BC Hydro
Power smart

Site C Clean Energy Project

Temporary Upstream Fish Passage Facility Operations Report

Reporting Period: August 1 to 31, 2021

Prepared by BC Hydro

December 21, 2021

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 will be operated at the outlet of the generating station to provide fish passage during the operation phase of the Project.

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 2021.

This report has the following sections:

- Biological operation;
- Environmental conditions;
- Mechanical operation;
- Adjustments; and
- Photos.

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 4.1 of the Fish Passage Management Plan[2].

Summary

In general the operation of the temporary facility was effective at providing for the upstream passage of fish during the reporting period. One thousand fish were sorted and sampled at the temporary facility – 997 were transported and released due to three mortalities (all Mountain Whitefish) identified during processing (Table 1). Specifically, the facility operator sorted 638 Mountain Whitefish, 235 Longnose Sucker, 83 Largescale Sucker, 16 White Sucker, 10 Northern Pikeminnow, 8 Bull Trout, 6 Arctic Grayling, and 4 Kokanee (Photos 1, 2, and 3).

Several adjustments were made to improve the biological and mechanical operation of the temporary facility. Where appropriate, the adjustments summarized in Table 5 will be reflected in an updated revision of the OPP for operations in 2022. Large numbers of Mountain Whitefish and Suckers, as well as several Bull Trout, Rainbow Trout and Arctic Grayling, were observed in the last pool of the fishway and not passing through the vee-trap into the pre-sort holding pool where fish can be captured by the facility operator. Between August 16 and 31, 2021, the facility operator made several minor adjustments to the operating procedures of the facility to improve passage at the top of the fishway and increase trapping efficiency. In this case passage is defined as

[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

the proportion of fish at the top of the fishway (Pools 23, 24 and 25) that were subsequently crowded and sorted by the facility operator. Trapping efficiency is defined as the proportion of fish in the pre-sort holding pool that were subsequently crowded and sorted by the facility operator. BC Hydro used an overhead light system and additional flow in the pre-sort holding pool (Photos 4 and 5) to mimic the conditions fish would experience at other locations in the fishway. Ultimately the adjustments that were made, which are further described in Table 5, resulted in the capture of the first eight adult Bull Trout at the facility (Photos 1 and 6).

Appendix I provides a high-level summary of operation of the temporary facility during the reporting period.

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

Biological operation

In total, 1000 fish were sorted in the temporary facility during the reporting period (Table 1; Figure 1). Five mortalities – four Mountain Whitefish (one in the pre-sort holding pool and three during processing) and one Longnose Sucker in the pre-sort holding pool – were observed during the reporting period (combined with mortalities observed in previous months, 0.6% of all fish sorted in 2021), which is in-line with the anticipated levels of mortality during operations[3].

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

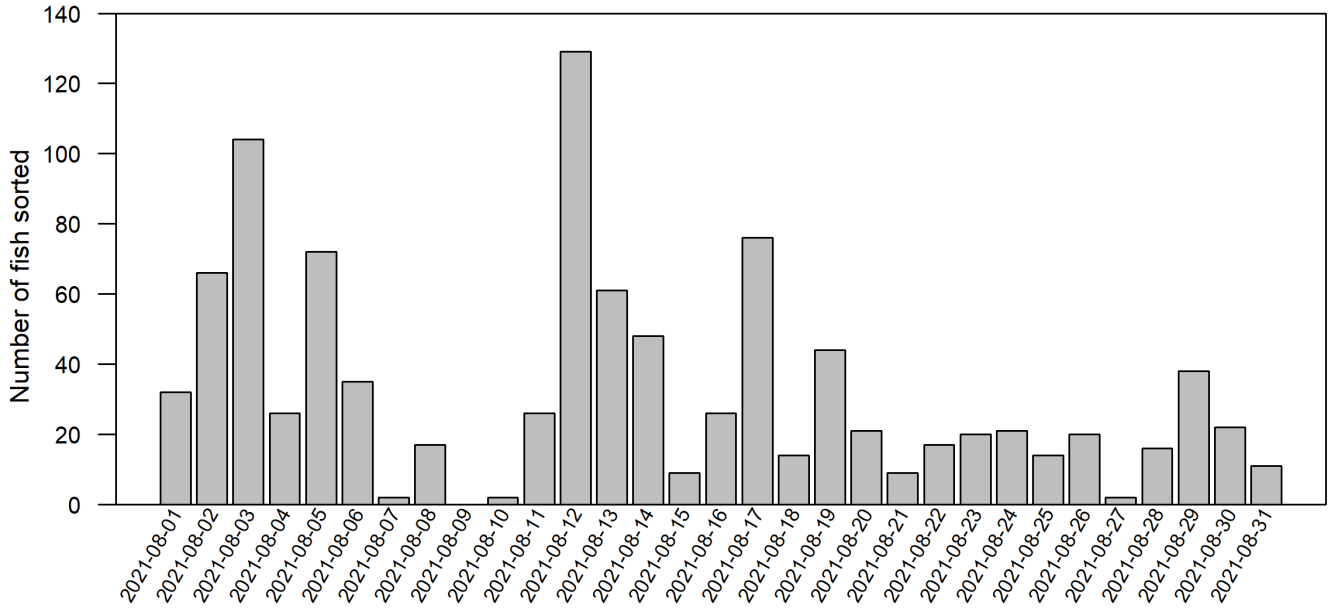
Species	Sorted	Transported and released	PIT tagged	Mortalities	Genetics	Microchemistry or ageing
Arctic Grayling	6	6	6	0	6	6
Brook Stickleback						
Brook Trout						
Bull Trout	8	8	4	0	5	5
Burbot						
Finescale Dace						
Flathead Chub						
Goldeye						
Kokanee	4	4	N/A	0	N/A	1
Lake Chub						
Lake Trout						
Lake Whitefish						
Largescale Sucker	83	83	77	0	N/A	N/A
Longnose Dace						
Longnose Sucker	235	235	221	1	N/A	N/A
Mountain Whitefish	638	635	599	4	N/A	7
Northern Pike						
Northern Pikeminnow	10	10	N/A	0	N/A	N/A
Northern Redbelly Dace						
Peamouth						
Pearl Dace						
Prickly Sculpin						
Pygmy Whitefish						
Rainbow Trout						
Redside Shiner						
Slimy Sculpin						
Spoonhead Sculpin						
Spottail Shiner						
Trout-perch						
Walleye						
White Sucker	16	16	15	0	N/A	N/A
Yellow Perch						
Grand total	1000	997	894	5	10	18

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

[3] 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 129 fish were sorted daily during the reporting period (Figure 1).

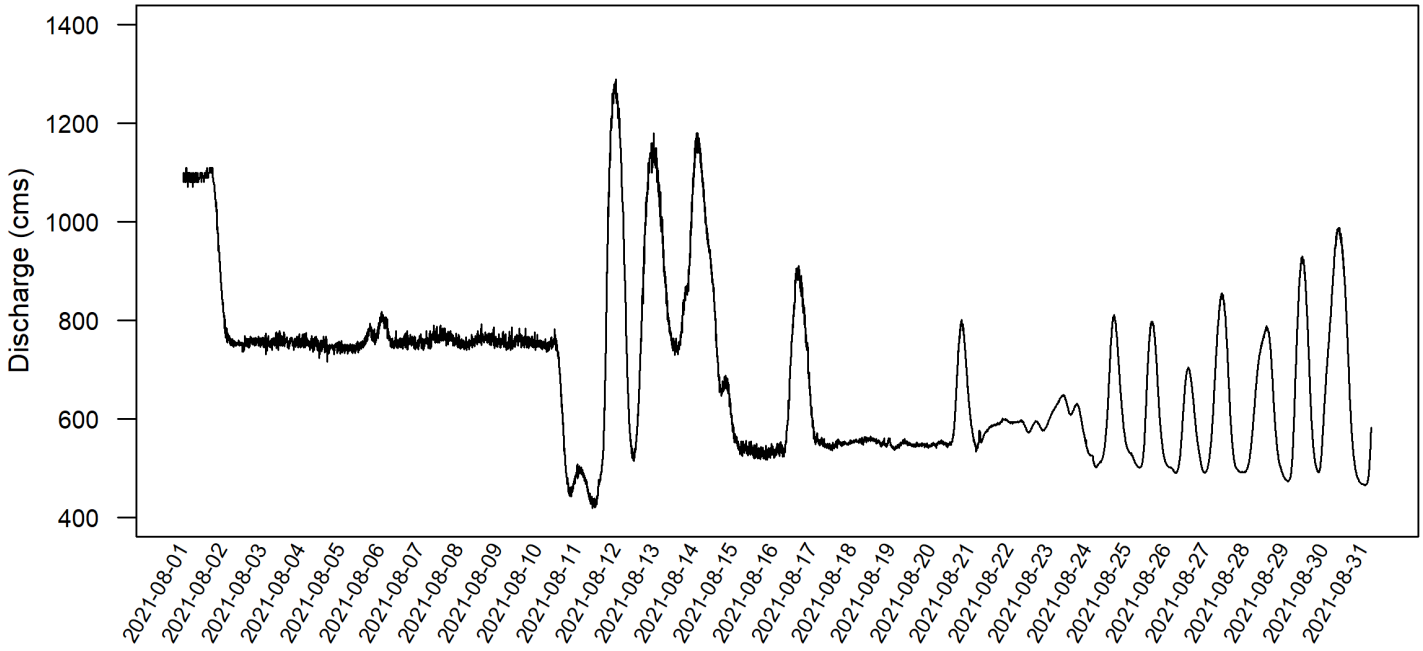
Figure 1. Daily number of fish sorted in the temporary facility during the reporting period.



Environmental conditions

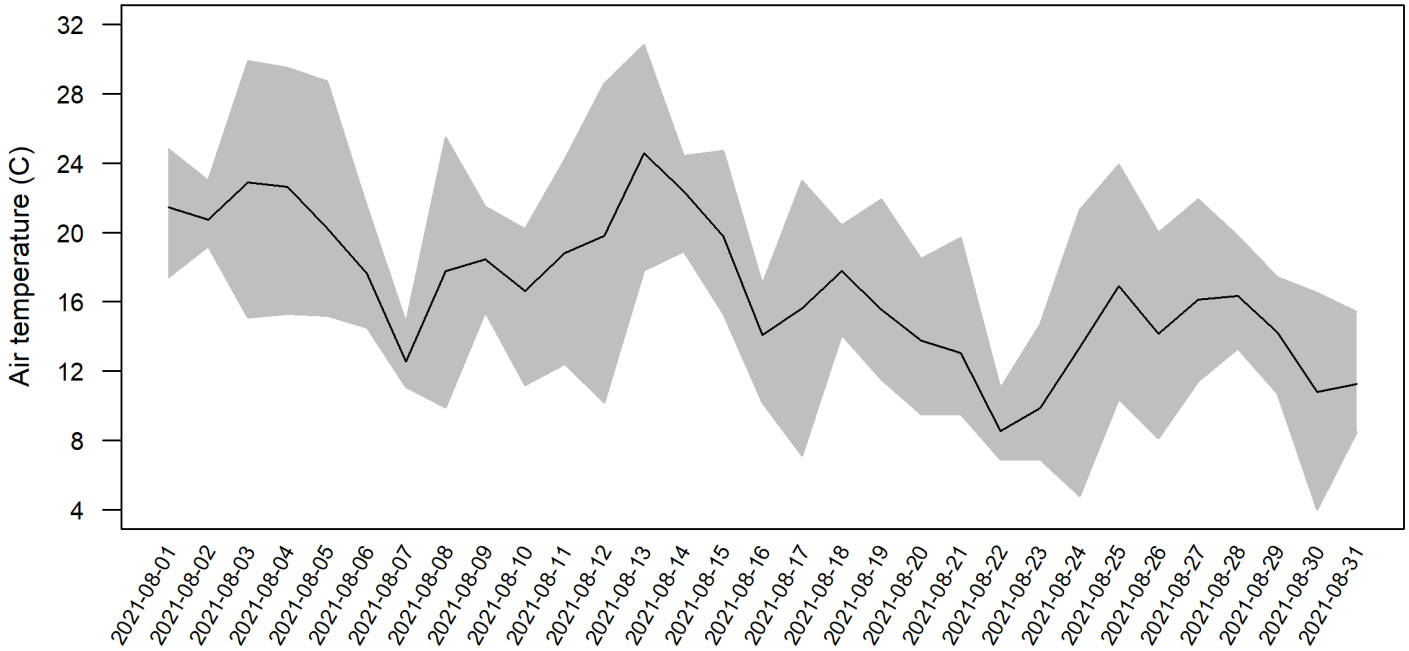
Discharge in the Peace River fluctuated during the reporting period from a low of 418 cms on August 11 to a high of 1290 cms on August 12 (Figure 2).

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 9; 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 4.0°C on August 30 to a high of 30.8°C on August 13 (Figure 3).

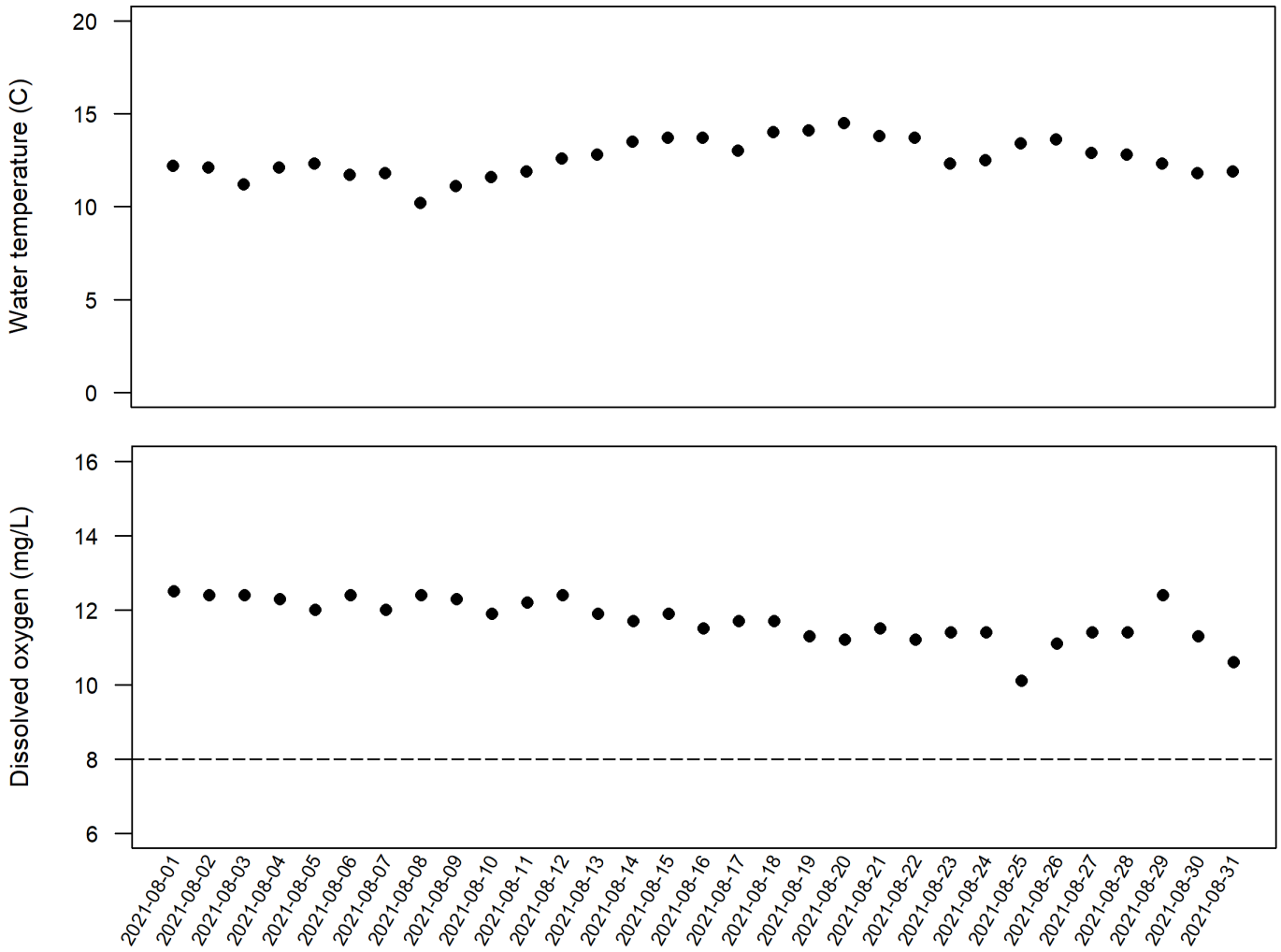
Figure 3. Mean daily air temperature (black line; °C) during the reporting period as measured by the provincial air monitoring station located on the dam site at the Site C Workers Accomodation[4] (E309527). Shaded area represents the minimum and maximum daily air temperatures.



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

Water temperature fluctuated during the reporting period from a low of 10.2°C on August 8 to a high of 14.5°C on August 20 (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.

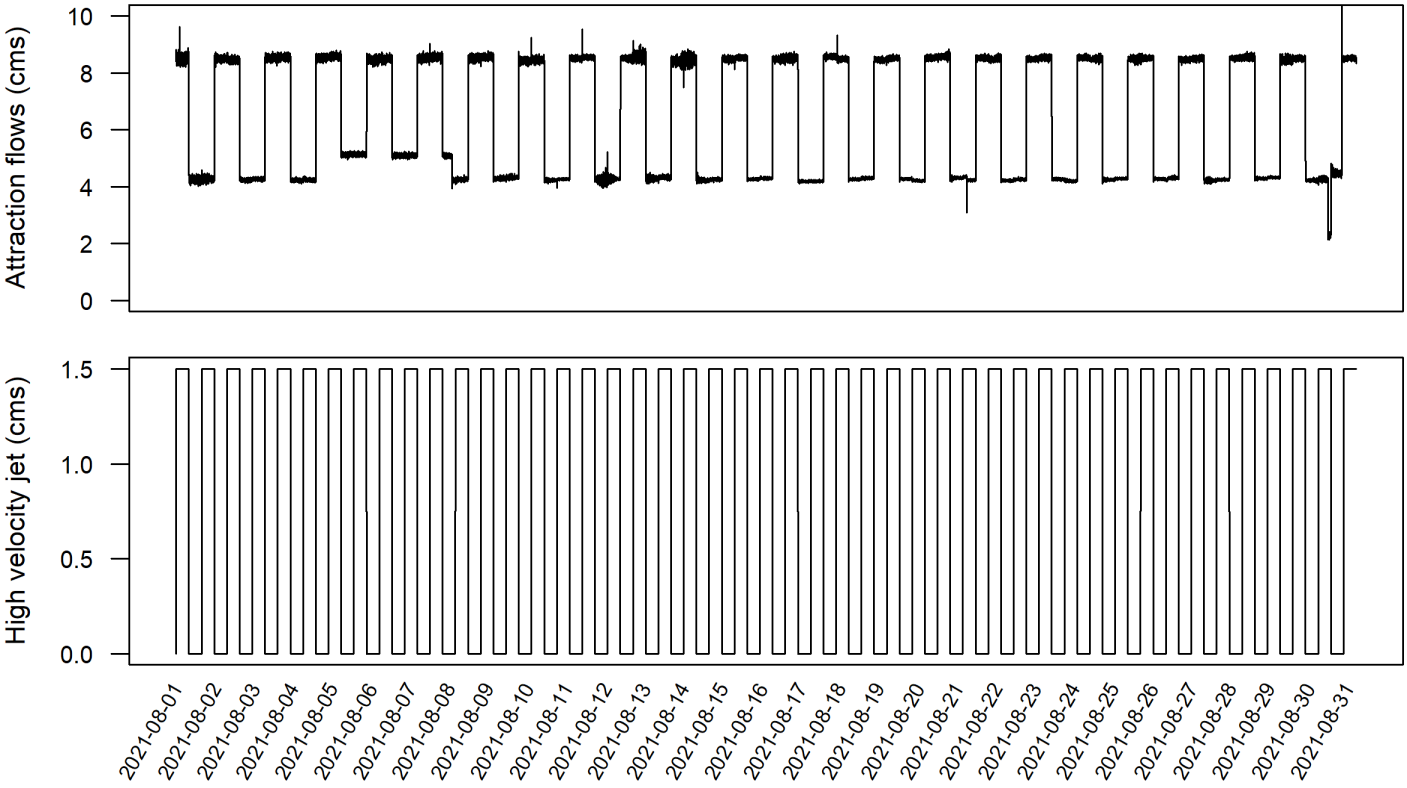


Mechanical operation

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).

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 one 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
2021-08-01	3	08:30, 11:00, 13:00
2021-08-02	3	08:30, 11:00, 13:00
2021-08-03	2	08:30, 13:00
2021-08-04	3	08:30, 11:00, 13:00
2021-08-05	2	08:30, 13:00
2021-08-06	3	08:30, 11:00, 13:00
2021-08-07	3	08:30, 11:00, 13:00
2021-08-08	3	08:30, 11:00, 13:00
2021-08-09	2	08:30, 12:00
2021-08-10	3	08:30, 11:00, 13:00
2021-08-11	3	08:30, 11:00, 13:00
2021-08-12	2	08:30, 13:00
2021-08-13	3	08:30, 11:00, 13:00
2021-08-14	3	08:30, 11:00, 13:00
2021-08-15	3	08:30, 11:00, 13:00
2021-08-16	3	08:30, 11:00, 13:00
2021-08-17	3	08:30, 11:00, 13:00
2021-08-18	3	08:30, 11:00, 14:00
2021-08-19	3	08:30, 11:00, 13:00
2021-08-20	3	08:30, 11:00, 13:00
2021-08-21	3	08:30, 11:00, 13:00
2021-08-22	1	08:30
2021-08-23	2	08:30, 11:00
2021-08-24	2	08:30, 11:00
2021-08-25	3	08:30, 11:00, 13:00
2021-08-26	3	08:30, 11:00, 13:00
2021-08-27	3	08:30, 11:00, 13:00
2021-08-28	3	08:30, 11:00, 13:00
2021-08-29	3	08:30, 11:00, 13:00
2021-08-30	2	08:30, 11:00
2021-08-31	2	08:30, 11:00

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
N/A	N/A	N/A	N/A	N/A

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 2022.

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

Component	Adjustment
Mechanical operation	Following observation of large numbers of fish at the top of the fishway, the facility operator made several minor adjustments to the operating procedures of the facility to improve passage at the top of the fishway and increase trapping efficiency. Adjustments included: • Overhead light system – consisting of four, 1300 lumen light bulbs plugged into a programmable timer – was installed at the upstream end of the pre-sort holding pool (Photo 4) to either (1) mimic daylight conditions in the pre-sort holding pool, or (2) keep the lights on at night to attract certain species of fish into the pre-sort holding pool; • Overhead camera system was installed in the pre-sort holding pool adjacent to the overhead light system to observe fish behaviour and confirm entry into the pre-sort holding pool (Photos 4 and 6); • Underwater camera system was installed in the last pool of the fishway and at the vee-trap to observe fish behaviour and confirm entry into the pre-sort holding pool; • Sprayers (via valve 050-FF-RW-26) located at the upstream end of the pre-sort holding pool were turned on to create disturbance on the water surface and the allusion that water was flowing from an upstream source (Photo 5); • A hose was installed to release a jet of flow aimed at the vee-trap opening; • Pump 9 – which supplies water to the fish lock – remained running at all times to increase the amount of flow passing through the pre-sort holding pool during trapping; and • Vee-trap gate closed by the facility operator at 04:00 to prevent fish that entered the pre-sort holding pool during the night from moving back downstream at dawn. All of the above factors were experimentally manipulated and monitored to determine the conditions that maximize passage and trapping efficiency.

Photos

Photo 1. Three Bull Trout passed the facility on August 18, 2021 (top) and were transported and released later the same day at the Halfway River (bottom). In total eight Bull Trout passed the facility during the reporting period.

Photo 2. Facility operator processes an Arctic Grayling in the sorting facility (August 1, 2021).

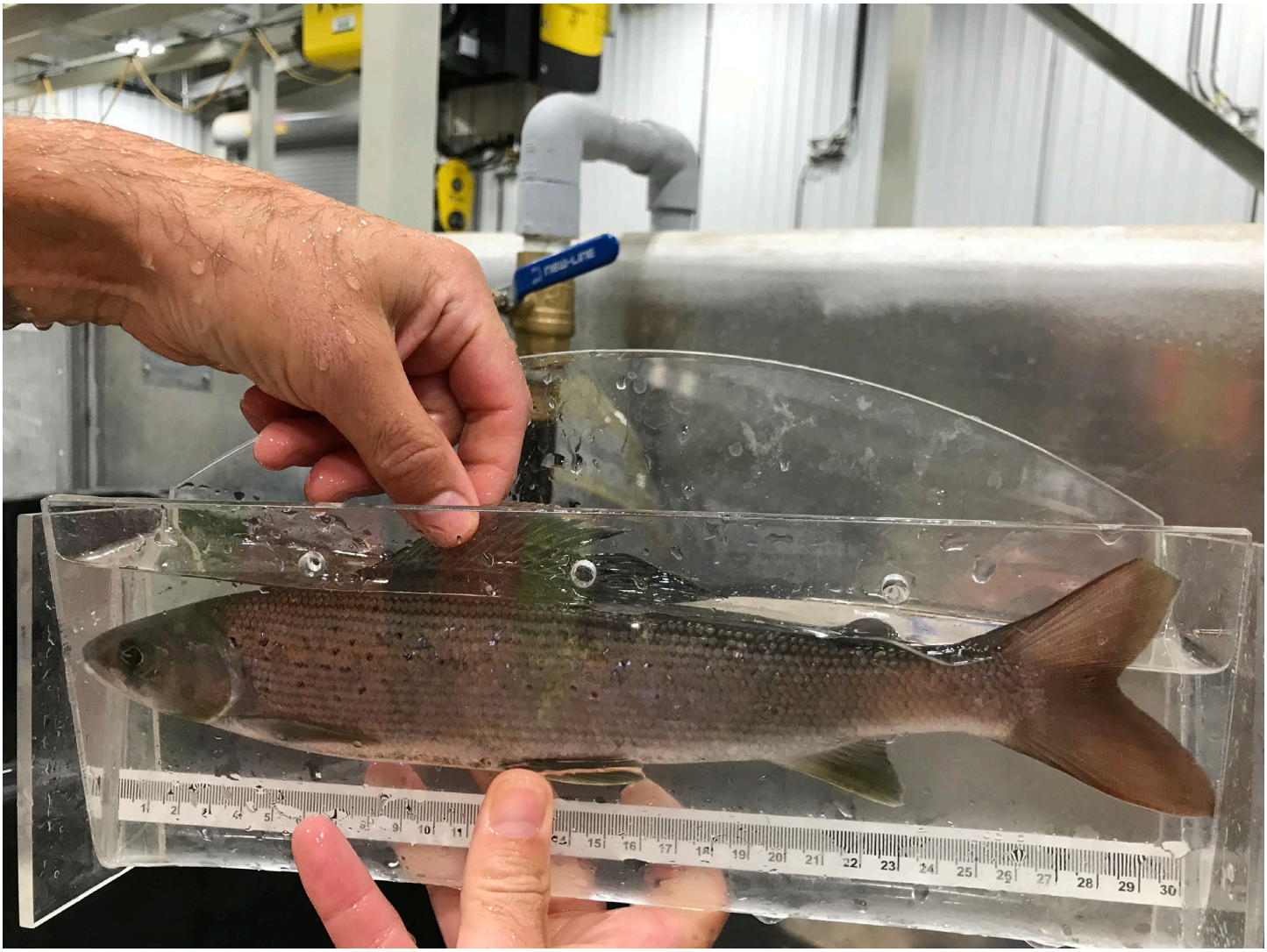


Photo 3. Facility operator processes a Largescale Sucker in the sorting facility (August 1, 2021).

Photo 4. Overhead light and camera system at the upstream end of the pre-sort holding pool (August 16, 2021).

Photo 5. Sprayers located at the upstream end of the pre-sort holding pool (August 16, 2021).

Photo 6. Screenshot from the overhead camera system of the first adult Bull Trout (circled red) trapped in the pre-sort holding pool (August 17, 2021).

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 during the reporting period.

From:	Brent Mossop and Nich Burnett, Fish and Aquatic – Site C Clean Energy Project
Reporting Period:	August 1 to 31, 2021
Subject:	Monthly Update on Upstream Fish Passage

1000 fish sorted at facility

8 Bull Trout transported to the Halfway River

Operated facility for 31 days

Category	Performance	Commentary
Safety		• Effective interfaces among contractors
Fish Passage[1]		• Observed higher passage in August compared to other months • Passed 8 Bull Trout
Sorting & Transport		• Sorted 1000 fish from eight species
Fish Mortality		• Five mortalities during reporting period • Survival rate >99% for all fish sorted in 2021
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		• Minor adjustments made to improve passage at the top of the fishway and increase trapping efficiency

Meets or Exceeds Expectations	Nearing Expectations	Far Below Expectations

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

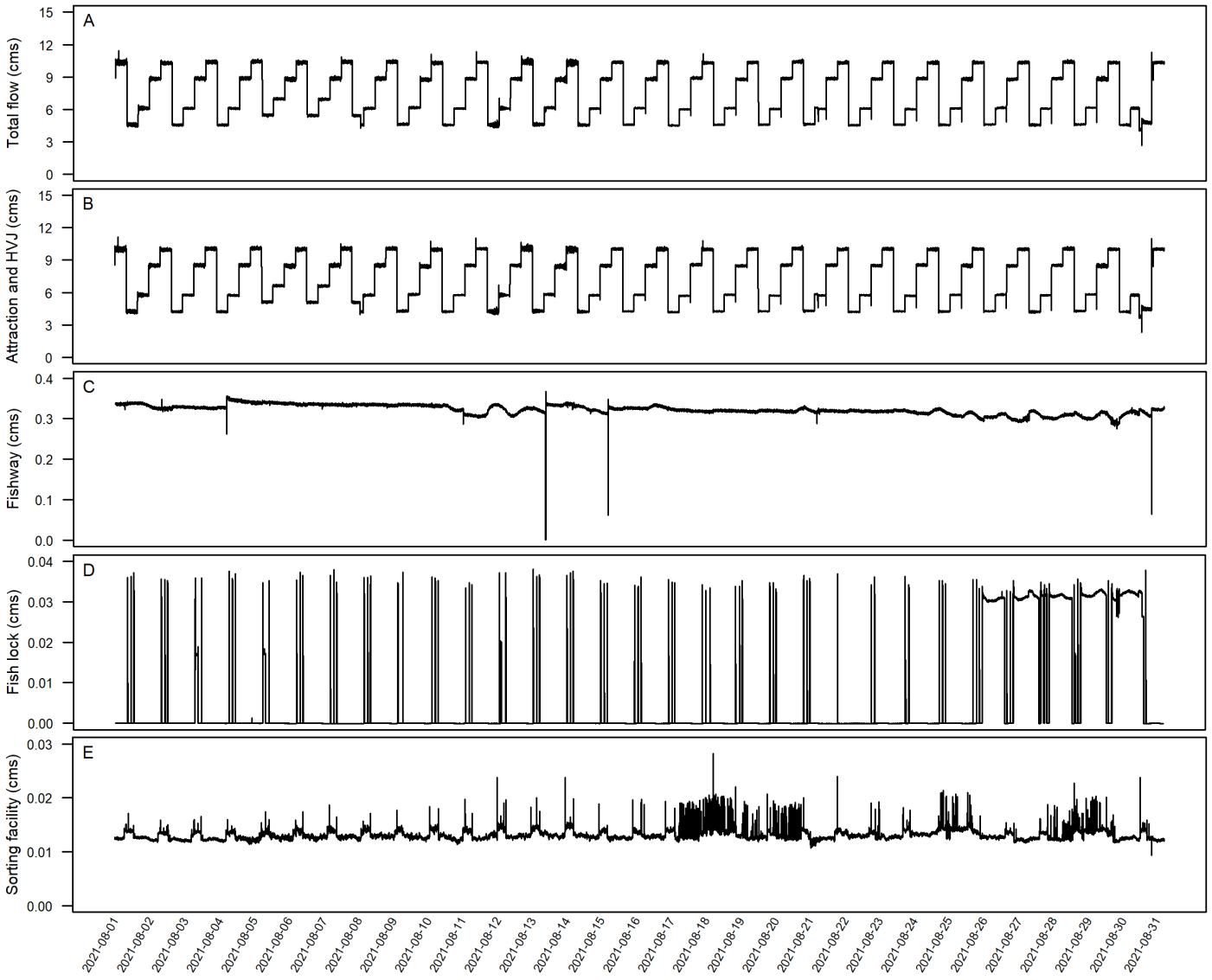
Target Species

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[5], 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).



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