Appendix 12-B

Fish and Fish Habitat Baseline Assessment

Crown Mountain Coking Coal Project

Fish and Fish Habitat Baseline Assessment

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Prepared for
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Prepared by:

We trust that this document provides adequate information to describe the baseline fish and fish habitat conditions for aquatic environments associated with the NWP Coal Limited – Crown Mountain Project. Please do not hesitate to contact us with any inquiries about this document.

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Abbreviations

AFDM	Ash-Free Dry Mass
BC	British Columbia
BC MOE	British Columbia Ministry of Environment
BT	Bull Trout
CABIN	Canadian Aquatic Biomonitoring Network
CCME	Canadian Council of Ministers of the Environment
Chl-*a*	Chlorophyll-*a*
EB	Eastern Brook Trout
e.g.,	For example
EPT	Ephemeroptera, Plecoptera, and Trichoptera
et al.	And others
EVO	Elkview Operations
FHAP	Fish Habitat Assessment Procedures
GPS	Global Positioning System
HSI	Habitat Suitability Curves
i.e.	That is
LPL	Lowest practical level
LSA	Local Study Area
MW	Mountain Whitefish
NAD	North American Datum
NFC	No fish caught
RB	Rainbow Trout
RISC	Resources Information Standards Committee
S.B.C.	Statue of British Columbia
sp.	Species
spp.	Multiple Species
U.S. EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
WCT	Westslope Cutthroat Trout
WSC	Watershed Code
WUA	Weighted Useable Area
YOY	Young of the Year

Executive Summary

NWP Coal Canada Ltd. (NWP Coal) is proposing the development of the Crown Mountain Coking Coal Project (the Project), an open pit metallurgical coal mine in the East Kootenay Region of southeastern British Columbia. The Project footprint is situated on the height-of-land between the Grave Creek and Alexander Creek watersheds. The footprint is located approximately 12 km northeast of Sparwood, BC with an approximate total area of 1300 ha.

The Project is subject to review under the British Columbia Environmental Assessment Act (2002) and the Canadian Environmental Assessment Act (2012), and as such requires a series of baseline assessments to describe the existing environment. This report provides baseline results for the discipline of Fish and Fish Habitat. The purpose of the Fish and Fish Habitat baseline report was to characterize the environment using existing data and new data collected to fill information gaps. The specific objectives of the baseline study were to:

- Characterize fish and fish habitat resources within the LSA;
- Provide the baseline information necessary to support a future Environmental Assessment of the Project; and,
- Facilitate the design of monitoring programs that will allow before and after comparisons, and comparisons between reference (or control) sites and test sites.

These objectives were met primarily through baseline sampling, which was used to describe: potential fish distribution (both spatially and temporally); habitat quality in potentially affected areas regardless of fish bearing status; and the existing benthic community (invertebrate and algal). This information will be used to facilitate the completion of an EA and the identification of site-specific and regional mitigation actions to support responsible resource development by NWP Coal in the Elk Valley. The data presented in this report describe existing conditions before mining, which is information that will also be used to inform fish offsetting and biodiversity management plans. Specific sampling components included:

- Overwintering fish habitat survey;
- Spring fish spawning survey;
- Fish inventory (reconnaissance-level fish and fish habitat assessments);
- Fish community (fish density estimates and detailed fish habitat assessments);
- Level 1 Fish Habitat Assessment Procedures;
- Benthic invertebrate community structure;
- Periphyton community structure;
- Fall fish spawning survey; and
- Calcite assessment.

Field studies were completed in 2014, 2017, and 2019 and included sampling in winter, spring, summer, and fall. A total of 60.1 km of stream length was assessed. Of this, 49.1 km (82%) was determined to be fish bearing, and the remaining 11.0 km (18%) was non-fish bearing. Westslope Cutthroat Trout (WCT) had the largest range within the local study area (LSA), and was the only fish species found in the upper reaches of the Grave Creek watershed and tributaries. Bull Trout (BT) are known to be primarily in the Michel Creek and Elk River mainstem. However, baseline sampling did detect low juvenile BT distribution in Alexander Creek, up to Reach 9 of Alexander Creek and Reach 1 of West Alexander Creek. Furthermore, adult BT were also documented in Alexander Creek Reach 7. Eastern Brook Trout (EB), a non-native species, were present at low abundance and were found only in Alexander Creek Reach 7. Juvenile Mountain Whitefish (MW) were confirmed to occur at Alexander Creek Reach 2 during 2019. Kokanee (KO), Burbot (BB),

Longnose Sucker (LSU) and Rainbow Trout (RB) were not observed during the baseline surveys and are only reported in the Regional Study Area (RSA) in the provincial fisheries database.

The 9 streams located within the LSA were differentiated into 19 morphologically distinct reaches. Reference reaches for the Project were located on upper Grave Creek (Reach 4) and Alexander Creek (Reaches 10 and 11). In addition to the lotic environments, lentic environments were also assessed. A desktop assessment identified 27 wetlands of potential importance. These were narrowed down to six wetlands by Dillon Consulting following an initial habitat classification and assessment for continued monitoring. The results of this assessment are presented in Chapter 5 of this report.

1 Introduction

NWP Coal Canada Ltd. (NWP Coal) is proposing the development of the Crown Mountain Coking Coal Project (the Project), an open pit metallurgical coal mine in the East Kootenay Region of southeastern British Columbia. The Project footprint is situated on the height-of-land between the Grave Creek and Alexander Creek watersheds. The footprint is located approximately 12 km northeast of Sparwood, BC with an approximate total area of 1300 ha.

The Project is subject to review under the British Columbia Environmental Assessment Act (2002) and the Canadian Environmental Assessment Act (2012), and as such requires a series of baseline assessments to describe the existing environment. This report provides baseline results for the discipline of Fish and Fish Habitat. The purpose of the Fish and Fish Habitat baseline report was to characterize the environment using existing data and new data collected to fill information gaps. The specific objectives of the baseline study were to:

- Characterize fish and fish habitat resources potentially affected by the Project and within reference areas;
- Provide the baseline information necessary to support a future Environmental Assessment of the Project; and,
- Facilitate the design of monitoring programs that will allow before and after comparisons, and comparisons between reference (or control) sites and test sites.

These objectives were met primarily through baseline sampling, which was used to describe: potential fish distribution (both spatially and temporally); habitat quality in potentially affected areas regardless of fish bearing status; and the existing benthic community (invertebrate and algal). This information will be used to facilitate the completion of an EA and the identification of site-specific and regional mitigation actions to support responsible resource development by NWP Coal in the Elk Valley. The data presented in this report describe existing conditions before mining, which is information that will also be used to inform fish offsetting and biodiversity management plans. Specific sampling components included:

- Overwintering fish habitat survey;
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- Periphyton community structure;
- Fall fish spawning survey; and
- Calcite assessment.

1.1 Study Area

The fish and fish habitat Local Study Area (LSA) was selected on the basis of the Project footprint, the boundaries of local watersheds, and the spatial extent of potential immediate direct and indirect effects (both short and long-term) of the Project on fish and fish habitat, water quality, surface water hydrology, and hydrogeology. The LSA also considers other land users within these watersheds. The 235 km^2 LSA is located within the Alexander Creek and Grave Creek watersheds and includes three main sub-watersheds of: mainstem Alexander Creek, West Alexander Creek and tributaries, and Grave Creek and tributaries (Figure 1).

Streams sampled within the LSA included: Alexander Creek, West Alexander Creek, four unnamed tributaries on West Alexander Creek (Unnamed West Alexander Creeks 1 – 3 and Unnamed West Alexander Creek 1b), Grave Creek, and two unnamed tributaries on Grave Creek (Unnamed Grave Creek 1 and 2) (Table 1). The Alexander Creek watershed captures flow leaving the Project to the south and east, while the northern and western limits are defined by the Grave Creek watershed. Teck Coal's Elkview Operations (EVO) is located immediately west of the LSA and contributes surface water only into the lower two reaches of Grave Creek. Sampling was completed at 22 sites within the LSA. Alexander Creek Reaches 10 and 11, and Grave Creek Reach 4 were considered reference areas for the Project, since they are upstream of the potential effects of the Project. Figure 2 presents a map of all study sites sampled in this assessment.

The Regional Study Area (RSA) is 4,380 km^2 and includes the Elk River watershed up to the Canada-United States boarder at Lake Koocanusa. This includes a portion of the Elk River watershed, the Kootenay River, and the Koocanusa Reservoir (Figure 1). Potential effects to fish and fish habitat will be assessed within the RSA using a cumulative effects approach.

Table 1. Fish and fish habitat site locations (NAD 83 UTM Zone 11).

Stream	Reach	Site code	Easting	Northing
Alexander Creek	1	ALE1	660765	5504374
	2	ALE2	662307	5503804
	7	ALE7	664473	5513786
	8	ALE8	664364	5516713
	9	ALE9	664742	5519044
	10	ALE10	664692	5521766
	11	ALE11	664516	5521918
West Alexander Creek	1	WAL1d/s	663965	5516285
		WAL1u/s	662700	5518396
	2	WAL2	662288	5520645
	3	WAL3	662156	5520803
	4	WAL4	661801	5521215
Unnamed West Alexander Creek 1	1	UWA1	662511	5519231
Unnamed West Alexander Creek 1b	1	UWA1b-1	662331	5520612
	2	UWA1b-2	662413	5520677
Unnamed West Alexander Creek 2	1	UWA2	662254	5520843
Unnamed West Alexander Creek 3	1	UWA3	662127	5520848
Grave Creek	3	GRA3	659720	5523889
	4	GRA4	661656	5524410
Unnamed Tributary of Grave Creek 1	1	UTG1	660960	5524122
Unnamed Tributary of Grave Creek 2	2	UTG2-1	661679	5524330
	2	UTG2-2	662161	5523814

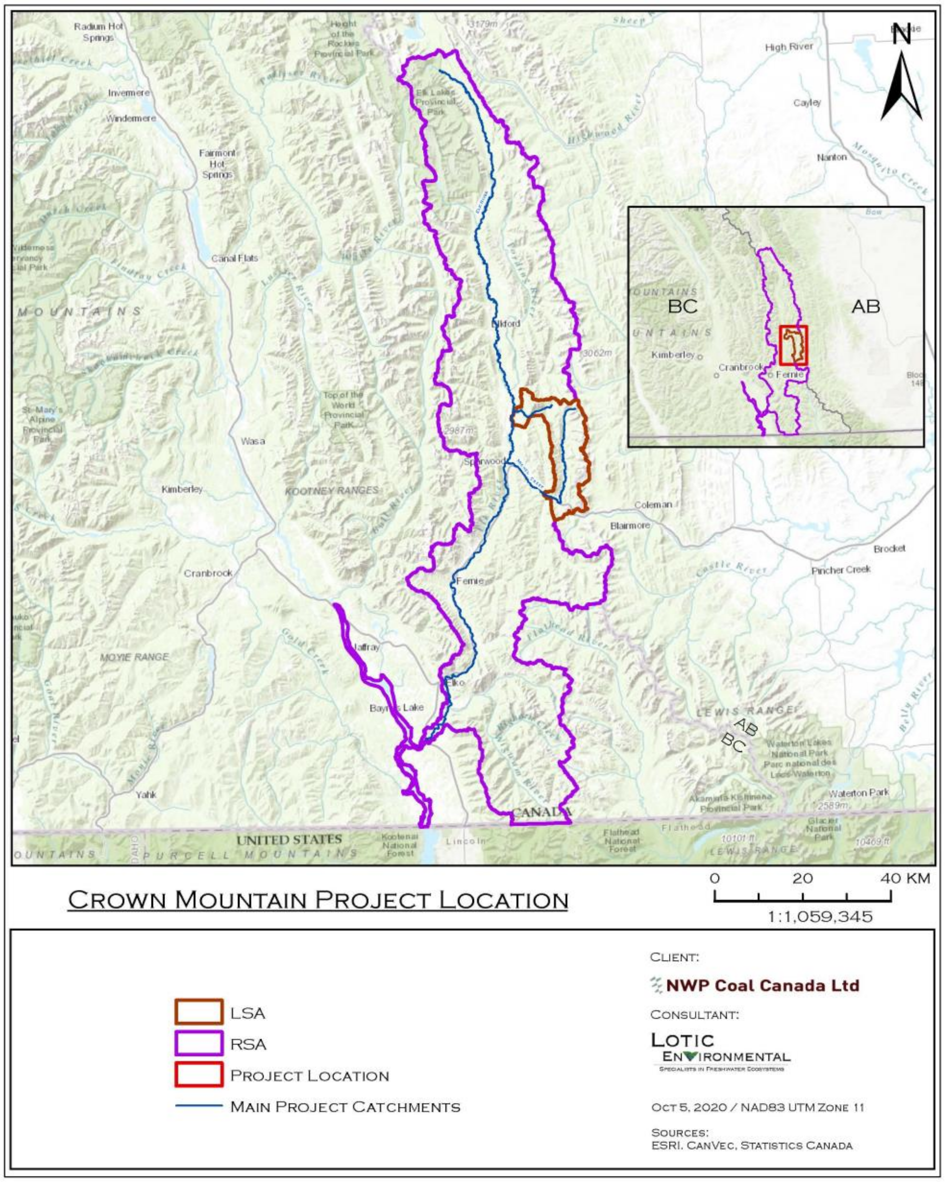

Figure 1. Project location, regional (RSA), and local (LSA) study areas.

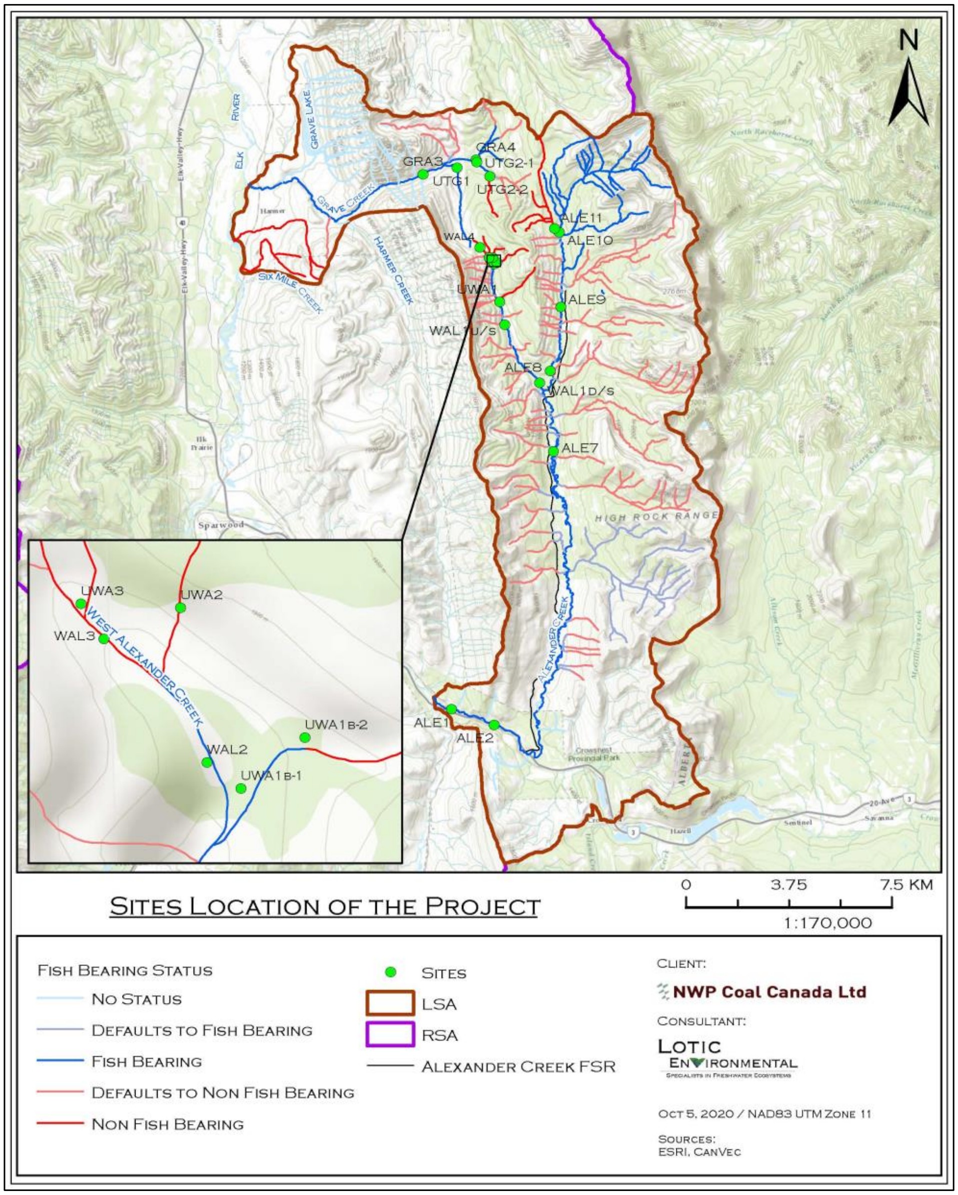

Figure 2. Location of sample sites.

1.2 Documented Fish Species within the Local and Regional Study Area

Species found within the Local Study Area (LSA) include Westslope Cutthroat Trout (WCT; *Oncorhynchus clarkii lewisi*), Bull Trout (BT; *Salvelinus confluentus*), Eastern Brook Trout (EB; *S. fontinalis*), Mountain Whitefish (MW; *Ptychocheilus williamsoni*) and Rainbow Trout (RB; *O. mykiss*) (Table 2). Additional species found in the Regional Study Area (RSA) include: Longnose sucker (LSU; *Catostomus catostomus*), Longnose Dace (LNC; *Rhinichthys cataractae*), Torrent Sculpin (CRH; *Cottus rhotheus*), Burbot (BB; *Lota lota*), Kokanee (KO; *O. nerka*), Peamouth Chub (PCC, *Mylcheilus caurinus*), and Northern Pikeminnow (NSC; *Ptychocheilus oregonensis*). Distribution of RB, BB, KO, Peamouth Chub (PCC) and Northern Pike Minnow is limited to downstream of a migratory barrier in the Elk River near Elko, BC and in the Koocanusa Reservoir/Kootenay River. Table 2 details those species present in both areas and are listed based on species common name, scientific name, species code, general spawning time, and study area. Study area refers to whether these species are known to occur in the local or regional study area. Species code data are taken from BC CDC (2019).

Table 2. Species present in the LSA and the RSA.

Species Name	Scientific Name	Species Code	Spawning Time	Study Area
Westslope Cutthroat Trout	*Oncorhynchus clarkii lewisi*	WCT	May-June	LSA/RSA
Bull Trout	*Salvelinus confluentus*	BT	September-October	LSA/RSA
Eastern Brook Trout	*S. fontinalis*	EB	September-November	LSA*/RSA*
Mountain Whitefish	*Prosopium williamsoni*	MW	November-February	LSA/RSA
Rainbow Trout	*O. mykiss*	RB	March-June	LSA*/RSA*
Longnose Sucker	*Catostomus catostomus*	LSU	April-June	RSA
Longnose Dace	*Rhinichthys cataractae*	LNC	May-July	RSA
Torrent Sculpin	*Cottus rhotheus*	CRH	April-May	RSA
Burbot	*Lota lota*	BB	January-March	RSA
Kokanee	*O. nerka*	KO	August-October	RSA*
Peamouth Chub	*Mylcheilus caurinus*	PCC	May-June	RSA
Northern Pike Minnow	*Ptychocheilus oregonensis*	NSC	May-July	RSA

*introduced

1.3 Benthic invertebrates

Benthic invertebrates (also known as aquatic insects) play an important role in the food chain, and serve as food sources for many species of fish. Benthic invertebrates are good indicators of aquatic health. Benthic invertebrate communities are affected by changes in water quality, such as pH, temperature, turbidity, flow, chemistry and substrate composition. Benthic invertebrates are good model organisms because they are easy to collect, less mobile than other organisms, and different species can tolerate varying levels of pollution. Some species are more tolerant to pollution and degradation than others, and these species are often used as indicator species to determine the health of the aquatic site. However, a low amount of sensitive species, or a high amount of pollution tolerant species does not necessarily mean that a site is degraded, as some species may not exist in certain areas. For these reasons, community composition and taxa abundances are used instead of identifying specific presence or absence of taxa. In addition, collecting information on these sites prior to disturbance sets a baseline that future monitoring can compare against and then measure the effects of mining in the area after disturbance

Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (EPT) are all known to have lower tolerance to pollution than other taxa, and the proportions of these orders are used to indicate disturbance levels at a system. Chironomidae (lake flies) are more sensitive to pollution, and can be found in higher abundances in disturbed sites. Together, percent of EPT and chironomidae can provide important information on the health of the ecosystem.

1.4 Periphyton

Periphyton (substrate-associated algae and microheterotrophs) are primary producers that provide food for organisms higher in the aquatic food chain, such as benthic invertebrates and fish. Land-use changes can lead to high inputs of nutrients (mainly phosphorus and nitrogen) into water systems, which results in excessive growth of periphyton, altering the structure of the food web by increasing algal growth (Smith et al. 1999). The distribution and community composition of periphyton could be a limiting factor for invertebrate distribution, if impaired.

Since periphyton is an important food source, it is common for ash-free dry mass (AFDM) to be used as an indicator of food availability at a site. It is also possible for the AFDM or abundance of algae to be low at a site, even though the invertebrate abundance is high. This is attributed to heavy grazing by invertebrates and highlights the importance of joint assessments for a comprehensive understanding of the food web at a site. AFDM alone can not account for the abundance of algae at a site, but it can be used as an easy-to-use contributing indicator of food availability, resilience and sustainability at a site.

Excessive growth of periphyton leads to algal blooms, and algal biomass is measured by chlorophyll-a (Chl-*a*). Waters with high levels of nutrients from fertilizers, septic systems, sewage treatment plants and urban runoff may have high concentrations of Chl-*a* and excess amounts of algae. Chl-*a* provides an estimate for the contribution of autotrophs to the periphytic community productivity. Thus, invertebrate abundances and periphyton biomass together can provide important information on the level of pollution at a site.

2 Methods

All sampling tasks and dates completed are presented in Appendix A.

2.1 Level 1 Fish Habitat Assessment Procedures (FHAP)

BC MOE (2016) recommends that all habitat predicted to be permanently affected by a proposed mine be surveyed and measured. The two primary types of potential loss of fish habitat for the Project area are:

- Direct habitat loss anticipated from waste rock dump development
- Indirect habitat loss from potential flow reduction

All potentially permanently affected reaches were assessed following the BC FHAP (Johnston and Slaney 1996). Systematic stratified subsampling was used to sample every fourth habitat unit of each meso-habitat type (e.g., pool, riffle, glide, and cascade). Therefore, detailed measurements were collected for 25% of each meso-habitat type. In addition to FHAP data, substrate descriptions and depth-velocity profiles were also completed on a portion of the subsampled units. This was done to facilitate assessments using Habitat Suitability Index (HSI) methods, as required in the environmental assessment (EA) or for a future application under the *Fisheries Act*. Streambed substrate and depth-velocity profiles were described as per fish community habitat sampling methods. Each subsampled habitat unit was located using GPS coordinates, photographed, and marked in the field with labelled flagging tape to facilitate accurate location identification should subsequent surveys be required. The continuous survey of habitat type and length was maintained to delineate each habitat type within the reach. This provided an absolute estimate of linear proportions of each habitat type. A Level 1 FHAP (Johnston and Slaney 1996) survey was completed on the fish bearing reaches of Alexander Creek (ALE7 to ALE10) and West Alexander Creek (WAL1 and WAL2). The FHAP surveys for WAL1, WAL2, and ALE8 to 10 occurred in August 2014. The FHAP survey for ALE7 was completed in October 2017. Lower Alexander Creek, Grave Creek, and the two unnamed Grave Creek tributaries did not require a Level 1 FHAP survey because there are no plans to permanently affect those areas.

2.2 Wetland Habitat Descriptions

Reconnaissance fieldwork was completed from July 15 to July 26, 2019 on 27 locations identified from air photos where potential wetlands could exist. From fieldwork it was determined that six wetlands were of high importance. At these six wetlands data were collected for surface water, sediment, and benthic invertebrates from September 18-20, 2019. Each wetland was described in regards to the potential for fish absence/presence, general observations (substrate, depth, length/width, side channels, inflow/outflow channels, and any relevant wildlife observed), as well as *in-situ* water quality data taken using a YSI handheld multimeter.

2.3 Fish use

2.3.1 Distribution - Fish Inventory

Fish inventories were completed to determine fish distribution, identify migratory barriers, and confirm stream reaches. Each of the above-mentioned streams lacking past sampling information on the BC government database within the LSA were sampled, with the exception of ALE7, WAL1, and mainstem Grave Creek. Fish inventories were not completed on reaches with prior knowledge of fish bearing status in the Provincial database (ALE7, GRA1-GRA4; BC MOE 2018). Sampling was completed on a total of 14 reaches on 8 streams during 2014 and 2017 (please see above for details on confirming a site as fish bearing). As per the *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators* (BC MOE 2016), in order to confirm a site as non-fish bearing it had to be sampled for two consecutive years, both ending in no capture or observations.

Fish inventory surveys were required to:

- Assess fish presence (i.e. fish distribution) and describe the general fish community structure at fish-bearing locations.
- Obtain general habitat information, identify migratory barriers to fish, and define reaches. Habitat measurements included channel morphology, gradient, substrate, and riparian.

Fish inventory assessments were reach-based with one site per reach, and thus, first required reach break delineation to guide where sampling occurred. Reach break establishment followed standard Reconnaissance 1:20,000 Fish and Fish Habitat Inventory Standards and Procedures (RISC 2001). A reach was defined as a section of stream with a distinct channel morphology, confinement, and riparian.

With reaches established, sampling was conducted by a two-person, backpack electrofishing crew. Electrofishing was completed as a single, open pass over a site length of greater than 100 m or that of 10 times the bankfull width, whichever was longer. A minimum of two, baited minnow traps were set and left overnight at each electrofishing location if conditions permitted (e.g., sufficient water depth). Minnow traps were only deployed when fish were captured during the first pass of electrofishing or when the stream was established as fish bearing. Fish presence in the lentic habitat of WAL4 was assessed by minnow traps and visual assessment. Stream reach and site location data are presented in Appendix B. Fish movement barriers are presented in Appendix C.

Captured fish were identified to species, measured to fork length (to the nearest mm), weighed (to the nearest 0.1 g for fish > 100 mm and nearest 1 g for fish < 100 mm), and photographed. Deformities, erosions, lesions and tumors (DELT) assessments were performed on all fish handled. Fishing effort and habitat data were collected on Reconnaissance 1:20,000 fish inventory and habitat site cards, respectively.

Fish captured were described by species and life-stage. McPhail (2007) describes fry, or young-of-year (YOY), as fish in their first year (0+). The term juvenile is commonly used to describe fish from one year of age (1+) up to the age of maturity, while the term adult refers to fish that have reached maturity (McPhail 2007). Regional fork length ranges are listed below in Table 3, Table 4, and Table 5 for WCT, BT, and EB, respectively. WCT life stages of fry, juvenile, and adult were generally assigned based on the fork-length frequency analysis results provided in Robinson (2014) and corroborated by fork-length-frequency distributions obtained during this study, which clarifies the life stage and age-class expected based on length. Local differences can cause these ranges to vary; however, the Robinson (2014) size-classes do compare well with other studies in the Elk River watershed (Cope *et al.* 2014). Age of maturation for WCT can vary during years 2 to 5 by individual and by gender (Downs *et al.* 1997). WCT identified as three years of age and older were classified as adults for this assessment. While understanding that fish three years of age and older can represent a mixture of mature and immature fish (i.e., adults and sub-adults), it is expected that they will require similar habitat based on size and not their state of maturity. This definition is supported by literature and local observation as an appropriate age where a substantial number of individuals will be sexually mature (Liknes and Graham 1988; Downs *et al.* 1997; Shepard *et al.* 1997). BT size-at-age also relies on regional data from the Elk River watershed (Smithson and Robinson 2017), while EB size-at-age relied on literature values (Kennedy et al. 2003). Westslope Cutthroat Trout length-frequency data is presented in Appendix D. Fish abundance by site is presented in Appendix E. Individual fish inventory data is presented in Appendix F.

Table 3. WCT fork length at age (Robinson 2014).

Stage	Age-class	Fork Length Range (mm)
Fry	0+	29 - 67
Juvenile	1+	68 - 130
	2+	131 - 170
Mature (sub-adult and adult)	3+ and greater	> 170

Table 4. BT fork length at age (Smithson and Robinson 2017).

Stage	Age-class	Fork length range (mm)
Fry	0+	53 - 71
Juvenile	1+	128 - 136
Mature (sub adult and adult)	2+	228

Table 5. EB fork length at age (Kennedy et al. 2003).

Stage	Age-class	Fork length range (mm)
Fry	0+	60 - 75
Juvenile	1+	99 - 134
Mature (sub adult and adult)	2+	138 - 187

2.3.2 Rearing - Fish Community

Fish community assessments were completed in all fish bearing reaches, with exception of WAL2 (further detail below). Fish community sampling used a combination of fish use and associated habitat data to described use during the summer rearing period. These assessments began with estimates of fish density. Fish density estimates were made from the depletion pattern of fish captured during three-pass, depletion removal electrofishing over closed site conditions (i.e., site is isolated by stop nets to prevent fish from leaving the site during sampling). Based on fish inventory assessments, local fish bearing streams included in fish community sampling were: Alexander Creek (reaches 1, 2, and 7-10), West Alexander Creek (reaches 1 and 2), Grave Creek (reaches 3 and 4), unnamed tributary of Grave Creek #1, and unnamed tributary of Grave Creek #2 (Reach 1). Fish density and corresponding fish habitat data were collected over longer, multi-channel unit sites with data recorded at a channel unit scale. The purpose of using longer sites was to satisfy the sampling objectives of a baseline study; that is to describe all fish present, not just a targeted species/life stage or the most abundant. Given the low densities observed within streams in the LSA, sampling smaller areas (e.g., individual meso-habitats) would create the potential for rare species/life stages to go undetected.

WAL1 was an extended (6.5 km) reach of moderate gradient within the proposed project footprint. WAL2; conversely, was a short (0.25 km), high-gradient reach with decreased habitat potential. It was decided that WAL1 would have two fish community assessments to better describe the fish distribution within the reach. The fish community assessment for WAL2 was moved downstream approximately 2km to a site that would represent conditions in the upper portion of WAL1.

Fish Community site length followed Resources Information Standards Committee (RISC) (2001) standards, where sites were generally the greater of 100 m or 10 times the bankfull width. Fish density assessments were completed by a three-person electrofishing crew, with one operator, one netter, and one onshore observer. Where fish were captured, the onshore observer noted species and size-class on a hand drawn map showing locations within the stream (e.g., stream margins within specific micro-habitat). These observations can be used to provide more accurate accounts of the habitat use for certain life stages. Observations of species, fork length (mm), weight (g), and external health were made for all fish captured. Photographs of representative fish were also taken. Scales and genetic samples were not collected. Fish community assessments were completed at ALE7, ALE8, ALE9, ALE10, WAL1d/s, WAL1u/s, GRA3, GRA4, UTG1, and UTG2-1 from August 22 - October 10, 2017, and at ALE1 and ALE2 from September 12-13, 2019.

The fish density data was supported by the collection of detailed habitat information, as per the *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators* (BC MOE 2016). Fish habitat surveys were completed at all fish community sites, over the entire area electrofished. The area was first described using the hand drawn map created by the onshore observer during electrofishing and included the different habitat types, cover features (e.g., boulders, woody debris, etc.), and anthropogenic features, such as culverts. The hand drawn maps were later digitized using Geographic Information System (GIS) software to represent habitat use by life-stage. Universal Transverse Mercator (UTM) coordinates were collected for site boundaries, which were used to generate site maps as a visual means of presenting site conditions along with site photos. Habitat data were also collected on the BC Level 1 FHAP form which included both stream substrate size classification and percent/rating of total available fish cover (Johnston and Slaney 1996) (Table 6 and Table 7).

The habitat data recorded included:

- Habitat type (i.e., cascade, glide, pool, riffle, or other);
- Habitat length (m);
- Gradient in percent (%);
- Bankfull and water depth (m);
- Bankfull and wetted width (m);
- Residual pool depth (m);
- Bed material type and spawning gravel presence;
- Total large woody debris;
- Number of functional large woody debris;
- Cover type (instream and overhead) and rating;
- Off-channel habitat;
- Disturbance indicators;
- Riparian vegetation; and,
- Barriers.

<u>Additional fish community and FHAP data are presented in the following appendices</u>:
Appendix G. Fish Community Individual Data
Appendix H. Fish Community Site Data
Appendix I. Fish Community Maps
Appendix J. Fish Community Flows
Appendix K. Level 1 – FHAP Form Data
Appendix L. FHAP Flow Data
Appendix M. FHAP Pebble Count Data
Appendix N. FHAP Delineation Maps
Appendix O. Site Photos

Table 6. Stream substrate size classification based on Johnston and Slaney (1996).

Substrate Type	Substrate Size (mm)
Fines*	<2
Gravels	2 - 64
Cobbles	64 - 256
Boulders	256 - 4000
Bedrock	>4000

Table 7. Percent and rating of total available fish cover presented in Johnston and Slaney (1996).

Cover %	Rating
<2	Trace
2 - 10	Poor
10 - 20	Fair
>20	Good

Detailed substrate and hydraulic data were collected on a subset of up to three units of each habitat type present. Depth-velocity profiles were described using a Hach FH950 flow meter to measure the depth and velocity at the mid-point of 10 to 20 evenly spaced intervals across the stream channel. Velocity measurements were collected at 60% of the total water column depth. *In situ* water quality information was also collected using a YSI Pro Plus multimeter, including: temperature, DO, pH, specific conductance and redox potential.

Stream morphology was defined using the BC Channel Assessment Procedures (CAP) (BC MOE 1996) into one of three main categories based on substrate size, gradient, large woody debris presence, and channel width. The three mainstream morphology categories were:

- Riffle-Pool
- Cascade-Pool
- Step-Pool

MicroFish 3.0 computer software (Van Deventer and Platts 2006) was used to calculate fish abundance (N) (i.e., depletion-removal estimates) by individual species. MicroFish 3.0 works by using maximum-probability estimation to perform estimates of abundance and associated confidence intervals. Fish density estimates were calculated by using the fish abundance estimates, as the number of fish standardized to the size of the fish community site. Density (D) was reported as the number of fish/100 m^2 and reported by species as an overall site total (Equation 1). Population size is (N).

Equation 1

$$D = \frac{N}{site\ area\ (m^2)} \times 100m^2$$

Habitat data were used to support the findings of any fish use assessments (e.g., spawning, inventory, or community). The FHAP habitat data were used to describe site conditions, channel morphology, and habitat values qualitatively.

2.3.3 Spawning

Spawning surveys were completed to document spawning use for spring and fall spawning species. Spring spawning surveys were completed on all fish bearing sections of streams within the LSA. WCT are the primary spring-spawning fish species found within the LSA. ALE7, ALE10, WAL1, WAL2, GRA3, UTG1, and UTG2 were assessed in June of 2014 and 2017. GRA4 was only assessed in June 2017. Two rounds of spawning surveys were completed each spring. Survey dates were chosen to target the descending limb of the hydrograph, when WCT typically spawn (Magee *et al.* 1996).

Fall spawning surveys were initially conducted at ALE10 and WAL1 since juvenile BT and EB (fall spawning species) were observed within these reaches. Surveys were completed similarly to spring spawning and were completed between October 4 to 6, 2014 and October 4 to 5, 2017. A follow-up survey was completed from September 23-25, 2019 to include ALE7.

Methods were consistent between sampling season. A two-person crew surveyed each stream in an upstream direction from the start of each fish bearing reach to a previously determined limit of fish distribution. All redds, spawning fish, and other notable features were photographed and described, with their coordinates obtained by a handheld Global Positioning System. Redd locations were described by: habitat unit type (e.g., pool, riffle, glide, or cascade), substrate type, and association with cover. If no redds were found, observations of potential suitable spawning habitat were recorded. Suitable habitat was based on: cover availability, proximity to holding water, adequate flows, and suitable gravel size. Based on depth-velocity ranges reported in Schmetterling (2000), adequate flows had depths ranging from 4.2 – 22.9 cm and velocities ranging from 25 to 78 cm/s. Following the FHAP, suitable spawning gravel was considered to be 10 to 75 mm in size (Johnston and Slaney 1996). Spawning surveys were conducted to document fish use in streams that may potentially be affected by the Project.

2.3.4 Overwintering

Overwintering fish habitat potential was determined using parameters collected during overwintering surveys, rather than attempting direct fish capture (e.g., electrofishing, trapping, and underwater cameras). Past attempts at conducting direct fish capture have been limited by snow and ice cover throughout the Elk Valley. Additionally, it is suspected that during winter conditions, specific life stages of fish will inhabit the interstitial spaces of the streambed, thus reducing the probability of detection (Finstad et al. 2004). Therefore, due to the low confidence in capturing or observing fish by means of active capture methods, potential overwintering use was assessed based on habitat condition, instead of direct fish use. Parameters such as water temperatures, dissolved oxygen (DO) levels, water depth, ice cover, and flow rates were used to assess the suitability of fish overwintering potential in the study streams (Figure 3). Overwintering surveys were conducted in the upper portions of the Alexander Creek watershed where safely accessible. ALE7, ALE8, ALE10, WAL1d/s, WAL2, and UTG2-1 (selected based on Figure 2) were all surveyed for overwintering potential on March 14, 2014. Late winter was selected as the survey period since flows were most likely to be lowest at this time. The overwintering period for fish in this area is November to March (Heidt and Stalker 2007). During this time, observations based on water depth, temperature, and DO concentrations were used to classify overwintering potential as “good”, “moderate”, or “poor” (Figure 3). Areas with flowing water, adequate DO concentrations, and depths greater than 0.2 m were considered to have good overwintering potential. Flowing water was considered a requirement to good overwintering potential as it delivers oxygenated water and reduces (but does not prevent) ice formation. DO levels were compared to the Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life (CCME 1999). For life to be sustained in a cold-water system, the minimal threshold of 6.5 mg/L must be met (CCME 1999). Overwintering fish survival relies heavily on water temperature. For instance, brook trout have been shown to cease feeding and growing when water temperatures are below 4°C (Dwyer et al. 1983). If the water temperature continues to decrease, a critical thermal minimum for fish will be reached (Dwyer et al. 1983). Fish death may occur below this critical thermal minimum. Yau and Taylor (2014) reported that juvenile WCT that were acclimatized to 15°C, had a critical thermal minimum of 1°C (±0.8°C). Therefore, 1°C was set as the lower threshold of a "good" thermal habitat range. Further research in BT suggests that temperature values between 10.9-15.4°C are optimal for feeding and growth (Selong et al., 2001). Parameters including suitable water depth (greater than 0.2m), suitable DO levels (greater than 6.5mg/L), and suitable temperatures (0.5 °C and above) are used to determine whether there is overwintering potential for fish species and to what extent (poor, moderate, or good).

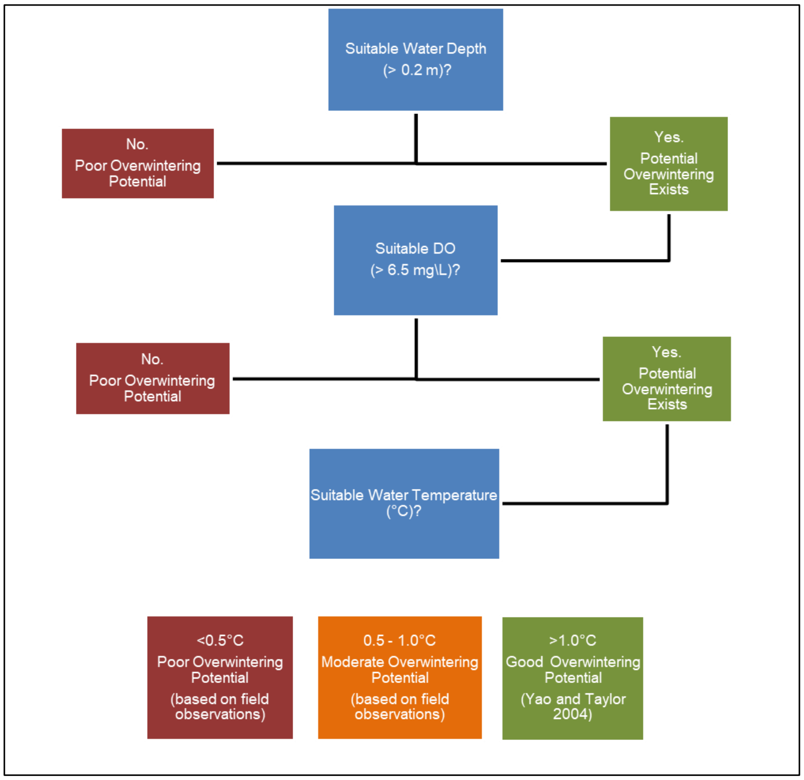

Figure 3. Overwintering Habitat Potential Assessment Pathway

2.3.5 Population Study

In 2020 a population study was conducted to compliment the baseline assessment. The purpose of this study was to assess the importance of West Alexander Creek to the Westslope Cutthroat Trout population since this is where habitat loss due to the Project is anticipated to occur. The study period was one year, from July 2020 to July 2021. Study components within this period were:

- Fish capture and tagging: August 5 to October 7, 2020.
- Snorkel surveys: August 30 to September 3, 2020.
- Spawning surveys: June 26 and July9, 2021.
- Telemetry: July 2020 to July 2021.

Fish Capture and Tagging

Fly fishing by experienced personnel was the method used to capture fish. In total, 212 angler-hours of effort were expended over 17 days in August, 2 days in September, and 3 days in October.

Two types of radio tags were used (manufactured by Lotek Wireless):

1. MST-930-T: frequency 150.340 MHz, weight of 4 g, equipped with temperature sensors.
2. MST-820: frequency 150.600 MHz, weight of 2 g.

The larger tags were implanted in fish with a minimum weight of 200 g (tag 2% or less of the body weight of the fish) and smaller tags were implanted in fish with a minimum weight of 100 g. All fish captured were measured (FL) and weighed. If WCT were not implanted with a radio tag, and were of sufficient size (i.e., 200 mm or more in FL) they were affixed with a yellow Floy tag and PIT tag. WCT between 120 mm and 200 mm FL were PIT tagged; fish under 120 mm FL were not tagged.

Snorkel Survey

Snorkel surveys were used to collect WCT abundance and density data from East Kootenay streams including the Bull River, Elk River, Wigwam River, St. Mary River, White River, Fording River, and Michel Creek. Snorkel surveys in Alexander and West Alexander Creeks were conducted from August 1 to September 3, 2020.

Spawning Survey

Spawning surveys were completed in West Alexander Creek on June 26 and July 9, 2021. These were conducted by two crew members walking the banks of the creek with polarized sunglasses and searching for WCT redds. When redds were observed, they were photographed, and the following were recorded: UTM coordinates, length of redd, habitat type the redd was present in, distance of the redd from the left bank, any fish associated with the redd, and general observations regarding the redd and surrounding habitat.

Telemetry

Movements of radio tagged WCT were monitored by stationary receiver, mobile ground tracking, and mobile helicopter tracking. Four stationary receivers were set up to act as “gateways” (i.e., to monitor movements into and out of particular areas. Ground based mobile tracking was conducted using a SRX1200-M receiver and handheld directional antenna. The stream was walked, and triangulation was used to determine the location of tagged fish. Tag ID, UTM coordinates and habitat notes were recorded at locations fish were detected. Because of the size of the expanded study area (i.e., large sections of Michel Creek and the Elk River) and the time that would have been required to cover it using ground-based tracking, this method was used opportunistically if fine scale locations were required.

Helicopter based mobile tracking was conducted on a similar schedule to stationary receiver download and maintenance (i.e., every three weeks). Because of the large area that needed to be covered, this was the main tracking method. The helicopter was equipped with two directional antennas which were connected to the SRX1200-M receiver. The time and location (UTM Coordinates) of detections were recorded.

2.4 Calcite Assessment

Calcite assessments were completed at one site per reach to describe baseline conditions. Future effects monitoring would likely increase this to be similar to Teck (2014). Field survey methods followed those reported in Teck (2014), which is based off of Robinson et al. (2013). In summary, the surveys began with a visual assessment of the streambed by wading through the stream and physically inspecting individual rocks for calcite over a minimum length of 100 m. Where calcite was observed, a modified Wolman pebble count (Wolman 1954) was conducted to quantify the degree of calcite presence using the two metrics used to calculate a Calcite Index (*CI*). Those metrics, Calcite presence (C_p) and Calcite concretion (C_c) are ultimately summed to calculate a *CI* value per site.

- Calcite presence: $CI_p = Calcite\ Presence\ Score\ = \frac{Sum\ of\ pebbles\ with\ calcite}{Number\ of\ pebbles\ counted}$
- Calcite concretion: $CI_c = Calcite\ Concretion\ Score = \frac{Sum\ of\ pebble\ concretion\ scores}{Number\ of\ pebbles\ counted}$

2.5 Benthic Invertebrate Community Structure

Benthic invertebrate community sampling was conducted in October 2014 and October 2017 at sites on Alexander Creek (ALE7-11), West Alexander Creek, unnamed tributaries of West Alexander Creek, Grave Creek, and the unnamed tributaries on Grave Creek (where streams were considered fish bearing). ALE1 and ALE2 were sampled in September 2019. Sampling for invertebrates followed the Canadian Benthic Aquatic Biomonitoring Network (CABIN) field protocols (Environment Canada 2012a).

Samples were collected from riffle/glide habitats using a 400 µm dip net. The sampler kicked vigorously for three minutes; zig-zagging the entire width of the stream while moving upstream. Care was taken not to disturb the stream before the invertebrate sample collection occurred. Samples were transferred to labelled containers and preserved with 10% formalin before being submitted to a CABIN certified taxonomy laboratory (Cordillera Consulting) for taxonomic identification. The CABIN field sheets were filled out and photographs were taken at each site. Habitat data collected at each site included: stream gradient, channel width, depth, velocity, habitat type, vegetation coverage (both riparian and aquatic), substrate characteristics (including a 100-pebble count), disturbance indicators, land use, and weather conditions. General water quality parameters (DO, pH, and water temperature) were also collected using an YSI multimeter.

To asses within-site variability, samples were collected in triplicate at 10% of all sites sampled (each consecutive replicate was collected upstream of the previous). Taxonomic quality assurance and quality control followed the guidelines in the CABIN lab protocol, such as ensuring that sorting was greater than 95% efficient on 10% of samples, and 10% of samples randomly selected were re-identified.

Invertebrate community metrics were used as indicators of aquatic health. A list of invertebrate metrics used and their importance is provided in Table 8. Invertebrate metrics were calculated in CABIN using family level data for all except total abundance.

Simpson's diversity index (*D*) was calculated using the following equation (Krebs 1985):

Equation 2.

$$D = 1 - \sum_{i=1}^{S} (p_i)^2$$

Where S is the total number of taxa at the site and p_i is the proportion of individuals in the *i*th species.

Shannon diversity index (H) was calculated using the following equation (Shannon and Weaver 1949):

Equation 3.

$$H = -\sum_{i=1}^{n} pi \ln pi$$

Where n is the number of species pi is the proportion of individuals in the ith species.

CABIN excludes certain taxa that are not adequately sampled using the CABIN field protocols or can bias samples with large numbers (Environment Canada 2012b). The following taxa were not included in metric calculations or community composition analyses: Ostracoda, Cladocera, Rotifera, Copepoda, Porifera, Nemata/Nematomorpha/Nemertea, and Playhelminthes.

2.5.1 CABIN Analyses

CABIN was developed and is maintained by Environment Canada. It is a useful tool to assess the health of streams in a consistent manner that is easily comparable between reports and projects, including Environmental Effects Monitoring projects.

CABIN compares the benthic invertebrate communities at reference sites, which are generally not affected by human disturbance, to test sites of interest by using the Benthic Assessment of Sediment (BEAST) and the Reference Condition Approach (RCA) (Table 8). Test sites are matched to suitable reference sites based on habitat variables and location. CABIN uses ordination plots to determine the distance between invertebrate communities at tests sites and the reference sites and assigns a potential level of impairment to the test site: reference condition, mildly divergent, divergent, or highly divergent. CABIN also uses the River Invertebrate Prediction and Classification System (RIVPACS) to calculate the ratio of taxa collected at a site to taxa expected to be at a site based on their presence at 70% of all the reference sites in the Columbia/Okanagan model. A RIVPACS ratio >1.00 can indicate community enrichment, while a ratio <1.00 can indicate impairment.

Table 8. Summary of Metrics Used as Bioassessment Indicators of Stream Disturbance (Based on Environment Canada (2012c) and Frenette (2008)).

Metric	Description	Disturbance Response
Total Abundance	The total of all benthic invertebrate organisms in the sample.	Variable
Taxa richness	The total number of taxa identified to the family level. A higher number of taxa indicates a greater ability to adapt to changes.	Variable. Decreases in richness generally indicate increases in disturbance, as only tolerant taxa are able to survive.
% Dominant	The proportion of individuals in the dominant or sub-dominant taxon of a sample. Communities that are even and diverse indicate good water quality.	Increase
Simpson's diversity index (*D*)	A quantitative measure that incorporates the number of species and their relative abundances within a sample. Diverse and even communities are better suited to adapt to change and are indicators of good water quality. Values range from 0 (indicating low community complexity) to 1 (indicating high community complexity).	Decrease
Shannon diversity index (H)	A quantitative measure that incorporates the number of species and their relative abundances within a sample. This index incorporates richness and evenness of the community. Values range from 0 (low species richness and evenness) to 5 (high species richness and evenness).	Decrease
% Ephemeroptera, Plecoptera, Trichoptera (%EPT)	The proportion of individuals in the Ephemeroptera, Plecoptera, and Trichoptera orders. These orders are often found in clean, cool waters and are sensitive to habitat changes. They are indicators of good water quality.	Decrease
% Ephemeroptera (E)	Similar to % EPT, except this excludes the proportions of Plecoptera and Trichoptera in the sample. % Ephemeroptera alone has been found to be a good indicator of coal mining influence (Frenette 2008; Pond et al*.* 2008).	Decrease
% Chironomidae	The proportion of individuals in the Chironomidae family. Species in this family tend to be tolerant of disturbances and are indicators of poor water quality.	Increase

Invertebrate community data for this project was analyzed in the Columbia/Okanagan reference model (Gaber 2012). The model determined five habitat characteristics that were best at distinguishing between invertebrate communities at the reference sites in the region: average water depth, latitude and longitude of the sampling location, the proportion (in percent) of the catchment area that has permanent ice cover, and the proportion (in percent) of the catchment area that has a slope of less than 30%. Based on these predictor variables, all sites in this project were assigned to reference group 3. The reference group has 17 reference sites that were used to compare the sites in this project against (Table 9).

Table 9. Summary of Invertebrate Metric Means and Standard Deviations for Reference Group 3 in CABIN's Columbia/Okanagan Model.

Metric	Group 3	
	Mean	SD
% Chironomidae	8.2	13.6
% Ephemeroptera (E)	43.5	15.9
%EPT	85.3	14.4
% of dominant family	39.7	10.9
% of 2 dominant families	59.2	10.0
Family Richness	17.1	2.4
Simpson's diversity index	0.8	0.1
Total Abundance	5757.3	4889.9

The metrics above describing the invertebrate community, comparisons to reference conditions and RIVPACs assessment are presented in the results section. Additional invertebrate data are presented in the following appendices:

Appendix P. Invertebrate Percent of Organisms
Appendix Q. Invertebrate Primary Production
Appendix R. Invertebrate Bray-Curtis

2.5.2 Lentic benthic invertebrate community structure

A representative area was identified in each wetland for invertebrate sampling collection, making sure to avoid obvious disturbances (e.g. game trails). Using a kick-net, a crew member would pass the net along the edges of the wetland moving the net up and down to stir up sediment and disturb vegetation. Contents of the netting were emptied into a sample tray using a spray bottle to clean the kick net. This process was repeated until a representative sample of the invertebrate community was collected. The sample (less a representative subsample collected for tissue chemistry) was placed into 1 L plastic container and preserved with a formalin solution.

2.6 Periphyton Community Structure

Periphyton sampling occurred in riffle and glide habitat at all sites where invertebrates were collected. Periphyton sampling was conducted at most sites in September 2014 and October 2017, while ALE1 and ALE2 were added to the program in September 2019. Samples were collected for taxonomy (community composition) and two biomass measurements: ash-free dry biomass (AFDM) and chlorophyll-*a* (chl-*a*). Each sample was collected as a composite of five rocks. Three circles of a known area (41.8 cm^2) were scraped from each rock (where possible), one circle for each of the three types of assessments (taxonomy, AFDM, and chl-*a*) in 2014. In 2017, the size of each circle scraped for chl-*a* was reduced to 8.3 cm^2 to facilitate filtering the sample after collection. This was necessary due to high volumes of algae, which made field filtering challenging. Metal tools rinsed with distilled water between sites were used for scraping. A visual assessment was conducted at each site prior to collection to ensure that all periphyton community types were proportionally collected.

Triplicate samples were collected at 10% of the sites to assess within-site variability. Photographs were taken of each scraped rock to document substrate type and size. Types and amounts of riparian vegetation on right and left banks, degree of shade, stream gradient, water depth, substrate composition, and depth and velocity at which each rock was sampled were also recorded. The chl-*a* scrapings were placed into a 125 mL amber plastic bottle and set in a dark cooler with ice. The AFDM scrapings were placed into a 125 mL wide-mouth LDPE jar and were also set in a dark cooler with ice. Chl-*a* and AFDM samples were frozen at the end of each sampling day and shipped to ALS laboratories (Burnaby, BC) for analysis once all of the samples were collected. In 2017, chl-*a* samples were filtered onto a 0.45 µm glass fiber filter on the day of sampling. The filters were then gently folded into dark plastic containers and frozen immediately after filtering. Taxonomy samples were collected in a 125 mL LDPE jar and preserved with Lugol's iodine solution at the time of collection. Samples for taxonomy were sent to Plankton R Us Inc. Laboratory (Winnipeg, MB) for identification and enumerations (as cell counts). Taxonomic analysis included a random selection of 10% of the samples for a recount to assess lab procedures, identification, and enumeration efficiency.

Periphyton community metrics are not developed as well as invertebrate metrics for assessing aquatic health. Periphyton dominant group, dominant taxa, chl-*a* and AFDM will be presented in results. Periphyton biomass estimates can indicate site impairment if values decrease over time. Alternatively, high periphyton biomasses are a nuisance and indicate nutrient enrichment at a site. Chl-*a* values for this project were compared against the provincial recommended guideline of 100 mg/m^2 for maintaining good aquatic health (BC MOE 2001). Collectively, this information was used to determine the overall aquatic health of the sites surveyed, based on periphyton.

Additional periphyton group data will be presented in Appendix S.

2.7 Instream Flow Study

An instream flow study (IFS) is required to assess fish habitat changes that may result from reductions in the quantity of stream flow. Flow reductions can occur in creeks associated with the development of waste dumps (West Alexander Creek), pits (upper Alexander Creek and West Alexander Creek), and water storage/withdrawal (Grave Creek). Through consultation with the project team (specifically Hydrology) and under the mine design provided for this baseline assessment, flow reductions were only identified as a possibility in the Grave Creek system where water storage and withdrawal are proposed. Streamflows were monitored by Environment and Climate Change Canada from 1970 to 1999 near the mouth of Grave Creek. These data were used to determine mean annual flow. The Hydrology discipline completed a screening level assessment of the withdrawal scenario and determined that the water withdrawal would not result in an increased number of days when Grave Creek discharge was below 20% Mean Annual Discharge (MAD); a threshold triggering a full IFS as described in the as per the *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators* (BC MOE 2016). Nonetheless, NWP Coal opted to conduct a modified IFS that focused on effects to fish passage as a result of water withdrawal and not a traditional IFS that looks to quantify changes in habitat availability as a result of the proposed project. This was a conservative assessment aimed to corroborate the implications of the hydrology screening assessment.

A field program was designed to assess the relationship between channel hydraulics and discharge. Specifically, the field program measured depth and velocity at various transects within the withdrawal reach over a range of flows; however, this passage assessment focused on depth as the critical passage criterion. Data were primarily collected in riffles and cascades, as these habitat unit types were identified as the first to likely experience passage issues under reduced flows. Data were secondarily collected in glides, but for the purpose of developing stage-discharge relationships with staff gauges at water level logger stations. Flows were collected from August 1, 2018 to June 6, 2019 on eight dates representative of different points on the hydrograph to include a range of flows to establish flow-depth relationships. Three replicates were collected for cascades, four replicates for glides and two replicates for riffles. The maximum depth from each cross-section was plotted against the mean flow for each sample day separately for each habitat unit type. These data were fit to a power regression and predictive relationship between flow and depth was calculated. A depth of 0.1 m was used to determine the lowest flow that would maintain fish passage (i.e. the critical minimum flow requirement). This depth was used as a conservative estimate as it represents a water depth that is approximately two times the depth of the adult fish captured in the Grave Creek, and also aligns with the recommendations for minimum depth for trout passage of ~0.4 ft (California Department of Fish and Wildlife, 2017). Again, for conservatism, the habitat unit with the highest critical minimum flow will be used as the recommendation for the minimum flow that will maintain adequate depths for fish passage in all habitat units on the stream.

3 Alexander Creek

3.1 Overview

Alexander Creek is a fourth order tributary of Michel Creek, and is located 10 km southeast of Sparwood, BC. Alexander Creek drains the southerly (Reaches 1 to 7) and easterly (Reaches 8 to 11) limits of the proposed project footprint. West Alexander Creek is the major tributary of the Alexander Creek system and drains the western portion of the project. Alexander Creek was delineated into 11 reaches; 7 of these were included in detail in this baseline study. Alexander Creek Reaches 7, 8, and 9 are immediately downstream of/adjacent to the proposed project area and have the potential to be affected by the Project. Reaches 1 and 2 are also downstream, but further afield, marking the downstream limit of the LSA in this watershed. Reaches 10 and 11 are upstream of the project area and are not expected to be affected by the Project. They are therefore considered reference areas for this baseline study. Alexander Creek reaches 1 to 10 are fish bearing with WCT, BT, MW, and EB present (BC MOE 2018 and this study). Figure 9 below shows the location of sampled sites on the Alexander Creek. Reaches 1 and 2 were sampled in detail to provide a description of downstream habitat within the LSA, while reaches 7-11 were sampled to describe habitat in the immediate vicinity of the Project footprint within the LSA. Reach 3-6 were only sampled during spawning surveys.

Alexander Creek Reach 1 marks the downstream end of the LSA. It begins at the confluence with Michel Creek and extends upstream for 1.68 km. Reach 1 is characterized by riffle-pool morphology with a low average gradient of 1.54%, typical of its morphology. The channel is relatively unconfined with a mature mixed riparian forest over a moderately wide floodplain.

Alexander Creek transitions from Reach 1 to Reach 2 as gradient (1.21%) decreases and confinement increase. The channel becomes transitional between riffle-pool and cascade-pool in morphology. Reach 2 extends upstream for 1.88 km and is paralleled by Highway 3 for the entire length.

Alexander Creek reaches 3-6 begin where Alexander Creek bends to the north and away from Highway 3. The section is characterized by alternating reaches of aggrading areas with less confinement and higher sinuosity, and transport reaches with higher confinement and lower sinuosity. The upstream end of Reach 6 is near the Deadman Pass Forest Service Road bridge.

Alexander Creek Reach 7 extends 7.74 km upstream from the Deadman Pass Forest Service Road bridge upstream to the Alexander/West Alexander Creek confluence. Reach 7 has a low average gradient of 0.89% and is categorized as a riffle-pool morphology. There are sections of Reach 7 that have extensive stream braiding. This reach is a notable area in the lack of valley confinement relative to downstream reaches.

Alexander Creek Reach 8 extends 1.57 km upstream from the confluence of Alexander and West Alexander Creeks. The reach break between ALE7 and ALE8 is characterized by a change in morphology and gradient. ALE8 has a steeper gradient (2.25%) than ALE7 resulting in many long cascades (Figure 5). Alexander Creek Reach 8 is categorized as a riffle-pool morphology bordering on cascade-pool. Channel braiding is limited in the reach (Table 10).

Alexander Creek Reach 9 begins where the gradient increases and the stream becomes more confined (Figure 6). The average gradient for Reach 9 is 3.4%, which was classified as cascade-pool morphology. Alexander Creek Reach 9 extends 5.7 km upstream to the reach break where an unnamed tributary enters, resulting in an observable reduction in stream width.

Alexander Creek Reach 10 begins at the confluence with an unnamed tributary and extends for 0.21 km upstream to bedrock falls. ALE10 is a reference reach since it is upstream of future potential mine impacts. These bedrock falls at the upstream end were determined to be a barrier to fish passage. The average gradient for ALE10 is 10.4%, which gives it a step-pool morphology (Figure 7).

Alexander Creek Reach 11 begins at a long bedrock falls, which was determined to be a barrier to fish migration and is considered a reference reach as it is upstream of mine impacts. These falls have resulted in a gradient greater than 20% for 20 m, limiting fish access into ALE11 (Figure 8). Alexander Creek Reach 11 extends for 3.58 km upstream to the headwaters of Alexander Creek. The average gradient for ALE11 is 10.9% which gives it a step-pool morphology. Alexander Creek Reach 11 is considered non-fish bearing.

Figure 4. Upstream view of glide habitat at ALE7.

Figure 5. Upstream view of cascade habitat at ALE8.

Figure 6. Upstream view of riffle habitat at ALE9.

Figure 7. Upstream view of glide habitat at ALE10.

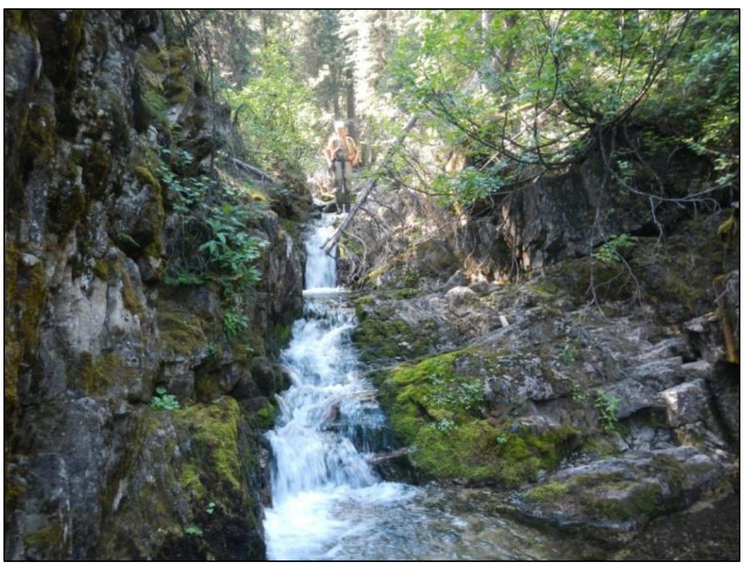

Figure 8. Upstream view of bedrock falls in ALE11.

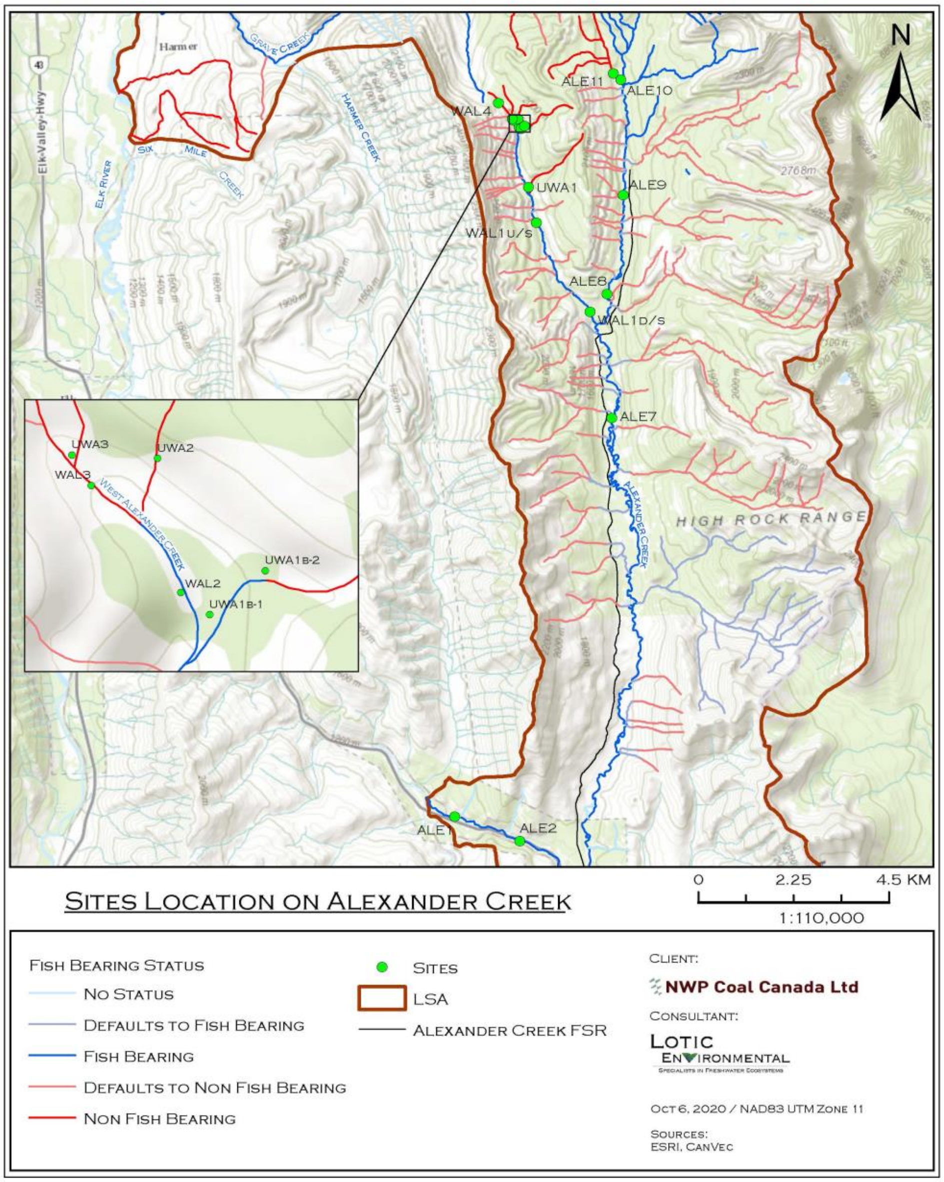

Figure 9. Sample site location on Alexander Creek.

West Alexander Creek is a second order stream and a tributary of Alexander Creek, comprising four reaches. Reaches 1 and 2 (WAL1 and WAL2) are fish bearing, while Reaches 3 and 4 (WAL3 and WAL4) are non-fish bearing. West Alexander Creek has four tributaries: Unnamed West Alexander 1 (UWA1), Unnamed West Alexander 1b (UWA1b), Unnamed West Alexander 2 (UWA2), and Unnamed West Alexander 3 (UWA3). Fish species that were captured in West Alexander Creek and its tributaries include WCT and BT.

West Alexander Creek Reach 1 starts at the confluence with Alexander Creek and ends at the confluence with UWA1b, where there is a notable reduction in stream size upstream of the tributary confluence. West Alexander Creek Reach 1 is 6.75 km long with an average gradient of 4.36%, giving it a cascade-pool morphology (Figure 10). The riparian vegetation is mature forest. Due to the extended length of WAL1, it was decided that two fish community sites would be completed within this reach to better represent the conditions across the entire reach. One fish community site was located close to the Alexander Creek confluence and was called West Alexander Reach 1 Downstream (WAL1 d/s). The second fish community site, called West Alexander Reach 1 Upstream (WAL1 u/s), was located approximately halfway up the reach.

West Alexander Creek Reach 2 extends 0.26 km upstream from the confluence with UWA1b up to a dry cascade that had a slope of >30%. The average gradient for WAL2 is 15.0%, giving it a step-pool morphology.

West Alexander Creek Reach 3 is considered non-fish bearing as it has a gradient of 45% for over 200 m (Figure 11) (FPCBC 1998). West Alexander Creek Reach 3 is 0.58 km in length. This reach was also frequently observed to dewater. The dewatered channel essentially exists to convey flow from the headwater wetland habitat of WAL4 to WAL2. There are two small tributaries (UWA2 and UWA3) that enter in WAL3. The gradient barrier and frequent dewatering of WAL3 prevents fish migration upstream. West Alexander Creek Reach 3 does not provide any fish habitat.

West Alexander Reach 4 is a wetland area at the headwaters of the West Alexander watershed (Figure 12). Overland flow leaving the wetland quickly goes underground throughout much of the year. The gradient barrier and frequent dewatering of WAL3 prevents fish migration into WAL4. No tributaries were observed entering the wetland. The area of the wetland is approximately 4,107 m^2 with depths ranging from 0.5 m near the shore to approximately 2 m in the center of the wetland when full. The substrate was dominated by fines and organics. The riparian vegetation was dominated by mature coniferous forest.

Figure 10. Upstream view of riffle habitat at WAL1 D/S fish community site.

Figure 11. Upstream view of steep gradient at WAL3.

Figure 12. WAL4 wetland looking north.

Unnamed West Alexander Creek 1 is a first order, unnamed tributary on the east side of West Alexander Creek. Unnamed West Alexander Creek 1 is 2.04 km long with an average gradient of 25.0% and is located approximately 4.21 km northwest of the Alexander Creek/West Alexander Creek confluence. Unnamed West Alexander Creek 1 is classified as a step-pool morphology and is non-fish bearing with the exception of the first 15 m. There is a 1.93 m high waterfall barrier approximately 15 m from the confluence with West Alexander Creek. Approximately 100 m upstream of this waterfall is a second waterfall.

Unnamed West Alexander Creek 1b (UWA1b) is a first order, unnamed tributary on the east side of West Alexander Creek, which is located approximately 5.57 km northwest from the Alexander Creek/West Alexander Creek confluence. There are two reaches on this stream (UWA1b-1 and UWA1b-2). Unnamed West Alexander Creek 1b Reach 2 is 1.39 km long with an average gradient of 20.0%. Unnamed West Alexander Creek 1b Reach 2 starts at the increase in gradient upstream of UWA1b-1 and ends at the headwaters. The slope increased to >30% for 200 m and this steep gradient is considered a barrier to fish movement (Figure 13). Unnamed West Alexander Creek 1b Reach 2 is classified as a step-pool morphology and is considered non-fish bearing based on gradient (FPCBC, 1998).

Unnamed West Alexander Creek 2 is a first order, unnamed tributary on the east side of West Alexander Creek. Unnamed West Alexander Creek 2 is 0.77 km long with an average gradient of 23.8% and is located approximately 5.71 km upstream from the Alexander Creek/West Alexander Creek confluence. Unnamed West Alexander Creek 2 is one of the two tributaries that enter WAL3. Unnamed West Alexander Creek 2 is classified as a step-pool morphology and is non-fish bearing. There is a 10 m high waterfall barrier located 15 m from the confluence with WAL3.

Unnamed West Alexander Creek 3 is a first order, unnamed tributary on the east side of WAL3. Unnamed West Alexander Creek 3 is 0.87 km long with an average gradient of 14.8% and is located approximately 5.83 km upstream from the Alexander Creek/West Alexander Creek confluence. Unnamed West Alexander Creek 3 is classified as a step-pool morphology and is non-fish bearing. There is a gradient barrier of >60% for 100 m located 5 m from the confluence with West Alexander Creek (Figure 14).

Figure 13. Upstream view of gradient barrier at UWA1b-2.

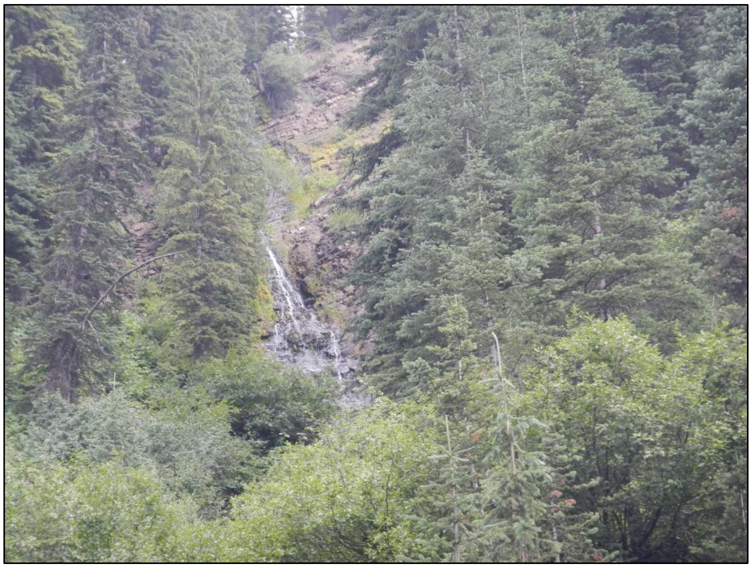

Figure 14. Upstream view of gradient barrier at UWA3.

3.2 Habitat Summary

Fish community surveys provided overall habitat summaries for ALE1 and ALE2. ALE1 was characterized by riffle-pool morphology having an average bankfull width of 8.17 m and an average bankfull depth of 0.42 m. Water depths were variable throughout but on average were 0.28 m at the time of survey with. There was limited stream canopy cover and substrate typically characterized by cobbles and gravels. Overall habitat quality was considered good for this reach with a mature riparian, diverse channel units, and sufficient overhead cover.

ALE2 was transitional to cascade-pool morphology with substrate dominated by cobble and boulder throughout the reach. The average bankfull width was 10.0 m and average bankfull depth was 0.57 m. The wetted depth was 0.33 m. Canopy cover was limited and characterized by mixed forest.

Habitat mapping for ALE7 was completed for a 76.5 m section of stream. The average gradient was 1.5% and the substrate was dominated by gravels and cobbles. The mean cover was considered poor at 6%. Cover was provided by undercut banks and large woody debris. The average bankfull width was 13.2 m and the average bankfull depth was 0.55 m. The average water depth at that time was 0.19 m. The riparian vegetation was mixed forest. Low levels of calcite deposition were observed during the pebble count measurements. FHAP sampling collected habitat composition data over the entire 7.74 km length of ALE7. The habitat composition for the reach was: 46.2% glide, 24.2% riffle, 23.8% cascade, and 5.8% pool (Table 10).

Alexander Creek Reach 8 has an average bankfull width of 11.78 m, an average wetted width of 6.62 m, and an average bankfull depth of 0.42 m. The substrate was dominated by cobble and gravel. The FHAP sampling collected habitat composition data over the entire 1.569 km length of ALE8. The habitat composition for the reach was: 53.4% cascade, 35.1% riffle, 10.7% glide, and 0.9% pool. Habitat mapping was completed for the 103 m long ALE8 fish community site. Mean percent cover per habitat unit of 6% which is considered poor. Cover was provided by cut banks, boulders, and large woody debris.

ALE9 had an average bankfull width of 9.63 m, an average wetted width of 5.51 m, and a mean bankfull depth of 0.57 m. The substrate was dominated by cobble and gravel. The FHAP sampling collected habitat composition data over the entire 5.7 km length of ALE9. The habitat composition for the reach was: 64.8% cascade, 17.9% riffle, 15.7% glide, and 1.7% pool. Habitat mapping was conducted for the ALE9 fish community site. There was a mean percent cover per habitat unit of 9% which is considered poor. Cover present in this reach was provided by boulders and cut banks.

The FHAP sampling collected habitat composition data over the entire 0.21 km length of ALE10. The habitat composition for the reach was: 51.5% cascade, 21.9% glide, 19.5% riffle, and 7.1% pool (Table 10). Alexander Creek Reach 10 had an average bankfull width of 3.81 m, an average wetted width of 2.34 m, and a mean bankfull depth of 0.76 m. The substrate was dominated by cobble and gravel. A habitat map was created for the 96.6 m long ALE10 fish community site. The mean percent cover per habitat unit was 7%, which is considered poor. The cover was provided by large woody debris, boulders, and undercut banks.

FHAP sampling collected habitat composition data over a 6.75 km length of WAL1 (Table 10). The habitat composition for the reach was: 54.2% cascade, 29.9% riffle, 13.1% glide, and 2.8% pool. Calcite was not observed during pebble count sampling. West Alexander Creek Reach 1 had a mean bankfull width of 5.89 m, a mean bankfull depth of 0.45 m, average wetted width of 3.63 m, and an average water depth of 0.15 m. For WAL2, FHAP sampling collected habitat composition data over the 0.26 km. The mean bankfull width was 3.82 m, the mean bankfull depth was 0.28 m, the mean wetted width was 3.04 m, and the mean water depth was 0.12 m (Table 10). The habitat composition for the reach was: 70.9% cascade, 10.9% riffle, 10.3% glide, and 8.0% pool. The substrate of WAL2 was dominated by cobble and gravel. There was a moderate amount of cover provided by small and large woody debris and boulders. The riparian vegetation was primarily mature coniferous forest. Calcite was not noted in this reach.

Habitat data for UWA1 were collected during fish inventory sampling. In July 2014, UWA1 had an average wetted width of 1.89 m and limited cover. Cover was provided by trace amounts of small and large woody debris. The substrate was dominated by cobbles and gravels. The water depth within the reach was shallow. Habitat data were collected on UWA1b-1 during fish inventory sampling. In August 2017, the site had an average bankfull width of 2.85 m and an average wetted width of 1.95 m. There was a moderate amount of cover provided by small and large woody debris, boulders, and overhanging vegetation. The substrate was dominated by cobbles and gravel. The stream was deeply channelized near the confluence with West Alexander Creek.

Habitat data were collected at UWA3 during fish inventory sampling. In July 2014, there was an average bankfull width of 2.07 m and an average wetted width of 1.20 m. Water depths were very shallow (<0.1 m). There was a trace amount of cover provided by small woody debris. The substrate was dominated by large rock/bedrock and boulders. The riparian vegetation was mixed forest.

Table 10. Habitat summary and fish bearing status for Alexander Creek sampling sites.

Site ID	Fish Bearing	Reach Length (m)	Bankfull Width (m)	Bankfull Depth (m)	Wetted Width (m)	Water Depth (m)	% Cascade	% Glide	% Pool	% Riffle	% Other
ALE1	Yes	991.80	8.17	0.13	7.32	0.28	-	-	-	-	-
ALE2	Yes	1878.4	10.0	0.33	9.72	0.25	-	-	-	-	-
ALE7	Yes	9296.2	11.56	0.55	8.88	0.28	23.80%	46.20%	5.80%	24.20%	0.00%
ALE8	Yes	1870.4	11.78	0.42	6.62	0.18	53.40%	10.70%	0.90%	35.10%	0.00%
ALE9	Yes	5436.3	9.63	0.57	5.51	0.26	64.80%	15.70%	1.70%	17.90%	0.00%
ALE10	Yes	246.6	3.81	0.76	2.34	0.12	51.50%	21.90%	7.10%	19.50%	0.00%
ALE11	No	3581.1	3.55	-	2.71	0.4	-	-	-	-	-
WAL1	Yes	5484.1	5.89	0.45	3.63	0.15	54.20%	13.10%	2.80%	29.90%	0.00%
WAL2	Yes	240.2	3.82	0.28	3.04	0.12	70.90%	10.30%	8.00%	10.90%	0.00%
WAL3	No	578.3	2.07	-	1.2	<0.1	-	-	-	-	-
WAL4	No	424.9	5.89	0.45	3.63	0.15	54.2%	13.1%	2.8%	29.9%	0.0%
UWA1	No	2040.8	-	-	1.89	-	-	-	-	-	-
UWA1b-1	No	182.1	2.85	-	1.95	-	-	-	-	-	-
UWA1b-2	No	1385.9	2.80	-	1.89	-	-	-	-	-	-
UWA2	No	777.4	1.65	-	1.42	<0.1	-	-	-	-	-
UWA3	No	869.6	2.07	-	1.20	<0.1	-	-	-	-	-

3.3 Fish Use

3.3.1 Distribution

Fish inventory sampling was completed on all reaches listed above, with the exception of ALE1-ALE7 (previously determined to be fish bearing from provincial database). In 2014, four reaches were sampled on Alexander Creek (ALE8, ALE9, ALE10, and ALE11), three reaches were sampled on West Alexander Creek (WAL2, WAL3, and WAL4), and three unnamed tributaries to West Alexander Creek (UWA1, UWA2, and UWA3) were sampled. In 2017, sampling was only required on reaches suspected as being non-fish bearing, which included four Unnamed West Alexander Creek tributaries (UWA1, UWA1b, UWA2, and UWA3), one reach of West Alexander Creek (WAL4), and one reach of Alexander Creek (ALE11). Each of these were confirmed to be non-fish bearing.

Reaches considered fish bearing following fish inventory included: ALE1-ALE10, WAL1, and WAL2. Fish species captured were WCT, BT (Figure 15), MW and EB (Figure 16). Fish bearing status was either confirmed directly by fish capture, inferred if connected to a fish bearing reach in absence of a fish barrier, or as noted confirmed in the Provincial database. Additional information came from sampling completed during the Aquatic Health discipline and is included here for a complete representation of the fish species and life stages detected in the LSA as part of the Crown Mountain project. Fish were captured in all fish bearing reaches except ALE8 and ALE10. Both of these reaches defaulted to fish bearing based on unimpeded connection to downstream fish bearing reaches.

Table 11. Fish Inventory Sampling Summary for Fish Bearing Reaches in the Alexander Creek Watershed.

Site	Sample Date	Electrofishing Effort (s)	Species	Total Number Captured	Min Fork Length (mm)	Max Fork Length (mm)
ALE7	July 12, 2017	1,848	BT	1	172	172
	August 2, 2017	3,856	WCT	2	186	190
			EB	2	170	240
			BT	1	250	250
	August 4, 2017	1,550	BT	4	160	191
			EB	1	175	175
ALE8	August 1, 2014	415	-	-	-	-
ALE9	July 10, 2014	396	WCT	2	150	160
	July 12, 2017	1,691	WCT	2	159	169
	August 3, 2017	2,301	WCT	6	159	225
			BT	2	150	160
ALE10	July 10, 2014	202	-	-	-	-
WAL1	July 30, 2014	385	WCT	1	45	45
	July 12, 2017	3005	WCT	3	148	198
			BT	2	186	240
	August 3, 2017	1490	WCT	6	149	229
			BT	2	100	200
WAL2	July 28, 2014	169	WCT	3	180	202

3.3.2 Rearing

Summer rearing fish use was assessed via fish community surveys performed on ALE7 to ALE10 and WAL1 during the summer and fall of 2014 (Table 12). As discussed in the methods section, WAL1 represented the large majority of the fish bearing channel in West Alexander Creek and the decision was made to sample WAL1 at two locations and none in WAL2. The two WAL1 fish community sites are labeled WAL1d/s and WAL1u/s. ALE1 and ALE2 were sampled for fish community in August 2019.

Fish community sampling was completed to provide a more detailed and quantifiable assessment of fish density in fish bearing reaches. Data summarised in Table 12 presents fish community results including: species captured, total number of species capture, minimum/maximum fork length (mm), and pooled fish density (fish/100m^2). WCT were ubiquitous throughout the Alexander Creek watershed and were found to have the highest site-specific density of all species present, with exception of ALE1. ALE1 was dominated by EB. BT was the species with the second largest distribution. Fish densities ranged from <1 to 14 fish/100m^2 with the downstream reach of West Alexander Creek having the highest density of fish observed. The species with the highest density at ALE1 was EB (7.12 fish/100m^2). ALE7, ALE8, and ALE9 all had low densities of fish (<1 fish/100m^2). No fish were captured at ALE10.

Table 12. Fish Community Assessment Data for Sites on Alexander Creek.

Site ID	Date	Species	Total	Min Fork Length (mm)	Max Fork Length (mm)	Density (fish/ 100 m²)
ALE1	Sep. 12, 2019	EB	12	20	44	7.12
		MW	3	68	74	1.12
		BT	1	68	68	0.75
		WCT	1	121	121	0.37
ALE2	Sep. 13, 2019	WCT	14	72	152	4.66
		BT	5	128	139	2.33
		MW	1	82	82	0.29
ALE7	Sep. 14, 2017	WCT	4	127	199	<1
		EB	2	195	199	<1
ALE8	Sep. 14, 2017	BT	7	121	200	1
ALE9	Sep. 19, 2017	WCT	5	80	186	1
		BT	1	146	146	<1
ALE10	Sep. 18, 2017	NFC	0	0	0	0
WAL1 d/s	Aug. 22, 2017	WCT	11	55	151	4
WAL1 u/s	Aug. 22, 2017	WCT	23	48	182	14

*NFC = No fish captured during sampling.

In summary, results suggest that fish use in all reaches sampled is primarily by juvenile age-classes. WAL1 was the only reach WCT fry was detected in using electrofishing. The abundance observed and distribution between WAL 1 and WAL2 suggests that spawning is likely occurring throughout this reach. MW were not captured in the upper portions of the Alexander Creek watershed. However, MW fry were captured in ALE1 and ALE2, closer to the Michel Creek mainstem (Figure 16).

Figure 15. Juvenile WCT captured from ALE9 (left) and juvenile BT captured at ALE8 (right).

Figure 16. EB captured at ALE1 (left) and MW captured at ALE2 (right).

3.3.3 Spawning

A total of 38 potential spawning habitat units were documented as being good for potential use by spawning WCT during the spring spawning survey at ALE7. These sites contained appropriate spawning gravel size, some overhead cover, suitable flow, adequate water depth, sufficient proximity to holding water. Three separate observations of WCT were noted during the 2017 survey; however, none of these fish were displaying spawning behaviour. While suitable spawning habitat was noted, no redds were observed during the fall survey.

No redds or spawning fish were reported in fall 2014. However, three potential redds were observed during the fall spawning surveys in October 2017 (Figure 17). The three redds were located on the edge of glides in gravel/small cobble substrate. The water depths at the redds were approximately 0.1 - 0.2 m. The sizes of the redds were approximately 0.5 by 1.5 m. This size suggests that these were more likely BT redds, as opposed to the other fall spawning species in this portion of the watershed, EB.

Figure 17. Suspected BT redd in glide habitat in ALE7 (October 2017).

Spawning potential was considered moderate for WCT throughout Reach 8. Areas of sizeable spawning gravel were infrequent but sufficient due to good water depths and low gradients. Fall spawning habitat was noted as poor due to shallow water depths. No fish or redds were observed during spring or fall spawning surveys.

Spawning potential throughout ALE9 was considered moderate for WCT. Areas of sizeable spawning gravel were infrequent, but sufficient due to suitable water depths and low gradients at a habitat unit scale. Three WCT were observed during the 2017 spring survey, but were not displaying any typical spawning behaviour. Fall spawning habitat was noted as poor due to shallow water depths. No fish or redds were observed during fall spawning surveys.

Spawning potential throughout ALE10 was considered poor. Areas of sizeable spawning gravel were limited due to shallow water depths and steep gradients. No fish or redds were observed during spring or fall spawning surveys.

A total of 22 habitat units were documented in WAL1 as having good potential to be used by WCT for spawning. These sites contained adequate spawning gravel size, overhead cover, flow, and water depth. One pair of WCT was observed during the 2017 spring spawning survey, but was not displaying typical spawning behaviour. Limited spawning potential was observed for fall-spawning species (e.g. BT and EB) as water depths were seasonally shallow. No spawning fish or redds were observed during either fall spawning survey.

Steeper gradients and a lack of suitable spawning substrate limited the spawning potential in WAL2. This reach is considered to have negligible spawning potential.

A second fall spawning survey was conducted in September 2019 to provide additional information of BT use throughout Alexander Creek and to specifically extend efforts downstream to confluence with Michel Creek. The 2019 survey was conducted from Michel Creek upstream to ALE7. ALE1 and ALE2 were classified as having good spawning potential based on the presence of appropriate spawning gravel size, some overhead cover, suitable flow, adequate water depth, and sufficient proximity to holding water. One confirmed redd was documented in ALE5.

Table 13. Spawning potential in the Alexander Creek watershed.

Reach	Spawning Potential
ALE1	Good
ALE2	Good
ALE7	Good
ALE8	Moderate
ALE9	Moderate
ALE10	Poor
WAL1	Good
WAL2	Poor

Based on spring and fall spawning surveys Alexander Creek provided variable spawning suitability for all life stages of fish (see Table 13). Out of those sites classified as fish bearing, ALE1, ALE2, ALE7, and WAL1 provided the best potential habitats for spawning use, with WAL1 corroborated by high WCT fry density. Many of the other reaches had moderate to poor spawning potential based on high channel gradient, low water depth, and large substrate size.

3.3.4 Overwintering

During overwintering surveys, flowing water was observed within ALE7 and the channel was free of ice and snow. *In situ* winter water temperatures were 2.0°C and DO levels were suitable at 12.22 mg/L. Deep pools were frequent within this reach. Depth and velocity were recorded for a glide habitat and the depth ranged from 0.02 to 0.24 m and velocity ranged from 0.00 to 0.12 m/s. Overwintering potential was therefore considered good.

Overwintering potential was considered good at ALE8, with a temperature of 1.5°C and 12.98 mg/L DO. Deep pools were infrequent within this reach. Depth and velocity were recorded for a riffle habitat and the depth ranged from 0.01 to 0.28 m and velocity ranged from 0.01 to 0.41 m/s.

The DO level of 12.98 mg/L was favorable within ALE9 as it remained well above the 6.5 mg/L threshold for sustaining aquatic life in water. However, shallow depths and low temperatures produced overall poor overwintering potential within the reach.

Within ALE10, water temperature was cold at 0.2°C and the DO level was 12.75 mg/L indicating poor overwintering potential. Deep pools were infrequent within this reach. Depth and velocity were recorded for a riffle habitat, with the depth ranging from 0.07 to 0.16 m and velocity ranging from 0.00 to 0.13 m/s.

Overwintering surveys were limited in West Alexander Creek due to numerous avalanche paths terminating in the valley bottom where the reach is located. This resulted in safety concerns, limiting access during winter months. Both WAL1 and WAL2 were observed from helicopter. Only short sections of Reach 1 were observed to be flowing during the overwintering survey, while large portions of the channel were covered by ice and snow. *In situ* winter water temperature measured near the confluence with Alexander Creek was 0.1°C, but DO levels were suitable at 12.62 mg/L (Table 14). Depth was 0.14 m. Overwintering was considered poor in this reach.

While not directly surveyed in winter, it was perceived that WAL2 provided limited overwintering habitat due to shallow water depth, steep gradient, and short length observed in the open water season.

The lower portions of Alexander Creek (i.e. ALE1 and ALE2) were qualitatively assessed using general observations, as well as additional temperature data. ALE1 is routinely observed to maintain surface flow year-round, with suitable depths. Observations of open water during extreme cold periods and temperature data collected by Lotic Environmental (unpublished data) have documented ALE1 as having relatively warm water during winter periods. As such, overwintering is considered good in this reach. ALE2 is a higher gradient with extended cascade sections. These sections are routinely observed with extensive anchor ice formation, precluding suitable overwintering use.

Based on depth, temperature, and DO, overwinter potential was classified as poor, moderate, or good. Based on these factors, ALE8 provided the best overwintering potential across Alexander Creek with good overwintering potential and moderately suitable habitat for all life stages of fish present (Table 14).

Table 14. Overwintering potential in the Alexander Creek watershed.

Reach	Winter Temp (°C)	Winter DO (mg/L)	Overwintering Potential
ALE1	-	-	Good (inferred)
ALE2	-	-	Poor (inferred)
ALE7	2	12.11	Good
ALE8	1.5	12.48	Good
ALE9	-0.1	12.98	Poor
ALE10	0.2	12.75	Poor
WAL1	0.1	12.62	Poor
WAL2	-	-	Poor (inferred)

3.3.5 Population Study

Results of the population study indicate the WCT in the Alexander Creek watershed are composed of two populations and/or life history cohorts. The differences in these populations, or sub-populations were substantial in terms of size, total distance moved, and home range (Robinson et al. 2022).

Radio tagged WCT in West Alexander Creek and upper Alexander Creek were smaller bodied (mean fork lengths of 220 mm and 246 mm; mean weights of 132 g and 216 g, respectively), exhibited much lower total distances moved (1.9 km and 2.8 km, respectively), and smaller home ranges (1.1 km and 1.9 km, respectively). WCT from middle and lower Alexander Creek were larger bodied (mean fork lengths of 321 mm and 416 mm; mean weights of 449 g and 905 g, respectively), exhibited much greater total distances moved (38.8 km and 53.3 km, respectively), and larger home ranges (24.9 km and 28.5 km, respectively).

WCT in West Alexander Creek and upper Alexander Creek appear to be fluvial resident populations that hold, feed, overwinter, and spawn in these locations. Based on overwintering data collected during the baseline assessment and the population study it is believed that a portion of these fish over-winter in interstitial spaces fed by groundwater, but additional data is needed to substantiate this. Spawning was recorded in West Alexander Creek, but additional study is required to assess how far down on Alexander Creek the smaller fluvial population is spawning.

WCT in middle and lower Alexander Creek appear to be fluvial migratory and leave Alexander Creek in the fall (September/October) to overwinter in the Elk River, then return to Alexander Creek in the spring (May/June), likely to spawn. See Robinson et al. (2022) for more details on the findings of the population study.

3.4 Calcite Assessment

A low amount of calcite was observed in ALE7, ALE8, and ALE9 (Table 15). The amount observed is higher, but within range for reference streams (i.e. no upstream mining) within the Elk River watershed. No calcite was found to be present at the other sampled sites in the Alexander Creek and tributaries.

Table 15. Calcite Assessment Summary.

Reach	Mean Concretion Score (0-2)	Mean Calcite Presence Score (0-1)	Mean Calcite Index Score
ALE1	0	0.11	0.11
ALE2	0	0.15	0.15
ALE7	0	0.26	0.26
ALE8	0	0.20	0.20
ALE9	0	0.21	0.21
ALE10	0	0	0.00
ALE11	0	0	0.00
WAL1	0	0	0.00

3.5 Invertebrate Community Assessment

Invertebrates were collected at Alexander Creek in 2014, 2017 and 2019. There were more than twice as many invertebrates collected in samples from 2017 at ALE7, ALE8, and ALE10 compared with samples in 2014 (Table 16). UWA3 had the highest number of taxa predicted to occur in the sample based on the RIVPACs assessment, but were instead some of these taxa found to be absent (Table 17). ALE7 and ALE8 transitioned from being similar to reference conditions to mildly divergent from 2014 to 2017, all other sites stayed the same categorization of disturbance between years (Table 18).

Table 16. Macroinvertebrate metrics and CABIN assessment for Crown Mountain (Alexander Creek) local study area.

Site	TA	TR	% D	*D*	H	%EPT	%E	%C
				Year 2014				
Site	**TA**	**TR**	**% D**	***D***	**H**	**%EPT**	**%E**	**%C**
ALE7	4200	20	53.92	0.79	1.90	78.76	67.97	17.32
ALE8	6000	19	49.02	0.83	2.06	81.33	62.95	16.71
ALE9	7480	18	58.38	0.74	1.95	92.43	69.46	6.49
ALE10	3989	18	36.21	0.87	2.29	94.43	45.96	3.34
UWA2	1750	17	35.56	0.87	2.25	86.98	50.16	11.74
UWA3	1292	15	58.82	0.8	1.93	65.02	23.53	31.89
WAL1	7100	19	58.87	0.8	2.04	88.45	62.82	3.66
				Year 2017				
Site	**TA**	**TR**	**% D**	***D***	**H**	**%EPT**	**%E**	**%C**
ALE7	27860	21	52.95	0.81	2.02	80.59	59.59	15.86
ALE8	21640	21	62.58	0.77	1.79	86.62	76.99	12.63
ALE9	5550	20	49.39	0.85	2.23	86.59	60.98	11.28
ALE10	9580	17	52.78	0.79	1.97	81.41	48.72	10.26
UWA2	1894	18	51.56	0.84	2.12	70.31	37.5	26.56
WAL1	11020	21	36.26	0.88	2.37	76.19	33.52	14.10
				Year 2019				
Site	**TA**	**TR**	**% D**	***D***	**H**	**%EPT**	**%E**	**%C**
ALE1	5617	23	39.10	0.87	2.35	79.40	54.63	8.66
ALE2	4414	23	34.63	0.89	2.45	72.82	46.28	5.50

TA – Total Abundance of all Benthic Invertebrate Organisms, TR – Taxa Richness, % D - The Proportion of Individuals in Dominant and Second Dominant Taxon, *D* - Simpson's Diversity Index, H – Shannon Diversity Index, % EPT - % Ephemeroptera, Plecoptera and Trichoptera, % E - % Ephemeroptera, % C - % Chironomidae.

Table 17. RIVPACS assessment results for sites on Alexander Creek.

Site	2014	2017	2019
ALE1	-	-	1.06
ALE2	-	-	0.97 TAEN
ALE7	0.96 HYDR	1.05	-
ALE8	0.86 HYDR, PSYC	0.96 HYDR	-
ALE9	0.95 HYDR	1.05	-
ALE10	0.86 HYDR, TAEN	0.76 CHLO, PSYC, TAEN	-
UWA2	0.76 HYDR, PSYC, TAEN	0.76 EPHE, HYDR, TAEN	-
UWA3	0.57 EPHE, HYDR, PERL, PSYC, TAEN	-	-
WAL1	1.06	1.06	-

CHLO – Chloroperlidae, EPHE – Ephemerellidae, HYDR – Hydropsychidae, PERL – Perlodidae, PSYC – Psychodidae, TAEN – Taeniopterygidae, (-) Refers to no data available.

Table 18. Site comparisons and probabilities to reference groups for Alexander Creek sites.

Site	2014	2017	2019
ALE1	-	-	Group 3; 0.72
ALE2	-	-	Group 3; 0.73
ALE7	Group 3; 0.89	Group 3; 0.89	-
ALE8	Group 3; 0.88	Group 3; 0.88	-
ALE9	Group 3; 0.91	Group 3; 0.91	-
ALE10	Group 3; 0.95	Group 3; 0.95	-
UWA2	Group 3; 0.91	Group 3; 0.91	-
UWA3	Group 3; 0.91	-	-
WAL1	Group 3; 0.76	Group 3; 0.76	-

Green – Similar to reference, Blue – Mildly divergent, Yellow – Divergent, Red – Highly divergent, (-) Refers to no data available.

3.6 Periphyton Community Assessment

Periphyton surveys were completed on Alexander Creek during 2014 and 2017. ALE9 had the highest amount of chl-*a* and AFDM in 2014, but levels dropped in the 2017 sample (

Table 19). All other sites had relatively low chl-*a* and AFDM across both years. Chrysophytes and diatoms were the dominant groups on periphyton in 2014 and 2017, however, in 2019 chlorophyte and cyanobacteria were more prevalent.

Table 19. Periphyton Community for Crown Mountain Local Study Region (Alexander Creek)

		2014		
Site ID	**Dominant Group (%)**	**Dominant Taxon**	**Chl-a (mg/m^2)**	**AFDM (g/m^2)**
ALE7	Chrysophytes (99.2)	*Hydrurus* sp.	0.58	0.44
ALE8	Chrysophytes (95.03)	*Hydrurus* sp.	0.01	0.52
ALE9	Chrysophytes (99.5)	*Hydrurus* sp.	2.94	2.16
ALE10	Diatoms (83.6)	*Gomphonema minutum*	0.02	0.02
WAL1	Diatoms (64.1)	*Gomphonema minutum*	0.01	0.02
WAL2	Diatoms (55.3)	*Homoeothrix varians*	0.02	0.10
		2017		
Site ID	**Dominant Group (%)**	**Dominant Taxon**	**Chl-a (mg/m^2)**	**AFDM (g/m^2)**
ALE7	Diatoms (35.5)	*Hydrurus* sp.	0.06	0.04
ALE8	Chrysophytes (76.9)	*Hydrurus* sp.	0.16	0.32
ALE9	Chrysophytes (43.2)	*Heteroleibeinia profunda*	0.06	0.28
ALE10	Diatoms (59.4)	*Achnanthes minutissima*	0.05	0.09
WAL1	Diatoms (91.1)	*Diatoma vulgare*	0.03	0.07
		2019		
Site ID	**Dominant Group (%)**	**Dominant Taxon**	**Chl-a (mg/m^2)**	**AFDM (g/m^2)**
ALE1	Chlorophyte (65.0)	*Diatoma vulgare*	0.25	0.22
ALE2	Cyanobacteria (97.9)	*Heteroleibeinia profunda*	0.29	0.51
UWA2	Cyanobacteria (61.0)	*Heteroleibeinia profunda*	0.04	0.16

Chl-a - Chlorophyll-a, AFDM - ash-free dry biomass.

4 Grave Creek

4.1 Overview

Grave Creek is a fourth order stream and a tributary of the Elk River, comprising four fish bearing reaches. It drains into the northern portion of the LSA. Grave Creek Reaches 1 and 2 are downstream of the Project area and have been described in Teck Coal's Baldy Ridge Baseline Assessment. Grave Creek Reach 3 (GRA3) and Reach 4 (GRA4) are located upstream of the Baldy Ridge assessment area and were therefore assessed as part of the Crown Mountain Project. Two tributaries of Grave Creek, Unnamed Tributary of Grave Creek 1 (UTG1) and Unnamed Tributary of Grave Creek 2 (UTG2) are located within the proposed Project footprint. A migration barrier (5 m high waterfall) on Grave Creek Reach 1 has previously been identified as a barrier to all species of fish excluding WCT. Therefore, for this Project, it is accepted that only WCT reside in the Grave Creek reaches that lie within the LSA. Figure 18 shows the location of sampled sites on Grave Creek.

The following summaries of these reaches are from Lotic Environmental (2015).

> *"Grave Creek Reach 1 extends 1.4 km upstream from the confluence of the Elk River to a point upstream of the outflow confluence of Grave Lake. The upstream limit to Reach 1 is marked by a change in confinement, as the stream enters a canyon section (Reach 2). Fish species that have been reported in Grave Creek include westslope cutthroat trout, rainbow trout, bull trout, eastern brook trout, kokanee, mountain whitefish, longnose sucker, and redside shiner (Berdusco 2008; BC MOE 2014). There are four bedrock waterfalls located downstream of the Grave Lake outlet that range in size from one to three metres in height. These waterfalls serve as possible barriers to fish passage throughout the reach. During this study, westslope cutthroat trout was the only species captured upstream of the highest waterfall, which is approximately one kilometre upstream from the Elk River confluence." "Grave Creek Reach 2 extends 3.0 km from the Reach 1/2 break to the confluence with Harmer Creek. Relative to Reach 1, this reach is more confined and had higher gradient. Westslope cutthroat trout were the only fish captured in Reach 2 during this study, and in 2008 (Berdusco 2008)."*

Grave Creek Reach 3 is located upstream of the confluence with Harmer Creek and any surface water influence from Elkview Operations. There are two main forest service roads (FSRs)- Harmer Creek FSR and Grave Creek FSR that cross GRA3. Grave Creek Reach 3 extends for 6.37 km upstream of the confluence with Harmer Creek and is located downstream of the confluences with UTG1 and UTG2. Reach 3 ends at the confluence of UTG1, where there is a decrease in channel width. Grave Creek Reach 3 had an average gradient of 5.5%, giving it a cascade-pool morphology. Grave Creek Reach 4 is a reference site and extends 2.32 km upstream from the confluence with UTG1 to the headwaters of Grave Creek. Grave Creek Reach 4 is upstream of the confluences with UTG1 and UTG2, and is considered a reference site for this baseline study. Grave Creek Reach 4 has an average gradient of 24.1%, giving it a step-pool morphology. This reach is defined by a smaller channel size relative to GRA3 and less confinement upstream of the canyon.

Unnamed Tributary of Grave Creek 1 (UTG1) is a first order, unnamed tributary entering on the south side of Grave Creek at the break between GRA3 and GRA4. The stream is located approximately 1.63 km east of where the Grave Creek FSR crosses Grave Creek. Unnamed Tributary of Grave Creek 1 is 3.14 km long with an average gradient of 9.36%, giving it a step-pool morphology. Unnamed Tributary of Grave Creek 1 was determined to be fish bearing. There is only one reach on UTG1-1 and it begins at the confluence with Grave Creek and ends at the headwaters. Unnamed Tributary Grave Creek 2 (UTG2) is a second order, unnamed tributary on the east side of Grave Creek. There are two reaches on Unnamed Tributary of Grave Creek 2 (UTG2-1 and UTG2-2). Unnamed Tributary of Grave Creek 2

Reach 1 is 0.68 km long and is located approximately 2.47 km east from where the Grave Creek Forestry Road crosses Grave Creek. Unnamed Tributary of Grave Creek 2 Reach 1 is fish bearing based on average gradient and morphology and begins at the confluence with Grave Creek. The reach has an average gradient of 7.1%, giving it a cascade-pool morphology. Unnamed Tributary of Grave Creek 2 Reach 2 is 1.78 km long and is located approximately 2.85 km east from where the Grave Creek Forestry Road crosses Grave Creek. Unnamed Grave Creek 2 Reach 2 has an average gradient of 20.0%, giving it a step-pool morphology. This reach begins with a 30% gradient for 100 m, which prevents fish from moving into the reach from UTG2-1. As such, UTG2-2 is considered non-fish bearing.

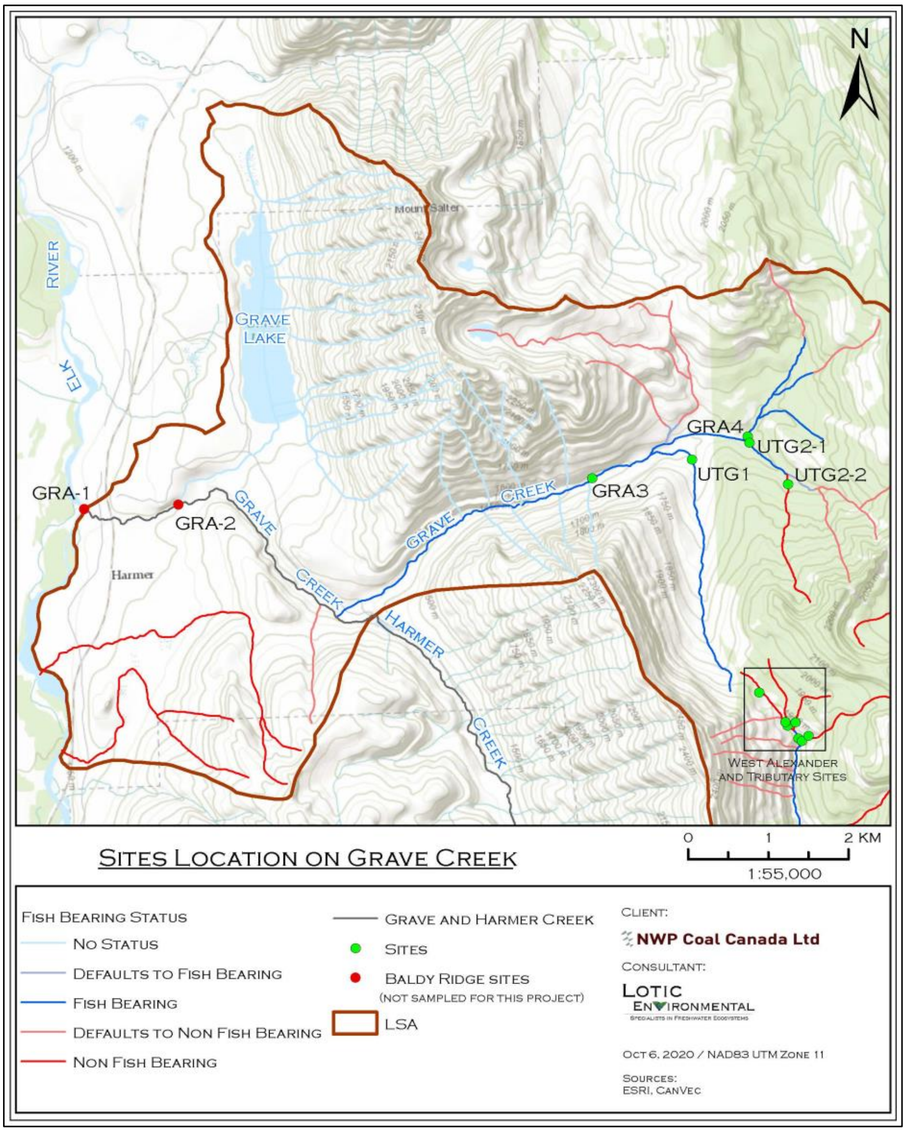

Figure 18. Sample site locations on Grave Creek.

4.2 Habitat Summary

Habitat mapping for GRA3 was completed for a 100 m section of stream. The morphology of this 100 m section of GRA3 site was a riffle-pool (Figure 19). GRA3 was composed of five glides, three riffles, and four cascades, indicating good channel complexity. The substrate was dominated by cobble and gravel. Cover was considered poor with a mean percent cover per habitat unit of 4%, provided by boulders, large woody debris and undercut banks. The average bankfull width was 5.76 m. The average wetted width was 3.42 m, and the average water depth was 0.12 m. The riparian vegetation was mixed forest.

Figure 19. Upstream view of riffle habitat at GRA3.

The average bankfull width of GRA4 was 4.37 m (Table 20). The average wetted width was 2.56 m and the average water depth was 0.13 m. Cover was considered good with a mean percent cover per habitat unit of 13%, provided by boulders, large and small woody debris, and overhanging vegetation. The substrate was dominated by cobble and boulders (Figure 20). The riparian vegetation was mature coniferous forest.

Habitat data were collected during fish inventory and community sampling for UTG1. The average bankfull width was 3.76 m. The average wetted width was 2.05 m, and the average water depth was 0.12 m. The substrate was dominated by cobble and gravel. Cover was considered poor with a mean percent cover per habitat unit of 3% provided by large and small woody debris, and undercut banks. The riparian vegetation was mature coniferous forest.

Habitat data were collected during fish inventory sampling. In July 2014, UTG2-1 had an average bankfull width of 4.74 m and an average wetted width of 1.89 m. Cover was limited and provided by small and large woody debris. The substrate was dominated by gravel and cobble. The riparian vegetation was mixed forest.

Habitat data were collected during fish inventory sampling. In July 2014, UTG2-2 had an average bankfull width of 2.66 m and an average wetted width of 2.45 m. Cover was moderate and was provided by small and large woody debris, and overhanging vegetation. The substrate was dominated by gravel and cobble. The riparian vegetation was mixed forest.

Table 20. Habitat summary for Grave Creek fish sites.

Site ID	Fish Bearing	Reach Length (m)	Bankfull Width (m)	Wetted Width (m)	Water Depth (m)	Average Gradient (%)
GRA3	Yes	6366	5.76	3.42	0.12	5.50%
GRA4	Yes	2323.8	4.37	2.56	0.13	24.10%
UTG1	Yes	3141.9	3.76	2.05	0.12	9.36%
UTG2-1	Yes	679.3	4.74	1.89	-	7.10%
UTG2-2	No	1780.7	-	-	-	-

Figure 20. Upstream view of riffle habitat at GRA4.

4.3 Fish Use

4.3.1 Distribution

Two unnamed tributaries of Grave Creek (UTG1 and UTG2) were sampled during fish inventory in July 2014. UTG1 was confirmed fish bearing to the headwaters and required no further assessment of fish distribution. UTG2 was differentiated into two reaches, UTG2-1 and

UTG2-2. No fish were captured or observed during the fish inventory sampling in either reach. However, fish were observed in UTG2-1 during spawning surveys confirming the fish bearing status. In 2017, sampling focused on the suspected non-fish bearing reach of UTG2-2. This reach begins with a 30% gradient for 100 m. This gradient barrier prevents fish from moving into the reach from Reach 1. No fish were captured upstream of this barrier in either year. Therefore, UTG2-2 is considered non-fish bearing. As with Alexander Creek, additional data on fish distribution by species and life stage is available through Aquatic Health sampling completed in July 2017. This information is included in Table 21. As with Lotic Environmental (2015), WCT was the only fish species sampled in these reaches.

Table 21. Fish inventory sampling summary for fish bearing reaches in the Grave Creek watershed.

Site	Sample Date	Electrofishing Effort (s)	Species	Total Number Captured	Min Fork Length (mm)	Max Fork Length (mm)
GRA3	July 11, 2017	1,316	WCT	3	155	201
	July 14, 2017	658	WCT	5	152	186
GRA4	July 10, 2017	1,265	WCT	12	135	171
UTG1	July 29, 2014	311	WCT	4	47	201
UTG2-1	July 29, 2014	325	NFC	0	0	0

4.3.2 Rearing

Fish community surveys were performed on fish bearing reaches of Grave Creek (GRA3 and GRA4), as well as UTG1 during fall of 2017 (Table 22). Fish community sampling of UTG2 was not required as it is likely unimpacted from the proposed mine and was included for inventory to provide a more complete assessment of fish habitat availability within the Grave Creek watershed. Each site was sampled using a 3-pass electrofishing over a minimum distance of 100m for each site or 10 times the bankfull width (RISC 2001). WCT was the only species captured across Grave Creek.

Fish community surveys were performed on fish bearing reaches of Grave Creek. Data in Table 22 summarize fish community results including: species captured, total number of species capture, minimum/maximum fork length (mm), and average fish density per 100m^2.

Table 22. Fish community assessment data for sites on Grave Creek.

Site ID	Date	Species	Total	Min Fork Length (mm)	Max Fork Length (mm)	Density (fish/ 100 m²)
GRA3	Sep-20-17	WCT	5	150	209	1
GRA4	Oct-11-17	WCT	16	76	165	7
UTG1	Oct-11-17	WCT	4	61	119	2

4.3.3 Spawning

Fall spawning surveys were not required in these reaches as no fall spawning fish are present upstream of the Grave Creek Reach 1 barrier. Spawning surveys were completed in the spring of 2014 and 2017. In GRA3 areas of suitable spawning habitat were noted during spring surveys. However, no direct evidence of spawning (i.e., redds or paired fish) was observed.

At GRA4, two adult WCT were observed pairing up near the Branch C FSR. The fish were displaying spawning behaviour. However, no redd was observed. Overall, spawning potential was considered to be good in this reach (Table 23).

Ten habitat units were documented in UTG1 as moderate potential to be used by WCT for spawning during the spring spawning survey. These sites contained good spawning gravel size, fair overhead cover, good flow, and fair water depth. A pair of WCT was observed during the 2014 survey, but they did not display any typical spawning behaviour. A second survey in 2014 found one Westslope Cutthroat Trout redd. As such, spawning potential in UTG1 was considered good.

In UTG2-1, eight habitat units had good potential to be used as WCT spawning sites. Spawning sites had fair depth, a good range of flows, good pea-sized gravel, but limited cover. Two WCT were observed holding in suitable spawning habitat in 2014. However, no redds were observed at this time or at any other time during spawning surveys.

Table 23. Spawning potential in Grave Creek.

Reach	Spawning Potential
GRA3	Moderate-good
GRA4	Good
UTG1	Good
UTG2-1	moderate

4.3.4 Overwintering

Overwintering potential at Grave Creek was not directly assessed. However, depths, temperature, and DO levels during fall surveys suggest overwintering potential is likely for all fish bearing Grave Creek sites. This is further supported by the fact that this is an isolated WCT population that must carry out all stages in these streams.

4.4 Calcite Assessment

No calcite was detected during calcite assessments on the Grave Creek sites. All sites assessed had a *CI* of 0.00.

4.5 Invertebrate Community Assessment

Invertebrate data was collected in 2014 and 2017 at Grave Creek sites. The number of taxa was much higher in GRA3 in 2014 (16553 individuals) compared with GRA3 in 2017 (2793). Percent of EPT decreased in GRA4 from 2014 to 2017, which is also seen in percent of E (Table 24).The RIVPACs assessment also shows that in 2017 GRA4 had more taxa that were predicted to be present but were absent from the sample, however, GRA4 transitions to being more similar to reference conditions in 2017 (Table 25, Table 29). All sites in Grave Creek are similar to reference conditions, except for UTG2-1, which is mildly divergent.

Table 24. Macroinvertebrate metrics and CABIN assessment for Grave Creek sites.

Year 2014

Site	TA	TR	% D	*D*	H	%EPT	%E	%C
GRA3	16553	21	73.01	0.72	1.64	98.99	43.44	0.32
GRA4	1655	18	44.41	0.86	2.25	97.58	57.1	1.51
Year 2017								
Site	**TA**	**TR**	**% D**	***D***	**H**	**%EPT**	**%E**	**%C**
GRA3	2793	16	51.93	0.82	1.98	98.07	38.89	1.21
GRA4	5229	21	37.22	0.89	2.52	78.41	32.95	7.95
UTG1	7100	18	54.11	0.78	2.06	94.05	60.06	3.97
UTG2-1	1348	19	35.79	0.89	2.45	78.42	24.86	14.75

TA – Total Abundance of all Benthic Invertebrate Organisms, TR – Taxa Richness, % D - The Proportion of Individuals in Dominant and Second Dominant Taxon, *D* - Simpson's Diversity Index, H – Shannon Diversity Index, % EPT - % Ephemeroptera, Plecoptera and Trichoptera, % E - % Ephemeroptera, % C - % Chironomidae.

Table 25. RIVPACS assessment results for sites on Grave Creek.

Site	2014	2017
GRA3	1.05	1.05
GRA4	1.05	0.86 HYDR, PERL
UTG1	-	0.96 PERL
UTG2-1	-	1.05

HYDR - Hydropsychidae, PERL - Perlodidae, (-) Refers to no data available.

Table 26. Site comparisons and probabilities to reference groups for Grave Creek sites.

Site	2014	2017
GRA3	Group 3; 0.84	Group 3; 0.84
GRA4	Group 3; 0.92	Group 3; 0.92
UTG1	-	Group 3; 0.79
UTG2-1	-	Group 3; 0.91

Green – Similar to reference, Blue – Mildly divergent, Yellow – Divergent, Red – Highly divergent, (-) Refers to no data available.

4.6 Periphyton Community Assessment

Periphyton surveys were done on Grave Creek during 2014 and 2017. All sites have low amounts of chlorophyll-a and AFDM (Table 27). GRA4 transitioned from being dominantly chlorophyte to chyrsophytes from 2014-2017. UTG2-1 remained being predominately diatoms in both years.

Table 27. Periphyton community for Crown Mountain local study region (Grave Creek).

Site ID	Dominant Group (%)	Dominant Taxon	Chl-a (mg/m²)	AFDM (g/m²)
		Year 2014		
GRA4	Chlorophyte (38.4)	*Rivularia* sp.	0.03	0.08
UTG2-1	Diatoms (64.7)	*Gomphonema minutum*	0.00	0.02
		Year 2017		
Site ID	**Dominant Group (%)**	**Dominant Taxon**	**Chl-a (mg/m²)**	**AFDM (g/m²)**
GRA3	Cyanobacteria (75.3)	*Gloeocapsa punctata*	0.09	0.05
GRA4	Chyrsophyte (60.6)	*Chamaesiphon incrustans*	0.01	0.02
UTG1	Cyanobacteria (72.5)	*Heteroleibeinia profunda*	0.06	0.06
UTG2-1	Diatoms (54.8)	*Heteroleibeinia profunda*	0.03	0.08

Chl-a - Chlorophyll-a, AFDM - ash-free dry biomass.

4.7 Instream Flow Study

The maximum depth versus discharge relationships for cascades, riffles, and glides are shown in Figure 21 , Figure 22, and Figure 23, respectively, with flow being mean daily discharge estimated at hydrology station GH2. The r^2 values ranged from 0.6376 to 0.8559, suggesting a good fit for this predictive purpose. Discharge required to maintain this depth and satisfy fish passage was highest for riffles (0.034 m^3/s) and cascades (0.029 m^3/s). Glides required lower discharge at 0.014 m^3/s. These results are intuitive and support the assumption that flow would become limiting in the shallower, turbulent flows of riffles and cascades before the laminar glides. This assessment suggests a minimum flow of 0.034 m^3/s should be maintained in order for fish to move freely throughout this reach (Appendix T). Given a mean annual discharge of 0.210 m^3/s and 20% MAD of 0.042 m^3/s this assessment confirms that a minimum instream flow set to 20% MAD would be expected to maintain fish passage (Figure 21 - Figure 24).

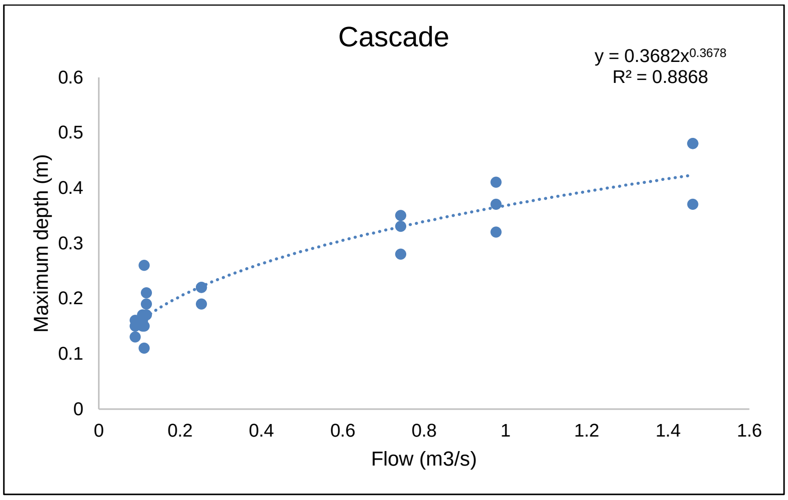

Figure 21. Maximum depth versus flow for cascades within Grave Creek.

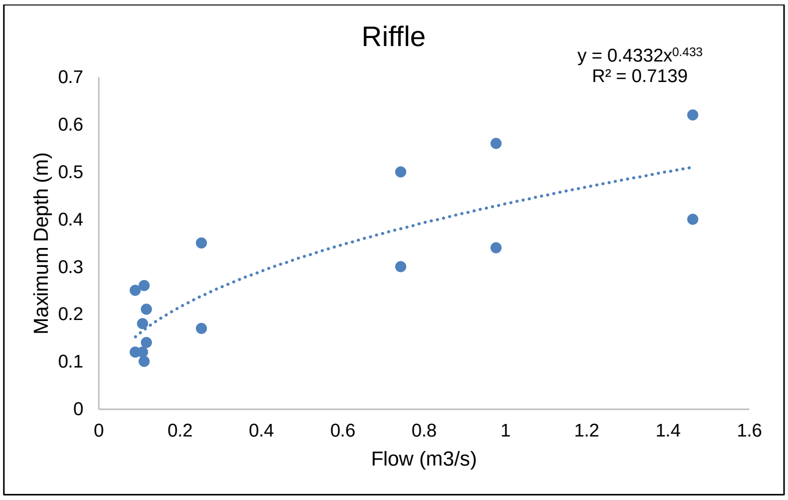

Figure 22. Maximum depth versus flow for riffles within Grave Creek.

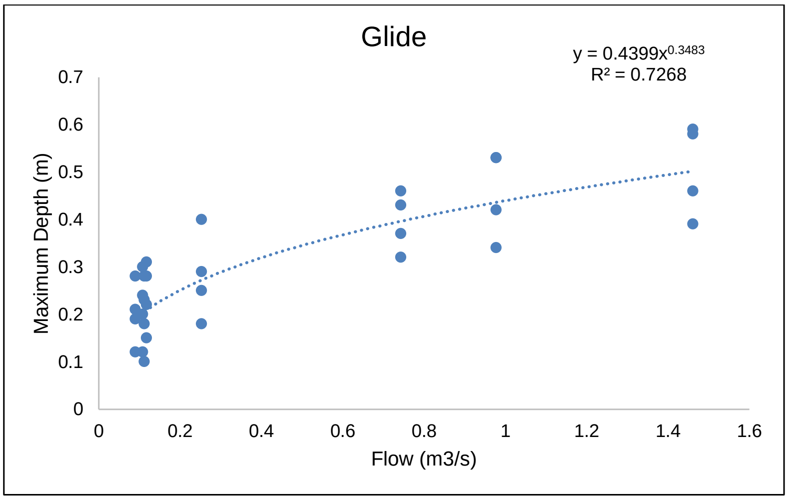

Figure 23. Maximum depth versus flow for glides within Grave Creek.

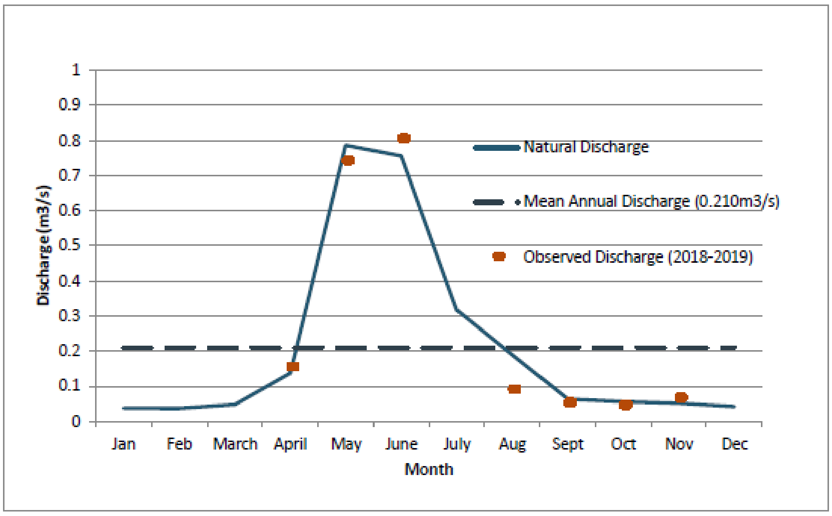

Figure 24 Mean annual discharge (MAD) of Grave Creek compared to the natural discharge of Graves Creek diversion site (Appendix T).

4.8 Unnamed Tributaries to the Elk River and UTG3

Three additional tributaries near the rail loadout on Grave Prairie were investigated for their status as classified streams and if classified as a stream, for the potential of being fish bearing based on evidence from their flow accumulation.

4.8.1 Unnamed Tributary to the Elk 1

This is the most northern tributary. It is a dry seasonal channel (Figure 25). The channel has extensive overhanging vegetation in the form of terrestrial shrubs (mainly snowberry) and grasses. The channel consists mainly of fine materials, but has some gravel in some sections. Channel is approximately 30-40 cm deep. There was no connectivity to fish bearing water and the ephemeral conditions precluded presence of an isolated fish population.

Figure 25 Unnamed tributary to the Elk 1 is seasonally dry.

4.8.2 Unnamed Tributary to the Elk 2

This is the center tributary. It is a dry seasonal channel (Figure 26). Surrounding area was wooded and was lined by riparian vegetation, but no surface flow was observed. The channel not very defined for the majority that we followed it and consisted of fine materials, no gravels were observed. Some wet areas were present, but no flow was observed. There was no connectivity to fish bearing water and the ephemeral conditions precluded presence of an isolated fish population.

Figure 26 Unnamed tributary to the Elk 2 is seasonally dry.

4.8.3 Unnamed Tributary to the Elk 3

This is the most southern channel of the three assessed on Grave Prairie. The flow was present in a defined channel (Figure 27). The stream was considered likely limiting to supporting fish. Additionally, the culvert at the road was a hanging culvert with a drop of approximately 1 m (Figure 28). Substrate consist of fine gravels and finer materials. This site should be sampled later in the year to determine if it dries later in the year and to confirm non-fish bearing status.

Figure 27. Unnamed tributary to the Elk 3 has a defined channel.

Figure 28. Unnamed tributary to the Elk 3 flows through a culvert.

4.8.4 Unnamed Tributary to Grave Creek 3 (UTG3)

This tributary is a ground water fed channel with a bankfull width of 0.2 m. The tributary goes subsurface 50 m after it crosses the Grave Creek FSR. Further downstream it returns to the surface and increases in size. There are two confirmed fish barriers downstream from that point. Between the fish barrier and the confluence, the stretch is fish bearing (approximately 500 m). Substrate in this area is mainly fine gravel and sand. At the confluence with the creek, the tributary widens to 0.4 m.

5 Lentic Ecosystems

5.1 Overview

Inventory and assessment of wetland habitat was completed within the LSA in 2019. A desktop study completed to determine the location of potential wetlands of importance identified 27 potential wetlands (Figure 29). These locations were surveyed from July 15-26, 2019 to provide wetland habitat descriptions based on:

- Fish presence or absence
- Substrate
- Area
- Depth
- Length and width
- Side channels and connectivity to main watersheds
- Inflow and outflow channels
- Wildlife (e.g. amphibians, birds etc. that could potentially be impacted by The Project)

After the initial wetland habitat description surveys were completed these 27 locations were narrowed down to 6 potential wetlands deemed ‘high importance’. These were sampled further from September 18- 20, 2019 for:

- Surface water quality
- Sediment analyses
- Benthic invertebrates

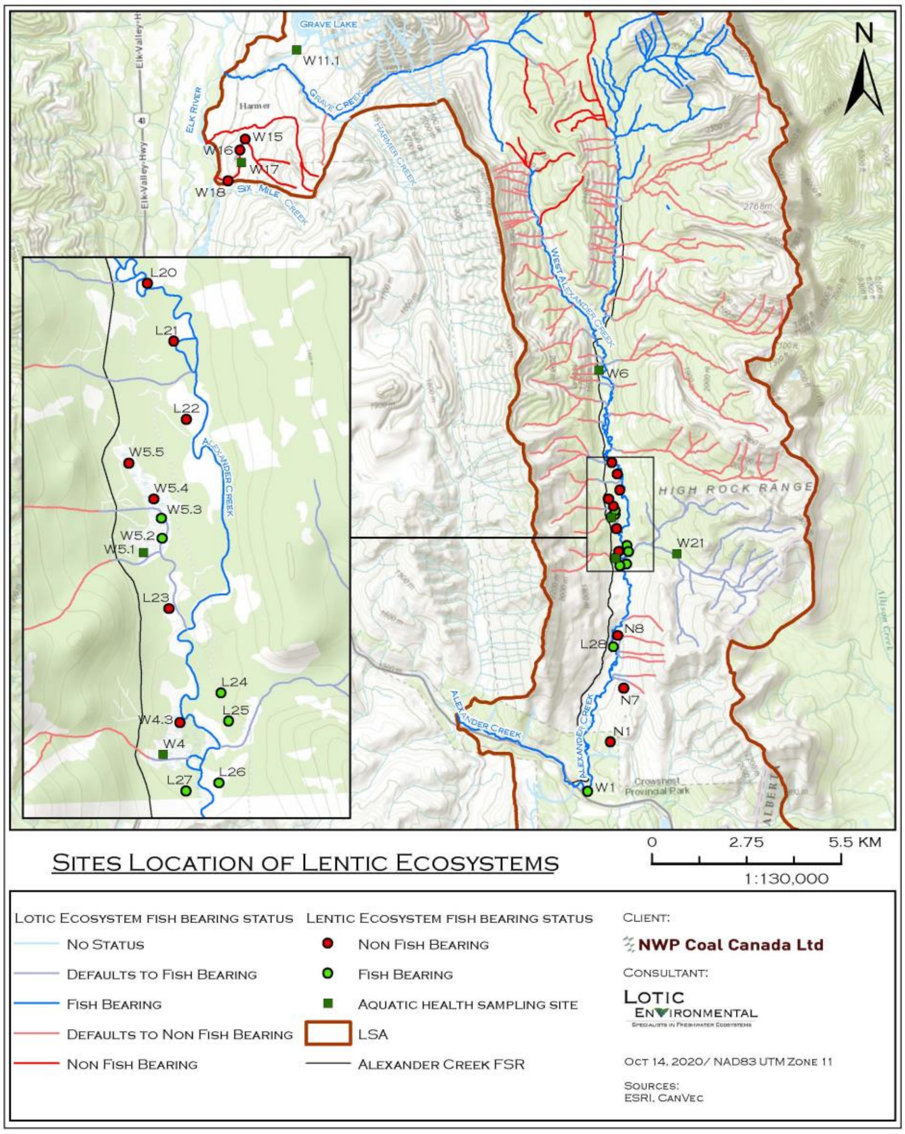

Figure 29. Location of lentic ecosystem/wetlands.

5.2 Habitat Summary

Wetland site W1 is a wetland with poor fish habitat, 3-4 springs, shallow depths (0.2 m), substrate composed of fines, and is likely a beaver impoundment. Sandpipers were observed around the wetland. The habitat could be suitable for fish rearing, but has no overwintering potential and access to Alexander Creek is limited is by two very shallow benches (0.2 m) isolating the wetland by fall. The wetland had a maximum depth of 1 m, is 84 m in length by 45 m in width, and has 4 outflow channels to the Alexander. During fish community sampling 2 minnow traps were set and the wetland benches were electro-fished. One unknown juvenile fish was observed (~100 mm) but not captured during electrofishing (Figure 30).

Wetland site W4 is a large wetland 120 m in length by 20 m in width with variable water depths between 0.2-0.5 m and cover provided by dead trees. The sediment was fines largely filled with aquatic macrophyte vegetation. The riparian was dense willow and spruce, which provide overhead cover for side channels. The wetland has four side channels, most of which were dry during sampling. One channel likely connects the wetland to Alexander Creek at higher water. Four minnow traps were set and two inlet channels were electrofished. No fish were observed or caught but one large tadpole was caught in a minnow trap and photographed (Figure 30).

Wetland site W5.1 is a complex consisting of two very shallow wetland pools (~0.1 m) connected by a central channel that flows further back and an outflow channel (Figure 30). Both wetlands were 10 m in width and 55 m in length collectively. Cover was composed of woody debris/logs. There was some cobble in the central channel but otherwise substrate is very sandy and dark/muddy. There were two spring fed areas of this wetland with both toads and birds observed utilizing the wetland. One minnow trap was set in this in the outflow which was also electrofished. One unknown juvenile (~100 mm) was observed during electrofishing, but not captured (Figure 30).

Wetland site W5.2 is one large wetland (30 m length by 45 m width) connected to wetland 5.1 through a side channel. It was also connected to Alexander Creek along a 400 m long side channel, defaulting this wetland to fish bearing status. There was some macrophyte and algal cover on the substrate and emergent vegetation along the edges. Birds were observed perched on the dead trees within the wetland and a beaver dam at one end of the wetland. Minnow traps were set and electrofishing was conducted in a side channel that led towards Alexander Creek. No fish were caught or observed (Figure 31).

Wetland site W5.3 was connected to W5.2 via an outlet channel and is 30 m in length by 45 m in width. There was minimal aquatic vegetation with some willow coverage along the inflow and outflow channels. Water depth was variable (0.2-0.3 m) along the margins of the wetland and quickly transitioned to being quite deep (>1 m) in the middle of the wetland. The substrate was dark organic fines throughout. Many cedar waxwings were observed throughout. Water depths were not appropriate for electrofishing, but minnow traps were set. No fish were caught (Figure 31).

Wetland sites W5.4 and W5.5 were found to be dry fields. These sites were consequently not sampled for fish presence/absence.

Figure 30. Top left is Wetland W1 downstream view, top right is Wetland W4 upstream view. Bottom left is connecting channels behind Wetland W5.1. Bottom right is cross-section of Wetland W5.1.

Wetland site W6 is a large wetland (67 m length by 41 m width). The two outflow channels connected it to Alexander Creek, while two inflow channels contribute to the variation in depth (0.2-0.8 m) across the wetland. There was large woody debris throughout, where many birds were seen perched. There was little aquatic vegetation and the substrate was organic fines. Minnow traps were set throughout this wetland and all inflow/outflow channels were electrofished. No fish were caught or observed (Figure 31).

Wetland sites W15 and W16 were both large grassy fields with tall grass and some wetted areas. A lack of surface water precluded fish sampling and resulted in both wetlands being classified as non-fish bearing. Bulrushes were observed growing at W16 suggesting seasonal wetting and a shallow water table.

Wetland sites W17 is a wetland in the Grave Creek watershed. It was 70 m in length by 20 m in width. No defined inflow channel was noted. The one outflow channel had some slow flow blocked up by some woody debris. Water depths were variable (~0.3 m) and deeper further into the wetland. There was dense aquatic vegetation and fines throughout along with large water beetles. Multiple tadpoles and frogs were seen inhabiting this wetland near the outflow channel and across the wetland. No fish were captured or observed after setting minnow traps. There was no appropriate area to electrofish (Figure 32).

Figure 31. Top left is Wetland W5.2 upstream view and right is Wetland W5.3 upstream view. Bottom left is Wetland W6 upstream view and pictured right is its main inflow channel.

Wetland site W18 is a very small (30 m in length by 14 m in width) wetland with stagnant water dominated by instream vegetation (fines and aquatic ferns). It had a small, low flowing, inflow channel. The outflow channel was a culvert that flowed into Black Creek. The culvert was perched and acting as a barrier to fish movement. Minnow traps were set near the inflow to assess fish presence, but captured no fish. There were no suitable areas to electrofish (Figure 32).

None of the Wetland N1, N7, and N8 sites were suitable to sample for fish presence. Wetland N1 was a marshy/grassy area with a small channel (~0.05 m in length) running through it. This channel was not deep enough to electrofish and was spring fed. Wetland N1 was not close to Alexander Creek and would be considered a high elevation. Wetland N7 and Wetland N8 were both at high elevations, grassy, and not connected to any fish bearing water.

Figure 32. On the left is Wetland W17 upstream view and on the right is Wetland W18 in an overhead view.

Wetland L20 was a large grassy area, with small pools of water, surrounded by shrubs and some relict side channels (none of which had signs of recent flow). This habitat was unsuitable for fish presence sampling and it was considered non-fish bearing.

Wetland L21 was a small side channel of Alexander Creek with very low flow rates, low depth (<0.01 m). While flows were low enough to preclude sampling, this area does default to fish bearing due to connectivity to Alexander Creek.

Wetland L22 was a high flowing side channel with good fish habitat, some undercut banks, and large woody debris providing cover. The site was considered a flowing side channel of Alexander Creek and therefore defaulted to fish bearing.

Wetland L23 was mapped in a non-wetted floodplain surrounded by creeks that in high water could potentially create a wetland like environment. Wetland L28 was an area of sedges, grasses, and shrubs with a spring fed channel. The side channel flows into the Alexander ~200 m downwards.

Wetland L24 was and old beaver pond with a tributary to Alexander Creek nearby. It was 40 m in length by 7 m in width with a maximum depth of 0.4 m. The inlet channel appeared to be spring fed. Substrate was fines. There were large logs and grasses along the edges that would provide good habitat for fish rearing. Electrofishing the perimeter of the wetland produced three juvenile brook trout ranging from 86-97 mm in fork length.

Wetland L25 was a tributary off of Alexander Creek. It was not considered a wetland. One juvenile brook trout (~100 mm) and approximately 12 fry (assumed brook trout).

Wetland L26 is located on the Alexander Creek floodplain (Figure 33). The riparian was heavily vegetated with grasses and shrubs. The area was connected to Alexander Creek, defaulting it to fish bearing. The average depth of 0.5 m and large size (300 x 32 m) was considered to provide good rearing opportunity. This wetland has two inflow channels while the outflow was connected to Alexander Creek at the time of survey. Minnow traps were set both in the wetland and inflow. One juvenile bull trout (105 mm fork length) was captured in the wetland.

Figure 33. Top left is Wetland L26 taken towards the downstream view and on the right is Wetland L27 at upstream view. Bottom left is Wetland W21 in an upstream view and right is a beaver dam impoundment creating benches at Wetland W21.

Wetland L27 was found to be a small shallow wetland 60 m in length by 24 m in width with average depths of 0.5 m. There was a dry channel that runs alongside it and an inflow that had very low flows into the wetland. There was no real instream vegetation and substrate was organic. There was some coverage from instream dead trees and logs, which provide good rearing habitat. Abundant beaver activity and small birds were observed along the edges of the wetland. It is possible that in high flow this wetland would connect to Alexander Creek. Four minnow traps were set across this wetland but captured no fish. There were no suitable channels to electrofish in this wetland (Figure 33).

Wetland site W21 (originally L29/L30) was originally listed as two separate wetlands, but has been classified as one large wetland since the initial sampling event. Collectively this wetland is a beaver dam impoundment that is connected by benches. The outflow channel appeared to have excellent fish habitat potential. There was good rearing habitat throughout the wetland with low gradients and shallow average depth. On the west side there was a channel with deep adult holding pools, as well as within the body of the wetland. Fines were dominant throughout with some gravel along inflow channels. No fish were captured or observed after setting six minnow traps in the wetlands and electrofishing the outlet channel (Figure 33).

Habitat data are summarized in Table 28.

Table 28. Habitat summary for sampled lentic habitats.

Site ID	Potential fish bearing	Total area (m^2)	Water Depth (m)	Length (m)	Width (m)	Side channel presence	Mainstem connectivity	Outflow identified	Inflow identified	Substrate	Notes
W1	Yes	4880	0.2-1	84	45	Yes	Yes	Yes	Yes	Dark	Fish observed
W4	Yes	20263	0.2-0.5	120	20	Yes	Yes	Yes	Yes	Macrophyte	NFC default to fish bearing
W4.3	No	-	-	-	-	-	-	-	-	-	Confirmed with site visit: Low probability for fish presence
W5.1	Yes	5923	0.1	55	10	Yes	Yes	Yes	Yes	Sandy/dark	Fish observed
W5.2	Yes	7367	0.3	30	45	Yes	Yes	Yes	Yes	Algae/dark	NFC default to fish bearing
W5.3	Yes	1696	0.2-0.3	30	45	Yes	Yes	Yes	Yes	Fines/dark	NFC default to fish bearing
W5.4	No	18548	-	-	-	-	-	-	-	-	Confirmed with site visit: Low probability for fish presence
W5.5	No	-	-	-	-	-	-	-	-	-	Confirmed with site visit: Low probability for fish presence
W6	Yes	4050	0.2-0.8	67	41	Yes	Yes	Yes	Yes	Dark/woody	NFC default to fish bearing
W15	No	27963	-	-	-	-	-	-	-	-	Confirmed with site visit: Low probability for fish presence
W16	No	26119	-	-	-	-	-	-	-	-	Confirmed with site visit: Low probability for fish presence
W17	No	7567	0.3	70	20	No	No	Yes	No	Fines	Confirmed with site visit: Low probability for fish presence
W18	No	1000	0.2	30	14	No	No	Yes	Yes	Fines	Confirmed with site visit: Low probability for fish presence
W11.1	Yes	852	-	-	-	-	-	-	-	-	Default to fish bearing. Not sampled in July 2019.
N1	No	-	-	-	-	-	-	-	-	-	Confirmed with site visit: Low probability for fish presence
N7	No	-	-	-	-	-	-	-	-	-	Confirmed with site visit: Low probability for fish presence
N8	No	-	-	-	-	-	-	-	-	-	Confirmed with site visit: Low probability for fish presence
L20	No	-	-	-	-	-	-	-	-	-	Confirmed with site visit: Low probability for fish presence
L21	Yes	-	-	-	-	-	-	-	-	-	Low probability for fish presence, but defaulting to FB
L22	No	-	-	-	-	-	-	-	-	-	Confirmed with site visit: Low probability for fish presence
L23	No	-	-	-	-	-	-	-	-	-	Confirmed with site visit: Low probability for fish presence
L24	Yes	-	0.4	40	7	Yes	Yes	Yes	Yes	Fines	Fish captured
L25	Yes	-	-	-	-	-	-	-	-	-	Fish observed. Tributary.
L26	Yes	-	0.5	300	32	Yes	Yes	Yes	Yes	Fines	Fish captured
L27	Yes	-	0.5	60	24	Yes	Yes	Yes	Yes	Muddy/dark	Potential for fish presence in high water levels
L28	No	-	-	-	-	-	-	-	-	-	Confirmed with site visit: Low probability for fish presence
W21	Yes	23955	1	79	>200	Yes	Yes	Yes	Yes	Fines/gravel	NFC excellent fish habitat

5.3 Fish Presence/Absence Surveys

Fish presence/absence surveys completed from July 15-22, 2019 resulted in the capture of three juvenile EB and one juvenile BT across all electrofishing and minnow trapping efforts (Table 29). Unknown juvenile fish and fry were also observed (but not captured) at wetlands 1, 5.1, and L25. Fish presence surveys indicated that 23 of the 27 wetlands surveyed had potential for fish presence. Of these 23, 12 were considered fish bearing after the first year of inventory sampling and 13 had low probability for fish presence (Table 28).

Table 29. Fish presence/absence sampling for fish bearing wetlands.

Site ID	Sample Date	Electro fishing Effort (s)	Minnow Traps Set	Species	Total Number Captured/ Observed	Min Fork Length (mm)	Max Fork Length (mm)
W1	July 15, 2019	307	2	Unknown	1 observed	~100	~100
W4	July 17, 2019	187	4	NFC	-	-	-
W5.1	July 18, 2019	124	1	Unknown	1 observed	~100	~100
W5.2	July 18, 2019	30	3	NFC	-	-	-
W5.3	July 18, 2019	-	3	NFC	-	-	-
W6	July 22, 2019	116	5	NFC	-	-	-
W11.1	Not sampled in July 2019	-	-	-	-	-	-
L24	July 16, 2019	81	0	EB	3	86	96
L25	July 16, 2019	-	0	Unknown	12 fry observed	~50	~50
				EB	1 observed	~100	~100
L26	July 16, 2019	-	3	BT	1	105	105
L27	July 17, 2019	-	4	NFC	-	-	-
W21	July 16, 2019	969	4	NFC	-	-	-

5.4 In-situ water quality

In-situ water quality data for wetlands sampled in July 2019 shows YSI data was variable throughout the study and are summarized in Table 33.

5.5 Benthic invertebrate community structure

In September 2019 benthic macoinvertebrate samples were collected from six wetlands in the Alexander Creek Valley. These samples were collected from W4, W5.1, W6, W11.1, W17 and W21. A triplicate sample was collected from W21. Table 30 below provides a summary of the metric results performed in CABIN. RIVPACS assessment showed that multiple taxa that were expected to be present in the samples were absent. Taxa that were absent in most of the samples were; Chloroperlidae, Ephemerellidae, Rhyacophilidae and Perlodidae (Table 31). W4 and W21 replicate 2 and 3 were found to be at reference condition. The first replicate sample collected from W21 was mildly divergent and W5.1 and W6 were divergent. W11.1 and W17 were both found to be highly divergent from the CABIN reference condition (Table 32).

Table 30. Macroinvertebrate metrics and CABIN assessment for lentic sample sites.

	Year 2019							
Site	**TA**	**TR**	**% D**	***D***	**H**	**%EPT**	**%E**	**%C**
W4	2066.66	9	86.51	0.57	1.14	8.88	6.58	26.97
W5.1	618	17	51.95	0.8	2.15	41.23	15.58	40.01
W6	1513.64	8	93.99	0.28	0.62	12.31	2.7	84.38
W11.1	65	5	93.75	0.278	0.60	1.56	0	1.56
W17	3033.33	10	69.36	0.70	1.36	4.46	4.46	32.03
W21	5533.33	14	67.7	0.71	1.61	50.62	39.75	47.2

TA – Total abundance of all benthic invertebrate organisms, TR – Taxa richness, % D - The proportion of individuals in dominant and second dominant taxon, *D* - Simpson's diversity index, H – Shannon diversity index, % EPT - % Ephemeroptera, Plecoptera and Trichoptera, % E - % Ephemeroptera, % C - % Chironomidae.

Table 31. RIVPACS assessment results for sites on lentic sample sites.

Site	2019 results
W4	0.29 CHLO EPHE HEPT HYDR NEMO PERL PSYC RHYA
W5.1	0.57 BEAT HYDR PSYC RHYA TAEN
W6	0.19 CHLO EPHE HEPT HYDR NEMO PERL PSYC RHYA TAEN
W11.1	0.09 BEAT CHLO EPHE HEPT LEBE NEMO PERL RHYA SPER TAEN
W17	0.19 CHLO EPHE HEPT HYDR NEMO PERL PSYC RHYA TAEN
W21	0.84 RHYA TAEN

BEAT – Beatidae, CHLO – Chloroperlidae, EPHE – Ephemerellidae, HEPT - Heptageniidae, LEBE – Lebertiidae, NEMO – Nemouridae, RHYA - Rhyacophilidae, PERL - Perlodidae, SPER – Sperchontidae, TAEN – Taeniopterygidae, HYDR – Hydropsychidae PSYC – Psychodidae (-) Refers to no data available.

Table 32. Site comparisons and probabilities to reference groups for lentic sample sites.

Site	2019
W4	Group3; 0.9
W5.1	Group 3; 0.89
W6	Group 3; 0.89
W11.1	Group 1; 1
W17	Group 3; 0.9
W21-1	Group 3; 0.74
W21-2	Group 3; 0.74
W21-3	Group 3; 0.74

Green – Similar to reference, Blue – Mildly divergent, Yellow – Divergent, Red – Highly divergent, (-) Refers to no data available.

Table 33. In-situ water quality for wetland sampling in July and September 2019.

Date	Wetland ID	Time	Temperature (°C)	Pressure (mmHg)	DO (%)	Do (mg/L)	Specific Conductivity (µS/cm)	Conductivity	pH	Redox (mV)
15-Jul-19	W1	10:58	7.3	652.1	52.2	6.26	484.9	320.6	6.68	145.3
17-Jul-19	W4	9:57	11.4	338.7	62.3	6.65	180	280.2	6.81	167.7
17-Jul-19	W4.3	-	-	-	-	-	-	-	-	-
18-Jul-19	W5.1	11:21	7.4	634.9	76.2	9.72	362.9	240.3	7.73	137.5
18-Jul-19	W5.2	12:10	5.5	634.7	51.3	6.47	351.3	219.3	6.9	181.3
18-Jul-19	W5.3	13:12	10.1	634	116	13.05	276	197.6	6.96	
22-Jul-19	W5.4	-	-	-	-	-	-	-	-	-
22-Jul-19	W5.5	-	-	-	-	-	-	-	-	-
22-Jul-19	W6	14:08	12.2	640.3	88.6	9.34	462.4	350.6	7.79	125.1
16-Jul-19	N1	-	-	-	-	-	-	-	-	-
16-Jul-19	N7	-	-	-	-	-	-	-	-	-
15-Jul-19	N8	-	-	-	-	-	-	-	-	-
23-Jul-19	L20	-	-	-	-	-	-	-	-	-
23-Jul-19	L21	-	-	-	-	-	-	-	-	-
23-Jul-19	L22	-	-	-	-	-	-	-	-	-
18-Jul-19	L23	-	-	-	-	-	-	-	-	-
17-Jul-19	L24	12:40	6.6	640.9	99.2	12.04	304.9	197.1	6.73	161.6
16-Jul-19	L25	13:41	8.7	640.8	98.6	11.31	246.3	169.1	7.41	139.6
16-Jul-19	L26	14:26	9.2	640.8	106.5	12.25	237.5	165.3	6.9	162.3
17-Jul-19	L27	9:18	11.5	639.4	70.6	7.73	381.2	281.4	7.09	159.4
15-Jul-19	L28	10:35	7.6	646.7	71.9	8.57	282.1	186.7	6.78	132.8
11-Jul-19	W21	10:24	5.8	634.5	88.8	11.06	240.4	151.4	6.28	196.7
18-Sept-19	W4	11:37	-	-	-	-	-	-	-	-
18-Sept-19	W5.1	13:40	-	-	-	-	-	-	-	-
19-Sept-19	W6	8:30	6	635.4	58.4	7.25	502.8	324.7	6.99	132
20-Sept-19	W11.1	14:45	8.3	651.4	43.2	5.06	836	567	7.06	159
20-Sept-19	W17	12:00	11	656.2	63.3	6.9	842	617	6.74	164.5
19-Sept-19	W21	11:20	4.9	633.6	58.5	7.5	347	213	658	129.9

6 Discussion

6.1 Summary

The results of this report summarize the baseline conditions for the Alexander Creek and Grave Creek watersheds from 2014 to 2017 and for lentic ecosystems in 2019. Overall, this study reviewed 45.09 km of stream length. Of this 47.96 km, 33.77 km (70%) was determined to be fish bearing, and the remaining 14.19 km (30%) was non-fish bearing. By reach, a total of 23 reaches (16 for Alexander Creek and 7 for Grave Creek) were assessed across both watersheds. Of these, 14 were fish bearing with 8 within the Alexander Creek watershed and 6 within the Grave Creek watershed. Non-fish bearing reaches were typically high gradient, headwater sections of a watercourse.

Fish bearing reaches were surveyed for habitat quality, fish distribution, rearing use, spawning use, overwintering potential, invertebrate community, and periphyton community. Lentic ecosystems were surveyed for fish bearing potential, habitat quality, *in-situ* water quality, and invertebrate community.

Collectively, the results of this study can be used to describe baseline fish and fish habitat conditions prior to development of the Crown Mountain Coking Coal project.

6.2 Habitat

Habitat type and subsequent fish use within the Alexander Creek watershed was variable. As is typically seen in mountain environments, reaches appeared to trend from lower gradient riffle-pool morphology at lower elevation and valley bottom to moderate-high cascade-pool and step-pool towards the headwaters. Gradient ultimately limited fish distribution in all streams, with exception of UTG1 that was classified fish bearing to its headwaters. This diversity is required to provide suitable habitat for all life stages of fish in an overall watershed context. While no one reach is suspected as being high use for all life stages and timing (with potentially exception of ALE7), the watershed overall provides the habitat necessary for these fish species to carry out their life cycle. For example, WAL1 appears to be a high use spawning reach, while ALE7 has found to provide highly favorable overwintering conditions. As such, connectivity will be an important feature to maintain within the watershed as these fish species can require large home ranges (i.e. > 10 km).

Habitat quality was also variable, but was generally considered fair to good in channels of both riffle-pool and cascade-pool morphology. One reach that was somewhat of an exception to this was WAL2, where high proportions of cascades (i.e. 70-90%), poor quantity of cover, and a steep gradient provided poor habitat for most life stages of fish. Overall, instream habitat within the Alexander Creek watershed is considered to be good quality and in a relatively unimpacted condition.

Grave Creek also provided suitable habitat for all life stages of fish where classified as fish bearing. Grave Creek mainstem is a smaller stream than Alexander Creek that was characterized by water depths of on average 0.12 m. A diversity of cover types, good habitat complexity, and an intact riparian forest provides high quality habitat for adult, juvenile, and fry life-stages. Tributary habitat was essentially limited to UTG1 and headwater tributaries upstream of the project inputs. While short relative to other streams in the Elk Valley, this tributary is considered important given the overall limited amount of habitat availability in the Grave Creek watershed isolated upstream of the migratory barrier in Reach 1 and that it contains a genetically pure WCT population. Combined, this population should be considered high for conservation value. Habitat conditions in Grave Creek remained consistent from this baseline assessment to previous observations in the Baldy Ridge Baseline Assessment completed in 2009-2011 (Lotic Environmental 2015).

6.3 Fish Use

Four species of fish were documented in the LSA during baseline sampling. These were: WCT, BT, EB, and MW. Each of these species were previously documented and as such were expected to be documented again within the LSA. Based on provincial fisheries data observations of RB were also possible (BC MOE 2018); however, these accounts are restricted to stocked, sterile RB in Grave Lake and also potential misidentifications in the record. Previous research from Lotic Environmental (2015) indicates the presence of MW to be limited to reaches downstream of the LSA and as such MW were only documented in ALE1 and ALE2. RB presence in theses watersheds is also likely an artifact of previous stocking by the provincial government and now limited to a sterile (AF3N) population in Grave Lake.

The Alexander Creek watershed has been found to contain native WCT and BT, as well as introduced EB throughout. The use of the Alexander Creek watershed by BT appears to be primarily by juveniles (1+ and 2+). However, one potential redd and one mature BT observed during this baseline assessment suggest that limited spawning may be occurring in Reach 7 and downstream. While likely occurring in the LSA, this is considered to be relatively low use in comparison to the high-use BT spawning tributaries known in the Elk River watershed such as Wigwam River and Line Creek (Lotic Environmental 2015). The presence of BT is noted throughout much of the Alexander Creek watershed and is important. The BT (interior lineage) is a species of Special Concern in BC (blue-listed) and is listed under COSEWIC (BC CDC 2019). MW were found in Alexander Creek limited to lower reaches.

WCT were ubiquitous throughout the Alexander Creek watershed. WCT is also a species of Special Concern in BC (blue-listed) and is listed under COSEWIC (BC CDC 2019). Furthermore, WCT are a federal species of Special Concern, listed under Schedule 1 throughout their range in British Columbia under the federal Species at Risk Act (SARA; BC CDC 2019). It was noted that suitable habitat was documented for all life stages within the Alexander Creek watershed. This however, was provided through access to a diversity of reaches with specific habitat qualities. Most reaches provided suitable juvenile rearing. Adult rearing was likely limited to lower gradient reaches such as ALE7, where deeper pools and overhead cover were more abundant. Overwintering potential at Alexander Creek was overall poor with the exception of ALE7 and ALE8, which had water depths >0.2 m, DO >6.6 mg/L, and water temperatures >0.5°C. Lastly, spawning use was also not equal among reaches. Spawning potential was high in both ALE7 and WAL1. However, results from fish community assessment suggest that WAL1 is likely a relatively high spawning use reach based on the abundance of fry. Again, while WCT, and to some extent BT, can carry out all life phases in the Alexander Creek watershed, use certainly appears to vary by reach.

Due to the dewatered section and a steep gradient at WAL2, this site would be the upstream limit of fish distribution for the West Alexander Creek drainage. The location of this barrier left little non-fish bearing habitat in the headwaters of this drainage. A bedrock barrier at the ALE10/11 reach break marked the upstream limit of fish distribution in Alexander Creek mainstem. This differs from West Alexander in that the non-fish bearing area is relatively large in the upper Alexander Creek drainage represented by ALE11.

Fish community and inventory sampling again showed that Grave Creek is only supporting populations of WCT. This is in contrast to Alexander, which showed populations of WCT, BT, and EB. As described previously, Grave Creek is an isolated population above a bedrock falls in Reach 1 and is non-fish bearing beyond site UTG2-2 due to a 30% gradient at over 100 m. These barriers strongly limit the amount of habitat available to this isolated population of WCT. GRA2 has a length of 3000.0 m (Lotic Environmental 2015), GRA3 is 6366.0 m in length, GRA4 has a length of 2323.8 m, UTG1 is 3141.9 m while UTG2 is only 679.3 m in length. The total habitat available to the isolated WCT population is therefore limited and considered high value.

Grave Creek spawning opportunity appeared to be more widely distributed than Alexander Creek in that each reach downstream of the Project provided moderate-good spawning potential. Overwintering potential throughout Grave Creek was considered good, but likely occurred in interstitial spaces of the substrate as opposed to deeper pools. This is based on the habitat observed (e.g., deep pools (>1 m) are generally lacking) and the fact that this isolated population is persisting.

6.4 Invertebrate Community Assessment

Alexander Creek invertebrate communities had high % EPT present in all samples. Although some of the sites were found to be mildly divergent, the RIVPACS assessment found that only a few taxa were absent from the samples when compared to reference condition. WAL1 was at reference condition in 2014 and 2017 and had no taxa absent with a probability of occurrence higher than 0.7. ALE1 had a similar result in 2019. The sample invertebrate community was at reference condition and no taxa with a probability of occurrence higher than 0.7 was found to be absent at this site. The taxa found to be absent from samples most often were; Hydropsychidae, Psychodidae and Taeniopterygidae.

The Grave Creek sites had similar results with all sites testing at reference or mildly divergent from reference condition. GRA4 was at reference condition in 2014 and 2017. The RIVPACS assessment showed that only GRA4 and UTG1 had taxa with high probability of occurrence rates missing. These were Hydropsychidae and Perlodidiae. The member of the caddisfly family (Tricoptera) Hydropsychidae is often found in lower elevation streams of the foothills and floodplains (Cunjak and Newbury 2005). Hydropsychidae are carnivores and selective eaters (Fuller and Mackay 1979). A lack of appropriate or preferred food source could be a contributing factor in their absence from these higher geomorphological order streams. Perlodidae are a family of stoneflies. Most of these taxa are also carnivorous in nymph stage, further supporting the lack of appropriate prey as a possible reason why these two taxa may have been absent from the GRA4 and UTG1 sites, instead of it being any indication of impairment or deteriorated water quality. Lack of suitable habitat and food resources are most likely the reason for the mild divergence from reference condition.

The lentic sample sites had very different community composition than that of the Lotic samples. This is to be expected and perfectly normal. Lentic environments are often characterized by high nutrient storage capacity, lower oxygen, higher temperatures and a multitude of organic processing being present in the sediment and deposited layers within the wetland bed. The vegetation often plays a critical role in nutrient and chemical trapping but also in providing habitat and shelter to a multitude of species including fish, periphyton and invertebrates. CABIN is still in the process of refining the lentic sampling protocol and analyses. However, for the purposes of this report the platform was able to provide important community composition information as part of the baseline assessment of current condition before being impacted by the project. Only W4 and W21 were found to have samples at reference condition. The rest of the samples were divergent or even highly divergent as was the case with W11.1 and W17. These were the two sites with the largest number of taxa absent from the sample as assessed by the RIVPACS analyses. The taxa found to be absent most often from lentic samples were; Chloroperlidae, Ephemerellidae, Rhyacophilidae and Perlodidae. Chloroperlidae and Perlodidae are both members of the Stonefly family (Plecoptera). Ephemerellidae are members of the Mayfly family (Ephemeroptera). Rhyacophilidae is a taxon in the caddisfly family (Tricoptera). These are EPT taxa that were predominantly missing from the wetlands. Since EPT are sensitive to changes in oxygen, temperature and chemical composition of the water they occur in, it would make sense that the EPT taxa would be lower in these wetland habitats, regardless of whether the wetland is in actual good healthy condition. Since wetlands function as nutrient and water storage and filter units within the aquatic network, lower oxygen, higher water temperatures and chemical load in the sediment is natural and does not indicate impairment of health. These wetlands are considered to be in very good condition. Throughout lentic and lotic sites, a very similar group of taxa were often found to be absent from the samples. Due to the fact that they more often than not, belonged to the EPT group of taxa, it is safe to say that these groups of organisms are sensitive to changes in water quality and presence of specific food sources. Their absence does not necessarily mean the water quality or habitat is impaired or poor, since other members of these families were still found to be present, and often these sites were still found to be at reference condition despite the absent taxa. It is then more accurate to state that these sites have been classified to have the potential to host even a larger diversity of EPT than what was found at the time of sampling, emphasizing the good condition of the sampled sites.

6.5 Periphyton Community Assessment

In order to provide habitat (food source, appropriate oxygen levels, etc.) for invertebrate communities, periphyton composition and availability is critical. A healthy periphyton community can provide necessary food resources, but also act as high productivity areas in tributaries feeding into the main arteries of rivers and depositing nutrients. Chl-*a* is often used as an indication of this productivity at the base of the food web. AFDM, similarly can also be used to determine whether a site is enriched, just highly productive or if it is a lower productivity site, in which cases preserving the periphyton could become even more critical for the maintenance of a healthy ecosystem. Chl-*a* was relatively high at ALE19 during 2014 but was at a much lower level during sampling in 2017. A similar pattern was seen in the AFDM. The dominant species was predominantly *Hydrurus* sp. and *Gomphonema minutum.*

The Grave Creek sites had very low Chl-*a* and AFDM values recorded during 2014 and 2017. GRA4 was dominated by Chrysophytes in 2014 and 2017 while UTG2-1 had Diatoms dominating the community in both years. There seems to be some level of consistency in the periphyton community composition at large in the Grave Creek reaches.

7 Conclusion

The Fish and Fish Habitat Baseline Assessment program has successfully met the objectives of the program, namely: characterizing the existing environment (including both lotic and lentic ecosystems), providing a foundation from which an effects assessment can be conducted, and informing the design of effects monitoring programs into the future. The baseline assessment has documented two main watersheds within the LSA and characterized similarities and differences of these. A similarity of these is the isolated nature of these watersheds. Much of the Grave Creek watershed exists physically isolated from the downstream Elk River. Grave Creek Reach 2 and higher are located upstream of a migratory barrier located at the Reach 1/2 break. This has created an isolated population of WCT. Isolated populations are typically less resilient to external factors as habitat is limited, genetic mixing is low, and the ability for fish movement to offset any decline in abundance is non-existent. Further limiting habitat availability in upper Grave Creek is the loss of access to Harmer Creek as a result of the barrier created by Elkview Operation’s Harmer Dam, and the natural barrier on the UTG2 tributary. The limited amount of habitat available to the Grave Creek WCT does put it at a higher risk of impact from external factors such as industrial pressures. While there is an absence of a physical barrier between Alexander Creek and Michel Creek, the geographic separation of the upper parts of the watershed to downstream Michel Creek likely results in the upper Alexander Creek fish populations being at least in part, resident. This means that fish in the upper reaches must have access to habitats suitable to carry out all life phases the same way that an isolated population requires this. The life stages of BT observed in Alexander Creek suggest that there is likely a downstream population that contributes juvenile to rear in this area. However, the WCT population has a higher likelihood of containing individuals that are resident and do not require migration to Michel Creek and other streams in the RSA. Of particular value is the spawning use inferred for WAL1, as indicated by the relative abundance of fry and juveniles, and as confirmed in the population study. An absence of fry in all other reaches suggests that WAL1 may be providing unique and critical habitat to this watershed. Furthermore the population study showed that there may be a morphologically smaller and behaviourally distinct subpopulation of WCT inhabiting the upper sections of Alexander creek and lower sections West Alexander Creek which provides suitable habitat for all life stages and had fish present year round.

One key difference between the Alexander Creek and Grave Creek watersheds is the fish community. As discussed, the Grave Creek (upstream of Reach 1) contains only WCT. Alexander Creek has four fish species: WCT, BT, EB, and MW. The relevance of this is that fish habitat management must consider the differences in habitat requirements when assessing the project for environmental effects. One example is the difference in spawning periods. Effects must assess potential changes to both spring and fall/winter flows as eggs can be expected to be incubating in both of these periods. Another consideration is the interaction of both native species (WCT and BT) with the introduced EB. Literature clearly demonstrates the likelihood for EB to displace both of these Species of Concern through various mechanisms. Some anecdotal information also exists to suggest that habitat degradation can preferentially benefit EB over the native WCT and EB.

In summary, the baseline assessment has described fish distribution and communities within the project area. The results show how the majority of streams (82%) were determined to be fish bearing. Furthermore, this assessment indicates the possibility for two subpopulations of WCT occurring the LSA. The baseline assessment also showed where unique life phases are occurring and where larger areas of non-fish bearing stream exists. This information will be valuable for incorporation into mine design and effects mitigation exercises.

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9 Units of Measure

%	Percent
°C	Degrees Celsius
µg/cm^2	Micrograms per square centimetre
µm	Micrometre
µS/cm	Micro Siemens per centimetre
cm	Centimetre
cm^2	Square centimetre
g	Gram
g/m^2	Grams per square meter
hrs	Hours
km	Kilometre
m	Metre
mg	Milligram
mg/L	Milligrams per litre
mg/m^2	Milligrams per square meter
mL	Millilitre
mm	Millimetre
m/s	Metres per second
mV	Millivolts
s	Seconds

10 Glossary

Adult	A fish that is sexually mature.
Bankfull	This stage is defined by the elevation point of seasonal flooding, indicated by deposits of fine sediment at the active scour mark, break in stream bank slope, perennial vegetation limit, rock discoloration, and root hair exposure.
Bankfull Depth	The maximum channel depth when the stream is flowing at bankfull discharge.
Bankfull Width	The width of the channel during bankfull discharge.
Barriers	Natural or man-made obstructions to fish movement.
Bedrock	The body of consolidated rock that underlies gravel, soil or other subregion material.
Benthic Invertebrates	Invertebrate organisms that live at, in or in association with the bottom of lakes, ponds and streams. These organisms are important for the aquatic community since they are involved in the mineralization and recycling of organic matter produced in the water above, or brought in from external sources. They are also major food source for fish.
Biomass	The total mass of living organisms for a given area or sample.
Canopy	The overhanging cover, shelter or shade provided by the tallest layer of vegetation in an area.
Cascade	Water in a watercourse which follows a gradient steeper than 4% and usually has cobbles, boulders, or bedrock substrate.
Channel	A natural or artificial confinement that contains moving water, and has a defined bed and banks.
Channel units	Hydrological similar stream segments distinguishable at a sub-reach scale. Also referred to as habitat units in the FHAP manual (Johnston and Slaney 1996), Examples include pools, riffles, glides, and cascades.
Chlorophyll *a*	A green pigment found in plants that converts carbon dioxide and water into sugar. In water, chlorophyll *a* measurement serves as an indicator of algae concentrations.
Conductivity	Measuring the total concentration of dissolved ions in water to determine the waters' capability of conducting an electrical current.
Confluence	The area where two streams or stream branches combine into one.

Coniferous	Tree species that retain their leaves during winter and bear cones.
Cover	Structural elements in the wetted channel or within 1 m of the water surface that provides areas for fish to rest or hide.
Deciduous	Tree species that lose their leaves at the end of the growing season.
Dissolved Oxygen (DO)	Measurement of the concentration of dissolved (gaseous) oxygen in the water. Expressed in milligrams per litre (mg/L) and percent (%).
D95	The particle size measured in mm along the B-axis for which 95% of the particles are equal to or small than.
Electrofishing	Is a standard fish capture method where an electrical current is passed through the water to attract and momentarily immobilize fish.
Embeddedness	How deeply the dominant substrate is buried in the finer particles of the surrounding material.
Ephemeral	Something that lasts only for a short time.
Fines clay).	Substrate particles less the 2 mm in diameter (sand, silt and
Fish	Fish as defined in the Fisheries Act, includes parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.
Fish Habitat	Fish habitat, as defined in the Fisheries Act, includes the spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly to carry out their life processes.
Fork Length	The length of a fish measured from the most anterior portion of the head to the tip of the shortest caudal fin rays.
Fry	Fish in their first year that are capable of feeding themselves (i.e., not feeding off of the yolk sac).
Glide	An area with a generally flat bottom and no surface turbulence. Generally, with a gradient of less than 1%.
Global Positioning System	A system of satellites, computers and receivers that is able to determine the precise latitude and longitude of a receiver on Earth.

Habitat	The area or environment where an organism or ecological community normally lives or occurs.
Habitat unit	A distinct section of stream with specific characteristics of water depth, velocity, substrate and cover for fish.
Juvenile	A fish of age between its second year of life and the age at which it becomes sexually mature. A reproductively immature fish older 1+ years or older.
Kick net	A long handled triangular metal frame holding a mesh bag (e.g., 400-micron size) with a collection cup at the end that is used for collecting benthic invertebrates.
Large Woody Debris	Is a piece of wood larger than 10 cm in diameter or 2 m in length, and is found in the bankfull channel.
Local Study Area (LSA)	The aquatic LSA is the area where effects from the Project are likely to occur, such as potential changes to stream flows.
Macrophytes	Plants that live in or near water.
Morphology	Morphology or fluvial geomorphology is the term used to describe the shape of the channel based on various channel parameters such as width, depth, width/depth ratio, meander wavelength, sinuosity, bed material, gradient and bank slope.
Overwintering Habitat	Habitat used by fish during the winter for refuge and feeding.
Profundal	The benthic area away from shore in a lake or pond.
Periphyton	Is a mixture of algae, cyanobacteria, and other associated microorganisms attached to any submerged surface.
pH	Measures the concentration of hydrogen ions in an aqueous solution. A pH value less than 7 is considered acidic, and greater than 7 is basic (alkaline).
Pool	An area of slower, deeper water, and has a gradient around 0%.
Reach	A comparatively short, and uniform length of river or stream channel. The length of the reach is defined by the purpose of the study.
Rearing Habitat	Habitat used by juvenile fish for feeding and/or refuge from predators.
Redd	Where a female fish digs a nest/pit in the stream bed gravel, stones or sand, where eggs are later deposited.

Redox	A chemical reaction in which one substance is oxidized and the other is reduced based on the exchange of oxygen, hydrogen or electrons.
Reference	An area that is minimally affected by human interactions and displays the expected biological integrity of the area.
Riffle	An area of generally shallow, turbulent water, with a moderate gradient of 1 to 4%. Gravel and cobbles are usually dominate substrate.
Riparian	The area pertaining to the margins of a waterbody.
Seining	The act of pulling a vertical fishing net through the water column.
Small Woody Debris	Is a piece of wood smaller than 10 cm in diameter or 2 m in length, and is found in the bankfull channel.
Spawning	Is a reproductive stage for adult fish which includes the deposition of eggs and fertilization.
Spawning Habitat	Is an area where fish are found actively spawning or an area where fish could potentially spawn based on suitable characteristics (e.g., water depth, flow, overhead cover, and gravel size).
Species	Organisms that are capable of natural or potential interbreeding are grouped together in the same category of taxa classification.
Stream Order	A hierarchical ordering of streams based on the number of branches or forks.
Substrate	Rocks and/or sediment that makes up the stream bed.
Waterbody	Is a general term referring to a natural or man-made structure that holds standing or flowing water (e.g., lakes, reservoir, wetlands, streams, creeks, rivers).
Watercourse	Is a natural stream that either continuously or periodically flows through a confined channel. The stream also has a defined bed or banks, and flows in one direction.
Watershed	A set of streams or creeks that all flow into a larger waterbody due to topographical features in the area.
Wetted Width	The width of the water surface across a channel at the time of the survey. It is measured perpendicular to the stream flow.
Wetlands	An area that is permanently or temporarily saturated by surface or groundwater, and is capable of supporting

	vegetation that is adapted to living in saturated soil. This includes: marshes, bogs, and swamps.
Young of the Year	Refers to fish that are less than one year old.

11 Appendices

Appendix A. Sampling event by date.

Stream	Site	Overwintering 2014	Spring Spawning 2014	Spring Spawning 2017	Spring Spawning 2019	Fall Spawning 2014	Fall Spawning 2017	Fall Spawning 2019	Fish Inventory			Fish Community			FHAP			Benthic Invertebrate			Periphyton			Fish Tissue 2017	Fish Tissue 2019	Sediment 2017	Sediment 2019
									2014	2017	2019	2014	2017	2019	2014	2017	2019	2014	2017	2019	2014	2017	2019				
Alexander Creek	ALE1	-	-	-	-	-	-	Sep 23	-	-	-	-	-	Sep 12	-	-	-	-	-	Sep 10	-	-	Sep 10	-	-	-	-
	ALE2	-	-	-	-	-	-	Sep 23	-	-	-	-	-	Sep 13	-	-	-	-	-	Sep 10	-	-	Sep 10	-	-	-	Sep 18
	ALE3	-	-	-	-	-	-	Sep 24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	ALE4	-	-	-	-	-	-	Sep 24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	ALE5	-	-	-	-	-	-	Sep 24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	ALE6	-	-	-	-	-	-	Sep 25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	ALE7	Mar 6	Jul 10	Jun 29	-	Oct 4	Oct 4	Sep 25	-	-	-		Sep 14	-	-	Oct 17	-	-	Oct 10		Sep 2	Oct 10	-	Jul 12	-	Oct 10	-
	ALE8	Mar 6	Jul 10	Jun 14	-	Oct 4	Oct 4	-	Aug 1	-	-		Sep 14	-	Aug 11	-	-	-	Oct 10		Sep 2	Oct 10	-	Jul 12	-	Oct 10	-
	ALE9	Mar 6	Jul 10	Jun 14	-	Oct 5	Oct 5	-	Jul 31	-	-		Sep 19	-	Aug 12	-	-	-	Oct 10		Sep 4	Oct 10	-	Aug 3	-	Oct 10	-
	ALE10	Mar 6	Jul 10	Jun 14	-	Oct 5	Oct 5	-	Jul 31	-	-		Sep 18	-	-	-	-	-	Oct 11		Sep 9	Oct 11	-	-	-	Oct 11	-
	ALE11-R	-	-	-	-	-	-	-	Jul 31	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
West Alexander Creek	WAL1	Mar 6	Jul 9	Jun 13	-	Oct 6	Oct 5	-	-	-	-	-	Aug 22	-	Aug 13	-	-	-	Oct 13		Sep 2	Oct 11	-	Aug 3	-	Oct 11	-
	WAL2	-	Jul 9	Jun 13	-	Oct 6	Oct 5	-	Jul 30	-	-	-	-	-	Sep 9	-	-	-	-		-	-	-	-	-	-	-
	WAL3	-	-	-	-	-	-	-	Jul 30	Aug 1	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
	WAL4	-	-	-	-	-	-	-	Jul 28	Aug 1	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
Unnamed W. Alexander Tributary 1	UWA1	-	-	-	-	-	-	-	Jul 30	Aug 1	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
Unnamed W. Alexander Tributary 1b	UWA1-b	-	-	-	-	-	-	-	-	Aug 1	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
Unnamed W. Alexander Tributary 2	UWA2	-	-	-	-	-	-	-	Jul 30	Aug 1	-	-	-	-	-	-	-	-	Oct 13		Sep 9	Oct 11	-	-	-	-	-
Unnamed W. Alexander Tributary 3	UWA3	-	-	-	-	-	-	-	Jul 29	Aug 1	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
Grave Creek	GRA3	-	Jul 8	Jun 12	-	-	-	-	-	-	-	-	Sep 20	-	-	-	-	-	Oct 11		-	Oct 11	-	-	-	Oct 11	-
	GRA4-R	-	Jul 8	Jun 12	-	-	-	-	-	-	-	-	Oct 11	-	-	-	-	-	Oct 12		Sep 3	Oct 12	-	Jul 10	-	Oct 12	-
Unnamed Grave Tributary 1	UGT1-1	-	Jul 8	Jun 12	-	-	-	-	Jul 28	-	-	-	Oct 11	-	-	-	-	-	Oct 12		Sep 3	-	-	Jul 14	-	Oct 12	-
Unnamed Grave Tributary 2	UGT2-1	Mar 6	Jul 16	Jun 12	-	-	-	-	Jul 29		-	-	-	-	-	-	-	-	Oct 12		Sep 3	-	-	-	-	-	-
	UGT2-2	-	-	-	-	-	-	-	Jul 28	Jul 31	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-

Appendix B. Sample site location.

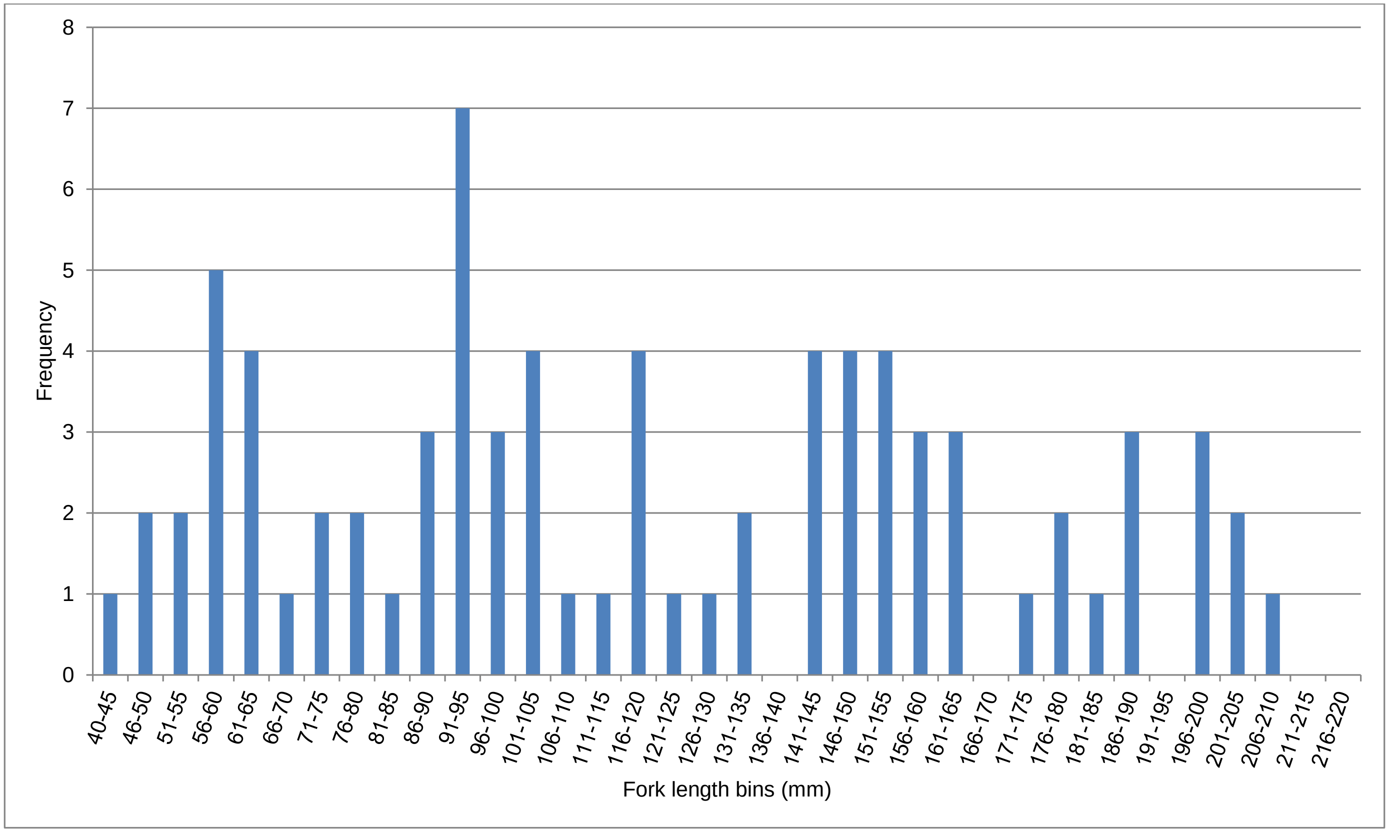
Stream Name	Reach Number	Site	Reach Break End Easting	Reach Break End Northing	Reach Break Cause	Reach Length (m)	Reach Gradient (%)	Site Easting	Site Northing
Alexander Creek	1	ALE1	661308	5504156	Change in confinement, gradient and sinuosity	991.801	0.02	660765	5504374
Alexander Creek	2	ALE2	663391	5502844	Change in confinement and sinuosity	1878.4	0.01	662437	3503779
Alexander Creek	7	ALE7	664387	5515465	Change in confinement	9296.2	0.89	664473	5513786
Alexander Creek	8	ALE8	664403	5516844	Change in flow volume/channel width	1870.4	2.25	664364	5516713
Alexander Creek	9	ALE9	664689	5521745	Change in gradient	5436.3	3.44	664742	5519044
Alexander Creek	10	ALE10	664544	5521919	Change in flow volume/channel width	246.6	10.14	664692	5521766
Alexander Creek	11	ALE11	663981	5525260	Barrier	3581.1	10.92	664516	5521918
West Alexander Creek	1	WAL1	662284	5520560	Change in flow volume/channel width	5484.9	4.36	662700	5518396
West Alexander Creek	2	WAL2	662232	5520754	Barrier	240.2	14.99	662288	5520645

Stream Name	Reach Number	Site	Reach Break End Easting	Reach Break End Northing	Reach Break Cause	Reach Length (m)	Reach Gradient (%)	Site Easting	Site Northing
West Alexander Creek	3	WAL3	661889	5521182	Change in gradient	578.3	12.28	662156	5520803
West Alexander Creek	4	WAL4	661570	5521468	Wetland	424.9	6.35	661801	5521215
Unnamed West Alexander #1	1	UWA1	663794	5520487	n/a	2040.8	24.99	662511	5519231
Unnamed West Alexander #1b	1	UWA1b-1	662413	5520677	Barrier	182.1	10.00	662331	5520612
Unnamed West Alexander #1b	2	UWA1b-2	663550	5521095	Change in gradient	1385.9	19.99	662413	5520677
Unnamed West Alexander #2	1	UWA2	662686	5521171	n/a	777.4	23.80	662254	5520843
Unnamed West Alexander #3	1	UWA3	661917	5521628	n/a	869.6	14.83	662127	5520848
Grave Creek	3	GRA3	661815	5524642	Change in flow volume/channel width	6366	5.50	659720	5523889
Grave Creek	4	GRA4	661926	5526591	n/a	2323.8	24.14	661656	5524410
Unnamed Trib. Grave Creek #1	1	UTG1	661259	5521644	n/a	3141.9	9.36	660960	5524122
Unnamed Trib. Grave Creek #2	1	UTG2-1	662111	5523886	Change in flow and gradient	679.3	7.07	661679	5524330
Unnamed Trib. Grave Creek #2	2	UTG2-2	662436	5522343	n/a	1780.7	20.22	662161	5523814

Appendix C. Fish Movement Barriers.

Stream Name	Reach Number	Barrier Type	Barrier Easting	Barrier Northing	Comments
Alexander Creek	10/11	Cascade/waterfall	664544	5521919	Cascade has a gradient 25% for approximately 50 m and 1 m vertical drops present. All bedrock
West Alexander Creek	2/3	Gradient >30%	662232	5520754	Gradient >30% for >100 m. Upper part also dewaters
Unnamed West Alexander #1	1	Waterfall	662501	5519221	Waterfall is 1.5 m high.
Unnamed West Alexander #1b	1/2	Gradient >25%	662413	5520677	Gradient >25% for >100 m.
Unnamed West Alexander #2	1	Cascade/waterfall	662238	5520763	Waterfall has a slope >60% for >100 m in length
Unnamed West Alexander #3	1	Cascade/waterfall	662124	5520834	Waterfall has a slope >60% for >70 m in length
Unnamed Trib. Grave Creek #2	1/2	Gradient >30%	662111	5523886	Gradient >30% for 100 m.

Appendix D. Westslope Cutthroat Trout (WCT) Length-Frequency.



Appendix E. Fish Abundance by Site.

Site	Species	Number of fish caught	Population estimate (# of fish)	95% confidence interval	Capture probability
	WCT	4	4	4-6	0.667
ALE7	EB	2	2	2-15	0.500
ALE8	BT	7	7	7-8	0.778
	WCT	5	5	5-6	0.714
ALE9	BT	1	1	1-1	1.000
ALE10	NFC	0	-	-	-
WAL1d/s	WCT	11	11	11-13	0.647
WAL1u/s	WCT	23	27	23-37	0.451
GRA3	WCT	5	5	5-7	0.625
GRA4	WCT	16	17	16-21	0.571
UTG1	WCT	4	4	4-7	0.571

Appendix F. Fish Inventory Individual Data.

Sample Year	Site ID	Method	Species	Length (mm)	Weight (g)	Maturity
2019	ALE1	EF	EB	38	0.6	Immature
2019	ALE1	EF	EB	38	0.7	Immature
2019	ALE1	EF	EB	37	0.6	Immature
2019	ALE1	EF	BT	144	28.8	Immature
2019	ALE1	EF	MW	72	3.4	Immature
2019	ALE1	EF	MW	68	3.3	Immature
2019	ALE1	EF	MW	74	3.7	Immature
2019	ALE1	EF	EB	38	1.7	Immature
2019	ALE1	EF	EB	42	0.8	Immature
2019	ALE1	EF	EB	32	0.4	Immature
2019	ALE1	EF	EB	28	0.2	Immature
2019	ALE1	EF	EB	38	0.7	Immature
2019	ALE1	EF	BT	68	3.4	Immature
2019	ALE1	EF	EB	33	0.4	Immature
2019	ALE1	EF	WCT	121	18.5	Immature
2019	ALE1	EF	EB	34	0.3	Immature
2019	ALE1	EF	EB	43	2	Immature
2019	ALE1	EF	EB	44	2.1	Immature
2019	ALE2	EF	WCT	134	27.8	Immature
2019	ALE2	EF	WCT	103	12.6	Immature
2019	ALE2	EF	WCT	82	6.4	Immature
2019	ALE2	EF	WCT	72	4.5	Immature
2019	ALE2	EF	BT	138	23.8	Immature
2019	ALE2	EF	BT	139	24.7	Immature
2019	ALE2	EF	WCT	84	6.6	Immature
2019	ALE2	EF	WCT	84	6.4	Immature
2019	ALE2	EF	BT	71	-	Immature
2019	ALE2	EF	WCT	77	-	Immature
2019	ALE2	EF	BT	55	-	Immature
2019	ALE2	EF	WCT	82	-	Immature
2019	ALE2	EF	WCT	135	28.9	Immature
2019	ALE2	EF	BT	128	24.3	Immature
2019	ALE2	EF	WCT	152	45	Immature
2019	ALE2	EF	WCT		-	Immature
2019	ALE2	EF	WCT	84	7.8	Immature
2019	ALE2	EF	WCT	83	6.1	Immature
2019	ALE2	EF	MW	77	4.1	Immature
2019	ALE2	EF	WCT	82	6.7	Immature
2019	ALE2	EF	WCT	83	6.1	Immature
2019	ALE2	EF	BT	134	28.8	Immature
2019	ALE2	EF	BT	126	21.5	Immature
2019	ALE2	EF	WCT	110	15.2	Immature
2019	Wetland L24	EF	EB	98	12.7	Immature
2019	Wetland L24	EF	EB	86	6.6	Immature
2019	Wetland L24	EF	EB	96	10.4	Immature
2019	Wetland L26	MT	BT	105	-	Immature
2014	ALE9	EF	WCT	150	-	Mature
2014	ALE9	EF	WCT	160	-	Mature
2014	WAL1	EF	WCT	45	1.2	Immature
2014	WAL2	EF	WCT	190	81	Mature
2014	WAL2	EF	WCT	202	96.7	Mature

Sample Year	Site ID	Method	Species	Length (mm)	Weight (g)	Maturity
2014	WAL2	EF	WCT	180	81.9	Mature
2014	UTG1	EF	WCT	159	55.8	Mature
2014	UTG1	EF	WCT	201	97.5	Mature
2014	UTG1	EF	WCT	47	1.8	Immature
2014	UTG1	EF	WCT	70	-	Immature

Appendix G. Fish Community Individual Data.

Stream	Site ID	Species	Length (mm)	Weight (g)	Maturity
Grave Creek	GRA4	Westslope Cutthroat Trout	157	43	Mature
Grave Creek	GRA4	Westslope Cutthroat Trout	151	47	Mature
Grave Creek	GRA4	Westslope Cutthroat Trout	91	9	Immature
Grave Creek	GRA4	Westslope Cutthroat Trout	93	11	Immature
Grave Creek	GRA4	Westslope Cutthroat Trout	105	13	Immature
Grave Creek	GRA4	Westslope Cutthroat Trout	100	11	Immature
Grave Creek	GRA4	Westslope Cutthroat Trout	92	9	Immature
Grave Creek	GRA4	Westslope Cutthroat Trout	93	8	Immature
Grave Creek	GRA4	Westslope Cutthroat Trout	76	6	Immature
Grave Creek	GRA4	Westslope Cutthroat Trout	165	61	Mature
Grave Creek	GRA4	Westslope Cutthroat Trout	116	17	Immature
Grave Creek	GRA4	Westslope Cutthroat Trout	142	31	Immature
Grave Creek	GRA4	Westslope Cutthroat Trout	135	29	Immature
Grave Creek	GRA4	Westslope Cutthroat Trout	92	10	Immature
Grave Creek	GRA4	Westslope Cutthroat Trout	155	45	Mature
Grave Creek	GRA4	Westslope Cutthroat Trout	90	9	Immature
Grave Creek	GRA3	Westslope Cutthroat Trout	189	88	Mature
Grave Creek	GRA3	Westslope Cutthroat Trout	197	105	Mature
Grave Creek	GRA3	Westslope Cutthroat Trout	209	123	Mature
Grave Creek	GRA3	Westslope Cutthroat Trout	151	45	Mature
Grave Creek	GRA3	Westslope Cutthroat Trout	150	45	Mature
Alexander Creek	ALE7	Westslope Cutthroat Trout	198	101	Mature
Alexander Creek	ALE7	Westslope Cutthroat Trout	175	63	Mature
Alexander Creek	ALE7	Brook Trout	199	99	Mature
Alexander Creek	ALE7	Westslope Cutthroat Trout	199	98	Mature
Alexander Creek	ALE7	Westslope Cutthroat Trout	127	21	Immature
Alexander Creek	ALE7	Brook Trout	199	93	Mature
Alexander Creek	ALE8	Bull Trout	200	96	Immature
Alexander Creek	ALE8	Bull Trout	121	19	Immature
Alexander Creek	ALE8	Bull Trout	138	25	Immature
Alexander Creek	ALE8	Bull Trout	121	18	Immature
Alexander Creek	ALE8	Bull Trout	139	28	Immature
Alexander Creek	ALE8	Bull Trout	139	30	Immature

Stream	Site ID	Species	Length (mm)	Weight (g)	Maturity
Alexander Creek	ALE8	Bull Trout	130	23	Immature
Alexander Creek	ALE9	Westslope Cutthroat Trout	98	8	Immature
Alexander Creek	ALE9	Westslope Cutthroat Trout	142	34	Immature
Alexander Creek	ALE9	Westslope Cutthroat Trout	144	34	Immature
Alexander Creek	ALE9	Bull Trout	146	27	Immature
Alexander Creek	ALE9	Westslope Cutthroat Trout	186	79	Mature
Alexander Creek	ALE9	Westslope Cutthroat Trout	80	6	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	151	52	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	120	31	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	86	6	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	56	2	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	75	6	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	72	5	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	122	24	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	116	24	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	55	3	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	56	2	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	103	22	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	182	92	Mature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	48	1	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	161	448	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	115	22	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	165	58	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	160	51	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	85	9	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	131	29	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	58	2	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	56	2	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	144	42	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	93	13	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	105	15	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	55	2	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	90	8	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	57	2	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	180	92	Mature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	149	41	Immature

Stream	Site ID	Species	Length (mm)	Weight (g)	Maturity
West Alexander Creek	WAL1	Westslope Cutthroat Trout	61	3	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	63	3	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	106	17	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	96	12	Immature
West Alexander Creek	WAL1	Westslope Cutthroat Trout	65	3	Immature
Unnamed Grave Trib #1	UTG1	Westslope Cutthroat Trout	103	15	Immature
Unnamed Grave Trib #1	UTG1	Westslope Cutthroat Trout	61	3	Immature
Unnamed Grave Trib #1	UTG1	Westslope Cutthroat Trout	94	9	Immature
Unnamed Grave Trib #1	UTG1	Westslope Cutthroat Trout	119	21	Immature

Appendix H. Fish Community Site Data.

Stream: Alexander Creek — Date: 14-Sep-17

Unit Number	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient %	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Dom.	Bed Material Sub-Dom.	Spawning Gravel		Total LWD Tally	Functional LWD 10-20 cm	Functional LWD 20-50 cm	Functional LWD > 50 cm	Cover Type	Cover %	Cover Type	Cover %	Offchannel Type	Offchannel Access	Offchannel Length (m)	Disturbance Indicators			Riparian Type	Riparian Structure	Canopy Closure %	Barriers	Comments
1	7	8.5	G	3	8.5	1.0	0.44	0.12	0.09	0.46	13.29	11.95	-	-	-	-	F	G	N	-	0	0	0	0	C	12	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
2	7	19.7	R	1	11.2	2.0	0.35	0.17	0.08	0.09	14.85	13.93	-	-	-	-	G	C	N	-	0	0	0	0	-	-	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
3	7	63.9	G	1	44.2	0.5	0.55	0.35	0.19	0.23	12.67	9.59	-	-	-	-	G	C	N	-	3	0	0	0	C	7	LWD	2	-	-	-	EB	-	-	C	MF	20-40	-	
4	7	76.5	R	1	12.6	2.5	0.40	0.27	0.18	0.03	11.98	8.35	-	-	-	-	C	G	N	-	0	0	0	0	C	2	-	-	-	-	-	EB	-	-	C	MF	20-40	-	

Stream: Alexander Creek — Date: 14-Sep-17

Unit Number	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient %	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Dom.	Bed Material Sub-Dom.	Spawning Gravel		Total LWD Tally	Functional LWD 10-20 cm	Functional LWD 20-50 cm	Functional LWD > 50 cm	Cover Type	Cover %	Cover Type	Cover %	Offchannel Type	Offchannel Access	Offchannel Length (m)	Disturbance Indicators			Riparian Type	Riparian Structure	Canopy Closure %	Barriers	Comments
1	8	11.7	G	1	11.7	0.5	0.54	0.50	0.40	0.25	8.20	5.80	-	-	-	-	C	G	L	R	0	0	0	0	C	7	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
2	8	26.9	C	1	15.2	5.5	0.58	0.20	0.31	0.09	8.95	4.94	-	-	-	-	C	B	N	-	0	0	0	0	C	15	B	2	-	-	-	EB	-	-	C	MF	20-40	-	
3	8	35.1	G	1	8.2	1.0	0.53	0.11	0.32	0.48	10.60	7.19	-	-	-	-	C	F	N	-	0	0	0	0	C	5	B	2	-	-	-	EB	-	-	C	MF	20-40	-	
4	8	58.8	R	1	23.7	3.0	0.42	0.13	0.22	0.14	9.20	7.98	-	-	-	-	C	G	L	R	1	0	0	0	C	2	B	2	-	-	-	EB	-	-	C	MF	20-40	-	
5	8	67.8	G	1	9.0	1.0	0.63	0.18	0.44	0.20	11.70	8.97	-	-	-	-	C	F	L	R	1	0	0	0	B	2	LWD	2	-	-	-	EB	-	-	C	MF	20-40	-	
6	8	96.5	R	1	28.7	2.0	0.46	0.15	0.33	0.15	9.45	7.90	-	-	-	-	C	G	L	R	0	0	0	0	B	2	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
7	8	103.2	G	1	6.7	1.0	0.77	0.20	0.32	0.24	9.11	7.47	-	-	-	-	C	G	L	R	0	0	0	0	B	2	-	-	-	-	-	EB	-	-	C	MF	20-40	-	

Stream: Alexander Creek — Date: 19-Sep-17

Unit Number	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient %	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Dom.	Bed Material Sub-Dom.	Spawning Gravel		Total LWD Tally	Functional LWD 10-20 cm	Functional LWD 20-50 cm	Functional LWD > 50 cm	Cover Type	Cover %	Cover Type	Cover %	Offchannel Type	Offchannel Access	Offchannel Length (m)	Disturbance Indicators			Riparian Type	Riparian Structure	Canopy Closure %	Barriers	Comments
1	9	7.8	G	1	7.8	1.0	0.66	0.13	0.22	0.18	6.69	5.60	-	-	-	-	G	C	L	R	1	0	0	0	B	5	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
2	9	40.7	C	1	32.9	4.0	0.71	0.22	0.14	0.08	6.42	5.14	-	-	-	-	C	G	L	R	0	0	0	0	B	10	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
3	9	47.9	G	1	7.2	0.5	1.04	0.25	0.48	0.47	6.20	5.05	-	-	-	-	C	G	L	R	0	0	0	0	B	7	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
4	9	71.9	C	1	24.0	6.0	0.54	0.20	0.13	0.02	6.58	4.27	-	-	-	-	C	G	L	R	0	0	0	0	B	12	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
5	9	78.5	G	1	6.6	1.5	0.61	0.20	0.42	0.07	6.29	3.92	-	-	-	-	C	G	L	R	0	0	0	0	B	7	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
6	9	95.6	C	1	17.1	4.0	0.37	0.12	0.09	0.06	7.25	6.52	-	-	-	-	C	G	L	R	0	0	0	0	B	10	C	5	-	-	-	-	-	-	C	MF	20-40	-	

Stream: Alexander Creek — Date: 18-Sep-17

Unit Number	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient %	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Dom.	Bed Material Sub-Dom.	Spawning Gravel		Total LWD Tally	Functional LWD 10-20 cm	Functional LWD 20-50 cm	Functional LWD > 50 cm	Cover Type	Cover %	Cover Type	Cover %	Offchannel Type	Offchannel Access	Offchannel Length (m)	Disturbance Indicators			Riparian Type	Riparian Structure	Canopy Closure %	Barriers	Comments
1	10	8.7	G	1	8.7	1.0	0.46	0.03	0.24	0.19	4.00	3.60	-	-	-	-	F	G	L	R	2	2	0	0	LWD	10	B	5	-	-	-	EB	-	-	C	MF	20-40	-	
2	10	11.4	R	1	2.7	2.5	0.57	0.10	0.06	0.10	3.44	1.52	-	-	-	-	C	G	N	-	0	0	0	0	-	-	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
3	10	13.7	G	1	2.3	1.0	0.82	0.22	0.20	0.12	4.78	3.73	-	-	-	-	F	G	L	R	3	1	2	0	LWD	10	B	5	-	-	-	EB	-	-	C	MF	20-40	-	
4	10	23.1	C	1	9.4	6.0	0.76	0.04	0.12	0.06	5.10	1.32	-	-	-	-	C	G	N	-	2	2	0	0	C	5	B	5	-	-	-	EB	-	-	C	MF	20-40	-	
5	10	29.5	P	1	6.4	0.0	1.00	0.34	0.50	0.12	2.62	2.62	0.52	0.12	0.4	SC	F	C	N	-	3	0	0	0	LWD	15	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
6	10	37.3	R	1	7.8	2.5	0.72	0.12	0.18	0.09	4.04	2.31	-	-	-	-	C	G	N	-	0	0	0	0	-	-	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
7	10	42.9	C	1	5.6	11.0	0.63	0.03	0.08	0.10	3.96	1.98	-	-	-	-	C	G	N	-	2	0	0	0	LWD	2	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
8	10	51.2	G	1	8.3	1.0	0.77	0.10	0.18	0.06	2.97	2.67	-	-	-	-	F	C	N	-	1	0	0	0	-	-	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
9	10	56.8	C	1	5.6	10.0	0.59	0.05	0.11	0.04	3.19	1.95	-	-	-	-	G	C	N	-	0	0	0	0	-	-	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
10	10	71.9	R	1	15.1	2.0	0.60	0.10	0.06	0.08	3.93	2.48	-	-	-	-	G	C	L	R	3	2	0	0	LWD	10	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
11	10	96.6	C	1	24.7	4.0	0.72	0.06	0.14	0.08	3.91	1.55	-	-	-	-	C	F	N	-	2	0	2	0	LWD	5	C	5	-	-	-	EB	-	-	C	MF	20-40	-	

Stream: West Alexander Creek d/s — Date: 23-Aug-17

Unit Number	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient %	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth (m)	Pools Only Crest (m)	Pools Only Residual (m)	Pools Only Pool Type	Bed Material Dom.	Bed Material Sub-Dom.	Spawning Gravel		Total LWD Tally	Functional LWD 10-20 cm	Functional LWD 20-50 cm	Functional LWD > 50 cm	Cover Type	Cover %	Cover Type	Cover %	Offchannel Type	Offchannel Access	Offchannel Length (m)	Disturbance Indicators			Riparian Type	Riparian Structure	Canopy Closure %	Barriers	Comments
1	1	7.1	P	1	7.1	0.0	0.96	0.68	0.44	0.32	7.06	3.64	0.68	0.08	0.6	SC	C	F	N	-	3	0	0	0	LWD	10	C	5	-	-	-	EB	-	-	C	MF	20-40	-	
2	1	13.6	R	1	6.5	2.5	0.52	0.05	0.04	0.14	6.61	3.61	-	-	-	-	C	G	N	-	2	0	0	0	C	2	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
3	1	22.1	G	1	8.5	1.0	0.37	0.03	0.23	0.27	4.45	2.75	-	-	-	-	C	F	N	-	0	0	0	0	OV	2	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
4	1	23.7	R	1	1.6	2.0	0.36	0.06	0.13	0.06	7.98	2.35	-	-	-	-	C	G	N	-	1	0	1	0	-	-	-	-	-	-	-	-	-	-	C	MF	20-40	-	
5	1	30.4	G	1	6.7	0.5	0.78	0.21	0.43	0.23	6.30	2.47	-	-	-	-	C	F	N	-	2	0	0	0	LWD	7	C	7	-	-	-	EB	-	-	C	MF	20-40	-	
6	1	45.1	R	1	14.7	3.5	0.53	0.18	0.11	0.05	7.71	2.50	-	-	-	-	C	G	N	-	2	0	2	0	LWD	2	C	2	-	-	-	EB	-	-	C	MF	20-40	-	
7	1	50.2	G	1	5.1	1.0	0.62	0.41	0.49	0.08	5.80	2.95	-	-	-	-	C	F	N	-	2	0	0	0	C	15	LWD	15	-	-	-	EB	-	-	C	MF	20-40	-	
8	1	54.4	R	1	4.2	3.5	0.21	0.07	0.11	0.07	5.60	4.34	-	-	-	-	C	G	N	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	C	MF	20-40	-	
9	1	66.1	G	1	11.7	1.0	0.54	0.40	0.23	0.27	4.65	3.39	-	-	-	-	F	C	N	-	4	0	0	0	C	10	LWD	7	-	-	-	EB	-	-	C	MF	20-40	-	
10	1	73.4	C	1	7.3	6.0	0.25	0.06	0.07	0.15	6.65	5.13	-	-	-	-	C	G	L	R	2	2	0	0	LWD	15	C	5	-	-	-	EB	-	-	C	MF	20-40	-	
11	1	87.8	R	1	14.4	3.0	0.36	0.15	0.12	0.08	5.98	3.25	-	-	-	-	C	F	L	R	1	0	1	0	LWD	7	-	-	-	-	-	EB	-	-	C	MF	20-40	-	

Stream: West Alexander Creek u/s | Date: 22-Aug-17

Unit Number	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient %	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth (m)	Crest (m)	Residual (m)	Pool Type	Bed Material Type Dom.	Sub-Dom.	Spawning Gravel		Total LWD Tally	Functional LWD Tally 10-20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Type	%	Offchannel Habitat Type	Access	Length (m)	Disturbance Indicators			Riparian Vegetation Type	Structure	Canopy Closure %	Barriers	Comments
1	1	4.3	G	1	4.3	1	0.46	0.35	0.16	0.06	4.40	4.10	-	-	-	-	F	G	N	-	2	0	0	0	C	15	LWD	5	-	-	-	EB	-	-	C	MF	20-40	-	
2	1	9.9	P	1	5.6	0	0.88	0.34	0.51	0.76	4.55	8.95	0.76	0.12	0.64	SC	F	G	N	-	3	0	1	2	C	15	LWD	10	-	-	-	-	-	-	C	MF	20-40	-	
3	1	15.6	G	1	5.7	1	0.46	0.19	0.44	0.25	7.60	3.49	-	-	-	-	F	G	N	-	12	2	1	0	LWD	20	C	10	-	-	-	-	-	-	C	MF	20-40	-	
4	1	49.7	R	1	34.1	2.5	0.61	0.09	0.18	0.12	2.59	2.00	-	-	-	-	C	G	L	R	13	2	2	1	LWD	20	C	7	-	-	-	-	-	-	C	MF	20-40	-	
5	1	63.0	G	1	13.3	1	0.26	0.10	0.14	0.06	5.60	2.90	-	-	-	-	F	G	L	R	3	0	0	0	C	15	LWD	5	-	-	-	EB	-	-	C	MF	20-40	-	

Stream: Grave Creek | Date: 20-Sep-17

Unit Number	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient %	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth (m)	Crest (m)	Residual (m)	Pool Type	Bed Material Type Dom.	Sub-Dom.	Spawning Gravel		Total LWD Tally	Functional LWD Tally 10-20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Type	%	Offchannel Habitat Type	Access	Length (m)	Disturbance Indicators			Riparian Vegetation Type	Structure	Canopy Closure %	Barriers	Comments
1	3	5.8	G	1	3.0	1.0	0.37	0.41	0.14	0.04	6.70	2.90	-	-	-	-	F	G	N	-	2	0	0	0	C	20	-	-	-	-	-	EB	-	-	M	MF	40-70	-	
2	3	6.2	R	1	3.2	2.0	0.26	0.09	0.10	0.04	7.30	4.10	-	-	-	-	C	G	N	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	M	MF	40-70	-	
3	3	13.3	G	1	7.1	1.0	0.36	0.20	0.21	0.14	5.30	2.95	-	-	-	-	F	G	N	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	M	MF	40-70	-	
4	3	27.5	C	1	14.2	4.0	0.25	0.07	0.10	0.04	4.20	3.58	-	-	-	-	C	G	L	R	1	1	0	0	LWD	5	-	-	-	-	-	EB	-	-	M	MF	40-70	-	
5	3	32.4	G	1	4.9	1.0	0.42	0.12	0.15	0.08	5.71	3.33	-	-	-	-	C	F	L	R	0	0	0	0	-	-	-	-	-	-	-	EB	-	-	M	MF	40-70	-	
6	3	45.7	C	1	13.3	4.5	0.41	0.11	0.14	0.04	5.31	2.83	-	-	-	-	C	G	L	R	0	0	0	0	-	-	-	-	-	-	-	EB	-	-	M	MF	40-70	-	
7	3	51.2	G	1	5.5	1.0	0.47	0.18	0.34	0.22	5.90	2.98	-	-	-	-	F	C	N	-	0	0	0	0	C	5	-	-	-	-	-	EB	-	-	M	MF	40-70	-	
8	3	63.2	C	1	12.0	5.0	0.25	0.07	0.11	0.04	5.08	3.15	-	-	-	-	C	G	L	R	1	0	0	0	LWD	2	-	-	-	-	-	EB	-	-	M	MF	40-70	-	
9	3	66.9	R	1	3.7	2.5	0.32	0.12	0.13	0.05	5.87	2.96	-	-	-	-	C	G	L	R	0	0	0	0	-	-	-	-	-	-	-	EB	-	-	M	MF	40-70	-	
10	3	80.8	C	1	13.9	5.5	0.28	0.09	0.14	0.06	5.96	4.15	-	-	-	-	C	G	L	R	0	0	0	0	B	7	-	-	-	-	-	EB	-	-	M	MF	40-70	-	
11	3	90.8	R	1	10.0	2.5	0.26	0.05	0.12	0.02	6.78	4.88	-	-	-	-	C	G	L	R	2	2	0	0	LWD	5	-	-	-	-	-	-	-	-	M	MF	40-70	-	
12	3	99.9	G	1	9.1	1.0	0.42	0.12	0.17	0.13	5.02	3.24	-	-	-	-	G	F	L	R	0	0	0	0	C	2	-	-	-	-	-	EB	-	-	M	MF	40-70	-	

Stream: Grave Creek | Date: 20-Sep-17

Unit Number	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient %	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth (m)	Crest (m)	Residual (m)	Pool Type	Bed Material Type Dom.	Sub-Dom.	Spawning Gravel		Total LWD Tally	Functional LWD Tally 10-20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Type	%	Offchannel Habitat Type	Access	Length (m)	Disturbance Indicators			Riparian Vegetation Type	Structure	Canopy Closure %	Barriers	Comments
1	4	2.6	G	1	2.6	0.5	0.55	0.16	0.32	0.14	4.88	2.88	-	-	-	-	F	C	N	-	3	3	0	0	B	10	LWD	7	-	-	-	EB	-	-	C	MF	40-70	-	
2	4	4.6	C	1	2.0	5.0	0.45	0.04	0.09	0.13	5.05	1.53	-	-	-	-	C	G	N	-	0	0	0	0	B	15	LWD	2	-	-	-	-	-	-	C	MF	40-70	-	
3	4	7.0	G	1	2.4	1.0	0.37	0.08	0.16	0.08	4.38	1.81	-	-	-	-	C	F	N	-	1	1	0	0	OV	2	LWD	2	-	-	-	EB	-	-	C	MF	40-70	-	
4	4	12.6	C	1	5.6	5.0	0.47	0.10	0.18	0.05	3.87	1.88	-	-	-	-	C	G	N	-	1	1	0	0	B	10	LWD	5	-	-	-	EB	-	-	C	MF	40-70	-	
5	4	16.8	G	1	4.2	1.0	0.45	0.16	0.28	0.08	5.05	4.27	-	-	-	-	F	C	N	-	0	0	0	0	B	2	OV	2	-	-	-	EB	-	-	C	MF	40-70	-	
6	4	20.2	C	1	3.4	8.0	0.36	0.05	0.10	0.08	4.55	2.11	-	-	-	-	C	F	N	-	0	0	0	1	B	5	OV	5	-	-	-	EB	-	-	C	MF	40-70	-	
7	4	29.1	G	1	8.9	1.0	0.56	0.18	0.35	0.14	4.69	2.81	-	-	-	-	F	C	L	R	0	0	0	0	B	12	-	-	-	-	-	EB	-	-	C	MF	40-70	-	
8	4	35.5	R	1	6.4	2.0	0.53	0.11	0.20	0.18	3.18	2.36	-	-	-	-	G	B	H	R	1	0	0	0	B	15	OV	7	-	-	-	-	-	-	C	MF	40-70	-	
9	4	42.4	C	1	6.9	8.0	0.48	0.05	0.24	0.14	3.82	2.11	-	-	-	-	C	B	N	-	3	1	1	0	B	17	SWD	10	-	-	-	EB	PW	-	C	MF	40-70	-	
10	4	47.2	R	1	4.8	3.0	0.42	0.09	0.16	0.18	3.42	1.78	-	-	-	-	C	F	N	-	1	1	0	0	B	5	LWD	2	-	-	-	EB	-	-	C	MF	40-70	-	
11	4	49.7	C	1	2.5	10.0	0.45	0.12	0.05	0.08	5.05	3.00	-	-	-	-	C	B	N	-	0	0	0	0	B	10	-	-	-	-	-	EB	-	-	C	MF	40-70	-	
12	4	53.7	R	1	4.0	2.0	0.48	0.06	0.13	0.08	5.17	3.90	-	-	-	-	F	C	N	-	4	0	0	0	B	15	LWD	3	-	-	-	-	-	-	C	MF	40-70	-	
13	4	56.1	C	1	2.4	7.0	0.57	0.12	0.16	0.15	4.47	2.33	-	-	-	-	C	B	N	-	2	0	0	0	B	20	SWD	5	-	-	-	-	-	-	C	MF	40-70	-	
14	4	59.3	G	1	3.2	1.0	0.48	0.12	0.30	0.11	4.78	2.00	-	-	-	-	F	B	N	-	3	0	1	0	OV	5	-	-	-	-	-	-	-	-	C	MF	40-70	-	
15	4	65.1	C	1	5.8	12.0	0.37	0.18	0.10	0.11	5.26	3.52	-	-	-	-	C	B	N	-	4	0	2	0	SWD	7	B	5	-	-	-	-	-	-	C	MF	40-70	-	
16	4	74.3	G	1	9.2	1.0	0.36	0.04	0.22	0.25	4.54	2.85	-	-	-	-	F	C	N	-	1	0	0	1	B	7	SWD	5	-	-	-	-	-	-	C	MF	40-70	-	
17	4	78.4	C	1	4.1	16.0	0.52	0.07	0.13	0.15	4.35	2.75	-	-	-	-	B	C	N	-	0	0	0	0	B	15	-	-	-	-	-	-	-	-	C	MF	40-70	-	
18	4	85.8	G	1	7.4	1.0	0.26	0.05	0.13	0.05	3.00	1.93	-	-	-	-	F	B	N	-	2	0	0	0	B	7	SWD	2	-	-	-	-	-	-	C	MF	40-70	-	
19	4	92.8	C	1	7.0	6.5	0.41	0.05	0.10	0.03	3.57	2.84	-	-	-	-	C	B	N	-	3	0	0	0	SWD	7	B	2	-	-	-	-	-	-	C	MF	40-70	-	

Stream: Unnamed Trib Grave Creek #1 | Date: 11-Oct-17

Unit Number	Reach Number	Distance (m)	Habitat Unit Type	Habitat Unit Cat	Length (m)	Gradient %	Mean Depth Bankfull (m)	Mean Depth Water (m)			Mean Width Bankfull (m)	Mean Width Wetted (m)	Pools Only Max Depth (m)	Crest (m)	Residual (m)	Pool Type	Bed Material Type Dom.	Sub-Dom.	Spawning Gravel		Total LWD Tally	Functional LWD Tally 10-20 cm	20 - 50 cm	> 50 cm	Cover Type	%	Type	%	Offchannel Habitat Type	Access	Length (m)	Disturbance Indicators			Riparian Vegetation Type	Structure	Canopy Closure %	Barriers	Comments
1	1	6.9	G	1	6.9	1.0	0.36	0.15	0.17	0.11	2.53	1.59	-	-	-	-	C	G	N	-	1	0	0	0	-	-	-	-	-	-	-	-	-	-	C	MF	40-70	-	
2	1	23.0	R	1	16.1	3.0	0.41	0.12	0.14	0.08	3.20	2.30	-	-	-	-	C	G	N	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	C	MF	40-70	-	
3	1	29.1	C	1	6.1	7.0	0.43	0.09	0.10	0.17	3.82	2.75	-	-	-	-	G	C	N	-	1	1	0	0	LWD	2	-	-	-	-	-	MB	-	-	C	MF	40-70	-	
4	1	34.4	G	1	5.3	1.0	0.28	0.09	0.16	0.06	3.07	2.05	-	-	-	-	G	C	N	-	1	0	0	0	C	7	-	-	-	-	-	EB	-	-	C	MF	40-70	-	
5	1	45.5	C	1	11.1	5.0	0.35	0.16	0.11	0.08	4.90	2.42	-	-	-	-	G	C	N	-	0	0	0	0	C	5	-	-	-	-	-	EB	-	-	C	MF	40-70	-	
6	1	56.9	R	1	11.4	2.5	0.27	0.11	0.10	0.06	3.13	1.93	-	-	-	-	C	G	N	-	1	0	0	0	C	10	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
7	1	61.9	C	1	5.0	14.0	0.37	0.10	0.11	0.14	5.73	1.95	-	-	-	-	G	C	N	-	0	0	0	0	SWD	7	C	5	-	-	-	-	-	-	C	MF	20-40	-	
8	1	68.0	G	1	6.1	1.0	0.33	0.10	0.19	0.11	3.22	2.00	-	-	-	-	G	C	N	-	0	0	0	0	-	-	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
9	1	73.5	C	1	5.5	4.0	0.34	0.12	0.09	0.08	3.85	1.59	-	-	-	-	G	C	N	-	0	0	0	0	-	-	-	-	-	-	-	EB	-	-	C	MF	20-40	-	
10	1	77.7	G	1	4.2	1.0	0.40	0.10	0.12	0.10	3.00	2.93	-	-	-	-	G	C	N	-	1	1	0	0	-	-	-	-	-	-	-	JM	-	-	C	MF	20-40	-	
11	1	82.8	R	1	5.1	2.5	0.30	0.12	0.17	0.16	3.57	1.22	-	-	-	-	C	G	N	-	1	0	0	0	C	5	-	-	-	-	-	-	-	-	C	MF	20-40	-	
12	1	100.0	C	1	17.2	5.0	0.49	0.10	0.17	0.09	5.08	1.82	-	-	-	-	C	G	N	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	C	MF	20-40	-	

Appendix I. Fish Community Maps.

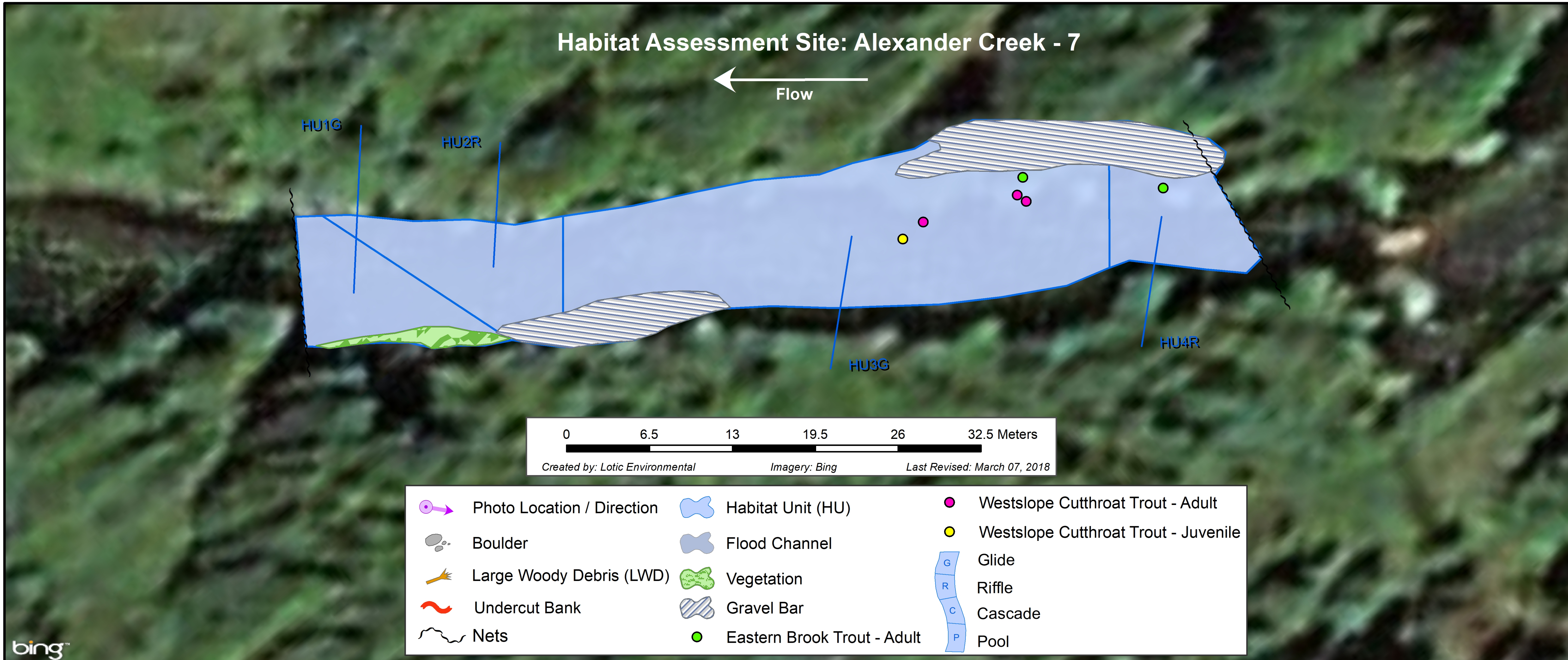


Image 2446 - Upstream view of site

Image 2450 - Across view of glide in HU3

Image 2447 - Downstream view of riffle in HU4

Image 2448 - Upstream view of net

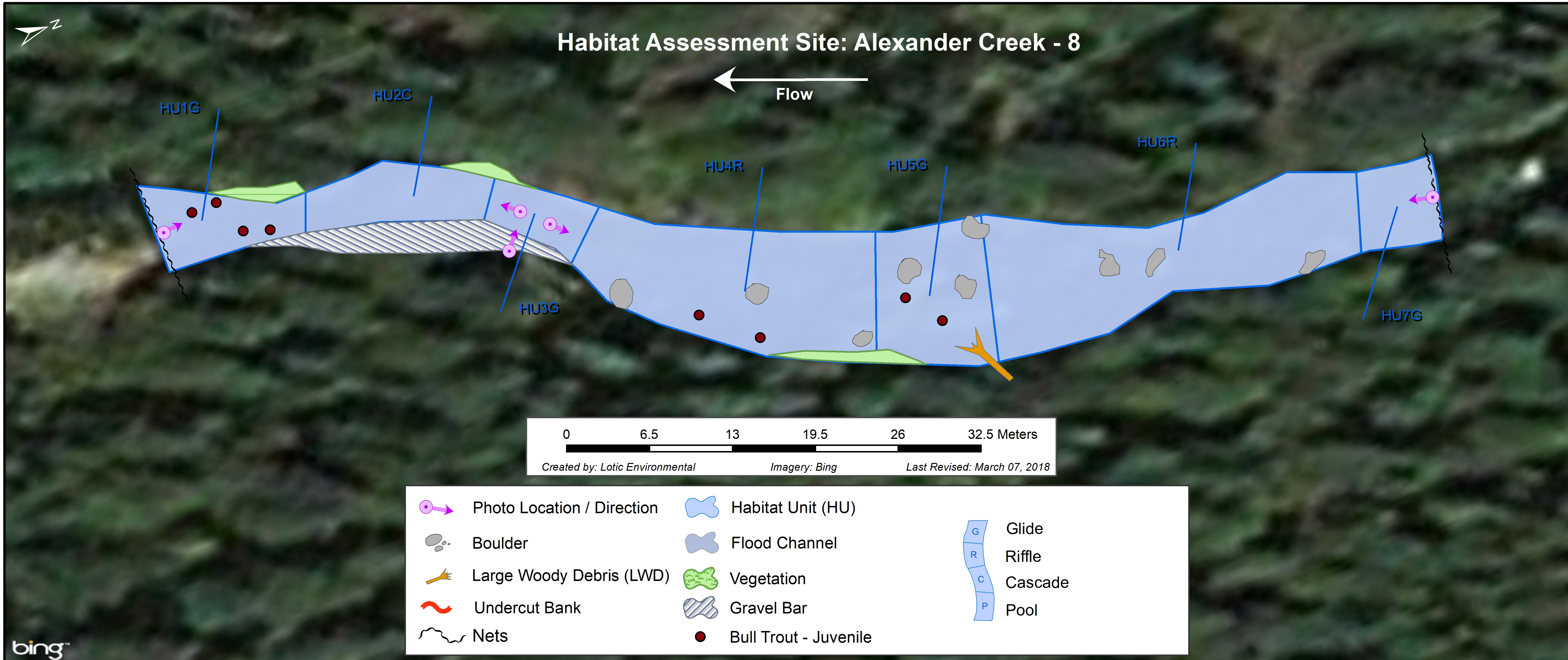



Image 7823 - Typical upstream stream view of a cascade


Image 7830 - Typical downstream view of a cascade


Image 7838 - Typical downstream view of a glide


Image 7841 - Typical upstream view of a riffle

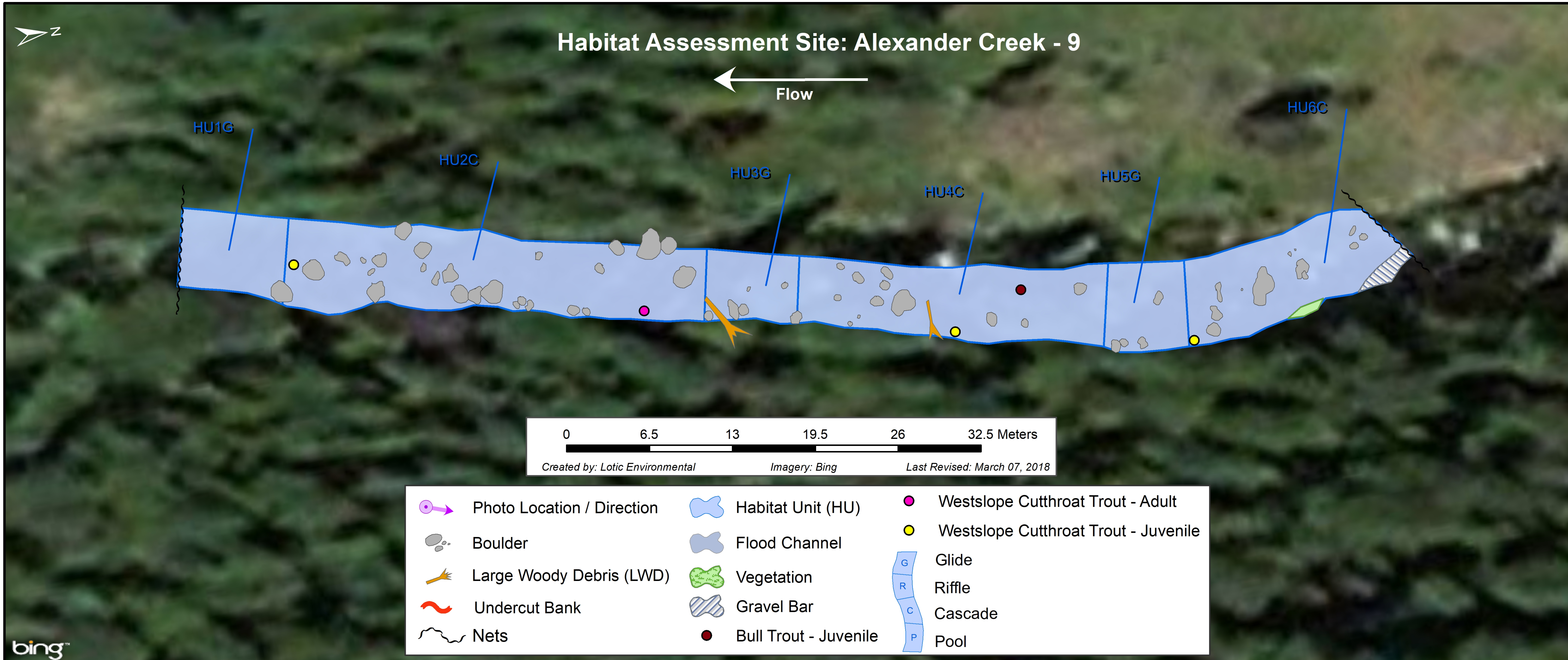



Image 2466 - Upstream view of site from HU cascade


Image 2467 - Downstream view of site from HU cascade

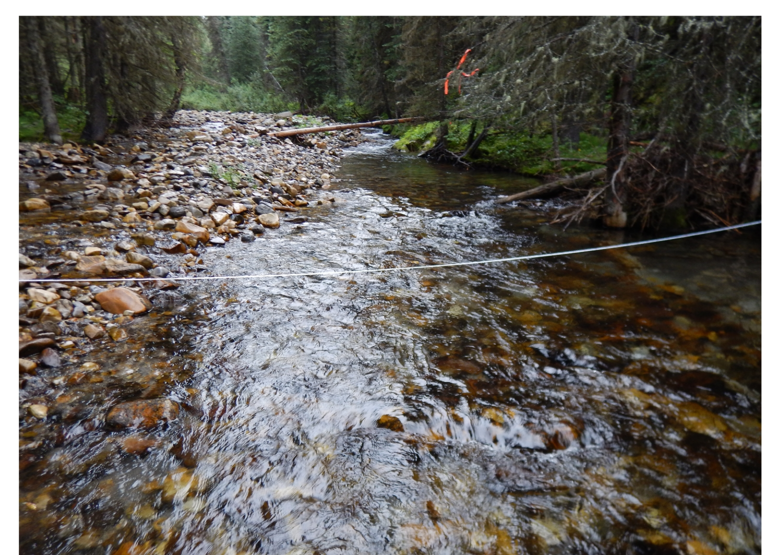


Image 0158 - Typical upstream view of a riffle


Image 0161 - Typical upstream view of a glide

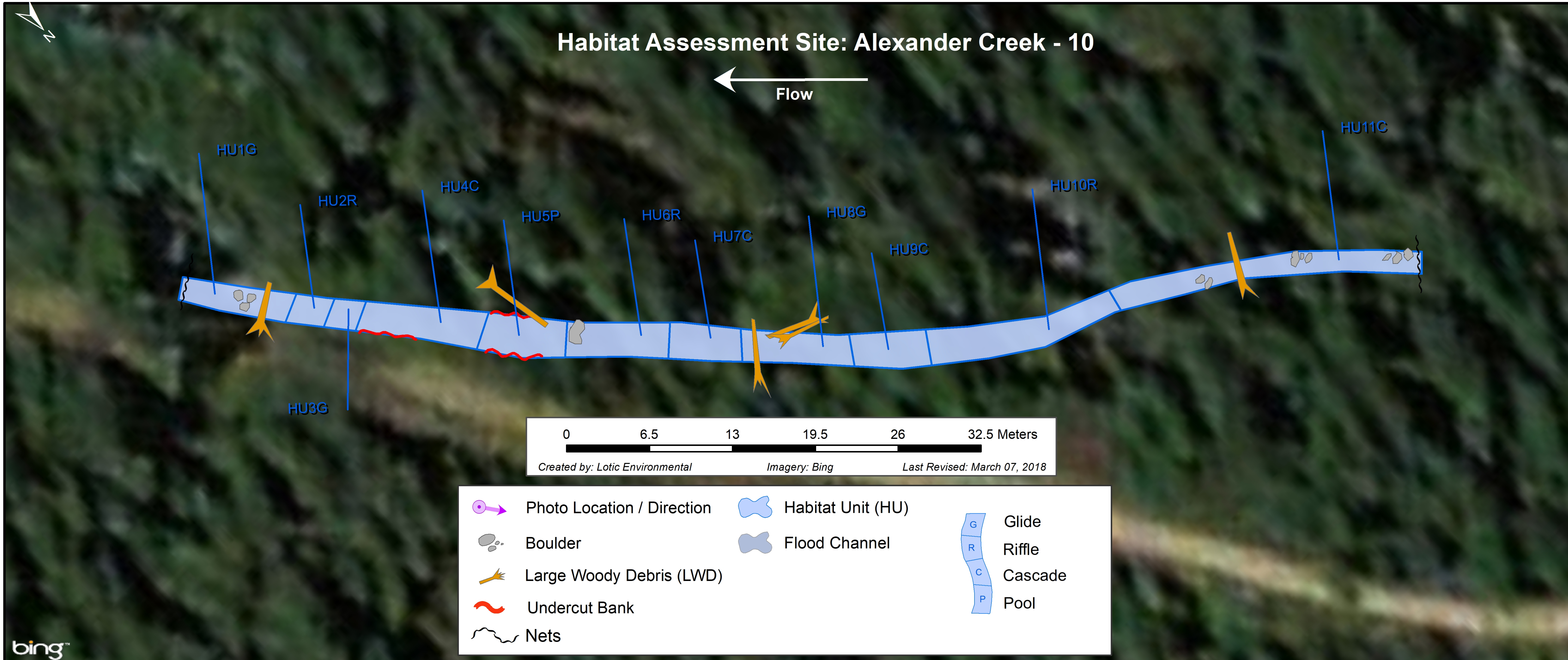


Image 2458 - Upstream view of glide in HU1

Image 2460 - Upstream view of site from glide in HU3

Image 7412 - Typical upstream view of reach 10 habitat

Image 7413 - Typical downstream view of reach 10 habitat

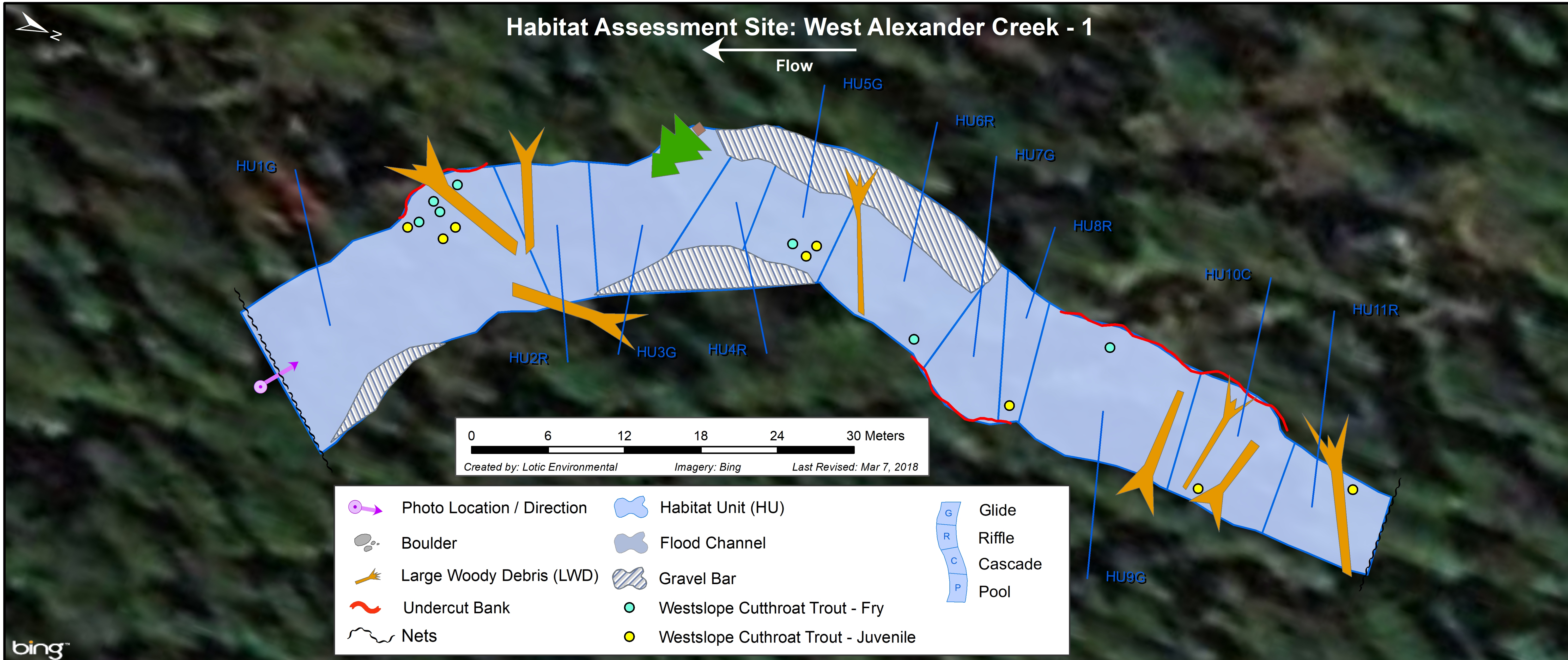


Image 2280 - Upstream view of glide in HU1

Image 2282 - Upstream view of glide in HU7

Image 7243 - Typical upstream view of a riffle

Image 7292 - Typical upstream view of a cascade

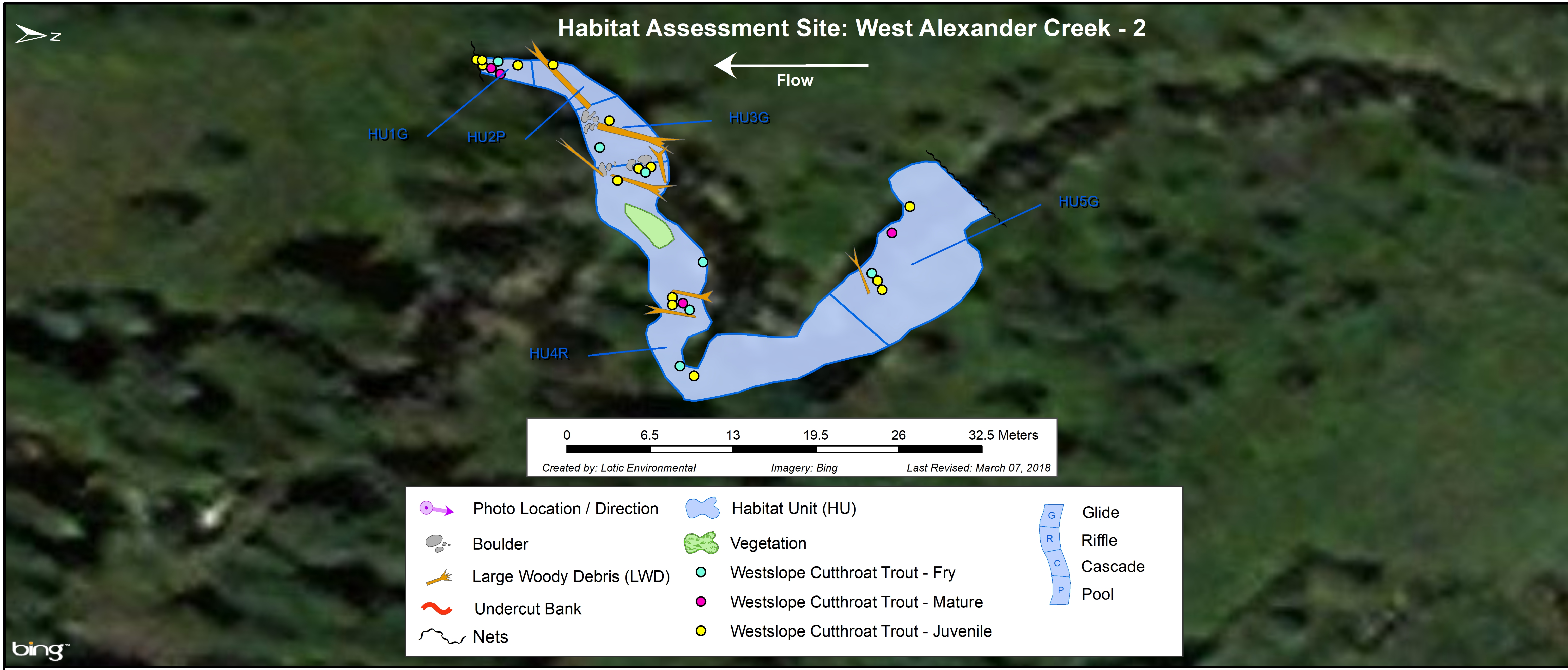


Image 7405 - Typical upstream view of reach 2 habitat

Image 7406 - Typical downstream view of reach 2 habitat

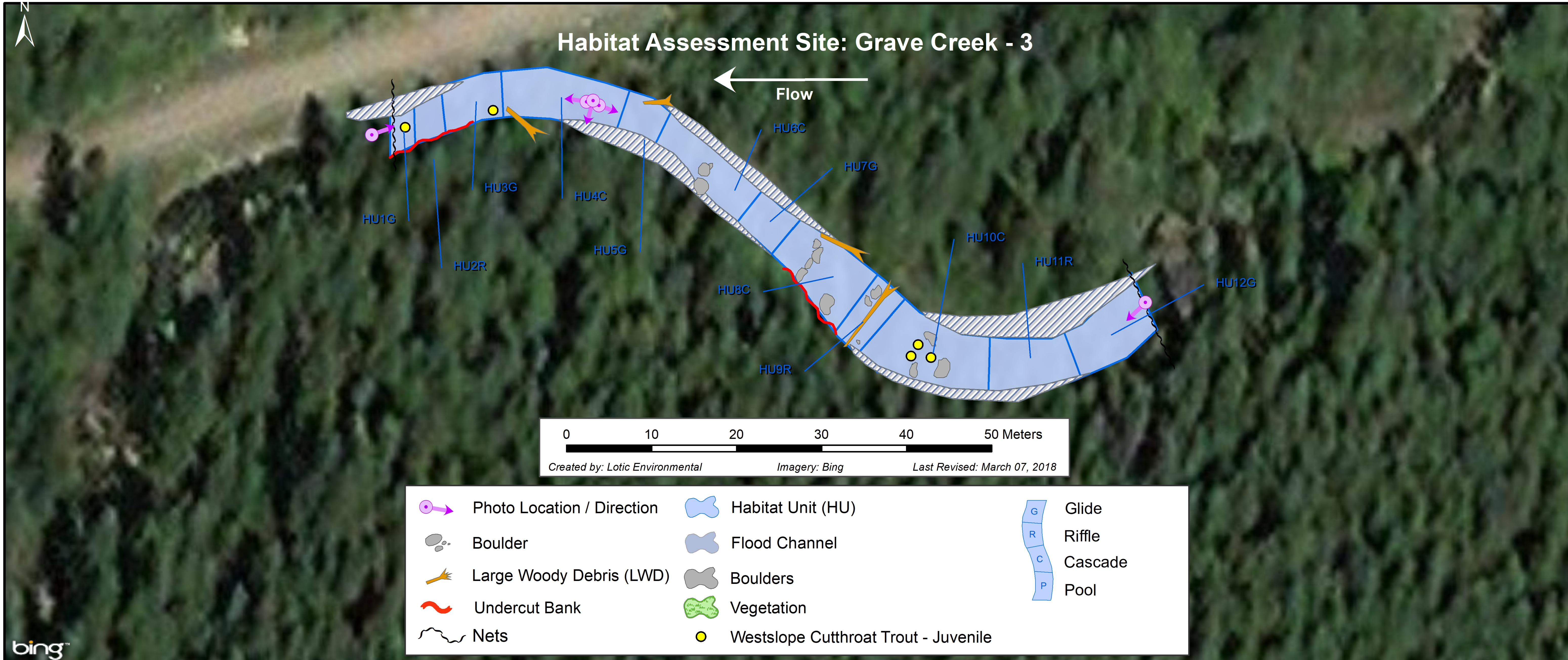


Image 2475 - Upstream view of glide in HU1

Image 2476 - Upstream view from cascade in HU4

Image 2477 - Downstream view from cascade in HU4

Image 2479 - Downstream view of glide in HU12

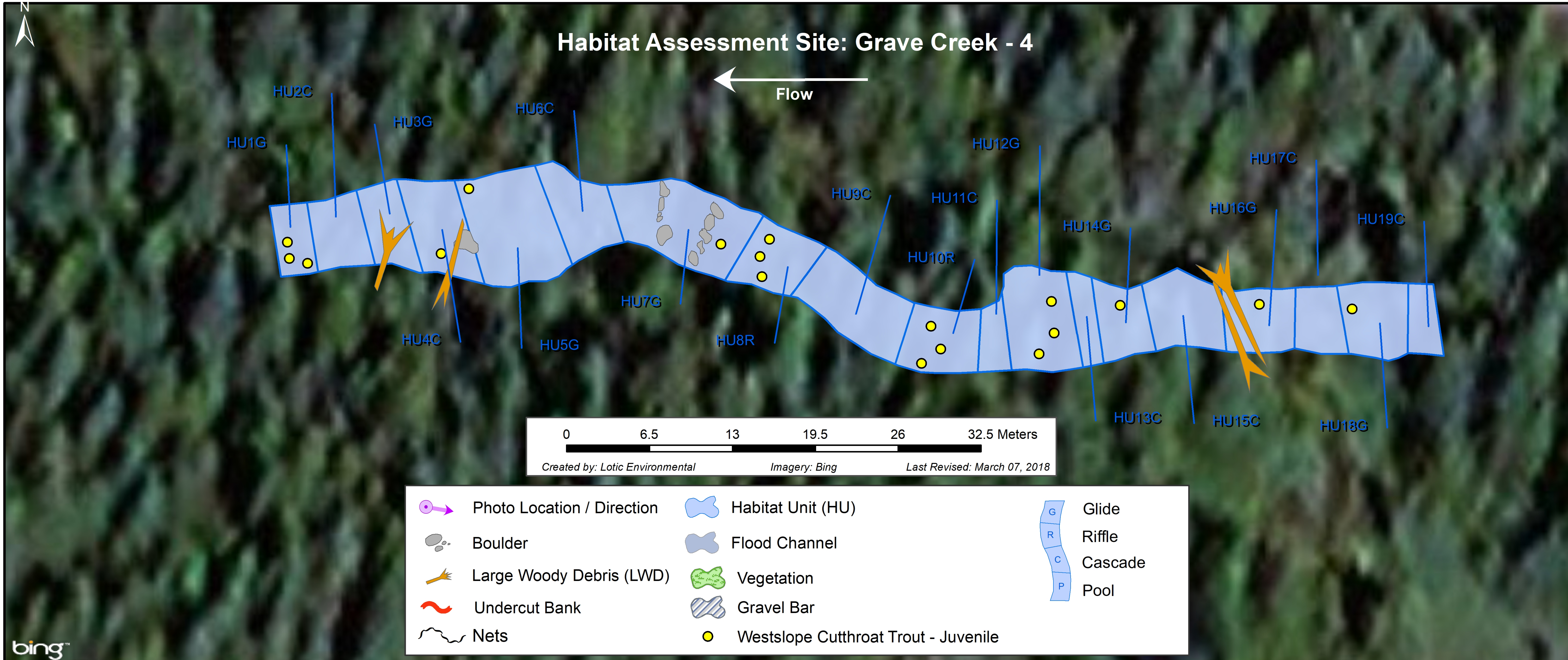


Image 3079 - Upstream view of glide in HU1

Image 3106 - Typical upstream view of a glide

Image 1164 - Typical upstream view of reach 4 habitat

Image 3477 - Typical upstream view of reach 4 habitat

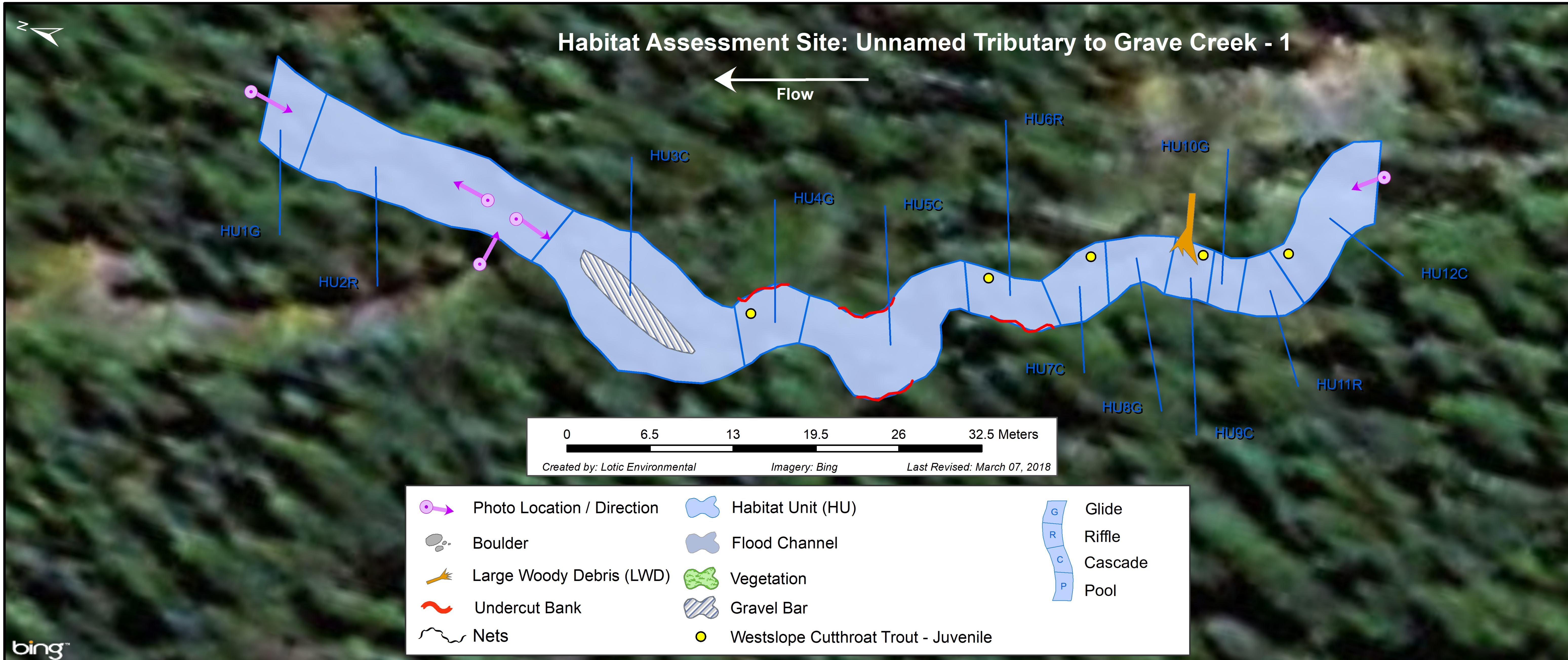


Image 3070 - Upstream view of riffle in HU2

Image 3061 - Upstream view of cascade in HU3

Image 3064 - Upstream view of glide in HU4

Image 3073 - Upstream view of cascade in HU9

Appendix J. Fish Community Flows.

Site:	ALE 7		**Date:**	September 14, 2017
Crew:	BR/JB		**Wetted Width (m):**	9.59
HU #:	G1		**Spacing (m):**	0.48
Type/Cat	Glide		**Weather:**	Sunny & Clear

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	3.79	0.02	0.00	0.000
2	4.27	0.07	0.04	0.001
3	4.75	0.09	0.09	0.004
4	5.23	0.12	0.06	0.003
5	5.71	0.20	0.10	0.010
6	6.19	0.21	0.14	0.014
7	6.67	0.28	0.12	0.016
8	7.15	0.26	0.15	0.019
9	7.63	0.26	0.20	0.025
10	8.11	0.28	0.22	0.325
11	8.58	0.30	0.22	0.031
12	9.06	0.34	0.17	0.028
13	9.54	0.34	0.14	0.023
14	10.02	0.35	0.12	0.020
15	10.50	0.32	0.16	0.025
16	10.98	0.35	0.15	0.025
17	11.46	0.39	0.12	0.022
18	11.94	0.41	0.13	0.026
19	12.42	0.33	0.12	0.019
20	12.90	0.22	0.05	-0.139
			Qtotal	**0.497**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	13.14			
LDB	3.55			

Site:	ALE 7		**Date:**	September 14, 2017
Crew:	BR/JB		**Wetted Width (m):**	7.12
HU #:	R1		**Spacing (m):**	0.36
Type/Cat	Riffle		**Weather:**	Sunny & Clear

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	1.41	0.27	0.04	0.004
2	1.76	0.36	0.43	0.055
3	2.12	0.32	0.46	0.053
4	2.48	0.28	0.31	0.031
5	2.83	0.30	0.32	0.034
6	3.19	0.26	0.43	0.040
7	3.54	0.22	0.29	0.023
8	3.90	0.24	0.28	0.024
9	4.26	0.24	0.54	0.046
10	4.61	0.20	0.30	0.235
11	4.97	0.18	0.18	0.012
12	5.32	0.18	0.16	0.010
13	5.68	0.11	0.12	0.005
14	6.04	0.07	0.07	0.002
15	6.39	0.08	0.03	0.001
16	6.75	0.07	0.09	0.002
17	7.10	0.06	0.07	0.001
18	7.46	0.08	0.02	0.001
19	7.82	0.06	0.03	0.001
20	8.17	0.03	0.08	-0.019
			Qtotal	**0.559**

Photo U/S			
Photo D/S			
Photo X/S			
Photo Sub.		**Camera:**	
RDB	8.35		
LDB	1.23		

Site:	ALE 8		**Date:**	August 25, 2017
Crew:	BR/SK/JB		**Wetted Width (m):**	4.76
HU #:	G1		**Spacing (m):**	0.24
Type/Cat	Glide		**Weather:**	Sunny, Clear

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	1.26	0.48	0.18	0.021
2	1.50	0.50	0.27	0.032
3	1.74	0.53	0.27	0.034
4	1.97	0.57	0.28	0.038
5	2.21	0.49	0.48	0.056
6	2.45	0.40	0.37	0.036
7	2.69	0.55	0.33	0.044
8	2.93	0.48	0.38	0.043
9	3.16	0.47	0.29	0.032
10	3.40	0.49	0.24	0.308
11	3.64	0.37	0.22	0.020
12	3.88	0.56	0.26	0.035
13	4.12	0.34	0.23	0.018
14	4.35	0.25	0.18	0.011
15	4.59	0.30	0.15	0.011
16	4.83	0.31	0.11	0.008
17	5.07	0.28	0.11	0.007
18	5.31	0.13	0.10	0.003
19	5.54	0.06	0.05	0.001
20	5.78	0.03	0.06	-0.010
			Qtotal	**0.746**

Photo U/S			
Photo D/S			
Photo X/S			
Photo Sub.		**Camera:**	
RDB	5.90		
LDB	1.14		

Site:	ALE 8		**Date:**	August 25, 2017
Crew:	BR/SK/JB		**Wetted Width (m):**	8.19

HU #:	R1		**Spacing (m):**	0.41
Type/Cat	Riffle		**Weather:**	Sunny & Clear

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	1.90	0.05	0.02	0.000
2	2.31	0.06	0.14	0.003
3	2.72	0.07	0.23	0.007
4	3.13	0.13	0.10	0.005
5	3.54	0.08	0.18	0.006
6	3.95	0.14	0.36	0.021
7	4.36	0.13	0.20	0.011
8	4.77	0.27	0.43	0.048
9	5.18	0.23	0.07	0.007
10	5.59	0.16	0.40	0.288
11	6.00	0.20	0.40	0.033
12	6.41	0.21	0.21	0.018
13	6.82	0.22	0.56	0.051
14	7.23	0.15	0.61	0.038
15	7.64	0.20	0.29	0.024
16	8.05	0.16	0.52	0.034
17	8.46	0.20	0.31	0.025
18	8.87	0.15	0.64	0.039
19	9.28	0.14	0.37	0.021
20	9.69	0.04	0.00	0.000
			Qtotal	**0.678**

Photo U/S			
Photo D/S			
Photo X/S			
Photo Sub.		**Camera:**	
RDB	9.89		
LDB	1.70		

Site:	ALE 8		**Date:**	August 25, 2017
Crew:	BR/SK/JB		**Wetted Width (m):**	5.18
HU #:	C1		**Spacing (m):**	0.26
Type/Cat	Cascade		**Weather:**	Sunny & Clear

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	2.33	0.07	0.13	0.002
2	2.59	0.06	0.19	0.003
3	2.85	0.22	0.15	0.009
4	3.11	0.20	0.52	0.027
5	3.37	0.45	1.27	0.149
6	3.63	0.33	1.25	0.105
7	3.88	0.28	1.14	0.081
8	4.14	0.31	0.39	0.031
9	4.40	0.15	0.37	0.014
10	4.66	0.19	0.40	0.217
11	4.92	0.19	-0.10	-0.005
12	5.18	0.21	-0.06	-0.003
13	5.44	0.16	0.27	0.011
14	5.70	0.09	0.22	0.005
15	5.96	0.02	0.07	0.000
16	6.22	0.01	0.01	0.000
17	6.47	0.01	0.00	0.000
18	6.73	0.03	0.02	0.000
19	6.99	0.01	0.01	0.000
20	7.29	0.01	0.00	0.000
			Qtotal	**0.647**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	7.38			
LDB	2.20			

Site:	ALE 9	**Date:**	September 19, 2017
Crew:	BR/JB	**Wetted Width (m):**	4.01
HU #:	C1	**Spacing (m):**	0.20

Type/Cat	Cascade		**Weather:**	Sunny, Clear

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	3.53	0.23	0.00	0.000
2	3.73	0.22	0.00	0.000
3	3.93	0.22	0.28	0.012
4	4.13	0.22	0.08	0.004
5	4.33	0.20	0.00	0.000
6	4.53	0.16	0.06	0.002
7	4.73	0.15	0.09	0.003
8	4.93	0.11	0.25	0.005
9	5.13	0.10	0.29	0.006
10	5.33	0.09	0.12	0.024
11	5.54	0.14	0.19	0.005
12	5.74	0.18	0.22	0.008
13	5.94	0.18	0.37	0.013
14	6.14	0.11	0.04	0.001
15	6.34	0.08	0.21	0.003
16	6.54	0.06	0.23	0.003
17	6.74	0.02	-0.03	0.000
18	6.94	0.03	0.05	0.000
19	7.14	0.03	0.00	0.000
20	7.34	0.05	0.00	0.000
			Qtotal	**0.090**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	7.44			
LDB	3.43			

Site:	ALE 9	**Date:**	September 19, 2017
Crew:	BR/JB	**Wetted Width (m):**	4.93
HU #:	G2	**Spacing (m):**	0.25
Type/Cat	Glide	**Weather:**	Sunny & Clear

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	1.95	0.01	0.00	0.000
2	2.20	0.06	-0.02	0.000
3	2.45	0.09	0.00	0.000
4	2.69	0.26	0.09	0.006
5	2.94	0.38	0.15	0.014
6	3.19	0.32	0.46	0.036
7	3.43	0.28	0.27	0.019
8	3.68	0.36	0.18	0.016
9	3.93	0.31	0.15	0.011
10	4.17	0.36	0.02	0.020
11	4.42	0.40	0.01	0.001
12	4.67	0.30	0.00	0.000
13	4.91	0.30	-0.01	-0.001
14	5.16	0.28	0.00	0.000
15	5.40	0.38	-0.02	-0.002
16	5.65	0.34	-0.01	-0.001
17	5.90	0.22	-0.01	-0.001
18	6.14	0.24	-0.02	-0.001
19	6.39	0.28	-0.01	-0.001
20	6.64	0.07	0.00	0.000
			Qtotal	**0.117**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	6.76			
LDB	1.83			

Site:	ALE 8	**Date:**	August 25, 2017
Crew:	BR/SK/JB	**Wetted Width (m):**	5.18
HU #:	C1	**Spacing (m):**	0.26
Type/Cat	Cascade	**Weather:**	Sunny & Clear

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	2.33	0.07	0.13	0.002

2	2.59	0.06	0.19	0.003
3	2.85	0.22	0.15	0.009
4	3.11	0.20	0.52	0.027
5	3.37	0.45	1.27	0.149
6	3.63	0.33	1.25	0.105
7	3.88	0.28	1.14	0.081
8	4.14	0.31	0.39	0.031
9	4.40	0.15	0.37	0.014
10	4.66	0.19	0.40	0.217
11	4.92	0.19	-0.10	-0.005
12	5.18	0.21	-0.06	-0.003
13	5.44	0.16	0.27	0.011
14	5.70	0.09	0.22	0.005
15	5.96	0.02	0.07	0.000
16	6.22	0.01	0.01	0.000
17	6.47	0.01	0.00	0.000
18	6.73	0.03	0.02	0.000
19	6.99	0.01	0.01	0.000
20	7.29	0.01	0.00	0.000
			Qtotal	**0.647**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	7.38			
LDB	2.20			

Site:	ALE 10		**Date:**	September 18, 2017
Crew:	BR/JB		**Wetted Width (m):**	1.40
HU #:	R1		**Spacing (m):**	0.14
Type/Cat	Riffle		**Weather:**	Cloudy
Interval	**Station**	**Depth (m)**	**Velocity (m/s) @ 0.6 depth**	**Discharge (m3/s)**

1	1.92	0.02	0.00	0.000
2	2.06	0.06	0.06	0.001
3	2.20	0.08	0.14	0.002
4	2.34	0.10	0.10	0.001
5	2.48	0.06	0.05	0.000
6	2.62	0.06	-0.02	0.000
7	2.76	0.08	0.47	0.005
8	2.90	0.08	0.16	0.002
9	3.04	0.10	0.04	0.001
10	3.18	0.08	0.17	0.002
11				0.000
12				0.000
13				0.000
14				0.000
15				0.000
16				0.000
17				0.000
18				0.000
19				0.000
20				0.000
			Qtotal	**0.013**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	3.25			
LDB	1.85			

Site:	ALE 10		**Date:**	September 18, 2017
Crew:	BR/JB		**Wetted Width (m):**	1.00
HU #:	C1		**Spacing (m):**	0.32
Type/Cat	Cascade		**Weather:**	Cloudy
Interval	**Station**	**Depth (m)**	**Velocity (m/s) @ 0.6 depth**	**Discharge (m3/s)**
1	1.85	0.01	0.00	0.000
2	1.98	0.04	0.00	0.000

3	2.11	0.03	0.11	0.000
4	2.24	0.11	0.07	0.001
5	2.37	0.14	0.15	0.003
6	2.51	0.10	0.01	0.000
7	2.64	0.12	0.19	0.003
8	2.77	0.07	0.43	0.004
9	2.90	0.06	0.49	0.004
10	3.03	0.08	0.00	0.000
11				0.000
12				0.000
13				0.000
14				0.000
15				0.000
16				0.000
17				0.000
18				0.000
19				0.000
20				0.000
			Qtotal	**0.015**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	3.25			
LDB	1.85			

Site:	ALE 10		**Date:**	September 18, 2017
Crew:	BR/JB		**Wetted Width (m):**	2.41
HU #:	P1		**Spacing (m):**	0.12
Type/Cat	Pool		**Weather:**	Cloudy

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	1.13	0.12	0.00	0.000
2	1.25	0.14	0.00	0.000
3	1.37	0.26	0.00	0.000
4	1.49	0.32	0.00	0.000

5	1.61	0.32	0.01	0.000
6	1.73	0.34	0.00	0.000
7	1.85	0.34	0.00	0.000
8	1.97	0.36	0.00	0.000
9	2.09	0.29	0.00	0.000
10	2.22	0.30	0.00	0.000
11	2.34	0.50	0.00	0.000
12	2.46	0.52	0.00	0.000
13	2.58	0.50	0.03	0.002
14	2.70	0.34	0.04	0.002
15	2.82	0.33	0.02	0.001
16	2.94	0.34	0.03	0.001
17	3.06	0.35	0.04	0.002
18	3.18	0.35	0.05	0.002
19	3.30	0.34	0.06	0.002
20	3.42	0.30	0.00	0.000
			Qtotal	**0.012**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	3.48			
LDB	1.07			

Site:	ALE 10		**Date:**	September 18, 2017
Crew:	BR/JB		**Wetted Width (m):**	2.27
HU #:	G3		**Spacing (m):**	0.11
Type/Cat	Glide		**Weather:**	Cloudy

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	1.33	0.02	-0.01	0.000
2	1.44	0.08	0.01	0.000
3	1.55	0.09	0.01	0.000
4	1.67	0.06	0.03	0.000
5	1.78	0.08	0.10	0.001
6	1.89	0.08	0.11	0.001

7	2.01	0.02	-0.03	0.000
8	2.12	0.06	-0.01	0.000
9	2.23	0.06	0.17	0.001
10	2.35	0.06	0.11	0.008
11	2.46	0.04	0.04	0.000
12	2.58	0.12	0.11	0.002
13	2.69	0.19	0.10	0.002
14	2.80	0.20	0.05	0.001
15	2.92	0.16	0.09	0.002
16	3.03	0.08	0.05	0.000
17	3.14	0.07	0.02	0.000
18	3.26	0.06	0.01	0.000
19	3.37	0.05	0.00	0.000
20	3.48	0.01	0.00	0.000
			Qtotal	**0.019**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	3.54			
LDB	1.27			

Site:	WALR1		**Date:**	August 23, 2017
Crew:	BR/SK/JB		**Wetted Width (m):**	3.64
HU #:	1		**Spacing (m):**	0.18
Type/Cat	Pool		**Weather:**	

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	3.05	0.02	0.01	0.000
2	3.23	0.06	-0.04	0.000
3	3.42	0.04	0.00	0.000
4	3.60	0.08	0.01	0.000
5	3.78	0.09	-0.01	0.000
6	3.96	0.20	0.01	0.000
7	4.14	0.32	-0.02	-0.001

8	4.33	0.46	-0.02	-0.002
9	4.51	0.53	-0.01	-0.001
10	4.69	0.62	0.03	0.037
11	4.87	0.63	0.05	0.006
12	5.05	0.58	0.10	0.011
13	5.24	0.52	0.12	0.011
14	5.42	0.39	0.08	0.006
15	5.60	0.38	0.07	0.005
16	5.78	0.28	0.06	0.003
17	5.96	0.00	0.02	0.000
18	6.15	0.05	0.01	0.000
19	6.33	0.04	-0.01	0.000
20	6.51	0.00	0.00	0.000
			Qtotal	**0.075**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**	SK	
RDB	6.60			
LDB	2.96			

Site:	WALR1		**Date:**	August 23, 2017
Crew:	BR/SK/JB		**Wetted Width (m):**	2.47
HU #:	G1		**Spacing (m):**	0.12
Type/Cat	Glide		**Weather:**	

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	4.17	0.01	0.00	0.000
2	4.30	0.03	0.04	0.000
3	4.42	0.03	0.03	0.000
4	4.54	0.06	0.13	0.001
5	4.67	0.11	0.12	0.002
6	4.79	0.16	0.15	0.003
7	4.91	0.17	0.16	0.003
8	5.04	0.20	0.16	0.004
9	5.16	0.17	0.24	0.005

10	5.28	0.18	0.22	-0.207
11	5.41	0.16	0.22	0.004
12	5.53	0.16	0.21	0.004
13	5.65	0.18	0.12	0.003
14	5.78	0.15	0.12	0.002
15	5.90	0.14	0.10	0.002
16	6.02	0.10	0.07	0.001
17	6.15	0.04	0.06	0.000
18	6.27	0.02	0.03	0.000
19	6.39	0.02	0.00	0.000
20	6.52	0.02	-0.01	0.001
			Qtotal	**-0.171**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB				
LDB				

Site:	WALR1		**Date:**	August 23, 2017
Crew:	BR/SK/JB		**Wetted Width (m):**	2.50
HU #:	R3		**Spacing (m):**	0.13
Type/Cat	Riffle		**Weather:**	

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	3.06	0.02	0.00	0.000
2	3.18	0.06	0.01	0.000
3	3.31	0.05	0.10	0.001
4	3.44	0.03	0.05	0.000
5	3.56	0.04	0.13	0.001
6	3.69	0.08	0.05	0.001
7	3.81	0.06	0.19	0.001
8	3.94	0.17	0.13	0.003
9	4.06	0.16	0.14	0.003
10	4.19	0.18	0.27	-0.200
11	4.31	0.16	0.39	0.008

12	4.44	0.17	0.50	0.011
13	4.56	0.11	0.36	0.005
14	4.69	0.08	0.23	0.002
15	4.81	0.05	0.07	0.000
16	4.94	0.03	0.11	0.000
17	5.06	0.03	0.11	0.000
18	5.19	0.01	0.02	0.000
19	5.31	0.01	0.00	0.000
20	5.44	0.01	0.04	-0.002
			Qtotal	**-0.167**

Photo U/S			
Photo D/S			
Photo X/S			
Photo Sub.		**Camera:**	
RDB			
LDB			

Site:	WALR1	**Date:**	August 23, 2017
Crew:	BR/SK/JB	**Wetted Width (m):**	5.13
HU #:	1	**Spacing (m):**	0.26
Type/Cat	Cascade	**Weather:**	

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	3.08	0.05	0.05	-0.012
2	3.33	0.06	0.16	0.002
3	3.59	0.06	0.31	0.005
4	3.85	0.08	0.11	0.002
5	4.10	0.01	0.03	0.000
6	4.36	0.01	0.00	0.000
7	4.62	0.07	0.03	0.001
8	4.87	0.05	0.06	0.001
9	5.13	0.10	0.08	0.002
10	5.39	0.05	0.16	-0.018
11	5.64	0.08	0.20	0.004
12	5.90	0.06	0.30	0.005
13	6.16	0.06	0.45	0.007

14	6.41	0.04	0.22	0.002
15	6.67	0.04	0.03	0.000
16	6.93	0.01	0.08	0.000
17	7.18	0.02	0.02	0.000
18	7.44	0.01	0.02	0.000
19	7.70	0.05	0.51	0.007
20	7.95	0.04	0.63	-0.197
			Qtotal	**-0.190**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**	SK	
RDB	2.95			
LDB	8.08			

Site:	WAL2	**Date:**	August 22, 2017
Crew:	BR, JB, SK	**Wetted Width (m):**	3.45
HU #:	G1	**Spacing (m):**	0.17
Type/Cat	Glide	**Weather:**	Sunny & Clear

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	2.54	0.14	0.01	0.000
2	2.71	0.18	0.04	0.001
3	2.88	0.22	0.03	0.001
4	3.05	0.21	0.02	0.001
5	3.23	0.22	0.03	0.001
6	3.40	0.24	0.03	0.001
7	3.57	0.24	0.04	0.002
8	3.74	0.21	0.07	0.003
9	3.92	0.20	0.09	0.003
10	4.09	0.20	0.08	0.030
11	4.26	0.20	0.08	0.003
12	4.43	0.24	0.07	0.003
13	4.61	0.24	0.07	0.003
14	4.78	0.26	0.09	0.004

15	4.95	0.24	0.08	0.003
16	5.12	0.20	0.06	0.002
17	5.30	0.12	0.05	0.001
18	5.47	0.09	0.05	0.001
19	5.64	0.07	0.04	0.000
20	5.81	0.01		0.000
			Qtotal	**0.064**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	5.90			
LDB	2.45			

Site:	GRAV 3		**Date:**	September 20, 2017
Crew:	BR/JB		**Wetted Width (m):**	2.78
HU #:	R2		**Spacing (m):**	0.14
Type/Cat	Riffle		**Weather:**	
Interval	**Station**	**Depth (m)**	**Velocity (m/s) @ 0.6 depth**	**Discharge (m3/s)**
1	1.90	0.04	0.06	0.000
2	2.04	0.08	0.02	0.000
3	2.18	0.08	0.09	0.001
4	2.32	0.08	0.15	0.002
5	2.46	0.05	0.25	0.002
6	2.59	0.04	0.07	0.000
7	2.73	0.05	0.04	0.000
8	2.87	0.07	0.07	0.001
9	3.01	0.06	0.23	0.002
10	3.15	0.10	0.18	0.028
11	3.29	0.10	0.08	0.001
12	3.43	0.08	0.31	0.003
13	3.56	0.10	0.26	0.004

14	3.71	0.10	0.36	0.005
15	3.85	0.08	0.21	0.002
16	3.98	0.09	0.20	0.002
17	4.12	0.08	0.16	0.002
18	4.26	0.08	0.01	0.000
19	4.40	0.04	0.11	0.001
20	4.54	0.03	0.20	-0.027
			Qtotal	**0.029**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	4.61			
LDB	1.83			

Site:	GRAV 3		**Date:**	September 20, 2017
Crew:	BR/JB		**Wetted Width (m):**	4.52
HU #:	G3		**Spacing (m):**	0.23
Type/Cat	Glide		**Weather:**	

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	1.57	0.01	0.00	0.000
2	1.80	0.01	0.00	0.000
3	2.03	0.05	0.16	0.002
4	2.25	0.04	0.04	0.000
5	2.48	0.06	0.01	0.000
6	2.70	0.07	0.00	0.000
7	2.93	0.08	0.06	0.001
8	3.16	0.08	0.07	0.001
9	3.38	0.08	0.30	0.005
10	3.61	0.05	0.13	0.016
11	3.83	0.12	0.09	0.002
12	4.06	0.12	0.01	0.000
13	4.29	0.10	0.26	0.006
14	4.51	0.14	0.13	0.004
15	4.74	0.12	0.31	0.008

16	4.96	0.12	0.05	0.001
17	5.19	0.13	0.15	0.004
18	5.42	0.11	0.11	0.003
19	5.64	0.10	0.00	0.000
20	5.87	0.04	0.00	0.000
			Qtotal	**0.056**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	5.98			
LDB	1.46			

Site:	GRAV 3		**Date:**	September 20, 2017
Crew:	BR/JB		**Wetted Width (m):**	2.82
HU #:	G3		**Spacing (m):**	0.14
Type/Cat	Glide		**Weather:**	

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	1.59	0.04	0.00	0.000
2	1.73	0.07	0.05	0.000
3	1.87	0.08	0.17	0.002
4	2.01	0.08	0.14	0.002
5	2.15	0.10	0.16	0.002
6	2.30	0.08	0.07	0.001
7	2.44	0.07	0.17	0.002
8	2.58	0.08	0.21	0.002
9	2.72	0.11	0.01	0.000
10	2.86	0.08	-0.05	-0.006
11	3.00	0.09	-0.02	0.000
12	3.14	0.10	-0.09	-0.001
13	3.28	0.06	0.27	0.002
14	3.42	0.10	0.35	0.005
15	3.56	0.12	0.49	0.009
16	3.71	0.09	0.36	0.005
17	3.85	0.16	0.81	0.018

18	3.99	0.16	0.59	0.013
19	4.13	0.16	0.58	0.013
20	4.27	0.12	0.53	-0.267
			Qtotal	**-0.199**
Photo U/S				
Photo D/S				
Photo X/S				
Photo Sub.		**Camera:**		
RDB	4.34			
LDB	1.52			

Site:	GRAV 4	**Date:**	October 10, 2017
Crew:	BR/JT	**Wetted Width (m):**	2.00
HU #:	G2	**Spacing (m):**	0.20
Type/Cat	Glide	**Weather:**	

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	4.01	0.01	-0.02	0.000
2	4.21	0.01	-0.01	0.000
3	4.41	0.16	0.02	0.001
4	4.61	0.17	0.03	0.001
5	4.81	0.20	0.04	0.002
6	5.01	0.20	0.07	0.003
7	5.21	0.22	0.01	0.000
8	5.41	0.20	0.02	0.001
9	5.61	0.04	0.00	0.000
10	5.81	0.04	0.00	0.000
11				0.000
12				0.000
13				0.000
14				0.000
15				0.000
16				0.000
17				0.000
18				0.000

19				0.000
20				0.000
			Qtotal	**0.007**
Photo U/S		3064		
Photo D/S		3066		
Photo X/S		3065		
Photo Sub.		**Camera:**	SK	
RDB	5.91			
LDB	3.91			

Site:	GRAV 4		**Date:**	October 10, 2017
Crew:	BR/JT		**Wetted Width (m):**	1.66
HU #:	C1		**Spacing (m):**	0.17
Type/Cat	Cascade		**Weather:**	Sunny & Cool

Interval	**Station**	**Depth (m)**	**Velocity (m/s) @ 0.6 depth**	**Discharge (m3/s)**
1	3.09	0.01	0.01	0.000
2	3.26	0.01	0.01	0.000
3	3.43	0.01	0.07	0.000
4	3.59	0.02	0.02	0.000
5	3.76	0.04	0.10	0.001
6	3.92	0.05	0.49	0.004
7	4.09	0.06	0.66	0.007
8	4.26	0.08	0.34	0.004
9	4.42	0.10	0.04	0.001
10	4.59	0.09	-0.09	-0.001
11				0.000
12				0.000
13				0.000
14				0.000
15				0.000
16				0.000
17				0.000
18				0.000
19				0.000
20				0.000

			Qtotal	**0.015**
Photo U/S		3061		
Photo D/S		3063		
Photo X/S		3062		
Photo Sub.			**Camera:**	SK
RDB	4.67			
LDB	3.01			

Site:	GRAV 4		**Date:**	October 10, 2017
Crew:	BR/JT		**Wetted Width (m):**	2.20
HU #:	R1		**Spacing (m):**	0.11
Type/Cat	Riffle		**Weather:**	

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	3.06	0.02	0.01	0.000
2	3.17	0.04	-0.02	0.000
3	3.28	0.08	0.01	0.000
4	3.39	0.11	0.04	0.000
5	3.50	0.12	0.08	0.001
6	3.61	0.12	0.25	0.003
7	3.72	0.14	0.18	0.003
8	3.83	0.14	0.17	0.003
9	3.94	0.12	0.14	0.002
10	4.05	0.10	0.03	0.004
11	4.16	0.08	0.01	0.000
12	4.27	0.08	0.02	0.000
13	4.38	0.09	0.03	0.000
14	4.49	0.07	0.06	0.000
15	4.60	0.06	0.03	0.000
16	4.71	0.08	0.03	0.000
17	4.82	0.06	0.01	0.000
18	4.93	0.06	0.06	0.000
19	5.04	0.06	0.26	0.002
20	5.15	0.08	0.33	-0.135
			Qtotal	**-0.115**

Photo U/S	3067		
Photo D/S	3069		
Photo X/S	3068		
Photo Sub.		**Camera:**	SK
RDB	5.20		
LDB	3.00		

Site:	UTG 1		**Date:**	October 10, 2017
Crew:	BR/JT		**Wetted Width (m):**	1.85
HU #:	G4		**Spacing (m):**	0.19
Type/Cat	Glide		**Weather:**	

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	2.09	0.08	0.00	0.000
2	2.28	0.07	0.02	0.000
3	2.46	0.10	-0.01	0.000
4	2.65	0.09	0.05	0.001
5	2.83	0.03	0.11	0.001
6	3.02	0.08	0.22	0.003
7	3.20	0.10	0.28	0.005
8	3.39	0.14	0.19	0.005
9	3.57	0.14	0.01	0.000
10	3.76	0.01	0.00	0.000
11				0.000
12				0.000
13				0.000
14				0.000
15				0.000
16				0.000
17				0.000
18				0.000
19				0.000
20				0.000
			Qtotal	**0.015**

Photo U/S			
Photo D/S			
Photo X/S			
Photo Sub.		**Camera:**	
RDB	3.85		
LDB	2.00		

Site:	UTG 1		**Date:**	October 10, 2017
Crew:	BR/JT		**Wetted Width (m):**	2.20
HU #:	R1		**Spacing (m):**	0.11
Type/Cat	Riffle		**Weather:**	

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	4.36	0.02	0.02	0.000
2	4.47	0.02	0.00	0.000
3	4.58	0.02	0.01	0.000
4	4.69	0.01	0.01	0.000
5	4.80	0.03	0.11	0.000
6	4.91	0.05	0.08	0.000
7	5.02	0.06	0.14	0.001
8	5.13	0.03	0.02	0.000
9	5.24	0.04	0.12	0.001
10	5.35	0.07	0.37	0.031
11	5.46	0.08	0.09	0.001
12	5.57	0.05	0.03	0.000
13	5.68	0.12	0.13	0.002
14	5.79	0.10	0.26	0.003
15	5.90	0.06	0.40	0.003
16	6.01	0.06	0.34	0.002
17	6.12	0.06	0.05	0.000
18	6.23	0.02	0.11	0.000
19	6.34	0.01	0.01	0.000
20	6.45	0.01	0.01	-0.001
			Qtotal	**0.044**

Photo U/S	3070

Photo D/S	3072		
Photo X/S	3071		
Photo Sub.		**Camera:**	SK
RDB	6.50		
LDB	4.30		

Site:	UTG 1	**Date:**	October 10, 2017
Crew:	BR/JT	**Wetted Width (m):**	1.94
HU #:	C4	**Spacing (m):**	0.19
Type/Cat	Cascade	**Weather:**	

Interval	Station	Depth (m)	Velocity (m/s) @ 0.6 depth	Discharge (m3/s)
1	2.90	0.01	0.01	0.000
2	3.10	0.02	0.10	0.000
3	3.29	0.05	0.15	0.001
4	3.48	0.05	0.19	0.002
5	3.67	0.04	0.20	0.002
6	3.87	0.05	0.13	0.001
7	4.06	0.09	0.04	0.001
8	4.26	0.08	0.32	0.005
9	4.45	0.08	0.09	0.001
10	4.64	0.10	0.03	0.001
11				0.000
12				0.000
13				0.000
14				0.000
15				0.000
16				0.000
17				0.000
18				0.000
19				0.000
20				0.000
			Qtotal	**0.014**

Photo U/S	3073
Photo D/S	3075

Photo X/S		3074	
Photo Sub.		**Camera:**	SK
RDB	4.74		
LDB	2.80		

Appendix K. Level 1 FHAP Form Data.

Appendix K. Level 1 - FHAP Form Data

Stream:	Alexander Creek		Date:		02-Oct-17		Mean Depth				Mean Width		Pools Only				Bed Material Type				Total	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators			Riparian Vegetation			Barriers	Comments
Unit	Reach	Distance	Habitat Unit		Length	Gradient	Bankfull	Water (m)			Bankfull	Wetted	Max	Crest	Residual	Pool	Dom.	Sub-	Spawning Gravel		LWD	10-	20 -	> 50					Type	Access	Length				Type	Structure	Canopy		
Number	Number	(m)	Type	Cat	(m)	%	(m)				(m)	(m)	Depth (m)	(m)	(m)	Type		Dom.			Tally	20 cm	50 cm	cm	Type	%	Type	%			(m)						Closure %		
1	7	337.0	G	1	45.3	0.5	0.21	0.12	0.45	0.82	13.23	10.75	-	-	-	-	F	C	Y	R	4	-	-	-	LWD	7	C	15	-	-	-	-	-	-	C	MF	1-20	-	
2	7	447.0	C	1	13.0	3.5	0.22	0.17	0.16	0.22	16.00	14.83	-	-	-	-	G	C	Y	R	2	1	1	-	C	7	LWD	10	-	-	-	EB	-	-	C	MF	1-20	-	
3	7	493.1	P	1	12.7	0.5	0.17	0.08	1.13	0.38	14.55	14.38	1.26	0.43	0.83	SC	G	C	Y	R	2	-	-	2	LWD	10	-	-	-	-	-	-	-	-	C	MF	1-20	-	
4	7	568.4	G	1	75.5	1	0.18	0.18	0.51	0.71	14.27	9.05	-	-	-	-	G	F	Y	R	1	-	-	-	C	15	-	-	-	-	-	EB	-	-	C	MF	1-20	-	
5	7	756.9	R	1	6.9	2.5	0.10	0.09	0.19	0.11	16.13	10.57	-	-	-	-	G	C	Y	R	0	-	-	-	C	TR	-	-	-	-	-	EB	-	-	C	MF	1-20	-	
6	7	860.8	G	1	103.9	1	0.12	0.17	0.27	0.14	12.32	9.65	-	-	-	-	G	C	Y	R	1	-	-	-	C	10	-	-	WL	P	75	EB	-	-	C	MF	21-40	-	
7	7	934.5	C	1	8.0	4.5	0.28	0.16	0.08	0.25	15.24	11.50	-	-	-	-	G	C	Y	R	8	2	2	-	LWD	10	-	-	-	-	-	EB	-	-	C	MF	1-20	-	
8	7	1014.2	P	1	15.9	1	0.26	0.20	0.21	0.30	19.55	18.78	0.95	0.28	0.67	D	F	G	Y	R	10	1	3	-	LWD	30	C	7	-	-	-	EB	PD	-	C	MF	21-40	-	
9	7	1026.8	R	1	12.6	2	0.28	0.38	0.29	0.21	7.78	7.48	-	-	-	-	G	C	Y	R	1	-	-	-	C	TR	OV	TR	SC	G	-	EB	PD	-	C	MF	1-20	-	
10	7	1050.9	G	1	24.1	1.5	0.37	0.24	0.42	0.37	8.26	6.53	-	-	-	-	C	G	Y	R	3	-	1	-	LWD	10	-	-	-	-	-	EB	-	-	C	MF	1-20	-	
11	7	1184.7	R	1	7.5	2	0.42	0.25	0.27	0.17	7.68	5.07	-	-	-	-	C	G	Y	R	0	-	-	-	-	-	-	-	-	-	-	EB	-	-	C	MF	1-20	-	
12	7	1197.1	G	1	12.4	1	0.32	0.34	0.54	0.11	7.22	5.44	-	-	-	-	G	C	Y	R	0	-	-	-	C	5	-	-	-	-	-	EB	-	-	C	MF	1-20	-	
13	7	1204.9	C	1	7.8	5	0.12	0.14	0.12	0.32	11.23	11.11	-	-	-	-	C	G	N	-	9	5	3	1	OV	TR	-	-	-	-	-	EB	-	-	C	MF	1-20	-	
14	7	1328.5	R	1	44.8	2.5	0.13	0.19	0.14	0.20	12.47	11.41	-	-	-	-	C	G	Y	R	2	-	-	-	-	-	-	-	-	-	-	EB	-	-	C	MF	1-20	-	
15	7	1432.1	C	1	9.4	4.5	0.16	0.22	0.23	0.21	16.75	10.92	-	-	-	-	G	C	N	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	M	MF	21-40	-	
16	7	1437.8	G	1	5.7	1	0.23	0.29	0.14	0.34	15.07	8.97	-	-	-	-	F	G	Y	R	2	-	-	1	LWD	5	-	-	-	-	-	EB	-	-	M	MF	1-20	-	
17	7	1447.5	R	1	9.7	2.5	0.28	0.30	0.25	0.18	14.64	11.48	-	-	-	-	C	G	N	-	3	-	1	-	LWD	TR	-	-	-	-	-	-	-	-	M	MF	1-20	-	
18	7	1500.7	P	1	9.8	0.5	0.17	0.44	0.84	0.38	9.18	6.00	0.92	0.38	0.54	SC	C	G	N	-	4	2	1	-	LWD	10	C	5	-	-	-	EB	PD	-	M	MF	1-20	-	
19	7	1609.5	G	1	15.6	1	0.12	0.14	0.32	0.16	12.62	8.97	-	-	-	-	G	C	Y	R	0	-	-	-	C	5	OV	TR	-	-	-	-	-	-	M	MF	1-20	-	
20	7	1636.4	R	1	26.9	2	0.12	0.22	0.17	0.09	13.47	13.27	-	-	-	-	G	C	N	-	0	-	-	-	-	-	-	-	-	-	-	EB	-	-	M	MF	1-20	-	
21	7	1756.8	C	1	3.1	4	0.17	0.17	0.15	0.18	8.73	6.95	-	-	-	-	G	C	N	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	M	MF	1-20	-	
22	7	1782.7	G	1	25.9	1	0.30	0.24	0.45	0.20	6.78	5.52	-	-	-	-	G	C	N	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	M	MF	1-20	-	
23	7	1926.8	G	1	31.8	1.5	0.27	0.25	0.24	0.14	12.10	7.40	-	-	-	-	G	C	Y	R	0	-	-	-	-	-	-	-	-	-	-	EB	-	-	M	MF	1-20	-	
24	7	1943.2	R	1	16.4	2	0.30	0.18	0.15	0.08	15.07	8.16	-	-	-	-	G	C	N	-	1	-	-	-	-	-	-	-	-	-	-	EB	-	-	M	MF	1-20	-	
25	7	2100.6	C	1	21.1	4	0.21	0.15	0.18	0.28	9.27	7.90	-	-	-	-	G	C	N	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	C	MF	21-40	-	
26	7	2112.8	G	1	12.2	1	0.26	0.28	0.30	0.11	9.73	8.31	-	-	-	-	G	C	Y	R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	C	MF	21-40	-	
27																																							
28	7	3184.8	G	1	55.0	1	1.14	0.38	0.44	0.27	8.45	8.25	-	-	-	-	C	G	N	-	0	1	0	1	LWD	5	-	-	-	-	-	EB	-	-	S	YF	21-40	-	
29	7	3218.1	C	1	33.3	4.5	0.21	0.01	0.35	0.12	7.45	8.45	-	-	-	-	C	G	N	-	2	0	0	0	LWD	5	-	-	-	-	-	EB	-	-	S	MF	21-40	-	
30	7	3315.7	R	1	14.9	2	0.13	0.14	0.12	0.19	11.22	11.07	-	-	-	-	C	G	N	-	2	1	1	0	LWD	TR	-	-	-	-	-	EB	-	-	S	MF	21-40	-	
31	7	3300.8	G	1	31.7	1	0.35	0.01	0.44	0.3	10.94	9.51	-	-	-	-	G	C	L	R	4	2	1	0	LWD	20	C	10	-	-	-	EB	-	-	M	MF	21-40	-	
32	7	3347.3	P	1	7.9	0.5	0.31	0.68	0.42	0.46	10.98	7.07	0.98	0.36	0.62	SC	C	G	N	-	2	-	-	-	OV	10	LWD	TR	-	-	-	EB	-	-	C	MF	1-20	-	
33																																							
34	7	6786.3	C	1	18.1	4	0.25	0.08	0.1	0.04	17.3	7.68	-	-	-	-	C	G	N	-	0	-	-	-	B	5	-	-	-	-	-	EB	-	-	M	MF	21-40	-	
35	7	6802.8	P	1	16.5	0.5	0.24	0.35	0.72	0.43	9.73	4.18	0.90	0.23	0.77	SC	G	C	Y	R	3	1	-	-	C	20	LWD	5	-	-	-	EB	-	-	M	MF	21-40	-	
36	7	6880.4	P	1	5.2	0.5	0.32	0.11	0.65	0.46	5.02	4.02	0.7	0.18	0.52	SC	C	G	Y	R	0	-	-	-	-	-	-	-	-	-	-	-	-	-	C	MF	21-40	-	
37	7	6943.4	R	1	32.6	2.5	0.12	-	-	-	14.40	11.65	-	-	-	-	G	C	Y	R	2	-	-	-	SWD	7	-	-	-	-	-	EB	-	-	M	MF	21-40	-	
38	7	7169.8	P	1	10.7	0.5	0.1	0.24	0.76	0.82	9.5	4	0.91	0.14	0.77	SC	G	C	L	R	0	-	-	-	C	15	-	-	-	-	-	DW	-	-	C	MF	1-20	-	
39	7	7249.3	C	1	23.1	5.5	0.45	0.2	0.08	0.03	10.2	7.43	-	-	-	-	C	G	N	-	0	-	-	-	-	-	-	-	-	-	-	EB	-	-	M	MF	21-40	-	
40	7	7330.8	C	1	14.3	5	0.71	0.08	0.22	0.06	8.3	5.69	-	-	-	-	C	G	L	R	0	-	-	-	B	25	-	-	-	-	-	EB	-	-	C	MF	21-40	-	
41	7	7339.9	R	1	9.1	2	0.24	0.25	0.11	0.04	10.2	7.43	-	-	-	-	C	G	N	-	0	-	-	-	-	-	-	-	-	-	-	EB	-	-	M	MF	21-40	-	
42	7	7316.5	G	1	45.5	1	0.39	0.16	0.56	0.26	9.12	5.5	-	-	-	-	C	G	L	R	0	-	-	-	LWD	5	-	-	-	-	-	EB	-	-	M	MF	21-40	-	

Stream:	Alexander Creek		Date:		21-Aug-14		Mean Depth				Mean Width		Pools Only				Bed Material Type				Total	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators			Riparian Vegetation			Barriers	Comments
Unit	Reach	Distance	Habitat Unit		Length	Gradient	Bankfull	Water (m)			Bankfull	Wetted	Max	Crest	Residual	Pool	Dom.	Sub-	Spawning Gravel		LWD	10-	20 -	> 50					Type	Access	Length				Type	Structure	Canopy		
Number	Number	(m)	Type	Cat	(m)	%	(m)				(m)	(m)	Depth (m)	(m)	(m)	Type		Dom.			Tally	20 cm	50 cm	cm	Type	%	Type	%			(m)						Closure %		
1	8	101.3	C	1	12.1	6	0.24	0.02	0.13	0.08	7.02	4.89	-	-	-	-	C	G	-	-	1	1	-	-	LWD	TR	OV	TR	-	-	-	EB	-	-	M	MF	21-40	-	
2	8	131.6	R	1	30.3	3	0.20	0.02	0.27	0.16	8.80	4.41	-	-	-	-	C	G	-	-	1	1	-	-	OV	TR	-	-	-	-	-	EB	-	-	M	MF	21-40	-	
3	8	243.2	G	1	11.3	1	0.53	0.25	0.32	0.12	7.05	3.86	-	-	-	-	C	F	-	-	1	-	1	-	LWD	TR	C	5	-	-	-	EB	-	-	M	MF	1-20	-	
4	8	305.7	R	1	20.6	2	0.28	0.05	0.15	0.27	7.74	4.58	-	-	-	-	C	G	-	-	0	-	-	-	C	TR	OV	TR	-	-	-	EB	-	-	M	MF	1-20	-	
5	8	325.6	C	1	10.1	7	0.23	0.06	0.17	0.08	9.20	6.93	-	-	-	-	C	B	-	-	0	-	-	-	B	5	-	-	-	-	-	EB	-	-	M	MF	1-20	-	
6	8	505.2	R	1	11.4	3	0.44	0.09	0.44	0.03	11.34	6.24	-	-	-	-	C	B	-	-	0	-	-	-	C	TR	-	-	-	-	-	EB	-	-	M	MF	1-20	-	
7	8	557.7	C	1	36.5	9	0.40	0.09	0.36	0.14	11.25	4.65	-	-	-	-	C	B	-	-	0	-	-	-	C	TR	-	-	-	-	-	EB	-	-	M	MF	21-40	-	
8	8	771.7	G	1	18.9	1	0.70	0.17	0.46	0.26	17.02	4.46	-	-	-	-	C	F	-	-	0	-	-	-	C	15	-	-	-	-	-	EB	-	-	M	MF	21-40	-	
9	8	828.1	C	1	56.4	8	0.48	0.18	0.14	0.09	13.10	6.46	-	-	-	-	C	B	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	M	MF	1-20	-	
10	8	838.1	R	1	10.0	2	0.43	0.04	0.24	0.06	11.70	7.10	-	-	-	-	C	B	-	-	1	-	-	-	B	10	-	-	-	-	-	EB	-	-	M	MF	1-20	-	
11	8	928.3	C	1	17.4	9	0.26	0.02	0.12	0.04	27.35	11.70	-	-	-	-	C	B	-	-	1	1	-	-	B	10	C	TR	-	-	-	EB	-	-	M	MF	1-20	-	Lots of periphyton
12	8	1231.9	R	1	9.9	2	0.45	0.07	0.25	0.59	8.45	7.40	-	-	-	-	C	B	-	-	0	-	-	-	B	15	C	TR	-	-	-	EB	-	-	M	MF	1-20	-	
13	8	1271.1	C	1	39.2	9	0.36	0.05	0.25	0.03	14.05	9.07	-	-	-	-	C	B	-	-	2	-	2	-	B	15	LWD	5	-	-	-	EB	-	-	M	MF	1-20	-	
14	8	1387.4	G	1	10.7	1	0.86	0.05	0.48	0.40	13.60	6.50	-	-	-	-	C	B	-	-	1	1	-	-	B	20	LWD	5	-	-	-	EB	-	-	M	MF	1-20	-	
15	8	1421.0	R	1	15.5	3	0.48	0.06	0.48	0.40	9.50	7.72	-	-	-	-	C	B	-	-	0	-	-	-	B	10	OV	TR	-	-	-	EB	-	-	M	MF	1-20	-	
16	8	1436.7	C	1	15.7	6	0.33	0.10	0.22	0.19	11.30	9.95	-	-	-	-	C	B	-	-	1	-	-	-	B	10	LWD	TR	-	-	-	EB	-	-	M	MF	1-20	-	

Stream:	Alexander Creek		Date:		22-Aug-14		Mean Depth				Mean Width		Pools Only				Bed Material Type				Total	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators			Riparian Vegetation			Barriers	Comments
Unit	Reach	Distance	Habitat Unit		Length	Gradient	Bankfull	Water (m)			Bankfull	Wetted	Max	Crest	Residual	Pool	Dom.	Sub-	Spawning Gravel		LWD	10-	20 -	> 50					Type	Access	Length				Type	Structure	Canopy		
Number	Number	(m)	Type	Cat	(m)	%	(m)				(m)	(m)	Depth (m)	(m)	(m)	Type		Dom.			Tally	20 cm	50 cm	cm	Type	%	Type	%			(m)						Closure %		
1	9	260.3	C	1	80.4	11	0.67	0.40	0.52	0.20	10.01	4.25	-	-	-	-	C	B	-	-	1	1	-	-	B	30	C	5	-	-	-	EB	-	-	M	MF	1-20	-	
2	9	270.1	R	1	9.8	3	0.71	0.10	0.42	0.38	9.40	8.35	-	-	-	-	C	B	-	-	2	-	1	-	LWD	TR	C	5	-	-	-	-	-	-	C	MF	1-20	-	Small trib w poor
3	9	692.4	C	1	170.2	6	0.51	0.32	0.22	0.04	7.43	5.20	-	-	-	-	C	B	-	-	0	-	-	-	B	10	-	-	SC	G	170	-	-	-	C	MF	1-20	-	
4	9	814.1	R	1	12.0	3	0.52	0.42	0.34	0.14	9.35	7.15	-	-	-	-	C	G	-	-	0	-	-	-	-	-	-	-	SC	G	120	-	-	-	C	MF	1-20	-	
5	9	823.9	G	1	9.8	1	0.82	0.64	0.60	0.32	11.90	3.85	-	-	-	-	C	R	-	-	1	-	-	-	C	20	-	-	SC	G	10	-	-	-	C	MF	1-20	-	
6	9	863.9	C	1	40.0	5	0.37	0.02	0.10	0.14	11.73	4.80	-	-	-	-	C	B	-	-	1	1	-	-	OV	35	-	-	-	-	-	PD	-	-	C	MF	1-20	-	
7	9	1065.6	C	1	57.1	5	0.48	0.14	0.08	0.17	9.50	5.00	-	-	-	-	C	B	-	-	1	-	-	-	B	TR	-	-	-	-	-	PD	-	-	C	MF	1-20	-	
8	9	1090.3	G	1	24.7	1	0.47	0.09	0.22	0.24	7.70	5.50	-	-	-	-	C	B	-	-	0	-	-	-	OV	10	-	-	-	-	-	EB	-	-	C	MF	1-20	-	

Stream:	West Alexander Creek		Date:		13-Aug-14		Mean Depth				Mean Width		Pools Only				Bed Material Type				Total	Functional LWD Tally			Cover				Offchannel Habitat			Disturbance Indicators			Riparian Vegetation			Barriers	Comments
Unit	Reach	Distance	Habitat Unit		Length	Gradient	Bankfull	Water (m)			Bankfull	Wetted	Max	Crest	Residual	Pool	Dom.	Sub-	Spawning Gravel		LWD	10-	20 -	> 50					Type	Access	Length				Type	Structure	Canopy		
Number	Number	(m)	Type	Cat	(m)	%	(m)				(m)	(m)	Depth (m)	(m)	(m)	Type		Dom.			Tally	20 cm	50 cm	cm	Type	%	Type	%			(m)						Closure %		
1	1	152.7	C	1	8.0	5	0.37	0.11	0.07	0.07	9.40	8.35	-	-	-	-	C	B	-	-	0	-	-	-	-	-	-	-	-	-	-	EB	-	-	M	MF	1-20	-	
2	1	187.2	G	1	34.5	0	0.52	0.11	0.22	0.30	7.80	6.29	-	-	-	-	C	F	-	-	0	-	-	-	-	-	-	-	-	-	-	EB	-	-	M	MF	1-20	-	
3	1	368.7	R	1	48.2	1	0.41	0.01	0.17	0.16	7.75	5.30	-	-	-	-	C	G	-	-	1	-	-	-	-	-	-	-	-	-	-	PD	-	-	M	MF	1-20	-	
4	1	378.8	C	1	10.1	5	0.51	0.10	0.17	0.16	9.10	2.80	-	-	-	-	C	B	-	-	0	-	-	-	-	-	-	-	-	-	-	EB	-	-	M	MF	1-20	-	
5	1	487.0	G	1	16.9	1	0.65	0.20	0.24	0.21	6.35	3.50	-	-	-	-	F	C	-	-	0	-	-	-	OV	15	-	-	-	-	-	EB	-	-	S	SHR	1-20	-	
6	1	499.1	C	1	12.1	7	0.50	0.17	0.15	0.06	5.37	3.00	-	-	-	-	B	C	-	-	0	-	-	-	OV	5	B	5	-	-	-	EB	-	-	C	MF	1-20	-	
7	1	513.8	R	1	14.7	3	0.45	0.13	0.23	0.18	6.45	2.40	-	-	-	-	C	G	-	-	4	-	-	-	LWD	5	-	-	-	-	-	EB	PD	-	C	MF	1-20	-	
8	1	691.4	G	1	20.4	1	0.30	0.07	0.18	0.17	10.45	4.00	-	-	-	-	G	F	-	-	1	-	1	-	LWD	5	IV	5	-	-	-	EB	-	-	M	MF	1-20	-	
9	1	716.9	R	1	25.5	2	0.35	0.19	0.14	0.05	5.90	4.00	-	-	-	-	C	G	-	-	0	-	-	-	OV	5	-	-	-	-	-	EB	-	-	M	MF	1-20	-	
10	1	802.1	C	1	32.8	7	0.36	0.02	0.06	0.15	5.40	3.50	-	-	-	-	C	G	-	-	0	-	-	-	OV	10	IV	TR	-	-	-	EB	-	-	M	MF	1-20	-	
11	1	977.1	C	1	66.6	4	0.47	0.10	0.20	0.10	4.39	2.50	-	-	-	-	C	B	-	-	0	-	-	-	OV	45	-	-	-	-	-	EB	-	-	M	MF	21-40	-	
12	1	1039.3	R	1	38.6	3	0.27	0.15	0.18	0.10	4.60	3.85	-	-	-	-	C	G	-	-	0	-	-	-	OV	TR	C	5	-	-	-	-	-	-	M	MF	21-40	-	
13	1	1049.4	G	1	10.1	1	0.32	0.14	0.27	0.16	3.50	2.40	-	-	-	-	G	C	-	-	1	-	-	-	OV	15	IV	TR	-	-	-	-	-	-	M	MF	1-20	-	
14	1	1068.0	P	1	7.1	0	0.49	0.16	0.41	0.50	6.75	3.40	0.65	0.15	0.4	U	C	B	-	-	3	1	-	-	OV	45	LWD	5	-	-	-	-	-	-	M	MF	1-20	-	
15	1	1200.4	C	1	7.4	5	0.42	0.21	0.07	0.04	4.90	2.40	-	-	-	-	C	G	-	-	5	3	-	-	C	TR	-	-	-	-	-	EB	PD	-	M	MF	1-20	-	
16	1	1243.1	R	1	34.3	4	0.38	0.12	0.12	0.10	4.90	2.40	-	-	-	-	C	G	-	-	17	3	3	1	LWD	25	OV	10	-	-	-	EB	-	-	C	MF	1-20	-	
17	1	1309.5	G	1	10.6	1	0.73	0.21	0.44	0.24	6.50	3.80	-	-	-	-	C	G	-	-	3	-	-	-	LWD	15	C	10	-	-	-	EB	-	-	C	MF	21-40	-	
18	1	1382.5	C	1	19.6	4	0.38	0.05	0.10	0.03	4.60	3.00	-	-	-	-	C	G	-	-	3	-	1	-	C	15	LWD	5	-	-	-	EB	-	-	C	MF	21-40	-	
19	1	1407.5	R	1	8.0	2	0.28	0.06	0.16	0.15	5.31	2.90	-	-	-	-	G	F	-	-	1	1	-	-	OV	10	C	8	-	-	-	EB	-	-	C	MF	21-40	-	
20	1	1484.3	C	1	14.9	4	0.31	0.10	0.10	0.07	7.57	3.75	-	-	-	-	C	G	-	-	5	2	-	-	LWD	10	OV	TR	-	-	-	EB	-	-	C	MF	21-40	-	
21	1	1499.7	G	1	6.5	1	0.35	0.33	0.27	0.16	10.60	3.20	-	-	-	-	C	G	-	-	1	-	-	-	C	5	-	-	-	-	-	EB	-	-	C	MF	21-40	-	
22	1	1637.8	R	1	12.6	2	0.19	0.03	0.10	0.15	5.04	4.54	-	-	-	-	C	G	-	-	0	-	-	-	C	15	OV	10	-	-	-	EB	-	-	C	MF	1-20	-	
23	1	1697.1	C	1	10.7	5	0.73	0.13	0.11	0.16	6.60	3.08	-	-	-	-	C	B	-	-	3	-	-	-	OV	40	-	-	-	-	-	EB	PD	-	M	MF	1-20	-	
24	1	1848.2	C	1	20.1	6	0.34	0.03	0.22	0.12	6.25	3.15	-	-	-	-	C	B	-	-	0	-	-	-	C	10	-	-	-	-	-	EB	-	-	C	MF	21-40	-	
25	1	1854.5	R	1	6.3	2	0.31	0.10	0.15	0.10	5.70	4.40	-	-	-	-	C	G	-	-	0	-	-	-	C	5	-	-	-	-	-	EB	-	-	C	MF	21-40	-	
26	1	1946.8	C	1	7.8	7	0.47	0.07	0.04	0.09	6.40	4.70	-	-	-	-	C	G	-	-	3	1	1	-	C	10	-	-	-	-	-	EB	-	-	C	MF	41-70	-	
27	1	1957.1	R	1	10.3	2	0.66	0.29	0.28	0.21	4.45	3.80	-	-	-	-	C	G	-	-	0	-	-	-	C	8	-	-	-	-	-	EB	-	-	C	MF	71-90	-	
28	1	2052.1	P	1	9.0	0	0.66	0.31	0.52	0.25	8.19	6.50	-	-	-	-	G	F	-	-	2	1	-	-	C	8	-	-	-	-	-	EB	-	-	C	MF	21-40	-	
29	1	2163.7	C	1	25.6	4	0.41	0.05	0.06	0.12	5.20	3.46	-	-	-	-	C	G	-	-	10	1	2	1	LWD	15	C	8	-	-	-	EB	PD	-	C	MF	21-40	-	
30	1	2219.0	G	1	17.4	1	-	-	-	-	-	-	-	-	-	-	G	F	-	-	4	1	1	-	LWD	12	-	-	-	-	-	-	-	-	C	MF	41-70	-	
31	1	2305.5	R	1	11.4	2	0.65	0.10	0.27	0.27	3.55	3.25	-	-	-	-	C	F	-	-	0	-	-	-	OV	TR	-	-	-	-	-	-	-	-	S	SHR	1-20	-	
32	1	2378.8	C	1	40.5	5	0.51	0.09	0.14	0.10	6.05	4.80	-	-	-	-	C	B	-	-	7	-	4	-	LWD	8	SWD	TR	-	-	-	EB	-	-	C	MF	21-40	-	
33	1	2559.0	R	1	5.9	2	0.44	0.14	0.27	0.11	5.00	2.80	-	-	-	-	C	B	-	-	2	-	-	-	LWD	5	OV	TR	-	-	-	-	-	-	C	MF	1-20	-	
34	1	2607.9	C	1	48.9	5	0.24	0.16	0.11	0.05	4.25	3.10	-	-	-	-	B	C	-	-	1	1	-	-	B	5	LWD	TR	-	-	-	-	-	-	C	MF	1-20	-	
35	1	2659.8	C	1	12.1	10	0.37	0.10	0.08	0.14	5.15	3.40	-	-	-	-	C	B	-	-	3	-	-	-	B	5	-	-	-	-	-	-	-	-	C	MF	1-20	-	
36	1	2686.6	R	1	5.9	2	0.31	0.06	0.08	0.10	5.00	3.95	-	-	-	-	C	F	-	-	1	1	-	-	OV	8	C	TR	-	-	-	-	-	-	C	MF	1-20	-	
37	1	2770.4	C	1	43.0	5	0.46	0.18	0.22	0.14	4.45	2.30	-	-	-	-	B	C	-	-	0	-	-	-	OV	5	B	TR	-	-	-	EB	-	-	C	MF	1-20	-	
38	1	2832.3	R	1	10.2	4	0.24	0.05	0.10	0.05	4.90	4.00	-	-	-	-	C	B	-	-	0	-	-	-	OV	TR	-	-	-	-	-	-	-	-	S	SHR	1-20	-	

39	1	2852.2	C	1	19.9	9	0.43	0.11	0.26	0.14	4.05	3.20	-	-	-	-	C	B	-	-	6	-	2	-	LWD	8	B	TR	-	-	-	-	-	-	S	SHR	1-20	-	
40	1	3126.3	C	1	42.4	7	0.80	0.05	0.10	0.09	10.52	1.70	-	-	-	-	C	G	-	-	>20	4	1	-	LWD	10	OV	TR	-	-	-	EB	MC	-	C	MF	1-20	-	
41	1	3171.3	R	1	6.5	3	0.54	0.24	0.13	0.06	4.60	3.05	-	-	-	-	C	G	-	-	3	2	-	-	LWD	5	OV	TR	-	-	-	-	-	-	C	MF	1-20	-	
42	1	3259.1	C	1	10.8	5	0.57	0.17	0.16	0.12	4.40	3.15	-	-	-	-	C	B	-	-	2	1	-	-	OV	TR	-	-	-	-	-	-	-	-	C	MF	1-20	-	
43	1	3342.4	P	1	4.9	0	0.51	0.16	0.30	0.18	4.45	3.60	0.43	0.03	0.4	S	F	C	-	-	4	-	1	-	LWD	15	SWD	TR	-	-	-	-	-	-	C	MF	1-20	-	
44	1	3365.4	C	1	23.1	9	0.49	0.03	0.09	0.16	5.50	3.40	-	-	-	-	C	B	-	-	5	-	-	-	C	TR	-	-	-	-	-	-	-	-	C	MF	1-20	-	
45	1	3379.1	R	1	13.6	3	0.48	0.20	0.20	0.16	8.30	3.60	-	-	-	-	C	G	-	-	4	-	-	-	LWD	TR	-	-	-	-	-	-	-	-	C	MF	21-40	-	
46	1	3428.1	G	1	5.4	1	0.45	0.17	0.35	0.15	5.00	2.80	-	-	-	-	F	C	-	-	11	-	3	-	LWD	10	-	-	-	-	-	-	-	-	S	SHR	1-20	-	
47	1	3473.8	C	1	15.4	12	0.86	0.01	0.10	0.21	6.40	5.90	-	-	-	-	C	B	-	-	7	-	3	-	LWD	10	C	5	-	-	-	-	-	-	C	MF	1-20	-	
48	1	3549.7	R	1	9.7	3	0.42	0.10	0.15	0.26	7.37	2.55	-	-	-	-	C	F	-	-	1	1	-	-	C	5	SWD	5	-	-	-	-	-	-	C	MF	1-20	-	
49	1	3661.6	C	1	49.0	8	0.32	0.15	0.02	0.07	4.20	3.60	-	-	-	-	C	B	-	-	15	-	7	-	LWD	10	C	5	-	-	-	EB	-	-	C	MF	21-40	-	
50	1	3801.9	R	1	21.6	3	0.53	0.28	0.20	0.01	3.30	2.20	-	-	-	-	C	G	-	-	2	-	1	-	OV	50	-	-	-	-	-	-	-	-	S	SHR	21-40	-	
51	1	3824.2	C	1	22.3	5	0.26	0.15	0.13	0.04	4.10	3.70	-	-	-	-	C	F	-	-	1	-	1	-	B	5	SWD	10	-	-	-	EB	-	-	C	MF	21-40	-	
52	1	3906.8	P	1	8.0	0	0.34	0.14	0.31	0.26	4.75	4.40	0.82	0.14	0.68	S	F	G	-	-	5	-	1	-	LWD	40	-	-	-	-	-	-	-	-	C	MF	1-20	-	
53	1	3932.0	C	1	12.5	6	0.55	0.09	0.18	0.17	4.80	3.70	-	-	-	-	C	B	-	-	1	1	-	-	C	10	-	-	-	-	-	EB	-	-	C	MF	41-70	-	
54	1	4018.1	G	1	17.6	1	0.57	0.08	0.18	0.22	6.90	3.74	-	-	-	-	F	G	-	-	4	-	1	-	C	TR	-	-	-	-	-	-	-	-	C	MF	1-20	-	

Appendix L. FHAP Flow data.

Stream:	Alexander Creek	**Date:**	August 21, 2014
Site:	ALE8	**Wetted Width (m):**	4.89
Habitat Unit:	1	**Spacing (m):**	0.2445
Type:	Cascade	**Zero @ (m)**	0.12225

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	1.27	0.02	0.01
2	1.51	0.11	0.69
3	1.76	0.12	1.09
4	2.00	0.12	0.92
5	2.25	0.07	0.41
6	2.49	0.06	0.16
7	2.73	0.08	0.03
8	2.98	0.10	0.16
9	3.22	0.13	0.68
10	3.47	0.12	0.39
11	3.71	0.11	0.49
12	3.96	0.07	0.97
13	4.20	0.07	0.64
14	4.45	0.09	0.67
15	4.69	0.14	0.29
16	4.93	0.20	1.11
17	5.18	0.21	0.88
18	5.42	0.17	0.81
19	5.67	0.16	0.27
20	5.91	0.06	0.01
RDB	6.04		
LDB	1.15		

Stream:	Alexander Creek	**Date:**	August 21, 2014
Site:	ALE8	**Wetted Width (m):**	4.41
Habitat Unit:	2	**Spacing (m):**	0.2205
Type:	Riffle	**Zero @ (m)**	0.11025

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.61	0.07	0.09
2	0.83	0.11	0.33
3	1.05	0.14	0.35
4	1.27	0.25	0.16
5	1.49	0.24	0.48

6	1.71	0.11	0.70
7	1.93	0.16	0.66
8	2.15	0.20	0.56
9	2.37	0.20	0.60
10	2.59	0.25	0.49
11	2.81	0.22	0.60
12	3.03	0.25	0.70
13	3.25	0.23	0.50
14	3.47	0.27	0.53
15	3.69	0.27	0.55
16	3.91	0.25	0.32
17	4.13	0.13	0.25
18	4.35	0.16	0.16
19	4.57	0.11	0.03
20	4.79	0.02	0.00
RDB	4.91		
LDB	0.50		

Stream:	Alexander Creek	**Date:**	August 21, 2014
Site:	ALE8	**Wetted Width (m):**	3.86
Habitat Unit:	3	**Spacing (m):**	0.193
Type:	Glide	**Zero @ (m)**	0.0965

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	2.23	0.20	0.21
2	2.42	0.20	0.44
3	2.62	0.21	0.41
4	2.81	0.25	0.36
5	3.00	0.26	0.43
6	3.20	0.25	0.53
7	3.39	0.31	0.51
8	3.58	0.25	0.61
9	3.78	0.35	0.66
10	3.97	0.32	0.68
11	4.16	0.28	0.77
12	4.35	0.26	0.66
13	4.55	0.26	0.65
14	4.74	0.25	0.42
15	4.93	0.20	0.29
16	5.13	0.13	0.09
17	5.32	0.12	0.01
18	5.51	0.12	0.00
19	5.71	0.05	0.00
20	5.90	0.02	0.00

RDB	6.00
LDB	2.14

Stream:	Alexander Creek	**Date:**	August 21, 2014
Site:	ALE8	**Wetted Width (m):**	4.58
Habitat Unit:	4	**Spacing (m):**	0.229
Type:	Riffle	**Zero @ (m)**	0.1145
Interval	**Distance from LDB (m)**	**Depth (m)**	**Velocity (m/s) @ 0.6 depth**
1	3.63	0.05	0.14
2	3.86	0.07	0.37
3	4.04	0.06	0.01
4	4.32	0.13	0.26
5	4.55	0.12	0.47
6	4.77	0.15	0.44
7	5.00	0.10	0.68
8	5.23	0.16	0.60
9	5.46	0.21	0.61
10	5.69	0.26	0.75
11	5.92	0.21	0.66
12	6.15	0.27	0.64
13	6.38	0.26	0.73
14	6.61	0.25	0.60
15	6.84	0.17	0.56
16	7.06	0.11	0.51
17	7.29	0.11	0.38
18	7.52	0.05	0.31
19	7.75	0.07	0.34
20	7.98	0.06	0.50
RDB	8.10		
LDB	3.52		

Stream:	Alexander Creek	**Date:**	August 21, 2014
Site:	ALE8	**Wetted Width (m):**	6.93
Habitat Unit:	5	**Spacing (m):**	0.3465
Type:	Cascade	**Zero @ (m)**	0.17325
Interval	**Distance from LDB (m)**	**Depth (m)**	**Velocity (m/s) @ 0.6 depth**
1	3.38	0.01	0.01
2	3.72	0.02	0.01
3	4.07	0.09	0.26
4	4.42	0.08	0.89
5	4.76	0.15	0.18
6	5.11	0.15	0.51

7	5.46	0.15	0.59
8	5.80	0.12	0.69
9	6.15	0.06	0.07
10	6.50	0.06	0.85
11	6.84	0.10	0.51
12	7.19	0.05	0.55
13	7.54	0.08	0.21
14	7.88	0.10	0.52
15	8.23	0.16	0.61
16	8.58	0.12	0.92
17	8.92	0.12	0.57
18	9.27	0.06	1.01
19	9.62	0.17	0.79
20	9.96	0.15	0.77
RDB	10.14		
LDB	3.21		

Stream:	Alexander Creek	**Date:**	August 21, 2014
Site:	ALE8	**Wetted Width (m):**	6.24
Habitat Unit:	6	**Spacing (m):**	0.312
Type:	Glide	**Zero @ (m)**	0.156

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.51	0.07	0.18
2	0.82	0.02	0.01
3	1.13	0.04	0.01
4	1.44	0.09	0.16
5	1.75	0.12	0.05
6	2.07	0.15	0.28
7	2.38	0.22	0.28
8	2.69	0.27	0.19
9	3.00	0.35	0.48
10	3.31	0.47	0.62
11	3.63	0.44	0.36
12	3.93	0.38	0.55
13	4.25	0.35	0.46
14	4.56	0.24	0.45
15	4.87	0.20	0.27
16	5.19	0.09	0.04
17	5.49	0.01	0.01
18	5.81	0.03	0.01
19	6.12	0.01	0.00
20	6.43	0.02	0.00
RDB	6.59		

LDB	0.35

Stream:	Alexander Creek	**Date:**	August 21, 2014
Site:	ALE8	**Wetted Width (m):**	4.65
Habitat Unit:	7	**Spacing (m):**	0.2325
Type:	Cascade	**Zero @ (m)**	0.116

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	2.61	0.02	0.02
2	2.85	0.07	0.01
3	3.08	0.03	0.02
4	3.31	0.09	0.41
5	3.55	0.06	0.18
6	3.78	0.07	0.11
7	4.01	0.12	0.33
8	4.24	0.16	0.18
9	4.48	0.17	0.14
10	4.71	0.21	0.20
11	4.94	0.23	0.42
12	5.17	0.36	0.85
13	5.41	0.34	1.30
14	5.64	0.29	0.58
15	5.88	0.24	0.61
16	6.10	0.36	0.92
17	6.33	0.20	0.57
18	6.57	0.19	0.89
19	6.80	0.14	1.11
20	7.03	0.24	0.28
RDB	7.15		
LDB	2.50		

Stream:	Alexander Creek	**Date:**	August 21, 2014
Site:	ALE8	**Wetted Width (m):**	4.46
Habitat Unit:	8	**Spacing (m):**	0.233
Type:	Glide	**Zero @ (m)**	0.1165

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	2.07	0.02	0.01
2	2.30	0.09	0.00
3	2.53	0.17	0.00
4	2.77	0.20	0.00
5	2.99	0.24	0.06
6	3.23	0.21	0.01
7	3.46	0.44	0.05

8	3.70	0.43	0.18
9	3.93	0.44	0.13
10	4.16	0.44	0.14
11	4.40	0.41	0.22
12	4.63	0.48	0.22
13	4.86	0.51	0.35
14	5.09	0.35	0.42
15	5.33	0.46	0.44
16	5.56	0.46	0.40
17	5.80	0.46	0.10
18	6.03	0.45	0.15
19	6.26	0.26	0.02
20	6.49	0.08	0.00
RDB	6.61		
LDB	1.95		

Stream:	Alexander Creek	**Date:**	August 21, 2014
Site:	ALE8	**Wetted Width (m):**	6.45
Habitat Unit:	9	**Spacing (m):**	0.323
Type:	Cascade	**Zero @ (m)**	0.1613

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.76	0.11	0.16
2	1.08	0.18	0.44
3	1.41	0.22	0.69
4	1.73	0.28	1.39
5	2.05	0.29	0.70
6	2.38	0.32	0.64
7	2.69	0.24	0.23
8	3.02	0.20	0.54
9	3.34	0.13	0.05
10	3.66	0.14	0.06
11	3.99	0.10	0.76
12	4.31	0.16	0.30
13	4.63	0.14	0.53
14	4.96	0.20	0.09
15	5.28	0.10	0.02
16	5.60	0.13	0.09
17	5.92	0.13	0.49
18	6.25	0.09	0.04
19	6.57	0.12	0.37
20	6.89	0.13	0.02
RDB	7.05		
LDB	0.60		

Stream:	Alexander Creek	**Date:**	August 21, 2014
Site:	ALE8	**Wetted Width (m):**	7.10
Habitat Unit:	10	**Spacing (m):**	0.355
Type:	Riffle	**Zero @ (m)**	0.1775

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	1.04	0.02	0.00
2	1.40	0.10	0.01
3	1.75	0.20	0.17
4	2.11	0.20	0.34
5	2.46	0.20	0.18
6	2.82	0.16	0.40
7	3.17	0.22	0.58
8	3.53	0.21	0.91
9	3.88	0.24	0.78
10	4.24	0.25	0.32
11	4.59	0.35	0.64
12	4.95	0.35	0.58
13	5.30	0.23	0.27
14	5.66	0.24	0.02
15	6.01	0.06	0.14
16	6.37	0.14	0.23
17	6.72	0.12	0.01
18	7.08	0.07	0.01
19	7.43	0.06	0.00
20	7.79	0.04	0.00
RDB	7.97		
LDB	0.87		

Stream:	Alexander Creek	**Date:**	August 21, 2014
Site:	ALE8	**Wetted Width (m):**	11.70
Habitat Unit:	11	**Spacing (m):**	0.585
Type:	Cascade	**Zero @ (m)**	0.2925

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	4.39	0.02	0.00
2	4.97	0.12	0.08
3	5.56	0.12	0.17
4	6.14	0.05	0.21
5	6.73	0.05	0.10
6	7.31	0.05	0.20
7	7.90	0.03	0.01
8	8.48	0.04	0.00

9	9.07	0.11	0.68
10	9.65	0.14	0.05
11	10.24	0.14	0.32
12	10.82	0.13	0.54
13	11.41	0.16	0.35
14	11.99	0.17	0.51
15	12.58	0.22	0.23
16	13.16	0.23	0.70
17	13.75	0.20	0.17
18	14.33	0.15	0.16
19	14.92	0.20	0.00
20	15.50	0.13	0.54
RDB	15.80		
LDB	4.10		

Stream:	Alexander Creek	**Date:**	August 21, 2014
Site:	ALE8	**Wetted Width (m):**	7.40
Habitat Unit:	12	**Spacing (m):**	0.370
Type:	Riffle	**Zero @ (m)**	0.185

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	1.03	0.07	0.06
2	1.40	0.14	0.01
3	1.77	0.09	0.24
4	2.14	0.15	0.01
5	2.51	0.26	0.38
6	2.88	0.30	0.35
7	3.25	0.25	0.34
8	3.62	0.40	0.23
9	3.99	0.40	0.46
10	4.36	0.34	0.31
11	4.73	0.19	0.59
12	5.10	0.30	0.58
13	5.47	0.27	0.42
14	5.84	0.27	0.85
15	6.21	0.30	0.49
16	6.58	0.15	0.66
17	6.95	0.16	0.04
18	7.32	0.05	0.00
19	7.69	0.06	0.00
20	8.06	0.01	0.00
RDB	8.25		
LDB	0.85		

Stream:	Alexander Creek	**Date:**	August 22, 2014
Site:	ALE8	**Wetted Width (m):**	9.07
Habitat Unit:	13	**Spacing (m):**	0.4535
Type:	Cascade	**Zero @ (m)**	0.22675

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	2.93	0.05	0.06
2	3.39	0.03	0.29
3	3.84	0.05	0.16
4	4.29	0.06	0.12
5	4.75	0.06	0.10
6	5.20	0.03	0.04
7	5.65	0.09	0.05
8	6.11	0.05	0.00
9	6.56	0.09	0.16
10	7.01	0.08	0.14
11	7.47	0.15	0.08
12	7.92	0.21	0.43
13	8.37	0.20	0.24
14	8.83	0.25	0.40
15	9.28	0.28	0.30
16	9.73	0.30	0.62
17	10.19	0.45	0.88
18	10.64	0.38	0.84
19	11.09	0.28	0.50
20	11.55	0.24	0.38
RDB	11.78		
LDB	2.71		

Stream:	Alexander Creek	**Date:**	August 22, 2014
Site:	ALE8	**Wetted Width (m):**	6.50
Habitat Unit:	14	**Spacing (m):**	0.325
Type:	Glide	**Zero @ (m)**	0.1625

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	2.96	0.02	0.00
2	3.28	0.05	0.09
3	3.61	0.07	-0.03
4	3.93	0.11	0.30
5	4.26	0.12	0.29
6	4.58	0.16	0.23
7	4.91	0.15	0.20
8	5.23	0.12	0.29
9	5.56	0.20	0.60

10	5.88	0.30	0.42
11	6.21	0.32	0.56
12	6.53	0.42	0.61
13	6.86	0.48	0.63
14	7.18	0.30	0.12
15	7.51	0.46	0.19
16	7.83	0.53	0.35
17	8.16	0.54	0.08
18	8.48	0.54	0.08
19	8.81	0.40	0.04
20	9.13	0.11	0.02
RDB	9.30	Comments: Negative values due to back eddy	
LDB	2.80		

Stream:	Alexander Creek	**Date:**	August 22, 2014
Site:	ALE8	**Wetted Width (m):**	7.72
Habitat Unit:	15	**Spacing (m):**	0.386
Type:	Riffle	**Zero @ (m)**	0.193

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	2.19	0.10	0.03
2	2.57	0.08	0.29
3	2.96	0.07	0.05
4	3.35	0.07	0.07
5	3.73	0.06	0.54
6	4.12	0.07	0.36
7	4.50	0.06	0.33
8	4.89	0.20	0.23
9	5.28	0.32	0.45
10	5.66	0.41	0.54
11	6.05	0.37	0.37
12	6.43	0.29	0.52
13	6.82	0.40	0.64
14	7.21	0.48	0.14
15	7.59	0.43	0.51
16	7.98	0.44	0.53
17	8.36	0.32	0.27
18	8.75	0.24	0.05
19	9.14	0.21	0.03
20	9.52	0.06	-0.02
RDB	9.72	Comments: Negative values due to back eddy	
LDB	2.00		

Stream:	Alexander Creek	**Date:**	August 22, 2014
Site:	ALE8	**Wetted Width (m):**	9.95
Habitat Unit:	16	**Spacing (m):**	0.4975
Type:	Riffle	**Zero @ (m)**	0.24875

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	1.64	0.25	0.43
2	2.14	0.30	0.55
3	2.64	0.23	0.73
4	3.14	0.12	-0.04
5	3.63	0.18	0.73
6	4.13	0.11	0.41
7	4.63	0.10	0.88
8	5.13	0.06	0.39
9	5.62	0.13	0.34
10	6.12	0.14	0.61
11	6.62	0.19	0.52
12	7.12	0.22	0.33
13	7.61	0.18	0.44
14	8.11	0.12	0.30
15	8.61	0.17	0.58
16	9.11	0.07	0.35
17	9.60	0.08	0.49
18	10.10	0.08	0.36
19	10.60	0.13	0.19
20	11.10	0.10	0.42
RDB	11.35	Comments: Negative values due to back eddy	
LDB	1.40		

Stream:	Alexander Creek	**Date:**	August 22, 2014
Site:	ALE9	**Wetted Width (m):**	4.25
Habitat Unit:	1	**Spacing (m):**	0.2125
Type:	Cascade	**Zero @ (m)**	0.10625

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	3.35	0.14	0.02
2	3.56	0.22	0.18
3	3.78	0.24	0.10
4	3.99	0.36	0.00
5	4.20	0.40	0.01
6	4.41	0.40	0.35
7	4.63	0.38	0.11

8	4.84	0.38	0.34
9	5.05	0.31	0.48
10	5.26	0.40	0.66
11	5.48	0.46	0.71
12	5.69	0.49	0.48
13	5.90	0.52	0.88
14	6.11	0.50	0.61
15	6.33	0.48	0.70
16	6.54	0.46	0.56
17	6.75	0.39	0.64
18	6.96	0.20	-0.08
19	7.18	0.18	0.00
20	7.39	0.01	0.00
RDB	7.50	Comments: Negative values due to back eddy	
LDB	3.25		

Stream:	Alexander Creek	**Date:**	August 22, 2014
Site:	ALE9	**Wetted Width (m):**	8.35
Habitat Unit:	2	**Spacing (m):**	0.4175
Type:	Riffle	**Zero @ (m)**	0.20875

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.51	0.08	-0.02
2	0.93	0.04	0.22
3	1.34	0.07	0.16
4	1.76	0.07	0.10
5	2.18	0.10	0.08
6	2.60	0.14	0.07
7	3.01	0.13	0.10
8	3.43	0.22	-0.01
9	3.85	0.36	0.09
10	4.27	0.42	0.17
11	4.68	0.53	0.16
12	5.10	0.42	0.28
13	5.52	0.42	0.17
14	5.94	0.50	0.09
15	6.35	0.38	0.02
16	6.77	0.30	0.04
17	7.19	0.20	0.04
18	7.61	0.20	0.03
19	8.02	0.20	0.01
20	8.44	0.12	-0.01

RDB	8.65	Comments: Negative values due to back eddy	
LDB	0.30		

Stream:	Alexander Creek	**Date:**	August 22, 2014
Site:	ALE9	**Wetted Width (m):**	5.20
Habitat Unit:	3	**Spacing (m):**	0.26
Type:	Cascade	**Zero @ (m)**	0.13

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	1.23	0.19	-0.02
2	1.49	0.22	-0.01
3	1.75	0.28	-0.01
4	2.01	0.22	0.00
5	2.27	0.32	0.00
6	2.53	0.40	0.03
7	2.79	0.45	0.06
8	3.05	0.44	0.16
9	3.31	0.52	0.14
10	3.57	0.22	0.22
11	3.83	0.31	0.18
12	4.09	0.22	0.26
13	4.35	0.27	0.15
14	4.61	0.16	0.16
15	4.87	0.04	0.30
16	5.13	0.10	0.21
17	5.39	0.16	0.09
18	5.65	0.10	0.08
19	5.91	0.05	0.04
20	6.17	0.03	0.00

RDB	6.30	Comments: Negative values due to back eddy	
LDB	1.10		

Stream:	Alexander Creek	**Date:**	August 22, 2014
Site:	ALE9	**Wetted Width (m):**	7.15
Habitat Unit:	4	**Spacing (m):**	0.3575
Type:	Riffle	**Zero @ (m)**	0.17875

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.48	0.13	0.01
2	0.84	0.18	0.02
3	1.19	0.25	0.00

4	1.55	0.28	-0.01
5	1.91	0.42	0.01
6	2.27	0.39	0.05
7	2.62	0.34	0.11
8	2.98	0.36	0.16
9	3.34	0.35	0.14
10	3.70	0.34	0.07
11	4.05	0.28	-0.02
12	4.41	0.24	0.04
13	4.77	0.08	0.15
14	5.13	0.12	0.16
15	5.48	0.14	0.12
16	5.84	0.06	0.06
17	6.20	0.02	0.03
18	6.56	0.01	0.00
19	6.91	0.02	0.01
20	7.27	0.06	0.10
RDB	7.45	Comments: Negative values due to back eddy	
LDB	0.30		

Stream:	Alexander Creek	**Date:**	August 22, 2014
Site:	ALE9	**Wetted Width (m):**	3.85
Habitat Unit:	5	**Spacing (m):**	0.1925
Type:	Glide	**Zero @ (m)**	0.09625

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.10	0.40	-0.01
2	0.29	0.40	-0.01
3	0.48	0.46	-0.01
4	0.67	0.38	0.04
5	0.87	0.52	0.08
6	1.06	0.64	0.10
7	1.25	0.66	0.12
8	1.44	0.64	0.11
9	1.64	0.61	0.06
10	1.83	0.60	0.08
11	2.02	0.56	0.03
12	2.21	0.42	0.03
13	2.41	0.38	0.02
14	2.60	0.30	0.02
15	2.79	0.32	0.01
16	2.98	0.30	0.00
17	3.18	0.24	0.02
18	3.37	0.12	0.01

19	3.56	0.08	0.00
20	3.75	0.02	-0.02
RDB	3.85	Comments: Negative values due to back eddy	
LDB	0.00		

Stream:	Alexander Creek	**Date:**	August 22, 2014
Site:	ALE9	**Wetted Width (m):**	4.80
Habitat Unit:	6	**Spacing (m):**	0.24
Type:	Cascade	**Zero @ (m)**	0.12

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.57	0.04	0.09
2	0.81	0.01	0.00
3	1.05	0.01	0.00
4	1.29	0.01	0.00
5	1.53	0.02	-0.02
6	1.77	0.07	0.00
7	2.01	0.06	0.00
8	2.25	0.15	0.00
9	2.49	0.09	0.13
10	2.73	0.10	0.09
11	2.97	0.13	0.11
12	3.21	0.14	0.09
13	3.45	0.13	0.01
14	3.69	0.12	0.00
15	3.93	0.14	0.18
16	4.17	0.10	0.13
17	4.41	0.10	0.10
18	4.65	0.15	0.20
19	4.89	0.18	0.12
20	5.13	0.16	-0.01
RDB	5.25	Comments: Negative values due to back eddy	
LDB	0.45		

Stream:	Alexander Creek	**Date:**	August 22, 2014
Site:	ALE9	**Wetted Width (m):**	5.00
Habitat Unit:	7	**Spacing (m):**	0.25
Type:	Cascade	**Zero @ (m)**	0.125

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.23	0.10	0.02
2	0.48	0.12	0.03
3	0.73	0.14	0.07
4	0.98	0.16	0.13
5	1.23	0.14	0.04
6	1.48	0.16	-0.02
7	1.73	0.06	0.11
8	1.98	0.12	-0.01
9	2.23	0.10	0.08
10	2.48	0.08	0.00
11	2.73	0.10	0.09
12	2.98	0.10	0.19
13	3.23	0.12	-0.01
14	3.48	0.12	0.00
15	3.73	0.17	0.20
16	3.98	0.12	0.03
17	4.23	0.01	0.05
18	4.48	0.15	0.21
19	4.73	0.18	0.09
20	4.98	0.08	-0.02
RDB	5.10	Comments: Negative values due to back eddy	
LDB	0.10		

Stream:	Alexander Creek	**Date:**	August 22, 2014
Site:	ALE9	**Wetted Width (m):**	5.50
Habitat Unit:	8	**Spacing (m):**	0.275
Type:	Glide	**Zero @ (m)**	0.1375

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	3.04	0.04	-0.01
2	3.31	0.04	-0.01
3	3.59	0.06	0.02
4	3.86	0.10	0.04
5	4.14	0.09	0.02
6	4.41	0.15	0.04
7	4.69	0.09	0.01
8	4.96	0.10	0.04
9	5.24	0.10	0.01
10	5.51	0.24	0.04
11	5.79	0.22	0.02
12	6.06	0.24	0.02
13	6.34	0.22	0.06

14	6.61	0.14	0.07
15	6.89	0.22	0.08
16	7.16	0.13	0.05
17	7.44	0.18	0.05
18	7.71	0.14	0.05
19	7.99	0.12	0.06
20	8.26	0.12	-0.01
RDB	8.40	Comments: Negative values due to back eddy	
LDB	2.90		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	8.35
Habitat Unit:	1	**Spacing (m):**	0.835
Type:	Cascade	**Zero @ (m)**	0.4175

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	3.12	0.01	0.00
2	3.96	0.11	0.10
3	4.79	0.06	0.24
4	5.63	0.03	0.55
5	6.46	0.07	0.33
6	7.20	0.05	0.51
7	8.13	0.08	0.02
8	8.97	0.07	0.01
9	9.80	0.12	0.34
10	10.64	0.04	0.01
RDB	11.05		
LDB	2.70		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	6.29
Habitat Unit:	2	**Spacing (m):**	0.629
Type:	Glide	**Zero @ (m)**	0.3145

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.97	0.02	0.00
2	1.60	0.11	0.00
3	2.23	0.15	0.00
4	2.86	0.27	0.00
5	3.49	0.22	0.01
6	4.12	0.31	0.01

7	4.74	0.28	0.01
8	5.37	0.30	0.00
9	6.00	0.20	0.00
10	6.63	0.15	0.00
RDB	6.95		
LDB	0.66		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	5.30
Habitat Unit:	3	**Spacing (m):**	0.530
Type:	Riffle	**Zero @ (m)**	0.265

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	2.32	0.02	0.05
2	2.85	0.01	0.01
3	3.38	0.05	0.01
4	3.91	0.07	0.02
5	4.44	0.17	0.15
6	4.97	0.18	0.01
7	5.50	0.16	0.01
8	6.03	0.16	0.04
9	6.56	0.17	0.07
10	7.09	0.08	0.12
RDB	7.35		
LDB	2.05		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	2.80
Habitat Unit:	4	**Spacing (m):**	0.280
Type:	Cascade	**Zero @ (m)**	0.140

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.89	0.19	0.08
2	1.17	0.10	0.03
3	1.45	0.16	0.46
4	1.73	0.12	0.70
5	2.01	0.17	0.23
6	2.29	0.21	0.36
7	2.57	0.13	0.74
8	2.85	0.16	0.10
9	3.13	0.14	0.26
10	3.41	0.07	0.39

RDB	3.55
LDB	0.75

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	3.50
Habitat Unit:	5	**Spacing (m):**	0.350
Type:	Glide	**Zero @ (m)**	0.175
Interval	**Distance from LDB (m)**	**Depth (m)**	**Velocity (m/s) @ 0.6 depth**
1	1.13	0.10	0.00
2	1.48	0.20	0.03
3	1.83	0.17	0.04
4	2.18	0.20	0.11
5	2.53	0.24	0.01
6	2.88	0.27	0.11
7	3.23	0.32	0.11
8	3.58	0.21	0.12
9	3.93	0.17	0.04
10	4.28	0.05	0.00
RDB	4.45		
LDB	0.95		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	3.00
Habitat Unit:	6	**Spacing (m):**	0.300
Type:	Cascade	**Zero @ (m)**	0.150
Interval	**Distance from LDB (m)**	**Depth (m)**	**Velocity (m/s) @ 0.6 depth**
1	0.25	0.12	0.01
2	0.55	0.17	0.13
3	0.85	0.12	0.15
4	1.15	0.12	0.44
5	1.45	0.15	0.45
6	1.75	0.16	0.55
7	2.05	0.10	0.88
8	2.35	0.06	0.21
9	2.65	0.06	0.31
10	2.95	0.04	0.05
RDB	3.10		
LDB	0.10		

Stream:	West Alexander Creek	**Date:**	August 13, 2014

Site:	WAL1	**Wetted Width (m):**	2.40
Habitat Unit:	7	**Spacing (m):**	0.240
Type:	Riffle	**Zero @ (m)**	0.120

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	1.42	0.01	0.01
2	1.66	0.13	0.14
3	1.90	0.15	0.07
4	2.14	0.24	0.20
5	2.38	0.23	0.31
6	2.62	0.21	0.31
7	2.86	0.19	0.17
8	3.10	0.18	0.13
9	3.34	0.16	0.10
10	3.58	0.05	0.01
RDB	3.70		
LDB	1.30		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	4.00
Habitat Unit:	8	**Spacing (m):**	0.400
Type:	Glide	**Zero @ (m)**	0.200

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.50	0.05	0.00
2	0.90	0.07	0.00
3	1.30	0.17	0.00
4	1.70	0.20	0.09
5	2.10	0.18	0.14
6	2.50	0.20	0.17
7	2.90	0.20	0.11
8	3.30	0.17	0.14
9	3.70	0.16	0.02
10	4.10	0.10	0.07
RDB	4.30		
LDB	0.30		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	4.00
Habitat Unit:	9	**Spacing (m):**	0.400
Type:	Riffle	**Zero @ (m)**	0.200

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.46	0.07	0.01
2	0.86	0.19	0.38
3	1.26	0.17	0.25
4	1.66	0.22	0.20
5	2.06	0.14	0.23
6	2.46	0.05	0.10
7	2.86	0.05	0.17
8	3.26	0.05	0.13
9	3.66	0.04	0.09
10	4.06	0.01	0.00
RDB	4.26		
LDB	0.26		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	3.50
Habitat Unit:	10	**Spacing (m):**	0.350
Type:	Cascade	**Zero @ (m)**	0.175

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	1.28	0.05	0.10
2	1.63	0.02	0.31
3	1.98	0.04	0.36
4	2.33	0.05	0.25
5	2.68	0.06	0.04
6	3.03	0.11	0.48
7	3.38	0.10	0.07
8	3.73	0.15	0.57
9	4.08	0.16	0.39
10	4.43	0.06	0.19
RDB	4.60		
LDB	1.10		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	2.50
Habitat Unit:	11	**Spacing (m):**	0.250
Type:	Cascade	**Zero @ (m)**	0.125

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	1.08	0.03	0.01
2	1.33	0.10	0.30
3	1.58	0.10	0.07

4	1.83	0.16	0.47
5	2.08	0.20	0.68
6	2.33	0.20	0.14
7	2.58	0.16	0.08
8	2.83	0.10	0.40
9	3.08	0.05	0.02
10	3.33	0.01	0.00
RDB	3.45		
LDB	0.95		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	3.85
Habitat Unit:	12	**Spacing (m):**	0.385
Type:	Riffle	**Zero @ (m)**	0.1925

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	1.19	0.02	0.00
2	1.58	0.15	0.01
3	1.96	0.17	0.22
4	2.35	0.24	0.09
5	2.73	0.18	0.18
6	3.12	0.12	0.27
7	3.50	0.11	0.12
8	3.89	0.10	0.11
9	4.27	0.10	0.15
10	4.66	0.04	0.00
RDB	4.85		
LDB	1.00		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	2.90
Habitat Unit:	13	**Spacing (m):**	0.290
Type:	Glide	**Zero @ (m)**	0.145

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.35	0.08	0.00
2	0.64	0.14	0.23
3	0.93	0.17	0.25
4	1.22	0.21	0.23
5	1.51	0.27	0.14
6	1.80	0.31	0.01
7	2.09	0.26	0.14
8	2.38	0.16	0.12

9	2.67	0.12	0.08
10	2.96	0.01	0.00
RDB	3.10		
LDB	0.20		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	3.40
Habitat Unit:	14	**Spacing (m):**	0.340
Type:	Pool	**Zero @ (m)**	0.170

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.17	0.05	0.00
2	0.51	0.16	0.00
3	0.85	0.34	0.00
4	1.19	0.40	0.00
5	1.53	0.41	0.10
6	1.87	0.61	0.25
7	2.21	0.60	0.01
8	2.55	0.50	0.00
9	2.89	0.37	0.00
10	3.23	0.02	0.00
RDB	3.40		
LDB	0.00		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	5.20
Habitat Unit:	15	**Spacing (m):**	0.520
Type:	Cascade	**Zero @ (m)**	0.260

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	0.51	0.15	0.00
2	1.03	0.21	0.01
3	1.55	0.04	0.74
4	2.07	0.03	0.69
5	2.59	0.07	0.70
6	3.11	0.11	0.15
7	3.63	0.08	0.88
8	4.15	0.04	0.26
9	4.67	0.01	0.01
10	5.19	0.01	0.01
RDB	5.45		
LDB	0.25		

Stream:	West Alexander Creek	**Date:**	August 13, 2014
Site:	WAL1	**Wetted Width (m):**	2.40
Habitat Unit:	16	**Spacing (m):**	0.240
Type:	Riffle	**Zero @ (m)**	0.120

Interval	Distance from LDB (m)	Depth (m)	Velocity (m/s) @ 0.6 depth
1	2.52	0.04	0.01
2	2.76	0.12	0.17
3	3.00	0.11	0.36
4	3.24	0.16	0.25
5	3.48	0.12	0.47
6	3.72	0.16	0.45
7	3.96	0.13	0.43
8	4.20	0.10	0.28
9	4.44	0.08	0.47
10	4.68	0.11	0.25
RDB	4.80		
LDB	2.40		

Appendix M. FHAP Pebble Count Data.

Stream: Alexander Creek		Habitat type:	Cascade			Date: 11-Aug-14	
Site: Reach 8						HU#: 1	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	6			51	14		
2	55			52	33		
3	132			53	96		
4	10			54	54		
5	60			55	60		
6	15			56	58		
7	25			57	115		
8	F			58	60		
9	17			59	53		
10	49	0.5		60	F	1	
11	13			61	120		
12	116			62	20		
13	25			63	68		
14	12			64	70		
15	17			65	134		
16	11			66	85		
17	84			67	72		
18	78			68	81		
19	14			69	61		
20	61	0		70	94	0	
21	12			71	64		
22	14			72	86		
23	39			73	41		
24	12			74	71		
25	100			75	45		
26	11			76	32		
27	58			77	122		
28	7			78	63		
29	72			79	57		
30	9	0		80	70	0	
31	72			81	43		
32	83			82	65		
33	6			83	57		
34	38			84	31		
35	6			85	64		
36	115			86	65		
37	7			87	66		
38	8			88	41		
39	100			89	72		
40	8			90	111	0.5	
41	7			91	55		
42	75			92	54		
43	85			93	60		
44	16			94	101		
45	4			95	69		
46	142			96	45		
47	40			97	65		
48	F			98	71		
49	75			99	143		
50	34	0		100	18	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0 = unembedded. C = calcite, F = fines

Stream: Alexander Creek		Habitat type:	Riffle			Date: 11-Aug-14		
Site: Reach 8						HU#: 2		
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	152				51	F		
2	74				52	F		
3	92				53	70		
4	61				54	36		
5	80				55	151		
6	53				56	131		
7	62				57	74		
8	84				58	89		
9	F				59	24		
10	60	0			60	23	0	
11	F				61	45		
12	49				62	198		
13	210				63	60		
14	63				64	54		
15	125				65	84		
16	94				66	36		
17	38				67	100		
18	63				68	243		
19	63				69	97		
20	55	0			70	76	0.5	
21	31				71	57		
22	55				72	62		
23	43				73	48		
24	90				74	45		
25	55				75	60		
26	30				76	193		
27	102				77	283		
28	84				78	86		
29	66				79	75		
30	52	0			80	62	0	
31	85				81	81		
32	56				82	105		
33	173				83	103		
34	17				84	53		
35	52				85	89		
36	34				86	41		
37	44				87	93		
38	F				88	F		
39	41				89	F		
40	95	0.75			90	F	1	
41	65				91	156		
42	62				92	161		
43	77				93	320		
44	94				94	241		
45	94				95	115		
46	41				96	206		
47	32				97	382		
48	53				98	59		
49	F				99	312		
50	F	1			100	36	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

Stream: Alexander Creek		Habitat type:	Glide			Date: 11-Aug-14	
Site: Reach 8						HU#: 3	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	F			51	139		
2	F			52	71		
3	F			53	99		
4	F			54	102		
5	F			55	75		
6	F			56	F		
7	F			57	46		
8	F			58	153		
9	F			59	87		
10	F	1		60	112	0	
11	F			61	74		
12	F			62	100		
13	F			63	90		
14	F			64	44		
15	F			65	61		
16	63			66	72		
17	97			67	51		
18	58			68	41		
19	49			69	31		
20	45	0		70	65	0.25	
21	124			71	76		
22	64			72	25		
23	104			73	40		
24	49			74	54		
25	25			75	79		
26	86			76	38		
27	36			77	80		
28	22			78	66		
29	101			79	49		
30	51	0		80	52	0	
31	54			81	132		
32	191			82	83		
33	73			83	100		
34	83			84	98		
35	30			85	45		
36	67			86	46		
37	68			87	53		
38	39			88	110		
39	50			89	61		
40	58	0		90	76	0	
41	124			91	79		
42	100			92	44		
43	101			93	66		
44	61			94	62		
45	45			95	50		
46	132			96	85		
47	64			97	129		
48	73			98	113		
49	63			99	141		
50	50	0		100	42	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

Stream: Alexander Creek		Habitat type:	Riffle		Date: 11-Aug-14	
Site: Reach 8					HU#: 4	

Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	43			51	115		
2	49			52	70		
3	71			53	42		
4	86			54	F		
5	80			55	49		
6	60			56	26		
7	50			57	115		
8	127			58	138		
9	105			59	50		
10	144	0		60	55	0.25	
11	56			61	78		
12	71			62	76		
13	128			63	142		
14	44			64	F		
15	111			65	60		
16	151			66	54		
17	44			67	74		
18	127			68	50		
19	98			69	88		
20	42	0		70	80	0	
21	120			71	112		
22	55			72	58		
23	60			73	81		
24	52			74	164		
25	46			75	69		
26	71			76	49		
27	40			77	67		
28	57			78	59		
29	71			79	98		
30	40	0		80	96	0.25	
31	70			81	74		
32	72			82	60		
33	150			83	85		
34	76			84	33		
35	80			85	107		
36	110			86	145		
37	194			87	46		
38	65			88	73		
39	56			89	77		
40	66	0.25		90	120	0.25	
41	F			91	120		
42	70			92	130		
43	91			93	82		
44	70			94	F		
45	92			95	154		
46	30			96	34		
47	63			97	75		
48	95			98	36		
49	66			99	F		
50	66	0		100	33	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

Stream: Alexander Creek			Habitat type:	Cascade		Date: 11-Aug-14	
Site: Reach 8						HU#: 5	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	44			51	82		
2	61			52	115		
3	877			53	74		
4	89			54	36		
5	F			55	107		
6	F			56	162		
7	F			57	F		
8	200			58	61		
9	280			59	36		
10	71	0		60	92	0.25	
11	62			61	68		
12	21			62	17		
13	131			63	16		
14	97			64	32		
15	108			65	28		
16	45			66	20		
17	90			67	16		
18	20			68	100		
19	66			69	62		
20	77	0		70	21	0.25	
21	85			71	22		
22	77			72	111		
23	150			73	44		
24	156			74	71		
25	96			75	42		
26	100			76	72		
27	91			77	76		
28	71			78	39		
29	46			79	140		
30	124	0		80	124	0.5	
31	88			81	60		
32	74			82	116		
33	146			83	172		
34	76			84	40		
35	75			85	114		
36	133			86	100		
37	213			87	118		
38	79			88	68		
39	37			89	255		
40	74	0.25		90	62	0	
41	174			91	91		
42	105			92	41		
43	50			93	141		
44	331			94	65		
45	31			95	80		
46	176			96	70		
47	42			97	51		
48	54			98	125		
49	160			99	109		
50	200	0.25		100	100	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

Stream: Alexander Creek		Habitat type:	Riffle		Date: 11-Aug-14		
Site: Reach 8					HU#: 6		
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	170			51	70		
2	75			52	61		
3	50			53	65		
4	56			54	57		
5	272			55	56		
6	145			56	244		
7	170			57	88		
8	58			58	61		
9	65			59	130		
10	47	0		60	24	0	
11	F			61	42		
12	34			62	183		
13	61			63	194		
14	46			64	167		
15	57			65	32		
16	186			66	104		
17	112			67	48		
18	124			68	F		
19	163			69	245		
20	116	0		70	186	0	
21	40			71	120		
22	172			72	93		
23	120			73	45		
24	73			74	101		
25	F			75	56		
26	53			76	140		
27	86			77	148		
28	50			78	120		
29	79			79	44		
30	45	0		80	43	0	
31	55			81	21		
32	56			82	50		
33	158			83	32		
34	F			84	100		
35	56			85	90		
36	67			86	24		
37	70			87	153		
38	126			88	F		
39	46			89	18		
40	111	0.75		90	52	0	
41	39			91	123		
42	60			92	37		
43	62			93	72		
44	220			94	36		
45	39			95	80		
46	134			96	166		
47	116			97	93		
48	85			98	130		
49	152			99	55		
50	93	0		100	162	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

Stream: Alexander Creek			Habitat type:	Cascade		Date: 11-Aug-14	
Site: Reach 8						HU#: 7	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	308			51	33		
2	73			52	65		
3	181			53	88		
4	44			54	84		
5	113			55	91		
6	51			56	123		
7	192			57	85		
8	51			58	52		
9	95			59	175		
10	12	0		60	65	0.5	
11	27			61	250		
12	47			62	263		
13	54			63	75		
14	87			64	128		
15	70			65	85		
16	85			66	55		
17	84			67	60		
18	48			68	87		
19	70			69	347		
20	82	0		70	165	0.25	
21	190			71	97		
22	125			72	20		
23	71			73	150		
24	73			74	400		
25	25			75	250		
26	F			76	158		
27	59			77	65		
28	72			78	184		
29	211			79	186		
30	59	0		80	77	0	
31	93			81	346		
32	119			82	F		
33	170			83	F		
34	47			84	50		
35	185			85	66		
36	92			86	86		
37	11			87	131		
38	166			88	167		
39	F			89	91		
40	20	0		90	28	0.25	
41	100			91	36		
42	27			92	110		
43	60			93	80		
44	126			94	126		
45	F			95	28		
46	166			96	127		
47	54			97	80		
48	30			98	166		
49	86			99	81		
50	217	0.5		100	55	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

Stream: Alexander Creek		Habitat type:	Glide		Date: 11-Aug-14	
Site: Reach 8					HU#: 8	

Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	192			51	61		
2	F			52	120		
3	F			53	22		
4	F			54	F		
5	F			55	F		
6	F			56	46		
7	F			57	48		
8	F			58	111		
9	F			59	60		
10	F	1		60	48	0	
11	F			61	72		
12	123			62	65		
13	174			63	230		
14	211			64	93		
15	143			65	121		
16	105			66	165		
17	56			67	65		
18	100			68	241		
19	67			69	116		
20	187	0.5		70	44	0	
21	160			71	40		
22	94			72	40		
23	96			73	54		
24	202			74	71		
25	143			75	39		
26	136			76	71		
27	109			77	72		
28	125			78	51		
29	74			79	F		
30	232	0		80	F	0	
31	70			81	50		
32	68			82	0		
33	133			83	35		
34	181			84	55		
35	174			85	27		
36	93			86	28		
37	210			87	156		
38	245			88	98		
39	147			89	27		
40	85	0		90	95	0.5	
41	49			91	120		
42	118			92	54		
43	210			93	66		
44	46			94	115		
45	71			95	50		
46	55			96	55		
47	62			97	56		
48	71			98	95		
49	98			99	34		
50	70	0		100	115	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

Stream: Alexander Creek		Habitat type:	Cascade			Date: 11-Aug-14	
Site: Reach 8						HU#: 9	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	210			51	133		
2	70			52	145		
3	103			53	33		
4	85			54	68		
5	400			55	75		
6	61			56	56		
7	253			57	290		
8	400			58	207		
9	265			59	254		
10	490	0		60	163	0	
11	180			61	75		
12	83			62	56		
13	135			63	143		
14	110			64	153		
15	121			65	385		
16	144			66	218		
17	65			67	68		
18	112			68	190		
19	85			69	155		
20	78	0		70	143	0	
21	210			71	379		
22	55			72	78		
23	193			73	50		
24	98			74	64		
25	38			75	70		
26	147			76	126		
27	144			77	59		
28	234			78	107		
29	233			79	80		
30	190	0		80	301	0.25	
31	214			81	122		
32	64			82	77		
33	148			83	153		
34	128			84	68		
35	63			85	71		
36	114			86	61		
37	19			87	100		
38	175			88	49		
39	132			89	320		
40	53	0.5		90	68	0	
41	339			91	102		
42	184			92	98		
43	197			93	105		
44	221			94	83		
45	183			95	186		
46	68			96	90		
47	177			97	214		
48	39			98	61		
49	382			99	26		
50	69	0		100	F	1	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

Stream: Alexander Creek		Habitat type:	Riffle			Date: 11-Aug-14		
Site: Reach 8						HU#: 10		
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	65				51	110		
2	300				52	82		
3	150				53	124		
4	65				54	50		
5	F				55	30		
6	301				56	67		
7	55				57	62		
8	42				58	282		
9	100				59	173		
10	36	0			60	76	0	
11	230				61	64		
12	61				62	F		
13	21				63	40		
14	65				64	74		
15	264				65	45		
16	59				66	95		
17	75				67	31		
18	40				68	81		
19	64				69	75		
20	36	0.25			70	86	0.5	
21	140				71	111		
22	49				72	63		
23	30				73	25		
24	60				74	36		
25	210				75	81		
26	41				76	224		
27	105				77	72		
28	100				78	60		
29	32				79	21		
30	64	0			80	74	0.5	
31	168				81	271		
32	70				82	105		
33	40				83	136		
34	41				84	180		
35	61				85	46		
36	32				86	72		
37	92				87	76		
38	70				88	47		
39	304				89	50		
40	68	0			90	80	0	
41	35				91	97		
42	46				92	10		
43	40				93	46		
44	221				94	97		
45	234				95	56		
46	107				96	222		
47	250				97	195		
48	52				98	F		
49	150				99	154		
50	150	0.25			100	54	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

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Stream: Alexander Creek		Habitat type:	Cascade			Date: 11-Aug-14	
Site: Reach 8						HU#: 11	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	178			51	111		
2	111			52	218		
3	115			53	186		
4	263			54	185		
5	245			55	222		
6	162			56	110		
7	310			57	157		
8	200			58	148		
9	210			59	111		
10	272	0.25		60	85	0.25	
11	74			61	179		
12	224			62	60		
13	130			63	110		
14	63			64	F		
15	144			65	173		
16	190			66	175		
17	40			67	44		
18	163			68	174		
19	90			69	146		
20	80	0		70	48	0	
21	172			71	17		
22	125			72	49		
23	172			73	31		
24	32			74	111		
25	30			75	20		
26	26			76	33		
27	45			77	10		
28	71			78	11		
29	29			79	156		
30	33	0		80	112	0.25	
31	100			81	163		
32	50			82	73		
33	9			83	110		
34	85			84	155		
35	220			85	33		
36	302			86	152		
37	175			87	89		
38	103			88	312		
39	181			89	81		
40	160	0.25		90	316	0.5	
41	193			91	175		
42	100			92	43		
43	194			93	82		
44	195			94	156		
45	46			95	75		
46	31			96	86		
47	60			97	5		
48	175			98	400		
49	94			99	204		
50	203	0		100	132	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

Stream: Alexander Creek			Habitat type:	Riffle		Date: 11-Aug-14	
Site: Reach 8						HU#: 12	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	364			51	15		
2	35			52	122		
3	120			53	32		
4	91			54	120		
5	334			55	38		
6	162			56	47		
7	F			57	54		
8	F			58	120		
9	39			59	145		
10	39	0		60	21	0.25	
11	51			61	306		
12	30			62	250		
13	91			63	180		
14	111			64	371		
15	53			65	252		
16	55			66	385		
17	339			67	220		
18	41			68	300		
19	320			69	234		
20	205	0.5		70	153	0.5	
21	80			71	100		
22	281			72	140		
23	F			73	105		
24	120			74	128		
25	23			75	F		
26	80			76	81		
27	45			77	86		
28	15			78	220		
29	50			79	39		
30	30	0		80	21	0	
31	17			81	65		
32	50			82	72		
33	31			83	19		
34	31			84	18		
35	38			85	44		
36	20			86	23		
37	24			87	15		
38	15			88	66		
39	20			89	15		
40	13	0		90	60	0	
41	16			91	111		
42	70			92	10		
43	35			93	422		
44	361			94	55		
45	76			95	70		
46	127			96	31		
47	117			97	77		
48	108			98	46		
49	142			99	115		
50	86	0		100	76	0	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,							

Stream: Alexander Creek		Habitat type:	Cascade			Date: 11-Aug-14	
Site: Reach 8						HU#: 13	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	240			51	155		
2	250			52	75		
3	270			53	46		
4	394			54	50		
5	231			55	32		
6	255			56	126		
7	153			57	77		
8	356			58	48		
9	184			59	F		
10	180	0		60	140	0.25	
11	187			61	50		
12	272			62	160		
13	155			63	61		
14	222			64	80		
15	135			65	36		
16	198			66	171		
17	F			67	F		
18	233			68	153		
19	65			69	75		
20	50	0		70	34	0.25	
21	32			71	60		
22	51			72	180		
23	330			73	35		
24	27			74	105		
25	44			75	24		
26	60			76	45		
27	36			77	60		
28	F			78	66		
29	225			79	75		
30	17	0		80	130	0.25	
31	31			81	79		
32	62			82	91		
33	129			83	225		
34	315			84	63		
35	12			85	217		
36	17			86	199		
37	16			87	46		
38	333			88	F		
39	235			89	138		
40	14	0		90	175	0.5	
41	183			91	43		
42	175			92	112		
43	201			93	85		
44	165			94	49		
45	294			95	98		
46	293			96	91		
47	154			97	150		
48	155			98	114		
49	115			99	47		
50	70	0		100	112	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

Stream: Alexander Creek		Habitat type:	Glide		Date: 11-Aug-14		
Site: Reach 8					HU#: 14		
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	260			51	184		
2	311			52	17		
3	383			53	30		
4	F			54	110		
5	F			55	6		
6	F			56	122		
7	95			57	32		
8	65			58	41		
9	345			59	51		
10	57	0.25		60	80	0	
11	224			61	59		
12	421			62	55		
13	105			63	72		
14	314			64	46		
15	F			65	132		
16	52			66	40		
17	89			67	170		
18	F			68	40		
19	71			69	54		
20	51	0		70	125	0	
21	58			71	69		
22	60			72	294		
23	242			73	355		
24	171			74	70		
25	90			75	139		
26	158			76	78		
27	F			77	65		
28	F			78	51		
29	F			79	60		
30	300	0.5		80	F	1	
31	144			81	64		
32	62			82	F		
33	195			83	31		
34	40			84	50		
35	450			85	114		
36	160			86	55		
37	171			87	25		
38	179			88	80		
39	840			89	F		
40	100	0.25		90	44	0	
41	271			91	54		
42	65			92	F		
43	88			93	52		
44	73			94	51		
45	152			95	70		
46	68			96	71		
47	115			97	53		
48	183			98	69		
49	73			99	90		
50	317	0		100	28	0	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,							

Stream: Alexander Creek		Habitat type:	Riffle		Date: 11-Aug-14		
Site: Reach 8					HU#: 15		
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	166			51	50		
2	270			52	44		
3	80			53	25		
4	56			54	60		
5	99			55	192		
6	26			56	55		
7	70			57	252		
8	23			58	182		
9	20			59	47		
10	16	0		60	130	0.5	
11	160			61	37		
12	63			62	130		
13	377			63	215		
14	163			64	343		
15	F			65	115		
16	30			66	116		
17	111			67	119		
18	183			68	132		
19	56			69	120		
20	65	0		70	80	0	
21	59			71	43		
22	455			72	46		
23	17			73	183		
24	350			74	277		
25	30			75	180		
26	15			76	148		
27	255			77	840		
28	345			78	127		
29	75			79	68		
30	16	0		80	66	0	
31	18			81	45		
32	23			82	75		
33	33			83	43		
34	25			84	65		
35	20			85	109		
36	65			86	98		
37	36			87	86		
38	32			88	76		
39	134			89	280		
40	160	0.25		90	190	0.5	
41	66			91	172		
42	50			92	F		
43	50			93	145		
44	50			94	150		
45	43			95	127		
46	25			96	120		
47	85			97	F		
48	30			98	132		
49	39			99	125		
50	19	0		100	210	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

Stream: Alexander Creek		Habitat type:	Cascade			Date: 11-Aug-14	
Site: Reach 8						HU#: 16	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	243			51	21		
2	365			52	25		
3	99			53	26		
4	379			54	132		
5	72			55	16		
6	310			56	20		
7	370			57	145		
8	33			58	35		
9	72			59	193		
10	220	0		60	52	0	
11	69			61	263		
12	131			62	100		
13	48			63	260		
14	74			64	43		
15	162			65	391		
16	70			66	43		
17	55			67	6		
18	373			68	314		
19	70			69	39		
20	194	0		70	16	0	
21	F			71	255		
22	65			72	16		
23	251			73	20		
24	291			74	56		
25	292			75	311		
26	60			76	16		
27	60			77	89		
28	187			78	20		
29	40			79	78		
30	40	0		80	45	0.25	
31	172			81	172		
32	18			82	223		
33	19			83	93		
34	143			84	481		
35	238			85	211		
36	299			86	49		
37	88			87	231		
38	99			88	118		
39	27			89	350		
40	108	0		90	363	0.5	
41	105			91	275		
42	60			92	289		
43	54			93	198		
44	80			94	111		
45	39			95	52		
46	81			96	210		
47	54			97	275		
48	23			98	69		
49	20			99	171		
50	25	0		100	72	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded,

Stream: Alexander Creek			Habitat type:	Cascade		Date: 11-Aug-14		
Site: ALE9						HU#: 1		
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	F				51	65		
2	F				52	78		
3	F				53	80		
4	119				54	F		
5	470				55	43		
6	99				56	56		
7	84				57	171		
8	210				58	32		
9	112				59	106		
10	126	0.5			60	34	0	
11	25				61	93		
12	50				62	32		
13	154				63	211		
14	47				64	183		
15	93				65	84		
16	271				66	189		
17	63				67	278		
18	170				68	79		
19	110				69	70		
20	109	0			70	69	0.5	
21	270				71	201		
22	75				72	26		
23	63				73	166		
24	53				74	194		
25	33				75	70		
26	158				76	161		
27	66				77	58		
28	412				78	54		
29	113				79	115		
30	458	0.25			80	67	0.5	
31	F				81	75		
32	F				82	36		
33	F				83	90		
34	F				84	76		
35	F				85	428		
36	10				86	291		
37	354				87	78		
38	32				88	108		
39	38				89	170		
40	334	0.5			90	94	0.75	
41	50				91	127		
42	58				92	191		
43	396				93	199		
44	104				94	148		
45	271				95	46		
46	28				96	141		
47	41				97	40		
48	27				98	63		
49	95				99	34		
50	36	0			100	195	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 11-Aug-14	
Site: ALE9							HU#: 2	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	550				51	116		
2	285				52	120		
3	92				53	90		
4	139				54	44		
5	78				55	103		
6	110				56	90		
7	F				57	F		
8	312				58	17		
9	126				59	96		
10	92	0			60	19	0	
11	211				61	155		
12	151				62	61		
13	105				63	53		
14	87				64	64		
15	178				65	288		
16	101				66	160		
17	623				67	123		
18	70				68	43		
19	62				69	71		
20	492	0.25			70	68	0	
21	138				71	120		
22	58				72	189		
23	106				73	60		
24	49				74	35		
25	70				75	F		
26	37				76	78		
27	161				77	39		
28	113				78	F		
29	86				79	F		
30	260	0.75			80	93	0	
31	114				81	F		
32	99				82	121		
33	98				83	198		
34	133				84	500		
35	70				85	204		
36	F				86	321		
37	F				87	75		
38	28				88	10		
39	68				89	169		
40	24	0			90	96	0	
41	46				91	38		
42	50				92	301		
43	355				93	59		
44	72				94	65		
45	55				95	64		
46	84				96	48		
47	95				97	753		
48	283				98	75		
49	71				99	43		
50	98	0			100	68	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 11-Aug-14	
Site: ALE9							HU#: 3	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	320				51	59		
2	14				52	27		
3	393				53	111		
4	26				54	12		
5	211				55	131		
6	24				56	273		
7	604				57	169		
8	21				58	42		
9	552				59	64		
10	103	0			60	34	0	
11	16				61	F		
12	55				62	58		
13	66				63	83		
14	F				64	76		
15	68				65	471		
16	60				66	14		
17	210				67	6		
18	F				68	382		
19	30				69	95		
20	101	0			70	327	0.25	
21	31				71	260		
22	553				72	141		
23	115				73	382		
24	98				74	123		
25	122				75	75		
26	66				76	68		
27	220				77	44		
28	57				78	168		
29	200				79	434		
30	59	0			80	125	0.25	
31	50				81	161		
32	94				82	155		
33	29				83	360		
34	73				84	37		
35	27				85	75		
36	423				86	49		
37	41				87	42		
38	179				88	67		
39	11				89	30		
40	80	0			90	184	0.5	
41	290				91	21		
42	444				92	25		
43	F				93	68		
44	51				94	37		
45	158				95	63		
46	115				96	550		
47	6				97	431		
48	58				98	228		
49	5				99	286		
50	44	0			100	190	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 11-Aug-14	
Site: ALE9							HU#: 4	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	234				51	125		
2	239				52	41		
3	111				53	260		
4	129				54	55		
5	322				55	36		
6	146				56	101		
7	71				57	42		
8	88				58	139		
9	210				59	97		
10	170	0			60	34	0	
11	100				61	121		
12	112				62	155		
13	339				63	106		
14	100				64	133		
15	164				65	166		
16	88				66	F		
17	221				67	80		
18	F				68	F		
19	F				69	8		
20	F	1			70	F	1	
21	F				71	91		
22	F				72	13		
23	233				73	8		
24	93				74	11		
25	58				75	64		
26	121				76	61		
27	77				77	44		
28	56				78	15		
29	99				79	90		
30	41	0			80	5	0	
31	80				81	57		
32	16				82	92		
33	55				83	98		
34	62				84	F		
35	44				85	60		
36	61				86	14		
37	73				87	110		
38	58				88	148		
39	182				89	35		
40	46	0			90	67	0	
41	240				91	36		
42	255				92	35		
43	17				93	64		
44	70				94	208		
45	82				95	60		
46	81				96	47		
47	49				97	93		
48	237				98	22		
49	23				99	52		
50	76	0			100	28	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Glide			Date: 11-Aug-14	
Site: ALE9							HU#: 5	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	146				51	156		
2	101				52	35		
3	77				53	101		
4	13				54	108		
5	13				55	80		
6	98				56	145		
7	104				57	163		
8	26				58	197		
9	40				59	254		
10	181	0.75			60	74	0.25	
11	77				61	42		
12	10				62	60		
13	35				63	111		
14	55				64	172		
15	38				65	108		
16	114				66	132		
17	59				67	43		
18	57				68	210		
19	8				69	40		
20	8	1			70	16	0	
21	44				71	32		
22	37				72	21		
23	178				73	62		
24	80				74	15		
25	78				75	10		
26	193				76	200		
27	24				77	8		
28	28				78	48		
29	29				79	89		
30	125	0.25			80	50	0	
31	105				81	30		
32	39				82	36		
33	113				83	77		
34	56				84	22		
35	188				85	57		
36	58				86	32		
37	145				87	41		
38	39				88	47		
39	126				89	B		
40	84	0.5			90	F	1	
41	32				91	F		
42	34				92	F		
43	61				93	F		
44	252				94	F		
45	259				95	F		
46	4				96	F		
47	6				97	F		
48	9				98	F		
49	263				99	F		
50	104	0			100	F	1	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0								

Stream: Alexander Creek			Habitat type:	Cascade			Date: 11-Aug-14	
Site: ALE9							HU#: 6	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	192				51	55		
2	111				52	24		
3	130				53	116		
4	342				54	100		
5	141				55	93		
6	190				56	116		
7	341				57	70		
8	224				58	47		
9	72				59	33		
10	194	0.5			60	133	0.5	
11	53				61	124		
12	162				62	36		
13	238				63	34		
14	83				64	46		
15	115				65	170		
16	65				66	98		
17	102				67	196		
18	199				68	170		
19	108				69	174		
20	274	0.5			70	36	0	
21	83				71	134		
22	70				72	148		
23	109				73	48		
24	59				74	218		
25	116				75	181		
26	62				76	41		
27	331				77	243		
28	64				78	162		
29	F				79	143		
30	190	0.5			80	112	0	
31	348				81	111		
32	413				82	93		
33	153				83	215		
34	31				84	160		
35	278				85	203		
36	92				86	102		
37	66				87	222		
38	35				88	247		
39	114				89	56		
40	75	0.25			90	145	0.5	
41	79				91	79		
42	254				92	260		
43	49				93	135		
44	305				94	95		
45	90				95	92		
46	151				96	101		
47	34				97	131		
48	15				98	178		
49	165				99	266		
50	15	0			100	50	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 11-Aug-14	
Site: ALE9							HU#: 7	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	404				51	238		
2	248				52	115		
3	221				53	64		
4	222				54	60		
5	155				55	133		
6	171				56	145		
7	141				57	227		
8	169				58	228		
9	53				59	251		
10	446	0.75			60	250	0.5	
11	66				61	237		
12	55				62	232		
13	52				63	252		
14	76				64	111		
15	221				65	143		
16	40				66	56		
17	51				67	121		
18	103				68	76		
19	96				69	56		
20	223	0.5			70	76	0	
21	32				71	52		
22	63				72	71		
23	53				73	241		
24	220				74	83		
25	59				75	224		
26	F				76	200		
27	9				77	46		
28	40				78	36		
29	50				79	96		
30	154	0			80	330	0.5	
31	100				81	155		
32	242				82	242		
33	111				83	178		
34	252				84	231		
35	240				85	F		
36	76				86	281		
37	21				87	331		
38	73				88	47		
39	33				89	56		
40	54	0.25			90	42	0	
41	188				91	56		
42	105				92	F		
43	240				93	64		
44	53				94	38		
45	88				95	13		
46	56				96	78		
47	301				97	41		
48	92				98	366		
49	45				99	365		
50	56	0			100	91	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: Alexander Creek			Habitat type:	Glide			Date: 11-Aug-14	
Site: ALE9							HU#: 8	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	480				51	130		
2	710				52	172		
3	445				53	111		
4	26				54	129		
5	39				55	341		
6	317				56	60		
7	431				57	F		
8	34				58	166		
9	62				59	14		
10	111	0			60	99	0.25	
11	30				61	172		
12	66				62	12		
13	44				63	80		
14	225				64	151		
15	59				65	70		
16	135				66	12		
17	252				67	158		
18	71				68	5		
19	F				69	40		
20	190	0.25			70	6	0	
21	82				71	96		
22	56				72	256		
23	30				73	90		
24	115				74	5		
25	425				75	4		
26	F				76	151		
27	F				77	92		
28	F				78	261		
29	F				79	110		
30	42	0			80	83	0.5	
31	40				81	62		
32	21				82	320		
33	86				83	121		
34	206				84	265		
35	39				85	181		
36	48				86	222		
37	283				87	300		
38	31				88	134		
39	120				89	139		
40	55	0			90	F	1	
41	46				91	F		
42	83				92	101		
43	59				93	164		
44	64				94	75		
45	77				95	37		
46	46				96	80		
47	57				97	86		
48	413				98	51		
49	228				99	81		
50	100	0.25			100	224	0.5	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0								

Stream: Alexander Creek			Habitat type:	Cascade			Date: 11-Aug-14	
Site: ALE9							HU#: 9	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	770				51	228		
2	39				52	95		
3	94				53	347		
4	647				54	F		
5	612				55	182		
6	162				56	124		
7	F				57	301		
8	90				58	95		
9	112				59	162		
10	211	0.75			60	261	0.25	
11	168				61	173		
12	103				62	60		
13	140				63	167		
14	192				64	398		
15	138				65	196		
16	36				66	55		
17	43				67	80		
18	105				68	44		
19	20				69	115		
20	432	0.5			70	65	0	
21	49				71	51		
22	106				72	61		
23	120				73	96		
24	49				74	146		
25	120				75	73		
26	162				76	35		
27	11				77	75		
28	85				78	153		
29	6				79	150		
30	38	0			80	80	0	
31	481				81	211		
32	18				82	706		
33	4				83	81		
34	42				84	80		
35	48				85	125		
36	177				86	106		
37	224				87	761		
38	190				88	150		
39	622				89	40		
40	140	0.5			90	60	0	
41	216				91	105		
42	51				92	112		
43	181				93	108		
44	170				94	90		
45	322				95	83		
46	243				96	130		
47	65				97	164		
48	28				98	120		
49	26				99	60		
50	27	0			100	36	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek		Habitat type:	Cascade			Date: 11-Aug-14		
Site: ALE9						HU#: 10		
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	301				51	9		
2	F				52	89		
3	135				53	11		
4	272				54	16		
5	150				55	133		
6	89				56	10		
7	46				57	182		
8	214				58	171		
9	61				59	86		
10	50	0.25			60	13	0	
11	183				61	262		
12	130				62	11		
13	82				63	65		
14	216				64	121		
15	56				65	13		
16	123				66	12		
17	108				67	16		
18	133				68	25		
19	42				69	333		
20	109	0			70	50	0	
21	110				71	16		
22	36				72	19		
23	401				73	189		
24	222				74	68		
25	182				75	16		
26	F				76	383		
27	55				77	19		
28	237				78	26		
29	90				79	15		
30	95	0			80	41	0	
31	227				81	10		
32	394				82	170		
33	45				83	80		
34	138				84	164		
35	30				85	130		
36	65				86	97		
37	15				87	40		
38	283				88	128		
39	16				89	101		
40	60	0			90	148	0.25	
41	92				91	53		
42	14				92	30		
43	200				93	69		
44	4				94	86		
45	100				95	22		
46	244				96	47		
47	6				97	79		
48	82				98	20		
49	122				99	21		
50	20	0			100	24	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 11-Aug-14	
Site: ALE9							HU#: 11	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	300				51	39		
2	261				52	15		
3	115				53	25		
4	300				54	104		
5	155				55	17		
6	268				56	76		
7	192				57	410		
8	298				58	15		
9	148				59	228		
10	51	0			60	4	0	
11	242				61	183		
12	192				62	130		
13	249				63	158		
14	100				64	86		
15	214				65	407		
16	200				66	47		
17	F				67	138		
18	46				68	152		
19	57				69	72		
20	110	0			70	154	0	
21	38				71	197		
22	35				72	87		
23	71				73	379		
24	125				74	89		
25	123				75	161		
26	160				76	110		
27	101				77	111		
28	111				78	200		
29	310				79	240		
30	122	0			80	95	0	
31	314				81	202		
32	131				82	555		
33	75				83	23		
34	261				84	23		
35	86				85	95		
36	120				86	24		
37	46				87	112		
38	70				88	67		
39	205				89	62		
40	41	0			90	60	0.5	
41	41				91	67		
42	46				92	109		
43	40				93	148		
44	55				94	274		
45	153				95	64		
46	24				96	32		
47	304				97	211		
48	95				98	214		
49	34				99	55		
50	113	0			100	78	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 11-Aug-14	
Site: ALE9							HU#: 12	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	464				51	365		
2	302				52	195		
3	185				53	60		
4	242				54	53		
5	281				55	55		
6	272				56	48		
7	225				57	112		
8	231				58	40		
9	243				59	48		
10	110	0			60	63	0	
11	93				61	80		
12	70				62	74		
13	583				63	51		
14	123				64	49		
15	64				65	50		
16	400				66	70		
17	56				67	45		
18	91				68	78		
19	46				69	54		
20	43	0			70	60	0	
21	17				71	39		
22	55				72	45		
23	120				73	78		
24	38				74	339		
25	15				75	34		
26	41				76	281		
27	11				77	29		
28	345				78	F		
29	4				79	70		
30	156	0			80	85	0	
31	42				81	54		
32	F				82	16		
33	59				83	25		
34	16				84	45		
35	10				85	45		
36	54				86	60		
37	10				87	9		
38	50				88	6		
39	7				89	20		
40	262	0.25			90	70	0	
41	80				91	81		
42	7				92	70		
43	244				93	53		
44	1028				94	42		
45	116				95	45		
46	520				96	40		
47	80				97	68		
48	209				98	32		
49	370				99	86		
50	83	0			100	26	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 11-Aug-14	
Site: ALE9							HU#: 13	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	293				51	164		
2	216				52	77		
3	141				53	63		
4	160				54	53		
5	132				55	60		
6	600				56	32		
7	320				57	100		
8	82				58	155		
9	41				59	33		
10	F	1			60	65	0	
11	280				61	74		
12	36				62	314		
13	26				63	35		
14	123				64	86		
15	20				65	414		
16	264				66	190		
17	20				67	148		
18	37				68	166		
19	38				69	72		
20	141	0.25			70	177	0.25	
21	152				71	81		
22	70				72	266		
23	383				73	272		
24	44				74	161		
25	104				75	132		
26	87				76	268		
27	20				77	75		
28	35				78	160		
29	58				79	89		
30	90	0			80	175	0.5	
31	25				81	134		
32	26				82	86		
33	25				83	138		
34	F				84	100		
35	F				85	80		
36	5				86	164		
37	133				87	121		
38	65				88	252		
39	60				89	60		
40	80	0			90	140	0.25	
41	200				91	104		
42	115				92	112		
43	16				93	90		
44	78				94	392		
45	194				95	51		
46	74				96	50		
47	44				97	241		
48	375				98	45		
49	90				99	346		
50	40	0			100	66	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 11-Aug-14	
Site: ALE9							HU#: 14	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	194				51	F		
2	113				52	75		
3	35				53	102		
4	47				54	105		
5	55				55	71		
6	232				56	44		
7	204				57	93		
8	100				58	65		
9	121				59	95		
10	85	0			60	27	0	
11	85				61	27		
12	124				62	31		
13	563				63	20		
14	250				64	104		
15	131				65	184		
16	115				66	46		
17	123				67	41		
18	117				68	252		
19	113				69	56		
20	174	0.5			70	136	0	
21	100				71	96		
22	81				72	53		
23	282				73	44		
24	150				74	42		
25	115				75	59		
26	250				76	60		
27	93				77	131		
28	34				78	440		
29	65				79	57		
30	56	0.5			80	71	0.25	
31	60				81	66		
32	56				82	55		
33	681				83	32		
34	54				84	12		
35	60				85	30		
36	92				86	22		
37	37				87	22		
38	54				88	19		
39	121				89	F		
40	80	0			90	F	1	
41	85				91	F		
42	90				92	165		
43	122				93	61		
44	190				94	73		
45	133				95	151		
46	54				96	79		
47	36				97	215		
48	92				98	104		
49	125				99	50		
50	F	1			100	120	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-14	
Site: ALE9							HU#: 15	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	255				51	116		
2	109				52	41		
3	143				53	109		
4	99				54	73		
5	F				55	198		
6	735				56	141		
7	175				57	80		
8	122				58	127		
9	119				59	62		
10	113	0.5			60	92	0.5	
11	149				61	80		
12	92				62	254		
13	91				63	1194		
14	66				64	183		
15	183				65	145		
16	66				66	125		
17	115				67	188		
18	111				68	86		
19	285				69	153		
20	70	0			70	40	0.25	
21	147				71	44		
22	513				72	82		
23	42				73	115		
24	53				74	20		
25	66				75	11		
26	67				76	953		
27	449				77	361		
28	70				78	280		
29	75				79	325		
30	96	0.25			80	123	0	
31	F				81	445		
32	24				82	431		
33	10				83	F		
34	6				84	426		
35	61				85	143		
36	45				86	169		
37	244				87	65		
38	321				88	34		
39	100				89	290		
40	132	0			90	431	0.25	
41	503				91	100		
42	F				92	415		
43	21				93	145		
44	10				94	122		
45	13				95	91		
46	62				96	46		
47	40				97	48		
48	95				98	70		
49	113				99	146		
50	43	0			100	509	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Glide			Date: 12-Aug-14	
Site: ALE9							HU#: 16	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	151				51	F		
2	35				52	105		
3	84				53	50		
4	165				54	45		
5	264				55	152		
6	405				56	57		
7	145				57	135		
8	F				58	102		
9	230				59	190		
10	41	0.25			60	70	0.25	
11	60				61	117		
12	73				62	32		
13	47				63	142		
14	79				64	116		
15	158				65	43		
16	87				66	117		
17	135				67	44		
18	42				68	24		
19	26				69	117		
20	82	0			70	60	0.75	
21	210				71	505		
22	57				72	128		
23	73				73	220		
24	87				74	49		
25	F				75	59		
26	84				76	145		
27	284				77	43		
28	105				78	100		
29	57				79	89		
30	40	0			80	123	0	
31	335				81	120		
32	66				82	90		
33	215				83	65		
34	190				84	70		
35	179				85	F		
36	43				86	25		
37	F				87	72		
38	45				88	111		
39	83				89	80		
40	30	0			90	45	0	
41	45				91	92		
42	23				92	26		
43	360				93	117		
44	F				94	20		
45	23				95	17		
46	141				96	110		
47	205				97	108		
48	450				98	132		
49	F				99	90		
50	F	1			100	130	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek		Habitat type:	Cascade			Date: 12-Aug-14	
Site: ALE9						HU#: 17	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	274			51	132		
2	143			52	184		
3	222			53	96		
4	64			54	103		
5	81			55	270		
6	82			56	90		
7	82			57	F		
8	185			58	47		
9	80			59	60		
10	109	0		60	96	0.25	
11	124			61	155		
12	143			62	250		
13	116			63	149		
14	125			64	210		
15	170			65	22		
16	155			66	83		
17	99			67	47		
18	198			68	75		
19	96			69	110		
20	116	0		70	191	0	
21	106			71	37		
22	123			72	121		
23	146			73	135		
24	173			74	308		
25	333			75	140		
26	264			76	70		
27	192			77	217		
28	221			78	52		
29	111			79	60		
30	150	0		80	71	0	
31	112			81	85		
32	152			82	60		
33	170			83	110		
34	61			84	185		
35	24			85	305		
36	21			86	266		
37	43			87	159		
38	282			88	119		
39	100			89	87		
40	57	0.25		90	83	0.25	
41	140			91	70		
42	183			92	44		
43	724			93	100		
44	178			94	245		
45	120			95	233		
46	25			96	267		
47	67			97	60		
48	81			98	F		
49	250			99	100		
50	137	0		100	140	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle		Date: 12-Aug-14	
Site: ALE9						HU#: 18	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	36			51	134		
2	150			52	51		
3	291			53	67		
4	165			54	90		
5	134			55	72		
6	158			56	123		
7	240			57	661		
8	130			58	374		
9	145			59	55		
10	100	0		60	23	0	
11	152			61	25		
12	105			62	24		
13	307			63	F		
14	85			64	370		
15	75			65	690		
16	62			66	154		
17	46			67	148		
18	107			68	116		
19	F			69	130		
20	71	0		70	108	0.25	
21	71			71	81		
22	84			72	225		
23	313			73	243		
24	116			74	211		
25	156			75	108		
26	161			76	57		
27	54			77	264		
28	70			78	94		
29	35			79	475		
30	35	0		80	104	0.25	
31	151			81	F		
32	80			82	63		
33	76			83	31		
34	200			84	25		
35	110			85	54		
36	215			86	160		
37	96			87	95		
38	143			88	87		
39	120			89	52		
40	62	0.5		90	104	0.75	
41	35			91	70		
42	42			92	40		
43	283			93	36		
44	71			94	27		
45	40			95	13		
46	55			96	165		
47	60			97	243		
48	101			98	141		
49	63			99	25		
50	85	0.5		100	29	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-14	
Site: ALE9							HU#: 19	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	200				51	62		
2	110				52	35		
3	209				53	10		
4	253				54	106		
5	276				55	15		
6	113				56	143		
7	81				57	24		
8	86				58	107		
9	112				59	63		
10	115	0			60	79	0	
11	175				61	104		
12	66				62	527		
13	199				63	110		
14	113				64	240		
15	162				65	173		
16	172				66	373		
17	83				67	244		
18	76				68	321		
19	50				69	209		
20	56	0			70	40	0	
21	55				71	280		
22	580				72	422		
23	290				73	115		
24	228				74	F		
25	350				75	345		
26	76				76	76		
27	280				77	56		
28	134				78	45		
29	162				79	165		
30	101	0.25			80	70	0.25	
31	165				81	91		
32	115				82	371		
33	40				83	434		
34	195				84	492		
35	162				85	131		
36	102				86	160		
37	91				87	294		
38	107				88	991		
39	142				89	452		
40	35	0.25			90	45	0.25	
41	30				91	85		
42	202				92	106		
43	31				93	82		
44	78				94	139		
45	291				95	20		
46	217				96	46		
47	174				97	100		
48	F				98	232		
49	100				99	81		
50	147	0.5			100	75	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-14	
Site: ALE9							HU#: 20	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	518				51	175		
2	110				52	132		
3	96				53	140		
4	243				54	126		
5	140				55	72		
6	132				56	158		
7	86				57	60		
8	66				58	200		
9	170				59	180		
10	111	0			60	150	0.5	
11	240				61	65		
12	196				62	60		
13	250				63	80		
14	85				64	72		
15	36				65	91		
16	40				66	60		
17	55				67	40		
18	110				68	35		
19	60				69	75		
20	11	0			70	240	0.5	
21	150				71	60		
22	196				72	45		
23	282				73	30		
24	200				74	22		
25	310				75	28		
26	252				76	225		
27	170				77	300		
28	104				78	166		
29	130				79	260		
30	75	0			80	120	0.5	
31	60				81	F		
32	65				82	52		
33	62				83	91		
34	53				84	46		
35	67				85	40		
36	130				86	80		
37	70				87	115		
38	99				88	100		
39	400				89	280		
40	159	0.25			90	130	0.5	
41	220				91	70		
42	150				92	100		
43	211				93	32		
44	115				94	81		
45	177				95	30		
46	135				96	30		
47	191				97	10		
48	142				98	10		
49	293				99	6		
50	160	0			100	100	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Pool			Date: 12-Aug-14	
Site: ALE9							HU#: 21	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	211				51	145		
2	60				52	232		
3	40				53	186		
4	197				54	70		
5	120				55	35		
6	28				56	15		
7	55				57	22		
8	69				58	22		
9	69				59	27		
10	50	0			60	21	0	
11	228				61	17		
12	56				62	34		
13	57				63	48		
14	50				64	10		
15	38				65	25		
16	86				66	22		
17	65				67	46		
18	32				68	25		
19	160				69	25		
20	655	0			70	18	0	
21	339				71	17		
22	95				72	16		
23	60				73	31		
24	328				74	26		
25	355				75	20		
26	310				76	F		
27	444				77	277		
28	492				78	168		
29	270				79	280		
30	530	0			80	68	0.25	
31	300				81	200		
32	222				82	220		
33	260				83	136		
34	370				84	121		
35	26				85	80		
36	40				86	45		
37	42				87	191		
38	45				88	170		
39	36				89	570		
40	35	0.25			90	130	0.75	
41	65				91	22		
42	73				92	25		
43	52				93	30		
44	55				94	36		
45	73				95	40		
46	80				96	F		
47	72				97	35		
48	421				98	142		
49	255				99	190		
50	180	0			100	34	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 12-Aug-14	
Site: ALE9							HU#: 22	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	91				51	137		
2	91				52	164		
3	76				53	389		
4	84				54	68		
5	115				55	33		
6	40				56	102		
7	89				57	126		
8	75				58	120		
9	60				59	44		
10	215	0			60	46	0	
11	80				61	80		
12	75				62	65		
13	80				63	137		
14	87				64	111		
15	70				65	142		
16	55				66	197		
17	65				67	186		
18	100				68	151		
19	72				69	62		
20	60	0			70	170	0	
21	80				71	211		
22	70				72	187		
23	98				73	96		
24	84				74	134		
25	100				75	139		
26	130				76	140		
27	160				77	123		
28	121				78	218		
29	55				79	42		
30	99	0			80	45	0	
31	50				81	80		
32	42				82	186		
33	136				83	200		
34	161				84	147		
35	170				85	265		
36	90				86	170		
37	72				87	76		
38	47				88	90		
39	68				89	141		
40	16	0			90	192	0	
41	82				91	80		
42	60				92	150		
43	111				93	123		
44	136				94	76		
45	82				95	211		
46	49				96	170		
47	40				97	352		
48	86				98	168		
49	232				99	250		
50	100	0			100	61	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek		Habitat type:	Cascade		Date: 12-Aug-14			
Site: ALE9					HU#: 23			
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	335				51	122		
2	34				52	64		
3	176				53	17		
4	52				54	85		
5	64				55	36		
6	71				56	140		
7	44				57	144		
8	65				58	244		
9	470				59	564		
10	370	0.5			60	200	0	
11	42				61	440		
12	80				62	181		
13	55				63	153		
14	40				64	147		
15	35				65	75		
16	366				66	42		
17	72				67	48		
18	41				68	36		
19	37				69	33		
20	681	0			70	55	0	
21	152				71	67		
22	62				72	73		
23	F				73	55		
24	28				74	92		
25	230				75	100		
26	157				76	38		
27	109				77	45		
28	211				78	48		
29	281				79	35		
30	199	0			80	39	0.25	
31	98				81	211		
32	158				82	53		
33	43				83	72		
34	77				84	61		
35	102				85	111		
36	64				86	113		
37	99				87	123		
38	350				88	245		
39	38				89	206		
40	374	0			90	41	0	
41	35				91	36		
42	111				92	37		
43	104				93	260		
44	92				94	291		
45	213				95	157		
46	128				96	148		
47	30				97	73		
48	33				98	178		
49	248				99	199		
50	71	0.25			100	71	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Glide			Date: 12-Aug-14	
Site: ALE9							HU#: 24	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	F				51	F		
2	F				52	F		
3	F				53	F		
4	F				54	F		
5	F				55	F		
6	F				56	F		
7	F				57	F		
8	F				58	F		
9	F				59	F		
10	F	1			60	F	1	
11	F				61	F		
12	F				62	F		
13	F				63	F		
14	F				64	F		
15	F				65	F		
16	F				66	F		
17	F				67	F		
18	F				68	F		
19	F				69	F		
20	F	1			70	F	1	
21	F				71	F		
22	F				72	F		
23	F				73	F		
24	F				74	F		
25	F				75	F		
26	F				76	F		
27	F				77	F		
28	F				78	F		
29	F				79	F		
30	F	1			80	F	1	
31	F				81	1000		
32	F				82	800		
33	F				83	463		
34	F				84	184		
35	F				85	43		
36	F				86	45		
37	F				87	40		
38	F				88	67		
39	F				89	25		
40	F	1			90	42	0.5	
41	F				91	32		
42	F				92	340		
43	F				93	246		
44	F				94	438		
45	F				95	350		
46	F				96	264		
47	F				97	560		
48	F				98	98		
49	F				99	82		
50	F	1			100	50	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-14	
Site: ALE9							HU#: 25	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	1050				51	200		
2	250				52	184		
3	357				53	232		
4	255				54	60		
5	192				55	32		
6	104				56	40		
7	36				57	37		
8	14				58	45		
9	41				59	90		
10	65	0			60	80	0	
11	12				61	36		
12	36				62	32		
13	180				63	45		
14	287				64	91		
15	244				65	34		
16	172				66	63		
17	255				67	90		
18	76				68	192		
19	111				69	135		
20	87	0.5			70	114	0	
21	115				71	111		
22	154				72	130		
23	137				73	252		
24	290				74	240		
25	156				75	79		
26	100				76	501		
27	37				77	146		
28	82				78	111		
29	76				79	104		
30	45	0			80	67	0.25	
31	65				81	117		
32	81				82	85		
33	122				83	144		
34	200				84	398		
35	211				85	296		
36	164				86	48		
37	311				87	97		
38	F				88	122		
39	500				89	125		
40	92	0			90	289	0	
41	214				91	415		
42	36				92	308		
43	182				93	235		
44	45				94	128		
45	39				95	78		
46	170				96	65		
47	46				97	102		
48	49				98	153		
49	52				99	200		
50	90	0			100	65	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek		Habitat type:	Glide		Date: 12-Aug-14		
Site: ALE9					HU#: 26		
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	479			51	60		
2	387			52	F		
3	671			53	89		
4	322			54	104		
5	154			55	231		
6	90			56	104		
7	97			57	76		
8	228			58	59		
9	180			59	99		
10	170	0		60	46	0	
11	176			61	150		
12	132			62	86		
13	115			63	78		
14	123			64	50		
15	134			65	89		
16	200			66	64		
17	90			67	80		
18	81			68	49		
19	45			69	55		
20	70	0		70	34	0.75	
21	75			71	30		
22	497			72	30		
23	300			73	78		
24	226			74	59		
25	310			75	48		
26	52			76	62		
27	63			77	359		
28	28			78	98		
29	42			79	114		
30	59	0		80	89	0	
31	70			81	399		
32	571			82	198		
33	260			83	58		
34	30			84	72		
35	39			85	55		
36	45			86	40		
37	60			87	49		
38	78			88	56		
39	70			89	30		
40	115	0		90	25	0	
41	124			91	68		
42	238			92	35		
43	60			93	50		
44	72			94	49		
45	270			95	70		
46	133			96	12		
47	94			97	190		
48	180			98	128		
49	32			99	30		
50	110	0.25		100	47	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-14	
Site: ALE9							HU#: 27	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	125				51	38		
2	213				52	136		
3	151				53	165		
4	100				54	100		
5	162				55	138		
6	159				56	185		
7	104				57	154		
8	182				58	210		
9	139				59	277		
10	85	0			60	300	0.2	
11	456				61	80		
12	151				62	30		
13	249				63	99		
14	140				64	133		
15	92				65	40		
16	92				66	78		
17	156				67	135		
18	130				68	50		
19	534				69	60		
20	215	0			70	113	0.25	
21	630				71	142		
22	128				72	187		
23	133				73	F		
24	92				74	400		
25	200				75	166		
26	124				76	155		
27	108				77	111		
28	173				78	80		
29	256				79	80		
30	509	0.25			80	91	0	
31	215				81	82		
32	51				82	100		
33	40				83	84		
34	55				84	300		
35	340				85	125		
36	390				86	132		
37	422				87	144		
38	F				88	198		
39	10				89	106		
40	300	0.25			90	182	0	
41	174				91	85		
42	184				92	70		
43	160				93	72		
44	F				94	90		
45	122				95	84		
46	134				96	191		
47	78				97	52		
48	45				98	46		
49	62				99	35		
50	43	0			100	40	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle		Date: 12-Aug-14	
Site: ALE9						HU#: 28	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	28			51	48		
2	490			52	120		
3	140			53	60		
4	43			54	92		
5	200			55	198		
6	155			56	159		
7	147			57	170		
8	48			58	134		
9	96			59	228		
10	128	0.25		60	90	0	
11	45			61	70		
12	672			62	65		
13	850			63	66		
14	322			64	81		
15	286			65	73		
16	355			66	75		
17	400			67	40		
18	35			68	132		
19	170			69	128		
20	362	0.5		70	100	0	
21	40			71	156		
22	40			72	182		
23	20			73	238		
24	10			74	140		
25	15			75	80		
26	17			76	52		
27	20			77	60		
28	24			78	65		
29	F			79	70		
30	280	0		80	81	0	
31	320			81	92		
32	68			82	100		
33	200			83	54		
34	399			84	37		
35	50			85	45		
36	55			86	80		
37	45			87	112		
38	47			88	200		
39	274			89	375		
40	310	0.25		90	360	0	
41	70			91	312		
42	52			92	225		
43	30			93	200		
44	32			94	78		
45	47			95	111		
46	49			96	164		
47	114			97	240		
48	115			98	200		
49	76			99	960		
50	120	0		100	71	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 29	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	111				51	301		
2	94				52	115		
3	60				53	85		
4	135				54	65		
5	55				55	60		
6	200				56	266		
7	84				57	30		
8	445				58	37		
9	600				59	42		
10	245	0			60	48	0	
11	300				61	266		
12	322				62	241		
13	F				63	340		
14	90				64	200		
15	78				65	133		
16	62				66	36		
17	75				67	30		
18	94				68	20		
19	50				69	41		
20	60	0			70	22	0	
21	40				71	50		
22	39				72	302		
23	35				73	128		
24	90				74	72		
25	80				75	222		
26	F				76	234		
27	49				77	70		
28	60				78	35		
29	46				79	56		
30	40	0			80	120	0.5	
31	45				81	458		
32	65				82	263		
33	253				83	140		
34	1009				84	73		
35	328				85	176		
36	526				86	331		
37	470				87	280		
38	672				88	92		
39	800				89	45		
40	240	0			90	26	0	
41	455				91	34		
42	720				92	61		
43	843				93	38		
44	1523				94	167		
45	278				95	180		
46	346				96	255		
47	168				97	128		
48	200				98	57		
49	110				99	125		
50	397	0			100	65	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 12-Aug-16	
Site: ALE9							HU#: 30	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	215				51	108		
2	97				52	95		
3	265				53	73		
4	300				54	234		
5	40				55	170		
6	60				56	214		
7	85				57	105		
8	142				58	43		
9	57				59	39		
10	80	0			60	60	0	
11	50				61	87		
12	83				62	152		
13	43				63	20		
14	31				64	118		
15	45				65	106		
16	40				66	165		
17	100				67	153		
18	113				68	451		
19	123				69	218		
20	190	0.5			70	270	0	
21	87				71	75		
22	146				72	300		
23	121				73	122		
24	302				74	146		
25	208				75	58		
26	238				76	69		
27	106				77	72		
28	120				78	36		
29	120				79	98		
30	167	0.25			80	65	0.25	
31	105				81	51		
32	62				82	F		
33	55				83	190		
34	F				84	124		
35	57				85	96		
36	95				86	72		
37	98				87	148		
38	96				88	78		
39	49				89	65		
40	145	0.5			90	80	0.25	
41	235				91	195		
42	123				92	75		
43	75				93	80		
44	60				94	96		
45	36				95	90		
46	45				96	104		
47	40				97	79		
48	57				98	95		
49	100				99	36		
50	172	0.25			100	105	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Glide			Date: 12-Aug-16	
Site: ALE9							HU#: 31	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	148				51	164		
2	80				52	155		
3	283				53	57		
4	124				54	193		
5	170				55	90		
6	F				56	83		
7	45				57	35		
8	178				58	30		
9	221				59	28		
10	210	0			60	29	0	
11	181				61	743		
12	62				62	170		
13	290				63	252		
14	143				64	241		
15	140				65	36		
16	456				66	81		
17	192				67	100		
18	197				68	82		
19	143				69	64		
20	189	0			70	50	0	
21	164				71	70		
22	178				72	139		
23	62				73	42		
24	35				74	115		
25	41				75	242		
26	119				76	F		
27	356				77	F		
28	162				78	45		
29	F				79	26		
30	400	0			80	25	0	
31	270				81	30		
32	378				82	20		
33	200				83	21		
34	283				84	13		
35	373				85	325		
36	341				86	64		
37	82				87	108		
38	164				88	47		
39	52				89	78		
40	35	0			90	53	0.25	
41	351				91	27		
42	362				92	70		
43	415				93	45		
44	231				94	36		
45	F				95	15		
46	12				96	191		
47	15				97	217		
48	16				98	124		
49	20				99	76		
50	45	0.5			100	108	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: +A1926:I1982Alexander Creek			Habitat type:	Pool			Date: 12-Aug-16	
Site: ALE9							HU#: 32	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	R				51	F		
2	R				52	F		
3	R				53	F		
4	R				54	F		
5	R				55	F		
6	R				56	235		
7	R				57	160		
8	R				58	193		
9	R				59	164		
10	R	0			60	345	0.5	
11	R				61	280		
12	R				62	243		
13	R				63	71		
14	R				64	93		
15	R				65	100		
16	R				66	222		
17	R				67	194		
18	R				68	121		
19	R				69	300		
20	R	0			70	92	0	
21	R				71	97		
22	R				72	114		
23	R				73	251		
24	R				74	330		
25	R				75	172		
26	R				76	141		
27	R				77	205		
28	R				78	122		
29	R				79	115		
30	R	0			80	161	0	
31	R				81	73		
32	R				82	31		
33	R				83	35		
34	R				84	103		
35	R				85	71		
36	R				86	65		
37	R				87	93		
38	R				88	51		
39	R				89	42		
40	R	0			90	107	0	
41	R				91	86		
42	R				92	135		
43	R				93	220		
44	R				94	140		
45	R				95	335		
46	R				96	216		
47	R				97	71		
48	R				98	45		
49	R				99	37		
50	R	0			100	99	0	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0								

Stream: +A1926:I1982Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 33	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	490				51	231		
2	280				52	93		
3	129				53	335		
4	294				54	431		
5	183				55	133		
6	225				56	85		
7	100				57	76		
8	145				58	100		
9	301				59	162		
10	179	0			60	140	0	
11	178				61	241		
12	115				62	67		
13	247				63	55		
14	164				64	78		
15	380				65	152		
16	114				66	225		
17	295				67	347		
18	77				68	186		
19	111				69	111		
20	133	0			70	210	0	
21	271				71	172		
22	246				72	105		
23	173				73	285		
24	27				74	248		
25	19				75	152		
26	33				76	39		
27	49				77	19		
28	26				78	31		
29	310				79	210		
30	169	0			80	108	0.25	
31	161				81	F		
32	73				82	21		
33	174				83	13		
34	143				84	255		
35	161				85	164		
36	100				86	178		
37	132				87	210		
38	94				88	243		
39	75				89	135		
40	53	0			90	80	0	
41	67				91	46		
42	44				92	43		
43	80				93	67		
44	90				94	70		
45	65				95	133		
46	59				96	50		
47	222				97	156		
48	190				98	255		
49	359				99	247		
50	90	0			100	82	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Glide			Date: 12Aug-16	
Site: ALE9							HU#: 34	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	490				51	111		
2	240				52	69		
3	F				53	24		
4	30				54	43		
5	21				55	45		
6	23				56	280		
7	17				57	235		
8	19				58	354		
9	534				59	200		
10	444	0.5			60	500	0	
11	990				61	392		
12	133				62	F		
13	64				63	185		
14	97				64	221		
15	35				65	10		
16	49				66	5		
17	75				67	F		
18	F				68	130		
19	80				69	104		
20	172	0.25			70	133	0	
21	221				71	100		
22	271				72	67		
23	F				73	54		
24	F				74	40		
25	225				75	81		
26	46				76	143		
27	67				77	130		
28	51				78	F		
29	70				79	F		
30	70	0.5			80	280	0	
31	300				81	105		
32	265				82	92		
33	734				83	60		
34	555				84	36		
35	F				85	24		
36	F				86	24		
37	304				87	35		
38	78				88	91		
39	40				89	60		
40	F	1			90	40	0	
41	56				91	190		
42	40				92	93		
43	170				93	89		
44	220				94	30		
45	222				95	31		
46	F				96	26		
47	F				97	21		
48	F				98	260		
49	62				99	320		
50	40	0			100	319	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 35	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	155				51	91		
2	132				52	78		
3	115				53	90		
4	194				54	46		
5	F				55	132		
6	42				56	765		
7	35				57	6		
8	222				58	65		
9	125				59	94		
10	86	0			60	62	0	
11	65				61	63		
12	47				62	190		
13	98				63	F		
14	45				64	34		
15	42				65	61		
16	370				66	23		
17	281				67	31		
18	142				68	405		
19	480				69	38		
20	193	0			70	753	0	
21	135				71	86		
22	100				72	111		
23	F				73	43		
24	62				74	35		
25	60				75	42		
26	200				76	610		
27	151				77	453		
28	192				78	37		
29	71				79	70		
30	170	0.25			80	310	0.25	
31	113				81	54		
32	74				82	60		
33	63				83	615		
34	100				84	12		
35	65				85	425		
36	574				86	133		
37	105				87	137		
38	350				88	75		
39	142				89	83		
40	136	0.25			90	7	0	
41	55				91	142		
42	50				92	18		
43	62				93	420		
44	17				94	5		
45	284				95	290		
46	915				96	F		
47	105				97	62		
48	107				98	30		
49	60				99	353		
50	41	0			100	36	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 12-Aug-16	
Site: ALE9							HU#: 36	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	171				51	36		
2	113				52	40		
3	69				53	75		
4	745				54	71		
5	161				55	76		
6	92				56	156		
7	108				57	49		
8	315				58	111		
9	213				59	145		
10	170	0.25			60	92	0	
11	109				61	210		
12	84				62	51		
13	63				63	47		
14	125				64	67		
15	57				65	50		
16	153				66	90		
17	83				67	400		
18	362				68	222		
19	213				69	170		
20	170	0			70	230	0	
21	F				71	71		
22	F				72	81		
23	289				73	75		
24	120				74	123		
25	77				75	108		
26	411				76	42		
27	200				77	111		
28	240				78	240		
29	113				79	45		
30	90	0.75			80	36	0	
31	552				81	142		
32	57				82	399		
33	111				83	50		
34	152				84	86		
35	11				85	85		
36	18				86	85		
37	30				87	92		
38	34				88	53		
39	F				89	76		
40	28	0			90	F	1	
41	31				91	221		
42	10				92	46		
43	2				93	71		
44	70				94	305		
45	36				95	110		
46	78				96	430		
47	300				97	39		
48	F				98	85		
49	69				99	61		
50	105	0.75			100	55	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 37	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	440				51	75		
2	506				52	390		
3	546				53	181		
4	90				54	122		
5	479				55	115		
6	79				56	175		
7	49				57	62		
8	155				58	36		
9	270				59	375		
10	273	0.5			60	22	0	
11	235				61	F		
12	62				62	40		
13	100				63	195		
14	353				64	25		
15	90				65	284		
16	80				66	310		
17	85				67	126		
18	75				68	107		
19	302				69	194		
20	143	0			70	350	0	
21	293				71	423		
22	124				72	90		
23	253				73	63		
24	225				74	642		
25	95				75	99		
26	200				76	33		
27	79				77	30		
28	40				78	36		
29	130				79	175		
30	75	0.25			80	121	0.75	
31	223				81	415		
32	55				82	210		
33	200				83	215		
34	64				84	121		
35	141				85	143		
36	142				86	F		
37	112				87	121		
38	304				88	72		
39	263				89	71		
40	90	0			90	62	1	
41	154				91	59		
42	82				92	70		
43	245				93	119		
44	51				94	243		
45	261				95	141		
46	85				96	198		
47	220				97	45		
48	100				98	5		
49	56				99	4		
50	75	0			100	80	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 12-Aug-16	
Site: ALE9							HU#: 38	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	92				51	F		
2	107				52	F		
3	41				53	41		
4	143				54	F		
5	892				55	67		
6	132				56	165		
7	180				57	387		
8	184				58	407		
9	229				59	77		
10	260	0.5			60	217	0	
11	43				61	145		
12	107				62	256		
13	11				63	F		
14	98				64	1016		
15	64				65	F		
16	83				66	F		
17	44				67	293		
18	46				68	218		
19	91				69	242		
20	105	0.5			70	111	0	
21	245				71	193		
22	110				72	12		
23	91				73	272		
24	421				74	298		
25	460				75	109		
26	86				76	276		
27	506				77	122		
28	501				78	96		
29	183				79	192		
30	138	0.25			80	163	0	
31	280				81	81		
32	110				82	125		
33	33				83	163		
34	36				84	72		
35	40				85	116		
36	51				86	136		
37	285				87	143		
38	170				88	52		
39	45				89	11		
40	30	0			90	29	0	
41	609				91	17		
42	260				92	161		
43	105				93	31		
44	333				94	31		
45	417				95	47		
46	48				96	56		
47	32				97	1132		
48	65				98	55		
49	638				99	230		
50	122	0			100	220	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 12-Aug-16	
Site: ALE9							HU#: 38	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	92				51	F		
2	107				52	F		
3	41				53	41		
4	443				54	F		
5	892				55	67		
6	132				56	165		
7	180				57	387		
8	184				58	407		
9	229				59	73		
10	260	0.5			60	217	0	
11	43				61	145		
12	107				62	256		
13	11				63	F		
14	98				64	1016		
15	64				65	F		
16	83				66	F		
17	44				67	293		
18	46				68	218		
19	91				69	242		
20	105	0.5			70	111	0	
21	245				71	193		
22	110				72	12		
23	91				73	272		
24	421				74	298		
25	460				75	109		
26	86				76	276		
27	505				77	122		
28	501				78	96		
29	183				79	192		
30	138	0.25			80	163	0	
31	280				81	81		
32	110				82	125		
33	33				83	163		
34	36				84	72		
35	40				85	116		
36	51				86	136		
37	385				87	143		
38	170				88	52		
39	45				89	11		
40	30	0			90	29	0	
41	609				91	17		
42	260				92	161		
43	105				93	31		
44	333				94	31		
45	417				95	47		
46	48				96	56		
47	32				97	1132		
48	65				98	55		
49	638				99	230		
50	122	0			100	220	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 39	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	223				51	F		
2	171				52	52		
3	275				53	70		
4	125				54	F		
5	183				55	55		
6	140				56	57		
7	121				57	294		
8	215				58	553		
9	380				59	607		
10	345	0			60	350	0.25	
11	360				61	181		
12	151				62	510		
13	F				63	102		
14	F				64	32		
15	F				65	37		
16	111				66	55		
17	124				67	40		
18	233				68	37		
19	410				69	49		
20	389	0.5			70	193	0	
21	330				71	126		
22	560				72	307		
23	150				73	423		
24	231				74	91		
25	26				75	123		
26	531				76	100		
27	142				77	63		
28	327				78	94		
29	111				79	181		
30	71	0			80	135	0	
31	70				81	272		
32	23				82	104		
33	10				83	54		
34	24				84	40		
35	20				85	88		
36	12				86	111		
37	6				87	80		
38	5				88	55		
39	7				89	70		
40	5	0			90	45	0	
41	3				91	54		
42	9				92	85		
43	10				93	220		
44	4				94	214		
45	3				95	113		
46	3				96	180		
47	144				97	110		
48	119				98	394		
49	112				99	39		
50	54	0			100	45	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Glide		Date: 12-Aug-16	
Site: ALE9						HU#: 40	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	182			51	76		
2	191			52	311		
3	130			53	248		
4	249			54	244		
5	718			55	44		
6	175			56	296		
7	34			57	583		
8	45			58	F		
9	16			59	319		
10	98	0		60	136	0.5	
11	155			61	51		
12	56			62	54		
13	31			63	55		
14	36			64	88		
15	195			65	210		
16	172			66	227		
17	307			67	F		
18	32			68	95		
19	24			69	366		
20	37	0		70	134	0.75	
21	44			71	170		
22	421			72	218		
23	34			73	107		
24	287			74	273		
25	240			75	229		
26	193			76	R		
27	257			77	R		
28	17			78	114		
29	283			79	R		
30	213	0.25		80	R	0	
31	195			81	R		
32	41			82	R		
33	70			83	101		
34	78			84	343		
35	187			85	F		
36	172			86	251		
37	26			87	112		
38	47			88	322		
39	45			89	192		
40	41	0		90	420	0.25	
41	201			91	210		
42	132			92	83		
43	116			93	211		
44	93			94	282		
45	112			95	146		
46	69			96	F		
47	53			97	F		
48	14			98	208		
49	28			99	131		
50	35	0.5		100	105	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 41	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	500				51	290		
2	610				52	132		
3	171				53	44		
4	142				54	38		
5	183				55	53		
6	114				56	142		
7	122				57	228		
8	281				58	200		
9	423				59	307		
10	340	0.75			60	93	0	
11	343				61	F		
12	90				62	71		
13	F				63	56		
14	35				64	61		
15	44				65	31		
16	132				66	28		
17	230				67	17		
18	F				68	33		
19	F				69	10		
20	210	0			70	30	0	
21	120				71	44		
22	85				72	220		
23	61				73	261		
24	194				74	167		
25	207				75	143		
26	260				76	49		
27	184				77	10		
28	573				78	10		
29	131				79	10		
30	91	0			80	10	0	
31	80				81	7		
32	100				82	6		
33	52				83	7		
34	101				84	8		
35	44				85	6		
36	47				86	6		
37	78				87	10		
38	95				88	4		
39	221				89	4		
40	335	0.25			90	5	0	
41	464				91	4		
42	173				92	3		
43	88				93	231		
44	40				94	44		
45	52				95	36		
46	F				96	72		
47	146				97	45		
48	373				98	38		
49	245				99	183		
50	272	0			100	10	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek		Habitat type:				Date: 12-Aug-16	
Site: ALE9						HU#: 42	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	351				51	611		
2	456				52	242		
3	272				53	210		
4	295				54	329		
5	143				55	368		
6	205				56	281		
7	116				57	49		
8	95				58	95		
9	98				59	6		
10	140	0.75			60	110	0.75	
11	152				61	108		
12	272				62	44		
13	133				63	116		
14	173				64	141		
15	215				65	50		
16	424				66	153		
17	180				67	301		
18	285				68	F		
19	621				69	F		
20	172	0.25			70	18	0	
21	373				71	16		
22	41				72	20		
23	172				73	51		
24	266				74	128		
25	142				75	235		
26	468				76	242		
27	176				77	111		
28	100				78	416		
29	44				79	44		
30	373	0.5			80	251	0.5	
31	65				81	292		
32	47				82	53		
33	172				83	121		
34	155				84	52		
35	230				85	135		
36	350				86	182		
37	168				87	76		
38	210				88	51		
39	232				89	78		
40	198	0.5			90	70		
41	104				91	21		
42	143				92	48		
43	129				93	54		
44	48				94	120		
45	31				95	99		
46	15				96	43		
47	18				97	90		
48	19				98	121		
49	10				99	252		
50	163	0.5			100	380	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 43	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	321				51	190		
2	333				52	88		
3	390				53	93		
4	191				54	90		
5	430				55	123		
6	201				56	102		
7	440				57	F		
8	190				58	F		
9	100				59	165		
10	160	0.25			60	65	0.25	
11	339				61	164		
12	101				62	286		
13	88				63	330		
14	55				64	110		
15	73				65	124		
16	123				66	56		
17	140				67	28		
18	142				68	30		
19	471				69	22		
20	335	0.75			70	35	0	
21	130				71	39		
22	135				72	60		
23	156				73	65		
24	270				74	38		
25	353				75	130		
26	138				76	140		
27	129				77	107		
28	363				78	163		
29	350				79	132		
30	341	0.25			80	90	0	
31	150				81	27		
32	312				82	31		
33	163				83	24		
34	270				84	35		
35	501				85	40		
36	44				86	60		
37	160				87	28		
38	F				88	23		
39	F				89	146		
40	180	0.5			90	126	0	
41	F				91	62		
42	110				92	80		
43	234				93	111		
44	125				94	194		
45	90				95	100		
46	132				96	71		
47	290				97	60		
48	225				98	66		
49	174				99	64		
50	250	0.5			100	31	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 44	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	260				51	220		
2	271				52	411		
3	283				53	155		
4	214				54	131		
5	344				55	66		
6	222				56	52		
7	373				57	24		
8	156				58	16		
9	231				59	11		
10	199	0			60	11	0	
11	132				61	15		
12	66				62	9		
13	52				63	14		
14	89				64	9		
15	70				65	6		
16	51				66	7		
17	39				67	11		
18	91				68	7		
19	240				69	6		
20	170	0.25			70	5	0	
21	262				71	5		
22	239				72	5		
23	88				73	8		
24	281				74	5		
25	142				75	14		
26	120				76	9		
27	154				77	6		
28	88				78	3		
29	86				79	123		
30	85	0.25			80	90	0	
31	60				81	330		
32	10				82	241		
33	41				83	183		
34	39				84	127		
35	54				85	72		
36	81				86	64		
37	55				87	66		
38	25				88	98		
39	150				89	61		
40	122	0			90	43	0.25	
41	190				91	42		
42	54				92	38		
43	53				93	76		
44	F				94	107		
45	F				95	73		
46	F				96	55		
47	75				97	48		
48	200				98	24		
49	375				99	34		
50	251	0			100	10	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Glide			Date: 12-Aug-16	
Site: ALE9							HU#: 45	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	285				51	168		
2	221				52	172		
3	248				53	242		
4	97				54	143		
5	118				55	44		
6	76				56	95		
7	111				57	176		
8	88				58	15		
9	133				59	205		
10	146	0			60	101	0	
11	357				61	111		
12	298				62	222		
13	405				63	44		
14	152				64	553		
15	315				65	371		
16	235				66	180		
17	355				67	343		
18	313				68	114		
19	224				69	154		
20	270	0			70	118	0.25	
21	233				71	208		
22	291				72	95		
23	343				73	81		
24	417				74	310		
25	F				75	236		
26	F				76	26		
27	61				77	302		
28	105				78	314		
29	74				79	134		
30	205	0			80	30		
31	233				81	25		
32	404				82	211		
33	240				83	149		
34	165				84	10		
35	206				85	12		
36	207				86	114		
37	115				87	48		
38	14				88	16		
39	11				89	11		
40	174	0.5			90	24	0	
41	201				91	10		
42	375				92	8		
43	261				93	99		
44	16				94	10		
45	F				95	191		
46	587				96	121		
47	190				97	253		
48	130				98	282		
49	128				99	124		
50	317	0.5			100	93	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 11-Aug-16	
Site: ALE9							HU#: 46	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	126				51	132		
2	74				52	51		
3	135				53	194		
4	289				54	205		
5	248				55	480		
6	168				56	426		
7	95				57	403		
8	101				58	182		
9	113				59	205		
10	121	0.25			60	225	0.25	
11	171				61	196		
12	173				62	295		
13	136				63	257		
14	11				64	604		
15	10				65	208		
16	261				66	110		
17	201				67	343		
18	323				68	225		
19	116				69	216		
20	278	0.5			70	571	0.5	
21	12				71	210		
22	106				72	100		
23	F				73	51		
24	F				74	214		
25	F				75	26		
26	372				76	34		
27	90				77	20		
28	143				78	F		
29	231				79	F		
30	300	0			80	F	1	
31	183				81	43		
32	185				82	6		
33	94				83	8		
34	132				84	19		
35	118				85	44		
36	173				86	20		
37	360				87	51		
38	64				88	47		
39	118				89	43		
40	105	0			90	75	0.75	
41	104				91	161		
42	280				92	19		
43	55				93	F		
44	89				94	27		
45	74				95	315		
46	53				96	304		
47	95				97	109		
48	223				98	140		
49	82				99	188		
50	181	0.25			100	195	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 47	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	443				51	50		
2	172				52	12		
3	480				53	15		
4	210				54	132		
5	201				55	24		
6	122				56	82		
7	251				57	156		
8	190				58	60		
9	52				59	80		
10	57	0.25			60	65	0	
11	155				61	194		
12	68				62	233		
13	445				63	F		
14	530				64	180		
15	203				65	108		
16	170				66	80		
17	144				67	83		
18	67				68	150		
19	120				69	560		
20	130	0			70	100	0	
21	132				71	173		
22	95				72	70		
23	100				73	64		
24	27				74	65		
25	112				75	71		
26	11				76	37		
27	72				77	70		
28	F				78	162		
29	90				79	90		
30	100	0.25			80	111	0.25	
31	F				81	70		
32	66				82	93		
33	211				83	101		
34	R				84	145		
35	R				85	128		
36	R				86	112		
37	R				87	78		
38	R				88	14		
39	R				89	53		
40	310	0			90	23	0	
41	R				91	11		
42	R				92	10		
43	R				93	17		
44	R				94	6		
45	200				95	4		
46	107				96	26		
47	71				97	42		
48	80				98	71		
49	60				99	112		
50	101	0			100	52	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Glide			Date: 12-Aug-16	
Site: ALE9							HU#: 48	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	318				51	194		
2	298				52	211		
3	218				53	122		
4	336				54	12		
5	43				55	275		
6	134				56	71		
7	176				57	87		
8	240				58	206		
9	275				59	78		
10	250	0.25			60	116		
11	257				61	F		
12	235				62	F		
13	137				63	17		
14	83				64	13		
15	71				65	14		
16	72				66	13		
17	111				67	21		
18	113				68	10		
19	96				69	10		
20	150	0			70	F	1	
21	66				71	F		
22	F				72	9		
23	11				73	332		
24	15				74	14		
25	11				75	66		
26	15				76	271		
27	14				77	14		
28	137				78	186		
29	292				79	186		
30	268	0			80	181	0	
31	12				81	100		
32	204				82	134		
33	142				83	171		
34	276				84	157		
35	98				85	99		
36	88				86	338		
37	82				87	381		
38	76				88	84		
39	57				89	190		
40	65	0			90	101	0	
41	134				91	128		
42	113				92	98		
43	142				93	40		
44	146				94	16		
45	350				95	28		
46	310				96	124		
47	168				97	28		
48	199				98	26		
49	281				99	23		
50	253	0.25			100	44	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 49	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	F				51	206		
2	F				52	44		
3	F				53	58		
4	F				54	F		
5	F				55	14		
6	17				56	20		
7	45				57	10		
8	11				58	21		
9	23				59	95		
10	9	0			60	46	0	
11	5				61	72		
12	4				62	110		
13	4				63	48		
14	250				64	11		
15	121				65	41		
16	273				66	173		
17	74				67	77		
18	110				68	58		
19	114				69	198		
20	35	0			70	132	0	
21	40				71	170		
22	40				72	409		
23	383				73	291		
24	155				74	363		
25	371				75	214		
26	383				76	194		
27	152				77	35		
28	235				78	38		
29	188				79	22		
30	360	0			80	14	0	
31	270				81	10		
32	171				82	6		
33	300				83	12		
34	205				84	5		
35	143				85	3		
36	234				86	5		
37	230				87	4		
38	251				88	214		
39	378				89	98		
40	16	0			90	63	0.75	
41	15				91	80		
42	12				92	77		
43	28				93	65		
44	10				94	F		
45	27				95	29		
46	15				96	15		
47	359				97	30		
48	511				98	21		
49	172				99	11		
50	170	0			100	12	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 12-Aug-16	
Site: ALE9							HU#: 50	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	373				51	F		
2	174				52	81		
3	334				53	194		
4	481				54	223		
5	576				55	300		
6	153				56	66		
7	228				57	105		
8	341				58	67		
9	301				59	408		
10	72	0			60	344	0	
11	F				61	98		
12	F				62	91		
13	F				63	426		
14	F				64	21		
15	F				65	15		
16	F				66	41		
17	162				67	11		
18	85				68	62		
19	34				69	14		
20	131	0.25			70	9	0	
21	78				71	26		
22	195				72	14		
23	311				73	11		
24	236				74	14		
25	241				75	201		
26	215				76	23		
27	522				77	77		
28	21				78	18		
29	15				79	16		
30	16	0.5			80	91	0	
31	11				81	313		
32	15				82	49		
33	19				83	241		
34	15				84	362		
35	269				85	158		
36	307				86	287		
37	393				87	42		
38	22				88	F		
39	23				89	F		
40	20	0			90	43	0.25	
41	16				91	71		
42	10				92	45		
43	14				93	11		
44	11				94	20		
45	280				95	8		
46	288				96	10		
47	174				97	5		
48	78				98	6		
49	F				99	151		
50	F	1			100	106	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 51	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	F				51	9		
2	233				52	8		
3	210				53	4		
4	161				54	4		
5	322				55	6		
6	111				56	3		
7	79				57	4		
8	56				58	155		
9	133				59	206		
10	290	0.75			60	80	0.25	
11	66				61	533		
12	42				62	178		
13	46				63	142		
14	28				64	153		
15	15				65	142		
16	11				66	100		
17	32				67	154		
18	10				68	106		
19	14				69	F		
20	8	0			70	45	0	
21	5				71	33		
22	3				72	15		
23	3				73	14		
24	250				74	12		
25	187				75	3		
26	108				76	5		
27	295				77	65		
28	283				78	30		
29	347				79	44		
30	421	0			80	10	0	
31	F				81	12		
32	F				82	12		
33	380				83	4		
34	F				84	26		
35	F				85	12		
36	23				86	142		
37	19				87	170		
38	28				88	244		
39	21				89	216		
40	70	0			90	120	0.75	
41	351				91	144		
42	122				92	45		
43	94				93	59		
44	43				94	35		
45	15				95	20		
46	20				96	49		
47	12				97	30		
48	15				98	256		
49	14				99	128		
50	10	0			100	10	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Glide			Date: 12-Aug-16	
Site: ALE9							HU#: 52	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	377				51	44		
2	482				52	24		
3	22				53	107		
4	94				54	20		
5	123				55	28		
6	702				56	23		
7	610				57	25		
8	211				58	27		
9	303				59	19		
10	176	0.5			60	90	0.25	
11	403				61	88		
12	248				62	68		
13	246				63	11		
14	273				64	17		
15	F				65	59		
16	F				66	294		
17	201				67	F		
18	872				68	30		
19	101				69	4		
20	40	0			70	24	0	
21	41				71	35		
22	45				72	134		
23	73				73	14		
24	115				74	F		
25	163				75	30		
26	411				76	58		
27	257				77	68		
28	280				78	155		
29	78				79	95		
30	347	0.5			80	87	0.5	
31	174				81	70		
32	279				82	15		
33	193				83	F		
34	418				84	26		
35	89				85	34		
36	38				86	73		
37	40				87	74		
38	31				88	17		
39	100				89	31		
40	76	0			90	110	0	
41	52				91	103		
42	121				92	10		
43	48				93	55		
44	25				94	5		
45	55				95	140		
46	10				96	11		
47	32				97	78		
48	76				98	203		
49	153				99	28		
50	F	1			100	22	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 53	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	210				51	7		
2	234				52	19		
3	200				53	11		
4	275				54	10		
5	55				55	141		
6	481				56	10		
7	74				57	9		
8	116				58	5		
9	161				59	103		
10	80	0			60	6	0	
11	182				61	5		
12	200				62	253		
13	283				63	372		
14	234				64	123		
15	215				65	207		
16	125				66	170		
17	103				67	R		
18	26				68	27		
19	82				69	65		
20	31	0			70	123	0.5	
21	30				71	76		
22	400				72	88		
23	36				73	F		
24	61				74	F		
25	92				75	13		
26	91				76	42		
27	67				77	91		
28	143				78	20		
29	55				79	123		
30	200	0			80	22	0	
31	54				81	16		
32	310				82	181		
33	303				83	13		
34	349				84	131		
35	53				85	164		
36	61				86	112		
37	69				87	468		
38	316				88	65		
39	214				89	258		
40	121	0			90	150	0.25	
41	410				91	151		
42	185				92	473		
43	82				93	175		
44	51				94	75		
45	20				95	196		
46	15				96	82		
47	13				97	195		
48	35				98	300		
49	15				99	363		
50	5	0			100	72	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 12-Aug-16
Site: ALE9							HU#: 54
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	168			51	F		
2	125			52	F		
3	92			53	165		
4	51			54	127		
5	20			55	F		
6	11			56	303		
7	31			57	35		
8	42			58	275		
9	367			59	59		
10	147	0.5		60	122	0	
11	100			61	95		
12	36			62	138		
13	211			63	191		
14	221			64	134		
15	143			65	469		
16	138			66	72		
17	139			67	15		
18	205			68	75		
19	105			69	182		
20	35	0		70	16	0.25	
21	400			71	133		
22	25			72	125		
23	20			73	108		
24	150			74	22		
25	10			75	23		
26	162			76	122		
27	211			77	75		
28	110			78	115		
29	136			79	38		
30	284	0.5		80	70	0.5	
31	650			81	80		
32	287			82	50		
33	118			83	55		
34	112			84	72		
35	188			85	152		
36	48			86	110		
37	260			87	100		
38	40			88	40		
39	68			89	68		
40	95	0		90	100	0.25	
41	30			91	200		
42	15			92	130		
43	15			93	207		
44	50			94	12		
45	121			95	7		
46	37			96	5		
47	72			97	F		
48	122			98	13		
49	151			99	113		
50	35	0		100	82	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 55	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	F				51	39		
2	F				52	175		
3	F				53	173		
4	233				54	54		
5	161				55	64		
6	100				56	253		
7	174				57	160		
8	173				58	93		
9	111				59	53		
10	40	0			60	351	0.25	
11	203				61	360		
12	143				62	105		
13	6				63	90		
14	35				64	52		
15	20				65	288		
16	23				66	62		
17	240				67	351		
18	211				68	310		
19	293				69	55		
20	284	0.75			70	93	0	
21	270				71	71		
22	15				72	40		
23	7				73	113		
24	5				74	384		
25	12				75	70		
26	298				76	325		
27	51				77	375		
28	30				78	12		
29	205				79	10		
30	221	0.25			80	10	0	
31	92				81	10		
32	83				82	50		
33	47				83	105		
34	55				84	12		
35	36				85	80		
36	330				86	52		
37	50				87	81		
38	105				88	450		
39	451				89	53		
40	92	0			90	355	0.5	
41	100				91	43		
42	153				92	263		
43	235				93	155		
44	256				94	140		
45	158				95	97		
46	141				96	F		
47	204				97	368		
48	471				98	75		
49	71				99	51		
50	214	0			100	301	0.75	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 12-Aug-16	
Site: ALE9							HU#: 56	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	160				51	158		
2	54				52	52		
3	110				53	105		
4	F				54	64		
5	F				55	60		
6	F				56	21		
7	41				57	F		
8	48				58	79		
9	141				59	30		
10	413	0.75			60	128	0	
11	54				61	10		
12	52				62	1056		
13	66				63	123		
14	153				64	12		
15	213				65	155		
16	61				66	5		
17	139				67	248		
18	49				68	50		
19	169				69	237		
20	27	0.5			70	65	0.5	
21	10				71	190		
22	112				72	151		
23	15				73	50		
24	90				74	98		
25	14				75	110		
26	183				76	35		
27	370				77	368		
28	191				78	131		
29	47				79	140		
30	40	0			80	128	0.25	
31	46				81	115		
32	39				82	55		
33	5				83	75		
34	58				84	30		
35	125				85	58		
36	24				86	80		
37	333				87	21		
38	23				88	458		
39	F				89	53		
40	840	0.75			90	105	0.75	
41	140				91	170		
42	35				92	135		
43	313				93	36		
44	40				94	130		
45	70				95	35		
46	151				96	95		
47	65				97	340		
48	F				98	155		
49	169				99	333		
50	40	0.5			100	112	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Glide			Date: 12-Aug-16	
Site: ALE9							HU#: 57	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	59				51	251		
2	53				52	218		
3	15				53	80		
4	105				54	56		
5	55				55	80		
6	163				56	330		
7	122				57	192		
8	535				58	F		
9	211				59	187		
10	235	0			60	105	0.25	
11	157				61	439		
12	206				62	99		
13	432				63	165		
14	163				64	281		
15	333				65	143		
16	103				66	80		
17	305				67	402		
18	101				68	134		
19	121				69	196		
20	135	0			70	355	0.5	
21	227				71	93		
22	112				72	310		
23	262				73	80		
24	130				74	335		
25	176				75	85		
26	312				76	685		
27	391				77	70		
28	201				78	76		
29	355				79	38		
30	88	0			80	30	0	
31	62				81	11		
32	40				82	15		
33	44				83	356		
34	F				84	279		
35	158				85	545		
36	355				86	802		
37	222				87	183		
38	210				88	131		
39	109				89	F		
40	155	0			90	34	0	
41	135				91	33		
42	330				92	25		
43	95				93	22		
44	44				94	16		
45	21				95	204		
46	43				96	243		
47	321				97	232		
48	78				98	31		
49	176				99	11		
50	115	0			100	35	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 58	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	629				51	505		
2	52				52	405		
3	20				53	40		
4	52				54	74		
5	221				55	30		
6	56				56	154		
7	545				57	90		
8	100				58	150		
9	146				59	92		
10	50	0			60	535	0.5	
11	20				61	75		
12	542				62	47		
13	37				63	76		
14	281				64	15		
15	300				65	52		
16	211				66	84		
17	62				67	70		
18	416				68	88		
19	230				69	65		
20	382	0.25			70	60	0	
21	137				71	18		
22	143				72	322		
23	29				73	207		
24	54				74	310		
25	59				75	315		
26	F				76	44		
27	220				77	501		
28	10				78	88		
29	248				79	25		
30	14	0			80	43	0	
31	63				81	30		
32	7				82	65		
33	532				83	F		
34	105				84	13		
35	55				85	30		
36	72				86	70		
37	310				87	182		
38	250				88	191		
39	2				89	23		
40	58	0			90	127	0	
41	40				91	37		
42	75				92	140		
43	16				93	158		
44	23				94	105		
45	15				95	128		
46	229				96	20		
47	85				97	19		
48	223				98	53		
49	140				99	24		
50	50	0			100	20	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek		Habitat type:	Riffle		Date: 12-Aug-16			
Site: ALE9					HU#: 59			
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	513				51	211		
2	533				52	51		
3	710				53	131		
4	45				54	78		
5	53				55	96		
6	185				56	205		
7	29				57	81		
8	283				58	F		
9	31				59	119		
10	21	0			60	142	0	
11	111				61	23		
12	155				62	77		
13	191				63	352		
14	F				64	119		
15	111				65	175		
16	R				66	213		
17	28				67	F		
18	28				68	68		
19	405				69	113		
20	203	0.25			70	95	0	
21	125				71	145		
22	100				72	267		
23	24				73	168		
24	160				74	49		
25	98				75	253		
26	33				76	F		
27	116				77	207		
28	125				78	125		
29	141				79	275		
30	310	0			80	36	0	
31	295				81	258		
32	78				82	32		
33	68				83	183		
34	435				84	79		
35	30				85	175		
36	31				86	35		
37	40				87	268		
38	F				88	45		
39	93				89	78		
40	167	0.25			90	48	0.25	
41	111				91	862		
42	105				92	62		
43	445				93	239		
44	62				94	90		
45	295				95	119		
46	243				96	175		
47	153				97	213		
48	184				98	F		
49	70				99	68		
50	118	0			100	113	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 60	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	482				51	R		
2	356				52	R		
3	372				53	R		
4	326				54	R		
5	46				55	R		
6	F				56	R		
7	62				57	R		
8	590				58	R		
9	47				59	R		
10	23	0			60	R	0	
11	44				61	R		
12	20				62	R		
13	35				63	R		
14	65				64	R		
15	16				65	R		
16	10				66	R		
17	14				67	R		
18	11				68	R		
19	457				69	R		
20	622	0.5			70	R	0	
21	142				71	R		
22	115				72	R		
23	94				73	R		
24	270				74	R		
25	129				75	R		
26	329				76	R		
27	76				77	R		
28	10				78	R		
29	362				79	R		
30	411	0			80	R	0	
31	230				81	R		
32	225				82	R		
33	16				83	R		
34	127				84	R		
35	15				85	R		
36	12				86	R		
37	10				87	R		
38	203				88	R		
39	192				89	R		
40	274	0			90	R	0	
41	R				91	R		
42	R				92	R		
43	R				93	R		
44	R				94	R		
45	R				95	R		
46	R				96	R		
47	R				97	R		
48	R				98	R		
49	R				99	R		
50	R	0			100	R	0	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0								

Stream: Alexander Creek			Habitat type:	Pool			Date: 12-Aug-16	
Site: ALE9							HU#: 61	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	R				51	127		
2	R				52	91		
3	R				53	88		
4	R				54	30		
5	R				55	35		
6	R				56	43		
7	R				57	155		
8	R				58	412		
9	R				59	216		
10	R	0			60	71	0.5	
11	R				61	183		
12	R				62	256		
13	R				63	105		
14	R				64	162		
15	R				65	128		
16	R				66	99		
17	R				67	111		
18	R				68	86		
19	R				69	45		
20	R	0			70	40	0	
21	R				71	F		
22	R				72	24		
23	R				73	21		
24	R				74	13		
25	R				75	16		
26	R				76	19		
27	R				77	27		
28	R				78	10		
29	R				79	8		
30	R	0			80	6	0	
31	R				81	7		
32	R				82	71		
33	R				83	108		
34	R				84	65		
35	R				85	54		
36	R				86	93		
37	R				87	20		
38	R				88	11		
39	R				89	17		
40	40	0			90	10	0	
41	40				91	4		
42	35				92	70		
43	42				93	71		
44	241				94	39		
45	168				95	42		
46	150				96	183		
47	273				97	50		
48	62				98	73		
49	89				99	77		
50	103	0.5			100	110	0.75	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Riffle			Date: 12-Aug-16	
Site: ALE9							HU#: 62	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	R				51	F		
2	R				52	F		
3	R				53	F		
4	R				54	10		
5	R				55	15		
6	R				56	15		
7	R				57	16		
8	R				58	15		
9	R				59	149		
10	R	0			60	61	0	
11	R				61	112		
12	R				62	49		
13	R				63	170		
14	R				64	104		
15	R				65	F		
16	R				66	10		
17	R				67	10		
18	R				68	15		
19	R				69	13		
20	R	0			70	12	0	
21	R				71	14		
22	R				72	15		
23	R				73	10		
24	R				74	F		
25	R				75	12		
26	R				76	14		
27	R				77	10		
28	R				78	345		
29	R				79	456		
30	R	0			80	25	0	
31	R				81	15		
32	R				82	38		
33	R				83	F		
34	R				84	35		
35	R				85	34		
36	130				86	26		
37	140				87	29		
38	191				88	31		
39	170				89	44		
40	175	0			90	20	0	
41	121				91	80		
42	105				92	55		
43	72				93	33		
44	22				94	45		
45	207				95	46		
46	160				96	47		
47	133				97	45		
48	152				98	85		
49	98				99	204		
50	84	0			100	146	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 63	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	209				51	F		
2	162				52	F		
3	140				53	R		
4	138				54	R		
5	132				55	R		
6	84				56	162		
7	110				57	92		
8	235				58	41		
9	156				59	68		
10	62	0			60	113	0	
11	20				61	298		
12	10				62	365		
13	140				63	409		
14	101				64	110		
15	83				65	120		
16	478				66	104		
17	68				67	198		
18	100				68	55		
19	108				69	62		
20	256	0			70	252	0.5	
21	26				71	R		
22	25				72	R		
23	20				73	61		
24	14				74	43		
25	636				75	25		
26	639				76	14		
27	501				77	592		
28	122				78	236		
29	229				79	170		
30	206	0.5			80	352	0.75	
31	242				81	235		
32	161				82	769		
33	463				83	127		
34	83				84	70		
35	91				85	336		
36	86				86	113		
37	420				87	249		
38	67				88	142		
39	10				89	191		
40	55	0			90	78	0	
41	25				91	41		
42	23				92	306		
43	36				93	308		
44	24				94	142		
45	168				95			
46	12				96			
47	302				97			
48	14				98			
49	F				99			
50	F	1			100			
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0								

Stream: Alexander Creek			Habitat type:	Glide			Date: 12-Aug-16	
Site: ALE9							HU#: 64	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	205				51	63		
2	110				52	100		
3	72				53	92		
4	300				54	104		
5	214				55	78		
6	F				56	89		
7	F				57	15		
8	F				58	35		
9	25				59	30		
10	20	0			60	68	0	
11	15				61	120		
12	25				62	70		
13	310				63	63		
14	26				64	62		
15	64				65	40		
16	74				66	40		
17	73				67	71		
18	223				68	53		
19	F				69	94		
20	F	1			70	55	0.5	
21	260				71	F		
22	56				72	F		
23	142				73	F		
24	111				74	50		
25	106				75	123		
26	47				76	55		
27	51				77	46		
28	30				78	33		
29	42				79	40		
30	80	0			80	112	0.5	
31	15				81	144		
32	F				82	243		
33	F				83	181		
34	55				84	284		
35	50				85	96		
36	331				86	358		
37	163				87	251		
38	148				88	73		
39	70				89	50		
40	F	1			90	43	0	
41	F				91	80		
42	F				92	72		
43	F				93	61		
44	F				94	111		
45	F				95	78		
46	F				96	110		
47	F				97	103		
48	F				98	141		
49	F				99	88		
50	F	1			100	99	0.75	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

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Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 65	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	110				51	161		
2	312				52	24		
3	69				53	38		
4	50				54	172		
5	26				55	105		
6	38				56	381		
7	59				57	74		
8	41				58	F		
9	68				59	25		
10	80	0.5			60	18	0	
11	302				61	15		
12	351				62	351		
13	198				63	217		
14	76				64	R		
15	53				65	R		
16	61				66	R		
17	50				67	R		
18	F				68	R		
19	312				69	R		
20	493	0.5			70	R	0	
21	69				71	R		
22	36				72	R		
23	111				73	R		
24	76				74	R		
25	91				75	R		
26	104				76	R		
27	88				77	R		
28	321				78	R		
29	241				79	R		
30	135	0.5			80	R	0	
31	96				81	R		
32	100				82	R		
33	34				83	R		
34	28				84	R		
35	30				85	R		
36	29				86	R		
37	30				87	R		
38	389				88	R		
39	R				89	R		
40	R	0			90	R	0	
41	R				91	R		
42	R				92	R		
43	R				93	R		
44	R				94	R		
45	R				95	R		
46	R				96	R		
47	R				97	R		
48	R				98	R		
49	R				99	R		
50	73	0			100	R	0	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0								

Stream: Alexander Creek		Habitat type:	Riffle		Date: 12-Aug-16		
Site: ALE9					HU#: 66		
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	30			51	75		
2	38			52	391		
3	21			53	72		
4	35			54	42		
5	F			55	56		
6	281			56	198		
7	151			57	153		
8	193			58	205		
9	491			59	96		
10	73	0.5		60	88	0.75	
11	40			61	29		
12	316			62	31		
13	122			63	34		
14	609			64	30		
15	201			65	109		
16	166			66	56		
17	384			67	30		
18	535			68	132		
19	46			69	241		
20	34	0.5		70	121	0.25	
21	31			71	83		
22	138			72	48		
23	125			73	134		
24	88			74	101		
25	56			75	92		
26	27			76	258		
27	28			77	129		
28	34			78	66		
29	98			79	53		
30	103	0.75		80	21	0.25	
31	216			81	83		
32	222			82	20		
33	156			83	F		
34	115			84	F		
35	153			85	F		
36	46			86	F		
37	72			87	33		
38	281			88	49		
39	215			89	55		
40	14	0.25		90	139	0.75	
41	223			91	142		
42	122			92	90		
43	145			93	673		
44	35			94	101		
45	30			95	109		
46	40			96	F		
47	212			97	F		
48	215			98	25		
49	340			99	34		
50	125	0.5		100	122	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 12-Aug-16	
Site: ALE9							HU#: 67	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	311				51	142		
2	115				52	385		
3	35				53	252		
4	291				54	246		
5	135				55	192		
6	261				56	234		
7	181				57	116		
8	113				58	152		
9	29				59	325		
10	52	0			60	143	0	
11	29				61	141		
12	35				62	101		
13	81				63	40		
14	211				64	241		
15	415				65	142		
16	151				66	232		
17	R				67	308		
18	R				68	98		
19	R				69	95		
20	R	0			70	906	0	
21	R				71	30		
22	R				72	10		
23	R				73	136		
24	R				74	127		
25	R				75	482		
26	R				76	345		
27	R				77	F		
28	R				78	F		
29	R				79	F		
30	382	0			80	545	0.5	
31	151				81	F		
32	194				82	F		
33	171				83	275		
34	292				84	124		
35	176				85	492		
36	111				86	R		
37	F				87	R		
38	F				88	R		
39	F				89	R		
40	20	0			90	R	0	
41	15				91	R		
42	16				92	R		
43	12				93	112		
44	13				94	253		
45	20				95	194		
46	15				96	271		
47	235				97	362		
48	304				98	14		
49	F				99	11		
50	14	0.5			100	260	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek		Habitat type:	Cascade			Date: 11-Aug-14	
Site: ALE10						HU#: 1	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	146			51	F		
2	130			52	F		
3	46			53	F		
4	38			54	65		
5	42			55	116		
6	61			56	252		
7	311			57	53		
8	42			58	54		
9	44			59	41		
10	160	0.5		60	136	0	
11	312			61	41		
12	152			62	253		
13	131			63	151		
14	201			64	218		
15	205			65	172		
16	135			66	63		
17	213			67	210		
18	40			68	77		
19	24			69	61		
20	23	0		70	155	0.5	
21	122			71	446		
22	66			72	145		
23	45			73	161		
24	51			74	173		
25	68			75	177		
26	60			76	139		
27	143			77	63		
28	99			78	42		
29	105			79	72		
30	43	0		80	193	0.5	
31	92			81	145		
32	41			82	161		
33	62			83	173		
34	101			84	189		
35	98			85	324		
36	83			86	149		
37	F			87	256		
38	F			88	96		
39	F			89	135		
40	F	1		90	95	0	
41	F			91	66		
42	F			92	27		
43	F			93	73		
44	F			94	135		
45	F			95	136		
46	F			96	78		
47	143			97	92		
48	121			98	44		
49	152			99	265		
50	105	0.5		100	83	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: Alexander Creek			Habitat type:	Cascade			Date: 11-Aug-14	
Site: ALE10							HU#: 2	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	290				51	154		
2	245				52	F		
3	146				53	413		
4	100				54	25		
5	210				55	19		
6	146				56	113		
7	270				57	52		
8	171				58	31		
9	243				59	63		
10	190	1			60	55	0	
11	140				61	92		
12	43				62	45		
13	125				63	47		
14	200				64	40		
15	150				65	7		
16	68				66	59		
17	98				67	17		
18	47				68	352		
19	156				69	146		
20	80	0			70	75	0	
21	130				71	230		
22	121				72	275		
23	192				73	67		
24	70				74	94		
25	55				75	94		
26	42				76	243		
27	134				77	143		
28	465				78	85		
29	40				79	85		
30	35	0			80	60	0.75	
31	50				81	221		
32	313				82	65		
33	400				83	310		
34	72				84	113		
35	234				85	48		
36	155				86	152		
37	165				87	134		
38	68				88	112		
39	131				89	36		
40	52	0			90	17	0	
41	8				91	19		
42	R				92	16		
43	305				93	24		
44	62				94	123		
45	33				95	146		
46	39				96	116		
47	89				97	22		
48	170				98	74		
49	95				99	17		
50	260	0.5			100	26	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25% embedded, 0

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-14		
Site: WAL1						HU#: 1		
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	246				51	287		
2	133				52	201		
3	37				53	152		
4	50				54	121		
5	98				55	138		
6	11				56	163		
7	9				57	F		
8	98				58	51		
9	173				59	92		
10	192	0.25			60	186	0.5	
11	32				61	138		
12	39				62	101		
13	162				63	109		
14	193				64	56		
15	64				65	48		
16	16				66	217		
17	45				67	38		
18	24				68	65		
19	13				69	82		
20	117	0.5			70	205	0.5	
21	145				71	F		
22	121				72	125		
23	190				73	66		
24	173				74	52		
25	98				75	248		
26	48				76	76		
27	29				77	72		
28	123				78	158		
29	246				79	92		
30	245	0.25			80	130	0	
31	109				81	247		
32	52				82	140		
33	83				83	89		
34	39				84	31		
35	111				85	F		
36	143				86	48		
37	72				87	128		
38	16				88	116		
39	15				89	93		
40	89	0.5			90	95	0.5	
41	224				91	112		
42	194				92	113		
43	269				93	68		
44	98				94	F		
45	83				95	151		
46	105				96	172		
47	46				97	165		
48	23				98	62		
49	137				99	55		
50	140	0.5			100	43	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek			Habitat type:	Glide		Date: 13-Aug-14	
Site: WAL1						HU#: 2	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	272			51	F		
2	198			52	16		
3	101			53	14		
4	89			54	15		
5	70			55	12		
6	462			56	201		
7	476			57	180		
8	126			58	315		
9	113			59	211		
10	188	0.5		60	195	0.5	
11	179			61	F		
12	82			62	102		
13	46			63	106		
14	132			64	26		
15	165			65	25		
16	78			66	11		
17	27			67	16		
18	116			68	F		
19	66			69	166		
20	51	0.25		70	98	0.75	
21	132			71	F		
22	105			72	132		
23	39			73	203		
24	94			74	202		
25	242			75	156		
26	32			76	232		
27	46			77	158		
28	203			78	87		
29	23			79	F		
30	48	0.5		80	174	0.75	
31	110			81	217		
32	108			82	133		
33	99			83	115		
34	93			84	F		
35	85			85	204		
36	153			86	218		
37	92			87	212		
38	102			88	84		
39	F			89	101		
40	36	0		90	85	0.5	
41	92			91	76		
42	153			92	32		
43	159			93	41		
44	103			94	F		
45	164			95	F		
46	198			96	F		
47	F			97	F		
48	178			98	121		
49	302			99	F		
50	15	0.5		100	F	1	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%							

Stream: West Alexander Creek			Habitat type:	Riffle		Date: 13-Aug-14	
Site: WAL1						HU#: 3	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	108			51	30		
2	72			52	18		
3	38			53	40		
4	135			54	131		
5	167			55	138		
6	240			56	156		
7	137			57	78		
8	301			58	50		
9	68			59	130		
10	50	0.5		60	83	0.25	
11	220			61	163		
12	81			62	170		
13	141			63	125		
14	40			64	34		
15	70			65	118		
16	21			66	115		
17	141			67	76		
18	113			68	78		
19	175			69	82		
20	61	0		70	297	0.25	
21	82			71	201		
22	43			72	183		
23	66			73	72		
24	113			74	202		
25	25			75	480		
26	12			76	66		
27	92			77	33		
28	68			78	122		
29	335			79	430		
30	100	0.5		80	65	0	
31	67			81	35		
32	184			82	32		
33	255			83	142		
34	39			84	146		
35	122			85	93		
36	81			86	101		
37	94			87	118		
38	38			88	92		
39	39			89	94		
40	89	0.25		90	140	0.5	
41	342			91	153		
42	256			92	229		
43	203			93	235		
44	245			94	172		
45	98			95	93		
46	138			96	378		
47	28			97	46		
48	18			98	114		
49	22			99	100		
50	168	0.75		100	266	0.75	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Cascade		Date: 13-Aug-14		
Site: WAL1					HU#: 4		
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	226			51	71		
2	200			52	41		
3	105			53	68		
4	215			54	65		
5	98			55	119		
6	190			56	120		
7	26			57	85		
8	24			58	78		
9	19			59	86		
10	14	0		60	94	0.5	
11	15			61	140		
12	18			62	198		
13	15			63	93		
14	139			64	78		
15	105			65	263		
16	98			66	198		
17	131			67	194		
18	133			68	94		
19	118			69	164		
20	321	0.25		70	49	0	
21	50			71	44		
22	55			72	35		
23	183			73	181		
24	133			74	192		
25	174			75	130		
26	272			76	38		
27	31			77	64		
28	53			78	299		
29	24			79	42		
30	21	0		80	33	0	
31	10			81	34		
32	11			82	120		
33	25			83	174		
34	11			84	123		
35	15			85	144		
36	11			86	194		
37	184			87	106		
38	242			88	173		
39	290			89	182		
40	193	0.5		90	101	0	
41	171			91	242		
42	299			92	201		
43	296			93	24		
44	90			94	36		
45	129			95	24		
46	113			96	174		
47	212			97	14		
48	42			98	39		
49	25			99	55		
50	14	0		100	184	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Glide		Date: 13-Aug-14		
Site: WAL1					HU#: 5		
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	26			51	42		
2	27			52	294		
3	30			53	221		
4	73			54	175		
5	28			55	48		
6	42			56	63		
7	56			57	58		
8	50			58	205		
9	30			59	123		
10	51	0.5		60	F	1	
11	38			61	F		
12	362			62	F		
13	68			63	F		
14	148			64	F		
15	161			65	F		
16	267			66	F		
17	35			67	F		
18	52			68	F		
19	411			69	F		
20	65	0.5		70	F	1	
21	141			71	F		
22	47			72	F		
23	49			73	F		
24	158			74	F		
25	252			75	F		
26	323			76	F		
27	52			77	F		
28	65			78	F		
29	41			79	F		
30	168	0.75		80	F	1	
31	269			81	F		
32	273			82	F		
33	112			83	F		
34	113			84	F		
35	157			85	F		
36	63			86	F		
37	143			87	F		
38	59			88	F		
39	128			89	F		
40	142	0.5		90	F	1	
41	191			91	F		
42	75			92	F		
43	64			93	F		
44	38			94	F		
45	30			95	F		
46	84			96	F		
47	259			97	F		
48	387			98	F		
49	98			99	F		
50	345	0.75		100	F	1	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-14		
Site: WAL1						HU#: 6		
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	320				51	245		
2	187				52	240		
3	367				53	172		
4	172				54	105		
5	195				55	104		
6	136				56	90		
7	162				57	35		
8	130				58	50		
9	200				59	161		
10	189	0			60	160	0.75	
11	135				61	125		
12	125				62	120		
13	381				63	84		
14	246				64	101		
15	177				65	60		
16	139				66	65		
17	171				67	F		
18	320				68	25		
19	42				69	15		
20	98	0.25			70	149	0.25	
21	F				71	230		
22	38				72	229		
23	304				73	411		
24	241				74	295		
25	200				75	171		
26	209				76	114		
27	231				77	175		
28	106				78	200		
29	121				79	215		
30	110	0.5			80	260	0.5	
31	170				81	263		
32	171				82	181		
33	198				83	170		
34	200				84	262		
35	265				85	125		
36	104				86	254		
37	10				87	206		
38	22				88	113		
39	28				89	F		
40	20	0			90	235	0.25	
41	22				91	F		
42	20				92	310		
43	25				93	286		
44	24				94	240		
45	142				95	160		
46	235				96	195		
47	200				97	181		
48	321				98	169		
49	168				99	92		
50	235	0.25			100	80	0.5	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%								

Stream: West Alexander Creek		Habitat type:	Riffle		Date: 13-Aug-14			
Site: WAL1					HU#: 7			
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments	
1	F			51	100			
2	100			52	235			
3	52			53	60			
4	40			54	110			
5	35			55	48			
6	50			56	30			
7	37			57	36			
8	30			58	62			
9	109			59	100			
10	100	0.25		60	151	0.25		
11	190			61	175			
12	57			62	118			
13	133			63	60			
14	96			64	185			
15	88			65	90			
16	85			66	86			
17	236			67	85			
18	80			68	91			
19	50			69	30			
20	65	0		70	41	0.25		
21	94			71	41			
22	168			72	49			
23	133			73	80			
24	85			74	121			
25	120			75	171			
26	107			76	119			
27	183			77	133			
28	68			78	89			
29	60			79	196			
30	57	0.75		80	130	0.5		
31	40			81	30			
32	35			82	F			
33	30			83	F			
34	10			84	20			
35	57			85	30			
36	80			86	F			
37	88			87	44			
38	82			88	60			
39	70			89	50			
40	96	0.25		90	65	0		
41	79			91	58			
42	175			92	35			
43	110			93	80			
44	115			94	F			
45	70			95	75			
46	105			96	55			
47	178			97	28			
48	80			98	68			
49	69			99	65			
50	118	0		100	75	0.25		

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek			Habitat type:	Glide			Date: 13-Aug-14	
Site: WAL1							HU#: 8	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	F				51	66		
2	F				52	F		
3	30				53	10		
4	116				54	10		
5	70				55	8		
6	50				56	55		
7	64				57	70		
8	F				58	20		
9	68				59	30		
10	41	0			60	31	0	
11	51				61	47		
12	32				62	F		
13	62				63	60		
14	F				64	60		
15	F				65	38		
16	F				66	56		
17	55				67	48		
18	72				68	89		
19	49				69	68		
20	49	0			70	45	0.5	
21	40				71	47		
22	60				72	70		
23	100				73	F		
24	58				74	79		
25	42				75	28		
26	F				76	56		
27	61				77	F		
28	43				78	45		
29	28				79	F		
30	80	0.25			80	24	0.25	
31	80				81	36		
32	36				82	50		
33	50				83	60		
34	25				84	70		
35	54				85	78		
36	119				86	31		
37	79				87	55		
38	56				88	48		
39	66				89	32		
40	78	0.5			90	41	0	
41	26				91	26		
42	62				92	39		
43	F				93	F		
44	F				94	F		
45	F				95	65		
46	F				96	45		
47	86				97	63		
48	95				98	45		
49	69				99	14		
50	58	0			100	71	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: West Alexander Creek		Habitat type:	Riffle		Date: 13-Aug-14		
Site: WAL1					HU#: 9		
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	90			51	95		
2	25			52	42		
3	69			53	71		
4	58			54	39		
5	113			55	44		
6	104			56	52		
7	35			57	128		
8	35			58	119		
9	64			59	88		
10	105	0		60	72	0.25	
11	60			61	150		
12	60			62	69		
13	55			63	121		
14	110			64	70		
15	25			65	89		
16	79			66	48		
17	113			67	55		
18	92			68	36		
19	71			69	65		
20	48	0.5		70	128	0	
21	52			71	70		
22	76			72	42		
23	61			73	50		
24	69			74	78		
25	65			75	78		
26	80			76	36		
27	43			77	64		
28	73			78	50		
29	58			79	65		
30	45	0.75		80	F	1	
31	70			81	75		
32	95			82	84		
33	46			83	42		
34	72			84	55		
35	44			85	37		
36	70			86	88		
37	F			87	57		
38	46			88	35		
39	60			89	70		
40	80	0		90	55	0.25	
41	66			91	102		
42	76			92	86		
43	64			93	110		
44	60			94	50		
45	55			95	79		
46	38			96	99		
47	42			97	158		
48	39			98	162		
49	35			99	39		
50	52	0.25		100	69	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Lotic Environmental
Specialists in Freshwater Ecosystems

Stream: West Alexander Creek			Habitat type:	Cascade		Date: 13-Aug-14	
Site: WAL1						HU#: 10	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	60			51	120		
2	60			52	115		
3	90			53	99		
4	75			54	52		
5	F			55	76		
6	169			56	99		
7	170			57	F		
8	117			58	115		
9	108			59	68		
10	95	0.25		60	60	0.5	
11	85			61	154		
12	90			62	95		
13	140			63	90		
14	95			64	40		
15	35			65	80		
16	46			66	86		
17	F			67	79		
18	100			68	75		
19	106			69	56		
20	31	0		70	69	0.25	
21	41			71	150		
22	64			72	160		
23	122			73	300		
24	100			74	122		
25	65			75	50		
26	51			76	189		
27	55			77	90		
28	50			78	69		
29	72			79	48		
30	95	0.5		80	55	0	
31	82			81	85		
32	88			82	40		
33	180			83	35		
34	84			84	100		
35	68			85	60		
36	105			86	137		
37	75			87	128		
38	78			88	90		
39	130			89	89		
40	116	0.25		90	95	0.75	
41	94			91	85		
42	91			92	62		
43	130			93	88		
44	125			94	133		
45	78			95	94		
46	100			96	105		
47	60			97	56		
48	45			98	81		
49	70			99	56		
50	140	0		100	80	0.5	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%							

Stream: West Alexander Creek			Habitat type:	Cascade		Date: 13-Aug-14	
Site: WAL1						HU#: 11	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	175			51	342		
2	46			52	152		
3	80			53	208		
4	48			54	183		
5	54			55	172		
6	78			56	202		
7	54			57	138		
8	39			58	265		
9	169			59	238		
10	100	0.25		60	75	0.5	
11	108			61	150		
12	55			62	153		
13	54			63	76		
14	323			64	242		
15	317			65	74		
16	48			66	178		
17	78			67	142		
18	288			68	280		
19	122			69	296		
20	100	0.5		70	143	0.25	
21	95			71	121		
22	101			72	142		
23	149			73	122		
24	84			74	178		
25	64			75	301		
26	40			76	100		
27	55			77	152		
28	33			78	F		
29	52			79	92		
30	103	0		80	F	1	
31	50			81	212		
32	276			82	243		
33	75			83	143		
34	41			84	201		
35	82			85	25		
36	147			86	35		
37	70			87	26		
38	109			88	10		
39	48			89	15		
40	92	0.25		90	35	0	
41	201			91	15		
42	276			92	114		
43	210			93	178		
44	136			94	181		
45	158			95	272		
46	262			96	14		
47	F			97	39		
48	F			98	38		
49	F			99	90		
50	39	0.5		100	40	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Riffle			Date: 13-Aug-14	
Site: WAL1						HU#: 12	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	71			51	F		
2	101			52	63		
3	82			53	15		
4	73			54	20		
5	81			55	105		
6	61			56	57		
7	95			57	301		
8	168			58	52		
9	130			59	56		
10	182	0.5		60	75	0	
11	153			61	195		
12	F			62	71		
13	160			63	74		
14	F			64	76		
15	F			65	165		
16	17			66	105		
17	15			67	63		
18	8			68	173		
19	9			69	251		
20	115	0		70	32	0	
21	255			71	55		
22	113			72	142		
23	195			73	144		
24	190			74	100		
25	95			75	62		
26	68			76	122		
27	F			77	101		
28	88			78	145		
29	63			79	92		
30	F	1		80	86	0	
31	38			81	89		
32	20			82	143		
33	38			83	98		
34	45			84	120		
35	33			85	211		
36	38			86	170		
37	166			87	74		
38	47			88	106		
39	54			89	186		
40	84	0		90	77	0	
41	83			91	109		
42	F			92	66		
43	F			93	121		
44	F			94	155		
45	F			95	22		
46	862			96	16		
47	202			97	32		
48	303			98	16		
49	115			99	21		
50	70	0		100	84	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Glide			Date: 13-Aug-14	
Site: WAL1						HU#: 13	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	51			51	106		
2	66			52	F		
3	40			53	24		
4	45			54	75		
5	30			55	F		
6	20			56	F		
7	111			57	29		
8	179			58	F		
9	211			59	245		
10	53	0.5		60	150	0.5	
11	95			61	156		
12	151			62	60		
13	98			63	103		
14	181			64	72		
15	243			65	204		
16	136			66	143		
17	231			67	150		
18	101			68	40		
19	107			69	F		
20	75	0.25		70	72	0	
21	82			71	27		
22	90			72	20		
23	80			73	35		
24	52			74	20		
25	50			75	22		
26	57			76	16		
27	52			77	42		
28	25			78	155		
29	201			79	141		
30	262	0		80	55	0.25	
31	103			81	F	.	
32	171			82	16		
33	111			83	186		
34	71			84	216		
35	130			85	91		
36	45			86	115		
37	45			87	25		
38	335			88	101		
39	245			89	272		
40	106	0.5		90	65	0.75	
41	68			91	215		
42	41			92	103		
43	244			93	45		
44	30			94	76		
45	64			95	112		
46	F			96	F		
47	15			97	92		
48	20			98	301		
49	16			99	182		
50	20	0.5		100	93	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Pool			Date: 13-Aug-15	
Site: WAL1						HU#: 14	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	60			51	46		
2	35			52	63		
3	20			53	35		
4	46			54	67		
5	31			55	66		
6	15			56	52		
7	26			57	38		
8	18			58	F		
9	22			59	F		
10	83	0		60	102	0.75	
11	56			61	72		
12	22			62	103		
13	54			63	201		
14	136			64	68		
15	F			65	37		
16	F			66	111		
17	F			67	30		
18	36			68	50		
19	101			69	28		
20	50	0		70	60	0	
21	111			71	21		
22	83			72	10		
23	61			73	25		
24	54			74	7		
25	70			75	233		
26	186			76	F		
27	287			77	42		
28	85			78	46		
29	50			79	79		
30	23	0		80	111	0	
31	35			81	51		
32	115			82	80		
33	F			83	40		
34	F			84	63		
35	52			85	59		
36	115			86	105		
37	F			87	78		
38	F			88	27		
39	F			89	5		
40	F	1		90	40	0.5	
41	F			91	46		
42	333			92	38		
43	165			93	34		
44	70			94	62		
45	58			95	54		
46	48			96	64		
47	118			97	62		
48	137			98	63		
49	35			99	75		
50	39	0.5		100	98	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: West Alexander Creek		Habitat type:	Cascade		Date: 13-Aug-15	
Site: WAL1					HU#: 15	

Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	131			51	15		
2	62			52	60		
3	73			53	15		
4	60			54	10		
5	73			55	16		
6	64			56	F		
7	73			57	53		
8	125			58	F		
9	103			59	95		
10	65	0.25		60	24	0	
11	75			61	21		
12	115			62	31		
13	105			63	22		
14	78			64	26		
15	99			65	42		
16	100			66	45		
17	93			67	26		
18	138			68	125		
19	112			69	72		
20	101	0		70	68	0	
21	73			71	56		
22	49			72	60		
23	123			73	96		
24	56			74	73		
25	97			75	55		
26	90			76	65		
27	F			77	66		
28	108			78	32		
29	94			79	127		
30	87	0		80	90	0	
31	60			81	56		
32	58			82	40		
33	40			83	86		
34	F			84	87		
35	62			85	73		
36	60			86	101		
37	135			87	53		
38	92			88	50		
39	79			89	62		
40	75	0.25		90	60	0	
41	99			91	47		
42	36			92	52		
43	20			93	72		
44	55			94	51		
45	F			95	60		
46	30			96	92		
47	76			97	43		
48	27			98	44		
49	24			99	43		
50	22	0		100	72	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek			Habitat type:	Riffle		Date: 13-Aug-15	
Site: WAL1						HU#: 16	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	17			51	39		
2	165			52	120		
3	130			53	88		
4	150			54	114		
5	115			55	35		
6	66			56	47		
7	43			57	55		
8	35			58	122		
9	30			59	71		
10	96	0		60	122	0	
11	85			61	60		
12	110			62	28		
13	F			63	40		
14	40			64	35		
15	31			65	130		
16	10			66	118		
17	125			67	117		
18	45			68	78		
19	76			69	86		
20	71	0.75		70	95	0	
21	60			71	46		
22	75			72	120		
23	36			73	95		
24	17			74	88		
25	20			75	43		
26	41			76	70		
27	26			77	81		
28	F			78	135		
29	F			79	96		
30	92	0.75		80	90	0.25	
31	64			81	100		
32	17			82	88		
33	40			83	100		
34	22			84	129		
35	45			85	126		
36	120			86	140		
37	136			87	110		
38	65			88	106		
39	106			89	79		
40	75	0		90	117	0.5	
41	34			91	80		
42	51			92	85		
43	105			93	76		
44	100			94	40		
45	F			95	63		
46	72			96	35		
47	75			97	61		
48	141			98	122		
49	88			99	115		
50	69	0		100	89	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Glide			Date: 13-Aug-15	
Site: WAL1						HU#: 17	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	75			51	43		
2	40			52	F		
3	99			53	49		
4	50			54	F		
5	71			55	F		
6	75			56	70		
7	42			57	88		
8	36			58	141		
9	F			59	30		
10	95	0.25		60	88	0.5	
11	150			61	75		
12	F			62	F		
13	60			63	F		
14	100			64	F		
15	111			65	23		
16	122			66	85		
17	96			67	96		
18	140			68	35		
19	143			69	28		
20	85	0.25		70	30	0	
21	70			71	31		
22	86			72	25		
23	93			73	30		
24	F			74	26		
25	115			75	F		
26	92			76	52		
27	85			77	F		
28	96			78	78		
29	55			79	85		
30	110	0		80	32	0	
31	20			81	50		
32	112			82	45		
33	114			83	37		
34	50			84	17		
35	110			85	F		
36	90			86	F		
37	10			87	86		
38	48			88	F		
39	51			89	49		
40	80	0		90	62	0.25	
41	F			91	F		
42	F			92	60		
43	F			93	115		
44	F			94	156		
45	136			95	78		
46	115			96	56		
47	122			97	F		
48	106			98	60		
49	120			99	F		
50	F	1		100	99	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Cascade				Date: 13-Aug-15	
Site: WAL1							HU#: 18	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	190				51	25		
2	150				52	30		
3	123				53	37		
4	118				54	70		
5	116				55	70		
6	142				56	112		
7	76				57	92		
8	79				58	97		
9	30				59	60		
10	55	0			60	74	0.25	
11	55				61	88		
12	38				62	173		
13	40				63	117		
14	48				64	120		
15	98				65	F		
16	96				66	15		
17	173				67	36		
18	175				68	76		
19	58				69	50		
20	142	0.5			70	80	1	
21	81				71	75		
22	96				72	47		
23	205				73	40		
24	115				74	115		
25	115				75	99		
26	132				76	82		
27	52				77	31		
28	55				78	45		
29	62				79	140		
30	20	0			80	91	0.25	
31	88				81	92		
32	104				82	15		
33	85				83	F		
34	92				84	45		
35	87				85	86		
36	80				86	111		
37	48				87	F		
38	85				88	75		
39	80				89	182		
40	71	0.25			90	40	0.25	
41	70				91	108		
42	76				92	47		
43	45				93	52		
44	75				94	36		
45	47				95	40		
46	48				96	81		
47	25				97	22		
48	17				98	F		
49	232				99	40		
50	108	0			100	176	0.25	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%								

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: West Alexander Creek			Habitat type:	Riffle			Date: 13-Aug-15	
Site: WAL1							HU#: 19	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	94				51	67		
2	90				52	55		
3	70				53	F		
4	68				54	F		
5	17				55	F		
6	15				56	54		
7	25				57	15		
8	31				58	32		
9	40				59	62		
10	25	0			60	95	0.25	
11	36				61	F		
12	38				62	23		
13	20				63	36		
14	30				64	25		
15	31				65	38		
16	42				66	F		
17	35				67	30		
18	26				68	40		
19	33				69	62		
20	65	0			70	30	0	
21	84				71	35		
22	65				72	28		
23	79				73	68		
24	60				74	57		
25	78				75	F		
26	56				76	16		
27	71				77	17		
28	50				78	30		
29	F				79	15		
30	F	1			80	15	0	
31	F				81	7		
32	F				82	10		
33	F				83	41		
34	40				84	27		
35	10				85	15		
36	22				86	F		
37	16				87	10		
38	35				88	10		
39	20				89	16		
40	32	0			90	9	0	
41	24				91	9		
42	30				92	12		
43	12				93	17		
44	24				94	14		
45	25				95	61		
46	46				96	28		
47	25				97	12		
48	45				98	25		
49	41				99	59		
50	73	0			100	35	0	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%								

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-15	
Site: WAL1						HU#: 20	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	65			51	88		
2	90			52	57		
3	138			53	55		
4	190			54	69		
5	86			55	60		
6	90			56	55		
7	76			57	46		
8	125			58	42		
9	170			59	30		
10	60	0.5		60	85	0.25	
11	100			61	80		
12	90			62	122		
13	96			63	160		
14	79			64	49		
15	50			65	62		
16	79			66	30		
17	75			67	76		
18	115			68	122		
19	99			69	80		
20	104	0.25		70	60	0	
21	82			71	55		
22	50			72	35		
23	73			73	70		
24	76			74	89		
25	47			75	126		
26	160			76	75		
27	122			77	86		
28	176			78	215		
29	105			79	105		
30	122	0		80	88	0.5	
31	85			81	50		
32	89			82	93		
33	F			83	90		
34	45			84	81		
35	48			85	49		
36	32			86	55		
37	55			87	120		
38	65			88	96		
39	98			89	108		
40	99	0.25		90	85	0	
41	78			91	55		
42	80			92	57		
43	55			93	65		
44	46			94	44		
45	116			95	35		
46	82			96	F		
47	85			97	F		
48	40			98	21		
49	79			99	40		
50	36	0.75		100	51	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek			Habitat type:	Glide			Date: 13-Aug-16	
Site: WAL1							HU#: 21	
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	152				51	92		
2	163				52	74		
3	48				53	F		
4	73				54	F		
5	91				55	F		
6	233				56	34		
7	81				57	60		
8	145				58	78		
9	78				59	44		
10	88	0			60	61	0	
11	138				61	33		
12	142				62	70		
13	105				63	66		
14	112				64	55		
15	171				65	F		
16	67				66	F		
17	62				67	F		
18	250				68	F		
19	61				69	65		
20	41	0.5			70	45	0	
21	130				71	46		
22	201				72	58		
23	183				73	41		
24	62				74	59		
25	133				75	75		
26	177				76	51		
27	92				77	93		
28	91				78	68		
29	120				79	30		
30	68	0			80	76	0	
31	131				81	22		
32	45				82	33		
33	89				83	170		
34	115				84	115		
35	56				85	97		
36	34				86	223		
37	58				87	F		
38	71				88	65		
39	45				89	76		
40	62	0			90	26	0.5	
41	51				91	30		
42	152				92	126		
43	65				93	16		
44	70				94	84		
45	64				95	74		
46	65				96	F		
47	112				97	55		
48	71				98	90		
49	79				99	201		
50	F	1			100	51	0.25	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%								

Stream: West Alexander Creek			Habitat type:	Riffle		Date: 13-Aug-17	
Site: WAL1						HU#: 22	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	33			51	175		
2	F			52	111		
3	25			53	112		
4	117			54	261		
5	24			55	120		
6	172			56	63		
7	241			57	132		
8	231			58	190		
9	251			59	73		
10	46	0.5		60	100	0	
11	175			61	111		
12	200			62	130		
13	100			63	171		
14	161			64	191		
15	95			65	205		
16	157			66	57		
17	95			67	190		
18	127			68	173		
19	129			69	59		
20	190	0		70	181	0	
21	151			71	33		
22	85			72	103		
23	24			73	144		
24	28			74	242		
25	132			75	24		
26	F			76	45		
27	F			77	65		
28	45			78	320		
29	41			79	61		
30	37	0		80	56	0	
31	26			81	91		
32	27			82	125		
33	151			83	59		
34	150			84	44		
35	51			85	25		
36	60			86	86		
37	172			87	F		
38	146			88	30		
39	248			89	35		
40	76	0		90	F	1	
41	43			91	50		
42	141			92	41		
43	152			93	52		
44	265			94	98		
45	171			95	F		
46	51			96	F		
47	105			97	24		
48	200			98	35		
49	172			99	152		
50	191	0.25		100	155	0.5	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%							

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-17	
Site: WAL1						HU#: 23	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	22			51	38		
2	115			52	45		
3	190			53	356		
4	70			54	111		
5	90			55	30		
6	105			56	36		
7	66			57	64		
8	10			58	50		
9	24			59	58		
10	515	0		60	85	0	
11	91			61	45		
12	18			62	53		
13	34			63	80		
14	41			64	92		
15	8			65	46		
16	123			66	78		
17	35			67	40		
18	151			68	66		
19	172			69	51		
20	137	0		70	71	0	
21	92			71	155		
22	35			72	62		
23	33			73	105		
24	20			74	121		
25	35			75	98		
26	40			76	150		
27	271			77	80		
28	130			78	25		
29	163			79	98		
30	111	0		80	50	0	
31	82			81	102		
32	373			82	84		
33	265			83	228		
34	213			84	242		
35	70			85	78		
36	68			86	94		
37	55			87	55		
38	178			88	67		
39	92			89	110		
40	66	0.5		90	178	0.25	
41	131			91	58		
42	174			92	70		
43	96			93	39		
44	50			94	89		
45	270			95	39		
46	101			96	30		
47	83			97	65		
48	150			98	96		
49	132			99	211		
50	142	0		100	90	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-17	
Site: WAL1						HU#: 24	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	344			51	54		
2	F			52	205		
3	125			53	43		
4	201			54	F		
5	50			55	121		
6	25			56	F		
7	20			57	92		
8	152			58	25		
9	80			59	153		
10	141	0.5		60	103	0	
11	191			61	84		
12	35			62	301		
13	120			63	410		
14	104			64	312		
15	115			65	92		
16	123			66	54		
17	134			67	78		
18	62			68	182		
19	108			69	132		
20	246	0.5		70	171	0.5	
21	125			71	111		
22	105			72	230		
23	91			73	122		
24	72			74	155		
25	141			75	181		
26	172			76	133		
27	301			77	282		
28	178			78	386		
29	F			79	115		
30	51	0		80	83	0	
31	48			81	150		
32	15			82	172		
33	16			83	158		
34	104			84	136		
35	113			85	305		
36	152			86	129		
37	146			87	25		
38	102			88	29		
39	F			89	403		
40	F	1		90	303	0.75	
41	83			91	422		
42	211			92	421		
43	565			93	305		
44	36			94	335		
45	20			95	106		
46	29			96	189		
47	40			97	58		
48	52			98	92		
49	76			99	F		
50	44	0		100	25	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Riffle				Date: 13-Aug-17	
Site: WAL1							HU#: 25	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	201				51	F		
2	55				52	133		
3	F				53	125		
4	31				54	70		
5	13				55	60		
6	41				56	28		
7	36				57	40		
8	125				58	172		
9	115				59	130		
10	79	0			60	50	0	
11	155				61	43		
12	10				62	137		
13	22				63	216		
14	56				64	411		
15	78				65	161		
16	38				66	90		
17	23				67	172		
18	63				68	F		
19	56				69	25		
20	41	0			70	102	0.5	
21	13				71	124		
22	63				72	134		
23	30				73	25		
24	10				74	20		
25	15				75	15		
26	100				76	73		
27	10				77	F		
28	16				78	192		
29	15				79	F		
30	20	0			80	165	0.25	
31	131				81	143		
32	282				82	121		
33	83				83	38		
34	100				84	252		
35	111				85	52		
36	82				86	F		
37	62				87	55		
38	73				88	24		
39	45				89	235		
40	50	0			90	F	1	
41	39				91	95		
42	40				92	110		
43	79				93	31		
44	120				94	211		
45	99				95	222		
46	95				96	21		
47	73				97	81		
48	45				98	262		
49	142				99	132		
50	80	0.5			100	125	0	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%								

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: West Alexander Creek		Habitat type:	Cascade		Date: 13-Aug-17	
Site: WAL1					HU#: 26	

Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	360			51	82		
2	260			52	44		
3	267			53	102		
4	280			54	72		
5	181			55	36		
6	265			56	25		
7	122			57	108		
8	F			58	100		
9	45			59	120		
10	71	0.5		60	62	0	
11	218			61	83		
12	65			62	71		
13	89			63	170		
14	60			64	79		
15	28			65	56		
16	32			66	65		
17	48			67	70		
18	20			68	85		
19	41			69	52		
20	46	0		70	65	0	
21	35			71	117		
22	100			72	70		
23	111			73	69		
24	155			74	55		
25	130			75	115		
26	261			76	168		
27	139			77	165		
28	55			78	202		
29	276			79	89		
30	155	0.5		80	43	0	
31	200			81	75		
32	225			82	118		
33	80			83	82		
34	95			84	232		
35	F			85	209		
36	30			86	129		
37	20			87	92		
38	8			88	37		
39	112			89	85		
40	135	0		90	115	0	
41	105			91	219		
42	95			92	71		
43	161			93	59		
44	155			94	80		
45	78			95	56		
46	172			96	137		
47	F			97	109		
48	128			98	118		
49	190			99	135		
50	135	0		100	68	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek			Habitat type:	Riffle			Date: 13-Aug-17	
Site: WAL1							HU#: 27	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	375				51	25		
2	119				52	25		
3	115				53	125		
4	165				54	200		
5	45				55	156		
6	55				56	53		
7	92				57	122		
8	108				58	165		
9	58				59	211		
10	74	0			60	260	0	
11	20				61	221		
12	280				62	163		
13	15				63	52		
14	230				64	70		
15	19				65	F		
16	15				66	135		
17	251				67	70		
18	63				68	F		
19	105				69	F		
20	50	0			70	F	1	
21	103				71	F		
22	142				72	F		
23	81				73	F		
24	60				74	126		
25	188				75	416		
26	95				76	111		
27	75				77	172		
28	83				78	15		
29	135				79	270		
30	162	0.25			80	72	0	
31	98				81	41		
32	75				82	111		
33	78				83	91		
34	F				84	32		
35	65				85	F		
36	82				86	16		
37	268				87	22		
38	65				88	55		
39	59				89	99		
40	F	1			90	33	0	
41	58				91	193		
42	62				92	32		
43	43				93	34		
44	40				94	106		
45	69				95	360		
46	170				96	85		
47	388				97	61		
48	78				98	77		
49	68				99	55		
50	8	0			100	80	0.5	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%								

Stream: West Alexander Creek		Habitat type:	Pool			Date: 13-Aug-17	
Site: WAL1						HU#: 28	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	241			51	32		
2	300			52	33		
3	183			53	77		
4	142			54	54		
5	95			55	20		
6	230			56	20		
7	72			57	33		
8	45			58	72		
9	70			59	180		
10	90	0		60	36	0	
11	190			61	70		
12	F			62	112		
13	F			63	85		
14	F			64	60		
15	F			65	25		
16	F			66	30		
17	F			67	90		
18	F			68	45		
19	F			69	152		
20	F	1		70	111	0	
21	F			71	146		
22	F			72	59		
23	F			73	60		
24	F			74	130		
25	F			75	10		
26	F			76	21		
27	F			77	124		
28	86			78	35		
29	32			79	75		
30	85	0		80	35	0.5	
31	70			81	136		
32	254			82	35		
33	35			83	45		
34	92			84	50		
35	30			85	40		
36	145			86	65		
37	45			87	55		
38	118			88	12		
39	144			89	23		
40	26	0		90	30	0	
41	45			91	45		
42	95			92	20		
43	69			93	20		
44	71			94	30		
45	40			95	126		
46	100			96	30		
47	68			97	55		
48	62			98	131		
49	135			99	120		
50	F	1		100	45	0	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%							

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-17	
Site: WAL1						HU#: 29	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	88			51	40		
2	209			52	25		
3	190			53	110		
4	194			54	115		
5	180			55	157		
6	104			56	95		
7	75			57	92		
8	86			58	97		
9	80			59	63		
10	119	0.25		60	308	0	
11	105			61	85		
12	122			62	82		
13	82			63	179		
14	100			64	100		
15	131			65	61		
16	59			66	36		
17	125			67	41		
18	170			68	132		
19	115			69	70		
20	75	0		70	150	0	
21	180			71	50		
22	80			72	45		
23	70			73	204		
24	116			74	95		
25	80			75	55		
26	330			76	33		
27	100			77	90		
28	110			78	142		
29	120			79	184		
30	36	0		80	160	0.5	
31	55			81	70		
32	50			82	30		
33	150			83	150		
34	100			84	92		
35	102			85	88		
36	70			86	85		
37	75			87	60		
38	115			88	80		
39	50			89	55		
40	60	0		90	50	0.25	
41	19			91	132		
42	64			92	50		
43	88			93	92		
44	78			94	58		
45	123			95	23		
46	110			96	185		
47	99			97	142		
48	23			98	103		
49	25			99	155		
50	27	0		100	50	0	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%							

Stream: West Alexander Creek		Habitat type:	Glide		Date: 13-Aug-17		
Site: WAL1					HU#: 30		

Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	60			51	43		
2	23			52	85		
3	45			53	82		
4	42			54	84		
5	31			55	45		
6	F			56	91		
7	F			57	73		
8	35			58	85		
9	17			59	110		
10	15	0		60	57	0.25	
11	33			61	99		
12	10			62	50		
13	20			63	72		
14	16			64	97		
15	8			65	133		
16	21			66	155		
17	25			67	52		
18	25			68	71		
19	26			69	42		
20	F	1		70	F	1	
21	170			71	F		
22	125			72	42		
23	110			73	183		
24	180			74	F		
25	65			75	219		
26	70			76	40		
27	30			77	70		
28	45			78	47		
29	50			79	83		
30	55	0.25		80	7	0	
31	67			81	67		
32	71			82	112		
33	110			83	109		
34	F			84	92		
35	162			85	88		
36	F			86	150		
37	180			87	42		
38	47			88	186		
39	49			89	55		
40	68	0		90	90	0.25	
41	52			91	154		
42	95			92	F		
43	62			93	F		
44	41			94	79		
45	73			95	70		
46	F			96	19		
47	45			97	120		
48	63			98	33		
49	72			99	20		
50	80	0		100	22	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: West Alexander Creek		Habitat type:	Riffle			Date: 13-Aug-17		
Site: WAL1						HU#: 31		
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	155				51	51		
2	56				52	15		
3	90				53	100		
4	74				54	154		
5	46				55	122		
6	123				56	50		
7	46				57	105		
8	102				58	113		
9	36				59	30		
10	160	0.25			60	45	0.25	
11	61				61	9		
12	61				62	208		
13	42				63	41		
14	229				64	46		
15	186				65	60		
16	F				66	70		
17	92				67	51		
18	87				68	100		
19	76				69	64		
20	F	1			70	44	0	
21	F				71	119		
22	F				72	125		
23	F				73	161		
24	F				74	60		
25	F				75	55		
26	F				76	55		
27	F				77	130		
28	F				78	50		
29	F				79	55		
30	F	1			80	162	0.25	
31	F				81	54		
32	F				82	125		
33	F				83	70		
34	F				84	174		
35	F				85	243		
36	F				86	209		
37	F				87	80		
38	F				88	111		
39	F				89	90		
40	F	1			90	181	0.5	
41	101				91	119		
42	71				92	182		
43	157				93	24		
44	67				94	26		
45	253				95	61		
46	90				96	194		
47	161				97	88		
48	66				98	96		
49	13				99	104		
50	30	0.25			100	43	0.5	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%								

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: West Alexander Creek		Habitat type:	Cascade		Date: 13-Aug-17		
Site: WAL1					HU#: 32		
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	165			51	96		
2	95			52	F		
3	23			53	74		
4	80			54	71		
5	82			55	55		
6	69			56	71		
7	304			57	65		
8	61			58	230		
9	F			59	142		
10	25	0.75		60	310	0	
11	80			61	113		
12	35			62	78		
13	70			63	67		
14	63			64	153		
15	202			65	70		
16	91			66	F		
17	25			67	76		
18	20			68	95		
19	200			69	208		
20	203	0.5		70	220	0.25	
21	180			71	200		
22	187			72	70		
23	111			73	91		
24	41			74	54		
25	105			75	4		
26	66			76	245		
27	67			77	F		
28	208			78	66		
29	374			79	119		
30	90	0.25		80	180	0.75	
31	177			81	105		
32	80			82	49		
33	120			83	50		
34	F			84	91		
35	42			85	66		
36	50			86	115		
37	111			87	78		
38	92			88	88		
39	144			89	285		
40	65	0.25		90	171	0	
41	103			91	193		
42	82			92	217		
43	127			93	70		
44	181			94	32		
45	115			95	44		
46	100			96	93		
47	74			97	144		
48	91			98	F		
49	66			99	133		
50	80	0.25		100	78	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: West Alexander Creek		Habitat type:		Riffle		Date: 13-Aug-17		
Site: WAL1						HU#: 33		
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	105				51	35		
2	136				52	113		
3	34				53	62		
4	46				54	223		
5	87				55	30		
6	33				56	41		
7	224				57	66		
8	F				58	110		
9	45				59	316		
10	170	0.5			60	63	0	
11	44				61	F		
12	76				62	59		
13	63				63	144		
14	75				64	87		
15	44				65	49		
16	142				66	72		
17	109				67	417		
18	109				68	122		
19	111				69	45		
20	41	0			70	99	0.25	
21	20				71	75		
22	213				72	157		
23	39				73	43		
24	25				74	182		
25	90				75	F		
26	101				76	F		
27	32				77	F		
28	35				78	300		
29	71				79	139		
30	103	0.25			80	193	0.25	
31	90				81	113		
32	33				82	321		
33	45				83	117		
34	119				84	F		
35	40				85	373		
36	70				86	80		
37	163				87	50		
38	45				88	202		
39	85				89	72		
40	74	0.25			90	78	0.25	
41	235				91	41		
42	76				92	40		
43	183				93	60		
44	233				94	51		
45	F				95	85		
46	75				96	178		
47	46				97	165		
48	74				98	45		
49	152				99	100		
50	41	0			100	108	0.25	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%								

Stream: West Alexander Creek			Habitat type:	Cascade		Date: 13-Aug-17	
Site: WAL1						HU#: 34	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	674			51	F		
2	100			52	390		
3	108			53	386		
4	35			54	74		
5	80			55	60		
6	71			56	65		
7	92			57	153		
8	45			58	47		
9	46			59	170		
10	140	0.25		60	160	0.75	
11	111			61	75		
12	300			62	81		
13	87			63	64		
14	276			64	410		
15	F			65	84		
16	90			66	76		
17	50			67	488		
18	115			68	112		
19	303			69	444		
20	100	0		70	81	0.5	
21	51			71	180		
22	32			72	103		
23	511			73	95		
24	292			74	F		
25	161			75	55		
26	71			76	76		
27	63			77	24		
28	90			78	115		
29	53			79	204		
30	315	0.75		80	111	0.5	
31	104			81	478		
32	98			82	55		
33	75			83	F		
34	90			84	305		
35	265			85	49		
36	124			86	76		
37	91			87	185		
38	95			88	176		
39	F			89	30		
40	70	0		90	144	0	
41	12			91	96		
42	73			92	130		
43	371			93	171		
44	50			94	F		
45	85			95	124		
46	413			96	150		
47	108			97	90		
48	294			98	153		
49	281			99	60		
50	146	0.5		100	51	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:					Date: 13-Aug-17	
Site: WAL1							HU#: 35	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	125				51	11		
2	60				52	85		
3	222				53	130		
4	81				54	63		
5	93				55	50		
6	209				56	168		
7	111				57	132		
8	434				58	46		
9	121				59	230		
10	130	0.5			60	270	0.25	
11	191				61	163		
12	185				62	284		
13	115				63	98		
14	125				64	223		
15	646				65	223		
16	211				66	335		
17	94				67	121		
18	F				68	116		
19	85				69	111		
20	35	0.5			70	125	0	
21	363				71	200		
22	111				72	105		
23	140				73	188		
24	170				74	210		
25	29				75	75		
26	67				76	92		
27	65				77	50		
28	127				78	44		
29	490				79	141		
30	540	0			80	55	0.5	
31	115				81	90		
32	300				82	F		
33	114				83	F		
34	91				84	F		
35	23				85	64		
36	150				86	90		
37	205				87	143		
38	59				88	159		
39	63				89	70		
40	128	0			90	70	0	
41	161				91	102		
42	F				92	123		
43	32				93	364		
44	95				94	91		
45	100				95	95		
46	90				96	153		
47	42				97	415		
48	23				98	76		
49	25				99	24		
50	20	0			100	80	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek			Habitat type:	Riffle			Date: 13-Aug-17	
Site: WAL1							HU#: 36	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	113				51	73		
2	115				52	255		
3	105				53	77		
4	55				54	365		
5	99				55	395		
6	35				56	161		
7	69				57	393		
8	90				58	195		
9	41				59	198		
10	25	0.5			60	185	0.25	
11	12				61	187		
12	33				62	163		
13	40				63	79		
14	15				64	53		
15	8				65	F		
16	10				66	47		
17	463				67	65		
18	120				68	52		
19	72				69	43		
20	101	0			70	38	0	
21	90				71	32		
22	121				72	285		
23	123				73	371		
24	141				74	370		
25	73				75	F		
26	131				76	F		
27	141				77	F		
28	59				78	F		
29	53				79	55		
30	35	0.5			80	19	0	
31	135				81	19		
32	82				82	40		
33	85				83	350		
34	178				84	185		
35	89				85	255		
36	52				86	65		
37	265				87	113		
38	94				88	49		
39	45				89	131		
40	46	0.25			90	108	0.25	
41	25				91	321		
42	183				92	84		
43	68				93	57		
44	23				94	26		
45	93				95	F		
46	47				96	27		
47	91				97	17		
48	98				98	24		
49	82				99	43		
50	50	0.25			100	46	0.25	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%								

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: West Alexander Creek			Habitat type:	Cascade		Date: 13-Aug-17	
Site: WAL1						HU#: 37	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	360			51	F		
2	260			52	169		
3	305			53	151		
4	195			54	195		
5	210			55	140		
6	57			56	141		
7	331			57	71		
8	155			58	352		
9	323			59	39		
10	113	0.25		60	211	0.25	
11	169			61	61		
12	175			62	260		
13	186			63	183		
14	168			64	106		
15	101			65	141		
16	35			66	211		
17	71			67	100		
18	29			68	24		
19	30			69	F		
20	89	0		70	115	0	
21	35			71	115		
22	105			72	193		
23	105			73	138		
24	136			74	143		
25	320			75	155		
26	225			76	100		
27	163			77	90		
28	125			78	25		
29	135			79	13		
30	113	0		80	98	0.25	
31	115			81	193		
32	74			82	60		
33	35			83	81		
34	281			84	341		
35	345			85	96		
36	132			86	85		
37	86			87	98		
38	90			88	73		
39	125			89	135		
40	357	0.25		90	59	0	
41	261			91	241		
42	152			92	92		
43	313			93	175		
44	160			94	185		
45	313			95	165		
46	60			96	118		
47	135			97	121		
48	240			98	133		
49	265			99	68		
50	13	0		100	323	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Riffle			Date: 13-Aug-17	
Site: WAL1						HU#: 38	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	165			51	50		
2	123			52	20		
3	105			53	15		
4	114			54	111		
5	F			55	20		
6	123			56	76		
7	140			57	113		
8	66			58	268		
9	29			59	29		
10	111	0.75		60	11	0	
11	127			61	10		
12	105			62	35		
13	115			63	101		
14	10			64	139		
15	9			65	135		
16	9			66	35		
17	7			67	186		
18	56			68	395		
19	47			69	28		
20	25	0		70	213	0.75	
21	169			71	42		
22	60			72	127		
23	133			73	38		
24	63			74	186		
25	53			75	145		
26	33			76	160		
27	10			77	94		
28	7			78	251		
29	21			79	169		
30	43	0		80	130	1	
31	13			81	F		
32	63			82	79		
33	45			83	85		
34	20			84	53		
35	39			85	37		
36	113			86	80		
37	78			87	123		
38	116			88	157		
39	53			89	120		
40	111	0.75		90	125	0.25	
41	98			91	75		
42	385			92	20		
43	255			93	52		
44	35			94	45		
45	132			95	F		
46	F			96	65		
47	70			97	5		
48	138			98	5		
49	79			99	74		
50	73	0.75		100	79	0.75	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-17	
Site: WAL1						HU#: 39	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	413			51	70		
2	193			52	85		
3	174			53	163		
4	95			54	210		
5	41			55	268		
6	67			56	161		
7	166			57	103		
8	161			58	40		
9	79			59	26		
10	45	0.75		60	28	0	
11	32			61	40		
12	29			62	155		
13	91			63	133		
14	275			64	96		
15	126			65	453		
16	26			66	178		
17	44			67	283		
18	70			68	325		
19	143			69	210		
20	75	0.5		70	145	0.75	
21	80			71	99		
22	145			72	135		
23	374			73	178		
24	F			74	98		
25	111			75	138		
26	205			76	81		
27	605			77	162		
28	163			78	430		
29	161			79	95		
30	132	0.5		80	193	0.5	
31	45			81	161		
32	73			82	153		
33	146			83	498		
34	395			84	301		
35	30			85	176		
36	29			86	185		
37	16			87	213		
38	10			88	163		
39	10			89	161		
40	115	0.75		90	123	0.75	
41	140			91	191		
42	130			92	74		
43	133			93	30		
44	91			94	115		
45	182			95	170		
46	121			96	63		
47	158			97	62		
48	64			98	149		
49	213			99	98		
50	74	0		100	90	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-17	
Site: WAL1						HU#: 40	
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	127			51	138		
2	139			52	135		
3	85			53	140		
4	60			54	106		
5	57			55	125		
6	61			56	39		
7	74			57	59		
8	F			58	35		
9	95			59	27		
10	92	0		60	10	0	
11	41			61	35		
12	25			62	16		
13	85			63	87		
14	95			64	70		
15	36			65	63		
16	27			66	44		
17	84			67	43		
18	35			68	63		
19	11			69	65		
20	92	0.25		70	17	0	
21	13			71	12		
22	35			72	14		
23	17			73	7		
24	37			74	48		
25	15			75	37		
26	37			76	47		
27	47			77	305		
28	76			78	139		
29	82			79	115		
30	156	0		80	83	0	
31	127			81	71		
32	65			82	13		
33	57			83	75		
34	155			84	9		
35	213			85	78		
36	109			86	160		
37	96			87	90		
38	125			88	140		
39	F			89	60		
40	127	0.25		90	140	0.25	
41	47			91	67		
42	98			92	93		
43	70			93	91		
44	93			94	115		
45	116			95	86		
46	97			96	135		
47	110			97	119		
48	117			98	98		
49	58			99	F		
50	140	0		100	91	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Riffle			Date: 13-Aug-17	
Site: WAL1						HU#: 41	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	176			51	45		
2	119			52	200		
3	21			53	F		
4	48			54	65		
5	45			55	36		
6	50			56	175		
7	21			57	87		
8	19			58	15		
9	35			59	15		
10	21	0		60	17	0	
11	56			61	18		
12	F			62	25		
13	35			63	187		
14	13			64	F		
15	123			65	129		
16	116			66	140		
17	F			67	F		
18	50			68	29		
19	37			69	13		
20	160	0.5		70	13	0	
21	26			71	47		
22	115			72	73		
23	116			73	182		
24	193			74	F		
25	83			75	131		
26	121			76	24		
27	139			77	52		
28	145			78	86		
29	40			79	106		
30	50	0		80	F	1	
31	100			81	59		
32	119			82	10		
33	30			83	12		
34	25			84	10		
35	17			85	100		
36	7			86	10		
37	47			87	71		
38	90			88	27		
39	39			89	14		
40	53	0.25		90	57	0	
41	30			91	180		
42	75			92	20		
43	74			93	20		
44	123			94	F		
45	55			95	37		
46	45			96	45		
47	123			97	20		
48	17			98	10		
49	35			99	46		
50	51	0		100	4	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-17		
Site: WAL1						HU#: 42		
Count	**Dia. (mm)**	**Embed. score**	**Comments**		**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	142				51	98		
2	101				52	30		
3	170				53	85		
4	142				54	84		
5	130				55	145		
6	123				56	63		
7	80				57	141		
8	35				58	142		
9	61				59	91		
10	30	0			60	60	0.25	
11	36				61	93		
12	420				62	71		
13	113				63	90		
14	81				64	71		
15	70				65	F		
16	93				66	66		
17	F				67	126		
18	97				68	104		
19	202				69	105		
20	115	0			70	97	0.5	
21	130				71	76		
22	170				72	80		
23	113				73	35		
24	125				74	140		
25	310				75	196		
26	F				76	180		
27	75				77	119		
28	90				78	80		
29	111				79	113		
30	30	0.25			80	126	0.25	
31	15				81	F		
32	225				82	65		
33	117				83	97		
34	46				84	55		
35	200				85	7		
36	163				86	46		
37	131				87	123		
38	50				88	65		
39	55				89	131		
40	71				90	F	1	
41	75				91	42		
42	75				92	180		
43	163				93	229		
44	103				94	111		
45	50				95	F		
46	103				96	109		
47	67				97	109		
48	71				98	150		
49	105				99	46		
50	57	0			100	89	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:					Date: 13-Aug-17	
Site: WAL1							HU#: 43	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	F				51	F		
2	F				52	F		
3	F				53	F		
4	F				54	F		
5	F				55	F		
6	F				56	F		
7	F				57	F		
8	F				58	F		
9	F				59	F		
10	F	1			60	F	1	
11	F				61	F		
12	F				62	F		
13	F				63	F		
14	F				64	F		
15	F				65	F		
16	F				66	F		
17	F				67	F		
18	F				68	F		
19	F				69	F		
20	F	1			70	F	1	
21	F				71	F		
22	F				72	F		
23	F				73	F		
24	F				74	F		
25	F				75	F		
26	F				76	F		
27	F				77	F		
28	F				78	F		
29	F				79	F		
30	F	1			80	85		
31	F				81	111		
32	F				82	63		
33	F				83	10		
34	F				84	70		
35	F				85	68		
36	F				86	57		
37	F				87	60		
38	F				88	121		
39	F				89	49		
40	F	1			90	74	0	
41	F				91	50		
42	F				92	57		
43	F				93	53		
44	F				94	21		
45	F				95	26		
46	F				96	130		
47	F				97	125		
48	F				98	142		
49	F				99	168		
50	F	1			100	135	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek			Habitat type:	Cascade			Date: 13-Aug-17	
Site: WAL1							HU#: 44	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	180				51	97		
2	51				52	95		
3	96				53	84		
4	115				54	81		
5	65				55	170		
6	67				56	322		
7	54				57	155		
8	43				58	118		
9	125				59	127		
10	55	0			60	211	0.5	
11	126				61	78		
12	71				62	37		
13	100				63	F		
14	40				64	45		
15	16				65	87		
16	154				66	93		
17	65				67	86		
18	43				68	99		
19	76				69	115		
20	60	0.25			70	42	0	
21	148				71	20		
22	80				72	31		
23	225				73	33		
24	F				74	100		
25	60				75	62		
26	66				76	75		
27	131				77	271		
28	77				78	185		
29	199				79	172		
30	107	0.5			80	71	0	
31	198				81	75		
32	177				82	80		
33	70				83	143		
34	F				84	145		
35	75				85	152		
36	132				86	120		
37	74				87	133		
38	103				88	54		
39	188				89	56		
40	70	0			90	60	0	
41	52				91	66		
42	94				92	130		
43	111				93	133		
44	146				94	32		
45	72				95	63		
46	76				96	63		
47	115				97	334		
48	165				98	76		
49	130				99	277		
50	111	0			100	118	1	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%								

Stream: West Alexander Creek		Habitat type:	Riffle		Date: 13-Aug-17		
Site: WAL1					HU#: 45		
Count	**Dia. (mm)**	**Embed. score**	**Comments**	**Count**	**Dia. (mm)**	**Embed. score**	**Comments**
1	F			51	F		
2	35			52	F		
3	32			53	124		
4	21			54	50		
5	20			55	48		
6	11			56	43		
7	10			57	95		
8	36			58	30		
9	43			59	192		
10	36	0.25		60	65	0.5	
11	105			61	231		
12	175			62	48		
13	60			63	24		
14	51			64	52		
15	36			65	61		
16	F			66	179		
17	55			67	105		
18	42			68	37		
19	110			69	118		
20	90	0.5		70	195	0	
21	50			71	66		
22	80			72	43		
23	63			73	F		
24	42			74	40		
25	45			75	105		
26	F			76	264		
27	65			77	46		
28	37			78	299		
29	85			79	94		
30	60	0.5		80	93	0.75	
31	45			81	20		
32	76			82	21		
33	47			83	83		
34	60			84	8		
35	103			85	92		
36	284			86	104		
37	113			87	141		
38	F			88	95		
39	40			89	63		
40	111	0.5		90	108	0.5	
41	5070			91	76		
42	F			92	125		
43	54			93	100		
44	73			94	94		
45	F			95	123		
46	F			96	44		
47	F			97	117		
48	F			98	107		
49	F			99	150		
50	F	1		100	50	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Glide			Date: 13-Aug-17	
Site: WAL1						HU#: 46	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	F			51	F		
2	F			52	F		
3	F			53	F		
4	F			54	F		
5	F			55	F		
6	F			56	F		
7	F			57	F		
8	F			58	F		
9	F			59	F		
10	F	1		60	F	1	
11	F			61	174		
12	F			62	83		
13	F			63	113		
14	F			64	119		
15	F			65	78		
16	F			66	142		
17	F			67	78		
18	F			68	90		
19	F			69	95		
20	F	1		70	31	0	
21	F			71	163		
22	F			72	98		
23	F			73	184		
24	F			74	150		
25	F			75	35		
26	F			76	23		
27	F			77	30		
28	F			78	25		
29	F			79	87		
30	F	1		80	112	0.25	
31	F			81	185		
32	F			82	84		
33	F			83	123		
34	F			84	60		
35	F			85	115		
36	F			86	119		
37	F			87	11		
38	F			88	13		
39	F			89	21		
40	F	1		90	85	0	
41	F			91	30		
42	F			92	15		
43	F			93	36		
44	F			94	53		
45	F			95	73		
46	F			96	36		
47	F			97	60		
48	F			98	56		
49	F			99	21		
50	F	1		100	20	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-17	
Site: WAL1						HU#: 47	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	400			51	90		
2	124			52	135		
3	240			53	240		
4	191			54	188		
5	153			55	95		
6	35			56	F		
7	80			57	105		
8	63			58	90		
9	41			59	41		
10	90	0.25		60	30	0.75	
11	85			61	60		
12	66			62	406		
13	F			63	298		
14	F			64	115		
15	246			65	70		
16	112			66	93		
17	55			67	96		
18	90			68	33		
19	76			69	23		
20	141	0		70	146	0.5	
21	85			71	44		
22	73			72	52		
23	179			73	70		
24	182			74	163		
25	141			75	104		
26	108			76	79		
27	90			77	64		
28	189			78	F		
29	190			79	235		
30	85			80	40	0	
31	90			81	74		
32	151			82	410		
33	93			83	50		
34	40			84	78		
35	100			85	73		
36	9			86	114		
37	F			87	79		
38	80			88	86		
39	320			89	138		
40	230	0		90	65	0	
41	160			91	196		
42	135			92	106		
43	118			93	195		
44	55			94	37		
45	98			95	22		
46	70			96	66		
47	174			97	79		
48	103			98	186		
49	152			99	284		
50	365	0.5		100	23	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: West Alexander Creek		Habitat type:	Riffle			Date: 13-Aug-17	
Site: WAL1						HU#: 48	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	F			51	40		
2	F			52	31		
3	F			53	34		
4	F			54	43		
5	F			55	58		
6	F			56	79		
7	F			57	83		
8	F			58	30		
9	F			59	35		
10	F	1		60	34	0	
11	F			61	56		
12	F			62	50		
13	F			63	60		
14	F			64	52		
15	F			65	94		
16	F			66	25		
17	F			67	40		
18	F			68	40		
19	F			69	46		
20	F	1		70	60	0	
21	F			71	67		
22	F			72	64		
23	F			73	96		
24	F			74	43		
25	F			75	66		
26	F			76	61		
27	F			77	73		
28	F			78	38		
29	F			79	60		
30	F	1		80	64	0.25	
31	53			81	74		
32	35			82	65		
33	49			83	20		
34	47			84	15		
35	48			85	21		
36	42			86	15		
37	18			87	8		
38	50			88	3		
39	33			89	16		
40	53	0		90	50	0.25	
41	50			91	76		
42	56			92	75		
43	63			93	70		
44	57			94	144		
45	78			95	61		
46	55			96	65		
47	40			97	80		
48	78			98	63		
49	74			99	183		
50	88	0.25		100	47	0.25	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-17	
Site: WAL1						HU#: 49	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	119			51	171		
2	75			52	39		
3	90			53	30		
4	69			54	27		
5	85			55	15		
6	70			56	12		
7	47			57	133		
8	55			58	35		
9	56			59	F		
10	160	0.25		60	F	0	
11	139			61	108		
12	105			62	85		
13	47			63	149		
14	30			64	448		
15	75			65	48		
16	110			66	232		
17	32			67	33		
18	83			68	49		
19	125			69	55		
20	53	0		70	16	0	
21	105			71	53		
22	68			72	52		
23	79			73	28		
24	85			74	34		
25	90			75	28		
26	52			76	50		
27	35			77	138		
28	75			78	149		
29	168			79	28		
30	130	0.25		80	160	0.25	
31	257			81	225		
32	113			82	128		
33	F			83	176		
34	36			84	55		
35	45			85	49		
36	94			86	F		
37	121			87	143		
38	323			88	130		
39	59			89	85		
40	52	0		90	222	0	
41	91			91	115		
42	16			92	63		
43	15			93	115		
44	31			94	13		
45	17			95	97		
46	9			96	184		
47	130			97	128		
48	171			98	F		
49	179			99	F		
50	263	0.75		100	F	1	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Riffle			Date: 13-Aug-17	
Site: WAL1						HU#: 50	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	139			51	47		
2	17			52	R		
3	48			53	F		
4	59			54	R		
5	42			55	F		
6	171			56	R		
7	95			57	F		
8	15			58	R		
9	79			59	87		
10	82	0		60	F	1	
11	20			61	145		
12	38			62	115		
13	14			63	65		
14	27			64	148		
15	28			65	130		
16	32			66	85		
17	39			67	51		
18	117			68	15		
19	60			69	37		
20	86	0		70	45	0	
21	110			71	48		
22	305			72	111		
23	83			73	79		
24	47			74	65		
25	64			75	F		
26	151			76	85		
27	278			77	85		
28	95			78	103		
29	110			79	36		
30	109	0.5		80	78	0	
31	28			81	65		
32	167			82	55		
33	52			83	85		
34	28			84	21		
35	R			85	100		
36	73			86	68		
37	57			87	100		
38	152			88	80		
39	46			89	108		
40	F	1		90	30	0	
41	105			91	51		
42	112			92	63		
43	46			93	60		
44	25			94	168		
45	187			95	220		
46	145			96	210		
47	65			97	185		
48	27			98	320		
49	39			99	52		
50	88	0.25		100	35	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-17	
Site: WAL1						HU#: 51	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	158			51	F		
2	172			52	F		
3	135			53	220		
4	109			54	243		
5	115			55	520		
6	117			56	289		
7	140			57	200		
8	35			58	440		
9	26			59	53		
10	135	0.5		60	150	0.25	
11	38			61	39		
12	35			62	195		
13	21			63	85		
14	210			64	27		
15	343			65	50		
16	120			66	193		
17	68			67	101		
18	80			68	66		
19	83			69	71		
20	290	0.5		70	70	0.25	
21	25			71	F		
22	50			72	143		
23	35			73	50		
24	10			74	115		
25	F			75	105		
26	F			76	33		
27	F			77	80		
28	70			78	43		
29	62			79	41		
30	264	0		80	50	0.25	
31	481			81	33		
32	134			82	39		
33	45			83	56		
34	13			84	48		
35	17			85	103		
36	29			86	22		
37	185			87	7		
38	F			88	10		
39	F			89	4		
40	F	1		90	4	0	
41	115			91	32		
42	F			92	52		
43	F			93	39		
44	111			94	34		
45	23			95	33		
46	64			96	7		
47	61			97	F		
48	23			98	15		
49	17			99	16		
50	22	0		100	70	0.25	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%							

Stream: West Alexander Creek		Habitat type:	Pool			Date: 13-Aug-17	
Site: WAL1						HU#: 52	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	F			51	F		
2	F			52	F		
3	F			53	F		
4	F			54	F		
5	F			55	F		
6	F			56	F		
7	F			57	F		
8	F			58	F		
9	F			59	F		
10	F	1		60	F	1	
11	F			61	F		
12	F			62	F		
13	F			63	F		
14	F			64	F		
15	F			65	F		
16	F			66	F		
17	F			67	F		
18	F			68	F		
19	F			69	F		
20	F	1		70	F	1	
21	F			71	F		
22	F			72	F		
23	F			73	F		
24	F			74	F		
25	F			75	F		
26	F			76	F		
27	F			77	F		
28	F			78	F		
29	F			79	F		
30	F	1		80	F	1	
31	F			81	F		
32	F			82	F		
33	F			83	F		
34	F			84	F		
35	F			85	F		
36	F			86	15		
37	F			87	7		
38	F			88	50		
39	F			89	23		
40	F	1		90	27	0	
41	F			91	100		
42	F			92	14		
43	F			93	45		
44	F			94	40		
45	F			95	16		
46	F			96	21		
47	F			97	39		
48	F			98	26		
49	F			99	15		
50	F	1		100	10	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-17	
Site: WAL1						HU#: 53	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	22			51	115		
2	118			52	180		
3	17			53	55		
4	135			54	F		
5	135			55	97		
6	135			56	91		
7	144			57	38		
8	75			58	33		
9	40			59	124		
10	120	0		60	35	1	
11	140			61	40		
12	84			62	27		
13	168			63	26		
14	164			64	43		
15	68			65	121		
16	136			66	50		
17	125			67	31		
18	168			68	30		
19	52			69	10		
20	148	0.75		70	72	0	
21	104			71	20		
22	86			72	14		
23	29			73	11		
24	15			74	114		
25	101			75	15		
26	32			76	117		
27	225			77	130		
28	111			78	119		
29	179			79	F		
30	68	0		80	45	0.75	
31	55			81	65		
32	131			82	243		
33	110			83	175		
34	95			84	130		
35	155			85	80		
36	185			86	110		
37	124			87	99		
38	46			88	104		
39	F			89	78		
40	62	0		90	58	0.25	
41	76			91	54		
42	113			92	55		
43	65			93	61		
44	98			94	50		
45	111			95	40		
46	60			96	34		
47	84			97	25		
48	185			98	7		
49	92			99	8		
50	111	0		100	45	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

LOTIC ENVIRONMENTAL
SPECIALISTS IN FRESHWATER ECOSYSTEMS

Stream: West Alexander Creek		Habitat type:	Glide			Date: 13-Aug-17		
Site: WAL1						HU#: 54		
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	F				51	F		
2	F				52	F		
3	F				53	F		
4	F				54	F		
5	F				55	F		
6	F				56	F		
7	F				57	F		
8	F				58	F		
9	F				59	F		
10	F	1			60	F	1	
11	F				61	F		
12	F				62	F		
13	F				63	F		
14	F				64	F		
15	F				65	F		
16	F				66	F		
17	F				67	F		
18	F				68	F		
19	F				69	F		
20	F	1			70	F	1	
21	F				71	F		
22	F				72	F		
23	F				73	F		
24	F				74	F		
25	F				75	22		
26	F				76	38		
27	F				77	57		
28	F				78	108		
29	F				79	40		
30	F	1			80	39	0.25	
31	F				81	52		
32	F				82	50		
33	F				83	23		
34	F				84	20		
35	F				85	40		
36	F				86	8		
37	F				87	36		
38	F				88	48		
39	F				89	50		
40	F	1			90	60	0	
41	F				91	45		
42	F				92	145		
43	F				93	141		
44	F				94	61		
45	F				95	25		
46	F				96	49		
47	F				97	130		
48	F				98	68		
49	F				99	57		
50	F	1			100	38	0.25	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%								

Stream: West Alexander Creek		Habitat type:	Riffle			Date: 13-Aug-17		
Site: WAL1						HU#: 55		
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	F				51	35		
2	F				52	27		
3	F				53	66		
4	F				54	81		
5	F				55	52		
6	F				56	60		
7	F				57	10		
8	F				58	17		
9	F				59	46		
10	36	0			60	40	0	
11	41				61	55		
12	110				62	15		
13	6				63	32		
14	24				64	38		
15	39				65	51		
16	45				66	66		
17	29				67	58		
18	40				68	55		
19	119				69	74		
20	132	0.5			70	37	0	
21	120				71	50		
22	69				72	34		
23	70				73	47		
24	91				74	54		
25	40				75	59		
26	31				76	55		
27	5				77	99		
28	30				78	49		
29	46				79	55		
30	60	0.75			80	F	1	
31	47				81	F		
32	18				82	F		
33	40				83	F		
34	161				84	20		
35	51				85	17		
36	29				86	20		
37	23				87	15		
38	25				88	75		
39	50				89	81		
40	76	0			90	56	0.25	
41	60				91	59		
42	48				92	55		
43	49				93	41		
44	65				94	F		
45	56				95	F		
46	40				96	75		
47	51				97	25		
48	21				98	37		
49	17				99	95		
50	78	0.25			100	41	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Cascade			Date: 13-Aug-17	
Site: WAL1						HU#: 56	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	62			51	66		
2	31			52	F		
3	67			53	49		
4	45			54	65		
5	65			55	55		
6	33			56	40		
7	51			57	51		
8	105			58	70		
9	39			59	57		
10	51	0		60	65	0	
11	40			61	46		
12	29			62	60		
13	43			63	47		
14	45			64	96		
15	80			65	82		
16	78			66	65		
17	48			67	79		
18	45			68	91		
19	81			69	56		
20	83	0		70	60	0	
21	52			71	88		
22	59			72	42		
23	85			73	39		
24	75			74	30		
25	67			75	68		
26	65			76	F		
27	86			77	22		
28	68			78	60		
29	70			79	43		
30	49	0		80	30	0	
31	99			81	36		
32	48			82	66		
33	59			83	34		
34	46			84	5		
35	35			85	35		
36	32			86	12		
37	45			87	42		
38	33			88	72		
39	100			89	59		
40	75	0		90	50	0.25	
41	62			91	44		
42	55			92	65		
43	45			93	31		
44	61			94	35		
45	80			95	39		
46	104			96	79		
47	43			97	51		
48	71			98	109		
49	86			99	50		
50	70	0.25		100	56	0	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek		Habitat type:	Glide			Date: 13-Aug-17	
Site: WAL1						HU#: 57	
Count	Dia. (mm)	Embed. score	Comments	Count	Dia. (mm)	Embed. score	Comments
1	95			51	30		
2	76			52	49		
3	53			53	55		
4	45			54	65		
5	30			55	50		
6	49			56	43		
7	65			57	55		
8	63			58	35		
9	55			59	75		
10	37	0		60	64	0	
11	75			61	60		
12	74			62	67		
13	30			63	52		
14	59			64	91		
15	60			65	55		
16	57			66	45		
17	65			67	40		
18	42			68	52		
19	30			69	42		
20	41	0.25		70	60	0.5	
21	27			71	118		
22	33			72	35		
23	78			73	65		
24	45			74	56		
25	50			75	75		
26	37			76	F		
27	39			77	104		
28	81			78	F		
29	19			79	84		
30	70	0		80	60	0	
31	51			81	F		
32	54			82	88		
33	85			83	78		
34	74			84	69		
35	81			85	65		
36	66			86	43		
37	62			87	52		
38	96			88	F		
39	75			89	F		
40	90	0.75		90	F	1	
41	70			91	F		
42	24			92	81		
43	31			93	56		
44	61			94	42		
45	68			95	70		
46	41			96	51		
47	100			97	69		
48	50			98	84		
49	77			99	35		
50	108	0.25		100	58	0	

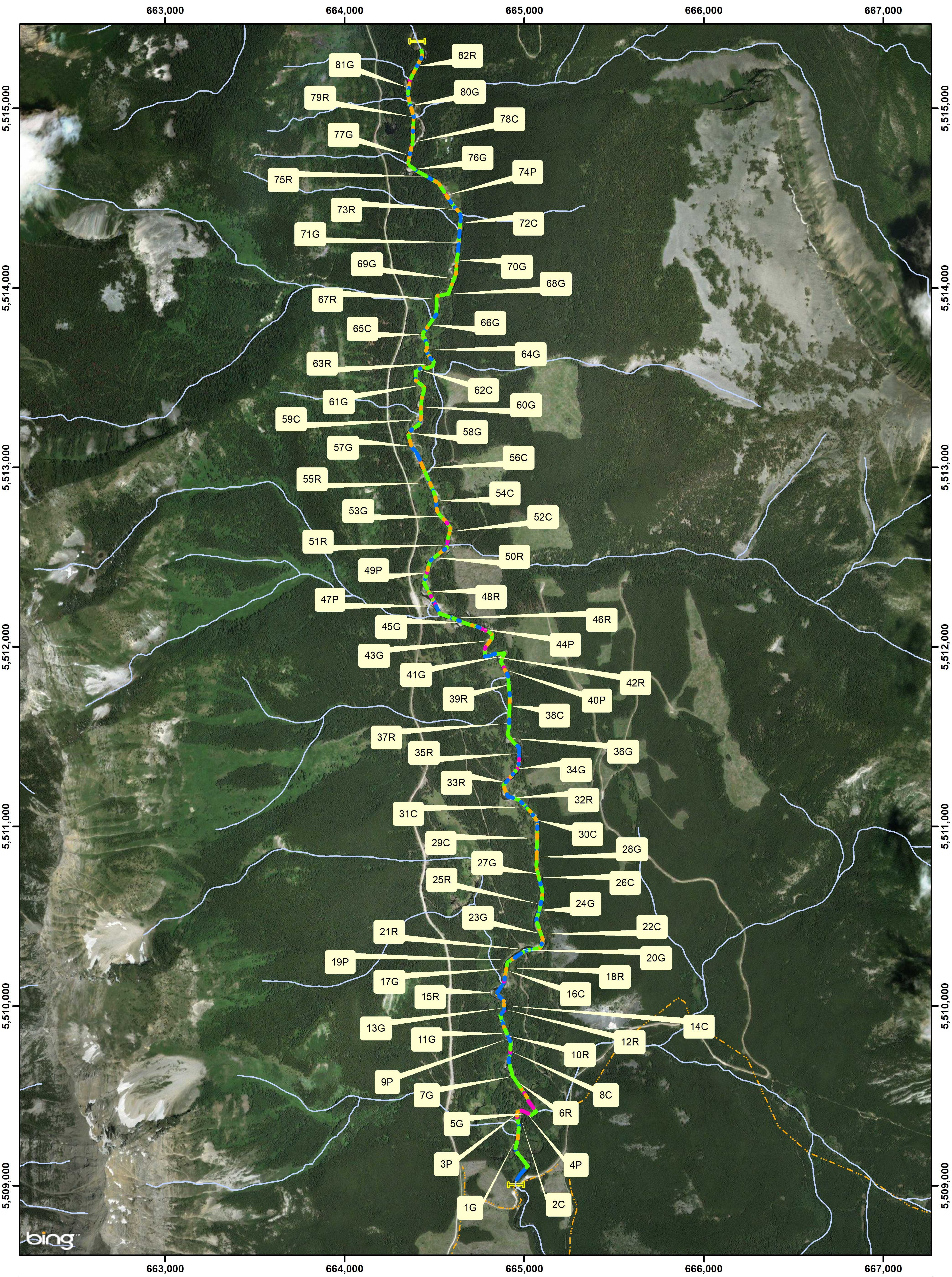
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek			Habitat type:		Riffle		Date: 13-Aug-17	
Site: WAL1							HU#: 58	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	75				51	68		
2	40				52	101		
3	35				53	311		
4	36				54	243		
5	71				55	61		
6	82				56	192		
7	106				57	31		
8	115				58	38		
9	38				59	65		
10	F	1			60	49	0	
11	F				61	103		
12	F				62	60		
13	65				63	44		
14	152				64	39		
15	120				65	140		
16	54				66	108		
17	53				67	183		
18	70				68	131		
19	38				69	87		
20	25	0.5			70	54	0	
21	39				71	81		
22	15				72	263		
23	27				73	160		
24	20				74	181		
25	F				75	70		
26	54				76	201		
27	75				77	86		
28	89				78	F		
29	173				79	61		
30	150	0.25			80	34	0.5	
31	F				81	40		
32	322				82	35		
33	127				83	55		
34	F				84	110		
35	115				85	242		
36	232				86	65		
37	152				87	43		
38	45				88	24		
39	F				89	53		
40	12	0			90	15	0.5	
41	87				91	21		
42	148				92	19		
43	352				93	F		
44	71				94	F		
45	84				95	90		
46	52				96	77		
47	87				97	36		
48	53				98	24		
49	188				99	22		
50	132	0.5			100	111	0.5	

Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%

Stream: West Alexander Creek			Habitat type:	Glide			Date: 13-Aug-17	
Site: WAL1							HU#: 59	
Count	Dia. (mm)	Embed. score	Comments		Count	Dia. (mm)	Embed. score	Comments
1	78				51	64		
2	40				52	50		
3	38				53	25		
4	120				54	31		
5	25				55	42		
6	44				56	37		
7	110				57	26		
8	105				58	21		
9	64				59	18		
10	100	0.25			60	69	0	
11	70				61	68		
12	36				62	49		
13	113				63	46		
14	61				64	26		
15	66				65	28		
16	44				66	59		
17	93				67	50		
18	50				68	15		
19	42				69	24		
20	20	0			70	F	1	
21	31				71	F		
22	26				72	F		
23	50				73	F		
24	62				74	F		
25	51				75	F		
26	32				76	F		
27	25				77	F		
28	74				78	F		
29	73				79	F		
30	56	0.5			80	F	1	
31	50				81	F		
32	45				82	F		
33	51				83	F		
34	34				84	F		
35	30				85	F		
36	50				86	F		
37	82				87	F		
38	100				88	F		
39	71				89	F		
40	85	0.5			90	F	1	
41	30				91	F		
42	25				92	F		
43	39				93	F		
44	56				94	F		
45	67				95	F		
46	44				96	F		
47	40				97	F		
48	29				98	F		
49	44				99	F		
50	41	0.5			100	F	1	
Embeddedness scoring: 1 = fully embedded, 0.75 = 75% embedded, 0.50 = 50% embedded, 0.25 = 25%								

Appendix N. FHAP Delineation.



Alexander Creek - Reach 7

Water Network

Reach Break

Teck Coal Roads

Cascade

Glide

Pool

Riffle

0 250 500 1,000

Meters

1:20,000

UTM Zone 11 NAD83

False Easting: 500,000

Data Sources:

Streams (NHN)

Roads (Teck Coal)

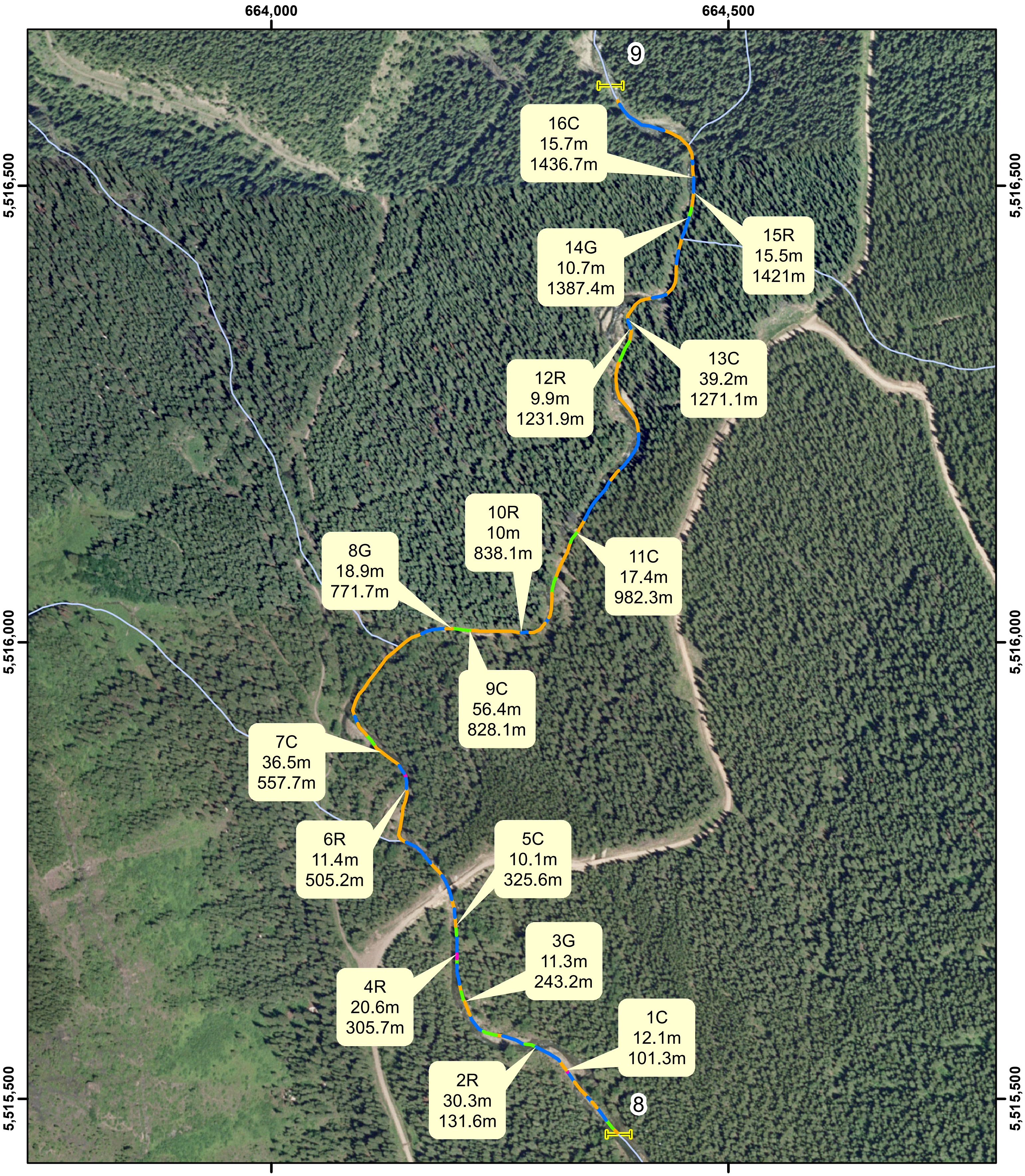
Imagery (Bing)

Created On:
March 21, 2018

Prepared For:
NWP Coal Canada Ltd

Completed By:
Lotic Environmental
Specialists in Freshwater Ecosystems

Path: ALE7_Habdelin_03202018

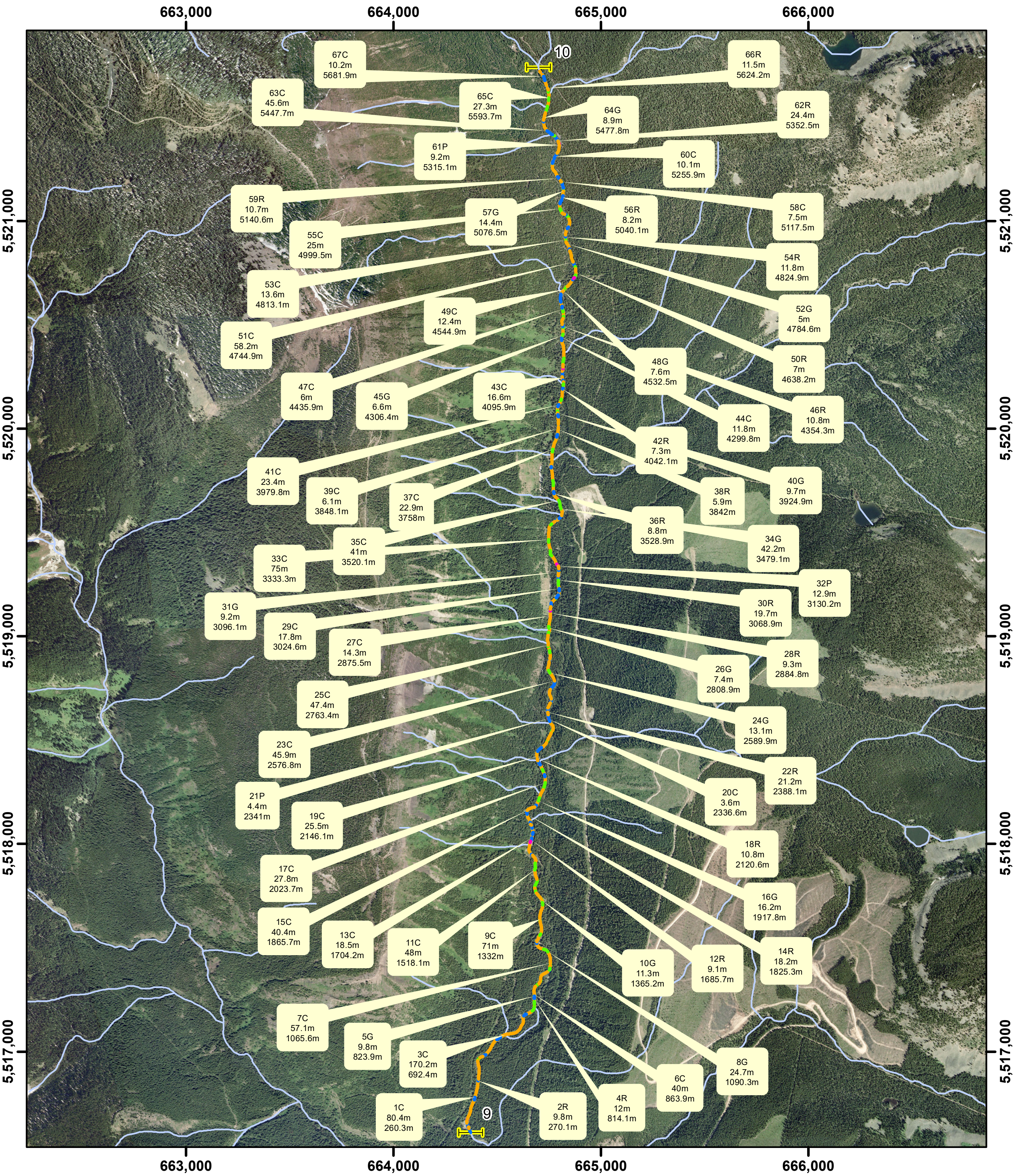


ALEXANDER CREEK - REACH 8

CASCADE
POOL
STREAM
GLIDE
RIFFLE
REACH BREAK

0 50 100 200
METERS
1:5,500
UTM ZONE 11 NAD83
FALSE EASTING: 500,000
DATA SOURCES: GEOBASE

EDITED ON:
JUNE 6, 2016
COMPLETED BY:
LOTIC
ENVIRONMENTAL



Alexander Creek - Reach 9

Cascade | Pool | Stream
Glide | Riffle | Reach Break

0 225 450 900
Meters
1:24,000
UTM Zone 11 NAD83
False Easting: 500,000
Data Sources: Geobase

Edited On:
June 6, 2016
Completed By:
Lotic
Environmental

Alexander Creek - Reach 10

Cascade Pool Stream

Glide Riffle Reach Break

0 5 10 20

Meters

1:1,000

UTM Zone 11 NAD83

False Easting: 500,000

Data Sources: Geobase

Edited On:
June 6, 2016

Completed By:

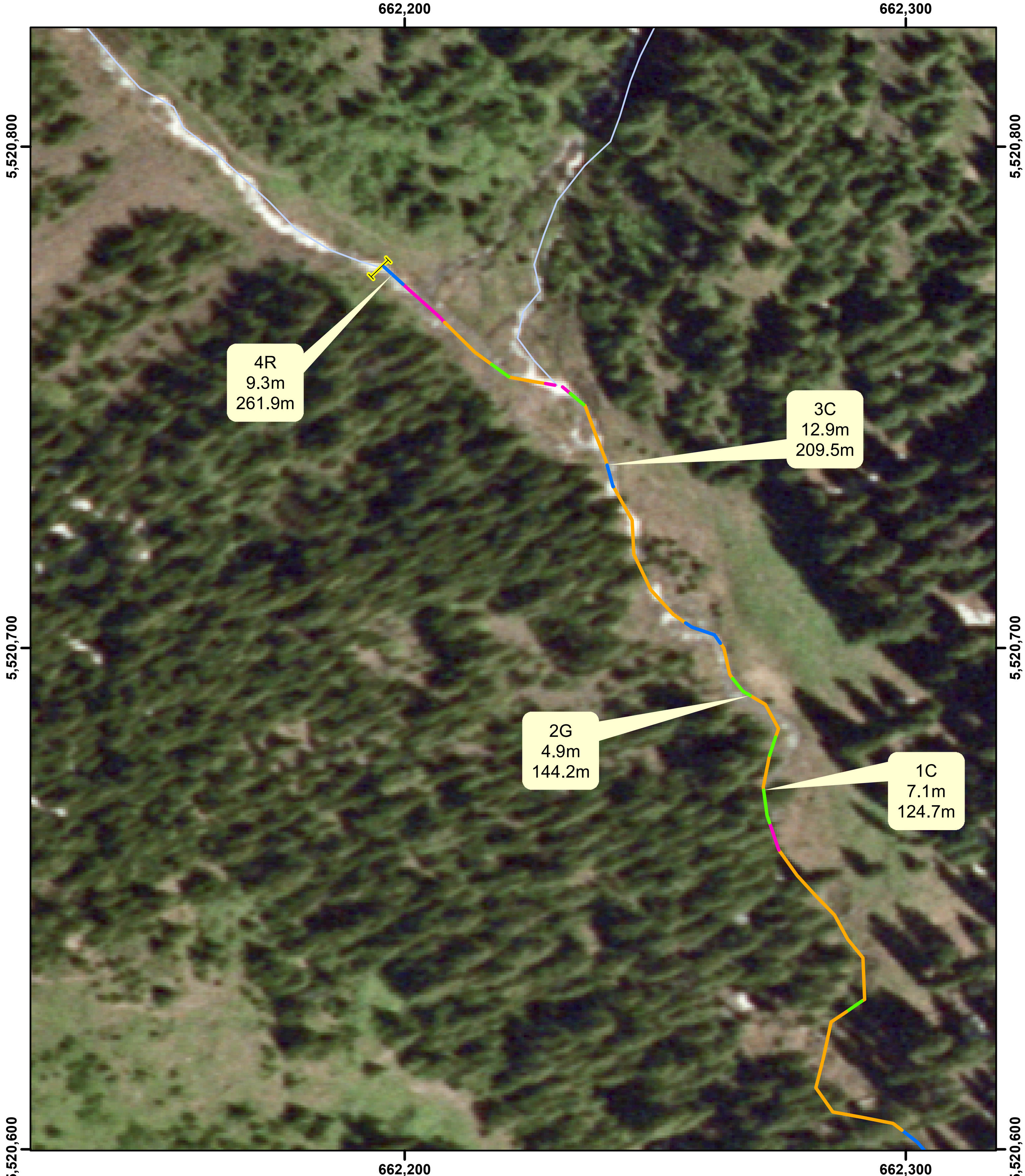
Lotic Environmental

West Alexander Creek - Reach 1

Cascade
Pool
Stream
Glide
Riffle
Reach Break

0 200 400 800
Meters
1:21,000
UTM Zone 11 NAD83
False Easting: 500,000
Data Sources: Geobase

Edited On:
June 7, 2016
Completed By:
Lotic Environmental



West Alexander Creek - Reach 2

Cascade Pool Stream
Glide Riffle Reach Break

0 5 10 20
Meters
1:1,000
UTM Zone 11 NAD83
False Easting: 500,000
Data Sources: Geobase

Edited On:
June 7, 2016
Completed By:
Lotic Environmental

Appendix O. Site Photos.

Appendix O. Site Photos

1 – Upstream view

2 – Downstream view

3 – Cross sectional view or representative substrate

4 – Periphyton sample example

List of Sites
ALE1
ALE2
ALE7
ALE8
ALE9
ALE10
GRA3
GRA4
UTG1
UTG2
UWA1
UWA2
UWA3
WAL1

ALE1

 **1**	 **2**
 **3**	 **4**

ALE2

1

2

3

4

ALE7

 **1**	 **2**
 **3**	

ALE8

 1	 2
 3	 4

ALE9


1


2


3


4

ALE10

1

2

3

4

GRA3

1

2

3

4

GRA4

<table>
<tr><td>
1</td><td>
2</td></tr>
<tr><td>
3</td><td></td></tr>
</table>

UTG1

 **1**	 **2**
 **3**	 **4**

UTG2

1

2

3

4

UWA1

 **1**	**2**
3	**4**

UWA2

1

2

3

4

UWA3

1

2

3

WAL1

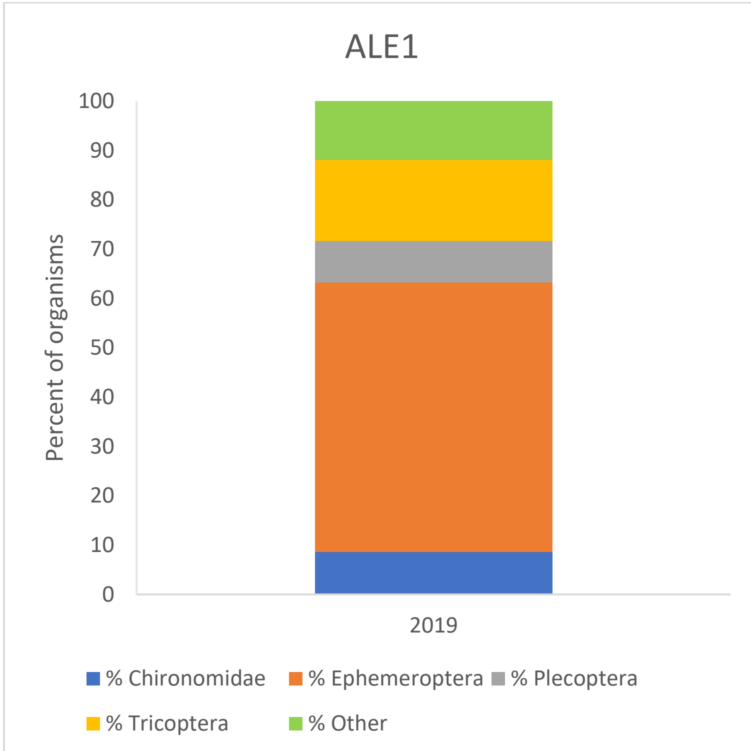
1

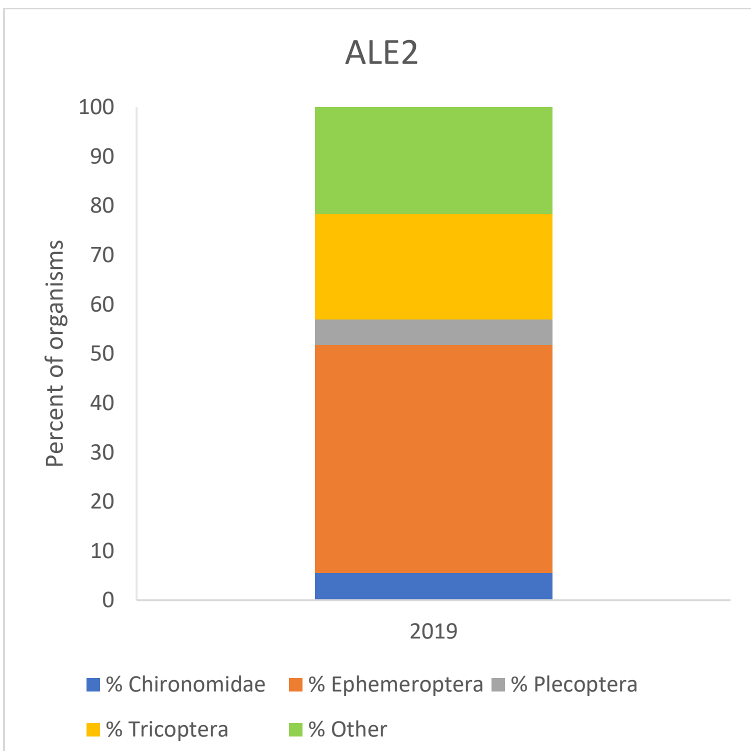
2

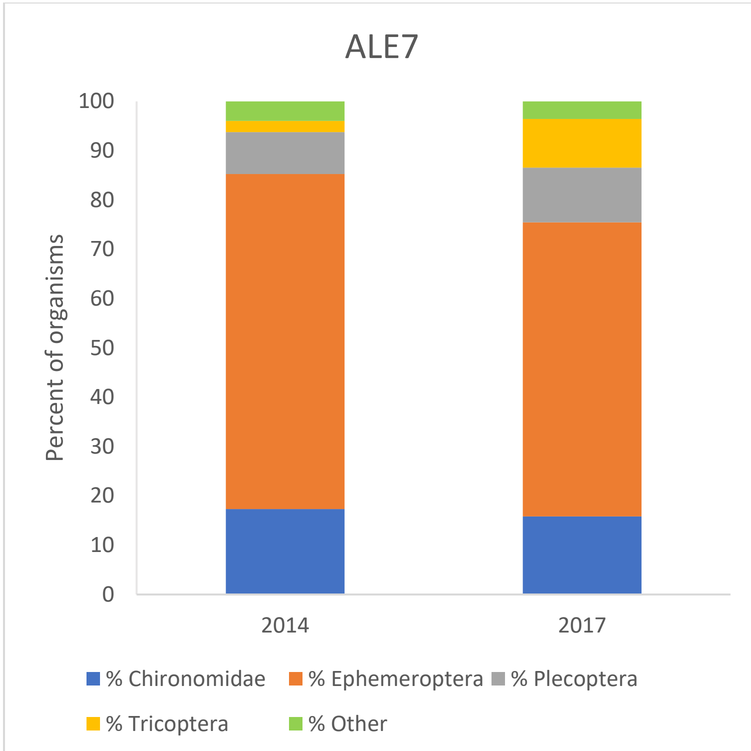
3

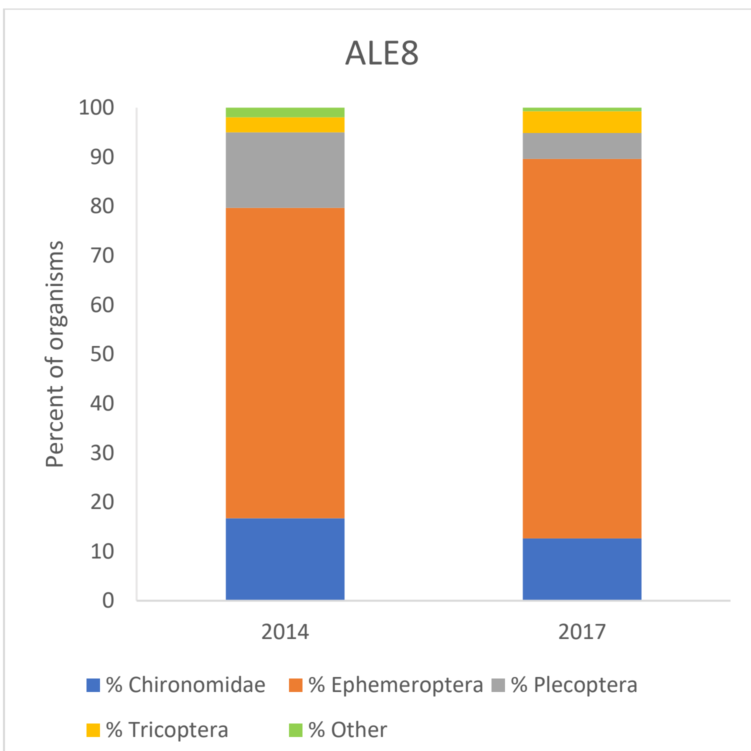
Appendix P. Invertebrate Percent of Organisms.

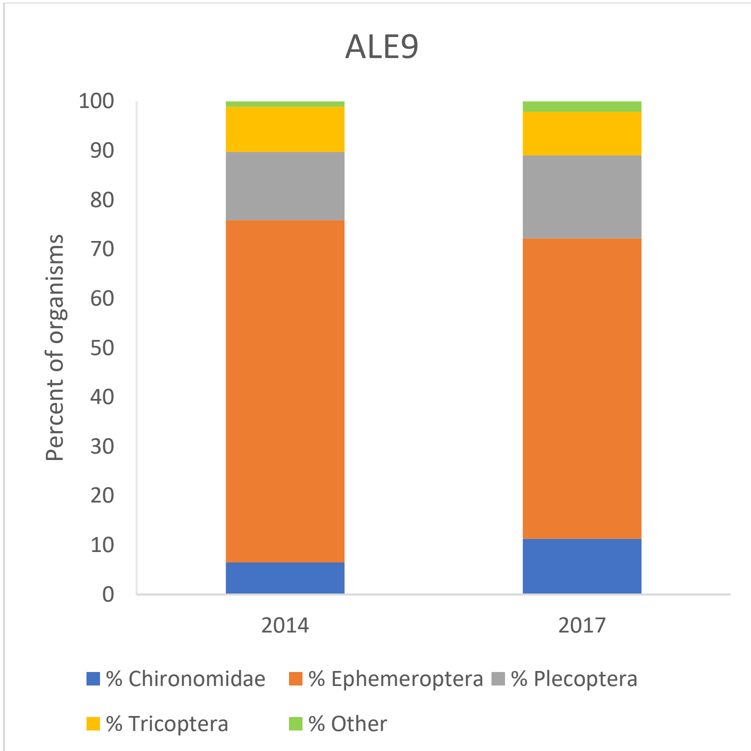
Alexander Creek

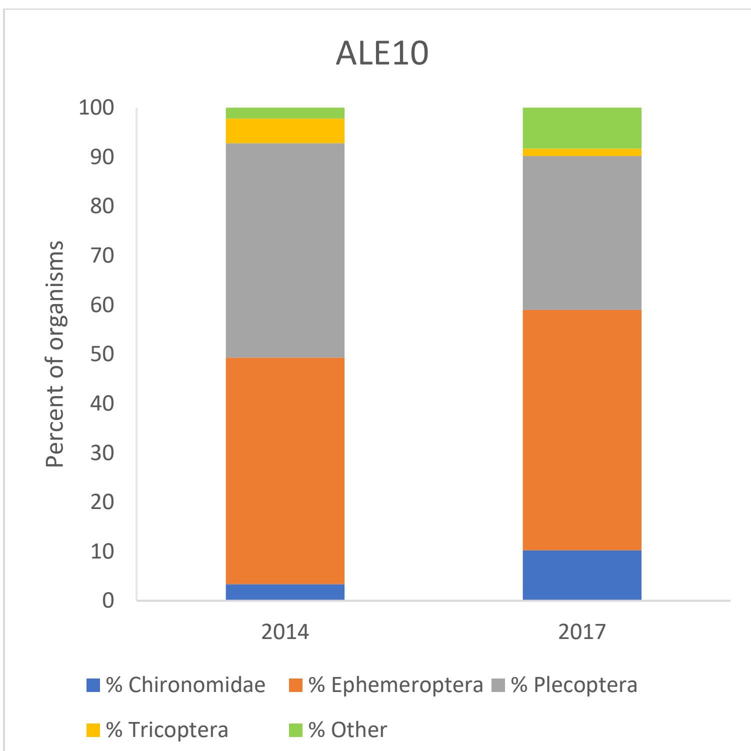


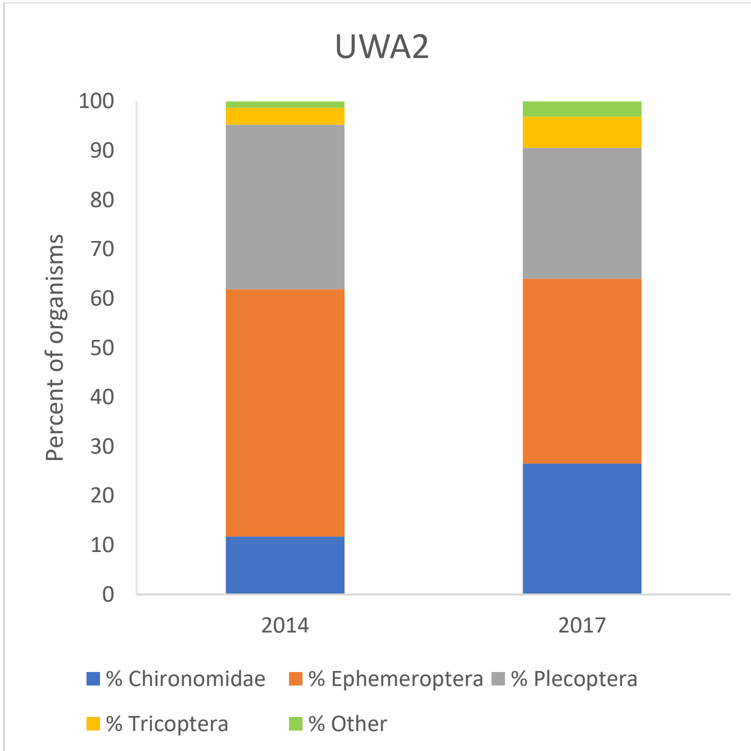


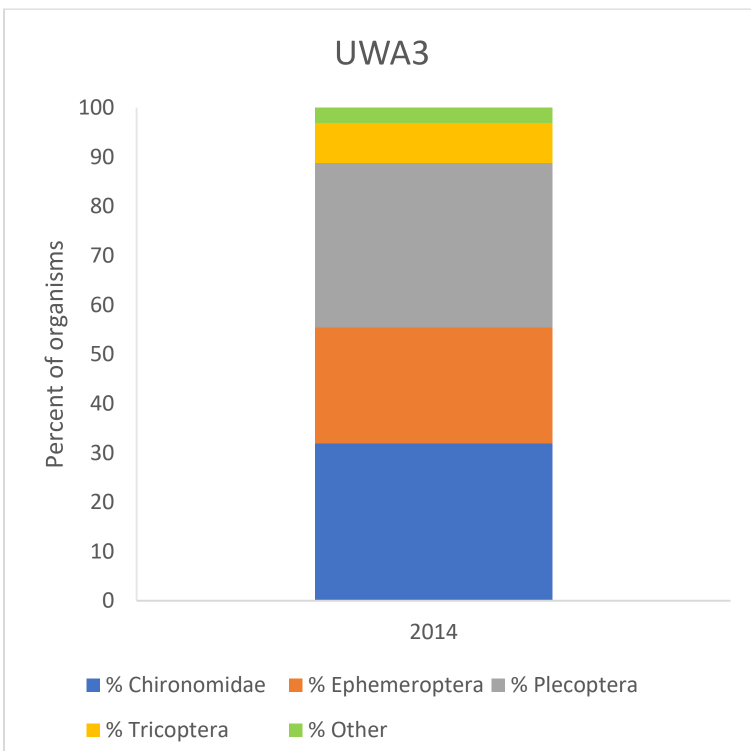

ALE7
Percent of organisms
100
90
80
70
60
50
40
30
20
10
0
2014
2017
% Chironomidae
% Ephemeroptera
% Plecoptera
% Tricoptera
% Other

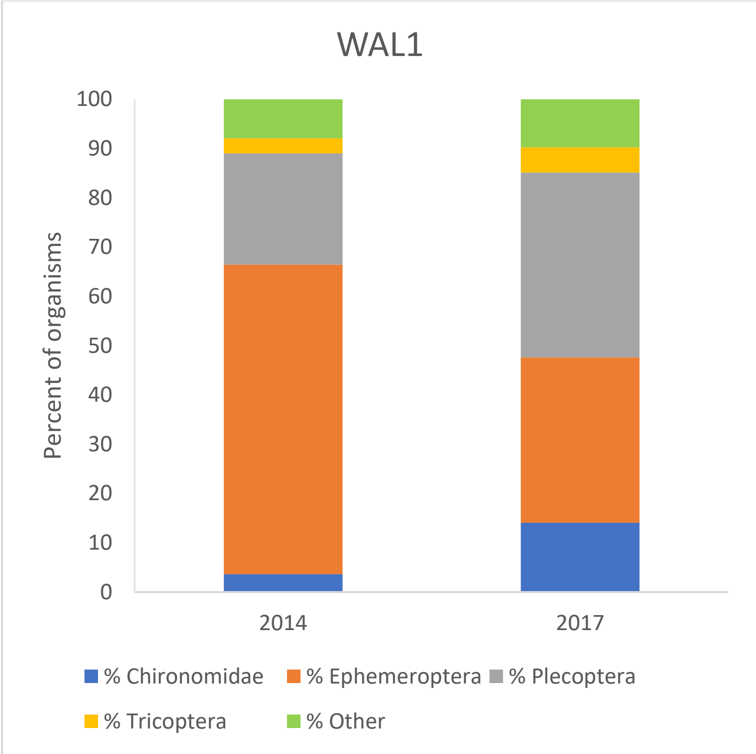

ALE8
Percent of organisms
100
90
80
70
60
50
40
30
20
10
0
2014
2017
% Chironomidae
% Ephemeroptera
% Plecoptera
% Tricoptera
% Other


ALE9
100
90
80
70
60
50
40
30
20
10
0
Percent of organisms
2014
2017
% Chironomidae
% Ephemeroptera
% Plecoptera
% Tricoptera
% Other


ALE10
100
90
80
70
60
50
40
30
20
10
0
Percent of organisms
2014
2017
% Chironomidae
% Ephemeroptera
% Plecoptera
% Tricoptera
% Other

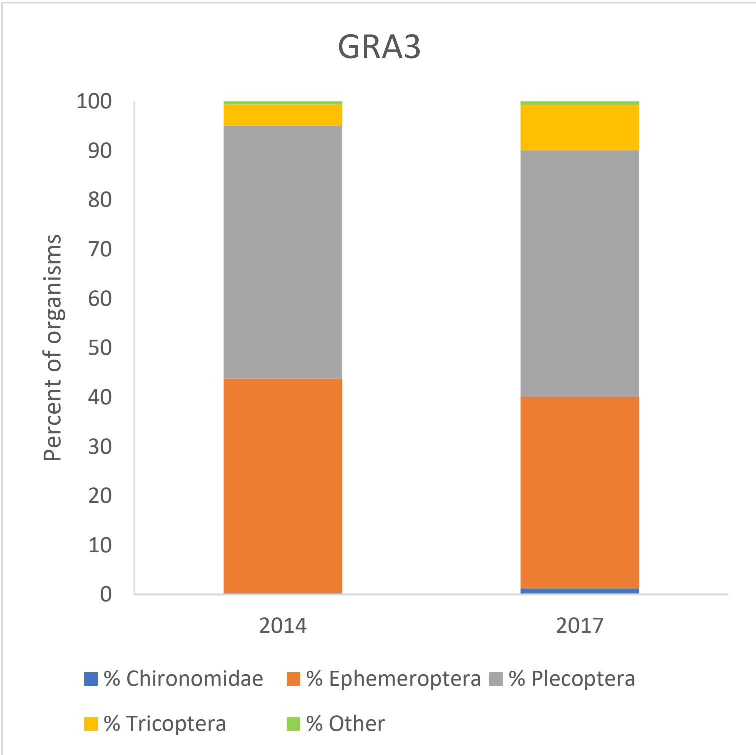

UWA2
100
90
80
70
60
50
40
30
20
10
0
Percent of organisms
2014
2017
% Chironomidae
% Ephemeroptera
% Plecoptera
% Tricoptera
% Other


UWA3
100
90
80
70
60
50
40
30
20
10
0
Percent of organisms
2014
% Chironomidae
% Ephemeroptera
% Plecoptera
% Tricoptera
% Other

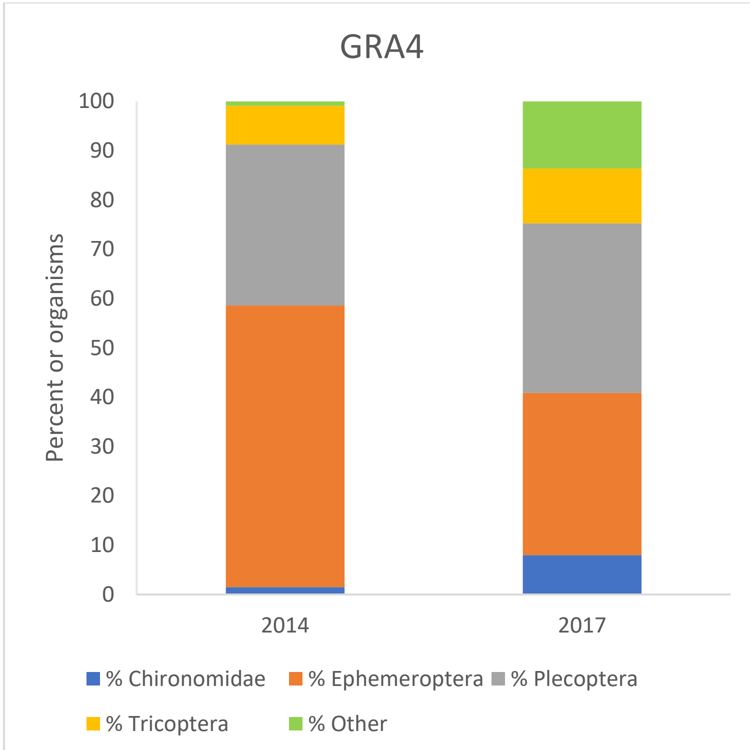


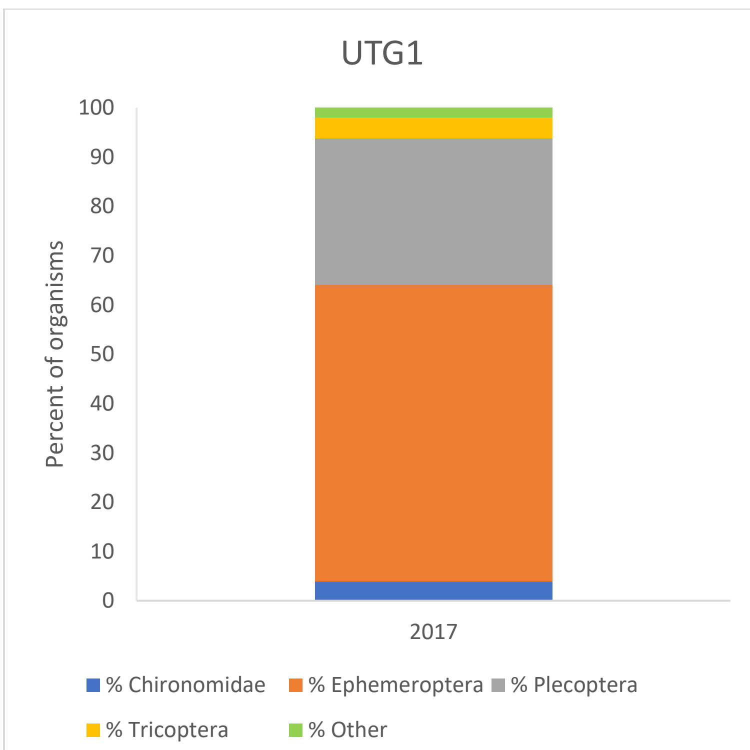
WAL1
Percent of organisms
100
90
80
70
60
50
40
30
20
10
0
2014
2017
% Chironomidae
% Ephemeroptera
% Plecoptera
% Tricoptera
% Other

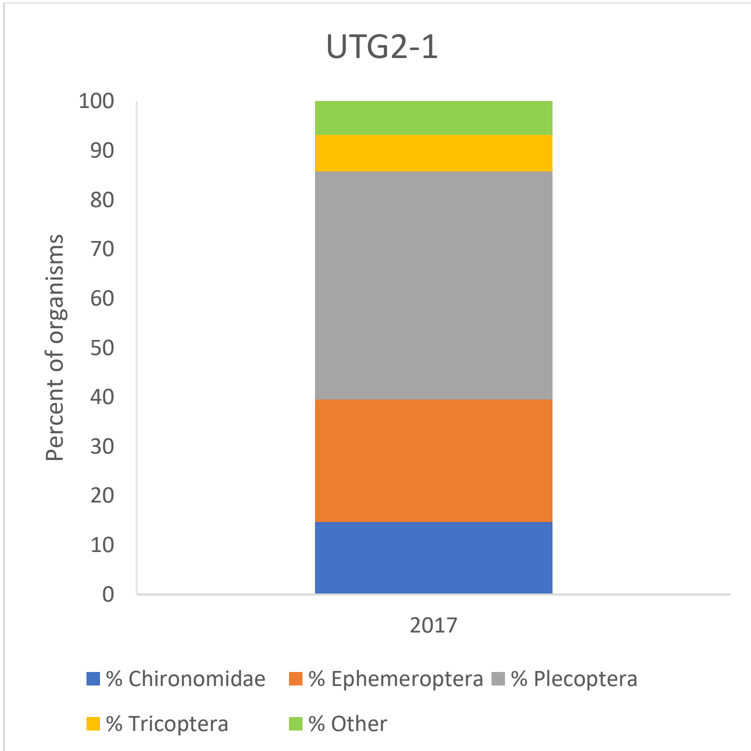
Grave Creek



GRA3
Percent of organisms
100
90
80
70
60
50
40
30
20
10
0
2014
2017
% Chironomidae
% Ephemeroptera
% Plecoptera
% Tricoptera
% Other

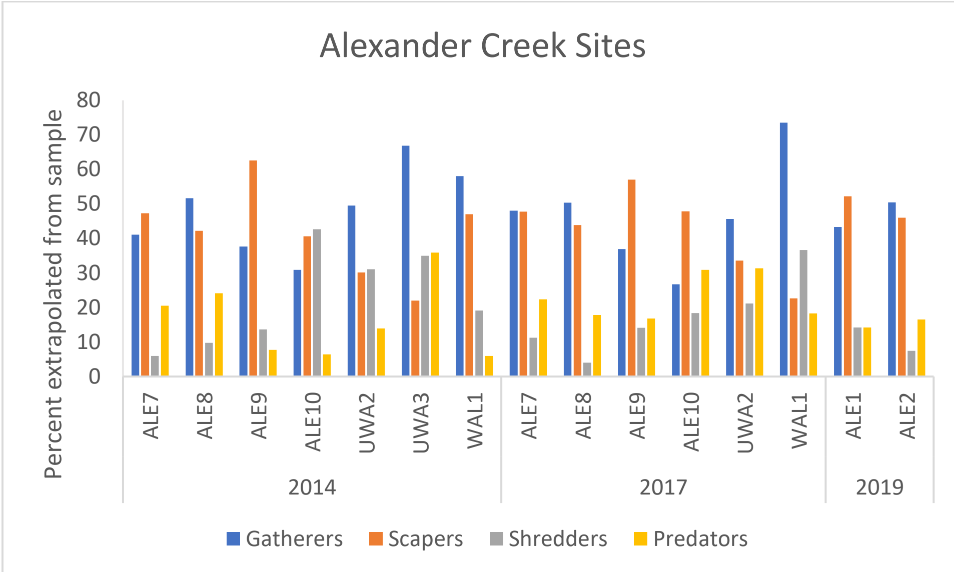

GRA4
Percent or organisms
100
90
80
70
60
50
40
30
20
10
0
2014
2017
% Chironomidae
% Ephemeroptera
% Plecoptera
% Tricoptera
% Other

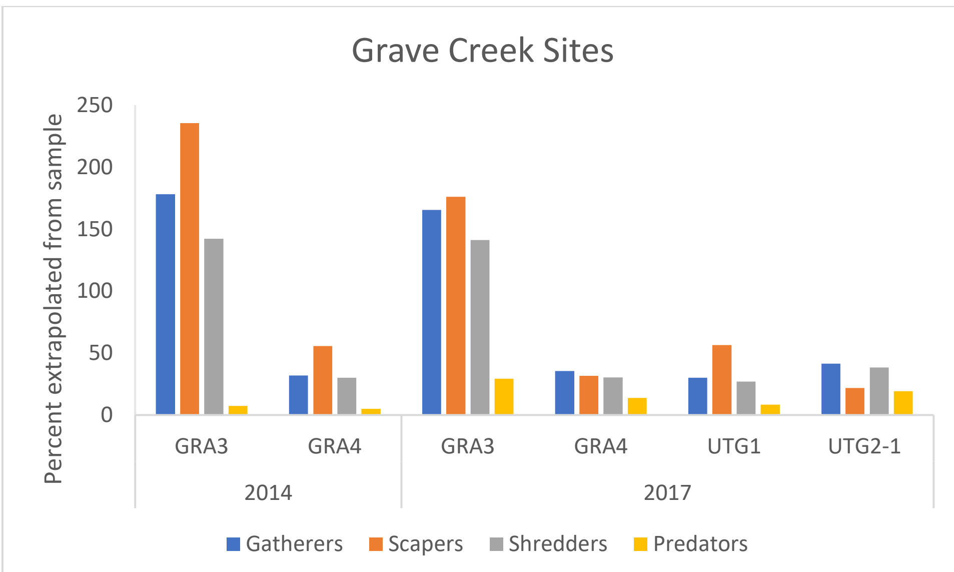

UTG1
Percent of organisms
100
90
80
70
60
50
40
30
20
10
0
2017
% Chironomidae
% Ephemeroptera
% Plecoptera
% Tricoptera
% Other


UTG2-1
Percent of organisms
100
90
80
70
60
50
40
30
20
10
0
2017
% Chironomidae
% Ephemeroptera
% Plecoptera
% Tricoptera
% Other

Appendix Q. Invertebrate Primary Production.

Appendix Q. Invertebrate Primary Producers





Appendix R. Invertebrate Bray-Curtis.

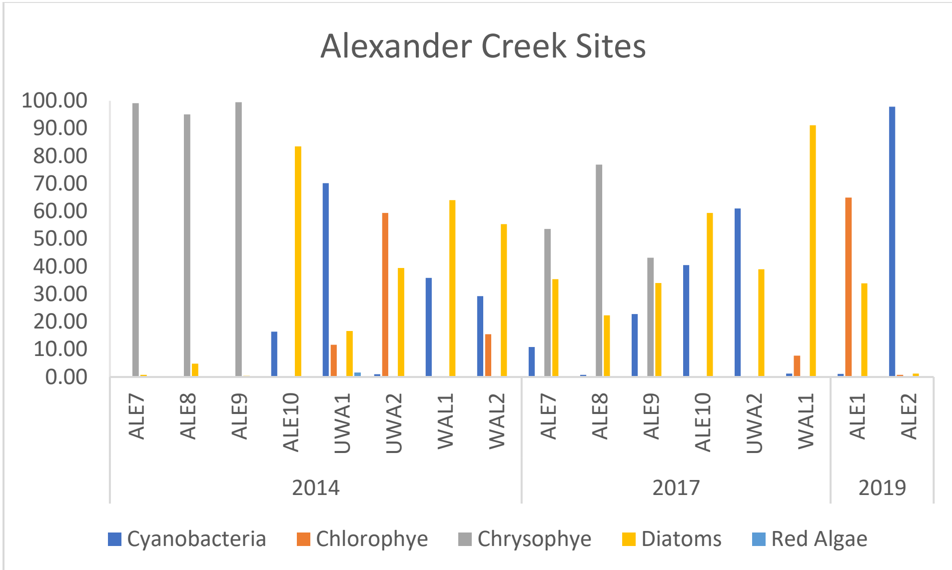
Appendix R. Invertebrate Bray-Curtis

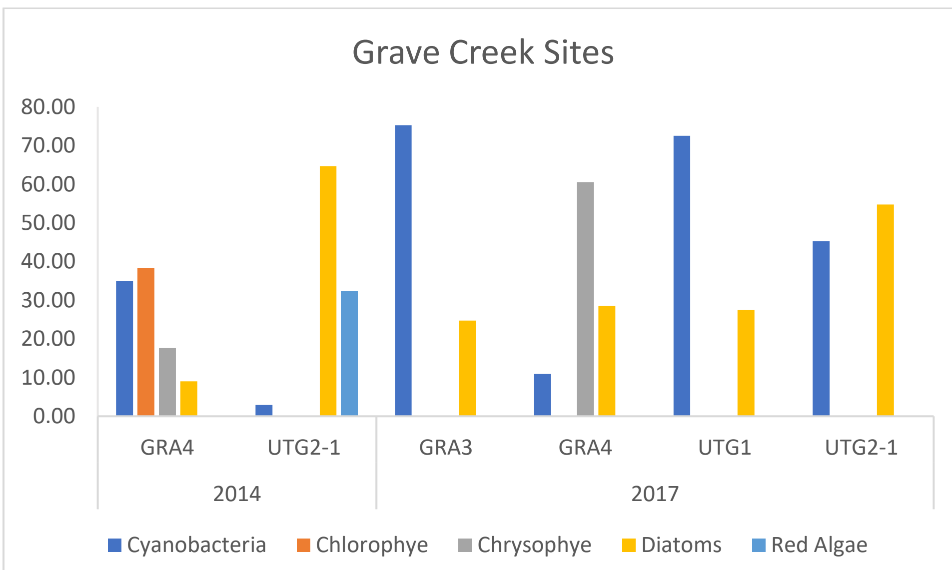
Site	2014	2017	2019
ALE1			0.46
ALE2			0.49
ALE7	0.52	0.80	
ALE8	0.43	0.76	
ALE9	0.51	0.41	
ALE10	0.47	0.77	
UWA2	0.53	0.62	
UWA3	0.72		
WAL1	0.45	0.74	

Site	2014	2017
GRA3	0.71	0.46
GRA4	0.50	0.49
UTG1		0.45
UTG2-1		0.66

Appendix S. Periphyton Group Data.

Appendix S. Periphyton by Group





Appendix T. Annual Hydrograph MAD Grave Creek

Memo

To: Mike Robinson, Lotic Environmental Ltd.

From: Paul Donahue, Dillon Consulting Limited

cc: Mike Allen, Mia Otto, Laura Dilley, Hannah Blanchard

Date: September 14, 2020

Subject: Development of Annual Hydrograph and MAD for Grave Creek Diversion Site

Our File: 12-6231

The proposed Crown Mountain Coking Coal Project requires an instream flow study (IFS) to assess changes to fish habitat that may result from streamflow reductions associated with water storage/withdrawal from Grave Creek. Dillon previously completed a screening level assessment of the withdrawal scenario and determined that withdrawal would not result in an increased number of days when Grave Creek discharge was below 20% Mean Annual Discharge (MAD); a threshold triggering a full IFS as per the BC MOE's *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (2016)*. Lotic conducted a modified IFS that focused on effects to fish passage as a result of water withdrawal that was aimed to corroborate the implications of the screening assessment. The purpose of this memo is to provide a mean annual hydrograph and MAD for the proposed diversion site on Grave Creek to support the assessment of the minimum instream flow required to maintain fish passage in Grave Creek.

Streamflows near the mouth of Grave Creek were previously monitored by Environment and Climate Change Canada (ECCC) from 1970 to 1999. The streamflow records are available on the ECCC webpage (https://wateroffice.ec.gc.ca/) for station # 08NK019 – Grave Creek at the Mouth. This station was located at 49°50'36" N, 114°51'36" W and provided 30 years of streamflow data for the 83.9 km^2 Grave Creek drainage basin.

To better understand the flow conditions further upstream in the vicinity of the proposed Grave Creek water diversion site (estimated to be 7 km upstream of the historical ECCC gauge site and possessing a drainage area of approximately 19.3 km^2), Lotic Environmental Ltd. conducted a series of stream gauging surveys along the Grave Creek channel during the 2018 and 2019 open water seasons. Specifically, stream flows were collected at a number of locations in the creek and notably included flow estimates near the site of the historical ECCC gauge site (G1) and the proposed diversion site (G3 & C3). This information allows for a direct comparison of the seasonal runoff conditions for these two sites (**Figure 1**). **Table 1** below presents the compiled flow measurement data.

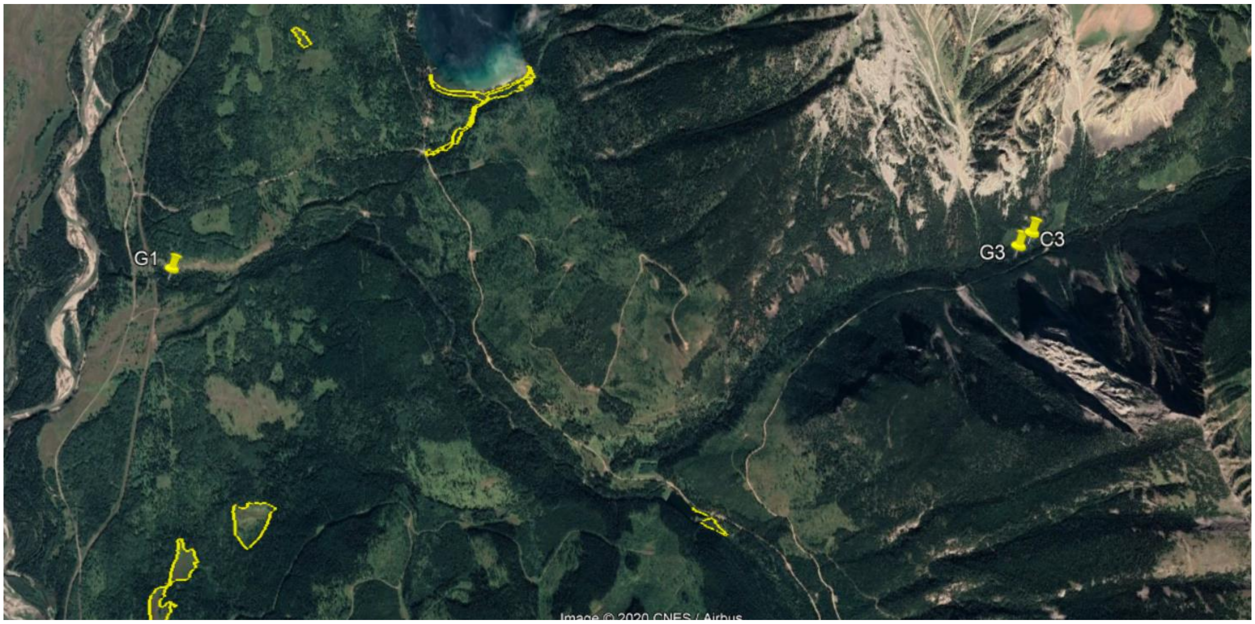


Figure 1: Plan View of Grave Creek Showing the Historical ECCC Gauge Site (G1) and Diversion Site (Vicinity of G3 & C3)

Table 1: Compiled Grave Creek Measured Flow Data (2018 to 2019)

Date	G1 Transect	C3 Transect	G3 Transect	C3/G1	G3/G1
	Discharge (m^3/s)	Discharge (m^3/s)	Discharge (m^3/s)	Ratio	Ratio
2018-08-02	0.470	0.084	0.098	0.179	0.209
2018-09-04	0.335	0.047	0.059	0.140	0.176
2018-10-01	0.367	0.037	0.054	0.101	0.147
2018-11-05	0.347	0.079	0.055	0.228	0.159
2019-04-23	1.048	0.164	0.145	0.156	0.138
2019-05-17	2.585	0.896	-	0.347	-
2019-05-27	1.741	0.589	-	0.338	-
2019-06-06	1.962	0.806	-	0.411	-
Average	**1.107**	**0.338**	**0.082**	**0.237**	**0.166**

Table 1 above presents the range of measured flows and calculated flow ratios (division of monthly flows at various sites) for the G1 and the diversion flow gauging sites. It is noteworthy that the C3/G1 flow ratio of **0.237** correlates well with the Drainage Area Ratio for the two sites (i.e., 19.3 km^2 / 83.9 km^2 = **0.230**). Consequently, as the C3 site also possesses a moderately larger and more complete set of seasonal flow measurements compared to the G3 site, applying the flow ratio was deemed to be an appropriate approach for prorating the long term gauge records at the ECCC gauge to the diversion site

at least for the open water season. Hence it was estimated that the upstream diversion site could therefore be expected to generally receive approximately **24%** of the annual flow and runoff amounts as compared to the mouth of the creek (G1 site).

Table 2 below summarizes the average monthly flow estimates and mean annual discharge (MAD) for the ECCC gauge site and the prorating of these numbers to the proposed diversion site. **Figure 2** illustrates the derived annual hydrograph based on monthly average flows. It is noteworthy that during much of the non-open water months of December to April (i.e., winter months), there was an absence of flow estimates in the 2018 to 2019 flow monitoring program to validate the use of the flow ratio as a prorating tool. As such, it is expected that due to freeze up conditions in the higher elevation areas found upstream of the diversion site. Winter base flows may be proportionally lower than those found in the downstream reaches. As such, conservatively, the prorated average monthly flows during this period were reduced by 50%. It is noteworthy that further investigation is required to confirm this assumption concerning the non-open water season flow regime.

Table 2: Estimated Monthly Hydrograph and MAD for the Proposed Diversion Site

Month	Mean Monthly Discharge	
	ECCC Grave Creek Records (m^3/s)	Estimated Discharge (m^3/s)
January	0.323	0.037
February	0.321	0.037
March	0.419	0.048
April	1.190	0.137
May	3.420	0.787
June	3.290	0.757
July	1.380	0.317
August	0.824	0.190
September	0.551	0.063
October	0.488	0.056
November	0.449	0.052
December	0.365	0.042
MAD	**1.085**	**0.210**

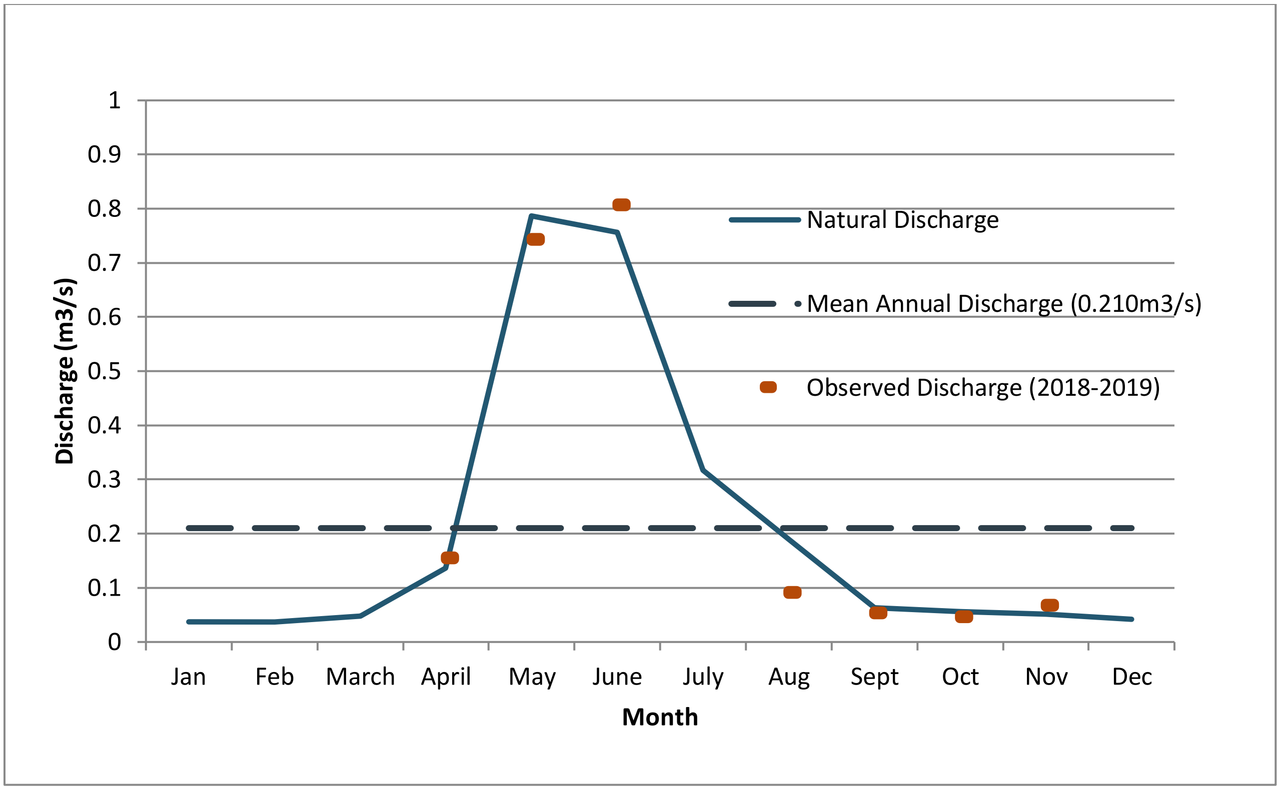


Figure 2: Grave Creek Monthly Hydrograph