Fisheries and Aquatic Habitat Monitoring and Follow-up Program Annual Report: Jan 1, 2019 to Dec 31, 2019

Site C Clean Energy Project

March 1, 2020

Table of Contents

Acronyms

EAC	Environmental Assessment Certificate
EAO	BC Environmental Assessment Office
EIS	Environmental Impact Statement
FAHMFP	Fisheries and Aquatic Habitat Monitoring and Follow-up Program
FLNRO	BC Ministry of Forests, Lands and Natural Resource Operations
MOE	BC Ministry of Environment

1.0 Introduction

1.1 Background

The Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP) monitors potential changes in physical habitat, lower trophic levels, fish abundance, and community composition during the construction and operation of the Site C Clean Energy Project (the Project), as required by Condition 7 of the Project's Environmental Assessment Certificate (EAC), Schedule B. Baseline studies conducted for the environmental assessment of the Project were developed with future monitoring in mind such that the sample sites and methodologies could be repeated to monitor potential changes to fish and fish habitat. The FAHMFP includes 18 monitoring programs and one follow-up program that are spatially and logistically distinct. Each program's monitoring plan includes a series of fisheries management questions and hypotheses that reflect uncertainties in predictions of the potential changes as a result of the Project, as described in the Project's Environmental Impact Statement (EIS). Each program includes a number of specific monitoring tasks.

A final version of the FAHMFP was submitted on December 22, 2015, and is available on the Project's website[1]. All references to the FAHMFP in this report refer to this version of the FAHMFP.

1.2 Summary

This report is being submitted in compliance with Condition 7 of the EAC, Schedule B. This annual report documents that all components of the FAHMFP that were scheduled to be implemented in 2019 were implemented (see Tables 1 to 3), in accordance with the implementation schedules in the FAHMFP.

2.0 Fisheries and Aquatic Habitat Monitoring and Follow up Program

2.1 Background

The Conditions in the EAC contemplate three plans and programs that relate to fish and fish habitat. These are summarized below to provide context for the FAHMFP.

1) **Fisheries and Aquatic Habitat Management Plan:** Fisheries and Aquatic Habitat Management Plan (submitted to the Canadian Environmental Assessment Agency [CEAA] and the BC Environmental Assessment Office [EAO] in June 2015) in accordance with EAC Condition 4 and Federal Decision Statement Condition 8 includes standard mitigation measures (e.g., erosion and sediment control measures) described in the Project's Construction Environmental Management Plan[2] and project-specific mitigation measures (e.g. reservoir shoreline habitat enhancement works and capping of dam site material relocation site with fish habitat features).
2) **Fisheries and Aquatic Habitat Monitoring and Follow-up Program:** The FAHMFP is a requirement of Condition 7 of the EAC, Schedule B. Condition 7 requires the development and implementation of a FAHMFP that provides for: a) monitoring fish and fish habitat during the construction and operation of the Project, and b) an outline for a procedure to evaluate and implement future mitigation and compensation options during operation of the Project.

[1] Available at: https://www.sitecproject.com/document-library/environmental-management-plans-and-reports
[2] Available at: https://www.sitecproject.com/document-library/environmental-management-plans-and-reports

3) **Fish Passage Management Plan:** The Fish Passage Management Plan included in the EIS (Volume 2 Appendix Q) describes the approach to manage fish passage at the Project. Following Condition 6 of the EAC, Schedule B, a Fish Passage Management Plan, which will include updates since submission of the EIS, will be prepared by Qualified Environmental Professionals and submitted prior to Project activities that may affect upstream fish passage. The EIS (Volume 2 Section 12) identified the river diversion phase of construction as the first construction activity that is expected to affect upstream fish passage. The planned monitoring for fish movement and fish passage is described in the FAHMFP.

2.2 Overview of Fisheries and Aquatic Habitat Monitoring and Follow-up Program

The FAHMFP consists of 18 monitoring programs and one follow-up program.

The 18 monitoring programs are organized in space and time such that the section of Peace River that transitions to the Site C Reservoir is monitored under the programs titled 'Peace River' prior to reservoir filling, and programs titled 'Site C Reservoir' following reservoir filling. Table 1 summarizes these monitoring programs.

Table 1. Summary of Monitoring Programs

Monitoring Program ID	Monitoring Program Name and Description
Mon-1a	**Site C Reservoir Fish Community Monitoring Program** Monitor the effects of river to reservoir transformation on the fish community in Site C Reservoir and associated tributaries.
Mon-1b	**Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program** Monitor fish populations in Peace River and Site C reservoir that migrate to tributaries to determine effects of the Project and the effectiveness of mitigation measures for fish and fish habitat.
Mon-2	**Peace River Fish Community Monitoring Program** Monitor fish populations in the Peace River to determine effects of the Project and the effectiveness of mitigation measures for fish and fish habitat.
Mon-3	**Peace River Physical Habitat Monitoring Program** Monitor the effects of the Project on physical habitat.
Mon-4	**Site C Reservoir Riparian Vegetation Monitoring Program** Monitor the effectiveness of planned riparian planting adjacent to Site C Reservoir.
Mon-5	**Peace River Riparian Vegetation Monitoring Program** Monitor how the construction and operation of the Project affects the quality and quantity (species composition, biological productivity, spatial area) of riparian vegetation along the Peace River downstream of Site C.
Mon-6	**Site C Reservoir Fish Food Organisms Monitoring Program** Monitor the effects of Site C Reservoir formation on the production of fish food organisms.
Mon-7	**Peace River Fish Food Organisms Monitoring Program** Monitor the effects of Project construction and operations on the biomass of invertebrates and the availability of fish food organisms downstream of Site C.

Monitoring Program ID	Monitoring Program Name and Description
Mon-8	**Site C Reservoir Water and Sediment Quality Monitoring Program** Monitor the effects of reservoir formation on water and sediment quality.
Mon-9	**Peace River Water and Sediment Quality Monitoring Program** Monitor the effects of the Project on water and sediment quality downstream of Site C.
Mon-10	**Site C Fish Entrainment Monitoring Program** Monitor entrainment rates and survival rates of entrained fish during the operation of Site C.
Mon-11	**Site C TDG Monitoring Program** Monitor Total Dissolved Gas (TDG) supersaturation and potential effects to downstream fish populations resulting from Gas Bubble Disease (GBD) during Site C Project construction and operation.
Mon-12	**Site C Fish Stranding Monitoring Program** Monitor Project construction and operation effects associated with flow fluctuations and fish stranding on the Peace River fish community.
Mon-13	**Site C Fishway Effectiveness Monitoring Program** Monitor the performance of the temporary and permanent fishways at the Project.
Mon-14	**Site C Trap and Haul Fish Release Location Monitoring Program** Monitor the movements following release of fish collected at Site C fishways and transported and released several upstream release locations.
Mon-15	**Site C Small Fish Species Translocation Monitoring Program** Monitor small fish species populations in the Peace River to determine effects of the project on genetic structure, movement, and genetic exchange.
Mon-16	**Site C Reservoir Constructed Shallow Water Habitat Areas Sediment and Vegetation Monitoring Program** Monitor the suitability of benthic substrates in constructed shallow water habitats of Site C Reservoir for aquatic plants and monitor the natural colonization of aquatic plants in these habitats.
Mon-17	**Peace River Water Level Fluctuations Monitoring Program** Investigate the effects of water level fluctuations on the catchability of Peace River fish and the biomass and production of periphyton, downstream of Site C.

There is one follow-up program in the FAHMFP, the Tributary Mitigation Opportunities Evaluation Program. This program identifies enhancement opportunities for stream dependent indicator species described in the EIS including Arctic Grayling, Bull Trout, Burbot, Goldeye, Mountain Whitefish, Rainbow Trout, and Walleye.

2.3 Development of the Plan and Reporting Requirements

Construction of the Project began on July 27, 2015. The final FAHMFP was submitted to the EAO on December 22, 2015 in accordance with:

- EAC Schedule B, Condition 7: “The EAC Holder must file the final Fisheries and Aquatic Habitat Monitoring and Follow-up Program with EAO, FLNR, MOE and Aboriginal Groups within 150 days following the commencement of the construction and operations phases.”

BC Hydro committed to providing reports on the implementation of the FAHMFP to the EAO annually by March 1 of the year following data collection. This reporting timing is consistent with conditions for reporting under the *Fisheries Act* authorizations for the Project[3]. This report is being submitted by March 1, 2020, to fulfill the reporting requirements for the calendar year 2019.

Note that the FAHMFP refers to calendar 'Construction Years' that correspond to Construction Year 1 (2015), Construction Year 2 (2016), etc. (see Fig. 5 of the FAHMFP). The FAHMFP describes that monitoring under the FAHMFP begins in Construction Year 2 (2016; see Fig. 5 of the FAHMFP).

3.0 Summary of Implementation Status: Monitoring Follow-up Programs

All monitoring programs scheduled to take place in 2019 were implemented. Table 2 summarizes the implementation.

Table 2.Status of monitoring tasks, as per the schedule in the Fisheries and Aquatic Habitat Monitoring and Follow-up Program

Monitoring Program ID	Description	Data Collection Tasks Implemented	Status of Analysis and Reporting [a]
Mon-1a: Site C Reservoir Fish Community Monitoring Program	Monitor the effects of river to reservoir transformation on the fish community in Site C Reservoir and associated tributaries.	N/A (Monitoring begins during Project operations)	N/A (Monitoring begins during Project operations)
Mon-1b: Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program	Monitor fish populations in Peace River and Site C Reservoir that migrate to tributaries to determine effects of the Project and the effectiveness of mitigation measures for fish and fish habitat.	2a – Peace River Arctic Grayling and Bull Trout Movement Assessment	Ongoing
		2b – Peace River Bull Trout Spawning Assessment	Ongoing
		2c – Site C Reservoir Tributaries Fish Population Indexing Survey	Ongoing
		2d – Site C Fish Movement Assessment	Ongoing
Mon-2 Peace River Fish Community Monitoring Program	Monitor fish populations in the Peace River to determine effects of the Project and the effectiveness of mitigation measures for fish and fish	2a – Peace River Large Fish Indexing Survey	Ongoing
		2d – Offset Effectiveness Monitoring	Ongoing

[3] Available at: https://www.sitecproject.com/document-library/permits-and-authorizations

Monitoring Program ID	Description	Data Collection Tasks Implemented	Status of Analysis and Reporting [a]
	habitat.	2f – Beatton River Arctic Grayling Status Assessment	Ongoing
Mon-3 Peace River Physical Habitat Monitoring Program	Monitor the effects of the Project on physical habitat in the Peace River.	2a – Channel Morphology	Ongoing
		2b – Substrate Size	
		2c – Offset Effectiveness Monitoring	
Mon-4 Site C Reservoir Riparian Vegetation Monitoring Program	Monitor the effectiveness of planned riparian planting adjacent to Site C Reservoir.	N/A (Monitoring occurs in subsequent years)	N/A (Monitoring occurs in subsequent years)
Mon-5 Peace River Riparian Vegetation Monitoring Program	Monitor how the construction and operation of the Project affects the quality and quantity (species composition, biological productivity, spatial area) of riparian vegetation along the Peace River downstream of Site C.	2a – Aerial Imagery Interpretation	Ongoing
		2b – Vegetation Surveys/Ground Truthing	
Mon-6 Site C Reservoir Fish Food Organisms Monitoring Program	Monitor the effects of Site C Reservoir formation on the production of fish food organisms.	N/A (Monitoring was not scheduled to occur during 2019. Monitoring occurred during previous years and is scheduled to occur in subsequent years)	N/A (analysis and reporting will resume when monitoring is scheduled to occur in subsequent years)
Mon-7 Peace River Fish Food Organisms Monitoring Program	Monitor the effects of Project construction and operations on the biomass of invertebrates and the availability of fish food organisms downstream of Site C.	N/A (Monitoring was not scheduled to occur during 2019. Monitoring occurred during previous years and is scheduled to occur in subsequent years)	N/A (analysis and reporting will resume when monitoring is scheduled to occur in subsequent

Monitoring Program ID	Description	Data Collection Tasks Implemented	Status of Analysis and Reporting [a]
			years)
Mon-8 Site C Reservoir Water and Sediment Quality Monitoring Program	Monitor the effects of reservoir formation on water and sediment quality.	2a – General Water and Sediment Quality Monitoring	Ongoing
		2b – Temperature Monitoring	Ongoing
		2c – Turbidity Monitoring	Ongoing
Mon-9 Peace River Water and Sediment Quality Monitoring Program	Monitor the effects of the Project on water and sediment quality downstream of Site C.	2a – General Water and Sediment Quality Monitoring	Ongoing
		2b – Temperature Monitoring	Ongoing
		2c – Turbidity Monitoring	Ongoing
Mon-10 Site C Fish Entrainment Monitoring Program	Monitor entrainment rates and survival rates of entrained fish during the operation of Site C.	N/A (Monitoring occurs in subsequent years)	N/A (Monitoring occurs in subsequent years)
Mon-11 Site C TDG Monitoring Program	Monitor Total Dissolved Gas (TDG) supersaturation and potential effects to downstream fish populations resulting from Gas Bubble Disease (GBD) during Site C Project construction and operation.	N/A (Monitoring occurs in subsequent years)	N/A (Monitoring occurs in subsequent years)
Mon-12 Site C Fish Stranding Monitoring	Monitor Project construction and operation effects associated with	2a – Identification of Monitoring Sites	Ongoing

Monitoring Program ID	Description	Data Collection Tasks Implemented	Status of Analysis and Reporting [a]
Program	flow fluctuations and fish stranding on the Peace River fish community.	2b – Monitoring Stranding Sites	Ongoing
Mon-13 Site C Fishway Effectiveness Monitoring Program	Monitor the performance of the temporary and permanent fishways at the Project.	N/A (Monitoring occurs in subsequent years)	N/A (Monitoring occurs in subsequent years)
Mon-14 Site C Trap and Haul Fish Release Location Monitoring Program	Monitor the movements following release of fish collected at Site C fishways and transported and released several upstream release locations.	N/A (Monitoring occurs in subsequent years)	N/A (Monitoring occurs in subsequent years)
Mon-15 Site C Small Fish Species Translocation Monitoring Program	Monitor small fish species populations in the Peace River to determine effects of the project on genetic structure, movement, and genetic exchange.	N/A (Monitoring occurs in subsequent years)	N/A (Monitoring occurs in subsequent years)
Mon-16 Site C Reservoir Constructed Shallow Water Habitat Areas Sediment and Vegetation Monitoring Program	Monitor the suitability of benthic substrates in constructed shallow water habitats of Site C Reservoir for aquatic plants and monitor the natural colonization of aquatic plants in these habitats.	N/A (Monitoring occurs in subsequent years)	N/A (Monitoring occurs in subsequent years)
Mon-17 Peace River Water Level Fluctuations Monitoring Program	Investigate the effects of water level fluctuations on the catchability of Peace River fish and the biomass and production of periphyton, downstream of Site C.	N/A (Monitoring occurs in subsequent years)	N/A (Monitoring occurs in subsequent years)

[a] Status of Analysis and Reporting: As of February 15, 2020, 'Ongoing' refers to analysis and reporting of 2019 data collection that continues or is in draft form.

Table 3. Follow-up tasks implemented in 2019, as per the schedule in the Fisheries and Aquatic Habitat Monitoring and Follow-up Program.

Follow-up Program	Description	Data Collection Tasks Implemented	Status of Analysis and Reporting
Site C Tributary Mitigation Opportunities Evaluation Program	Identify enhancement opportunities for stream dependent indicator species described in the EIS including Arctic Grayling, Bull Trout, Burbot, Goldeye, Mountain Whitefish, Rainbow Trout, and Walleye.	2a – Initial Mitigation Project Identification	Ongoing
		2b – WSEP Tier 1 Assessments	
		2c – Identification of Additional Candidate Watersheds	

The following sections summarize the data collection that occurred in 2019 for the monitoring programs and tasks that were implemented (Table 2).

3.1 Mon-1b Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program

Task 2a: Peace River Arctic Grayling and Bull Trout Movement Assessment

The purpose of the Peace River Arctic Grayling and Bull Trout Movement Assessment is to determine the magnitude, direction and seasonality of Arctic Grayling and Bull Trout movements within the Peace River, Site C Reservoir and tributaries to help determine the effect the Project may have on these metrics, and to inform various monitoring programs.

Thirty-eight Arctic Grayling (32 adults, 6 immature) and 138 Bull Trout (75 adults, 63 immature) were radio tagged in the Peace River and its tributaries in 2019. Radio tagged fish were monitored by the fixed radio telemetry array deployed under the Site C Fish Movement Assessment (Mon-1b, Task 2d).

Analysis and reporting of the data collected in 2019 are ongoing.

Task 2b: Peace River Bull Trout Spawning Assessment

In 2019, the Peace River Bull Trout Spawning Assessment occurred in the upper portion of the Halfway Watershed. Trained observers conducted aerial and ground surveys over a four-week period to visually enumerate Bull Trout redds (i.e., a nest in the gravel that is excavated during spawning) in six spawning tributaries: the Chowade River, Cypress Creek, Fiddes Creek, Turnoff Creek, Needham Creek, and the upper Halfway River. Data were collected for estimating observer efficiency and survey life of redds by marking and re-sighting redds during aerial and ground surveys.

To supplement the aerial and ground survey approach, electronic counters paired with video validation equipment, and PIT arrays were operated in the Chowade River and Cypress Creek from mid-August to early October. Equipment was remotely powered by solar panels and

battery banks, and sites were visited weekly throughout the monitoring period to conduct detailed testing and calibration of the equipment. Data will be used to estimate the population abundance, migration timing, spawning duration and behaviour of Bull Trout in the Chowade River and Cypress Creek, and detect Bull Trout and Rainbow Trout PIT-tagged under other monitoring programs (Mon-1b, Task 2c and Mon-2, Task 2a).

Analysis and reporting of the data collected in 2019 are ongoing.

Task 2c: Site C Reservoir Tributaries Fish Population Indexing Survey

The Site C Reservoir Tributaries Fish Population Indexing Survey monitors the abundance of Arctic Grayling in the Moberly River, Bull Trout in the Chowade River and Cypress and Fiddes creeks, and Rainbow Trout in Colt, Farrell, and Kobes creeks. As part of a multi-year study, the results from 2019 intend to provide additional baseline data prior to subsequent phases of construction and operation.

For streams where sampling targeted Bull Trout, backpack electrofishing effort was focused on upstream reaches and locations that contained high quality rearing habitat for this species. Captured Bull Trout were implanted with passive integrated transponder (PIT) tags to monitor their movements through PIT arrays installed in the Chowade River and Cypress Creek as part of the Peace River Bull Trout Spawning Assessment (Mon-1b, Task 2b). These tagged fish may also be recaptured under other monitoring programs in the FAHMFP. Young of the Year (YOY) and immature Bull Trout (i.e., fish less than 250 mm FL that were not YOY) were recorded in all three systems. In 2019, 509 PIT tags were deployed into Bull Trout in these three systems.

For streams where sampling targeted Rainbow Trout, backpack electrofishing effort occurred at previously established sites, allowing changes to the Rainbow Trout population to be monitored over time. These locations included four sites on Colt Creek, four sites on Farrell Creek, and five sites on Kobes Creek. YOY and immature Rainbow Trout were recorded in all three systems. In 2019, 180 PIT tags were deployed into Rainbow Trout in these three systems.

The entire length of the Moberly River between Moberly Lake and the river's confluence with the Peace River was accessed by inflatable boat. Sample effort in 2019 included 41 backpack electrofishing sites, 62 small boat electroshocking sites, and 81 angling sites. Arctic Grayling were encountered during small boat electroshocking (n = 9), backpack electrofishing (n = 4) and angling (n = 22) surveys. Thirty-three of the 35 captured Arctic Grayling were implanted with PIT tags.

Analysis and reporting of the data collected in 2019 are ongoing.

Task 2d: Site C Fish Movement Assessment

The purpose of the Site C Fish Movement Assessment is to determine the magnitude, direction and seasonality of fish movements in the Peace River and its tributaries during the construction and operation phases of the Project. Movement data will be shared among monitoring programs to address specific fisheries management questions.

In 2019, twenty-six fixed radio telemetry stations were deployed throughout the Peace Region to monitor the movements of radio tagged fish. Stations were deployed in the Peace River from Peace Canyon Dam to the Many Islands area in Alberta, and at the confluences of all major

tributaries (Maurice Creek, Lynx Creek, Farrell Creek, Halfway River, Cache Creek, Wilder Creek, Moberly River, Pine River, Beatton River, Kiskatinaw River, Pouce Coupe River).

Three hundred and twenty-nine fish were radio tagged in 2019 under Mon-1b, Task 2c and Mon-2, Task 2a:

- 38 Arctic Grayling;
- 138 Bull Trout;
- 71 Rainbow Trout;
- 18 Burbot; and
- 64 Walleye.

Analysis and reporting of the data collected in 2019 are ongoing.

3.2 Mon-2 Peace River Fish Community Monitoring Program

Task 2a: Peace River Large Fish Indexing Survey

Sampling under Mon-2, Task 2a was conducted in six different sections of the Peace River mainstem located between Peace Canyon Dam and the Many Islands area in Alberta. All large-bodied fish were monitored; however, the program focused on seven indicator species including Arctic Grayling, Bull Trout, Burbot, Goldeye, Mountain Whitefish, Rainbow Trout, and Walleye. Sampling occurred during the late summer to early fall period. Additional surveys were conducted in 2019 at select locations in the late spring to early summer period to target Goldeye and Walleye prior to these species' downstream migrations out of the study area. For both surveys, fish were sampled by boat electroshocking within nearshore habitats (less than 2.0 m depth). Length, weight, and ageing structures were collected from all captured indicator species. Depending of fish size and sample session, captured indicator species were marked with PIT tags.

Analysis and reporting of the data collected in 2019 are ongoing.

Task 2d: Offset Effectiveness Monitoring

In 2019, effectiveness monitoring of habitat offset areas (River Road rock spurs and Upper Site 109L)[1] focused on three components: physical habitat (Mon-3, Task 2c), general fish use, and Mountain Whitefish spawning.

Channel morphology and substrate characteristics within constructed offsets were monitored during the summer period using an Acoustic Doppler Profiler (ADP) and substrate measurements. Fish use of each offset was assessed by conducting boat electroshocking and minnow trap surveys between mid-August and early October 2019. Egg collection mats were deployed in Upper Site 109L and in adjacent areas of Sections 5 and 6 of the Peace River from late-October 2019 to mid-February 2020.

Analysis and reporting of the data collected in 2019 are ongoing.

[1] These habitat offsets are listed in the Project's Fisheries Act Authorization for Site Preparation, and are described in 'Section 6.2.1 Mitigation Measures Downstream of Site C Dam Site' of the Project's Fisheries and Aquatic Habitat Management Plan.

Task 2f: Beatton River Arctic Grayling Status Assessment

The Beatton River Arctic Grayling Status Assessment aims to increase the current knowledge and understanding of the life history patterns of Arctic Grayling in the Beatton River Watershed. In 2019, Mon-2, Task 2f collected information on the age and size structure, growth, recruitment, and population abundance of Beatton River Arctic Grayling. Data will be compared to populations elsewhere in the Peace Region (e.g., Moberly and Halfway Rivers through Mon-1b, Task 2c).

Analysis and reporting of the data collected in 2019 are ongoing.

3.3 Mon-3 Peace River Physical Habitat Monitoring Program

Tasks 2a and 2b: Channel Morphology and Substrate Size

Channel morphology and substrate characteristics were monitored in the summer using an ADP and substrate measurements. Profiles were generated at 13 transects within the boundaries of the Site C Diversion Headpond and a further 39 profiles were generated between the Project and the Many Islands area in Alberta. These same transects were surveyed in 2015, which will allow for comparison among years.

Analysis and reporting of the data collected in 2019 are ongoing.

Task 2c: Offset Effectiveness Monitoring

Physical habitat was assessed at two habitat offset areas[3] that have been constructed: River Road rock spurs and Upper Site 109L. The elevation of the banks, riverbed, and water surface were surveyed using boat and wading surveys. The surveys employed a GPS and benchmark system, and an ADP. Cross sections of the main channel of the Peace River were surveyed. Overall, measurements of channel cross sections were recorded at nine cross sections of the main channel of the Peace River. Videography surveys were employed to categorize substrate sizes within Upper Site 109L.

Analysis and reporting of the data collected in 2019 are ongoing.

3.4 Mon-5 Peace River Riparian Vegetation Monitoring Program

Tasks 2a and 2b: Aerial Imagery Interpretation and Vegetation Surveys

In 2019, aerial imagery, LiDAR elevation data, and vegetation/ground truthing data were collected and collated to assess the downstream response of riparian vegetation to the construction and operation of the Project. Remote sensing analysis and aerial photo interpretation will be used to quantify existing riparian vegetation metrics in the Peace River.

[3]These habitat offsets are listed in the Project's Fisheries Act Authorization for Site Preparation, and are described in 'Section 6.2.1 Mitigation Measures Downstream of Site C Dam Site' of the Project's Fisheries and Aquatic Habitat Management Plan.

Analysis and reporting of the data collected in 2019 are ongoing.

3.5 Mon-8 Site C Reservoir Water and Sediment Quality Monitoring Program and Mon-9 Peace River Water and Sediment Quality Monitoring Program

Mon-8 and 9 monitor the same parameters but in different locations: the area of the future Site C Reservoir, and the Peace River downstream of the Project, respectively. For simplicity, the following section summarizes implementation for both programs in 2019. These programs collect information and parameters focused on fish and fish habitat.

Task 2a: General Water and Sediment Quality Monitoring

Water quality monitoring was conducted to collect information on those parameters that may affect fish and fish habitat. Sampling occurred monthly between May and October. Sampling locations were located in the Peace River between Peace Canyon Dam and the Many Islands area in Alberta. Sampling locations were also located in Dinosaur and Williston Reservoirs to monitor water flowing into the Peace River.

Water quality sampling focused on measuring parameters that may change in concentration throughout the growing season. Parameters followed those measured during baseline studies including both field-based measured parameters (e.g., water conductivity, pH, and dissolved oxygen), and collection of samples for laboratory analysis of nutrients and general parameters.

Sediment samples were collected in October. Sediments were collected from within the near-shore littoral zones, and adjacent to the water sample locations, in Williston and Dinosaur Reservoirs. Sediments were collected from near-shore areas adjacent to river water sample locations. Samples were analyzed for particle size, nutrients, and total metals.

Analysis and reporting of the data collected in 2019 is ongoing.

Task 2b: Temperature Monitoring

Continuous measurements of water temperature were recorded between the Williston Reservoir and the Pouce Coupe River in Alberta. Temperature loggers were checked for calibration, set to record temperature at hourly intervals and secured to the river bank or anchored to the river bed. Data loggers were downloaded approximately every three to four months.

Analysis and reporting of the data collected in 2019 are ongoing.

Task 2c: Turbidity Monitoring

Continuous Peace River turbidity monitoring occurred at four monitoring sites in the Peace River in 2019. Two turbidity monitoring stations, Peace above Pine - Left Bank (PAP-LB) and Peace above Pine – Right Bank (PAP-RB), are located in the Downstream Reach between the Project and the Pine River. The two upstream monitoring stations, Peace above Moberly – Left Bank (PAM-LB) and Peace above Moberly – Right Bank (PAM-RB), are located on opposite banks of the Peace River immediately upstream of the Project and the Moberly River.

Analysis and reporting of the data collected in 2019 are ongoing.

3.6 Mon-12 Site C Fish Stranding Monitoring Program

Mon-12 aims to determine the magnitude of baseline fish stranding along the Peace River, from the Diversion Headpond (upstream of Site C) to the Many Islands area in Alberta, and compare the baseline conditions to stranding in the construction and operation phases of the Project.

Ten days of sampling were undertaken in 2019, between July 27 and October 20, in the Diversion Headpond, Reach 1 (between the Project and the Taylor Bridge) and Reach 2 (Pine River to Alces River). Each trip was coordinated with BC Hydro Operations personnel at the Peace Canyon Dam to ensure sampling occurred following a reduction in discharge at Peace Canyon Dam and to account for the lag time between the reduction in flows upstream and the effects observed downstream. A total of 167 sampling events were completed using a combination of interstitial sampling of dewatered substrates and backpack electrofishing in isolated pools within a combination of targeted and randomly selected sampling sites.

Analysis and reporting of the data collected in 2019 are ongoing.

3.7 Follow-up Program: Site C Tributary Mitigation Opportunities Evaluation Program

Task 2a: Initial Mitigation Project Identification

A review of existing information was used to establish the distributions and habitat requirements of target fish species, and to characterize existing potential habitat limitations in tributary fish habitats. An initial evaluation of the key limiting factors and likelihood of mitigation success by tributary and indicator species was conducted. This information will be used under Task 2b.

Task 2b: WSEP Tier 1 Assessment

A modified Watershed Status Evaluation Program (WSEP) Tier 1 assessment protocol was developed to assess watershed status and to identify factors that may impair ecological function, limit fish production, and may limit or enhance the success of potential mitigation. The modified WSEP Tier 1 Assessment workflow consisted of a comprehensive multi-stage GIS analysis and an iterative review of watershed indicator selection and ranking. The steps included:

- Initial delineation and description of the study area;
- Assembly of relevant available spatial data in a GIS framework;
- The definition and calculation of key watershed indicators, including habitat quantity, habitat pressure and habitat vulnerability indicators; and
- Summary roll-up of habitat pressure indicators into discrete habitat disturbance indicators.

Task 2c: Identification of Additional Candidate Watersheds

In 2019, the team undertook stream habitat assessment fieldwork as part of Task 2c, which included site inspections accessed by aerial overflights and on the ground. Members of the Blueberry River and West Moberly First Nation participated in these site inspections. The goal of the field work was to evaluate opportunities identified during the Tier 1 Assessment.

Analysis and reporting of the data collected in 2018 and 2019 are ongoing.

4.0 Qualified Professionals

This report was prepared by the following Qualified Individuals:

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