1626 on 16 Aug	3 hours, 53 mins	R.S., ROV Inspection/Slip Ring and Brush Replace
F2	1233 on 16 Aug	1625 on 16 Aug	3 hours, 52 mins	R.S., ROV Inspection/Slip Ring and Brush Replace
F1	2130 on 16 Aug	0558 on 17 Aug	8 hours, 28 mins	R.S., Nighttime Lamprey Ops
F2	2131 on 17 Aug	0601 on 18 Aug	8 hours, 30 mins	R.S., Nighttime Lamprey Ops
F1	2129 on 18 Aug	0557 on 19 Aug	8 hours, 28 mins	R.S., Nighttime Lamprey Ops
F2	2129 on 19 Aug	0559 on 20 Aug	8 hours, 30 mins	R.S., Nighttime Lamprey Ops
F1	2131 on 20 Aug	0558 on 21 Aug	8 hours, 27 mins	R.S., Nighttime Lamprey Ops
F2	2133 on 21 Aug	0557 on 22 Aug	8 hours, 24 mins	R.S., Nighttime Lamprey Ops
F1	2131 on 22 Aug	0556 on 23 Aug	8 hours, 25 mins	R.S., Nighttime Lamprey Ops
F2	2129 on 23 Aug	0600 on 24 Aug	8 hours, 31 mins	R.S., Nighttime Lamprey Ops
F1	2131 on 24 Aug	0558 on 25 Aug	8 hours, 27 mins	R.S., Nighttime Lamprey Ops
F2	2131 on 25 Aug	0602 on 26 Aug	8 hours, 31 mins	R.S., Nighttime Lamprey Ops
F1	2204 on 26 Aug	0558 on 27 Aug	7 hours, 54 mins	R.S., Nighttime Lamprey Ops
F2	2132 on 27 Aug	0658 on 28 Aug	9 hours, 28 mins	R.S., Nighttime Lamprey Ops
F1	2131 on 28 Aug	0557 on 29 Aug	8 hours, 26 mins	R.S., Nighttime Lamprey Ops
F2	2132 on 29 Aug	0600 on 30 Aug	8 hours, 28 mins	R.S., Nighttime Lamprey Ops
F1	2107 on 30 Aug	2133 on 30 Aug	26 mins	R.S., Float Trash
F2	2130 on 30 Aug	0602 on 31 Aug	8 hours, 32 mins	R.S., Nighttime Lamprey Ops
F1	1755 on 31 Aug	1854 on 31 Aug	59 mins	R.S., Float Trash
F1	2130 on 31 Aug	0114 on 01 Sept	3 hours, 44 mins	R.S., Nighttime Lamprey Ops
F2	0010 on 02 Sept	0354 on 02 Sept	3 hours, 44 mins	R.S., Float Trash
F1	0247 on 02 Sept	0353 on 02 Sept	1 hour, 6 mins	R.S., Float Trash
F1	2252 on 02 Sept	0043 on 03 Sept	1 hour, 51 mins	R.S., Float Trash
F2	2209 on 03 Sept	0408 on 04 Sep	5 hours, 59 mins	R.S., Float Trash
F1	2213 on 03 Sept	0406 on 04 Sep	5 hours, 53 mins	R.S., Float Trash
F2	0008 on 05 Sep	0355 on 05 Sep	3 hours, 47 mins	R.S., Float Trash
F1	0013 on 05 Sep	0350 on 05 Sep	3 hours, 37 mins	R.S., Float Trash
F1	1741 on 10 Sep	1819 on 10 Sep	38 mins	R.S., Float Trash
F2	1859 on 06 Nov	2139 on 06 Nov	2 hours, 40 mins	R.S., Float Trash
F2	1832 on 14 Nov	1947 on 14 Nov	1 hour, 15 mins	R.S., Float Trash
F1	1952 on 14 Nov	2100 on 14 Nov	1 hour, 8 mins	R.S., Float Trash
F2	1839 on 16 Nov	1955 on 16 Nov	1 hour, 16 mins	R.S., Float Trash
F1	1840 on 16 Nov	1951 on 16 Nov	1 hour, 11 mins	R.S., Float Trash
F1	1910 on 18 Nov	2021 on 18 Nov	1 hour, 11 mins	R.S., Float Trash
F2	1910 on 18 Nov	2024 on 18 Nov	1 hour, 14 mins	R.S., Float Trash
F2	0530 on 20 Nov	0605 on 20 Nov	35 mins	R.S., Float Trash
F1	0610 on 20 Nov	0641 on 20 Nov	31 mins	R.S., Float Trash
F2	1927 on 20 Nov	2012 on 20 Nov	45 mins	R.S., Float Trash
F1	1951 on 20 Nov	2010 on 20 Nov	19 mins	R.S., Float Trash
F1	2157 on 26 Nov	2247 on 26 Nov	50 mins	R.S., Float Trash
F2	2158 on 26 Nov	2252 on 26 Nov	54 mins	R.S., Float Trash

F1	1330 on 01 Dec	P.O, 2-Year Overhaul
F2	1330 on 01 Dec	P.O, Annual Overhaul

Definitions: Reserve Status (R.S.) and Planned Outage (P.O.).

3. FISH PASSAGE PLAN COMPLIANCE

3.1 Fish Passage Plan Violations

Project Fisheries and the Project Operators conduct fishway inspections each day during fish passage season and at least three days per week during the winter maintenance period. Project Biologists conducted 101% (315 / 312) of the required daily fishway inspections. The number of FPP violations and the percentage of days the item was in criteria were calculated using Project Biologist's inspection data only (**Table 5**). 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 (%)
Units Running Out of Priority	177	43.8%
PH1		
Collection Channel Differential	44	86%
A-Branch Weir Differential	75	76.2%
B-Branch North Ent. Gate	1	99.7%
B-Branch Entrance Differential	4	98.7%
WG1 & WG65 Not Responsive	3	99.1%
PH1 Velocity	1	99.7%
FV3-7	5	98.4%
FG2-19	315	0%
FG3-3 (A-Branch)	3	99.1%
FG3-4 (A-Branch)	48	84.8%
FG3-21 (B-Branch)	1	99.7%
FG3-23 (B-Branch)	1	99.7%
FG3-24 (B-Branch)	1	99.7%
FG3-29 (B-Branch)	1	99.7%
FG3-31	1	99.7%
FG3-32	1	99.7%
FG3-33	3	99.1%
Ice & Trash Sluiceway	315	0.0%
Spillway – Spill Pattern	4	98.7%
Spillway – Avian Lines	182	42.2%
PH2		
UMT Weir Differential	3	99.1%
Weir 37 Differential	54	82.9%
Weir 38 Differential	24	92.4%
WA Shore SUE Monolith Ent/TW Differential	70	77.8%

WA Shore SDE Monolith Ent/TW Differential	74	76.5%
WA Shore NUE Monolith Ent/TW Differential	26	91.7%
WA Shore NDE Monolith Ent/TW Differential	25	92.1%
PH2 Velocity	9	97.1%
A2 Diffuser	252	20%
FG6-10	1	99.7%
FG6-11	143	54.6%
FG6-12 (Cascades Island)	38	87.9%
FG6-19 (Cascades Island)	2	99.4%
Hydrocannon (SMF)	3	99.1%

3.1.1. Units Running Out of Priority Order: There were several occurrences when the units ran out of priority according to FPP guidance (**Table BON-1. Bonneville Dam Turbine Unit Priority Order, 2022 FPP**).

- Unit 13 was forced out of service in February until October, for 8 months 9 days causing units to run out of order.
- Units 11, 12, and 14 were forced out of service in February for 1 day, causing units to run out of order.
- Unit 11 was forced out of service in March for 1 day, causing units to run out of order.
- Unit 5 was run out of order in July for 1 day in preparation for U7 outage, violating unit priority order.
- Unit 9 was run out of order in September for 1 day, due to 230 kV limits, violating unit priority order.
- Unit 10 was run out of order in September for 1 day, due to 230 kV limits, violating unit priority order.
- Unit 1 was run out of order in September for 7 days, due to 230 kV limits, violating unit priority order.
- Unit 10 was placed into reserve service in November for 1 day, causing units to run out of order.
- Unit 6 was forced out of service in November for 3 days, causing units to run out of order.
- Unit 9 was forced out of service in November for 2 days, causing units to run out of order.
- Unit 18 was forced out of service in December for 3 days, causing units to run out of order.

3.1.2. Collection Channel Differentials: PH1 south (typically WG-2) and north (typically WG-64) entrances are controlled by different sources. The aging Symax PLC system and sensors add difficulty to maintaining a 1.0-2.0’ differential. Funding remains an issue with upgrading the PLC at PH1. PH2 South encountered low collection channel differentials caused by single unit fish ops due to an extended bi-annual maintenance outage of F2. This outage began the 13 December and returned to service on 22 March.

3.1.3. A-Branch Weir Differential: Leakage from the FV3-7 conduit along A-Branch is believed to be the cause for slightly above average differentials. Often the differential is +0.1’ above criteria during the year.

3.1.4 FG2-19: FG2-19 (PH1) was found mechanically bound in the mostly closed position on 24 February by PH1 Mechanics. No repairs can be made until the PH1CC can be dewatered in the next Oregon Fishway Winter Maintenance Period (Winter 2023/2024).

3.1.5. FG3-4: FG3-4 (A-Branch) motor failure on 14 November 2022. A work order was created, and repairs are underway.

3.1.6. Weir 37: Weir 37 (PH2) encountered a gear box failure on 13 December 2021 this caused differentials to be greater than 1.1’. The gear box was returned to service on 24 May 2022

3.1.7. PH1 ITS: The PH1 Ice and Trash Sluiceway end gate failed on 30 December 2018. Auto-chain gates 3B, 6C, and 10B are operational; fixed-gates 1A and 1B remain closed for safety reasons.

3.1.8. A2 Diffuser: A2 Diffuser (PH2) was found mechanically bound in the closed position on 24 April. Repairs will be made while the AWS is dewatered in the 2022/2023 winter maintenance period.

3.1.9 FG6-11: FG6-11 (CI) was found mechanically bound in the closed position due to stripped shaft threads. A work order has been created and repairs will be made during the next full dewatering of the Cascades Island fishway.

3.1.10. FG6-12: FG6-12 (CI) was found mechanically bound in the open position for unknown reasons. A work order has been created and repairs will be made during the next full dewatering of the Cascades Island fishway.

3.1.11. Avian Lines: 5 avian lines were cut from the B2CC avian line array on 02 September 2021. Avian lines are installed prior to 10 April each year and normally remain in place as a form of avian abatement through the start of winter when they may be taken down if winter maintenance activities require. These 5 lines were damaged and hanging extremely low to the water, creating a hazard to a survey vessel entering the BON BRZ for a hydro survey on 03 September. They were returned to service on March 22nd of 2022. Another avian line from the B2CC array was broken during a high flow and high tailwater event occurring in June/July 2022.

3.1.12. Temperature Monitoring: Fishway temperature monitoring is a requirement set in the FPP (**FPP Section 2.4.2.11**). During the summer of 2022, 1 of the 12 temperature probes (CI Entrance) became completely unserviceable. The LFS temperature probe was taken out of service shortly after temperature monitoring started. This was due to the decision to shut down the LFS for the season. Prior to this 11 of 12 temperature probes across Bonneville monitored temperatures accurately through the season.

3.2 STS / VBS Inspections

Submersible traveling screens (STS) and vertical barrier screens (VBS) are typically inspected once a month (**Table 6**). Each STS has a timer that automatically shows elapsed time of operation, with thirty-one days of continuous operation equaling 744 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 mid-December for juvenile fish passage and for adult fallbacks. PH1 screens have been permanently removed.

Table 6. 2021 STS / VBS Inspections.

Unit	Install Dates & Run Hours Upon Installation	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	Removal Dates & Run Hours at Removal
11	25-Feb-22 63330	875	687	1010	688	288	477	671	669	696	30-Nov-22 69391
12	25-Feb-22 48786	894	145	951	499	165	479	663	669	878	13-Dec-22 54129
13	OOS 7950	0	0	0	0	0	0	0	0	0	OOS 7950
14	24-Feb-22 18451	827	143	861	689	244	467	453	668	967	13-Dec-22 23770
15	24-Feb-22 26497	519	142	837	691	750	263	243	442	889	13-Dec-22 31273
16	23-Feb-22 38856	537	143	873	691	686	117	36	332	758	12-Dec-22 43029
17	22-Feb-22 8822	562	134	0	0	813	273	478	374	987	12-Dec-22 12443
18	23-Feb-22 9733	541	690	1013	690	843	277	453	667	984	12-Dec-22 15891

3.3 Avian Counts and Abatement Measures

Bonneville Project Fisheries recorded daily bird counts between 01 April through 31 October 2022 (**Figure 2)**. These counts consist of the total numbers of gulls, cormorants, pelicans, grebes, and Caspian terns that were observed in the tailraces of Powerhouse 1, Powerhouse 2, Spillway tailrace, B2 Corner Collector outfall, and the Juvenile Bypass outfalls.

USDA Wildlife Service's avian hazing occurred from 01 April through 31 July 2022. This hazing was focused on locations included but not limited to the tailrace side of the powerhouses, the spillway, and the shoreline.

The passive hazing abatements at Bonneville Lock & Dam are the avian wires and hydro-cannons. Avian wires are installed prior to April 10 of each year, in the tailraces of Powerhouse 1, Powerhouse 2, and the spillway. On March 01 the underground water supply pipe for the Hydro-cannon was broken and inoperable. It was returned to service March 03, other than this time the Hydro-cannons operated continuously on top of the outfall flumes of the Smolt Monitoring Facility from 01 March through 01 November 2022.

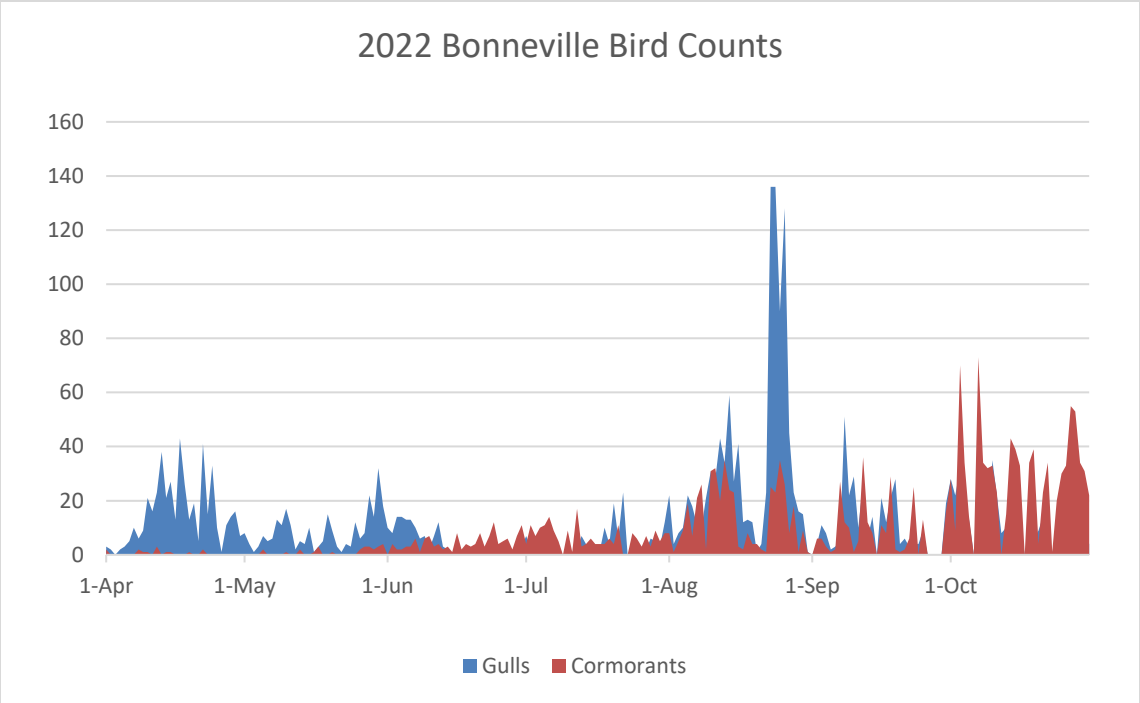

Figure 2. 2022 Bonneville Avian Counts.
Please note that pelicans, grebes, and terns are not included in this figure due to the extremely low observations (<5 for total monitoring period). However, data can be provided upon request.

3.4 Fish Counts

The Corps of Engineers contracted with Four Peaks Environmental for fish counting during the 2022 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 (http://www.fpc.org/).

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 trainings 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 15 May through 01 October (**Figure 3**). Temperature probes are installed at the following locations: A-Branch Entrance, B-Branch Entrance, Bradford Island Exit, Washington Shore Entrance (NDE), Washington Shore Exit (near FV6-9), AFF, SMF, BI LPS, CI LPS, WA LPS, and the LFS. Additionally, the Technical Management Team (TMT) tracks BON forebay temperature on their website. The TMT temperature is publicly accessible in real-time, and is the standard utilized per the FPP to determine when high-temperature fish sampling restrictions are operative in BON facilities. In 2022, these temperatures were available from 28 February through 22 September. Detailed daily temperatures can be found in the weekly reports and are available upon request.

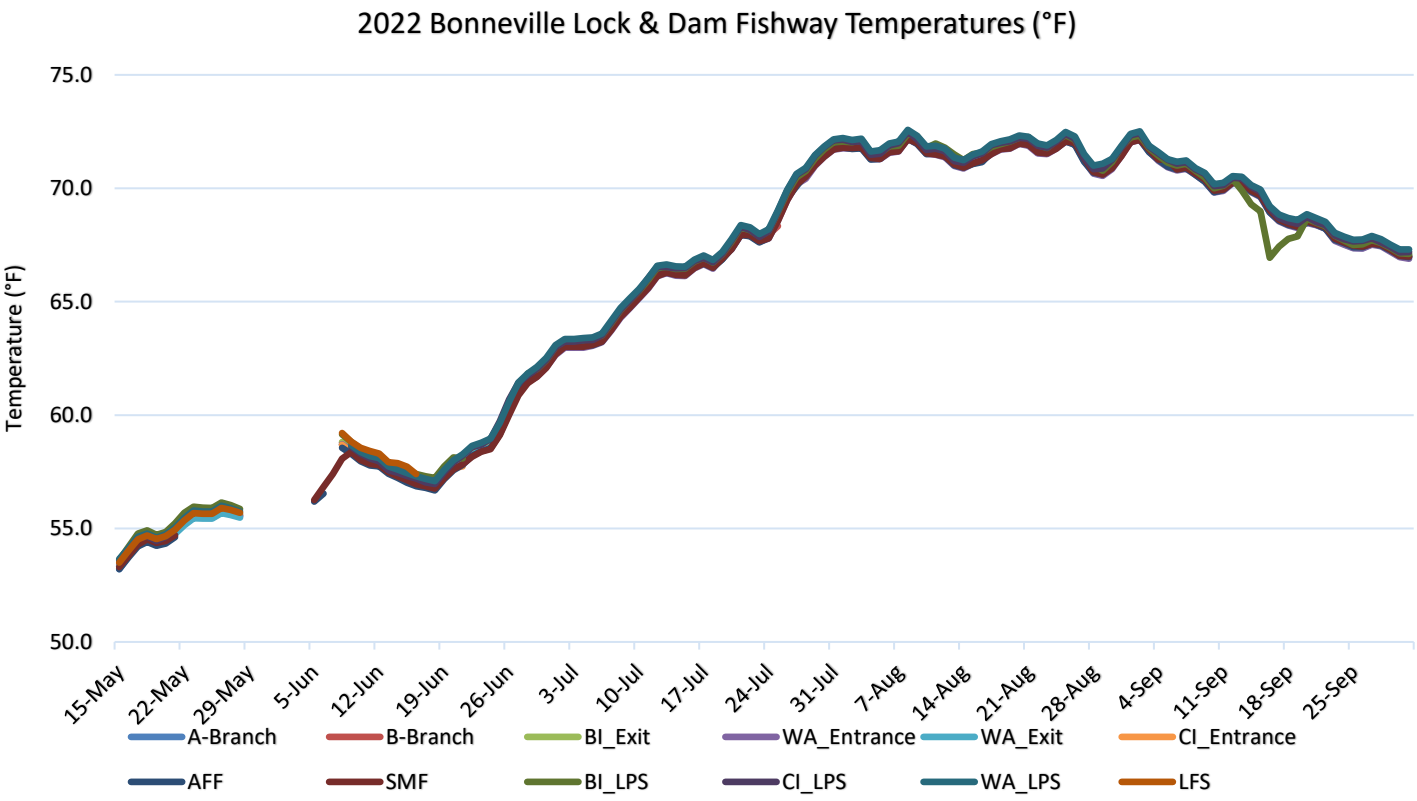

Figure 3. 2022 Temperatures at Bonneville.
Please note the following temperature probe issues: Programming errors resulted in no collection of data on the dates between 29 May through June 7. The LFS was taken out of service on 29 May, due to this event temperature recording was stopped at this location. CI_Entrance temperature probe was stuck inside the stilling well pipe, temperatures at this location were not able to be retrieved as of 22 June.

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

2021. ITS end gate slot inspected by USACE engineers to facilitate the future gate repair.
2019. Broken ITS end gate removed.
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

2022. B-Branch fishway orifices were rounded on the downstream side and plates were placed on diffuser grating downstream of orifices to provide improvements for lamprey passage.
2022. Optical counters were installed on Bradford Island LPS exit ramp
2022. Lamprey orifices were cut into the concrete of the serpentine section at Bradford Island Fishway

2020. Lamprey refuge boxes were moved to their permanent locations in the BI flow control section.
2019. Bradford Island LPS exit ramp had grooves deepened and lid installed to dissuade algae growth and avian predation.
2018/19. Tested reduced nighttime entrance velocities at PH1 and B-branch entrances.
2018/19. 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

2021. PSMFC installed new PIT antennas at UMT Entrance and count station window.
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

2020. Cascade Island lamprey trap was constructed and placed into service 3 June 2020.
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

2021. PSMFC installed four new PIT antennas in WA flow control section.
2017. Removal of Collection Channel velocity meter.
2017. Permanent SLEDs (Sea Lion Exclusion 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

2022. The testing of the hydraulic environment in the gatewells of Unit 14 and Unit 15 occurred after modifications were made to Unit 15 gatewells A & B to improve FGE flow criteria.
2022. A concrete corbel was added behind the VBSs of Unit 11 gatewells A & B to improve FGE flow criteria.

2021. A concrete corbel was added behind the VBSs of Unit 15 gatewells A and B to improve FGE flow criteria. Pending tests in Spring 2022 to determine hydraulic environment after modifications.
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

2022. The Lamprey Flume Structure was taken OOS indefinitely on May 29.
2021. Four new pumps for the lamprey passage structures installed at WA shore.
2021. Lamprey refuge boxes were moved to their permanent locations in the WA flow control section.
2020. Repair of the blown LFS inspection hatch by District Dive Safety.
2019. Orifice slots in weir 1 closed permanently. Six additional slots drilled in odd numbered weirs to exit (7, 9, 11, 13, 15, &17).
2019. Lamprey weir caps installed on NDE and NUE.
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. LFS 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 spacers were installed on the AWS picket leads 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

2017. Salvaged logs added to Bass Lake to provide habitat.
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

2021-2022. Weekly reports and daily fishway inspections for Bonneville Dam. U.S. Army Corps of Engineers, Portland District. Bonneville Lock and Dam.

2022. Fish Passage Plan for Corps of Engineers Projects. U. S. Army Corps of Engineers, Northwestern Division, Portland, Oregon.