BC Hydro
Power smart

Site C Clean Energy Project

Temporary Upstream Fish Passage Facility Operations Report

Reporting Period: May 1 to 31, 2022

Prepared by BC Hydro

June 6, 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 the Sucker species) 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 May 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

Two hundred and four fish – 146 Mountain Whitefish, 41 Largescale Sucker, 10 Arctic Grayling, 6 White Sucker, and 1 Longnose Sucker – were sorted and sampled at the temporary facility, and transported and released into the Peace River upstream of the Project (Table 1, Photo 1). In addition to operating the temporary facility, BC Hydro conducted four sessions of contingent fish capture downstream of the diversion tunnel outlet and transported 295 Largescale Sucker, 148 Longnose Sucker, 34 Bull Trout, 16 White Sucker, 15 Rainbow Trout and 13 Arctic Grayling upstream of the Project (Table 6, Photos 2 and 3). One thousand and thirty eight 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 May 2022 to improve the biological and mechanical operation of the temporary facility.

- In May, the operator stopped closing the vee-trap gate before sunrise, which was an approach used in the late summer and early fall of 2021 primarily to capture Bull Trout that had entered the pre-sort holding pool at night. Moving forward the operator only closed the vee-trap gate as part of a normal sorting cycle (i.e., operation of the crowder) to maximize the trapping time for all other species.

- Contingent fish capture crews started to transport Arctic Grayling to the Moberly River and all other fish species (except for Bull Trout, Goldeye and Walleye) to the Peace River in a single transport trip. Arctic Grayling were placed in a floating fish basket (Photo 3) which was placed inside the transport pod with all other species destined for the Peace River. Crews first stopped and released Arctic Grayling into the Moberly River, and then continued upstream to release all other species into the Peace River. Such an adjustment – which closely aligns with the transport plans from the temporary and permanent facilities – reduced the need for multiple transport trips and prolonged holding times.

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, 204 fish were sorted in the temporary facility during the reporting period (Table 1; Figure 1). Two mortalities – 1 Largescale Sucker in the fish lock and 1 Longnose Sucker in the AWS Receiving Pool – were observed during the reporting period (1.4% 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.

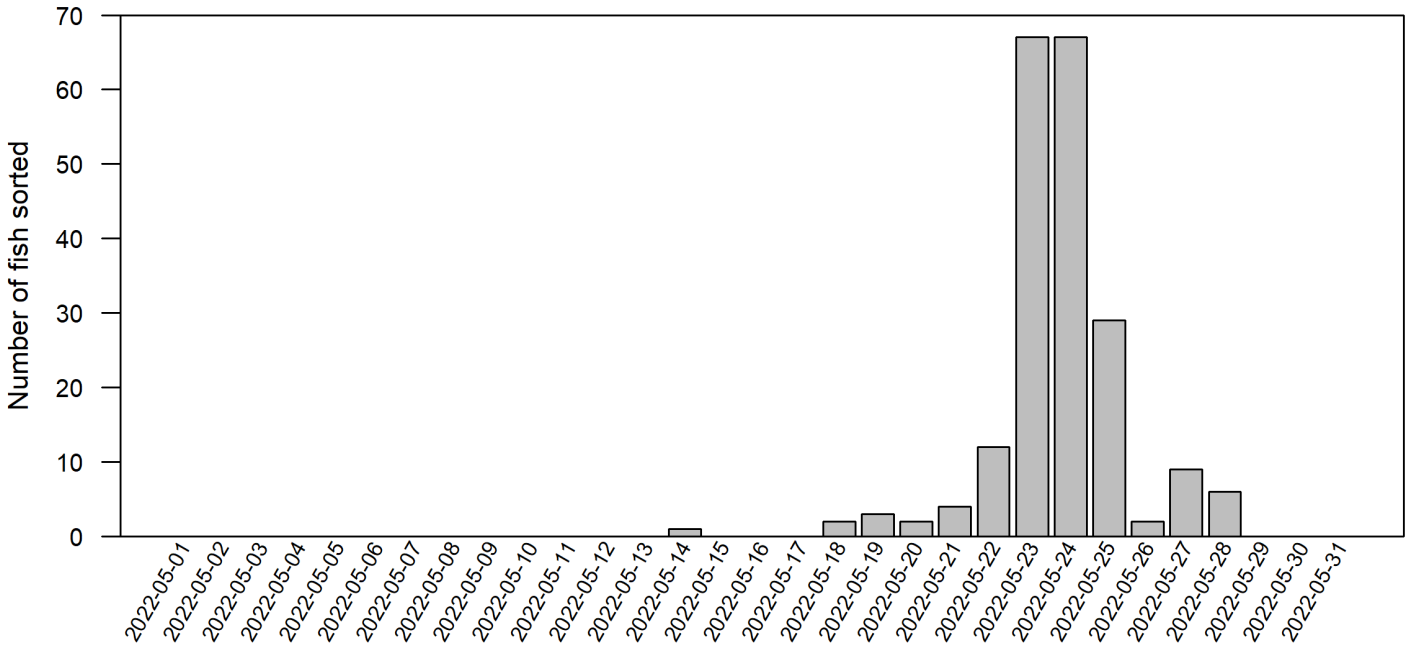
Species	Sorted	Transported and released	PIT tagged	Mortalities	Genetics	Microchemistry or ageing
Arctic Grayling	10	10	10	0	10	10
Brook Stickleback						
Brook Trout						
Bull Trout						
Burbot						
Finescale Dace						
Flathead Chub						
Goldeye						
Kokanee						
Lake Chub						
Lake Trout						
Lake Whitefish						
Largescale Sucker	41	41	35	1	N/A	N/A
Longnose Dace						
Longnose Sucker	1	1	1	1	N/A	N/A
Mountain Whitefish	146	146	126	0	N/A	106
Northern Pike						
Northern Pikeminnow						
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	6	6	2	0	N/A	N/A
Yellow Perch						
Grand total	204	204	174	2	10	116

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 67 fish were sorted daily during the reporting period (Figure 1). Similar rates of passage were observed in May 2021, where 196 fish passed the facility and 426 fish were passed via contingent fish capture.

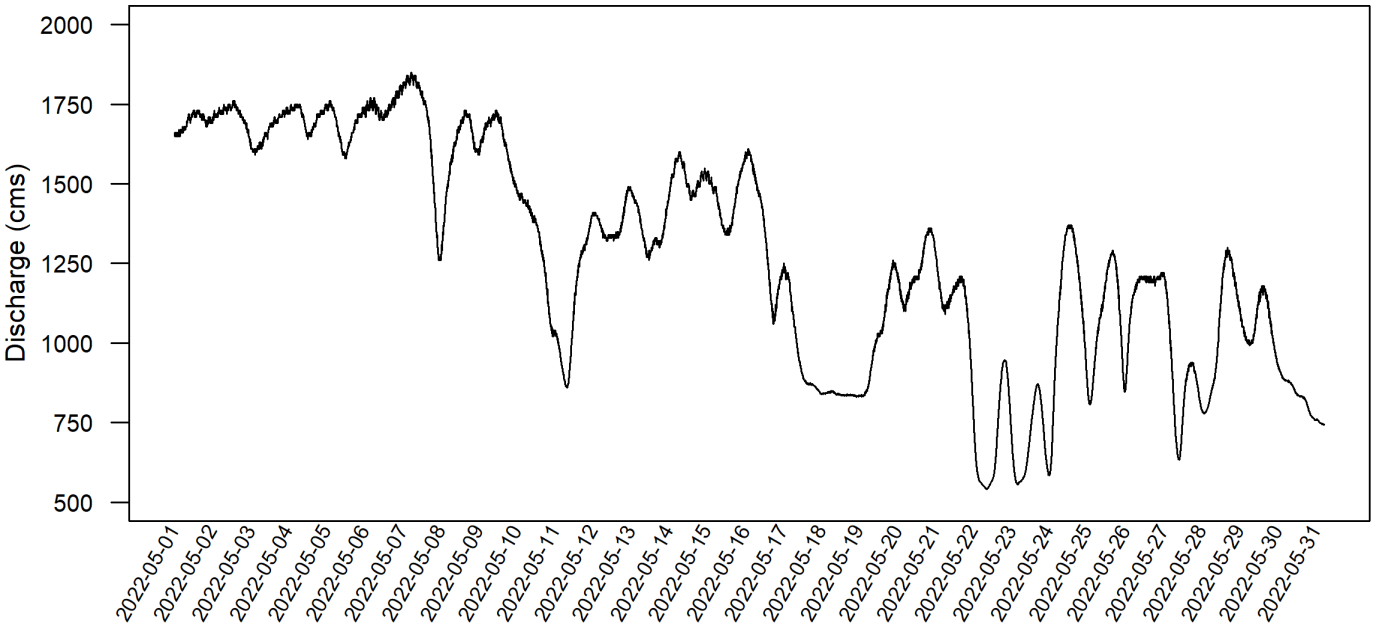
Figure 1. Daily number of fish sorted in the temporary facility during the reporting period.



Environmental conditions

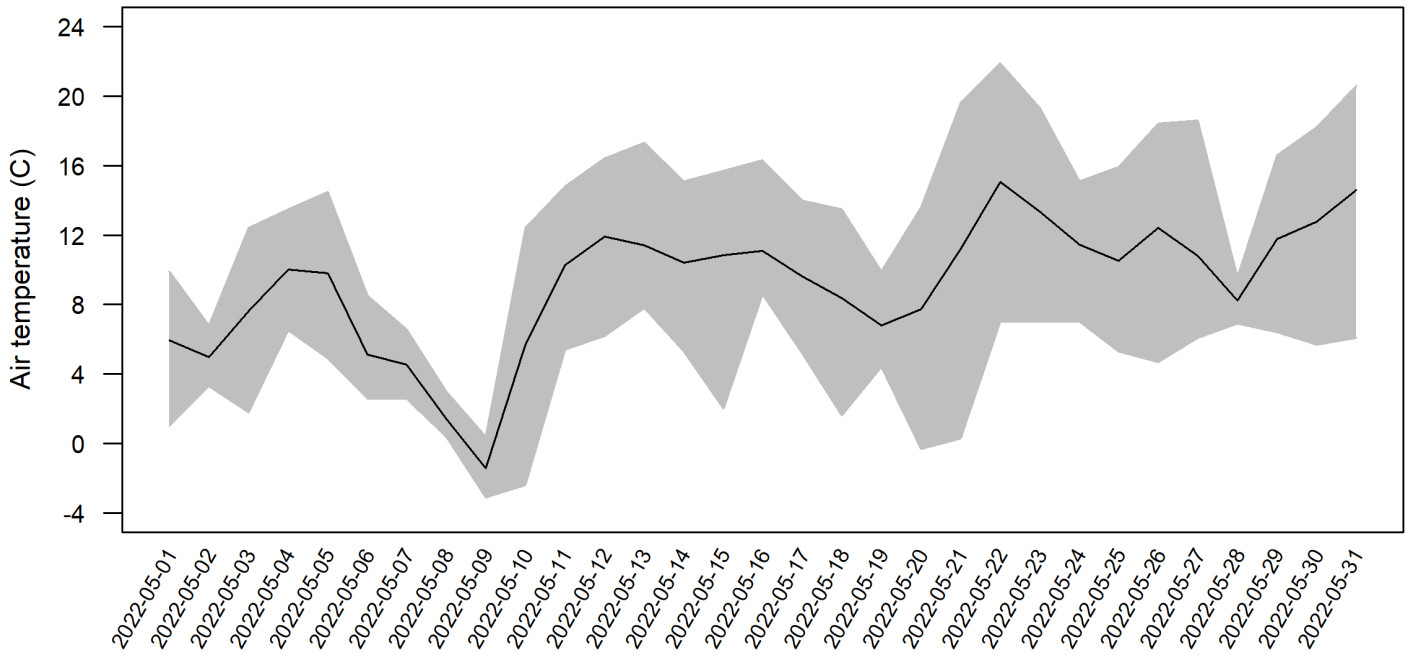
Discharge in the Peace River fluctuated during the reporting period from a low of 541 cms on May 22 to a high of 1850 cms on May 7 (Figure 2).

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 June 1; 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 -3.1°C on May 9 to a high of 21.9°C on May 22 (Figure 3).

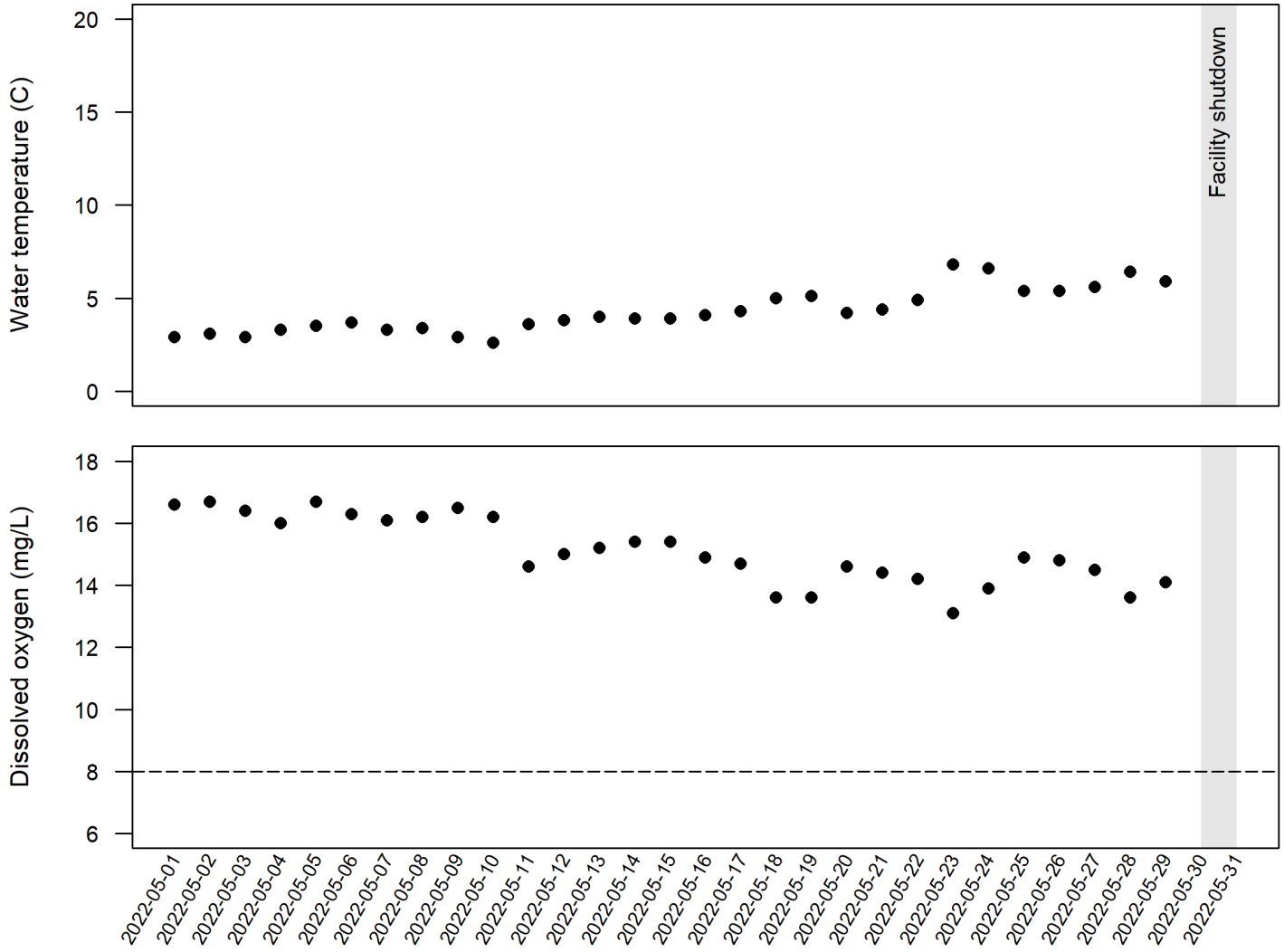
Figure 3. Mean daily air temperature (black line; °C) during the reporting period as measured by the provincial air monitoring station located on the dam site at the Site C Workers Accomodation[7] (E309527). Shaded area represents the minimum and maximum daily air temperatures.



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

Water temperature steadily increased during the reporting period from a low of 2.6°C on May 10 to a high of 6.8°C on May 23 (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.

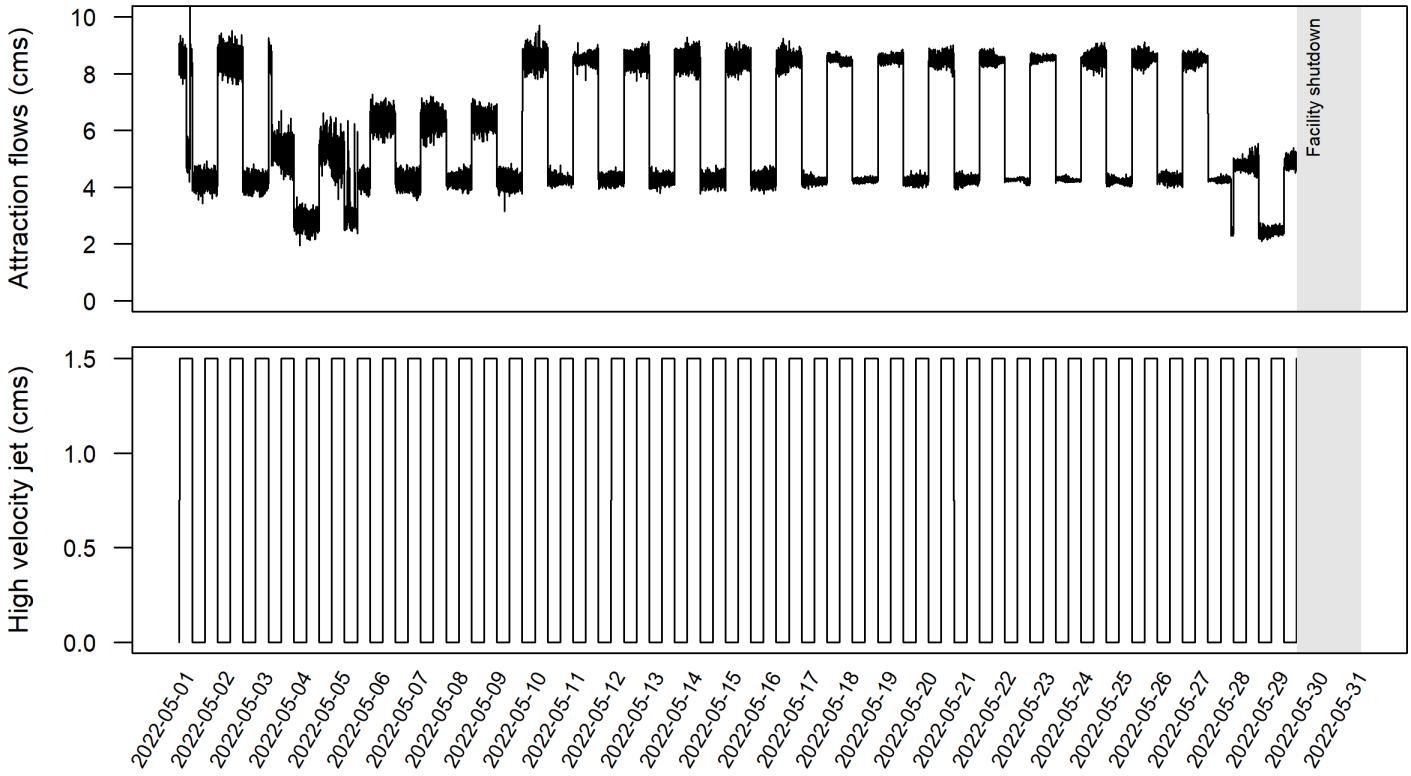


Mechanical operation

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 early May and the end of May (Tables 3 and 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 four sorting cycles were conducted each day during the reporting period, with the exception of May 29 to 31 when the facility was shutdown (Table 2).

Table 2. Daily total number of sorting cycles.

Date	Number of sorting cycles	Start time
2022-05-01	3	08:30, 11:00, 13:00
2022-05-02	3	08:30, 11:00, 13:00
2022-05-03	3	08:30, 11:00, 13:00
2022-05-04	3	08:30, 11:00, 13:00
2022-05-05	3	08:30, 11:00, 13:00
2022-05-06	3	08:30, 11:00, 13:00
2022-05-07	3	08:30, 11:00, 13:00
2022-05-08	3	08:30, 11:00, 13:00
2022-05-09	3	08:30, 11:00, 13:00
2022-05-10	3	08:30, 11:00, 13:00
2022-05-11	4	08:30, 11:00, 14:30, 16:15
2022-05-12	3	08:30, 11:00, 13:00
2022-05-13	3	08:30, 11:00, 13:00
2022-05-14	3	08:30, 11:00, 13:00
2022-05-15	3	08:30, 11:00, 13:00
2022-05-16	3	08:30, 11:00, 13:00
2022-05-17	3	08:30, 11:00, 13:00
2022-05-18	3	08:30, 11:00, 13:00
2022-05-19	3	08:30, 11:00, 13:00
2022-05-20	3	08:30, 11:00, 13:00
2022-05-21	3	08:30, 11:00, 13:00
2022-05-22	3	08:30, 11:00, 13:00
2022-05-23	2	08:30, 13:00
2022-05-24	2	08:30, 13:00
2022-05-25	3	08:30, 11:00, 13:00
2022-05-26	3	08:30, 11:00, 13:00
2022-05-27	3	08:30, 11:00, 13:00
2022-05-28	3	08:30, 11:00, 13:00
2022-05-29	-	Facility shutdown
2022-05-30	-	Facility shutdown
2022-05-31	-	Facility shutdown

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

Date	Standby or shutdown	Rationale
2022-05-29 14:41 to 2022-05-31 23:59	Shutdown	High rainfall on May 28 resulted in a significant increase in local inflows (Moberly and Halfway rivers) and debris and suspended sediment in the Peace River (Photo 4). Debris and suspended sediment clogged the water intake screens such that water could not pass through the wetwell to feed the pumps; this caused the differential between the diversion tunnel outlet and wetwell to exceed criteria and the facility to auto shutdown. BC Hydro kept the facility down to protect mechanical equipment (e.g., pumps) from damage and ensure fish health.

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
2022-05-03 to 2022-05-10	Malfunction	Attraction flow pumps not following flow schedule described in Section 3.2.1.3 of the OPP.	Two causes: (1) communication error on Pump 1 caused repeated faulting over a two-day period (May 3 to 5), and (2) one of the entrance gates was in manual mode and not operating as per auto control design (May 5 to 10).	Communication error in the PLC was resolved and the entrance gate was set into automatic mode.

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	Several adjustments to the top of the fishway in August, September and October 2021 were continued in April 2022 to improve the biological and mechanical operation of the temporary facility (References: Temporary Upstream Fish Passage Facility, Operations Reports, August 1 to 31, 2021, September 1 to 30, 2021, and October 1 to 31, 2021).
	On May 17, the operator stopped closing the vee-trap gate before sunrise, which was an approach used in the late summer and early fall of 2021 primarily to capture Bull Trout that had entered the pre-sort holding pool at night. Moving forward the operator only closed the vee-trap gate as part of a normal sorting cycle (i.e., operation of the crowder) to maximize the trapping time for all other species.
Biological operation	On May 11, contingent fish capture crews started to transport Arctic Grayling to the Moberly River and all other species (except for Bull Trout, Goldeye and Walleye) to the Peace River in a single transport trip. Arctic Grayling were placed in a floating fish basket (Photo 3) which was placed inside the transport pod with all other species destined for the Peace River. Crews first stopped and released Arctic Grayling into the Moberly River, and then continued upstream to release all other species into the Peace River. Such an adjustment – which closely aligns with the transport plans from the temporary and permanent facilities – reduced the need for multiple transport trips and prolonged holding times.

Contingent fish capture and transport

In total, 521 fish were transported upstream through contingent fish capture during the reporting period (Table 6). Specifically, 295 Largescale Sucker, 148 Longnose Sucker, 34 Bull Trout, 16 White Sucker, 15 Rainbow Trout and 13 Arctic Grayling were transported upstream of the Project (Photos 2 and 3).

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

Species	Session 5		Session 6		Session 7		Session 8		Total
	May 4 and 5		May 11 and 12		May 18 and 19		May 24 and 25		
	U	D	U	D	U	D	U	D	
Arctic Grayling	5		3		2		3		13
Brook Stickleback									
Brook Trout									
Bull Trout	6		3		9		16		34
Burbot		2				1		1	4
Finescale Dace									
Flathead Chub									
Goldeye									
Kokanee		8		10		11		1	30
Lake Chub									
Lake Trout				1		3			4
Lake Whitefish									
Largescale Sucker	20		49		84		142	2	297
Longnose Dace									
Longnose Sucker	9		25	1	40	4	74	2	155
Mountain Whitefish		239		351		223		153	966
Northern Pike									
Northern Pikeminnow		2		1		5		12	20
Northern Redbelly Dace									
Peamouth									
Pearl Dace									
Prickly Sculpin									
Pygmy Whitefish									
Rainbow Trout	5	2	5		2	1	3		18
Redside Shiner								1	1
Slimy Sculpin								1	1
Spoonhead Sculpin									
Spottail Shiner									
Trout-perch									
Walleye									
White Sucker			5		2		9		16
Yellow Perch									
Total	45	253	90	364	139	248	247	173	1559
Grand total	298		454		387		420		

Photos

Photo 1. Biologists sample an Arctic Grayling in the sorting facility (May 18, 2022).

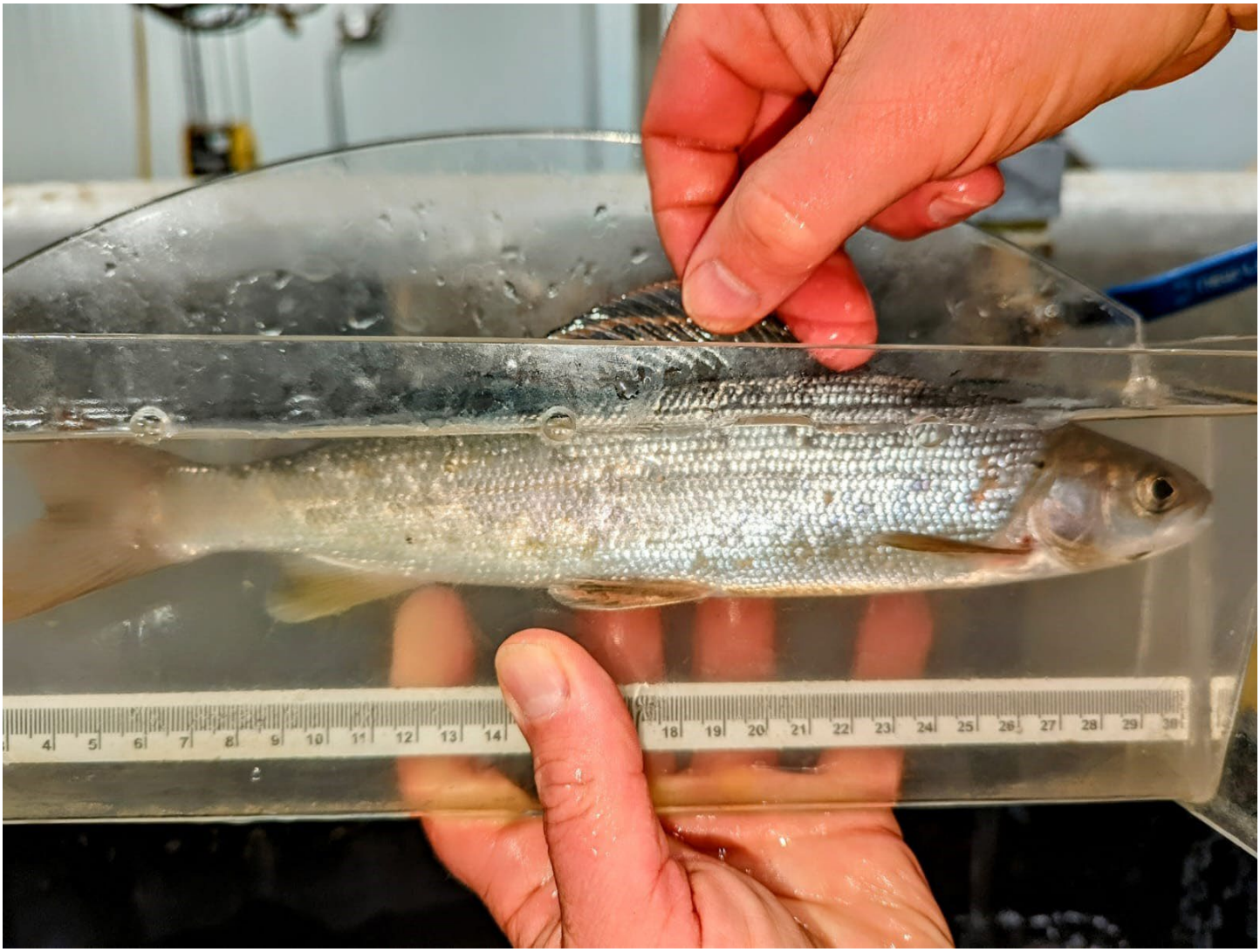
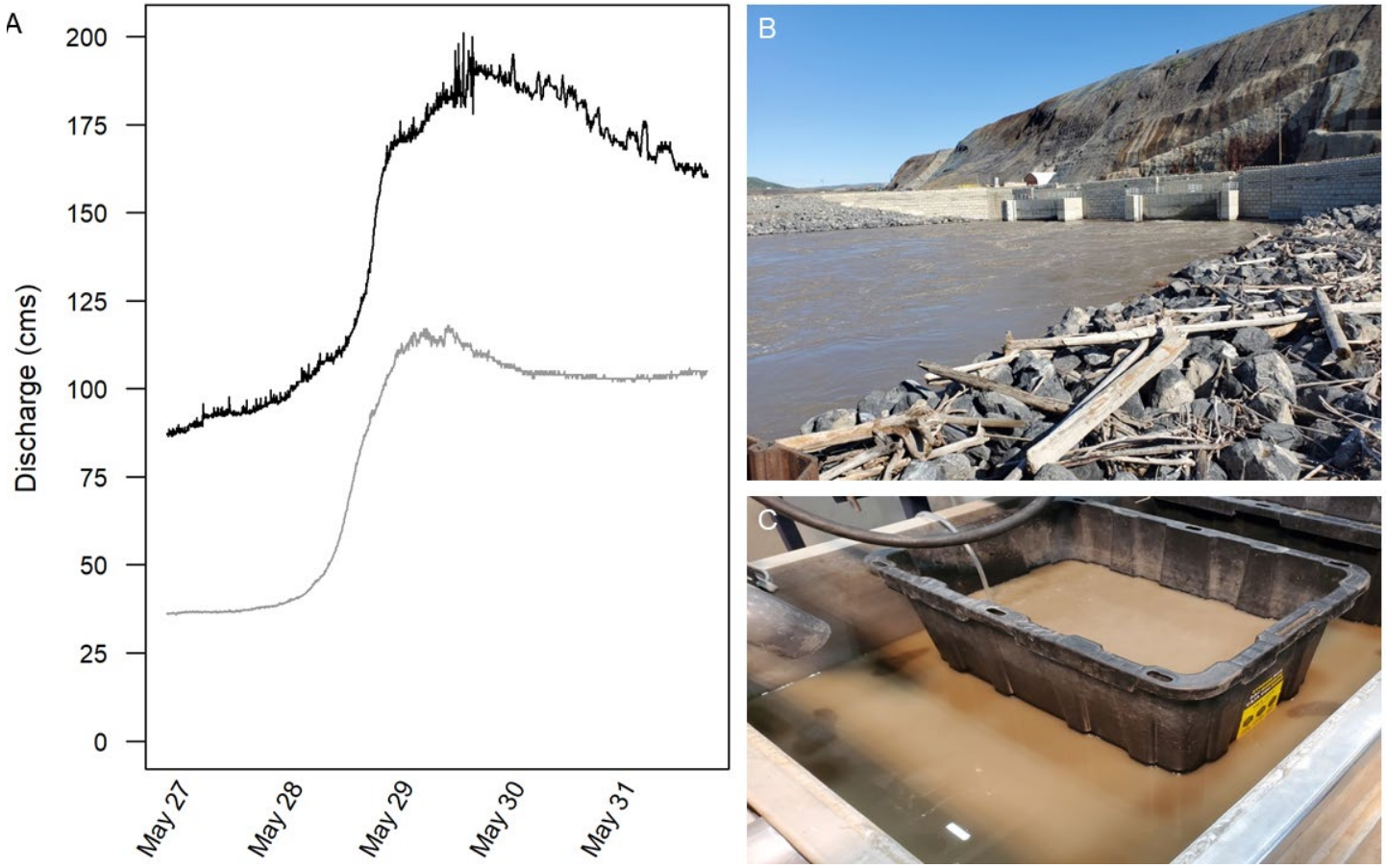


Photo 2. Crews sample a Rainbow Trout during contingent fish capture, which showed clear signs of spawning colouration (May 12, 2022).

Photo 3. Contingent fish capture crews placed Arctic Grayling into a separate floating fish basket along with all other species in the transport pod. Such an adjustment reduced the need for multiple transports and prolonged holding times (May 11, 2022).

Photo 4. High rainfall on May 28, 2022 resulted in a significant increase in local inflows[8] (Moberly [grey] and Halfway [black] rivers; A) and debris and suspended sediment in the Peace River. High loads of debris and suspended sediment in the diversion tunnel outlet (B; May 30, 2022) clogged the water intake screens such that water could not pass through the wetwell to feed the pumps; this caused the differential between the diversion tunnel outlet and wetwell to exceed criteria and the facility to auto shutdown. On May 29, 2022, BC Hydro decided to keep the facility shut down to protect mechanical equipment (e.g., pumps) from damage and ensure fish health. (C) Water quality in the sorting facility on May 30, 2022.



[8] Discharge in the Moberly and Halfway rivers as measured at the Moberly River near Fort St John (07FB008) and Halfway River near Farrell Creek (07FA006) WSC hydrometric stations. Data were downloaded from the WSC on June 2; the downloaded data were provided at 5-minute intervals and were listed as provisional by the WSC.

Photo 5. BC Hydro toured representatives from Blueberry River First Nation, McLeod Lake Indian Band, Prophet River First Nation, Fort Nelson First Nation, Duncan's First Nation, Kelly Lake First Nation, Horse Lake First Nation and Métis Nation British Columbia around the temporary facility as part of broader site tours (May 18, 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:	May 1 to 31, 2022
Subject:	Monthly Update on Upstream Fish Passage

204 fish sorted at facility

Operated facility for 28 days

521 fish transported through contingent fish capture

Category	Performance	Commentary
Safety		• Effective interfaces among contractors
Fish Passage[1]		• Passage rates consistent with those observed in May 2021
Sorting & Transport		• 204 fish from 5 species
Fish Mortality		• Two mortalities during reporting period • Survival rate >98% for all fish sorted in 2022
Operation Within Criteria		• Operated within and outside of design criteria • Shutdown due to debris and sediment clogging intake screens
External Communication		• Toured representatives from 8 Indigenous nations around the temporary facility (Photo 5)
Effectiveness Monitoring		• Monitoring equipment performing well
Learning & Adjustment		• Adjustments to reduce contingent transport trips and fish holding times

Meets or Exceeds Expectations	Nearing Expectations	Far Below Expectations

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

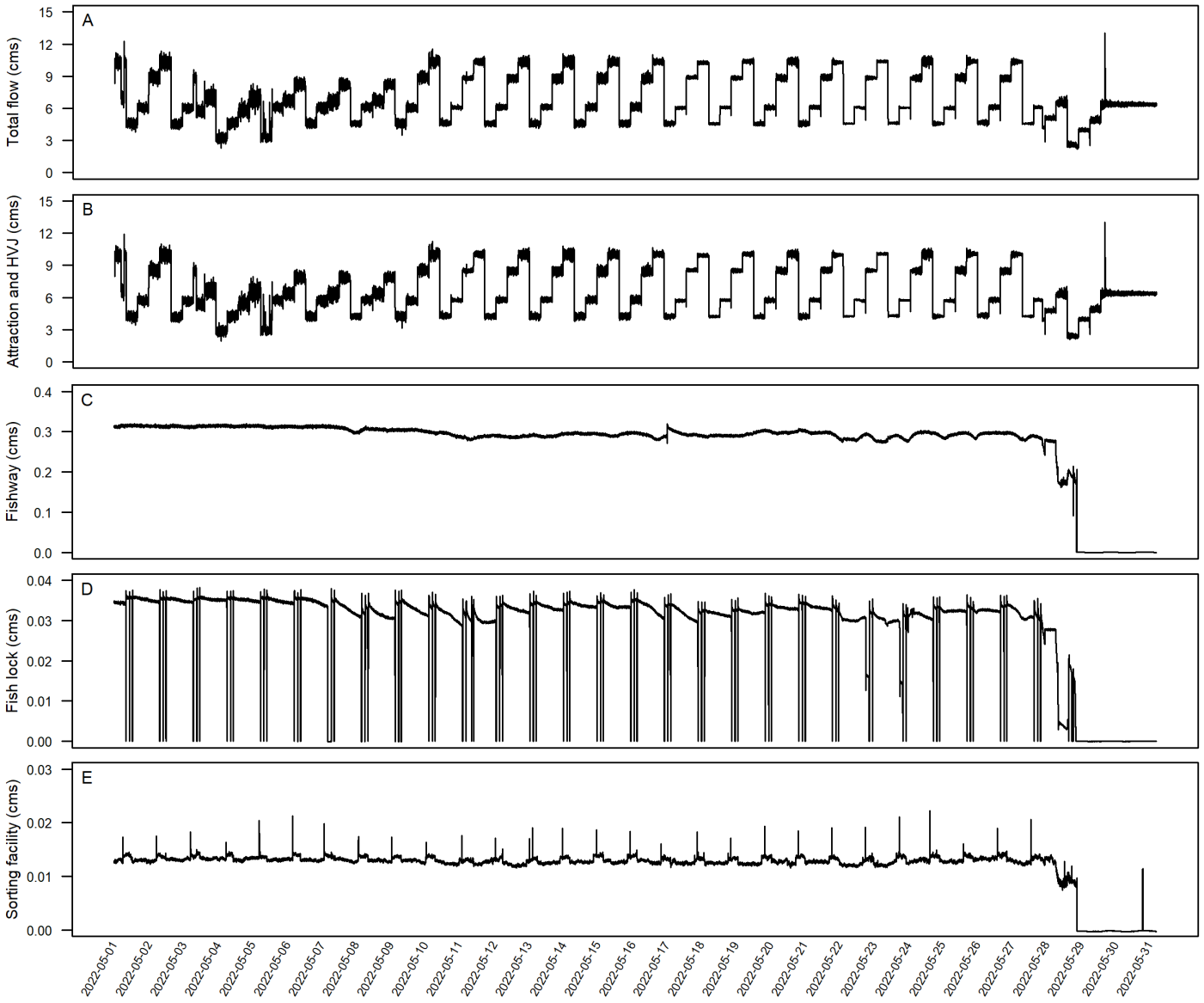
Target Species

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[9], 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).



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