BC Hydro
Power smart

Site C Clean Energy Project

Temporary Upstream Fish Passage Facility Operations Report

Reporting Period: August 1 to 31, 2022

Prepared by BC Hydro

September 12, 2022

Introduction

BC Hydro diverted the Peace River through two diversion tunnels on the left bank of the dam site during the fall of 2020. River diversion represented the first activity in the construction of the Site C Clean Energy Project (the Project) to affect upstream fish movement in the Peace River (EIS, Volume 2, Appendix Q[1]). As such, the temporary upstream fish passage facility (hereafter temporary facility) was operated to pass fish upstream and allow them to fulfill portions of their lifecycles upstream of the Project.

Note that the temporary facility will operate during the river diversion phase of construction (2020 to 2023) on the left bank of the Peace River at the outlet of the diversion tunnels. BC Hydro intends to operate the temporary facility from April 1 to October 31 each year based on the timing of fish movements in the Peace River and to avoid damaging mechanical equipment during cold weather conditions from November to March. Following the closure of the diversion tunnels and reservoir filling in the fall of 2023, the permanent upstream fish passage facility (hereafter permanent facility) will be operated at the outlet of the generating station to provide fish passage during the operation phase of the Project.

In 2022 water surface elevations at the temporary facility have been high and above the operating range (i.e., engineering design criteria) of the temporary facility, which led to a number of adjustments to infrastructure and operations to allow the temporary facility to operate above design criteria. High water surface elevations also have the potential to reduce the biological effectiveness of the temporary facility. As a result, BC Hydro implemented the contingent measures listed in Section 4.8 of the Fish Passage Management Plan[2].

Contingent measures consisted of weekly boat electroshocking surveys (hereafter contingent fish capture and transport) to capture target species downstream of the diversion tunnel outlet and transport and release them upstream of the Project. Only those species trying to fulfill life history requirements upstream of the Project (Arctic Grayling, Bull Trout, Rainbow Trout, and Mountain Whitefish) were transported and released upstream of the Project during the reporting period (EIS, Volume 2, Appendix O[3]; BC Hydro 2015[4]). All other species were released at their capture location downstream of the Project.

Operation of the temporary facility and implementation of contingent fish capture collectively provided for upstream fish passage for target species during the reporting period.

Structure of the report

This report summarizes the data and information presented in weekly reports prepared by the facility operator, as described in the Manual of Operational Parameters and Procedures (OPP), and covers the full extent of operations in August 2022.

This report has the following sections:

- Biological operation;
- Environmental conditions;
- Mechanical operation;
- Adjustments; and
- Contingent fish capture and transport.

Biological operation is defined as the sorting, sampling, tagging, transport and release of fish. Mechanical operation is defined as the operation of the pumps, gates, crowder, lock, sensors, loggers, and other mechanical equipment to ensure the temporary facility achieves the biological objectives described in Section

[1] Available at: https://www.ceaa-acee.gc.ca/050/documents_staticpost/63919/85328/Vol2_Appendix_Q.pdf
[2] Available at: http://sitecproject.com/sites/default/files/Fish%20Passage%20Management%20Plan.pdf
[3] Available at: https://www.ceaa-acee.gc.ca/050/documents_staticpost/63919/85328/Vol2_Appendix_O.pdf
[4] Available at: http://sitecproject.com/sites/default/files/Fisheries-and-Aquatic-Habitat-Monitoring-and-Follow-up-Program.pdf

4.1 of the Fish Passage Management Plan[5].

Summary

Four hundred and ten fish – 352 Redside Shiner, 19 Mountain Whitefish, 12 Longnose Sucker, 9 Largescale Sucker, 6 White Sucker, 6 Northern Pikeminnow, 2 Rainbow Trout, 1 Bull Trout, 1 Kokanee, 1 Walleye, and 1 Pearl Dace – were sorted and sampled at the temporary facility (Table 1). All fish were transported and released into the Peace River upstream of the Project, with the exception of the Walleye that was released into the Peace River downstream of the Project, as described in the OPP (Photo 1). In addition to operating the temporary facility, BC Hydro conducted one session of contingent fish capture downstream of the diversion tunnel outlet and transported 16 Mountain Whitefish, 3 Bull Trout, and 1 Rainbow Trout upstream of the Project (Table 6). Seventeen fish from other species were encountered during contingent fish capture and were released downstream of the Project (Table 6).

Several adjustments to the top of the fishway in August, September and October 2021 were continued in August 2022 to improve the biological and mechanical operation of the temporary facility.

- Sediment continues to build up in the fish lock and pre-sort holding pool. Each week, the operator reduced flow in the fishway over a 15 minute period and released flow through the lock to flush sediment out of the lock and pre-sort holding pool. Such an approach has proved to be an effective and proactive way to manage sediment at the top of the fishway and has avoided shutting the facility down and using a hydrovac to clear out the sediment.
- Several adjustments were made to improve the efficiency of fish processing. Changes were made to the physical setup of the sorting area to reduce the risk of injury to fish, improve ergonomics and the ability of the operators to communicate with each other, and allow for both individuals to be involved in the tagging and sampling of fish (Photo 2). Changes were also made to the order in which measurements and samples were collected from fish to streamline the process.

Appendix I provides a high-level summary of operation of the temporary facility and implementation of contingent fish capture and transport during the reporting period.

Appendix II summarizes the total flow diverted from the Peace River to operate the temporary facility during the reporting period.

[5] Available at: http://sitecproject.com/sites/default/files/Fish%20Passage%20Management%20Plan.pdf

Biological operation

In total, 410 fish were sorted in the temporary facility during the reporting period (Table 1; Figure 1). Five mortalities – 2 Redside Shiner, 1 Largescale Sucker, 1 Longnose Sucker, and 1 Mountain Whitefish – were observed during the reporting period (0.7% of all fish sorted in 2022), which is in-line with the anticipated levels of mortality during operations[6].

Table 1. Total number of fish sorted, sampled, transported and released during the reporting period.

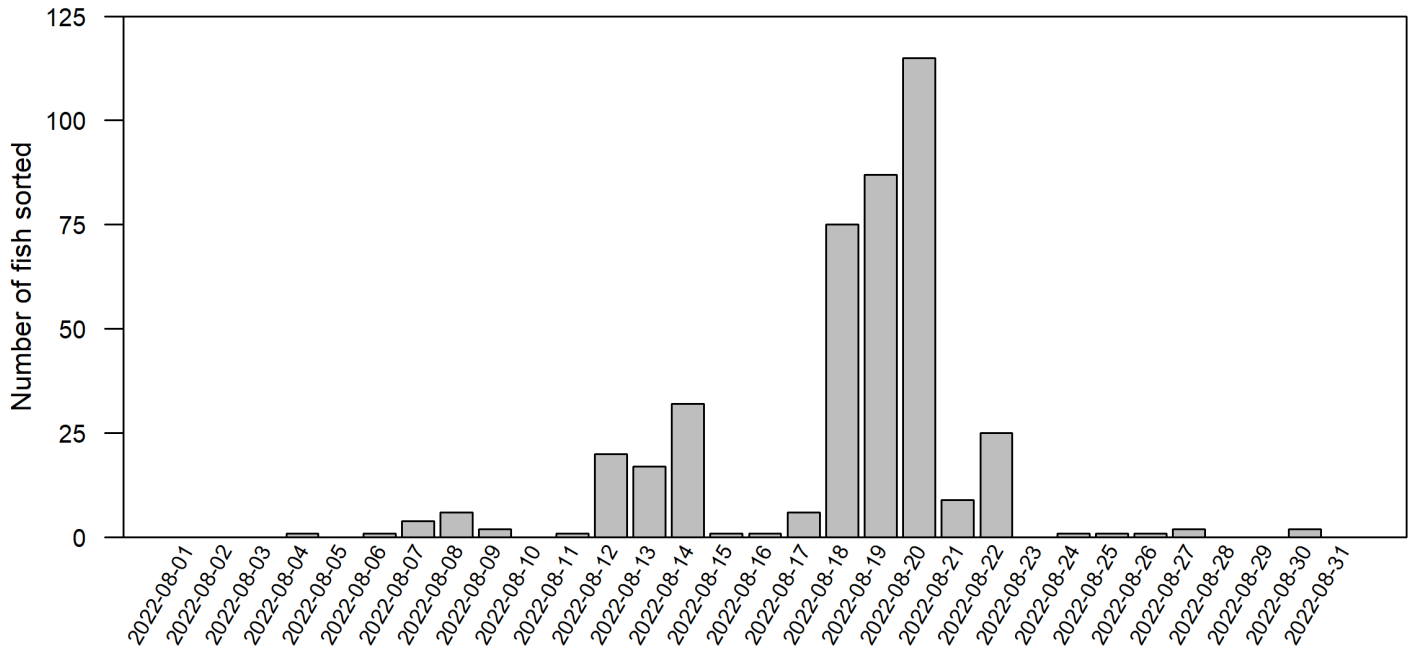
Species	Sorted	Transported and released	PIT tagged	Mortalities	Genetics	Microchemistry or ageing
Arctic Grayling						
Brook Stickleback						
Brook Trout						
Bull Trout	1	1	1	0	1	1
Burbot						
Finescale Dace						
Flathead Chub						
Goldeye						
Kokanee	1	1	N/A	0	N/A	1
Lake Chub						
Lake Trout						
Lake Whitefish						
Largescale Sucker	9	9	8	1	N/A	N/A
Longnose Dace						
Longnose Sucker	12	12	12	1	N/A	N/A
Mountain Whitefish	19	19	11	1	N/A	1
Northern Pike						
Northern Pikeminnow	6	6	N/A	0	N/A	N/A
Northern Redbelly Dace						
Peamouth						
Pearl Dace	1	1	N/A	0	1	N/A
Prickly Sculpin						
Pygmy Whitefish						
Rainbow Trout	2	2	2	0	2	2
Redside Shiner	352	352	N/A	2	352	N/A
Slimy Sculpin						
Spoonhead Sculpin						
Spottail Shiner						
Trout-perch						
Walleye	1	1	1	0	N/A	1
White Sucker	6	6	6	0	N/A	N/A
Yellow Perch						
Grand total	410	410	41	5	356	6

Not all fish species were PIT tagged or sampled for genetics, microchemistry, or ageing, as described in the OPP.

[6] The FAA for Main Civil Works and Facility Operations (15-HPAC-01160) describes an acceptable level of incidental mortality to be no more than 5% of the total number of fish sorted in the temporary facility on an annual basis.

Between zero and 115 fish were sorted daily during the reporting period (Figure 1).

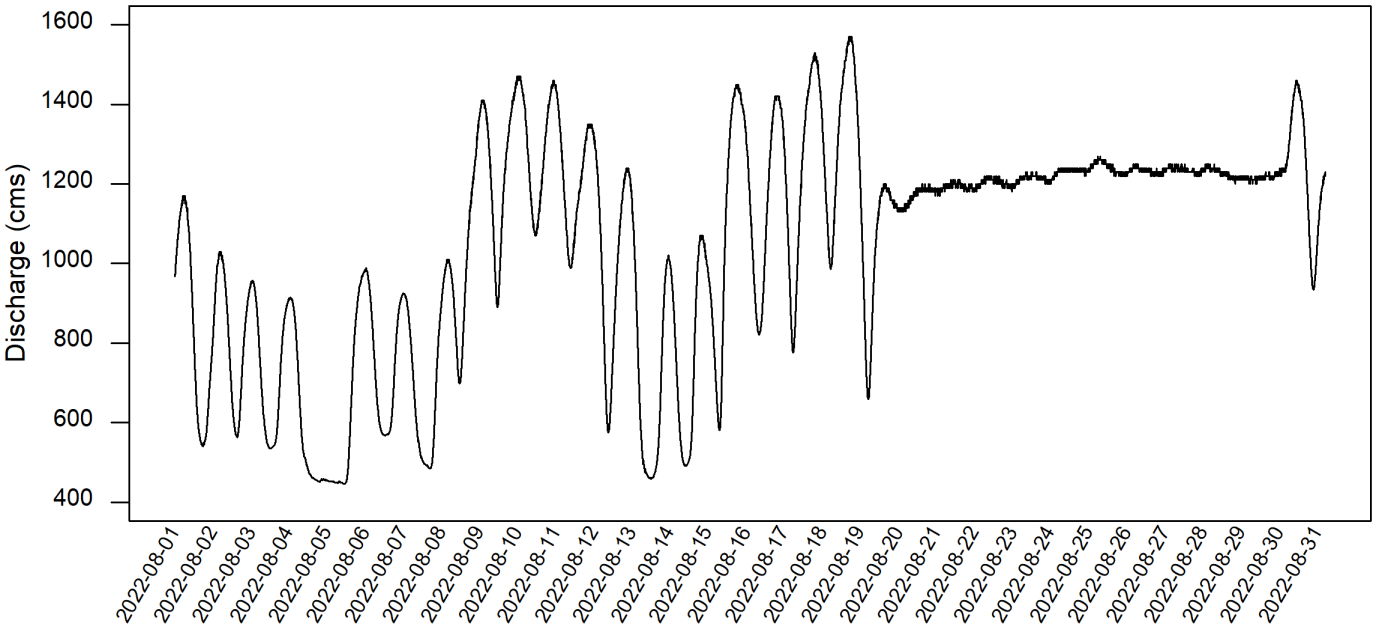
Figure 1. Daily number of fish sorted in the temporary facility during the reporting period.



Environmental conditions

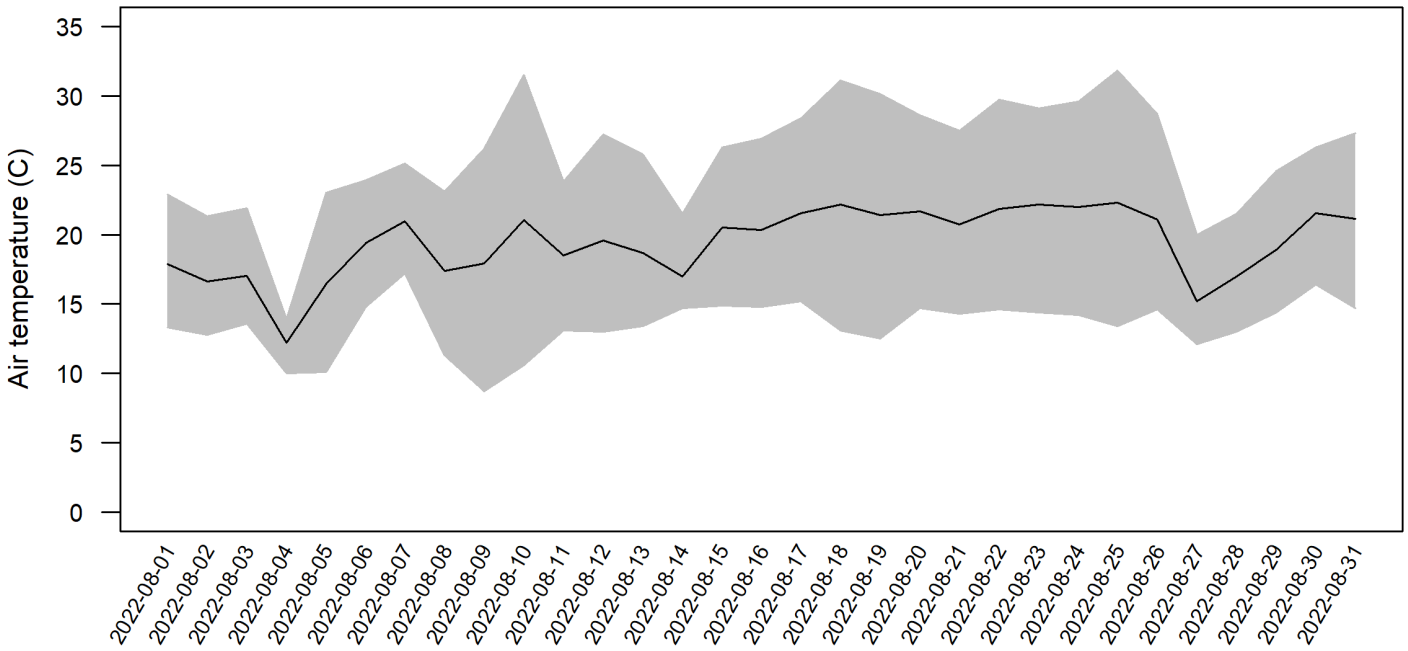
Discharge in the Peace River fluctuated during the reporting period from a low of 447 cms on August 5 to a high of 1570 cms on August 19 (Figure 2).

Figure 2. Discharge in the Peace River during the reporting period as measured at the Peace River above Pine River (07FA004) Water Survey of Canada (WSC) hydrometric station. Data were downloaded from the WSC on September 6; the downloaded data were provided at 5-minute intervals and were listed as provisional by the WSC.



Air temperature fluctuated during the reporting period from a low of 8.7°C on August 9 to a high of 31.8°C on August 25 (Figure 3).

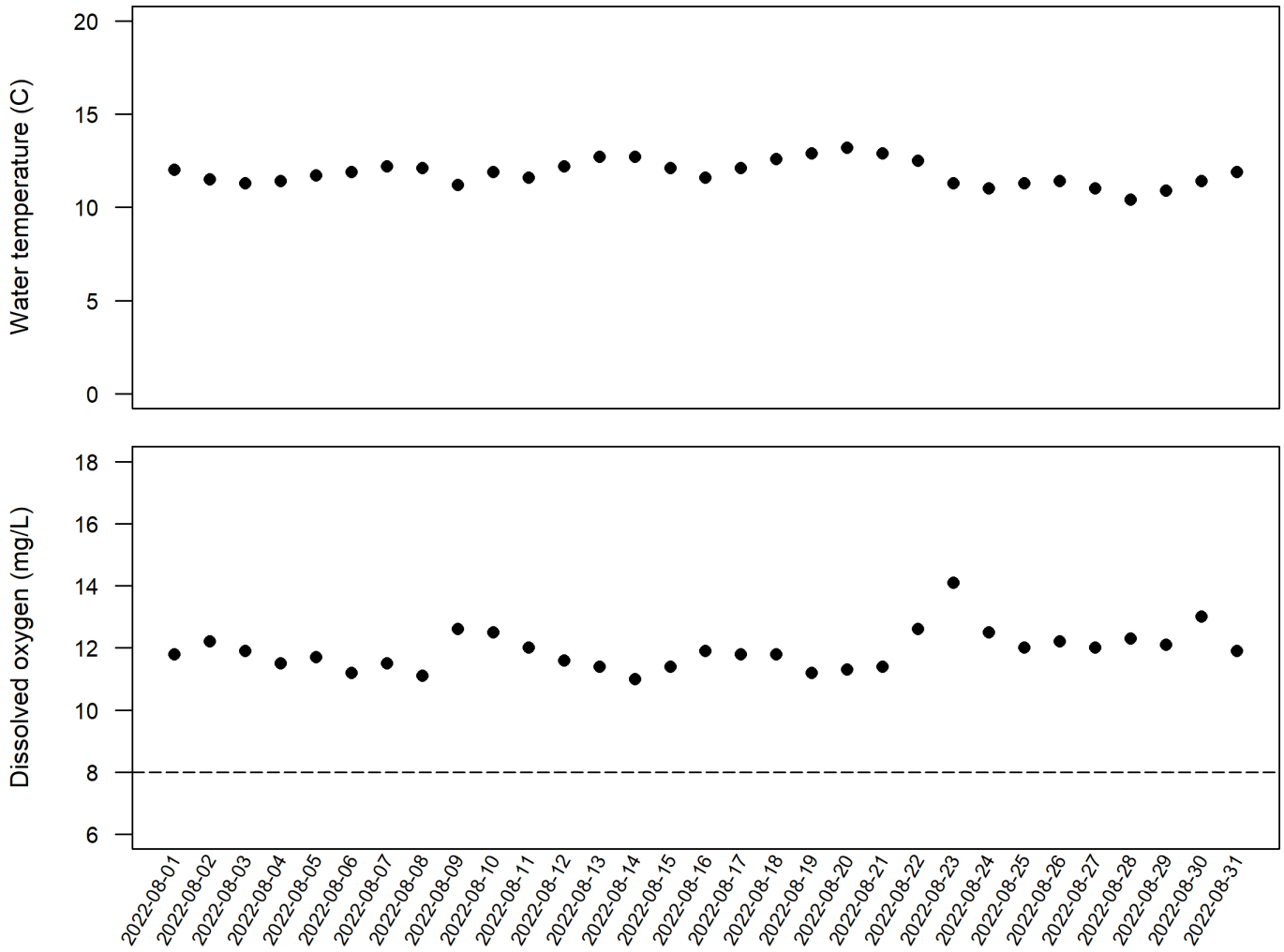
Figure 3. Mean daily air temperature (black line; °C) during the reporting period as measured by the provincial air monitoring station located on the dam site at the Site C Workers Accomodation[7] (E309527). Shaded area represents the minimum and maximum daily air temperatures.



[7] Available at: https://www.env.gov.bc.ca/epd/bcairquality/data/station.html?id=E309527

Water temperature remained stable during the reporting period (Figure 4). Dissolved oxygen remained above the minimum dissolved oxygen level (8.0 mg/L) described in the design report of the temporary facility.

Figure 4. Daily water temperature (°C) and dissolved oxygen (mg/L) during the reporting period as measured in the pre-sort holding pool of the temporary facility.

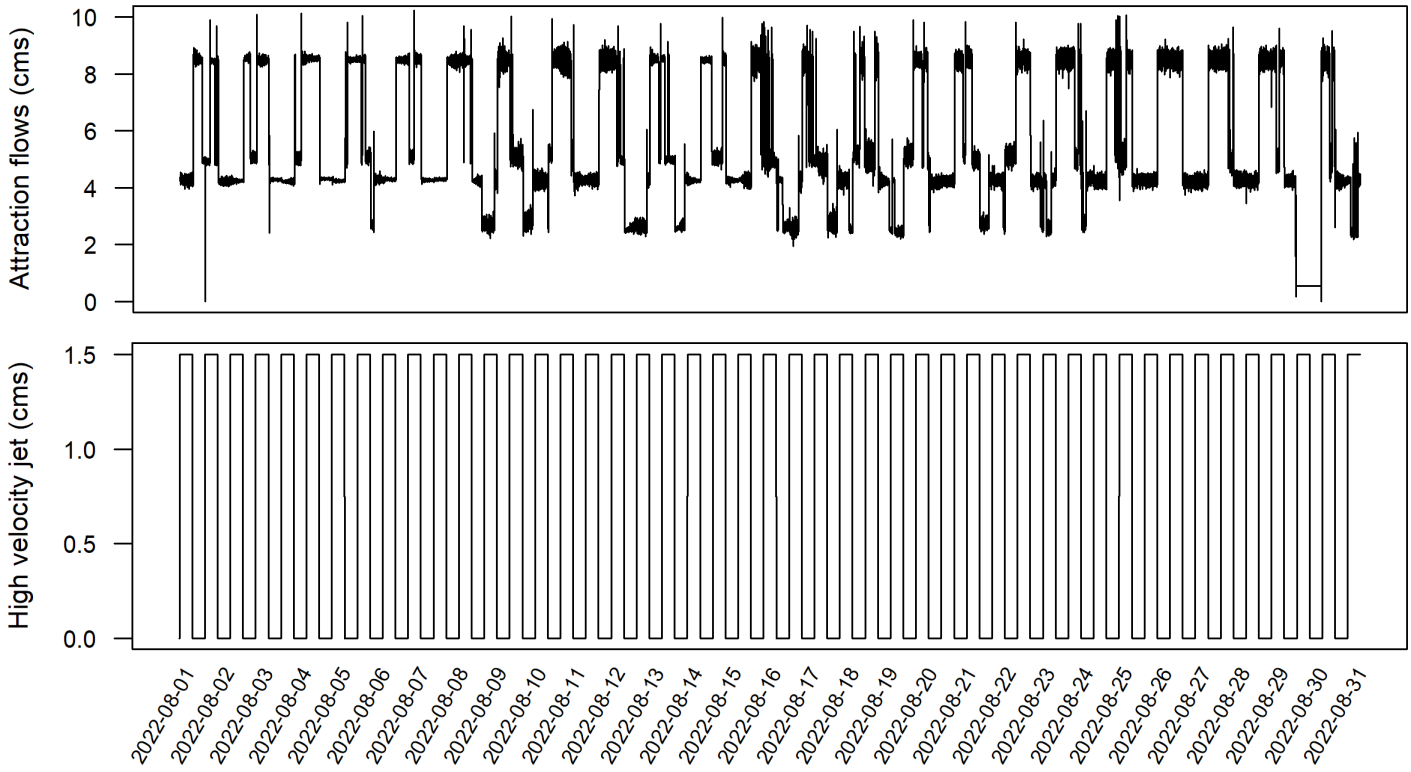


Mechanical operation

Operation of the attraction flows and high velocity jet intends to attract fish towards the fishway entrance. Once fish have entered the temporary facility, flows within the fishway intend to provide a flow signal for fish to detect and swim up each pool to the sorting facility.

BC Hydro operated the attraction flows and high velocity jet as described in Section 3.2.1.3 of the OPP, whereby conditions were changed every 8 hours during the reporting period (Figure 5), with the exception of August 30 (Table 4) .

Figure 5. Operation of the attraction flows and high velocity jet during the reporting period.



Fish were crowded daily from the pre-sort holding pool into the fish lock. Operators then proceeded to raise crowded fish to the elevation of the sorting facility. Note that this process is referred to as a “sorting cycle”. Between two and three sorting cycles were conducted each day during the reporting period (Table 2).

Table 2. Daily total number of sorting cycles.

Date	Number of sorting cycles	Start time
2022-08-01	2	08:30, 10:30
2022-08-02	2	11:00, 13:00
2022-08-03	3	08:30, 11:00, 13:00
2022-08-04	3	08:30, 11:00, 13:00
2022-08-05	3	08:30, 11:00, 13:00
2022-08-06	3	08:30, 11:00, 13:00
2022-08-07	3	08:30, 11:00, 13:00
2022-08-08	3	08:30, 11:00, 13:00
2022-08-09	3	08:30, 11:00, 13:00
2022-08-10	3	08:30, 11:00, 13:00
2022-08-11	3	08:30, 11:00, 13:00
2022-08-12	3	08:30, 11:00, 13:00
2022-08-13	3	08:30, 11:00, 13:00
2022-08-14	3	08:30, 11:00, 13:00
2022-08-15	3	08:30, 11:00, 13:00
2022-08-16	3	08:30, 11:00, 13:00
2022-08-17	3	08:30, 11:00, 13:00
2022-08-18	3	08:30, 11:00, 13:00
2022-08-19	3	08:30, 11:00, 13:00
2022-08-20	3	08:30, 11:00, 13:00
2022-08-21	3	08:30, 11:00, 13:00
2022-08-22	2	08:30, 10:38
2022-08-23	3	08:30, 11:00, 13:00
2022-08-24	3	08:30, 11:00, 13:00
2022-08-25	3	08:30, 11:00, 13:00
2022-08-26	3	08:30, 11:00, 13:00
2022-08-27	3	08:30, 11:00, 13:00
2022-08-28	3	08:30, 11:00, 13:00
2022-08-29	2	08:30, 11:00
2022-08-30	3	08:30, 11:00, 13:00
2022-08-31	3	08:30, 11:00, 13:00

Table 3. Summary of standby or shutdown periods during the reporting period.

Date	Standby or shutdown	Rationale
N/A	N/A	No standby or shutdown periods occurred during the reporting period.

Table 4. Root causes and corrective actions as a result of equipment malfunctions, breakdowns, or damage during the reporting period.

Date	Malfunction, breakdown or damage	Description	Root cause	Corrective action
Several	Malfunction	Pump 1 did not provide the complete attraction flows (4.25 or 8.5 cms) outlined in Section 3.2.1.3 of the OPP.	Sediment clogged the water intake screens such that water could not pass through the wetwell to feed the pumps.	Programmed attraction flow pumps (Pumps 1 and 2) to self-clean hourly and repaired the spray valves used to clean the water intake screens.
Several	Malfunction	Brail elevator repeatedly halted and slowed.	Suspected causes of sediment build-up in the fish lock and system malfunction.	Sediment was proactively flushed out of the fish lock on a weekly basis, and the system was reset to restore basic functionality.
2022-08-30	Malfunction	Operator noticed an issue with the speed control of Pump 1. Communication failed between PLC Cabinet #1 and Remote I/O Cabinet #2, which caused issues with the water level sensors and pump speed.	Media converter failed, which converts a typical ethernet copper connection (RJ45) to a fiber cable connection. Media converters allow us to run a greater distance between PLC cabinets using a fiber cable. Media converters are then used to convert back to an ethernet copper connection in the second PLC cabinet.	Distance between cabinets was short enough to run a temporary Cat5E connection (ethernet over copper) and bypass the media converter in both PLC cabinets. As a permanent fix, the operator rerouted a new Cat5E connection in the cable tray to eliminate the need for media converters.

Adjustments

Several adjustments were made during the reporting period to improve the biological and mechanical operation of the temporary facility (Table 5). BC Hydro described the potential for adjustments to the day-to-day biological and mechanical operation of the temporary facility in Section 7 of the Fish Passage Management Plan[2]. In general the temporary facility was operated as planned and described in the OPP. Where appropriate, the adjustments outlined below will be reflected in an updated revision of the OPP for operations in 2023.

Table 5. Summary of adjustments made to the biological and mechanical operation of the temporary facility during the reporting period.

Component	Adjustment
Mechanical operation	Sediment continues to build up in the fish lock and pre-sort holding pool. Each week, the operator reduced flow in the fishway over a 15 minute period and released flow through the lock to flush sediment out of the lock and pre-sort holding pool. Such an approach has proved to be an effective and proactive way to manage sediment at the top of the fishway and has avoided shutting the facility down and using a hydrovac to clear out the sediment.
Biological operation	Several adjustments were made to improve the efficiency of fish processing. Changes were made to the physical setup of the sorting area to reduce the risk of injury to fish, improve ergonomics and the ability of the operators to communicate with each other, and allow for both individuals to be involved in the tagging and sampling of fish (Photo 2). Changes were also made to the order in which measurements and samples were collected from fish to streamline the process.

Contingent fish capture and transport

In total, 20 fish were transported upstream through contingent fish capture during the reporting period (Table 6). Specifically, 16 Mountain Whitefish, 3 Bull Trout, and 1 Rainbow Trout were transported upstream of the Project.

Table 6. Number of fish captured by boat electroshocking and transported and released upstream (U) and downstream (D) of the Project.

Species	Session 12 August 9		Total
	U	D	
Arctic Grayling			
Brook Stickleback			
Brook Trout			
Bull Trout	3		3
Burbot			
Finescale Dace			
Flathead Chub			
Goldeye			
Kokanee			
Lake Chub			
Lake Trout			
Lake Whitefish			
Largescale Sucker		3	3
Longnose Dace			
Longnose Sucker		5	5
Mountain Whitefish	16	2	18
Northern Pike			
Northern Pikeminnow		2	2
Northern Redbelly Dace			
Peamouth			
Pearl Dace			
Prickly Sculpin			
Pygmy Whitefish			
Rainbow Trout	1		1
Redside Shiner		1	1
Slimy Sculpin			
Spoonhead Sculpin			
Spottail Shiner			
Trout-perch			
Walleye		1	1
White Sucker		3	3
Yellow Perch			
Total	20	17	37
Grand total	37		

Photos

Photo 1. Biologists sample a Walleye (top; August 13, 2022) and Pearl Dace (bottom; August 20, 2022) in the sorting facility; the Walleye was released downstream of the Project as described in the OPP.

Photo 2. Changes were made to the physical setup of the sorting area to reduce the risk of injury to fish, improve ergonomics and the ability of the operators to communicate with each other, and allow for both individuals to be involved in the tagging and sampling of fish (August 24, 2022).

Prepared by

This report was prepared by the following individuals:

Qualified Individual	Expertise
Brent Mossop, MRM, RPBio	Fisheries
Nich Burnett, MSc, RPBio	Fisheries

Appendix I. High-level summary of operation of the temporary facility and implementation of contingent fish capture during the reporting period.

From:	Brent Mossop and Nich Burnett, Fish and Aquatic – Site C Clean Energy Project
Reporting Period:	August 1 to 31, 2022
Subject:	Monthly Update on Upstream Fish Passage

410 fish sorted at facility

Operated facility for 31 days

20 fish transported through contingent fish capture

Category	Performance	Commentary
Safety		• Effective interfaces among contractors
Fish Passage[1]		• Passed 410 fish
Sorting & Transport		• Sorted 11 species
Fish Mortality		• Five mortalities during reporting period • Survival rate >99% for all fish sorted in 2022
Operation Within Criteria		• Operated within and outside of design criteria
External Communication		• Provided updates to CWR, IE and IEM
Effectiveness Monitoring		• Monitoring equipment performing well
Learning & Adjustment		• Changes to sorting area to reduce risk of injury of fish, and to improve ergonomics, communication, and efficiency (Photo 2)

Meets or Exceeds Expectations	Nearing Expectations	Far Below Expectations

[1] Infographic available here: https://www.sitecproject.com/sites/default/files/fish-passage-facility.pdf

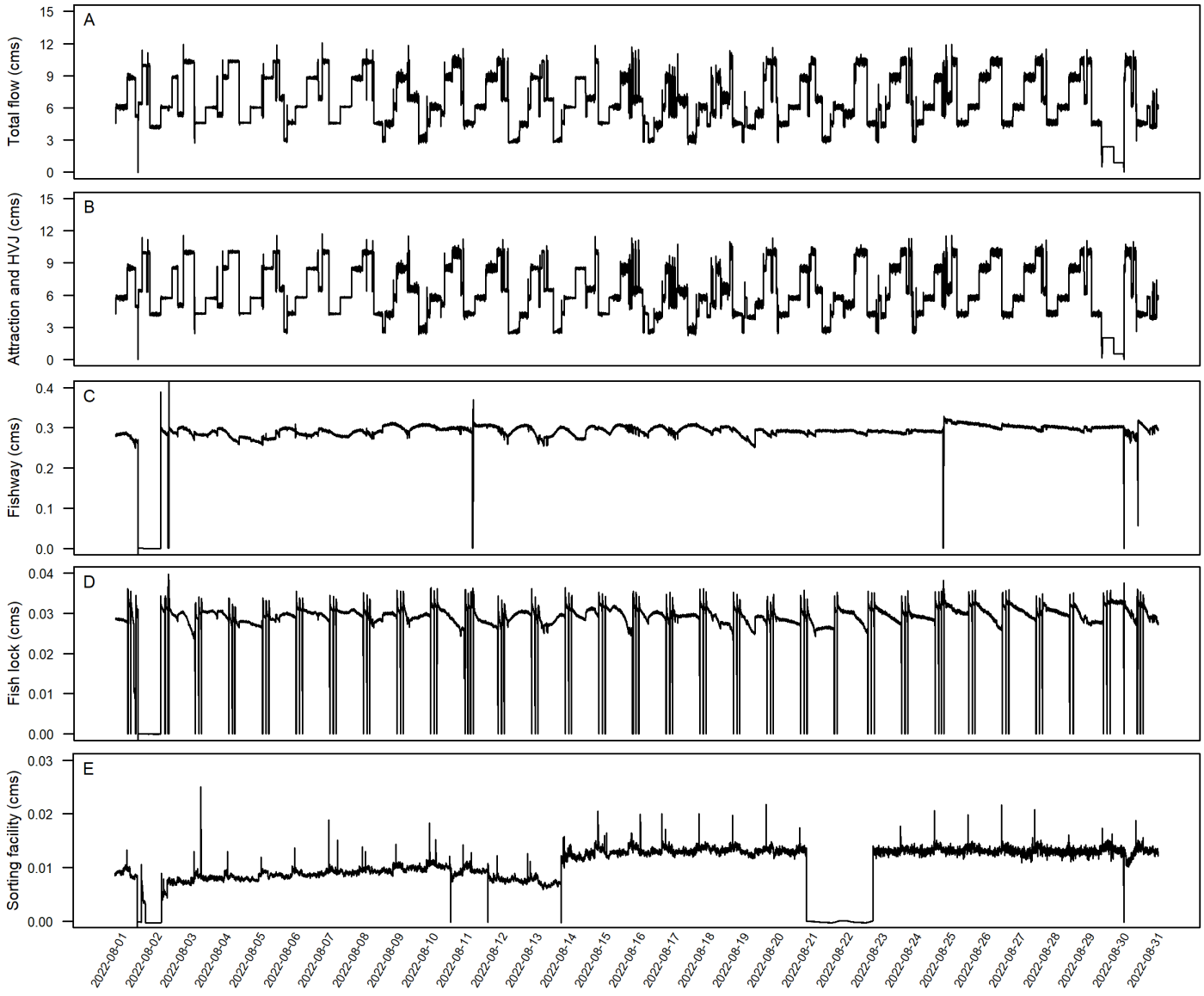
Target Species

Bull Trout

Rainbow Trout

Arctic Grayling

Appendix II. (A) Total flow (cms) diverted from the Peace River to operate the temporary facility during the reporting period. Total flow is a combination of flows used for the attraction flows and high velocity jet (B), fishway (C), fish lock (D), and sorting facility (E), as described in T023 Plan for Measurement of Flow. Under Conditional Water Licence 133987[8], BC Hydro is authorized to divert up to 15 cms of flow from the Peace River to operate the temporary facility; this authorized quantity was not exceeded during the reporting period (A).



[8] Available at: http://sitecproject.com/sites/default/files/fish-passage-facility-water-licences-133986-133987.pdf