# Site C Clean Energy Project

## Peace River Physical Habitat Monitoring Program (Mon-3)

## Construction Year 5 (2019)

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**REPORT**

# Peace River Physical Habitat Monitoring Program

*2019 Investigations (Mon-3)*

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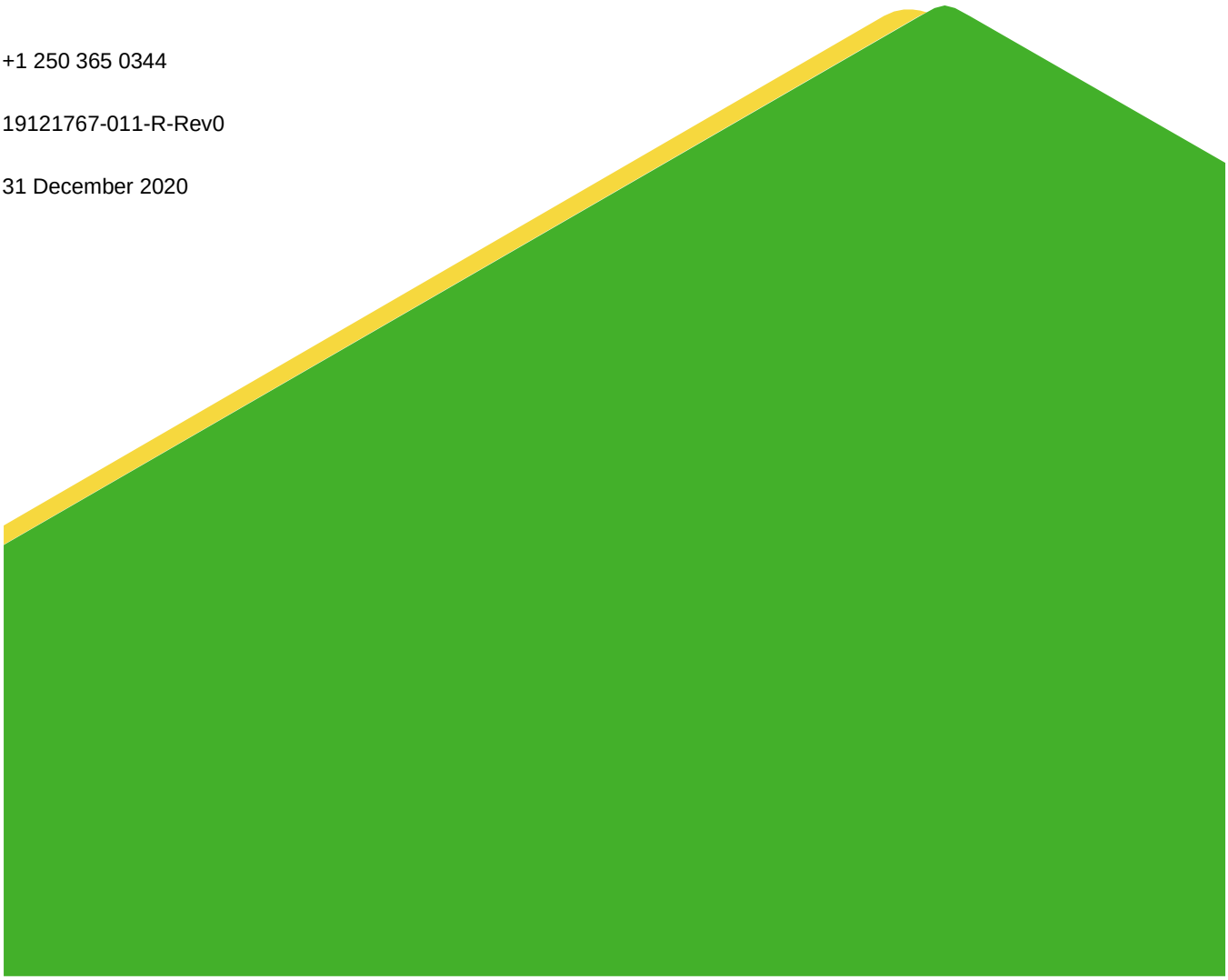

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# Executive Summary

The Site C Clean Energy Project (the Project), including Project construction, reservoir filling, and operation, could affect fish and fish habitat via three key pathways: changes to fish habitat (including nutrient concentrations and lower trophic biota), changes to fish health and fish survival, and changes to fish movement. These paths are examined in Volume 2 of the Project's Environmental Impact Statement (EIS; BC Hydro 2013).

BC Hydro submitted an application to Fisheries and Oceans Canada (DFO) for an authorization under Section 35(2)b of the *Fisheries Act* for several components of the Project associated with dam construction, reservoir preparation, and reservoir filling (BC Hydro 2015a). In accordance with Provincial Environmental Assessment Certificate (EAC) Condition No. 7 and Federal Decision Statement Condition Nos. 8.4.3 and 8.4.4 for the Project, BC Hydro developed the Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP; BC Hydro 2015b). The Peace River Physical Habitat Monitoring Program (Mon-3) represents one component of the FAHMFP that will monitor the effect of the Project on physical habitat in the Peace River.

Once complete, the Project will shift the point of regulation on the Peace River to approximately 85 km downstream of Peace Canyon Dam (PCD), which will influence physical processes driving river geomorphology, such as water velocities and sediment transport capacities (BC Hydro 2015b). Downstream of the Project, the daily range of water levels is predicted to increase, with the magnitude of these increases expected to be greatest closest to the Project. Associated changes to river flows will affect the types and distributions of aquatic habitats available to fish both upstream and downstream of the Project (BC Hydro 2015b).

The focus of Mon-3 is to monitor changes in physical habitat within the future diversion headpond during construction of the Project (2015 to 2023), and to monitor changes in physical habitat within the Peace River between the Project and the Many Islands area in Alberta during construction of the Project (2015 to 2023) and the first 30 years of operation (2023 to 2053; BC Hydro 2015a). Data collected in 2019 represent baseline data that will be used in before-after comparisons in future study years to monitor changes in physical habitat in the Peace River over time. When possible, the 2019 baseline dataset was supplemented with physical habitat data collected in 2015 (Golder 2016) and in 2017 and 2018 (Golder 2018, 2019) as part of the Offset Effectiveness Monitoring. Data collected as part of Offset Effectiveness Monitoring are spatially limited in extent, and do not cover the entire area surveyed in 2019.

In 2019, river cross-section surveys were conducted at 52 previously established transects on the Peace River (Golder 2015) to identify riverbed elevations. Bathymetry data were collected using an acoustic doppler profiler (ADP), and topographic data were collected using a real-time kinematic (RTK) GPS unit. Elevation data for portions of the river cross-sections that could not be surveyed by the ADP or RTK were extracted from LiDAR data collected and provided by BC Hydro. The above data were spliced together to produce a single dataset detailing the riverbed elevation at each transect location.

Grain size measurements were collected using a pebble count sampling procedure, with the field crew measuring the medial dimension (e.g., the b-axis) of at least 100 stones in a grid pattern laid out with a measuring tape at each sample location. The results from pebble counts were then used to calculate the D16, D35, D50, D84, and D95 percentiles (the particle size for which 16%, 35%, 50%, 84%, and 95% of the sample is finer than that size, respectively) at each location.

Overall, results from 2019 indicated an aggrading riverbed (i.e., deposition causing an increase in elevation) within the footprint of the future diversion headpond, a dynamic riverbed (i.e., aggrading and degrading) in the in-stream works area of the Project (between RKm 88 and RKm 105 as measured downstream from WAC Bennett Dam), and a static riverbed downstream of the Project between RKm 105.5 and RKm 110. Key results from the 2019 survey, which was conducted between 5 July and 14 September, as well as key trends observed between 2015 (Golder 2015) and 2019 are summarized as follows:

- Between 2015 and 2019, the riverbed near the upstream end of the diversion headpond aggraded, raising by as much as 1 m at some transects. The increase in deposited sediments is likely due to remobilization of upstream alluvial deposits and from sediment contributions from the Halfway River and Cache Creek. These potential sources are likely mobilized during high flow events between the two survey periods. The riverbed in the downstream portion of the diversion headpond appeared static. The additional sediment observed near the upstream end of the diversion headpond may continue to travel downstream over time and accumulate at other transect locations, which may confound the ability of future surveys to identify whether changes in channel profile and substrate composition are attributed solely to changes in the background sedimentation rate, development and operation of the future diversion headpond, construction activity, or a combination of all of these factors.
- Between 2015 and 2019, the riverbed was dynamic immediately downstream of the Project and within the footprint of in-stream works. Depending on the location, the riverbed degraded as much as 3 m or aggraded as much as 1 m. The most substantial aggradations were noted 800 m downstream of the mid-stream island that was recontoured for offset area Upper Site 109L (BC Hydro 2015c).
- The bed elevation within Upper Site 109L was lowered approximately 2 m during instream excavations in 2015 and 2016 to increase the amount of permanently wetted habitat available to fish and to reduce stranding risk. Since then, the channel has aggraded as much as 3 m. As of 2019, some portions of the riverbed have aggraded to elevations higher than those recorded prior to the development of the offset area.
- With the exception of minor variations in riverbed elevation near either the left or right downstream banks (as viewed facing downstream) the active channel at all 10 transects monitored between the downstream end of the in-stream works area and the Pine River's confluence with the Peace River were similar in both channel shape and riverbed elevations during the 2015 and 2019 surveys.
- Nineteen river cross-section surveys were conducted between the Pine River confluence and the Many Islands area. These data will be compared to similar surveys during future study years.
- Grain size measurements were completed in 2019 at 53 locations, from the upstream end of the future diversion headpond (approximately RKm 88) downstream to Many Islands area (RKm 225). The D50 and D95 values calculated from 2019 pebble count data were similar to historic D50 and D90 data recorded at locations between the Halfway River confluence and the British Columbia-Alberta border where the surveys overlapped (Church 2015), with gravel size sediment as the main river substrate. Downstream the British Columbia-Alberta border, the D50 and D95 values increase compared to the upstream area, and larger sized sediment (cobble) constitute a larger fraction of the sample compared to samples from sites further upstream.

- Based on the cross-section surveys and grain size measurements conducted between 2015 and 2019, it can be concluded that overall changes to fish habitat within the Mon-3 study area over this period have been minimal.

Data collected from 2015 to 2019 will represent the baseline, pre-Project state of physical habitat in the Peace River. Management hypotheses will be statistically tested after the river diversion phase of construction (i.e., after 2020). The findings of Mon-3 will provide valuable context to results and trends observed in other FAHMFP components, most notably the Peace River Large Fish Indexing Surveys (Mon-2, Task 2a; e.g., Golder and Gazey 2020), Offset Effectiveness Monitoring (Mon-2, Task 2d; e.g., Golder 2020), and the Site C Fish Stranding Monitoring Program (Mon-12).

# Acknowledgements

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| | |
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# List of Acronyms and Abbreviations

| Acronym | Description |
|---|---|
| ADP | Acoustic Doppler Profiler |
| DFO | Fisheries and Oceans Canada |
| EAC | Environmental Assessment Certificate |
| EIS | Environmental Impact Statement |
| FAHMFP | Fisheries and Aquatic Habitat Monitoring and Follow-up Program |
| LB | Left bank as viewed facing downstream |
| LiDAR | Light Detecting and Ranging |
| Mon-3 | Peace River Habitat Monitoring Program |
| PCD | Peace Canyon Dam |
| Project | Site C Clean Energy Project |
| RB | Right bank as viewed facing downstream |
| RKm | River Kilometre as measured downstream from WAC Bennett Dam |

# Table of Contents

## TABLES



## FIGURES

**APPENDICES**

# 1.0 INTRODUCTION

Potential effects of the Site C Clean Energy Project (the Project) on fish[1] and fish habitat[2] are described in Volume 2 of the Project's Environmental Impact Statement (EIS, BC Hydro 2012) as follows[3]:

> The Project has the potential to affect fish habitat in two ways. The Project may destroy fish habitat by placing a permanent physical structure on that habitat, or the Project may alter fish habitat by changing the physical or chemical characteristics of that habitat in such a way as to make it unusable by fish. Destruction or alteration of important habitats may be critical to the sustainability of a species population.
>
> The Project may affect fish health and survival. It may cause direct mortality of fish or indirect mortality of fish by changing system productivity, food resource type and abundance, and environmental conditions on which fish depend (e.g., water temperature).
>
> The Project may affect fish movement by physically blocking upstream and downstream migration of fish or by causing water velocities that exceed the swimming capabilities of fish, which results in hindered or blocked upstream migration of fish. Blocked or hindered fish movement has consequences to the species population. Fish may not be able to access important habitats in a timely manner or not at all (e.g., spawning habitats). Blocked fish movement may result in genetic fragmentation of the population.

Condition No. 7 of the Project's Provincial Environmental Assessment Certificate (EAC), Schedule B states the following:

> The EAC Holder must develop a Fisheries and Aquatic Habitat Monitoring and Follow-up Program [FAHMFP] 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 [Qualified Environmental Professional] or FLNRO [BC Ministry of Forests, Lands and Natural Resource Operations], to assess the need to adjust those measures to adequately mitigate the Project's effects.

Furthermore, the Project's Federal Decision Statement (FDS) states that a plan should be developed that addresses the following:

> Condition No. 8.4.3: an approach to monitor changes to fish and fish habitat baseline conditions in the Local Assessment Area (LAA); and
>
> Condition No. 8.4.4: 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.

The Peace River Physical Habitat Monitoring Program (Mon-3) is designed to provide supporting data to address the EAC and FDS conditions described above. Specifically, Mon-3 represents one component of the FAHMFP (BC Hydro 2015a) that aims to "monitor physical habitat within the [diversion] headpond (the Peace River from Site C upstream to near the Wilder Creek confluence) during Construction Years 5 to 8 [2019 to 2022] and within the Peace River downstream of the Project to the Many Islands area in Alberta during Construction Years 1 to 9 [2015 to 2023] and during Operation Years 1 to 30 [2023 to 2053]" (BC Hydro 2015a).

The potential effects of the Project on physical habitat in the future diversion headpond and in the Peace River downstream of the Project are described in Volume 2 of the Site C EIS[4]. These effects are briefly summarized below.

[1] Fish includes fish abundance, biomass, composition, health, and survival.
[2] Fish habitat includes water quality, sediment quality, lower trophic levels (periphyton and benthic invertebrates), and physical habitat.
[3] Site C EIS, Volume 2, Section 12.1.2.
[4] Site C EIS, Volume 2, Section 12.

The Project will shift the point of regulation on the Peace River approximately 85 km downstream of Peace Canyon Dam (PCD; the current point of regulation). The future diversion headpond will extend approximately 18 km upstream of the Project, influencing physical processes driving river geomorphology, including increasing water depths and decreasing water velocities (BC Hydro 2015b). Water levels in the future diversion headpond immediately upstream of the Project will be approximately 5.5 m higher than existing conditions (at the 90th percentile water level) and will be approximately 1.0 m higher than existing conditions near the Wilder Creek confluence (approximately 13 km upstream of the Project; KCB and SNC 2015). Changes in physical habitat within the future diversion headpond are expected to be greatest closest to the Project. The higher water levels in the future diversion headpond are expected to result in increased sediment inputs from the erosion of newly inundated areas, altering existing clean riverbed materials[5].

Downstream of the Project, changes to the flow regime will affect the temporal and spatial availability of aquatic habitat, with the Project's influence being greatest in the approximately 16 km long portion of the Peace River between the Project and the Pine River's confluence with the Peace River[6]. Following construction of the Project, the mean annual sediment transport load in the Peace River is expected to reduce by 54% immediately downstream of the Project and reduce by 21% at the Pine River confluence due to sediment (mainly sands) settling in the upstream reservoir (BC Hydro 2015b). Downstream of the Pine River confluence, the Project is not expected to result in substantial changes to sediment depositional patterns and any changes observed are expected to be due to natural processes (e.g., valley wall erosion and landslides along the river) or driven by the ongoing response of the river channel to upstream flow regulations that started in 1967[7].

Fish species in the Peace River have the potential to be affected by changes in physical habitat in a variety of ways. For example, spawning habitat may be altered by changes in water depths or substrate sizes, or substrate interstitial spaces may be filled in with finer materials. Furthermore, aggradation or degradation within near-shore areas may create or reduce shallow-water rearing habitats for Young of-the-Year and immature life stages. Increased deposition and scouring also have the potential to create new gravel bars or depressions which may result in the creation of habitat or increase fish stranding risk.

The current fluvial geomorphology and sediment transport regime in the Peace River have been in a state of adjustment to the regulated flow conditions created in 1967 by the development of WAC Bennett Dam. The fluvial geomorphology baseline conditions in the Peace River are both naturally variable and are undergoing a long-term response to regulation. Downstream of Peace Canyon Dam to the Site C damsite location, the Peace River flows mainly within a valley that is incised approximately 200 m below the Alberta Plateau surface. The river channel flows within a nearly continuous alluvial valley-bottom fill, but the river channel impinges against the valley walls in many locations. The river channel has a wandering to low-order braided planform with abundant gravel bars and wooded islands. The bed material in this reach is predominantly gravel and cobble. This reach of the river has been most influenced by upstream river regulation due to its location immediately downstream from the two existing dams, and in most places along this reach of the Peace River, the bed material has rarely been mobilized since the onset of regulation (EIS, Vol.2, BC Hydro 2012).

[5] Site C EIS, Volume 2, Section 12.4.1.2.
[6] Site C EIS, Volume 2, Section 12.4.2.2.
[7] Site C EIS, Volume 2, Section 12.4.2.2.

Downstream of the Project to the BC-Alberta border, the Peace River flows within similar morphological conditions (see above), and has also been influenced by upstream river regulation. Similar fluvial geomorphology characteristics were also observed in the channel where the bed material has rarely been mobilized since the onset of regulation (EIS, Vol.2, BC Hydro 2012).

From the BC-Alberta border downstream to the Many Islands area, the Peace River flows within a similar valley type, incised approximately 200 m below the surface of Alberta Plateau. The river valley becomes more narrow and the channel more continuously confined by valley walls downstream of the border. The river channel has a dominantly single-thread planform. The bed material in this reach is dominantly fine gravel (Church, 2011). The historical changes in geomorphology and sediment transport caused by river regulation are moderated in this reach of the river due to tributary inflows and the lower abundance of alluvial channel features.

Mon-3 is designed to address uncertainties presented in the Site C EIS (BC Hydro 2012). Existing physical habitat was described in the Site C EIS (BC Hydro 2012) using a combination of methods, including channel morphology, bed surface grain size, and physical habitat mapping. In 2019, data generated in support of Mon-3 included both hydrographic and topographic surveys of monitoring cross-sections using an acoustic doppler profiler (ADP) (hereafter the river cross-section surveys) and grain size measurements (i.e., pebble count surveys).

Mon-3 will monitor physical habitat within the future diversion headpond during construction (2015 to 2023) and monitor physical habitat within the Peace River from the Project downstream to the Many Islands area in Alberta during construction (2015 to 2023) and the first 30 years of operation (2023 to 2053). The findings of Mon-3 will provide valuable context to results and trends observed in other FAHMFP components including the Peace River Large Fish Indexing Surveys (Mon-2, Task 2a; e.g., Golder and Gazey 2020), Offset Effectiveness Monitoring (Mon-2, Task 2d; e.g., Golder 2020), and Site C Fish Stranding Monitoring Program (Mon-12).

## 1.1 Key Management Questions

The overarching management questions for Mon-3 reflect that the Project can affect physical habitat in different ways:

1) “How does the construction of the Project affect physical habitat in the Site C Construction Headpond?”

2) “How does the construction and operation of the Project affect physical habitat in the Peace River between the Project and the Many Islands area in Alberta?”

## 1.2 Management Hypotheses

Mon-3’s management questions will be addressed by testing a series of management hypotheses:

$H_1$: "The Site C Construction Headpond will not affect channel morphology or bed sediment composition within the extent of the headpond.”

$H_2$: “The construction and operation of the Project will not affect channel morphology, bed surface grain size composition, or wetted area in the Peace River between the Project and the Many Islands area in Alberta.”

Mon-3's management questions and hypotheses were setup in the Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP) developed as a requirement of Condition 7 of the Environmental Assessment Certificate (EAC) of the Project.

## 1.3 Study Objectives

In 2019, Mon-3 included a bathymetric and topographic survey to generate (together with elevation data extracted from LiDAR data provided by BC Hydro, for portions of the river that could not be surveyed by the ADP or RTK) river cross-section profiles at historical monitoring locations (Golder 2015) located between the upstream limit of the future diversion headpond and Many Islands in Alberta. At each river cross-section (i.e., transect) location, pebble counts were conducted at representative sites to obtain grain size data for analysis. When possible, results of the 2019 survey were compared to data collected in 2015 (Golder 2016), 2017 (Golder 2018), and 2018 (Golder 2019), and to historical river cross-section and grain size data collected from 1968 to 2005 (Church 2015). Data collected as part of offset effectiveness monitoring program from 2017 to 2018 (Golder 2018, 2019), are spatially confined, and do not cover the entire area study area.

## 1.4 Study Area and Study Period

The study area for Mon-3 includes an approximately 138 km long section of the Peace River from near the outlet of Cache Creek (RKm 87 as measured downstream from WAC Bennett Dam) downstream to the Many Islands area (RKm 225). Within this area, 52 river transects were surveyed, and included 12 transects upstream of the Project within the footprint of the future diversion headpond (Transect #US01 to #US12; RKm 87 to RKm 105.5), and 40 transects downstream of the Project (Transect #DS01 to #DS37; RKm 105.5 to RKm 225) (Appendix A, Figures A1 to A15). For analyses herein, transects situated downstream of the Project were grouped as follows: transects between the Project and the downstream extent of in-stream works associated with the Project's development (Transect #DS01 to #DS08; RKm 110); transects from the downstream extent of the in-stream works area to downstream of the Pine River's confluence with the Peace River (Transect #DS09 to #DS18; RKm 122); and transects from the Pine River's confluence downstream to the Many Islands area (Transect #DS19 to #DS37; RKm 225). UTM coordinates of the left and right banks of each transect (as viewed facing downstream) are provided in Appendix A, Table A1.

Grain size data were collected at 53 sites. Of those 53 sites, 17 were located upstream of the Project and 36 sites were located downstream of the Project (Appendix A, Figures A1 to A15). The locations of the 53 sites were selected to be both close to a river transect (either upstream or downstream of it) and to sample different river morphology features (mid-channel bars, side bars, or point bars). UTM coordinates of grain size measurement locations are provided in Appendix A, Table A2.

In 2019, field work for Mon-3 was conducted in the summer and fall. The bulk of the river cross-section surveys were conducted from 5 and 10 July (Table 1). A single day of surveys was also conducted on 14 September while crews were in the study area conducting grain size measurements. Grain size measurements were conducted from 10 to 14 September (Table 1). Field work was scheduled to coincide with anticipated high (July) and low (September) water levels in the Peace River. The river cross-section surveys were conducted to coincide with

anticipated higher water levels in the summer to facilitate the integration of 2019 LiDAR data provided by BC Hydro. Grain size data were collected in the fall to coincide with anticipated lower Peace River water levels to ensure larger areas of the active river channel were exposed and accessible for assessment.

**Table 1: Summary of field activities conducted in 2019 in support of BC Hydro's Peace River Physical Habitat Monitoring Program (Mon-3).**

| Sample Activity | Sample Dates |
|---|---|
| River Cross-Section Surveys | 5–8, 10 July 2019<br>14 September 2019 |
| Grain Size Assessment | 10–14 September 2019 |

# 2.0 METHODS

## 2.1 River Cross-Section Surveys

River cross-section surveys included areas of the active channel that were within the bankfull flow at the time of survey. Riverbanks located beyond the bankfull flow limits at the time of survey were not surveyed and were obtained from LiDAR survey data provided by BC Hydro. LiDAR data were collected by BC Hydro in May 2019. At each of the 52 transects, three different methods were used to collect coordinates (Easting, Northing, and Elevations) of surveyed elevations:

- Bathymetry surveys: A RiverSurveyor® M9 dual beam acoustic doppler profiler (ADP) system (SonTek/Xylem Inc., San Diego, CA, USA) was used to measure the river depth from a boat. These measurements of water depth were used to establish the riverbed surface elevation. The ADP transducer was mounted 0.15 m below the water surface with a minimum measurable river depth of 0.35 m. Water velocity data were collected during the survey and provided to BC Hydro but are not presented in this report.
- Topographic surveys: A Trimble® R8 GPS RTK system (Trimble Inc., Sunnyvale, CA, USA) was used to measure topography in select wadable areas of the Peace River and on shoreline areas above the water surface at the time of the survey. Topographic elevations were measured along the established transects and included areas of the active channel below the bankfull elevation. Survey data of the riverbanks upslope of the bankfull elevation were not collected along any of the river cross-sections.
- Elevation data for portions of the river cross-sections that were not surveyed by the ADP or RTK were extracted from LiDAR data provided by BC Hydro.

During bathymetric surveys, the Trimble GPS system was attached to the ADP system and the local positional coordinates (latitude and longitude) were transmitted to the ADP unit, which were incorporated into the raw data file collected by the ADP data software to provide UTM coordinates for surveyed locations. The survey methods were referenced to the same datum, and at the end of the survey, these data were spliced together to produce a single dataset.

The 2019 river cross-section data were compared to data collected in 2015 (Golder 2016), 2017 (Golder 2018), and 2018 (Golder 2019), when possible. Summary statistics (i.e., mean, median, standard deviation, quartiles, and range) were calculated for each transect completed in 2019 and were qualitatively compared to historical data where river cross-section data overlapped. Only the portions of the active channel, as assessed by the ADP and RTK, were included in summary statistics (i.e., LiDAR data were not included in these summaries).

To determine the change in channel storage (i.e., the volume of aggradation or degradation) between 2015 and 2019, the 2015 and 2019 river cross-sections were divided into 0.01 m lateral segments. Values for each segment were linearly interpolated between data points and the elevation for the 2019 river cross-section was subtracted from the 2015 river cross-section and the difference between these values was summed for all points along the river cross-section. The cumulative change in sediment storage along the channel was calculated by multiplying the river cross-sectional storage change at each river cross-section by the distance between transects.

## 2.2 Grain Size Measurements

Grain size distribution was assessed at 53 locations on the Peace River (Appendix A, Figures A1 to A15) using pebble count methodology. Pebble count sample locations were situated near river cross-section survey locations where there was a suitable amount of sub-aerial (i.e., unwetted) exposures of appropriate geomorphic features, which included point or mid-channel bar heads (i.e., the location where the bar meets the underwater riffle crest) and bank deposits. Where possible, sites that were sampled for grain size distribution during the 2015 field program (Golder 2016) were reassessed. Reassessing the same locations in both 2015 and 2019 was not possible in some cases as some of the sites assessed in 2015 were submerged at the time of the 2019 survey, (i.e., the water was too deep and/or too fast to wade safely) while other sites were situated within active construction areas associated with the Project and could not be safely accessed by field staff. For the locations found submerged at the time of survey the closest location with the same channel feature (e.g., point bar) was surveyed.

The pebble count sampling procedure followed the guidelines outlined in Bundt and Abt (2001). The field crew measured the medial dimension (e.g., the b-axis, where the a-axis and c-axis represent the longest and shortest axes in a stone, respectively) of at least 100 stones in a grid pattern laid out with a measuring tape. The spacing of the grid was determined separately for each sample location and was set at approximately twice the diameter of the largest stone in the sample area. Stones were measured with a ruler and then classified by phi size. Phi size classes are defined as the negative base-2 logarithms of sediment sizes on the Wentworth sediment size scale. Half phi sizes were used in the cobble range. Material class size definitions used in the field are presented in Appendix C, Table C1. The results from pebble counts were then used to calculate the D16, D35, D50, D84, and D95 percentiles (the particle size for which 16%, 35%, 50%, 84%, and 95% of the sample is finer than that size, respectively) at each sample location.

# 3.0 RESULTS

## 3.1 River Cross-Section Surveys

River cross-sections were measured at 52 transects in 2019 to obtain channel profile data (Appendix B, Figures B1 through B52). Each river cross-sections' UTM coordinates are provided in Appendix A, Table A1.

River cross-sections downstream of the Pine River's confluence with the Peace River were not assessed in 2015 and thalweg elevations from 2017 and 2018 were not plotted due to their limited spatial coverage. Between 2015 and 2019, the elevation of the thalweg increased by up to 1 m near the upstream end of the future diversion headpond (Figure 1 and Figure 2). The change in thalweg elevation between the Moberly River's confluence with the Peace River (Transect #US03) and the downstream extent of in-stream activities associated with the Project (Transect #DS08) (i.e., between approximately RKm 105 and 110) was variable and ranged between a decrease in thalweg elevation (degradation) of over 3 m at Transect #DS03 and an increase in thalweg elevation (aggradation) of over 1 m at Transect #DS05 (Figure 2). The two transects are approximately 1100 m apart. The thalweg decreased approximately 3 m at Transect #DS03, and the sediment volume in the area increased due to construction activity on the left bank (Figure 3).

Between 2015 and 2019, the Peace River aggraded upstream of the mouth of the Moberly River (Figure 3). Substantial aggradation was also documented at RKm 110 (Transect #DS06b). Transect #DS06b is situated within the offset area Upper Site 109L and the aggradation is consistent with results presented in Golder (2020). Between 2015 and 2019, cumulative change in sediment storage generally increased with downstream distance between RKm 90 and 102, and increased sharply approximately 3 km upstream of the Moberly River's confluence with the Peace River (Figure 4). The highest levels of cumulative change in sediment storage were documented downstream of the Moberly River's confluence.

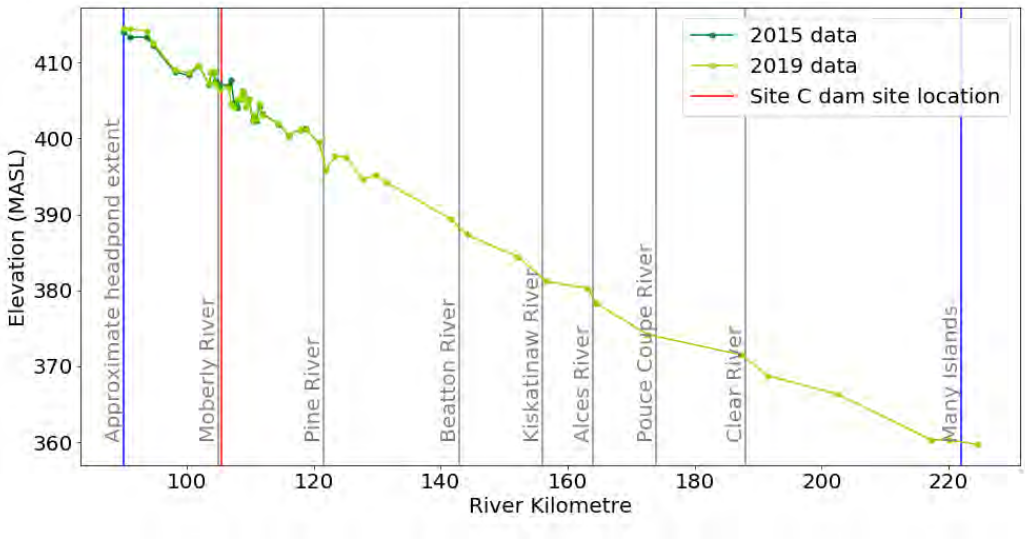



**Figure 1: Peace River thalweg elevations (in metres above sea level; MASL) by river kilometre as measured downstream from WAC Bennett Dam. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference. In 2015, cross-section profiles were only conducted downstream to the Pine River confluence.**

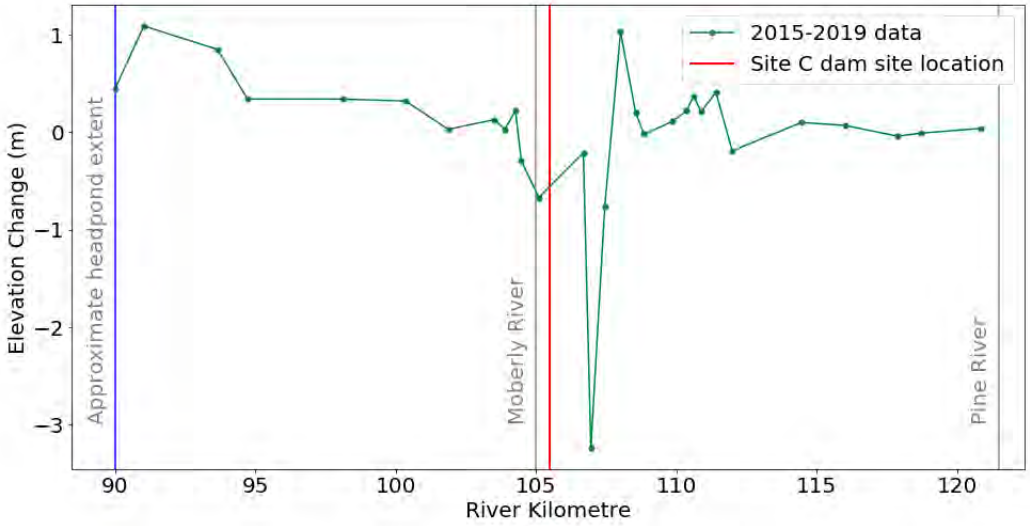



**Figure 2:** **Change in Peace River thalweg elevations (in metres) by river kilometre as measured downstream from WAC Bennett Dam. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference.**

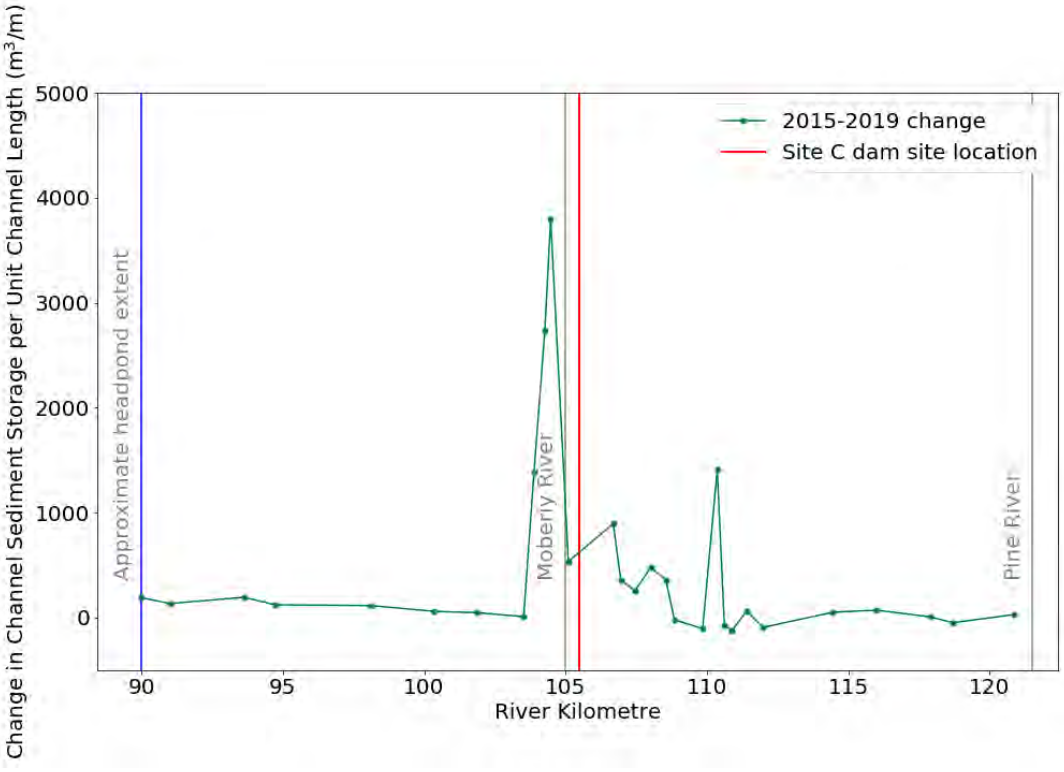



**Figure 3:** **Change in sediment storage ($m^3/m$) by river kilometre as measured downstream from WAC Bennett Dam. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference.**

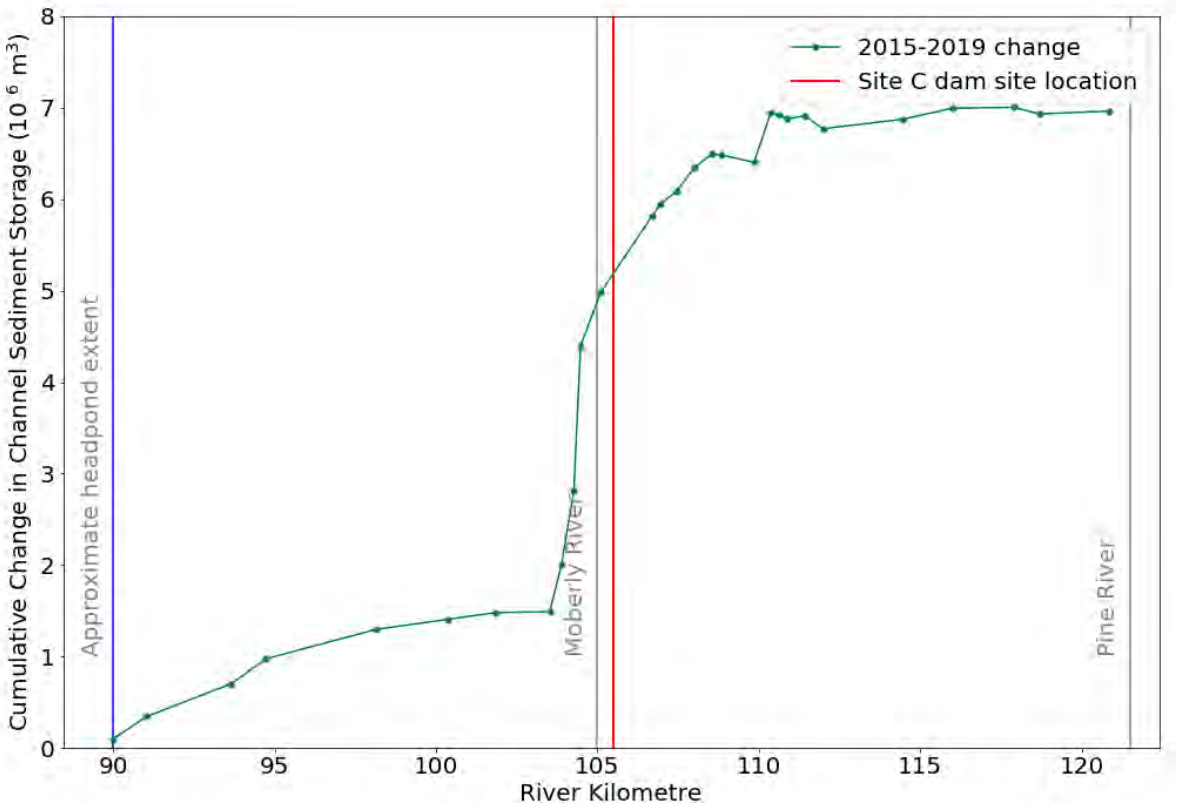



**Figure 4: Cumulative change in channel sediment storage ($m^3$) by river kilometre as measured downstream from WAC Bennett Dam. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference.**

### 3.1.1 Diversion Headpond

In both 2015 and 2019, river cross-sections were measured at 12 transects situated upstream of the Project and within the footprint of the future diversion headpond (Transect #US01 to #US12). For all 12 transects, the mean elevation was higher in 2019 than in 2015 (Table 2 and Figure 5). The elevations presented in Figure 5 are limited to the portions of the active channel that were measured using ADP and RTK.

**Table 2: Summary of changes observed during river cross-section surveys conducted in 2015 and 2019 within the footprint of the future diversion headpond (Transect #US01 to #US12). Transects are presented in upstream to downstream order.**

| Transect # | Description of observations and changes noted over the study period |
|---|---|
| Transect #US12 | The active channel maintained a larger main channel on the right bank (as viewed facing downstream) and a smaller secondary channel on the left bank (as viewed facing downstream). Riverbed elevations were slightly higher in 2019 compared to 2015. |
| Transect #US11 | The active channel maintained a larger main channel on the right bank and a smaller secondary channel on the left bank. Riverbed elevations were higher along the thalweg of the main channel in 2019 compared to 2015. |
| Transect #US10 | The active channel is a single channel with riverbed elevations slightly higher in 2019 compared to 2015. |
| Transect #US09 | The active channel maintained a larger main channel on the right bank. Riverbed elevations appear slightly higher in 2019 compared to 2015. |
| Transect #US08 | The active channel maintained a larger main channel on the right bank and a smaller secondary channel on the left bank. In 2019, the secondary channel was not accessible by boat due to low water levels and was not surveyed. Riverbed elevations were slightly higher in 2019 compared to 2015. |
| Transect #US07 | The active channel is a single channel with similar riverbed elevations in 2015 and 2019. |
| Transect #US06 | The active channel is a single channel with a shallow area in the middle (appearing as an island during low flows). Riverbed elevations were similar in 2015 and 2019. |
| Transect #US05 | The active channel is a single channel with riverbed elevations that were similar in 2015 and 2019. |
| Transect #US04 | The active channel is a single channel with riverbed elevations that were similar in 2015 and 2019, with the exception of the left bank where construction activities related to the Project modified the bank shape between 2015 and 2019. |
| Transect #US03 | The active channel is a single channel with riverbed elevations that were similar in 2015 and 2019, with the exception of the left bank where construction activities related to the Project modified the bank shape between 2015 and 2019. |
| Transect #US02 | The active channel is a single channel with riverbed elevations that were similar in 2015 and 2019, with the exception of the left bank where construction activities related to the Project modified the bank shape between 2015 and 2019. |
| Transect #US01 | The active channel is a single channel with riverbed elevations that were similar in 2015 and 2019. Construction activities along both banks modified the shape and location of each bank between 2015 and 2019. |

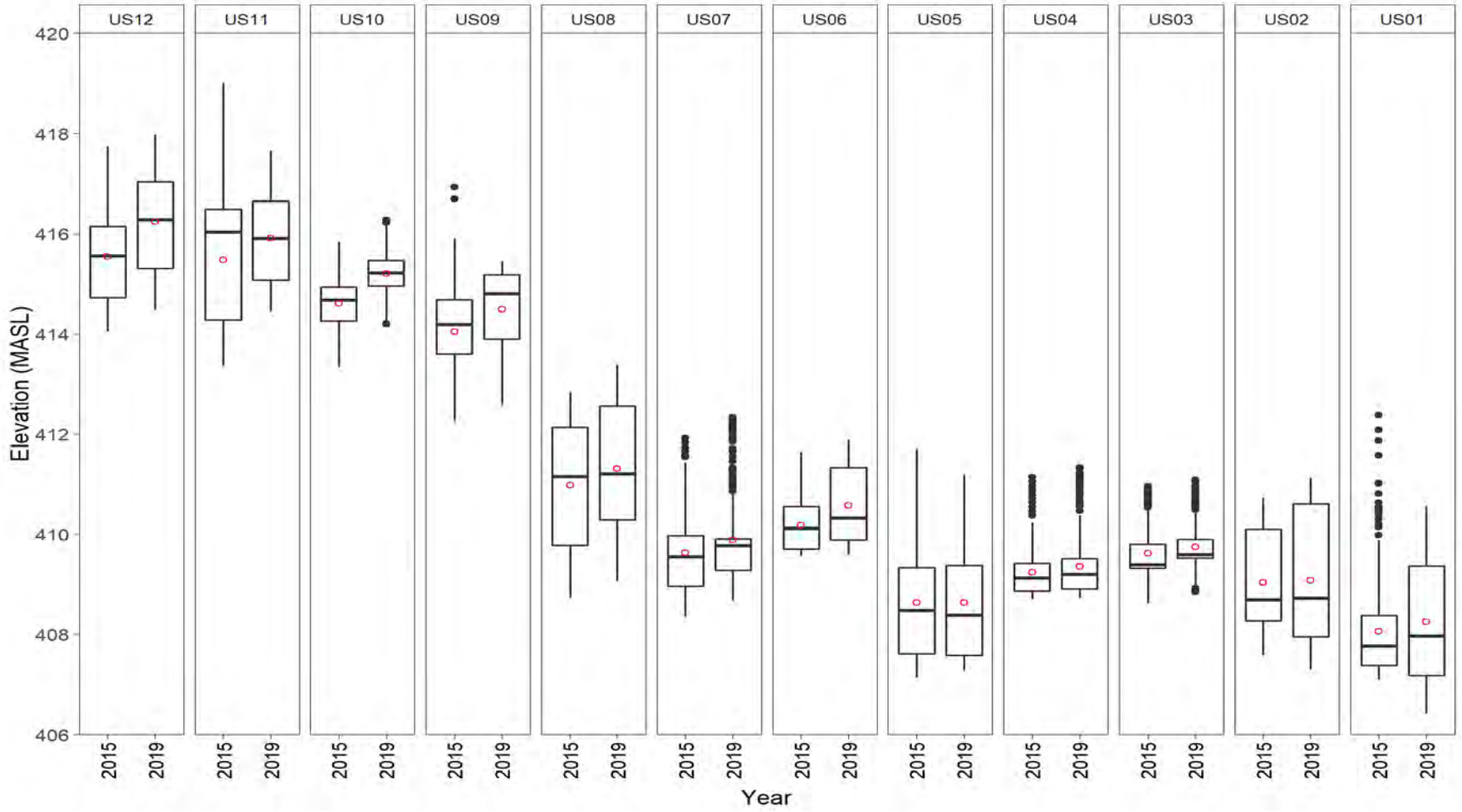



**Figure 5:** **The mean elevation (red circle), median (heavy horizontal line), and upper and lower quartiles (i.e., 25th and 75th percentiles; lower and upper bounds of rectangle). Whiskers (vertical line) extend from the upper/lower quartiles to the maximum/minimum value within 1.5 times the interquartile range. Data outside of 1.5 times the interquartile range ("outlying" values) are shown individually as points. Data are from Transects #US12 (most upstream) through #US01 (most downstream) within the future diversion headpond as recorded during 2015 and 2019 river cross-section bathymetry profile surveys.**

### 3.1.2 Peace River Downstream of the Project

#### *3.1.2.1 In-Stream Works Area*

River cross-sections were measured at 12 transects from Transect #DS01 to #DS08 in 2019. These transects encompass the portion of the Peace River between the Project (RKm 105.5) and the downstream extent of in-stream works associated with the Project (RKm 110). The mean elevation for these transects was higher in 2019 when compared to results from previous study years, with the exception of Transects #DS03, #DS04, and #DS08 (Table 3 and Figure 6). The elevations presented in Figure 6 are limited to the portions of the active channel that were measured using ADP and RTK.

**Table 3: Summary of changes observed in river cross-sections between 2015 and 2019 in the Project's downstream in-stream works area of the Peace River (Transect #DS01 to #DS08). Transects are presented in upstream to downstream order.**

| Transect # | Description of observations and changes noted over the study period |
|---|---|
| Transect #DS01 | The active channel is a single channel with riverbed elevations that were similar in 2015 and 2019. Construction activities along both banks modified the shape and location of each bank between 2015 and 2019. The Peace River construction bridge is situated within this transect. |
| Transect #DS03 | Transect surveyed in 2015, 2017, 2018, and 2019. River Road construction on the left bank, as viewed facing downstream, altered the location of the active channel. The active channel maintained a similar shape and similar riverbed elevations in 2017 and 2019. The 2018 survey was conducted slightly downstream of the transect line and is more representative of the bathymetry immediately downstream of Transect #DS03. |
| Transect #DS04 | Transect surveyed in 2015, 2017, 2018, and 2019. River Road construction on the left bank altered the location of the active channel. The active channel maintained a similar shape and similar riverbed elevations in 2017, 2018, and 2019. |
| Transect #DS05 | Transect surveyed in 2015, 2017, 2018, and 2019. River Road construction on the left bank altered the location of the active channel. The active channel on the left bank aggraded between 2015 and 2017 but maintained a similar shape and similar riverbed elevations in 2017, 2018, and 2019. |
| Transect #DS06A | Transect surveyed in 2017, 2018, and 2019. River Road construction and the development of habitat offset area Upper Site 109L along the left bank altered the location of the active channel. Between 2017 and 2019, riverbed elevations increased along the left bank by approximately 1.5 m. Between 2018 and 2019, the active channel maintained a similar shape but increased slightly in elevation. |
| Transect #DS06 | Transect surveyed in 2015, 2017, 2018, and 2019. River Road construction and the development of habitat offset area Upper Site 109L along the left bank altered the location of the active channel. Since completion of the construction activities in 2016, the active channel has maintained a similar shape but has increased slightly in elevation. |

| Transect # | Description of observations and changes noted over the study period |
|---|---|
| Transect #DS06B | Transect surveyed in 2017, 2018, and 2019. River Road construction and the development of habitat offset area Upper Site 109L along the left bank altered the location of the active channel. The active channel increased 1.5 m in riverbed elevation between 2018 and 2019 adjacent to the left bank, and a corresponding 1.5 m decrease in riverbed elevation was observed near mid-channel, suggesting that the active channel has been displaced away from the left bank. The remainder of the 2019 profile shows a slight increase of riverbed elevations between 2018 and 2019, but the channel's overall shape was unchanged. |
| Transect #DS07 | Transect surveyed in 2015, 2017, 2018, and 2019. River Road construction and the development of habitat offset area Upper Site 109L along the left bank altered the location of the active channel. The riverbed elevation along the left bank decreased substantially between 2015 and 2017 due to the construction of habitat offset area Upper Site 109L. Between 2017 and 2019, the active channel maintained a similar channel shape with a slight increase in riverbed elevations over time. |
| Transect #DS07B | Transect surveyed in 2017, 2018, and 2019. River Road construction and the development of habitat offset area Upper Site 109L along the left bank altered the location of the active channel. In 2019, the active channel showed a similar channel shape with a slight increase in riverbed elevations compared to 2017 and 2018. |
| Transect #DS07A | Compared to the 2017 survey, the 2019 survey showed a similar channel shape and similar riverbed elevations for the active channel, with the exception of the right bank, as viewed facing downstream, where construction associated with the development of habitat offset area Side Channel Site 108R modified the bank. |
| Transect #DS08 | Transect surveyed in 2015, 2017, 2018, and 2019. The active channel showed a similar channel shape and similar riverbed elevations for all survey years. |

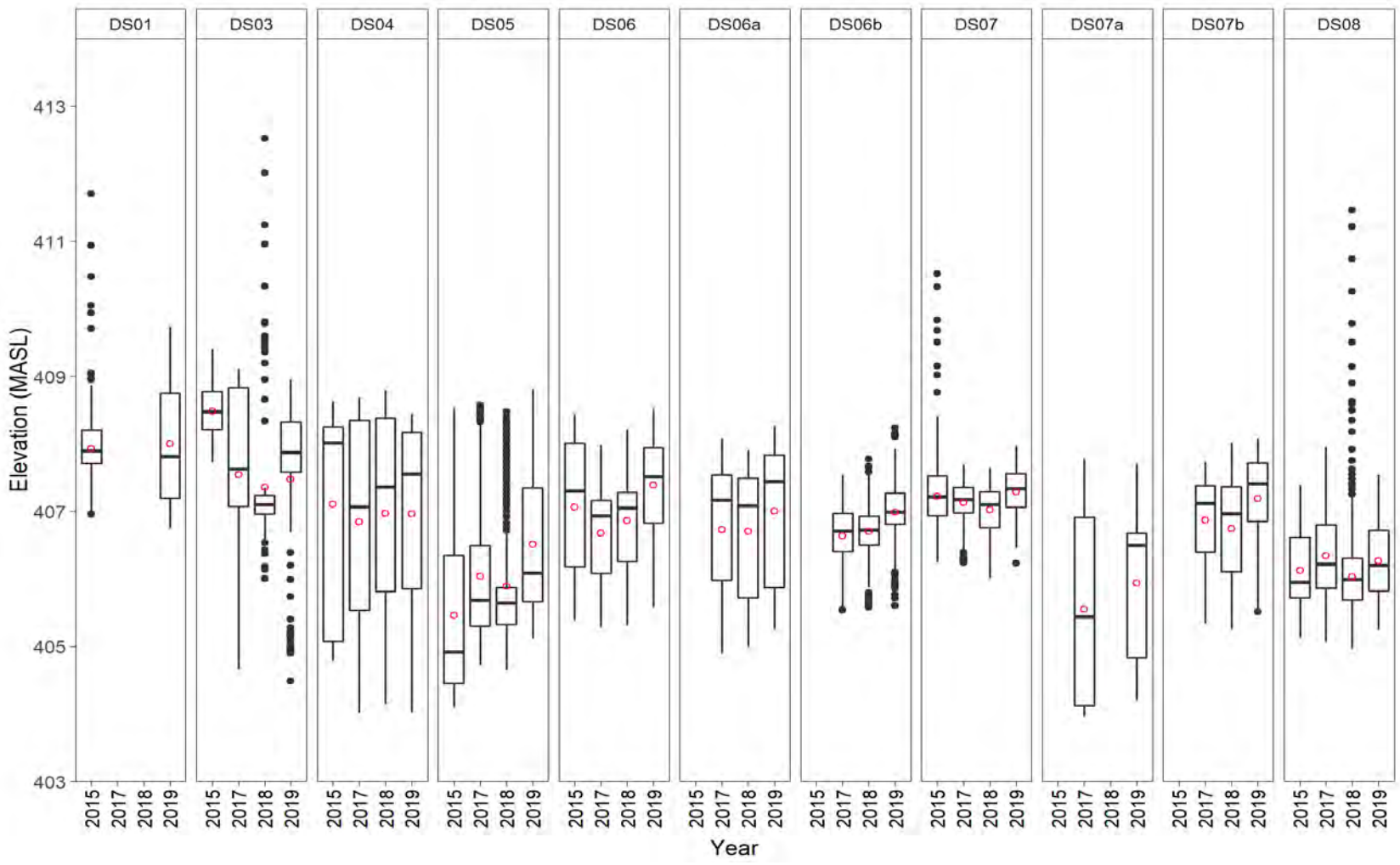



**Figure 6:** **The mean elevation (red circle), median (heavy horizontal line), and upper and lower quartiles (i.e., 25$^{th}$ and 75$^{th}$ percentiles; lower and upper bounds of rectangle). Whiskers (vertical line) extend from the upper/lower quartiles to the maximum/minimum value within 1.5 times the interquartile range. Data outside of 1.5 times the interquartile range ("outlying" values) are shown individually as points. Data are from Transects #DS01 (most upstream) through #DS08 (most downstream) of the Peace River as recorded during 2015 to 2019 river cross-section bathymetry profile surveys.**

#### 3.1.2.2 In-Stream Works Area to Pine River Confluence

River cross-sections were measured at 10 transects from Transect #DS09 to #DS18 in 2015 and 2019. These transects encompass the portion of the Peace River from the downstream extent of in-stream works associated with the Project to the Pine River's confluence with the Peace River. With the exception of minor variations in riverbed elevation near either the left or right banks, the active channel at all transects were similar in both channel shape and riverbed elevations during the 2015 and 2019 surveys (Figure 7). The elevations presented in Figure 7 are limited to the portions of the active channel that were measured using ADP and RTK.

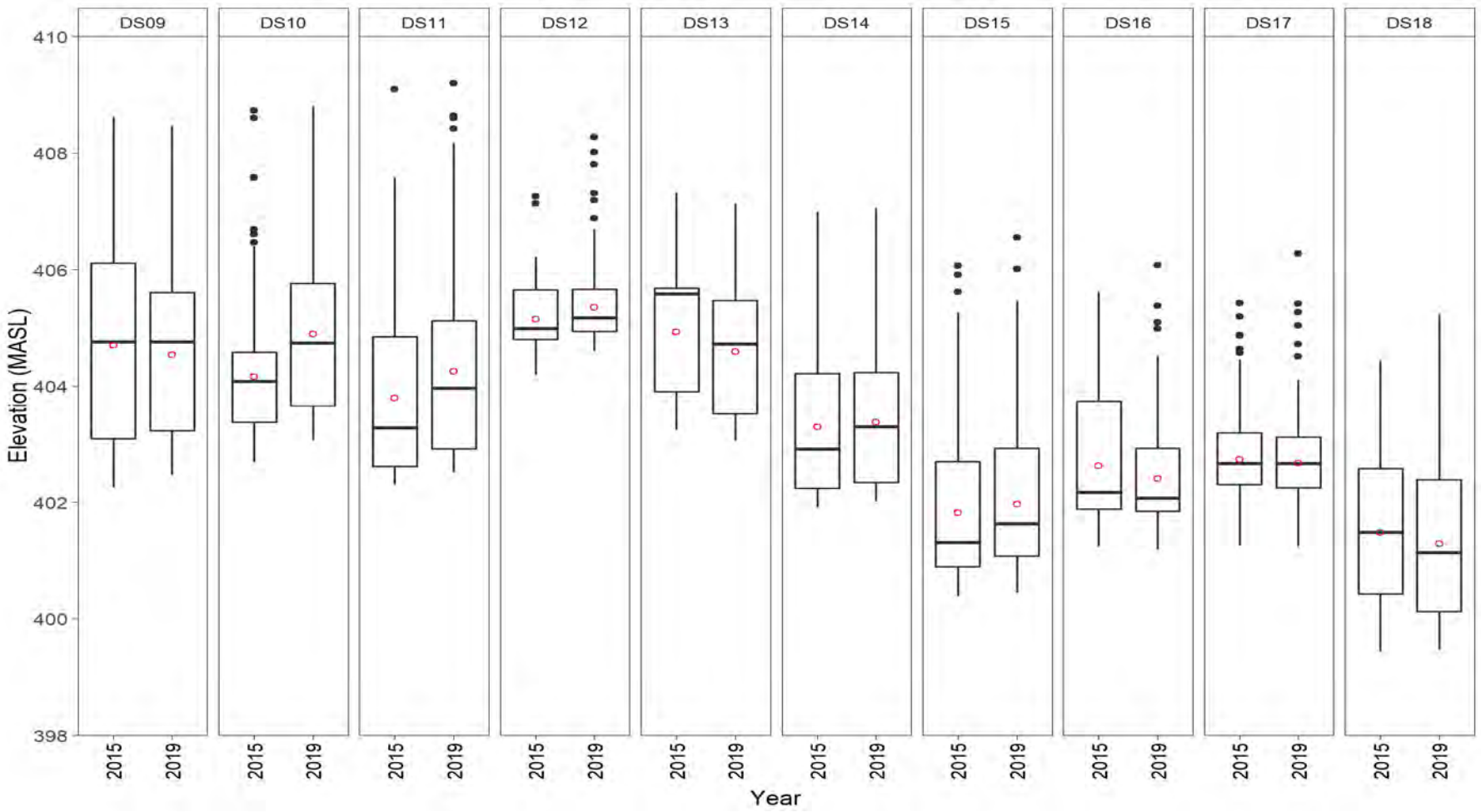



**Figure 7:** **The mean elevation (red circle), median (heavy horizontal line), and upper and lower quartiles (i.e., 25th and 75th percentiles; lower and upper bounds of rectangle). Whiskers (vertical line) extend from the upper/lower quartiles to the maximum/minimum value within 1.5 times the interquartile range. Data outside of 1.5 times the interquartile range ("outlying" values) are shown individually as points. Data are from Transects #DS09 (most upstream) through #DS18 (most downstream) of the Peace River as recorded during 2015 and 2019 river cross-section bathymetry profile surveys.**

#### 3.1.2.3 Pine River Confluence to Many Islands

River cross-section were measured at 19 transects from Transect #DS19 to #DS37 in 2019 (Figure 8). These transects encompass the portion of the Peace River from the Pine River's confluence downstream to the Many Islands area. These transects were not surveyed prior to 2019 and are not graphically compared to any historical data. The elevations presented in Figure 8 are limited to the portions of the active channel that were measured using ADP and RTK.

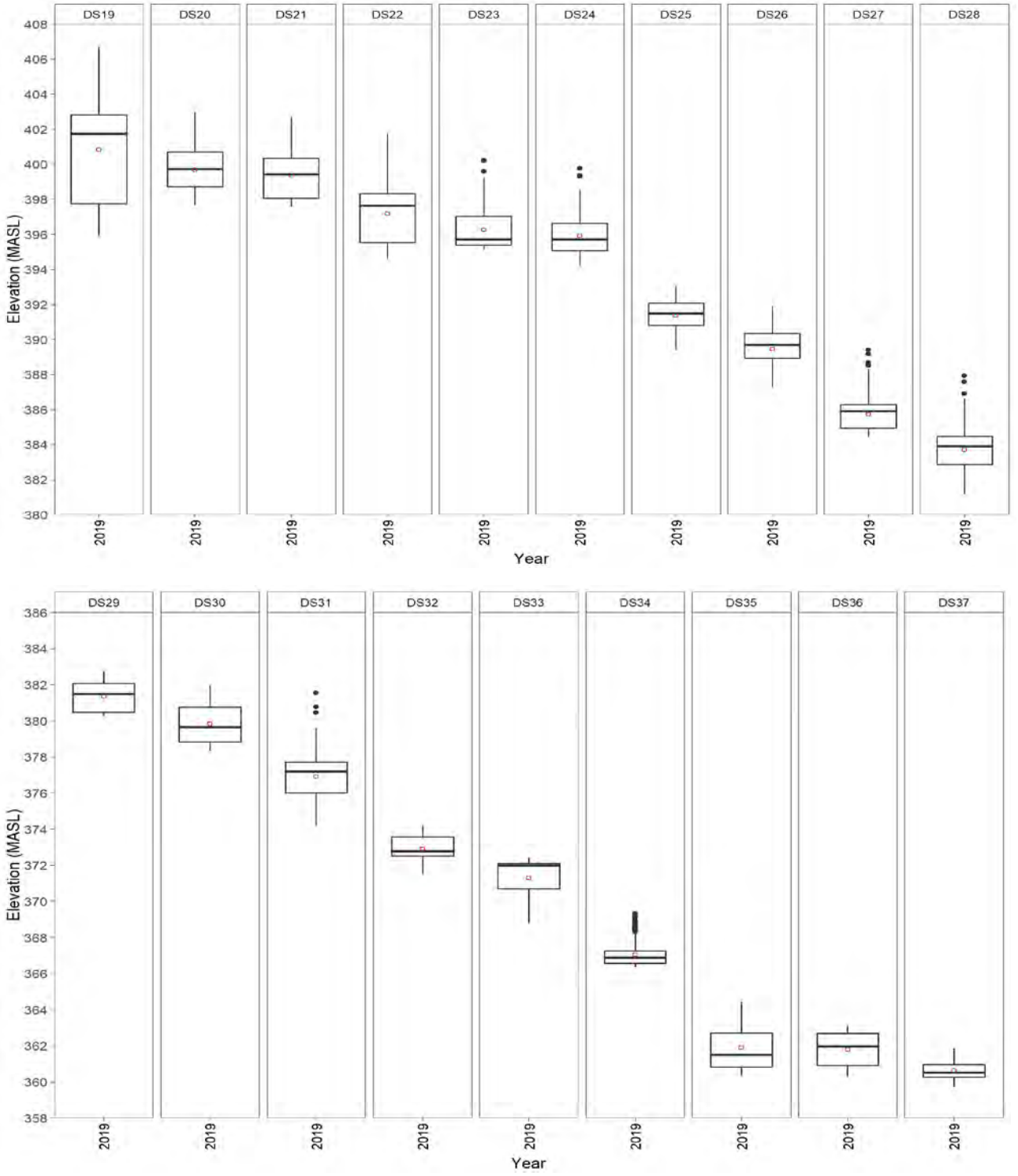



**Figure 8:** **The mean elevation (red circle), median (heavy horizontal line), and upper and lower quartiles (i.e., 25th and 75th percentiles; lower and upper bounds of rectangle). Whiskers (vertical line) extend from the upper/lower quartiles to the maximum/minimum value within 1.5 times the interquartile range. Data outside of 1.5 times the interquartile range ("outlying" values) are shown individually as points. Data are from Transects #DS19 (most upstream) through #DS37 (most downstream) of the Peace River as recorded during river cross-section bathymetry profile surveys, 2019.**

## 3.2 Historical River Cross-Section Comparison

River cross-sections were surveyed between 1968 and 2005 at multiple locations along Peace River and are presented in the Site C EIS report (BC Hydro 2012). These cross-sections extend from approximately river RKm 101 to RKm 128 (the Project is located at RKm 105.5).

The locations of some historical cross-sections are at different river kilometres when compared to cross-sections completed after 2015; a direct comparison to include all surveyed cross-section profiles was not possible. Thalweg elevations for each year with surveys at historical and Mon-3 cross-sections were plotted in a longitudinal profile to show natural variations in thalweg elevations (Figure 9). The longitudinal profile shows that the largest thalweg elevation variations were downstream of the Pine River confluence, near Transect DS21, with a variation of approximately 3.54 m between 1975 and 2019.

The river cross-sections surveys from between 1968 and 2005 are presented in Appendix B.

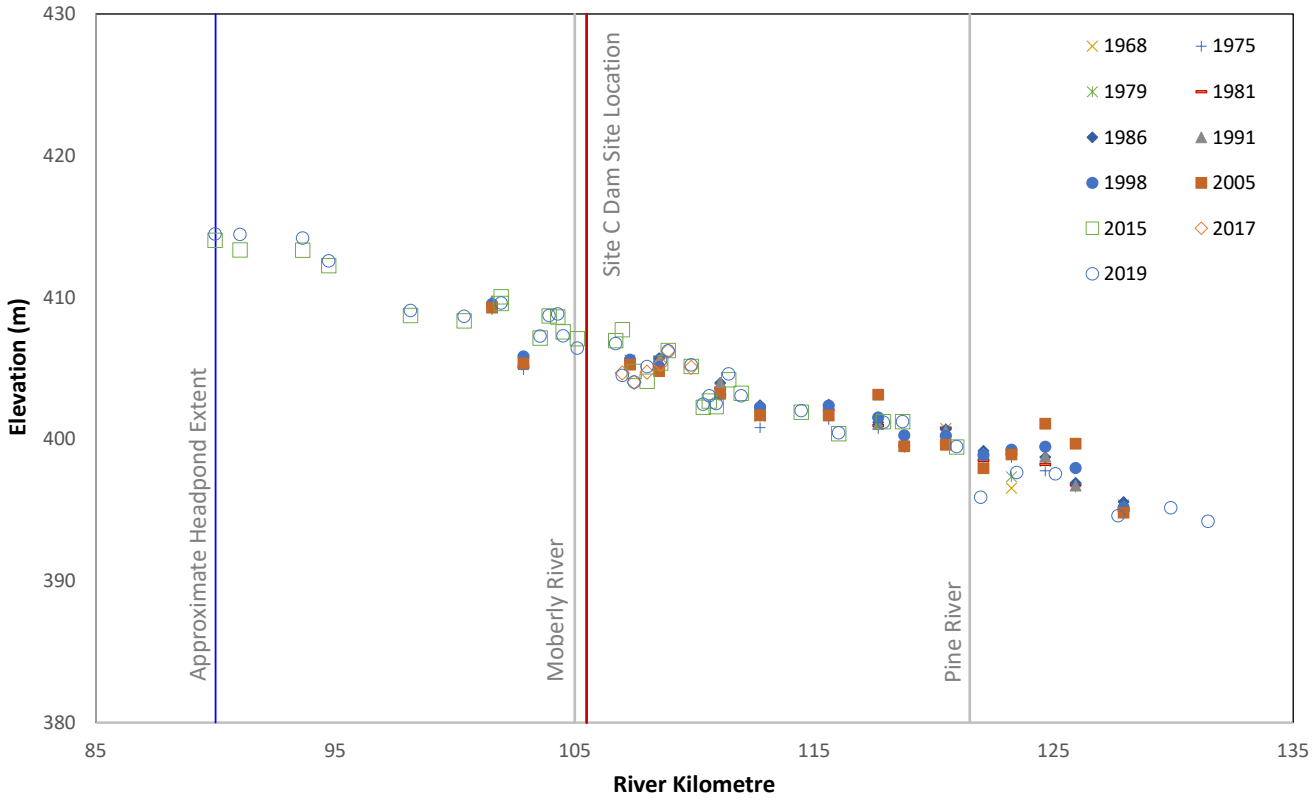



**Figure 9: Thalweg Profile from Historical and Recent Cross-Sections Surveys (1968 – 2019).**

## 3.3 Grain Size Measurements

In 2019, the grain size distribution of riverbed materials was estimated using the pebble count method at 38 locations. Fifteen sites that were surveyed during previous study years were not sampled in 2019 because they were inundated at the time of the survey or because they were located in areas under active construction. In 2019, the field survey was planned for anticipated low water levels; however, during the field surveys

(September 2019) high water levels were observed and field adjustments were made at each site to allow sampling to cover the available exposed channel feature. The survey followed a transect line (typically aligned upstream to downstream) with a constant spacing between the sampling points – approximately 0.4 m, similar to the 2015 program. A comparison of D50 between 2015 and 2019 surveys was completed for the sites with common measurements.

Overall, the distribution of D16, D35, D50, D84, and D95 percentiles in 2019 followed similar patterns throughout the study area (Figure 10 to Figure 14). The dominant substrate materials for the surveyed area were gravel (63% averaged over the study area) and cobble (33% averaged over the study area) in channel bar head and bank surfaces (Figure 15). While variability among sites was high, in general, the substrate of Peace River bars and banks over the study area became finer with distance downstream from RKm 90 to 180. Over this distance, the percentage of gravel increased, while the percentage of cobble decreased. The channel coarsened at approximately RKm 190. The percentage of sand size and finer material in the substrate was similar throughout the study area.

The range of grain sizes were similar in 2015 and 2019 for most reaches of the study area, although the sampled bar surfaces were typically finer in 2015 from approximately RKm 100 to RKm 110 (Figure 16).

Complete grain size distributions for 2019 are presented in Figure 17 through Figure 26. Results from multiple sites are compiled together in these figures to reduce the total number of plots presented. Additional figures presenting the D16 to D95 analyses and percentages by substrate type can be found in Appendix C.

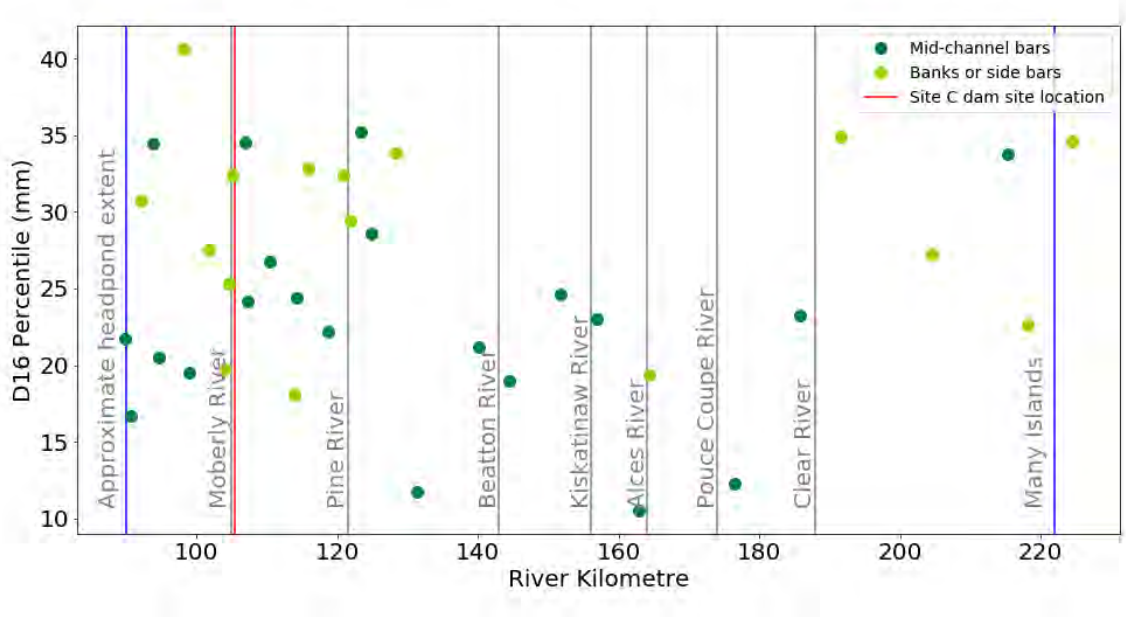



**Figure 10: Summary of D16 percentile values (in mm) by sample type (mid-channel bars or bank/side bars) and RKm as measured downstream from WAC Bennett Dam, 2019. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference.**

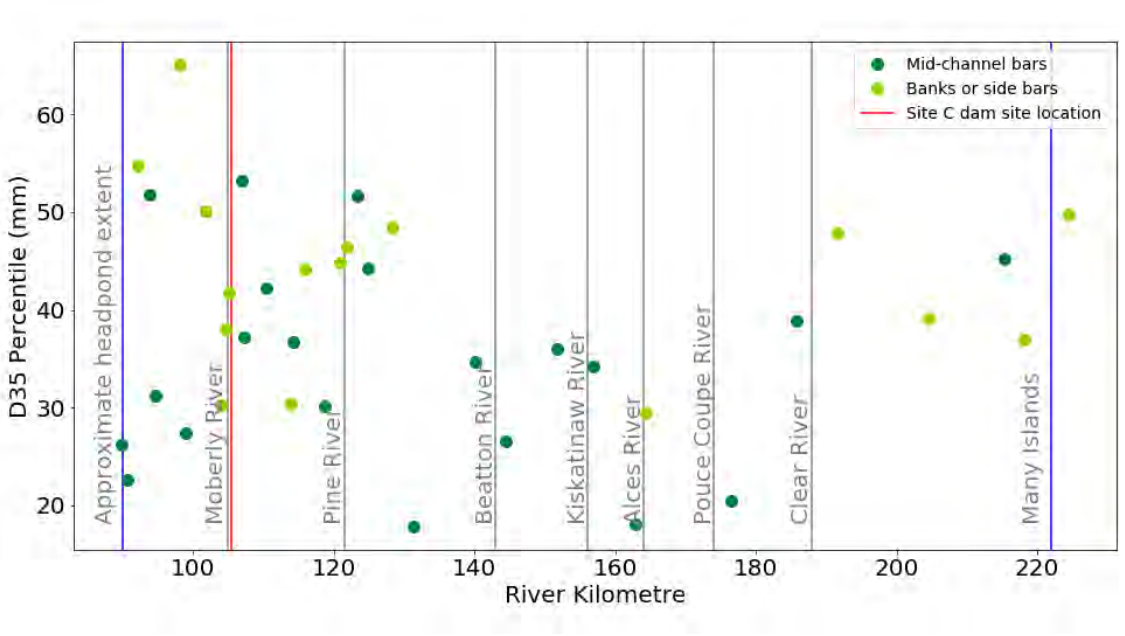



**Figure 11: Summary of D35 percentile values (in mm) by sample type (mid-channel bars or bank/side bars) and RKm as measured downstream from WAC Bennett Dam, 2019. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference.**

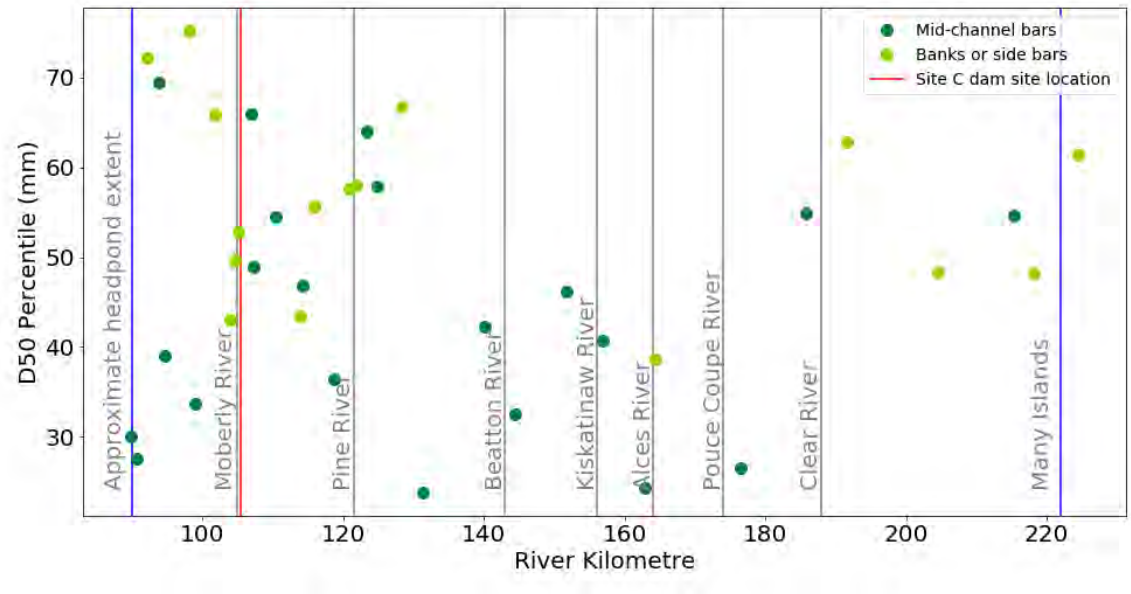



**Figure 12: Summary of D50 percentile values (in mm) by sample type (mid-channel bars or bank/side bars) and RKm as measured downstream from WAC Bennett Dam, 2019. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference.**

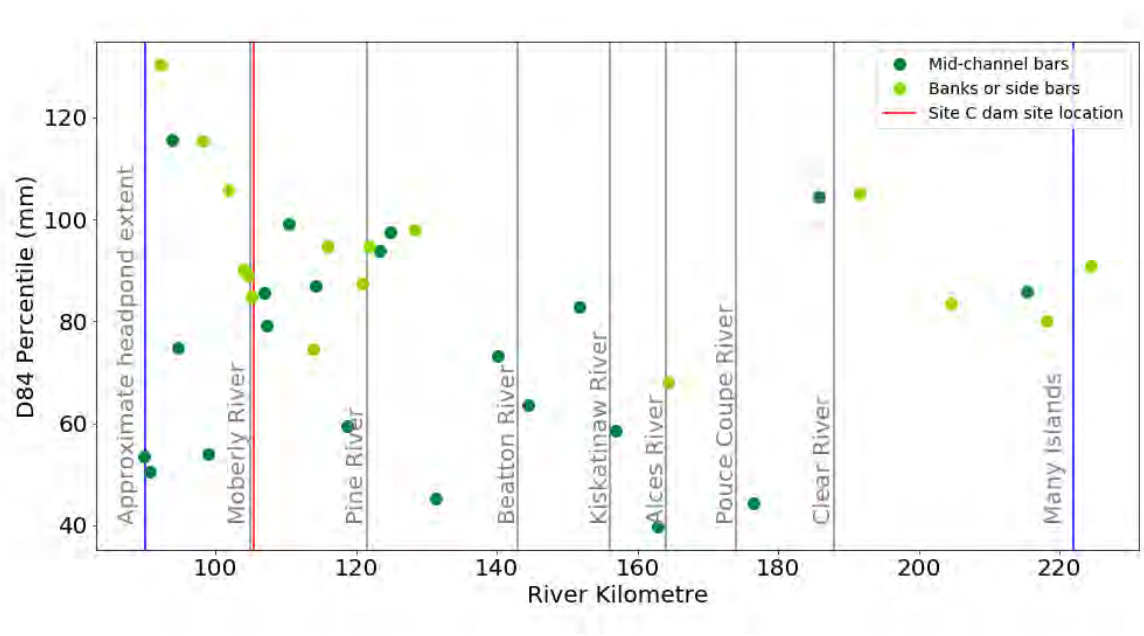



**Figure 13: Summary of D84 percentile values (in mm) by sample type (mid-channel bars or bank/side bars) and RKm as measured downstream from WAC Bennett Dam, 2019. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference.**

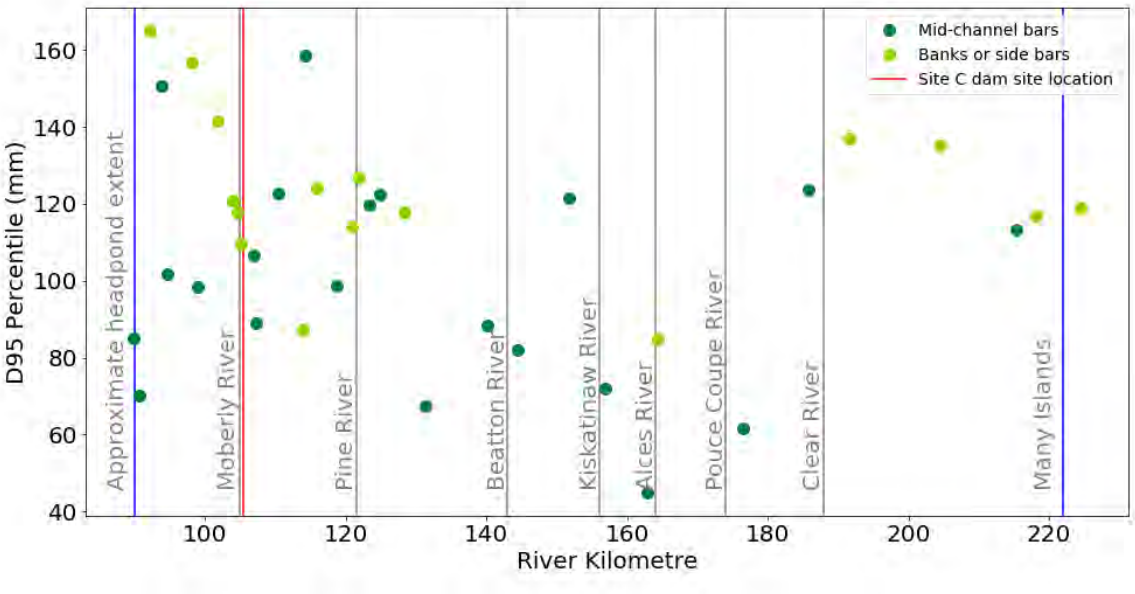



**Figure 14: Summary of D95 percentile values (in mm) by sample type (mid-channel bars or bank/side bars) and RKm as measured downstream from WAC Bennett Dam, 2019. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference.**

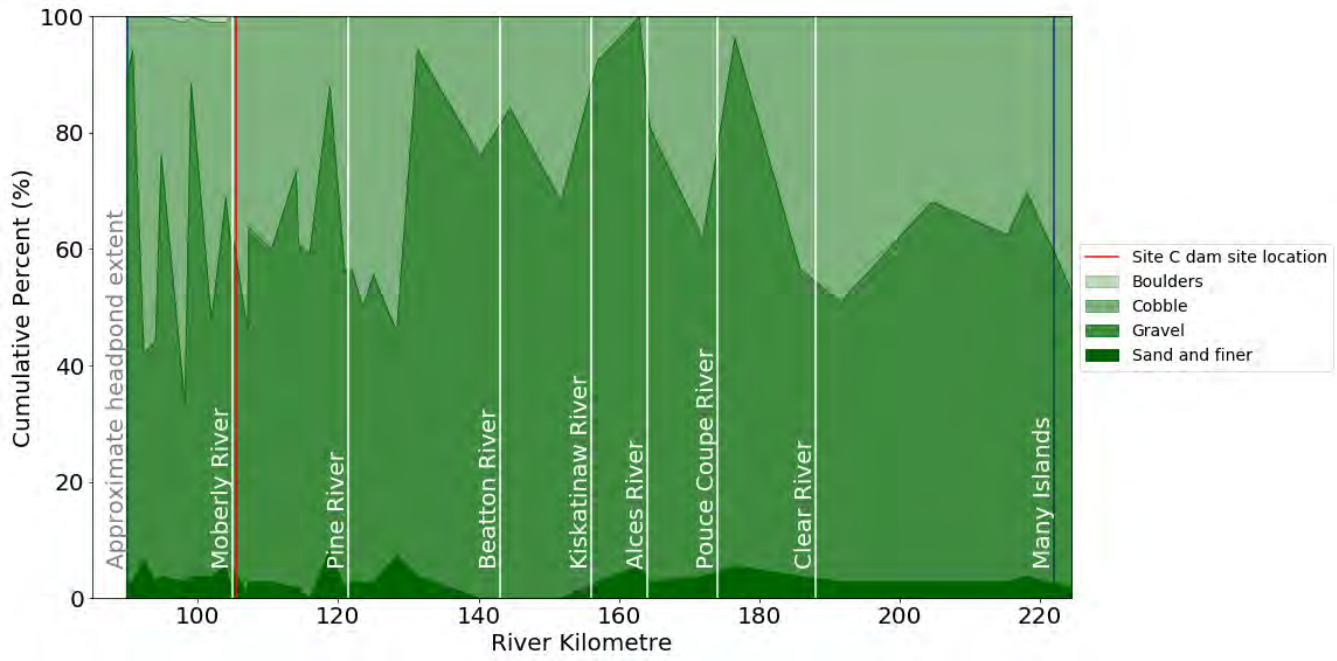



**Figure 15: Summary of percent material by substrate type by RKm as measured downstream from WAC Bennett Dam, 2019. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference. Boulders comprise less than 1% of the sample and are only visible in the top left portion of the figure.**

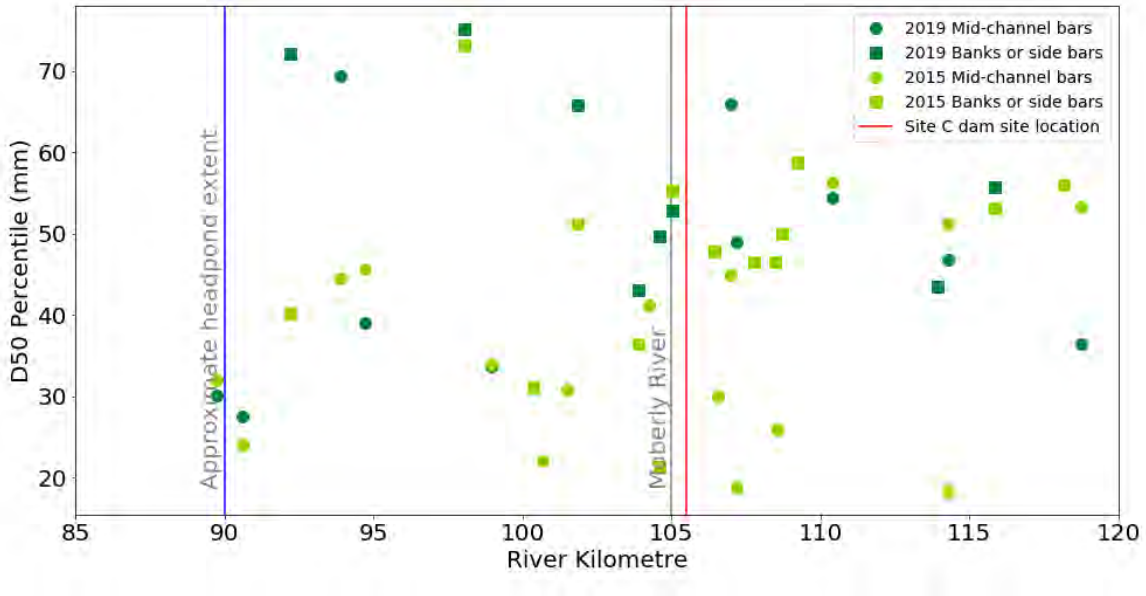



**Figure 16: Comparison of D50 values recorded in 2015 and 2019. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference.**

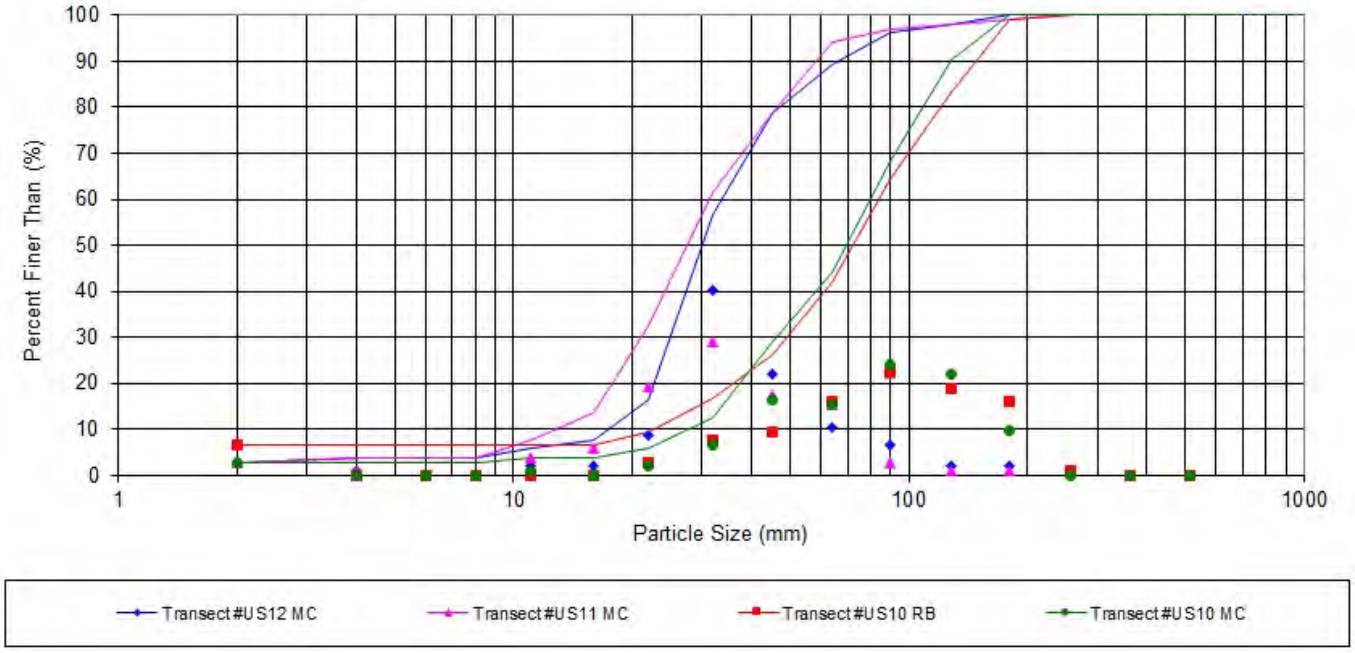



**Figure 17: Grain size distributions (points) and cumulative percentages (lines) at mid-channel bars (MC) along Transects #US12 (blue), #US11 (pink), and #US10 (green), and at the right bank (RB) of Transect #US10 (red) along the Peace River, 2019.**

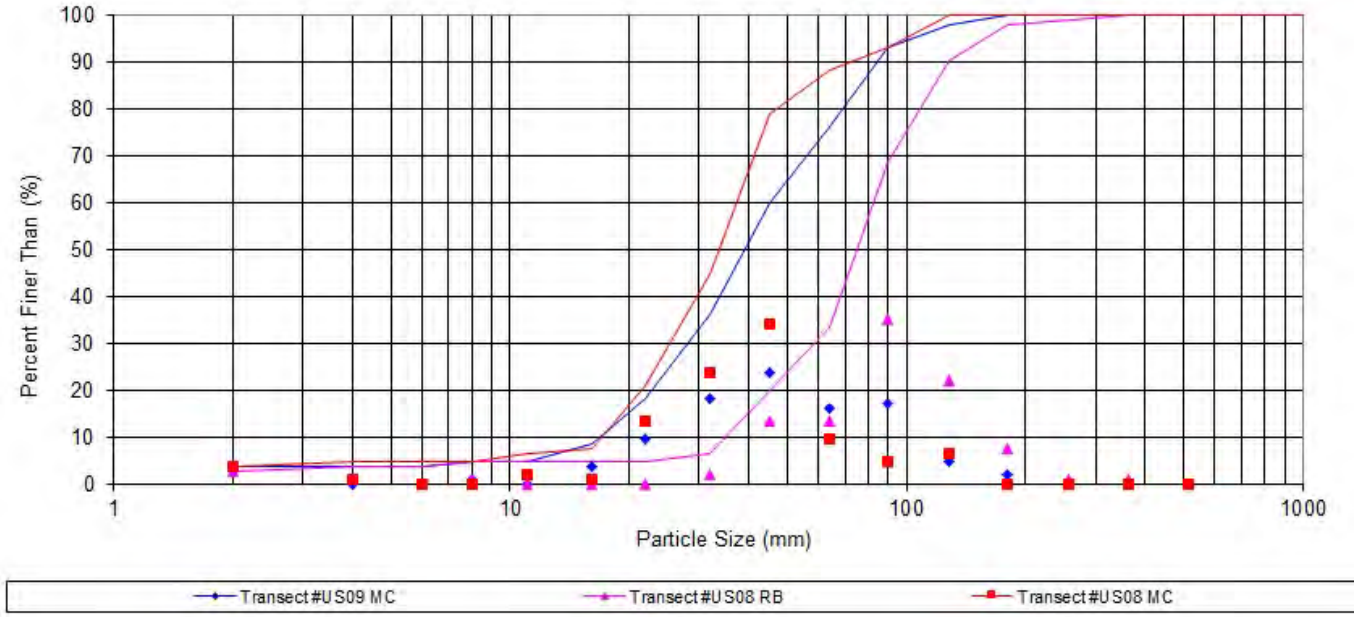



**Figure 18: Grain size distributions (points) and cumulative percentages (lines) at mid-channel bars (MC) along Transects #US09 (blue) and #US08 (red), and at the right bank (RB) of Transect #US08 (pink) along the Peace River, 2019.**

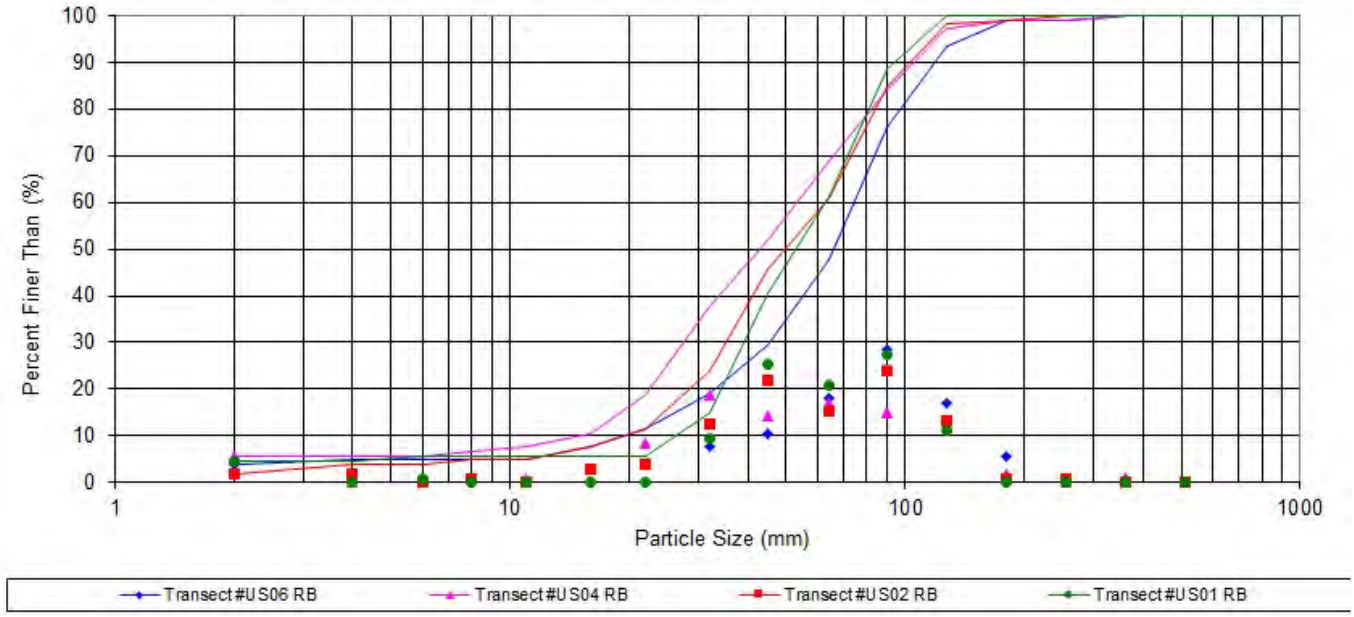



**Figure 19: Grain size distributions (points) and cumulative percentages (lines) along the right banks (RB) of Transects #US06 (blue), #US04 (pink), #US02 (red), and #US01 (green) along the Peace River, 2019.**

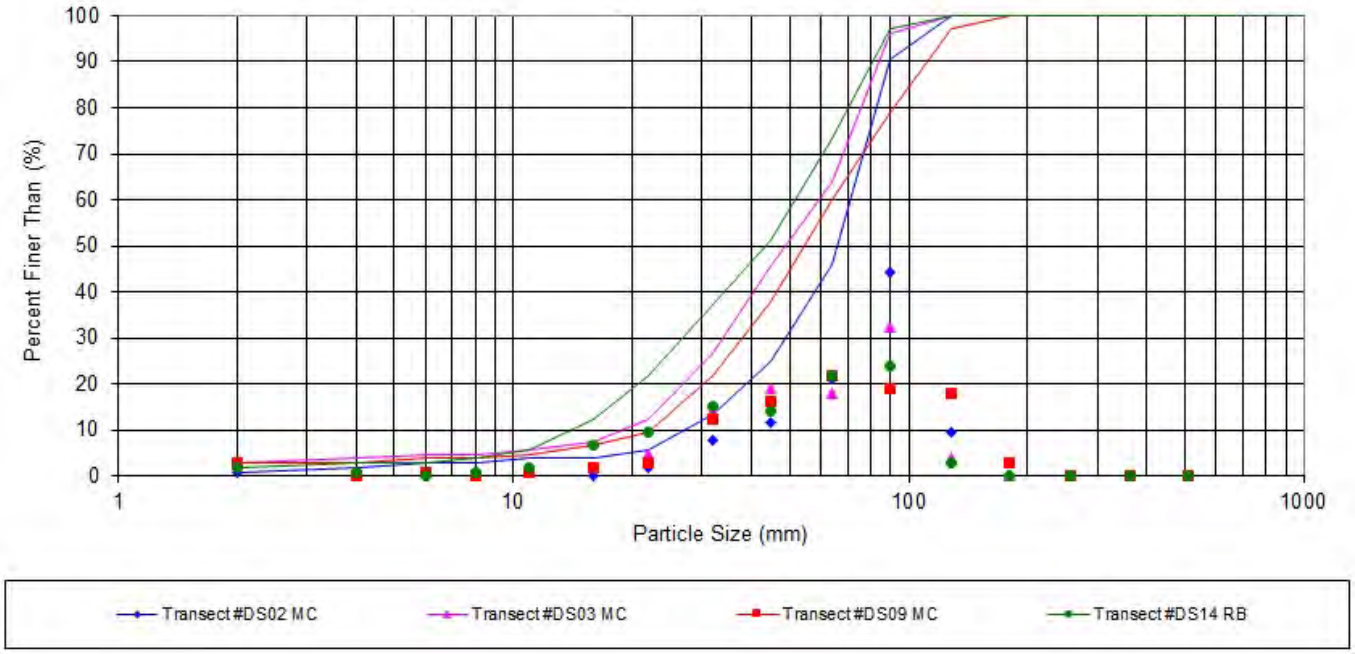



**Figure 20: Grain size distributions (points) and cumulative percentages (lines) at mid-channel bars (MC) along Transects #DS02 (blue), #DS03 (pink), and #DS09 (red), and at the right bank (RB) of Transect #DS14 (green) along the Peace River, 2019.**

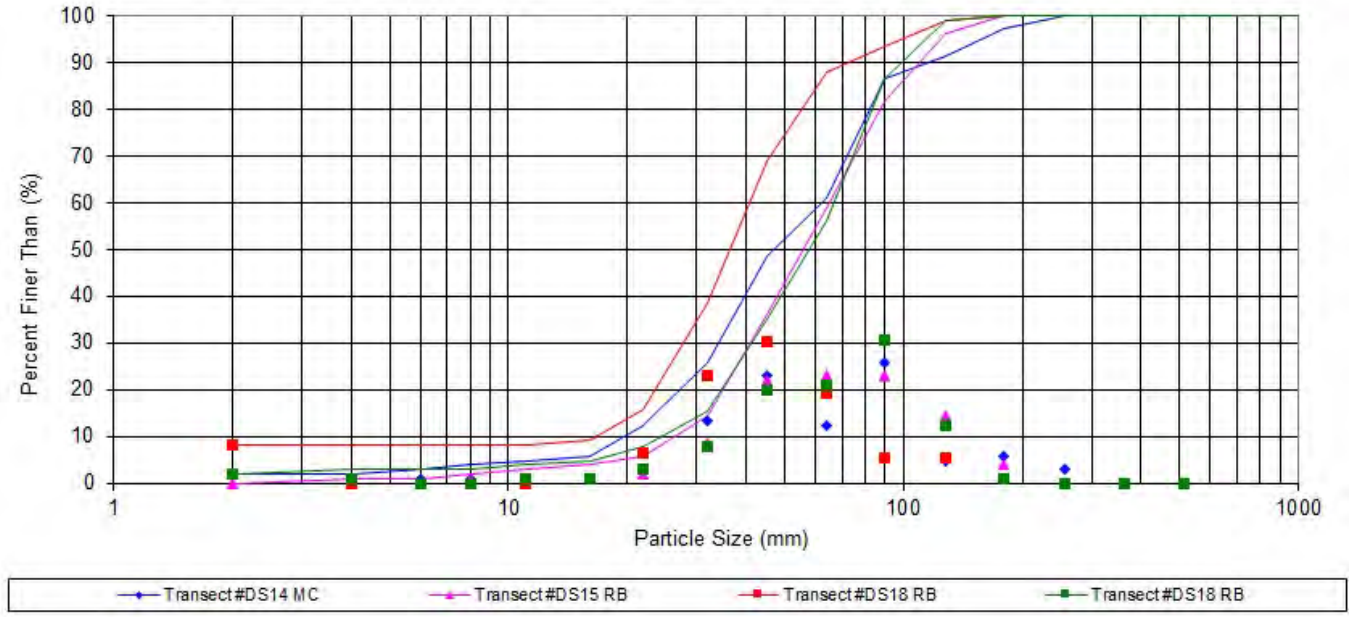



**Figure 21: Grain size distributions (points) and cumulative percentages (lines) at mid-channel bars (MC) along Transects #DS14 (blue) and #DS17 (red), and at the right banks (RB) of Transects #DS15 (pink) and #DS18 (green) along the Peace River, 2019.**

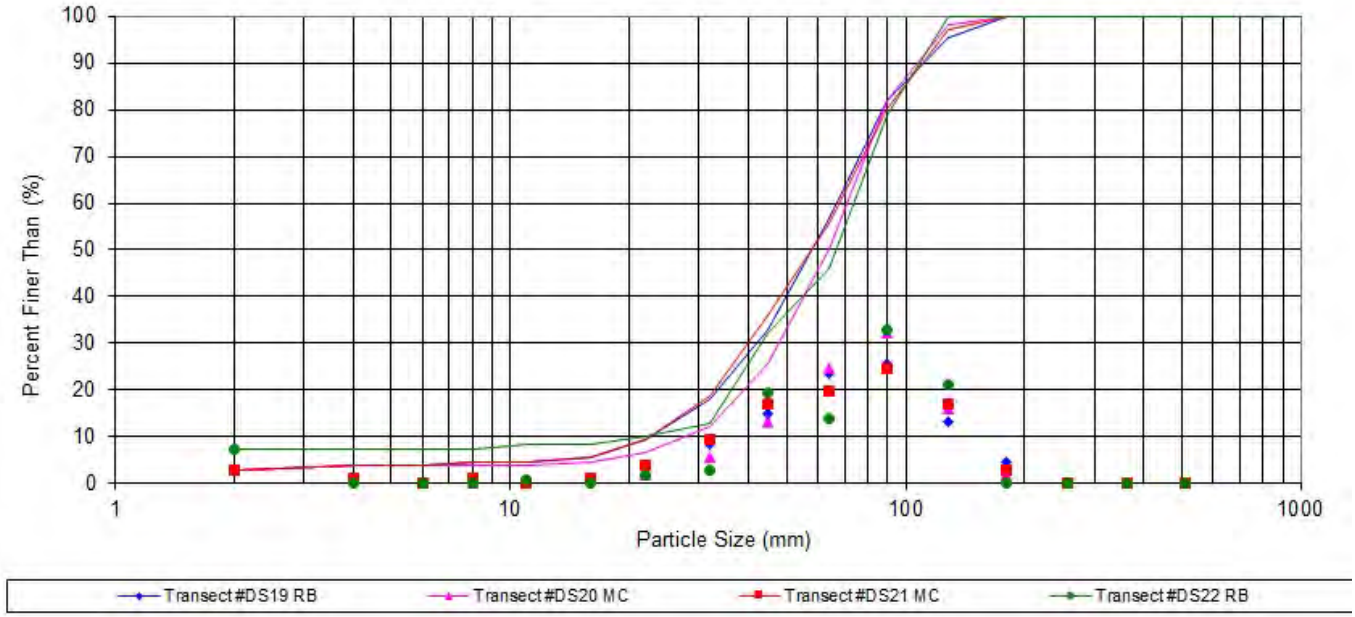



**Figure 22: Grain size distributions (points) and cumulative percentages (lines) at mid-channel bars (MC) along Transects #DS20 (pink) and #DS21 (red), at the right bank (RB) of Transect #DS22 (green), and at the left bank (LB) of Transect #19 (blue) along the Peace River, 2019.**

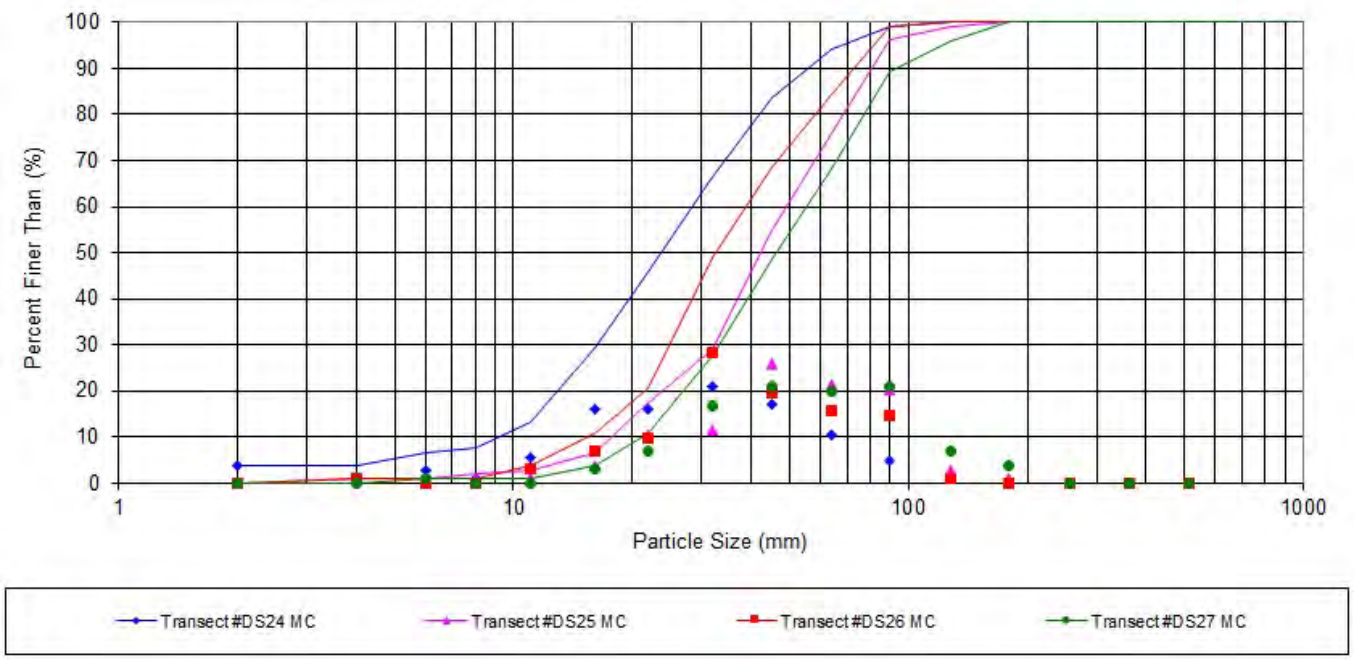



**Figure 23: Grain size distributions (points) and cumulative percentages (lines) at mid-channel bars (MC) along Transects #DS24 (blue), #DS25 (pink), #DS26 (red), and #DS27 (green) along the Peace River, 2019.**

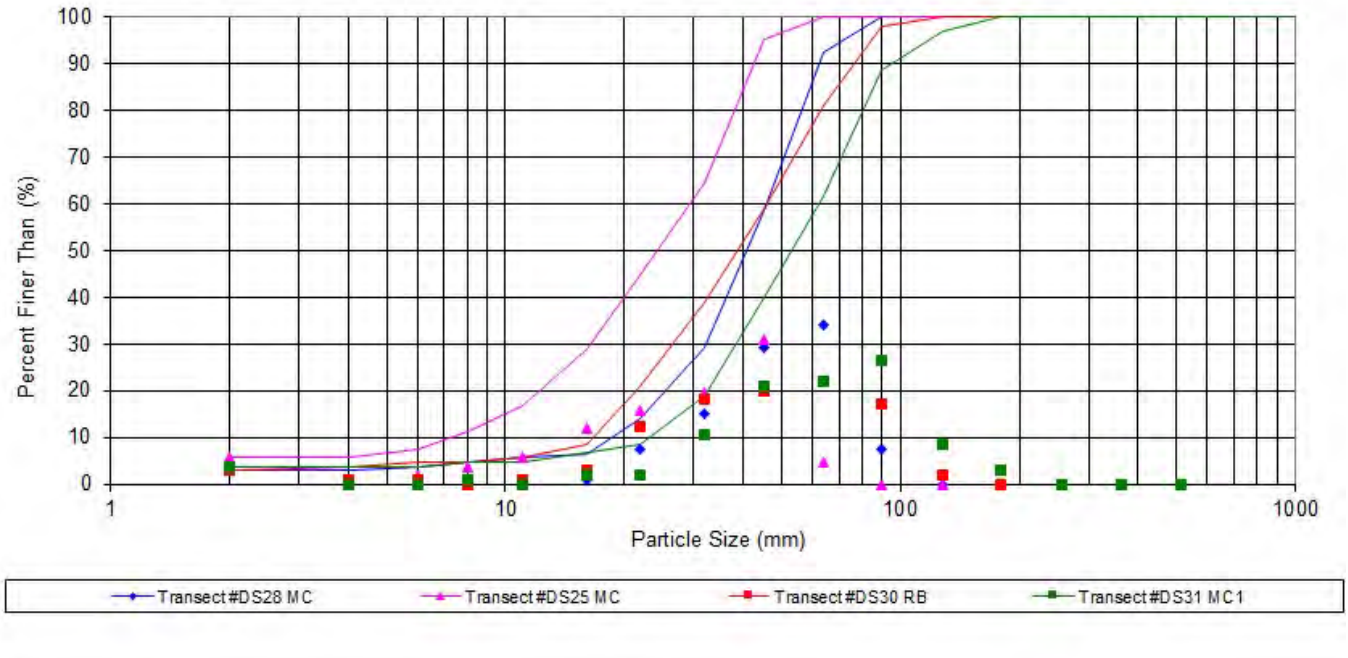



**Figure 24: Grain size distributions (points) and cumulative percentages (lines) at mid-channel bars (MC) along Transects #DS28 (blue), #DS29 (pink), and #DS31 (green), and at the right bank (RB) of Transect #DS30 (red) along the Peace River, 2019.**

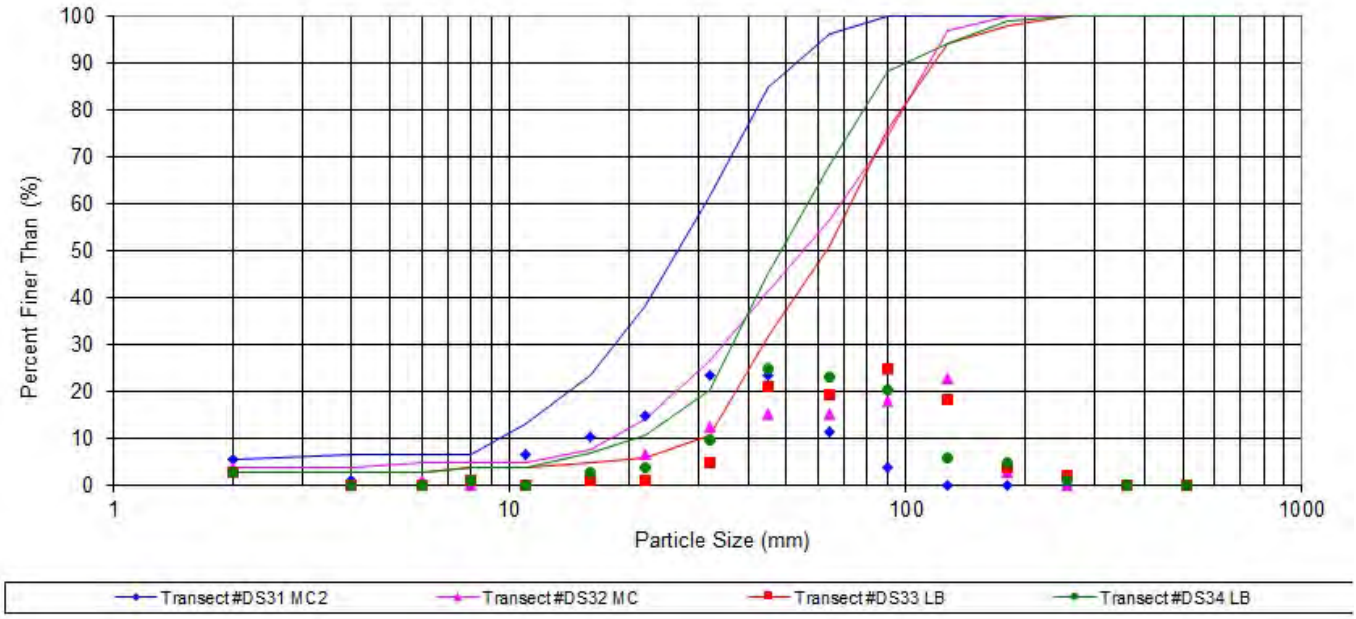



**Figure 25: Grain size distributions (points) and cumulative percentages (lines) at mid-channel bars (MC) along Transects #DS31 (blue) and #DS32 (pink), and at the left bank (LB) of Transects #DS33 (red) and #DS34 (green) along the Peace River, 2019.**

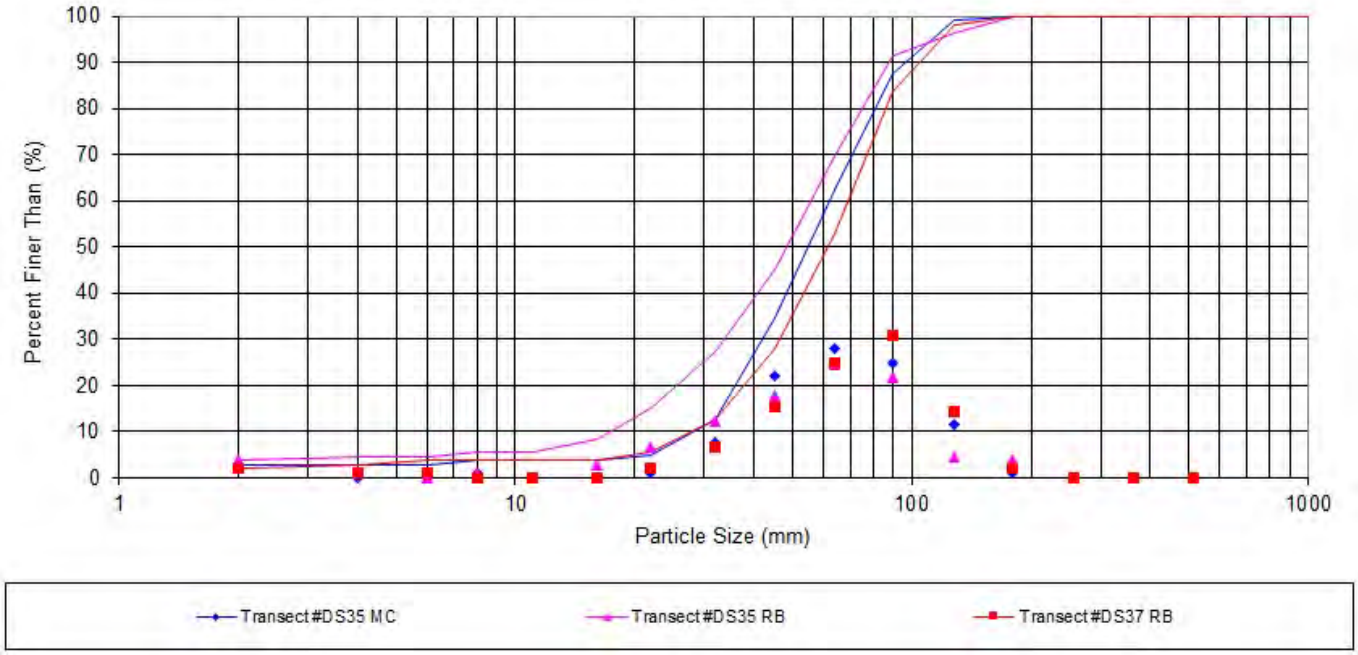



**Figure 26: Grain size distributions (points) and cumulative percentages (lines) at a mid-channel bar (MC) along Transect #DS35 (blue) and along the right banks (RB) of Transects #DS35 (pink) and #DS37 (red) along the Peace River, 2019.**

### 3.3.1 Historical Grain Size Measurements

Historical grain size measurement data were available for select years between 1968 and 2005 at multiple locations along Peace River and are presented in the Site C EIS (BC Hydro 2012). The measurements were collected at locations from downstream of Peace Canyon Dam to upstream of the Alces River's confluence with Peace River (near the BC-Alberta border).

The D50 percentile is presented in a longitudinal profile in Figure 27 and show larger variations in the D50 percentile upstream of the Halfway River confluence (i.e., near the upstream extent of the diversion headpond), and smaller variations downstream of the Halfway River confluence.

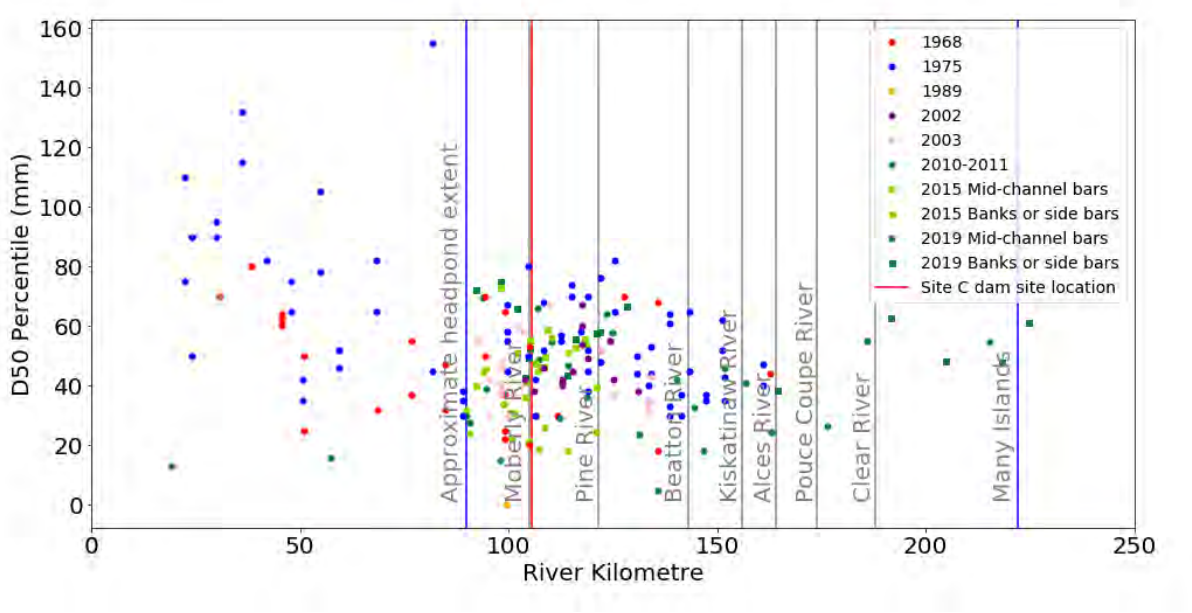



**Figure 27: Summary of D50 percentile (in mm) at river cross-sections surveyed between 1968 and 2019, by year and RKm, as measured downstream from WAC Bennett Dam. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference.**

The D90 percentile is presented in a longitudinal profile in Figure 28 and show larger variations in the D90 percentile upstream of the Halfway River confluence and smaller variations downstream of the Halfway River confluence.

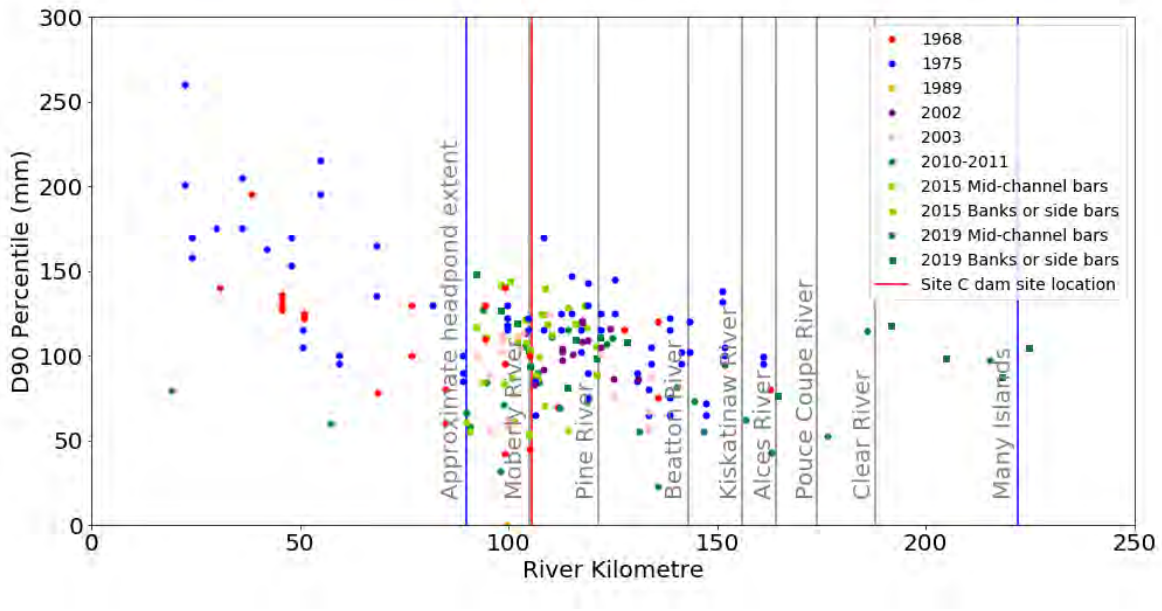



**Figure 28: Summary of D90 percentile (in mm) at river cross-sections surveyed between 1968 and 2019, by year and RKm, as measured downstream from WAC Bennett Dam. The locations of the confluences of major tributaries (grey lines) and the Project (red line) are noted for reference.**

# 4.0 DISCUSSION

Mon-3 will use physical habitat monitoring data to validate predictions and address uncertainties identified in the Site C EIS (BC Hydro 2012) regarding the Project's effect on physical habitat in the future diversion headpond and the Peace River between the Project and the Many Islands area. In 2019, river cross-section surveys and pebble counts were conducted within the footprint of the future diversion headpond and in the Peace River downstream of the Project to collect additional baseline data on riverbed elevations and substrate conditions in the Peace River prior to river diversion, which is currently scheduled to commence in the fall of 2020.

Data from the 2019 survey will be coupled with data collected in 2015, 2017, and 2018 to represent pre-Project baseline conditions in the study area prior to river diversion. These data will be compared to data collected during future study years (i.e., after river diversion and during operation of the Project) to test the program's hypotheses. Not all transects were surveyed during each of the four baseline study years, and data collected at some transects near the Project were inaccessible due to site preparation (BC Hydro 2015c) and river channelization activities (BC Hydro 2015b). Grain size data were collected in 2015 and 2019. Field crews attempted to sample the same locations during each study year; however, higher water levels in 2019 relative to 2015 limited access to some locations during the latter study year. Further, in 2019, constructions activities near the Project prevented access to some of the locations that were sampled in 2015.

Where possible, the relative change in riverbed elevation at each transect was assessed to determine if the channel had aggraded, degraded, or remained unchanged over the four-year study period. An increase in riverbed elevation indicated aggradation due to the accumulation of substrate and sediment. A decrease in riverbed elevation indicated degradation and a loss of substrate and sediment. Alternatively, little or no change in riverbed elevation indicated static conditions where gain and loss were approximately equal, and that any mobilized bedload was in transit through the site.

## 4.1 Diversion Headpond

$H_1$ of Mon-3 states that the diversion headpond construction will not affect channel morphology or bed sediment composition within the extent of the headpond. River diversion is currently scheduled to begin in the fall of 2020, after which, the diversion headpond will form and operate until reservoir filling. $H_1$ will be available for testing after river diversion commences. Survey data collected in 2015 and 2019 for this purpose are considered adequate for testing $H_1$ during future study years because they monitor changes in the channel profile (river transects) and changes in the grain size distribution at locations within the headpond.

Historic bathymetry assessments identified the reach of the Peace River between the Halfway River confluence and the Moberly River confluence, which includes a large portion of the future diversion headpond footprint, as a primarily degrading reach, where water velocities are sufficient to scour and transport sediment downstream (Church 2015). Contrary to Church (2015), the changes in riverbed elevation between 2015 and 2019 in the upstream-most 5 km of the future diversion headpond (i.e., Transects #US12 to #US09) identified a mixture of either aggraded or static channel profiles. The aggrading channel conditions between 2015 and 2019 were likely due to upstream alluvial deposits becoming mobilized during high flow events between the two survey periods. A preliminary review of discharge data from the Halfway River (Water Office 2019) indicated substantially higher maximum daily discharges (approximately 20-year flows) observed in 2011 (1490 $m^3/s$), 2012 (1590 $m^3/s$), and 2013 (1430 $m^3/s$). During consecutive very high annual peak flows, it is expected that a river will mobilize higher than normal volumes of sediment because the erosion areas from the year prior are relatively exposed (i.e., too little time has passed for vegetation to recover) and therefore it is easy to mobilize new materials during

the following high flow event. The Halfway River is the largest contributor of sediment into the Peace River (EIS, Vol.2, BC Hydro 2012). It is therefore reasonable to assume that the channel aggradation in the upstream end of the survey area in the Peace River is with sediments delivered by the Halfway River.

The additional sediment observed in Transects #US12 to #US09 may continue to travel downstream and accumulate at other transect locations, which may confound the ability of future surveys to identify whether changes in channel profile and substrate composition are attributed solely to changes in the background sedimentation rate, development and operation of the future diversion headpond, construction activity, or a combination of all of these factors.

Data collected at downstream transects within the future diversion headpond (Transects #US08 to #US01) indicated very little change in riverbed elevation or profile between 2015 and 2019.

The D50 and D95 values calculated from 2019 pebble count data were similar to historic D50 and D90 data recorded at locations between the Halfway River confluence and the Moberly River confluence where the surveys overlapped (Church 2015). The 2019 substrate size composition and distribution data will also serve as a baseline to identify changes to substrate and fish habitat in response to the development of the future diversion headpond.

Overall, the observed changes between the 2015 and 2019 surveys were expected for this reach of the Peace River, and they are an indicator of fluvial geomorphology processes happening in the tributaries upstream of the future headpond and downstream of Peace Canyon Dam. These changes can be considered part of the natural variability of the Peace River channel when compared with historical baseline surveys (EIS, Vol 2, App. I, BC Hydro 2012).

## 4.2 Peace River Downstream of the Project

$H_2$ of Mon-3 states that the construction and operation of the Project will not affect channel morphology, bed surface grain size composition, or wetted area in the Peace River between the Project and the Many Islands area in Alberta. $H_2$ will be available for testing after the start of river diversion. Survey data collected in 2015 and 2019 are considered adequate for testing $H_2$ during future study years because they will monitor changes in the channel profile (river transects) and changes in the grain size distribution at locations downstream of the Project.

The D50 and D95 values calculated from 2019 pebble count data were similar to historic D50 and D90 values recorded at locations between the Moberly River and the BC-Alberta border where the two surveys overlapped (Church 2015). The 2019 substrate size composition and distribution data will also serve as a baseline to identify post-Project changes to substrate and fish habitat.

### 4.2.1 In-Stream Works Area

Transects #DS01 to #DS08 are situated immediately downstream of the Project and encompass the footprint of downstream in-stream works associated with the Project. In-stream works completed between 2015 and 2019 resulted in substantial changes in the channel profile at most transect locations. With the exception of the two most downstream transects (Transect #DS07a and #DS08), the channel profiles at all transects within the downstream in-stream works area were influenced by the construction of River Road along the left bank. Construction of River Road narrowed the active channel and moved the bank approximately 20 m south relative to years prior to the road's construction. Substantial changes to the channel profile were noted mid-channel along Transect #DS03, related to mid-stream island channel recontouring (BC Hydro 2015c). River cross-section

surveys conducted along Transect #DS05 between 2015 and 2019 noted an approximate 2 m increase in bed elevation near mid-channel between 2015 and 2017, but a stable riverbed between 2017 and 2019. Reasons for the large aggregation between 2015 and 2017 are not known but could be related to upstream construction activities, particularly the excavation of the mid-stream island approximately 800 m upstream.

Transects #DS06a to #DS07b are situated within the offset area Upper Site 109L. The channel profile within the offset area has undergone substantial changes since the offset's construction in 2016. The bed elevation within the offset area was lowered approximately 2 m to increase the amount of permanently wetted habitat available to fish and to reduce stranding risk. Since recontouring, portions of the offset area have degraded as much as approximately 1 m (see Transect #DS06b; Appendix B, Figure B19) and aggraded as much as approximately 3 m (see Transect #DS06; Appendix B, Figure B18). In 2019, some portions of the riverbed aggraded to elevations higher than those recorded prior to the development of the offset area. Descriptions of riverbed changes within Upper Site 109L are provided in Golder (2020).

The observed changes between the 2015 and 2019 surveys were as expected for this part of the Peace River because the area is located within the in-stream works area associated with the Project.

### 4.2.2 In-Stream Works Area to Pine River Confluence

At Transects #DS09 to #DS18, river cross-section surveys conducted in 2015 and 2019 were similar. Some evidence of aggradation was evident at Transect #DS09 along the left bank and some evidence of degradation was evident along the same bank at Transect #DS10 (i.e., immediately downstream). The highest level of aggradation was recorded at Transect #DS12, where sediments had accumulated along the left bank. All other transects in this portion of the study area were similar in 2015 and 2019, suggesting a static riverbed. Historically, the Peace River downstream of the Moberly River confluence consisted of alternating sections of an aggrading and degrading riverbed as sediment loads introduced by the Moberly River were transported downstream (Church 2015). Both the 2015 and 2019 river cross-section survey results support this interpretation and future river cross-section surveys will provide additional data that will either corroborate historical data or will potentially identify changes in aggradation and degradation in response to the construction and operation of the Project.

The observed changes between the 2015 and 2019 surveys were expected for this area, and they are within the natural variability of the Peace River channel when compared with historical baseline surveys (EIS, Vol. 2, BC Hydro 2012).

### 4.2.3 Pine River Confluence to Many Islands

Historical bathymetry surveys in the Peace River between the Pine and Beatton river confluences found alternating sections of aggrading and degrading habitat. Downstream of the Beatton River confluence, the channel gradient decreases and aggrading depositional habitats are more common (Church 2015). Data collected at Transects #DS19 to #DS37 in 2019, coupled with data collected during future river cross-section surveys can be used to corroborate the findings of Church (2015) and potentially identify changes in aggradation and degradation in response to the construction and operation of the Project.

The observed changes between the 2015 and 2019 surveys were as expected for this area, and they are within the natural variability of the Peace River channel when compared with historical baseline surveys (EIS, Vol. 2, BC Hydro 2012).

## 4.3 Fish Habitat

Based on cross-section survey results and grain size measurements conducted between 2015 and 2019, overall changes to fish habitat within the Mon-3 study area over this period have been minimal. It is unknown whether the aggradation identified within the upstream-most 5 km of the future diversion headpond increased or decreased overall fish habitat; however, the aggradation was likely due to upstream alluvial deposits becoming mobilized during high flow events. These events are considered part of the natural variability of the Peace River channel and are therefore unlikely to have a noticeable influence on fish within this area.

The most apparent changes to fish habitat occurred within the in-stream works area. Between 2015 and 2019, fish habitat was reduced along the left bank within this area by the construction of the River Road; however, the habitat loss along the left bank due to the construction of the River Road coincided with the construction of habitat offset areas[8] by BC Hydro between 2015 and 2019 (Golder 2020). These offset areas were constructed immediately downstream of the Project and included rock spurs along the River Road and channel modifications at Upper Site 109L. These areas were constructed with the intent to increase the quantity and quality of available, permanently wetted habitat to support primary and secondary production for fish and provide rearing, feeding, overwintering, and potential spawning habitat for fish (BC Hydro 2015c). In addition, the offset areas were constructed to reduce fish stranding risk and increase the complexity and variability of fish habitat to support a variety of life stages for local fish populations. Effectiveness monitoring of the habitat offsetting areas in 2017, 2018, and 2019 identified that they provide a variety of suitable habitats for a variety of fish species and life stages. Furthermore, a high diversity of fish species were recorded during fish sampling efforts within the offset areas (Golder 2020).

The minimal difference in cross-section surveys or grain size measurements between 2015 and 2019 in the remainder of the Mon-3 study areas downstream of the in-stream works area suggests that there has been little overall change to fish habitat over this time period at these locations.

## 4.4 Summary

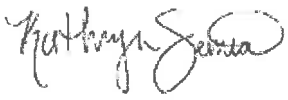
Major tributaries are the primary sources of sediment to the mainstem Peace River, with the largest contribution coming from the Moberly River (37,000 tonnes per year), followed by the Kiskatinaw River (14,000 tonnes per year), Pine River (8,600 tonnes per year), and Halfway River (6,900 tonnes per year; Church 2015).
The development of the Project is expected to alter the sediment transport and substrate composition in the Peace River downstream of the Project; however, the extent that these alterations will influence the quality or quantity of downstream aquatic habitat remains unclear. Data collected in 2015, 2017, 2018, and 2019 suggest very little change in the physical habitat present in the Peace River with the exception of areas directly affected by the development of the Project. As a result, overall changes observed in physical habitat over this time period are not likely to have a noticeable influence on fish species within the Peace River. During future study years, these data will serve as a baseline dataset for testing Mon-3's hypotheses and categorizing the potential effects that the construction and operation of the Project have on physical habitat in the Peace River.

[8] Fisheries and Oceans Canada (DFO) approved BC Hydro Offsetting Plan and issued a Fisheries Act Authorization [FAA; No. 15-HPAC-00170) for site preparation works on 30 September 2015.

## 5.0 CLOSURE

We trust that this report provides the information required. If there are any questions or require further detail, please contact the undersigned.

**Golder Associates Ltd.**



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https://golderassociates.sharepoint.com/sites/107993/project files/6 deliverables/issued to the client_for wp/19121767-011-r-rev0/19121767-011-r-rev0-mon-3_2019 peace river physical habitat monitoring 22apr_21.docx

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**APPENDIX A**

# Maps and UTM Coordinates

**Table B1: UTM Coordinates of transects located in the Peace River and surveyed as part of BC Hydro's Peace River Physical Habitat Monitoring Program, 2019. Transects are sorted from upstream to downstream with Transects #US12 to #DS30 situated in UTM Zone 10V and Transects #DS31 to #DS37 situated in UTM Zone 11V.**

| Transect Number | Left Downstream Bank | | Right Downstream Bank | |
|---|---|---|---|---|
| | Easting | Northing | Easting | Northing |
| US12 | 616127 | 6233874 | 615838 | 6233291 |
| US11 | 617001 | 6233312 | 616652 | 6232717 |
| US10 | 619308 | 6232508 | 619141 | 6231654 |
| US9 | 620268 | 6232665 | 620260 | 6231565 |
| US8 | 623284 | 6233361 | 623539 | 6232731 |
| US7 | 625547 | 6233588 | 625449 | 6233190 |
| US6 | 627148 | 6232966 | 626836 | 6232628 |
| US5 | 628331 | 6231622 | 627869 | 6231270 |
| US4 | 628501 | 6231310 | 628093 | 6230912 |
| US3 | 628846 | 6231010 | 628287 | 6230605 |
| US2 | 629005 | 6230872 | 628357 | 6230369 |
| US1 | 629461 | 6230481 | 628795 | 6229817 |
| DS1 | 630670 | 6229758 | 630134 | 6228786 |
| DS3 | 630856 | 6229716 | 630577 | 6228621 |
| DS4 | 631314 | 6229624 | 631318 | 6228394 |
| DS5 | 631894 | 6229580 | 632070 | 6228423 |
| DS6a | 632275 | 6229668 | 632673 | 6228536 |
| DS6 | 632409 | 6229718 | 632839 | 6228587 |
| DS6b | 632544 | 6229773 | 632995 | 6228661 |
| DS7 | 632669 | 6229861 | 633150 | 6228740 |
| DS7b | 632829 | 6229854 | 633279 | 6228828 |
| DS7a | 633063 | 6230053 | 633501 | 6228947 |
| DS8 | 633504 | 6230441 | 633974 | 6229272 |
| DS9 | 633901 | 6230725 | 634430 | 6229527 |
| DS10 | 634272 | 6230691 | 634615 | 6229678 |
| DS11 | 634801 | 6230531 | 634809 | 6229801 |
| DS12 | 635315 | 6230462 | 635323 | 6229902 |

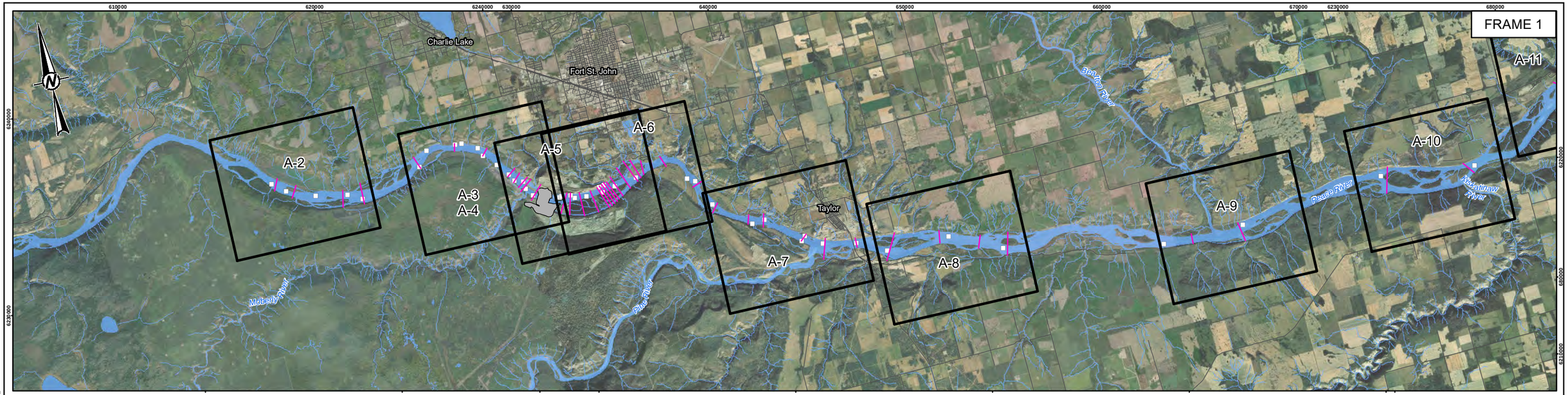
| Transect Number | Left Downstream Bank | | Right Downstream Bank | |
|---|---|---|---|---|
| | Easting | Northing | Easting | Northing |
| DS13 | 635823 | 6230523 | 636045 | 6229944 |
| DS14 | 637680 | 6228779 | 637153 | 6228588 |
| DS15 | 638221 | 6227477 | 637864 | 6227045 |
| DS16 | 639668 | 6226526 | 639517 | 6226049 |
| DS17 | 640442 | 6226405 | 640278 | 6225735 |
| DS18 | 642362 | 6224867 | 642035 | 6224572 |
| DS19 | 643284 | 6224430 | 642963 | 6223388 |
| DS20 | 644806 | 6224091 | 644808 | 6223601 |
| DS21 | 646872 | 6223891 | 646172 | 6222576 |
| DS22 | 649155 | 6223494 | 649069 | 6222859 |
| DS23 | 651210 | 6222776 | 650967 | 6222129 |
| DS24 | 652640 | 6222601 | 652364 | 6221443 |
| DS25 | 661944 | 6220369 | 661935 | 6219859 |
| DS26 | 664448 | 6220395 | 664621 | 6219400 |
| DS27 | 672708 | 6221474 | 672357 | 6220150 |
| DS28 | 676599 | 6220779 | 677055 | 6220184 |
| DS29 | 682132 | 6223850 | 682703 | 6223427 |
| DS30 | 683510 | 6224430 | 683643 | 6223855 |
| DS31 | 690816 | 6225578 | 690716 | 6225170 |
| DS32 | 703902 | 6230441 | 703841 | 6229965 |
| DS33 | 707746 | 6229905 | 707929 | 6229376 |
| DS34 | 716210 | 6236523 | 716459 | 6236044 |
| DS35 | 729098 | 6242440 | 729499 | 6242258 |
| DS36 | 731302 | 6244533 | 731775 | 6243595 |
| DS37 | 735044 | 6246439 | 735632 | 6245718 |

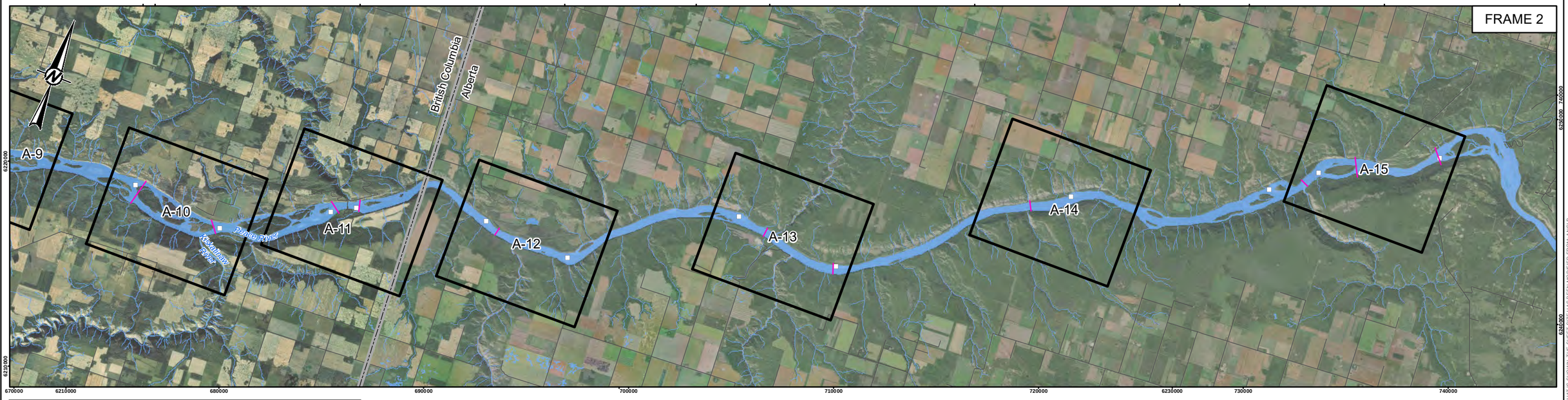
**Table A2: UTM Coordinates of grain size measurement locations on the Peace River and surveyed as part of BC Hydro's Peace River Physical Habitat Monitoring Program, 2019. Sites are sorted from upstream to downstream with Sites #US-12 MC to #DS-30 RB situated in UTM Zone 10V and Sites #DS-31 MC-1 to #DS-37 MC situated in UTM Zone 11V.**

| Site Identifier | 2019 Survey Date | UTM | | Survey Year | | Notes |
|---|---|---|---|---|---|---|
| | | Easting | Northing | 2015 | 2019 | |
| US-12 MC | 10-Sep-19 | 615742 | 6233749 | Yes | Yes | |
| US-11 MC | 10-Sep-19 | 616406 | 6233138 | Yes | Yes | |
| US-10 RB | 10-Sep-19 | 617828 | 6232536 | Yes | Yes | |
| US-10 MC | 10-Sep-19 | 619471 | 6232255 | Yes | Yes | |
| US-9 MC | 10-Sep-19 | 620089 | 6231937 | Yes | Yes | |
| US-8 RB | 10-Sep-19 | 623493 | 6232798 | Yes | Yes | |
| US-8 MC | 10-Sep-19 | 624098 | 6233588 | Yes | Yes | |
| US-7 LB | | 625560 | 6233531 | Yes | No | Site submerged in 2019; not assessed. |
| US-7 MC | | 625902 | 6233497 | Yes | No | Site submerged in 2019; not assessed. |
| US-6 MC | | 626675 | 6233060 | Yes | No | Site submerged in 2019; not assessed. |
| US-6 RB | 10-Sep-19 | 626861 | 6232628 | Yes | Yes | |
| US-5 RB-2 | | 627448 | 6231992 | Yes | No | Site submerged in 2019; not assessed. |
| US-5 RB-1 | | 627949 | 6231359 | Yes | No | Site submerged in 2019; not assessed. |
| US-4 RB | 10-Sep-19 | 628164 | 6230987 | Yes | Yes | |
| US-3 MC | | 628598 | 6230850 | Yes | No | Construction; not assessed in 2019. |
| US-2 RB | 10-Sep-19 | 628641 | 6230430 | Yes | Yes | |
| US-1 RB | 10-Sep-19 | 628933 | 6230041 | Yes | Yes | |
| DS-1 RB | | 630266 | 6229609 | Yes | No | Construction; not assessed in 2019. |
| DS-1 MC | | 630377 | 6229640 | Yes | No | Construction; not assessed in 2019. |
| DS-2 MC | 14-Sep-19 | 630695 | 6229502 | Yes | Yes | |
| DS-3 MC | 10-Sep-19 | 631039 | 6229416 | Yes | Yes | |
| DS-4 RB | | 631647 | 6229342 | Yes | No | Site submerged in 2019; not assessed. |

| Site Identifier | 2019 Survey Date | UTM | | Survey Year | | Notes |
|---|---|---|---|---|---|---|
| | | Easting | Northing | 2015 | 2019 | |
| DS-5 LB | | 632406 | 6229676 | Yes | No | Site submerged in 2019; not assessed. |
| DS-5 RB | | 632514 | 6229368 | Yes | No | Site submerged in 2019; not assessed. |
| DS-6 LB | | 632644 | 6229700 | Yes | No | Site submerged in 2019; not assessed. |
| DS-7 RB | | 633193 | 6229534 | Yes | No | Construction; not assessed in 2019. |
| DS-9 MC | 11-Sep-19 | 634188 | 6229962 | Yes | Yes | |
| DS-14 RB | 11-Sep-19 | 636960 | 6229322 | Yes | Yes | |
| DS-14 MC | 11-Sep-19 | 637361 | 6228850 | Yes | Yes | |
| DS-15 RB | 11-Sep-19 | 637884 | 6227501 | Yes | Yes | |
| DS-16 RB | | 639760 | 6226007 | Yes | No | Site submerged in 2019; not assessed. |
| DS-17 MC | 11-Sep-19 | 640359 | 6226073 | Yes | Yes | |
| DS-18 RB | 11-Sep-19 | 642038 | 6224570 | Yes | Yes | |
| DS-18 MC | | 642273 | 6224794 | Yes | No | Site submerged in 2019; not assessed. |
| DS-19 RB | 11-Sep-19 | 643107 | 6224188 | No | Yes | |
| DS-20 MC | 11-Sep-19 | 644797 | 6223871 | No | Yes | |
| DS-21 MC | 11-Sep-19 | 646298 | 6223120 | No | Yes | |
| DS-22 RB | 11-Sep-19 | 649002 | 6222888 | No | Yes | |
| DS-24 MC | 11-Sep-19 | 652334 | 6221740 | No | Yes | |
| DS-25 MC | 11-Sep-19 | 661938 | 6220289 | No | Yes | |
| DS-26 MC | 11-Sep-19 | 664359 | 6219807 | No | Yes | |
| DS-27 MC | 12-Sep-19 | 672348 | 6221253 | No | Yes | |
| DS-28 MC | 12-Sep-19 | 677081 | 6220458 | No | Yes | |
| DS-29 MC | 12-Sep-19 | 682180 | 6223269 | No | Yes | |
| DS-30 RB | 12-Sep-19 | 683544 | 6223981 | No | Yes | |
| DS-31 MC-1 | 12-Sep-19 | 690091 | 6225669 | No | Yes | |

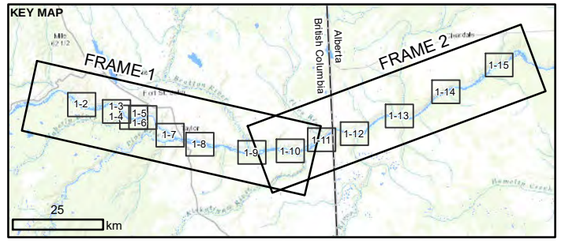
| Site Identifier | 2019 Survey Date | UTM | | Survey Year | | Notes |
|---|---|---|---|---|---|---|
| | | Easting | Northing | 2015 | 2019 | |
| DS-31 MC-2 | 12-Sep-19 | 691410 | 6225418 | No | Yes | |
| DS-32 MC | 12-Sep-19 | 702246 | 6230541 | No | Yes | |
| DS-33 LB | 12-Sep-19 | 708215 | 6229831 | No | Yes | |
| DS-34 LB | 13-Sep-19 | 718130 | 6237480 | No | Yes | |
| DS-35 MC | 13-Sep-19 | 727753 | 6241415 | No | Yes | |
| DS-35 RB | 13-Sep-19 | 730095 | 6243619 | No | Yes | |
| DS-37 MC | 13-Sep-19 | 735458 | 6246002 | No | Yes | |




**LEGEND**

- GRAIN SIZE PLOT LOCATION
- RIVER CROSS-SECTION LOCATION
- PROVINCIAL BORDER
- ROAD
- WATERCOURSE
- OUTLINE OF SITE C PERMANENT COMPONENTS
- FIGURE FRAME
- WATERBODY

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**REFERENCE(S)**

1. IMAGERY AND BASEMAP: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
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DATUM/PROJECTION: NAD83/UTM ZONE 10N

CLIENT
BC HYDRO

CONSULTANT
GOLDER

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| YYYY-MM-DD | 2020-09-08 |
| DESIGNED | KDR |
| PREPARED | CD |
| REVIEWED | GA |
| APPROVED | DF |

PROJECT
PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM – MON-3

TITLE
**OVERVIEW OF THE PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM STUDY AREA, 2019.**

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 19121767 | 10/10.3 | 0 | A-1 |

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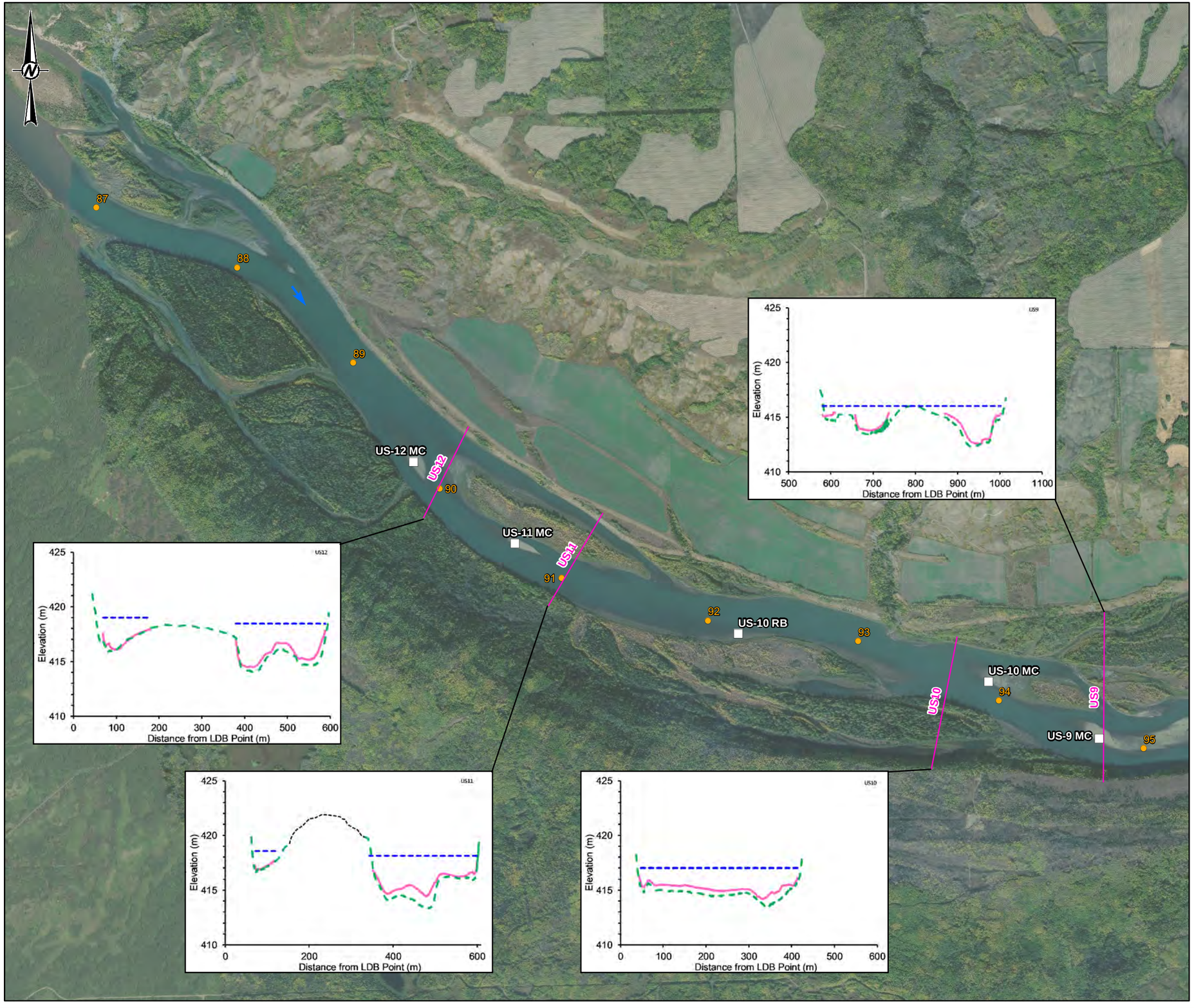
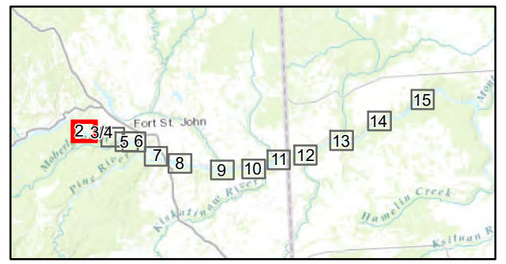



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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**NOTES**

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DATUM/PROJECTION: NAD83/UTM ZONE 10N

CLIENT
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PROJECT
PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM – MON-3

TITLE
**PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM STUDY AREA, 2019.**

CONSULTANT
GOLDER

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| YYYY-MM-DD | 2020-09-08 |
| DESIGNED | DC |
| PREPARED | CD |
| REVIEWED | GA |
| APPROVED | DF |

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 19121767 | 10/10.3 | 0 | A-2 |

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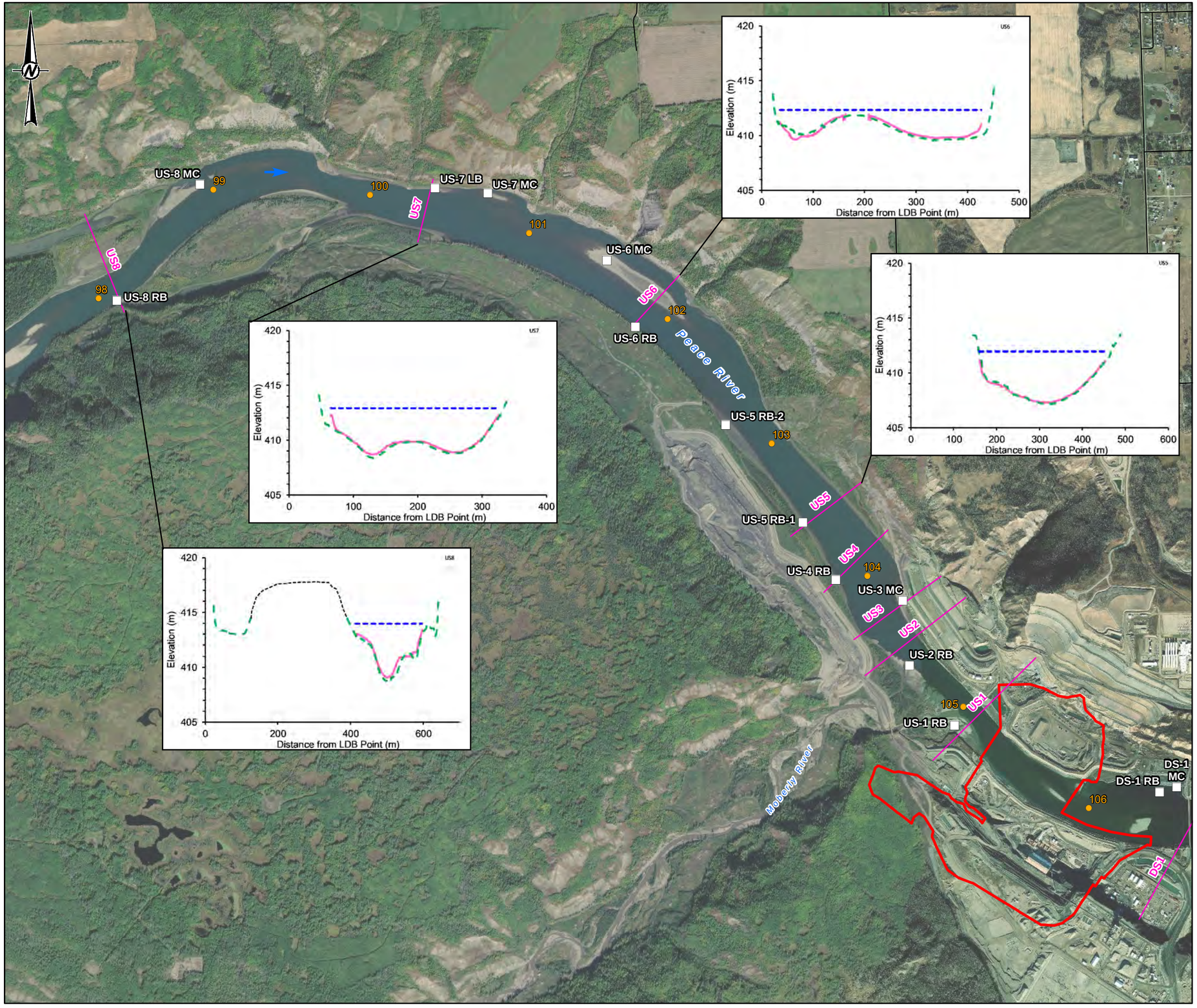
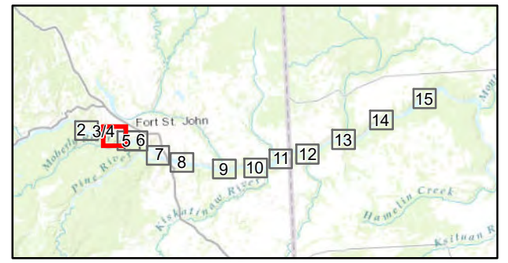



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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NOTES

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DATUM/PROJECTION: NAD83/UTM ZONE 10N

CLIENT
BC HYDRO

PROJECT
PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM – MON-3

TITLE
**PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM STUDY AREA, 2019.**

CONSULTANT
GOLDER

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| YYYY-MM-DD | 2020-09-08 |
| DESIGNED | DC |
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| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 19121767 | 10/10.3 | 0 | **A-3** |

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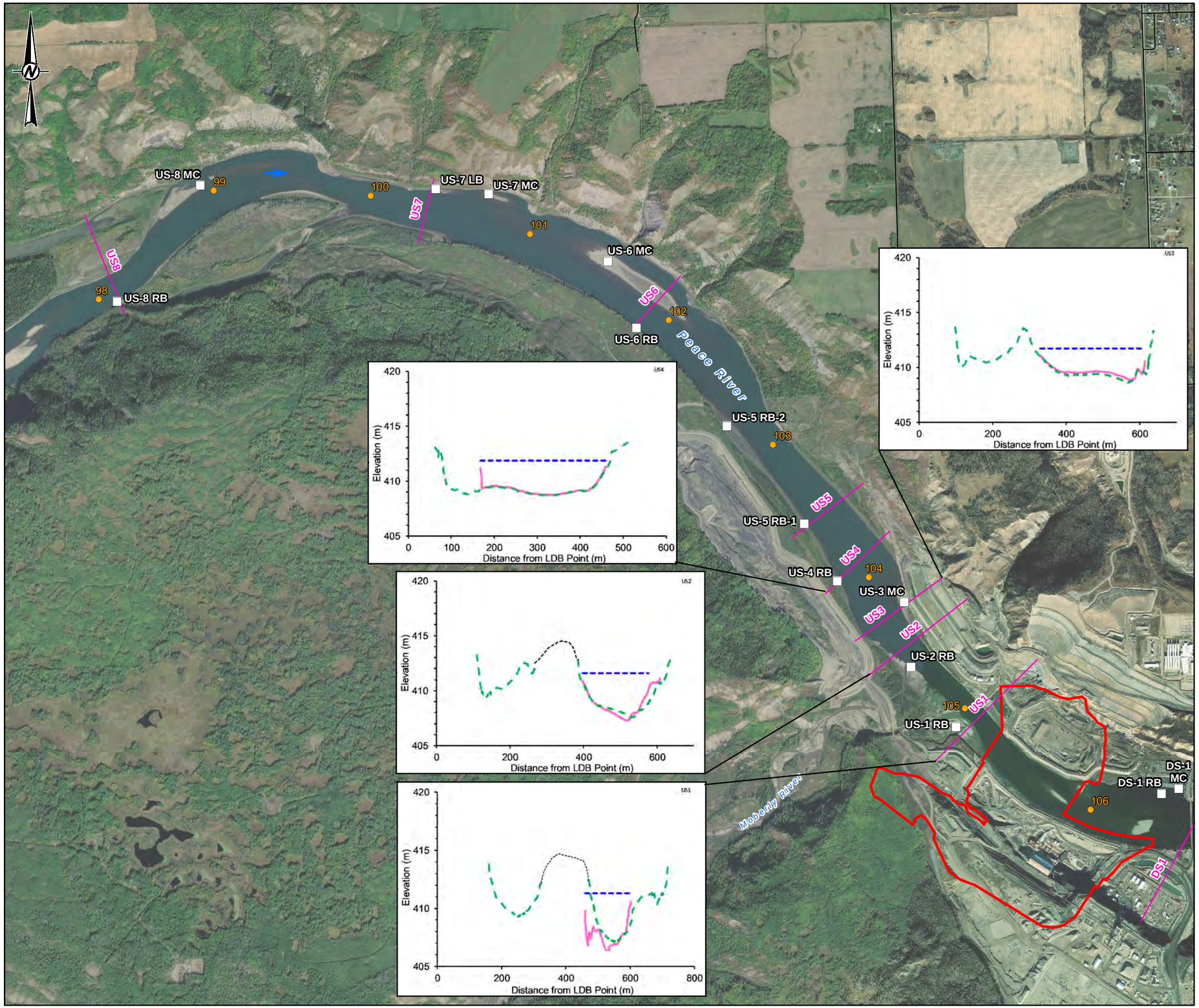
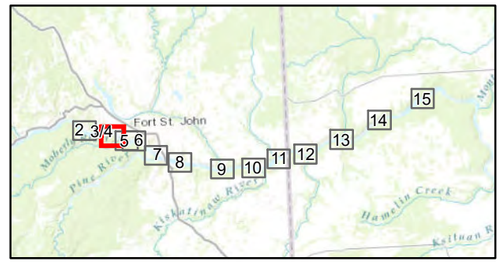



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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CLIENT
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PROJECT
PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM – MON-3

TITLE
**PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM STUDY AREA, 2019.**

CONSULTANT
GOLDER

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| YYYY-MM-DD | 2020-09-09 |
| DESIGNED | DC |
| PREPARED | CD |
| REVIEWED | GA |
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| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 19121767 | 10/10.3 | 0 | **A-4** |

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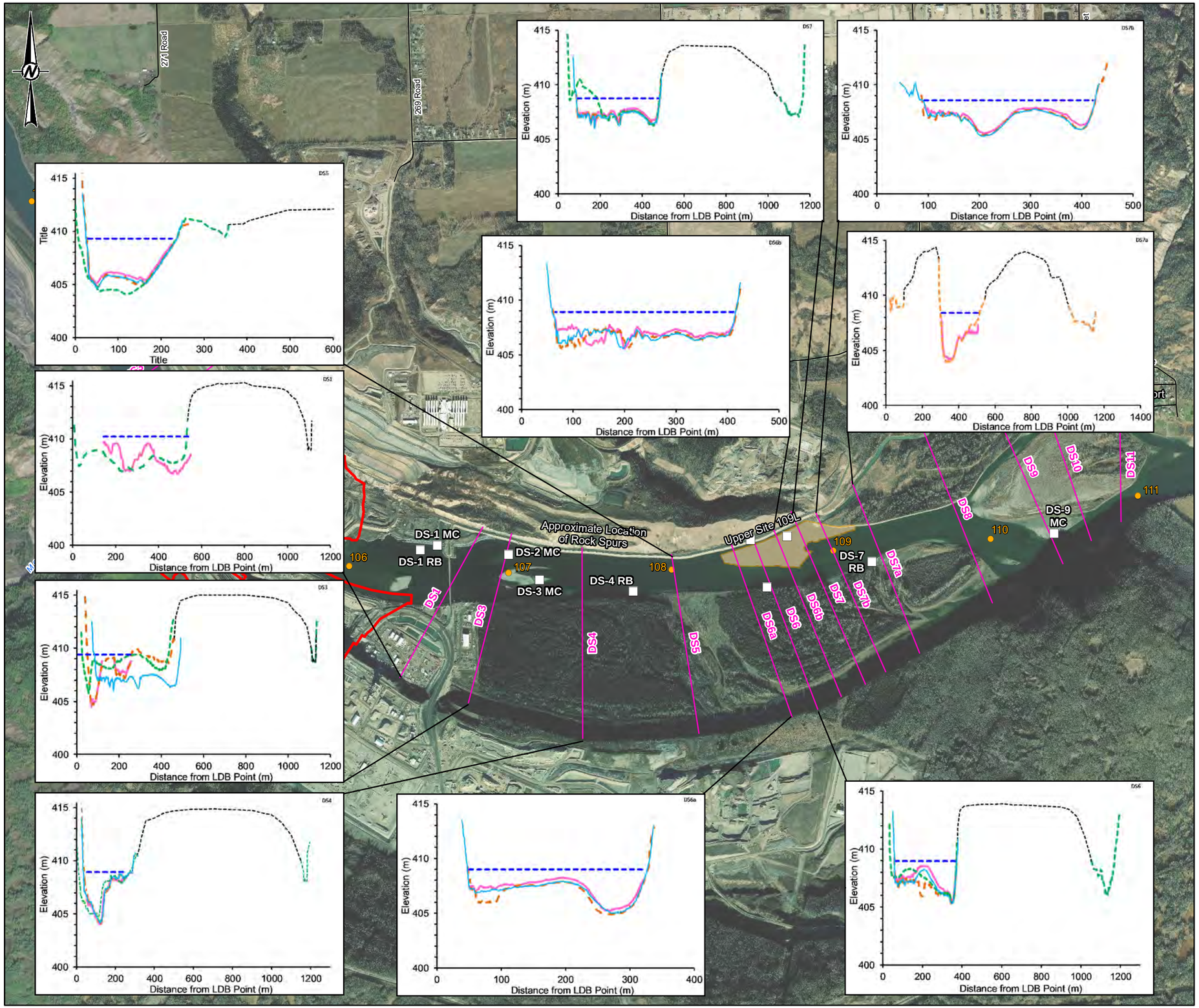
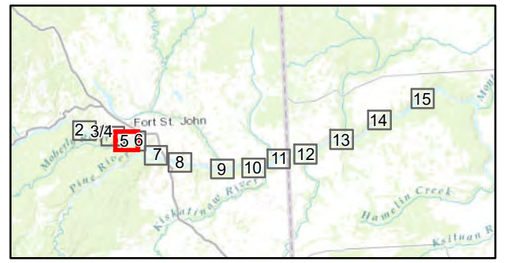



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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**NOTES**

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DATUM/PROJECTION: NAD83/UTM ZONE 10N

CLIENT
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PROJECT
PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM – MON-3

TITLE
**PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM STUDY AREA, 2019.**

CONSULTANT
GOLDER

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| YYYY-MM-DD | 2020-09-09 |
| DESIGNED | DC |
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| PROJECT NO. | PHASE | REV. | FIGURE |
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| 19121767 | 10/10.3 | 0 | **A-5** |

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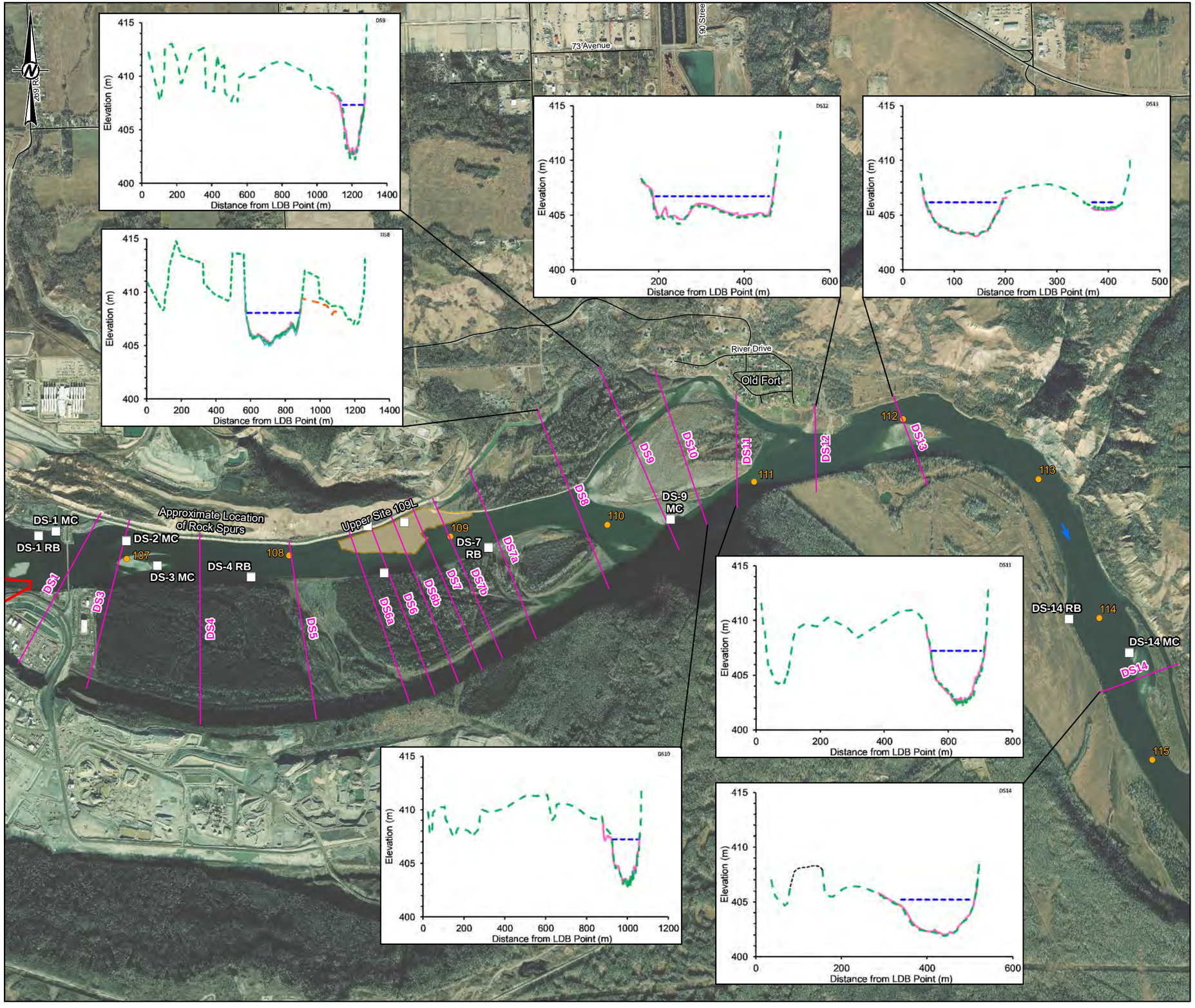
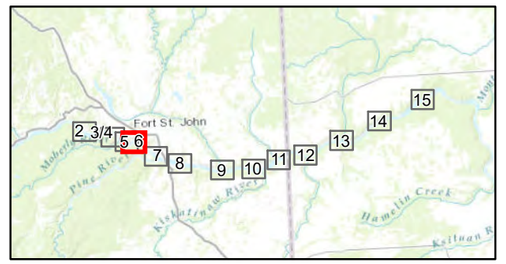



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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PROJECT
PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM – MON-3

TITLE
**PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM STUDY AREA, 2019.**

CONSULTANT
GOLDER

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| YYYY-MM-DD | 2020-09-09 |
| DESIGNED | DC |
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| REVIEWED | GA |
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| PROJECT NO. | PHASE | REV. | FIGURE |
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| 19121767 | 10/10.3 | 0 | A-6 |

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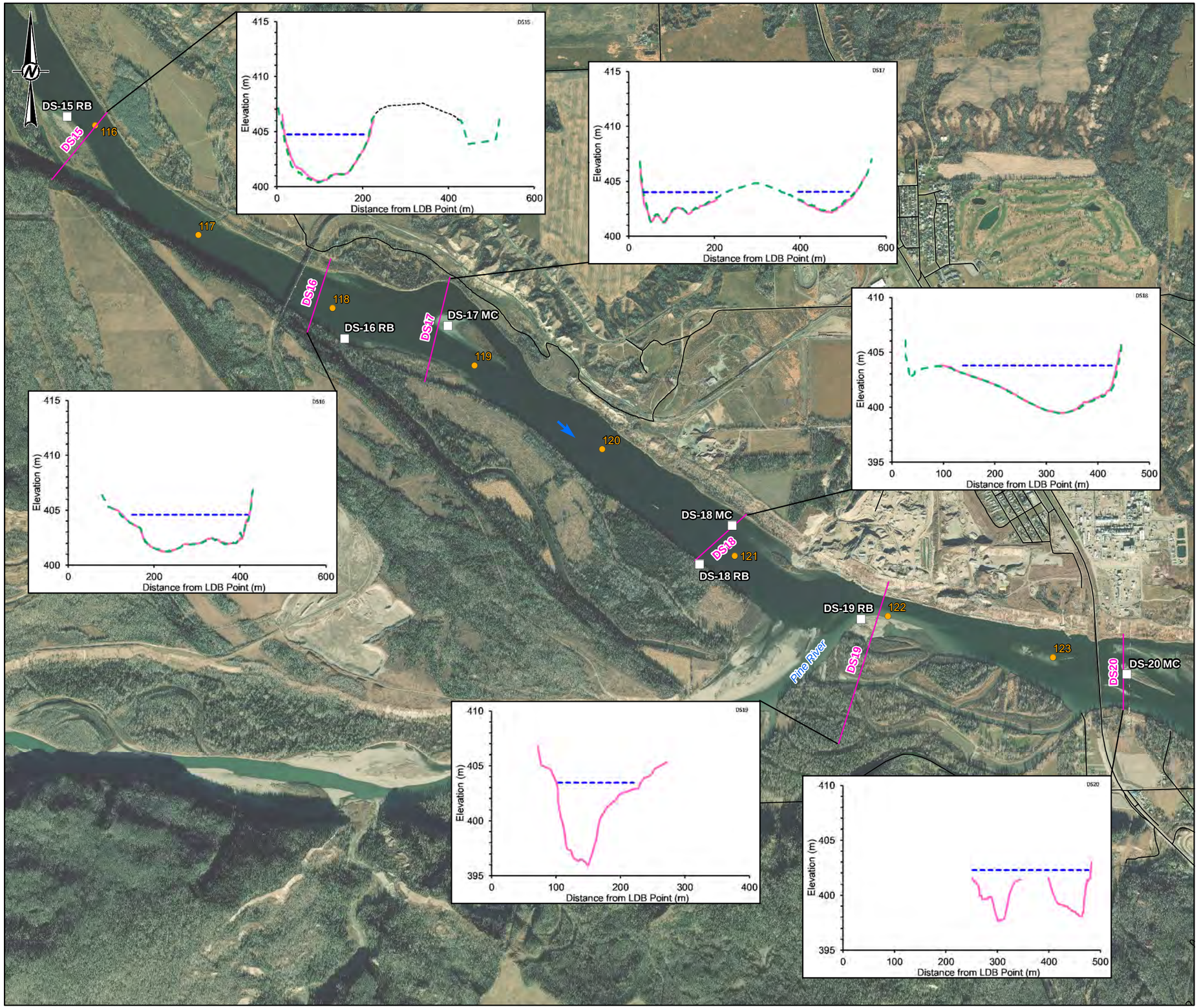
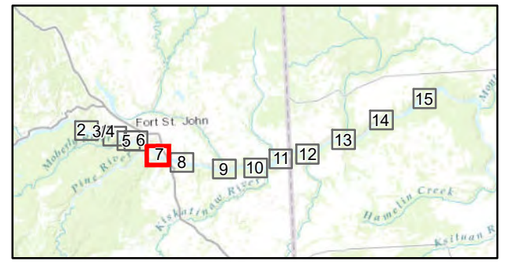



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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DATUM/PROJECTION: NAD83/UTM ZONE 10N

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PROJECT
PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM – MON-3

TITLE
**PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM STUDY AREA, 2019.**

CONSULTANT
GOLDER

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| YYYY-MM-DD | 2020-09-09 |
| DESIGNED | DC |
| PREPARED | CD |
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| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 19121767 | 10/10.3 | 0 | A-7 |

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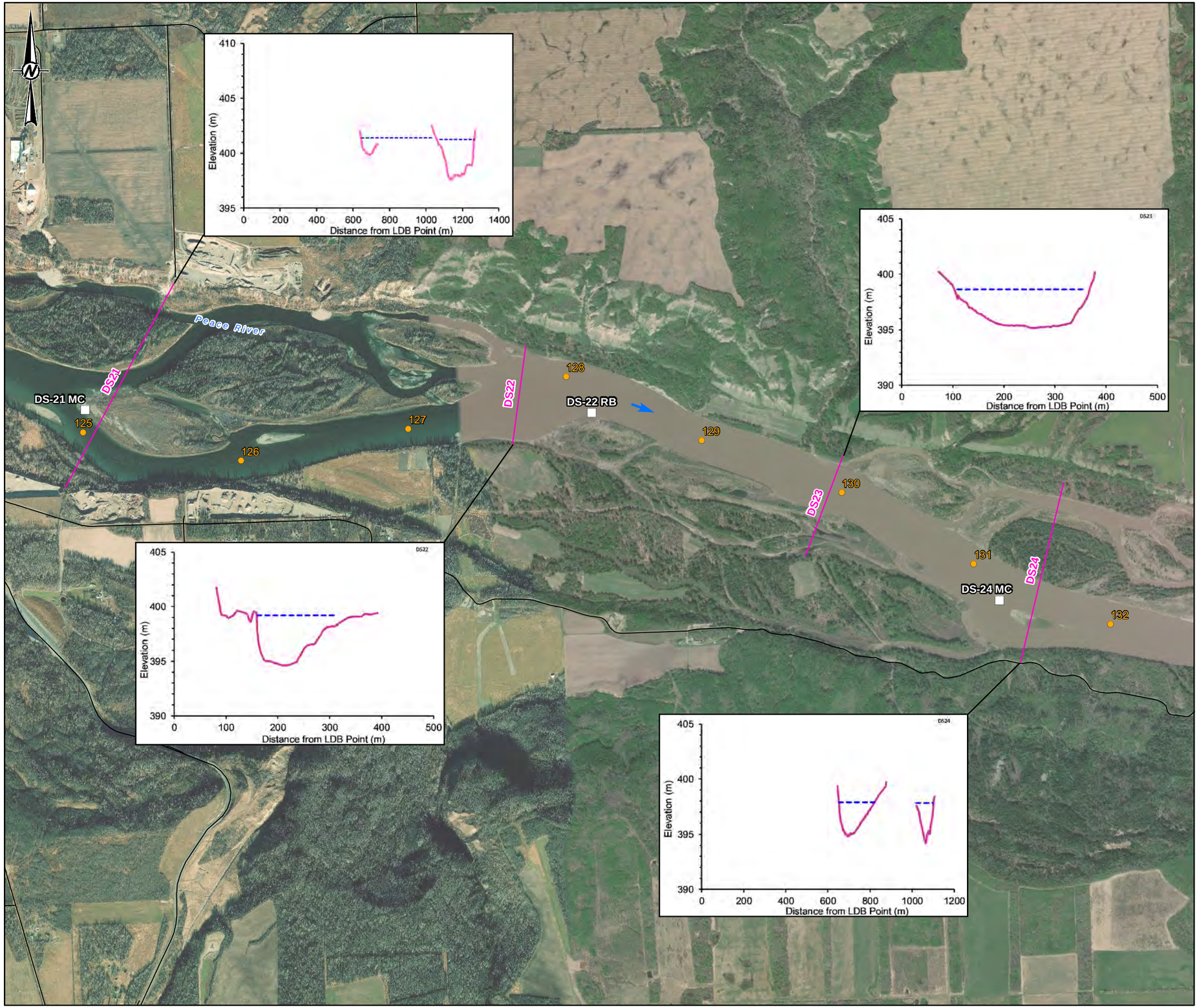
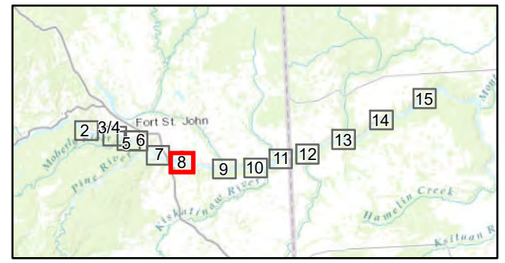



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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CLIENT
BC HYDRO

PROJECT
PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM – MON-3

TITLE
**PEACE RIVER PHYSICAL HABITAT MONITORING PROGRAM STUDY AREA, 2019.**

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| YYYY-MM-DD | 2020-09-09 |
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| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 19121767 | 10/10.3 | 0 | **A-8** |

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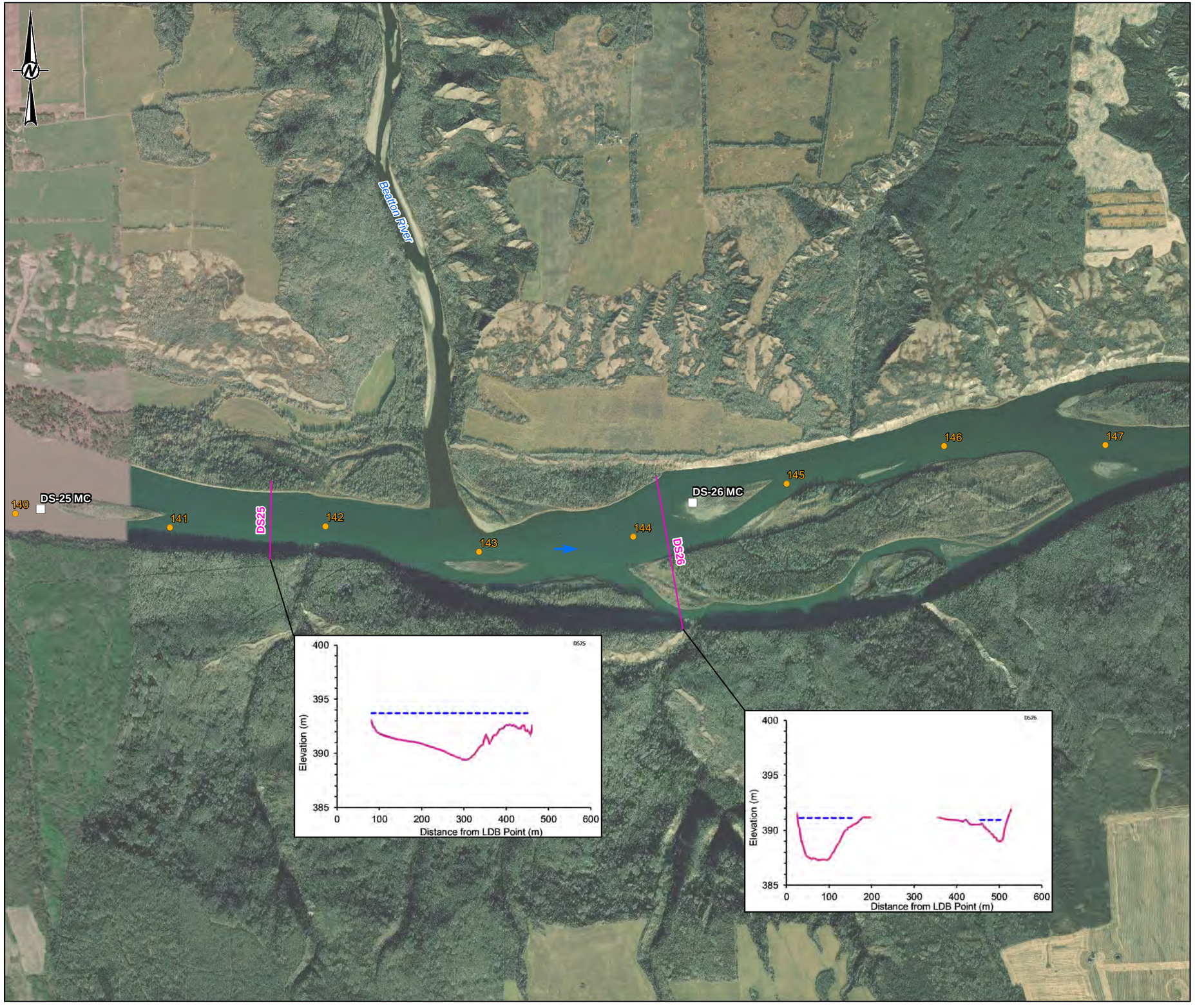
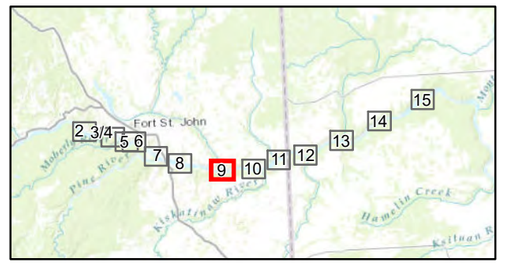



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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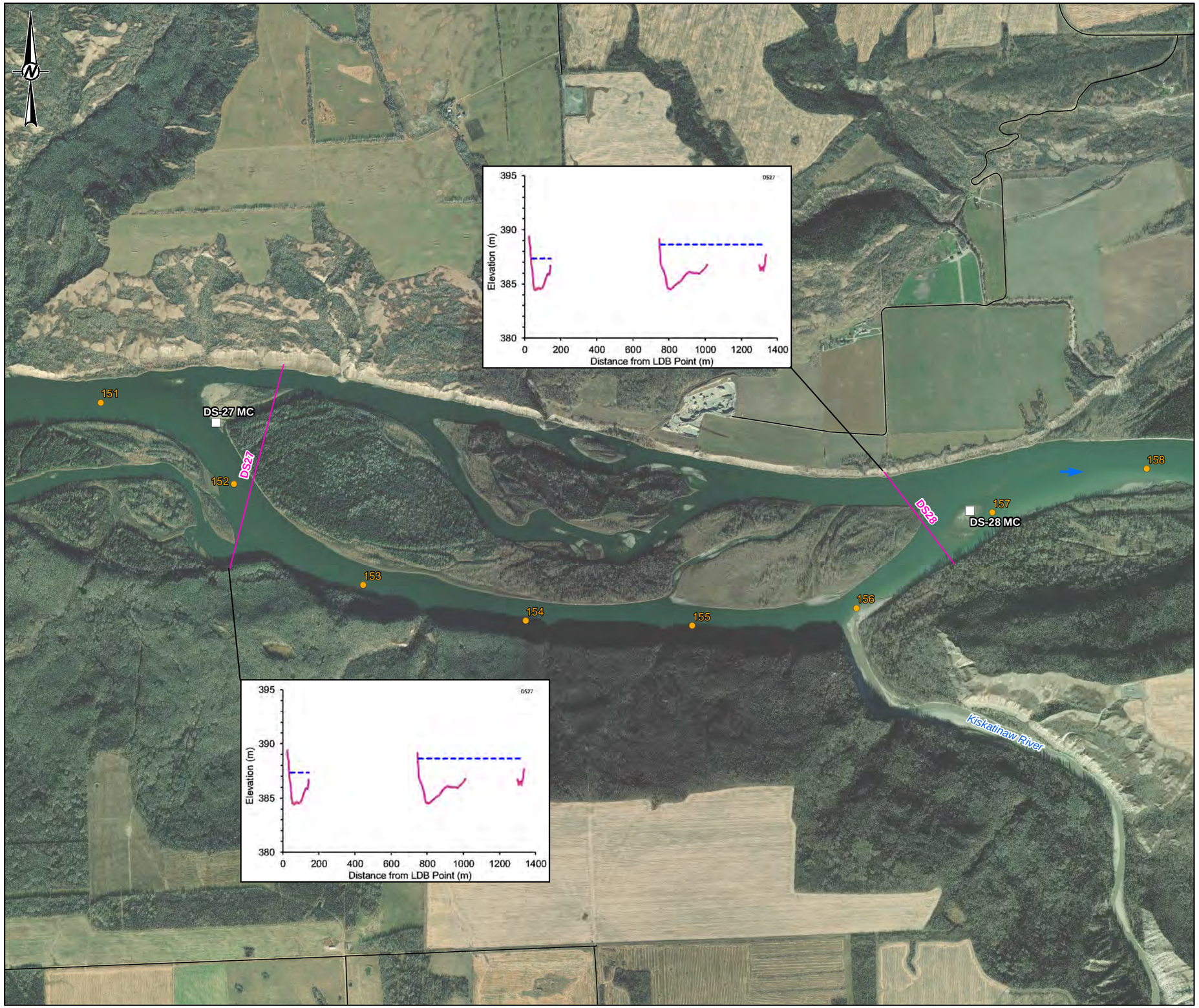
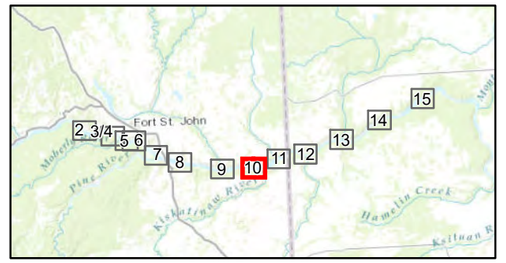



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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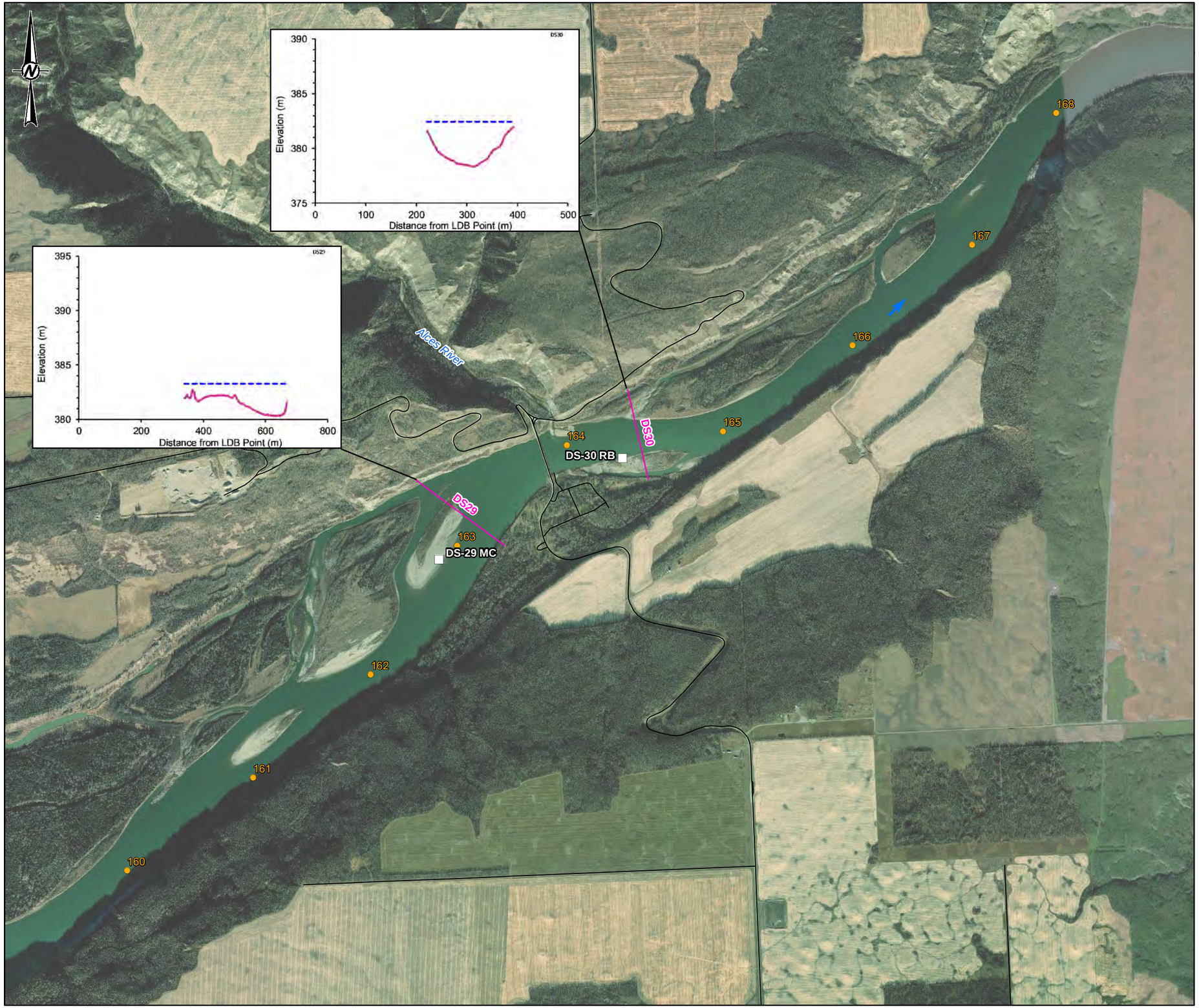
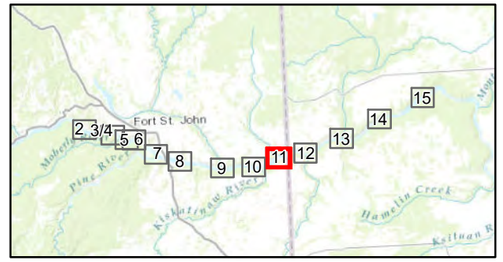



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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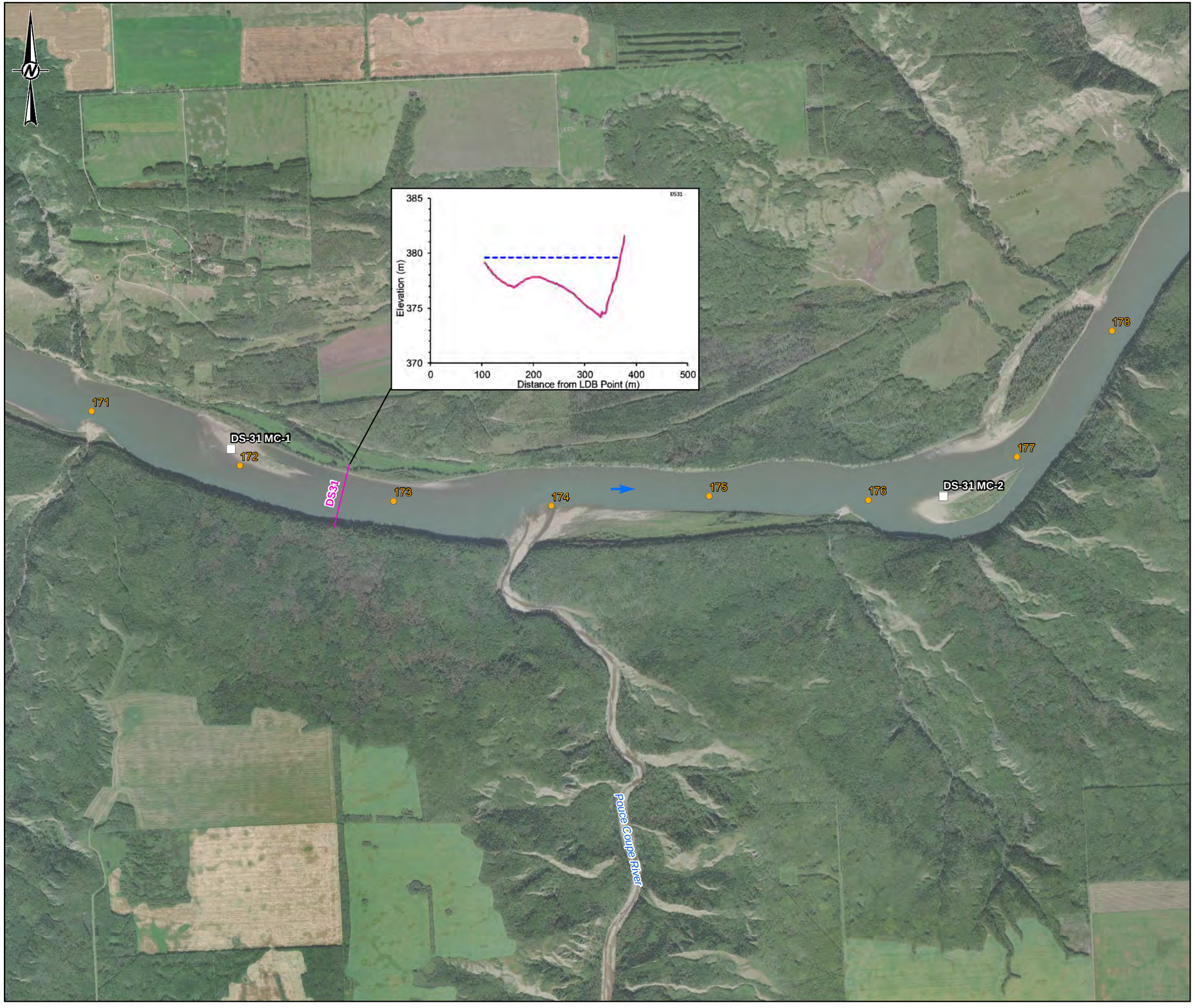
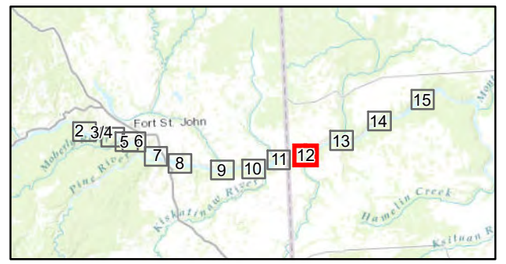



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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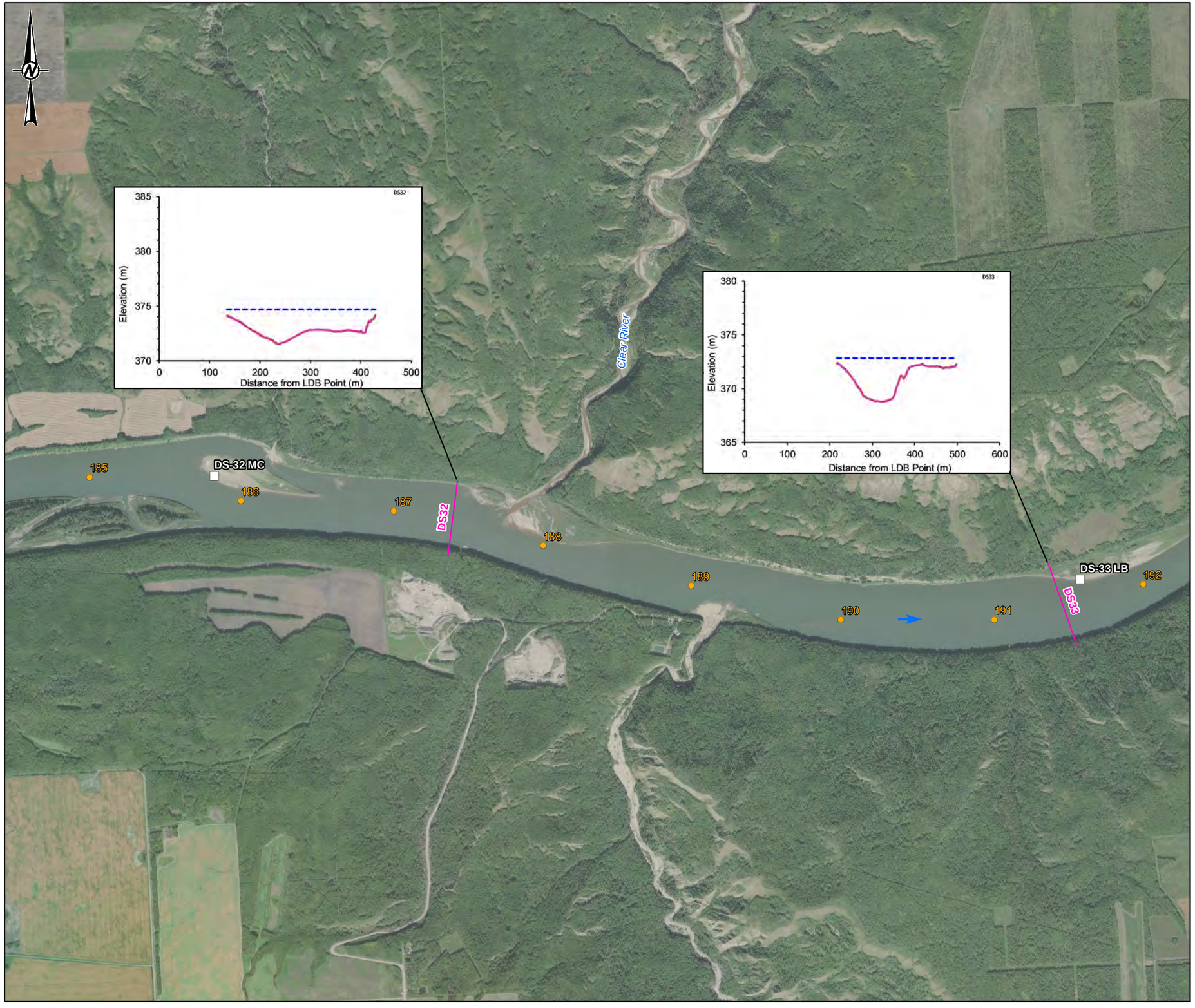
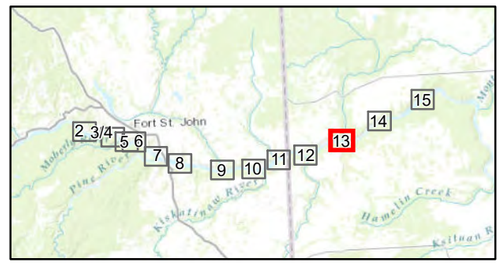



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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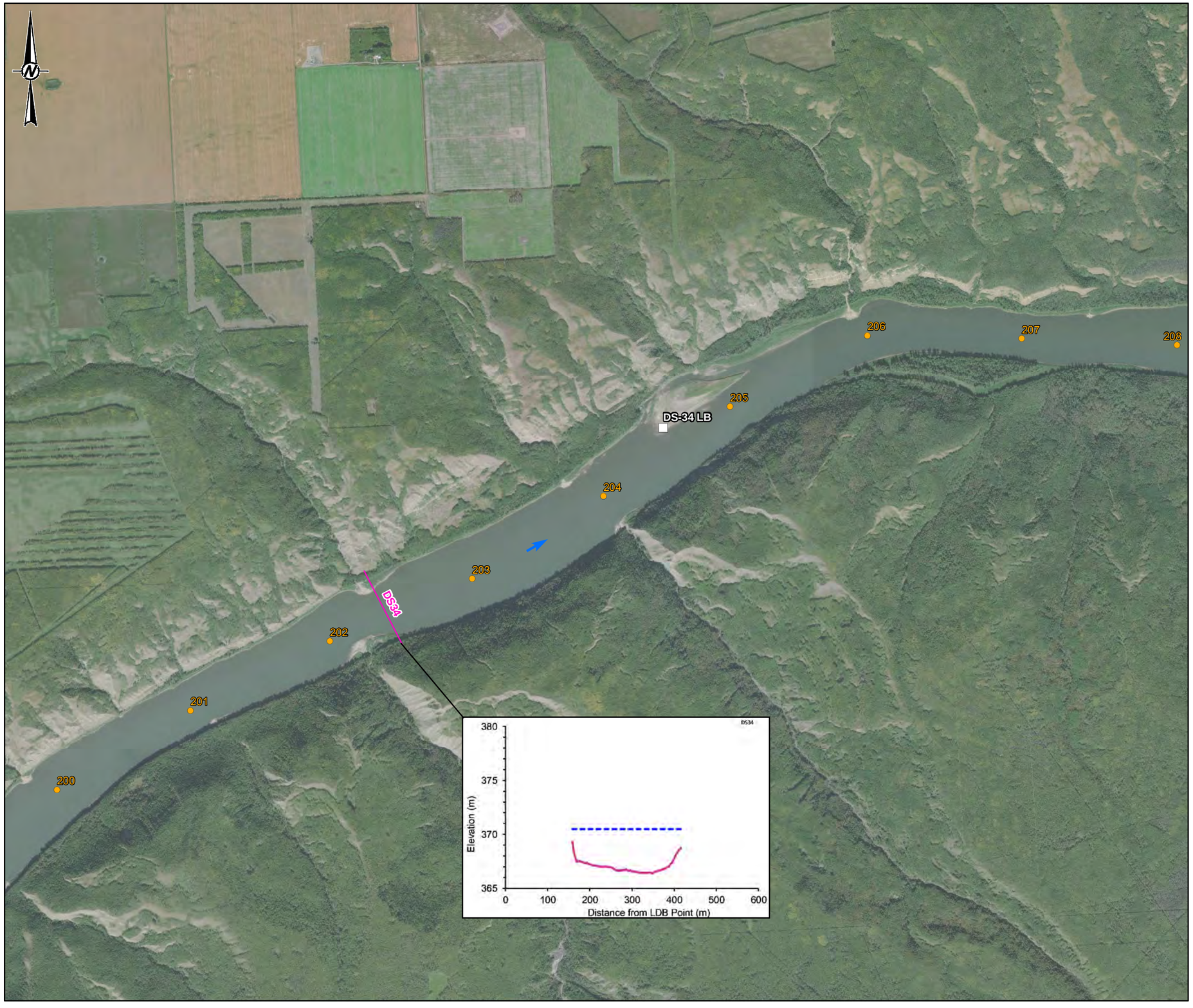
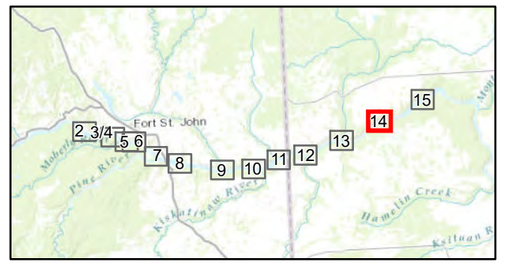



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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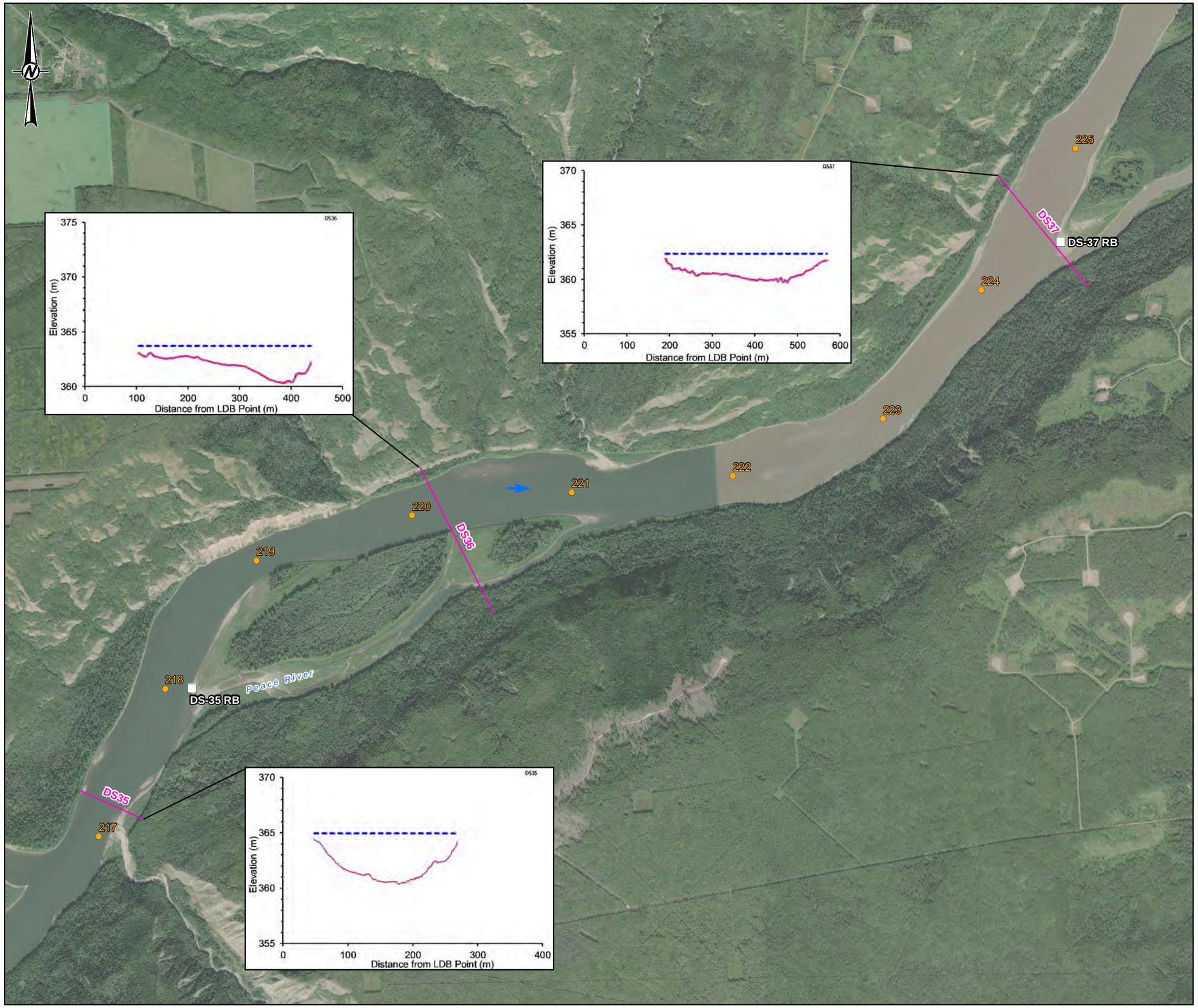
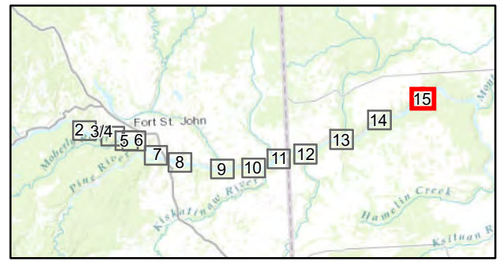



LEGEND

- GRAIN SIZE PLOT LOCATION
- RIVER KILOMETRE AS MEASURED DOWNSTREAM FROM WAC BENNETT DAM
- RIVER CROSS-SECTION LOCATION
- ROAD
- OUTLINE OF SITE C PERMANENT COMPONENTS
- UPPER SITE 109L
- FLOW DIRECTION

INSET PLOT LEGEND

- 2015 RIVERBED ELEVATION
- 2017 RIVERBED ELEVATION
- 2018 RIVERBED ELEVATION
- 2019 RIVERBED ELEVATION
- 2019 WATER SURFACE ELEVATION
- IMAGERY INFERRED ELEVATION

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**APPENDIX B**

# River Cross-Section Data (2015 to 2019)

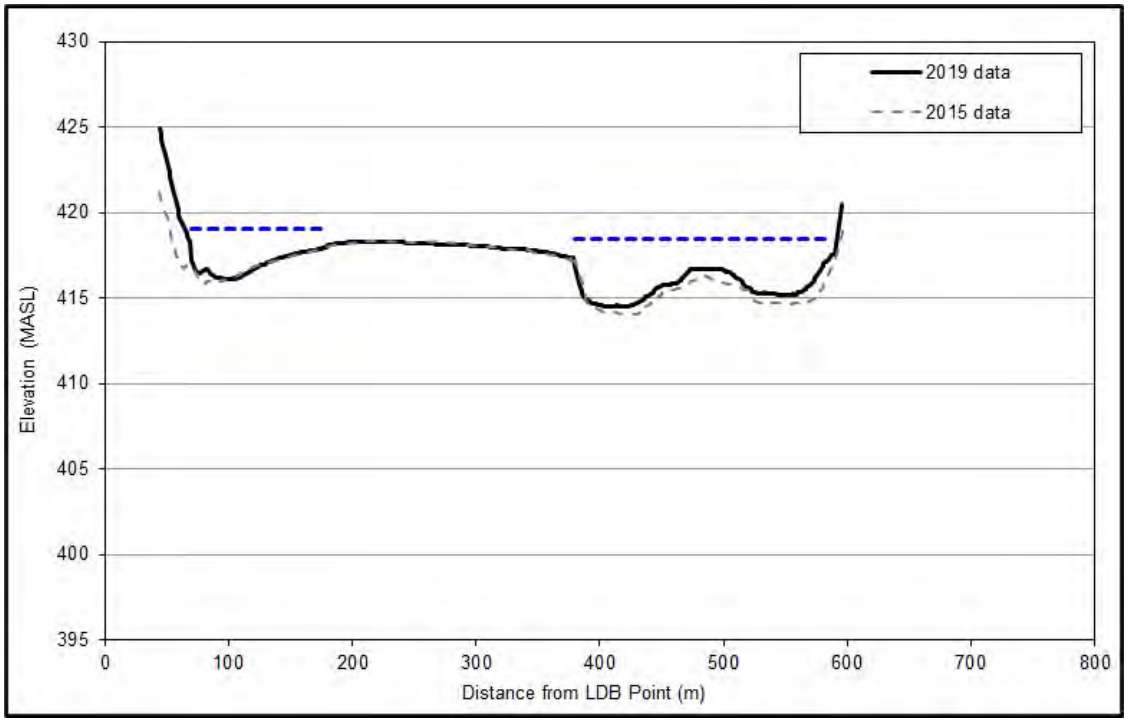



**Figure B1: River cross-section at Transect #US12, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

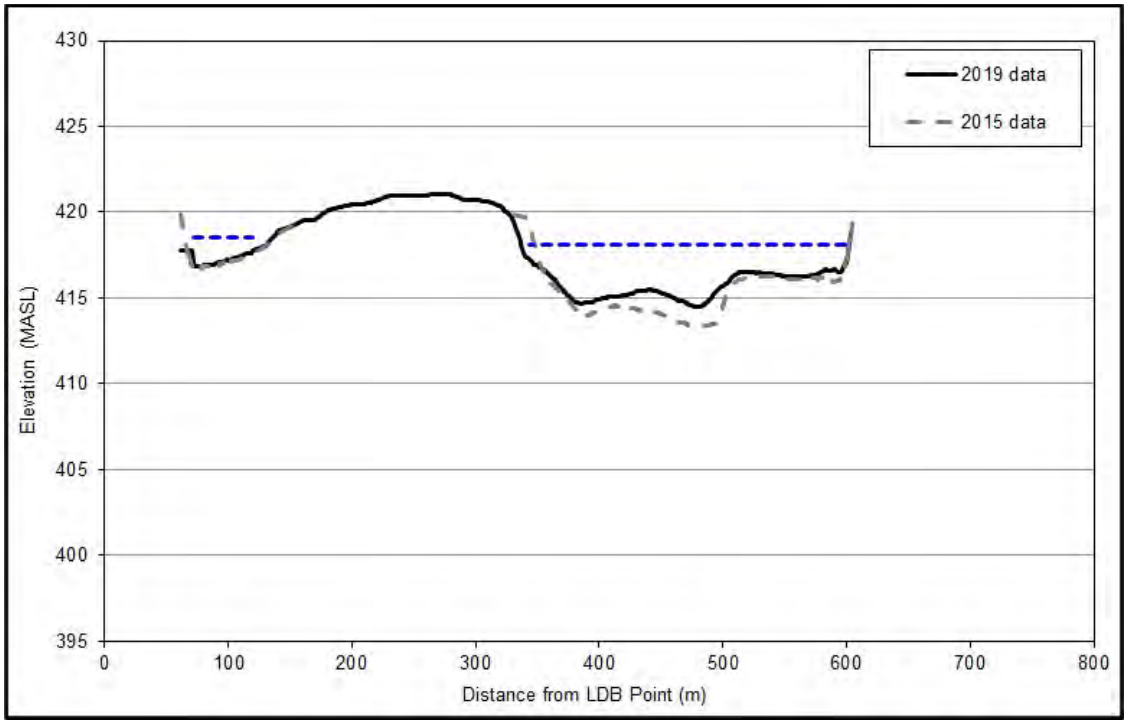



**Figure B2: River cross-section at Transect #US11, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

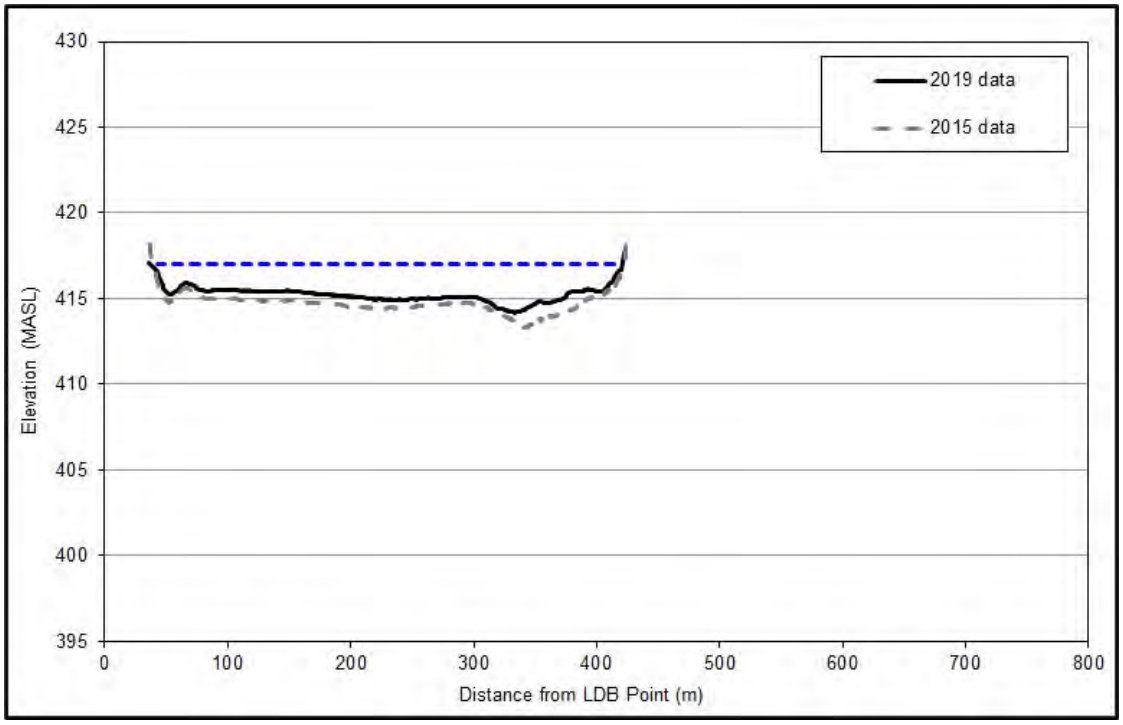



**Figure B3: River cross-section at Transect #US10, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

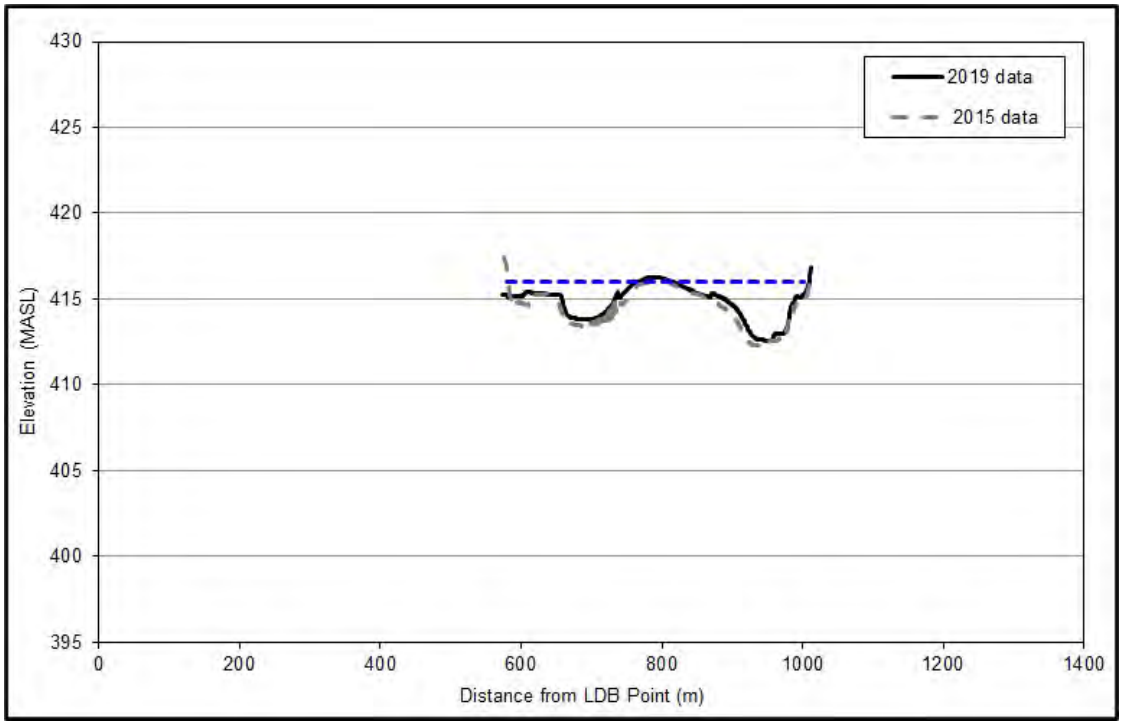



**Figure B4: River cross-section at Transect #US09, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

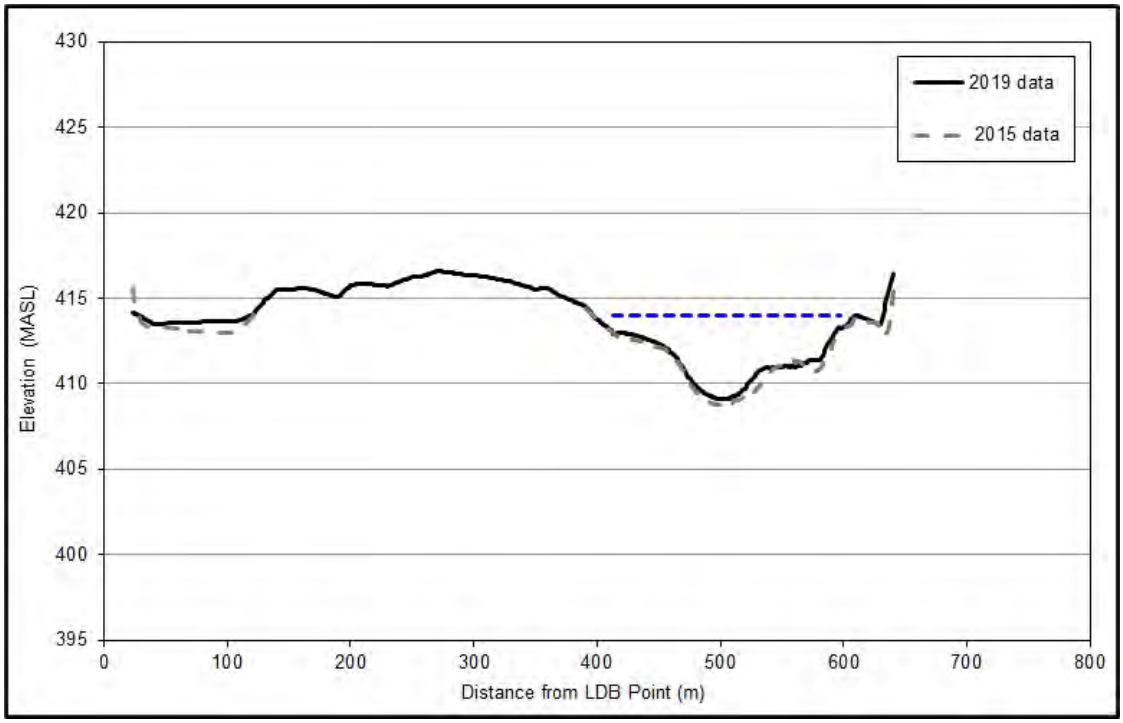



**Figure B5: River cross-section at Transect #US08, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

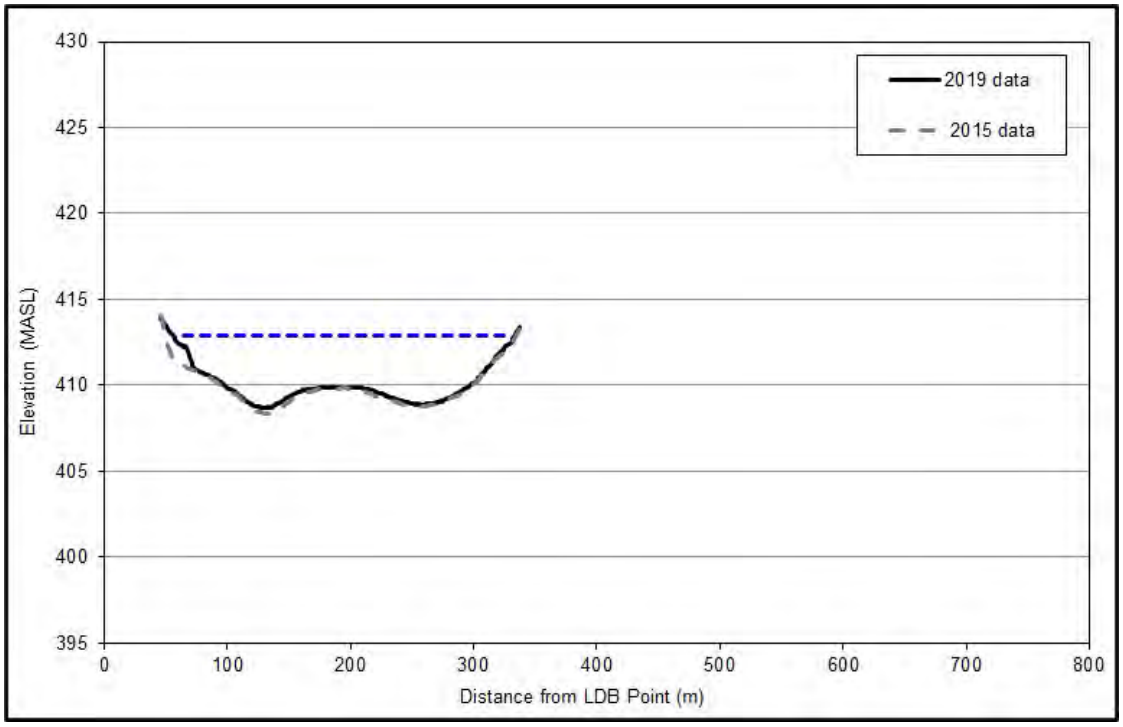



**Figure B6: River cross-section at Transect #US07, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

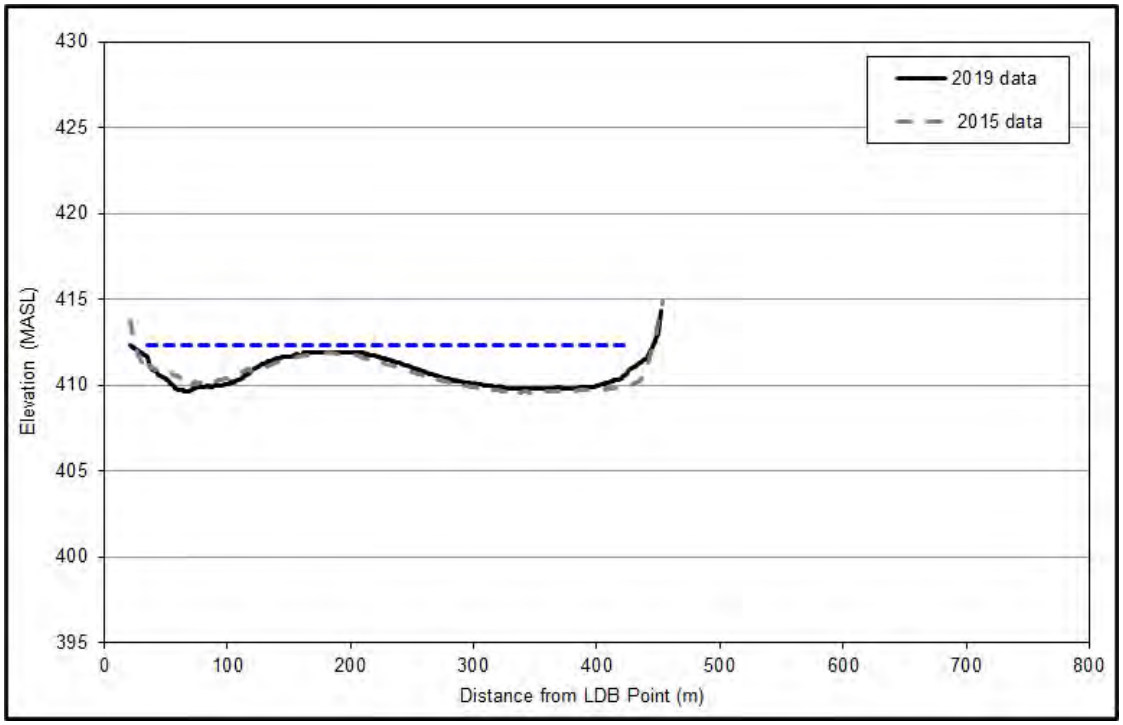



**Figure B7: River cross-section at Transect #US06, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

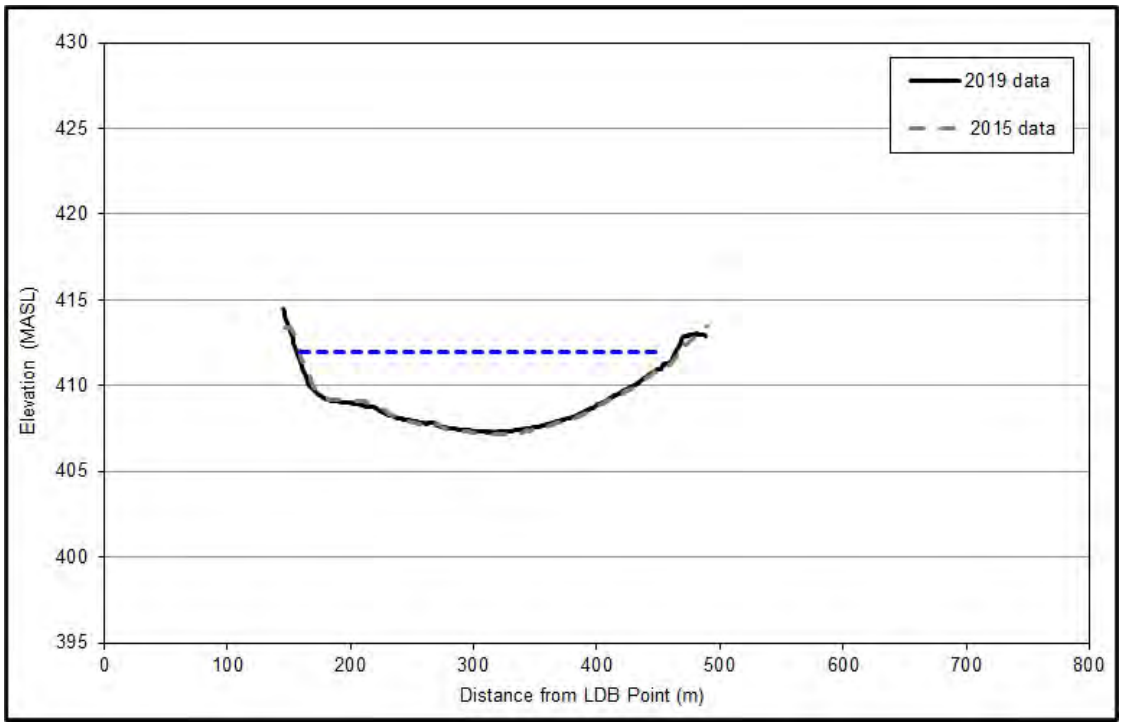



**Figure B8: River cross-section at Transect #US05, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

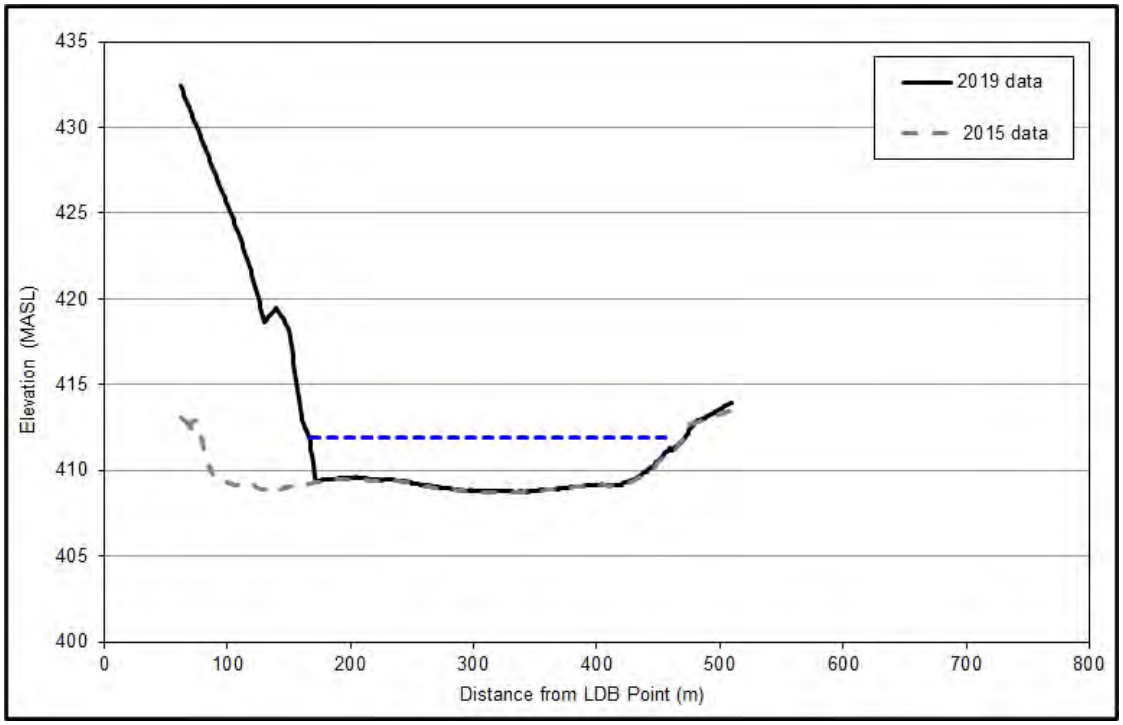



**Figure B9: River cross-section at Transect #US04, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

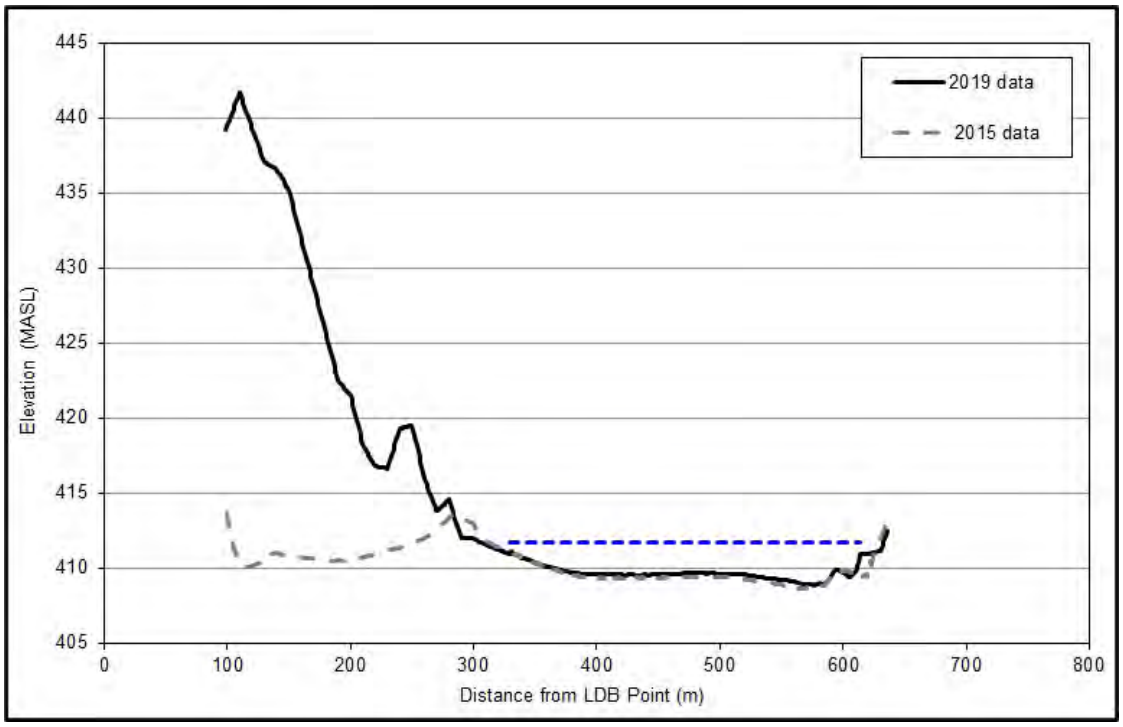



**Figure B10: River cross-section at Transect #US03, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

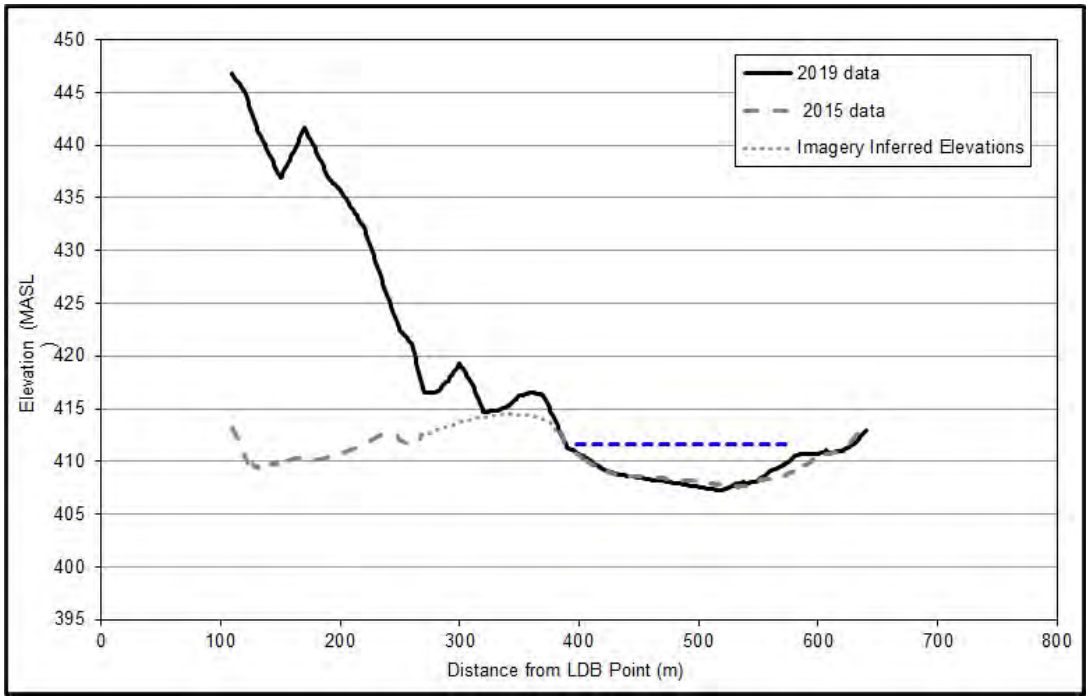



**Figure B11: River cross-section at Transect #US02, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

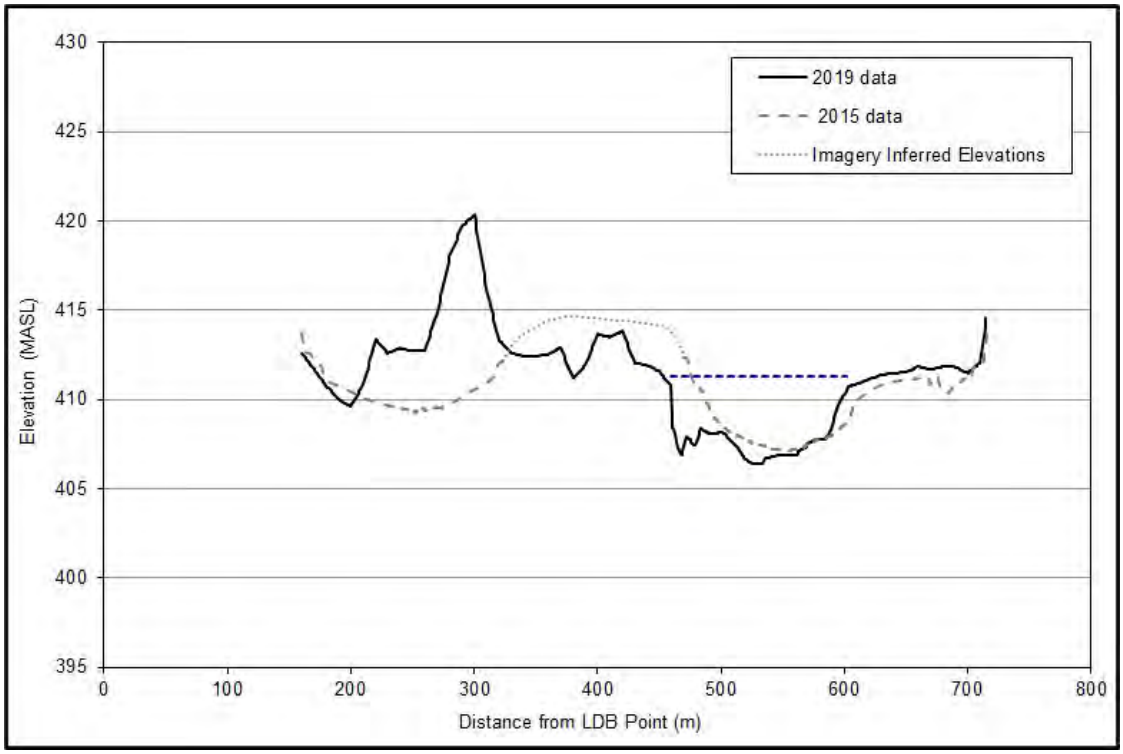



**Figure B12: River cross-section at Transect #US01, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

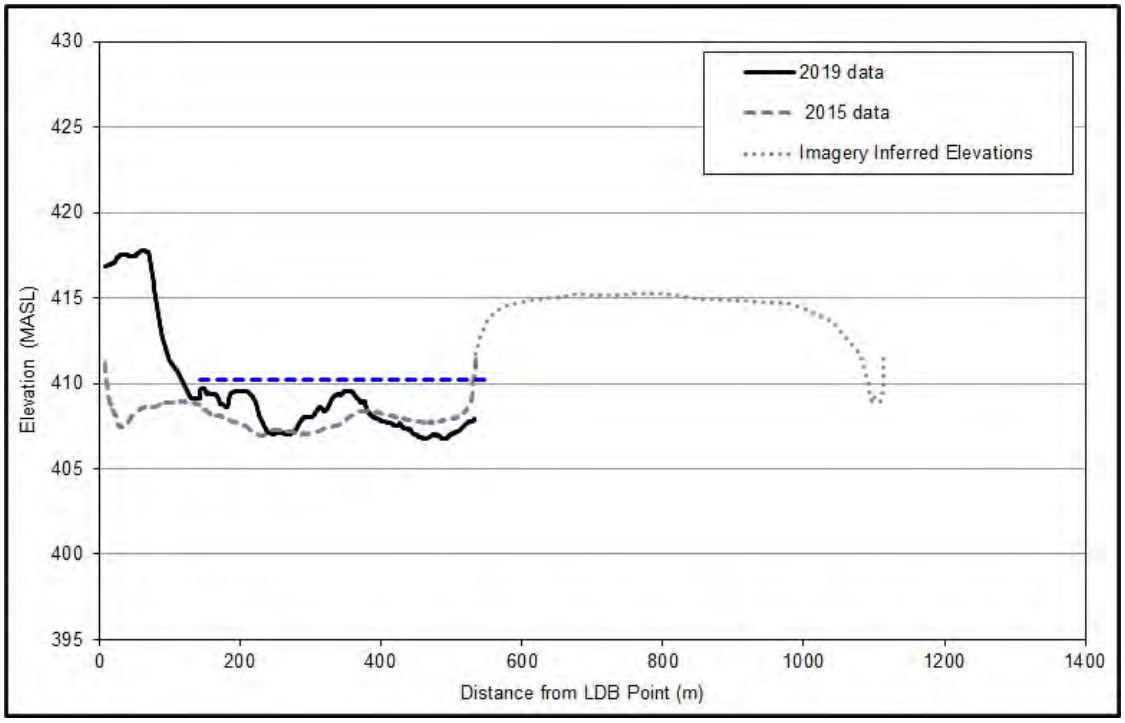



**Figure B13: River cross-section at Transect #DS01, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

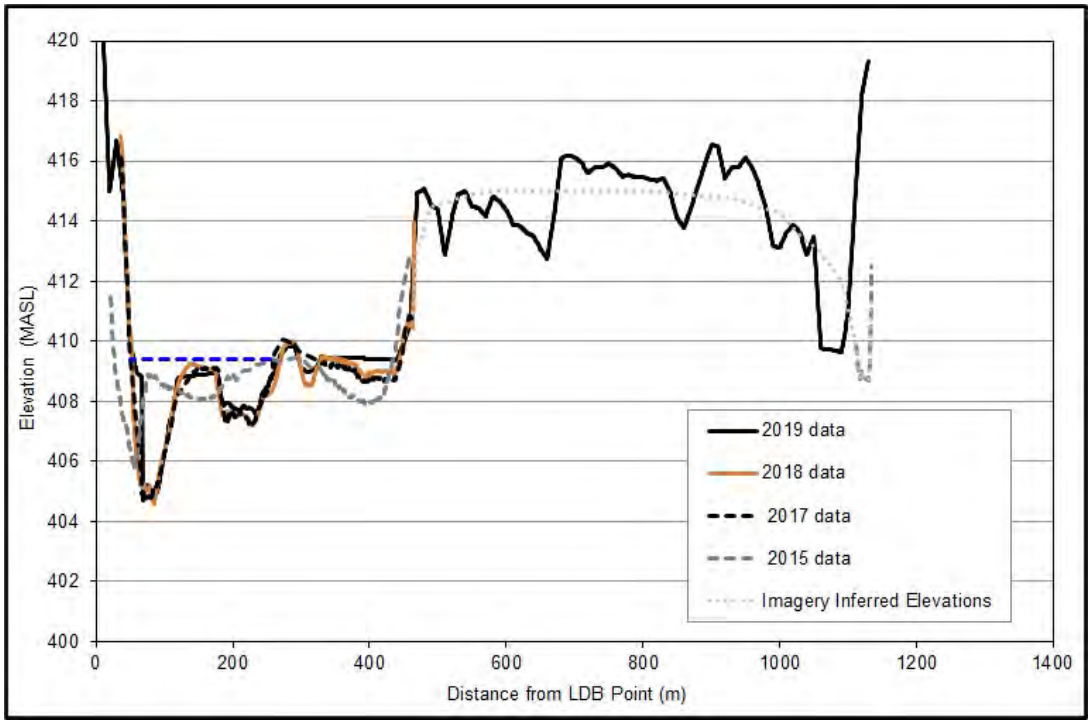



**Figure B14: River cross-section at Transect #DS03, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

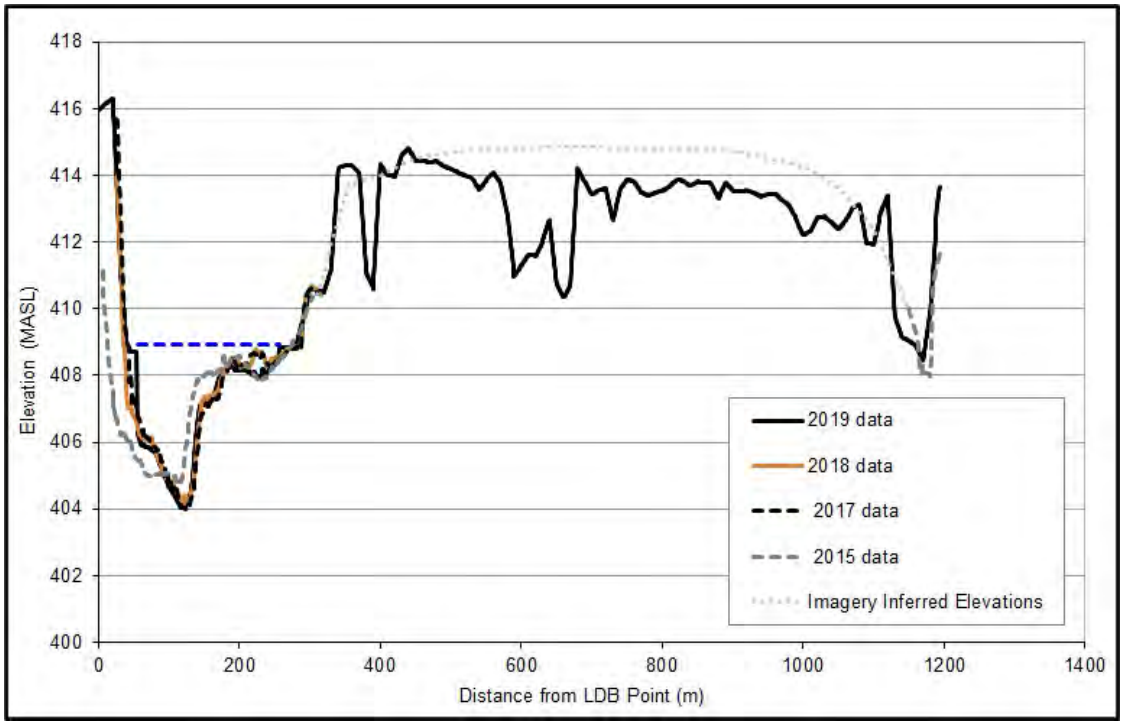



**Figure B15: River cross-section at Transect #DS04, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

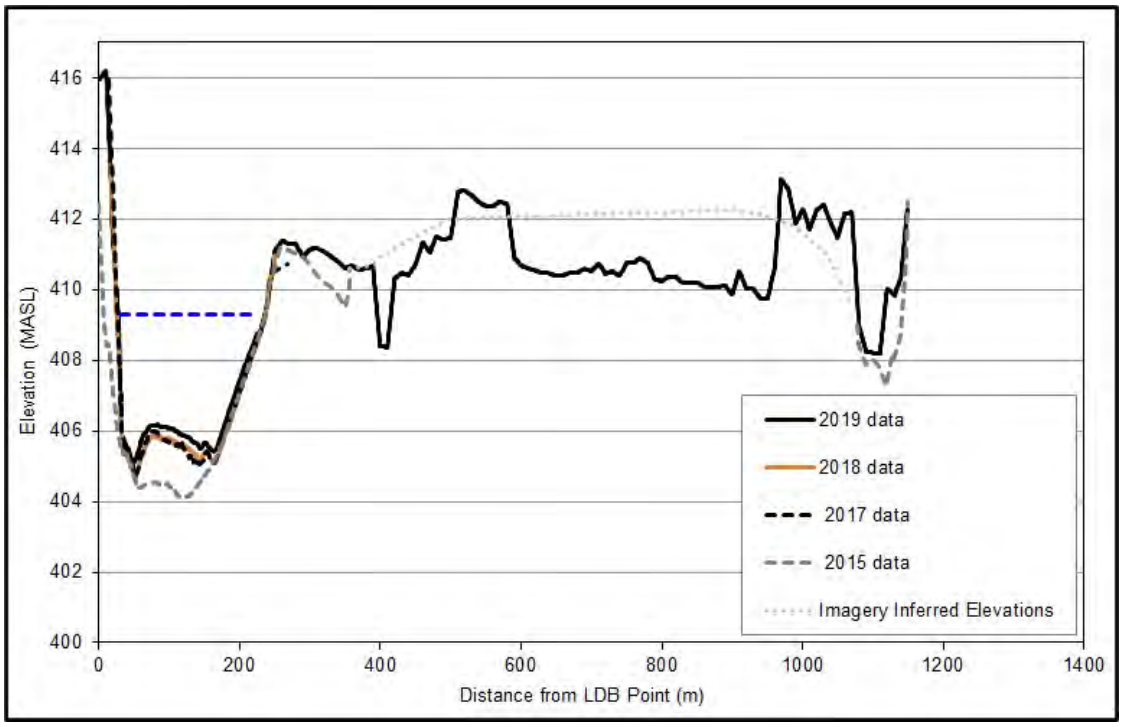



**Figure B16: River cross-section at Transect #DS05, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

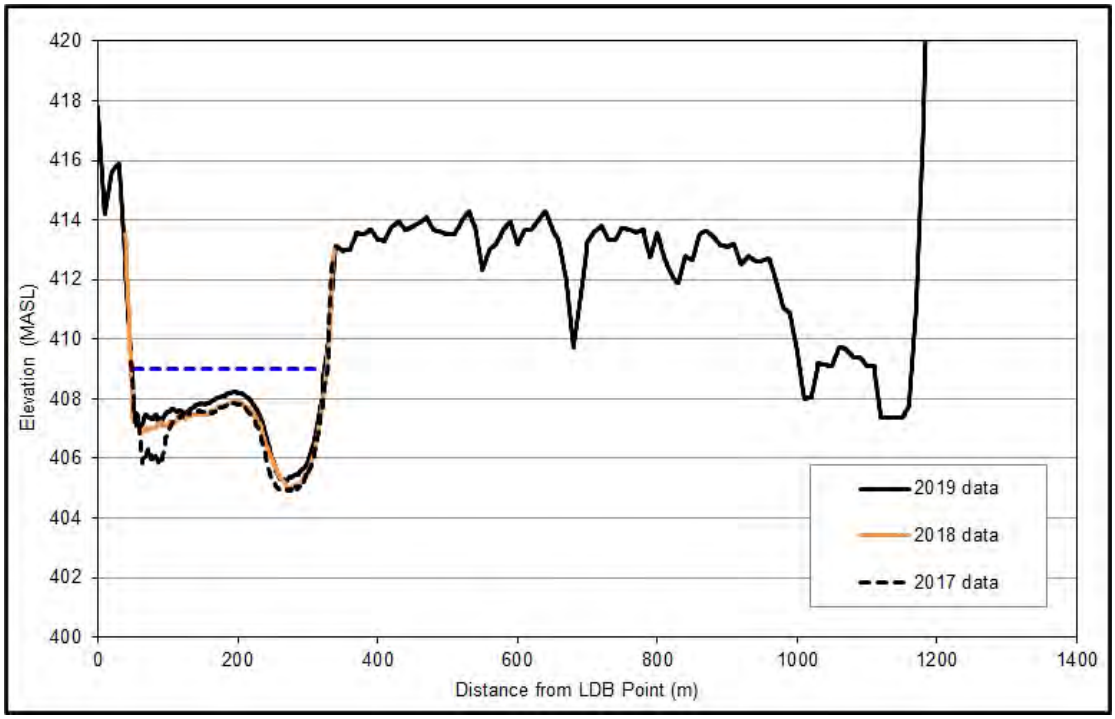



**Figure B17: River cross-section at Transect #DS06a, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

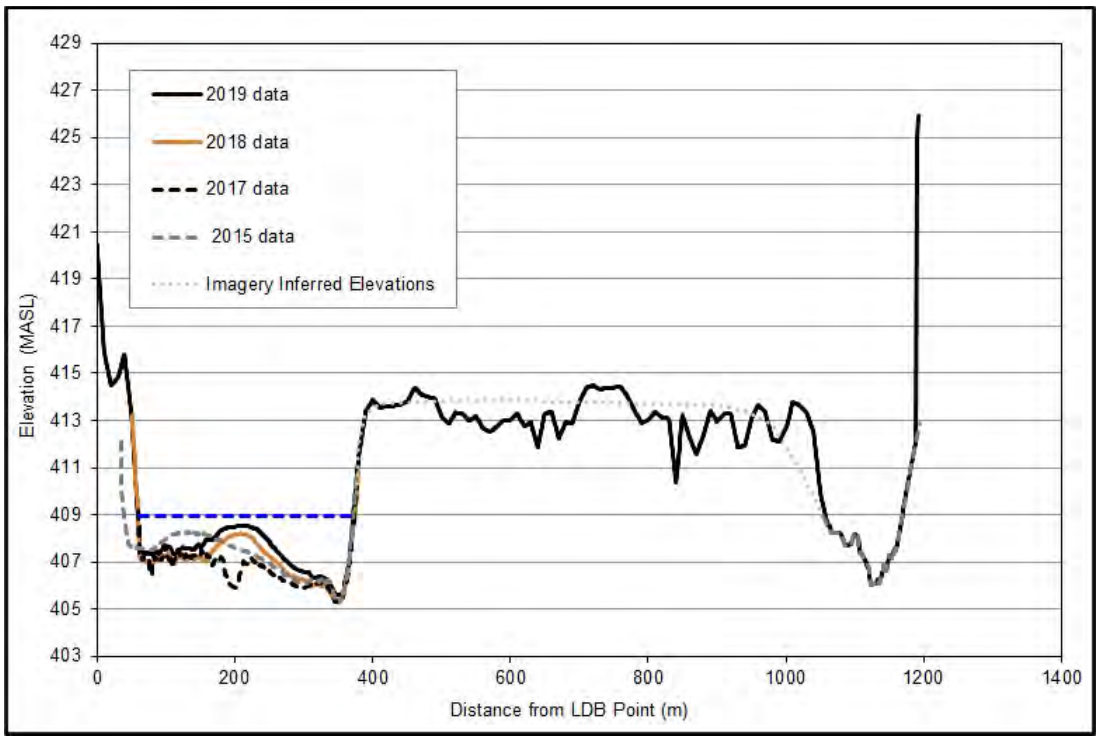



**Figure B18: River cross-section at Transect #DS06, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

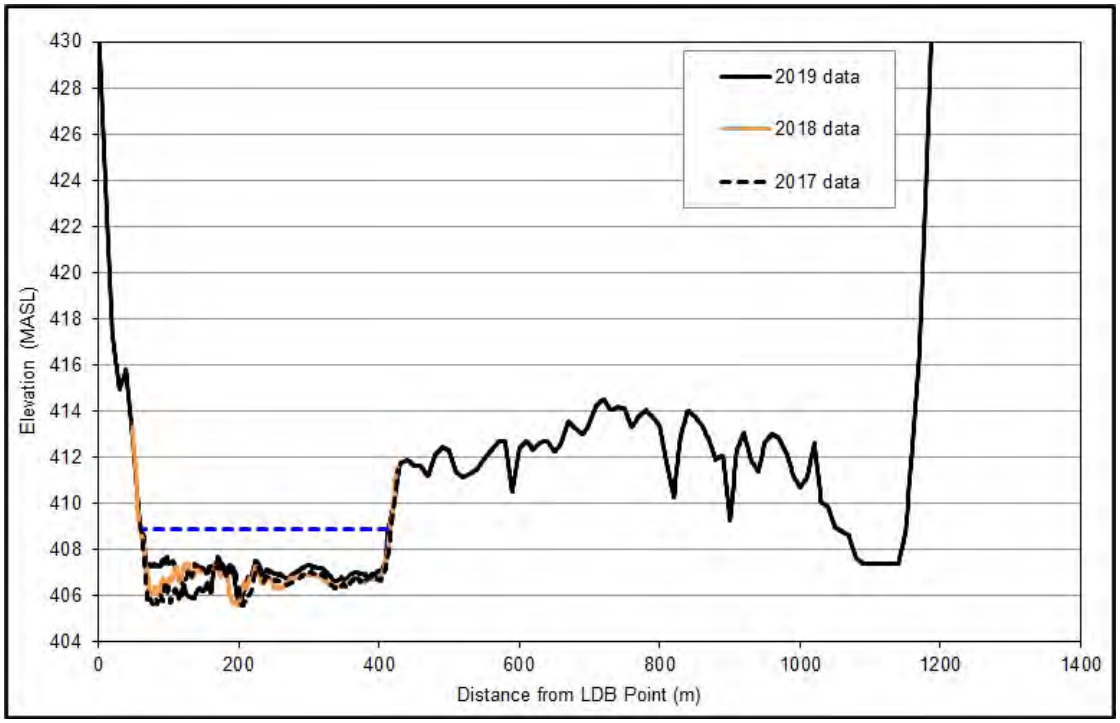



**Figure B19: River cross-section at Transect #DS06b, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

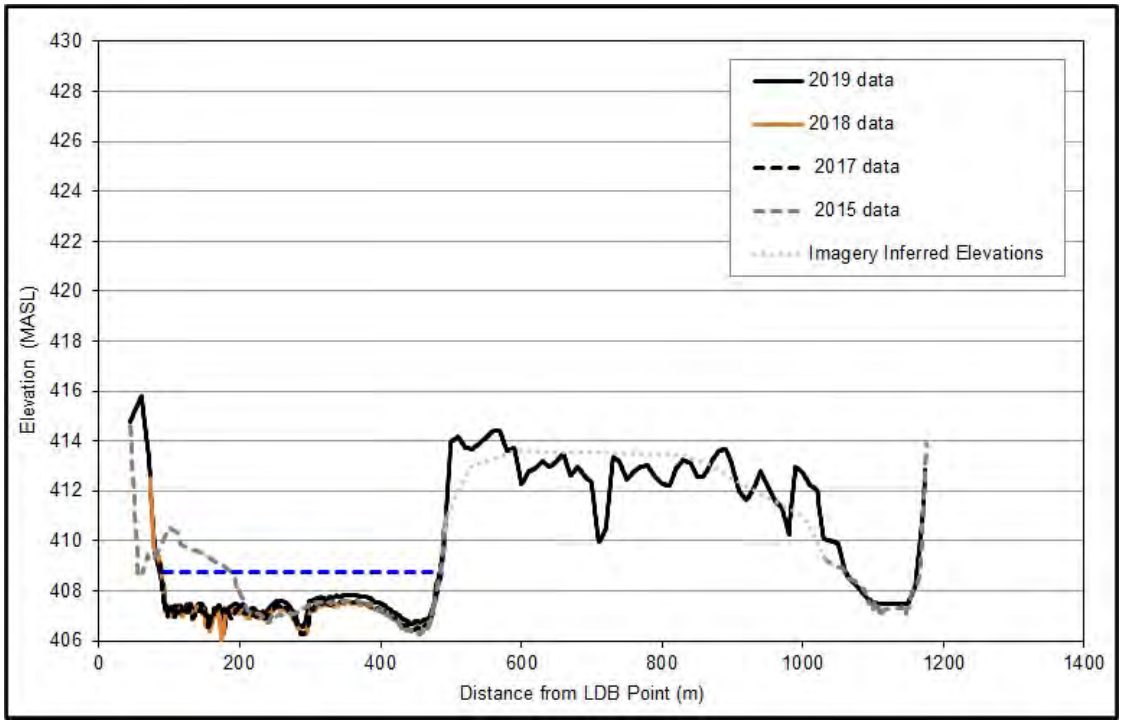



**Figure B20: River cross-section at Transect #DS07, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

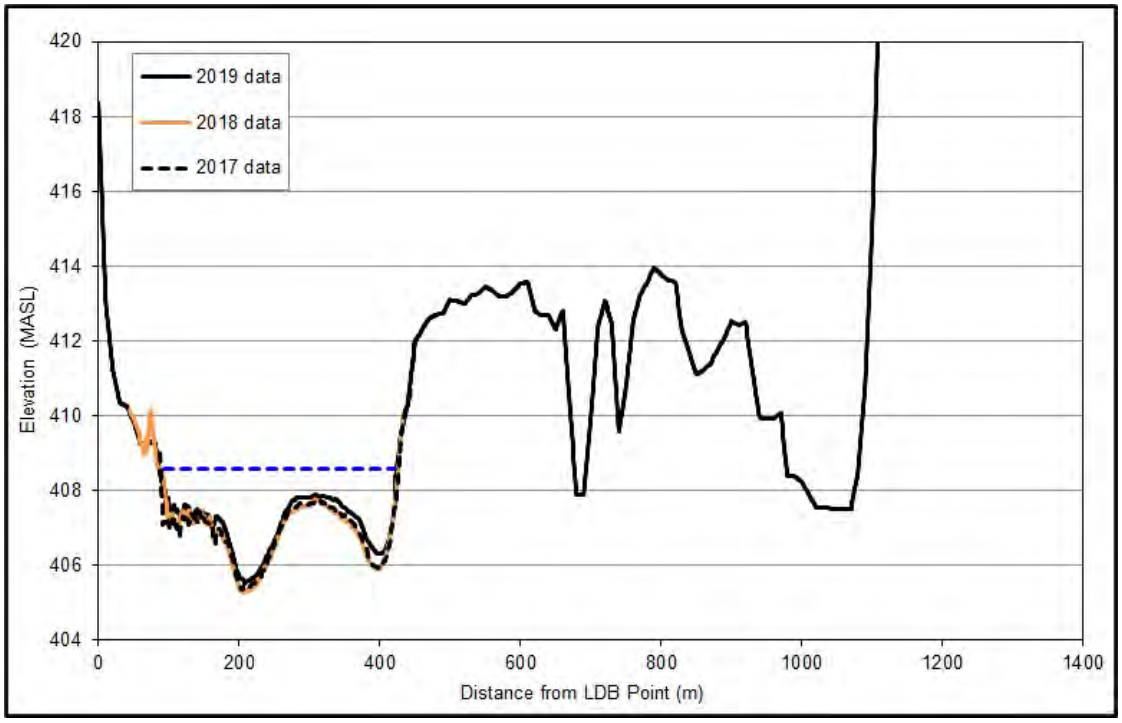



**Figure B21: River cross-section at Transect #DS07b, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

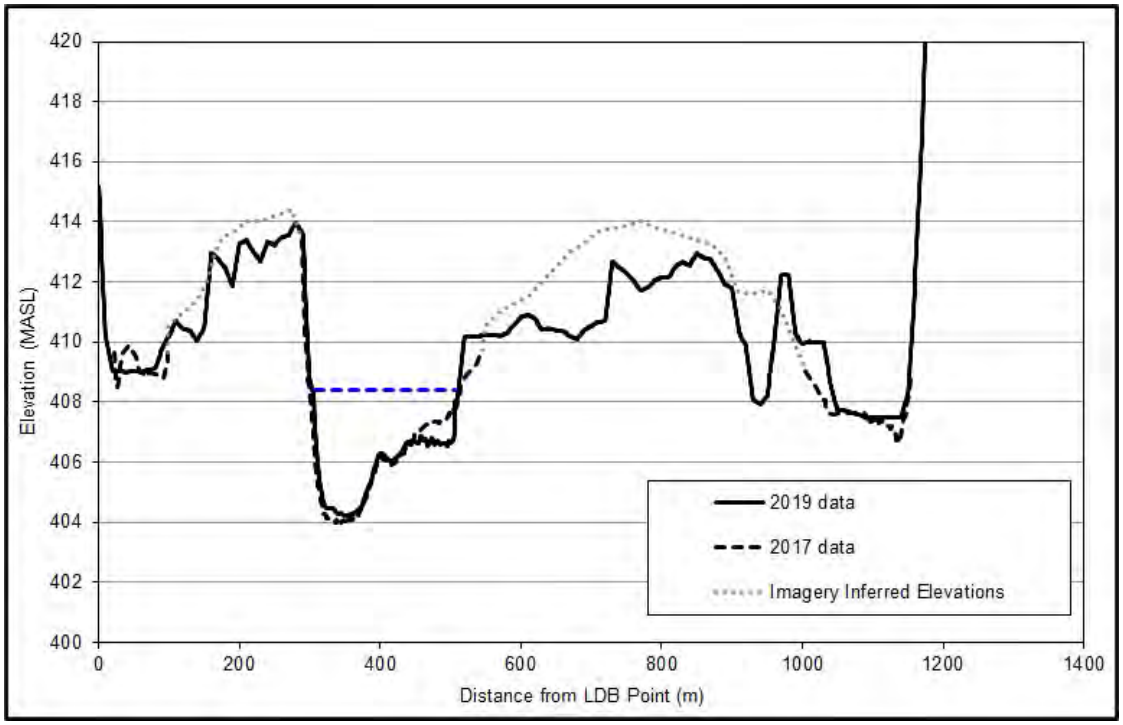



**Figure B22: River cross-section at Transect #DS07a, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

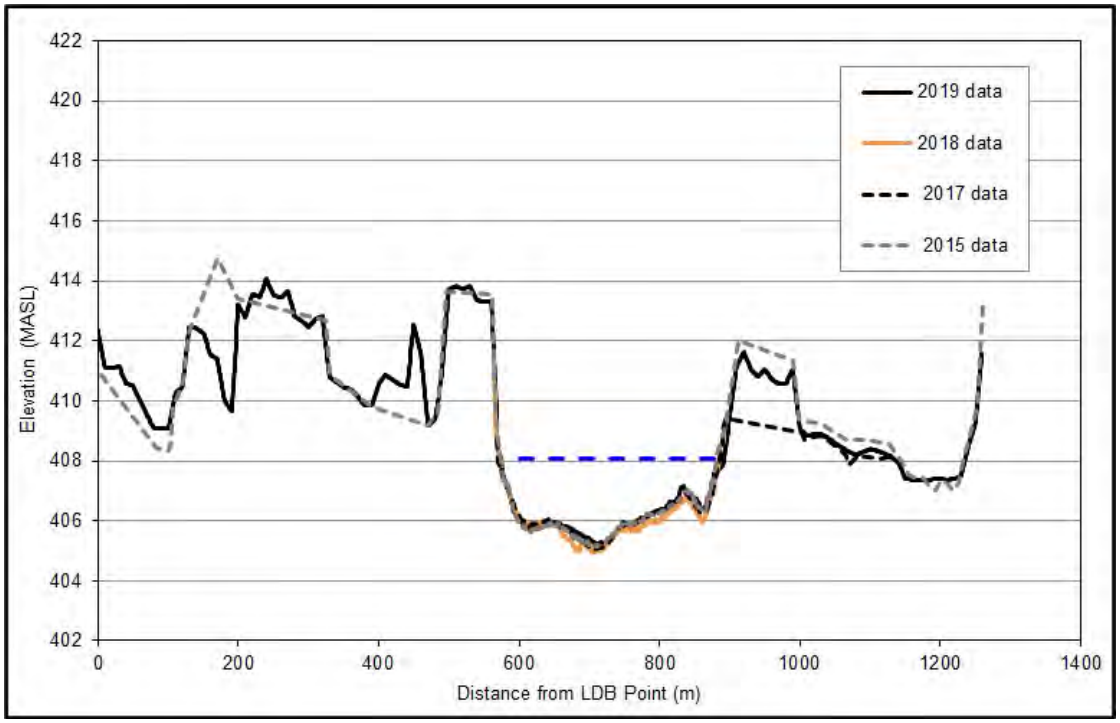



**Figure B23: River cross-section at Transect #DS08, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

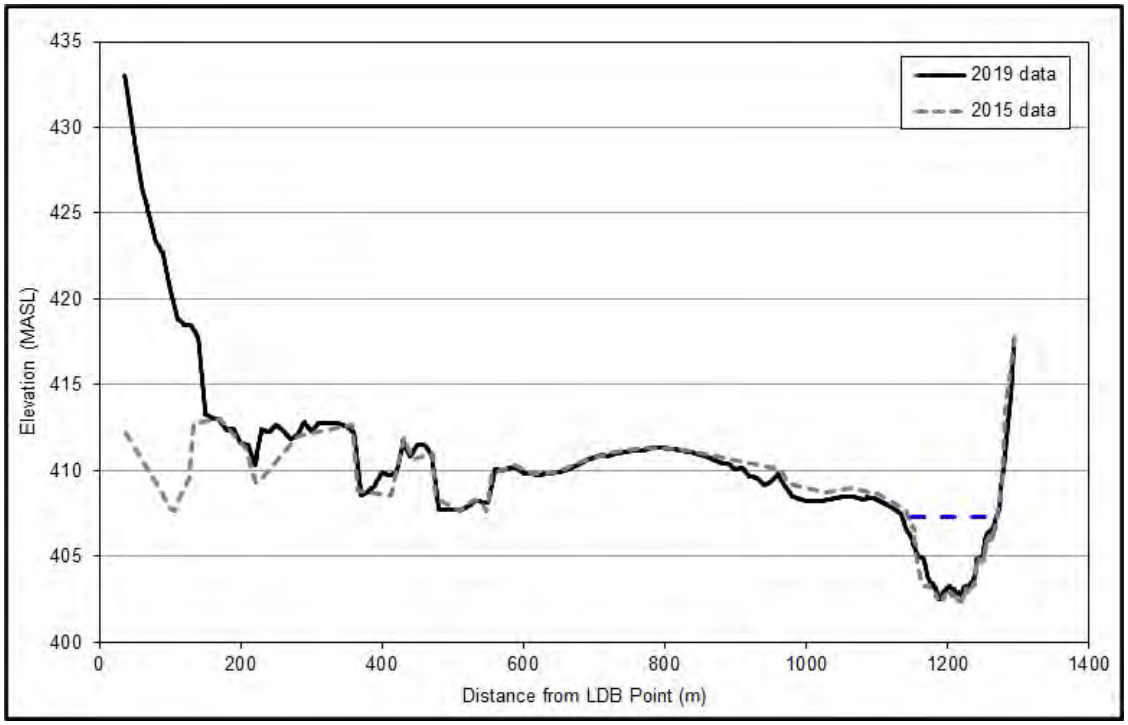



**Figure B24: River cross-section at Transect #DS09, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

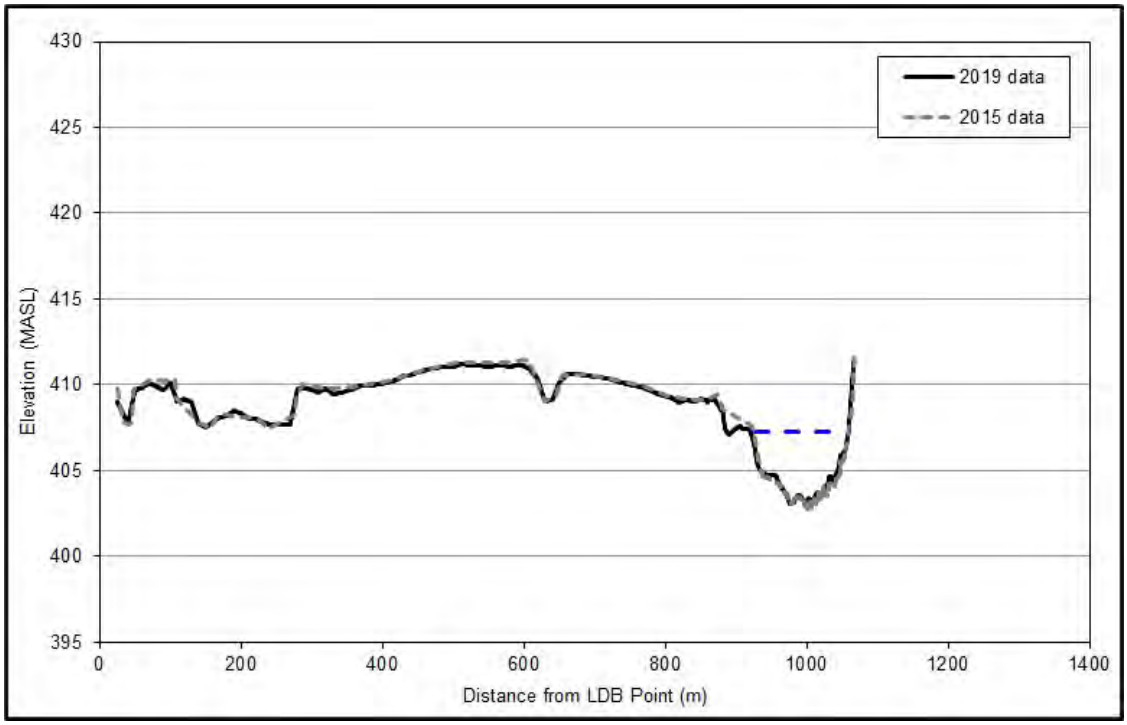



**Figure B25: River cross-section at Transect #DS10, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

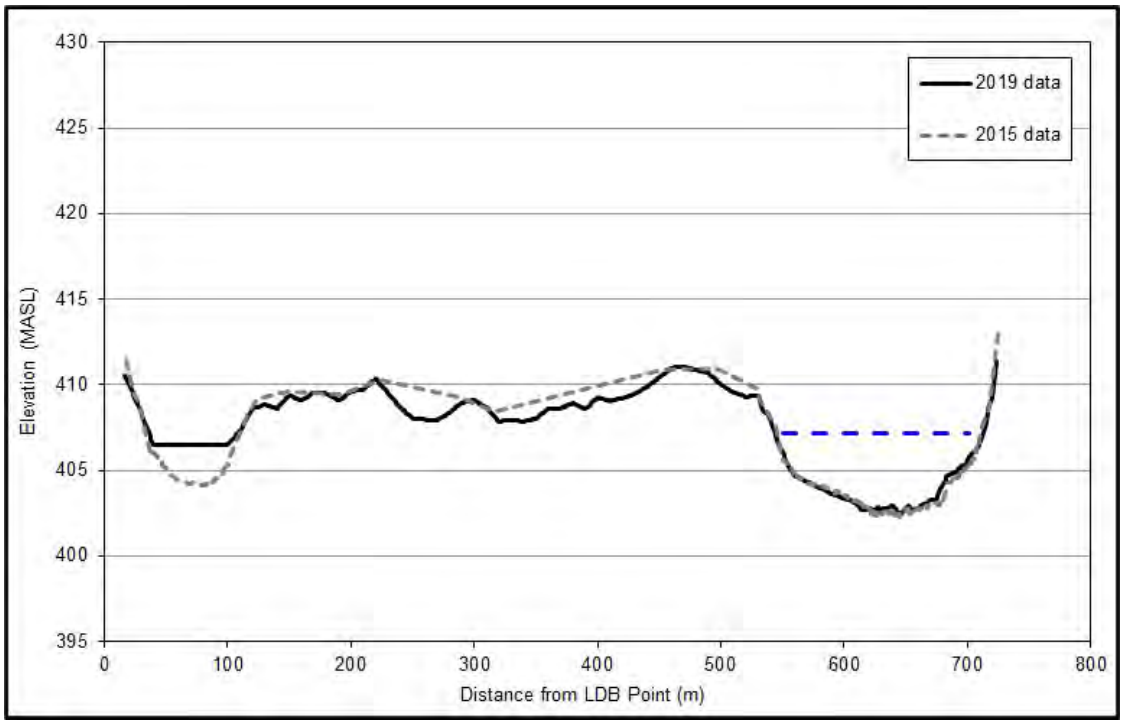



**Figure B26: River cross-section at Transect #DS11, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

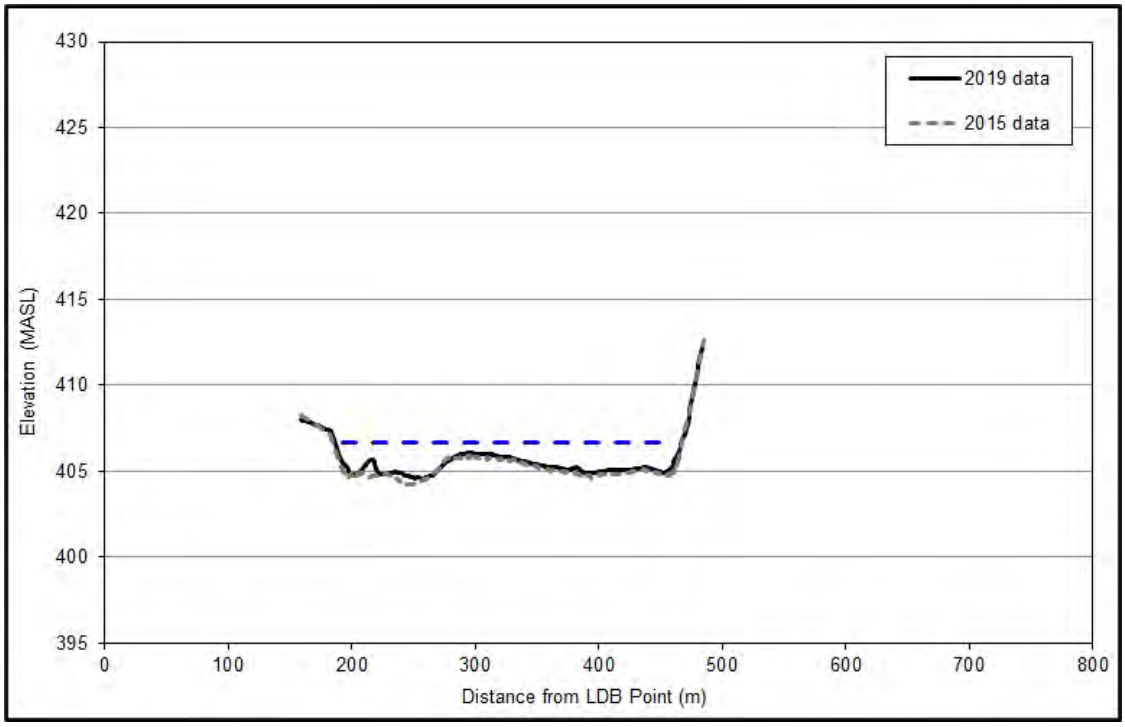



**Figure B27: River cross-section at Transect #DS12, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

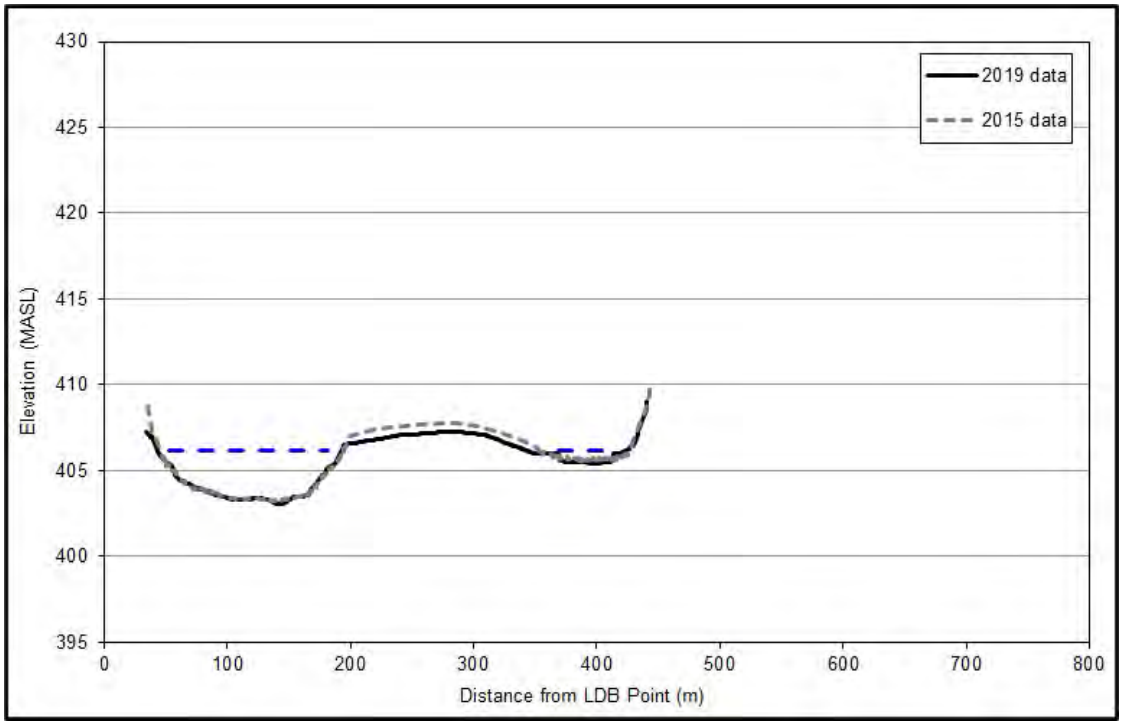



**Figure B28: River cross-section at Transect #DS13, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

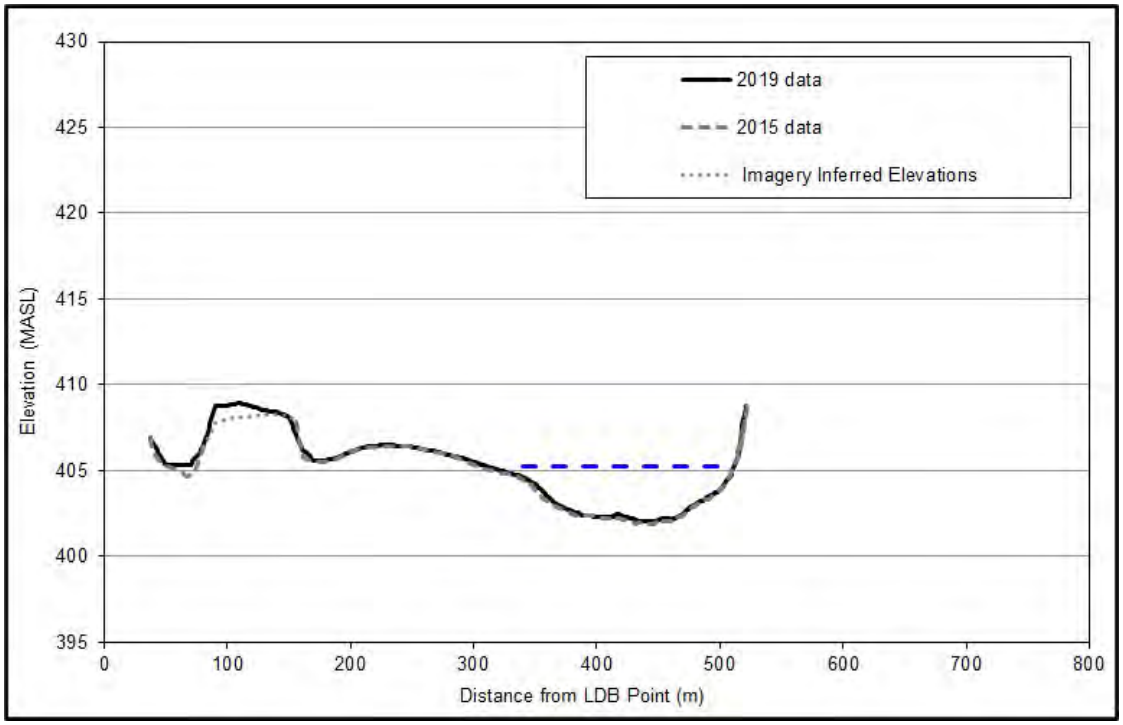



**Figure B29: River cross-section at Transect #DS14, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

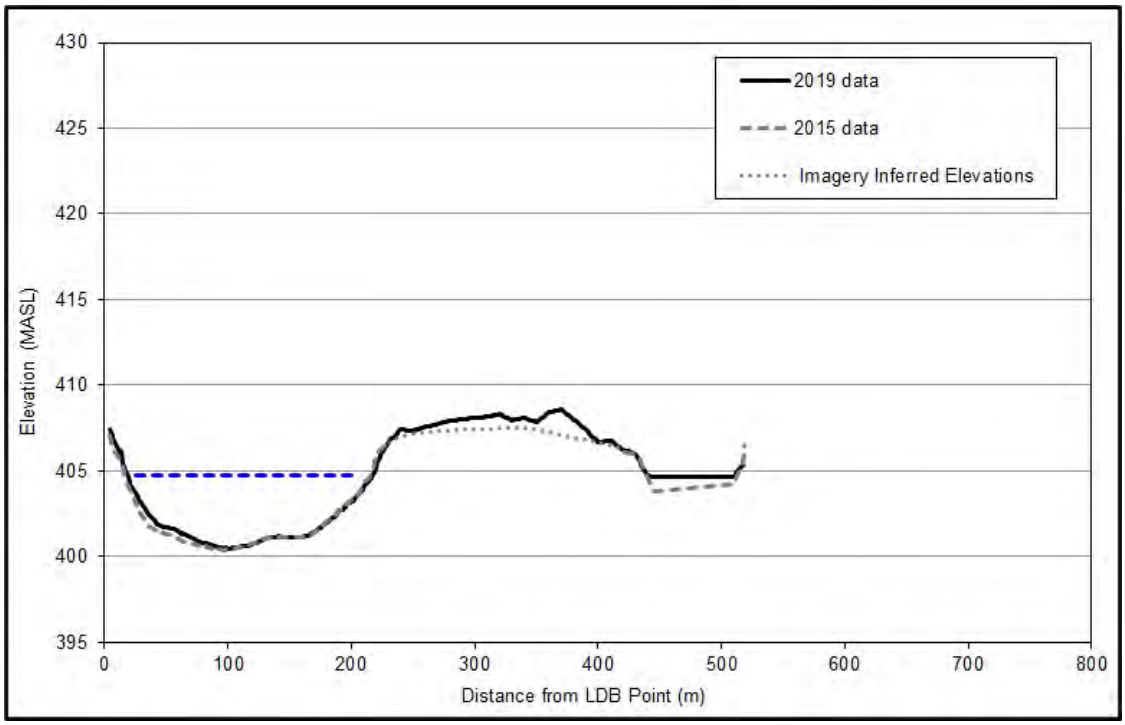



**Figure B30: River cross-section at Transect #DS15, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

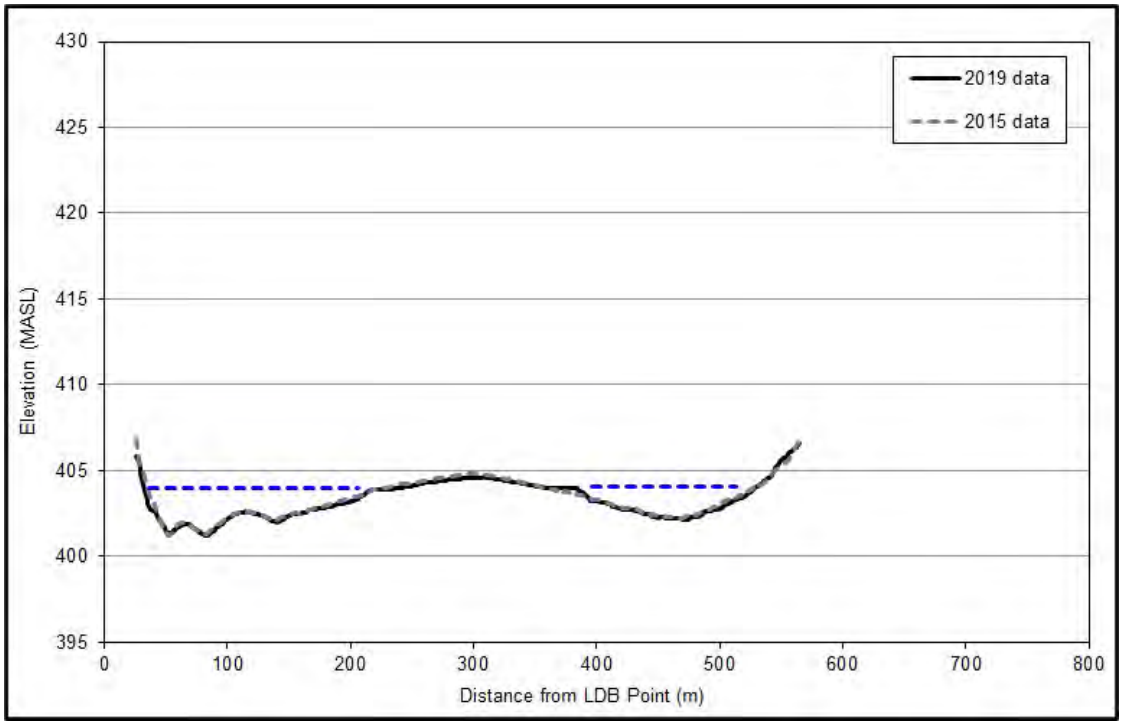



**Figure B31: River cross-section at Transect #DS16, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

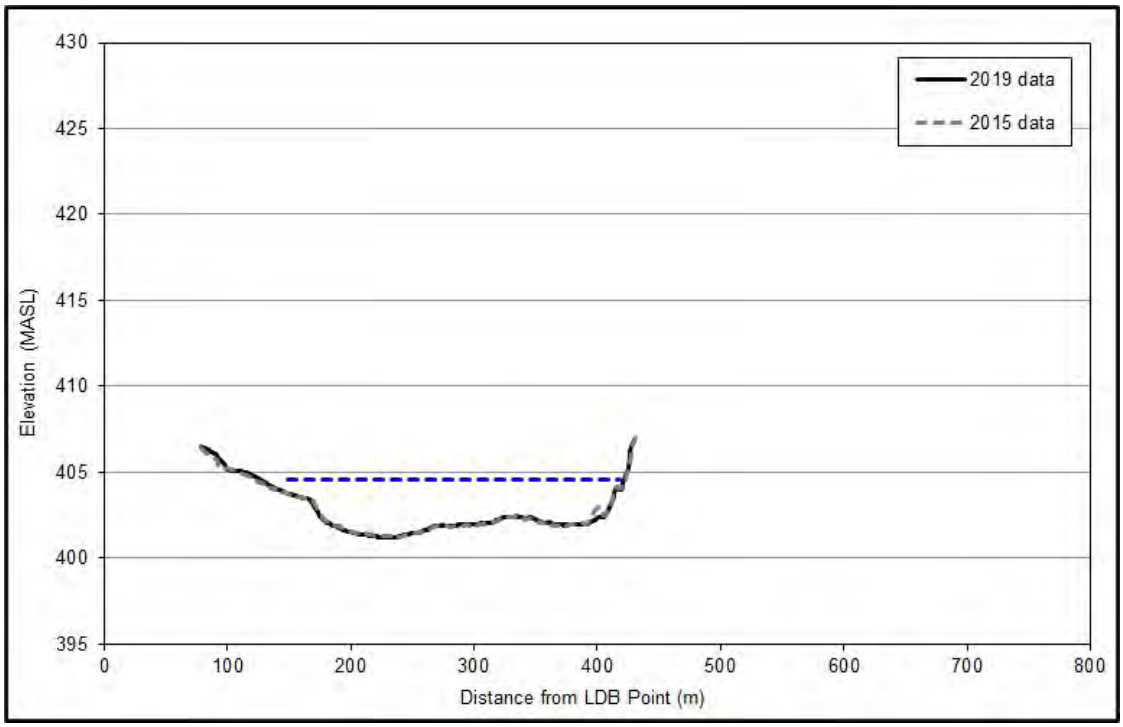



**Figure B32: River cross-section at Transect #DS17, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

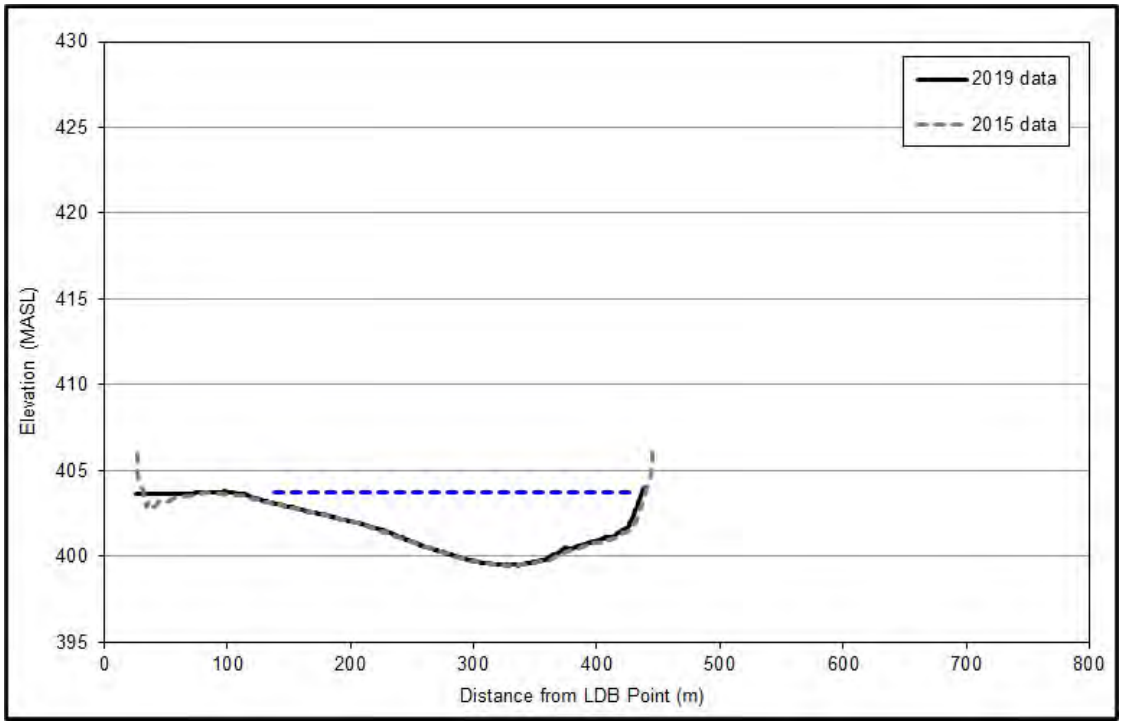



**Figure B33: River cross-section at Transect #DS18, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

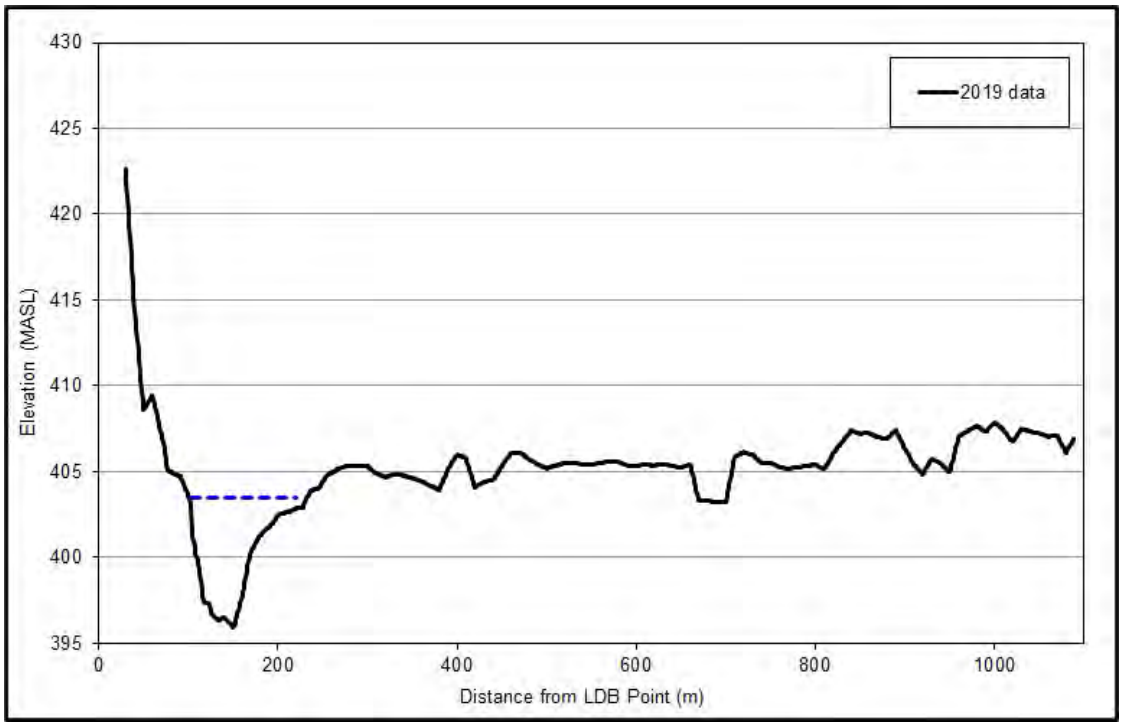



**Figure B34: River cross-section at Transect #DS19, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

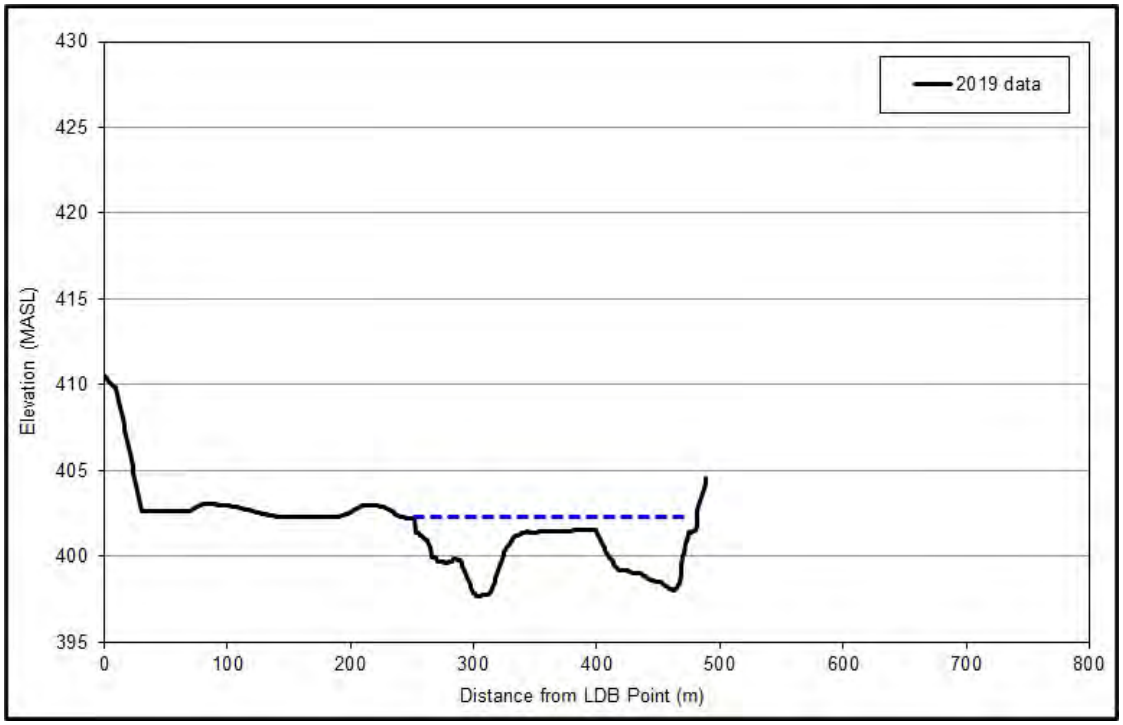



**Figure B35: River cross-section at Transect #DS20, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

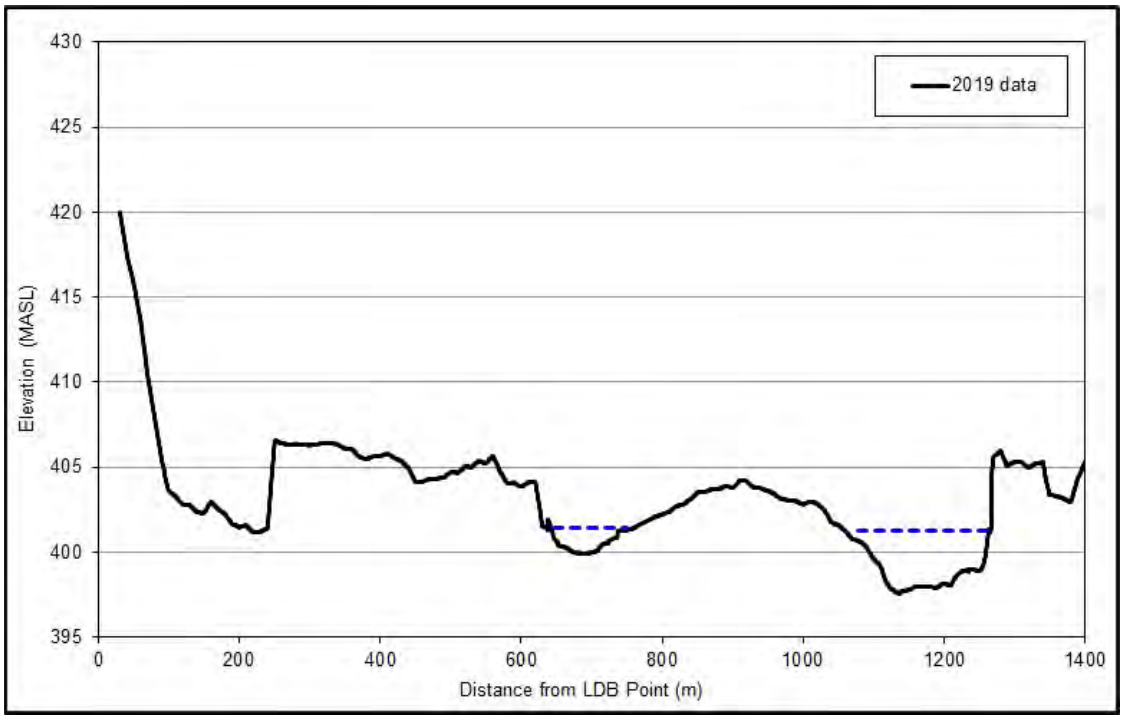



**Figure B36: River cross-section at Transect #DS21, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

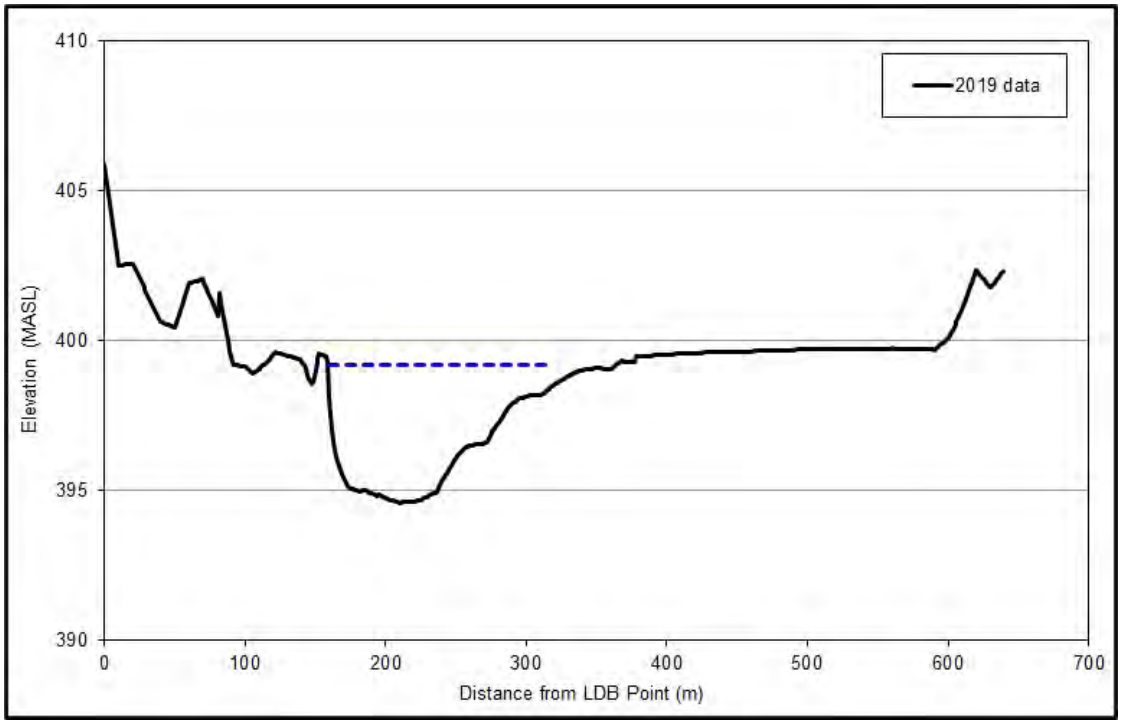



**Figure B37: River cross-section at Transect #DS22, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

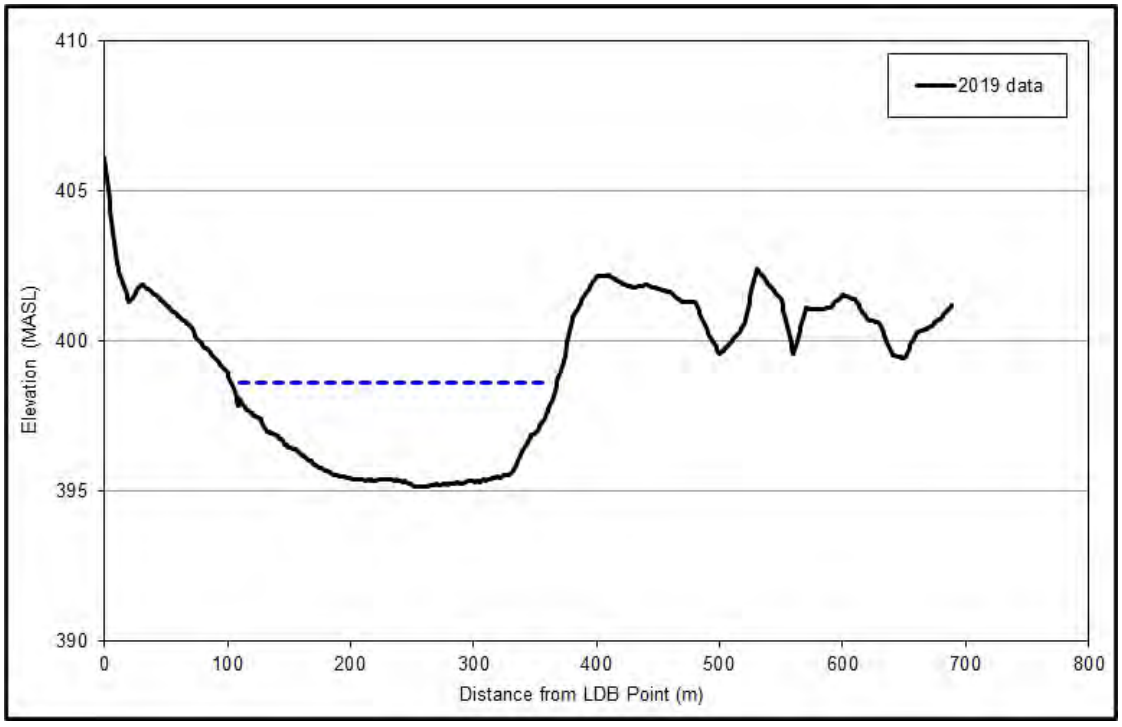



**Figure B38: River cross-section at Transect #DS23, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

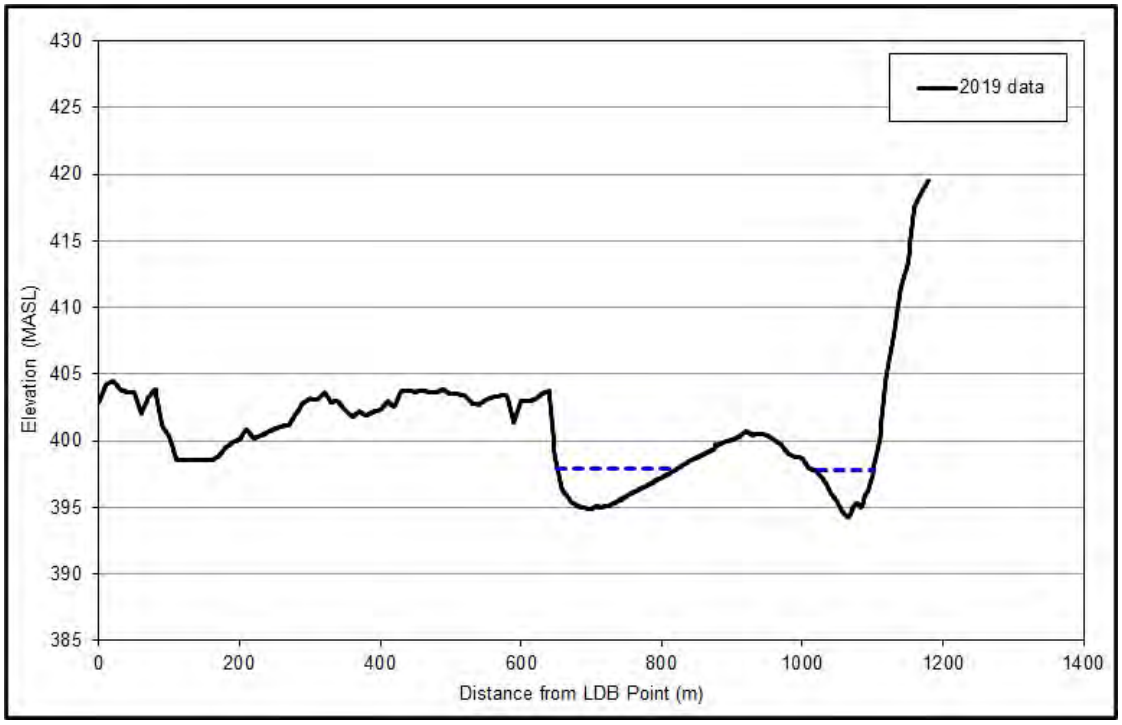



**Figure B39: River cross-section at Transect #DS24, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

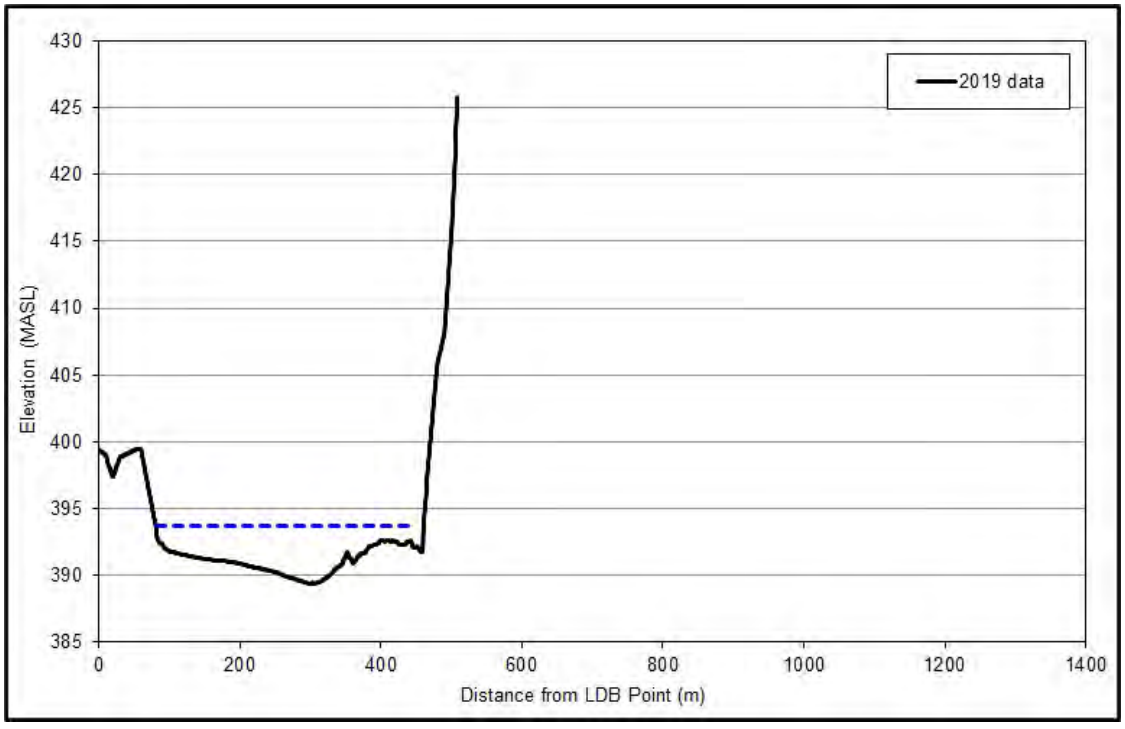



**Figure B40: River cross-section at Transect #DS25, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

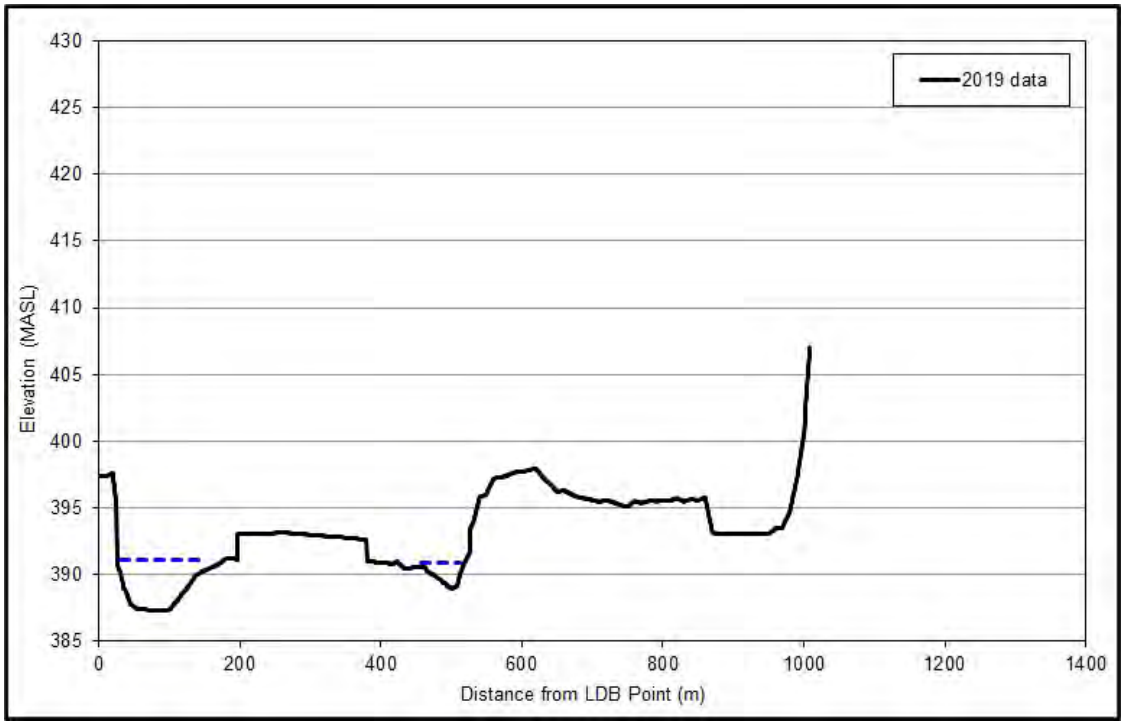



**Figure B41: River cross-section at Transect #DS26, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

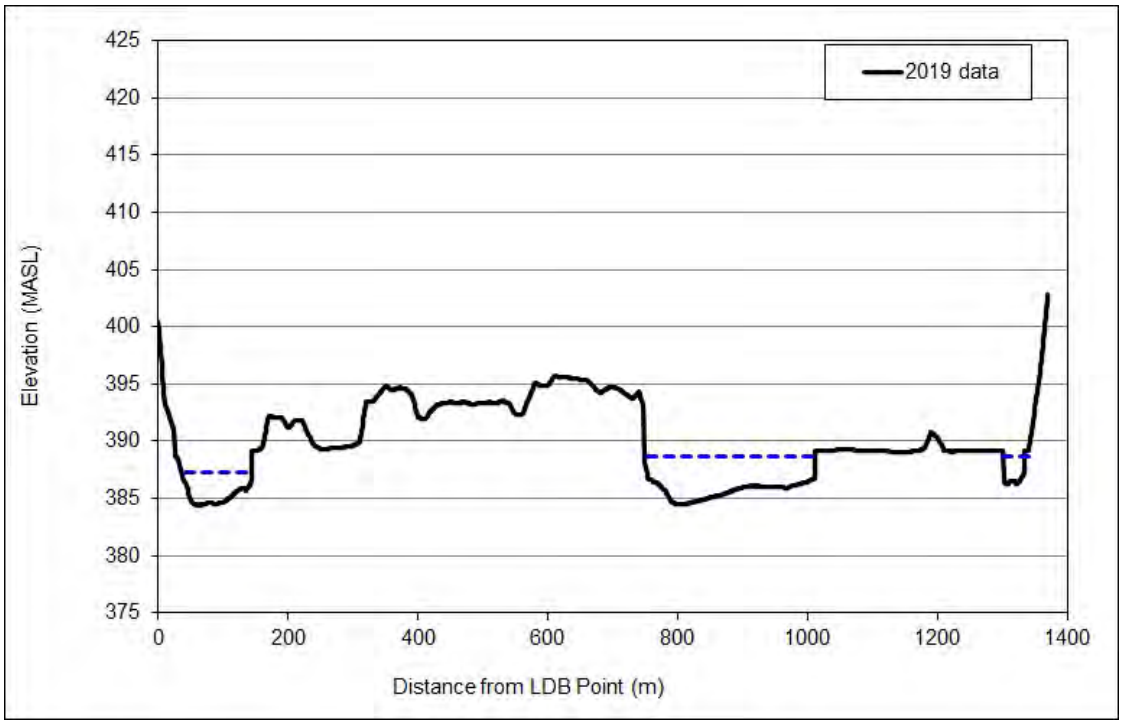



**Figure B42: River cross-section at Transect #DS27, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

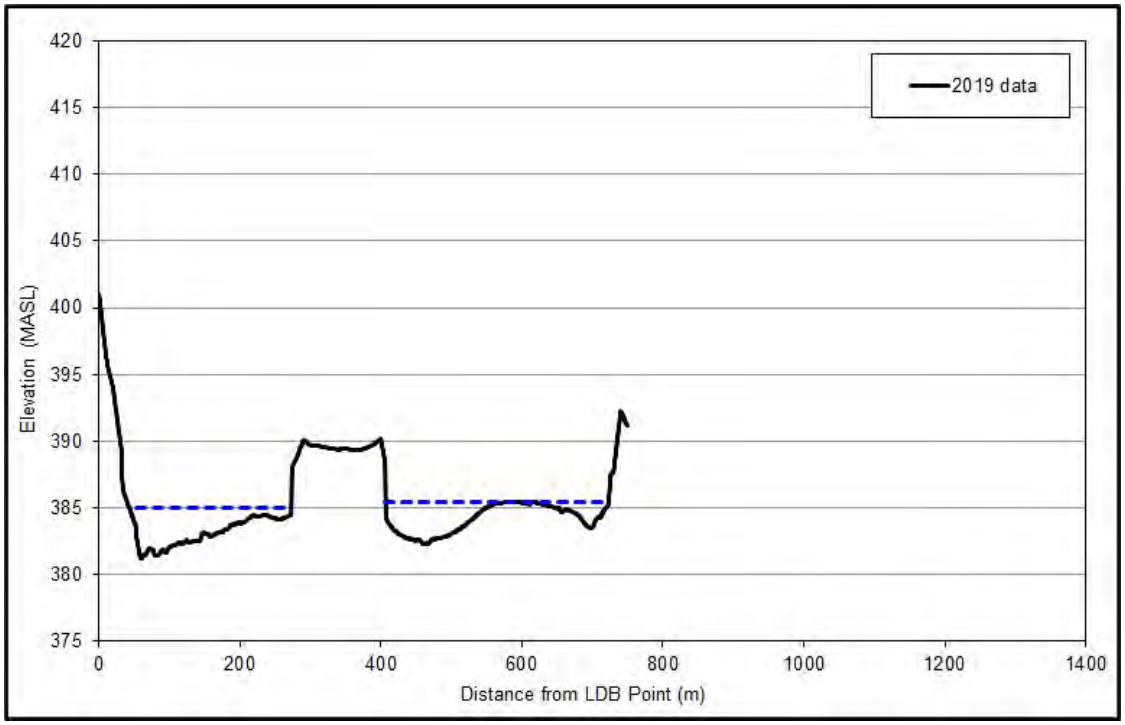



**Figure B43: River cross-section at Transect #DS28, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

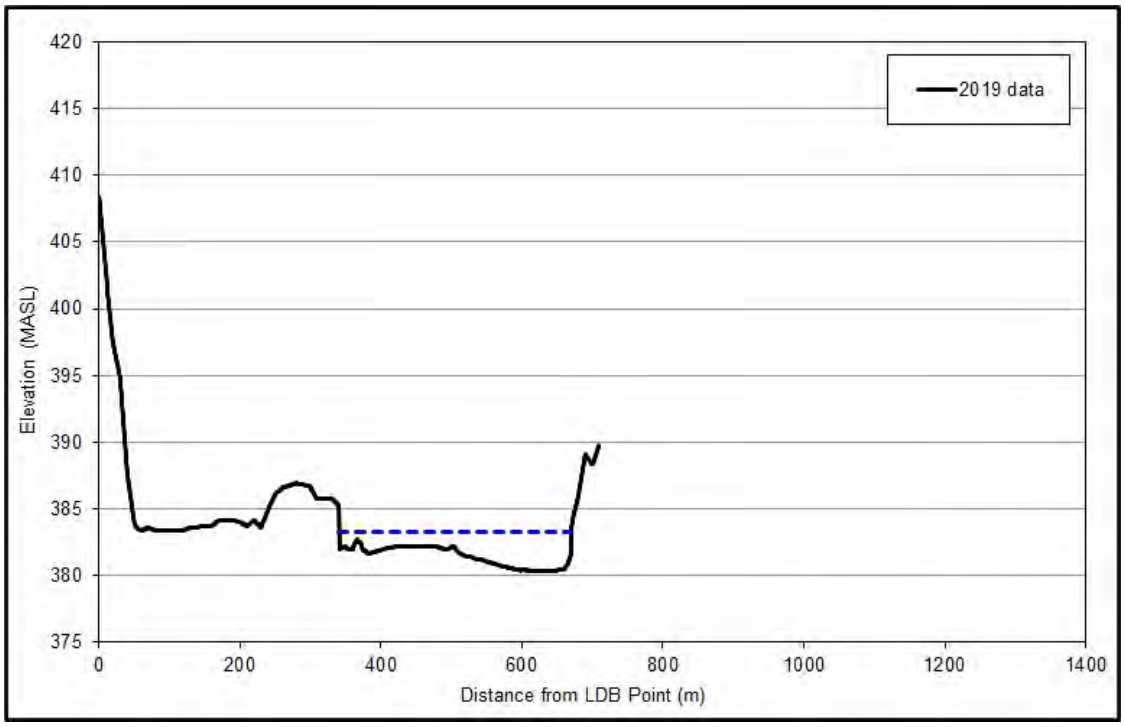



**Figure B44: River cross-section at Transect #DS29, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

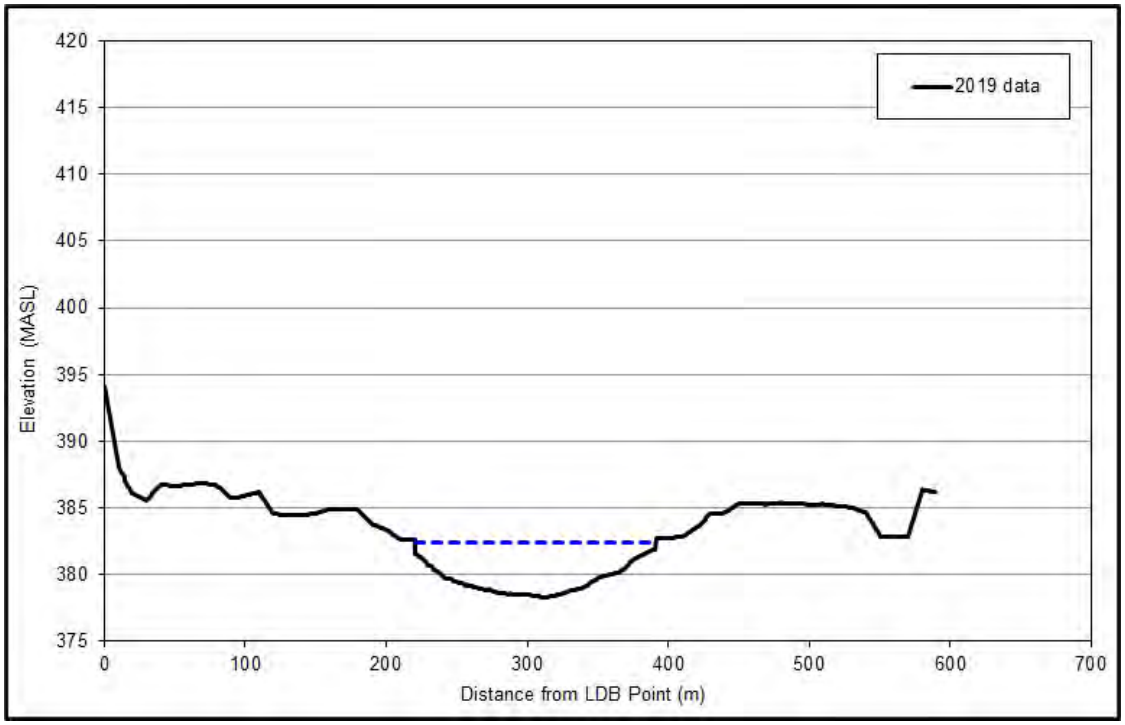



**Figure B45: River cross-section at Transect #DS30, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

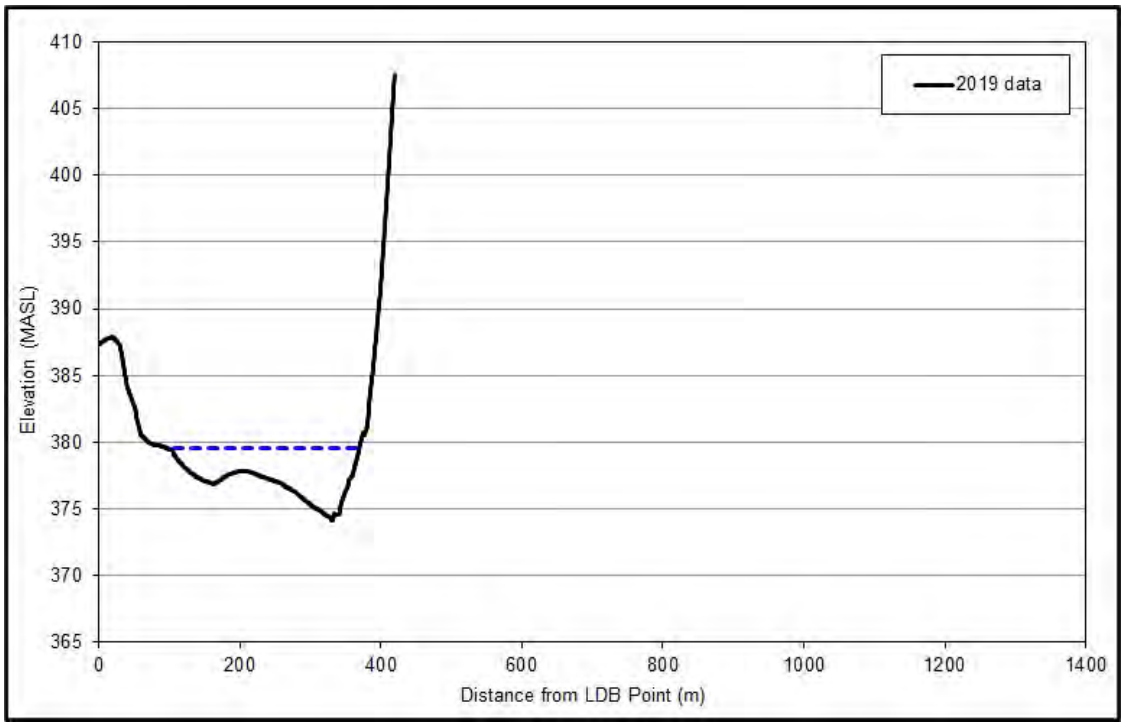



**Figure B46: River cross-section at Transect #DS31, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

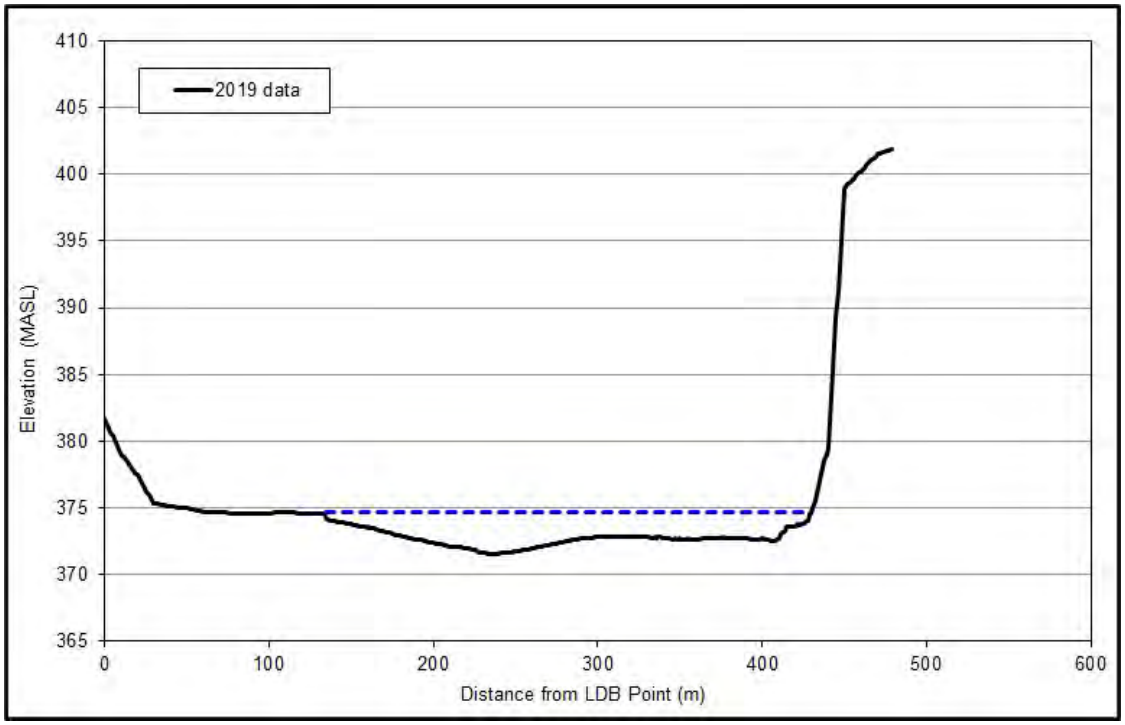



**Figure B47: River cross-section at Transect #DS32, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

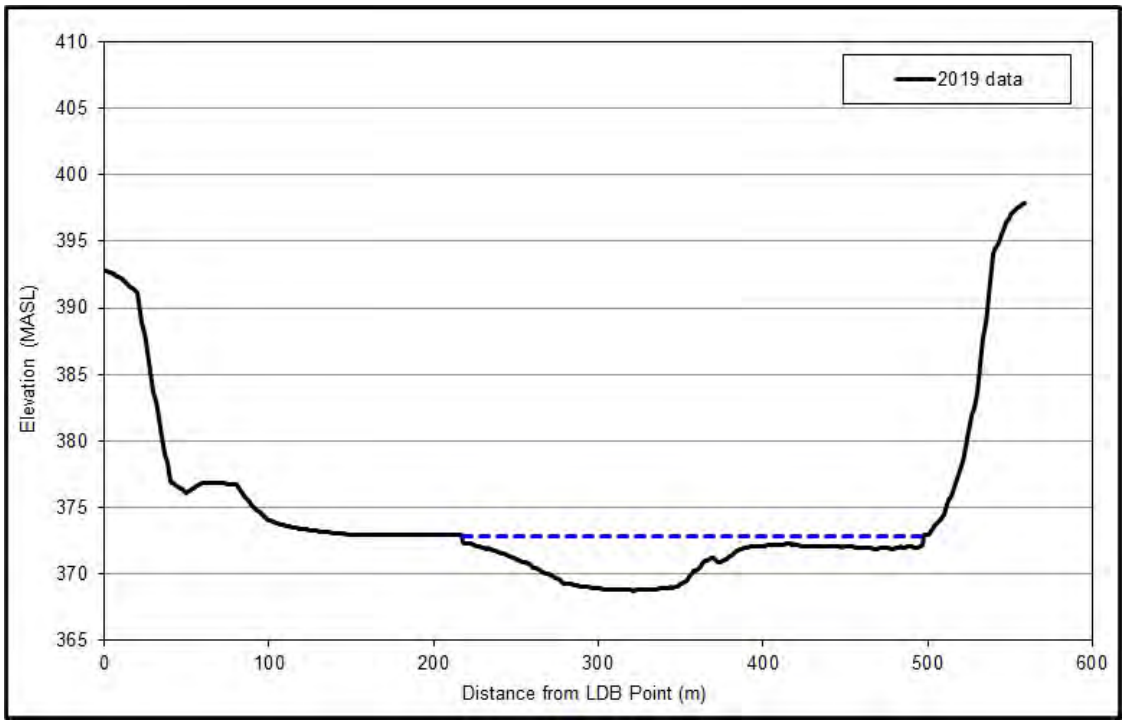



**Figure B48: River cross-section at Transect #DS33, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

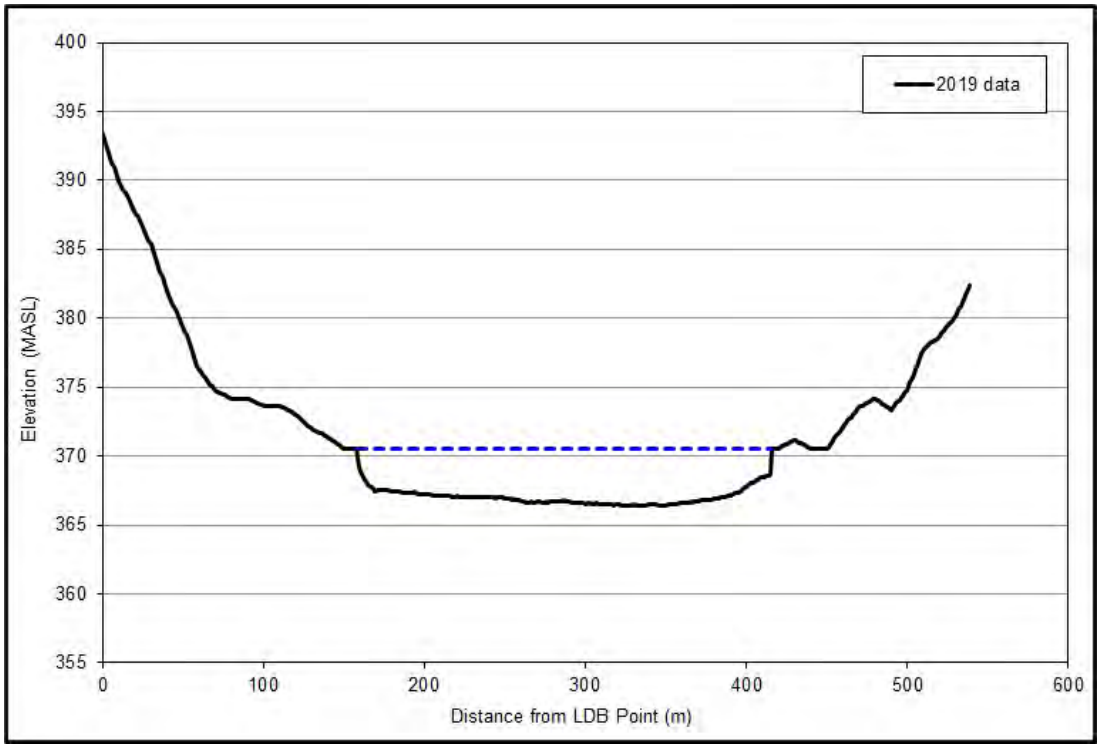



**Figure B49: River cross-section at Transect #DS34, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

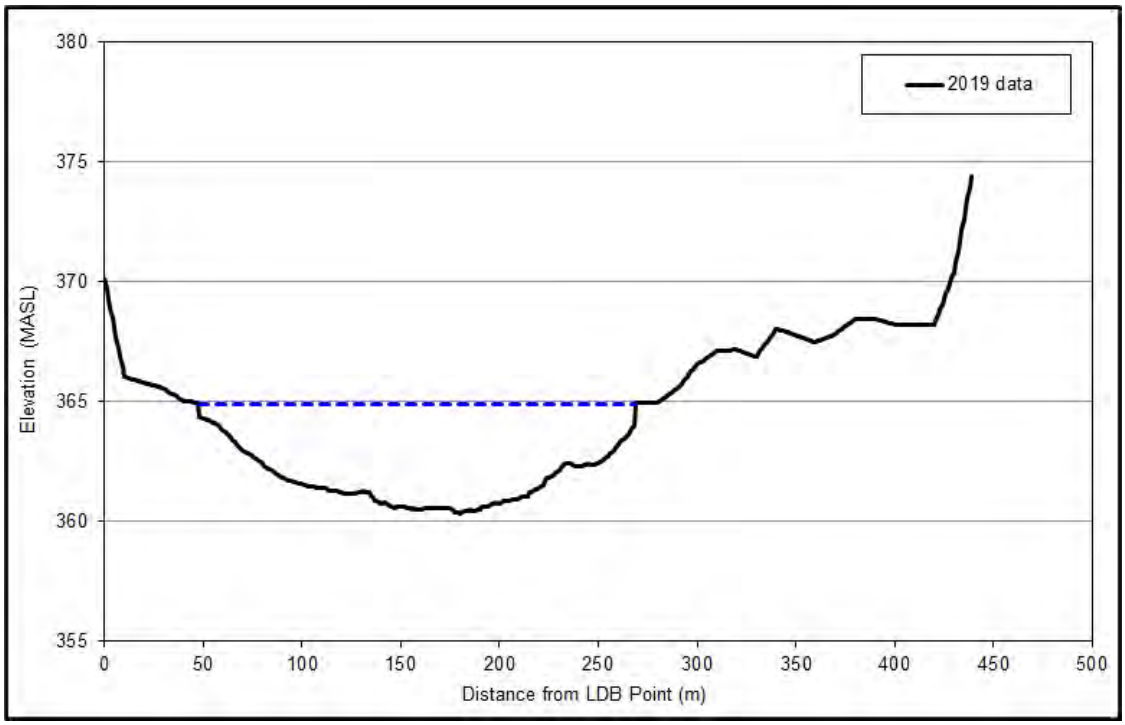



**Figure B50: River cross-section at Transect #DS35, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

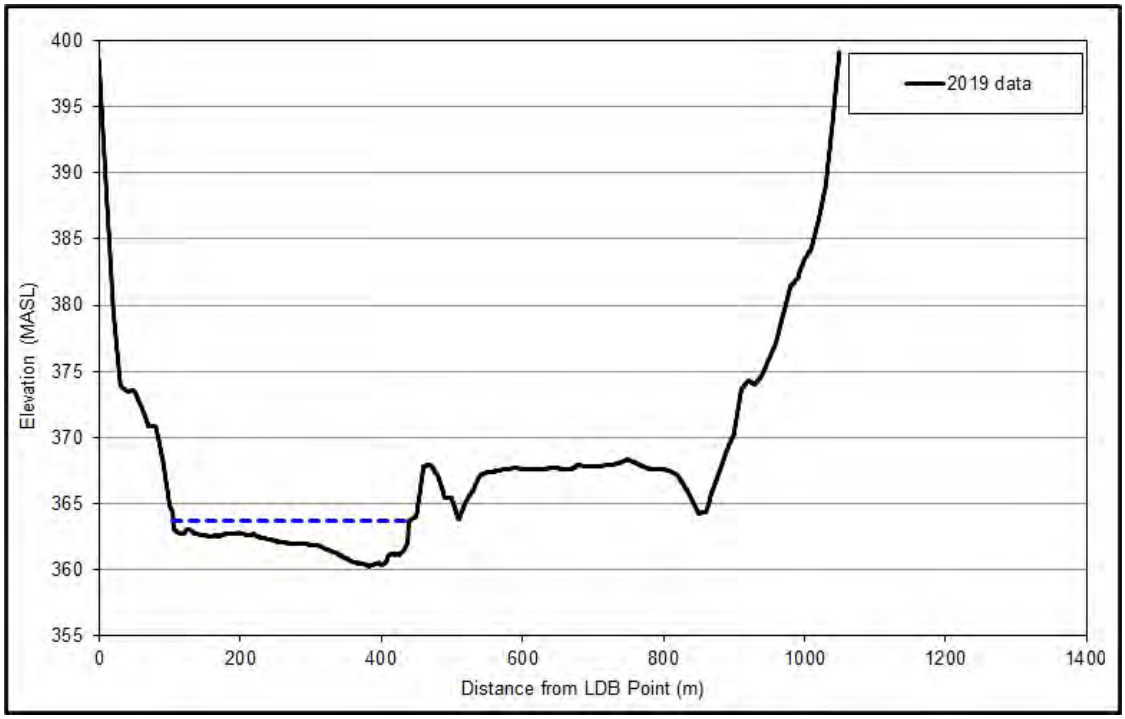



**Figure B51: River cross-section at Transect #DS36, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

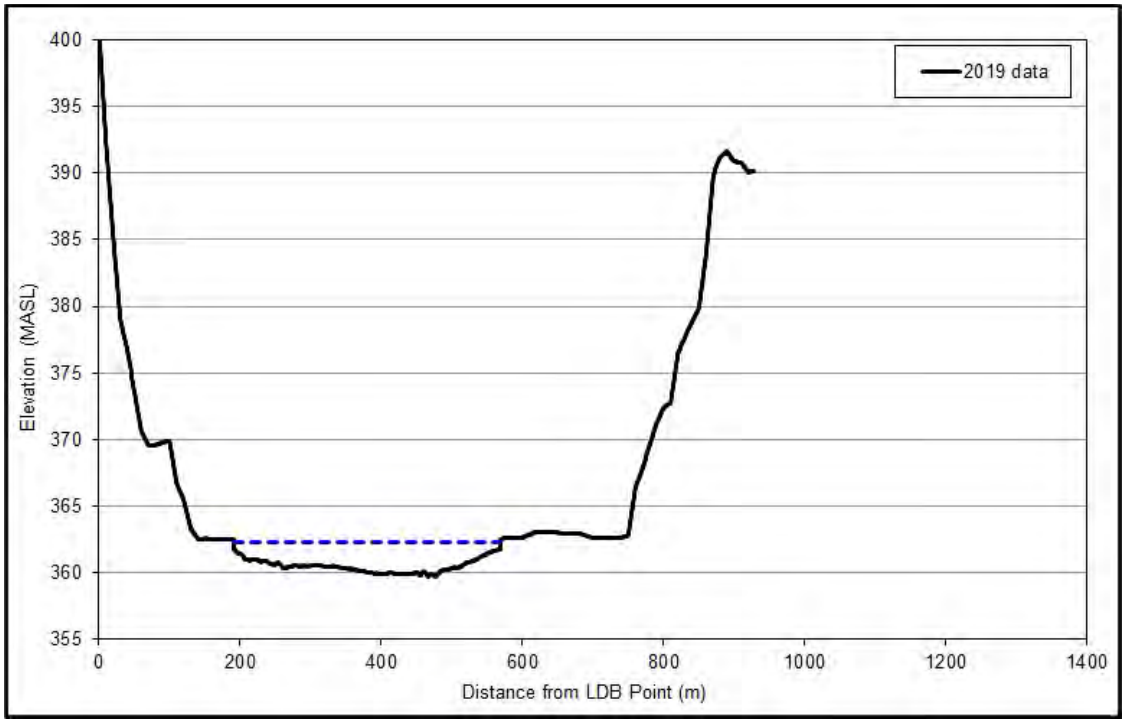



**Figure B52: River cross-section at Transect #DS37, Peace River Physical Habitat Monitoring Program (Mon-3), 2019. The blue dotted line denotes water levels at the time of the 2019 survey.**

# HISTORICAL CROSS-SECTIONS

This section presents the historical cross-sections surveyed on Peace River between 1968 and 2005. The cross-section locations are shown in Figure 53.

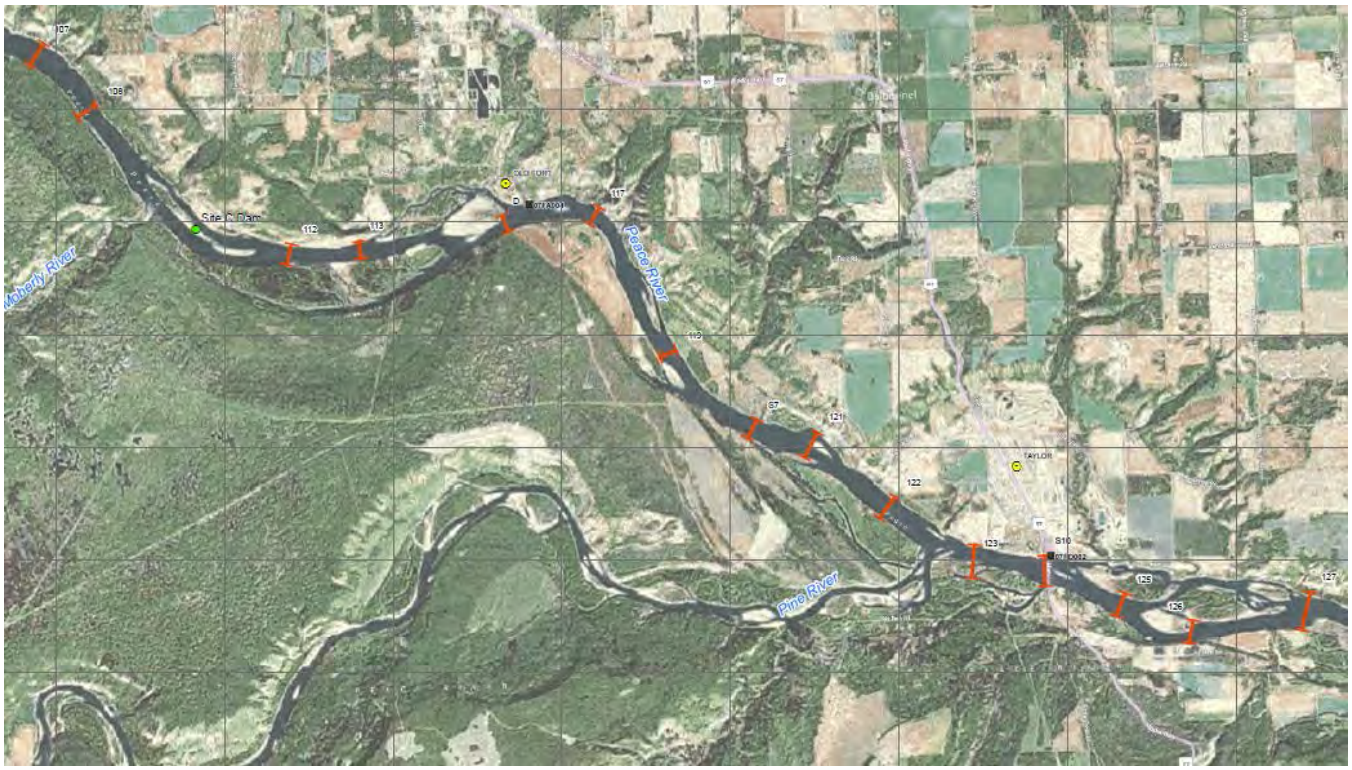
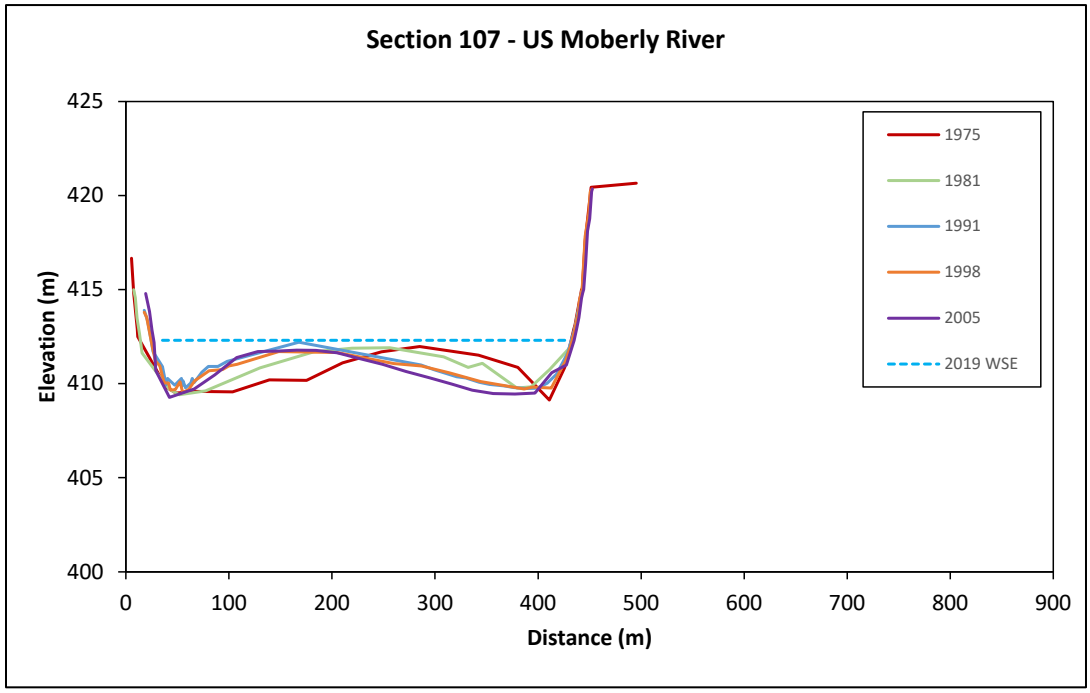
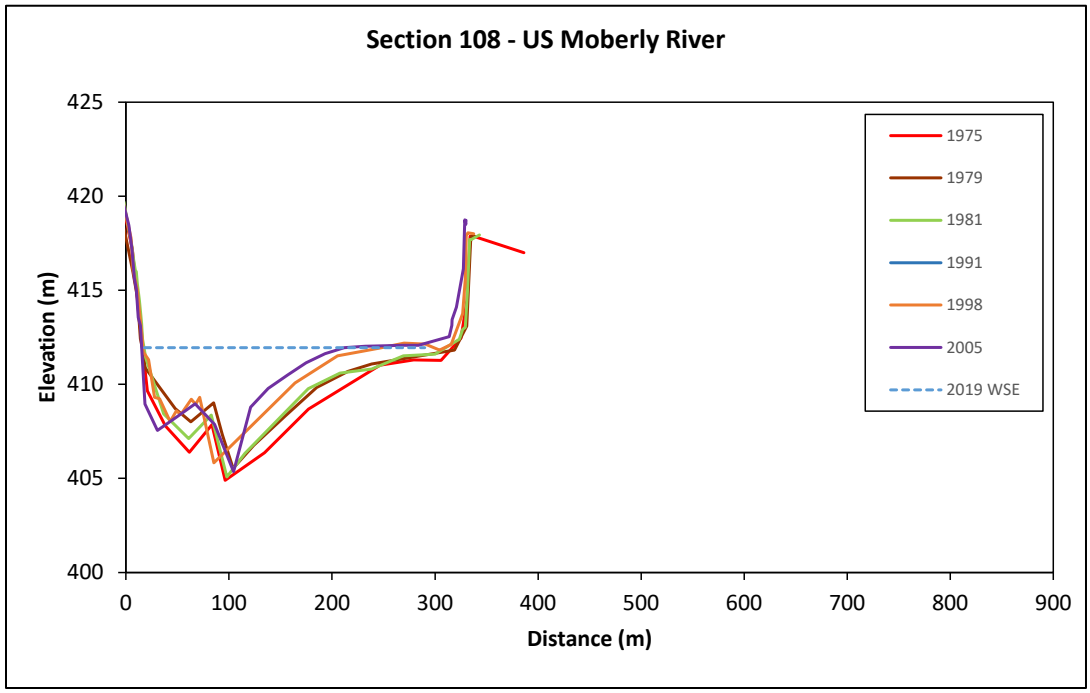
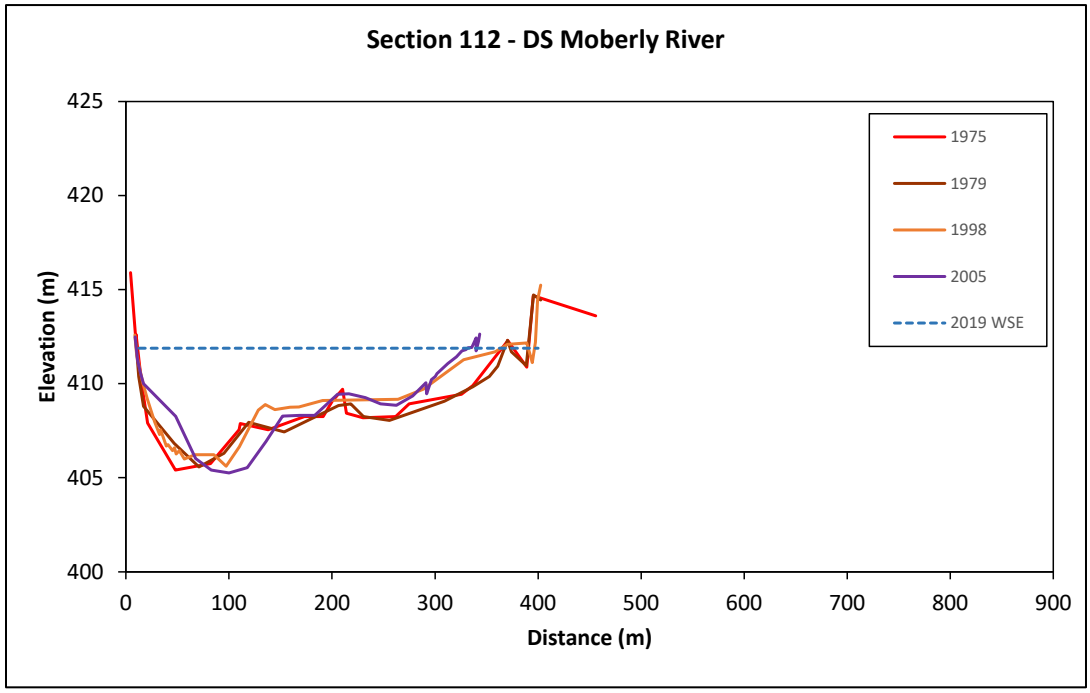
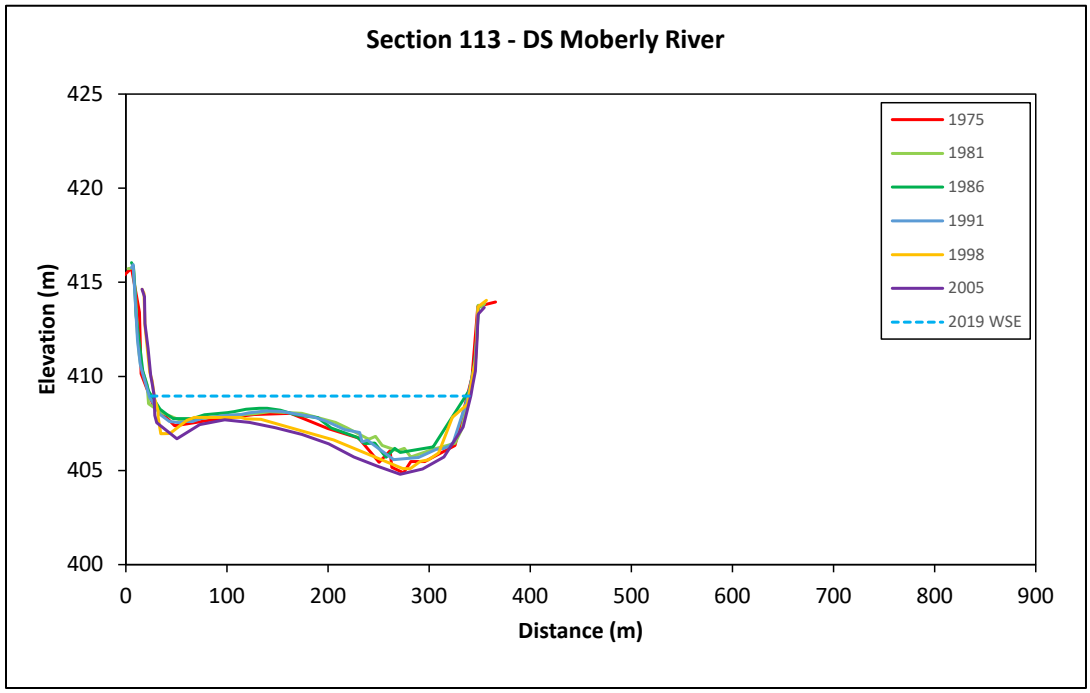


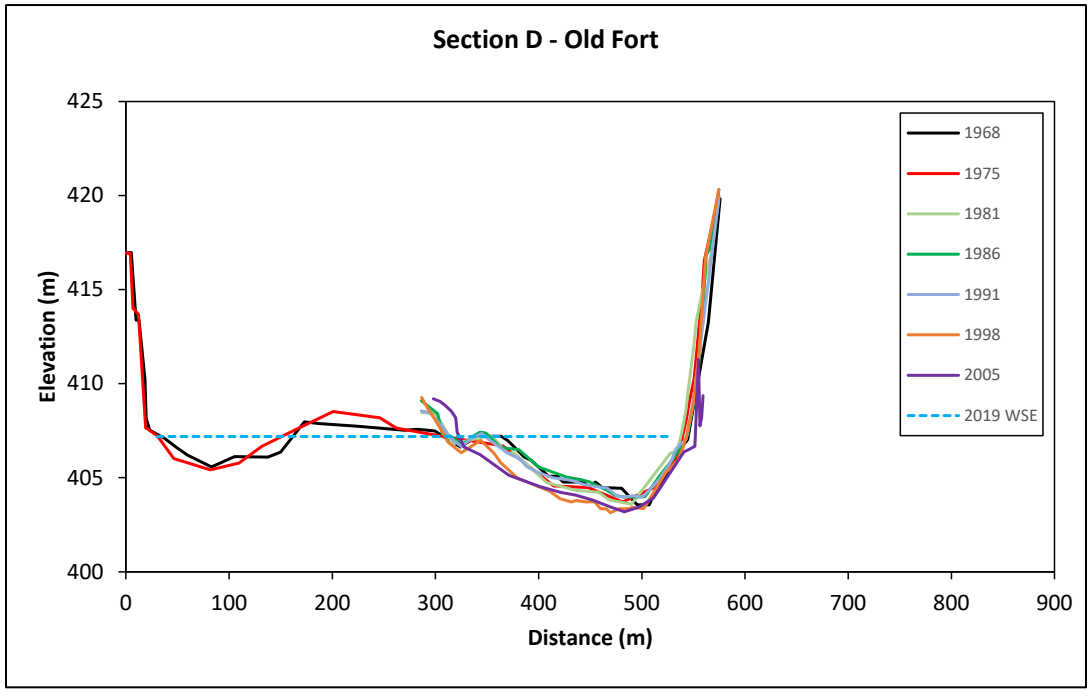

**Figure 53: Historical Cross-Section Locations**

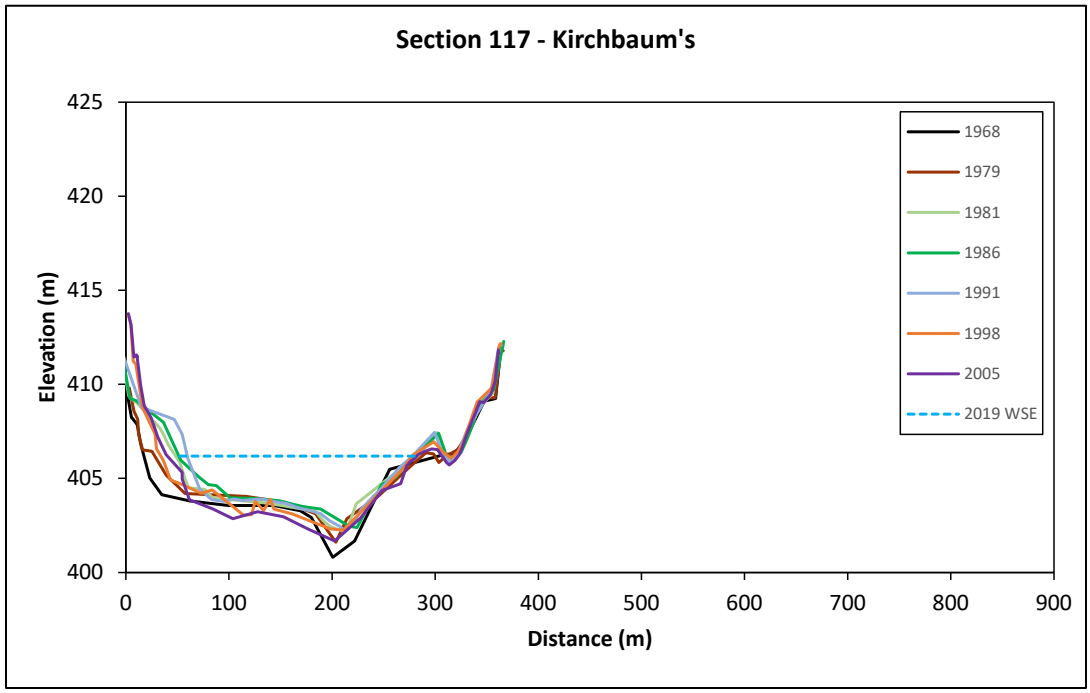

Section 107 - US Moberly River
Elevation (m)
425
420
415
410
405
400
0
100
200
300
400
500
600
700
800
900
Distance (m)
1975
1981
1991
1998
2005
2019 WSE

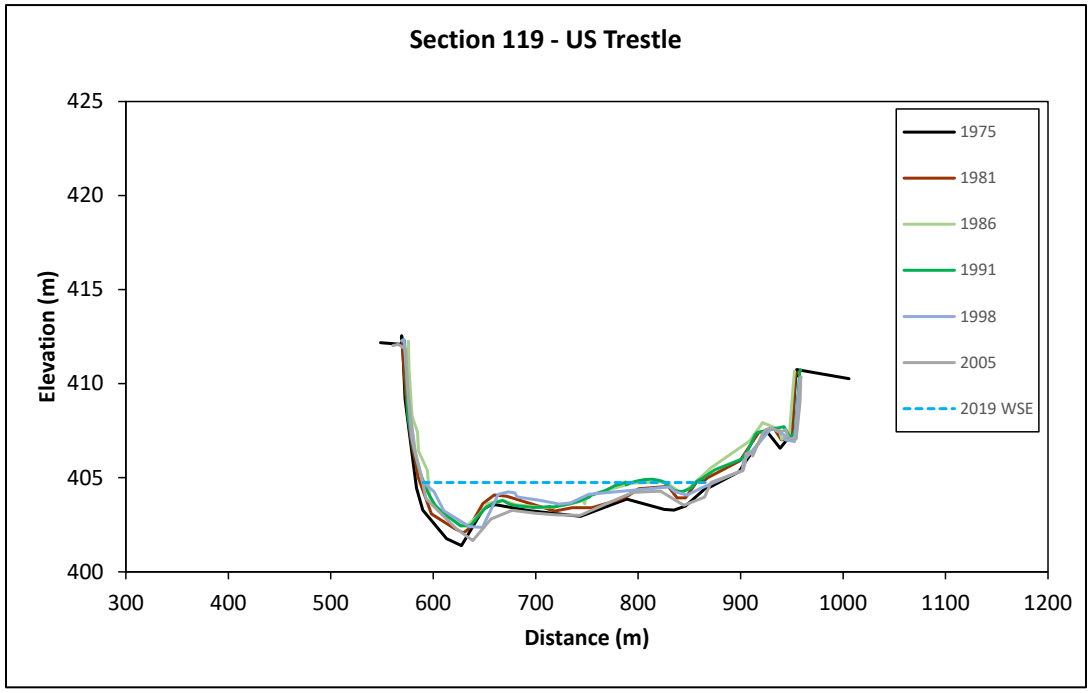

Section 108 - US Moberly River
Elevation (m)
425
420
415
410
405
400
0
100
200
300
400
500
600
700
800
900
Distance (m)
1975
1979
1981
1991
1998
2005
2019 WSE

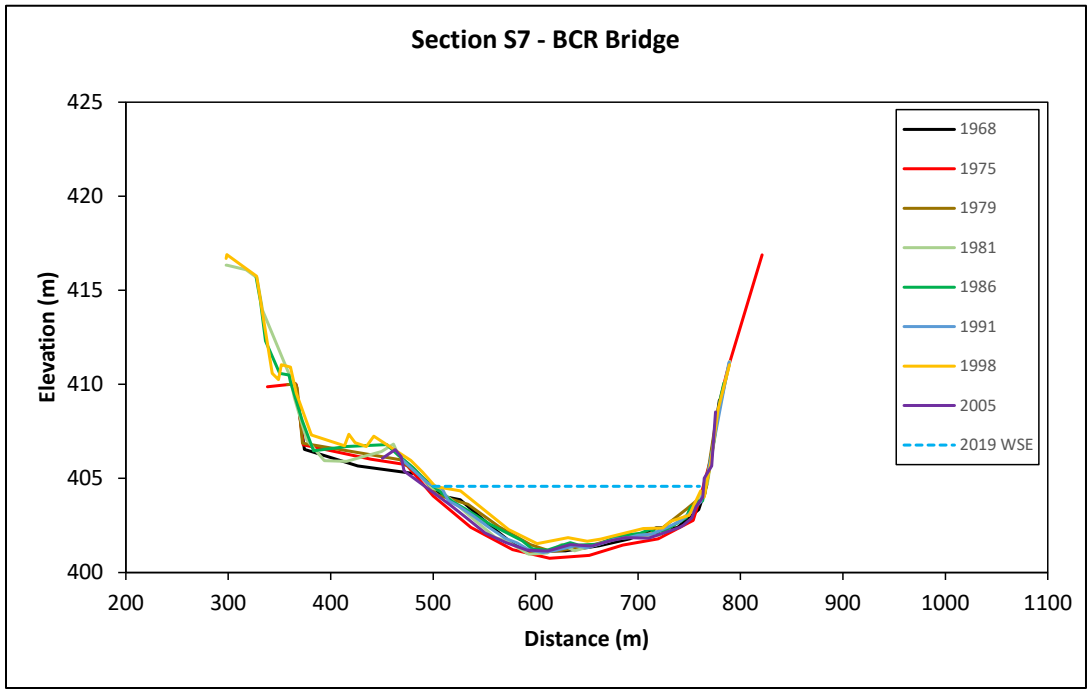

Section 112 - DS Moberly River
Elevation (m)
425
420
415
410
405
400
0
100
200
300
400
500
600
700
800
900
Distance (m)
1975
1979
1998
2005
2019 WSE

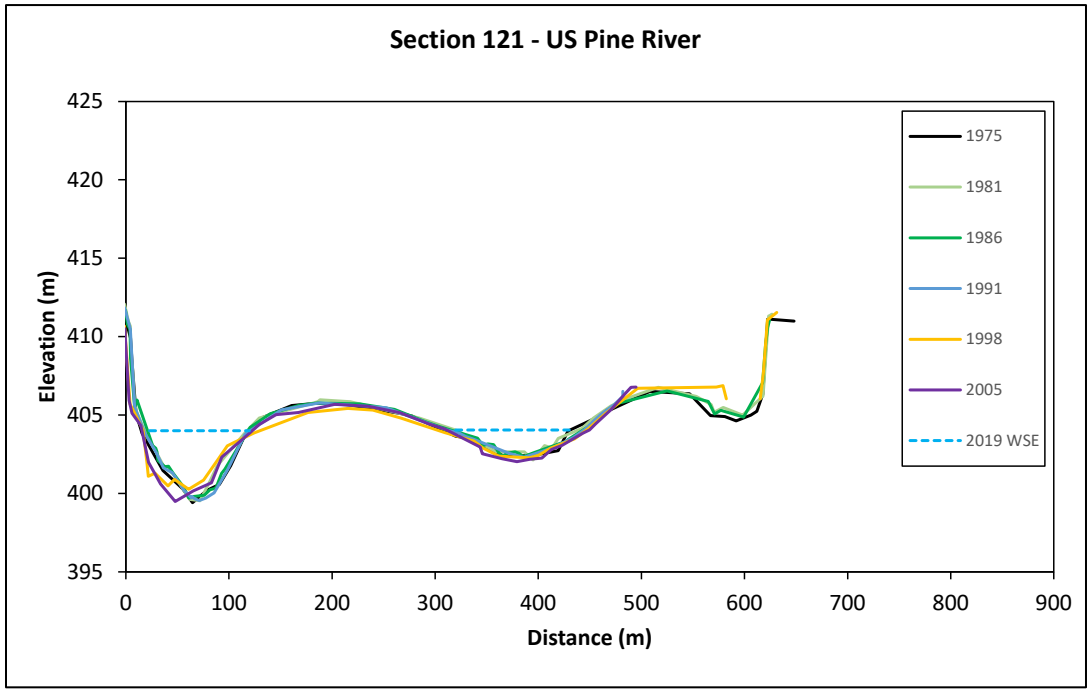

Section 113 - DS Moberly River
Elevation (m)
425
420
415
410
405
400
0
100
200
300
400
500
600
700
800
900
Distance (m)
1975
1981
1986
1991
1998
2005
2019 WSE

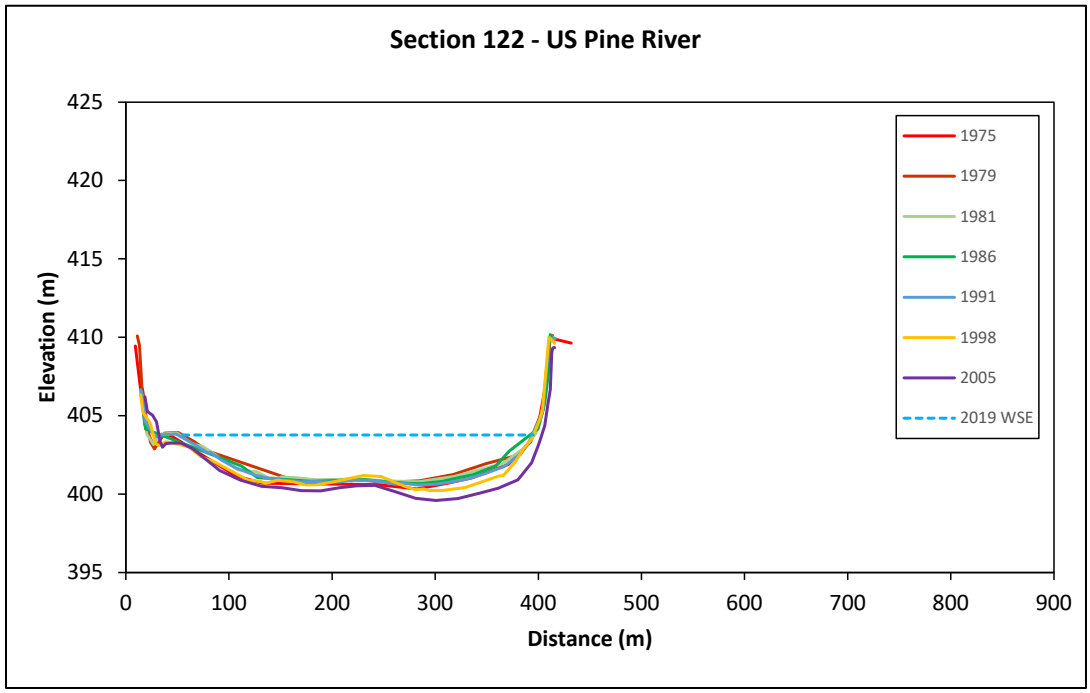

Section D - Old Fort
425
420
415
410
405
400
Elevation (m)
0
100
200
300
400
500
600
700
800
900
Distance (m)
1968
1975
1981
1986
1991
1998
2005
2019 WSE

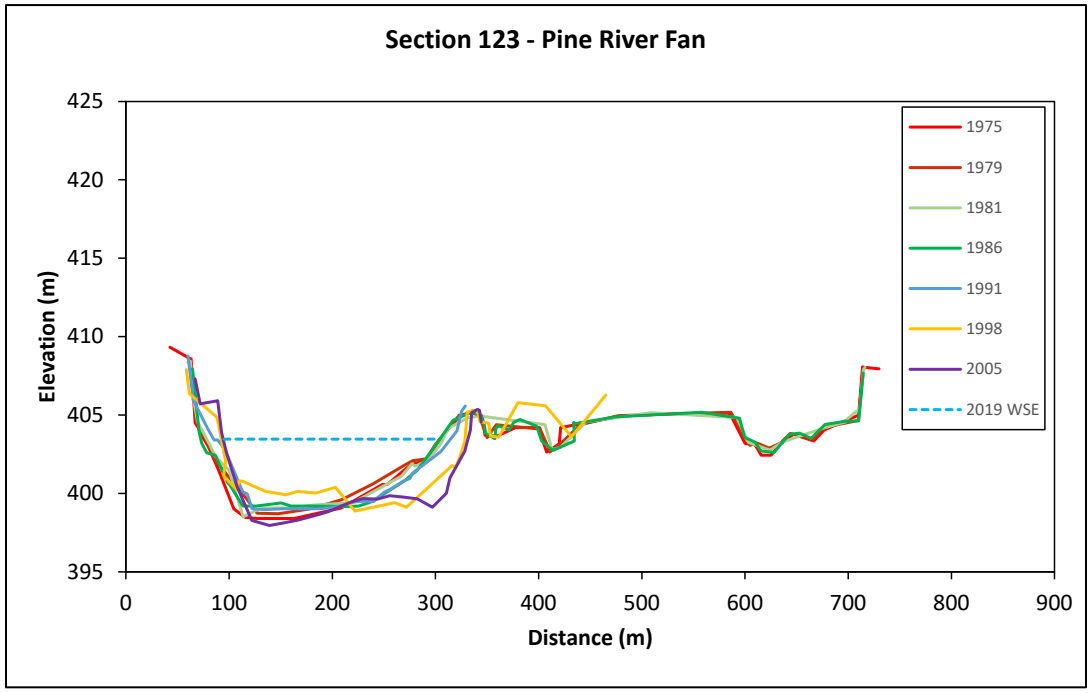

Section 117 - Kirchbaum's
425
420
415
410
405
400
Elevation (m)
0
100
200
300
400
500
600
700
800
900
Distance (m)
1968
1979
1981
1986
1991
1998
2005
2019 WSE

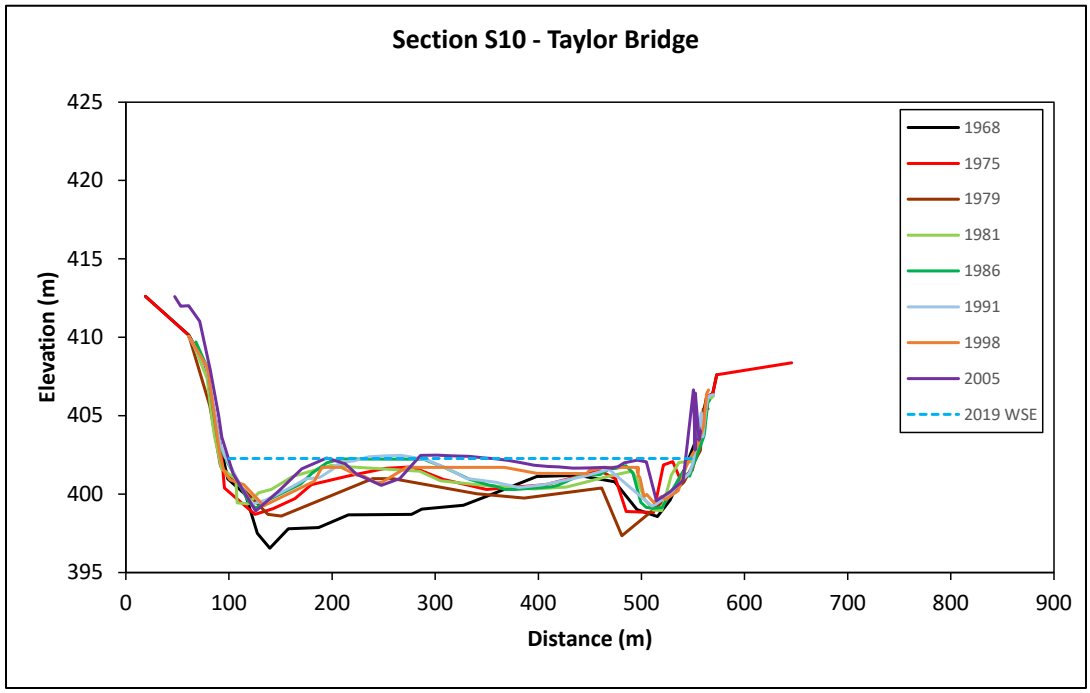

Section 119 - US Trestle
Elevation (m)
425
420
415
410
405
400
300
400
500
600
700
800
900
1000
1100
1200
Distance (m)
1975
1981
1986
1991
1998
2005
2019 WSE

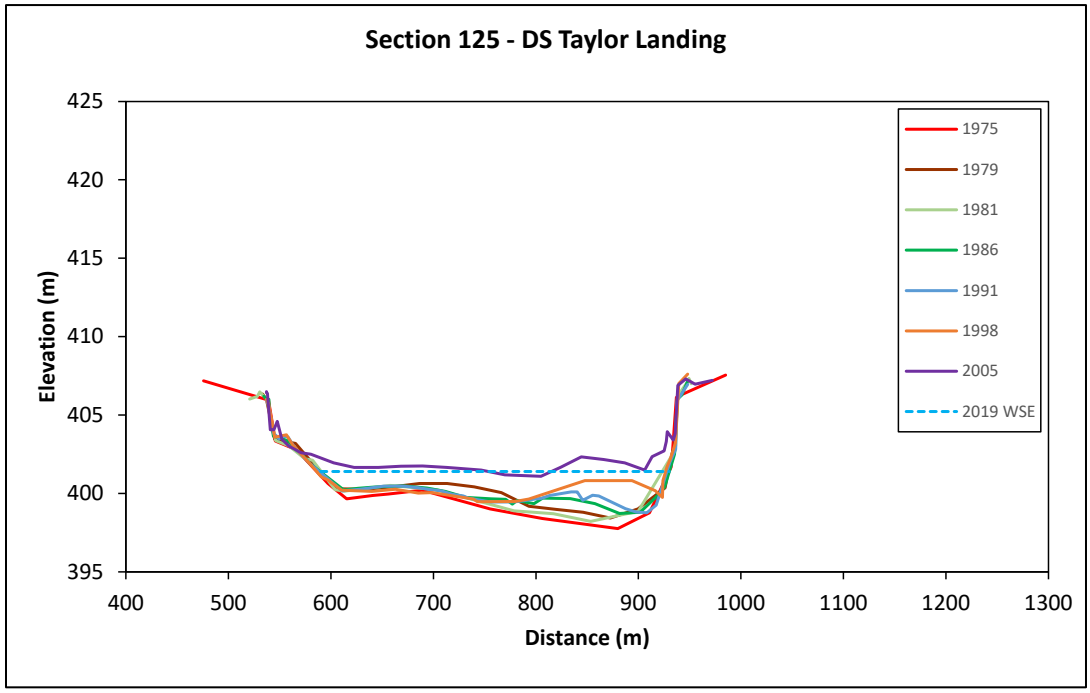

Section S7 - BCR Bridge
Elevation (m)
425
420
415
410
405
400
200
300
400
500
600
700
800
900
1000
1100
Distance (m)
1968
1975
1979
1981
1986
1991
1998
2005
2019 WSE

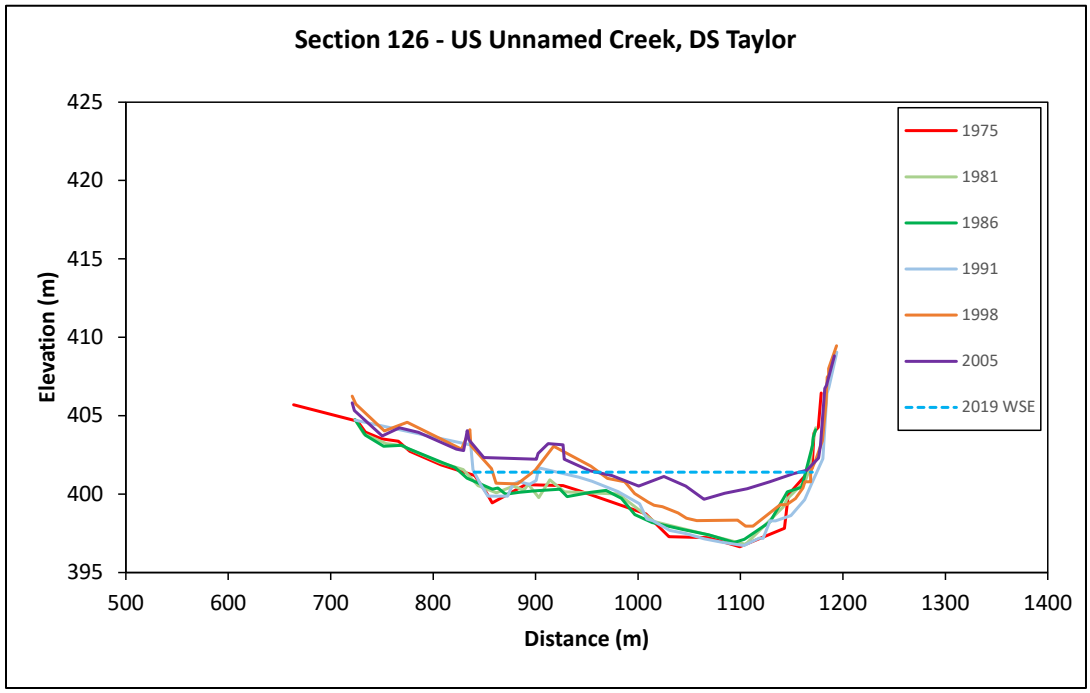

Section 121 - US Pine River
Elevation (m)
425
420
415
410
405
400
395
0
100
200
300
400
500
600
700
800
900
Distance (m)
1975
1981
1986
1991
1998
2005
2019 WSE

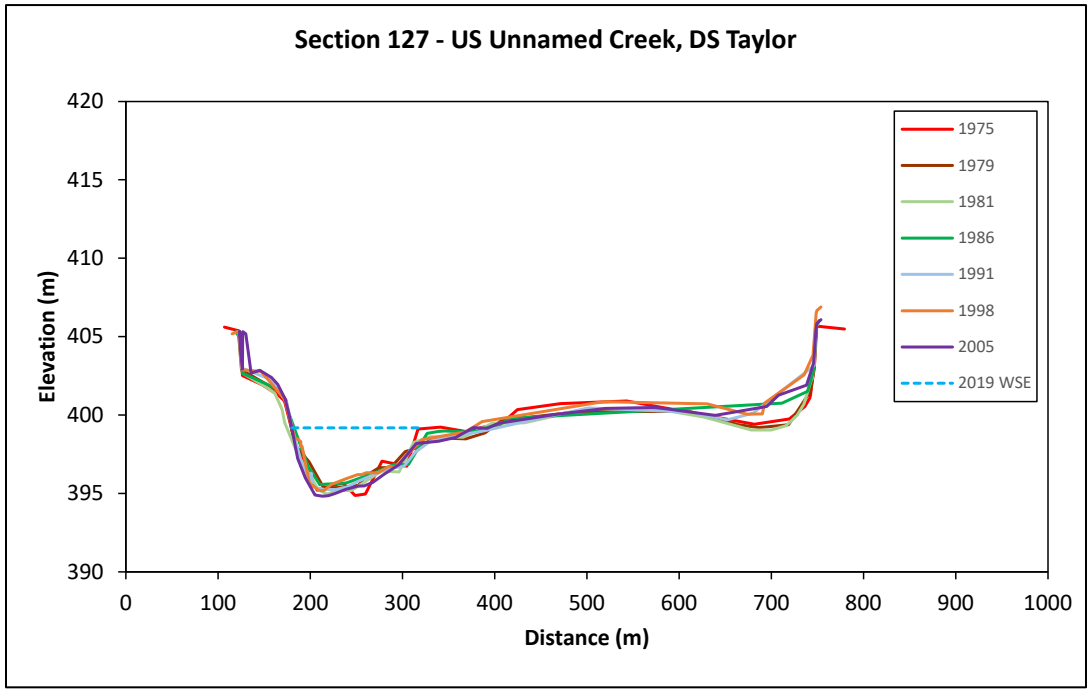

Section 122 - US Pine River
Elevation (m)
425
420
415
410
405
400
395
0
100
200
300
400
500
600
700
800
900
Distance (m)
1975
1979
1981
1986
1991
1998
2005
2019 WSE


Section 123 - Pine River Fan
Elevation (m)
425
420
415
410
405
400
395
0
100
200
300
400
500
600
700
800
900
Distance (m)
1975
1979
1981
1986
1991
1998
2005
2019 WSE


Section S10 - Taylor Bridge
Elevation (m)
425
420
415
410
405
400
395
0
100
200
300
400
500
600
700
800
900
Distance (m)
1968
1975
1979
1981
1986
1991
1998
2005
2019 WSE


Section 125 - DS Taylor Landing
Elevation (m)
425
420
415
410
405
400
395
400
500
600
700
800
900
1000
1100
1200
1300
Distance (m)
1975
1979
1981
1986
1991
1998
2005
2019 WSE


Section 126 - US Unnamed Creek, DS Taylor
Elevation (m)
425
420
415
410
405
400
395
500
600
700
800
900
1000
1100
1200
1300
1400
Distance (m)
1975
1981
1986
1991
1998
2005
2019 WSE


Section 127 - US Unnamed Creek, DS Taylor
Elevation (m)
420
415
410
405
400
395
390
0
100
200
300
400
500
600
700
800
900
1000
Distance (m)
1975
1979
1981
1986
1991
1998
2005
2019 WSE

**APPENDIX C**

# Grain Size Data

**Table C1: Size classes used for the grain size analysis during BC Hydro's Peace River Physical Habitat Monitoring Program, 2019 (Wentworth 1922).**

| Material | Size range (mm) |
|---|---|
| silt/clay | 0 - 0.062 |
| very fine sand | 0.062 - 0.125 |
| fine sand | 0.125 - 0.25 |
| medium sand | 0.25 - 0.5 |
| coarse sand | 0.5 - 1 |
| very coarse sand | 1 - 2 |
| very fine gravel | 2 - 4 |
| fine gravel | 4 - 8 |
| medium gravel | 8 - 16 |
| coarse gravel | 16 - 32 |
| very coarse gravel | 32 - 64 |
| small cobble | 64 - 90 |
| medium cobble | 90 - 128 |
| large cobble | 128 - 180 |
| very large cobble | 180 - 256 |
| small boulder | 256 - 512 |
| medium boulder | 512 - 1024 |
| large boulder | 1,024 – 2,048 |
| very large boulder | 2,048 – 4,096 |

**Table C2: Grain size data (in mm) collected during BC Hydro's Peace River Physical Habitat Monitoring Program, 2019.**

| Count | US-12 MC | | | US-11 MC | | | US-10 RB | | | US-10 MC | | | US-09 MC | | | US-08 RB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 32 | 52 | 0.8 | 65 | 25 | 0.8 | 140 | 50 | 0.06 | 68 | 55 | 0.8 | 70 | 25 | 0.5 | 48 | 120 | 0.1 |
| 2 | 45 | 42 | 1 | 30 | 40 | 1 | 60 | 42 | 0.06 | 35 | 90 | 2 | 20 | 27 | 0.7 | 70 | 55 | 0.5 |
| 3 | 10 | 32 | 1 | 40 | 220 | 2 | 110 | 62 | 0.08 | 90 | 100 | 1 | 30 | 38 | 1 | 90 | 35 | 3 |
| 4 | 24 | 12 | 3 | 60 | 32 | 3 | 190 | 65 | 0.1 | 80 | 45 | 9 | 35 | 60 | 2 | 120 | 130 | 7 |
| 5 | 18 | 22 | | 32 | 25 | | 160 | 125 | 0.3 | 42 | 50 | | 40 | 29 | 7 | 90 | 90 | 0.2 |
| 6 | 29 | 26 | | 40 | 24 | | 26 | 38 | 1 | 110 | 35 | | 15 | 50 | | 90 | 80 | |
| 7 | 27 | 25 | | 100 | 22 | | 160 | 90 | 2 | 125 | 35 | | 60 | 22 | | 100 | 45 | |
| 8 | 30 | 24 | | 20 | 22 | | 35 | 110 | | 55 | 50 | | 30 | 55 | | 65 | 100 | |
| 9 | 28 | 19 | | 32 | 17 | | 130 | 150 | | 90 | 45 | | 18 | 55 | | 80 | 50 | |
| 10 | 29 | 19 | | 39 | 32 | | 40 | 90 | | 35 | 130 | | 25 | 32 | | 110 | 75 | |
| 11 | 41 | 24 | | 25 | 20 | | 70 | 110 | | 92 | 55 | | 60 | 80 | | 95 | 70 | |
| 12 | 35 | 39 | | 65 | 10 | | 60 | 90 | | 140 | 150 | | 21 | 35 | | 180 | 50 | |
| 13 | 60 | 130 | | 35 | 27 | | 120 | 110 | | 85 | 50 | | 55 | 38 | | 35 | 50 | |
| 14 | 20 | 20 | | 50 | 32 | | 60 | 30 | | 45 | 80 | | 30 | 15 | | 60 | 80 | |
| 15 | 30 | 45 | | 60 | 29 | | 62 | 40 | | 32 | 80 | | 65 | 100 | | 75 | 40 | |
| 16 | 20 | 25 | | 37 | 24 | | 100 | 50 | | 48 | 110 | | 70 | 20 | | 100 | 40 | |
| 17 | 29 | 45 | | 21 | 20 | | 20 | 30 | | 43 | 35 | | 40 | 40 | | 70 | 170 | |
| 18 | 24 | 95 | | 40 | 10 | | 60 | 160 | | 52 | 32 | | 50 | 15 | | 45 | 120 | |
| 19 | 30 | 28 | | 38 | 18 | | 28 | 100 | | 105 | 40 | | 40 | 65 | | 35 | 120 | |
| 20 | 29 | 32 | | 40 | 25 | | 87 | 80 | | 30 | 22 | | 22 | 25 | | 40 | 40 | |
| 21 | 29 | 70 | | 48 | 17 | | 120 | 40 | | 150 | 100 | | 30 | 45 | | 190 | 120 | |
| 22 | 29 | 26 | | 34 | 10 | | 70 | 180 | | 180 | 60 | | 50 | 35 | | 40 | 80 | |
| 23 | 45 | 67 | | 60 | 22 | | 70 | 28 | | 50 | 105 | | 30 | 85 | | 90 | 75 | |
| 24 | 35 | 63 | | 27 | 12 | | 40 | 90 | | 125 | 80 | | 38 | 80 | | 50 | 110 | |
| 25 | 50 | 25 | | 32 | 17 | | 180 | 140 | | 140 | 45 | | 80 | 35 | | 100 | 135 | |
| 26 | 35 | 30 | | 32 | 32 | | 55 | 120 | | 120 | 100 | | 35 | 35 | | 150 | 105 | |
| 27 | 32 | 29 | | 18 | 14 | | 120 | 20 | | 65 | 70 | | 25 | 45 | | 70 | 90 | |
| 28 | 35 | 115 | | 20 | 27 | | 30 | 150 | | 130 | 25 | | 50 | 80 | | 90 | 100 | |
| 29 | 52 | 70 | | 15 | 11 | | 85 | 80 | | 45 | 100 | | 110 | 45 | | 95 | 35 | |
| 30 | 75 | 39 | | 35 | 16 | | 150 | 70 | | 60 | 80 | | 19 | 12 | | 45 | 40 | |
| 31 | 55 | 70 | | 20 | 22 | | 80 | 60 | | 150 | 70 | | 65 | 150 | | 60 | 80 | |
| 32 | 43 | 35 | | 20 | 36 | | 45 | 85 | | 100 | 30 | | 40 | 25 | | 60 | 50 | |
| 33 | 24 | 41 | | 30 | 22 | | 80 | 70 | | 95 | 80 | | 65 | 50 | | 95 | 30 | |
| 34 | 40 | 27 | | 60 | 160 | | 20 | 140 | | 90 | 60 | | 125 | 100 | | 100 | 80 | |
| 35 | 36 | 37 | | 60 | 29 | | 55 | 105 | | 80 | 80 | | 30 | 90 | | 55 | 80 | |
| 36 | 44 | 25 | | 50 | 18 | | 55 | 110 | | 35 | 75 | | 28 | 40 | | 50 | 30 | |
| 37 | 34 | 20 | | 30 | 30 | | 46 | 110 | | 135 | 120 | | 78 | 140 | | 130 | 260 | |
| 38 | 25 | 79 | | 29 | 17 | | 65 | 85 | | 60 | 95 | | 80 | 28 | | 70 | 65 | |
| 39 | 26 | 10 | | 48 | 60 | | 52 | 70 | | 110 | 65 | | 40 | 65 | | 80 | 150 | |
| 40 | 23 | 25 | | 30 | 27 | | 100 | 32 | | 40 | 115 | | 50 | 40 | | 80 | 100 | |
| 41 | 17 | 80 | | 37 | 90 | | 65 | 120 | | 95 | 85 | | 35 | 90 | | 120 | 65 | |
| 42 | 39 | 45 | | 50 | 27 | | 30 | 120 | | 60 | 120 | | 22 | 40 | | 70 | 80 | |
| 43 | 16 | 56 | | 41 | 31 | | 140 | 50 | | 22 | 80 | | 37 | 35 | | 80 | 85 | |
| 44 | 32 | 30 | | 37 | 55 | | 95 | 120 | | 55 | 90 | | 30 | 60 | | 45 | 135 | |
| 45 | 29 | 60 | | 48 | 50 | | 75 | 130 | | 110 | 85 | | 21 | 30 | | 75 | 80 | |
| 46 | 24 | 25 | | 13 | 51 | | 115 | 130 | | 50 | 110 | | 30 | 85 | | 60 | 60 | |
| 47 | 49 | 25 | | 12 | 32 | | 43 | 80 | | 40 | 75 | | 60 | 55 | | 80 | 95 | |
| 48 | 39 | 50 | | 32 | 50 | | 37 | 150 | | 30 | 100 | | 35 | 60 | | 105 | 105 | |
| 49 | 32 | 48 | | 35 | 40 | | 52 | 140 | | 25 | 40 | | 20 | 110 | | 120 | 75 | |
| 50 | 30 | 150 | | 17 | 37 | | 70 | 55 | | 130 | 80 | | 55 | 70 | | 85 | 75 | |

**Table C2: Continued.**

| Count | US-08 MC | | | US-06 RB | | | US-04 RB | | | US-02 RB | | | US-01 RB | | | DS-02 MC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 20 | 40 | 0.6 | 45 | 85 | 0.06 | 28 | 30 | 0.06 | 90 | 25 | 0.5 | 90 | 55 | 0.06 | 65 | 52 | 1 |
| 2 | 10 | 40 | 0.8 | 50 | 150 | 0.1 | 35 | 50 | 0.1 | 80 | 65 | 1 | 120 | 90 | 0.1 | 30 | 70 | 3 |
| 3 | 50 | 50 | 1 | 100 | 80 | 0.2 | 75 | 25 | 0.2 | 15 | 90 | 3 | 55 | 80 | 0.2 | 46 | 95 | 5 |
| 4 | 30 | 18 | 3 | 60 | 85 | 0.4 | 60 | 24 | 0.4 | 70 | 45 | 7 | 30 | 85 | 0.4 | 40 | 60 | 11 |
| 5 | 45 | 20 | 0.3 | 70 | 90 | 3 | 40 | 32 | 0.5 | 60 | 40 | 4 | 55 | 25 | 1 | 62 | 75 | |
| 6 | 20 | 30 | | 20 | 90 | | 70 | 70 | 1 | 30 | 50 | | 50 | 70 | 5 | 60 | 60 | |
| 7 | 85 | 30 | | 130 | 15 | | 110 | 55 | | 45 | 95 | | 65 | 40 | | 86 | 46 | |
| 8 | 12 | 30 | | 65 | 120 | | 100 | 12 | | 50 | 105 | | 55 | 30 | | 90 | 65 | |
| 9 | 35 | 40 | | 70 | 27 | | 40 | 35 | | 58 | 115 | | 43 | 35 | | 50 | 76 | |
| 10 | 25 | 45 | | 75 | 100 | | 30 | 170 | | 48 | 75 | | 27 | 43 | | 70 | 92 | |
| 11 | 25 | 10 | | 60 | 115 | | 80 | 40 | | 100 | 100 | | 38 | 40 | | 72 | 82 | |
| 12 | 32 | 60 | | 110 | 50 | | 18 | 45 | | 45 | 105 | | 40 | 95 | | 82 | 95 | |
| 13 | 35 | 60 | | 95 | 27 | | 28 | 120 | | 30 | 90 | | 75 | 45 | | 28 | 70 | |
| 14 | 70 | 40 | | 150 | 14 | | 50 | 40 | | 40 | 115 | | 40 | 75 | | 32 | 62 | |
| 15 | 37 | 35 | | 75 | 30 | | 16 | 40 | | 32 | 45 | | 57 | 72 | | 26 | 75 | |
| 16 | 26 | 25 | | 40 | 27 | | 45 | 47 | | 35 | 40 | | 53 | 43 | | 52 | 36 | |
| 17 | 40 | 20 | | 60 | 48 | | 90 | 75 | | 65 | 32 | | 115 | 44 | | 66 | 53 | |
| 18 | 26 | 45 | | 50 | 115 | | 18 | 30 | | 40 | 20 | | 100 | 75 | | 97 | 86 | |
| 19 | 43 | 120 | | 65 | 15 | | 52 | 8 | | 52 | 40 | | 28 | 100 | | 82 | 39 | |
| 20 | 55 | 55 | | 80 | 50 | | 36 | 48 | | 40 | 32 | | 80 | 70 | | 36 | 60 | |
| 21 | 60 | 55 | | 100 | 37 | | 47 | 65 | | 60 | 122 | | 55 | 60 | | 29 | 47 | |
| 22 | 20 | 45 | | 50 | 110 | | 17 | 85 | | 75 | 21 | | 115 | 80 | | 70 | 86 | |
| 23 | 40 | 40 | | 110 | 40 | | 38 | 80 | | 80 | 90 | | 105 | 40 | | 25 | 115 | |
| 24 | 35 | 100 | | 110 | 50 | | 52 | 70 | | 47 | 50 | | 70 | 45 | | 76 | 82 | |
| 25 | 18 | 20 | | 120 | 90 | | 18 | 100 | | 75 | 26 | | 45 | 90 | | 85 | 70 | |
| 26 | 55 | 60 | | 130 | 95 | | 44 | 30 | | 95 | 25 | | 90 | 80 | | 52 | 80 | |
| 27 | 25 | 40 | | 20 | 30 | | 22 | 100 | | 70 | 45 | | 110 | 110 | | 65 | 30 | |
| 28 | 25 | 100 | | 90 | 100 | | 95 | 120 | | 50 | 25 | | 90 | 24 | | 42 | 68 | |
| 29 | 23 | 42 | | 70 | 80 | | 80 | 20 | | 45 | 30 | | 33 | 45 | | 40 | 85 | |
| 30 | 85 | 40 | | 40 | 260 | | 70 | 55 | | 95 | 50 | | 85 | 85 | | 85 | 80 | |
| 31 | 95 | 19 | | 40 | 40 | | 15 | 30 | | 55 | 75 | | 55 | 90 | | 90 | 80 | |
| 32 | 32 | 22 | | 55 | 55 | | 24 | 89 | | 35 | 75 | | 45 | 60 | | 85 | 65 | |
| 33 | 20 | 32 | | 40 | 50 | | 70 | 26 | | 110 | 85 | | 47 | 50 | | 42 | 60 | |
| 34 | 35 | 25 | | 90 | 20 | | 49 | 30 | | 70 | 80 | | 70 | 60 | | 75 | 60 | |
| 35 | 26 | 30 | | 80 | 37 | | 40 | 50 | | 35 | 40 | | 62 | 40 | | 55 | 87 | |
| 36 | 19 | 40 | | 40 | 120 | | 32 | 95 | | 48 | 45 | | 90 | 100 | | 45 | 92 | |
| 37 | 37 | 35 | | 55 | 90 | | 72 | 25 | | 45 | 113 | | 35 | 40 | | 78 | 90 | |
| 38 | 36 | 30 | | 30 | 60 | | 24 | 115 | | 85 | 15 | | 35 | 42 | | 68 | 68 | |
| 39 | 20 | 28 | | 70 | 70 | | 38 | 25 | | 75 | 30 | | 48 | 33 | | 75 | 40 | |
| 40 | 29 | 45 | | 50 | 150 | | 20 | 40 | | 27 | 40 | | 115 | 64 | | 110 | 70 | |
| 41 | 29 | 40 | | 85 | 120 | | 85 | 110 | | 70 | 80 | | 30 | 50 | | 95 | 56 | |
| 42 | 30 | 120 | | 75 | 140 | | 20 | 50 | | 35 | 45 | | 60 | 38 | | 47 | 37 | |
| 43 | 45 | 38 | | 30 | 80 | | 100 | 50 | | 17 | 36 | | 23 | 35 | | 45 | 92 | |
| 44 | 40 | 120 | | 50 | 55 | | 32 | 50 | | 65 | 14 | | 70 | 95 | | 88 | 70 | |
| 45 | 45 | 42 | | 70 | 70 | | 30 | 100 | | 50 | 55 | | 27 | 75 | | 75 | 22 | |
| 46 | 70 | 40 | | 65 | 21 | | 29 | 48 | | 140 | 42 | | 40 | 35 | | 60 | 22 | |
| 47 | 40 | 36 | | 75 | 29 | | 20 | 100 | | 18 | 77 | | 80 | 50 | | 110 | 52 | |
| 48 | 120 | 32 | | 115 | 35 | | 150 | 260 | | 80 | 26 | | 75 | 48 | | 85 | 30 | |
| 49 | 70 | 18 | | 80 | 120 | | 10 | 55 | | 100 | 220 | | 25 | 78 | | 75 | 42 | |
| 50 | 40 | 28 | | 75 | 55 | | 110 | 55 | | 55 | 94 | | 60 | 70 | | 75 | 61 | |

**Table C2: Continued.**

| Count | DS-03 MC | | | DS-09 MC | | | DS-14 RB | | | DS14MC | | | DS-15 RB | | | DS-17 MC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 35 | 34 | 0.2 | 38 | 18 | 0.5 | 37 | 32 | 0.5 | 27 | 87 | 0.5 | 25 | 35 | 3 | 40 | 27 | 0.06 |
| 2 | 90 | 105 | 0.5 | 23 | 25 | 0.5 | 20 | 90 | 0.5 | 100 | 30 | 2 | 75 | 62 | 7 | 55 | 43 | 0.06 |
| 3 | 40 | 25 | 1 | 80 | 50 | 2 | 80 | 28 | 3 | 40 | 75 | 5 | 105 | 46 | 9 | 43 | 28 | 0.1 |
| 4 | 50 | 45 | 3 | 83 | 80 | 5 | 21 | 40 | 8 | 40 | 42 | 7 | 57 | 95 | 13 | 22 | 34 | 0.1 |
| 5 | 55 | 77 | 5 | 110 | 30 | 9 | 95 | 23 | 10 | 83 | 20 | 9 | 35 | 70 | 17 | 22 | 27 | 1 |
| 6 | 100 | 25 | | 46 | 36 | | 90 | 60 | | 42 | 55 | | 35 | 35 | | 40 | 18 | 0.5 |
| 7 | 27 | 90 | | 50 | 46 | | 58 | 10 | | 40 | 90 | | 110 | 60 | | 50 | 40 | 0.5 |
| 8 | 45 | 70 | | 90 | 29 | | 12 | 18 | | 40 | 48 | | 65 | 70 | | 34 | 90 | 0.06 |
| 9 | 70 | 72 | | 75 | 36 | | 19 | 16 | | 45 | 160 | | 120 | 55 | | 43 | 15 | 2 |
| 10 | 45 | 26 | | 120 | 55 | | 35 | 72 | | 35 | 130 | | 94 | 130 | | 52 | 61 | |
| 11 | 30 | 62 | | 26 | 26 | | 20 | 15 | | 190 | 25 | | 80 | 40 | | 34 | 26 | |
| 12 | 35 | 18 | | 55 | 30 | | 43 | 15 | | 70 | 125 | | 140 | 85 | | 33 | 24 | |
| 13 | 30 | 85 | | 29 | 28 | | 32 | 77 | | 37 | 25 | | 100 | 50 | | 65 | 145 | |
| 14 | 80 | 80 | | 105 | 60 | | 46 | 18 | | 69 | 57 | | 115 | 55 | | 55 | 50 | |
| 15 | 40 | 55 | | 55 | 50 | | 65 | 32 | | 27 | 18 | | 44 | 38 | | 56 | 50 | |
| 16 | 75 | 55 | | 46 | 70 | | 90 | 72 | | 90 | 160 | | 50 | 40 | | 27 | 117 | |
| 17 | 50 | 65 | | 100 | 36 | | 60 | 35 | | 75 | 40 | | 115 | 20 | | 42 | 44 | |
| 18 | 25 | 38 | | 105 | 110 | | 42 | 28 | | 23 | 26 | | 75 | 60 | | 26 | 45 | |
| 19 | 57 | 60 | | 55 | 100 | | 75 | 70 | | 60 | 140 | | 42 | 30 | | 25 | 45 | |
| 20 | 70 | 80 | | 85 | 50 | | 75 | 48 | | 95 | 90 | | 57 | 37 | | 30 | 48 | |
| 21 | 60 | 49 | | 110 | 35 | | 70 | 13 | | 39 | 45 | | 75 | 110 | | 18 | 50 | |
| 22 | 60 | 52 | | 60 | 22 | | 42 | 17 | | 70 | 71 | | 88 | 35 | | 26 | 30 | |
| 23 | 30 | 75 | | 30 | 105 | | 26 | 27 | | 55 | 56 | | 70 | 70 | | 47 | 45 | |
| 24 | 90 | 21 | | 85 | 100 | | 63 | 25 | | 140 | 24 | | 170 | 78 | | 17 | 19 | |
| 25 | 75 | 16 | | 60 | 25 | | 75 | 60 | | 78 | 84 | | 54 | 80 | | 18 | 29 | |
| 26 | 40 | 50 | | 54 | 95 | | 54 | 25 | | 35 | 102 | | 45 | 60 | | 28 | 36 | |
| 27 | 90 | 24 | | 44 | 90 | | 22 | 45 | | 87 | 56 | | 100 | 65 | | 40 | 80 | |
| 28 | 38 | 27 | | 35 | 90 | | 72 | 27 | | 25 | 34 | | 75 | 48 | | 40 | 50 | |
| 29 | 65 | 42 | | 38 | 110 | | 74 | 21 | | 130 | 105 | | 32 | 29 | | 42 | 50 | |
| 30 | 70 | 70 | | 50 | 57 | | 22 | 85 | | 190 | 70 | | 42 | 74 | | 70 | 45 | |
| 31 | 36 | 43 | | 80 | 64 | | 25 | 122 | | 36 | 66 | | 35 | 105 | | 26 | 40 | |
| 32 | 16 | 32 | | 50 | 47 | | 45 | 64 | | 65 | 78 | | 50 | 100 | | 60 | 27 | |
| 33 | 42 | 22 | | 100 | 44 | | 60 | 66 | | 19 | 76 | | 68 | 50 | | 25 | 26 | |
| 34 | 30 | 79 | | 86 | 76 | | 58 | 25 | | 31 | 69 | | 28 | 40 | | 30 | 40 | |
| 35 | 70 | 76 | | 120 | 36 | | 32 | 60 | | 41 | 80 | | 55 | 45 | | 35 | 50 | |
| 36 | 35 | 25 | | 32 | 35 | | 37 | 47 | | 52 | 34 | | 150 | 70 | | 110 | 40 | |
| 37 | 60 | 10 | | 52 | 56 | | 44 | 43 | | 38 | 20 | | 25 | 76 | | 40 | 25 | |
| 38 | 105 | 75 | | 22 | 36 | | 55 | 50 | | 78 | 47 | | 37 | 100 | | 110 | 48 | |
| 39 | 38 | 80 | | 16 | 40 | | 90 | 14 | | 17 | 27 | | 40 | 30 | | 60 | 25 | |
| 40 | 47 | 65 | | 79 | 90 | | 45 | 35 | | 24 | 60 | | 56 | 85 | | 100 | 30 | |
| 41 | 80 | 70 | | 24 | 130 | | 25 | 36 | | 26 | 78 | | 48 | 46 | | 50 | 35 | |
| 42 | 17 | 65 | | 90 | 110 | | 92 | 56 | | 50 | 73 | | 90 | 48 | | 40 | 26 | |
| 43 | 18 | 37 | | 95 | 85 | | 68 | 86 | | 240 | 53 | | 46 | 40 | | 42 | 24 | |
| 44 | 90 | 50 | | 37 | 110 | | 46 | 80 | | 52 | 40 | | 120 | 85 | | 30 | 35 | |
| 45 | 60 | 74 | | 58 | 70 | | 60 | 56 | | 70 | 17 | | 36 | 35 | | 50 | 70 | |
| 46 | 85 | 105 | | 12 | 140 | | 80 | 52 | | 40 | 23 | | 30 | 100 | | 35 | 47 | |
| 47 | 30 | 45 | | 105 | 130 | | 52 | 60 | | 40 | 20 | | 36 | 45 | | 100 | 55 | |
| 48 | 80 | 47 | | 115 | 70 | | 82 | 15 | | 15 | 33 | | 50 | 68 | | 65 | 35 | |
| 49 | 40 | 70 | | 40 | 90 | | 80 | 60 | | 45 | 70 | | 52 | 30 | | 30 | 40 | |
| 50 | 30 | 50 | | 45 | 34 | | 25 | 66 | | 35 | 87 | | 70 | 54 | | 35 | 100 | |

**Table C2: Continued.**

| Count | DS-18 RB | | | DS-19 LB | | | DS-20 MC | | | DS-21 MC | | | DS-22 RB | | | DS-24 MC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 47 | 48 | 1 | 30 | 100 | 0.1 | 98 | 67 | 0.06 | 70 | 42 | 0.06 | 100 | 38 | 0.06 | 40 | 60 | 0.3 |
| 2 | 34 | 98 | 2 | 20 | 105 | 0.2 | 76 | 50 | 0.9 | 85 | 58 | 0.9 | 75 | 100 | 0.06 | 15 | 20 | 0.7 |
| 3 | 105 | 27 | 3 | 50 | 35 | 0.3 | 39 | 55 | 1 | 95 | 37 | 1 | 60 | 45 | 0.1 | 25 | 20 | 1.3 |
| 4 | 37 | 75 | 9 | 80 | 60 | 3 | 65 | 56 | 3 | 70 | 40 | 3 | 34 | 78 | 0.1 | 10 | 57 | 1 |
| 5 | 45 | 35 | 12 | 81 | 105 | 14 | 34 | 102 | 21 | 50 | 57 | 7 | 70 | 40 | 10 | 20 | 15 | 5 |
| 6 | 52 | 100 | | 73 | 85 | 7 | 77 | 95 | 12 | 39 | 80 | 12 | 95 | 26 | 0.4 | 22 | 58 | |
| 7 | 40 | 85 | | 22 | 65 | | 30 | 110 | | 100 | 105 | | 40 | 75 | 0.4 | 18 | 67 | |
| 8 | 55 | 78 | | 88 | 64 | | 35 | 85 | | 75 | 30 | | 80 | 56 | 0.8 | 28 | 14 | |
| 9 | 52 | 45 | | 58 | 100 | | 75 | 48 | | 50 | 85 | | 22 | 110 | 1.5 | 10 | 20 | |
| 10 | 65 | 50 | | 57 | 70 | | 75 | 42 | | 44 | 105 | | 85 | 45 | | 50 | 24 | |
| 11 | 85 | 90 | | 70 | 55 | | 45 | 100 | | 26 | 105 | | 55 | 100 | | 37 | 37 | |
| 12 | 85 | 100 | | 100 | 120 | | 50 | 68 | | 52 | 42 | | 60 | 36 | | 10 | 50 | |
| 13 | 100 | 122 | | 135 | 27 | | 48 | 65 | | 55 | 92 | | 85 | 71 | | 14 | 16 | |
| 14 | 73 | 27 | | 17 | 68 | | 45 | 95 | | 82 | 37 | | 110 | 42 | | 12 | 55 | |
| 15 | 60 | 25 | | 80 | 140 | | 42 | 92 | | 57 | 40 | | 60 | 40 | | 15 | 53 | |
| 16 | 85 | 107 | | 35 | 55 | | 35 | 120 | | 32 | 57 | | 45 | 95 | | 14 | 75 | |
| 17 | 56 | 73 | | 90 | 54 | | 48 | 50 | | 56 | 32 | | 46 | 115 | | 14 | 24 | |
| 18 | 120 | 75 | | 72 | 85 | | 55 | 55 | | 45 | 29 | | 25 | 68 | | 8 | 28 | |
| 19 | 42 | 78 | | 28 | 80 | | 100 | 21 | | 65 | 105 | | 80 | 87 | | 35 | 40 | |
| 20 | 75 | 27 | | 42 | 80 | | 62 | 67 | | 72 | 110 | | 36 | 87 | | 40 | 10 | |
| 21 | 17 | 35 | | 70 | 40 | | 56 | 77 | | 40 | 100 | | 56 | 80 | | 12 | 40 | |
| 22 | 45 | 55 | | 50 | 60 | | 40 | 87 | | 40 | 90 | | 108 | 39 | | 18 | 32 | |
| 23 | 100 | 19 | | 110 | 60 | | 58 | 100 | | 70 | 100 | | 40 | 110 | | 10 | 110 | |
| 24 | 78 | 60 | | 50 | 54 | | 66 | 56 | | 39 | 20 | | 84 | 64 | | 45 | 44 | |
| 25 | 70 | 32 | | 100 | 40 | | 75 | 70 | | 22 | 68 | | 90 | 50 | | 24 | 75 | |
| 26 | 55 | 50 | | 135 | 53 | | 78 | 32 | | 76 | 170 | | 90 | 92 | | 6 | 30 | |
| 27 | 85 | 20 | | 130 | 115 | | 98 | 70 | | 32 | 52 | | 100 | 92 | | 29 | 12 | |
| 28 | 29 | 84 | | 80 | 30 | | 42 | 72 | | 40 | 46 | | 44 | 76 | | 17 | 15 | |
| 29 | 78 | 42 | | 150 | 50 | | 55 | 73 | | 65 | 34 | | 64 | 45 | | 28 | 30 | |
| 30 | 40 | 45 | | 100 | 90 | | 25 | 50 | | 25 | 48 | | 20 | 82 | | 15 | 20 | |
| 31 | 38 | 100 | | 120 | 36 | | 90 | 80 | | 80 | 24 | | 37 | 65 | | 15 | 30 | |
| 32 | 72 | 80 | | 90 | 37 | | 105 | 78 | | 80 | 22 | | 120 | 40 | | 16 | 25 | |
| 33 | 75 | 82 | | 75 | 35 | | 80 | 65 | | 80 | 62 | | 85 | 57 | | 58 | 19 | |
| 34 | 60 | 45 | | 90 | 50 | | 110 | 77 | | 42 | 65 | | 68 | 66 | | 28 | 22 | |
| 35 | 40 | 45 | | 30 | 45 | | 50 | 95 | | 92 | 60 | | 95 | 67 | | 20 | 20 | |
| 36 | 53 | 85 | | 90 | 25 | | 50 | 50 | | 35 | 100 | | 87 | 68 | | 42 | 38 | |
| 37 | 58 | 50 | | 50 | 62 | | 60 | 60 | | 65 | 55 | | 28 | 76 | | 5 | 39 | |
| 38 | 68 | 40 | | 60 | 115 | | 45 | 160 | | 70 | 46 | | 70 | 60 | | 23 | 55 | |
| 39 | 82 | 105 | | 50 | 80 | | 90 | 55 | | 45 | 106 | | 87 | 45 | | 25 | 65 | |
| 40 | 79 | 54 | | 35 | 57 | | 65 | 30 | | 70 | 50 | | 56 | 90 | | 20 | 48 | |
| 41 | 55 | 25 | | 40 | 55 | | 64 | 75 | | 52 | 96 | | 95 | 80 | | 15 | 10 | |
| 42 | 68 | 40 | | 70 | 36 | | 75 | 90 | | 53 | 115 | | 75 | 95 | | 34 | 15 | |
| 43 | 85 | 60 | | 110 | 24 | | 50 | 38 | | 60 | 130 | | 94 | 90 | | 63 | 70 | |
| 44 | 39 | 55 | | 52 | 27 | | 47 | 160 | | 37 | 100 | | 45 | 37 | | 18 | 25 | |
| 45 | 45 | 56 | | 49 | 82 | | 30 | 85 | | 140 | 70 | | 110 | 72 | | 43 | 29 | |
| 46 | 68 | 45 | | 44 | 25 | | 40 | 80 | | 105 | 90 | | 62 | 85 | | 28 | 30 | |
| 47 | 95 | 32 | | 52 | 120 | | 25 | 85 | | 24 | 90 | | 80 | 57 | | 34 | 20 | |
| 48 | 125 | 57 | | 45 | 20 | | 100 | 100 | | 23 | 90 | | 100 | 92 | | 19 | 43 | |
| 49 | 135 | 80 | | 35 | 80 | | 45 | 65 | | 58 | 75 | | 110 | 34 | | 35 | 38 | |
| 50 | 75 | 90 | | 40 | 68 | | 48 | 100 | | 115 | 18 | | 95 | 70 | | 30 | 29 | |

**Table C2: Continued.**

| Count | DS-25 MC | | | DS-26 MC | | | DS-27 MC | | | DS-28 MC | | | DS-29 MC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 120 | 32 | 0.2 | 24 | 37 | 0.06 | 24 | 35 | 0.06 | 54 | 39 | 0.06 | 20 | 47 | 0.06 |
| 2 | 39 | 25 | 0.7 | 35 | 22 | 0.1 | 45 | 52 | 0.1 | 30 | 30 | 0.1 | 30 | 35 | 0.1 |
| 3 | 65 | 15 | 3 | 25 | 32 | 0.2 | 50 | 40 | 0.2 | 55 | 65 | 0.2 | 22 | 18 | 0.2 |
| 4 | 22 | 50 | 7 | 40 | 32 | 1 | 17 | 28 | 0.6 | 54 | 44 | 8 | 43 | 37 | 0.4 |
| 5 | 70 | 42 | 15 | 70 | 39 | 10 | 14 | 22 | 0.9 | 40 | 56 | 9 | 20 | 25 | 5 |
| 6 | 34 | 49 | 10 | 60 | 17 | 0.45 | 38 | 32 | 0.7 | 32 | 37 | 5 | 36 | 26 | 2 |
| 7 | 34 | 85 | | 28 | 25 | 0.7 | 35 | 36 | 5 | 28 | 48 | | 18 | 30 | 0.1 |
| 8 | 20 | 17 | | 40 | 10 | 4 | 32 | 88 | | 70 | 47 | | 24 | 54 | |
| 9 | 42 | 80 | | 32 | 13 | | 100 | 65 | | 40 | 47 | | 60 | 40 | |
| 10 | 85 | 70 | | 26 | 68 | | 68 | 115 | | 35 | 22 | | 25 | 35 | |
| 11 | 20 | 32 | | 18 | 12 | | 12 | 77 | | 36 | 24 | | 40 | 30 | |
| 12 | 55 | 62 | | 31 | 32 | | 46 | 32 | | 55 | 38 | | 18 | 40 | |
| 13 | 45 | 27 | | 17 | 46 | | 71 | 25 | | 55 | 68 | | 12 | 38 | |
| 14 | 90 | 39 | | 65 | 32 | | 40 | 54 | | 60 | 40 | | 32 | 34 | |
| 15 | 26 | 34 | | 40 | 40 | | 65 | 96 | | 52 | 30 | | 35 | 40 | |
| 16 | 20 | 42 | | 80 | 28 | | 22 | 35 | | 20 | 32 | | 11 | 7 | |
| 17 | 19 | 52 | | 70 | 10 | | 84 | 90 | | 51 | 33 | | 14 | 14 | |
| 18 | 20 | 40 | | 55 | 36 | | 70 | 56 | | 86 | 50 | | 24 | 28 | |
| 19 | 60 | 55 | | 16 | 22 | | 130 | 95 | | 25 | 46 | | 20 | 25 | |
| 20 | 45 | 110 | | 52 | 24 | | 54 | 45 | | 60 | 57 | | 26 | 10 | |
| 21 | 16 | 56 | | 27 | 37 | | 90 | 35 | | 48 | 45 | | 34 | 13 | |
| 22 | 56 | 60 | | 32 | 86 | | 50 | 60 | | 45 | 22 | | 13 | 58 | |
| 23 | 70 | 45 | | 60 | 74 | | 55 | 57 | | 35 | 40 | | 10 | 13 | |
| 24 | 67 | 80 | | 45 | 37 | | 86 | 160 | | 55 | 14 | | 11 | 40 | |
| 25 | 140 | 25 | | 70 | 88 | | 48 | 32 | | 50 | 43 | | 8 | 23 | |
| 26 | 34 | 90 | | 22 | 25 | | 102 | 75 | | 30 | 32 | | 19 | 30 | |
| 27 | 57 | 75 | | 32 | 12 | | 76 | 49 | | 37 | 40 | | 42 | 28 | |
| 28 | 56 | 55 | | 65 | 19 | | 125 | 40 | | 30 | 57 | | 16 | 18 | |
| 29 | 19 | 60 | | 30 | 60 | | 67 | 38 | | 30 | 50 | | 35 | 17 | |
| 30 | 60 | 40 | | 52 | 30 | | 30 | 73 | | 62 | 18 | | 34 | 15 | |
| 31 | 38 | 65 | | 80 | 46 | | 22 | 60 | | 38 | 40 | | 7 | 10 | |
| 32 | 39 | 55 | | 55 | 32 | | 57 | 65 | | 22 | 54 | | 12 | 35 | |
| 33 | 36 | 65 | | 16 | 12 | | 21 | 74 | | 34 | 42 | | 47 | 13 | |
| 34 | 25 | 40 | | 57 | 22 | | 30 | 80 | | 46 | 54 | | 22 | 11 | |
| 35 | 35 | 24 | | 40 | 12 | | 50 | 59 | | 30 | 54 | | 38 | 43 | |
| 36 | 27 | 100 | | 38 | 95 | | 25 | 50 | | 32 | 42 | | 43 | 5 | |
| 37 | 29 | 75 | | 57 | 42 | | 24 | 33 | | 18 | 47 | | 33 | 35 | |
| 38 | 44 | 20 | | 45 | 20 | | 30 | 25 | | 42 | 18 | | 17 | 35 | |
| 39 | 57 | 67 | | 50 | 28 | | 80 | 110 | | 44 | 55 | | 8 | 26 | |
| 40 | 45 | 89 | | 60 | 40 | | 48 | 25 | | 20 | 50 | | 34 | 28 | |
| 41 | 26 | 42 | | 48 | 72 | | 40 | 35 | | 42 | 54 | | 22 | 14 | |
| 42 | 35 | 80 | | 68 | 24 | | 19 | 140 | | 46 | 50 | | 18 | 38 | |
| 43 | 37 | 74 | | 26 | 42 | | 65 | 40 | | 56 | 37 | | 35 | 35 | |
| 44 | 21 | 26 | | 29 | 19 | | 30 | 38 | | 35 | 42 | | 35 | 44 | |
| 45 | 52 | 47 | | 24 | 23 | | 22 | 84 | | 30 | 67 | | 43 | 12 | |
| 46 | 38 | 18 | | 35 | 72 | | 45 | 57 | | 50 | 48 | | 28 | 20 | |
| 47 | 57 | 50 | | 31 | 27 | | 16 | 62 | | 79 | 78 | | 45 | 14 | |
| 48 | 37 | 52 | | 80 | 40 | | 36 | 150 | | 75 | 24 | | 28 | 33 | |
| 49 | 75 | 34 | | 49 | 46 | | 26 | 40 | | 42 | 36 | | 20 | 25 | |
| 50 | 15 | 65 | | 38 | 27 | | 40 | 32 | | 40 | 62 | | 20 | 28 | |

**Table C2: Concluded.**

| Count | DS-30 RB | | | DS-31 MC | | | DS-31 MC2 | | | DS-32 MC | | | DS-33 LB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 55 | 36 | 0.5 | 105 | 37 | 0.06 | 35 | 25 | 0.06 | 75 | 20 | 0.06 | 52 | 110 | 0.06 |
| 2 | 80 | 46 | 1 | 40 | 76 | 0.5 | 38 | 58 | 0.2 | 28 | 105 | 0.08 | 110 | 70 | 0.8 |
| 3 | 10 | 36 | 2 | 58 | 60 | 0.7 | 19 | 30 | 0.5 | 72 | 45 | 0.9 | 140 | 30 | 0.1 |
| 4 | 30 | 27 | 3 | 50 | 48 | 0.2 | 29 | 55 | 0.7 | 95 | 30 | 0.2 | 75 | 35 | 8 |
| 5 | 22 | 27 | 5 | 45 | 65 | 7 | 75 | 70 | 4 | 36 | 12 | 12 | 110 | 45 | |
| 6 | 22 | 47 | | 28 | 40 | | 28.3 | 44 | 0.11 | 53 | 45 | 6 | 87 | 70 | |
| 7 | 48 | 77 | | 92 | 82 | | 35 | 14 | 0.3 | 65 | 81 | | 57 | 90 | |
| 8 | 55 | 24 | | 42 | 66 | | 43 | 18 | | 85 | 50 | | 65 | 45 | |
| 9 | 25 | 50 | | 40 | 52 | | 38 | 20 | | 70 | 42 | | 46 | 52 | |
| 10 | 80 | 70 | | 45 | 52 | | 45 | 10 | | 48 | 60 | | 95 | 110 | |
| 11 | 100 | 40 | | 40 | 66 | | 50 | 19 | | 39 | 29 | | 40 | 16 | |
| 12 | 70 | 80 | | 45 | 35 | | 40 | 22 | | 110 | 60 | | 95 | 42 | |
| 13 | 35 | 24 | | 60 | 76 | | 50 | 31 | | 72 | 90 | | 34 | 92 | |
| 14 | 65 | 52 | | 29 | 14 | | 13 | 13 | | 45 | 53 | | 130 | 58 | |
| 15 | 95 | 36 | | 82 | 65 | | 15 | 38 | | 117 | 140 | | 75 | 80 | |
| 16 | 18 | 34 | | 37 | 55 | | 37 | 23 | | 92 | 25 | | 85 | 45 | |
| 17 | 35 | 54 | | 110 | 87 | | 36 | 25 | | 97 | 125 | | 45 | 25 | |
| 18 | 22 | 38 | | 60 | 42 | | 14 | 12 | | 15 | 55 | | 40 | 52 | |
| 19 | 25 | 70 | | 65 | 42 | | 18 | 53 | | 90 | 60 | | 75 | 110 | |
| 20 | 50 | 40 | | 25 | 39 | | 49 | 22 | | 42 | 95 | | 120 | 98 | |
| 21 | 35 | 20 | | 58 | 56 | | 15 | 29 | | 115 | 18 | | 75 | 37 | |
| 22 | 15 | 70 | | 75 | 42 | | 65 | 30 | | 41 | 100 | | 110 | 42 | |
| 23 | 40 | 40 | | 72 | 110 | | 32 | 22 | | 47 | 105 | | 140 | 70 | |
| 24 | 60 | 20 | | 62 | 88 | | 39 | 40 | | 18 | 22 | | 50 | 25 | |
| 25 | 75 | 60 | | 44 | 160 | | 28 | 25 | | 24 | 72 | | 80 | 85 | |
| 26 | 85 | 47 | | 57 | 30 | | 32 | 28 | | 95 | 135 | | 50 | 22 | |
| 27 | 40 | 45 | | 65 | 130 | | 24 | 28 | | 98 | 32 | | 48 | 27 | |
| 28 | 30 | 26 | | 75 | 73 | | 18 | 27 | | 115 | 80 | | 95 | 105 | |
| 29 | 29 | 18 | | 100 | 35 | | 23 | 11 | | 110 | 72 | | 35 | 75 | |
| 30 | 17 | 28 | | 53 | 70 | | 22 | 36 | | 115 | 110 | | 55 | 190 | |
| 31 | 32 | 53 | | 17 | 87 | | 48 | 10 | | 106 | 28 | | 130 | 63 | |
| 32 | 30 | 34 | | 32 | 70 | | 37 | 44 | | 140 | 42 | | 62 | 50 | |
| 33 | 65 | 34 | | 52 | 60 | | 25 | 18 | | 42 | 45 | | 110 | 80 | |
| 34 | 20 | 65 | | 50 | 46 | | 13 | 47 | | 37 | 47 | | 55 | 41 | |
| 35 | 43 | 67 | | 82 | 36 | | 10 | 22 | | 29 | 42 | | 42 | 95 | |
| 36 | 25 | 21 | | 36 | 38 | | 38 | 29 | | 52 | 40 | | 57 | 32 | |
| 37 | 50 | 52 | | 73 | 120 | | 9 | 15 | | 122 | 28 | | 100 | 80 | |
| 38 | 28 | 49 | | 117 | 100 | | 25 | 40 | | 60 | 24 | | 70 | 40 | |
| 39 | 90 | 62 | | 75 | 54 | | 55 | 20 | | 81 | 90 | | 100 | 85 | |
| 40 | 12 | 29 | | 66 | 31 | | 25 | 50 | | 82 | 29 | | 70 | 74 | |
| 41 | 37 | 40 | | 60 | 23 | | 45 | 33 | | 75 | 22 | | 38 | 34 | |
| 42 | 56 | 24 | | 26 | 30 | | 25 | 46 | | 93 | 70 | | 40 | 72 | |
| 43 | 28 | 30 | | 74 | 29 | | 18 | 35 | | 19 | 52 | | 38 | 110 | |
| 44 | 40 | 20 | | 59 | 22 | | 10 | 24 | | 45 | 120 | | 75 | 50 | |
| 45 | 65 | 12 | | 16 | 35 | | 33 | 15 | | 29 | 25 | | 40 | 45 | |
| 46 | 90 | 17 | | 92 | 65 | | 11 | 40 | | 102 | 54 | | 80 | 52 | |
| 47 | 60 | 54 | | 66 | 50 | | 38 | 18 | | 55 | 18 | | 62 | 81 | |
| 48 | 46 | 36 | | 66 | 26 | | 36 | 26 | | 56 | 80 | | 52 | 190 | |
| 49 | 20 | 64 | | 37 | 70 | | 12 | 70 | | 65 | 35 | | 34 | 100 | |
| 50 | 60 | 65 | | 135 | 49 | | 18 | 47 | | 120 | 100 | | 60 | 70 | |

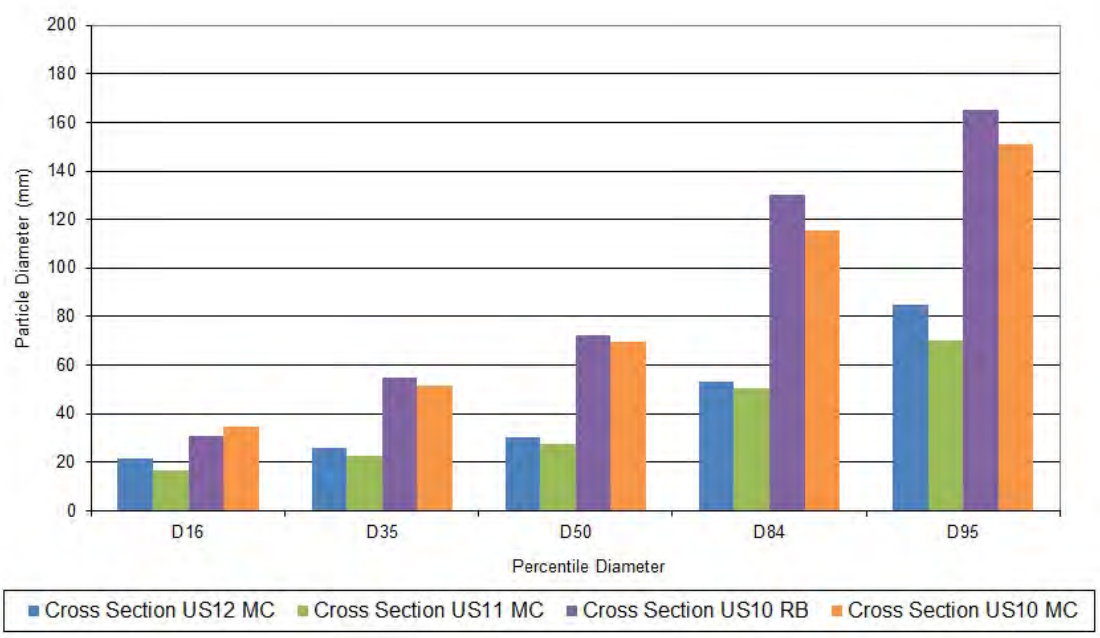



**Figure C1: Sample percentile diameter, Cross Sections US-12 MC, US-11 MC, US-10 RB, and US-10 MC, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

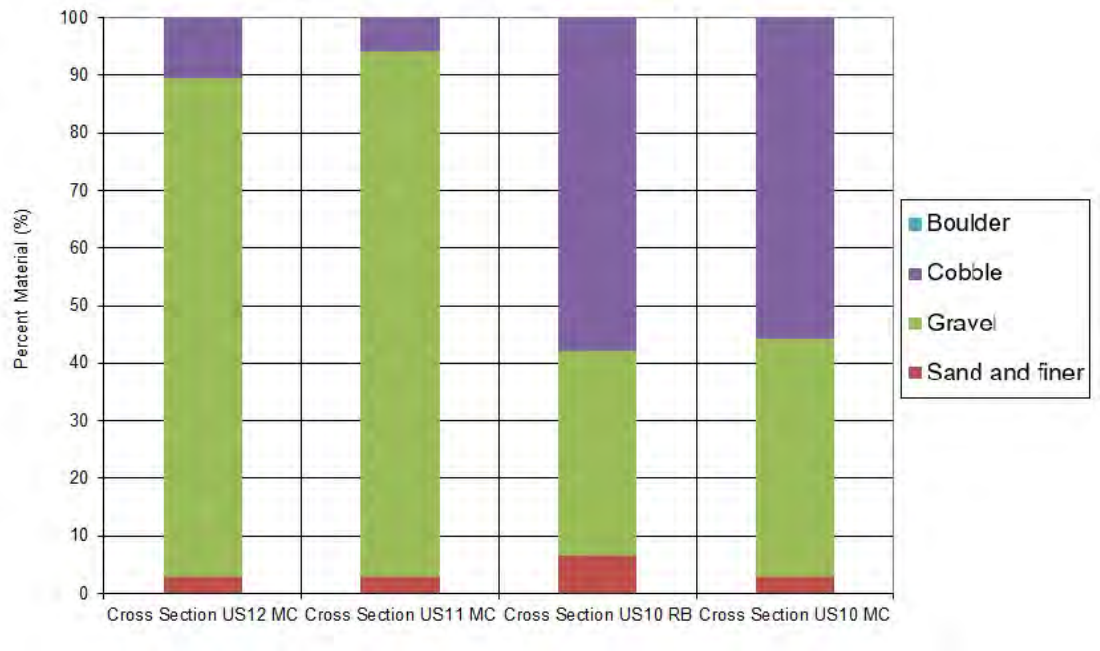



**Figure C2: Percent material by substrate type, Cross Sections US-12 MC, US-11 MC, US-10 RB, and US-10 MC, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

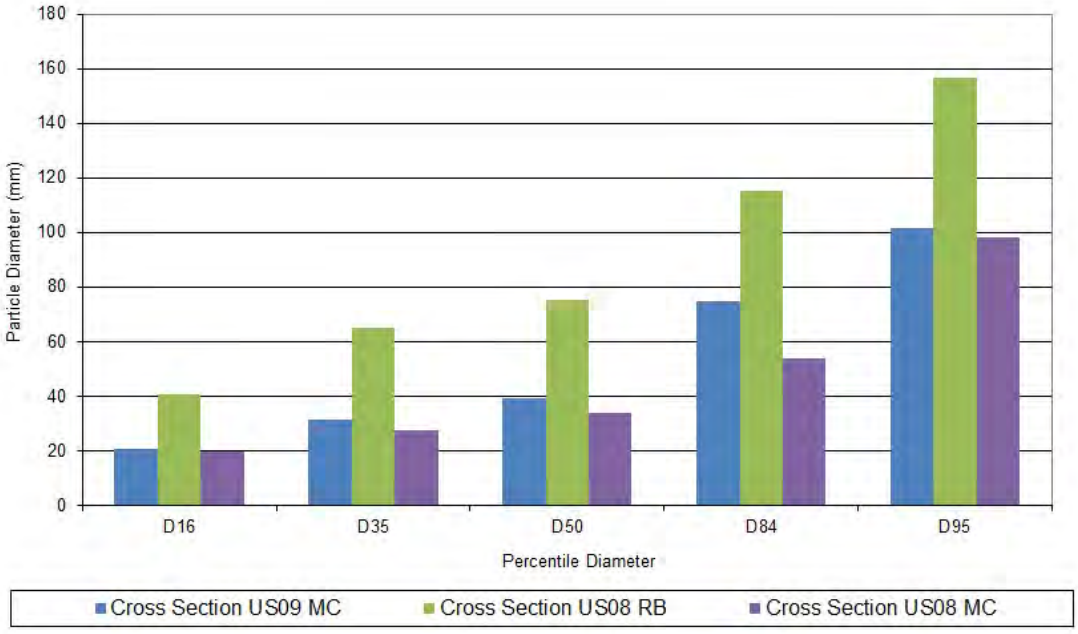



**Figure C3: Sample percentile diameter, Cross Sections US-09 MC, US-08 RB, and US-08 MC, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

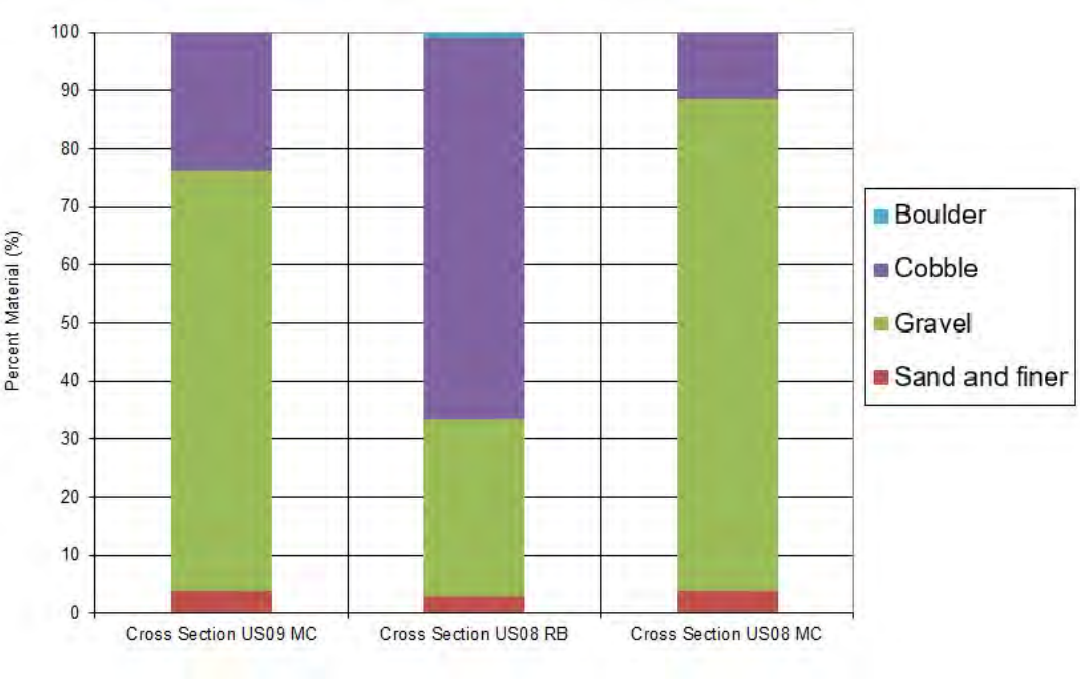



**Figure C4: Percent material by substrate type, Cross Sections US-09 MC, US-08 RB, and US-08 MC, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

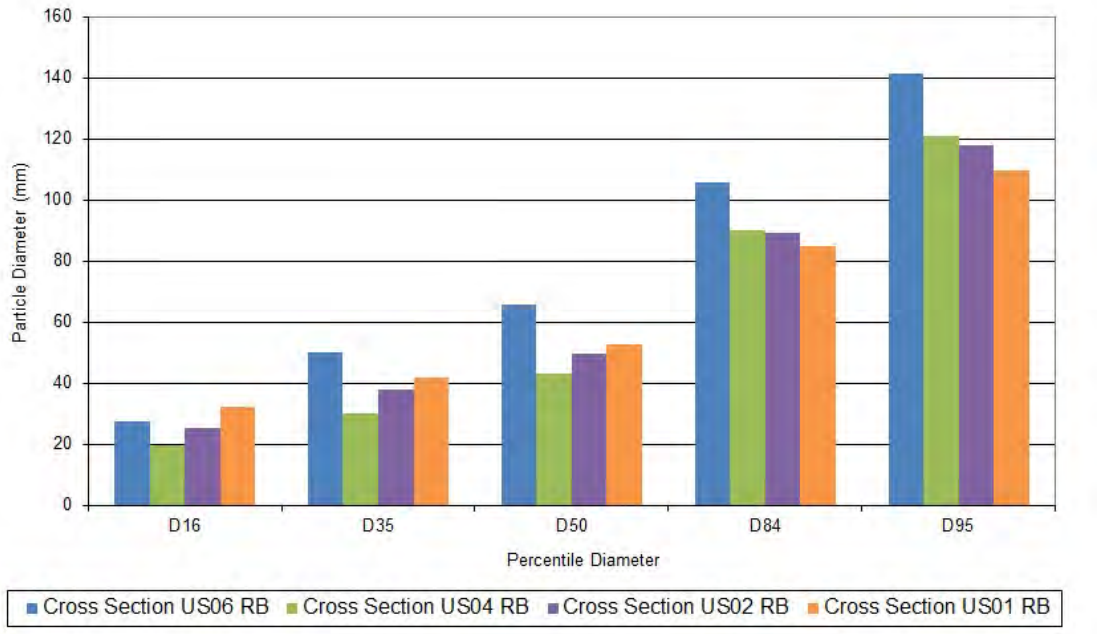



**Figure C5: Sample percentile diameter, Cross Sections US-06 RB, US-04 RB, US-02 RB, and US-01 RB, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

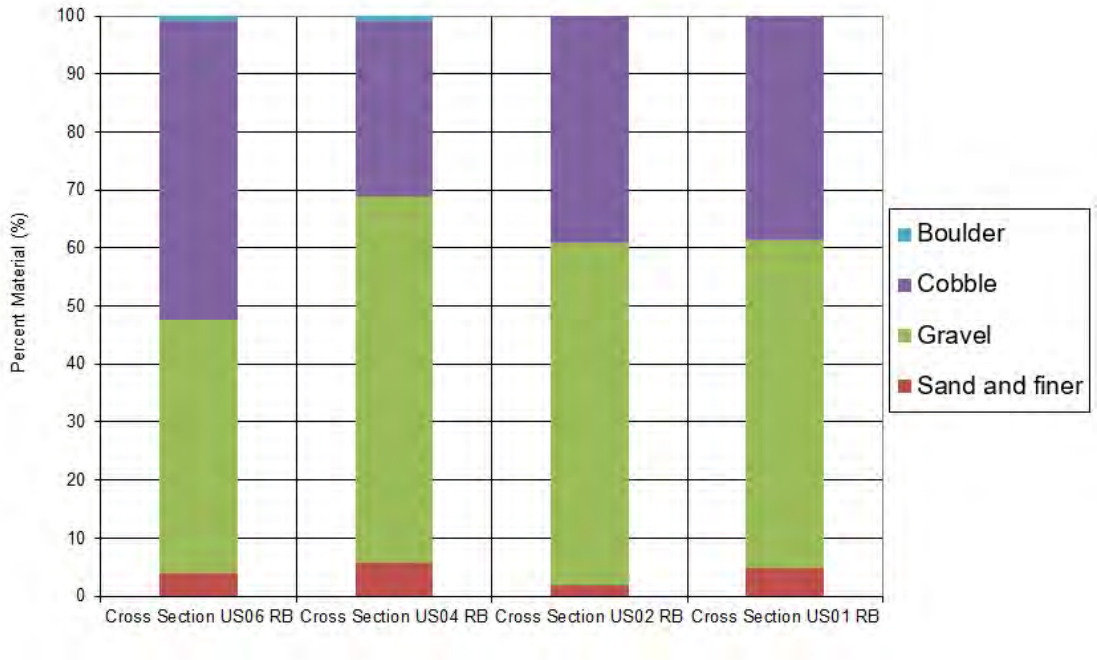



**Figure C6: Percent material by substrate type, Cross Sections US-06 RB, US-04 RB, US-02 RB, and US-01 RB, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

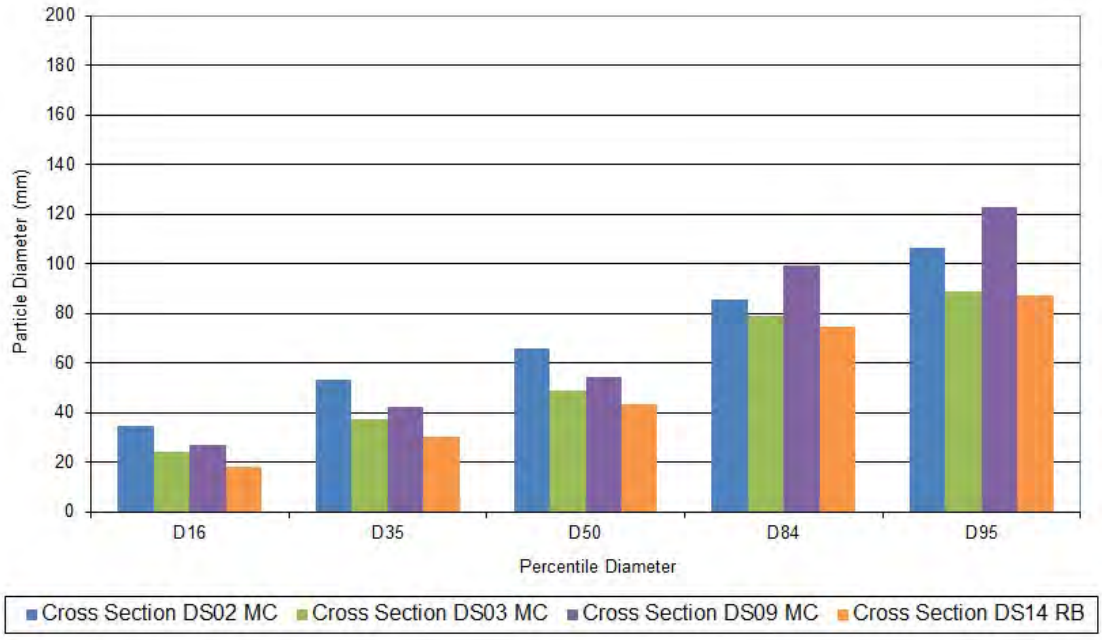



**Figure C7: Sample percentile diameter, Cross Sections DS-02 MC, DS-03 MC, DS-09 MC, and DS-14 RB, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

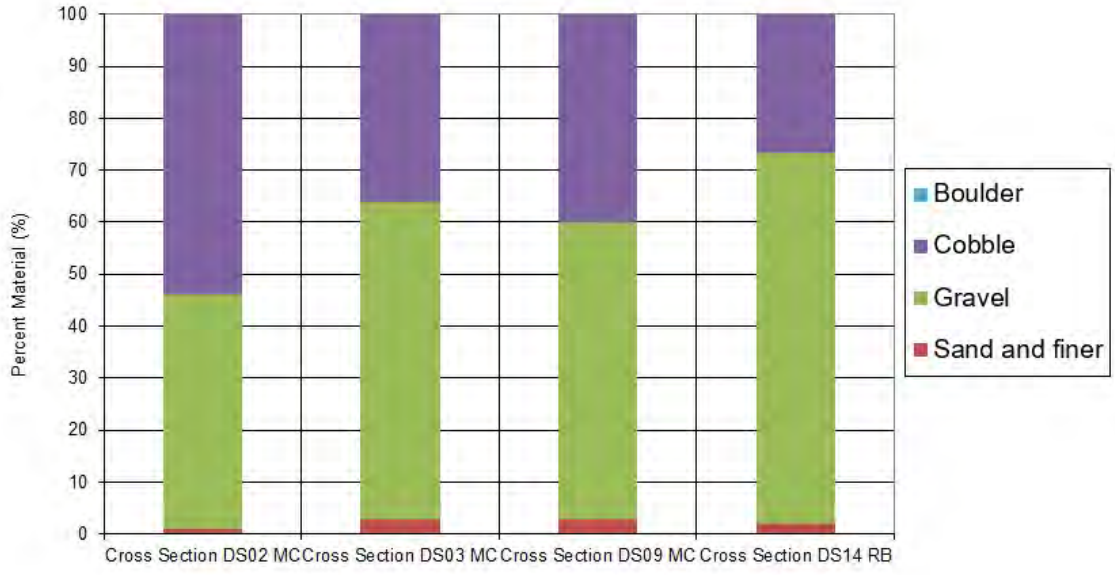



**Figure C8: Percent material by substrate type, Cross Sections DS-02 MC, DS-03 MC, DS-09 MC, and DS-14 RB, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

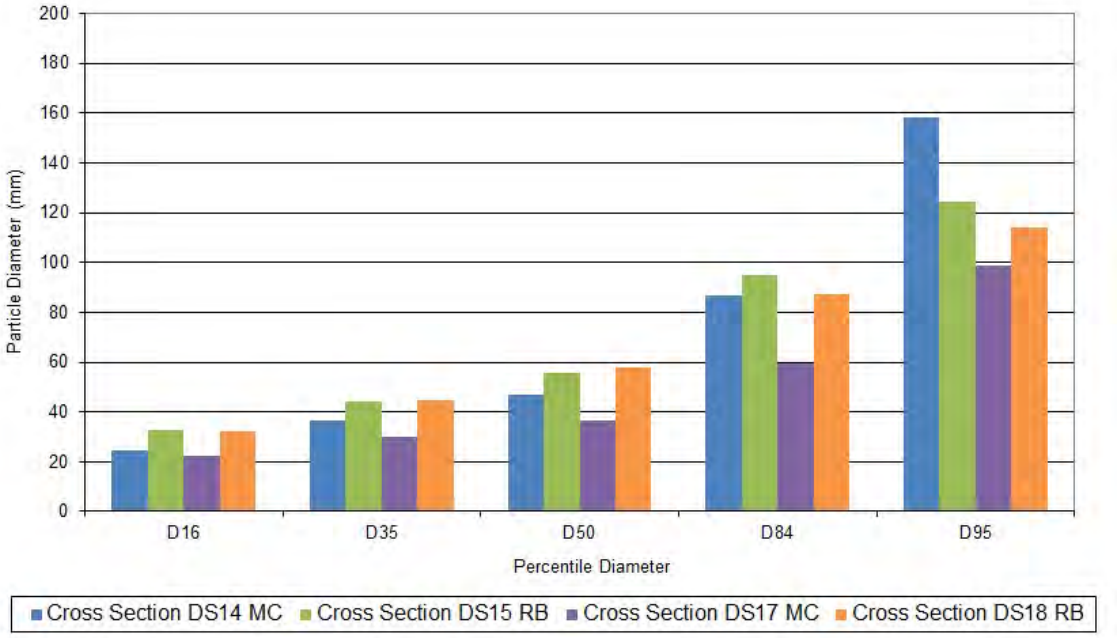



**Figure C9: Sample percentile diameter, Cross Sections DS-14 MC, DS-15 RB, DS-17 MC, and DS-18 RB, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

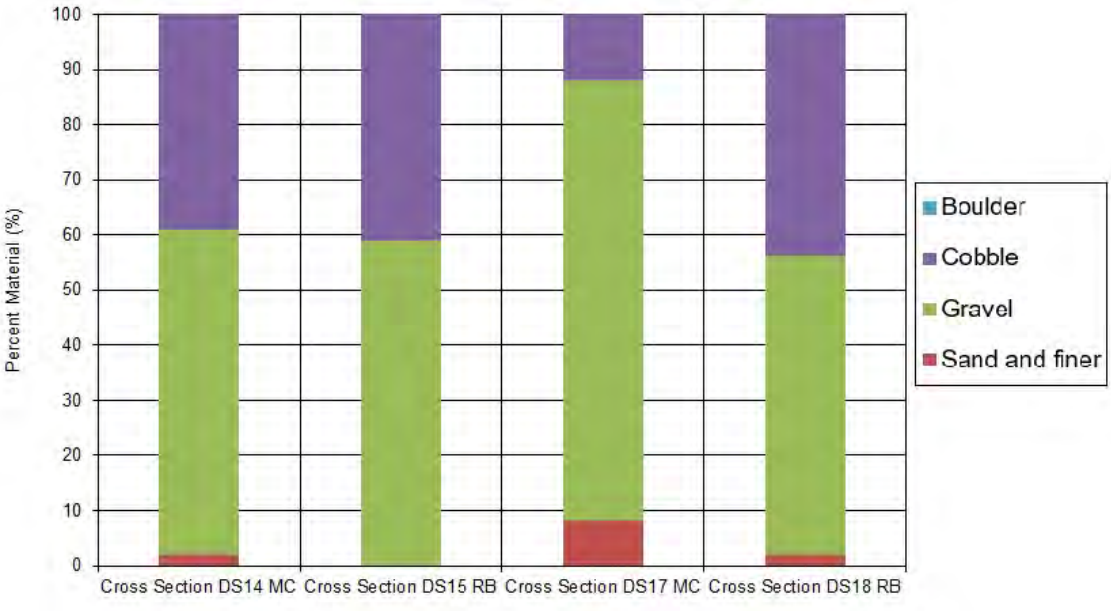



**Figure C10: Percent material by substrate type, Cross Sections DS-14 MC, DS-15 RB, DS-17 MC, and DS-18 RB, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

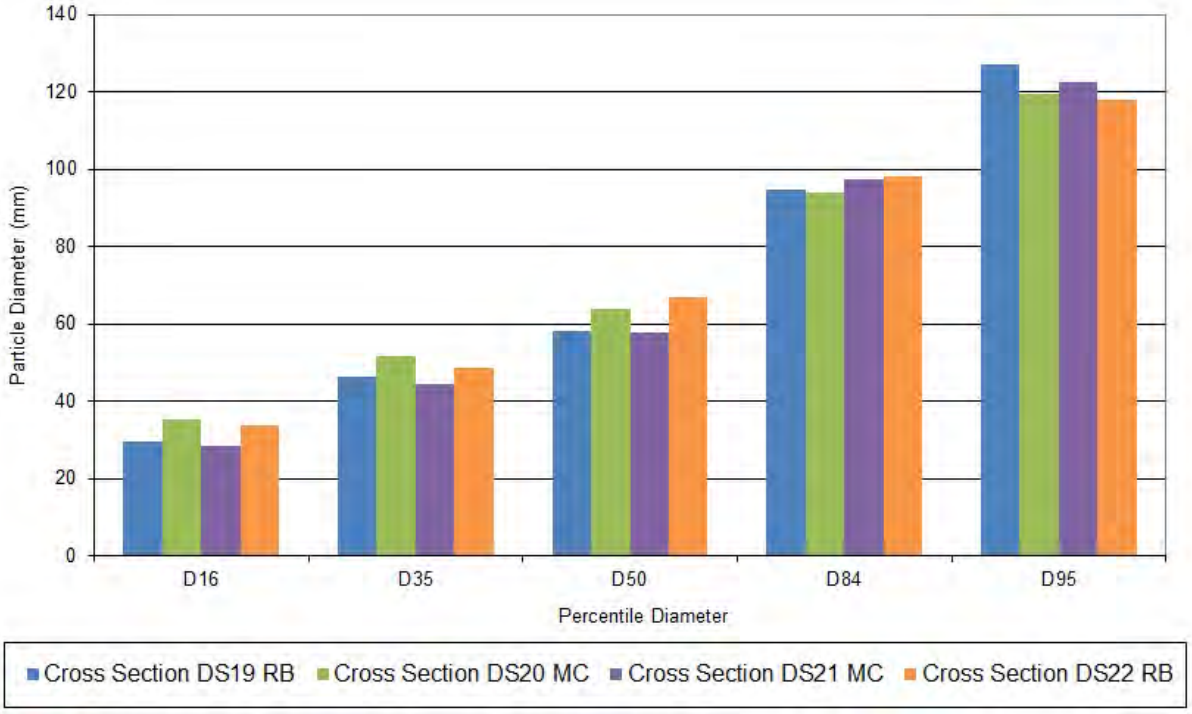



**Figure C11: Sample percentile diameter, Cross Sections DS-19 RB, DS-20 MC, DS-21 MC, and DS-22 RB, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

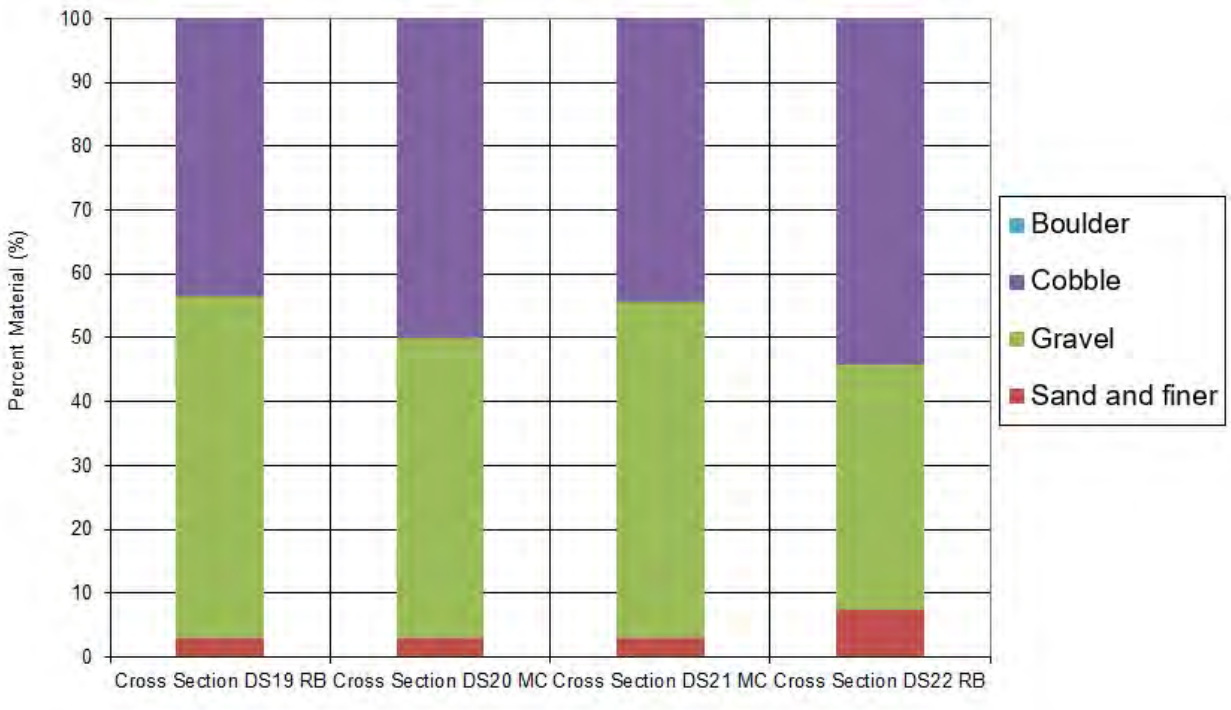



**Figure C12: Percent material by substrate type, Cross Sections DS-19 RB, DS-20 MC, DS-21 MC, and DS-22 RB, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

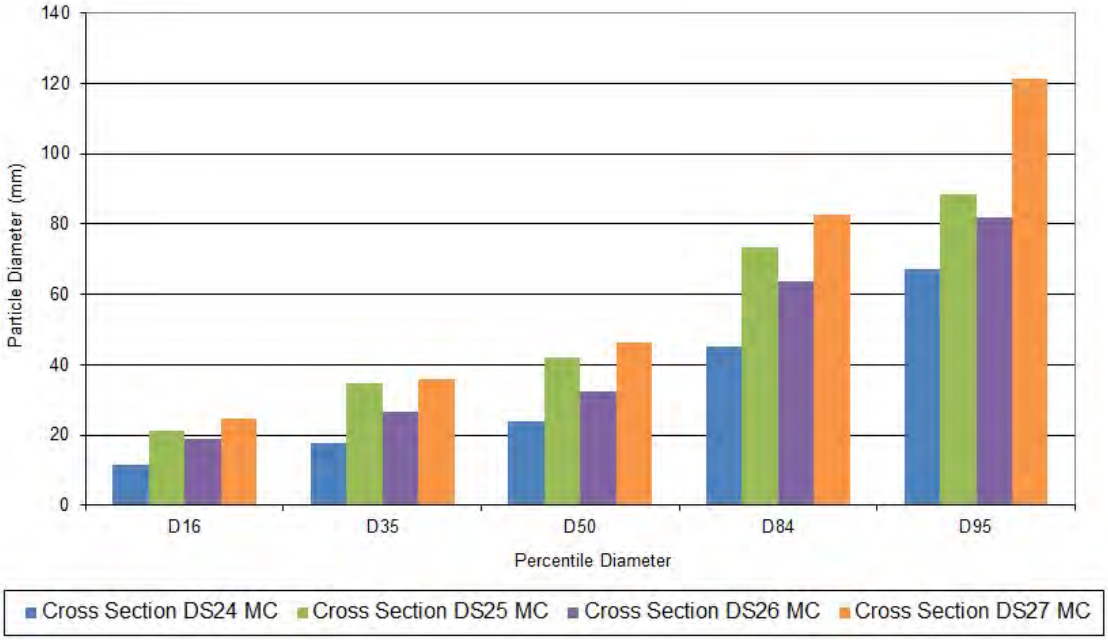



**Figure C13: Sample percentile diameter, Cross Sections DS-24 MC, DS-25 MC, DS-26 MC, and DS-27 MC, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

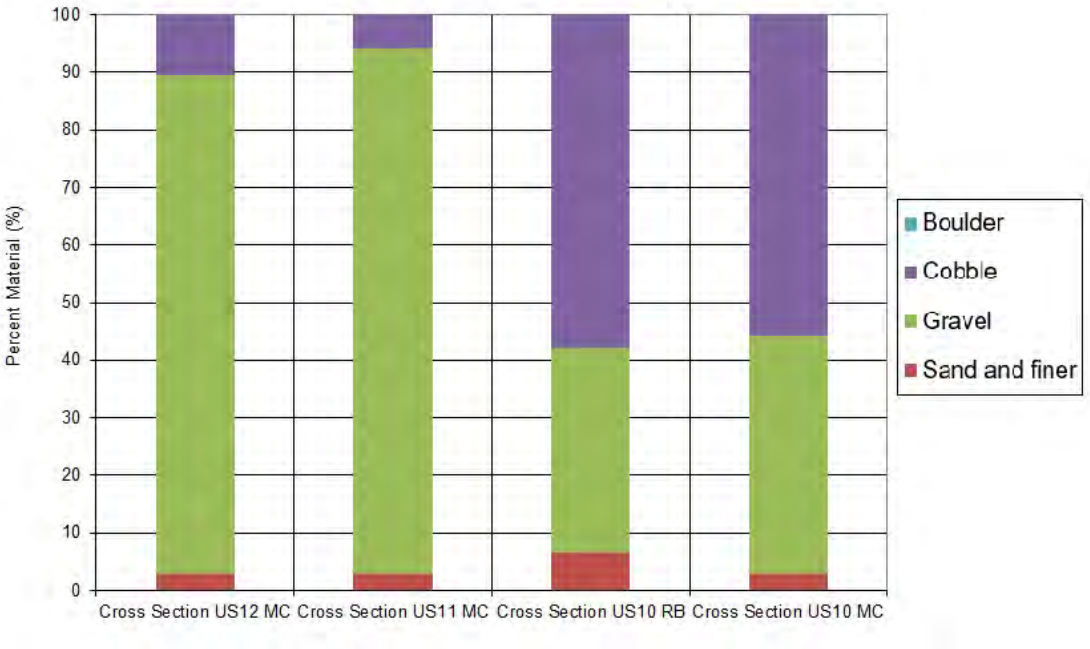



**Figure C14: Percent material by substrate type, Cross Sections DS-24 MC, DS-25 MC, DS-26 MC, and DS-27 MC, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

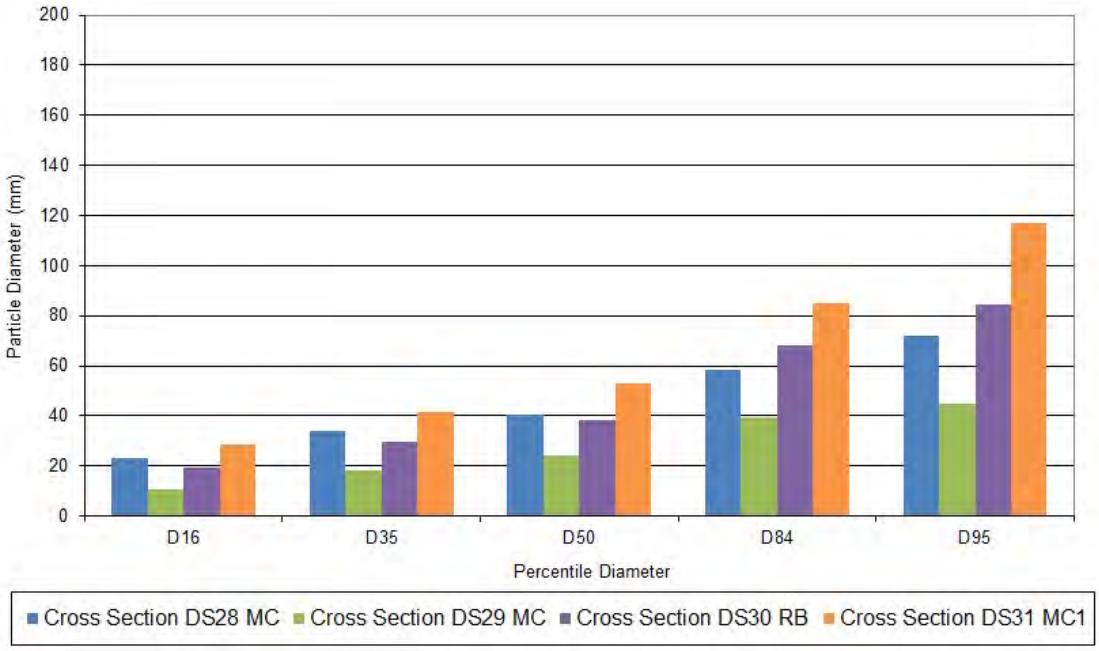



**Figure C15: Sample percentile diameter, Cross Sections DS-28 MC, DS-29 MC, DS-30 RB, and DS-31 MC, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

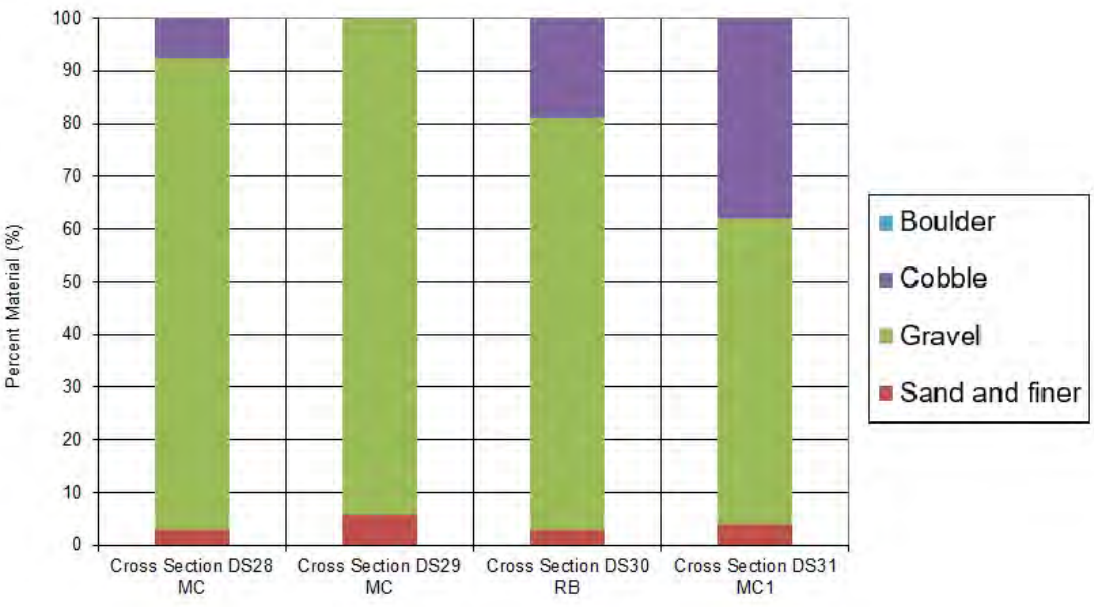



**Figure C16: Percent material by substrate type, Cross Sections DS-28 MC, DS-29 MC, DS-30 RB, and DS-31 MC, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

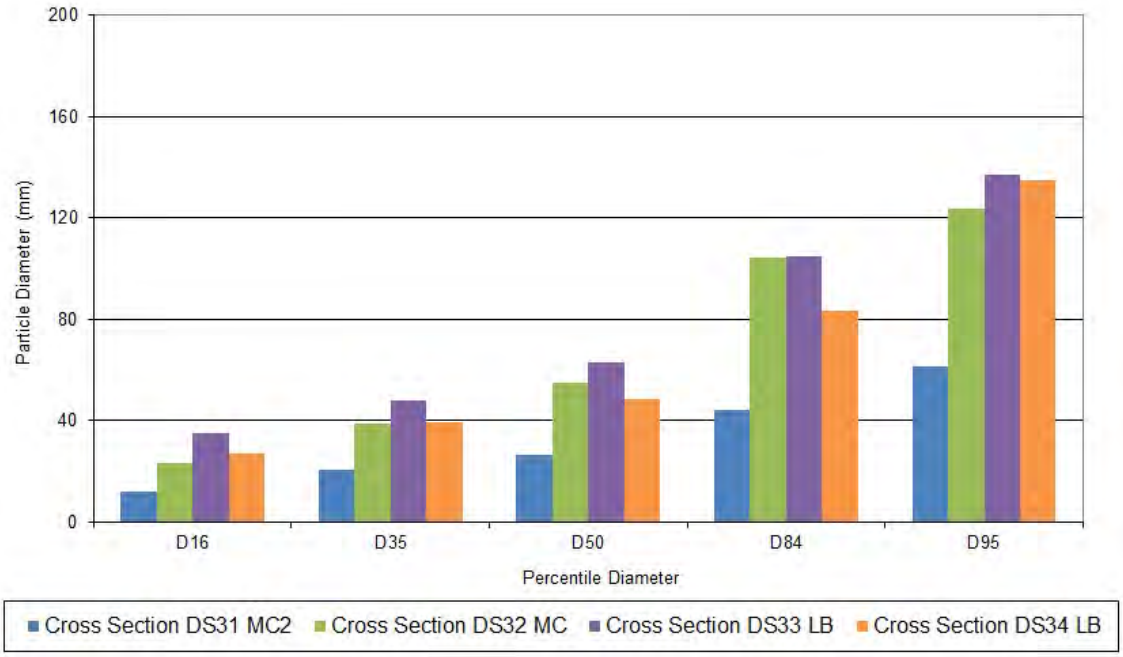



**Figure C17: Sample percentile diameter, Cross Sections DS-31 MC2, DS-32 MC, DS-33 LB, and DS-34 LB, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

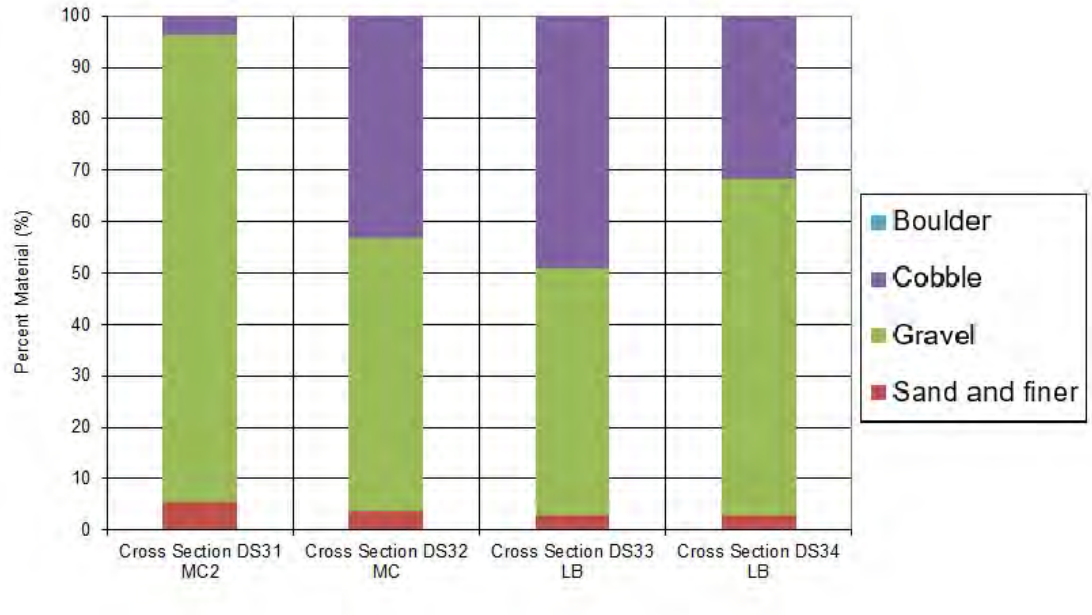



**Figure C18: Percent material by substrate type, Cross Sections DS-31 MC2, DS-32 MC, DS-33 LB, and DS-34 LB, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

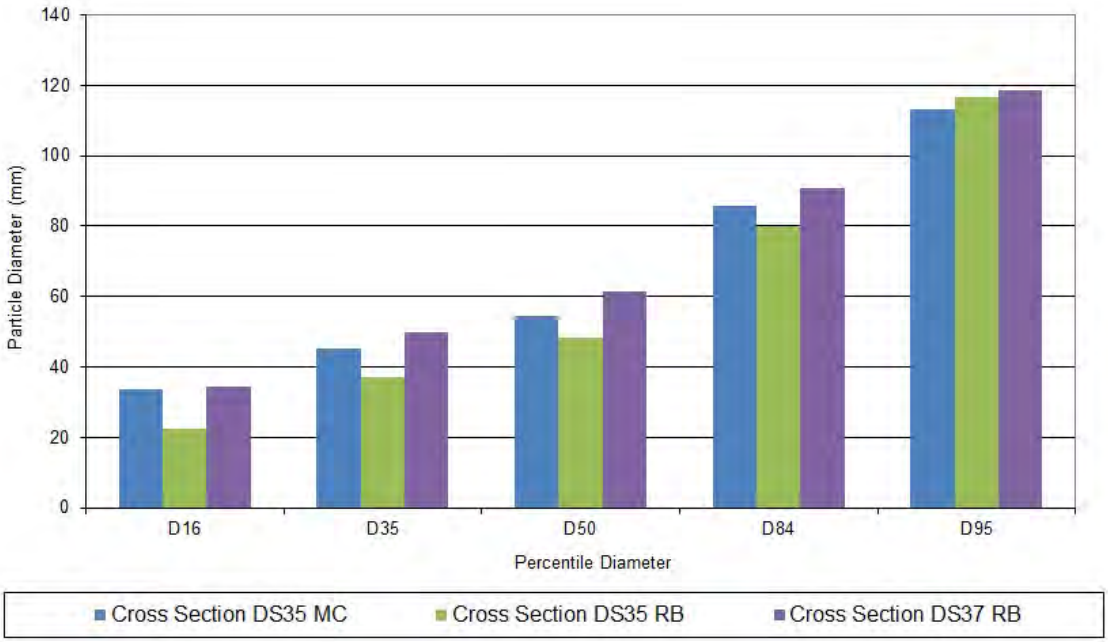



**Figure C19: Sample percentile diameter, Cross Sections DS-35 MC, DS-35 RB, and DS-37 RB, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**

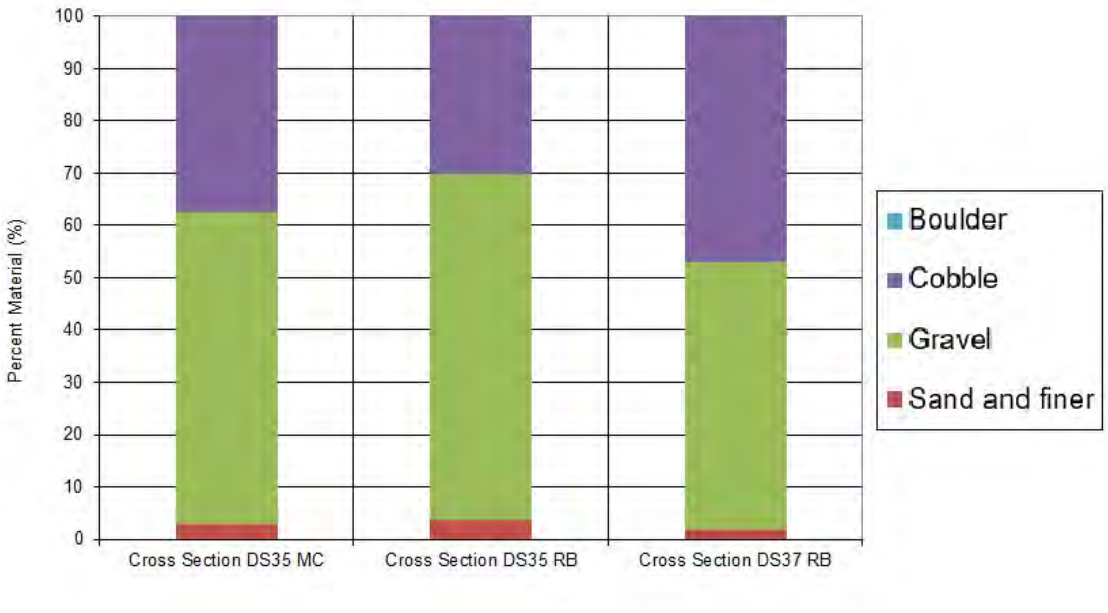



**Figure C20: Percent material by substrate type, Cross Sections DS-35 MC, DS-35 RB, and DS-37 RB, Peace River Physical Habitat Monitoring Program (Mon-3), 2019.**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