CENWW-ODO GRIFFITH February 2023

MEMORANDUM THRU:
Scott Green, Operations Project Manager, Lower Monumental Dam

FOR Chief, Operations Division
ATTN: Christopher Peery and Scott St. John

SUBJECT: Submission of 2022 Adult Monitoring Report, Lower Monumental Dam Juvenile Fish Facility.

1. Enclosed find the 2022 Adult Monitoring Report for Lower Monumental Dam as requested.

2. If you have any questions contact Denise Griffith at Lower Monumental Dam, (509) 282-7211.

DENISE S. GRIFFITH
Supervisory Fisheries Biologist, Lower Monumental Dam

Enclosure

2022 LOWER MONUMENTAL DAM ADULT MONITORING REPORT

United States Army Corps of Engineers
Lower Monumental Lock and Dam
5520 Devils Canyon Road
Kahlotus, Washington 99335

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LIST OF ACRONYMNS

BiOp-Biological Opinion
KCFS-kilo cubic feet per second
ESA-Endangered Species Act
FCRPS-Federal Columbia River Power System
FPP-Fish Passage Plan
KCFS-kilo cubic feet per second
NSE-North shore entrance
OOS-Out of service
RSW-Removable spillway weir
SPE-South powerhouse entrance
SSE-South shore entrance

INTRODUCTION

The following report is on fishway activities at Lower Monumental Dam and is required under the Endangered Species Act (ESA) consultation on the operation of the Federal Columbia River Power System (FCRPS) and its associated fish passage facilities. This report summarizes the operation and maintenance of adult fish passage facilities at Lower Monumental Dam, including the results of visual inspections of fishways conducted by fisheries staff during the adult fish passage period of March 1 to December 31, 2022. Inspection readings are provided in Appendix 1 (2022 Ladders LoMo.xlsx). Recommendations are provided for correcting problems found.

This report also contains a synopsis of juvenile fish facility operations. Additional information on juvenile fish collection and transportation activities at Lower Monumental Dam can be found in the report titled "2022 Juvenile Fish Collection and Bypass Report".

RIVER CONDITIONS

The highest daily average flow for the 2022 season was 210.3 kilo cubic feet second (kcfs) on June 13. The lowest daily average flow for the season occurred on November 20 with a flow of 12.2 kcfs. The average flow for the season was 44.8 kcfs. Mandatory spill occurred for 151 days from 00:00 hour on April 3, through midnight on August 31, with a maximum daily average spill of 112.1 kcfs on June 13, 2022. The removable spillway weir (RSW) was put into operation when Biological Opinion (BiOp) spill began on April 3, and was taken out of service for the season on August 4, 2022 due to high river temperatures and flows being less than 30 kcfs for 3 consecutive days and trending downward as stated in the Fish Passage Plan (FPP). Average river temperature for the 2022 season was 55.8 °F and ranged from 37.0 °F (December 27 – 31) to 71.0 °F (August 3 – 4 and August 20 - 21).

ADULT FISH FACILITY

Facility Description

The adult fishways at Lower Monumental are comprised of north and south shore fish ladders. The upper ladders extend from the forebay to tailwater and include ladder exits, slotted weirs, upper diffusers, overflow weirs with orifices, and fish counting stations with picketed leads. The lower ladders contain collection channels, channel diffusers, and ladder entrances. The north shore lower fish ladder has two north shore entrances (NSE-1 and NSE-2) and two south powerhouse entrances (SPE-1 and SPE-2). The south shore lower fish ladder has two entrances (SSE-1 and SSE-2). Auxiliary water is supplied by three turbine-driven pumps (fish pumps) located in the north side of the powerhouse. The water is pumped into a supply conduit that extends under the north and south shore lower ladders, distributing water to the lower ladder diffusers. Excess water from the juvenile fish bypass system, approximately 180-200 cubic feet per second (cfs), additionally contributes to the auxiliary water supply during the juvenile fish bypass/collection season.

Facility Modifications/Maintenance or Improvements

No new modifications were made to the adult fish passage system in 2022. Old coaxial cables, zip ties, research equipment and satellite dishes were removed from the south shore fishway and disposed of in March. The south powerhouse tailwater staff gauge frame broke off the concrete wall on April 13. All the staff gauges will be replaced during the winter of 2023.

Operations and Maintenance

Fish Ladder and Collection Channel

The adult fishways were in service throughout 2022 except for the winter maintenance season. Inspection and maintenance on the north and south shore fishways occurred from January 28 to February 16 and January 4 to January 27, respectively. Staff gauges SG1N, SG2N, SG3N, SG4N, SG4S, SG2S and SG3S were rehabbed during winter maintenance.

The upper fish ladders are dewatered annually for maintenance activities including debris removal, diffuser grating and structural support inspections, cleaning of picketed leads, staff gauges and fish counting windows, maintenance of count station window cleaning mechanisms, and repairing leaks in expansion joints. A minimum of twenty-four hours prior to dewatering, the auxiliary water is shut off to discourage newly arriving fish from starting up the ladders. The fish exit is then bulkheaded off, any fish in the exit pool are removed and released to the forebay, and the upper ladders are partially dewatered, leaving about 4 inches running through ladder weir orifices. This flow is maintained to move any remaining fish to tailwater. Approximately 24 hours later, the flow is reduced to two inches and maintenance personnel go down the ladder through the orifices to remove debris, move remaining fish to tailwater, and inspect the full length of the channel.

The lower ladders are typically dewatered to a depth of one foot providing a holding pool for fish. Once the target depth is obtained, maintenance personnel and biologists inspect entrance weirs, diffuser grates and exposed diffuser gate operating equipment. Staff gauges are then cleaned, and debris is removed. The north shore water is lowered to 0.50 ft for visual inspection of grating. When dewatering for repair is necessary, fish are crowded to the entrance pools, netted, and placed in a 600-gallon container (or 32-gallon containers if fish numbers are very low). The large container is manipulated with the crane to release fish to tailwater and refill the tank if needed. The need for replacement of the diffuser grates and clasps has been an issue for years and will be fully addressed when funding is available. This rehabilitation work began during the 2020 winter maintenance period when the gratings on north ladder diffusers 3, 4, 5 and 6 were replaced. No other problems were observed during the inspection of the lower north shore channel. The inspection of the lower south shore ladder found two loose deck grating panels near entrance SSE-1 and another one missing near entrance SSE-2. The panels were resecured or replaced before watering the entrance pool back up.

Auxiliary Water Supply

Fish pumps 1, 2, and 3 were out of service (OOS) from January 3 to March 1 for annual maintenance. Annual maintenance consists of changing oil in pedestals, adjusting or replacing packing and shaft seals, inspecting and cleaning heat exchangers, inspecting and replacing broken shear pins on the wicket gates, adjusting brakes, removing trash and debris from the fish pump turbine, and a general mechanical and electrical inspection. The more significant pump outages are summarized in Table 1.

Table 1. Fish pump outages at Lower Monumental Dam, 2022.

Affected Pump(s)	Dates	Reason for Outage/Comments
1, 2, 3	Jan 3 – Mar 1	Annual maintenance

ADULT FISHWAY INSPECTIONS

Methods

The automated fishway control system consists of a computer in the control room that interfaces with process level controllers and receives information from remote terminal units. The terminal units are fed by sensors detecting entrance weir gate positions, collection channel water and tailwater elevations, and upper diffuser pool levels within the fishways. The automated fishway control system is based on a GE Fanuc Series 90 control program. The computer is used to change the control parameters of the terminal units and provide datum acquisition and storage.

The remote terminal units control the fishway entrance weir gates according to set points that either regulate the gate depths below tailwater or channel-to-tailwater entrance head differentials. The computer printout contains the following information: dates; times (hour, minute, and second); channel temperatures; channel and tailwater elevations (feet above mean sea level) for the north shore, south powerhouse, and south shore; gate elevations; gate depths; entrance heads; and set points for the gate depths and entrance heads. The automated control system was operating throughout the 2022 operating season.

Operating criteria involve normal and special operating conditions. Under normal operating conditions, NSE-1, NSE-2, SPE-1, SPE-2, and SSE-1 weir gates are operated to meet criteria of at least 8 ft depths (depth criteria) or be on sill if less than 8ft depths occur (sill criteria). SSE-2 weir gate is operated with a 6-foot opening. Normal operating criteria for the rest of the ladder includes maximums of 0.5 ft heads at the exits, maximums of 0.4 ft and 0.3 ft heads at the north and south shore picketed leads, respectively, 1.0-1.3 ft of water over the ladder weirs, 1.5-4.0 foot per second (fps) collection channel velocity, and 1.0-2.0 ft head differentials at all fishway entrances.

Adult fishway inspections consist of observing facility operating conditions and recording visual readings from staff gauges, weir gate selsyns, and electronic meters. Wave action and impact from large debris have consistently resulted in loss of the south ladder tailwater staff gauge. Readings of the lower south ladder and tailwater are therefore taken from an electronic panel in the service gallery.

Inspections by fisheries staff and quality control personnel are normally conducted three or more times per reporting week with times randomized. An average of 3.6 inspections per week were performed (155 inspections /43 weeks) in 2022. Depths and head differentials that were out of criteria, as well as other problems, were reported to powerhouse shift operators and/or maintenance staff for correction. Powerhouse operators conduct shift inspections in addition to the inspections performed by fisheries staff.

Inspection Results

Visual readings are normally recorded and compared with automated control system readings to check

for calibration problems. Data from fishway inspections was entered into an Excel spreadsheet (Appendix 1). The average compliance of all criteria points in 2022 was 99.0%. A summary of fish ladder performance and variability is provided in Table 2.

Ladder exits

North shore ladder exit head differentials were in criteria during all inspections. South shore ladder exit head differentials were in criteria during all inspections. North and south shore exits were operated without debris booms again this season. A debris boom is being installed at the north ladder exit when that ladder goes out of service for winter maintenance.

Ladder weirs

The depths over the weirs of the north shore ladder were within criteria during all inspections. The depths over the weirs of the south shore ladder were within criteria during all inspections.

Counting stations

The head differential across the north shore counting station picketed leads was in criteria during all inspections. The head differential across the south shore counting station picketed leads was in criteria during all inspections.

Entrance heads

North shore entrance head differential was in criteria during all inspections. South powerhouse entrance head was in criteria during all inspections. South shore entrance head differential was in criteria during all inspections.

North shore entrance (NSE-1 & 2) depths

NSE-1 weir gate was in depth criteria during 94.2% of the inspections. Readings out of criteria were due to calibration issues within the automated control system. NSE-2 weir gate was in depth criteria during 98.1% of the inspections. Readings out of criteria were due to calibration issues within the automated control system.

South powerhouse entrance (SPE-1 & 2) depths

SPE-1 weir gate was in depth or sill criteria during 99.4% of the inspections (13.5% depth, 85.8% sill). Readings out of criteria were due to calibration issues within the automated control system during high spills and flows. SPE-2 weir gate was in depth or sill criteria during 99.4% of the inspections (12.9% depth, 86.5% sill). Readings out of criteria were due to calibration issues within the automated control system during high spills and flows.

South shore entrances (SSE-1 & 2)

SSE-1 weir gate was in depth or sill criteria during 96.1% of the inspections (41.9% depth, 54.2% sill). Readings out of criteria were due to calibration issues within the automated control system. SSE-2 weir gate was in criteria during 99.4% of the inspections. Reading out of criteria was due to the weir operation being defaulted to automatic mode which moved the weir gate off its set opening

height.

North shore collection channel velocity

The velocity unit is located in the north shore collection channel in the transition area between main units 1 and 2. The sending unit is positioned in the channel to avoid non-characteristic high or low readings that are not representative of overall velocity conditions. Accurate velocity readings require the inspector to wait for the digital display to warm up and achieve a duplication of its peak reading.

Velocities were in criteria during 100% of the inspections (criteria: 1.5-4.0 fps).

Table 2. Summary of adult fishway inspections at Lower Monumental Dam, 2022.

			------Not Enough Depth------			-------Too Much Depth-------		
Criteria and Locations	**No. in Depth Criteria/ No. in Sill Criteria/ No. of Inspections**	**% In Depth Criteria/ % In Sill Criteria**	**No./% Within 0.01-0.1 Foot**	**No./% Within 0.11-0.2 Foot**	**No./% >0.2 Foot**	**No./% Within 0.01-0.1 Foot**	**No./% Within 0.11-0.2 Foot**	**No./% >0.2 Foot**
North Channel Water Velocities	155 *** 155	100.0 ***	*** ***	*** ***	*** ***	*** ***	*** ***	*** ***
Differentials								
North Ladder								
Ladder Exit	155 *** 155	100.0 ***	*** ***	*** ***	*** ***	0 0.0	0 0.0	0 0.0
Ladder Weirs	155 *** 155	100.0 ***	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
Counting Station	155 *** 155	100.0 ***	*** ***	*** ***	*** ***	0 0.0	0 0.0	0 0.0
South Ladder								
Ladder Exit	155 *** 155	100.0 ***	*** ***	*** ***	*** ***	0 0.0	0 0.0	0 0.0
Ladder Weirs	154 *** 155	99.4 ***	1 0.6	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
Counting Station	155 *** 155	100.0 ***	*** ***	*** ***	*** ***	0 0.0	0 0.0	0 0.0
Coll. Channels								
North Shore Entrance	152 *** 155	98.1 ***	1 0.6	0 0.0	2 1.3	0 0.0	0 0.0	0 0.0
South Powerhouse Entrance	155 *** 155	100.0 ***	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
South Shore Entrance	155 *** 155	100.0 ***	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
Weir Depths								
NSE-1[2]	145 1 155	93.5 0.6	0 0.0	3 1.9	6 3.9	*** ***	*** ***	*** ***
NSE-2[2]	151 1 155	97.4 0.6	0 0.0	1 0.6	2 1.3	*** ***	*** ***	*** ***
SPE-1[2]	21 133 155	13.5 85.8	0 0.0	0 0.0	1 0.6	*** ***	*** ***	*** ***
SPE-2[2]	20 134 155	12.9 86.5	0 0.0	1 0.6	0 0.0	*** ***	*** ***	*** ***
SSE-1[2]	65 84 155	41.9 54.2	0 0.0	1 0.6	5 3.2	*** ***	*** ***	*** ***
SSE-2	154 Not Applic. 155	99.4 ***	0 0.0	0 0.0	0 0.0	*** ***	*** ***	*** ***

[1] Data from Appendix 1.

[2] "On sill" means the weir gate is resting on its sill and meets "on sill" criteria at this location

APPENDIX

Appendix 1. Lower Monumental Adult Fishway Inspections, 2022. (spreadsheet)