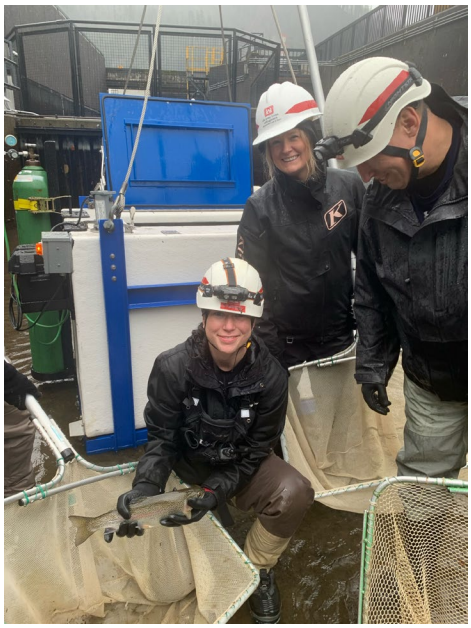
2023 Annual Fishway Status Report for Bonneville Project



Andrew Derugin,
Jeanette Flemmer, Tucker Gossett,
and Jase Owens

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 Administration.
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.
FG---------- Fish Gate
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 Shutdown; A unit in reserve shutdown is available, 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 **2023** Project Fisheries Annual Report for Bonneville Project summarizes activities occurring from **01 December 2022 through 30 November 2023** 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**).

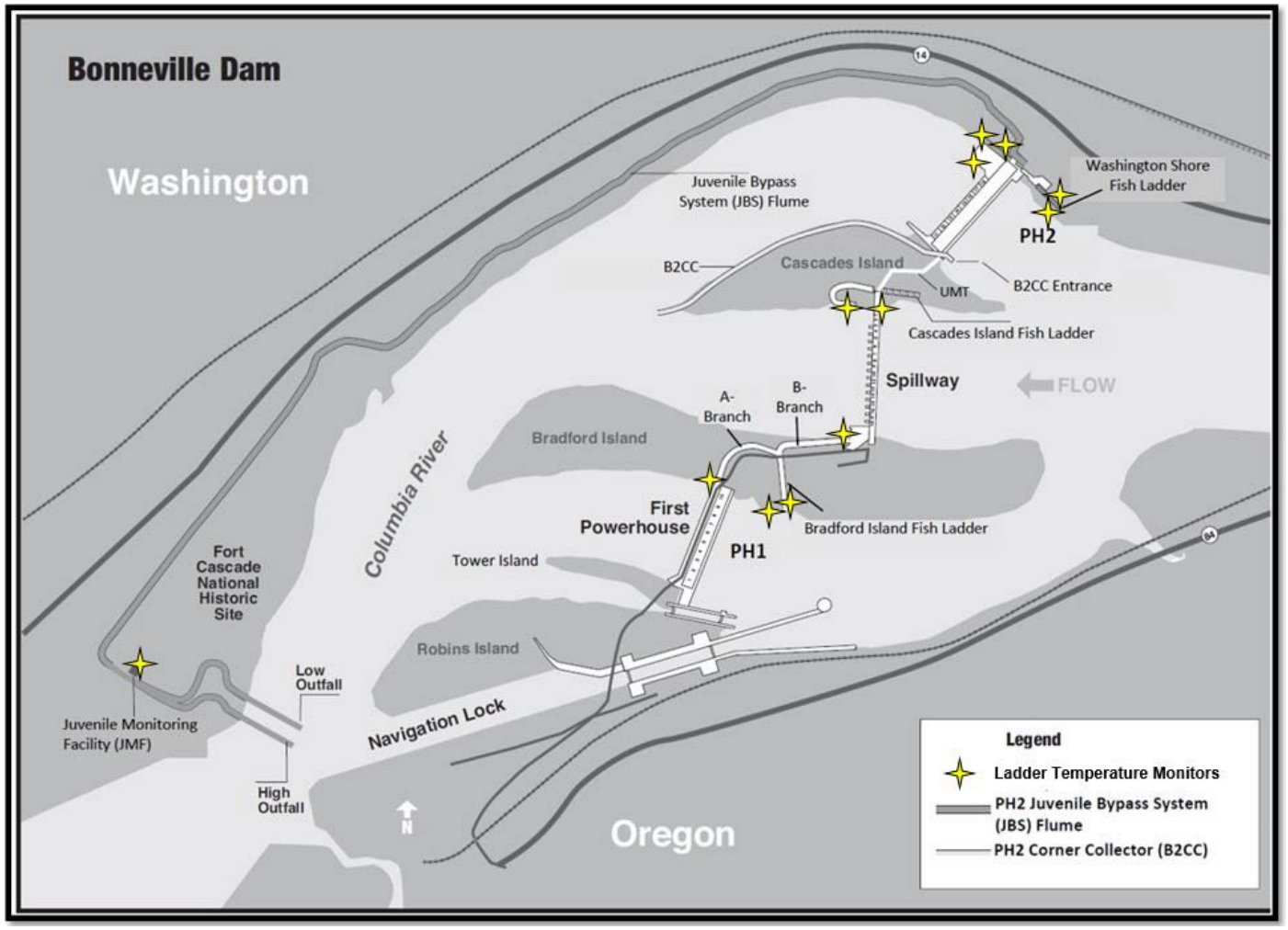


Figure 1. Bonneville Lock and Dam. Image obtained from FPP (2023).

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 2022	IN SERVICE DATE 2023	OOS DATE 2023	REASON FOR OUTAGE
BI LADDER	N/A	N/A	5-Dec	Winter Maintenance
A-BRANCH	N/A	N/A	5-Dec	Winter Maintenance
B-BRANCH	N/A	N/A	5-Dec	Winter Maintenance
CI LADDER	6-Dec	22-Feb	N/A	Winter Maintenance
WA SHORE LADDER	5-Dec	22-Feb	N/A	Winter Maintenance
UMT	5-Dec	22-Feb	N/A	Winter Maintenance
BI LPS	01-Nov	10-Apr	01-Nov	Winter Maintenance
CI LPS	01-Nov	10-Apr	01-Nov	Winter Maintenance
WA AWS LPS	01-Nov	10-Apr	01-Nov	Winter Maintenance
NDE LFS/LPS	16-June	N/A	N/A	Mechanical Malfunction
AFF LAMPREY TRAP	07-Sept	05-June	06-Sept	Low CPUE (seasonal)
CI LAMPREY TRAP	07-Sept	12-June	22-Aug	Low CPUE (seasonal)
BI WETTED WALL	N/A	11-May	01-November	Winter Maintenance
B2CC	1-Sept	08-Mar	1-Sept	Winter Maintenance
DSM	21-Dec	22-Feb	18-Dec	Winter Maintenance
AFF	21-Nov	21-Mar	27-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 FOR OUTAGE
13	1628 on 18 Feb 2022	0944 on 09 Feb 2023	355 days, 17 hours, 16 mins	F.O., Generator Ground and BPA Work – Grounded Clearance / P.O., 4-YR Overhaul
11	0740 on 30 Nov 2022	1434 on 06 Apr 2023	127 days, 6 hours, 54 mins	P.O., FGE Gatewell Improvement / Annual Overhaul / Extended for Bull Ring Wear
10	0015 on 05 Dec	0800 on 21 Dec	16 days, 7 hours, 45 mins	P.O., U10 Trash Rack Dive Ops and Replacement
9	0015 on 05 Dec	1900 on 16 Dec	11 days, 18 hours, 45 mins	P.O., U10 Trash Rack Dive Ops and Replacement
18	0706 on 12 Dec	1214 on 14 Dec	2 days, 5 hours, 8 mins	P.O., STS Removal / F.O., Gland Water Leak
16	0848 on 28 Dec	1325 on 29 Dec	1 day, 4 hours, 37 mins	F.O., TH Pump Oil Leak - Oil on Rotor
10	1004 on 03 Jan	1135 on 08 Mar	64 days, 1 hour, 31 mins	P.O., 5-YR Overhaul
18	0743 on 25 Jan	1527 on 27 Mar	61 days, 7 hours, 44 mins	P.O., FGE Gatewell Improvement
1	0003 on 30 Jan	1359 on 02 Feb	3 days, 13 hours, 56 mins	P.O., Annual Overhaul
16	0847 on 08 Feb	1322 on 09 Feb	1 day, 4 hours, 35 mins	P.O., Trash Raking / F.O., Water in Bearing Investigation
13	1102 on 09 Feb	0718 on 22 Feb	12 days, 20 hours, 16 mins	F.O., Kaplan Leakage Investigation
13	0752 on 24 Feb	1051 on 27 Feb	3 days, 2 hours, 59 mins	F.O., High STS Amps
16	0205 on 03 Mar	1402 on 06 Mar	3 days, 11 hours, 57 mins	F.O., Water in Turbine Bearing
16	0751 on 15 Mar	0806 on 27 Apr	43 days, 0 hours, 15 mins	P.O., FGE Gatewell Improvement
4	1631 on 29 Mar			F.O., Oil Leak Investigation
3	1600 on 30 Mar	1339 on 06 Jun	67 days, 21 hours, 39 mins	F.O., Oil Leak Investigation
17	0729 on 01 May	0800 on 15 Jun	45 days, 0 hours, 31 mins	P.O., FGE Gatewell Improvement
3	1105 on 12 Jun			F.O., Oil Leaks
14	2022 on 17 Jun	0709 on 20 Jun	2 days, 10 hours, 47 mins	F.O., STS Ground
2	0001 on 20 Jun	1106 on 29 Jun	9 days, 11 hours, 5 mins	P.O., Annual Overhaul
14	0735 on 20 Jun	1632 on 03 Aug	44 days, 8 hours, 57 mins	P.O., FGE Gatewell Improvement/Annual Overhaul/QTCI

1	0830 on 21 Jun	1106 on 29 Jun	8 days, 2 hours, 36 mins	F.O., SEL300G Fail/Omega Sensors
15	1420 on 01 Jul	1118 on 03 Jul	1 day, 20 hours, 58 mins	F.O., Water in Turbine Bearing Oil
12	0001 on 10 Jul	1607 on 13 Jul	3 days, 16 hours, 6 mins	P.O., Annual Overhaul
15	0729 on 10 Jul	1601 on 19 Oct	101 days, 8 hours, 32 mins	P.O., 4-YR Overhaul
5	1900 on 06 Aug	1818 on 09 Aug	2 days, 23 hours, 18 mins	P.O., Annual Overhaul
13	0804 on 07 Aug	1629 on 21 Sept	45 days, 8 hours, 25 mins	P.O., FGE Gatewell Improvement/T11 Transformer Maintenance
6	0001 on 14 Aug	0934 on 12 Sept	29 days, 9 hours, 33 mins	P.O., Annual Overhaul
7	0001 on 21 Aug	1600 on 24 Aug	3 days, 15 hours, 59 mins	P.O., Annual Overhaul
16	0730 on 23 Aug	1545 on 24 Aug	1 day, 8 hours, 15 mins	F.O., Gov Oil Leak
8	0030 on 28 Aug	1305 on 31 Aug	3 days, 12 hours, 35 mins	P.O., Annual Overhaul
14	0007 on 05 Sept	1629 on 21 Sept	16 days, 16 hours, 22 mins	P.O., T11 Transformer Maintenance
12	0014 on 05 Sept	1629 on 21 Sept	16 days, 16 hours, 15 mins	P.O., T11 Transformer Maintenance
11	0023 on 05 Sept	1629 on 21 Sept	16 days, 16 hours, 6 mins	P.O., T11 Transformer Maintenance/Thrust Cooler Replacement
12	0728 on 25 Sept	0825 on 20 Dec	86 days, 0 hours, 47 mins	P.O., FGE Gatewell Improvements/4-YR Overhaul
6	1132 on 10 Oct	1335 on 11 Oct	1 day, 2 hours, 3 mins	F.O., Exciter Comms Failure
18	(RS) 0651 on 12 Oct	DID NOT RTS	DID NOT RTS	(RS) P.O., BPA GENCON
18	1858 on 12 Oct	2141 on 16 Oct	4 days, 2 hours, 43 mins	F.O., Failed Brake Switch
9	1805 on 15 Oct	1205 on 24 Oct	8 days, 18 hours	P.O., Annual Overhaul
13	0001 on 06 Nov	2313 on 08 Nov	2 days, 23 hours, 12 mins	P.O., Annual Overhaul/QTCI
9	1911 on 25 Nov	1215 on 27 Nov	1 day, 17 hours, 4 mins	F.O., XW178 Tripped Open
10	1911 on 25 Nov	1154 on 27 Nov	1 day, 16 hours, 43 mins	F.O., XW178 Tripped Open

Definitions: Planned Outage (P.O.), Forced Outage (F.O.), and Reserve Shutdown (R.S.)

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 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 2022 – December 2023.

DATE	LOCATION	FISH SALVAGED	RELEASE SITE
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	Upsteam of Nav Lock
12/6/2022	UMT and Cascades Island to TW	mixture of 700 peamouth, pikeminnow,shad,suckers,sculpin, 15 lamprey, 1 steelhead,	Upsteam of Nav Lock
1/5/2023	U10 Scroll & Draft	1 juvenile Steelhead	Downstream
1/9/2023	PH2CC	2 juvenile salmonids, 2 SMB, 2 yellow perch, 7 minnows	Downstream
1/11/2023	PH2 AWS	7 juvenile salmon, 14 bass, 1 sturgeon, 10 sculpin, 8 perch, 4 stickleback, 1 catfish	Downstream
1/26/2023	U18 Scroll & Draft Tube	0	0
1/31/2023	F1 Draft Tube	1 Juvenile Sturgeon, 1 catfish	BISB Boat Launch
2/8/2023	U13 Taillogs	66 sculpin, 1 smallmouth bass, 2 catfish	Downstream
3/7/2023	U10 Taillogs	5 sculpin	Downstream
3/8/2023	Nav Lock Upper Sill	0	
3/13/2023	U18 Taillogs	0	
3/16/2023	U16 Scroll Case & Draft Tube	0	
4/6/2023	U11 Taillogs	75 sculpin, 3 Smallmouth Bass, 2 pikeminnow	Downstream
4/24/2023	U16 Taillogs	6 sculpin	Downstream
5/2/2023	U17 Scroll & Draft	None in Scroll, 8 Adult salmonids and 1 sturgeon in Draft Tube	Downstream
5/3/2023	U17 Scroll Case	3 Juvenile Salmonids	Downstream

5/31/2023	U3 Scroll Case	0	N/A
6/7/2023	U4 Scroll Case & Draft Tube	None in Scroll, 1 lamprey and 1 juvenile catfish in draft tube	Upstream
6/21/2023	U14 Scroll Case, Draft Tube, and Gatewells	1 juvenile salmonid in gatewell 14A	U16 Gatewell
7/10/2023	U15 Scroll Case and Draft Tube	1 juvenile salmonid	Downstream
7/27/2023	U14 Taillogs	1 pumpkinseed, 1 smallmouth bass	Downstream
8/7/2023	U13 Scroll Case & Draft Tube	SC: 1 steelhead, DT: 3 sturgeon	Downstream and BISB Boat Launch
8/8/2023	U13 Gatewells	50 juvenile shad	Adjacent functional gatewells
9/7/2023	U15 Taillogs	33 sculpin	Downstream
9/14/2023	U13 Taillogs	10 sculpin, 2 smallmouth bass, 1 pumpkinseed	Downstream
9/25/2023	U12 Scroll Case and Draft Tube	0 in SC/10 sturgeon in DT	Upstream
9/27/2023	U12 Gatewells	4500 juvenile shad	Adjacent functional gatewells
11/27/2023	AFF	1 sturgeon, 2 steelhead, 4 carp, and about 5000 shad, suckers, and other non-game fish	Fish ladder and boat launch

2.4 Fish Unit Outages

A list identifying all Fish Unit 1 and Fish Unit 2 shutdowns (RS and OOS) 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 RS between 2200 and 0400 hours to minimize impact on adult fish passage. An adjacent unit is then operated to pull trash away from the Fish Unit trashracks. Nighttime Lamprey Operations occur 01 June to 31 August. This operation requires reduced fish unit output to operate all north (NUE, NDE) and south (SUE, SDE) entrances at 0.5' of entrance head.

Table 4. List of Fish Unit Outages.

UNIT	OOS	RTS	DURATION	REASON
F1	1330 on 01 Dec	1345 on 08 Mar	97 days, 0 hours, 15 mins	P.O., 2-YR Overhaul
F2	1330 on 01 Dec	1545 on 28 Feb	89 days, 2 hours, 15 mins	P.O., Annual Overhaul
F2	0324 on 02 Mar	0802 on 02 Mar	4 hours, 38 mins	F.O., High Drawdown
F1	0419 on 13 Apr	1506 on 17 Apr	4 days, 10 hours, 47 mins	F.O., DC Ground
F1	1749 on 03 May	1941 on 03 May	1 hour, 52 mins	P.O., Float Trash
F2	2008 on 03 May	2211 on 02 May	2 hours, 3 mins	P.O., Float Trash
F2	2216 on 05 May	0000 on 06 May	1 hour, 44 mins	P.O., Float Trash
F1	2256 on 05 May	0000 on 06 May	1 hour, 4 mins	P.O., Float Trash
F2	2157 on 06 May	2349 on 06 May	1 hour, 52 mins	P.O., Float Trash
F1	2327 on 06 May	2350 on 06 May	23 mins	P.O., Float Trash
F2	2200 on 07 May	2303 on 07 May	1 hour, 3 mins	P.O., Float Trash
F1	2241 on 07 May	2304 on 07 May	23 mins	P.O., Float Trash
F2	2158 on 08 May	2301 on 08 May	1 hour, 3 mins	P.O., Float Trash
F1	2228 on 08 May	2302 on 08 May	34 mins	P.O., Float Trash
F2	0013 on 15 May	0148 on 15 May	1 hour, 35 mins	P.O., Float Trash
F1	0113 on 15 May	0149 on 15 May	36 mins	P.O., Float Trash
F2	0011 on 16 May	0140 on 16 May	1 hour, 29 mins	P.O., Float Trash
F1	0109 on 16 May	0139 on 16 May	30 mins	P.O., Float Trash
F2	0020 on 17 May	0054 on 17 May	34 mins	P.O., Float Trash
F2	1829 on 18 May	1857 on 18 May	28 mins	P.O., Float Trash
F2	0001 on 20 May	0035 on 20 May	34 mins	P.O., Float Trash
F2	0029 on 21 May	0115 on 21 May	46 mins	P.O., Float Trash
F2	1839 on 22 May	1930 on 22 May	51 mins	P.O., Float Trash
F2	1831 on 24 May	2124 on 24 May	2 hours, 53 mins	P.O., Float Trash
F1	0016 on 25 May	0021 on 25 May	5 mins	P.O., Float Trash
F2	0007 on 26 May	0331 on 26 May	3 hours, 24 mins	P.O., Float Trash
F1	0214 on 26 May	0327 on 26 May	1 hour, 13 mins	P.O., Float Trash
F2	0815 on 27 May	0849 on 27 May	34 mins	P.O., Float Trash
F1	0829 on 27 May	0846 on 27 May	17 mins	P.O., Float Trash
F1	0001 on 01 Jun	0526 on 01 Jun	5 hours, 25 mins	R.S., Nighttime Lamprey Ops

F2	2232 on 01 Jun	0545 on 02 Jun	7 hours, 13 mins	R.S., Nighttime Lamprey Ops
F2	2228 on 02 Jun	0530 on 03 Jun	7 hours, 2 mins	R.S., Nighttime Lamprey Ops
F2	2230 on 03 Jun	0531 on 04 Jun	7 hours, 1 min	R.S., Nighttime Lamprey Ops
F2	2227 on 04 Jun	0533 on 05 Jun	7 hours, 6 mins	R.S., Nighttime Lamprey Ops
F1	2227 on 05 Jun	0532 on 06 Jun	7 hours, 5 mins	R.S., Nighttime Lamprey Ops
F2	2252 on 06 Jun	0532 on 07 June	6 hours, 40 minutes	R.S., Nighttime Lamprey Ops
F1	2232 on 07 Jun	0531 on 08 June	6 hours, 59 minutes	R.S., Nighttime Lamprey Ops
F2	2230 on 08 June	1326 on 09 June	14 hours, 56 minutes	R.S., Nighttime Lamprey Ops
F1	2230 on 09 June	0533 on 10 June	7 hours, 3 minutes	R.S., Nighttime Lamprey Ops
F2	2229 on 10 Jun	0533 on 11 Jun	7 hours, 4 mins	R.S., Nighttime Lamprey Ops
F2	2229 on 11 Jun	0529 on 12 Jun	7 hours	R.S., Nighttime Lamprey Ops
F2	2230 on 12 Jun	0529 on 13 Jun	6 hours, 59 mins	R.S., Nighttime Lamprey Ops
F2	2230 on 13 Jun	0534 on 14 Jun	7 hours, 4 mins	R.S., Nighttime Lamprey Ops
F1	2229 on 14 Jun	0530 on 15 Jun	7 hours, 1 min	R.S., Nighttime Lamprey Ops
F2	2231 on 15 Jun	0539 on 16 Jun	7 hours, 8 mins	R.S., Nighttime Lamprey Ops
F1	2230 on 16 Jun	0536 on 17 Jun	7 hours, 6 mins	R.S., Nighttime Lamprey Ops
F2	2229 on 17 Jun	0530 on 18 Jun	7 hours, 1 min	R.S., Nighttime Lamprey Ops
F1	2229 on 18 Jun	0527 on 19 Jun	6 hours, 58 mins	R.S., Nighttime Lamprey Ops
F2	2230 on 19 Jun	0534 on 20 Jun	7 hours, 4 mins	R.S., Nighttime Lamprey Ops
F1	2230 on 20 Jun	0538 on 21 Jun	7 hours, 8 mins	R.S., Nighttime Lamprey Ops
F2	2227 on 21 Jun	0536 on 22 Jun	7 hours, 9 mins	R.S., Nighttime Lamprey Ops
F2	2228 on 22 Jun	0532 on 23 Jun	7 hours, 4 mins	R.S., Nighttime Lamprey Ops
F1	2228 on 23 Jun	0527 on 24 Jun	6 hours, 59 mins	R.S., Nighttime Lamprey Ops
F2	2230 on 24 Jun	0529 on 25 Jun	6 hours, 59 mins	R.S., Nighttime Lamprey Ops
F2	2230 on 25 Jun	0540 on 26 Jun	7 hours, 10 mins	R.S., Nighttime Lamprey Ops
F2	2230 on 26 Jun	0532 on 27 Jun	7 hours, 2 mins	R.S., Nighttime Lamprey Ops
F1	2232 on 27 Jun	0532 on 28 Jun	7 hours	R.S., Nighttime Lamprey Ops
F2	2229 on 28 Jun	0531 on 29 Jun	7 hours, 2 mins	R.S., Nighttime Lamprey Ops
F2	2229 on 29 Jun	0530 on 30 Jun	7 hours, 1 min	R.S., Nighttime Lamprey Ops
F1	2229 on 30 Jun	0005 on 01 Jul	1 hour, 36 mins	R.S., Nighttime Lamprey Ops
F2	2356 on 30 Jun	0531 on 01 Jul	5 hours, 35 mins	R.S., Nighttime Lamprey Ops
F1	2300 on 01 Jul	0528 on 02 Jul	6 hours, 28 mins	R.S., Nighttime Lamprey Ops
F2	2300 on 02 Jul	0629 on 03 Jul	7 hours, 29 mins	R.S., Nighttime Lamprey Ops
F1	2259 on 03 Jul	0531 on 04 Jul	6 hours, 32 mins	R.S., Nighttime Lamprey Ops
F2	2300 on 04 Jul	0536 on 05 Jul	6 hours, 36 mins	R.S., Nighttime Lamprey Ops
F1	2259 on 05 Jul	0532 on 06 Jul	6 hours, 33 mins	R.S., Nighttime Lamprey Ops
F2	2259 on 06 Jul	0532 on 07 Jul	6 hours, 33 mins	R.S., Nighttime Lamprey Ops
F1	2304 on 07 Jul	0530 on 08 Jul	6 hours, 26 mins	R.S., Nighttime Lamprey Ops
F2	2300 on 08 Jul	0531 on 09 Jul	6 hours, 31 mins	R.S., Nighttime Lamprey Ops
F1	2300 on 09 Jul	0529 on 10 Jul	6 hours, 29 mins	R.S., Nighttime Lamprey Ops
F2	2259 on 10 Jul	0531 on 11 Jul	6 hours, 32 mins	R.S., Nighttime Lamprey Ops
F1	0001 on 12 Jul	0655 on 12 Jul	6 hours, 54 mins	R.S., Nighttime Lamprey Ops
F2	2300 on 12 Jul	0532 on 13 Jul	6 hours, 32 mins	R.S., Nighttime Lamprey Ops
F1	0716 on 13 Jul	0746 on 13 Jul	30 mins	R.S., Repair 4TD Relay
F2	2300 on 13 Jul	0531 on 14 Jul	6 hours, 31 mins	R.S., Nighttime Lamprey Ops
F2	2300 on 14 Jul	0532 on 15 Jul	6 hours, 32 mins	R.S., Nighttime Lamprey Ops

F1	2300 on 15 Jul	0532 on 16 Jul	6 hours, 32 mins	R.S., Nighttime Lamprey Ops
F2	2256 on 16 Jul	0529 on 17 Jul	6 hours, 33 mins	R.S., Nighttime Lamprey Ops
F1	2259 on 17 Jul	0550 on 18 Jul	6 hours, 51 mins	R.S., Nighttime Lamprey Ops
F2	2259 on 18 Jul	0529 on 19 Jul	6 hours, 30 mins	R.S., Nighttime Lamprey Ops
F1	2259 on 19 Jul	0530 on 20 Jul	6 hours, 31 mins	R.S., Nighttime Lamprey Ops
F2	2257 on 20 Jul	0529 on 21 Jul	6 hours, 32 mins	R.S., Nighttime Lamprey Ops
F2	2300 on 21 Jul	0530 on 22 Jul	6 hours, 30 mins	R.S., Nighttime Lamprey Ops
F1	2300 on 22 Jul	0532 on 23 Jul	6 hours, 32 mins	R.S., Nighttime Lamprey Ops
F2	2300 on 23 Jul	0535 on 24 Jul	6 hours, 35 mins	R.S., Nighttime Lamprey Ops
F2	2301 on 24 Jul	0527 on 25 Jul	6 hours, 26 mins	R.S., Nighttime Lamprey Ops
F1	2259 on 25 Jul	0529 on 26 Jul	6 hours, 30 mins	R.S., Nighttime Lamprey Ops
F2	2344 on 26 Jul	0530 on 27 Jul	5 hours, 46 mins	R.S., Nighttime Lamprey Ops
F2	2300 on 27 Jul	0533 on 28 Jul	6 hours, 33 mins	R.S., Nighttime Lamprey Ops
F2	2259 on 28 Jul	0147 on 29 Jul	2 hours, 48 mins	R.S., Nighttime Lamprey Ops
F1	0148 on 29 Jul	0532 on 29 Jul	3 hours, 44 mins	R.S., Nighttime Lamprey Ops
F2	2259 on 29 Jul	0529 on 30 Jul	6 hours, 30 mins	R.S., Nighttime Lamprey Ops
F1	0159 on 30 Jul	0227 on 30 Jul	28 mins	R.S., Float Trash
F1	2259 on 30 Jul	0530 on 31 Jul	6 hours, 31 mins	R.S., Nighttime Lamprey Ops
F2	2300 on 31 Jul	0605 on 01 Aug	7 hours, 5 mins	R.S., Nighttime Lamprey Ops
F1	2245 on 01 Aug	0559 on 02 Aug	7 hours, 14 mins	R.S., Nighttime Lamprey Ops
F2	2244 on 02 Aug	0559 on 03 Aug	7 hours, 15 mins	R.S., Nighttime Lamprey Ops
F1	2244 on 03 Aug	0601 on 04 Aug	7 hours, 17 mins	R.S., Nighttime Lamprey Ops
F2	2245 on 04 Aug	0601 on 05 Aug	7 hours, 16 mins	R.S., Nighttime Lamprey Ops
F2	2244 on 05 Aug	0603 on 06 Aug	7 hours, 19 mins	R.S., Nighttime Lamprey Ops
F1	2245 on 06 Aug	0559 on 07 Aug	7 hours, 14 mins	R.S., Nighttime Lamprey Ops
F2	2248 on 07 Aug	0600 on 08 Aug	7 hours, 12 mins	R.S., Nighttime Lamprey Ops
F2	2244 on 08 Aug	0558 on 09 Aug	7 hours, 14 mins	R.S., Nighttime Lamprey Ops
F1	2253 on 09 Aug	0558 on 10 Aug	7 hours, 5 mins	R.S., Nighttime Lamprey Ops
F2	2240 on 10 Aug	0559 on 11 Aug	7 hours, 19 mins	R.S., Nighttime Lamprey Ops
F1	2246 on 11 Aug	0607 on 12 Aug	7 hours, 21 mins	R.S., Nighttime Lamprey Ops
F2	2245 on 12 Aug	0601 on 13 Aug	7 hours, 16 mins	R.S., Nighttime Lamprey Ops
F1	2244 on 13 Aug	0607 on 14 Aug	7 hours, 23 mins	R.S., Nighttime Lamprey Ops
F1	0808 on 14 Aug	1115 on 14 Aug	3 hours, 7 mins	R.S., PH2CC Fishway ROV Inspection
F2	0837 on 14 Aug	1114 on 14 Aug	2 hours, 37 mins	R.S., PH2CC Fishway ROV Inspection
F1	1241 on 14 Aug	1705 on 14 Aug	4 hours, 24 mins	R.S., CO2 Work
F2	2244 on 14 Aug	0559 on 15 Aug	7 hours, 15 mins	R.S., Nighttime Lamprey Ops
F2	0704 on 15 Aug	1138 on 15 Aug	4 hours, 34 mins	R.S., CO2 Work
F2	2245 on 15 Aug	0600 on 16 Aug	7 hours, 15 mins	R.S., Nighttime Lamprey Ops
F1	2129 on 16 Aug	0600 on 17 Aug	8 hours, 31 mins	R.S., Nighttime Lamprey Ops
F2	2135 on 17 Aug	0559 on 18 Aug	8 hours, 24 mins	R.S., Nighttime Lamprey Ops
F1	2129 on 18 Aug	0600 on 19 Aug	8 hours, 31 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	2129 on 20 Aug	0559 on 21 Aug	8 hours, 30 mins	R.S., Nighttime Lamprey Ops
F2	2130 on 21 Aug	0600 on 22 Aug	8 hours, 30 mins	R.S., Nighttime Lamprey Ops

F1	2129 on 22 Aug	0005 on 23 Aug	2 hours, 36 mins	R.S., Nighttime Lamprey Ops
F2	2354 on 22 Aug	0556 on 23 Aug	6 hours, 2 mins	R.S., Nighttime Lamprey Ops
F2	2130 on 23 Aug	0558 on 24 Aug	8 hours, 28 mins	R.S., Nighttime Lamprey Ops
F1	2130 on 24 Aug	2359 on 24 Aug	2 hours, 29 mins	R.S., Nighttime Lamprey Ops
F2	2346 on 24 Aug	0600 on 25 Aug	6 hours, 14 mins	R.S., Nighttime Lamprey Ops
F2	2130 on 25 Aug	0602 on 26 Aug	8 hours, 32 mins	R.S., Nighttime Lamprey Ops
F1	2127 on 26 Aug	0600 on 27 Aug	8 hours, 33 mins	R.S., Nighttime Lamprey Ops
F2	2128 on 27 Aug	0603 on 28 Aug	8 hours, 35 mins	R.S., Nighttime Lamprey Ops
F1	2127 on 28 Aug	0600 on 29 Aug	8 hours, 33 mins	R.S., Nighttime Lamprey Ops
F2	2148 on 29 Aug	0601 on 30 Aug	8 hours, 13 mins	R.S., Nighttime Lamprey Ops
F1	2129 on 30 Aug	0601 on 31 Aug	8 hours, 32 mins	R.S., Nighttime Lamprey Ops
F2	2130 on 31 Aug	0012 on 01 Sept	2 hours, 42 mins	R.S., Nighttime Lamprey Ops
F1	1457 on 21 Sept	1646 on 21 Sept	1 hour, 49 mins	R.S., T11 Restore
F2	0726 on 12 Oct	1605 on 12 Oct	8 hours, 39 mins	R.S., BPA GENCON
F1	0728 on 12 Oct	1623 on 12 Oct	8 hours, 55 mins	R.S., BPA GENCON
F2	0016 on 05 Nov	0119 on 05 Nov	1 hour, 3 mins	R.S., Float Trash
F1	0034 on 07 Nov	0144 on 07 Nov	1 hour, 10 mins	R.S., Float Trash
F2	0030 on 19 Nov	0331 on 19 Nov	3 hours, 1 min	R.S., Float Trash
F1	0143 on 19 Nov	0329 on 19 Nov	1 hour, 46 mins	R.S., Float Trash
F2	0124 on 20 Nov	0155 on 20 Nov	31 mins	R.S., Float Trash
F2	1739 on 25 Nov	2000 on 25 Nov	2 hours, 21 mins	R.S., Float Trash
F1	1857 on 25 Nov	1959 on 25 Nov	1 hour, 2 mins	R.S., Float Trash

Definitions: Reserve Shutdown (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 99.37% (314/316) 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 (%)
Unit Priority	90	71.52%
Biologist Inspections	2	99.37%
PH1		
A-Branch Staff Gauge	90	71.52%
B-Branch Entrance Differential	19	93.99%
B-Branch S. Entrance Gate Closed	32	89.87%
PH1CC South Entrance Differential	2	99.37%
PH1CC North Entrance Differential	4	98.73%
FG 2-19	309	0%
FG 3-4 (A-Branch)	9	97.15%
Ice & Trash Sluiceway	267	15.19%
Spillway-Spill Pattern vs. FPP	17	94.62%
PH2		
Cascades Island Fishway Entrance Differential	2	99.37%
UMT Weir Differential (Cascades Island)	8	97.47%
Weir 37 Differential	31	90.19%
Weir 38 Differential	10	96.84%
Weir 67 Differential	1	99.68%
FG 6-6 (Cascades Island)	47	85.13%
FG 6-7 (Cascades Island)	48	84.81%
FG 6-8 (Cascades Island)	47	85.13%
FG 6-9 (Cascades Island)	14	95.57%
FG 6-10 (Cascades Island)	34	89.24%
FG 6-11 (Cascades Island)	55	82.59%
FG 6-12 (Cascades Island)	80	74.68%
FG 6-13 (Cascades Island)	1	99.68%
FG 6-18 (Cascades Island)	135	57.28%
F1/F2	6	98.10%
B2CC Avian Lines	16	94.62%
WA Fishway South CC Velocity	1	99.68%
WA Shore NUE Monolith Ent/TW Differential	13	95.89%
WA Shore NDE Monolith Ent/TW Differential	12	96.20%
WA Shore SUE Monolith Ent/TW Differential	31	90.19%
WA Shore SDE Monolith Ent/TW Differential	36	88.61%
A2 Diffuser	7	97.47%

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-13 Bonneville Dam Turbine Unit Priority Order, 2023 FPP**).

- Unit 13 was forced out of service in February 2022 for a generator ground, causing units to run out of order in January 2023 for 4 days and in February 2023 for 10 days.
- Unit 16 was forced out of service in March 2023 for 5 days due to water in the turbine bearing, violating unit priority order.
- Units 3 and 4 were forced out of service in March for 25 days due to an oil leak investigation. This resulted in other PH1 Units to run out of priority order on multiple occurrences throughout the year.
- Units 5-8 were forced out of service in March for 2 days due to a BPA line outage, violating unit priority order.
- Units 11 and 18 were forced out of service in August for 2 days due to an unknown cause of trip, violating unit priority order.
- Unit 18 was forced out of service in October for 2 days due to a failed brake switch. Concurrently, Unit 3 was forced out of service due to an oil leak investigation, and Unit 6 was run in place, resulting in a violation of unit priority order.
- Units 9 and 10 underwent a forced outage in November for over 24 hours due to a trip caused by a bad temperature switch, resulting in a violation of unit priority order.

3.1.2. A-Branch Staff Gauge/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.

3.1.3. B-Branch South Entrance Gate Closed: The B-Branch South Entrance Gate (Bradford Island) was discovered to be stuck in the closed position in October 2023. The gate operator appeared to continue functioning at the time, but the gate would not move to adjust to lower tailwater elevations. A work order was issued on 16 October 2023. Investigation of the cause of this electrical issue and the subsequent repairs cannot occur until B-Branch Fishway is fully dewatered for 2023/2024 Winter Maintenance. The investigation and resulting repairs are scheduled to begin in late January 2024.

3.1.4. FG2-19: PH1 Collection Channel diffuser FG 2-19 was found mechanically bound in the mostly closed position on 02/24/22 by PH1 Mechanics. No repairs can be made until this section of the PH1CC can be dewatered. A work order has been issued.

3.1.5. Weir 37: Electricians were required to reprogram the PLC to operate Weir 37 bleed off valve to twice per day to resolve this issue.

3.1.6. FG6-6, 6-7,6-8, and 6-10: The Cascades Island Fishway diffusers FG 6-6, FG 6-7, FG 6-8, and FG 6-10 were found inoperable in June and July 2023. Upon investigation, it was found that their transformers require replacement. A work order has been created and repairs will be made once funds have been allocated.

3.1.7. FG6-11: The Cascades Island Fishway diffuser FG 6-11 is 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 dewater of the Cascades Island Fishway.

3.1.8. FG6-12: Cascades Island Fishway diffuser FG 6-12 is mechanically bound in the closed position for unknown reasons. A work order has been created and repairs will be made during the next full dewater of the Cascades Island Fishway.

3.1.9. FG6-18: Cascades Island Fishway diffuser FG 6-18 was found stuck in the open position with limitorque problems in the fall of 2022. A work order has been created and repairs have been attempted, but full repair requires complete dewatering of the fishway. These repairs will be made during the next full dewater of the Cascades Island Fishway.

3.1.10. PH1 ITS: Mechanical-chain gate 1A was opened on 10 January 2023 to increase downstream surface passage and reduce trash raking workloads on the FV 1-1 trash racks. For safety measures, an additional (7th) trash rack was installed in the 1A gate slot, extending the height of stacked trash racks to approx. +80’ el. Without the 7th trash rack, the existing 6 trash racks extend from the river floor (approx. -2’ el) to +68’ el. This additional trash rack provides a safety barrier to block accidental sluiceway entry of a person, vessel, or other undesirable object floating uncontrollably downstream.

3.1.11. WA Shore SDE Monolith Ent/TW Differential: WA Shore SDE was OOC for unknown reasons multiple times through the year. Operations was notified and adjustments were made to Fish Unit generation and discharge as well as entrance gate manipulation to obtain proper entrance/tailwater differentials.

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. 2023 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	23-Feb-23 69391	0	643	766	864	692	626	306	786	834	30-Nov-22 74908
12	23-Feb-23 54129	927	219	767	439	133	555	87	0	0	13-Dec-22 57256
13	23-Feb-23 7950	856	214	776	127	38	0	305	773	827	OOS 11866
14	23-Feb-23 23770	911	230	749	67	0	270	239	714	862	13-Dec-22 27812
15	22-Feb-23 31273	884	166	692	25	0	0	0	259	843	13-Dec-22 34142
16	22-Feb-23 43029	259	30	704	4	18	174	498	495	857	12-Dec-22 46068
17	22-Feb-23 12443	946	161	0	227	84	488	691	775	823	12-Dec-22 16638
18	Mar-23 15891	161	725	790	852	684	631	691	683	826	12-Dec-22 21934

3.3 Avian Counts and Abatement Measures

Bonneville Project Fisheries recorded daily bird counts between 01 April through 31 October 2023 (**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 2023 and 14 August to 31 October. 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 2023.

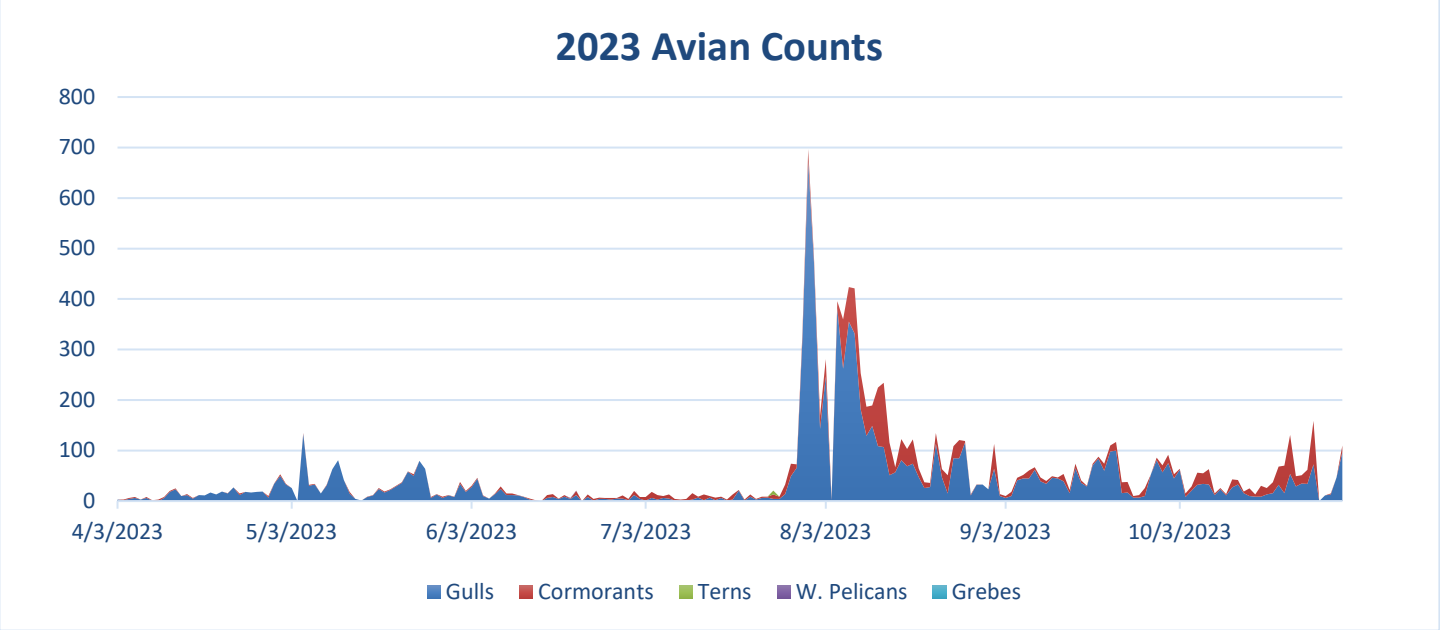


Figure 2. 2023 Bonneville Avian Counts.
Please note that pelicans, grebes, and terns are included in this figure. Due to the extremely low observations, it is difficult to recognize in the chart. Specific data can be provided upon request.

3.4 Fish Counts

The Corps of Engineers contracted with Four Peaks Environmental for fish counting during the 2023 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. Detailed daily temperatures can be found in the weekly reports and are available upon request.

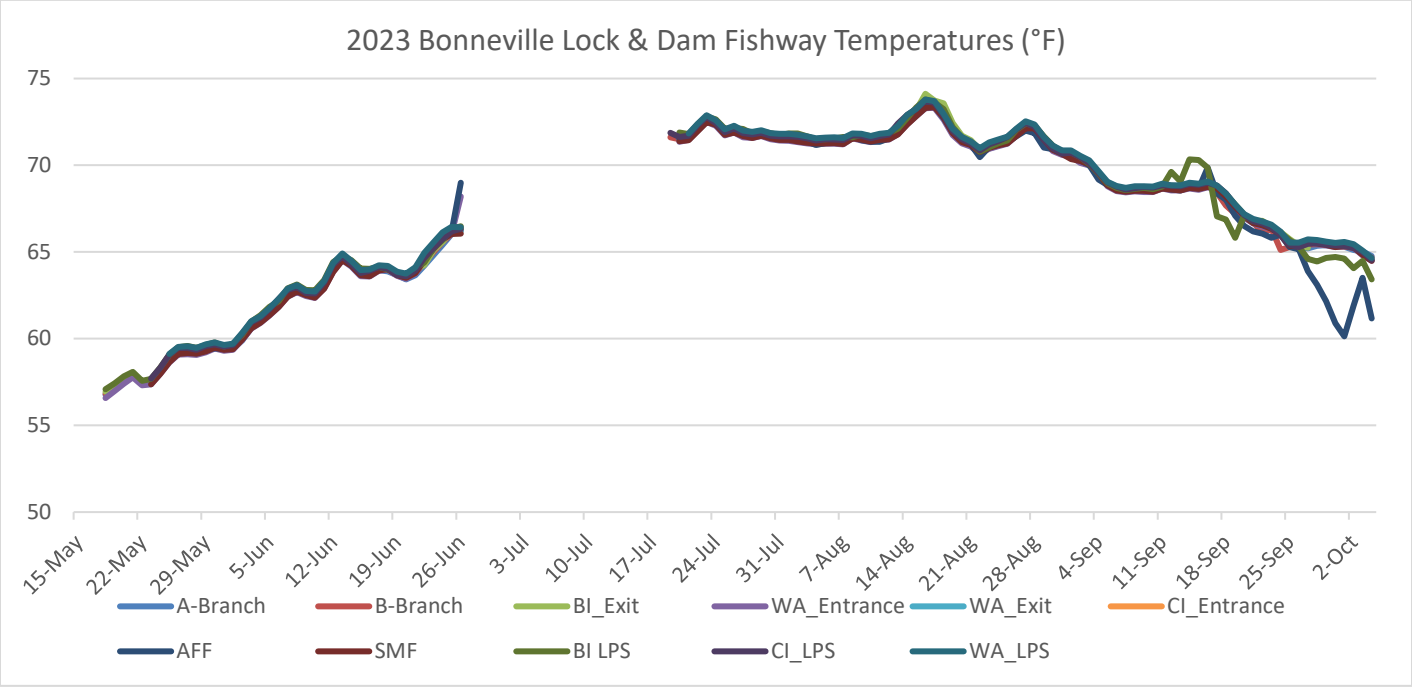


Figure 3. 2023 Temperatures at Bonneville.
Please note the following temperature probe issues: CI Entrance temperature probe remains stuck inside the stilling well pipe, temperatures at this location have not been able to be retrieved as of 22 June 2022.
Due to a failing data "shuttle", no data could be extracted from the temperature probes during the dates 6/27/23 – 7/19/23 without the possibility of losing or artificially corrupting the currently tracked data.

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

2023. ITS End Gate reinstalled.
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

2023/24. Lamprey ramp and bollards installed in B-Branch Entrance Bay. Variable width entrance weir installed.
2023/24. Additional lamprey orifices cut into concrete of serpentine section of Bradford Island Fishway.
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. Lamprey orifices were cut into concrete of two serpentine section weirs of the Bradford Island Fishway.
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

2023. FGE modifications to the remainder of the PH2 Unit's A & B gatewells occurred.
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

2022-2023. Weekly reports and daily fishway inspections for Bonneville Dam. U.S. Army Corps of Engineers, Portland District. Bonneville Lock and Dam.

2023. Fish Passage Plan for Corps of Engineers Projects. U. S. Army Corps of Engineers, Northwestern Division, Portland, Oregon.