

Site C Clean Energy Project

Temporary Upstream Fish Passage Facility Operations Report

Reporting Period: September 1 to 30, 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 Q¹). 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.

In 2021 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 Plan².

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. In general the month of September represents a transition between the upstream migrations of target species in the spring (Arctic Grayling and Rainbow Trout) and summer (Bull Trout) to the migrations of target species in the fall (Mountain Whitefish). Some species may be making upstream movements related to feeding in September, however species like Bull Trout are spawning in tributaries of the Halfway River in September³ and other species that spawn in the Peace River (e.g., Mountain Whitefish) may or may not be trying to access habitat upstream of the Project. Given this uncertainty, BC Hydro released all species encountered through contingent fish capture and transport upstream of the Project to align with operation of the temporary facility. Monitoring data collected during the reporting period will be reviewed to determine the movement patterns of the species transported in September.

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 September 2021.

This report has the following sections:

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

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://sitecproject.com/sites/default/files/Mon-1b-Task-2b-Peace-River-Bull-Trout-Spawning-Assessment-2019-Annual-Report.pdf>

- 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 Plan⁴.

Summary

In general the operation of the temporary facility was effective at providing for the upstream passage of fish during the reporting period. Three hundred and eighty seven fish were sorted and sampled at the temporary facility (Table 1). Specifically, the facility operator sorted 163 Largescale Sucker, 101 Mountain Whitefish, 50 Longnose Sucker, 27 Redside Shiner, 19 Northern Pikeminnow, 14 White Sucker, 9 Bull Trout, 2 Kokanee, 1 Arctic Grayling, and 1 Slimy Sculpin (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 25 Longnose Sucker, 20 Largescale Sucker, 13 White Sucker, 7 Bull Trout, 4 Northern Pikeminnow, 3 Northern Pike, 1 Burbot and 1 Lake Trout upstream of the Project (Table 6).

BC Hydro shut the facility down from September 9 to 16 to adjust the distribution of flow at the top of the fishway. More specifically, the adjustments allowed the operator to change the amount and location where flow entered the top of the fishway, while maintaining a total fishway flow of 0.36 cms. In general the intent was to increase flow through the vee-trap entrance to encourage fish to enter the pre-sort holding pool, and decrease flow downstream of the vee-trap that may reduce attraction into the pre-sort holding pool (Photo 2).

Several adjustments to the top of the fishway in August were continued in September to improve the biological and mechanical operation of the temporary facility. Additional adjustments were made in September, including the location where flow entered the top of the fishway (described above; Photo 2). Where appropriate, the adjustments summarized in Table 5 will be reflected in an updated revision of the OPP for operations in 2022.

River otters were repeatedly observed preying on fish inside the fishway during the reporting period (Photo 3). BC Hydro retained a qualified environmental professional to assess the activities of the otters and deter them from returning to the facility. Daily inspections for otters were mandated and radio noise and a predator scent were used to deter them. Deterrents will continue to be used if proven to be effective.

BC Hydro continued to share information related to the operation of the temporary facility through a number of venues, including the following:

- Presentation to Indigenous groups at Environmental Forum #20 on September 14.

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.

⁴ Available at: <http://sitecproject.com/sites/default/files/Fish%20Passage%20Management%20Plan.pdf>

Biological operation

In total, 387 fish were sorted in the temporary facility during the reporting period (Table 1; Figure 1). No mortalities were observed during the reporting period.

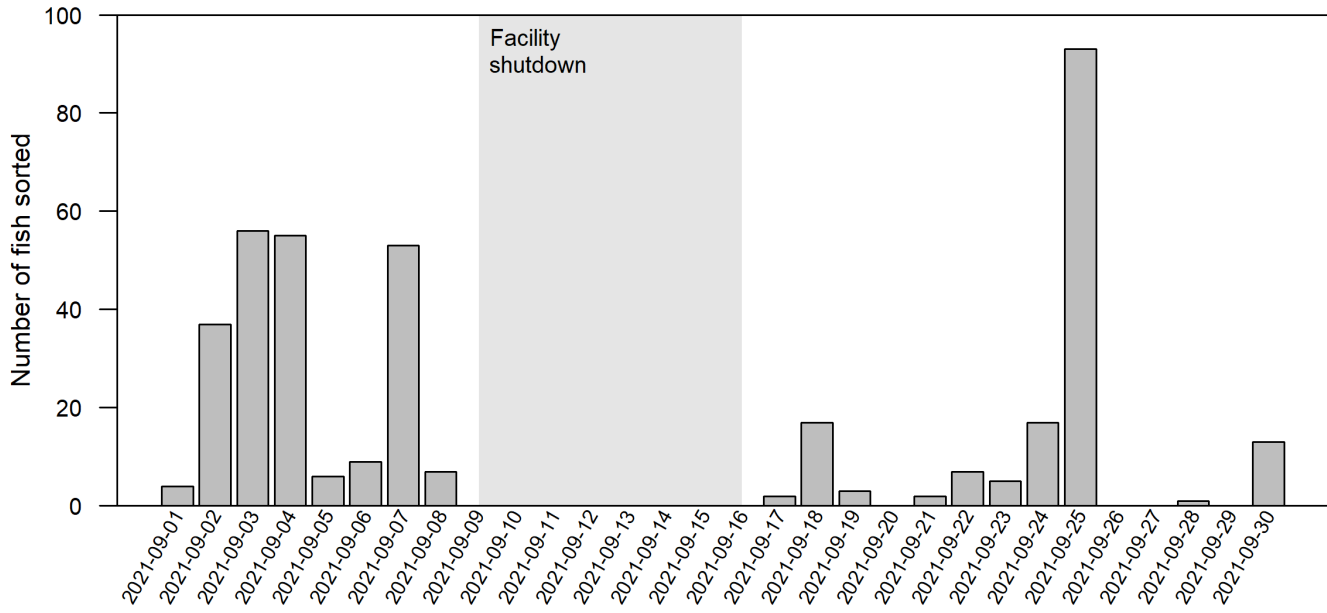
Table 1. Total number of fish sorted, sampled, transported and released during the reporting period.

Species	Sorted	Transported and released	PIT tagged	Mortalities	Genetics	Microchemistry or ageing
Arctic Grayling	1	1	0	0	1	1
Brook Stickleback						
Brook Trout						
Bull Trout	9	9	8	0	9	9
Burbot						
Finescale Dace						
Flathead Chub						
Goldeye						
Kokanee	2	2	N/A	0		2
Lake Chub						
Lake Trout						
Lake Whitefish						
Largescale Sucker	163	163	131	0	N/A	N/A
Longnose Dace						
Longnose Sucker	50	50	46	0	N/A	N/A
Mountain Whitefish	101	101	98	0	N/A	N/A
Northern Pike						
Northern Pikeminnow	19	19	N/A	0	N/A	N/A
Northern Redbelly Dace						
Peamouth						
Pearl Dace						
Prickly Sculpin						
Pygmy Whitefish						
Rainbow Trout						
Redside Shiner	27	27	N/A	0	24	N/A
Slimy Sculpin	1	1	N/A	0	0	N/A
Spoonhead Sculpin						
Spottail Shiner						
Trout-perch						
Walleye						
White Sucker	14	14	12	0	N/A	N/A
Yellow Perch						
Grand total	387	387	295	0	34	12

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

Between zero and 93 fish were sorted daily during the reporting period (Figure 1).

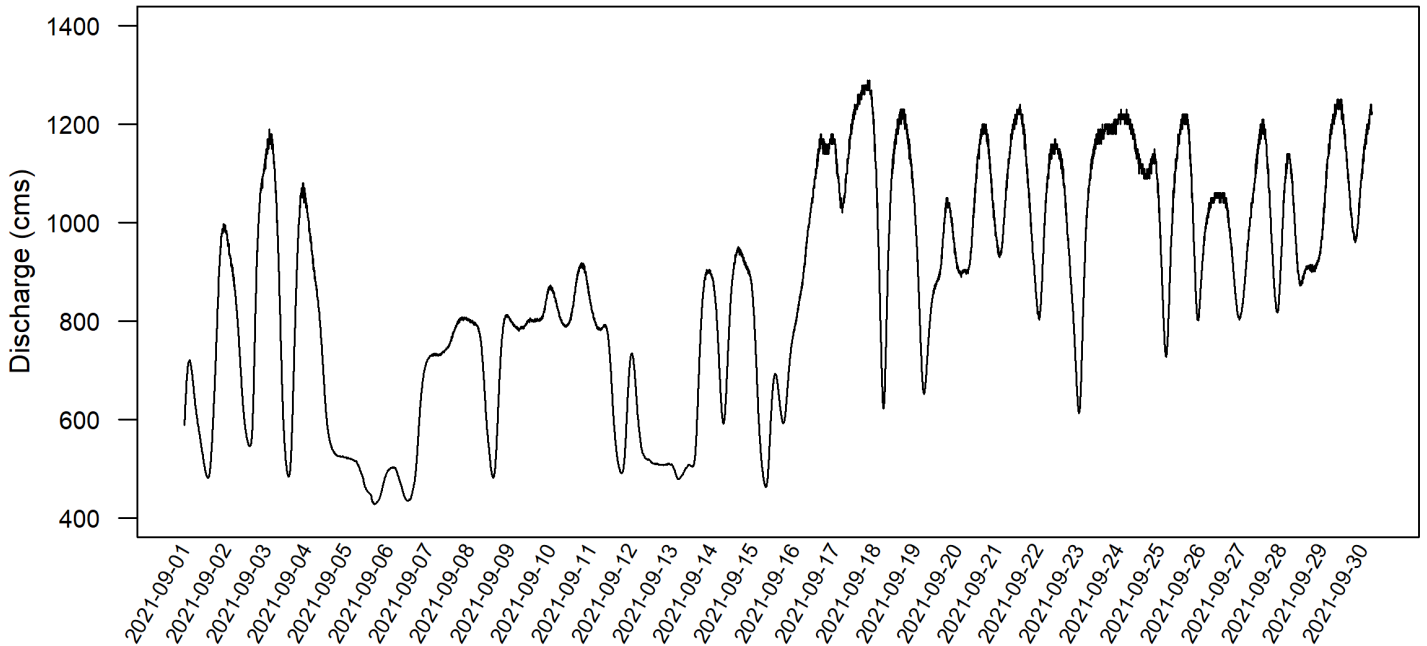
Figure 1. Daily number of fish sorted in the temporary facility during the reporting period.



Environmental conditions

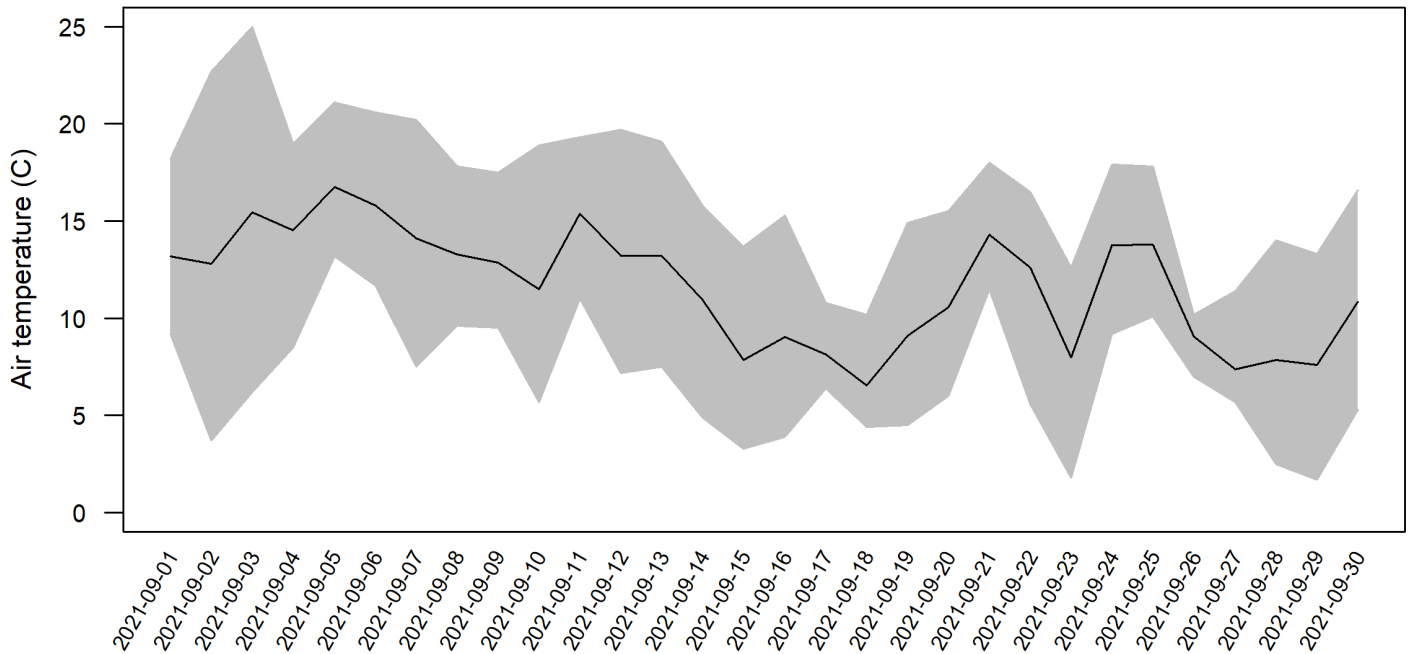
Discharge in the Peace River fluctuated during the reporting period from a low of 427 cms on September 5 to a high of 1290 cms on September 18 (Figure 2).

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 October 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 1.7°C on September 29 to a high of 25.0°C on September 3 (Figure 3).

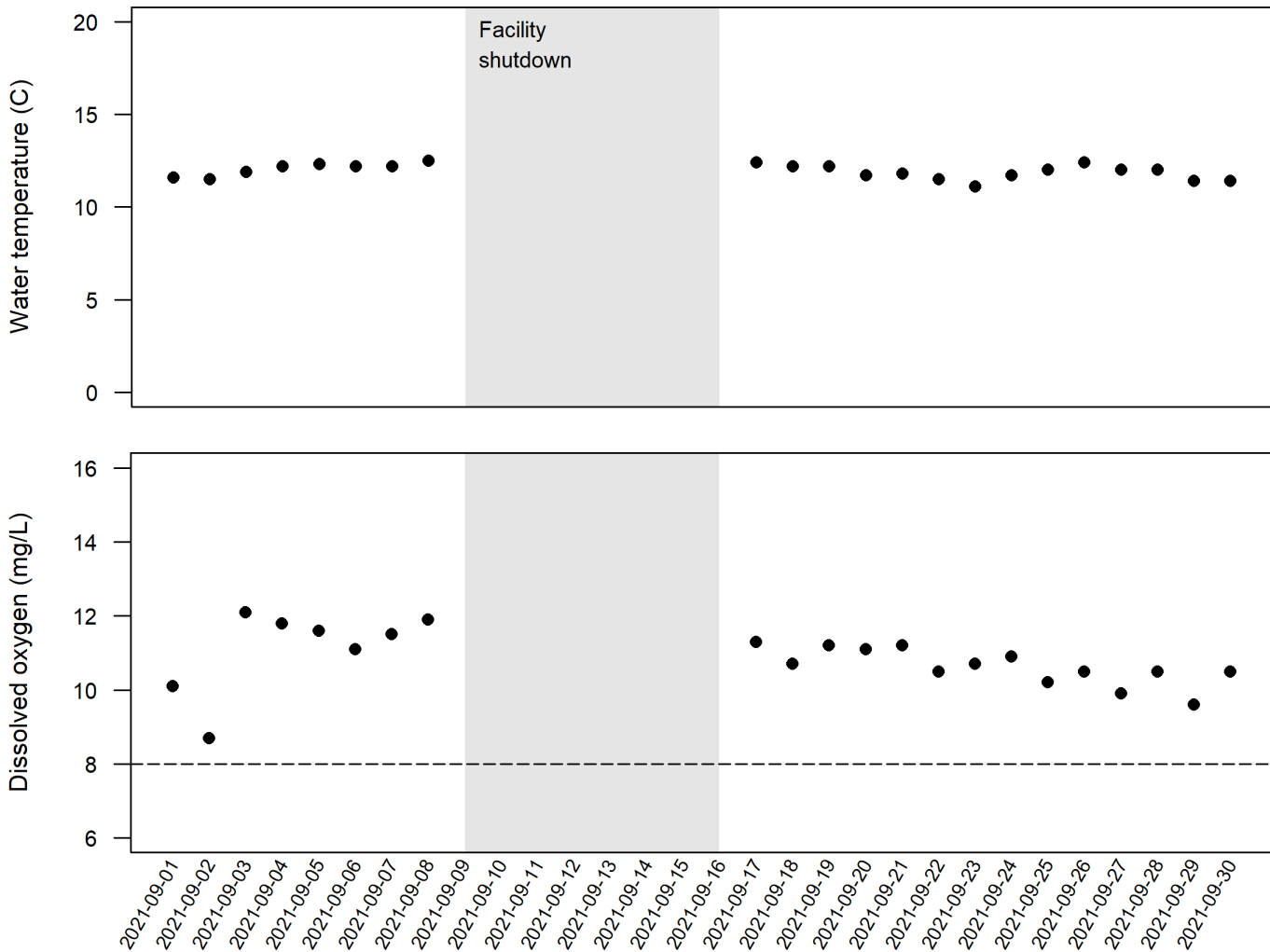
Figure 3. Mean daily air temperature (black line; °C) during the reporting period as measured by the provincial air monitoring station located on the dam site at the Site C Workers Accommodation⁵ (E309527). Shaded area represents the minimum and maximum daily air temperatures.



⁵ Available at: <https://www.env.gov.bc.ca/epd/bcairquality/data/station.html?id=E309527>

Water temperature remained stable during the reporting period from a low of 11.1°C on September 23 to a high of 12.5°C on September 8 (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.

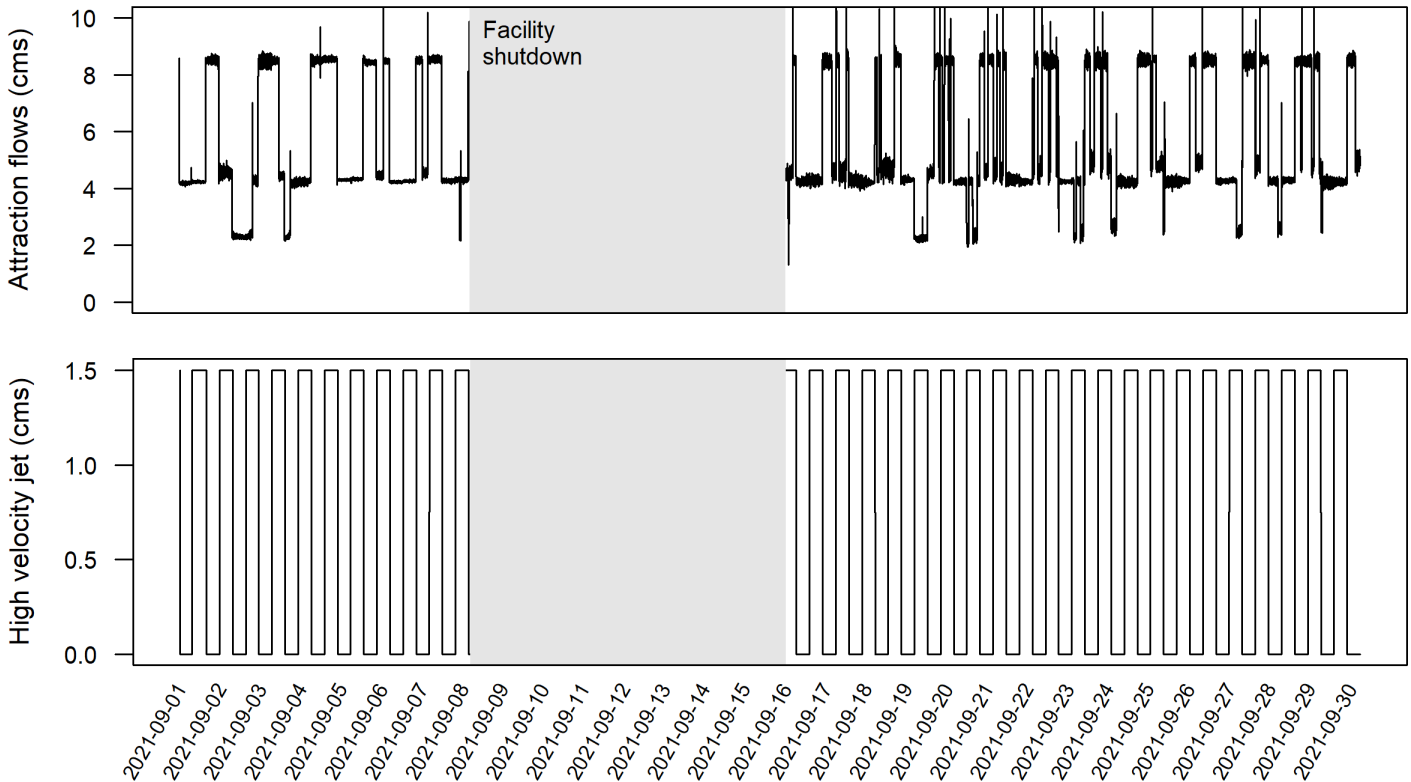


Mechanical operation

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). Attraction flow pumps continued to fault throughout September, which consisted of short periods of higher or lower attraction flow (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 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
2021-09-01	3	08:30, 11:00, 13:00
2021-09-02	2	08:30, 11:00
2021-09-03	1	08:30
2021-09-04	3	08:30, 11:00, 13:00
2021-09-05	3	08:30, 11:00, 13:00
2021-09-06	2	08:30, 11:00
2021-09-07	2	08:30, 11:00
2021-09-08	1	08:30
2021-09-09	-	Facility shutdown
2021-09-10	-	Facility shutdown
2021-09-11	-	Facility shutdown
2021-09-12	-	Facility shutdown
2021-09-13	-	Facility shutdown
2021-09-14	-	Facility shutdown
2021-09-15	-	Facility shutdown
2021-09-16	-	Facility shutdown
2021-09-17	3	08:30, 11:00, 13:00
2021-09-18	3	08:30, 11:00, 13:00
2021-09-19	3	08:30, 11:00, 13:00
2021-09-20	3	08:30, 11:00, 13:00
2021-09-21	3	08:30, 11:00, 13:00
2021-09-22	3	08:30, 11:00, 13:00
2021-09-23	3	08:30, 11:00, 13:00
2021-09-24	3	08:30, 11:00, 13:00
2021-09-25	2	08:30, 12:00
2021-09-26	3	08:30, 11:00, 13:00
2021-09-27	3	08:30, 11:00, 13:00
2021-09-28	3	08:30, 11:00, 13:00
2021-09-29	3	08:30, 11:00, 13:00
2021-09-30	3	08:30, 11:00, 13:00

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

Date	Standby or shutdown	Rationale
2021-09-08 09:26 to 2021-09-16 14:04	Shutdown	Facility was shutdown to: (1) install analog cards to valves at the top of the fishway (600-FF-RW-001 and 200-FF-RW-002) to change the distribution of flow and improve passage and increase trapping efficiency; and (2) replace a brass bushing on the fish lock that had worn down from operations.

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	Attraction flows dropping and spiking on occasion.	Variable frequency drive faulting due to debris accumulation on the pump station screens, which creates a large differential in hydraulic head between the diversion tunnel outlet and the wet well.	Variable frequency drive manually reset following each fault and the programming changed to self-clean on a more regular basis.
2021-09-08	Damage	Brass bushing on fish lock had worn down.	Continued use from daily operations.	Replaced bushing.
2021-09-20	Breakdown	Sprayer in the pre-sort holding pool inoperable.	Sprayer line plugged with silt and sand.	Removed the nozzle and flushed the line to dislodge silt and sand.

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 Plan². 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	Several adjustments to the top of the fishway in August were continued in September to improve the biological and mechanical operation of the temporary facility (Reference: Temporary Upstream Fish Passage Facility, Operations Report, August 1 to 31, 2021).
	Facility operator installed analog cards to valves at the top of the fishway (600-FF-RW-001 and 200-FF-RW-002) to change the distribution of flow and improve passage and increase trapping efficiency (Photo 2). From September 24 to 30, BC Hydro experimentally manipulated the valve settings and monitored the biological response. Manipulations were planned to continue in October 2021.
	Facility operator monitored the fish lock for the presence of otters prior to raising the rail hoist to the elevation of the sorting facility. If an otter was observed in the fish lock, which did not occur during the reporting period, the sorting cycle would be abandoned and the fish and otter released back into the pre-sort holding pool.

Contingent fish capture and transport

In total, 74 fish were transported upstream through contingent fish capture during the reporting period (Table 2). Specifically, 25 Longnose Sucker, 20 Largescale Sucker, 13 White Sucker, 7 Bull Trout, 4 Northern Pikeminnow, 3 Northern Pike, 1 Burbot and 1 Lake 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 16	
	September 14	
	U	D
Arctic Grayling		
Brook Stickleback		
Brook Trout		
Bull Trout	7	
Burbot	1	
Finescale Dace		
Flathead Chub		
Goldeye		
Kokanee		
Lake Chub		
Lake Trout	1	
Lake Whitefish		
Largescale Sucker	20	
Longnose Dace		
Longnose Sucker	25	
Mountain Whitefish		11
Northern Pike	3	
Northern Pikeminnow	4	
Northern Redbelly Dace		
Peamouth		
Pearl Dace		
Prickly Sculpin		
Pygmy Whitefish		
Rainbow Trout		
Redside Shiner		
Slimy Sculpin		
Spoonhead Sculpin		
Spottail Shiner		
Trout-perch		
Walleye		3
White Sucker	13	
Yellow Perch		
Total	74	14
Grand total	88	

Photos

Photo 1. Sampling a Redside Shiner in the sorting facility (September 8, 2021).



Photo 2. Analog cards were added to valves at the top of the fishway (600-FF-RW-001 and 200-FF-RW-002) to change the distribution of flow. In general the intent was to increase the amount of flow from the pre-sort holding pool (200-FF-RW-002) and decrease the amount of flow from Pool 25 (600-FF-RW-001). Total flow in the fishway, however, remained constant at 0.36 cms (Panel C in Appendix II). Adapted from IFC Construction Drawing 1020-C13-00305.

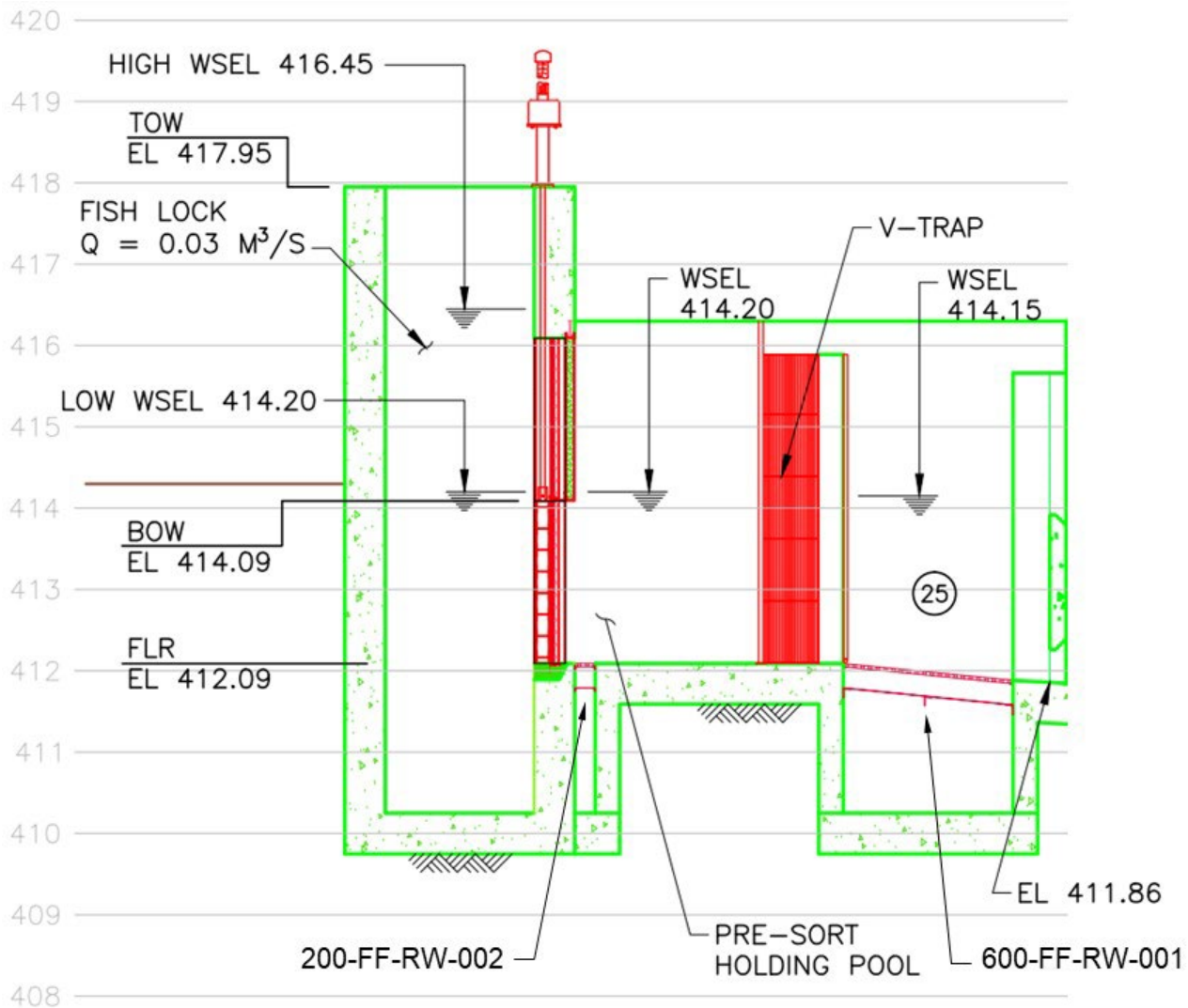


Photo 3. River otters were repeatedly observed predated on fish during the reporting period (September 30, 2021).



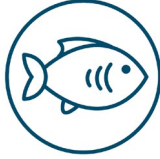
Prepared by

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 and implementation of contingent fish capture during the reporting period.

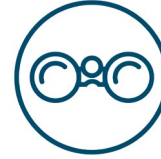
From: Brent Mossop and Nich Burnett, Fish and Aquatic – Site C Clean Energy Project
 Reporting Period: September 1 to 30, 2021
 Subject: Monthly Update on Upstream Fish Passage



387 fish sorted at facility



9 Bull Trout transported to the Halfway River



Operated facility for 22 days

Category	Performance	Commentary
Safety		<ul style="list-style-type: none"> Effective interfaces among contractors
Fish Passage ¹		<ul style="list-style-type: none"> Passed 387 fish including 9 Bull Trout
Sorting & Transport		<ul style="list-style-type: none"> Sorted 10 species
Fish Mortality		<ul style="list-style-type: none"> No mortalities during reporting period
Operation Within Criteria		<ul style="list-style-type: none"> Operated within and outside of design criteria Shutdown for 8 days to change flow distribution in fishway
External Communication		<ul style="list-style-type: none"> Presented to Indigenous groups at Environmental Forum
Effectiveness Monitoring		<ul style="list-style-type: none"> Monitoring equipment performing well
Learning & Adjustment		<ul style="list-style-type: none"> Adjustments to flow distribution at top of fishway to improve passage and increase trapping efficiency

Meets or Exceeds Expectations	Nearing Expectations	Far Below Expectations
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¹ Infographic available here: <https://www.sitecproject.com/sites/default/files/fish-passage-facility.pdf>

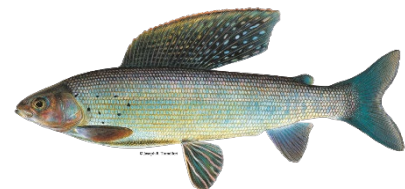
Target Species



Bull Trout

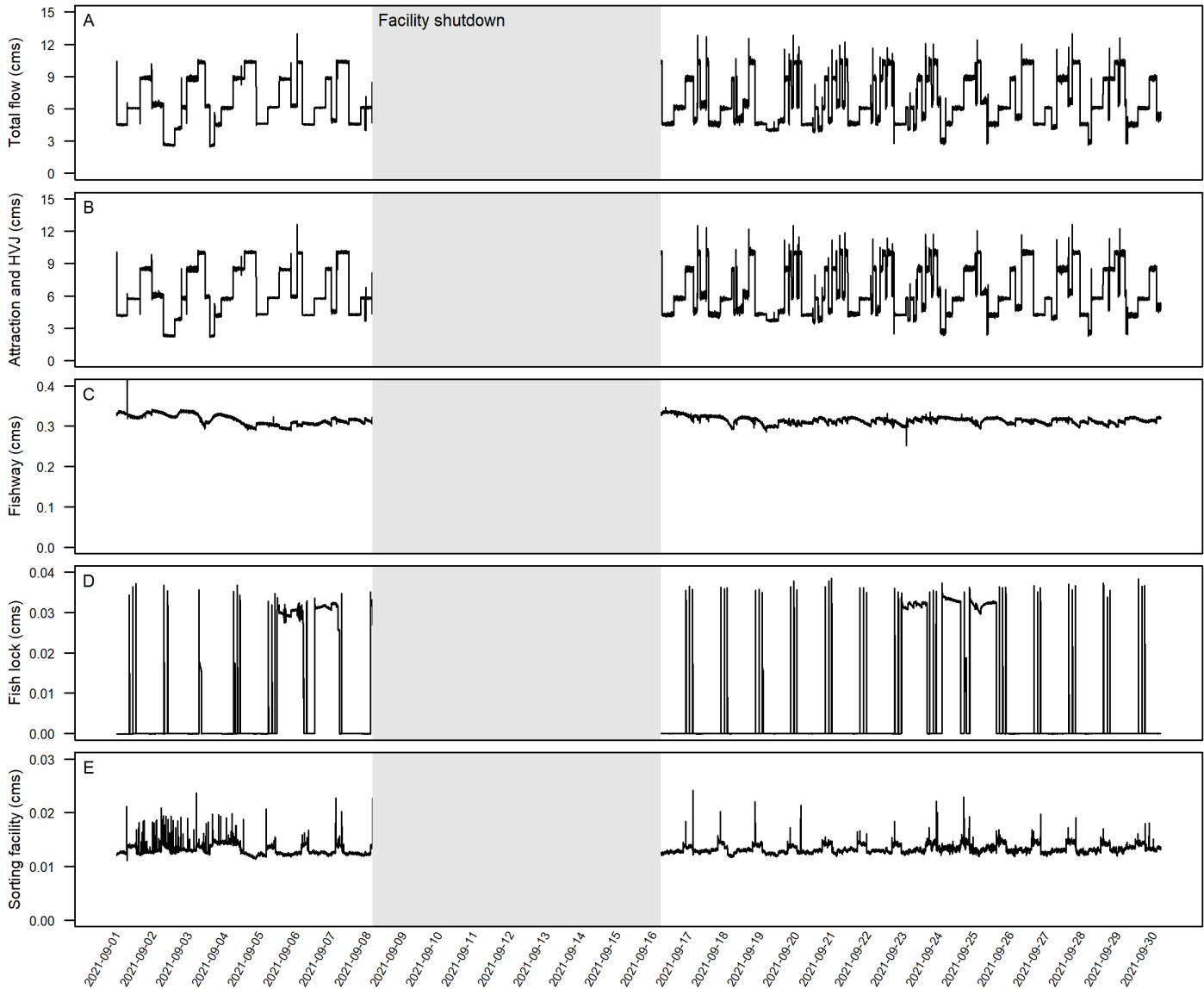


Rainbow Trout



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 133987⁶, 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).



⁶ Available at: <http://siteproject.com/sites/default/files/fish-passage-facility-water-licences-133986-133987.pdf>