

*Fisheries and Aquatic Habitat
Monitoring and Follow-up Program
Annual Report:
Jan 1, 2017 to Dec 31, 2017*

*Site C Clean Energy Project
March 1, 2018*

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Acronyms

EAC	Environmental Assessment Certificate
EAO	BC Environmental Assessment Office
EIS	Environmental Impact Statement
FAHMFP	Fisheries and Aquatic Habitat Monitoring and Follow-up Program
FLNR	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) describes monitoring of potential changes in physical habitat, lower trophic levels, fish abundance, and community composition during construction and operations 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 17 monitoring programs and one follow-up program that are spatially and logistically distinct. The Monitoring Plan includes a series of 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. 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 website¹. 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 2017 were implemented (see Tables 1 to 3), in accordance with the implementation schedules in the FAHMFP.

The Project is in an early stage of construction; as a result the FAHMFP is in an early stage of implementation. Additional components of the FAHMFP are scheduled to be implemented as construction of the Project progresses. For example, the Fishway Effectiveness Monitoring Program (Mon-13) is scheduled to begin when operation of the temporary fish passage facility begins during the river diversion stage of construction. Annual reporting will continue to document the implementation of the FAHMFP.

2.0 Fisheries and Aquatic Habitat Monitoring and Follow up Program

2.1 Background

This Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP) has been developed in accordance with the Condition 7 of the EAC Schedule B.

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

¹ Available at: <https://www.sitecproject.com/document-library/environmental-management-plans-and-reports>

[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 Plan² 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 EAC Schedule B, Condition 7. Condition 7 of the EAC requires development and implementation of a FAHMFP that provides for: a) monitoring fish and fish habitat during 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.
- 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. Following EAC Schedule B, Condition 6, 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 Project 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

There are 17 monitoring programs and one follow-up program in the FAHMFP.

The 17 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.

² Available at: <https://www.sitecproject.com/document-library/environmental-management-plans-and-reports>

Monitoring Program ID	Monitoring Program Name and Description
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.
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 Fluctuation 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.

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 Fisheries and Aquatic Habitat Monitoring and Follow-up Program 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 project³. This report is being submitted by March 1, 2018, to fulfill the reporting requirements for the calendar year 2017.

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 2017 were implemented. Table 2 summarizes the implementation.

Table 2. Monitoring tasks implemented in 2017, 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)

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
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.	2b - Peace River Bull Trout Spawning Assessment	Ongoing
		2c - Site C Reservoir Tributaries Fish Population Indexing Survey	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 habitat.	2a – Peace River Large Fish Indexing Survey	Ongoing
		2d – Offset Effectiveness Monitoring	Ongoing
Mon-3 Peace River Physical Habitat Monitoring Program	Monitor the effects of the Project on physical habitat.	2c - Offset Effectiveness Monitoring	Ongoing
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.	N/A (Monitoring occurs in subsequent years)	N/A (Monitoring occurs in subsequent years)
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.	2a - Biomass/production of fish food organisms – data collection.	Ongoing
		2b - Ecosystem attribute data collection.	
Mon-7 Peace River Fish Food Organisms	Monitor the effects of Project construction and operations on the biomass	2a - Biomass/production of fish food organisms – data collection.	Ongoing

Monitoring Program ID	Description	Data Collection Tasks Implemented	Status of Analysis and Reporting ^a
Monitoring Program	of invertebrates and the availability of fish food organisms downstream of Site C.	2b - Ecosystem attribute data collection.	Ongoing
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 Program	Monitor Project construction and operation effects associated with flow fluctuations and fish stranding on the Peace River fish community.	Task 2a - Identification of Monitoring Sites	Ongoing
		Task 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	Monitor the movements following release of fish collected at Site C fishways and transported and released several	N/A (Monitoring occurs in subsequent years)	N/A (Monitoring occurs in subsequent years)

Monitoring Program ID	Description	Data Collection Tasks Implemented	Status of Analysis and Reporting ^a
Program	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.	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 Fluctuation 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.	2a. Supplementary Sampling of Benthos and Periphyton	Ongoing
		2b – Supplementary Sampling of Small Fish Otoliths	Ongoing
		2c. Supplementary Sampling of Large Fish Ages	Ongoing

^a Status of Analysis and Reporting: As of Feb 15, 2017. 'Ongoing' refers to analysis and reporting of 2017 data collection that continues or is in draft form.

Table 3. Follow-up tasks implemented in 2017, 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.	Task 2a. Initial Mitigation Project Identification Task 2b. WSEP Tier 1 Assessments	Ongoing

The following sections summarize the 2017 data collection for those programs and tasks that were implemented (Table 2).

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

Task 2b: Peace River Bull Trout Spawning Assessment

In 2017, the 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 five spawning tributaries: the Chowade River, Cypress Creek, Fiddes Creek, Turnoff 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.

Data analysis and reporting of the data collected in 2017 are ongoing.

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

The Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program (Mon-1b) represents one component of the FAHMFP and is designed to monitor Peace River fish populations that spend portions of their lifecycles in Peace River tributaries and migrate past the Site C location to fulfill their life history requirements. Most notably, these species include Arctic Grayling (*Thymallus arcticus*), Bull Trout (*Salvelinus confluentus*), and Rainbow Trout (*Oncorhynchus mykiss*). The Site C Reservoir Tributaries Fish Population Indexing Survey is one component (Task 2c) of Mon-1b and is intended to monitor the abundances of these target species in the Chowade River, Cypress Creek, and the upstream portion of the Halfway River (termed the Halfway River watershed), the Moberly River, and Lynx and Maurice creeks. As part of a multi-year study, 2017 results are intended to provide baseline data prior to subsequent phases of Site C construction and reservoir creation and to identify the most effective sampling locations and methods to employ during future study years.

Specifically, Task 2c investigated immature Bull Trout populations in the Chowade River and Cypress, Fiddes, and Turnoff creeks, immature Rainbow Trout populations in Farrell, Colt, and Kobes creeks, and Arctic Grayling populations in the Moberly River. Backpack electrofishing, small fish boat electroshocking, angling, and beach seining were used as capture methods in the Moberly River. For all other streams, only backpack electrofishing was employed as a capture technique.

The study design was refined in 2017 to increase the number of immature Bull Trout captured and implanted with Passive Integrated Transponder (PIT) tags. In 2017, sampling in the Chowade River and Cypress Creek targeted the upstream portions (i.e., upstream of River Km 36 and 28 of each stream, respectively, as measured from the stream's confluence) where the highest numbers of immature Bull Trout were recorded during the 2016 study program. Sampling in Fiddes and Turnoff creeks occurred in areas readily accessible by helicopter.

Within these streams, sampling focused on locations that contained high quality habitat for immature Bull Trout (e.g., smaller side channels, abundant physical cover). Furthermore, in 2017, the Chowade River and Cypress Creek were sampled approximately 3 weeks earlier than in 2016. The movements of these tagged fish will be monitored under other components of the Site C FAHMFP.

Sampling targeting Rainbow Trout in 2017 occurred in Farrell, Colt, and Kobes creeks, in-lieu of sampling Lynx and Maurice Creeks. These streams were sampled following discussions with BC Hydro and the Project's Fisheries and Aquatic Habitat Mitigation and Monitoring Technical Committee. Maurice Creek was not surveyed in 2017 at the request of BC Hydro due to site access limitations associated with sampling crew safety and security. Fish collection activities were not attempted in Lynx Creek because water turbidity and conductivity continues to be at levels that preclude sampling and are judged to exclude use by fish. The conditions in Lynx Creek may be associated with upstream landslides. Sampling in Farrell Creek occurred in three sites that were previously established, as well as a fourth newly established site. All four sites were accessible by road and provided suitable habitat for immature Rainbow Trout. New sites were established on Colt Creek (n = 5) and Kobes Creek (n = 5) that were also accessible by road and provided suitable habitat for immature Rainbow Trout. Young of the Year (YOY) and immature Rainbow Trout (i.e., fish less than 250 mm FL that were not YOY) were recorded in all three systems; adult Rainbow Trout (i.e., fish greater than 249 mm FL) were not recorded in any of these systems.

The portion of the Moberly River between River Km 70 and 124 (as measured upstream from the Moberly River's confluence with the Peace River) were accessed by inflatable boat. The portion of the Moberly River between River Km 0 and 70 was accessed by helicopter. All four capture techniques were employed in the upstream portion of the Moberly River. Only angling and backpack electrofishing were used in the downstream portion of the Moberly River. Declining water levels over the course of the study period hindered boat access and reduced the feasibility of using the small fish boat electroshocker. In total, 40 backpack electrofishing sites, 20 angling sites, 11 small fish boat electroshocker sites, and 2 beach seine sites were sampled in the Moberly River during the 2017 survey. Two Arctic Grayling were recorded in all sites and methods combined; one adult Arctic Grayling captured by angling and one immature Arctic Grayling captured by backpack electrofishing. Both Arctic Grayling were implanted with PIT tags.

Analysis and reporting of the data collected in 2017 are ongoing.

3.2 Mon-2 Peace River Fish Community Monitoring Program

Task 2a: Peace River Large Fish Indexing Survey

Sampling for the Indexing Survey was conducted in six different sections of the Peace River mainstem located between Peace Canyon Dam (PCD) and the Many Islands area in Alberta. All large-bodied fish were monitored; however, the Program focused on seven indicator species including Arctic Grayling (*Thymallus arcticus*), Bull Trout (*Salvelinus confluentus*), Burbot (*Lota lota*), Goldeye (*Hiodon alosoides*), Mountain Whitefish (*Prosopium williamsoni*), Rainbow Trout (*Oncorhynchus mykiss*), and Walleye (*Sander vitreus*). 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 passive integrated transponder (PIT) tags. Analysis and reporting of the data collected in 2017 are ongoing.

Task 2d: Offset Effectiveness Monitoring

General fish use was assessed at two habitat offset locations⁴ that have been constructed: River Road rock spurs and upper Site 109L. Sampling for general fish use occurred using a combination of visual surveys, sonar surveys, and boat electroshocking.

The potential for spawning by Mountain Whitefish was assessed at upper Site 109L. Egg collection mats were deployed during the potential spawning period of Oct to Dec. These mats rest on the river bottom and trap eggs released by spawning Mountain Whitefish as the eggs drift downstream.

Analysis and reporting of the data collected in 2017 are ongoing.

3.3 Mon-3 Peace River Physical Habitat Monitoring Program

Task 2c: Offset Effectiveness Monitoring

Physical habitat was assessed at two habitat offset locations⁵ that have been constructed: River Road rock spurs and upper Site 109L. The elevation of the banks, riverbed and water surface was surveyed using boat and wading surveys. The surveys employed a GPS and benchmark system, and an Acoustic Doppler Current Profile (ADCP) system. 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. Analysis and reporting of the data collected in 2017 are ongoing.

3.4 Mon-6 Site C Reservoir Fish Food Organisms Monitoring Program and Mon-7 Peace River Fish Food Organisms Monitoring Program

These two fish food monitoring programs (Mon-6 and Mon-7) monitor the same parameters but in different locations: the area of the future Site C Reservoir, and the Peace River downstream of the Site C dam site, respectively. For simplicity, the following section summarizes the 2017 implementation for both programs.

Task a

The 2017 sampling of periphyton and benthic invertebrates was completed during ‘summer’ (June 13 – August 9) and ‘fall’ (August 4 – October 1) sessions. The samples were collected from 12 sites established between Williston Reservoir and the Peace River near Many Islands. Two of the sites are located within the Peace River tributaries: Halfway River and the Moberly River.

⁴These 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](#).

⁵These 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](#).

Fish stomach samples from Mountain Whitefish, Arctic Grayling, Rainbow Trout and Longnose Sucker were also collected under the Peace River Fish Community Monitoring Program (Mon-2) and processed under Mon-6 and 7 (per Task 3a).

Task b

Ecosystem attributes recorded in 2017 included the following:

- Habitat area - lotic habitat in the study area as measured using desktop mapping
- Water column turbidity and suspended solids
- Water temperature (continuous logging during the accrual periods)
- Water quality (DO, TDS, pH, total nitrogen, total phosphorus, total dissolved phosphorus, ammonium, soluble reactive phosphorus)
- Periphyton
- Zooplankton from Dinosaur & Williston Reservoirs

Analysis of 2017 data is 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

These two water and sediment quality monitoring programs (Mon-8 and Mon-9) monitor the same parameters but in different locations: the area of the future Site C Reservoir, and the Peace River downstream of the Site C dam site, respectively. For simplicity, the following section summarizes implementation for both programs in 2017. These programs collect information and parameters focused on fish and fish habitat.

Task 2a: General Water and Sediment Quality Monitoring

General 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 (PCD) 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 focussed 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 [$\mu\text{S}/\text{cm}$], 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 water and sediment quality data collected in 2017 are ongoing.

Task 2b: Temperature Monitoring

Continuous measurements of water temperature were recorded at Peace River sites between Williston Reservoir and the Pouce Coupe River confluence 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 months. Analysis and reporting of the data collected in 2017 are ongoing.

Task 2c. Turbidity Monitoring

Continuous Peace River turbidity monitoring occurred at four Peace River monitoring sites during the 2017 monitoring period. 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 Site C dam site and the Pine River confluence. 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 Site C dam site and Moberly River confluence.

Analysis and reporting of the data collected in 2017 are ongoing.

3.6 Mon-12 Site C Fish Stranding Monitoring Program

The fish stranding monitoring program is intended 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 construction and operations phases of the Project.

Ten days of sampling were undertaken in Year 2 (2017), between July 29 and September 24, throughout the entire study area, including the Diversion Headpond, Reach 1, Reach 2, and Reach 3. Each trip was coordinated with BC Hydro operations personnel at the Peace Canyon Dam to ensure sampling occurred following a reduction in discharge at the upstream BCH Peace Canyon Dam and to account for the lag flow change delay time between the Peace Canyon Dam and the downstream study area. A total of 140 sampling events were completed using a combination of interstitial sampling of dewatered substrates (77 samples) and backpack electrofishing in isolated pools (63 samples) within a combination of targeted and randomly selected sampling sites.

Analysis and reporting of the data collected in 2017 are ongoing.

3.7 Mon-17 Peace River Water Level Fluctuation Monitoring Program

The Peace River Water Level Fluctuation Monitoring Program provides information on potential changes to fish and fish habitat associated with changes to the daily hydrograph in the Peace River downstream of the Project that are predicted to occur during Project Operations. This information is integrated into the overall sampling design of the Fisheries and Aquatic Habitat Monitoring and Follow-up Program to address specific hypotheses related to Project operations.

Task 2a: Supplementary sampling of benthos and periphyton

The potential effect of shifts in the timing of flow peaking on periphyton accrual and the biomass of benthos will be examined using within and between site variations for both periphyton accrual and the biomass of benthos. These models will be used to predict the effects of peak flow timing and will be validated using before and after comparisons at individual sites, supplemented by data from years that differ in seasonal average flows.

In 2017, data on benthos and periphyton that are required for these analyses were collected over under the Fish Food Organisms Monitoring Programs (Mon 6 and 7). Sampling occurred across a range of river bed elevations and corresponding river levels.

Analysis and reporting of the data collected in 2017 are ongoing.

Task 2b: Supplementary sampling of small fish otoliths

The width of daily circuli in otoliths were measured in the lab from otoliths collected from Arctic Grayling, Longnose Sucker, Mountain Whitefish, and Rainbow Trout were. Analysis and reporting of the data collected are ongoing.

Task 2c: Supplementary sampling of large fish ages

Information on the age and size of fish is collected from fish sampled during the Peace River Peace River Fish Community Monitoring Program (Mon-2, Task 2a: Peace River Large Fish Indexing Survey). In 2017, ageing structures were collected from indicator species as part of the Peace River Large Fish Indexing Survey. This age data provides the information needed under this the task here (Supplementary sampling of large fish ages). These data will be used in analyses that are scheduled to occur in future years.

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

The following summarizes the methods and work in 2017.

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.
- Summary roll-up of habitat pressure indicators into discrete habitat disturbance indicators.

Analysis and reporting are ongoing.

4.0 Qualified Professionals

This report was prepared by the following Qualified Individuals:

Qualified Individual	Expertise
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