Site C Clean Energy Project

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

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

Construction Year 3 (2017)

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REPORT

2017 ANNUAL REPORT

Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c)

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Executive Summary

In accordance with Provincial Environmental Assessment Certificate Condition No. 7[1] and Federal Decision Statement Condition Nos. 8.4.3[2] and 8.4.4[3] for BC Hydro's Site C Clean Energy Project (the Project), BC Hydro has developed the Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP[4]). 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 life cycle in Peace River tributaries and migrate past the Project 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 populations of these target species in select tributaries and their responses to the construction and operation of the Project. In 2017, sampling was conducted in the Chowade and Moberly rivers, and Colt, Cypress, Farrell, Fiddes, Kobes, and Turnoff creeks. This report summarizes the findings of Task 2c during its second year (Site C Construction Year 3; 2017). The first four years of Task 2c (i.e., 2016-2019) are intended to finalize sampling protocols and provide baseline data prior to subsequent phases of Project construction, reservoir creation, and operation.

Specifically, Task 2c enumerated and collected life history measurements (lengths and weights) from 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 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 number of immature Bull Trout were recorded during the 2016 study program. Sampling in Fiddes and Turnoff creeks targeted 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 three weeks earlier than in 2016. The movements of tagged fish will be monitored under other components of the FAHMFP. The above refinements contributed to an increased Bull Trout catch (816 in 2017 compared to 176 in 2016) and an increased number of tags deployed (636 tags deployed in 2017 compared to 77 in 2016), but hindered direct comparisons of catch rates between the two study years due to the methodological changes.

[1] The EAC Holder must develop a Fisheries and Aquatic Habitat Monitoring and Follow-up Program to assess the effectiveness of measures to mitigate Project effects on healthy fish populations in the Peace River and tributaries, and, if recommended by a QEP or FLNR, to assess the need to adjust those measures to adequately mitigate the Project's effects.

[2] The plan shall include: an approach to monitor changes to fish and fish habitat baseline conditions in the Local Assessment Area;

[3] The plan shall include: an approach to monitor and evaluate the effectiveness of mitigation or offsetting measures and to verify the accuracy of the predictions made during the environmental assessment on fish and fish habitat.

[4] Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program available at https://www.sitecproject.com/document-library/environmental-management-plans-and-reports.

Sampling in Farrell Creek occurred at three sites that were previously established and sampled by Mainstream (2011a) and 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 Fork Length [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.

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 2017 (all sites and methods combined); one adult Arctic Grayling was captured by angling and one immature Arctic Grayling was captured by backpack electrofishing. Both Arctic Grayling were implanted with PIT tags.

Key results from the 2017 survey are summarized as follows:

Tributaries Targeting Bull Trout

- Sampling in the Chowade River and Cypress Creek targeted areas expected to have high densities of Bull Trout.
- In total, 288 Bull Trout were captured in the Chowade River and 261 Bull Trout were captured in Cypress Creek. Only five Bull Trout from these streams were classified as adults. Of the 288 Bull Trout recorded in the Chowade River, 208 were implanted with PIT tags. Of the 261 Bull Trout recorded in Cypress Creek, 207 were implanted with PIT tags. Changes to sampling methodologies between 2016 and 2017, which allowed more Bull Trout to be tagged in 2017, hindered comparisons between the two datasets.
- In total, 198 Bull Trout were captured in Fiddes Creek and 69 Bull Trout were captured in Turnoff Creek. All Bull Trout recorded in these two streams were either YOY or immature; adults were not recorded. Of the 198 Bull Trout recorded Fiddes Creek, 155 were implanted with PIT tags. Of the 69 Bull Trout recorded in Turnoff Creek, 66 were implanted with PIT tags.
- Four Rainbow Trout were captured in the Chowade River (all four were tagged) and six Rainbow Trout were captured in Cypress Creek (four were tagged). Rainbow Trout were not recorded in Fiddes or Turnoff creeks.
- Arctic Grayling were not recorded in the Chowade River or in Cypress, Fiddes, or Turnoff creeks.
- The modifications to the 2017 Chowade River and Cypress Creek study designs contributed to increased numbers of captured and tagged Bull Trout. However, focusing effort on habitats expected to yield high Bull Trout densities increases bias in CPUE estimates and increases uncertainty regarding the program's ability to test its hypothesis (i.e., Bull Trout juvenile abundance in the Halfway River will not decline relative to baseline estimates). It is unlikely that a single survey can deploy enough tags to meet the needs of other components of the FAHMFP while also gathering enough data to adequately monitor the overall immature Bull Trout populations in these two systems.

Tributaries Targeting Rainbow Trout

- YOY and immature Rainbow Trout were each recorded in Colt, Farrell, and Kobes creeks. Of the 263 Rainbow Trout captured in these three systems, 198 were implanted with PIT tags. The presence of YOY Rainbow Trout in these streams in August indicates that Rainbow Trout likely used these streams for spawning during the preceding spring spawning season.
- Three Bull Trout were recorded in Colt Creek; one was an adult and two were immature. All three were implanted with PIT tags. Bull Trout were not recorded in Farrell or Kobes creeks.
- Two Arctic Grayling were recorded in Colt Creek; both were immature and were not implanted with PIT tags. Arctic Grayling were not recorded in Farrell or Kobes creeks.

Moberly River

- The catch of Arctic Grayling in the Moberly River was substantially lower in 2017 (n = 2) when compared to the 2016 survey (n = 105). Low water levels and high water temperatures during the 2017 survey period likely contributed to the reduced catch.
- Declining water levels in the Moberly River over the duration of the 2017 survey period reduced the efficiency of the small fish boat electroshocker and hindered boat access. The use of inflatable boats was abandoned approximately halfway through the 2017 survey period. All remaining sites were accessed by helicopter.

Data collected from 2016 to 2017, in conjunction with data to be collected in 2018 and 2019, represent the baseline, pre-Project state of select Site C reservoir tributaries. Management hypotheses cannot be statistically tested until later into the Project's construction.

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1.0 INTRODUCTION

In accordance with Provincial Environmental Assessment Certificate Condition No. 7[5] and Federal Decision Statement Condition Nos. 8.4.3[6] and 8.4.4[7] for BC Hydro's Site C Clean Energy Project (the Project), BC Hydro developed the Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP[8]). 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 use tributaries in the future inundation zone of the proposed Site C reservoir to fulfill portions of their life cycle. 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 (Task 2c) is one component of Mon-1b and is intended to monitor the populations of Arctic Grayling, Bull Trout, and Rainbow Trout that are known to spawn in Site C reservoir tributaries and how these populations are impacted by the construction and operation of the Project.

This report summarizes the findings of Task 2c during Construction Year 3 (2017) of the Project. As the second year of a multi-year study, the results from 2017 are intended to contribute baseline data prior to subsequent phases of Project construction and reservoir formation and to identify the most effective sampling locations and methods to employ during future study years. During Year 1 (2016), surveys consisted of a broad spatial scope within each of the sampled tributaries (Golder 2017). During Year 2, effort was focused on the key areas that were identified during Year 1 surveys.

1.1 Bull Trout

A key uncertainty identified in the Project's Environmental Impact Statement (EIS) relates to the movement of Peace River Bull Trout during and after construction of the Project, which in turn, influences the number of spawning Bull Trout expected to be present in the Halfway River[9]. The Halfway River is known to be an important watershed for spawning by Peace River Bull Trout (AMEC and LGL 2008a, 2008b, 2010a, 2010b; BC MELP 2000; Burrows et al. 2001; Pattenden et al. 1991). The objective of the Peace River Bull Trout Spawning Assessment (Mon-1b, Task 2b) is to monitor Bull Trout spawner and redd abundance in select tributaries of the Halfway River watershed to monitor the population's response to the construction and operation of the Project. The abundance of adult Bull Trout in the Halfway River watershed, as monitored under Task 2b, may be influenced by changes in the abundance of juvenile Bull Trout in the study area and by changes in the abundance of the Halfway River's resident Bull Trout population. Therefore, Task 2c is designed, in part, to monitor juvenile Bull Trout abundance in the Halfway River watershed to test Hypothesis #3 within the Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program:

H_3: Bull Trout juvenile abundance in the Halfway River will not decline relative to baseline estimates.

[5] The EAC Holder must develop a Fisheries and Aquatic Habitat Monitoring and Follow-up Program to assess the effectiveness of measures to mitigate Project effects on healthy fish populations in the Peace River and tributaries, and, if recommended by a QEP or FLNR, to assess the need to adjust those measures to adequately mitigate the Project's effects.

[6] The plan shall include: an approach to monitor changes to fish and fish habitat baseline conditions in the Local Assessment Area;

[7] The plan shall include: an approach to monitor and evaluate the effectiveness of mitigation or offsetting measures and to verify the accuracy of the predictions made during the environmental assessment on fish and fish habitat.

[8] Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program available at https://www.sitecproject.com/document-library/environmental-management-plans-and-reports.

[9] Site C Clean Energy Project Environmental Impact Statement, Volume 2, Appendix Q3.

Prior to 2016, a program dedicated to monitoring juvenile Bull Trout abundance in the Halfway River watershed had not previously been implemented, although incidental catches were noted during some studies (e.g., Mainstream 2009a, 2010a, 2011a, 2013). Therefore, for the purposes of testing the above hypothesis, data collected during initial study years (i.e., 2016 and 2017) will serve as baseline data with which to compare against future study years.

A secondary objective of the current program was to deploy Passive Integrated Transponder (PIT) tags into captured fish to allow the movements of these fish to be monitored using PIT detector arrays that were installed in the Chowade River and Cypress Creek (Figure A1) as a component of Task 2b in 2017 (Ramos-Espinoza et al. 2018). To help meet this secondary objective, effort in the Chowade River and Cypress Creek in 2017 focused on areas of expected higher Bull Trout densities, based on 2016 survey results.

1.2 Rainbow Trout

The Project's EIS identified uncertainties regarding the continued use of Maurice and Lynx creeks for spawning and rearing by Peace River Rainbow Trout populations. Sampling in Maurice Creek was not conducted in 2016 due to site access limitations associated with sampling crew safety and security. Similar conditions prevented sampling of Maurice Creek in 2017. Sampling Lynx Creek was not conducted in 2016 (Golder 2017) or 2017 due to ongoing high turbidity levels[10] precluding fish sampling. The landslides have reduced the quality of Rainbow Trout spawning and rearing habitat within the Lynx Creek watershed through increased sediment deposition. Sampling Maurice Creek was not undertaken in 2017 and its use as an index stream for monitoring the long-term status of the Peace River Rainbow Trout population is not ideal. In 2017, effort in the Chowade River and Cypress Creek was focused on the upstream portions of each tributary where densities of immature Bull Trout were expected to be high and densities of Rainbow Trout were expected to be low. For the Chowade River, all sampling was conducted upstream of River Km 36 (as measured upstream from the Chowade River's confluence with the Halfway River). For Cypress Creek, all sampling was conducted upstream of River Km 28 (as measured upstream from the Cypress Creek confluence). For the above reasons, Farrell, Colt, and Kobes creeks were selected, in consultation with BC Hydro[11], as alternative tributaries to monitor local Rainbow Trout populations. Maurice, Lynx, and Farrell creeks represent the only three Peace River tributaries where substantial numbers of Rainbow Trout were recorded during baseline studies (e.g., Mainstream 2012), with Farrell Creek representing the only one of these three tributaries where sampling was feasible in 2017. Kobes and Colt creeks were sampled in 2017 to increase Rainbow Trout captures within the Halfway River watershed because other modifications to the 2017 study design were expected to reduce Rainbow Trout catches in other streams.

Farrell Creek is a tributary that flows into the Peace River approximately 23.5 km downstream of Peace Canyon Dam. Sampling in Farrell Creek will test the hypothesis that Rainbow Trout from Site C reservoir will continue to spawn and rear upstream of the Site C reservoir inundation zone following reservoir formation. The presence of Young-of-the-Year (YOY) Rainbow Trout in Farrell Creek during the 2017 summer survey confirms that Rainbow Trout spawned in the system during the preceding spring spawning season. The subsequent detection under

[10] The source of the high turbidity in Lynx Cr. is not known, and may be associated with recent upstream landslide activities http://hudsonshope.ca/residents/water-services/.

[11] BC Hydro also reviewed with the Project's Fisheries and Aquatic Habitat Mitigation and Monitoring Technical Committee, the streams to sample for Rainbow Trout.

other components of the FAHMFP of Rainbow Trout that were initially tagged as juveniles or YOY in Farrell Creek will help confirm that Rainbow Trout from the Peace River spawn in Farrell Creek.

Kobes Creek is a tributary to the Halfway River, flowing into the Halfway River at River Km 76 (as measured upstream from the Halfway River's confluence with the Peace River). Colt Creek is a tributary to the Graham River, flowing into the Graham River at River Km 11.5 (as measured upstream from the Graham River's confluence with the Halfway River). The Graham River flows into the Halfway River 90 km upstream from the Halfway River's confluence with the Peace River. Over time, Rainbow Trout data from Colt and Kobes creeks will be used to provide an index of relative Rainbow Trout abundance and to gather information regarding movements between sites and study years in the Halfway River watershed.

1.3 Arctic Grayling

The Project's EIS describes key uncertainties for the Peace River Arctic Grayling population upstream of the Project[12]. These include the species' ability to overwinter in the Moberly River and its response to the creation of Site C reservoir habitat. Arctic Grayling numbers are expected to be lower when compared to baseline estimates (e.g., baseline estimates in Mainstream 2013). This program will test Hypothesis #5 from the Site C Reservoir Tributaries Fish Community and Spawning Monitoring Program:

H_5: A self-sustained population of Arctic Grayling will remain in the Moberly River.

Sampling in the Moberly River under Task 2c in 2016 and 2017 was added to the existing pre-development baseline dataset to further describe the fish community located within and upstream of the Site C reservoir inundation zone while improving understanding of the Moberly River Arctic Grayling population.

[12] Site C Clean Energy Project Environmental Impact Statement, Volume 2, Appendix Q3.

2.0 METHODS

The Site C Reservoir Tributary Fish Population Indexing Survey represents a Before-After (BA) study design, with four years of data scheduled to be collected prior to River Diversion (currently scheduled for 2020). An additional 4 years of data are scheduled to be collected during River Diversion (2020 to 2023), with reservoir filling and operation commencing in 2024.

2.1 Study Area

The Task 2c study area includes tributaries that were previously identified as having key habitat for migratory Peace River Arctic Grayling, Bull Trout, and Rainbow Trout populations (Appendix A, Figures A1 to A9). Sections of each tributary that were sampled depended on sampling logistics and the species-specific hypotheses being tested. Results of the 2016 sampling program were used to guide sample site selection to focus on reaches and habitat types with higher densities of the target fish species. Target fish species within the tributaries sampled in 2017 are summarized in Table 1.

Table 1: Summary of target species by watershed for the Site C Reservoir Tributaries Fish Population Indexing Survey, 2017

Species	Watershed						
	Chowade River	Cypress Creek	Fiddes / Turnoff Creeks	Colt Creek	Farrell Creek	Kobes Creek	Moberly River
Arctic Grayling				o	o	o	X
Bull Trout	X[1]	X	X	o		o	
Rainbow Trout	o[2]	o		X	X	X	

[1] "X" denotes main target species for the tributary.

[2] "o" denotes secondary target species for the tributary.

River Km values presented in this report were based on the Government of Canada's CanVec series of hydrograph features[13]. For each tributary, the different line segments of the same stream were merged into a single line feature. River Km 0.0 (i.e., the tributary's confluence) was set at the lowest elevation of the line feature and 1 km intervals were established along the line feature using the Create Station Points tool (ArcGIS© extension ET GeoWizards).

2.1.1 Tributaries Targeting Bull Trout

Portions of the Halfway River watershed that were sampled during the 2017 survey included locations where catches of Bull Trout were greatest in 2016 (Golder 2017), and sections previously identified as important for Bull Trout spawning (Euchner and Mainstream 2013). Tributaries sampled included the Chowade River and Cypress, Fiddes, and Turnoff creeks (Table 1). Sampling within the upper Halfway River mainstem, which was conducted in

[13] Available for download at https://open.canada.ca/data/en/dataset/9d96e8c9-22fe-4ad2-b5e8-94a6991b744b.

2016 (Golder 2017), was not conducted in 2017 because the limited access to the area reduces the feasibility of sampling it as part of a long-term index of Bull Trout population status.

For the Chowade River, sampling was conducted between River Km 36.0 and River Km 53.0 (as measured upstream from the Chowade River's confluence with the Halfway River; Appendix A, Figure A4). For Cypress Creek, sampling was conducted between River Km 28.0 and River Km 60.0 (as measured upstream from the Cypress Creek's confluence with the Halfway River; Appendix A, Figure A3).

Fiddes and Turnoff creeks have been identified as containing critical spawning habitat for Bull Trout (Mainstream 2012) and results of the Peace River Bull Trout Spawning Assessment (Mon-1b, Task 2b) in 2016 indicated smaller Bull Trout spawner and redd sizes in these tributaries when compared to the Halfway River mainstem (Braun et al. 2017), which could indicate the presence of a resident Bull Trout population. Fiddes and Turnoff creeks were sampled in 2017 to gather additional information regarding Bull Trout habitat use and rearing in these two tributaries. Fiddes and Turnoff creeks flow into the Halfway River near River Km 241.5 (as measured upstream from the Halfway River's confluence with the Peace River); their confluences are within 200 m of each other (Appendix A, Figure A2). Fiddes and Turnoff creeks were not sampled in 2016 and site selection was based on ease of access (i.e., safe helicopter landing locations). All sampling within Turnoff Creek was conducted downstream of River Km 8.0 (as measured upstream from Turnoff Creek's confluence with the Halfway River) and all sampling within Fiddes Creek was conducted between River Km 6.0 and River Km 12.0 (as measured upstream from the Fiddes Creek's confluence with the Halfway River; Appendix A, Figure A2).

Sample sites were wadeable sections where backpack electrofishing was most effective and in habitats thought to be suitable for immature Bull Trout, including side channels, low velocity habitats near the channel margin, and areas where cover, such as woody debris or boulders, was prevalent. UTMs of all site locations are provided in Appendix A, Table A1. Individual sites were selected based on aerial surveys conducted at the start of the program, allowing crews to identify potentially suitable habitats that were within close proximity to safe landing locations.

2.1.2 Tributaries Targeting Rainbow Trout

Sample locations within Farrell Creek (Appendix A, Figure A7) were aligned with sites previously established by Mainstream (2011a) to allow comparisons to historical data when possible:

- Mainstream Site FA03 - Near the Kobes Creek Road bridge (River Km 63.4 as measured upstream from the Farrell Creek confluence);
- Mainstream Site FA04 - A location where Kobes Creek Road runs adjacent to Farrell Creek (River Km 65.7); and
- Mainstream Site FA05 - Upstream of the Beryl Prairie Road bridge (River Km 102.1).

In addition, a new site was established at River Km 101.7 immediately downstream of the Beryl Prairie Road bridge (Appendix A, Table A1) to increase the number of sites situated on Farrell Creek.

The BC Ministry of Environment's Habitat Wizard identifies a culvert where Beryl Prairie Road crosses Farrell Creek (near River Km 102) as a potential obstacle to fish movement. Mainstream Site FA05 was situated upstream of that crossing; therefore, crews conducted a visual assessment of the crossing prior to sampling to ensure the area was accessible to the Peace River Rainbow Trout population. The crossing consisted of a clear-span bridge design without a culvert; barriers to fish movement were not observed by the crew.

Sample locations within Colt Creek (Appendix A, Figures A5) and Kobes Creek (Appendix A, Figure A6) were established based on ease of access and the quality of fish habitat available (i.e., expected use by juvenile Rainbow Trout). UTMs of sample site locations are provided in Appendix A, Table A1.

2.1.3 Moberly River

The Moberly River study area was approximately 124 km long and was defined as the portion of the Moberly River from the outlet of Moberly Lake (River Km 123.7 as measured upstream from the Moberly River's confluence with the Peace River) downstream to the Moberly River confluence (River Km 0.0; Appendix A, Figures A8 and A9).

For the Moberly River, previous baseline studies had delineated river sections (Mainstream 2011b; Appendix A, Table A2). These section breaks were implemented for the 2017 study to maintain consistency with these baseline datasets. The habitat classifications delineated by Mainstream (2011b) were as follows:

1) Irregular meanders; frequent riffle complexes interspersed with extended runs with some flats; and

2) Tortuous meanders dominated by low water velocities; flats with few riffle sections.

Site selection for small fish boat electroshocking and backpack electrofishing in the Moberly River in 2017 was based on access, sampling logistics, and safety protocols (similar to 2016; Golder 2017). Angling sites were selected opportunistically, targeting preferred adult Arctic Grayling habitats. UTMs of sample site locations are provided in Appendix A, Table A1.

2.2 Study Period

Overall, 27 days of sampling were conducted during the 2017 survey (all watersheds combined; Table 2). R.L.&L. (1995) noted immature Bull Trout migrating downstream and out of the Halfway River watershed in mid-August. To facilitate catching immature Bull Trout prior to the onset of their downstream migration, sampling in the Chowade River and Cypress Creek was conducted over an 8-day period from 27 July to 3 August, approximately three weeks earlier than the 2016 study period (Golder 2017). Fiddes and Turnoff creeks were sampled on 4 and 5 August (Table 2).

Farrell, Kobes, and Colt creeks were sampled over a 6-day period between 6 and 11 August (Table 2).

The Moberly River was sampled over a 9-day period between 30 August and 8 September (Table 2). This study period is similar to study periods sampled in historical datasets (Mainstream 2011b; Golder 2017).

Table 2: Sampling schedule by tributary for the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017

Tributary	Sampling Dates	Number of Sampling Days
Chowade River	July 27 to 30	4
Cypress Creek	July 31 to August 3	4
Fiddes Creek	August 4 to 5	2
Turnoff Creek	August 4 to 5	2
Farrell Creek	August 6 to 7	2
Colt Creek	August 8 to 9	2
Kobes Creek	August 10 to 11	2
Moberly River	August 30 to September 8[a]	9

[a] Sampling was not conducted on September 2.

2.3 Fish Capture

2.3.1 Halfway River Watershed and Farrell Creek

Backpack electrofishing was used to capture fish in the Chowade River, and in Colt, Cypress, Farrell, Fiddes, Kobes, and Turnoff creeks. All sampling consisted of a single pass in open sites. Backpack electrofishing sites ranged in length from approximately 35 m to 920 m.

For the Chowade River, and Cypress, Fiddes, and Turnoff creeks (i.e., tributaries where Bull Trout were the primary target), sites were located in areas where immature Bull Trout densities were expected to be higher. These areas were generally located in side channels or braided sections of the stream that had lots of physical cover, channel widths less than approximately 5 m, mean water depths less than approximately 0.6 m, and water velocities less than 1.0 m/s. Within each site, effort was also focused on areas where the capture of immature Bull Trout was expected to be greatest. On occasion, two crews would sample within the same site. This multi-crew approach was used when sites had wetted widths that were too wide to effectively sample with a single backpack electrofisher or sites that contained multiple small side channels. On these occasions, catches from both crews were combined and analyzed as a single site. The multi-crew approach was employed only in the Chowade River and Cypress Creek.

Three of the four sites situated on Farrell Creek were previously delineated by Mainstream (2011b) and were located in mainstem habitats. The remaining Farrell Creek site and all sites on Colt and Kobes creeks were established in mainstem habitats in wadeable areas that were conducive to backpack electrofishing and thought to represent good quality Rainbow Trout habitat.

Backpack electrofishing was conducted with one person operating the electrofisher and one person netting fish. Captured fish were netted and transferred to coolers or buckets positioned on the shoreline along the length of the site. Smith-Root™ Model 12 and Model 12B backpack electrofishers (Smith-Root, Vancouver, WA, USA) were used, depending on the crew. Electrofisher settings were adjusted as needed to minimize injuries to fish while efficiently capturing the target size and species. Voltage ranged from 200 to 500 V, frequency was set at 60 Hz, and pulse width ranged from 4 to 8 ms.

Habitat variables recorded at each site (Table 3) included variables recorded during previous study years (Golder 2017) and variables recorded during similar baseline studies (e.g., Mainstream 2011b). These data were collected to provide a means of detecting changes in habitat availability or suitability in sample sites over time. Collected data (Appendix C, Table C1) were not intended to quantify habitat availability or imply habitat preferences.

Table 3: Habitat variables recorded at each site sampled as part of the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017

Variable	Description
Date	The date the site was sampled
Time	The time the site was sampled
Air Temp	Air temperature at the time of sampling (to the nearest 1°C)
Water Temp	Water temperature at the time of sampling (to the nearest 0.1°C)
Conductivity	Water conductivity at the time of sampling (to the nearest 10 µS/cm)
Secchi Bar Depth	The Secchi Bar depth recorded at the time of sampling (to the nearest 0.1 m)
Cloud Cover	A categorical ranking of cloud cover (Clear = 0-10% cloud cover; Partly Cloudy = 10-50% cloud cover; Mostly Cloudy = 50-90% cloud cover; Overcast = 90-100% cloud cover)
Weather	A general description of the weather at the time of sampling (e.g., comments regarding wind, rain, smoke, or fog)
Backpack Electrofisher Model	The model of backpack electrofisher used during sampling
Percent	The estimated duty cycle (as a percent) used during sampling
Amperes	The average amperes used during sampling
Mode	The mode (AC or DC) and frequency (in Hz) of current used during sampling
Volts	The voltage (V) used during sampling
Length Sampled	The length of shoreline sampled (to the nearest 1 m)
Time Sampled	The duration of electrofisher operation (to the nearest 1 second)
Mean Depth	The mean water depth sampled (to the nearest 0.1 m)
Maximum Depth	The maximum water depth sampled (to the nearest 0.1 m)
Effectiveness	A categorical ranking of sampling effectiveness (1 = good; 2 = moderately good; 3 = moderately poor; 4 = poor)
Water Clarity	A categorical ranking of water clarity (High = greater than 3.0 m visibility; Medium = 1.0 to 3.0 m visibility; Low = less than 1 m visibility)
Instream Velocity	A categorical ranking of water velocity (High = greater than 1.0 m/s; Medium = 0.5 to 1.0 m/s; Low = less than 0.5 m/s)
Instream Cover	The type (i.e., Interstices; Woody Debris; Cutbank; Turbulence; Flooded Terrestrial Vegetation; Aquatic Vegetation; Shallow Water; Deep Water) and amount (as a percent) of available instream cover
Crew	The field crew that conducted the sample
Sample Comments	Any additional comments regarding the sample

The type and amount of instream cover for fish were qualitatively estimated at all sites. Water velocities were visually estimated and categorized at each site as low (less than 0.5 m/s), medium (0.5 to 1.0 m/s), or high (greater than 1.0 m/s). Water clarity was visually estimated and categorized at each site as low (less than 1.0 m depth), medium (1.0 to 3.0 m depth), or high (greater than 3.0 m depth). Where water depths were sufficient, water clarity was also estimated using a "Secchi Bar" that was manufactured based on the description provided by Mainstream and Gazey (2014). Mean and maximum sample depths were visually estimated at each site.

A summary of effort by the number of sites surveyed, length of shoreline sampled, and seconds of backpack electrofisher operation is provided for each tributary in Table 4 and Appendix B, Table B1.

Table 4: Summary of backpack electrofishing effort employed by tributary during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017

Tributary	Number of Sites Sampled	Electrofishing Effort (seconds)	Survey Length (m)
Chowade River	27	29,755	6,455
Cypress Creek	17	47,070	7,735
Fiddes Creek	3	6,027	785
Turnoff Creek	3	8,778	1,105
Farrell Creek	4	14,973	1,745
Colt Creek	5	12,733	1,390
Kobes Creek	5	10,557	1,215

2.3.2 Moberly River

The initial study plan for the Moberly River survey consisted of crews travelling by inflatable boats down the length of the Moberly River from Moberly Lake to the river's confluence with the Peace River. The six-person team was to work as three separate crews; an angling crew, a small fish boat electroshocking crew, and a backpack electrofishing and beach seining crew. Declining water levels over the course of the survey period hindered boat use and on September 1, after approximately four days of sampling and consultation with BC Hydro, a decision was made to modify the approach. The upstream 54 km of the Moberly River, which encompassed Sections 1A, 1, 2, 3, and the upstream portion of Section 4 (Appendix A, Figure A8), was accessed by boat and sampled using small fish boat electroshocking, backpack electrofishing, beach seining, and angling. The downstream 70 km of the Moberly River, which encompassed the downstream portion of Section 4 and Sections 5 through 10 (Appendix A, Figures A8 and A9), was accessed solely by helicopter and was sampled using a backpack electrofishing and angling.

Small fish boat electroshocking was conducted out of a white-water-style raft (Avon™ 13 Pathmaker; 4 m long by 1.75 m wide; AVON Marine, Port Moody, BC, Canada). Sites were located in main channel habitats where water depths were deep enough and channel widths were wide enough to allow the crew to effectively maneuver the boat. The raft was equipped with a Smith-Root 2.5 Generated Powered Pulsator (GPP 2.5) and a generator contained in a waterproof tub. The electroshocker was connected to a cathode array curtain placed on the bow of the raft and two anode pole arrays extended approximately 1.5 m in front of the raft. The anode poles were angled between 20 and 40° off either side of the bow. While sampling, a single crew member was positioned at the bow of the boat. This crew member netted stunned fish and transferred them to a water-filled holding tank positioned behind the bow but in front of the oarsman. The netter attempted to capture all stunned fish, but priority was given to Arctic Grayling if more than one species was observed at the same time. The oarsman sat in an elevated chair

behind the holding tank and maneuvered the boat with oars braced in oar locks. Electroshocker settings were adjusted at each site, depending on local conditions and the size and species of fish observed, to minimize injury to fish. The electroshocker was generally operated at 60 Hz pulsed direct current (PDC) if mostly small fish (i.e., less than approximately 20 cm) were observed, and at 30 Hz PDC if many large fish (i.e., longer than approximately 20 cm) were observed. The amperage was adjusted as needed to attain the desired response in fish, which was galvanotaxis (forced swimming) without immediate tetany. This response typically corresponded to an amperage of 2.0 to 2.5 A as measured on the GPP gauge. Habitat conditions, as summarized in Table 3, were recorded at each site. Small fish boat electroshocking sites ranged between 150 to 425 m in length. The above methods were similar to those employed during the 2016 survey (Golder 2017).

Backpack electrofishing was used in locations where water depths were shallow enough and water velocities were low enough to allow safe wading and efficient fish capture using this technique. These sites were often side channel or braided areas. Two different models of backpack electrofisher were used, a Smith-Root™ Model 12 and a Smith-Root™ Model 12B. Electrofisher settings were adjusted as needed to minimize injuries to fish while allowing efficient capture of the target size and species. Voltage ranged from 200 to 525 V, frequency was set at 60 Hz, and pulse width ranged from 3 to 5 ms. Backpack electrofishing was conducted with one person operating the electrofisher and one person netting fish. Captured fish were netted and transferred to stream-side coolers or buckets set along the side of the sample site. Habitat conditions, as summarized in Table 3, were recorded at each site. Backpack electrofishing sites ranged in length from 18 to 340 m. The above methods were similar to those employed during the 2016 survey (Golder 2017).

Beach seine sites were situated in side channels and low water velocity areas, and other habitats conducive to this capture method (i.e., smaller substrates, clear of obstructions, with low and regular slopes). The beach seine was 4.5 m (width) x 1.5 m (height) with a mesh size of 5.0 mm. One seine haul was conducted at each site along the channel margins for a predetermined distance (range: 16 to 47 m). The above methods were similar to those employed during the 2016 survey (Golder 2017).

Angling was opportunistic and occurred at sites where either fish were observed feeding on the surface or in pools or other habitats that were difficult to sample using alternative capture methods. Both spin-casting and fly-fishing equipment were used, and the crew selected the equipment that they deemed most appropriate for the local conditions. Angling was not used as a capture method during the 2016 survey.

A summary of effort[14] employed during the Moberly River survey by section is provided in Table 5 and Appendix B, Tables B1 to B4. A total area of 95 m² was surveyed by beach seine (Appendix B, Table B2) and a total of 20 hours of angling was conducted (Appendix B, Table B3).

[14] Angling effort and habitat characteristics were recorded at each site. To increase potential catch of target species, angling also occurred opportunistically while the boats were travelling between sites and any fish captured while in transit were processed. The level of effort in this opportunistic sampling is not included in the effort summaries below.

Table 5: Summary of sampling effort employed in the Moberly River by section during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017

Section	Backpack Electrofishing			Small Fish Boat Electroshocking			Angling	Beach Seining
	Number of Sites	Effort (seconds)	Effort (m)	Number of Sites	Effort (seconds)	Effort (m)	Number of Sites	Number of Sites
MR-S1A	4	1,843	286	5	1,160	890	5	1
MR-S1	3	1,438	189	5	2,455	1,455	2	1
MR-S2	2	763	101	1	565	340	2	
MR-S3	1	808	81				2	
MR-S4	2	2,168	186					
MR-S5								
MR-S6	6	7,170	607					
MR-S7	10	15,589	1,643				1	
MR-S8	5	4,442	845				2	
MR-S9								
MR-S10	7	8,238	1,450				6	
Total	**40**	**42,459**	**5388**	**12**	**4,180**	**2,685**	**20**	**2**

2.4 Fish Processing

All captured fish were identified to species, counted, weighed to the nearest 1 g, and measured for fork length (FL). Total lengths (TL) were recorded for Burbot (*Lota lota*). When catches of species other than Arctic Grayling, Bull Trout, or Rainbow Trout exceeded 30 individuals per site, only the first 30 were measured; all other individuals were enumerated and released. Arctic Grayling, Burbot, Bull Trout, and Rainbow Trout in good condition following processing were implanted with half-duplex (HDX) PIT tags (ISO 11784/11785 compliant) (Oregon RFID, Portland, OR, USA). Tags were implanted within the left axial muscle below the dorsal fin origin and oriented parallel with the anteroposterior axis of the fish. Tagging criteria were established based on input from InStream Fisheries Research Inc. and are summarized as follows:

- Fish between 80 and 199 mm FL received 12 mm long HDX PIT tags (12.0 mm x 2.12 mm HDX+).
- Fish between 200 and 299 mm FL received 23 mm long HDX PIT tags (23.0 mm x 3.65 mm HDX+).
- Fish greater than 300 mm FL received 32 mm long HDX PIT tags (32.0 mm x 3.65 mm HDX+).

After processing, all fish were released at the downstream end of their capture site.

Scale samples were collected from all captured Arctic Grayling and Rainbow Trout. Scales were collected from above the lateral line and posterior to the dorsal fin. The first leading fin ray of the left pectoral fin was collected from all Bull Trout longer than 120 mm FL. Scale and fin ray samples were stored in appropriately labelled coin envelopes.

Small sections of fin tissue were collected from select Arctic Grayling, Bull Trout, and Rainbow Trout for potential genetic analysis (Table 6). Samples were preserved in 99% anhydrous ethanol and were not analyzed as part of this study but were provided to BC Hydro for long-term storage and future consideration.

Table 6: Summary of genetic samples collected as part of the Site C Reservoir Tributary Fish Population Indexing Survey, 2017

Location	Arctic Grayling	Bull Trout	Rainbow Trout
Chowade River		223	4
Cypress Creek		211	6
Turnoff Creek		32	
Fiddes Creek		41	
Colt Creek		2	
Moberly River	1		1

2.5 Moberly River Habitat Assessment

In the Moberly River, the same habitat variables listed in Table 3 were recorded at all sample sites. At select backpack electrofisher and beach seine sites, more detailed habitat data were collected following a modified version of the Level 1 assessment procedure described in BC's Watershed Restoration Technical Circular No. 8 (Johnston and Slaney 1996) and Fish and Fish Habitat Inventory: Standards and Procedures (RISC 2001). Mesohabitat types (pool, riffle, run, or glide) were identified and the GPS location of the upstream and downstream end of each habitat unit was recorded. Each backpack electrofishing or beach seine site was located within one mesohabitat unit. Within each site, various physical attributes were measured and recorded on standardized data forms. Information recorded included date and time, photograph number, UTM location, habitat type, wetted width, bankfull width and height, channel gradient (%), mean water depth and velocity (based on ¼, ½, and ¾ wetted channel width), maximum water depth in pools, and substrate composition (% fines, gravels, cobbles, boulders, bedrock). Percent substrate composition was visually estimated using a classification system based on the modified Wentworth Scale (Cummins 1962). In addition, each transect included a visual assessment of substrate characteristics compatible with baseline datasets (Mainstream 2009a, 2011b, Golder 2017). These included the following: 90th percentile particle size (D90); embeddedness (sand, silt, and clay) present within the substrate; and compaction, to evaluate the density or looseness of the substrate within the channel. Compaction and embeddedness were evaluated as low, moderate, or high. The presence or absence of large organic debris or large woody debris (%), defined as having a diameter greater than 10 cm and a length greater than 1 m, was recorded. The percent of overhead cover, off-channel habitat, and riparian vegetation were also recorded.

The modified Level 1 habitat assessment data collected in the Moberly River are provided in the Site C Reservoir Tributary Fish Population Indexing Survey database (see Section 4.7) and in Appendix C, Table C2, but are not discussed in detail in this report.

2.6 Fish Ageing

All Arctic Grayling and Rainbow Trout were aged by scale analysis. Scales were aged by counting the number of growth annuli present on the fish scale following methods outlined in Mackay et al. (1990) and RISC (1997). Scales were temporarily mounted between two slides and examined using a trinocular microscope equipped with a digital camera. If needed, several scales were examined and the highest quality scale was photographed using the integrated 3.1-megapixel digital macro camera and saved as a JPEG-type picture file. All scales were examined independently by two experienced individuals and ages assigned. For each scale sample, the agers had access to the species and the date of capture but no other information about the sampled fish (e.g., fork

length or capture history). If the two assigned ages did not agree, a third ager assigned an age. If two out of three agers agreed on the age, then this age was used for analysis. If two out of three agers did not agree on an age, then the sample was not used for analyses.

Bull Trout fin rays were aged by counting the number of growth annuli present on the sample following methods outlined in Mackay et al. (1990). Fin rays were coated in epoxy and allowed to dry. Once the epoxy dried, a jeweler's saw was used to create cross-sections of the fin ray sample. The cross-sections were permanently mounted on a microscope slide using a clear coat nail polish and examined using a digital microscope. If needed, several fin ray cross-sections were examined and the cross-section with the most visible annuli was used. All fin rays were examined independently by two experienced individuals using the same approach as detailed above for scales. Initial analyses of Bull Trout ageing structures suggested that the first annuli was not evident on fin rays, resulting in assigned ages that were one year younger than the true age of the fish. This result was further supported by comparing length-at-age data to modes in length-frequency histograms. Based on these data, one year was added to each assigned Bull Trout age.

2.7 Data Analysis

All data collected during field surveys were entered and stored in a custom MS-Access© database that conforms to BC Hydro's established Site C data standards. Data on field sheets were entered into spreadsheet format and the digital data were verified and checked by a second person before uploading the data to the database. Before data analysis, Quality Control / Quality Assurance (QA/QC) included checks of the range and format of all variables and graphical methods to check for possible errors including histograms and bivariate plots.

Catch was summarized by sample method, species, life stage, watercourse, and section (where applicable) and presented in tabular format. Catch-per-unit-effort (CPUE) for electrofishing was calculated by dividing the summed total number of fish in a tributary captured at all sites by the sum of effort at all sites. Sampling effort was measured in seconds of electrofisher operation and CPUE was expressed as the number of fish per hour. Length of site was not used to represent sampling effort for CPUE because sampling in the Chowade River and Cypress Creek focused only on optimal habitats and the entire site length was not always sampled (as described in Section 2.1.1).

Length-frequency histograms were plotted for the three target species (Bull Trout, Rainbow Trout, and Arctic Grayling) by tributary, where sample sizes of fish captured were sufficient. Length-frequency histograms were also plotted for Burbot and Mountain Whitefish (*Prosopium williamsoni*) for the Moberly River. Age-frequency histograms were plotted for Bull Trout (all four tributaries pooled) and Rainbow Trout (all three tributaries pooled). Length-at-age data were used to plot three-parameter von Bertalanffy growth curves for the Bull Trout and Rainbow Trout (Pardo et al. 2013). Linear regressions were used to characterize growth for some species due to the narrow range of age classes available for analysis.

Fish were assigned a life stage of YOY, immature, or adult based on their body length. The maximum size of YOY was determined for each species based on breaks between the first and second modes in the species' length-frequency histogram. Fish larger than 250 mm were classified as adult for all species. Although some individuals larger than 250 mm for some species are likely not mature adults, 250 mm was used as a consistent cut-off to summarize data by length-class. Backpack electrofishing was the only capture method used in the Halfway River watershed and is an ineffective method of capturing large-bodied fish such as adult Bull Trout. Catch data from the 2017 should not be considered a reliable indicator of adult Bull Trout abundance in these streams.

3.0 RESULTS

3.1 Tributaries Targeting Bull Trout

In total, 123 YOY, 688 immature, and 5 adult Bull Trout were captured by backpack electrofishing in the Chowade River and Cypress, Fiddes, and Turnoff creeks combined (Table 7 and Appendix B, Table B5). Of these 816 fish, 631 immature Bull Trout and 5 adult Bull Trout were implanted with PIT tags. All remaining Bull Trout were not tagged because they were either unhealthy (i.e., unlikely to survive the tagging process; *n* = 11) or too small to receive a PIT tag (i.e., less than 80 mm FL; *n* = 169).

Table 7: Number of fish caught and tagged in the Chowade River and Cypress, Fiddes, and Turnoff creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017

Species[a]	Life Stage[b]	Chowade River			Cypress Creek			Fiddes Creek			Turnoff Creek			Total		
		# Caught	# Tagged	CPUE (#/hour)	# Caught	# Tagged	CPUE (#/hour)	# Caught	# Tagged	CPUE (#/hour)	# Caught	# Tagged	CPUE (#/hour)	# Caught	# Tagged	CPUE (#/hour)
Bull Trout	Adult	2	2	0.2	3	3	0.2							**5**	**5**	**0.2**
	Imm.	216	206	26.1	221	204	16.9	185	155	110.5	66	66	27.1	**688**	**631**	**27.0**
	YOY	70	0	8.5	37	0	2.8	13	0	7.8	3	0	1.2	**123**	**0**	**4.8**
Rainbow Trout	Adult	4	4	0.5	3	2	0.2							**7**	**6**	**0.3**
	Imm.				3	2	0.2							**3**	**2**	**0.1**
	YOY													**0**	**0**	**0.0**
Mountain Whitefish	Adult	2	0	0.2	1	0	0.1							**3**	**0**	**0.1**
	Imm.	1	0	0.1										**1**	**0**	**0.0**
	YOY													**0**	**0**	**0.0**

[a] Table excludes 105 Slimy Sculpin (*Cottus cognatus*) captured in the Chowade River and 138 captured in Cypress Creek.
[b] Life stage was assigned based on fork length. Fish were classified as adult when longer than 249 mm FL and immature when less than 250 mm FL. The maximum size of YOY fish varied by species and was selected based on modes observed in length-frequency histograms and corroborated with length-at-age data when possible.

Adult Bull Trout captured in 2017 ranged between 260 and 430 mm FL in length and were recorded in the Chowade River (*n* = 2) and Cypress Creek (*n* = 3). Adult Bull Trout were not recorded in Fiddes or Turnoff creeks.

The total immature Bull Trout catch was similar in the Chowade River (*n* = 216) and Cypress Creek (*n* = 221); however, CPUE was higher in the Chowade River (26.1 fish/hour) when compared to Cypress Creek (16.9 fish/hour; Table 7). In total, 66 immature Bull Trout were caught in Turnoff Creek. The CPUE of this life stage in Turnoff Creek (27.1 fish/hour) was similar to the Chowade River (26.1 fish/hour). Substantially more immature Bull Trout were captured in Fiddes Creek (*n* = 185) when compared to Turnoff Creek (*n* = 66), despite more effort being employed in Turnoff Creek (2.438 hours) when compared to Fiddes Creek (1.674 hours; Appendix B, Table B1). Immature Bull Trout CPUE was five-fold higher in Fiddes Creek (110.5 fish/hour; Table 7) when compared to the overall CPUE for the remaining three tributaries combined (21.1 fish/hour; Appendix B, Table B1).

Bull Trout YOY were recorded in all four of the tributaries sampled, with higher CPUEs occurring in the Chowade River (8.5 fish/hour) and Fiddes Creek (7.8 fish/hour) and lower CPUE occurring in Cypress Creek (2.8 fish/hour) and Turnoff Creek (1.2 fish/hour; Table 7). Bull Trout YOY ranged in length between 32 and 55 mm FL. None of the Bull Trout YOY captured in 2017 were tagged.

Length-frequency histograms for Bull Trout (Figure 1) show a mode between approximately 30 and 60 mm FL and between approximately 70 and 110 mm FL, corresponding to the age-0 (YOY) and age-1 cohorts, respectively. These two modes were evident in all four of the sample tributaries. A third mode at approximately 140 to 160 mm FL likely corresponds to age-2 and older fish. This mode was not evident in the Chowade River and was less pronounced in Cypress, Fiddes, and Turnoff creeks when compared to the age-0 and age-1 modes. Bull Trout YOY (i.e., Bull Trout less than 56 mm FL) were smaller in Fiddes Creek (average = 38.5 mm FL) when compared to Bull Trout YOY in the Chowade River (average = 42.1 mm FL), Cypress Creek (average = 43.6 mm FL), and Turnoff Creek (average = 42.0 mm FL).

Overall (all four streams combined), 98.4% of the Bull Trout captured during the 2017 survey were less than 200 mm FL and when tagged, were implanted with a 12 mm PIT tag.

Most (79%) of the Bull Trout encountered during the 2017 survey were less than 120 mm FL and therefore too small for field crews to safely collect fin rays from. Bull Trout less than 120 mm FL are expected to be age-0 and age-1. Ages were assigned to 110 of the 161 Bull Trout captured in 2017 that were large enough for field personnel to safely collect fin rays from (Table 8). Ages ranged from age-2 to age-6; however, the majority (79%) were age-2 (Figure 2). The low number of older Bull Trout in the catch was expected and is partially due to the study specifically targeting immature life stages through backpack electrofishing. The growth curve suggests that age-6 Bull Trout had not yet reached their asymptotic length (Figure 3). The length-at-age data indicate overlapping length distributions beginning at age-2 (Figure 4), a result supported by the length-frequency histograms (Figure 1).

Four Rainbow Trout were captured in the Chowade River during the 2017 survey. All four were classified as adults with fork lengths ranging between 253 and 383 mm. One of these fish was age-3 (253 mm FL) and two were age-4 (351 and 383 mm FL). An age could not be determined for the last adult Rainbow Trout (361 mm FL). All four of the Rainbow Trout encountered in the Chowade River were implanted with PIT tags. Six Rainbow Trout were captured in Cypress Creek during the 2017 survey. All six were classified as age-3. Fork lengths ranged between 223 and 320 mm FL. Four of the six Rainbow Trout encountered in Cypress Creek were implanted with PIT tags. The remaining two succumbed to sampling.

Non-target species caught incidentally during the 2017 survey included 4 Mountain Whitefish and 243 Slimy Sculpin (Table 7). Mountain Whitefish were captured in the Chowade River (*n* = 3) and Cypress Creek (*n* = 1), but were not captured in Fiddes or Turnoff creeks. Slimy Sculpin also were captured in the Chowade River (*n* = 105) and Cypress Creek (*n* = 138), but were not captured in Fiddes or Turnoff creeks.

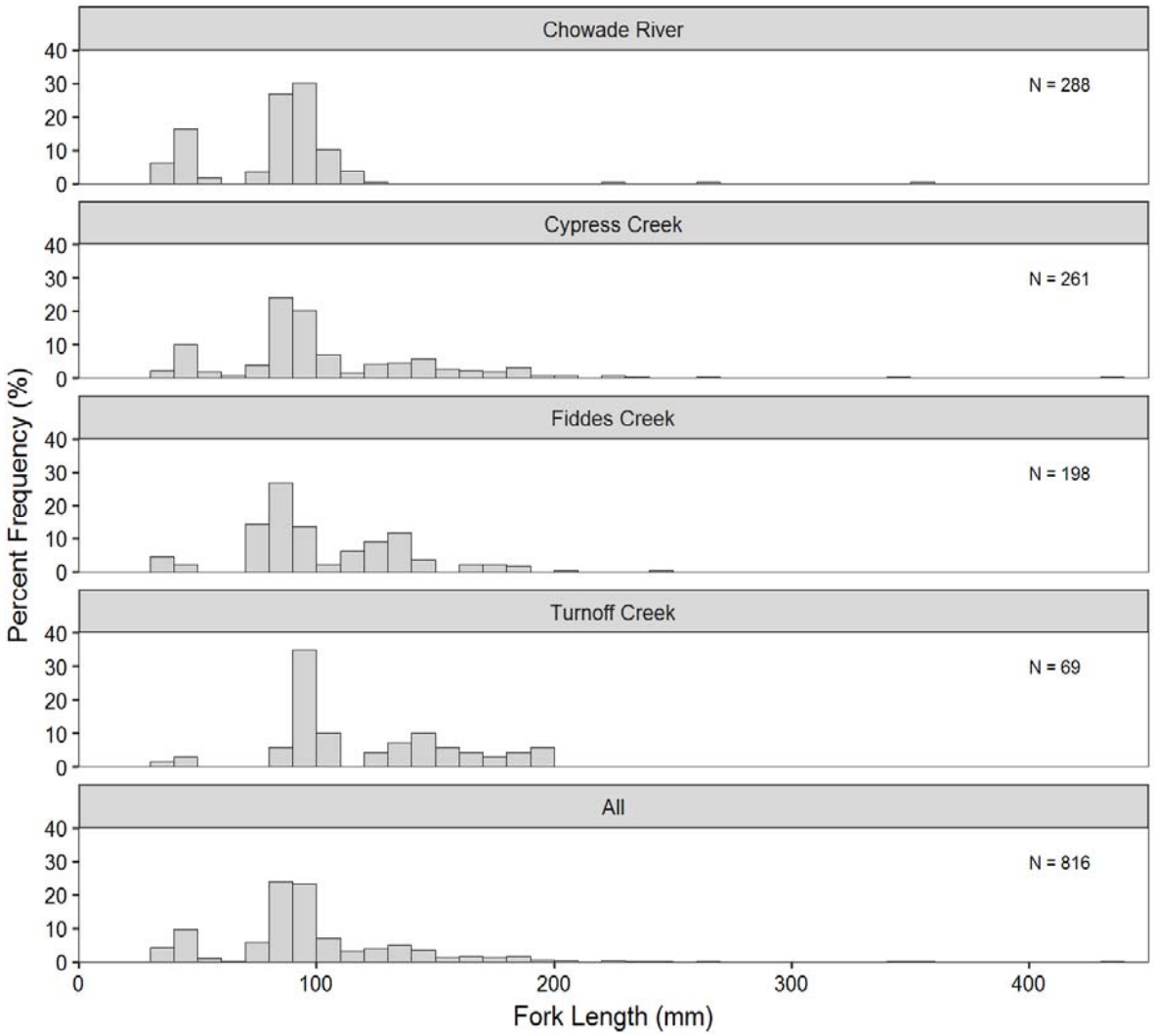

Figure 1: Length-frequency distribution for Bull Trout captured by backpack electrofishing in the Chowade River and Cypress, Fiddes, and Turnoff creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

Table 8: Average fork length by age for Bull Trout captured in the Chowade River and Cypress, Fiddes, and Turnoff creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017. Age-0 and age-1 fish were assigned ages based only on their fork lengths

Age	Chowade River			Cypress Creek			Fiddes Creek			Turnoff Creek		
	Average FL ± SD	Range	*n*[a]	Average FL ± SD	Range	*n*[a]	Average FL ± SD	Range	*n*[a]	Average FL ± SD	Range	*n*[a]
0	42 ± 4	34 – 55	70	44 ± 5	32 – 54	37	38 ± 2	34 – 44	13	42 ± 3	39 – 44	3
1	91 ± 8	73 – 121	206	90 ± 8	64 – 110	147	85 ± 8	70 – 110	113	96 ± 5	86 – 106	35
2				138 ± 9	122 – 162	39	136 ± 13	122 – 177	33	154 ± 23	125 – 195	16
3				182 ± 9	160 – 200	12	184 ± 16	161 – 206	5			
4	265	–	1	230	–	1	247	–	1			
5	355	–	1									
6				345		1						

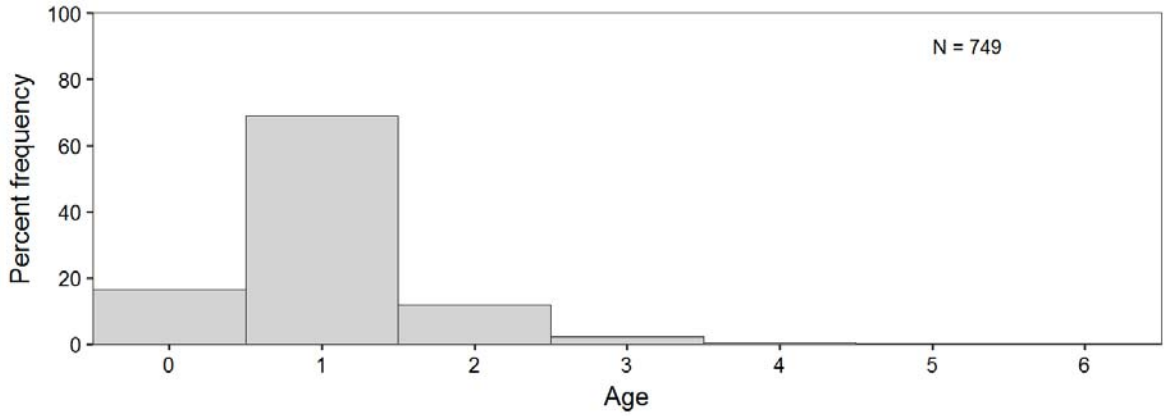

Figure 2: **Age-frequency distribution for Bull Trout captured in the Chowade River and Cypress, Fiddes, and Turnoff creeks combined during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017. Age-0 and age-1 fish were assigned ages based only on their fork lengths.**

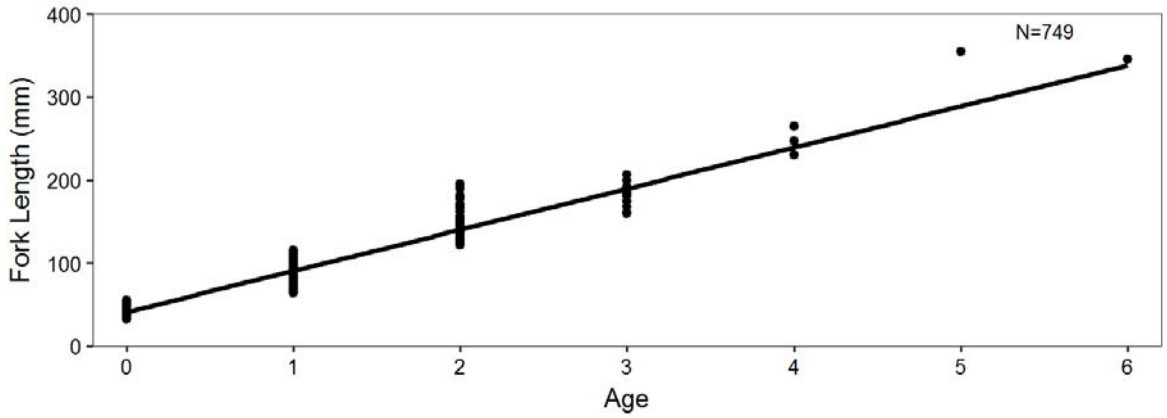

Figure 3: **Growth curve for Bull Trout captured in the Chowade River and Cypress, Fiddes, and Turnoff creeks combined during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017. Linear regression was used to describe the growth between age-classes because a von Bertalanffy model did not converge due to the low number of older fish in the *sample (y=53.1x + 32.7;* P*<0.0001;* R^2*=0.82). Age-0 and age-1 fish were assigned ages based only on their fork lengths.***

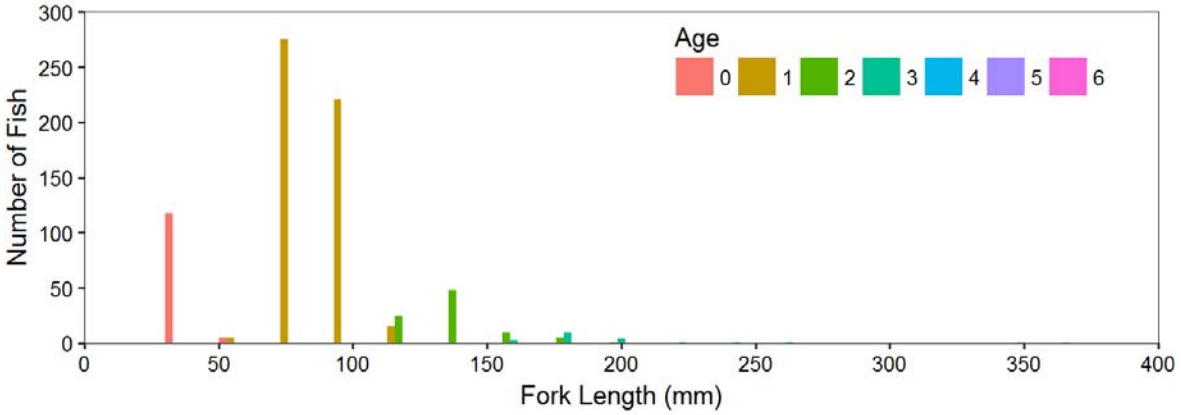

Figure 4: Length-frequency by age-class for Bull Trout captured in the Chowade River, and Cypress, Fiddes, and Turnoff creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017. Bars show the number of fish in each 20 mm bin. Age-0 and age-1 fish were assigned ages based only on their fork lengths.

3.1.1 Summary of Movement Data

Fish implanted with PIT tags as part of the current program (Mon-1b, Task 2c) could be detected by the Chowade River and Cypress Creek PIT arrays installed as part of Mon-1b, Task 2b (Ramos-Espinoza 2018) and could also be captured during boat electroshocking surveys conducted as part of the Peace River Large Fish Indexing Survey (Mon-2, Task 2a; Golder in prep.). The below summary represents a compilation of movement data collected for fish initially tagged as part of Mon-2, Task 2a or Mon-1b, Task 2c and detected at either the Chowade River or Cypress Creek PIT arrays in 2017.

Each PIT array has an upstream and downstream antenna. If a fish was first detected at an upstream antenna and then at a downstream antenna, it was assumed that the fish was travelling in a downstream direction. Similarly, if a fish was first detected at a downstream antenna and then detected at an upstream antenna, it was assumed that the fish was travelling upstream. During periods when only one antenna was operational at an array, video data were used to assign a direction of movement when possible.

Between 19 August and 2 October 2017, 56 different PIT tags were detected at the arrays (Ramos-Espinoza 2018). No tags initially released in Cypress Creek were detected at the Chowade River array and no tags initially released in the Chowade River were detected at the Cypress Creek array.

HDX PIT tags were deployed in the Peace River in 2016 and 2017 only. However, some fish encountered during Mon-2, Task 2a surveys were implanted with Full Duplex (FDX) tags prior to the 2016 field season and implanted with HDX tags during subsequent encounters. For these fish, their historical encounters based on their FDX tag are also included in the below summaries.

3.1.1.1 Chowade River Array Summary

One tag that was detected at the Chowade River array did not have any corresponding release data; its origin is unknown. The remaining 32 detections at the Chowade River array during the 2017 study period included 10 Bull Trout (Table 9) and 22 Rainbow Trout (Table 10) (Ramos-Espinoza 2018).

In 2016, 17 Bull Trout from the Chowade River were implanted with PIT tags. Of these 17 fish, 7 were classified as age-2 or younger based on their fork length (i.e., less than approximately 200 mm FL). None of these seven fish were detected by the Chowade River array in 2017. The remaining 10 Bull Trout that were tagged in the Chowade River in 2016 were classified as adults (i.e., larger than approximately 350 mm FL). Of those 10 fish, 3 (30%) were detected by the Chowade River array in 2017 (Table 9).

None of the 208 Bull Trout tagged in the Chowade River during the 2017 field program (Table 7) were recorded by the Chowade River array in 2017.

Seven Bull Trout detected at the Chowade River array in 2017 were initially tagged in the Peace River as part of the Peace River Fish Index Program (Mon-2, Task 2a). Of those seven fish, six were initially tagged in 2016. The remaining fish was initially tagged in 2015 with an FDX PIT tag and subsequently recaptured in 2016 and implanted with an HDX PIT tag.

Three Bull Trout were initially tagged in the Peace River in September 2016 upstream of the Halfway River's confluence with the Peace River (Section 1; Golder and Gazey 2017). These three fish travelled downstream approximately 39 km to enter the Halfway River, then travelled upstream 127 km to enter the Chowade River, and then travelled upstream an additional 21 km to reach the Chowade River array (total distance travelled approximately 187 km). A single Bull Trout was initially tagged in the Peace River approximately 7 km downstream of the Halfway River confluence (Section 3; Golder and Gazey 2017). It travelled upstream approximately 155 km to reach the Chowade River array. A single Bull Trout was initially tagged in the Peace River 48 km downstream of the Halfway River confluence (Section 5; Golder and Gazey 2017). It travelled upstream 196 km to reach the Chowade River array. In 2016, one Bull Trout was captured in the Many Islands area in Alberta (Section 9; Golder and Gazey 2017), approximately 152 km downstream of the Halfway River's confluence with the Peace River. This fish moved upstream a total of 300 km to reach the Chowade River array. The remaining Bull Trout was initially encountered in the Many Islands area in Alberta in early October 2015, recaptured in the same area in late September 2016, and recorded at the Chowade River array in early September 2017. It travelled upstream approximately 299 km between late September 2016 and early September 2017.

Four of the seven Bull Trout that were initially encountered in the Peace River in 2015 or 2016 and recorded at the Chowade River array in 2017 were recorded in the Peace River downstream of the Project.

Of the 65 Rainbow Trout tagged in the Chowade River in 2016 (Golder 2017), 19 (29%) were detected by the Chowade River array in 2017 (Table 10). Of the four Rainbow Trout tagged in the Chowade River in 2017 (Table 7), three (75%) were detected by the array in 2017. In total, 22 Rainbow Trout were detected by the Chowade River array. Of these, 20 were recorded travelling downstream and one was recorded travelling upstream; the direction of travel of the remaining Rainbow Trout could not be determined.

Table 9: Encounter history summary for Bull Trout detected at the Chowade River PIT array (Mon-1b, Task 2b) between 19 August and 2 October 2017. PIT array data summarized from Ramos-Espinoza (2018)

Tag Number	Encounter Date	Program	Fork Length (mm)	Stream	River Km[a]	Direction of Travel
900230000030477	8-Sep-2016	Mon-2b, Task 2a	439	Peace River	27.0	n/a
	16-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000123935	15-Sep-2016	Mon-2b, Task 2a	552	Peace River	25.2	n/a
	23-Sep-2016	Mon-2b, Task 2a	555	Peace River	25.3	n/a
	10-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Upstream
900230000124427	23-Aug-2016	Mon-1b, Task 2c	450	Chowade River	24.3	n/a
	20-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000125263	24-Aug-2016	Mon-1b, Task 2c	463	Chowade River	34.0	n/a
	13-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000125313	23-Sep-2016	Mon-2b, Task 2a	549	Peace River	30.5	n/a
	19-Aug-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
	20-Aug-2017	Mon-1b, Task 2b		Chowade River	21.0	Unknown[b]
	21-Aug-2017	Mon-1b, Task 2b		Chowade River	21.0	Unknown[b]
	22-Aug-2017	Mon-1b, Task 2b		Chowade River	21.0	Upstream
	5-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
	6-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Unknown[b]
	7-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Upstream
	22-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000125500	30-Sep-2016	Mon-2b, Task 2a	922	Peace River	218.1	n/a
	23-Aug-2017	Mon-1b, Task 2b		Chowade River	21.0	Upstream
	23-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000125631	23-Aug-2016	Mon-1b, Task 2c	380	Chowade River	36.1	n/a
	30-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Unknown[b]
900230000125710[c]	4-Oct-2015	Mon-2b, Task 2a	650	Peace River	219.5	n/a
	21-Sep-2016	Mon-2b, Task 2a	690	Peace River	217.7	n/a
	9-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Upstream
900230000125735	24-Sep-2016	Mon-2b, Task 2a	571	Peace River	73.1	n/a
	15-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000126029	2-Sep-2016	Mon-2b, Task 2a	573	Peace River	114.1	n/a
	26-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream

[a] River Km values for the Chowade River are measured upstream from the Chowade River's confluence with the Halfway River. The Chowade River enters the Halfway River approximately 127 km upstream from the Halfway River's confluence with the Peace River. River Km values for the Peace River are measured downstream from WAC Bennett Dam (River Km 0.0).

[b] This fish was detected at a single antenna and its direction of travel could not be confirmed using video data.

[c] This fish was implanted with an FDX tag (Tag Number 981098104937812) when it was encountered on 4 October 2015 and implanted with an HDX tag (Tag Number 900230000125710) when it was encountered on 21 September 2016.

Table 10: Encounter history summary for Rainbow Trout detected at the Chowade River PIT array (Mon-1b, Task 2b) between 19 August and 2 October 2017. PIT array data summarized from Ramos-Espinoza (2018)

Tag Number	Encounter Date	Program	Fork Length (mm)	Stream	River Km[a]	Direction of Travel
900228000540872	23-Aug-2016	Mon-1b, Task 2c	284	Chowade River	38.7	n/a
	19-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900228000541227	20-Aug-2016	Mon-1b, Task 2c	310	Chowade River	47.4	n/a
	20-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900228000541400	23-Aug-2016	Mon-1b, Task 2c	280	Chowade River	38.7	n/a
	23-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900228000541567	23-Aug-2016	Mon-1b, Task 2c	247	Chowade River	36.5	n/a
	11-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900228000541598	24-Aug-2016	Mon-1b, Task 2c	280	Chowade River	35.2	n/a
	26-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900228000541890	23-Aug-2016	Mon-1b, Task 2c	295	Chowade River	38.7	n/a
	21-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000032543	28-Jul-2017	Mon-1b, Task 2c	361	Chowade River	49.5	n/a
	23-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000032604	30-Jul-2017	Mon-1b, Task 2c	351	Chowade River	36.6	n/a
	20-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000032631	30-Jul-2017	Mon-1b, Task 2c	383	Chowade River	43.3	n/a
	19-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000124122	19-Aug-2016	Mon-1b, Task 2c	376	Chowade River	48.9	n/a
	23-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000124182	24-Aug-2016	Mon-1b, Task 2c	361	Chowade River	35.2	n/a
	1-Oct-2017	Mon-1b, Task 2b		Chowade River	21.0	Unknown[b]
900230000124312	22-Aug-2016	Mon-1b, Task 2c	393	Chowade River	42.4	n/a
	24-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000124414	19-Aug-2016	Mon-1b, Task 2c	390	Chowade River	49.8	n/a
	9-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000124457	24-Aug-2016	Mon-1b, Task 2c	338	Chowade River	35.2	n/a
	23-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000124847	19-Aug-2016	Mon-1b, Task 2c	364	Chowade River	49.8	n/a
	18-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000124930	23-Aug-2016	Mon-1b, Task 2c	313	Chowade River	38.7	n/a
	12-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000124980	20-Aug-2016	Mon-1b, Task 2c	317	Chowade River	47.4	n/a
	20-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000125079	19-Aug-2016	Mon-1b, Task 2c	353	Chowade River	49.8	n/a
	23-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000125273	24-Aug-2016	Mon-1b, Task 2c	316	Chowade River	34.0	n/a
	20-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000125778	19-Aug-2016	Mon-1b, Task 2c	348	Chowade River	49.8	n/a
	20-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000125781	23-Aug-2016	Mon-1b, Task 2c	382	Chowade River	38.7	n/a
	21-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Downstream
900230000125867	18-Aug-2016	Mon-1b, Task 2c	397	Chowade River	51.9	n/a
	5-Sep-2017	Mon-1b, Task 2b		Chowade River	21.0	Upstream

[a] River Km values for the Chowade River are measured upstream from the Chowade River's confluence with the Halfway River. The Chowade River enters the Halfway River approximately 127 km upstream from the Halfway River's confluence with the Peace River. River Km values for the Peace River are measured downstream from WAC Bennett Dam (River Km 0.0).

[b] This fish was detected at a single antenna and its direction of travel could not be confirmed using video data.

3.1.1.2 Cypress Creek Array Summary

During the 2017 study period, 23 tags were detected at the Cypress Creek array; these included 13 Bull Trout (Table 11) and 10 Rainbow Trout (Table 12) (Ramos-Espinoza 2018).

In 2016, 42 Bull Trout from Cypress Creek were implanted with PIT tags (Golder 2017). Of these 42 fish, 7 (17%) were detected by the Cypress Creek array in 2017. Of the 207 Bull Trout tagged in Cypress Creek during the 2017 field program (Table 7), five (2%) were recorded by the array in 2017.

An adult Bull Trout that was recorded in the Peace River downstream of the Beatton River's confluence (Section 7; Golder and Gazey 2017) in mid-September 2016 was detected by the Cypress Creek array in early September 2017. This fish travelled approximately 246 km upstream to reach the Cypress Creek array.

Table 11: Encounter history summary for Bull Trout detected at the Cypress Creek PIT array (Mon-1b, Task 2b) between 19 August and 2 October 2017. PIT array data summarized from Ramos-Espinoza (2018)

Tag Number	Encounter Date	Program	Fork Length (mm)	Stream	River Km[a]	Direction of Travel
900226000172956	1-Aug-2017	Mon-1b, Task 2c	140	Cypress Creek	34.7	n/a
	21-Aug-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900226000173105	25-Aug-2016	Mon-1b, Task 2c	156	Cypress Creek	58.7	n/a
	21-Aug-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900226000173133	25-Aug-2016	Mon-1b, Task 2c	160	Cypress Creek	58.4	n/a
	17-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900226000173279	25-Aug-2016	Mon-1b, Task 2c	154	Cypress Creek	58.4	n/a
	1-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900226000980296	2-Aug-2017	Mon-1b, Task 2c	95	Cypress Creek	33.8	n/a
	13-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900226000980480	3-Aug-2017	Mon-1b, Task 2c	181	Cypress Creek	28.2	n/a
	21-Aug-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900228000295457	25-Aug-2016	Mon-1b, Task 2c	281	Cypress Creek	33.0	n/a
	7-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Downstream
900230000030369	25-Aug-2016	Mon-1b, Task 2c	389	Cypress Creek	33.0	n/a
	2-Oct-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Downstream
900230000032027	1-Aug-2017	Mon-1b, Task 2c	345	Cypress Creek	35.6	n/a
	9-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Downstream
900230000033725	1-Aug-2017	Mon-1b, Task 2c	430	Cypress Creek	34.7	n/a
	22-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Downstream
900230000124126	25-Aug-2016	Mon-1b, Task 2c	433	Cypress Creek	29.1	n/a
	14-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900230000124832	6-Aug-2016	Mon-1b, Task 2c	342	Cypress Creek	19.5	n/a
	12-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900230000127139	14-Sep-2016	Mon-1b, Task 2c	564	Peace River	147.2	n/a
	8-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Downstream

[a] River Km values for Cypress Creek are measured upstream from the Cypress Creek's confluence with the Halfway River. Cypress Creek enters the Halfway River approximately 144 km upstream from the Halfway River's confluence with the Peace River. River Km values for the Peace River are measured downstream from WAC Bennett Dam (River Km 0.0).

[b] This fish was detected at a single antenna and its direction of travel could not be confirmed using video data.

The direction that Bull Trout were travelling when they were detected by the Cypress Creek array could only be determined for 5 of 23 individuals (22%); all five were travelling downstream.

Of the 29 Rainbow Trout tagged in Cypress Creek in 2016 (Golder 2017), seven (24%) were detected by the Cypress Creek array in 2017 (Table 12).

A Rainbow Trout that was tagged in the Halfway River in late August 2016 was detected by the Cypress Creek array in mid-September 2017. This fish travelled 97 km downstream in the Halfway River to reach the Cypress Creek's confluence, then travelled 18 km upstream in Cypress Creek to reach the array, covering a distance of approximately 115 km over a 1-year period.

Of the four Rainbow Trout tagged in Cypress Creek in 2017 (Table 7), two (50%) were detected by the array in 2017.

The direction that Rainbow Trout were travelling when they were detected by the Cypress Creek array could only be determined for 4 of 20 individuals encountered in 2017 (20%); all four were travelling downstream.

Table 12: Encounter history summary for Rainbow Trout detected at the Chowade River PIT array (Mon-1b, Task 2b) between 19 August and 2 October 2017. PIT array data summarized from Ramos-Espinoza (2018)

Tag Number	Encounter Date	Program	Fork Length (mm)	Stream	River Km[a]	Direction of Travel
900226000173081	24-Aug-2016	Mon-1b, Task 2c	193	Cypress Creek	35.6	n/a
	5-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900226000173180	6-Aug-2016	Mon-1b, Task 2c	160	Cypress Creek	19.8	n/a
	7-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900228000294970	3-Aug-2017	Mon-1b, Task 2c	272	Cypress Creek	29.5	n/a
	16-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900228000295082	3-Aug-2017	Mon-1b, Task 2c	312	Cypress Creek	29.5	n/a
	7-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900228000295317	25-Aug-2016	Mon-1b, Task 2c	245	Cypress Creek	33.0	n/a
	19-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Downstream
900228000295368	25-Aug-2016	Mon-1b, Task 2c	209	Cypress Creek	28.6	n/a
	17-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Downstream
900228000295452	25-Aug-2016	Mon-1b, Task 2c	239	Cypress Creek	33.4	n/a
	12-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900228000541735	24-Aug-2016	Mon-1b, Task 2c	232	Cypress Creek	34.6	n/a
	15-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Unknown[b]
900230000031276	25-Aug-2016	Mon-1b, Task 2c	352	Cypress Creek	33.8	n/a
	30-Aug-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Downstream
900230000125822	28-Aug-2016	Mon-1b, Task 2c	347	Halfway River	241.1	n/a
	14-Sep-2017	Mon-1b, Task 2b		Cypress Creek	18.0	Downstream

[a] River Km values for Cypress Creek are measured upstream from the Cypress Creek's confluence with the Halfway River. Cypress Creek enters the Halfway River approximately 144 km upstream from the Halfway River's confluence with the Peace River. River Km values for the Peace River are measured downstream from WAC Bennett Dam (River Km 0.0).
[b] This fish was detected at a single antenna and its direction of travel could not be confirmed using video data.

3.2 Tributaries Targeting Rainbow Trout

In 2017, Rainbow Trout were the primary target species for sampling conducted in Colt, Farrell, and Kobes creeks. The highest number of Rainbow Trout were captured in Colt Creek (*n* = 107), followed by Kobes Creek (*n* = 87) and Farrell Creek (*n* = 69) (Table 13 and Appendix B, Table B6). Of these 263 Rainbow Trout, 198 were implanted with PIT tags. Rainbow Trout that were not tagged were either unhealthy (i.e., unlikely to survive the tagging process; *n* = 5) or too small to receive a PIT tag (i.e., less than 80 mm FL; *n* = 60).

Table 13: Number of fish caught and tagged in Colt, Farrell, and Kobes creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017

Species	Life Stage[a]	Colt Creek			Farrell Creek			Kobes Creek			Total		
		# Captured	# Tagged	CPUE (#/hour)	# Captured	# Tagged	CPUE (#/hour)	# Captured	# Tagged	CPUE (#/hour)	# Captured	# Tagged	CPUE (#/hour)
Target Species													
Arctic Grayling	Adult												
	Imm.												
	YOY	2	0	0.6							**2**	**0**	**0.2**
Bull Trout	Adult	1	1	0.3							**1**	**1**	**0.1**
	Imm.	2	2	0.6							**2**	**2**	**0.2**
	YOY												
Rainbow Trout	Adult												
	Imm.	103	86	29.1	40	40	9.6	76	72	25.9	**219**	**198**	**20.6**
	YOY	4	0	1.1	29	0	7.0	11	0	3.8	**44**	**0**	**4.1**
Non-Target													
Lake Chub	All				67	0	16.1	71	0	24.2	**138**	**0**	**13.0**
Largescale Sucker	All				34	0	8.2	1	0	0.3	**35**	**0**	**3.3**
Longnose Dace	All	48	0	13.6	156	0	37.5	140	0	47.7	**344**	**0**	**32.4**
Longnose Sucker	All	22	0	6.2	50	0	12.0	31	0	10.6	**103**	**0**	**9.7**
Mountain Whitefish	All	7	0	2.0							**7**	**0**	**0.7**
Northern Pikeminnow	All				8	0	1.9				**8**	**0**	**0.8**
Redside Shiner	All				151	0	36.3	28	0	9.5	**179**	**0**	**16.8**
Slimy Sculpin	All	613	0	173.3	103	0	24.8	981	0	334.5	**1697**	**0**	**159.7**
Sucker Species	All				11	0	2.6	3	0	1.0	**14**	**0**	**1.3**
Trout-Perch	All				18	0	4.3				**18**	**0**	**1.7**

[a] Life stage was assigned based on fork length. Fish were classified as adult when longer than 249 mm FL and immature when less than 250 mm FL. The maximum size of YOY fish varied by species and was selected based on modes observed in length-frequency histograms and corroborated with length-at-age data when possible.

Backpack electrofishing is effective at capturing smaller-bodied fish but less effective at capturing larger-bodied fish. The lack of adult Rainbow Trout encountered during the 2017 survey is largely due to the capture methods employed and should not be considered as evidence that these tributaries were not used by adult Rainbow Trout during the study period.

CPUE of immature Rainbow Trout was similar in Colt Creek (29.1 fish/hour) and Kobes Creek (25.9 fish/hour), and was greater than two-fold higher than the CPUE in Farrell Creek (9.6 fish/hour; Table 13). Despite immature Rainbow Trout being less common in Farrell Creek, YOY Rainbow Trout CPUE was highest in Farrell Creek (7.0 fish/hour). YOY Rainbow Trout CPUE in Kobes and Colt creeks were 3.8 and 1.1 fish/hour, respectively.

YOY Rainbow Trout ranged in length between 31 and 50 mm FL. YOY Rainbow Trout captured in 2017 were not tagged due to their small size.

Length-frequency histograms for Rainbow Trout (Figure 5) show a mode between approximately 30 and 60 mm FL and between approximately 70 and 110 mm FL, corresponding to the age-0 (YOY) and age-1 cohorts, respectively. The age-0 mode was less evident in data collected from Colt Creek and the age-1 mode was less evident in data collected from Farrell Creek. Based on length-frequency data, length distributions of age-1 and age-2 Rainbow Trout overlap. YOY Rainbow Trout (i.e., Rainbow Trout less than 51 mm FL) were slightly larger in Farrell Creek (average = 42 mm FL) compared to Colt Creek (average = 37 mm FL) and Kobes Creek (average = 39 mm FL). Most (67%) of the Rainbow Trout encountered during the 2017 survey were less than 120 mm FL and largely represent the age-0 and age-1 cohorts.

Ages were assigned to 196 of the Rainbow Trout captured in 2017 (Table 14) and ranged from age-1 to age-3. An additional 44 Rainbow Trout less than 50 mm FL were assumed to be age-0 (YOY) based on length alone and were included in age-related analyses (Figure 6). The von Bertalanffy growth curve suggests that the Rainbow Trout encountered during the 2017 survey had not yet reached their asymptotic length (Figure 7). Length distributions overlapped for most of the individual age-classes (Figure 8) beginning at age-1. This result is supported by modes in Rainbow Trout length-frequency histograms (Figure 5).

Two Arctic Grayling, measuring 56 and 57 mm FL, were captured in Colt Creek. Both of these fish were YOY based on scale sample analysis. Arctic Grayling were not captured in Farrell or Kobes creeks.

Three Bull Trout were captured in Colt Creek. One Bull Trout measuring 97 mm FL was likely age-1. A Bull Trout measuring 280 mm FL was age-5 and a Bull Trout measuring 210 mm FL could not be assigned an age. Based on its length, it was likely age-3 or older. All three of the Bull Trout captured in Colt Creek were implanted with PIT tags. Bull Trout were not captured in Farrell or Kobes creeks.

Non-target species captured in these three streams during the 2017 survey, in declining order of abundance, included Slimy Sculpin (*n* = 1697), Longnose Dace (*Rhinichthys cataractae*; *n* = 344), Redside Shiner (*Richardsonius balteatus*; *n* = 179), Lake Chub (*Couesius plumbeus*; *n* = 138), Longnose Sucker (*Catostomus catostomus*; *n* = 103), Largescale Sucker (*Catostomus macrocheilus*; *n* = 35), Trout-perch (*Percopsis omiscomaycus*, *n* = 18), unidentified sucker species (*n* = 14), Northern Pikeminnow (*Ptychocheilus oregonensis*; *n* = 8), and Mountain Whitefish (*n* = 7; Table 13). Mountain Whitefish were the only non-target salmonid species encountered and were recorded in Colt Creek only. Fork lengths of captured Mountain Whitefish ranged between 106 and 210 mm.

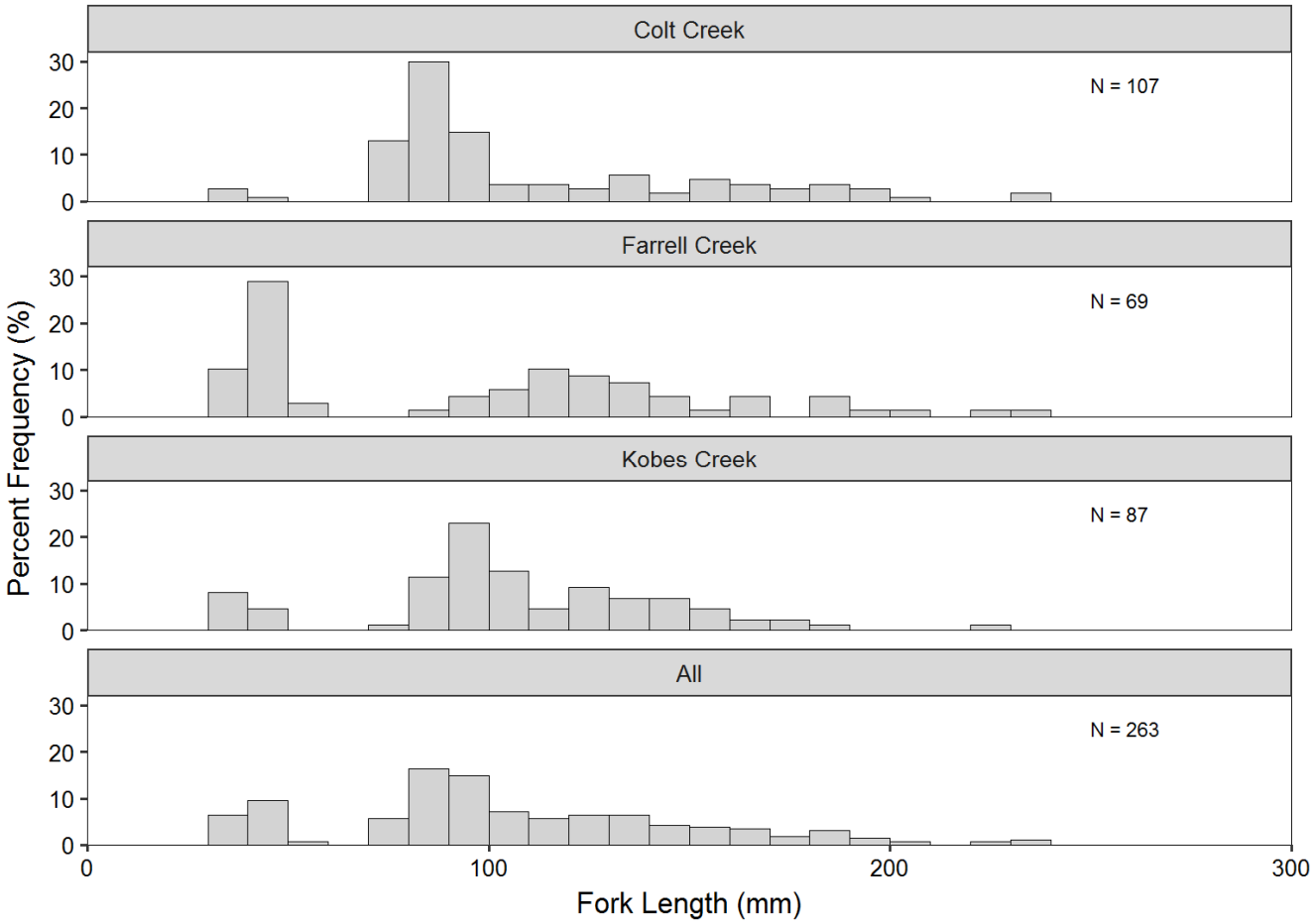

Figure 5: Length-frequency distribution for Rainbow Trout captured by backpack electrofishing in Colt, Farrell, and Kobes creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

Table 14: Average fork length by age for Rainbow Trout captured in Colt, Farrell, and Kobes creeks during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017

Age	Colt Creek			Farrell Creek			Kobes Creek		
	Average FL ± SD	Range	*n*[a]	Average FL ± SD	Range	*n*[a]	Average FL ± SD	Range	*n*[a]
0[a]	37 ± 4	32 – 40	4	42 ± 5	31 – 50	29	39 ± 4	33 – 47	11
1	93 ± 17	73 - 138	77	108 ± 14	81 - 134	17	102 ± 16	77 - 135	57
2	177 ± 18	141 - 202	15	150 ± 22	120 – 187	16	143 ± 19	119 - 177	8
3	238	-	1	215 ± 21	195 – 239	4	225	-	1

[a] Age-0 fish were assigned ages based on fork lengths alone; ages were not validated using scale samples.

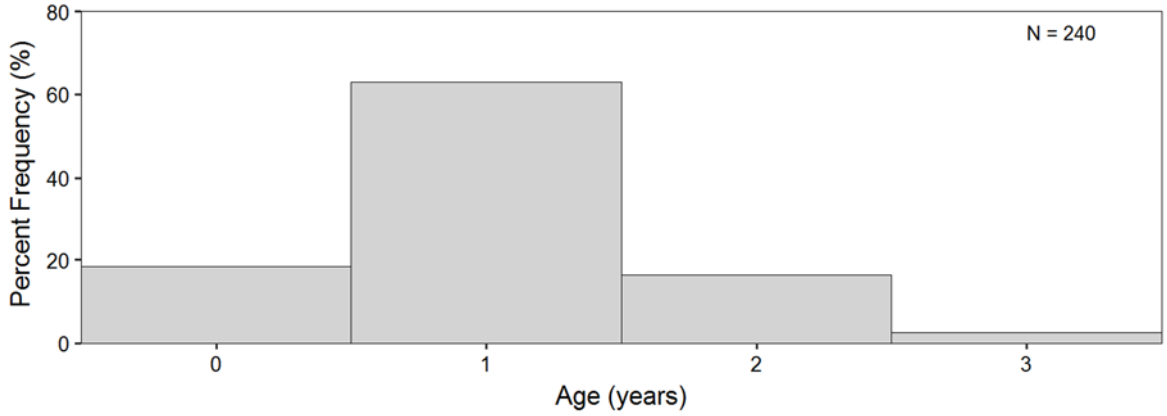

Figure 6: Age-frequency distribution for Rainbow Trout captured in Colt, Farrell, and Kobes creeks combined during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

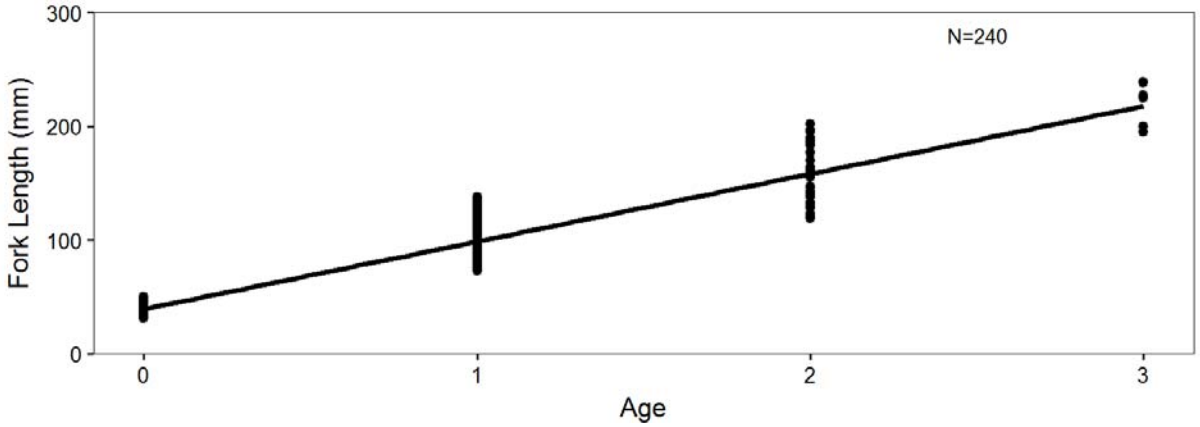

Figure 7: von Bertalanffy growth curve for Rainbow Trout captured in Colt, Farrell, and Kobes creeks combined during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017. Linear regression was used to describe the growth between age-classes because a von Bertalanffy model did not converge due to the limited number of older fish in *the sample (y=59.5x + 39.2;* P<*0.0001;* R^2=*0.85).*

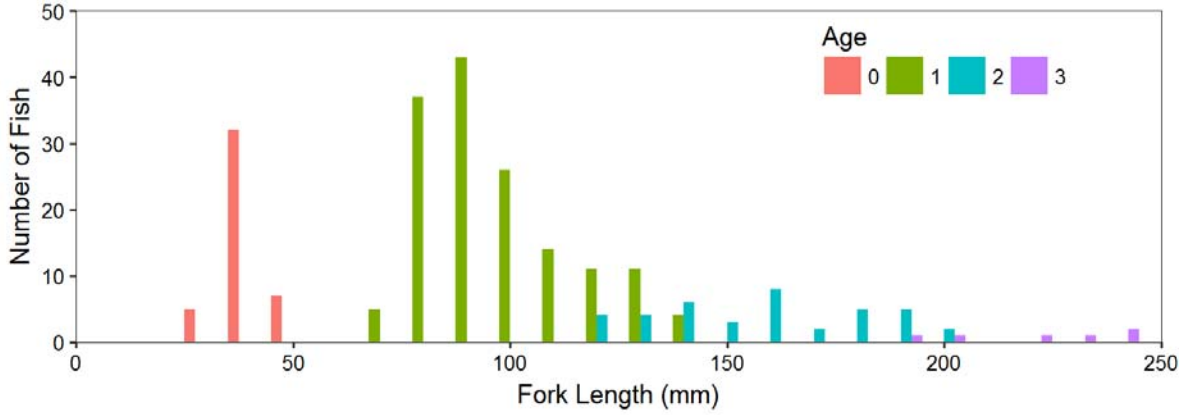

Figure 8: Length-frequency by age-class for Rainbow Trout captured in Colt, Farrell, and Kobes creeks combined during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017. Bars show the number of fish in each 20 mm bin.

3.3 Moberly River

3.3.1 Discharge

Over the course of the 2017 Moberly River study period, Moberly River discharge gradually declined and was substantially lower than discharges recorded during the 2016 study period (Figure 9). Between 2001 and 2015, discharge from late August to mid-September averaged 4.6 m^3/s. During this same seasonal time period, discharge in 2016 averaged 37.3 m^3/s and in 2017 averaged 1.1 m^3/s (Figure 9).

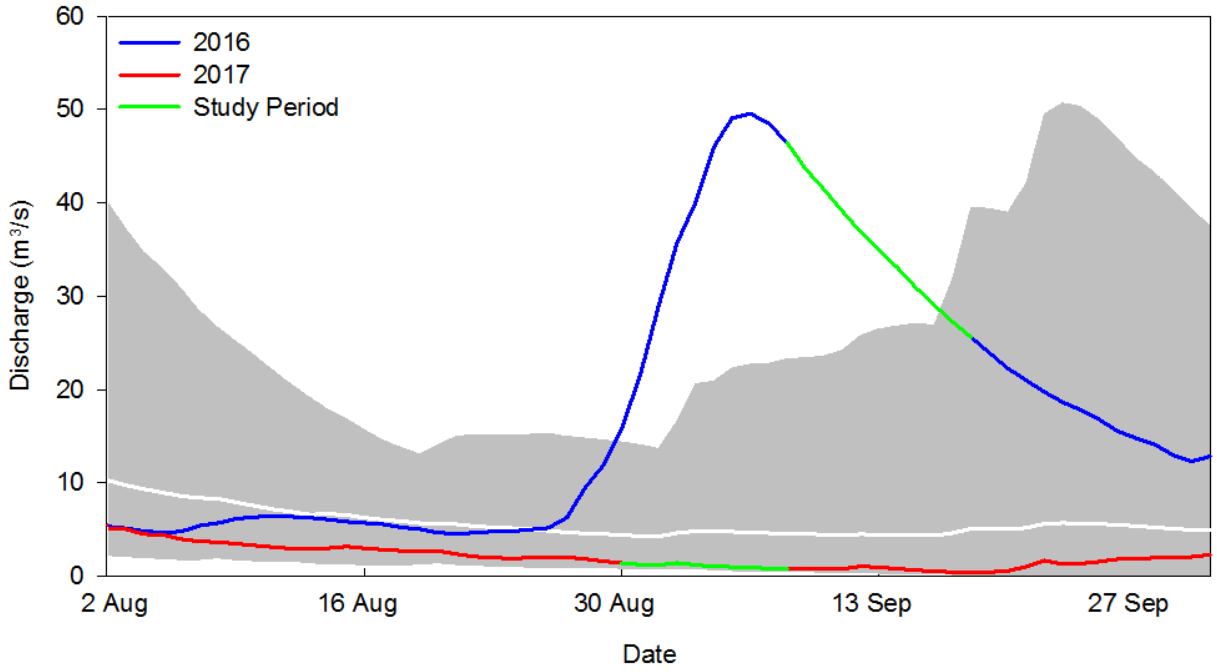

Figure 9: Mean daily discharge for the Moberly River at Water Survey of Canada gauging station 07FB008, 2 August to 30 September, 2016 and 2017. The shaded area represents minimum and maximum mean daily discharge values recorded at the station from 2001 to 2015. The white line represents average mean daily discharge values over the same time period.

3.3.2 Catch and Life History

Arctic Grayling were the primary target species for sampling conducted in the Moberly River. Only two Arctic Grayling were captured during the 2017 survey. One was captured by backpack electrofishing in Section 7 on 6 September 2017 near River Km 44.7. It had a fork length of 162 mm, weighed 43 g, and was age-1. The second Arctic Grayling was captured by angling (spin casting) in Section 10 on 8 September near River Km 10.7. It had a fork length of 257 mm, weighed 187 g, and was age-3. Both Arctic Grayling were implanted with PIT tags. A third Arctic Grayling was observed while angling near River Km 114.7, but it was not captured. Arctic Grayling were not captured by beach seining or small fish boat electroshocking. Due to the low number of Arctic Grayling encountered during the 2017 survey, additional life history summaries are not provided for this species.

One adult Rainbow Trout was captured in the Moberly River. It was captured by angling in Section 1 on 31 August near River Km 109.0 while the crew was travelling between sample sites. It had a fork length of 352 mm, weighed 481 g, was age-3, and was implanted with a PIT tag. Rainbow Trout were not captured using any other methods during the 2017 Moberly River survey. Bull Trout were not recorded in the Moberly River during the 2017 survey.

Non-target species comprised the majority of the catch for all methods and included, in declining order of abundance, Longnose Dace (*n* = 347), Redside Shiner (*n* = 212), Longnose Sucker (*n* = 206), Mountain Whitefish (*n* = 141), Slimy Sculpin (*n* = 140), Lake Chub (*n* = 56), Burbot (*n* = 39), Northern Pike (*n* = 23), Trout-Perch (*n* = 20), White Sucker (*Catostomus commersonii*; *n* = 14), Largescale Sucker (*n* = 11), Northern Pikeminnow (*n* = 4), Prickly Sculpin (*Cottus asper*; *n* = 1), and Walleye (*Sander vitreus*; *n* = 1). Species composition by section is presented in Appendix B, Table B7. CPUE was not calculated for the Moberly River because of the various capture methods used and the low catch of target species. A summary of catch by capture method for sportfish species is provided in Table 15.

Table 15: Number of sportfish caught and tagged in the Moberly River during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017

Species	Life Stage[a]	Angling		Backpack Electrofishing		Small Fish Boat Electroshocking		Total	
		Number Caught	Number Tagged	Number Caught	Number Tagged	Number Caught	Number Tagged	Number Caught	Number Tagged
Arctic Grayling	Adult	1	1	0	0	0	0	1	1
	Immature	0	0	1	1	0	0	1	1
Burbot	Adult	0	0	10	8	0	0	10	8
	Immature	0	0	7	5	1	0	8	5
	YOY	0	0	21	4	0	0	21	4
Mountain Whitefish	Adult	2	0	3	0	9	0	14	0
	Immature	0	0	79	0	48	0	127	0
Northern Pike	Adult	3	0	3	1	2	0	8	1
	Immature	0	0	15	0	0	0	15	0
Rainbow Trout	Adult	1	1	0	0	0	0	1	1
Walleye	Adult	1	1	0	0	0	0	1	1

[a] Life stage was assigned based on fork length. Fish were classified as adult when longer than 249 mm FL and immature when less than 250 mm FL. The maximum size of YOY fish varied by species and was selected based on modes observed in length-frequency histograms and corroborated with length-at-age data when possible.

Backpack electrofishing caught more fish than all other methods for most species and life stages. Exceptions included Trout-Perch, which were mostly captured by beach seining, and adult and immature Mountain Whitefish, which were mostly captured by small fish boat electroshocking. Although angling caught very few fish in total, some species or life stages were only captured by this method. These included adult Arctic Grayling, Rainbow Trout, and Walleye.

Length-frequencies are provided for Burbot and Mountain Whitefish because there were sufficient sample sizes for these species and they are key indicator species for other components of the Site C FAHMFP. The length-frequency histogram for Burbot suggests a mode representing YOY fish from 60 to 110 mm TL (Figure 10). Burbot larger than 110 mm TL ranged in length from 150 to 350 mm TL. The length-frequency histogram for Mountain Whitefish suggested a mode representing YOY fish from 70 to 120 mm FL, and a mode representing age-1 fish from 130 to 180 mm FL (Figure 11). The remaining Mountain Whitefish ranged in size up to 354 mm FL with no clear modes in the histogram, likely due to overlapping length distributions for the individual age classes and the small sample size.

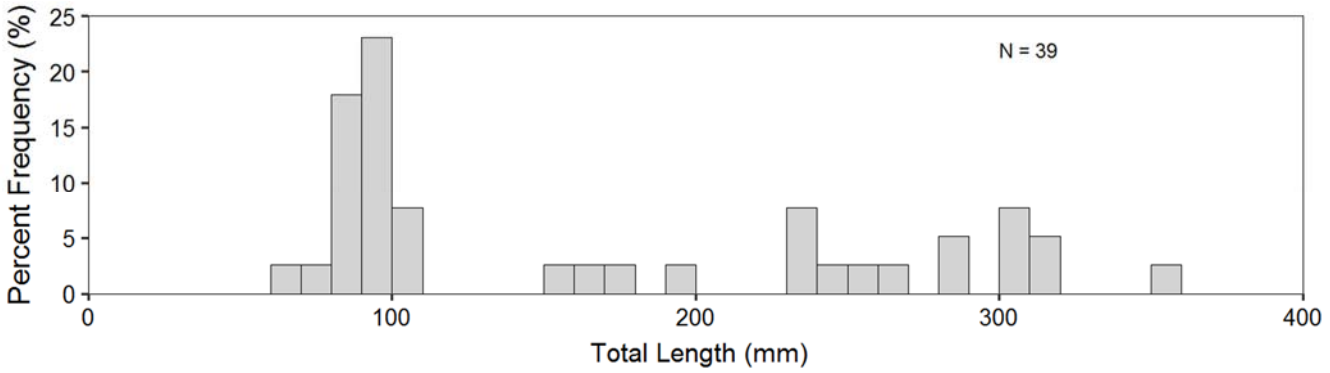

Figure 10: Length-frequency distribution for Burbot captured in the Moberly River (all capture methods combined) during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

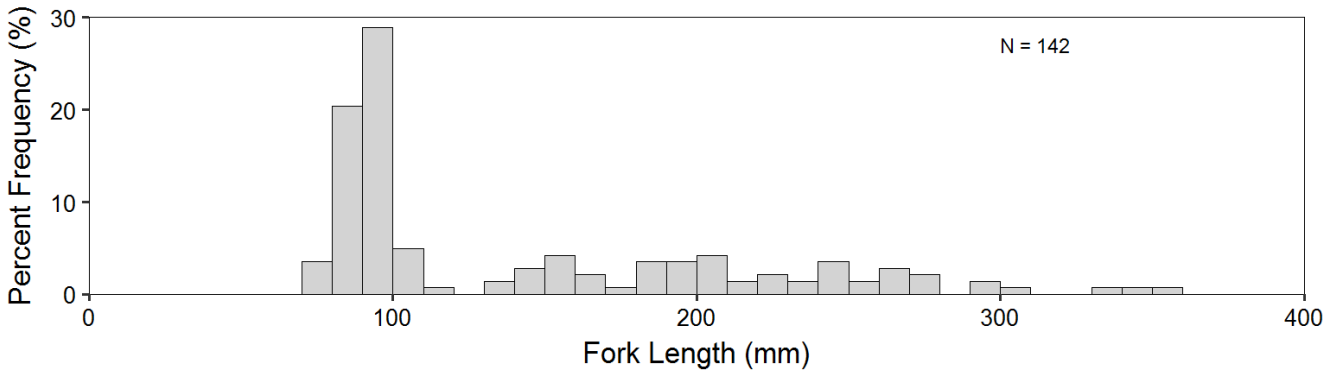

Figure 11: Length-frequency distribution for Mountain Whitefish captured in the Moberly River (all capture methods combined) during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

Data from the habitat assessments conducted at backpack electrofishing and beach seine sites are presented in Appendix C, Table C2.

4.0 DISCUSSION

The current program represented the second year of a multi-year monitoring program. The primary objective of the program is to collect data from Peace River fish populations that use tributaries situated within the future inundation zone of the Site C reservoir to fulfill portions of their life cycles. These data will be used to monitor population-level responses to the construction and operation of the Project. A secondary objective of the 2017 survey was to deploy PIT tags into fish to allow their movements to be monitored by other components of the Site C FAHMFP.

4.1 Tributaries Targeting Bull Trout

To accomplish the secondary objective mentioned above, prior to the 2017 field season, the results from the sampling in 2016 were reviewed by the Site C Fisheries and Aquatic Habitat Mitigation and Monitoring Technical Committee (BC Hydro 2017). Based on this review, the following changes were made to the study design for the Chowade River and Cypress Creek in 2017:

1) Sampling effort in 2017 was focused on sections of these tributaries that were identified during the 2016 survey (Golder 2017) as having higher densities of immature Bull Trout;

2) Only backpack electrofishing was employed in 2017 as this method had the highest catch rates of immature Bull Trout during the 2016 survey;

3) The surveys were conducted approximately three weeks earlier than in 2016 to increase the likelihood of capturing immature Bull Trout before they migrate downstream (see R.L.&L. 1995 for outmigration timing); and

4) The minimum fork length required to implant a PIT tag was reduced from 120 mm FL to 80 mm FL following discussions with InStream Fisheries Research Inc.

The above modifications increased the catch rates of immature Bull Trout and increased the number of PIT tags deployed compared to 2016. As described in the Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program, tagged fish that subsequently migrate downstream past the PIT arrays in the Chowade River and Cypress Creek will provide an understanding of the resident/migrant proportions of the population (Ramos-Espinoza et al. 2018). PIT arrays will also monitor the upstream migrations of these same fish in subsequent years when they return to the Halfway River watershed as adults to spawn. As such, these data could potentially be used to estimate annual transition probabilities between life stages (i.e., juvenile to subadult, subadult to adult) and adult survival rates.

The above modifications also helped reduce the number of adult Bull Trout encountered during the survey. In 2016, 25 adult Bull Trout were captured in the Chowade River and Cypress Creek combined (Golder 2017). In 2017, only five adult Bull Trout were captured in these two tributaries. Any modifications to the study design that reduce interactions with adult Bull Trout during their spawning or migration periods immediately prior to spawning will reduce the potential for effects of electrofishing on these fish.

The modifications to the sampling design (BC Hydro 2017) acknowledged that sampling habitats farther upstream in the tributaries to target Bull Trout would likely result in reduced catches of Arctic Grayling and Rainbow Trout (e.g., habitats with lower water temperatures that favour Bull Trout; BC Hydro 2017). Arctic Grayling were not

recorded in the Chowade River or Cypress Creek in 2017. In 2016, four Arctic Grayling were captured in the Chowade River and one Arctic Grayling was captured in Cypress Creek. However, all five of the Arctic Grayling captured in 2016 were captured by small fish boat electroshocking, a sample method that was not used in 2017. The lack of Arctic Grayling encountered in 2017 is likely an artifact of the modified study design and not an indication of population decline.

In total, 10 Rainbow Trout were recorded in the Chowade River (*n* = 4) and Cypress Creek (*n* = 6) in 2017, compared to 66 Rainbow Trout captured in the Chowade River and 30 Rainbow Trout captured in Cypress Creek in 2016. All of the Rainbow Trout captured in 2016 were captured using a small fish boat electroshocker; therefore, the low numbers of Rainbow Trout recorded in 2017 are also likely due to the modified study design.

Temporal comparisons of life history metrics within individual tributaries will be more feasible in future study years if repetitive and consistent sampling protocols are established. Changes to the capture methodologies between 2016 and 2017 hindered the comparison of life history data between the two study years for the Chowade River and Cypress Creek.

4.1.1 Movement Data

Based on length and age data, juvenile Bull Trout in the Chowade River and Cypress Creek likely migrate downstream to the Peace River at approximately age-3. In 2016, no age-2 or younger Bull Trout were tagged in the Chowade River and approximately 25 age-2 and younger Bull Trout were tagged in Cypress Creek; therefore, very few tags were available for detection during the 2017 juvenile downstream migration. In 2017, substantially higher numbers of age-2 and younger Bull Trout were implanted with PIT tags in both the Chowade River (*n* = 205) and Cypress Creek (*n* = 179). As such, higher juvenile Bull Trout detection rates are anticipated at the PIT arrays in future study years as these fish mature and migrate downstream.

Seven of the Bull Trout that were detected at the Chowade River array in 2017 were initially captured in the Peace River as part of the Peace River Large Fish Index (Mon-2, Task 2a). The initial capture locations of fish ranged between the Peace Canyon Dam area the Many Islands area in Alberta, covering the geographic scope of indexing survey.

The adult Rainbow Trout that was initially tagged in the upper Halfway River in late August of 2016 (tag number 900230000125822) and detected in Cypress Creek in mid-September 2017 was one of only 9 Rainbow Trout tagged in the upper Halfway River as part of the current study. The Halfway River is a recruitment source for the Peace River Rainbow Trout population (Mainstream 2012); however, the Halfway River also has a resident Rainbow Trout population. Meka et al. (2003) noted both highly migratory and non-migratory movement behaviors in riverine-based Rainbow Trout populations. Based on these data, it is possible that the Rainbow Trout sampled as part of the currently program represent a combination of three different ecotypes: a migratory Peace River population; a migratory Halfway River resident population; and, a non-migratory Halfway River resident population. Mark-recapture and microchemistry chemistry data could help support or discount this theory.

4.2 Tributaries Targeting Rainbow Trout

Sampling in Farrell Creek replaced sampling in Maurice and Lynx creeks for the reasons detailed in Section 1.2. Data from Farrell Creek will be used to test the Mon-1b hypothesis regarding Peace River Rainbow Trout continuing to spawn and rear in Site C reservoir tributaries upstream of the reservoir's inundation zone. During the 2017 survey, YOY Rainbow Trout (i.e., fish less than 50 mm FL) were recorded at two of the four locations sampled in Farrell Creek, and immature Rainbow Trout (i.e., fish between 51 and 250 mm FL) were recorded at all four sample locations. These data indicate that Rainbow Trout use Farrell Creek for spawning and rearing; however, uncertainty remains as to whether these fish are part of a local resident population or are part of a migratory Peace River population. In 2017, 40 Rainbow Trout were tagged in Farrell Creek. Recapturing these fish in the future in the Peace River mainstem under other components of the Site C FAHMFP would provide insight into this uncertainty. Despite this uncertainty, continued sampling in Farrell Creek using methods similar to those used in 2017 is expected to yield results capable of testing the Mon-1b hypothesis (i.e., that Peace River Rainbow Trout continue to spawn in select Site C reservoir tributaries upstream of the inundation zone).

Sampling was conducted in Colt and Kobes creeks in 2017 to collect additional baseline data for Rainbow Trout within the Halfway River watershed. Data collected as part of these surveys will not be used to specifically test any hypotheses under the Site C FAHMFP, but will contribute to the regional Rainbow Trout dataset and contribute to our understanding of any potential changes to Rainbow Trout in tributaries and the Site C reservoir. YOY and immature Rainbow Trout were recorded in both tributaries, indicating that both systems are used for spawning and rearing by this species. Adult Rainbow Trout were not recorded in either system, however the presence of YOY Rainbow Trout in early August could be viewed as evidence that mature spawning adults were present in the system the previous spring. The lack of adult Rainbow Trout in the catch during the 2017 survey could partially be due to the capture method used (backpack electrofishing only).

None of the three tributaries sampled for Rainbow Trout in 2017 (i.e., Farrell, Colt, and Kobes creeks) were sampled in 2016; therefore, comparisons to 2016 data (Golder 2017) were not possible. Length-frequency distributions and catch rates for Rainbow Trout in Farrell Creek in 2017 were compared to those recorded by Mainstream in 2010 (Mainstream 2011a). Catch rates were similar for the three sites that were surveyed during both study years. Length-frequency data indicate that most of the YOY Rainbow Trout recorded in 2010 were between 60 and 70 mm FL. Data from 2017 indicate that most of the YOY Rainbow Trout were between 30 and 40 mm FL. The difference in size is likely due to the differences in the two survey periods: mid-September in 2010 and early August in 2017. These data may indicate that YOY Rainbow Trout grow substantially during the first growing season. Maintaining consistent study periods across study years will be important to monitor changes to annual growth or length-at-age.

4.3 Moberly River

Sampling for Arctic Grayling in the Moberly River in 2017 supplemented pre-Project baseline data collected from 2008 to 2011 (Mainstream 2009a, 2009b, 2010a, 2011b, 2013) and 2016 (Golder 2017). There were very low catches of Arctic Grayling (one adult, one immature, and no YOY). The low Arctic Grayling catch may, in part, be due to low Moberly River discharge at the time of sampling (Figure 9). Also, water temperatures over the 2017 study period were approximately 2°C warmer than the water temperatures recorded over the 2016 study period. Moberly River Arctic Grayling migrate into the Peace River over the summer (Mainstream 2010b). Low water levels coupled with warmer water temperatures may have resulted in more Arctic Grayling migrating into the

Peace River mainstem during the 2017 study period when compared to other study years. Catch data from the Peace River Large Fish Index Survey (Golder in prep) do not indicate a substantial increase in Arctic Grayling numbers in 2017 relative to 2016.

In 2017, the Moberly River was sampled between 30 August and 8 September, closely aligning with the 2016 survey period (8 to 18 September). During a typical year, discharge from the Moberly River gradually declines over the late summer to fall period (WaterOffice 2017). Overall, the 2017 survey was conducted when discharge ranged between 0.8 and 1.5 m^3/s and the 2016 survey was conducted when discharge ranged between 25.6 and 46.5 m^3/s (WaterOffice 2017). The high water levels present in 2016 and the low water levels present in 2017 hindered sampling effectiveness. During future study years, the timing of the Moberly River survey should be synchronized with the Moberly River hydrograph rather than aligning with historical survey periods. Sampling the Moberly River when discharges are between 5 and 10 m^3/s should yield ideal conditions for the chosen capture methods (i.e., angling, backpack electrofishing, small fish boat electroshocking, and beach seining). Based on Moberly River hydrograph data collected between 2000 and 2017, these flows are typically present between 5 August and 7 October, but have occurred as early as between 29 June and 14 July in 2006 and as late as 9 to 27 September in 2007.

Non-target fish species recorded in the Moberly River during the 2017 survey were similar to those recorded in 2016. Prickly Sculpin (n = 1) and Walleye (n = 1) were the only species recorded in 2017 that were not also recorded in 2016, and Bull Trout, Finescale Dace, Flathead Chub, and Kokanee were the only species recorded in the Moberly River in 2016 that were not also recorded in 2017. All six of these species were captured in low numbers during the years they were recorded. Their absence in the catch in a particular study year is not likely indicative of a true change in species richness or diversity.

5.0 CLOSURE

We trust that this report meets your current requirements. If you have any further questions, please do not hesitate to contact the undersigned.

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DF/SR/asd

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APPENDIX A

Maps and UTM Locations

Table A1 Locations of sites sampled during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

River	Upstream River Km[a]	Site Name	Sample Method	Upstream UTM[b]			Downstream UTM[b]		
				Zone	Easting	Northing	Zone	Easting	Northing
Chowade River	67.4	CHR-EF-067.4-2017-07-27	Backpack Electrofishing	10V	480850	6284631	10V	481062	6284767
	67.3	CHR-EF-067.3-2017-07-27	Backpack Electrofishing	10V	480907	6284716	10V	481015	6284757
	58.4	CHR-EF-058.4-2017-07-27	Backpack Electrofishing	10V	487511	6284930	10V	487585	6284811
	58.3	CHR-EF-058.3-2017-07-28	Backpack Electrofishing	10V	487986	6284876	10V	488120	6285031
	58.2	CHR-EF-058.2-2017-07-28	Backpack Electrofishing	10V	487958	6284873	10V	487984	6284900
	58.1	CHR-EF-058.1-2017-07-28	Backpack Electrofishing	10V	487743	6284693	10V	488018	6284811
	54.2	CHR-EF-054.2-2017-07-28	Backpack Electrofishing	10V	490529	6285078	10V	490556	6285270
	53.9	CHR-EF-053.9-2017-07-28	Backpack Electrofishing	10V	490584	6285276	10V	490724	6285341
	51.2	CHR-EF-051.2-2017-07-28	Backpack Electrofishing	10V	492618	6284663	10V	492715	6284545
	51.1	CHR-EF-051.1-2017-07-28	Backpack Electrofishing	10V	492640	6284670	10V	492824	6284579
	50.6	CHR-EF-050.6-2017-07-28	Backpack Electrofishing	10V	492987	6284610	10V	493120	6284521
	49.6	CHR-EF-049.6-2017-07-28	Backpack Electrofishing	10V	494087	6284385	10V	494361	6284209
	49.5	CHR-EF-049.5-2017-07-28	Backpack Electrofishing	10V	494087	6284289	10V	494260	6284200
	49.2	CHR-EF-049.2-2017-07-29	Backpack Electrofishing	10V	494338	6284178	10V	494570	6284095
	49.1	CHR-EF-049.1-2017-07-29	Backpack Electrofishing	10V	494441	6284118	10V	494587	6284118
	48.4	CHR-EF-048.4-2017-07-29	Backpack Electrofishing	10V	495070	6283987	10V	495377	6283825
	48.2	CHR-EF-048.2-2017-07-29	Backpack Electrofishing	10V	495260	6283807	10V	495423	6283807
	46.8	CHR-EF-046.8-2017-07-29	Backpack Electrofishing	10V	496284	6283568	10V	496441	6283520
	46.7	CHR-EF-046.7-2017-07-29	Backpack Electrofishing	10V	496419	6283570	10V	496828	6283427
	43.5	CHR-EF-043.5-2017-07-30	Backpack Electrofishing	10V	498869	6283378	10V	499063	6283333
	43.3	CHR-EF-043.3-2017-07-30	Backpack Electrofishing	10V	498943	6283506	10V	499074	6283365
	43.2	CHR-EF-043.2-2017-07-30	Backpack Electrofishing	10V	499140	6283483	10V	499322	6283426
	43	CHR-EF-042.9-2017-07-30	Backpack Electrofishing	10V	499386	6283366	10V	499434	6283424
	40	CHR-EF-040.0-2017-07-30	Backpack Electrofishing	10V	501105	6282444	10V	501339	6282417
	39.9	CHR-EF-039.9-2017-07-30	Backpack Electrofishing	10V	501181	6282342	10V	501343	6282395
	37.1	CHR-EF-037.1-2017-07-30	Backpack Electrofishing	10V	503297	6281870	10V	503544	6281909
	36.6	CHR-EF-036.6-2017-07-30	Backpack Electrofishing	10V	503600	6281928	10V	503707	6282023
Colt Creek	30.5	COC-EF-030.5-2017-08-08	Backpack Electrofishing	10V	521162	6258312	10V	521282	6258423
	28.9	COC-EF-028.9-2017-08-08	Backpack Electrofishing	10V	522305	6259042	10V	522418	6259120
	14.1	COC-EF-014.1-2017-08-09	Backpack Electrofishing	10V	531684	6260266	10V	531904	6260368
	3.5	COC-EF-003.5-2017-08-08	Backpack Electrofishing	10V	537999	6258632	10V	538246	6258620
	3.1	COC-EF-003.1-2017-08-08	Backpack Electrofishing	10V	538252	6258617	10V	538350	6258640
Cypress Creek	59.1	CYC-EF-059.1-2017-07-31	Backpack Electrofishing	10V	485866	6299683	10V	486149	6299632
	40.8	CYC-EF-040.8-2017-07-31	Backpack Electrofishing	10V	495621	6302562	10V	495793	6302834
	40.6	CYC-EF-040.6-2017-07-31	Backpack Electrofishing	10V	495770	6302880	10V	495785	6302947
	39.1	CYC-EF-039.1-2017-07-31	Backpack Electrofishing	10V	496912	6303189	10V	497224	6303632
	38.3	CYC-EF-038.3-2017-07-31	Backpack Electrofishing	10V	497243	6303634	10V	497283	6303825
	35.9	CYC-EF-035.9-2017-08-01	Backpack Electrofishing	10V	498516	6303688	10V	498712	6303713
	35.6	CYC-EF-035.6-2017-08-01	Backpack Electrofishing	10V	498716	6303721	10V	498995	6303837
	35.3	CYC-EF-035.3-2017-08-03	Backpack Electrofishing	10V	498995	6303837	10V	499319	6303875
	35.2	CYC-EF-035.2-2017-08-03	Backpack Electrofishing	10V	499016	6304225	10V	499266	6304026
	34.7	CYC-EF-034.7-2017-08-01	Backpack Electrofishing	10V	499384	6303834	10V	499717	6304125
	34.5	CYC-EF-034.5-2017-08-01	Backpack Electrofishing	10V	499590	6304049	10V	499302	6304020

[a] Upstream River Km of each site as measured upstream from the stream's confluence.

[b] NAD83.

continued…

Table A1 Continued.

River	Upstream River Km[a]	Site Name	Sample Method	Upstream UTM[b]			Downstream UTM[b]		
				Zone	Easting	Northing	Zone	Easting	Northing
Cypress Creek	33.8	CYC-EF-033.8-2017-08-02	Backpack Electrofishing	10V	499918	6304247	10V	499875	6304616
	33.4	CYC-EF-033.4-2017-08-02	Backpack Electrofishing	10V	499834	6304597	10V	500196	6304766
	30.9	CYC-EF-030.9-2017-08-02	Backpack Electrofishing	10V	501483	6305847	10V	501949	6305597
	30.1	CYC-EF-030.1-2017-08-02	Backpack Electrofishing	10V	501950	6305535	10V	502329	6305452
	29.5	CYC-EF-029.5-2017-08-03	Backpack Electrofishing	10V	502642	6305479	10V	503038	6305421
	28.2	CYC-EF-028.2-2017-08-03	Backpack Electrofishing	10V	503784	6305426	10V	503907	6305127
Farrell Creek	102.1	FAC-EF-102.1-2017-08-06	Backpack Electrofishing	10V	560892	6238244	10V	560972	6238330
	101.7	FAC-EF-101.7-2017-08-06	Backpack Electrofishing	10V	561011	6238185	10V	561046	6238132
	65.7	FAC-EF-065.7-2017-08-07	Backpack Electrofishing	10V	573210	6238256	10V	573010	6238446
	63.4	FAC-EF-063.4-2017-08-07	Backpack Electrofishing	10V	572204	6239746	10V	572498	6240098
Fiddes Creek	11.7	FIC-EF-011.7-2017-08-05	Backpack Electrofishing	10V	478302	6306890	10V	478281	6307142
	11.4	FIC-EF-011.4-2017-08-05	Backpack Electrofishing	10V	478284	6307145	10V	478259	6307367
	7	FIC-EF-007.0-2017-08-04	Backpack Electrofishing	10V	479624	6310882	10V	479836	6311013
Kobes Creek	55.3	KOC-EF-055.3-2017-08-11	Backpack Electrofishing	10V	544250	6243194	10V	544132	6243355
	46.7	KOC-EF-046.7-2017-08-10	Backpack Electrofishing	10V	543215	6248252	10V	543405	6248365
	40.5	KOC-EF-040.5-2017-08-10	Backpack Electrofishing	10V	544122	6252301	10V	544002	6252160
	40.2	KOC-EF-040.2-2017-08-10	Backpack Electrofishing	10V	544124	6252323	10V	544067	6252515
	11.5	KOC-EF-011.5-2017-08-11	Backpack Electrofishing	10V	555148	6256341	10V	555230	6256202
Turnoff Creek	7.5	TOC-EF-007.5-2017-08-05	Backpack Electrofishing	10V	479486	6321950	10V	479539	6321734
	7.2	TOC-EF-007.2-2017-08-05	Backpack Electrofishing	10V	479557	6321739	10V	479693	6321527
	1.1	TOC-EF-001.1-2017-08-04	Backpack Electrofishing	10V	480740	6317221	10V	480695	6316851
Moberly River	123.5	MOR-AN-123.5-2017-08-30	Angling	10U	586381	6188490			
	119.6	MOR-EF-119.6-2017-08-30	Backpack Electrofishing	10U	587862	6189199	10U	587819	6189273
	119.5	MOR-ES-119.5-2017-08-30	Small Fish Boat Electroshocking	10U	588005	6189411	10U	588182	6189440
	119.4	MOR-EF-119.4-2017-08-30	Backpack Electrofishing	10U	587956	6189383	10V	587984	6189399
	119.2	MOR-AN-119.2-2017-08-30	Angling	10U	588228	6189475	10U	588333	6189495
	119.2	MOR-EF-119.2-2017-08-30	Backpack Electrofishing	10U	588183	6189423	10V	588233	6189463
	119.2	MOR-ES-119.2-2017-08-30	Small Fish Boat Electroshocking	10U	588371	6189504	10U	588233	6189459
	118.2	MOR-AN-118.2-2017-08-30	Angling	10U	588550	6189573	10U	588596	6189596
	116.2	MOR-ES-116.2-2017-08-31	Small Fish Boat Electroshocking	10U	589157	6191454	10U	589175	6191644
	115.9	MOR-BS-115.9-2017-08-31	Beach Seine	10U	589181	6191701			
	115.4	MOR-ES-115.4-2017-08-31	Small Fish Boat Electroshocking	10U	589468	6192040	10U	589473	6192219
	114.7	MOR-AN-114.7-2017-08-31	Angling	10U	589313	6192629	10U	589292	6192657
	114.3	MOR-ES-114.3-2017-08-31	Small Fish Boat Electroshocking	10U	589217	6192965	10U	589238	6193116
	114.1	MOR-EF-114.1-2017-08-31	Backpack Electrofishing	10U	589279	6193165	10V	589336	6193239
	111	MOR-AN-110.2-2017-08-31	Angling	10U	589994	6195664	10U	589970	6195653
	109	MOR-AN-109.0-2017-08-31	Angling	10U	590170	6196165	10U	590189	6196143
	104.8	MOR-ES-104.8-2017-09-01	Small Fish Boat Electroshocking	10U	590178	6198414	10U	590325	6198383
	104.3	MOR-AN-104.3-2017-09-01	Angling	10U	590573	6198494	10U	590611	6198543
	104.3	MOR-EF-104.3-2017-09-01	Backpack Electrofishing	10U	590453	6198397	10U	590476	6198416
	104.3	MOR-ES-104.3-2017-09-01	Small Fish Boat Electroshocking	10U	590583	6198496	10U	590503	6198612
	104	MOR-EF-104.0-2017-09-01	Backpack Electrofishing	10U	590507	6198735	10U	590575	6198733
	103.8	MOR-BS-103.8-2017-09-01	Beach Seine	10U	590696	6198816			

[a] Upstream River Km of each site as measured upstream from the stream's confluence.

[b] NAD83.

continued…

Table A1 Continued.

River	Upstream River Km[a]	Site Name	Sample Method	Upstream UTM[b]			Downstream UTM[b]		
				Zone	Easting	Northing	Zone	Easting	Northing
Moberly River	103.7	MOR-ES-103.7-2017-09-01	Small Fish Boat Electroshocking	10U	590670	6198628	10U	590767	6198761
	103.4	MOR-ES-103.4-2017-09-01	Small Fish Boat Electroshocking	10U	590576	6198877	10U	590580	6199168
	102.4	MOR-EF-102.4-2017-09-01	Backpack Electrofishing	10U	590810	6199192	10U	590868	6199254
	102	MOR-ES-102.0-2017-09-01	Small Fish Boat Electroshocking	10U	591011	6199656	10U	591210	6199732
	100.4	MOR-EF-100.4-2017-09-01	Backpack Electrofishing	10U	591335	6200295	10U	591416	6200288
	100.4	MOR-ES-100.4-2017-09-01	Small Fish Boat Electroshocking	10U	591432	6200294	10U	591436	6200482
	100.3	MOR-AN-100.3-2017-09-01	Angling	10U	591540	6200347	10U	591551	6200360
	99.5	MOR-AN-099.5-2017-09-01	Angling	10U	591371	6200911	10U	591392	6200905
	99.4	MOR-EF-099.4-2017-09-01	Backpack Electrofishing	10U	591351	6200926	10U	591332	6200927
	78.9	MOR-EF-078.9-2017-09-03	Backpack Electrofishing	10V	590446	6207397	10V	590432	6207485
	78.2	MOR-AN-078.8-2017-09-03	Angling	10V	590427	6207486	10U	590418	6207530
	75.7	MOR-AN-075.7-2017-09-03	Angling	10V	590756	6209588			
	69.8	MOR-EF-069.8-2017-09-04	Backpack Electrofishing	10V	592556	6211383	10V	592628	6211375
	69.7	MOR-EF-069.7-2017-09-04	Backpack Electrofishing	10V	592639	6211392	10V	592777	6211468
	51.6	MOR-EF-051.6-2017-09-05	Backpack Electrofishing	10V	599420	6215045	10V	599484	6215078
	51.4	MOR-EF-051.4-2017-09-05	Backpack Electrofishing	10V	599583	6215251	10V	599481	6215082
	50.9	MOR-EF-050.9-2017-09-05	Backpack Electrofishing	10V	599287	6215673	10V	599234	6215706
	50.8	MOR-EF-050.8-2017-09-05	Backpack Electrofishing	10V	599237	6215700	10V	599217	6215796
	48.1	MOR-EF-048.1-2017-09-05	Backpack Electrofishing	10V	600603	6217067	10V	600624	6217142
	48	MOR-EF-048.0-2017-09-05	Backpack Electrofishing	10V	600586	6217114	10V	600616	6217223
	46.5	MOR-EF-046.5-2017-09-06	Backpack Electrofishing	10V	601333	6217765	10V	601486	6217719
	46.4	MOR-EF-046.4-2017-09-06	Backpack Electrofishing	10V	601512	6217647	10V	601721	6217552
	44.8	MOR-EF-044.8-2017-09-06	Backpack Electrofishing	10V	602648	6217812	10V	602794	6217786
	44.7	MOR-EF-044.7-2017-09-06	Backpack Electrofishing	10V	602761	6217767	10V	602839	6217871
	39.3	MOR-EF-039.3-2017-09-06	Backpack Electrofishing	10V	606250	6220049	10V	606289	6220207
	39.2	MOR-EF-039.2-2017-09-06	Backpack Electrofishing	10V	606113	6220038	10V	606249	6220224
	35	MOR-AN-035.0-2017-09-06	Angling	10V	607905	6222767			
	35	MOR-EF-035.0-2017-09-06	Backpack Electrofishing	10V	607863	6222739	10V	607882	6222840
	34.9	MOR-EF-034.9-2017-09-06	Backpack Electrofishing	10V	607825	6222926	10V	607773	6223045
	31.7	MOR-EF-031.7-2017-09-07	Backpack Electrofishing	10V	608886	6223697	10V	608800	6223875
	31.6	MOR-EF-031.6-2017-09-07	Backpack Electrofishing	10V	608804	6223885	10V	608989	6224017
	27.5	MOR-AN-027.5-2017-09-07	Angling	10V	610051	6225179	10V	610100	6225167
	27.5	MOR-EF-027.5-2017-09-07	Backpack Electrofishing	10V	609961	6225247	10V	610043	6225177
	21.2	MOR-EF-021.2-2017-09-07	Backpack Electrofishing	10V	614149	6227777	10V	614342	6227913
	21.1	MOR-EF-021.1-2017-09-07	Backpack Electrofishing	10V	614101	6227799	10V	614172	6227908
	18.6	MOR-EF-018.6-2017-09-07	Backpack Electrofishing	10V	615684	6228657	10V	615810	6228631
	18.4	MOR-EF-018.4-2017-09-07	Backpack Electrofishing	10V	615803	6228720	10V	615902	6228716
	18.2	MOR-AN-018.2-2017-09-07	Angling	10V	615808	6228648			
	11.4	MOR-EF-011.4-2017-09-07	Backpack Electrofishing	10V	621145	6228188	10V	621321	6228046
	11	MOR-EF-011.0-2017-09-07	Backpack Electrofishing	10V	621354	6228054	10V	621565	6227825
	10.7	MOR-AN-010.7-2017-09-07	Angling	10V	621548	6227816			
	10.7	MOR-AN-010.7-2017-09-08	Angling	10V	621548	6227816			
	10	MOR-EF-010.0-2017-09-08	Backpack Electrofishing	10V	622022	6228087	10V	622164	6228188

[a] Upstream River Km of each site as measured upstream from the stream's confluence.

[b] NAD83.

continued…

Table A1 Concluded.

River	Upstream River Km[a]	Site Name	Sample Method	Upstream UTM[b]			Downstream UTM[b]		
				Zone	Easting	Northing	Zone	Easting	Northing
Moberly River	9.9	MOR-AN-009.9-2017-09-08	Angling	10V	622154	6228184	10V	622191	6228188
	9.9	MOR-EF-009.9-2017-09-08	Backpack Electrofishing	10V	622319	6228155	10V	622540	6228051
	7.7	MOR-AN-007.7-2017-09-08	Angling	10V	623783	6227470	10V	623814	6227470
	7.6	MOR-EF-007.6-2017-09-08	Backpack Electrofishing	10V	623851	6227460	10V	623958	6227442
	3.9	MOR-EF-003.9-2017-09-08	Backpack Electrofishing	10V	626203	6228447	10V	626063	6228318
	3.8	MOR-AN-003.8-2017-09-08	Angling	10V	626201	6228449	10V	626184	6228509
	1.6	MOR-EF-001.6-2017-09-08	Backpack Electrofishing	10V	627498	6229391	10V	627624	6229434
	1.4	MOR-AN-001.4-2017-09-08	Angling	10V	627631	6229419	10V	627682	6229436

[a] Upstream River Km of each site as measured upstream from the stream's confluence.
[b] NAD83.

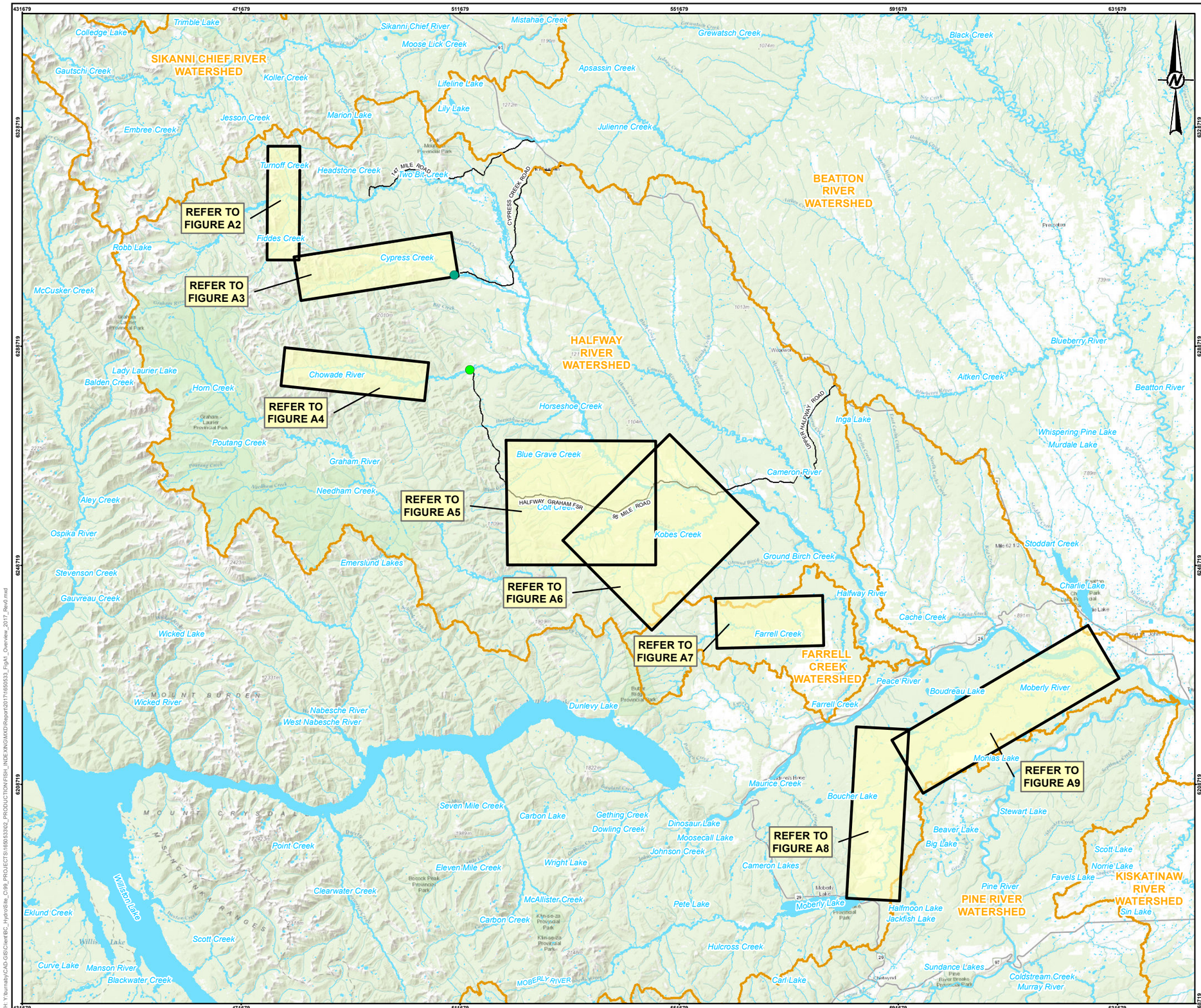
Table A2 Location information for Moberly River sections sampled during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

River	Section	Habitat Type	Length (km)	River Km[a]	Upstream UTM[b]			River Km[a]	Downstream UTM[b]		
					Zone	Easting	Northing		Zone	Easting	Northing
Moberly River	MR-S1A	Irregular Meanders[a]	5.9	119.6	10V	587890	6189345	113.8	10V	589439	6193416
	MR-S1	Tortuous Meanders	4.5	105.1	10V	590194	6198180	100.6	10V	591248	6200259
	MR-S2	Tortuous Meanders	15.8	100.6	10V	591248	6200259	84.8	10V	589031	6204822
	MR-S3	Tortuous Meanders	12.0	84.1	10V	589407	6205349	72.2	10V	591076	6210858
	MR-S4	Tortuous Meanders	11.3	72.2	10V	591076	6210858	60.9	10V	595402	6213268
	MR-S5	Tortuous Meanders	9.0	60.9	10V	595402	6213268	51.9	10V	599325	6214944
	MR-S6	Tortuous Meanders	4.3	51.9	10V	599325	6214944	47.6	10V	600924	6217136
	MR-S7	Irregular meandering; Braided; Frequently Confined	18.2	47.6	10V	600924	6217136	29.5	10V	609657	6224625
	MR-S8	Irregular meandering; Braided; Frequently Confined	11.4	29.5	10V	609657	6224625	18.0	10V	616182	6228657
	MR-S9	Irregular meandering; Braided; Frequently Confined	5.4	18.0	10V	616182	6228657	12.6	10V	619999	6228240
	MR-S10	Irregular meandering; Braided; Frequently Confined	12.6	12.6	10V	619999	6228240	0.0	10V	628556	6230023

[a] River Km as measured upstream from the Moberly River confluence.

[b] NAD83.

[c] Habitat types and section breaks for the Moberly River were established by Mainstream Aquatics Ltd. (2011).



LEGEND

- CHOWADE RIVER PIT TAG DETECTOR STATION
- CYPRESS CREEK PIT TAG DETECTOR STATION
- MAJOR WATERSHED

BASE MAP FEATURES

- HIGHWAY
- ROAD
- WATERCOURSE
- WATERBODY

KEY PLAN

0 15 30

1:700,000 KILOMETRES

REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. WATERSHED DATA OBTAINED FROM THE GOVERNMENT OF BRITISH COLUMBIA
3. BASEDATA SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESR I JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY (Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY (Mon-1b, Task 2c) STUDY AREA, 2017

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-09-04
DESIGNED	DR
PREPARED	JG/MH
REVIEWED	DF
APPROVED	GA

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2016/6000	0	**A1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

25mm

0

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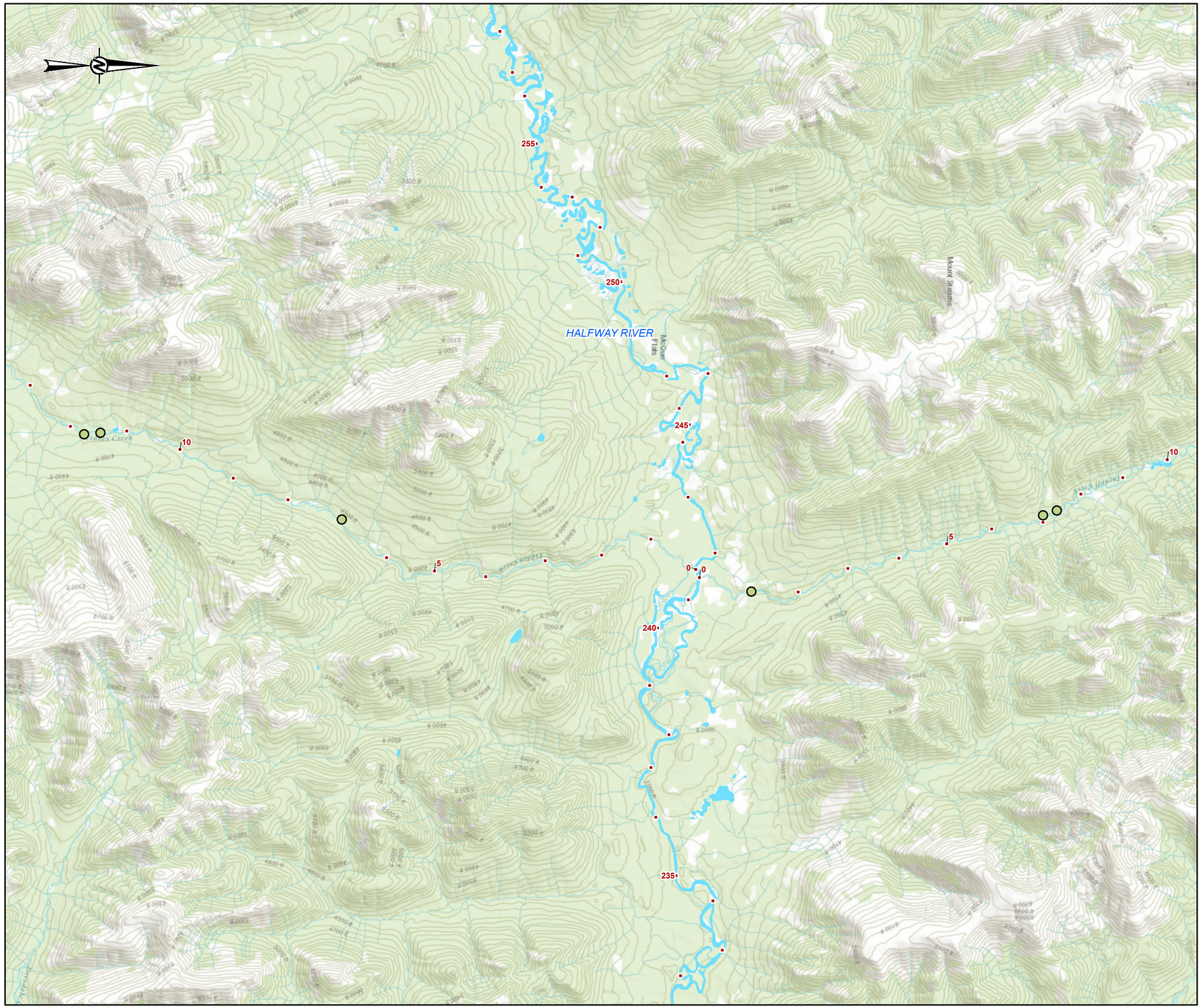


LEGEND

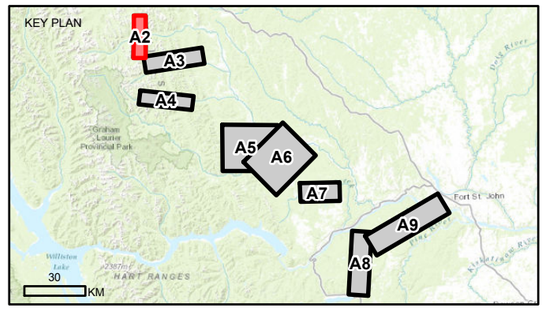
- RIVER KILOMETRE POSTS

UPSTREAM EXTENT OF EACH SAMPLE SITE

- BACKPACK ELECTROFISHING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



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REFERENCES

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2. WATERSHED DATA OBTAINED FROM THE GOVERNMENT OF BRITISH COLUMBIA
3. BASEDATA SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESR I JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY.

COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY
(Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) FIDDES AND TURNOFF CREEKS STUDY AREA, 2017.

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-09-04
DESIGNED	DR
PREPARED	JG/MH
REVIEWED	DF
APPROVED	GA

PROJECT NO.	CONTROL	REV.	FIGURE
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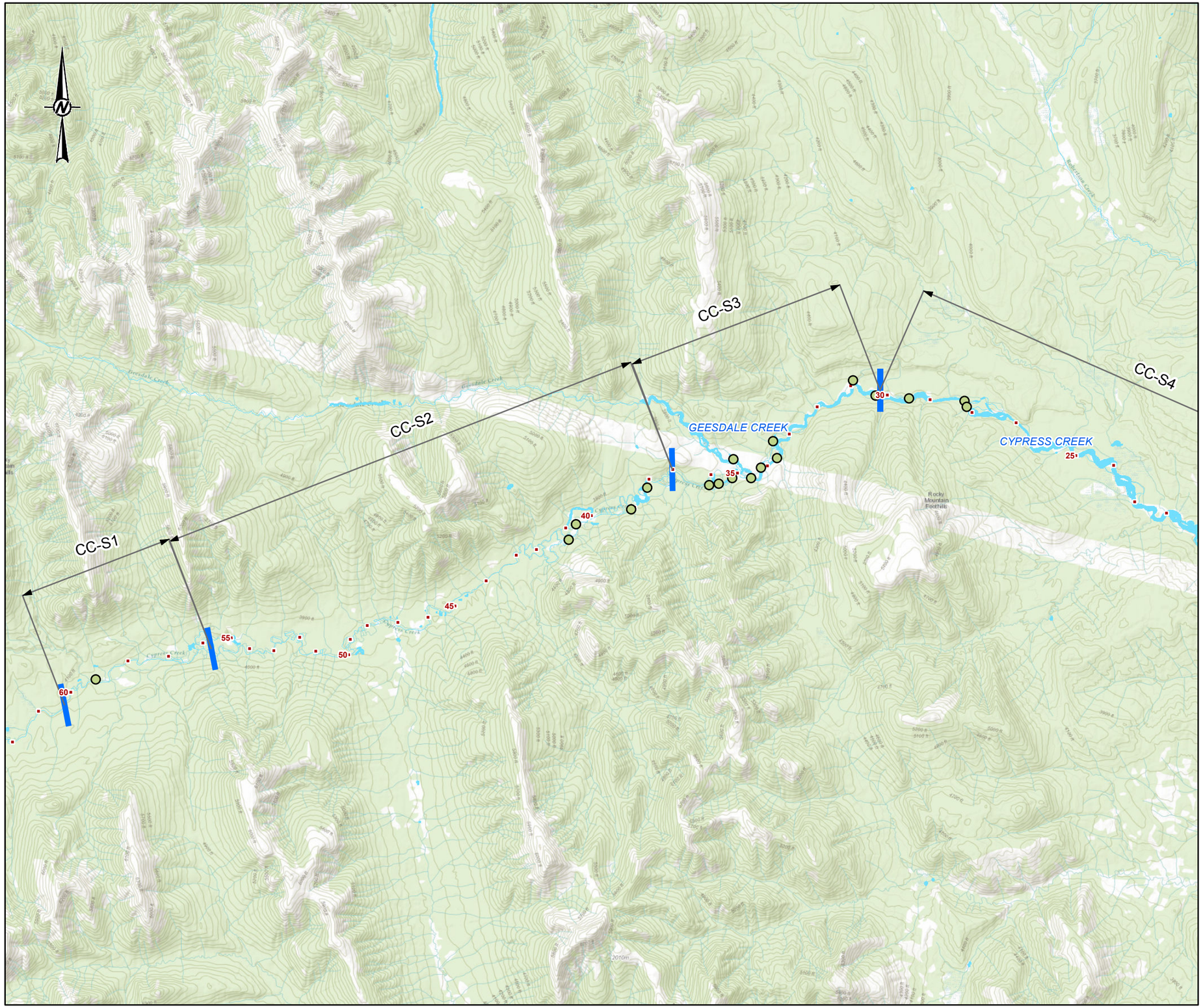


LEGEND

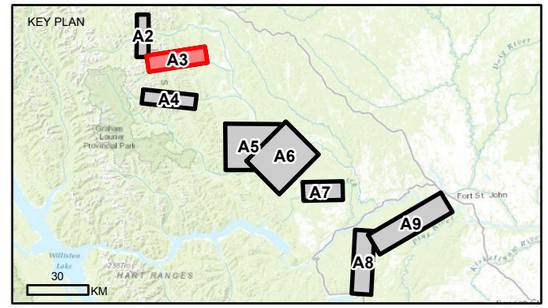
- RIVER KILOMETRE POSTS
- SECTION BREAK

UPSTREAM EXTENT OF EACH SAMPLE SITE

- BACKPACK ELECTROFISHING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



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REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. WATERSHED DATA OBTAINED FROM THE GOVERNMENT OF BRITISH COLUMBIA
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY
(Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) CYPRESS CREEK STUDY AREA, 2017.

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-09-04
DESIGNED	DR
PREPARED	JG/MH
REVIEWED	DF
APPROVED	GA

PROJECT NO.	CONTROL	REV.	FIGURE
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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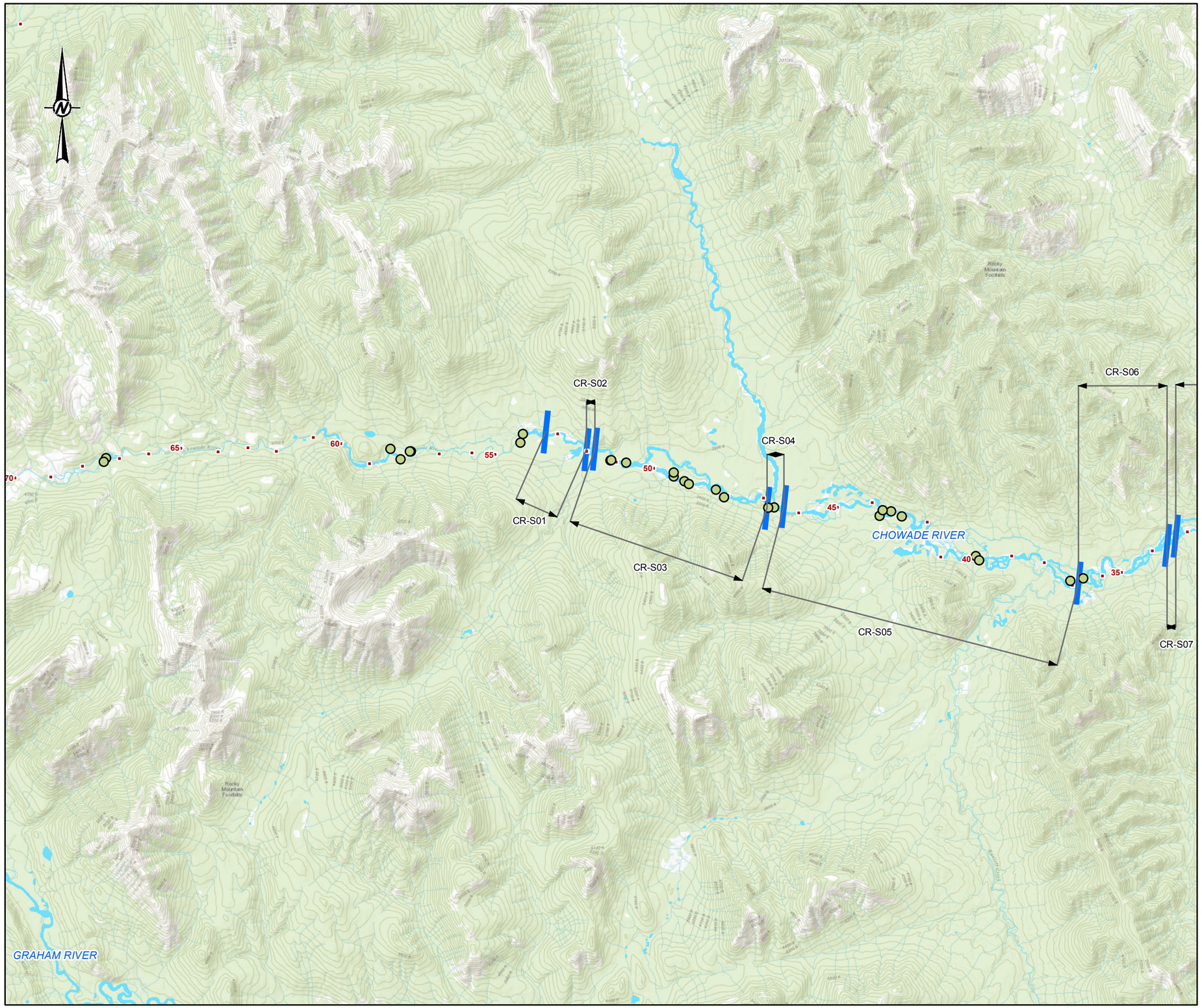


LEGEND

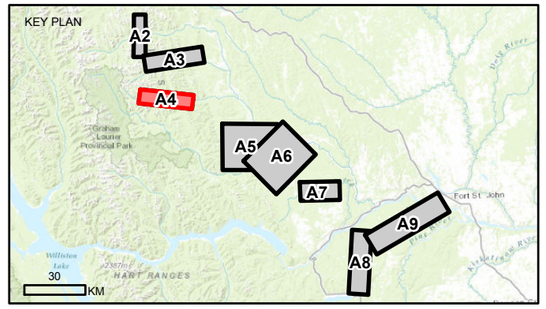
- RIVER KILOMETRE POSTS
- SECTION BREAK

UPSTREAM EXTENT OF EACH SAMPLE SITE

- BACKPACK ELECTROFISHING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



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REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY (Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) CHOWADE RIVER STUDY AREA, 2017.

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-09-04
DESIGNED	DR
PREPARED	JG/MH
REVIEWED	DF
APPROVED	GA

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2016/6000	0	**A4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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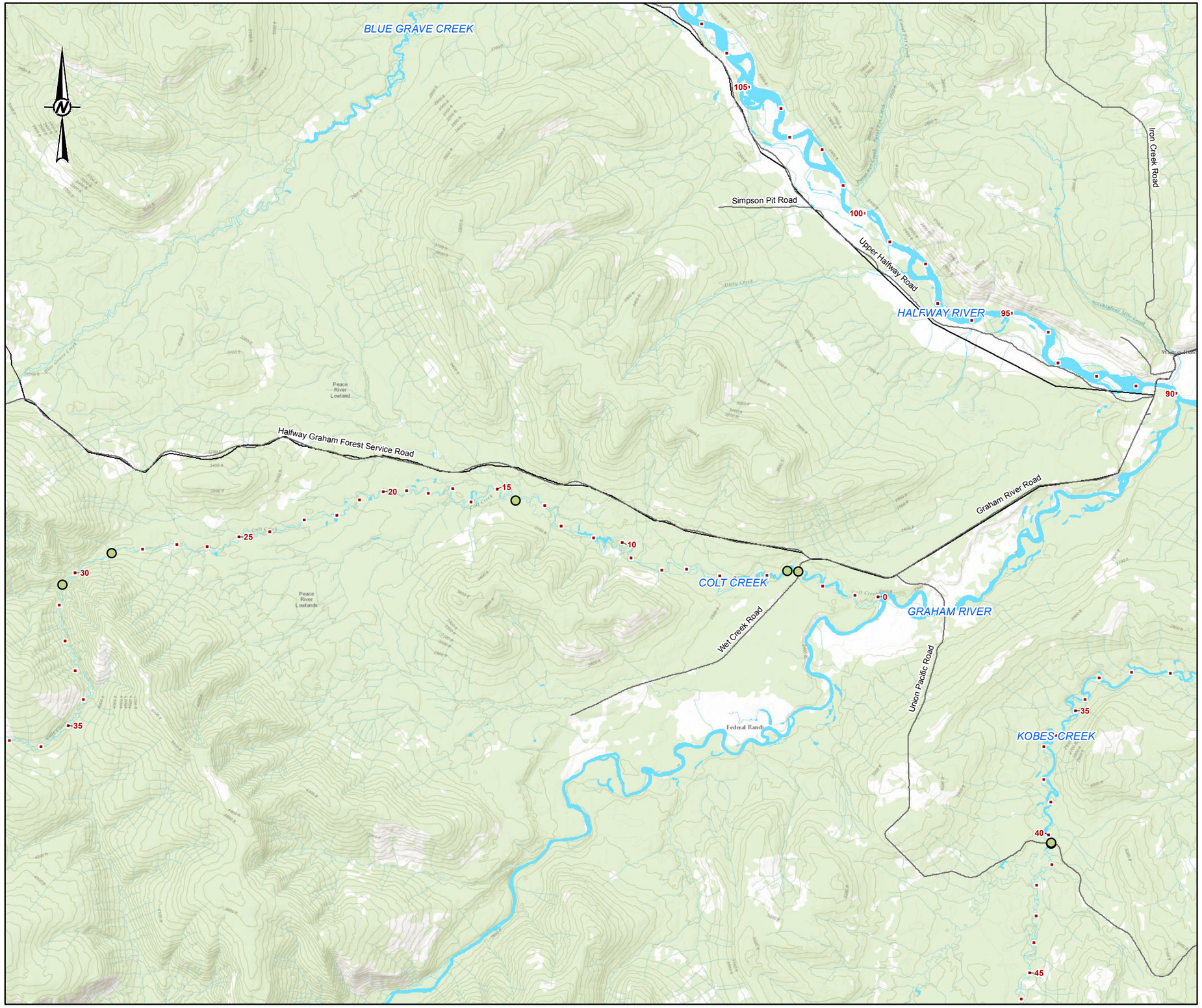


LEGEND

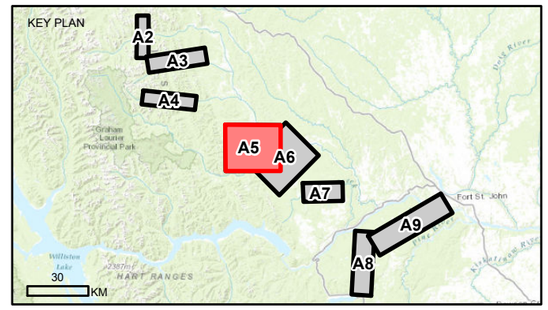
- RIVER KILOMETRE POSTS

UPSTREAM EXTENT OF EACH SAMPLE SITE

- BACKPACK ELECTROFISHING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



0 1,750 3,500

1:90,000 METRES

REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. WATERSHED DATA OBTAINED FROM THE GOVERNMENT OF BRITISH COLUMBIA
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY
(Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) COLT CREEK STUDY AREA, 2017.

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-09-04
DESIGNED	DR
PREPARED	JG/MH
REVIEWED	DF
APPROVED	GA

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2016/6000	0	**A5**

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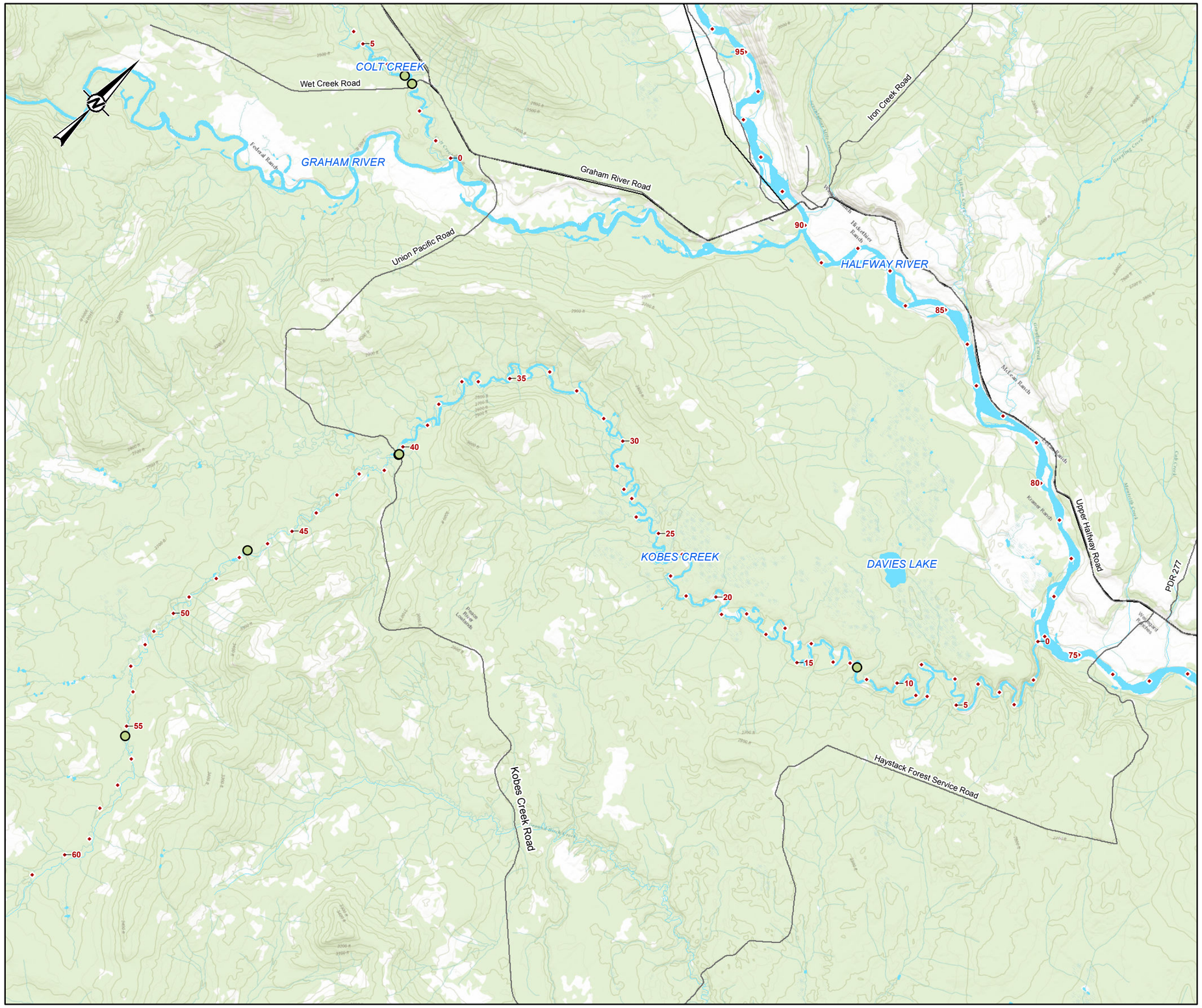


LEGEND

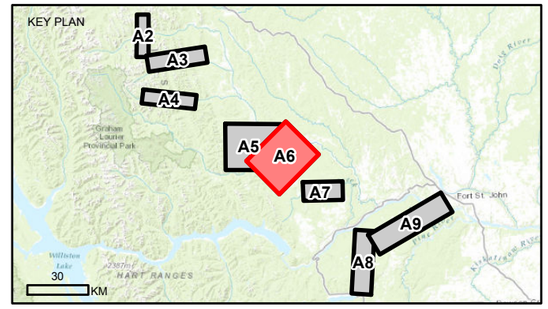
- RIVER KILOMETRE POSTS

UPSTREAM EXTENT OF EACH SAMPLE SITE

- BACKPACK ELECTROFISHING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



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REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT

BC HYDRO

PROJECT

SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY (Mon-1b, Task 2c)

TITLE

OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) KOBES CREEK STUDY AREA, 2017.

CONSULTANT

Golder Associates

YYYY-MM-DD	2018-09-04
DESIGNED	DR
PREPARED	JG/MH
REVIEWED	DF
APPROVED	GA

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2016/6000	0	**A6**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

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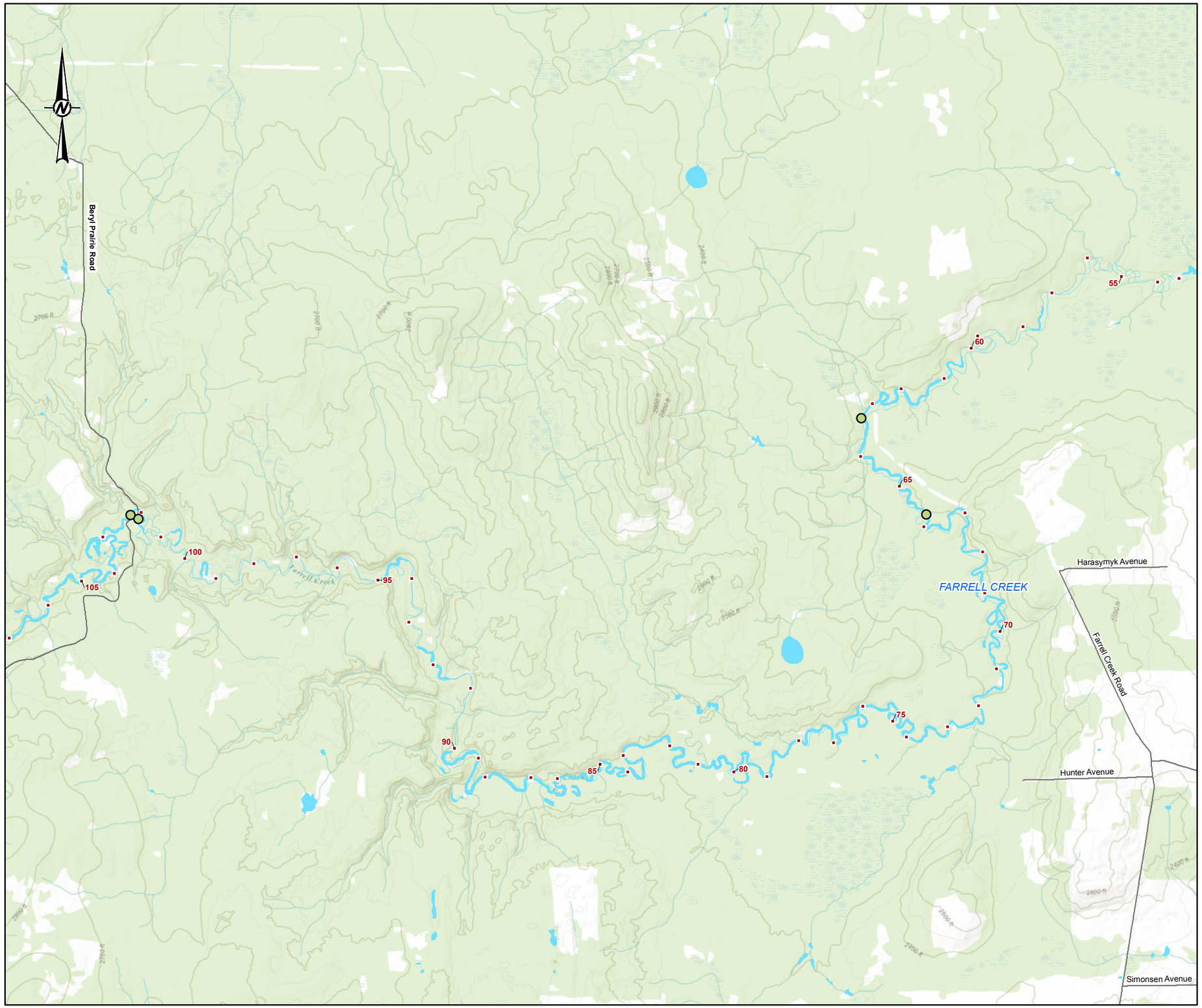


LEGEND

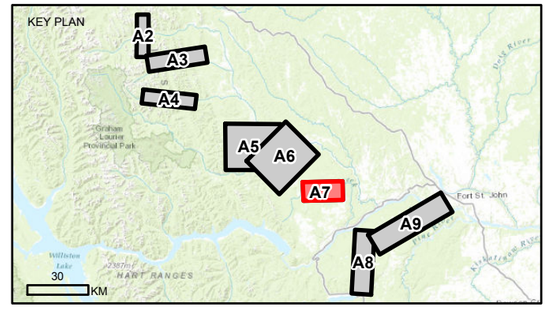
- RIVER KILOMETRE POSTS

UPSTREAM EXTENT OF EACH SAMPLE SITE

- BACKPACK ELECTROFISHING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



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REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY
(Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) FARRELL CREEK STUDY AREA, 2017.

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-09-04
DESIGNED	DR
PREPARED	JG/MH
REVIEWED	DF
APPROVED	GA

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2016/6000	0	**A7**

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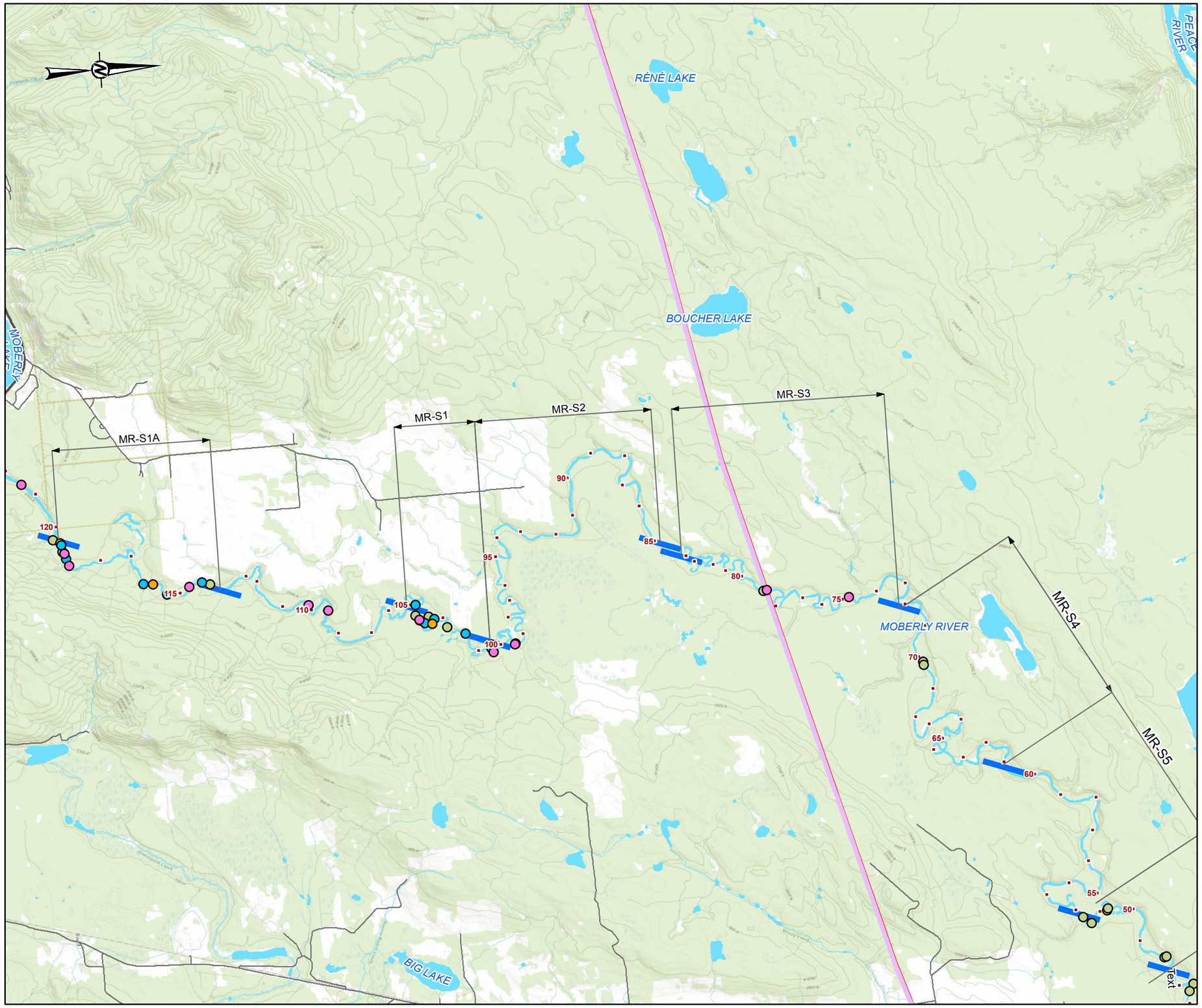


LEGEND

- RIVER KILOMETRE POSTS
- SECTION BREAK

UPSTREAM EXTENT OF EACH SAMPLE SITE

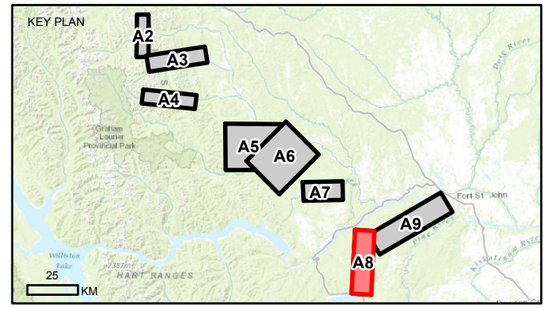
- ANGLING
- BACKPACK ELECTROFISHING
- BEACH SEINING
- SMALL FISH BOAT ELECTROSHOCKING

TRANSMISSION LINE RIGHT OF WAY (ROW)

- BCH EXISTING ROW
- ONE-TIME CLEARING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



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REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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4. ROW PROVIDED BY BCHYDRO, DATED 2017-07-13.

COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY
(Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) MOBERLY RIVER STUDY AREA, 2017.

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-09-04
DESIGNED	DR
PREPARED	JG/MH
REVIEWED	DF
APPROVED	GA

PROJECT NO.	CONTROL	REV.	FIGURE
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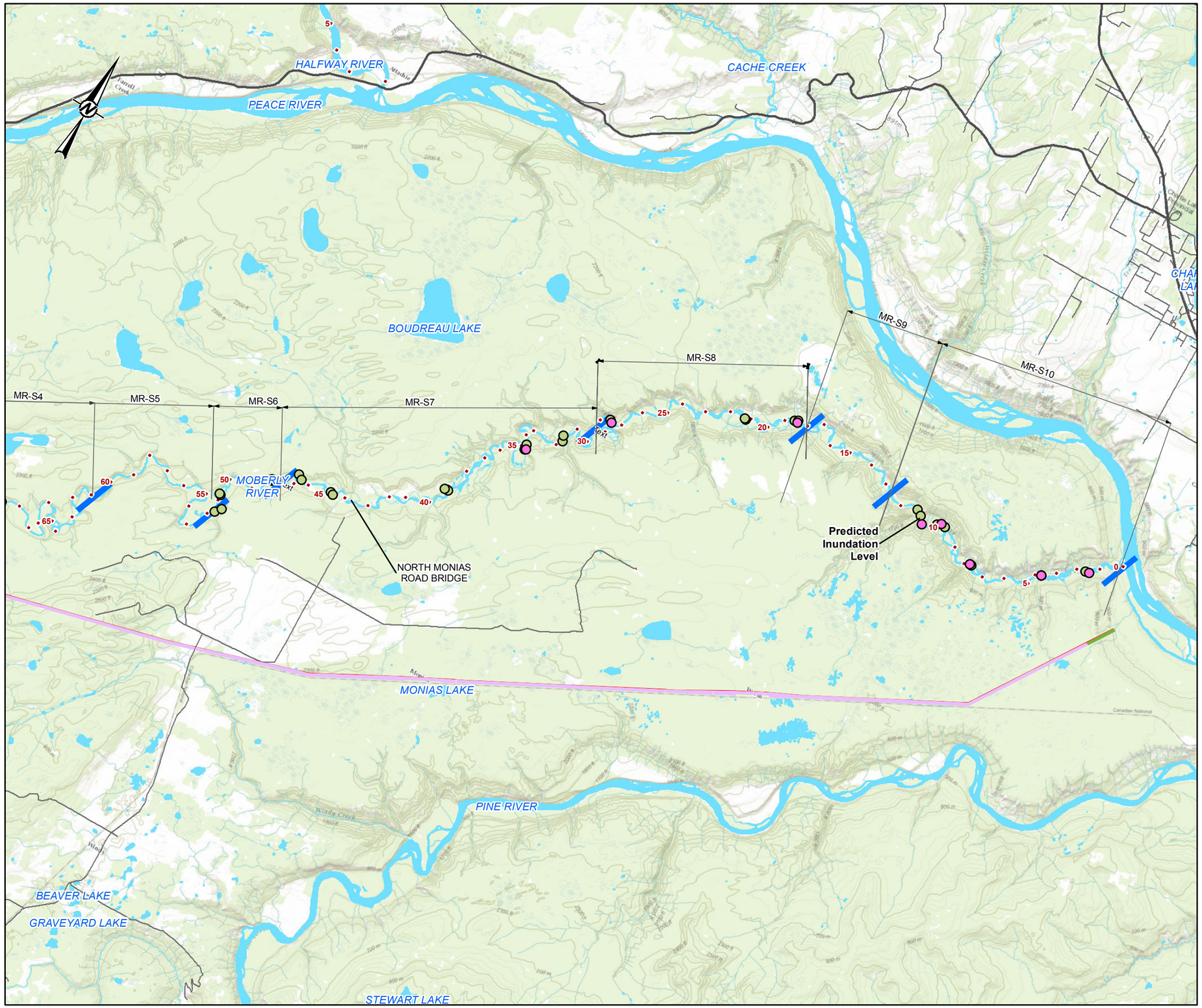


LEGEND

- RIVER KILOMETRE POSTS
- SECTION BREAK

UPSTREAM EXTENT OF EACH SAMPLE SITE

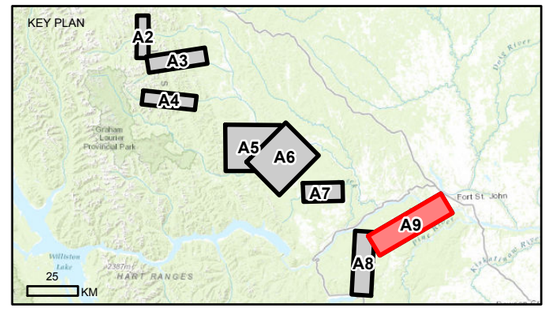
- ANGLING
- BACKPACK ELECTROFISHING
- BEACH SEINING
- SMALL FISH BOAT ELECTROSHOCKING

TRANSMISSION LINE RIGHT OF WAY (ROW)

- BCH EXISTING ROW
- LOO - PERMANENT SUBSTATION
- ONE-TIME CLEARING

BASE DATA

- ACCESS ROAD (APPROX.)
- WATERCOURSE
- WATERBODY



0 2,750 5,500

1:140,000 METRES

REFERENCES

1. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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4. ROW PROVIDED BY BCHYDRO, DATED 2017-07-13.

COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
SITE C RESERVOIR TRIBUTARIES FISH POPULATION INDEXING SURVEY
(Mon-1b, Task 2c)

TITLE
OVERVIEW OF THE SITE C RESERVOIR TRIBUTARIES FISH POPULATI0N INDEXING SURVEY (Mon-1b, Task 2c) MOBERLY RIVER STUDY AREA, 2017.

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-09-04
DESIGNED	DR
PREPARED	JG/MH
REVIEWED	DF
APPROVED	GA

PROJECT NO.	CONTROL	REV.	FIGURE
1650533	2016/6000	0	**A9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

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APPENDIX B

Catch and Effort Data

Table B1 Summary of backpack electrofishing sites sampled during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

River	Section[a]	River Km[b]	Site Name	Sample Date	Sample Length (m)	Sample Time (s)
Chowade River		67.4	CHR-EF-067.4-2017-07-27	27-Jul-2017	275	499
		67.3	CHR-EF-067.3-2017-07-27	27-Jul-2017	130	543
		58.4	CHR-EF-058.4-2017-07-27	27-Jul-2017	170	1018
		58.3	CHR-EF-058.3-2017-07-28	28-Jul-2017	240	500
		58.2	CHR-EF-058.2-2017-07-28	28-Jul-2017	35	1054
		58.1	CHR-EF-058.1-2017-07-28	28-Jul-2017	400	1551
		54.2	CHR-EF-054.2-2017-07-28	28-Jul-2017	230	803
		53.9	CHR-EF-053.9-2017-07-28	28-Jul-2017	180	701
		51.2	CHR-EF-051.2-2017-07-28	28-Jul-2017	170	887
		51.1	CHR-EF-051.1-2017-07-28	28-Jul-2017	265	923
		50.6	CHR-EF-050.6-2017-07-28	28-Jul-2017	165	1373
		49.6	CHR-EF-049.6-2017-07-28	28-Jul-2017	420	1418
		49.5	CHR-EF-049.5-2017-07-28	28-Jul-2017	235	1088
		49.2	CHR-EF-049.2-2017-07-29	29-Jul-2017	290	857
		49.1	CHR-EF-049.1-2017-07-29	29-Jul-2017	165	1379
		48.4	CHR-EF-048.4-2017-07-29	29-Jul-2017	380	1602
		48.2	CHR-EF-048.2-2017-07-29	29-Jul-2017	170	1639
		46.8	CHR-EF-046.8-2017-07-29	29-Jul-2017	175	1294
		46.7	CHR-EF-046.7-2017-07-29	29-Jul-2017	570	1976
		43.5	CHR-EF-043.5-2017-07-30	30-Jul-2017	240	1335
		43.25	CHR-EF-043.3-2017-07-30	30-Jul-2017	230	1235
		43.2	CHR-EF-043.2-2017-07-30	30-Jul-2017	235	720
		43	CHR-EF-042.9-2017-07-30	30-Jul-2017	140	629
		40	CHR-EF-040.0-2017-07-30	30-Jul-2017	285	1727
		39.9	CHR-EF-039.9-2017-07-30	30-Jul-2017	170	1428
		37.1	CHR-EF-037.1-2017-07-30	30-Jul-2017	320	618
		36.6	CHR-EF-036.6-2017-07-30	30-Jul-2017	170	958
Chowade River Total					**6455**	**29755**
Cypress Creek		59.1	CYC-EF-059.1-2017-07-31	31-Jul-2017	320	1486
		40.8	CYC-EF-040.8-2017-07-31	31-Jul-2017	510	2625
		40.6	CYC-EF-040.6-2017-07-31	31-Jul-2017	80	1534
		39.1	CYC-EF-039.1-2017-07-31	31-Jul-2017	920	4000
		38.3	CYC-EF-038.3-2017-07-31	31-Jul-2017	325	1901
		35.9	CYC-EF-035.9-2017-08-01	1-Aug-2017	245	1797
		35.6	CYC-EF-035.6-2017-08-01	1-Aug-2017	345	1984
		35.3	CYC-EF-035.3-2017-08-03	3-Aug-2017	640	3265
		35.2	CYC-EF-035.2-2017-08-03	3-Aug-2017	400	2447

[a] only applicable to Moberly River sites.

continued…

[b] as measured upstream from the stream's confluence.

Table B1 Continued.

River	Section[a]	River Km[b]	Site Name	Sample Date	Sample Length (m)	Sample Time (s)
		34.7	CYC-EF-034.7-2017-08-01	1-Aug-2017	590	4263
		34.5	CYC-EF-034.5-2017-08-01	1-Aug-2017	405	2107
		33.8	CYC-EF-033.8-2017-08-02	2-Aug-2017	480	3772
		33.4	CYC-EF-033.4-2017-08-02	2-Aug-2017	460	2751
		30.9	CYC-EF-030.9-2017-08-02	2-Aug-2017	640	3391
		30.1	CYC-EF-030.1-2017-08-02	2-Aug-2017	430	2164
		29.5	CYC-EF-029.5-2017-08-03	3-Aug-2017	460	3925
		28.2	CYC-EF-028.2-2017-08-03	3-Aug-2017	485	3658
Cypress Creek Total					**7735**	**47070**
Fiddes Creek		11.7	FIC-EF-011.7-2017-08-05	5-Aug-2017	275	2574
		11.4	FIC-EF-011.4-2017-08-05	5-Aug-2017	240	1434
		7	FIC-EF-007.0-2017-08-04	4-Aug-2017	270	2019
Fiddes Creek Total					**785**	**6027**
Turnoff Creek		7.5	TOC-EF-007.5-2017-08-05	5-Aug-2017	255	2170
		7.2	TOC-EF-007.2-2017-08-05	5-Aug-2017	290	1271
		1.1	TOC-EF-001.1-2017-08-04	4-Aug-2017	560	5337
Turnoff Creek Total					**1105**	**8778**
Colt Creek		30.5	COC-EF-030.5-2017-08-08	8-Aug-2017	290	1507
		28.9	COC-EF-028.9-2017-08-08	8-Aug-2017	290	1778
		14.1	COC-EF-014.1-2017-08-09	9-Aug-2017	280	3054
		3.5	COC-EF-003.5-2017-08-08	8-Aug-2017	310	2263
		3.1	COC-EF-003.1-2017-08-08	8-Aug-2017	220	4131
Colt Creek Total					**1390**	**12733**
Farrell Creek		102.1	FAC-EF-102.1-2017-08-06	6-Aug-2017	660	2543
		101.7	FAC-EF-101.7-2017-08-06	6-Aug-2017	280	3505
		65.7	FAC-EF-065.7-2017-08-07	7-Aug-2017	320	1625
		63.4	FAC-EF-063.4-2017-08-07	7-Aug-2017	485	7300
Farrell Creek Total					**1745**	**14973**
Kobes Creek		55.3	KOC-EF-055.3-2017-08-11	11-Aug-2017	215	1532
		46.7	KOC-EF-046.7-2017-08-10	10-Aug-2017	240	2135
		40.5	KOC-EF-040.5-2017-08-10	10-Aug-2017	215	2308
		40.2	KOC-EF-040.2-2017-08-10	10-Aug-2017	215	2391
		11.5	KOC-EF-011.5-2017-08-11	11-Aug-2017	330	2191
Kobes Creek Total					**1215**	**10557**
Moberly River	1A	119.6	MOR-EF-119.6-2017-08-30	30-Aug-2017	85	471
	1A	119.4	MOR-EF-119.4-2017-08-30	30-Aug-2017	32	321
	1A	119.2	MOR-EF-119.2-2017-08-30	30-Aug-2017	63	554
	1A	114.1	MOR-EF-114.1-2017-08-31	31-Aug-2017	106	497

[a] only applicable to Moberly River sites.

continued…

[b] as measured upstream from the stream's confluence.

Table B1 Concluded.

River	Section[a]	River Km[b]	Site Name	Sample Date	Sample Length (m)	Sample Time (s)
	1	104.3	MOR-EF-104.3-2017-09-01	1-Sep-2017	37	450
	1	104	MOR-EF-104.0-2017-09-01	1-Sep-2017	67	534
	1	102.4	MOR-EF-102.4-2017-09-01	1-Sep-2017	85	454
	2	100.4	MOR-EF-100.4-2017-09-01	1-Sep-2017	83	541
	2	99.4	MOR-EF-099.4-2017-09-01	1-Sep-2017	18	222
	3	78.9	MOR-EF-078.9-2017-09-03	3-Sep-2017	81	808
	4	69.8	MOR-EF-069.8-2017-09-04	4-Sep-2017	71	15
	4	69.7	MOR-EF-069.7-2017-09-04	4-Sep-2017	115	2153
	6	51.6	MOR-EF-051.6-2017-09-05	5-Sep-2017	50	1226
	6	51.4	MOR-EF-051.4-2017-09-05	5-Sep-2017	200	1139
	6	50.9	MOR-EF-050.9-2017-09-05	5-Sep-2017	60	1545
	6	50.8	MOR-EF-050.8-2017-09-05	5-Sep-2017	100	1069
	6	48.1	MOR-EF-048.1-2017-09-05	5-Sep-2017	85	529
	6	48	MOR-EF-048.0-2017-09-05	5-Sep-2017	112	1662
	7	46.5	MOR-EF-046.5-2017-09-06	6-Sep-2017	165	1907
	7	46.4	MOR-EF-046.4-2017-09-06	6-Sep-2017	130	2137
	7	44.8	MOR-EF-044.8-2017-09-06	6-Sep-2017	150	1163
	7	44.7	MOR-EF-044.7-2017-09-06	6-Sep-2017	195	2267
	7	39.3	MOR-EF-039.3-2017-09-06	6-Sep-2017	200	1894
	7	39.2	MOR-EF-039.2-2017-09-06	6-Sep-2017	150	1715
	7	35	MOR-EF-035.0-2017-09-06	6-Sep-2017	78	889
	7	34.9	MOR-EF-034.9-2017-09-06	6-Sep-2017	150	974
	7	31.7	MOR-EF-031.7-2017-09-07	7-Sep-2017	200	1380
	7	31.6	MOR-EF-031.6-2017-09-07	7-Sep-2017	225	1263
	8	27.5	MOR-EF-027.5-2017-09-07	7-Sep-2017	120	1059
	8	21.2	MOR-EF-021.2-2017-09-07	7-Sep-2017	300	1056
	8	21.1	MOR-EF-021.1-2017-09-07	7-Sep-2017	150	1008
	8	18.6	MOR-EF-018.6-2017-09-07	7-Sep-2017	150	885
	8	18.4	MOR-EF-018.4-2017-09-07	7-Sep-2017	125	434
	10	11.4	MOR-EF-011.4-2017-09-07	7-Sep-2017	225	1834
	10	11	MOR-EF-011.0-2017-09-07	7-Sep-2017	340	1482
	10	10	MOR-EF-010.0-2017-09-08	8-Sep-2017	150	1281
	10	9.9	MOR-EF-009.9-2017-09-08	8-Sep-2017	250	1114
	10	7.6	MOR-EF-007.6-2017-09-08	8-Sep-2017	120	835
	10	3.9	MOR-EF-003.9-2017-09-08	8-Sep-2017	215	657
	10	1.6	MOR-EF-001.6-2017-09-08	8-Sep-2017	150	1035
Moberly River Total					**5388**	**42459**
Grand Total					**19363**	**142597**

[a] only applicable to Moberly River sites.

[b] as measured upstream from the stream's confluence.

Table B2 Summary of beach seine sites sampled in the Moberly River during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

River	Section	River Km[a]	Site Name	Sample Date	Length Sampled (m)	Width Sampled (m)	Area Sampled (m^2)
Moberly River	MR-S1A	115.9	MOR-BS-115.9-2017-08-31	31-Aug-17	16	1.5	24
	MR-S1A	103.8	MOR-BS-103.8-2017-09-01	01-Sep-17	47	1.5	71
Total							**95**

[a] as measured upstream from the Moberly River's confluence with the Peace River.

Table B3 Summary of angling sites sampled in the Moberly River during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

River	Section	River Km[a]	Site Name	Sample Date	Number of Rods	Time (m)	Angler-Minutes
Moberly River	1A[b]	123.5	MOR-AN-123.5-2017-08-30	30-Aug-2017	1	NR[c]	
	1A	119.2	MOR-AN-119.2-2017-08-30	30-Aug-2017	2	35	70
	1A	118.2	MOR-AN-118.2-2017-08-30	30-Aug-2017	2	12	24
	1A	114.7	MOR-AN-114.7-2017-08-31	31-Aug-2017	2	32	64
	n/a[d]	111	MOR-AN-110.2-2017-08-31	31-Aug-2017	2	19	38
	n/a[d]	109	MOR-AN-109.0-2017-08-31	31-Aug-2017	2	14	28
	1	104.3	MOR-AN-104.3-2017-09-01	1-Sep-2017	2	26	52
	2	100.3	MOR-AN-100.3-2017-09-01	1-Sep-2017	2	11	22
	2	99.5	MOR-AN-099.5-2017-09-01	1-Sep-2017	2	24	48
	3	78.2	MOR-AN-078.8-2017-09-03	3-Sep-2017	2	16	32
	3	75.7	MOR-AN-075.7-2017-09-03	3-Sep-2017	1	NR	
	7	35	MOR-AN-035.0-2017-09-06	6-Sep-2017	1	20	20
	8	27.5	MOR-AN-027.5-2017-09-07	7-Sep-2017	3	20	60
	8	18.2	MOR-AN-018.2-2017-09-07	7-Sep-2017	1	24	24
	10	10.7	MOR-AN-010.7-2017-09-07	7-Sep-2017	1	19	19
	10	10.7	MOR-AN-010.7-2017-09-08	8-Sep-2017	1	23	23
	10	9.9	MOR-AN-009.9-2017-09-08	8-Sep-2017	2	21	42
	10	7.7	MOR-AN-007.7-2017-09-08	8-Sep-2017	2	29	58
	10	3.8	MOR-AN-003.8-2017-09-08	8-Sep-2017	2	56	112
	10	1.4	MOR-AN-001.4-2017-09-08	8-Sep-2017	2	51	102
Total							**838**

[a] as measured upstream from the Moberly River's confluence with the Peace River.

[b] Site located upstream up of the Section 1A boundary. The site was not located within a river section designated by Mainstream (2011b).

[c] NR= Not recorded. Angling while drifting downstream between other sample locations.

[d] Site located between the boundaries of Sections 1A and 1. The site was not located within a river section designated by Mainstream (2011b).

Table B4 Summary of small fish boat electroshocking sites sampled during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

River	Section	River Km[a]	Site Name	Sample Date	Sample Length (m)	Sample Time (s)
Moberly River	1A	119.5	MOR-ES-119.5-2017-08-30	30-Aug-2017	190	228
	1A	119.2	MOR-ES-119.2-2017-08-30	30-Aug-2017	150	227
	1A	116.2	MOR-ES-116.2-2017-08-31	31-Aug-2017	200	271
	1A	115.4	MOR-ES-115.4-2017-08-31	31-Aug-2017	180	206
	1A	114.3	MOR-ES-114.3-2017-08-31	31-Aug-2017	170	228
	1	104.8	MOR-ES-104.8-2017-09-01	1-Sep-2017	240	394
	1	104.3	MOR-ES-104.3-2017-09-01	1-Sep-2017	250	418
	1	103.7	MOR-ES-103.7-2017-09-01	1-Sep-2017	425	711
	1	103.4	MOR-ES-103.4-2017-09-01	1-Sep-2017	300	531
	1	102	MOR-ES-102.0-2017-09-01	1-Sep-2017	240	401
	2	100.4	MOR-ES-100.4-2017-09-01	1-Sep-2017	340	565
Moberly River Total					**2685**	**4180**

[a] as measured upstream from the Moberly River's confluence with the Peace River.

Table B5 Number of fish caught and observed by backpack electrofishing and their frequency of occurrence in the Chowade River and Cypress, Fiddes, and Turnoff creeks during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

Species	Life Stage	River								All Rivers	
		Chowade River		Cypress Creek		Fiddes Creek		Turnoff Creek			
		n	%[b]	n	%[b]	n	%[b]	n	%[b]	n	%[b]
Target Species											
Arctic Grayling	Adult									0	0
	Immature									0	0
	YOY									0	0
All Arctic Grayling		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Bull Trout	Adult	2	1	3	1					5	<1
	Immature	216	54	221	54	185	93	66	96	688	64
	YOY	70	18	37	9	13	7	3	4	123	11
All Bull Trout		**288**	**72**	**261**	**64**	**198**	**100**	**69**	**100**	**816**	**76**
Rainbow Trout	Adult	4	1	3	1					7	1
	Immature			3	1					3	<1
	YOY									0	0
All Rainbow Trout		**4**	**1**	**6**	**1**	**0**	**0**	**0**	**0**	**10**	**1**
Target Species Subtotal		**292**	**73**	**267**	**66**	**198**	**100**	**69**	**100**	**826**	**77**
Non-Target Species											
Mountain Whitefish	All	3	1	1	<1					4	<1
Slimy Sculpin	All	105	26	138	34					243	23
Non-Target Species Subtotal		**108**	**27**	**139**	**34**	**0**	**0**	**0**	**0**	**247**	**23**
All species		**400**	**100**	**406**	**100**	**198**	**100**	**69**	**100**	**1,073**	**100**

[a] Percent composition of the total catch.

Table B6 Number of fish caught and observed by backpack electrofishing and their frequency of occurrence in Colt, Farrell, and Kobes creeks creeks during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

Species	Life Stage	River						All Rivers	
		Colt Creek		Farrell Creek		Kobes Creek			
		n	%[b]	n	%[b]	n	%[b]	n	%[b]
Target Species									
Arctic Grayling	Adult							0	0
	Immature							0	0
	YOY	2	<1					2	<1
All Arctic Grayling		**2**	**<1**	**0**	**0**	**0**	**0**	**2**	**<1**
Bull Trout	Adult	1	<1					1	<1
	Immature	2	<1					2	<1
	YOY							0	0
All Bull Trout		**3**	**<1**	**0**	**0**	**0**	**0**	**3**	**<1**
Rainbow Trout	Adult							0	0
	Immature	103	13	40	6	76	6	219	8
	YOY	4	<1	29	4	11	1	44	2
All Rainbow Trout		**107**	**13**	**69**	**10**	**87**	**6**	**263**	**9**
Target Species Subtotal		**112**	**14**	**69**	**10**	**87**	**6**	**268**	**10**
Non-Target Species									
Lake Chub	All			67	10	71	5	138	5
Largescale Sucker	All			34	5	1	<1	35	1
Longnose Dace	All	48	6	156	23	140	10	344	12
Longnose Sucker	All	22	3	50	7	31	2	103	4
Mountain Whitefish	All	7	1					7	<1
Northern Pikeminnow	All			8	1			8	<1
Redside Shiner	All			151	23	28	2	179	6
Slimy Sculpin	All	613	76	103	15	981	73	1697	60
Sucker Unidentified	All			11	2	3	<1	14	<1
Trout-perch	All			18	3			18	1
Non-Target Species Subtotal		**690**	**86**	**598**	**90**	**1255**	**0**	**2543**	**90**
All species		**802**	**100**	**667**	**100**	**1342**	**100**	**2,811**	**100**

[a] Percent composition of the total catch.

Table B7 Number of fish caught and observed and their frequency of occurrence for all sample methods combined in sampled sections of the Moberly River during the Site C Reservoir Tributary Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

Species[a]	Section[b]																		All Rivers	
	1A		1		2		3		4		6		7		8		10			
	n	%[c]	n	%[c]	n	%[c]	n	%[c]	n	%[c]	n	%[c]	n	%[c]	n	%[c]	n	%[c]	n	%[c]
Arctic Grayling	1	<1											1	<1			1	<1	3	<1
Burbot	6	3	4	4	3	38	2	7	6	5	2	1	13	2			3	1	39	2
Lake Chub									2	2			4	<1	46	17	6	3	58	3
Largescale Sucker	1	<1									7	3	3	<1					11	1
Longnose Dace	18	8	3	3			6	20	58	44	66	30	305	36	133	48	68	31	657	32
Longnose Sucker	31	14	2	2	1	13	2	7	5	4	31	14	204	24	33	12	28	13	337	16
Mountain Whitefish	75	33	42	46	1	13			3	2	9	4	80	10	3	1	4	2	217	11
Northern Pike	1	<1	6	7			1	3			5	2	12	1					25	1
Northern Pikeminnow																	4	2	4	<1
Prickly Sculpin															1	<1			1	<1
Redside Shiner	14	6	10	11			9	30	29	22	61	27	158	19	52	19	102	47	435	21
Slimy Sculpin	29	13	4	4	3	38	10	33	28	21	39	17	49	6	8	3	1	<1	171	8
Sucker Unidentified	40	17	2	2							3	1	12	1			1	<1	58	3
Trout-perch	2	1	15	16					2	2			1	<1					20	1
Walleye																	1	<1	1	<1
White Sucker	11	5	3	3															14	1
All species	**229**	**11**	**91**	**4**	**8**	**0**	**30**	**1**	**133**	**6**	**223**	**11**	**842**	**41**	**276**	**13**	**219**	**11**	**2051**	**100**

[a] Excludes a Northern Pike captured at River Km 123.5 (upstream of Section 1A) and a Rainbow Trout captured at River Km 109.0 (between Sections 1A and 1).

[b] Sampling was not conducted in Sections 5 or 9.

[c] Percent composition of the total catch.

APPENDIX C

Habitat Data

Table C1 Habitat variables measured during the Site C Reservoir Tributaries Fish Population Indexing Survey (Mon-1b, Task 2c), 2017.

River	River Km	Site Name	Sample Date	Water Temp. (°C)	Water Cond. (µS/cm)	Secchi Depth (m)	Instream Velocity[a]	Substrate		Cover Type - Percent of Available Cover (%)								
								Dominant	Sub-dominant	Interstices	Large Woody Debris	Small Woody Debris	Cutbank	Turbulence	Terrestrial Vegetation	Aquatic Vegetation	Shallow Water	Deep Water
Chowade River	67.4	CHR-EF-067.4-2017-07-27	27-Jul-2017	5.0	350	Bottom	Medium	Cobble	Gravel	70	4	1	1	10		5	9	
	67.3	CHR-EF-067.3-2017-07-27	27-Jul-2017	5.0	350	Bottom	Medium	Cobble	Gravel		10	5	15	10	30	25		5
	58.4	CHR-EF-058.4-2017-07-27	27-Jul-2017	8.9	380	Bottom		Cobble	Gravel	30	15	10	5	5	20	15		
	58.3	CHR-EF-058.3-2017-07-28	28-Jul-2017	5.8	390	Bottom		Cobble	Gravel	45	3	2	5		25		15	5
	58.2	CHR-EF-058.2-2017-07-28	28-Jul-2017	5.8	390	Bottom		Sand	Silt		12	8	15		40	5	10	5
	58.1	CHR-EF-058.1-2017-07-28	28-Jul-2017	6.5	370	Bottom	Low	Cobble	Gravel	60	8	2	3	5	1	1	20	
	54.2	CHR-EF-054.2-2017-07-28	28-Jul-2017	7.8	370	Bottom	Medium	Cobble	Gravel	85	3	2	1	5		1	3	
	53.9	CHR-EF-053.9-2017-07-28	28-Jul-2017	7.5	370	Bottom	Medium	Cobble	Gravel	32	3		25		10	5	10	15
	51.2	CHR-EF-051.2-2017-07-28	28-Jul-2017	8.1	400	Bottom	Low	Cobble	Gravel	65	4	1				5	25	
	51.1	CHR-EF-051.1-2017-07-28	28-Jul-2017	8.1	400	Bottom	Medium	Cobble	Gravel	60	10	3	5	5	4	1	10	2
	50.6	CHR-EF-050.6-2017-07-28	28-Jul-2017	8.1	400	Bottom	Low	Gravel	Cobble	45	3	2	2			10	38	
	49.6	CHR-EF-049.6-2017-07-28	28-Jul-2017	8.8	400	Bottom	Medium	Cobble	Gravel	55	10	5	5	2	5	3	10	5
	49.5	CHR-EF-049.5-2017-07-28	28-Jul-2017	8.8	400	Bottom	Medium	Gravel	Sand	70	3	2	5	1		1	18	
	49.2	CHR-EF-049.2-2017-07-29	29-Jul-2017	6.6	410	Bottom	Medium	Cobble	Gravel	84	3	2	1				10	
	49.1	CHR-EF-049.1-2017-07-29	29-Jul-2017	7.3	410	Bottom		Cobble	Gravel	47	15	5	5		3		20	5
	48.4	CHR-EF-048.4-2017-07-29	29-Jul-2017	7.9	410	Bottom	Low	Sand	Gravel	5	45	45	10				5	
	48.2	CHR-EF-048.2-2017-07-29	29-Jul-2017	7.9	410	Bottom		Cobble	Gravel	50	20	5	5	5		1		14
	46.8	CHR-EF-046.8-2017-07-29	29-Jul-2017	8.2	410	Bottom	Medium	Boulder	Cobble	65	3		2	10			15	5
	46.7	CHR-EF-046.7-2017-07-29	29-Jul-2017	8.2	410	Bottom	Medium	Gravel	and; Boulde	83	5	5	1			1	5	
	43.5	CHR-EF-043.5-2017-07-30	30-Jul-2017	7.8	420	Bottom	Low	Sand	Gravel	15	20	15	5				45	
	43.3	CHR-EF-043.3-2017-07-30	30-Jul-2017	7.8	420	>2.0 m	Low	Cobble	Gravel	10	35	15	10	5	5		10	20
	43.2	CHR-EF-043.2-2017-07-30	30-Jul-2017	10.1	420	Bottom	Medium	Gravel	Sand	25	10	10	1	5			49	
	43	CHR-EF-042.9-2017-07-30	30-Jul-2017	10.1	420	Bottom	Low	Cobble	Gravel	5	50	20	15					10
	40	CHR-EF-040.0-2017-07-30	30-Jul-2017	9.6	420	Bottom	Medium	Sand	Gravel	15	20	10					50	5
	39.9	CHR-EF-039.9-2017-07-30	30-Jul-2017	9.6	420	Bottom	Medium	Sand	Cobble	10		10	20	10	5		5	15
	37.1	CHR-EF-037.1-2017-07-30	30-Jul-2017	10.4	420	Bottom	Medium	Silt	Gravel	25	15	10	1				49	
	36.6	CHR-EF-036.6-2017-07-30	30-Jul-2017	10.4	420	>2.0 m	Medium	Cobble	Gravel	20	20	20	30					5
Cypress Creek	59.1	CYC-EF-059.1-2017-07-31	31-Jul-2017	5.0	460	Bottom	Medium	Cobble	Gravel	85	2		1	10		2		
	40.8	CYC-EF-040.8-2017-07-31	31-Jul-2017	9.0	460	Bottom	Medium	Cobble	and; Boulde	30	15	20	1	4			30	
	40.6	CYC-EF-040.6-2017-07-31	31-Jul-2017	9.0	460	Bottom	Medium	Cobble	Gravel	55	20	2	3	5			10	5
	39.1	CYC-EF-039.1-2017-07-31	31-Jul-2017	9.7	460	Bottom	Medium	Gravel	Cobble; Boulder	85	5	5	4					1
	38.3	CYC-EF-038.3-2017-07-31	31-Jul-2017	9.7	460	Bottom	Medium	Cobble	Gravel	65	15	2	3	3		2	5	5
	35.9	CYC-EF-035.9-2017-08-01	1-Aug-2017	9.9	480	Bottom	Medium	Cobble	Gravel	50	25		3	10	3		4	5
	35.6	CYC-EF-035.6-2017-08-01	1-Aug-2017	9.9	480	Bottom	Medium	Cobble	Gravel	65	2	3	10				20	
	35.3	CYC-EF-035.3-2017-08-03	3-Aug-2017	8.8	480	Bottom	Medium	Cobble	Sand	50	2	3	1	5			37	2
	35.2	CYC-EF-035.2-2017-08-03	3-Aug-2017	8.5	380	Bottom	Medium	Cobble	Gravel	25	25	5	5	10	20		10	
	34.7	CYC-EF-034.7-2017-08-01	1-Aug-2017	10.5	460	Bottom		Cobble	Boulder	70	3	2		10			14	1
	34.5	CYC-EF-034.5-2017-08-01	1-Aug-2017	10.5	460	Bottom	Medium	Cobble	Gravel	40	15	10	5	5	15	2	3	5
	33.8	CYC-EF-033.8-2017-08-02	2-Aug-2017	10.6	440	Bottom	Medium	Cobble	Sand	50	10	10	1	5			24	
	33.4	CYC-EF-033.4-2017-08-02	2-Aug-2017	10.6	440	Bottom	Medium	Cobble	Boulder	50	15	1	2	13		1	2	16
	30.9	CYC-EF-030.9-2017-08-02	2-Aug-2017	13.7	440	Bottom	Medium	Cobble	Gravel	40	5	5		5			45	
	30.1	CYC-EF-030.1-2017-08-02	2-Aug-2017	13.7	440	Bottom	Medium	Cobble	Boulder	65	10	5	1	2	2		14	1
	29.5	CYC-EF-029.5-2017-08-03	3-Aug-2017	10.0	440	Bottom	Medium	Cobble	Gravel	65	1	1		20	5		7	1
	28.2	CYC-EF-028.2-2017-08-03	3-Aug-2017	9.5	440	Bottom		Cobble	Sand	50	13	5		20			10	2
Fiddes Creek	11.7	FIC-EF-011.7-2017-08-05	5-Aug-2017	10.7	480	Bottom	Medium	Cobble	ravel; Bould	53	1	1	1	10		4	30	
	11.4	FIC-EF-011.4-2017-08-05	5-Aug-2017	10.7	480	Bottom	Medium	Cobble	Boulder	65	2	2				10	20	1
	7	FIC-EF-007.0-2017-08-04	4-Aug-2017	7.1	470	Bottom	Medium	Cobble	Boulder	52	3			15		20	10	
Turnoff Creek	7.5	TOC-EF-007.5-2017-08-05	5-Aug-2017	9.5	520	Bottom	Medium	Cobble	Gravel	32	1	2	1	5		4	55	
	7.2	TOC-EF-007.2-2017-08-05	5-Aug-2017	8.6	520	Bottom		Cobble	Boulder	60	2	1	1	10	1	2	20	3
	1.1	TOC-EF-001.1-2017-08-04	4-Aug-2017	9.8	500	Bottom	Medium	Cobble	Boulder	40	2	3	1	30	1	2	20	1
Colt Creek	30.5	COC-EF-030.5-2017-08-08	8-Aug-2017	10.6	350	Bottom	Medium	Cobble	Boulder	80	5		5	5	5			
	28.9	COC-EF-028.9-2017-08-08	8-Aug-2017	10.6	360	Bottom	Medium	Cobble	Boulder	68	5		1	1			25	
	14.1	COC-EF-014.1-2017-08-09	9-Aug-2017	13.0	360	Bottom	Low	Cobble	Gravel	58	2	2	1		5	5	25	2
	3.5	COC-EF-003.5-2017-08-08	8-Aug-2017	18.0	360	Bottom	Low	Cobble	Gravel	60	20	2	1		2	2	12	1
	3.1	COC-EF-003.1-2017-08-08	8-Aug-2017	15.1	370	0.9 m	Low	Cobble	Gravel	50	2	3	1		1		42	1

[a] A categorical ranking of water velocity (high = greater than 1.0 m/s; medium = 0.5 to 1.0 m/s; low = less than 0.5 m/s)

…continued.

Table C1 Continued.

River	River Km	Site Name	Sample Date	Water Temp. (°C)	Water Cond. (µS/cm)	Secchi Depth (m)	Instream Velocity[a]	Substrate		Cover Type - Percent of Available Cover (%)								
								Dominant	Sub-dominant	Interstices	Large Woody Debris	Small Woody Debris	Cutbank	Turbulence	Terrestrial Vegetation	Aquatic Vegetation	Shallow Water	Deep Water
Farrell Creek	102.1	FAC-EF-102.1-2017-08-06	6-Aug-2017	16.5	480	0.75 m	Low	Silt; Sand	Gravel	15	30	5	2	1	11	1	22	13
	101.7	FAC-EF-101.7-2017-08-06	6-Aug-2017	16.5	480	0.75 m	Low	Sand	Gravel	5	20	20	5				25	25
	65.7	FAC-EF-065.7-2017-08-07	7-Aug-2017	19.6	560	Bottom	Low	sand	Gravel	5	18	5	5			2	45	20
	63.4	FAC-EF-063.4-2017-08-07	7-Aug-2017	17.5	560	>0.65 m	Low	and; Grav	Cobble	50	2	1	1				45	1
Kobes Creek	55.3	KOC-EF-055.3-2017-08-11	11-Aug-2017	15.2	100	Bottom	Low	Gravel	Cobble	20	10	5			35		30	
	46.7	KOC-EF-046.7-2017-08-10	10-Aug-2017	19.8	140	Bottom	Low	Cobble	and; Grave	40	10	5	1		5		39	
	40.5	KOC-EF-040.5-2017-08-10	10-Aug-2017	16.1	190	Bottom	Low	Cobble	Sand	60	2	3	1		1	1	30	2
	40.2	KOC-EF-040.2-2017-08-10	10-Aug-2017	16.1	190	Bottom	Low	Sand	Cobble	25	35	10	2		15		1	2
	11.5	KOC-EF-011.5-2017-08-11	11-Aug-2017	22.7	280	0.5 m	Low	Cobble	Sand	76	3	1			2	1	15	2
Moberly River	123.5	MOR-AN-123.5-2017-08-30	30-Aug-2017	18.8			Moderate											
	119.6	MOR-EF-119.6-2017-08-30	30-Aug-2017	17.0	360	1	Low	Sand	Gravel	20		20	25				35	
	119.5	MOR-ES-119.5-2017-08-30	30-Aug-2017	18.4	190	bottom	Low	Cobble	Gravel	70	4	1					25	
	119.4	MOR-EF-119.4-2017-08-30	30-Aug-2017	18.5	190	1.5	Moderate	Gravel	Cobble	60		10		30				
	119.2	MOR-ES-119.2-2017-08-30	30-Aug-2017	18.4	190		Low	Cobble	Gravel	15	15	10					25	35
	119.2	MOR-EF-119.2-2017-08-30	30-Aug-2017	18.0	190	1.5	High	Cobble	Gravel	20	20			60				
	119.2	MOR-AN-119.2-2017-08-30	30-Aug-2017	18.8	190	bottom	Moderate	Cobble	Boulder	10	20			10			30	30
	118.2	MOR-AN-118.2-2017-08-30	30-Aug-2017	18.0	190	bottom	Moderate	Cobble	Boulder	25				10			15	50
	116.2	MOR-ES-116.2-2017-08-31	31-Aug-2017	16.0	210	1	Low	Silt	Gravel	10	5	5					75	5
	115.9	MOR-BS-115.9-2017-08-31	31-Aug-2017	16.0	210	1	Moderate	Gravel	Silt	80							20	
	115.4	MOR-ES-115.4-2017-08-31	31-Aug-2017	16.2	210	bottom	Moderate	Cobble	Gravel	50	1	1					48	
	114.7	MOR-AN-114.7-2017-08-31	31-Aug-2017	17.5	210	bottom	Low	Sand	Cobble	5	10	10			10			65
	114.3	MOR-ES-114.3-2017-08-31	31-Aug-2017	16.4	210	bottom	Moderate	Cobble	Boulder	70	1	1		1			27	
	114.1	MOR-EF-114.1-2017-08-31	31-Aug-2017	16.0	210	1	Low	Sand	Gravel	20		50			20		10	
	111	MOR-AN-110.2-2017-08-31	31-Aug-2017	17.6	210	bottom	Moderate	Cobble	Sand		10	10		20			10	50
	109	MOR-AN-109.0-2017-08-31	31-Aug-2017	17.0			Low	Gravel	Sand	15	10	10			10			55
	104.8	MOR-ES-104.8-2017-09-01	1-Sep-2017	14.0	220	2	Low	Silt	Sand	5	15	10					5	65
	104.3	MOR-ES-104.3-2017-09-01	1-Sep-2017	14.0	220	2	Low	Silt	Sand	5	13	7					25	50
	104.3	MOR-AN-104.3-2017-09-01	1-Sep-2017	14.3	220	0.5	Low	Sand	Cobble		20	5		5				70
	104.3	MOR-EF-104.3-2017-09-01	1-Sep-2017	13.5	230	1	Low	Gravel	Silt	10		40			30			20
	104	MOR-EF-104.0-2017-09-01	1-Sep-2017	13.0	210	1	Moderate	Gravel	Silt	10		30		30	30			
	103.8	MOR-BS-103.8-2017-09-01	1-Sep-2017	15.0	210	1	Low	Silt	Gravel	30							70	
	103.7	MOR-ES-103.7-2017-09-01	1-Sep-2017	15.4	220	2	Low	Silt	Gravel	10	15	10					15	50
	103.4	MOR-ES-103.4-2017-09-01	1-Sep-2017	15.4	220	2	Low	Gravel	Sand	25	10	5					55	5
	102.4	MOR-EF-102.4-2017-09-01	1-Sep-2017	15.0	210	1	Low	Gravel	Silt	20	10	20	10		30			10
	102	MOR-ES-102.0-2017-09-01	1-Sep-2017	16.2	220	2	Low	Sand	Gravel	15	15	10					35	25
	100.4	MOR-ES-100.4-2017-09-01	1-Sep-2017	16.2	220	2	Low	Silt	Sand	5	7	3					60	25
	100.4	MOR-EF-100.4-2017-09-01	1-Sep-2017	15.0	210	1	Low	Silt	Gravel	38	2	50					10	
	100.3	MOR-AN-100.3-2017-09-01	1-Sep-2017	16.7	220		Low	Silt	Silt		5	5						90
	99.5	MOR-AN-099.5-2017-09-01	1-Sep-2017	15.0	210	bottom	Low	Silt	Sand		10	10			10	10		60
	99.4	MOR-EF-099.4-2017-09-01	1-Sep-2017	15.0	210	1	Low	Gravel	Silt		10	80						10
	78.9	MOR-EF-078.9-2017-09-03	3-Sep-2017	14.0	240	bottom	Low	Gravel	Cobble	40	3	2		10			45	
	78.2	MOR-AN-078.8-2017-09-03	3-Sep-2017	14.3	240		Low	Gravel	Cobble	5	20	15		10			20	30
	75.7	MOR-AN-075.7-2017-09-03	3-Sep-2017	14.3	240													
	69.8	MOR-EF-069.8-2017-09-04	4-Sep-2017	16.6	230	1	Low	Cobble	Gravel	40				60				
	69.7	MOR-EF-069.7-2017-09-04	4-Sep-2017	16.6	230	1	Low	Cobble	Gravel	50	10	10			20			10
	51.6	MOR-EF-051.6-2017-09-05	5-Sep-2017	17.0	210	1	Low	Gravel	Cobble	60	5	10		15	5			5
	51.4	MOR-EF-051.4-2017-09-05	5-Sep-2017	17.0	210	bottom	Low	Silt	Gravel	25		1		5			69	
	50.9	MOR-EF-050.9-2017-09-05	5-Sep-2017	16.5	210	bottom	Moderate	Gravel	Sand	50	3	7	1	27			10	2
	50.8	MOR-EF-050.8-2017-09-05	5-Sep-2017	16.5	210	1	Low	Gravel	Cobble	25	10	15		10	10			30
	48.1	MOR-EF-048.1-2017-09-05	5-Sep-2017	16.5	210	bottom	Low	Cobble	Gravel	40	5	10					5	40
	48	MOR-EF-048.0-2017-09-05	5-Sep-2017	16.5	210	1	Low	Gravel	Cobble	40	10	10	5	30	5			
	46.5	MOR-EF-046.5-2017-09-06	6-Sep-2017	14.9	210	bottom	Moderate	Gravel	Cobble	60		2		20			18	
	46.4	MOR-EF-046.4-2017-09-06	6-Sep-2017	14.9	220	1	Low	Gravel	Cobble	53	2	5		30				10
	44.8	MOR-EF-044.8-2017-09-06	6-Sep-2017	15.5	220	bottom	Low	Gravel	Cobble	30	3	7		5			30	25
	44.7	MOR-EF-044.7-2017-09-06	6-Sep-2017	15.5	220	1	Low	Cobble	Gravel			10			15			10
	39.3	MOR-EF-039.3-2017-09-06	6-Sep-2017	17.0	220	bottom	Low	Cobble	Gravel	50	8	7		15				20
	39.2	MOR-EF-039.2-2017-09-06	6-Sep-2017	13.0	220	1.5	Low	Gravel	Cobble	73	2	5			10			10
	35	MOR-EF-035.0-2017-09-06	6-Sep-2017	15.5	220	1.5	Low	Gravel	Cobble	40		5		30				25
	35	MOR-AN-035.0-2017-09-06	6-Sep-2017	15.5	220	1.5	Low	Gravel	Cobble	40		5		30				25

[a] A categorical ranking of water velocity (high = greater than 1.0 m/s; medium = 0.5 to 1.0 m/s; low = less than 0.5 m/s)

…continued.

Table C1 Concluded.

River	River Km	Site Name	Sample Date	Water Temp. (°C)	Water Cond. (µS/cm)	Secchi Depth (m)	Instream Velocity[a]	Substrate		Cover Type - Percent of Available Cover (%)								
								Dominant	Sub-dominant	Interstices	Large Woody Debris	Small Woody Debris	Cutbank	Turbulence	Terrestrial Vegetation	Aquatic Vegetation	Shallow Water	Deep Water
Moberly River	34.9	MOR-EF-034.9-2017-09-06	6-Sep-2017	15.5	220	bottom	Moderate	Cobble	Gravel	60		1		35			2	2
	31.7	MOR-EF-031.7-2017-09-07	7-Sep-2017	11.0	330	1.5	Low	Gravel	Cobble	30	15	25		10	5			15
	31.6	MOR-EF-031.6-2017-09-07	7-Sep-2017	11.0	330	bottom	Low	Cobble	Gravel	50	3	2		10			10	25
	27.5	MOR-EF-027.5-2017-09-07	7-Sep-2017	13.0	330	bottom	Moderate	Gravel	Cobble	40		5		15			35	5
	27.5	MOR-AN-027.5-2017-09-07	7-Sep-2017	13.0	330	bottom	Low	Silt	Gravel					10				80
	21.2	MOR-EF-021.2-2017-09-07	7-Sep-2017	15.0	190	1.5	Low	Gravel	Cobble	40	10	15		25	5			5
	21.1	MOR-EF-021.1-2017-09-07	7-Sep-2017	15.5	360	bottom	Low	Gravel	Cobble	60	3	2		25			5	5
	18.6	MOR-EF-018.6-2017-09-07	7-Sep-2017	15.0	210	1.5	Low	Gravel	Cobble	40	10	15		15	10			10
	18.4	MOR-EF-018.4-2017-09-07	7-Sep-2017	15.5	350	bottom	Low	Silt	Gravel	20	20	15	1	5			34	5
	18.2	MOR-AN-018.2-2017-09-07	7-Sep-2017	15.5	190	bottom	Low	Sand	Gravel		40	15		15				30
	11.4	MOR-EF-011.4-2017-09-07	7-Sep-2017	16.5	330	bottom	Low	Gravel	Cobble	70	5	5		15			5	
	11	MOR-EF-011.0-2017-09-07	7-Sep-2017	16.5	330	1.5	Low	Cobble	Boulder	60	10	10		10	5			5
	10.7	MOR-AN-010.7-2017-09-08	8-Sep-2017	15.0	330	bottom	Low	Silt	Sand									100
	10.7	MOR-AN-010.7-2017-09-07	7-Sep-2017	16.5	330	bottom	Low	Silt	Sand									100
	10	MOR-EF-010.0-2017-09-08	8-Sep-2017	15.0	330	1.5	Low	Gravel	Cobble	60	10	10		15				5
	9.9	MOR-EF-009.9-2017-09-08	8-Sep-2017	15.0	330	bottom	Moderate	Gravel	Cobble	60	2	3		20			14	1
	9.9	MOR-AN-009.9-2017-09-08	8-Sep-2017	15.0	330	1.5	Low	Cobble	Gravel		30	20						50
	7.7	MOR-AN-007.7-2017-09-08	8-Sep-2017	15.0	330	1.5	Low	Gravel	Silt		15	5						80
	7.6	MOR-EF-007.6-2017-09-08	8-Sep-2017	15.0	330	bottom	Moderate	Cobble	Gravel	60	3	5		30			2	
	3.9	MOR-EF-003.9-2017-09-08	8-Sep-2017	18.0	330	bottom	Low	Gravel	Cobble	58	3	3		30			5	1
	3.8	MOR-AN-003.8-2017-09-08	8-Sep-2017	18.0	330	1.5	Low	Gravel	Cobble	10	20	10						60
	1.6	MOR-EF-001.6-2017-09-08	8-Sep-2017	18.0	330	bottom	Moderate	Gravel	Cobble	50	5	5		25			10	5
	1.4	MOR-AN-001.4-2017-09-08	8-Sep-2017	18.0	330	1.5	Low	Gravel	Cobble	30	10	5						55

Table C2 Habitat variables recorded at backpack electrofishing and beach seining sites on the Moberly River during the Site C Reservoir Tributaries Fish Population Index Survey (Mon-1b, Task 2c), 2017.

River Section	Site Name	Sample Date	Water Temp. (°C)	Water Cond. (µS/cm)	Secchi Depth (m)	D90	Embeddedness (L/M/H)	Compaction (L/M/H)	Depth (m)			Velocity (m/s)			Percent Substrate						Bank Sampled (LDB/RDB/MID)[a]	Bank Habitat	Instream Habitat
									Near	Mid	Far	Near	Mid	Far	Organics	Silt/Clay	Sand	Gravel	Cobble	Boulder			
1A	MOR-EF-119.6-2017-08-30	30-Aug-17	17.0	360	1	22	M	L	0.25	0.50	-	-	-	-			50	40	10		MID	pool	riffle
1A	MOR-EF-119.4-2017-08-30	30-Aug-17	18.5	190	1.5	18	L	L	0.16	0.18	0.14	0.77	0.83	0.71	2		5	60	33		LDB	riffle	riffle
1A	MOR-EF-119.2-2017-08-30	30-Aug-17	18.0	190	1.5	23	L	M	0.40	0.24	0.27	0.53	0.62	0.55			5	20	75		RDB	riffle	riffle
1A	MOR-BS-115.9-2017-08-31	31-Aug-17	16.0	210	1	13	H	M	0.17	0.31	0.33	0.17	0.18	0.18		50		50			LDB	glide	run
1A	MOR-EF-114.1-2017-08-31	31-Aug-17	16.0	210	1	8	H	M	0.31	0.31	0.24	-	-	-			50	50			RDB	glide	run
1	MOR-EF-104.3-2017-09-01	1-Sep-17	13.5	230	1	13	M	M	0.49	0.69	0.70	-	-	-		20		80			RDB	pool	run
1	MOR-EF-104.0-2017-09-01	1-Sep-17	13.0	210	1	9	M	M	0.43	0.37	0.27	0.85	0.93	0.89	5	20		75			RDB	SC	riffle
1	MOR-BS-103.8-2017-09-01	1-Sep-17	15.0	210	1	7	M	L	0.15	0.29	0.39	-	-	-	2	65		33			RDB	glide	run
1	MOR-EF-102.4-2017-09-01	1-Sep-17	15.0	210	1	18	H	L	0.25	0.29	0.34	0.81	0.35	0.35	15	25		50	10		RDB	glide	run
2	MOR-EF-100.4-2017-09-01	1-Sep-17	15.0	210	1	2	H	L	0.24	0.29	0.31	0.17	0.42	0.38		60		40			RDB	glide	run
2	MOR-EF-099.4-2017-09-01	1-Sep-17	15.0	210	1	12	H	L	0.15	0.25	0.34	-	0.18	0.23	5	20		75			LDB	eddy	run
3	MOR-EF-078.9-2017-09-03	3-Sep-17	14.0	240	bottom	25	M	M	0.40	0.43	0.31	0.50	0.30	0.40			15	40	35	10	RDB	riffle	run
4	MOR-EF-069.8-2017-09-04	4-Sep-17	16.6	230	1	53	M	M	0.27	0.45	0.19	0.61	0.53	0.43				15	75	10	MID	riffle	riffle
4	MOR-EF-069.7-2017-09-04	4-Sep-17	16.6	230	1	45	M	M	0.50	0.76	0.75	-	0.06	0.06		20		30	40	10	LDB	glide	run
6	MOR-EF-051.6-2017-09-05	5-Sep-17	17.0	210	1	33	M	M	0.21	0.26	0.35	0.14	0.32	0.67		10		50	40		MID	riffle	riffle
6	MOR-EF-051.4-2017-09-05	5-Sep-17	17.0	210	bottom	30	M	M	0.14	0.26	0.48	0.01	0.01	0.01		39	10	35	15	1	RDB	glide	riffle, run
7	MOR-EF-050.9-2017-09-05	5-Sep-17	16.5	210	bottom	25	L	L	0.21	0.35	0.12	0.54	0.81	0.48			25	50	20	5	MID	riffle	riffle
7	MOR-EF-050.8-2017-09-05	5-Sep-17	16.5	210	1	20	M	M	0.46	0.92	0.56	0.17	0.12	0.01		15		50	35		MID	glide	run
7	MOR-EF-048.1-2017-09-05	5-Sep-17	16.5	210	bottom	30	M	L	0.58	0.50	0.50	0.09	0.10	0.09		5	10	30	40	15	RDB	glide	run, pool
7	MOR-EF-048.0-2017-09-05	5-Sep-17	16.5	210	1	14	M	M	0.14	0.19	0.36	0.44	0.49	0.45	5		5	50	30	10	RDB	riffle	riffle
8	MOR-EF-046.5-2017-09-06	6-Sep-17	14.9	210	bottom	25	M	M	0.19	0.17	0.10	0.43	0.55	0.53		5	15	40	35	5	LDB	glide	riffle
8	MOR-EF-046.4-2017-09-06	6-Sep-17	14.9	220	1	25	M	M	0.51	0.64	0.39	0.06	0.31	0.56		10		60	30		RDB	riffle	riffle
8	MOR-EF-044.8-2017-09-06	6-Sep-17	15.5	220	>1.0	22	M	M	0.46	0.86	0.97	0.14	0.13	0.06		10	5	40	40	5	LDB	glide	run, pool
8	MOR-EF-044.7-2017-09-06	6-Sep-17	15.5	220	1	0	M	M	0.25	0.26	0.50	0.40	0.60	0.40		10		40	50		MID	riffle	riffle
8	MOR-EF-039.3-2017-09-06	6-Sep-17	17.0	220	>1.0	27	M	M	0.64	0.62	0.52	0.09	0.12	0.12		5	10	30	50	5	LDB	glide	riffle, run
8	MOR-EF-039.2-2017-09-06	6-Sep-17	13.0	220	1.5	12	L	M	0.21	0.34	0.38	0.05	0.16	0.27		10		60	30		LDB	riffle	riffle
8	MOR-EF-035.0-2017-09-06	6-Sep-17	15.5	220	1.5	19	L	M	0.28	0.42	0.41	0.67	0.81	0.69		10		60	30		LDB	riffle	riffle
8	MOR-EF-034.9-2017-09-06	6-Sep-17	15.5	220	bottom	40	L	M	0.25	0.41	0.44	0.23	0.74	0.41			10	30	50	10	LDB	riffle	riffle
8	MOR-EF-031.7-2017-09-07	7-Sep-17	11.0	330	1.5	18	M	M	0.20	0.20	0.32	0.25	0.31	0.51		15		40	30	15	MID	riffle	riffle
8	MOR-EF-031.6-2017-09-07	7-Sep-17	11.0	330	>1.0	30	L	L	0.49	0.51	0.57	0.41	0.46	0.35			5	35	50	10	LDB	glide	riffle, run
9	MOR-EF-027.5-2017-09-07	7-Sep-17	13.0	330	>1.0	25	L	M	0.22	0.52	0.48	0.59	0.69	0.69			5	50	40	5	MID	glide	riffle
9	MOR-EF-021.2-2017-09-07	7-Sep-17	15.0	190	1.5	18	L	M	0.22	0.18	0.14	0.21	0.40	0.39		8		60	30	2	MID	riffle	riffle
9	MOR-EF-021.1-2017-09-07	7-Sep-17	15.5	360	>1.0	25	L	L	0.32	0.36	0.32	0.42	0.42	0.40		5	5	45	45		RDB	riffle	riffle
9	MOR-EF-018.6-2017-09-07	7-Sep-17	15.0	210	1.5	12	L	M	0.10	0.12	0.18	0.27	0.40	0.46		15	65	20			MID	riffle	riffle
9	MOR-EF-018.4-2017-09-07	7-Sep-17	15.5	350	bottom	16	H	M	0.21	0.29	0.17	0.14	0.36	0.52	5	50	10	25	10		MID	glide	run, flat
10	MOR-EF-011.4-2017-09-07	7-Sep-17	16.5	330	bottom	30	M	M	0.40	0.45	0.29	0.25	0.42	0.46			10	40	40	10	RDB	glide	riffle

[a]LDB = Left bank as viewed facing downstream; RDB = Right bank as viewed facing downstream; MID = Mid Channel.

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Table C2 Concluded.

River Section	Site Name	Sample Date	Water Temp. (°C)	Water Cond. (µS/cm)	Secchi Depth (m)	D90	Embeddedness (L/M/H)	Compaction (L/M/H)	Depth (m)			Velocity (m/s)			Percent Substrate						Bank Sampled (LDB/RDB/MID)[a]	Bank Habitat	Instream Habitat
									Near	Mid	Far	Near	Mid	Far	Organics	Silt/Clay	Sand	Gravel	Cobble	Boulder			
10	MOR-EF-011.0-2017-09-07	7-Sep-17	16.5	330	1.5	35	L	M	0.31	0.36	0.43	0.14	0.21	0.24				15	60	25	RDB	riffle	riffle
10	MOR-EF-010.0-2017-09-08	8-Sep-17	15.0	330	1.5	17	L	H	0.14	0.22	0.28	0.36	0.39	0.42		25		45	30		MID	riffle	riffle
10	MOR-EF-009.9-2017-09-08	8-Sep-17	15.0	330	bottom	20	M	M	0.20	0.18	0.13	0.81	0.72	0.12		1	9	50	35	5	RDB	riffle	riffle
10	MOR-EF-007.6-2017-09-08	8-Sep-17	15.0	330	bottom	25	L	L	0.21	0.31	0.20	0.72	0.89	0.40			10	40	49	1	MID	riffle	riffle
10	MOR-EF-003.9-2017-09-08	8-Sep-17	18.0	330	>1.0	17	M	L	0.14	0.20	0.20	0.25	0.34	0.26		2	13	50	35		RDB	riffle	riffle
10	MOR-EF-001.6-2017-09-08	8-Sep-17	18.0	330	bottom	21	M	M	0.17	0.30	0.21	0.55	0.87	0.64		5	10	45	37	3	LDB	riffle	riffle

[a]LDB = Left bank as viewed facing downstream; RDB = Right bank as viewed facing downstream; MID = Mid Channel.

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