

## **Site C Clean Energy Project**

### **Temporary Upstream Fish Passage Facility Operations Report**

**Reporting Period: April 1 to 30, 2021**

Prepared by BC Hydro

Submitted August 10, 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<sup>1</sup>). 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 (Map 1). 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 Plan<sup>2</sup>.

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 undergoing spawning migrations during the reporting period (EIS, Volume 2, Appendix O<sup>3</sup>; BC Hydro 2015<sup>4</sup>) were transported and released upstream of the Project, which included Arctic Grayling, Bull Trout, Rainbow Trout, and the Sucker species. 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 April 2021.

This report has the following sections:

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

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<sup>1</sup> Available at: [https://www.ceaa-acee.gc.ca/050/documents\\_staticpost/63919/85328/Vol2\\_Appendix\\_Q.pdf](https://www.ceaa-acee.gc.ca/050/documents_staticpost/63919/85328/Vol2_Appendix_Q.pdf)

<sup>2</sup> Available at: <http://sitecproject.com/sites/default/files/Fish%20Passage%20Management%20Plan.pdf>

<sup>3</sup> Available at: [https://www.ceaa-acee.gc.ca/050/documents\\_staticpost/63919/85328/Vol2\\_Appendix\\_O.pdf](https://www.ceaa-acee.gc.ca/050/documents_staticpost/63919/85328/Vol2_Appendix_O.pdf)

<sup>4</sup> Available at: <http://sitecproject.com/sites/default/files/Fisheries-and-Aquatic-Habitat-Monitoring-and-Follow-up-Program.pdf>

mechanical equipment to ensure the temporary facility achieves the biological objectives described in Section 4.1 of the Fish Passage Management Plan.

## Summary

Despite high water surface elevations, BC Hydro continuously operated the temporary facility during the reporting period. Seven fish – all Mountain Whitefish – were sorted and sampled at the temporary facility (Photo 1), and transported and released into the Peace River upstream of the Project (Table 1). In addition to operating the temporary facility, BC Hydro conducted five sessions of contingent fish capture downstream of the diversion tunnel outlet and transported 17 Bull Trout, 12 Largescale Sucker, 6 Longnose Sucker, 4 Rainbow Trout, and 3 Arctic Grayling upstream of the Project (Table 6, Photos 2 and 3). Nine hundred and thirty-seven fish from other species were encountered during contingent fish capture and were released downstream of the Project (Table 6).

Several adjustments were made to improve the biological and mechanical operation of the temporary facility. Adjustments summarized in Table 5 will be reflected in an updated revision of the OPP for operations in 2022.

BC Hydro shared information related to the operation of the temporary facility through a number of venues:

- Presentation to Indigenous groups at Environmental Forum #17 on April 14;
- Updates to DFO and FLNRORD on April 7 and 29; and
- Updates to CWR, IE and IEM on April 27.

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.

## Biological operation

In total, 7 Mountain Whitefish were sorted in the temporary facility during the reporting period (Table 1; Figure 1). No mortalities were observed during the reporting period.

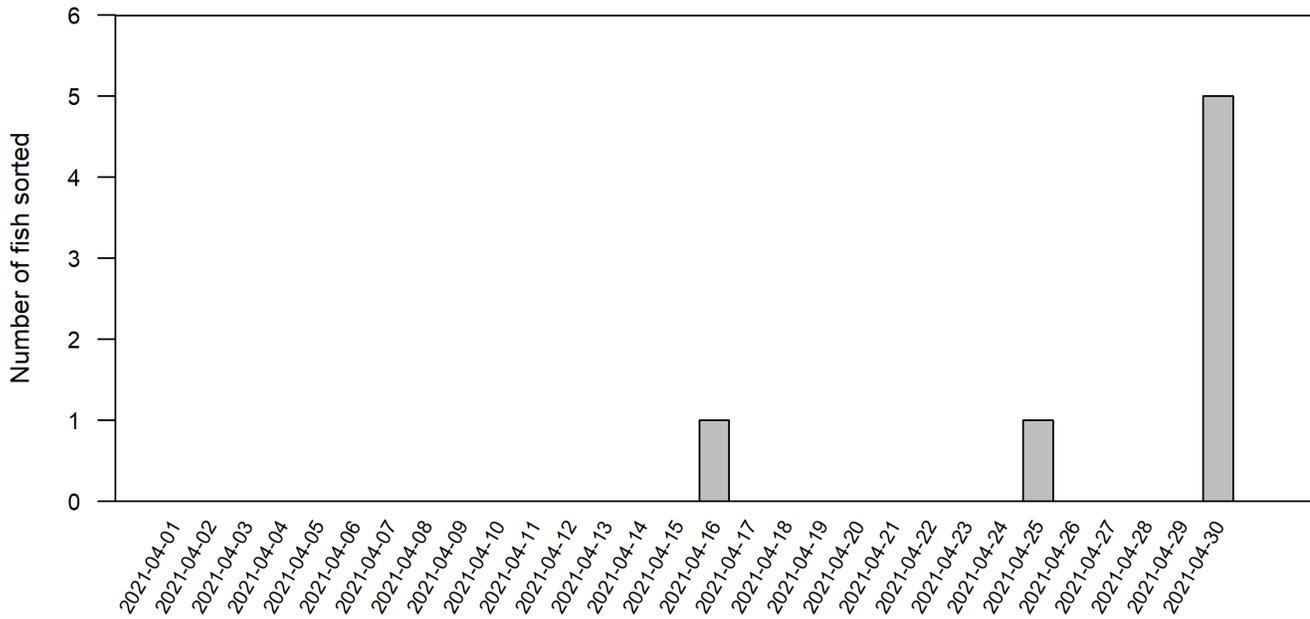
**Table 1.** Total number of fish sorted, sampled, transported and released during the reporting period.

Species	Sorted	Transported and released	PIT tagged	Mortalities	Genetics	Microchemistry or ageing
Arctic Grayling						
Brook Stickleback						
Brook Trout						
Bull Trout						
Burbot						
Finescale Dace						
Flathead Chub						
Goldeye						
Kokanee						
Lake Chub						
Lake Trout						
Lake Whitefish						
Largescale Sucker						
Longnose Dace						
Longnose Sucker						
Mountain Whitefish	7	7	6	0	N/A	7
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						
Yellow Perch						
<b>Grand total</b>	<b>7</b>	<b>7</b>	<b>6</b>	<b>0</b>	<b>N/A</b>	<b>7</b>

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

Between zero and 5 fish were sorted daily during the reporting period (Figure 1).

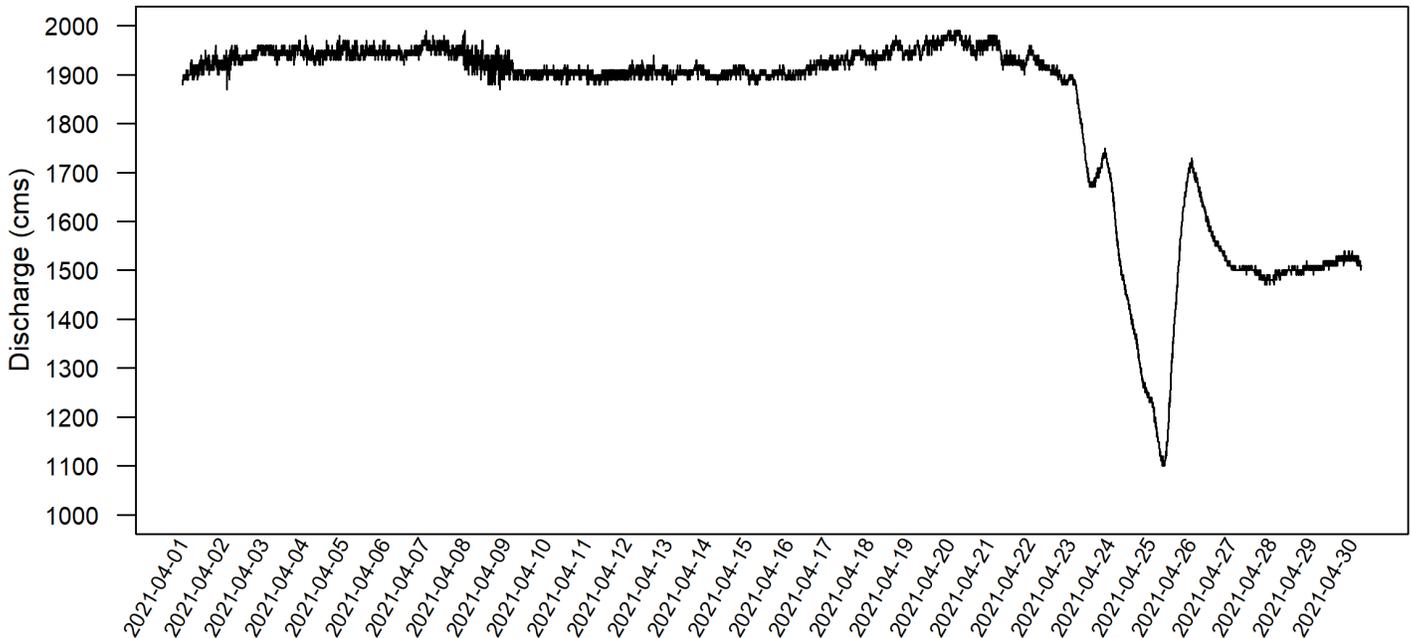
**Figure 1.** Daily number of fish sorted in the temporary facility during the reporting period.



## Environmental conditions

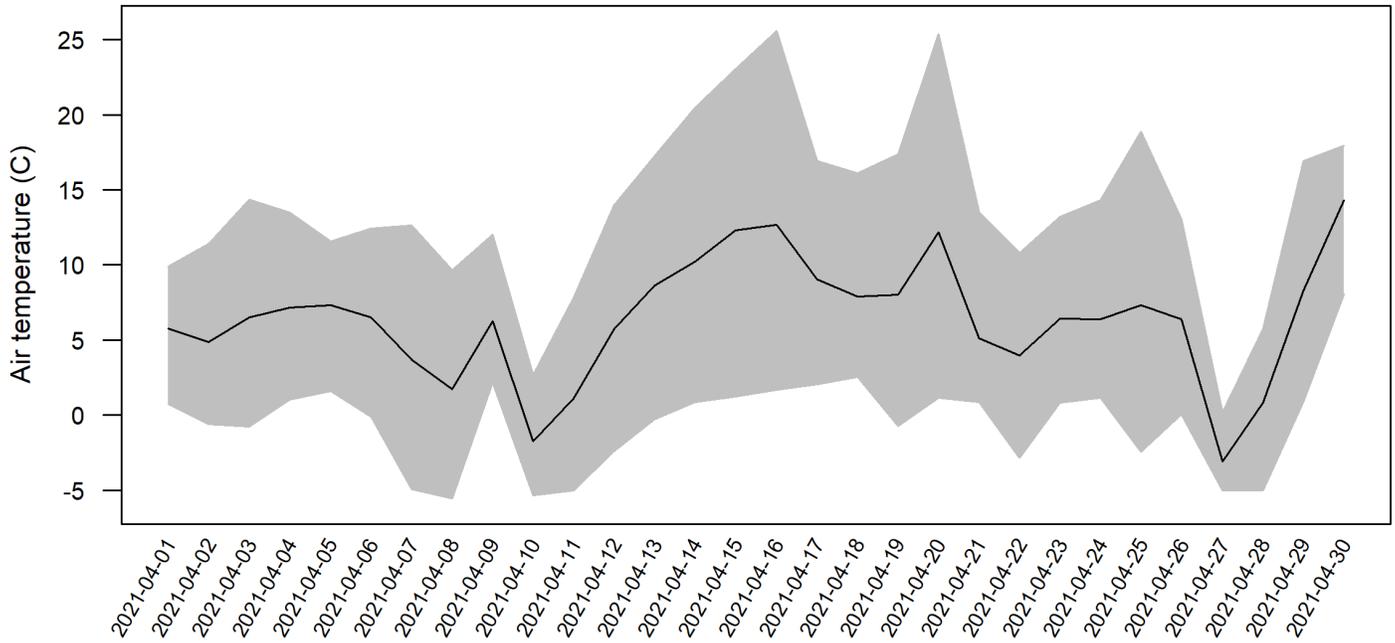
Discharge in the Peace River was approximately 1950 cms from April 1 to 23 (Figure 2). Flows decreased to a minimum of 1100 cms on April 25 and then increased to approximately 1500 cms for the remainder of April.

**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 May 5 at 5-minute intervals and were listed as provisional by the WSC.



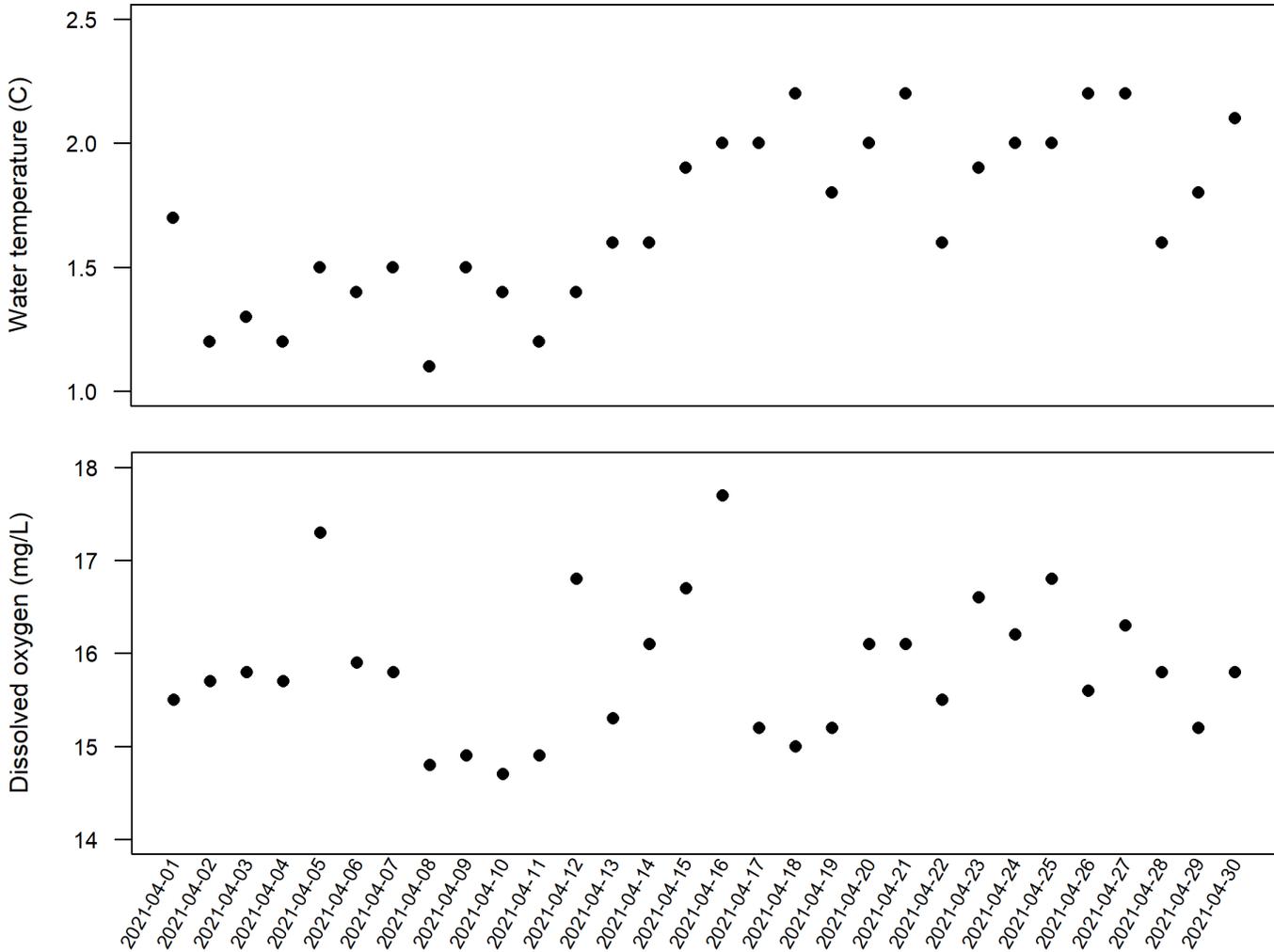
Air temperature fluctuated during the reporting period from a low of -6°C on April 8 to a high of 26°C on April 16 (Figure 3).

**Figure 3.** Mean daily air temperature (black line; °C) during the reporting period as measured at the temporary facility (Sensor No. TT-602). Shaded area represents the minimum and maximum daily air temperatures.



Water temperature steadily increased during the reporting period from a low of 1.1°C on April 8 to a high of 2.1°C on April 30 (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.

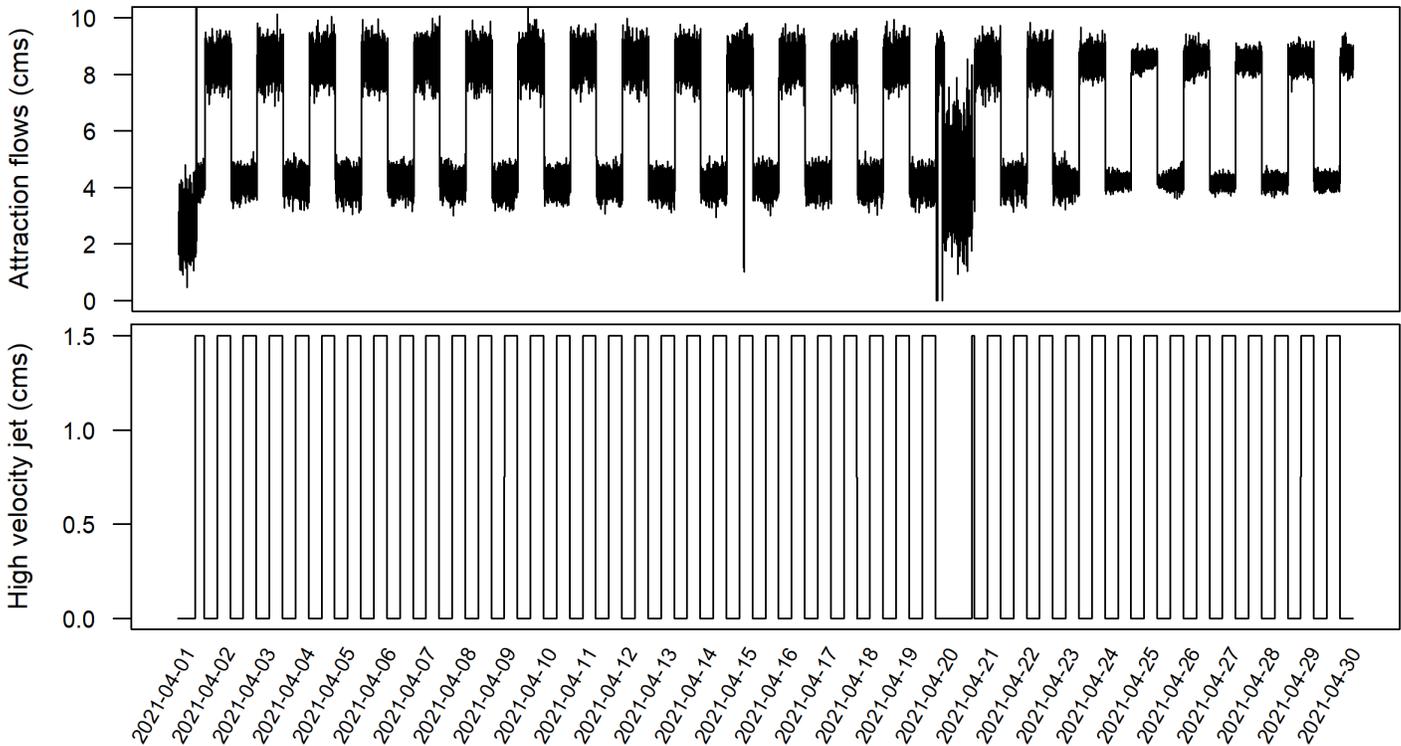


## Mechanical operation

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). One exception included a shutdown on April 20 when high water surface elevations exceeded the operating range of the temporary facility (Table 3).

**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”.

Three sorting cycles were conducted each day during the reporting period, with the exception of April 1, 21 and 26 (Table 2).

**Table 2.** Daily total number of sorting cycles.

<b>Date</b>	<b>Number of sorting cycles</b>	<b>Start time</b>
2021-04-01	1	13:30
2021-04-02	3	08:30, 11:00, 13:00
2021-04-03	3	08:30, 11:00, 13:00
2021-04-04	3	08:30, 11:00, 13:00
2021-04-05	3	08:30, 11:00, 13:00
2021-04-06	3	08:30, 11:00, 13:00
2021-04-07	3	08:30, 11:00, 13:00
2021-04-08	3	08:30, 11:00, 13:00
2021-04-09	3	08:30, 11:00, 13:00
2021-04-10	3	08:30, 11:00, 13:00
2021-04-11	3	08:30, 11:00, 13:00
2021-04-12	3	08:30, 11:00, 13:00
2021-04-13	3	08:30, 11:00, 13:00
2021-04-14	3	08:30, 11:00, 13:00
2021-04-15	3	08:30, 11:00, 13:00
2021-04-16	3	08:30, 11:00, 13:00
2021-04-17	3	08:30, 11:00, 13:00
2021-04-18	3	08:30, 11:00, 13:00
2021-04-19	3	08:30, 11:00, 13:00
2021-04-20	3	08:30, 11:00, 13:00
2021-04-21	2	11:00, 13:00
2021-04-22	3	08:30, 11:00, 13:00
2021-04-23	3	08:30, 11:00, 13:00
2021-04-24	3	08:30, 11:00, 13:00
2021-04-25	3	08:30, 11:00, 13:00
2021-04-26	2	08:30, 11:00
2021-04-27	3	08:30, 11:00, 13:00
2021-04-28	3	08:30, 11:00, 13:00
2021-04-29	3	08:30, 11:00, 13:00
2021-04-30	3	08:30, 11:00, 13:00

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

<b>Date</b>	<b>Standby or shutdown</b>	<b>Rationale</b>
2021-04-20 13:15 to 2021-04-21 06:30	Shutdown	High water surface elevations on April 20 exceeded the operating range of the temporary facility, causing automatic pump shutdowns and the fishway to drain. As such, the facility operator decided to shut down the facility after the third sorting cycle on April 20 to reduce the risk of fish stranding in the fishway overnight. The facility was operational by 06:30 on April 21.

**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
Winter 2020/2021	Damage	Fish return pipe was damaged during the winter (November 1, 2020 to March 31, 2021).	Ice and debris piled up on the fish return pipe caused the pipe to break in several locations.	Developed an alternative release plan for Goldeye and Walleye adjacent to the fishway entrance.
2021-04-01	Damage	Pump 4, which supplies water to the temporary facility, was not operational on the morning of April 1.	Broken coupling.	Broken coupling was replaced by 13:00 on April 1.
2021-04-13	Malfunction	Pump 2 was repeatedly faulting.	Fan failure on the variable frequency drive due to dust build-up.	Operator contacted the pump vendor to replace the fan. Pump 1 solely provided the attraction flows while the fan was being replaced for Pump 2.

## 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<sup>2</sup>. In general the temporary facility was operated as planned and described in the OPP. 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	Auto-shutdown criteria adjusted to account for high water surface elevations during the reporting period.
Biological operation	Stopnets were installed along the railing from the fishway entrance to the upstream end of Pool 9 to eliminate the risk of fish stranding on the walkway during operations at high water surface elevations (Photo 4).
	Release locations at the Halfway and Moberly rivers were inaccessible due to frozen conditions (Photo 5). Arctic Grayling and Bull Trout captured during the reporting period – via operating the fishway and implementing contingent fish capture and transport – were released in the Peace River upstream of the Project until access was possible.

## Contingent fish capture and transport

In total, 42 fish were transported upstream through contingent fish capture during the reporting period (Table 6). Specifically, 17 Bull Trout, 12 Largescale Sucker, 6 Longnose Sucker, 4 Rainbow Trout, and 3 Arctic Grayling were transported upstream of the Project. No mortalities were observed during the reporting period.

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

Species	Session 1		Session 2		Session 3		Session 4		Session 5		Total
	April 4 and 5		April 8		April 15		April 22 and 23		April 28		
	U	D	U	D	U	D	U	D	U	D	
Arctic Grayling					1				2		3
Brook Stickleback											
Brook Trout											
Bull Trout	4		4		3		4		2		17
Burbot											
Finescale Dace											
Flathead Chub											
Goldeye											
Kokanee								2			2
Lake Chub											
Lake Trout								1		1	2
Lake Whitefish											
Largescale Sucker			3				2		7		12
Longnose Dace											
Longnose Sucker							2		4		6
Mountain Whitefish		147		93		121		339		232	932
Northern Pike										1	1
Northern Pikeminnow											
Northern Redbelly Dace											
Peamouth											
Pearl Dace											
Prickly Sculpin											
Pygmy Whitefish											
Rainbow Trout					1		1		2		4
Redside Shiner											
Slimy Sculpin											
Spoonhead Sculpin											
Spottail Shiner											
Trout-perch											
Walleye											
White Sucker											
Yellow Perch											
<b>Total</b>	4	147	7	93	5	121	9	342	17	234	979
<b>Grand total</b>	151		100		126		351		251		

## Photos

**Photo 1.** Mountain Whitefish recovering from sampling and tagging prior to transport (April 16, 2021).



**Photo 2.** Boat electroshocking crew returns to the PRHP Boat Launch to process fish and transport and release target species upstream of the Project (April 5, 2021).



Photo 3. Large Bull Trout being processed during contingent fish capture and transport (April 5, 2021).



**Photo 4.** Stopnets were installed along the railing from the fishway entrance to the upstream end of Pool 9 to eliminate the risk of fish stranding on the walkway during operations at high water surface elevations (April 20, 2021).



**Photo 5.** Release location at the Halfway River was frozen for the first two weeks of April (top: April 8, 2021). Eleven Bull Trout from Sessions 1 to 3 of contingent fish capture and transport (Table 6) were released in the Peace River upstream of the Project until the Halfway River started to break up due to warm air temperatures mid-April (Figure 3) and were released in the Halfway River (bottom: April 20, 2021).



## Prepared by

This report was prepared by the following individuals:

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

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**Distribution List:**

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**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: April 1 to 30, 2021  
 Subject: Monthly Update on Upstream Fish Passage



7 fish sorted at facility



Operated facility for 30 days



42 fish transported through contingent fish capture

Category	Performance	Commentary
Safety	Meets or Exceeds Expectations	<ul style="list-style-type: none"> <li>Effective interfaces among contractors</li> </ul>
Fish Passage <sup>1</sup>	Nearing Expectations	<ul style="list-style-type: none"> <li>49 fish passed upstream of the Project in April</li> <li>Target species not passing fishway at predicted rates</li> </ul>
Sorting & Transport	Meets or Exceeds Expectations	<ul style="list-style-type: none"> <li>Improved procedures to process fish in sorting facility</li> </ul>
Fish Mortality	Meets or Exceeds Expectations	<ul style="list-style-type: none"> <li>No mortalities in April</li> </ul>
Operation Within Criteria	Nearing Expectations	<ul style="list-style-type: none"> <li>Operated within most engineering and design criteria</li> </ul>
External Communication	Meets or Exceeds Expectations	<ul style="list-style-type: none"> <li>Presented to Indigenous groups at Environmental Forum</li> <li>Provided updates to DFO, FLNRORD, CWR, IE and IEM</li> </ul>
Effectiveness Monitoring	Meets or Exceeds Expectations	<ul style="list-style-type: none"> <li>Improved ability to detect the movements of tagged fish</li> <li>Characterized fishway hydraulics under high water elevations</li> </ul>
Learning & Adjustment	Meets or Exceeds Expectations	<ul style="list-style-type: none"> <li>Moberly and Halfway rivers were frozen most of the month</li> <li>Shutdown criteria adjusted to operate at high water elevations</li> </ul>

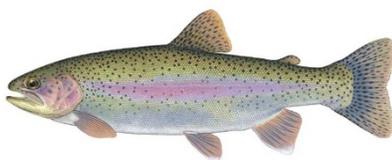
Meets or Exceeds Expectations	Nearing Expectations	Far Below Expectations
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<sup>1</sup> Infographic available here: <https://www.sitecproject.com/sites/default/files/fish-passage-facility.pdf>

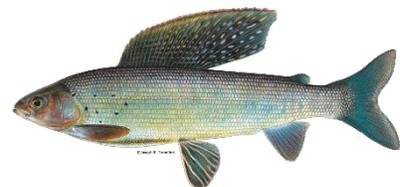
**Target Species**



Bull Trout

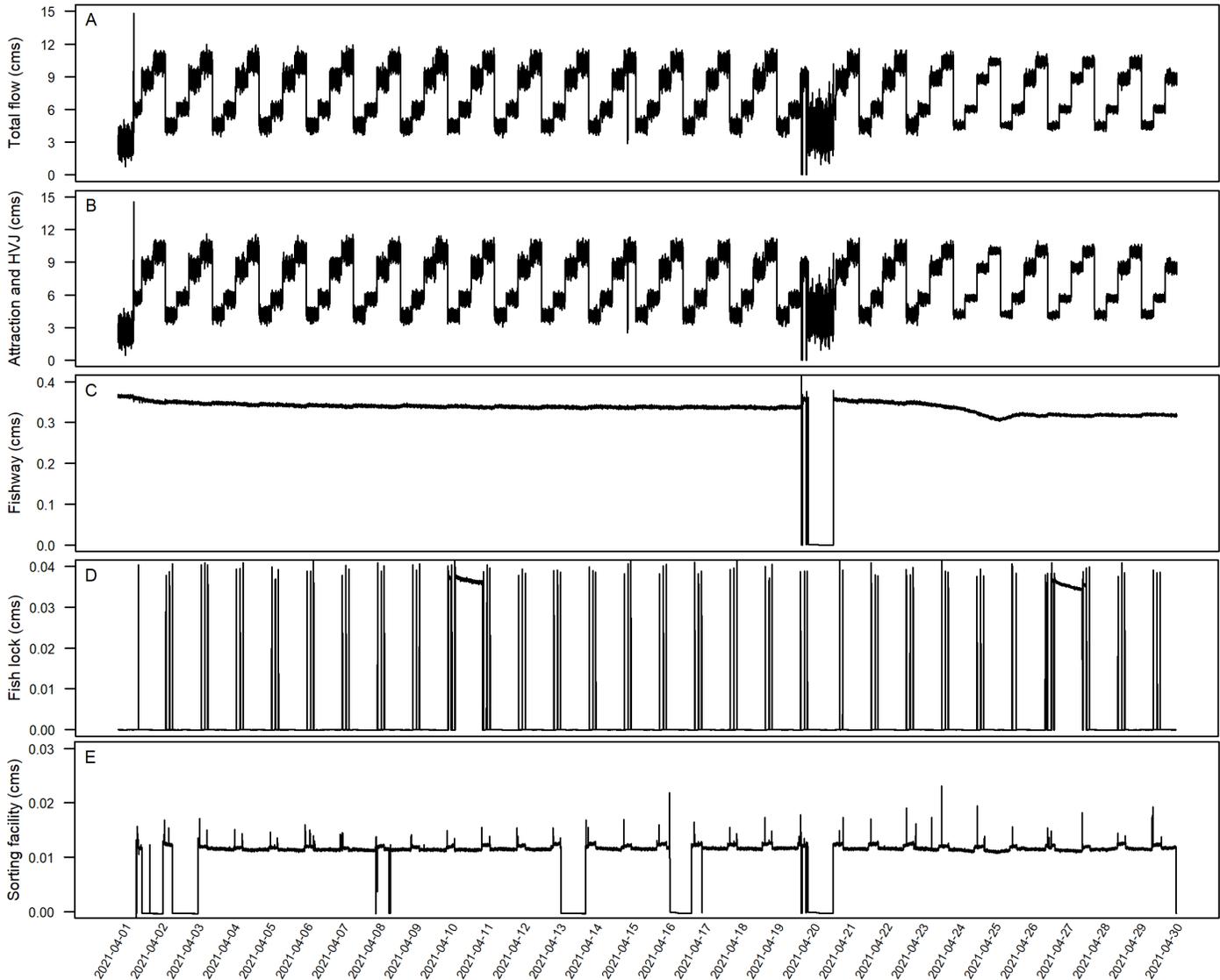


Rainbow Trout



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<sup>5</sup>, 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).



<sup>5</sup> Available at: <http://siteproject.com/sites/default/files/fish-passage-facility-water-licences-133986-133987.pdf>