Alena Creek Fish Habitat Enhancement Project

Year 4 Monitoring Report

Prepared for:

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EXECUTIVE SUMMARY

This report provides the Year 4 (2020) results of the long-term monitoring program implemented to evaluate the effectiveness of the Fish Habitat Enhancement Project (FHEP) constructed on Alena Creek (also known as Leanna Creek) as per the *Fisheries Act* Authorization (09-HPAC-PA2-00303) issued for the Upper Lillooet Hydro Project (the Project). The FHEP was designed to offset the footprint and operational habitat losses incurred by the Project. Alena Creek is a tributary to the Upper Lillooet River located approximately 4.1 km downstream of the confluence of Boulder Creek with the Upper Lillooet River.

Historical fish and fish habitat data from Alena Creek and long-term monitoring requirements for the FHEP were originally described in the Alena Creek Long-Term Monitoring Program (Harwood *et al*. 2013). Long-term monitoring requirements were subsequently revised and integrated into the Project's Operational Environmental Monitoring Plan (OEMP) (Harwood *et al*. 2017). Baseline data were collected for Alena Creek in 2013 and 2014. Post-construction (i.e., post enhancement) monitoring started in fall of 2016 and has continued through 2017 (Year 1), 2018 (Year 2), 2019 (Year 3), and 2020 (Year 4). This report presents the results of Year 4 monitoring.

Fish Habitat

A stability assessment was conducted to monitor the stability and functionality of each of the FHEP habitat features (riffles and woody debris) and ensure that any remedial action required to maintain their effectiveness is promptly identified and implemented. Photo-points were established during the as-built survey in 2016 at a total of eight survey transects and a panorama of photos was taken each monitoring year to evaluate changes in habitat conditions over time. Qualitative observations were also made along the entire FHEP enhanced reaches.

Excessive erosion that reduces the quality of the constructed habitat has not occurred to date. The channel adjustments that occurred after a peak flow event in November 2016 were modest and have largely stabilized due to vegetation establishment and natural sorting of sediment. However, in Year 3 (2019), multiple locations were identified where remediation was recommended, and instream repairs were conducted during the least risk timing window by a crew of four on August 6, 2020. Repairs were done by hand using gravel, cobble, small boulder, and large wood pieces found on site to improve functionality and limit erosion through bank revetments, flow deflector installation, riffle repairs, and gravel redistribution.

A beaver dam complex located immediately upstream of Reach 3 was causing partial flow bypass and formation of newly cut channels that increased fine sediment deposition within the reach; therefore, the dam height was lowered to prevent further channel erosion. No new beaver activity was observed above Reach 3 in 2020, and the dam was considered inactive in 2020. In November 2020, two newly constructed beaver dams in the lower end of Reach 3 created moderate backwatering in ALE-XS5, ALE-X06, and ALE-XS7. Beavers were trapped within the Alena Creek enhancement area and the dams found within the enhanced spawning channels were removed in the fall of 2020 by a licensed trapper from EBB Environmental Consulting Inc. with the objective of ensuring salmon spawner access and spawning riffle functionality.

In Reach 1, a log jam just upstream of ALE-XS1 has formed which should be monitored to ensure it does not cause backwatering of upstream riffles and associated fine sediment deposition. Associated bank erosion issues were partially addressed by placing cobble along the head of a cutoff channel that has formed and largely stabilized.

Recommendations for Year 5 included continued management of beaver activity, continuing photos at transects and throughout the constructed channels, and identification of erosion issues.

Fish Community

The adult fish community in Alena Creek was assessed by bank walk spawner surveys focused on Coho Salmon (*Oncorhynchus kisutch*), the dominant species within Alena Creek, completed over three surveys between November and December 2020. Coho Salmon were observed spawning and holding in the enhanced habitat in Alena Creek demonstrating their continued use. Within enhanced and unenhanced areas, a peak of 218 live Coho Salmon were observed on November 19, 2020, which was the highest annual peak observed during monitoring to date (previous peak counts ranged from 111 to 192, in 2011 and 2016 respectively). Annual peak counts occurred between November 5 and December 9 during monitoring years to date. Peak counts provide a general indication of continued and potentially greater use of Alena Creek post-enhancement, although among-year variability in spawner abundance is high. No Bull Trout were observed in Alena Creek in 2020.

Minnow trapping surveys, conducted to measure catch-per-unit-effort (CPUE) by species and life history stage at eight sites (five in the enhanced reaches), were conducted on September 20, 2020. Across all sites, the average Cutthroat Trout (*Oncorhynchus clarkii*) CPUE in 2020 (4.1 fish per 100 trap hours) was higher than in all previous monitoring years (except for 2014 when shorter set times led to inflated CPUE values). In all sampling years, the most abundant age class of Cutthroat Trout captured was 1+ parr, and numbers of fry were low in most years. The average Coho Salmon CPUE in 2020 was 75.1 fish per 100 trap hours, which was higher than in 2019 (33.3 fish per 100 trap hours) but lower than in 2018 (83.8 fish per 100 trap hours). CPUE across sites was higher in 2020 and 2018 than baseline (except 2014). No Bull Trout (*Salvelinus confluentus*) were captured in Alena Creek in 2020.

The enhancement in Alena Creek were designed to create habitat and increase productivity of the entire system. The capture of fish in the enhanced sites in 2020 (average CPUE 65.9 Coho/100 trap hours and 3.8 Cutthroat/100 trap hours) provides evidence of use and suggests that habitat is of high quality in the enhanced sites. The unenhanced sites had higher CPUE (average CPUE 94.4 Coho/100 trap hours and 4.9 Cutthroat/100 trap hours) indicating that they also provide high quality habitat, noting this could be due to the presence of proportionally more pool type habitat compared to the enhanced sites.

Hydrology

Seasonal trends in the Alena Creek hydrograph in 2020 were consistent with a coastal, snow-dominated watershed. Seasonal hydrograph patterns remained broadly consistent with observations from baseline and post-construction monitoring. Stage readings in 2020 remained relatively low throughout the winter (January to mid-March) when precipitation was snow dominated, then increased during snow melt in spring (March and April). Stage remained low during monitoring in late-summer and early fall (August to October) when precipitation was minimal. Stage spiked in early November.

In 2020, overall mean daily stage at Alena bridge was 0.24 ± 0.06 m. The daily maximum stage in 2020 was recorded on April 21, 2020 (0.48 m), corresponding with spring snowmelt. Stage spiked briefly in early November 2020 (0.46 m). The minimum stage in 2020 occurred on January 17, 2020 (0.18 m).

We recommend that the hydrology monitoring program continue for another year, for a total of five years post-construction as per the OEMP (Harwood *et al.* 2017).

Water Temperature

The objective of water temperature monitoring is to ensure functional conditions for spawning, incubation, and rearing by the fish species in the FHEP. Water temperature is being monitored continuously at two sites for the first five years post-construction and is being compared to the pre-construction data using a before-after-control-impact (BACI) design. Pre-construction water temperature monitoring occurred from April 17, 2013 to December 31, 2014 at the upstream site (ALE-USWQ1, upstream of all FHEP works) and from August 27, 2013 to December 31, 2014 at the downstream site (ALE-BDGWQ, located within the FHEP). Some data gaps occurred pre-construction in 2014 at the upstream site in winter/early spring 2014. No data gaps were recorded post-construction, with monitoring starting at both sites on November 23, 2016.

Analysis of the data included calculating the following temperature metrics: monthly statistics (average, minimum, and maximum water temperatures for each month of record), differences in water temperature between the upstream and downstream monitoring sites, number of days with extreme mean daily temperature (e.g., >18°C, and <1°C), the length of the growing season, exceedance of Bull Trout temperature thresholds (the species with the highest thermal sensitivity), and mean weekly maximum temperature (MWMxT). These metrics are compared to water temperature BC WQG (Oliver and Fidler 2001, MOE 2019) to assess suitability of the water temperature for aquatic life and specifically for Coho Salmon, Cutthroat Trout, and Bull Trout.

Alena Creek is a cool stream and no days with mean daily water temperatures >18°C were recorded in either pre-or post-construction periods at either site. Mean daily temperature was <1°C between zero and 19 days per year at the downstream site. Despite the small elevation (11 m) difference and short distance (~1 km) between the two sites, the downstream site exhibits greater variability in water temperature and is generally warmer than the upstream site in the summer and cooler in the winter, which is likely due to groundwater inflow and a tributary that enters Alena Creek between the two sites.

Overall, considering inter-annual variably in temperature, no substantial change in monthly temperature statistics has been observed in Year 4 in comparison to previous post-construction and pre-construction data. The daily average temperatures recorded at both sites were higher post-construction (2016-2020) than pre-construction (2013-2014) in the warmer months and the increase was more pronounced at the downstream site, likely due to the moderating effect of the groundwater inflow at the upstream site. The range in monthly average temperatures at the upstream site was 5.0°C to 8.1°C pre-construction and 4.0°C to 8.1°C post-construction (note that due to data gaps, the monthly minimum of 5.0 °C in December 2014 may not represent the coolest monthly average at this site pre-construction). At the downstream site, monthly average temperatures ranged from 2.2°C to 10.1°C pre-construction, and from 1.2°C to 11.7°C post-construction. Minimum average monthly temperatures for 2016 to 2019 occurred in December or February. In 2020, although the dataset is not yet complete, monthly average temperatures (1.9°C to 11.1°C) were within the range observed post-construction from 2016 to 2019. Instantaneous temperature ranges in the pre- (0.0°C to 14°C) and post-construction (0.0°C to 14.5°C) periods were similar.

Water temperatures at the monitoring sites were generally sub-optimally cool for Cutthroat Trout and Coho Salmon during pre- and post-construction periods, although some sub-optimally warm temperatures were recorded for Bull Trout and Cutthroat Trout incubation and spawning at the downstream site. In general, it appears the upstream site is more suitable than the downstream site for spawning and incubation of Bull Trout because there were fewer exceedances of the lower bound of the optimum temperature ranges during the winter months and fewer exceedances of the upper bound in the summer months. Warm surface waters at the upstream site during incubation stages may be partially mitigated by the groundwater inputs, such that temperature within potential redds may be lower than measured at the temperature logger.

We recommend that the monitoring program continue for another year for a total of five years post-construction based on the methodologies and schedule prescribed in the Project OEMP (Harwood *et al.* 2017).

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF MAPS

LIST OF APPENDICES

1. INTRODUCTION

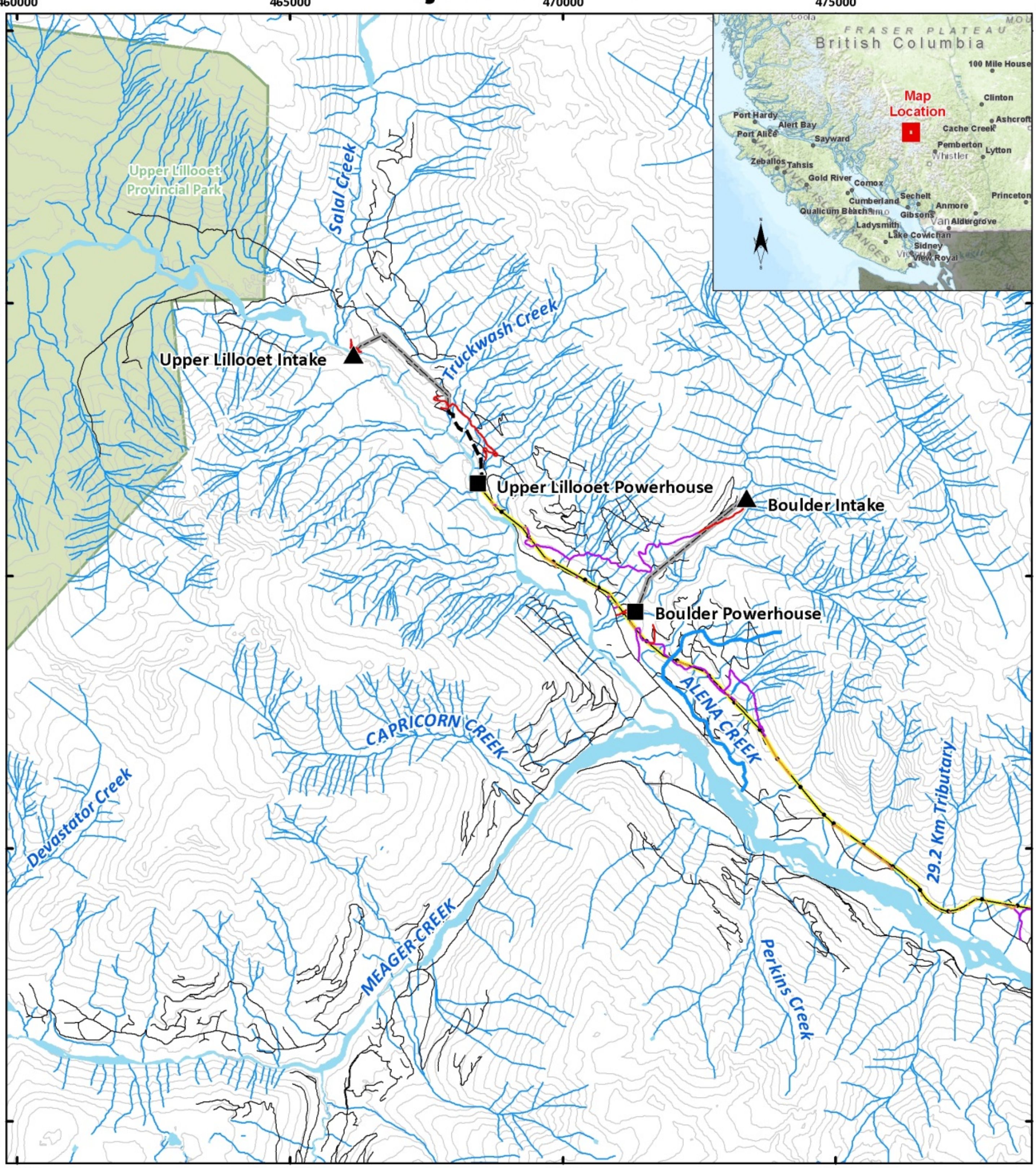
This report provides the Year 4 (2020) results of the long-term monitoring program implemented to evaluate the effectiveness of the Fish Habitat Enhancement Project (FHEP) constructed on Alena Creek (also known as Leanna Creek) as per the *Fisheries Act* Authorization (09-HPAC-PA2-00303) issued for the Upper Lillooet Hydro Project (the Project). Ecofish Research Limited (Ecofish) was retained by the Upper Lillooet River Power Limited Partnership (ULRPLP) to monitor the FHEP on Alena Creek, located northwest of Pemberton, BC. The FHEP was designed by Hemmera Envirochem Inc. (Hemmera 2015) and Ecofish (Appendix A) to offset the habitat losses incurred due to the footprint and operation of the Project. The Project is composed of two hydroelectric facilities (HEFs) on the Upper Lillooet River and Boulder Creek, and a 72-km-long 230 kV transmission line. Alena Creek is a tributary to the Upper Lillooet River located approximately 4.1 km downstream of the confluence of Boulder Creek with the Upper Lillooet River, and is therefore downstream of the two HEFs (Map 1).

Details of the predicted habitat losses incurred by Project construction and operation are provided in the aquatic and riparian footprint reports for the HEFs and the transmission line (Buchanan *et al.* 2013a, b). These habitat losses were authorized by Fisheries and Oceans Canada (DFO) through the issuance of a *Fisheries Act* Authorization (09-HPAC-PA2-00303) on September 26, 2013. The Authorization was amended on June 17, 2014. The amended Authorization requires the enhancement of 2,310 m^2 of instream habitat to offset the permanent loss of 1,935 m^2 of fish habitat associated with the construction of the Upper Lillooet HEF intake. Under the amended Authorization, there were no offset requirements associated with construction and operation of the Boulder Creek HEF, or with impacts to riparian habitat.

The offsetting plan involved fish habitat enhancement in Alena Creek, which was heavily impacted by the Capricorn/Meager Creek slide (hereafter referred to as the Meager Creek slide), which was a natural, catastrophic event that occurred on August 6, 2010 and deposited a large amount of woody debris and a thick slurry of sediment in and around Alena Creek. In addition to heavily impacting aquatic habitat, the slide affected riparian habitat by uprooting trees and smothering root systems with a thick layer of sediment. The FHEP, which was constructed in the summer of 2016, created a new section of channel, and enhanced both the aquatic and riparian habitat of Alena Creek. It will therefore benefit Coho Salmon (*Oncorhynchus kisutch*), Cutthroat Trout (*O. clarkii*), and Bull Trout (*Salvelinus confluentus*). The FHEP consists of a downstream (Reach 1) and upstream reach (Reach 3), separated by a naturally recovering low gradient reach (Reach 2) (Map 2). The actual location and geometry of constructed design features was summarized in the as-built drawings (West *et al.* 2017).

Historical fish and fish habitat data from Alena Creek, and long-term monitoring requirements for the FHEP, were originally described in the Alena Creek Long-Term Monitoring Program (Harwood *et al.* 2013). Long-term monitoring requirements were subsequently revised and integrated into Project's Operational Environmental Monitoring Plan (OEMP) (Harwood *et al.* 2017). Monitoring of the FHEP involves monitoring of six components relevant to assessing the effectiveness of the offset habitat: fish habitat, fish community, hydrology, water quality, water temperature, and riparian habitat ((Harwood *et al*. 2017). Among these, water quality monitoring was discontinued after Year 1 due to improvements observed and lack of anticipated adverse effects (Harwood et al. 2018). Monitoring was not conducted for riparian habitat in Year 4 as per the OEMP but will continue in Year 5. Results of Years 1 and 2 of Alena Creek pre-construction monitoring are documented in Harwood *et al*. (2016). Results of Year 1 through 3 (2017-2019) of post-construction monitoring are presented in Harwood *et al*. (2019a and b) and Thornton *et. al*. (2020). Results from Year 4 (2020) are summarized below.

Project Overview



Legend

ULHP Infrastructure

- Intake
- Powerhouse
- Proposed Facility Road (New)
- Proposed Tower Road (New)
- Upgrade Required to Existing Road
- Penstock
- Tunnel
- First Nation Reserve
- Parks and Protected Areas
- Roads
- Contours (100 m)

MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES

0 1 2 3 4 km

Scale: 1:100,000

NO.	DATE	REVISION	BY
1	07/04/2015	1095_ULP_Overview_AlenaCreek_2015Apr07_ADN	EF
2			
3			
4			
5			

Date Saved: 07/04/2015
Coordinate System: NAD 1983 UTM Zone 10N

ECOFISH RESEARCH

Map 1

Path: M:\Projects-Active\1095_UPPERLILLOOETPROJECT_NEW\MXD\Compensation\1095_ULP_Overview_AlenaCreek_2015Apr07_ADN.mxd

2. OBJECTIVES AND BACKGROUND

2.1. Fish Habitat

FHEP habitat features (riffles and woody debris) were installed in reaches 1 and 3 to enhance fish habitat. In 2016, thirteen riffles and more than 120 pieces of large wood were installed in Reach 1 to create 1,387 m^2 of enhanced fish habitat. A total of 668 m^2 of new instream habitat and 1,139 m^2 of floodplain was created in Reach 3 in 2016. Twelve cobble riffles and over 100 pieces of large woody debris were installed in Reach 3 as part of the FHEP. A stability assessment is conducted annually to monitor the establishment and functionality of each of the FHEP habitat features to promptly identify whether any remedial action is required to maintain the effectiveness of habitat features. The assessment is conducted throughout the enhanced reaches and at eight marked transects (transects ALE-XS1 through ALE-XS4 in Rach 1, and transects ALE-XS5 through ALE-XS8 in Reach 3; Map 3), that are revisited each year so that changes over time can be tracked. Details of the habitat features installed are provided in West *et al.* (2017).

2.2. Fish Community

The goal of enhancing aquatic and riparian habitat in Alena Creek was to provide spawning and rearing habitat for Coho Salmon, Cutthroat Trout, Bull Trout, and to support equivalent or greater fish use (based on fish abundance) in Alena Creek relative to pre-project conditions. Fish habitat use in Alena Creek was assessed by comparing adult Bull Trout and Coho Salmon spawner abundance and juvenile Cutthroat Trout and Coho Salmon abundance under baseline and post-enhancement conditions. The adults were sampled by counting fish during bank walks (spawner surveys) during the Bull Trout and Coho Salmon spawning seasons in September and October, and early November to early December, respectively. Juvenile fish were sampled using minnow traps deployed at eight sites in Alena Creek (five enhanced, three unenhanced). The catch per unit effort (CPUE) for minnow trapping can be compared among years to assess changes in fish abundance over time.

2.3. Hydrology

Water level data provide useful information on inter-seasonal variation in flow and assist in interpreting changes in the other monitoring components (e.g., water temperature and fish abundance). Hydrological monitoring in Alena Creek was undertaken by ULRPLP.

2.4. Water Quality

Sampling at two sites during pre-construction monitoring and Year 1 showed that water quality in Alena Creek has generally improved since pre-construction sampling began in 2013 (Harwood *et al.* 2019). Further, monitoring data in Year 1 showed that water quality in the FHEP is generally suitable for aquatic life, including salmonids. Considering these observations, and that instream habitat enhancement is not expected to result in adverse effects on water quality, water quality sampling was discontinued after Year 1 based on a recommendation in the Year 1 annual report (Harwood *et al.* 2018).

2.5. Water Temperature

Small incremental changes in water temperature can potentially affect stream biota, including fish. Fish are vulnerable to both small increases and decreases in water temperature, with tolerance levels varying among species and life-history stages and according to existing conditions. The objective of water temperature monitoring is to ensure that conditions within the Alena Creek FHEP support functional use for migration, spawning, incubation, and rearing by the fish species present. Collection of continuous water temperature data is allowing comparison of pre- and post-construction temperature data which permits the tracking of changes within the FHEP over time. Water temperature may be influenced by the instream enhancement features and maturation of the riparian vegetation planted during the habitat restoration.

Water temperature in Alena Creek is being monitored continuously at two sites (Map 2) for the first five years post-construction. One site is located upstream of the restoration works and serves as a control site, and the other is in the downstream end of the FHEP and serves as an impact site. This Year 4 (2020) annual monitoring data report provides a summary of pre-construction (2013-2014) and post-construction (2016-2020) water temperature monitoring results. This report is intended to be primarily a data summary report; any changes in water temperature related to the construction of the FHEP will be evaluated with a BACI analysis following five years of post-construction water temperature data collection.

2.6. Riparian Habitat

Riparian areas contribute to fish habitat quality through thermal regulation, minimizing sedimentation by stabilizing stream banks and intercepting run-off, providing nutrients, and by contributing channel-stabilizing large woody debris (LWD) and cover (Gregory *et al.* 1991, Naiman and Decamps 1997,
Naiman *et al.* 2000, Richardson 2004). To provide these benefits, a goal of the Alena Creek FHEP is to expedite succession of the riparian area from an early-successional deciduous stand towards a mixed coniferous/deciduous forest. As such, the FHEP included specific restoration and enhancement prescriptions for the riparian area (defined as the terrestrial area within 30 m of the high-water mark of each bank of the stream) to increase the density of conifers and ensure success of planted vegetation (Hemmera 2015).

The objective of the riparian restoration effectiveness monitoring program, as per the OEMP, is to describe the natural regeneration and planting success of riparian vegetation qualitatively and quantitatively, and to confirm that a diversity of well-established native tree and shrub species with low observed mortality rates are present within the Alena Creek FHEP area (Harwood *et al.* 2016; Harwood *et al.* 2017). Successful revegetation is defined by several targets: 1) survival of at least 80% of vegetation between monitoring years overall (considered to be 2,309 stems/ ha and 80% cover), and of the planted western redcedar (*Thuja plicata*) stock specifically (DFO and MELP 1998; Harwood *et al.* 2013, Harwood *et al.* 2017); 2) densities equal to or more than 1,200 tree stems/ ha and 2,000 shrub stems/ha (Harwood *et al.* 2017); and 3) a diversity of healthy vegetation including a transition to a mixed conifer/ deciduous stand from a deciduous stand (Harwood *et al*. 2017, Hemmera 2015).

No monitoring was conducted in Year 4 as per the OEMP; however, monitoring will continue in Year 5 to evaluate regeneration and planting success. Results from the fifth year of monitoring will be compared with three benchmarks: 1) data collected prior to the Meager Creek slide (as estimated from typical characteristics of floodplain sites in the same biogeoclimatic zone; Green and Klinka 1994); 2) data collected four years after the slide and prior to restoration work (Harwood *et al*. 2016); and 3) as-built surveys conducted immediately following restoration work in 2016 (Harwood *et al*. 2016) and following Year 1 and 3 monitoring in 2017and 2019 respectively (Harwood *et al*. 2019, Thornton *et al*. 2020).

3. METHODS

3.1. Fish Habitat

3.1.1. Transect Repeat Photos

Reach 1 and 3 of Alena Creek were enhanced as a part of the FHEP. To assess the stability of the enhancements, initial photos were taken at photo-points established during the as-built survey (completed shortly following FHEP construction in 2016). A total of eight transects were established and surveyed at that time. At each transect, a panorama of photos was taken to support evaluation of changes in habitat conditions over time. Photos were taken looking downstream, upstream, from river left to river right, and from river right to river left. The photo aspects were oriented to provide a full view of the bankfull channel and floodplain, with the transect tape included in the photo to provide a visual reference that would aid with analysis of the topographic transect surveys. The transect photos have been repeated during each year since construction (Harwood *et al*. 2016; 2017; 2018; 2019, and Thornton *et. al*. 2020) to allow for detection of changes in channel conditions. Additional photos were also taken throughout Reach 1 and 3 at key points.

3.1.2. Instream Repairs

A high flow event occurred shortly after construction in 2016 that affected habitat features constructed for the FHEP. Since this event, sections of the channel in Reach 3 have been eroding, causing outflanking of riffles and associated bank erosion in some locations. The increased erosion and fine sediment transported throughout Reach 3 since the high flow event has caused a redistribution of flow energy that has, in turn, caused a minor reduction in the quality of riffles and large wood features at meander bends. The eroding channel banks have caused moderate widening of the channel and associated deposition of fine sediment. These issues have largely stabilized; however, at some locations there remained a risk that more severe erosion could occur during future high flow events. To reduce this risk, it was determined that hand repairs could be completed to protect banks and redirect flow energy. On August 6, 2020, during the least risk timing window (MOE 2009), a crew of four staff from Ecofish and Lil'wat First Nation completed the repairs by hand. The repairs included the following actions:

1. Eroding banks were stabilized by creating a revetment composed of cobble, small boulder, and large wood.
2. Flow deflectors were installed to direct flow energy away from banks and towards root wad complexes in pools that have partially infilled with fines. Flow deflector were composed of a matrix of materials ranging in size from sand to small boulders and large wood.
3. Riffles that had been outflanked were rebuilt and contoured to prevent further bank erosion and keep flow energy focused on gravel deposits for cleaning purposes.
4. Gravel was redistributed from pools and slack water areas into pool tail-outs and riffles where spawning might occur.

Reach 1 was generally found to be stable after the high flow event except for one location where a channel spanning log had collapsed, creating a wood jam and minor avulsion of the channel around the jam. The channel at this location had largely stabilized and was not expected to continue eroding at an unnatural rate. Repairs at this location were restricted to placement of cobble along portion of the avulsed channel that would direct flow energy away from the channel bank and back towards the original channel alignment.

3.2. Fish Community

3.2.1. Adult Spawner Abundance

Spawner surveys in Alena Creek focused on Coho Salmon; however, Bull Trout were also monitored to provide additional information on project streams (i.e., Upper Lillooet and Boulder Creek). Spawner surveys for Bull Trout were done through bank walks conducted approximately every two weeks between September 16 and October 19, 2020 (a total of three surveys). Coho spawner surveys were conducted every two weeks between November 7 and December 4, 2020 (a total of three surveys). Consistent with previous years, bank walks, during which both live fish and carcasses were counted, occurred from the downstream confluence with the Upper Lillooet River to the upstream end of Alena Creek at the groundwater spring at the Lillooet River Forest Service Road (FSR) crossing at kilometer 36.5. Due to the meandering nature of the Upper Lillooet River, the downstream confluence with Alena Creek has varied over the monitoring years by up to ~1 km.

It is important to note that the carcasses counted in Alena Creek are quickly consumed by wildlife in the area, as evident by observations that they are not often whole and show signs of being eaten. Often only the pyloric caeca, which animals prefer not to eat, are left behind.

3.2.2. Juvenile Abundance

3.2.2.1. Minnow Trapping

Minnow trapping surveys were conducted in Alena Creek commencing in Year 4 on September 20, 2020. The objective of minnow trapping was to monitor the change among years in the relative abundance of juvenile fish, based on catch-per-unit-effort (CPUE), for individual species and life stages in the enhanced and unenhanced reaches of Alena Creek (Map 3).

Eight sites were sampled in 2018, 2019, and 2020 (five enhanced, three unenhanced), whereas six were sampled in previous years. Four to 10 traps were installed at each site. At ALE-MT06, 10 traps were set because the large pool present at this site required a higher level of sampling effort. Sampling was conducted in five of the six sites sampled in previous years (ALE-MT01, ALE-MT02, ALE-MT03, ALE-MT05 and ALE-MT06); however, due to American Beaver (*Castor canadensis*) (hereafter, beaver) activity in previous years, sampling at ALE-MT04 was discontinued in 2018 through 2020 as recommended in the Year 1 report (Harwood *et al.* 2019). Additionally, three new sites established in 2018 in FHEP habitat were sampled, specifically one site in Reach 1 (ALE-MT07) and two sites in Reach 3 (ALE-MT08 and ALE-09; Map 3). The Year 1 report had recommended that one of the additional sites be located just upstream of Reach 1 at the gravel augmentation pile installed as part of the enhancement works; however, due to beaver dam and stability issues at this location, the site was located just downstream of the gravel augmentation pile and in the Reach 1 FHEP area (ALE-MT07).

The minnow traps were baited using salmon roe and left overnight. When the traps were retrieved, captured fish were identified and measured (discussed below), then released.

3.2.2.2. Biological Information

All captured fish were enumerated and identified to species using standard field keys. Due to the volume of fish captured, only a subset at each site were measured for fork length using a measuring board (±1.0 mm) and weighed using a field scale (±0.1 g).

Scale samples to be used for aging were taken from a sub-sample of captured fish and these were aged at the Ecofish laboratory in Campbell River. For each fish included in the sub-sample, three representative scales were examined under a dissecting microscope, photographed, and apparent annuli noted on a digital image. Fish age was determined by a biologist and QA'd by a senior biologist. Where discrepancies were identified, they were discussed, and final age determination was based on the professional judgement of the senior biologist.

3.2.2.3. Data Analysis

Individual Fish Data

Biological data from the captured fish were analyzed to define the age structure, size structure, length-weight relationship, length at age, and condition factor by species. Discrete age classes were based on size bins established using length-frequency histograms and age data from the scale analysis. Discrete age classes were defined for fry (0+), parr (1+), parr (2+), and adults (3+). These discrete classes allowed measured fish to be assigned an age class based on fork length.

The condition of fish, which is an indication of overall health, can be calculated in a variety of ways, such as Fulton K or relative weight (W_r) (Blackwell *et al.* 2000). A potential problem with the use of Fulton K is an assumption of isometric growth (Blackwell *et al.* 2000); however, for this monitoring program the condition of fish was calculated separately for each age class, so violations of this assumption were not expected. The condition of fish was assessed by calculating Fulton's condition factor (*K*) and creating plots of species-specific length-weight relationships. Fulton's condition factor (*K*) was calculated for each fish captured by species and year using the following equation:

$$K = \left(\frac{W}{L^3}\right)100{,}000$$

where W is the weight in g, L is the length in mm, and $100{,}000$ is a scaling constant (Blackwell *et al.* 2000).

Relative Abundance

Relative abundance was evaluated using CPUE for minnow trap data, which was calculated as the number of fish captured per 100 trap hours.

3.3. Hydrology

Water level monitoring began at Alena Creek in April 2013. Two water level loggers were originally installed in Alena Creek: one at the Lillooet River FSR crossing (Alena Bridge) and another at the upstream end of the project area (Alena Upstream) (Map 2). Baseline monitoring at these two stations occurred from approximately 2013 to 2015. Post-construction monitoring started in 2016 and is ongoing. Pos-construction water level data has been collected at the Alena Bridge site in every monitoring year. The gauge was reinstalled and moved slightly on November 26, 2019. An offset was applied to data collected after that point to ensure stage data collected before and after removal was comparable.

In addition, a second gauge (R1) was installed based on recommendation by Harwood *et al.* (2018), at approximately 125 m upstream from the Alena Bridge gauge. This gauge was deployed from August 23, 2018 until fall 2019. The purpose of the second gauge was to examine for potential backwater effects that may be caused by the Upper Lillooet River side channel when flows were high, and to ensure the stage data collected were representative of Alena Creek water levels. Results from the Year 3 report (Thornton *et al.* 2020) indicated that backwatering from Upper Lillooet River to the FSR bridge was no longer occurring, and the gauge was removed in November 2019.

3.4. Water Temperature

3.4.1. Data Analysis and Collection

Pre-construction and post-construction water temperature monitoring occurred at two monitoring sites: ALE-USWQ1, located upstream of the enhancement works, and ALE-BDGWQ, located at the downstream end of the works, within the enhanced area and just upstream of the FSR bridge (Table 1, Map 2, Appendix B). Pre-construction water temperature monitoring occurred from April 17, 2013 to December 31, 2014 at the upstream control site (ALE-USWQ1) and from August 27, 2013 to December 31, 2014 at the downstream impact site (ALE-BDGWQ) (Map 2). Post-construction monitoring commenced at both sites on November 23, 2016. Year 4 data are available up to September 21, 2020 for the upstream site and downstream site (Table 1).

Pre-construction temperature data were recorded at 60-minute intervals using hydrometric gauges maintained by KPL. The temperature sensors incorporated into the gauges were installed in aluminum standpipes and had an accuracy of ±0.3°C and a resolution of ±0.001°C. Post-construction temperature data were recorded at 15-minute intervals using self-contained Tidbit v2 loggers made by Onset. The loggers have a range of -20°C to +70°C, are accurate to ±0.2°C, and have a resolution of 0.02°C. Water temperature at ALE-BDGWQ was concurrently logged by two Onset Tidbit loggers installed on separate anchors; this redundancy ensured availability of data in case one of the loggers malfunctioned or was lost. A second Tidbit logger was installed at ALE-USWQ1 in 2019.

Processing of water temperature data was conducted by first identifying and removing outliers and then compiling data into a time series for all sites. Identification and removal of outliers was conducted as part of a thorough Quality Assurance/Quality Control (QA/QC) process which ensured that any suspect or unreliable data were excluded from analysis and presentation Excluded data included, for example, data where the sensor was suspected of being out of the water, affected by snow or ice, or buried in sediment.

During the pre-construction monitoring period, there were gaps in the datasets from mid January 2014 to mid-March 2014 at the upstream site, and from the end of March through early April 2014 at the downstream site due to the suspected build-up of ice (McCarthy, pers. comm. 2014) (Table 1). At the upstream site, less than three weeks of water temperature data were available for January, February, and March 2014. Therefore, not all summary statistics and temperature metrics (see Section 3.4.1) could be calculated for these months, limiting the available winter season pre-construction data (Table 1). At the downstream site, less than three weeks of data were available for March 2014, limiting the available spring season pre-construction data (Table 1). There have been no data gaps post-construction to date (i.e., data set is 100 % complete; Table 1).

Table 1. Summary of water temperature site names, logging details, and period of data record in Alena Creek pre-construction (2013, 2014) and post-construction (November 2016 through 2020).

Type	Site	UTM Coordinates (10U)		Elevation (masl)[1]	Project Phase	Periods of Record		Number of Data Records	Logging Interval (min.)	No. of Days with Valid Data	% Complete[2]
		Easting	Northing			Start Date	End Date				
Upstream	ALE-USWQ1	472,976	5,606,870	391	Pre-Construction	17-Apr-13	30-Dec-14	623	60	561	91
					Post-construction	23-Nov-16	21-Sep-20	1,399	15	1,395	100
Downstream	ALE-BDGWQ	473,336	5,606,095	382	Pre-construction	27-Aug-13	30-Dec-14	491	60	453	93.6
					Post-construction	23-Nov-16	21-Sep-20	1,399	15	1,396	100

[1] Estimated from Google Earth.

Pre-construction (2013-2014) water temperature was monitored via hydrometric gauges maintained by KPL. Post-construction Tidbit temperature loggers were installed.

[2] The pre-construction data gap at the upstream site occurred between mid January and mid March 2014 due to icing concerns.

The pre-construction data gap at the downstream site occurred at the end of March through early April 2014, therefore a complete month of data (i.e., more than three weeks) for March are not available during this phase.

After identifying and removing outliers, the records from duplicate loggers were averaged and records from different download dates were combined into a single time-series for each monitoring site. The time series for all sites were then interpolated to a regular interval of 15 minutes (where data were not already logged on a 15-minute interval), starting at the full hour. Data are presented in plots that were generated from the resultant 15-minute interval temperature data.

Analysis of the data involved computing the following summary statistics: monthly statistics (mean, minimum, and maximum water temperatures for each month of record, as well as differences in water temperature among sites), days with extreme mean daily temperature (e.g., >18°C and <1°C), days with exceedances of the minimum and maximum Bull Trout temperature thresholds, the length of the growing season, the accumulated thermal units in the growing season (i.e., degree days), hourly rates of temperature change, and mean weekly maximum temperature (MWMxT). Table 2 defines these statistics and describes how they were calculated. The calculation of the end date of the length of the growing season (as defined in Table 2) was modified from 4°C (as per Coleman and Fausch 2007) to 5°C, because the MWMxTs at the upstream site were >4°C in the winter data set for the first year of pre-construction monitoring.

After Year 3 reporting, data underwent updated analysis to ensure it was processed according to current standards. As a result, some revisions were made to improve accuracy, and the values presented herein may differ from those presented in previous reports during Year 1 to Year 3. Some of the changes included:

- Hourly Rates of Water Temperature Change - the percentage of records after Year 3 were calculated as the total # of valid hourly change records with a rate of change >1ºC, whereas some data prior to Year 3 included the total # of temperature records, rather than valid records.
- Mean Weekly Maximum Temperature (MWMxT) - changes from previous versions of this analysis were:
    - The inclusion of a cut-off whereby a day is excluded from the calculation if it does not include data during the warmest period of the day. By default, a day is excluded when it does not have at least one hourly measurement between 11:00 and 18:00.
    - For growing season, a "week" was calculated as a centred average (i.e., three days before and three days after the day for which MWMxT is being calculated). Therefore, the computed start and end date of the growing season are three days later/earlier, respectively.
- Growing Season Statistics - start and end dates for weekly averages are defined after Year 3 in terms of calendar weeks (the start/end dates reported are the start of the calendar week containing the day the threshold was crossed), resulting in a change in start/end dates of ± 3 days. In some pre-Year 3 data, running weekly averages were calculated, and the start/end

dates were defined as the date the threshold was crossed minus three days (i.e., a centered weekly average).

Table 2. Water temperature metrics and method of calculation.

Metric	Description	Method of Calculation
Water temperature	Hourly or 15 minute data	Data (interpolated to 15 minute intervals where necessary) presented in graphical form.
Monthly statistics	Mean, minimum, and maximum on a monthly basis	Calculated from 15 minute data (interpolated where necessary) and presented in tabular format.
Rate of water temperature change	Hourly rate of change	Calculated from 15 minute data (interpolated where necessary); presented in summary tables and graphical form.
Degree days in growing season[1]	The beginning of the growing season is defined as the beginning of the first week that mean stream temperatures exceed and remain above 5°C; the end of the growing season was defined as the last day of the first week that mean stream temperature dropped below 4°C (as per Coleman and Fausch 2007).	Daily mean water temperatures were summed over this period (i.e., from the first day of the first week when weekly mean temperatures reached and remained above 5°C until the last day of the first week when weekly mean temperature dropped below 4°C).
Number of Days of Extreme Daily Mean Temperature	Daily average temperature extremes for all streams	Total number of days with daily mean water temperature >18°C , >20°C , and <1°C.
Number of Days of Exceedance	Daily maximum and minimum temperature thresholds for streams with Bull Trout / Dolly Varden	# days maximum daily temperature is >15°C; # days maximum incubation temperature is >10°C; # days minimum incubation temperature is <2°C; # days maximum spawning temperature is >10°C.
MWMxT (Mean Weekly Maximum Temperature)	Mean, minimum, and maximum on a running weekly (7 day) basis	Mean of the warmest daily maximum water temperature based on hourly data for 7 consecutive days; e.g., if MWMxT = 15°C on August 1, 2008, this is the mean of the daily maximum water temperatures from July 29 to August 4, 2008; this is calculated for every day of the year.

[1]The end of the growing season was defined as the last day of the first week that mean stream temperatures dropped below 5°C for Alena Creek.

3.4.1.1. Applicable Guidelines

The water temperature BC Water Quality Guidelines (BC WQG) for the protection of aquatic life (as per Oliver and Fidler 2001, MOE 2019) define water temperature thresholds and optimum temperature ranges specific to fish species and life stages. The fish community in Alena Creek consists of Coho Salmon, Cutthroat Trout, and Bull Trout. The water temperature BC Water Quality

Guidelines (BC WQG) for the protection of aquatic life (as per Oliver and Fidler 2001, MOE 2019) relevant to the summary statistics produced for this monitoring program are summarized below. Optimum water temperature ranges, as defined by the BC WQG for rearing, spawning, incubation, are provided for the fish species present in Alena Creek in Table 3. The timing of life history stages in Alena Creek (Harwood *et al.* 2016) that were used to define the start and end dates for each of the applicable life stages for Coho Salmon, Cutthroat Trout, and Bull Trout are shown in Table 4.

Table 3. Optimum water temperature ranges for Coho Salmon, Cutthroat Trout, and Bull Trout during spawning, incubation, rearing, and migration (MOE 2019).

Species	Optimum Water Temperature Range (°C)			
	Spawning	Incubation	Rearing	Migration
Coho Salmon	4.4 - 12.8	4.0 - 13.0	9.0 - 16.0	7.2 - 15.6
Cutthroat Trout	9.0 - 12.0	9.0 - 12.0	7.0 - 16.0	-
Bull Trout	5.0 - 9.0	2.0 - 6.0	6.0 - 14.0	-

The BC WQG for water temperature is ± 1°C outside the optimum temperature range for each life stage.

Table 4. Periodicity of fish species in Alena Creek.

Coho Salmon	Cutthroat Trout	Bull Trout
Spawning (Oct. 15 to Jan. 01)	Spawning (Apr. 01 to Jul. 01)	Spawning (Aug. 01 to Dec. 08)
Incubation (Oct. 15 to Apr. 01)	Incubation (May. 01 to Sep. 01)	Incubation (Aug. 01 to Mar. 01)
Rearing (Jan. 01 to Dec. 31)	Rearing (Jan. 01 to Dec. 31)	Rearing (Jan. 01 to Dec. 31)
Migration (Sep. 01 to Dec. 31)	-	-

Hourly Rates of Water Temperature Change

Rapid changes in heating or cooling of water temperature can affect fish growth and survival (Oliver and Fidler 2001). Hourly rates of change in water temperature were compared to the BC WQG, which specifies that the hourly rate of water temperature change should not exceed ±1.0°C/hr (MOE 2019).

Daily Temperature Extremes

Extreme cold or warm temperatures can also affect fish survival and productivity. The number of days when the daily mean temperature was <1°C, were calculated. Alena Creek is a cool stream where maximum temperatures recorded to date did not exceed 15°C, therefore extreme warm temperatures (>18°C) have not occurred. Thus, the number of days >18°C and >20°C, which are typically calculated for water temperature monitoring in relation to fish habitat, are not applicable. The maximum optimum temperature for the fish species present in the Project area is 16°C (Coho Salmon and Cutthroat Trout rearing life stage, Table 3).

Mean Weekly Maximum Temperature (MWMxT)

The MWMxT is an important indicator of prolonged periods of cold and warm water temperatures that fish are exposed to. The BC WQG for the protection of aquatic life states "Where fish distribution information is available, then mean weekly maximum water temperatures should only vary by ±1.0°C beyond the optimum temperature range of each life history phase (incubation, rearing, migration and spawning) for the most sensitive salmonid species present" (Oliver and Fidler 2001, MOE 2019). Accordingly, MWMxT values were compared to the optimum temperature ranges for the fish species present in Alena Creek based on the life history and periodicity (Table 3, Table 4).

Within each life history period, the completeness of the temperature data record (% complete) was calculated and results are only included if at least 50% of the data for the period was available. The minimum and maximum MWMxT values, % data within the optimum range, and % exceedance of ±1.0°C of the optimal temperature range was calculated for each life history period to evaluate the suitability of the temperature regime for each fish species at each monitoring site, pre- and post-construction.

Bull Trout Temperature Guidelines

Additional BC WQG (MOE 2019) water temperature guidelines are specified for streams with Bull Trout and Dolly Varden (Oliver and Fidler 2001; Table 1 in Appendix C). When either of these fish species are present, the guidelines state that:

- Maximum daily water temperature is 15°C;
- Maximum daily incubation temperature is 10°C;
- Minimum daily incubation temperature is 2°C; and
- Maximum daily spawning temperature is 10°C.

The number of days where these thresholds were exceeded were calculated using the appropriate daily maximum or minimum temperature values for each site where Bull Trout are present (Table 2).

4. RESULTS

4.1. Fish Habitat

4.1.1. Overview

Photos were taken at established photo-point locations in the enhanced reaches (Reach 1 and Reach 3) of Alena Creek on November 7, 2020. A comparison of all photos is available in Appendix D. Overall, the riparian vegetation has increased since 2016 and the channel has remained stable over this time. Grasses and herbaceous vegetation continue to establish well throughout the reaches and protect the bank from excessive erosion, while also providing cover for small salmonids. No substantial changes to the stream channel were noted that were not anticipated based on the dynamic stability criteria of the design.

New beaver activity was observed in the lower end of Reach 3. Previous beaver activity upstream of Reach 3 had ceased, but flow was still being partially diverted around the upper portion of Reach 3. Beavers were trapped within the Alena Creek enhancement area and the dams were removed in the fall of 2020 by a licensed trapper from EBB Environmental Consulting Inc. A description of channel condition, geomorphic processes, and instream repairs is provided for the two reaches in the following sections. Instream repairs completed on August 6, 2020 are also described in the following sections.

4.1.2. Reach 1

Reach 1 is the most downstream reach of Alena Creek; it extends up from the Lillooet River FSR bridge to approximately 200 m upstream (Map 3) . Photos of each transect from each year of monitoring are provided in Appendix D. A summary of observations of constructed features at each transect and repairs made near ALE-XS1 in 2020 are provided below:

- **ALE-XS1** – The channel had previously avulsed onto the river left floodplain and created a secondary channel less than 10 m long (Figure 1 to Figure 6). This channel appears to have been more active in 2020 than 2019, but this could be a result of differences in flows between surveys. The riffle is still composed of gravel and is relatively free of fines but has some algae growth. Cobble was placed upstream of ALE-XS1 along a portion of the avulsed channel to direct flows back to the original channel alignment and reduce bank erosion (Figure 6). There are no concerns for long term stability.

- **ALE-XS2** – The channel is backwatered in this location due to the collapse of one of the channel-spanning logs downstream, and the accumulation of small wood pieces have created a minor log jam (Figure 7). The collapse was identified during the 2019 assessment (Thornton *et al*. 2020). Some undercutting has occurred on river left under a longitudinally aligned log, which appears to be stable and has created good cover habitat. The root wads on river right continue to provide good cover habitat. The log jam has not grown but should be monitored closely in future years to ensure the jam is not causing excessive fines deposition or full channel avulsion.

- **ALE-XS3** - Channel hydraulic diversity remains as designed, and the riffle has low fines content. There are no concerns for long term stability.

- **ALE-XS4** – Pool depth has remained as designed with minimal aggradation of fines. Root wads continue to provide good cover conditions. There are no concerns for long term stability.

Figure 1. Looking from river left to river right at ALE-XS1 on September 19, 2016.

Figure 2. Looking from river left to river right at ALE-XS1 on November 10, 2017.

Figure 3. Looking from river left to river right at ALE-XS1 on November 5, 2018.

Figure 4. Looking from river left to river right at ALE-XS1 on November 13, 2019.

Figure 5. Looking from river left to river right at ALE-XS1 on November 7, 2020.

Figure 6. Cobble placement at the head of the side channel upstream of ALE-XS1 on August 06, 2020.

Figure 7. Log jam that has formed at a collapsed channel spanning log approximately 10 m upstream of at ALE-XS1. Photo taken on June 20, 2019.

4.1.3. Reach 3

4.1.3.1. Transect Repeat Photos

Reach 3 extends from approximately 600 m to 800 m upstream of the Lillooet River FSR bridge. A brief description of changes that have occurred to constructed features at each of the monitoring transects is provided below, followed by an overview description of changes occurring in the channel. Photos of at each transect from each year of monitoring are provided in Appendix D.

- **ALE-XS5**- Due to recent beaver activity in 2020 at the lower end of Reach 3, this section is moderately backwatered. Wetted widths and wetted depths have increased relative to 2019. Channel hydraulic diversity remains as designed, and the riffle has low fines content despite moderate bank erosion upstream. One channel-spanning log has collapsed but is only slightly affecting hydraulics. Rootwads upstream of the riffle continue to provide good cover for juvenile salmonids. There are no concerns for long term stability.
- **ALE-XS6** - A new beaver dam was constructed in this section, causing some moderate backwatering and sand deposition. Wetted widths and wetted depths have increased relative to 2019. Some sand deposition has occurred on riffle material, with sand likely originating partially from upstream supply and from bank erosion that largely occurred during the November 2016 high flow event. Grass and herbaceous bank vegetation have established that should prevent excessive erosion in the future. There are no concerns for long term stability.

- **ALE-XS7** – The pool has aggregated with sand to some extent and may now be at an equilibrium depth with the upstream sand supply. There has been an increase in deposition of sand mid channel since 2019. Rootwads continue to provide cover habitat, and riffles are generally free of fines. There are no concerns for long term stability.
- **ALE-XS8** – The riffle is still relatively free of fines and excessive erosion has not occurred. Deposition of fines has occurred on the glide that is unavoidable given upstream sediment supply and the newly cut side channel flowing into the top of Reach 3. There are no concerns for long term stability.

During Year 3 (2019), two channels were identified that formed on the west side of Reach 3 due to a large beaver pond approximately 30–50 m upstream of Reach 3. These channels are cutting into fine sediment and delivering it to Reach 3. The channel that enters Reach 3 approximately 40 m downstream from the head of Reach 3 was flowing throughout 2020 (Figure 8). The other channel that entered Reach 3 further downstream had ceased flowing during 2020, likely due to changes in upstream beaver activity. The beaver dam complex upstream of Reach 3 was considered inactive in 2020. The dams restrict fish migration to the upstream spawning reach, impede gravel supply to Reach 3, and cause diversion of flow around the Reach 3 constructed channel. The dams were managed through 2018, 2019, and 2020 in accordance with best management practices for dam removal provided by a licensed trapper from EBB Environmental Consulting Inc. As recommended in 2019, the dam that is blocking flow to the mainstem was lowered in order to prevent excessive flow diversion.

New beaver activity was observed in the lower end of Reach 3: two constructed beaver dams created moderate backwatering at ALE-XS5, ALE-XS6 and ALE-XS7 (Figure 9). Beavers were trapped within the Alena Creek enhancement area and dams were removed in the fall of 2020 by a licensed trapper from EBB Environmental Consulting Inc.

Figure 8. Confluence of overflow channel that formed during 2019 as a result of beaver activity upstream of Reach 3. Photo shows uppermost 20 m of Reach 3 (right) and overflow channel (left). Photo taken on November 13, 2019.

Figure 9. New Beaver dam at the lower end of Reach 3 that was identified during fall 2020 and subsequently removed.

4.1.3.2. Instream repairs

As recommended in 2019, instream repairs were completed in Reach 3 on August 6, 2020. The repairs were distributed throughout the reach: conditions were enhanced, and erosion protection was installed at roughly every other habitat unit (pool or riffle). A set of example photos illustrating the repairs completed are provided below in Figure 10 to Figure 17, with before repair and after repair photos shown where feasible. The photos are generally shown from downstream to upstream and were all taken on August 6, 2020. Examples including repairs of each type are:

Bank revetments: Figure 10, Figure 12, Figure 13, Figure 14, and Figure 16.

Flow deflectors: Figure 11, Figure 12, and Figure 13.

Rebuild riffle: Figure 10, Figure 16, and Figure 17.

Gravel redistribution: Figure 12 and Figure 15.

Figure 10. Repaired riffle crest and bank protection at downstream extent of Reach 3 near ALE-XS5, before (left) and after (right) repair. Flow is from left to right. Riffle was backwatered by beaver dam at the time of photo. River right wetted terrace is composed of coarse material that is not expected to erode.

Figure 11. **Instream repair near ALE-XS6, before (left) and after (right) repair. Flow is from right to left. Rock/wood flood deflector was installed to scour sand deposited under root wads and to focus flow back into the original channel alignment.**

Figure 12. **Bank erosion repair and gravel redistribution to create flow deflector near ALE-XS6, before (left) and after (right) repair. Flow is from bottom to top. Flow energy is concentrated away from eroding left bank and towards rootwads on river right.**

Figure 13. Flow deflector and bank stabilization installed at ALE-XS6, after repair. Flow in left photo is from right to left and arrow shows new deflector. Flow in right photo is from left to right and shows how redirected flow energy has already begun to clean out material deposited at base of root wads.

Figure 14. Bank stabilization repairs using cobble above ALE-XS7. Flow is from right to left.

Figure 15. Pool dug out near ALE-XS7, showing gravel redistributed to centre of channel. Flow is from bottom to top.

Figure 16. Restored riffle crest above ALE-XS7 before (left) and after (right) repair. Flow is from left to right.

Figure 17. Restored riffle crest and bank protection near ALE-XS8, before (left) and after (right) repair. Flow is from left to right.

4.2. Fish Community

4.2.1. Adult Spawner Abundance

The peak count of Coho Salmon spawners observed in 2020 was 218 live fish and 51 carcasses on November 19, 2020 and December 4, 2020, respectively (Table 5). The peak count of 218 adult spawning Coho Salmon in 2020 was the highest observed during monitoring to date. Previous peak counts of adult spawning Coho Salmon ranged from 111 to 192 (in 2011 and 2016 respectively) (Table 6). A comparison of observations among years also highlights the variability in run timing, with the annual peak live count recorded on November 5 in 2010 and 2018, November 14 in 2016, December 5 in 2017, December 9 in 2019, and November 19 in 2020. The peak counts provide a general indication of use and demonstrate that Alena Creek supports potentially greater use by Coho Salmon spawners currently than it did pre-enhancement, although among-year variability in spawner abundance is strongly affected by factors other than spawning habitat quality, such as marine survival. Example photos of adult Coho Salmon holding in enhanced habitat and unenhanced habitat on November 7, 2020 are provided in Figure 18 and Figure 19 respectively. No Bull Trout were observed in 2020, while counts in previous years ranged from one to nine (Table 5, Table 7).

Table 5. Summary of adult fish observed during fall spawner surveys in 2020.

Stream	Date	Survey Time (hh:mm)	Survey Distance (m)	Live Adults [1]		Adult Carcasses [1]	
				BT	CO	BT	CO
Alena Creek	16-Sep-20	01:30	1,750	0	0	0	0
	2-Oct-20	01:27	2,300	0	0	0	0
	21-Oct-20	01:31	2,300	0	0	0	0
	7-Nov-20	03:41	2,300	0	206	0	7
	19-Nov-20	03:12	2,300	0	218	0	51
	4-Dec-20	03:56	2,300	0	77	0	75
Alena Creek Total:		**15:17**	**13,250**	**0**	**501**	**0**	**133**

[1] BT = Bull Trout, CO = Coho Salmon

Table 6. Peak Coho Salmon spawner counts during baseline (2010-2011) and post-construction monitoring (2016 - 2020).

Year	Date [1]	Adult Spawning Coho		
		Live	Dead	Total
2010	5-Nov	127	0	127
2011	2-Dec	110	1	111
2016	27-Nov	174	18	192
2017	5-Dec	110	22	132
2018	5-Nov	126	0	126
2019	9-Dec	153	20	173
2020	19-Nov	218	51	269

[1] Date of adult spawning Coho Salmon peak count

Table 7. Peak Bull Trout spawner counts during baseline (2011) and post-construction monitoring (2018 - 2020).

Year	Date [1]	Adult Spawning Bull Trout		
		Live	Dead	Total
2011	4-Oct	9	0	9
2018	11-Oct	2	0	2
2019	1-Oct	1	0	1
2020	N/A	0	0	0

[1] Date of adult spawning Bull Trout peak count

Figure 18. Coho Salmon observed holding in enhanced habitat on November 7, 2020.

Figure 19. Spawning Coho Salmon observed in unenhanced habitat on November 7, 2020.

4.2.2. Juvenile Abundance

4.2.2.1. Overview

On September 20, 2020, 44 minnow traps were set overnight in riffle, pool, and glide habitats ranging in depth from 0.2 to 1.1 m (Table 8). A total of 981 fish (932 Coho Salmon and 49 Cutthroat Trout) were captured during minnow trap sampling (Table 8). No juvenile Bull Trout were captured in 2020. Raw data tables and representative photos of minnow trapping sites are presented in Appendix E.

Table 8. Summary of minnow trapping habitat characteristics and fish captures in Alena Creek on September 20, 2020.

Site	Date	Enhancement Status	# of Traps	Total Soak Time (hrs)	Mesh Size (mm)	Habitat Type	Trap Depth Range (m)	Total Captures		
								BT	CO	CT
ALE-MT01	20-Sep-20	Enhanced	5	110.4	3	Glide, Riffle	0.3 - 0.4	0	30	5
ALE-MT02	20-Sep-20	Enhanced	5	113.3	3	Pool, Riffle	0.2 - 0.5	0	25	5
ALE-MT07	20-Sep-20	Enhanced	5	117.8	3	Pool	0.2 - 0.7	0	54	3
ALE-MT03	20-Sep-20	Unenhanced	4	97.0	3	Pool, Glide	0.2 - 0.7	0	57	5
ALE-MT08	20-Sep-20	Unenhanced	5	130.0	3-6	Pool	0.7 - 1.1	0	104	3
ALE-MT09	20-Sep-20	Enhanced	5	131.5	6	Pool, Riffle	0.2 - 0.4	0	103	9
ALE-MT05	20-Sep-20	Enhanced	5	131.3	6	Pool, Riffle	0.4 - 0.5	0	205	1
ALE-MT06	20-Sep-20	Unenhanced	10	245.0	6	Pool	0.4 - 1.4	0	354	18
Grand Total:			**44**	**1,076.2**				**0**	**932**	**49**
Grand Average:			**5.5**	**134.5**				**0**	**117**	**6**

4.2.2.2. Cutthroat Trout

A total of 49 Cutthroat Trout, ranging in length from 55 mm to 160 mm, were captured during the 2020 sampling program (Table 9, Table 10). Catch per unit effort (CPUE) ranged from 0.8 fish per 100 trap hours at ALE-MT05 to 7.3 fish per 100 trap hours in ALE-MT06 (Table 9). The average CPUE was 4.2 fish per 100 trap hours (± 2.3 Standard Deviation (SD)) (Table 9). Summary statistics of fish length, weight, and condition factor are presented for each age class in Table 10. Discrete fork length ranges were defined for each age class (Table 11), based on a review of the length-frequency histogram (Figure 20) and aging data from scale analysis (Figure 21).

Cutthroat Trout Fry (0+)

A single Cutthroat Trout fry (0+) was captured in 2020 at ALE-MT06 (unenhanced) and at ALE-MT09 (enhanced) (Table 9).

Cutthroat Trout Parr (1+)

Cutthroat Trout parr (1+) were distributed throughout Alena Creek and were captured at all sites except for ALE-MT05 (unenhanced) (Table 9). A total of 30 Cutthroat Trout 1+ parr were captured, with the largest number of fish captured in ALE-MT06 (unenhanced) and ALE-MT09 (enhanced).

Cutthroat Trout Parr (2+)

Eight Cutthroat Trout 2+ parr were captured in 2020. They were captured at all sites except ALE-MT05 (unenhanced), ALE-MT07 (enhanced), and ALE-MT08 (unenhanced) (Table 9).

Cutthroat Trout Adults (≥3+)

A total of 3 adult Cutthroat Trout were captured in 2020 at ALE-MT06 (unenhanced) (Table 9).

Table 9. Catch and CPUE for Cutthroat Trout captured by minnow trapping in Alena Creek in 2020.

Site	Date	Enhancement Status	# of Traps	Total Soak Time (hrs)	Total CT Catch (# of Fish) [1]	CPUE (# of Fish/100 Trap hrs) [1]	Aged CT Catch (# of Fish)[2]				
							0+	1+	2+	3+	All
ALE-MT01	20-Sep-20	Enhanced	5	110.4	5	4.5	0	4	1	0	**5**
ALE-MT02	20-Sep-20	Enhanced	5	113.3	5	4.4	0	4	1	0	**5**
ALE-MT07	20-Sep-20	Enhanced	5	117.8	3	2.5	0	3	0	0	**3**
ALE-MT03	20-Sep-20	Unenhanced	4	97.0	5	5.2	0	4	1	0	**5**
ALE-MT08	20-Sep-20	Unenhanced	5	130.0	3	2.3	0	3	0	0	**3**
ALE-MT09	20-Sep-20	Enhanced	5	131.5	9	6.8	1	6	1	0	**8**
ALE-MT05	20-Sep-20	Enhanced	5	131.3	1	0.8	0	0	0	0	**0**
ALE-MT06	20-Sep-20	Unenhanced	10	245.0	18	7.3	1	6	4	3	**14**
Total:			**44**	**1,076.2**	**49**	**4.6**	**2**	**30**	**8**	**3**	**43**
Average:			**5.5**	**134.5**	**6**	**4.2**	**0**	**4**	**1**	**0**	**5**
Standard Deviation:				**46.2**	**5**	**2.3**	**0**	**2**	**1**	**1**	**4**

[1] Includes all captured fish in the minnow traps

[2] Only includes fish measured for fork length and assigned an age.

Table 10. **Summary of fork length, weight, and condition for juvenile Cutthroat Trout captured in Alena Creek in 2020.**

Age Class	Fork Length (mm)				Weight (g)				Condition Factor (K)			
	n	Average	Min	Max	n	Average	Min	Max	n	Average	Min	Max
Fry (0+)	1	55	55	55	1	1.9	1.9	1.9	2	1.14	1.14	1.14
Parr (1+)	19	90	74	113	18	7.7	4.1	14.1	30	0.98	0.82	1.21
Parr (2+)	7	126	119	140	7	19.3	15.3	27.3	0	0.95	0.87	1.00
Adult (≥3+)	3	156	150	160	3	34.4	32.0	36.7	1	0.91	0.89	0.95
All	**30**	**104**	**55**	**160**	**29**	**13.0**	**1.9**	**36.7**	**43**	**0.97**	**0.82**	**1.21**

Table 11. **Size bins by age class for juvenile Cutthroat Trout captured in Alena Creek in 2020.**

Age Class	Fork Length Range (mm)
Fry (0+)	≤55
Parr (1+)	70-113
Parr (2+)	119-140
Adult (≥3+)	≥150

Figure 20. **Fork length frequency for juvenile Cutthroat Trout captured (by minnow trapping) in Alena Creek in 2020.**

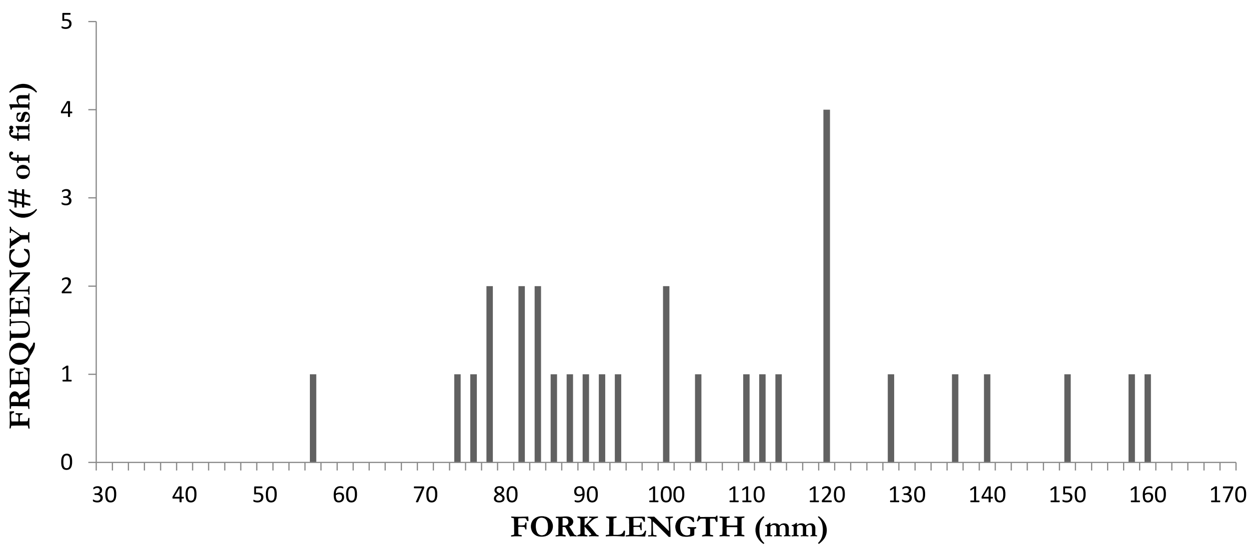
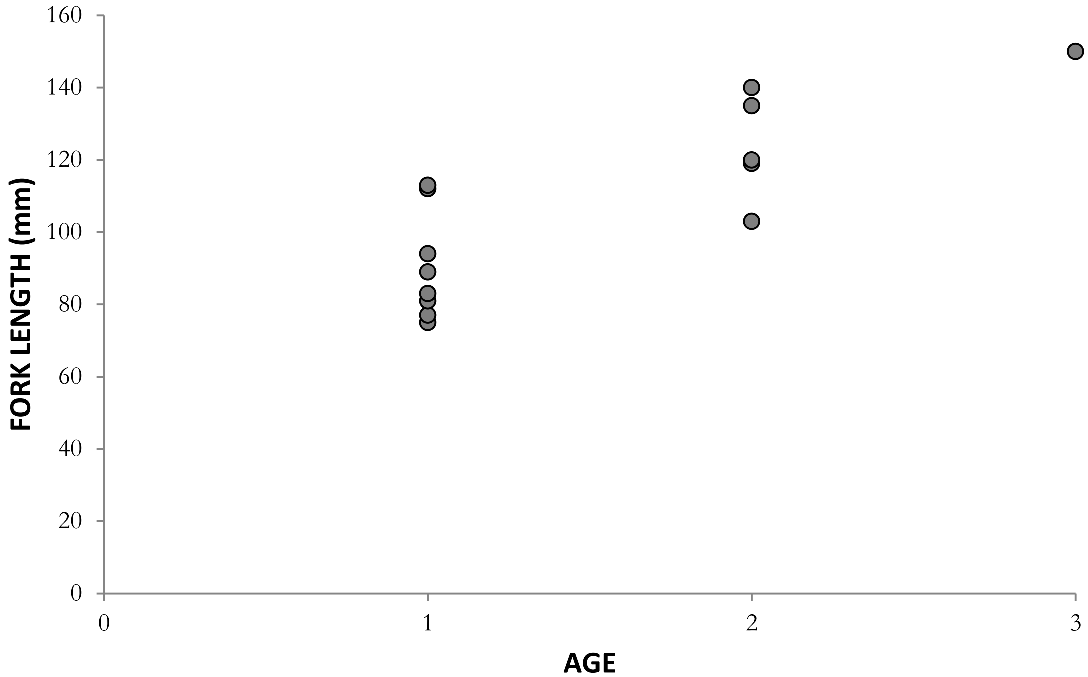


Figure 21. Fork length by age for juvenile Cutthroat Trout captured in Alena Creek in 2020.



4.2.2.3. Coho Salmon

A total of 932 juvenile Coho Salmon were captured during minnow trap sampling in Alena Creek on September 20, 2020 (Table 12). CPUE ranged from 22.1 fish per 100 trap hours at ALE-MT02 (enhanced) to 156.2 fish per 100 trap hours in ALE-MT05 (enhanced) (Table 12). The total average CPUE was 76.6 fish per 100 trap hours (± 50.2 SD) (Table 12). Summary statistics of fish length, weight, and condition factor are presented for each age class in Table 13. Discrete fork length ranges were defined for each age class (Table 13), based on a review of the length-frequency histogram (Figure 22) and aging data from scale analysis (Figure 23).

Coho Salmon Fry (0+)

Coho Salmon fry (0+) were captured at all sampling sites in 2020 and are distributed throughout the sampled reaches of Alena Creek (Table 12). Due to the large volume of Coho Salmon juveniles captured, not all fish were measured for fork length and therefore not all Coho Salmon could be assigned an age class. Based on total captures, we have assumed that Coho fry were most abundant at ALE-MT06 and ALE-MT08 in the unenhanced reach (Reach 2) and ALE-MT05 in the enhanced reach (Reach 3).

Coho Salmon Parr (1+)

Coho Salmon 1+ parr were captured at all sites in 2020 (Table 12). Based on total captures, 1+ parr were likely most abundant at ALE-MT06 and ALE-MT08 in the unenhanced reach (Reach 4).

Table 12. Catch and CPUE for Coho Salmon captured in Alena Creek in 2020.

Site	Date	Enhancement Status	# of Traps	Total Soak Time (hrs)	Total CO Catch (# of Fish)[1]	CPUE (# of Fish/100 Trap hrs)[1]	Measured CO Catch (# of Fish)[2]		
							0+	1+	All
ALE-MT01	20-Sep-20	Enhanced	5	110.4	30	27.2	19	11	**30**
ALE-MT02	20-Sep-20	Enhanced	5	113.3	25	22.1	20	5	**25**
ALE-MT07	20-Sep-20	Enhanced	5	117.8	54	45.9	40	14	**54**
ALE-MT03	20-Sep-20	Unenhanced	4	97.0	57	58.8	30	13	**43**
ALE-MT08	20-Sep-20	Unenhanced	5	130.0	104	80.0	58	46	**104**
ALE-MT09	20-Sep-20	Enhanced	5	131.5	103	78.3	24	11	**35**
ALE-MT05	20-Sep-20	Enhanced	5	131.3	205	156.2	23	39	**62**
ALE-MT06	20-Sep-20	Unenhanced	10	245.0	354	144.5	65	71	**136**
Total:			**44**	**1,076.2**	**932**	**86.6**	**279**	**210**	**489**
Average:			**5.5**	**134.5**	**117**	**76.6**	**35**	**26**	**61**
Grand Standard Deviation:				**46.2**	**112**	**50.2**	**18**	**23**	**39**

[1] Includes all captured fish in the minnow traps

[2] Only includes fish measured for fork length and assigned an age.

Table 13. Summary of fork length, weight, and condition for Coho Salmon captured in Alena Creek in 2020.

Age Class	Fork Length (mm)				Weight (g)				Condition Factor (K)			
	n	Average	Min	Max	n	Average	Min	Max	n	Average	Min	Max
Fry (0+)	165	55	41	70	160	2.2	0.8	4.6	279	1.24	0.63	2.26
Parr (1+)	89	82	73	105	88	6.6	4.2	11.5	210	1.16	0.98	1.59
All	**254**	**65**	**41**	**105**	**248**	**3.7**	**0.8**	**11.5**	**489**	**1.21**	**0.63**	**2.26**

Table 14. Size bins by age class for Coho Salmon captured in Alena Creek in 2020.

Age Class	Fork Length Range (mm)
Fry (0+)	41-70
Parr (1+)	73-105

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Figure 22. Fork length frequency for juvenile Coho Salmon captured (minnow trapping) in Alena Creek in 2020.

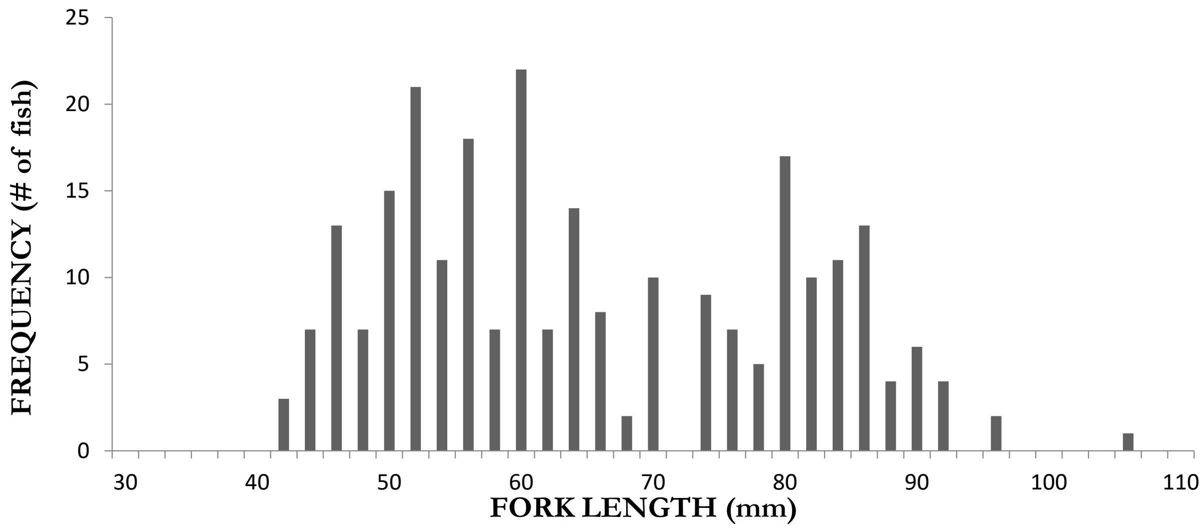
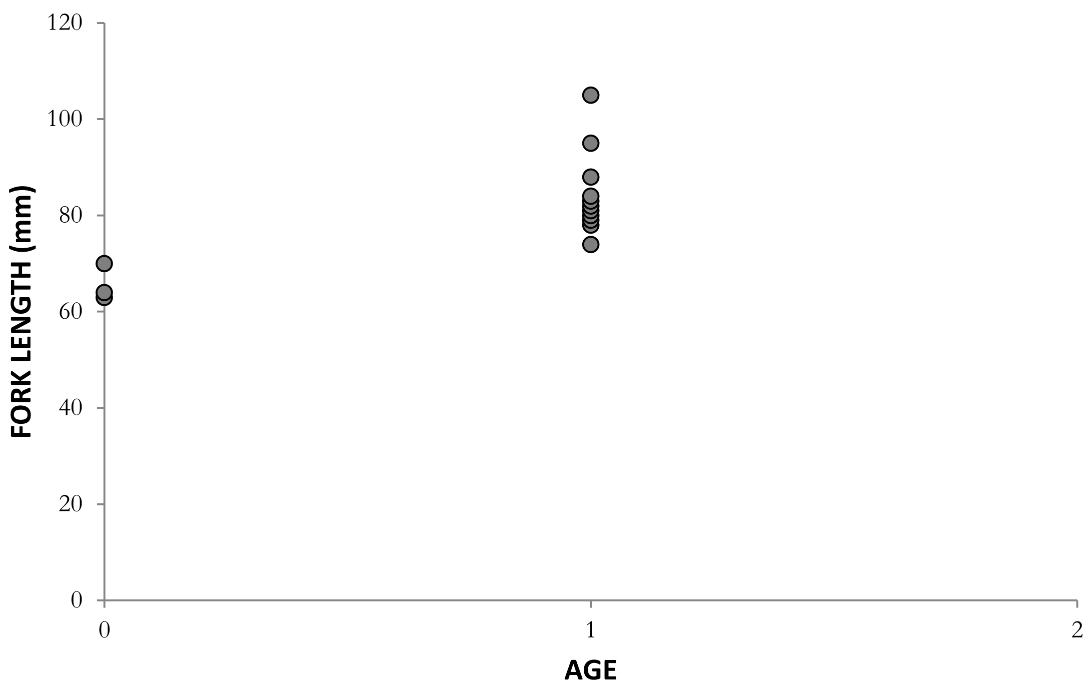


Figure 23. Fork length by age for Coho Salmon captured in Alena Creek in 2020.



4.2.2.4. Bull Trout

No Bull Trout were captured in Alena Creek minnow traps in 2020.

4.2.2.5. Comparison Among Years

Cutthroat Trout

The average Cutthroat Trout CPUE in 2020 (4.1 fish per 100 trap hours) was higher than in all previous sampling years except 2014 (Figure 24), when the average CPUE was 7.2 fish per 100 trap hours. The 2014 CPUE results are, however, biased high because the minnow traps were left only during the daytime in this year (due to bear activity) and soak times were therefore shorter than in other years (Harwood *et. al.* 2016). Given that catchability is not likely constant throughout the trap soak time, and that there is likely a high initial catch rate that diminishes over time (Harwood *et al.* 2016), a shorter soak time would result in an apparent higher CPUE. Between 2018 and 2020 there were more sites sampled than in previous years (eight sites versus six sites), although this should not affect comparability of CPUE among years since it is a standardized metric.

In 2020, Cutthroat Trout were relatively evenly distributed in relatively low numbers throughout Alena Creek; exceptions were at ALE-MT06 (unenhanced) and ALE-MT09 (enhanced), where CPUE was 7.3 and 6.8 fish per 100 trap hours, respectively (Figure 25). CPUE at remaining sites ranged from 0.8 to 5.2 fish per 100 trap hours. These captures were higher than in previous years.

In all sampling years, the most abundant age class of Cutthroat Trout captured was 1+ parr. Two fry were captured in 2020, whereas three fry were captured in 2019 and zero were captured in 2017 and 2018 (Table 9).

Figure 24. **Comparison of minnow trap CPUE for Cutthroat Trout during baseline (2013 and 2014) and post-construction (2017-2020) sampling. Error bars represent standard error. Note that 2014 CPUE may be an overestimation due to shorter soak time at some sites due to bear activity.**

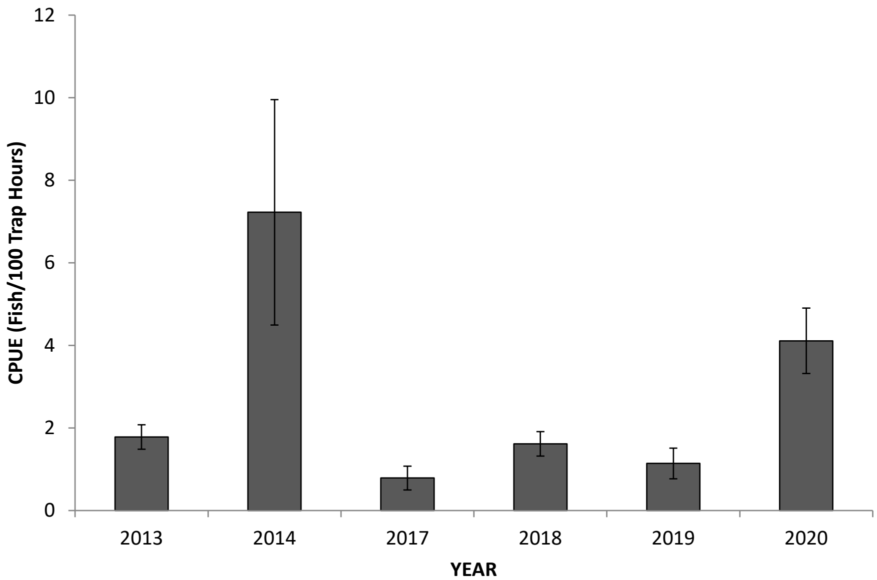
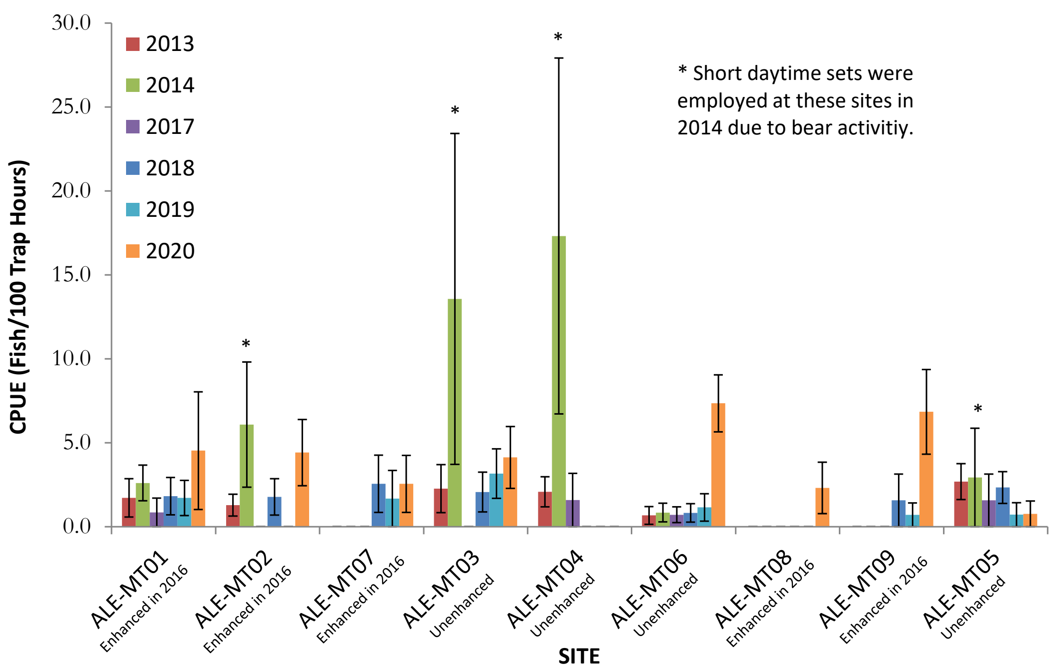


Figure 25. **Comparison of minnow trap CPUE for Cutthroat Trout at each site during baseline (2013 and 2014) and post-construction (2017-2020) sampling. Error bars represent standard error.**



Coho Salmon

The average Coho Salmon CPUE in 2020 was 75.1 fish per 100 trap hours, which was similar to the CPUE in 2018 and higher than the CPUE in 2019 (33.3 and 83.8 fish were captured per 100 trap hours in 2019 and 2018, respectively; Figure 26). CPUE was higher in 2020 and 2018 than baseline, considering that the 2014 CPUE results are biased high by the short daytime sets (as described for Cutthroat Trout above). Between 2018 and 2020 there were more sites sampled than in previous years (eight sites versus six sites), although this should not directly affect comparability of CPUE among years since it is a standardized metric.

In 2020, Coho Salmon fry and parr were captured at all sites. CPUE of Coho Salmon at individual sites in 2020 was generally similar to that in previous years of sampling, with the exception of ALE-MT05 (unenhanced) and ALE-MT06 (unenhanced), where CPUE was notably higher in 2020 than in previous years (Figure 27).

Figure 26. Comparison of minnow trap CPUE for Coho Salmon during baseline (2013 and 2014) and post-construction (2017-2020) sampling. Error bars represent standard error. Note that 2014 CPUE may be an overestimation due to shorter soak time at some sites due to bear activity.

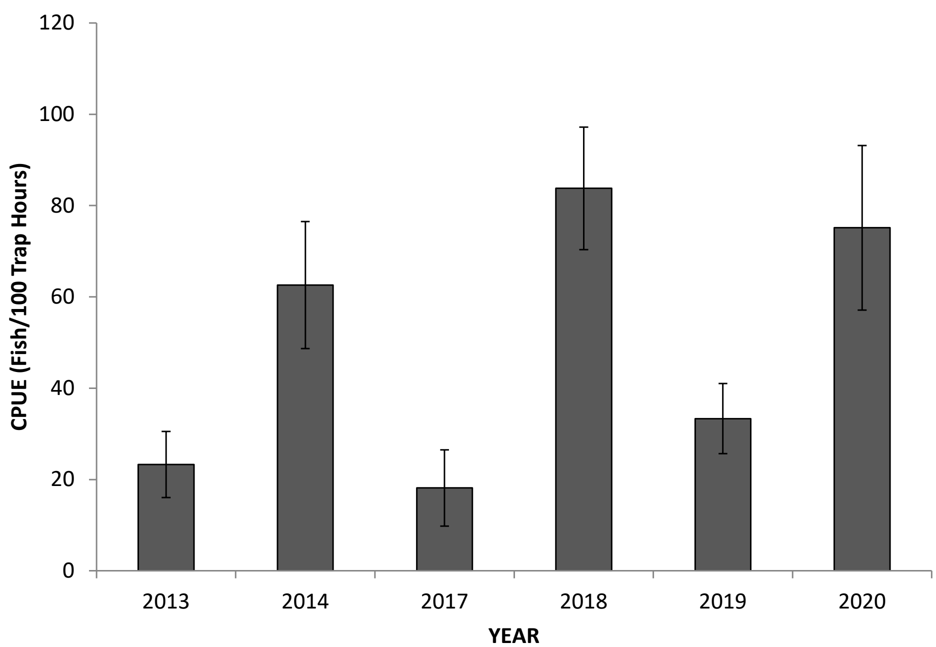
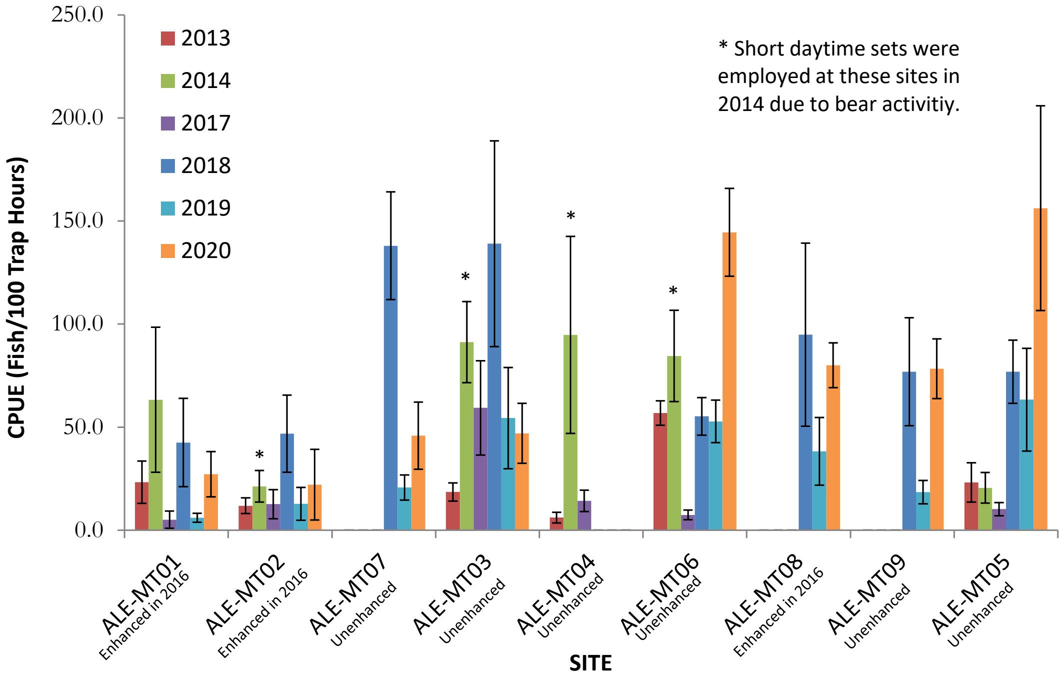


Figure 27. Comparison of minnow trap CPUE for Coho Salmon at each site during baseline (2013 and 2014) and post-construction (2017-2020) sampling. Error bars represent standard error.

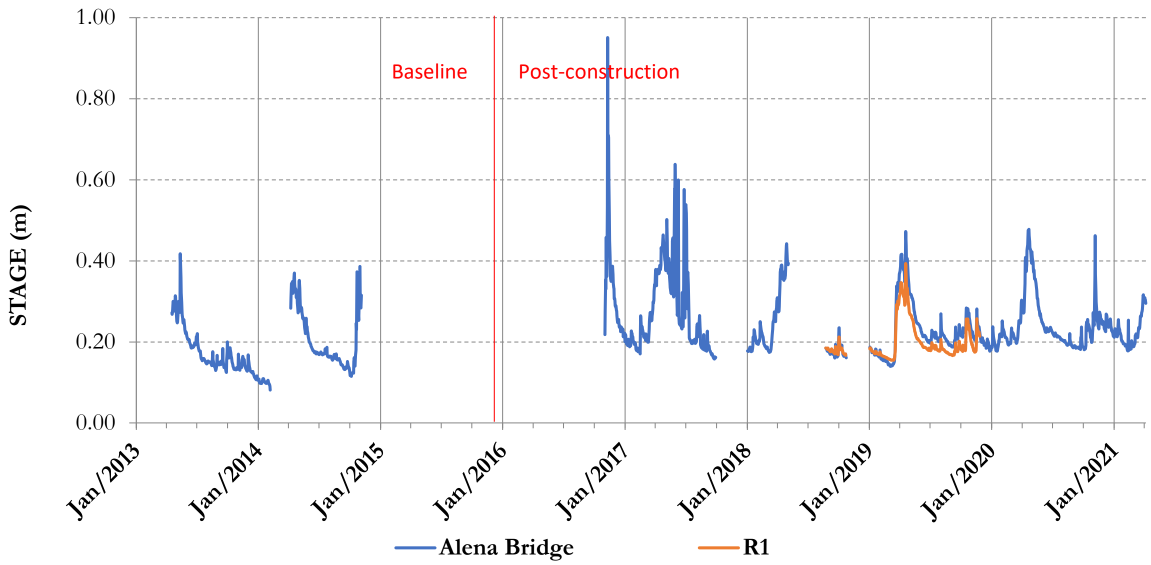


4.3. Hydrology

Seasonal trends in the Alena Creek hydrograph in 2020 were consistent with a coastal, snow-dominated watershed. Seasonal hydrograph patterns remained broadly consistent with observations from baseline and post-construction monitoring. Stage readings in 2020 remained relatively low throughout the winter (i.e., January 2020 to mid-March) when precipitation was snow dominated, then increased during snow melt in spring (March and April). Stage remained low during monitoring in late-summer and early fall (August 23 to October) when precipitation was minimal (Figure 28). A spike in stage occurred in late October 2020.

In 2020, overall mean daily stage at Alena bridge was 0.24 ± 0.06 m. The daily maximum stage in 2020 was recorded on April 21, 2020 (0.48 m), corresponding with spring snowmelt. This was less than the maximum stage measured since records began in May 2013, which was recorded on November 9, 2016 (0.95 m) during a 1-in-20-year return flood event on the Upper Lillooet River (McCoy, pers. comm. 2016), but was consistent with peak values recorded during baseline monitoring (Figure 28). In addition to the peak in April 2020, stage spiked in early November 2020 (0.46 m). The minimum stage in 2020 occurred on January 17, 2020 (0.18 m). This minimum value is higher than the lowest stage recorded since records began (0.08 m on February 5, 2014), and higher than the lowest stage recorded in post-construction years (0.14 m on March 4, 2019).

Figure 28. Stage in Alena Creek at the Lillooet River FSR bridge during baseline (April 2013 to November 2014), and post-construction monitoring (November 2016 to March 2021).



4.4. Water Temperature

4.4.1. Overview

The results of the pre-construction and post-construction water temperature metrics, including Year 4 (2020) data, are summarized in the following sections. Water temperature site photos are presented in Appendix B and annual water temperature figures and BC WQG for water temperature are presented in Appendix C. This report is a data summary report; thus, any changes in water temperature related to the construction of the FHEP will be evaluated with a BACI analysis following five years of post-construction water temperature data collection.

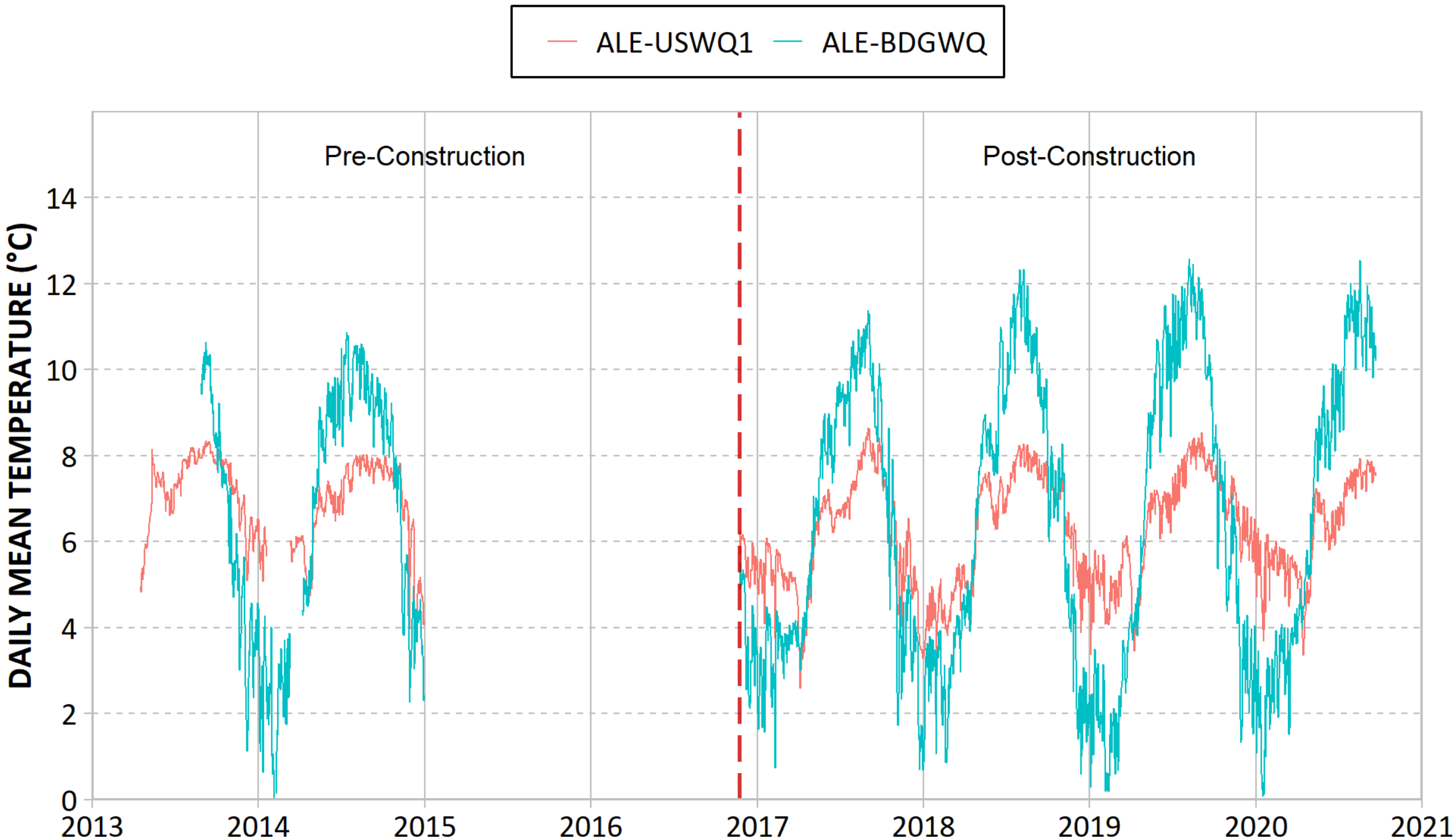
Monitoring in Years 1, 2, 3, and 4 (2017, 2018, 2019, 2020) complete nearly four full years of post-construction water temperature data collection at the upstream (control; ALE-USWQ1) and downstream (impact; ALE-BDGWQ) sites. The post-construction period of record is from November 23, 2016 to September 21, 2020 (Table 1, Map 2). Data availability is based on the most recent download of water temperature loggers.

Daily average, maximum, and minimum water temperature at ALE-USWQ1 and ALE-BDGWQ are shown in Figure 29. The pattern of differences in water temperature between the two sites during the winter and summer seasons is largely the same pre- and post-construction, as evident in the differences in the cumulative frequency distribution between the sites (Figure 30). Despite the small difference in elevation (11 m) and short distance (~1 km) between the sites, the downstream site has generally been warmer than the upstream site in the summer and cooler in the winter (Figure 29, Figure 30). It is thought that this is in part due to the temperature-regulating influence of groundwater at the upstream site, and to a tributary that enters Alena Creek between the two sites, which may account for some of the cooler temperatures downstream in the winter and warmer temperatures downstream in the summer (Figure 29, Figure 30, Map 2).

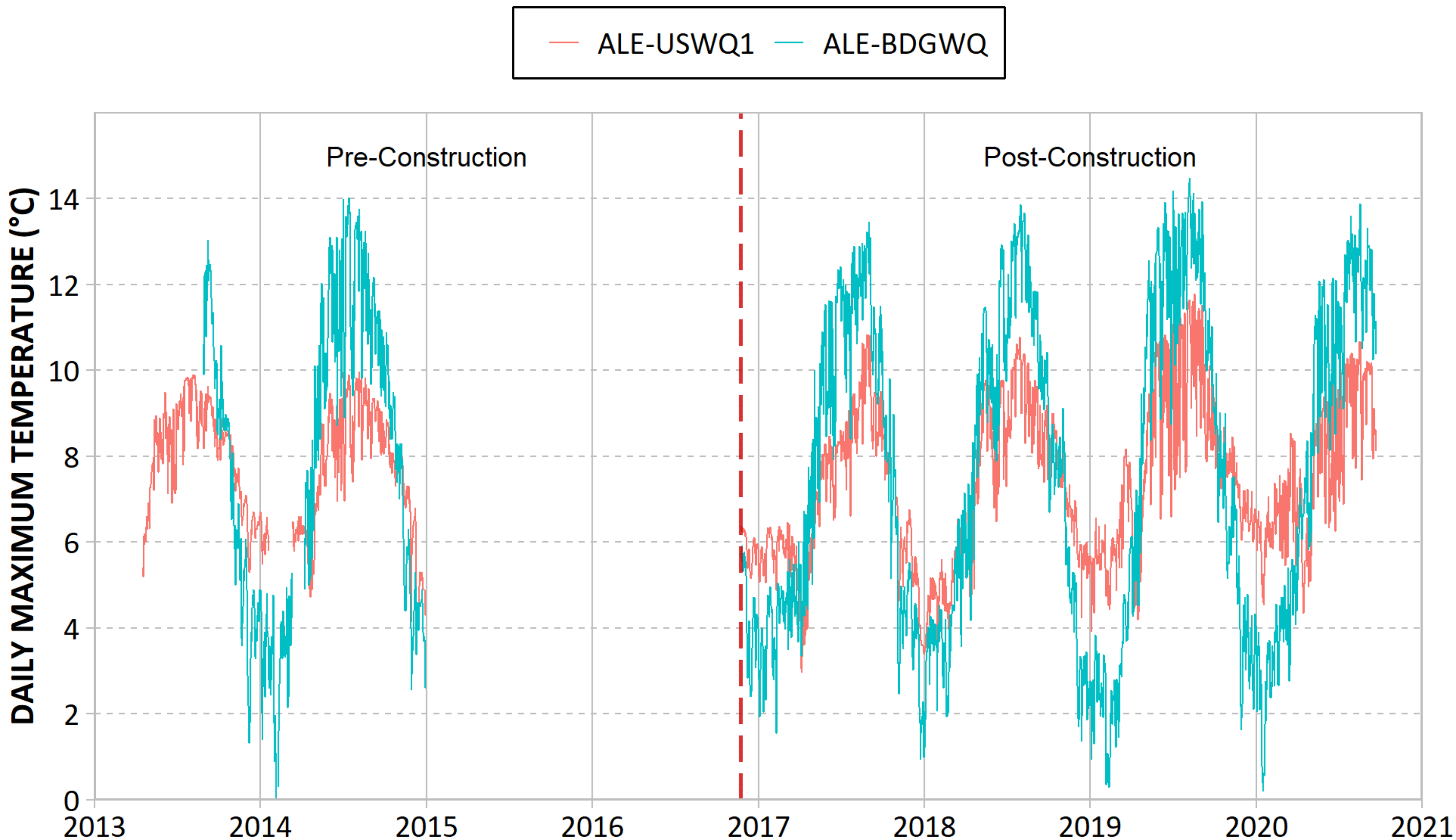
In general, water temperature upstream (ALE-USWQ1) varied over a narrower range than observed downstream (ALE-BDGWQ) (Figure 29). The daily average temperatures recorded at both sites were higher post-construction (2017-2020) than pre-construction (2013-2014) in the warmer months and the increase is more pronounced at the downstream site. Trends in the data attributable to the FHEP will be evaluated following five years of data collection through a BACI analysis.

Figure 29. Overall average (a), maximum (b), and minimum (c) temperature in Alena Creek pre-construction (2014 to 2015) and post-construction (2017 to 2020) recorded at the upstream control (ALE-USWQ1) and downstream impact (ALE-BDGWQ) sites.

(a) Daily Average



(b) Daily Maximum



(c) Daily Minimum

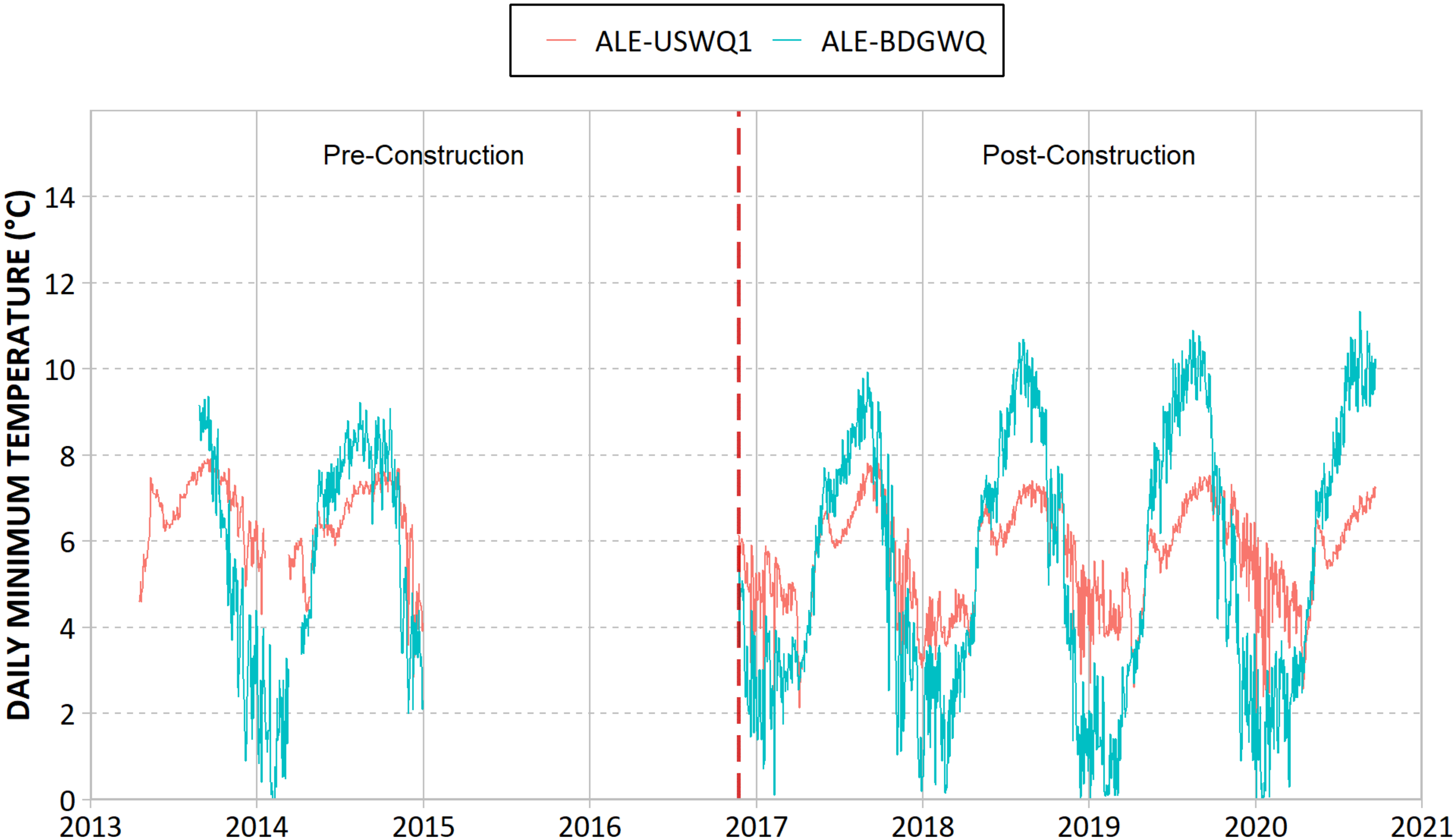
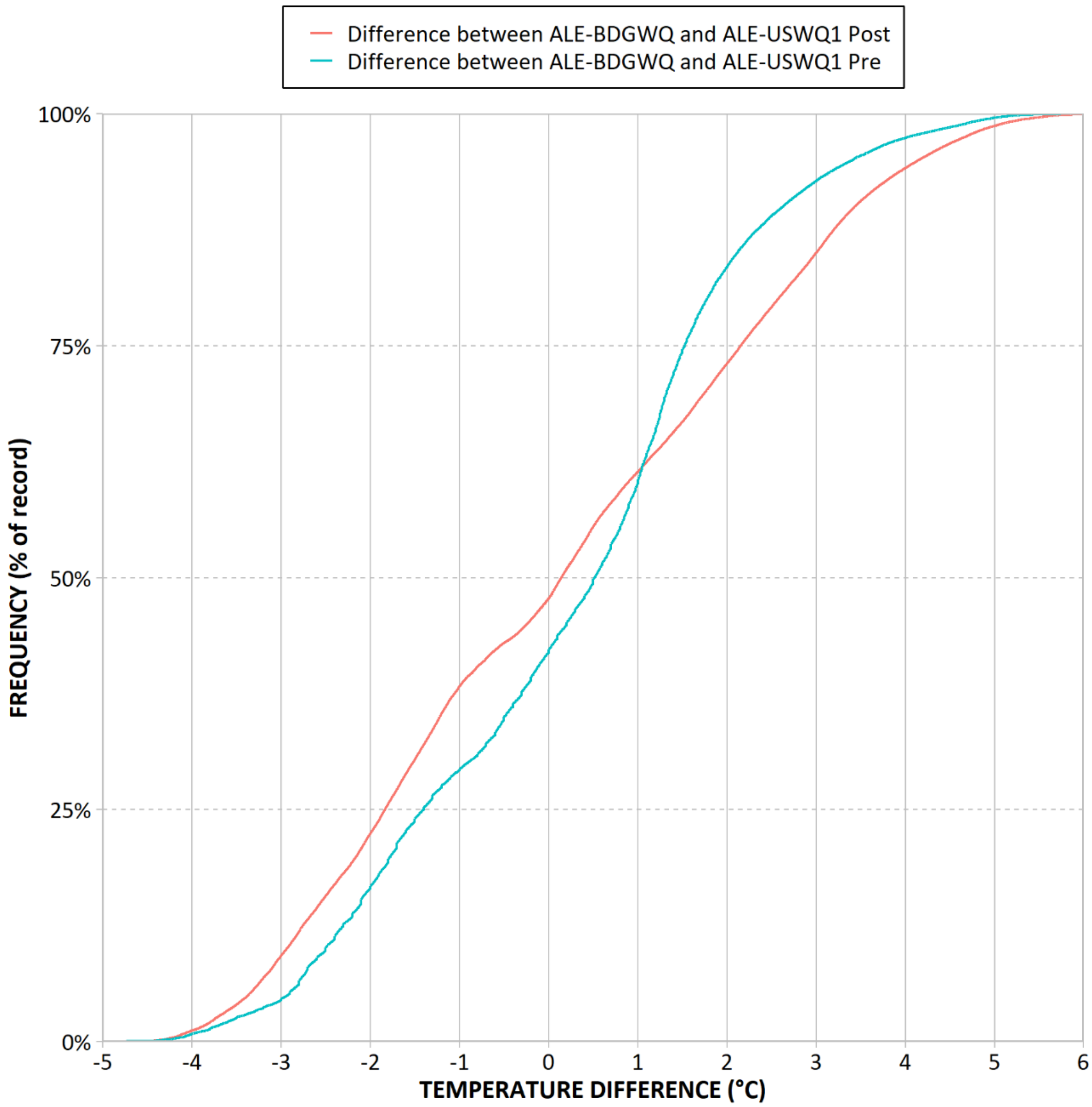


Figure 30. Cumulative frequency distribution of differences in pre-construction (2013 2014) and post-construction (2016-2020) instantaneous water temperature between the downstream site (ALE-BDGWQ) and the upstream site (ALE USWQ1) (positive values indicate warmer temperatures at ALE-BDGWQ).



4.4.2. Monthly Summary Statistics

The mean, instantaneous minimum, instantaneous maximum, and standard deviation for water temperature for each month of the record are summarized for the pre-construction period in Table 15 and for the post-construction period in Table 16 and Table 17. The minimum and maximum monthly average and instantaneous water temperatures are highlighted for each monitoring period (pre-construction and post-construction). Overall, at the upstream site, no substantial change in monthly average water temperature statistics has been observed in Year 4 (5.4°C to 7.5°C; Table 17) in comparison to monthly average temperature pre-construction (5.0°C in December 2014 to 8.1°C in September 2013; Table 15) and post-construction to date (4.0°C in April 2017 to 8.1°C to August 2019; Table 16). No data are available for January, February, or March 2014 pre-construction at the upstream site, therefore the monthly average minimum of 5.0°C measured in December 2014 may not be representative of the coolest monthly average pre-construction.

At the downstream site monthly average temperatures ranged from 2.2°C to 10.1°C pre-construction (Table 15), and from 1.2°C (February 2019) to 11.7°C (August 2019) post-construction (Table 16, Table 17). The 2020 monthly average water temperature ranged from 1.9°C (January 2020) to 11.1°C (August 2020). To date, 2019 exhibits the highest and lowest average monthly temperatures at the downstream site.

Pre-construction minimum and maximum instantaneous temperatures ranged from 2.8°C (December 2014) to 10.0°C (July and August 2014) at the upstream site and 0.0°C (February 2014) to 14.0°C (July 2014) at the downstream site (Table 15). Post-construction (2016 to 2019), instantaneous minimum and maximum temperatures ranged from 0.8°C (February 2017) to 11.8°C (August 2019) at the upstream site and 0.0°C (January 2019) to 14.5°C (August 2019) at the downstream site (Table 16). In 2020, instantaneous temperatures were within the post-construction ranges at the upstream (1.9°C to 10.7°C) and downstream sites (0.0°C to 13.9°C) (Table 17).

Table 15. Alena Creek monthly water temperature summary statistics measured pre-construction (May 2013 to December 2014) at the upstream site (ALE USWQ1) and downstream site (ALE-BDGWQ).

Year	Month	Water Temperature (°C)							
		ALE-USWQ1				ALE-BDGWQ			
		Avg	Min	Max	SD	Avg	Min	Max	SD
2013	May	7.2	5.4	9.0	0.8	-	-	-	-
	Jun	7.0	6.2	9.5	0.6	-	-	-	-
	Jul	7.6	6.5	9.9	0.9	-	-	-	-
	Aug	8.0	7.3	9.9	0.6	-	-	-	-
	Sep	8.1	7.3	9.6	0.4	9.6	6.9	13.0	1.2
	Oct	7.8	6.9	8.9	0.3	7.5	4.5	10.6	1.0
	Nov	7.0	6.1	8.1	0.4	5.2	2.4	7.6	1.0
	Dec	6.1	5.0	7.1	0.5	3.4	0.9	5.5	1.1
2014	Jan	-	-	-	-	2.7	0.4	4.9	1.1
	Feb	-	-	-	-	2.2	0.0	5.0	1.2
	Mar	-	-	-	-	-	-	-	-
	Apr	5.4	4.4	6.4	0.6	5.0	3.4	9.6	1.1
	May	6.7	5.3	8.9	0.6	7.9	5.3	12.0	1.4
	Jun	7.0	5.9	9.5	0.8	9.1	6.4	13.1	1.6
	Jul	7.4	6.3	10.0	0.9	9.9	7.4	14.0	1.7
	Aug	7.9	7.1	10.0	0.7	10.1	7.9	13.8	1.4
	Sep	7.7	6.6	9.4	0.5	9.2	6.4	12.2	1.1
	Oct	7.6	6.9	8.9	0.3	8.4	6.7	10.9	0.8
	Nov	6.9	3.6	8.0	0.9	5.4	2.0	8.3	1.6
	Dec	5.0	2.8	6.8	0.9	3.9	2.1	5.3	0.7

Monthly statistics were not generated for months with less than three weeks of data.

Monthly average and instantaneous maximum (red shading) and minimum (blue shading) are highlighted for the monitoring period.

Table 16. Alena Creek monthly water temperature summary statistics measured post-construction (December 2016 to September 2019) at the upstream site (ALE USWQ1) and downstream site (ALE-BDGWQ).

Year	Month	Water Temperature (°C)							
		ALE-USWQ1				ALE-BDGWQ			
		Avg	Min	Max	SD	Avg	Min	Max	SD
2016	Dec	5.5	2.5	6.3	0.4	3.5	1.5	5.7	0.9
2017	Jan	5.4	2.0	6.4	0.5	3.2	0.7	5.0	1.0
	Feb	5.3	0.8	6.4	0.5	3.2	0.1	5.1	0.9
	Mar	5.1	4.3	6.5	0.3	3.8	2.5	6.0	0.6
	Apr	4.0	2.1	6.4	0.9	4.3	2.5	8.3	1.1
	May	6.4	4.5	8.3	0.7	7.3	4.3	11.5	1.4
	Jun	6.7	5.8	8.5	0.6	8.5	6.5	12.3	1.4
	Jul	6.9	5.9	9.5	0.8	9.5	7.3	12.9	1.4
	Aug	7.9	6.6	10.8	0.9	10.4	8.1	13.2	1.3
	Sep	8.1	6.7	10.8	0.7	9.7	6.8	13.5	1.1
	Oct	6.9	3.8	8.8	0.8	6.9	2.5	9.8	1.2
	Nov	5.4	3.3	7.1	0.8	3.8	1.0	6.6	1.2
	Dec	4.6	3.1	6.6	0.9	2.8	0.2	5.3	1.3
2018	Jan	4.2	3.2	5.2	0.5	2.9	0.4	4.3	0.9
	Feb	4.3	3.6	5.6	0.4	2.5	0.1	4.5	1.1
	Mar	5.0	3.8	6.8	0.6	3.8	1.0	7.1	1.0
	Apr	5.1	3.4	8.5	1.0	5.2	2.4	9.9	1.4
	May	7.3	5.5	9.8	0.8	8.3	5.4	11.5	1.3
	Jun	6.9	5.7	9.8	0.8	9.0	6.4	12.9	1.5
	Jul	7.6	5.9	10.8	1.1	10.8	7.7	13.6	1.4
	Aug	8.0	6.8	10.4	0.8	11.1	8.3	13.9	1.1
	Sep	7.6	6.7	9.8	0.6	9.7	7.4	11.9	0.8
	Oct	7.2	5.6	9.0	0.6	7.2	5.0	8.8	0.8
	Nov	6.4	3.9	8.4	0.6	5.2	1.4	9.1	1.4
	Dec	5.2	2.9	6.8	0.6	2.1	0.1	4.8	0.9
2019	Jan	5.1	2.7	6.6	0.6	2.2	0.0	3.8	0.8
	Feb	4.6	3.8	6.4	0.6	1.2	0.1	3.2	0.8
	Mar	5.4	3.7	8.2	0.9	2.8	0.1	5.9	1.1
	Apr	4.5	2.6	7.7	0.9	4.8	2.7	9.6	1.4
	May	6.7	4.8	10.7	1.2	8.8	4.4	13.3	2.0
	Jun	6.8	5.3	10.8	1.2	10.0	6.2	13.9	1.6
	Jul	7.4	5.9	11.3	1.2	10.9	8.4	14.2	1.3
	Aug	8.1	6.7	11.8	1.2	11.7	9.2	14.5	1.2
	Sep	7.9	6.5	11.5	0.8	10.2	6.6	13.9	1.2
	Oct	7.2	5.5	9.5	0.6	7.0	3.6	9.9	1.3
	Nov	6.8	5.2	8.5	0.6	5.1	0.9	7.5	1.6
	Dec	6.2	4.4	7.2	0.5	3.0	0.7	4.8	0.9

Monthly statistics were not generated for months with less than three weeks of data.

Monthly average and instantaneous maximum (red shading) and minimum (blue shading) are highlighted for the monitoring period.

Post construction water temperature monitoring commenced on November 23, 2016.

Table 17. Alena Creek monthly water temperature summary statistics measured post-construction (January 2020 to August 2020) at the upstream site (ALE USWQ1) and downstream site (ALE-BDGWQ).

Year	Month	Water Temperature (°C)							
		ALE-USWQ1				ALE-BDGWQ			
		Avg	Min	Max	SD	Avg	Min	Max	SD
2020	Jan	5.4	1.9	7.1	0.9	1.9	0.0	3.9	1.1
	Feb	5.6	4.1	7.6	0.5	3.0	0.7	4.7	0.8
	Mar	5.4	3.5	8.5	0.9	3.4	0.3	6.4	1.0
	Apr	4.6	2.6	7.7	0.9	4.8	2.4	8.4	1.3
	May	6.6	4.5	9.4	0.9	8.0	4.6	12.1	1.7
	Jun	6.3	5.3	9.8	0.9	8.9	6.5	12.1	1.3
	Jul	7.1	5.8	10.4	1.1	10.5	7.8	13.6	1.4
	Aug	7.5	6.4	10.7	1.0	11.1	9.0	13.9	1.0
	Sep	-	-	-	-	-	-	-	-

Monthly statistics were not generated for months with less than three weeks of data.
Post construction water temperature monitoring commenced on November 23, 2016.
Monthly average and instantaneous maximum (red shading) and minimum (blue shading) are highlighted for the monitoring period, after a full year of monitoring data are available.

4.4.3. Growing Season Degree Days

The fall and early winter (October to December 31) weekly and maximum average temperatures upstream of the FHEP area have been relatively mild, remaining above 4°C during the pre- and post-construction monitoring periods (Figure 29). Therefore, the growing season end date for Alena Creek was calculated based on weekly average temperatures reaching 5°C rather than 4°C (see Section 3.4.1).

The start of the growing season based on the water temperature record at each site is consistently observed at the middle to end of April both pre- and post-construction (Table 18). The growing season end dates were more variable upstream ranging from early November (post-construction) to late December (pre-construction and post-construction). At the downstream site, the growing season end dates were in mid-November pre-construction and late October to mid-November post-construction.

Considering both sites, which define the downstream and upstream extent of the FHEP, the growing season varied from 1,634 to 1,836 degree days pre-construction and from 1,346 to 1,872 degree days post-construction (Table 18).

Table 18. Growing season length and degree days upstream and downstream of the FHEP in Alena Creek pre- and post-construction (2013-2020) as determined from water temperature monitoring at the upstream site (ALE USWQ1) and downstream site (ALE-BDGWQ).

Site	Project Phase	Year	No. of days with valid data	Growing Season Data Summary				
				Start Date	End Date	Length (day)	Data Gap (day)	Degree Days
Upstream (ALE-USWQ1)	Pre-construction	2013	256	20-Apr	28-Dec	253	1	1,836
		2014	305	27-Apr	9-Dec	227	1	1,634
	Post-construction	2017	364	28-Apr	4-Nov	191	0	1,346
		2018	365	20-Apr	10-Dec	235	0	1,670
		2019	364	22-Apr	28-Dec	251	0	1,769
		2020	264	28-Apr	-	-	-	-
Downstream (ALE-BDGWQ)	Pre-construction[1]	2013	125	-	17-Nov	-	-	-
		2014	328	23-Apr	12-Nov	205	0	1,796
	Post-construction	2017	364	23-Apr	1-Nov	193	0	1,644
		2018	365	17-Apr	11-Nov	209	0	1,872
		2019	365	20-Apr	29-Oct	193	0	1,843
		2020	264	18-Apr	-	-	-	-

[1]Temperature monitoring at ALE-BDGWQ began in August 2013, therefore the start date and accumulated thermal units for the 2013 growing season could not be calculated.

Degree days are accumulated thermal units.

4.4.4. Hourly Rates of Water Temperature Change

Hourly rates of change in water temperature were compared to the BC WQG, which specify that the hourly rate of water temperature change should not exceed ±1.0°C/hr (Table 19, Figure 31). Based on Ecofish's experience collecting pre-construction data on several other streams in British Columbia (file data), it is normal for a small percentage of data points to have hourly rates of water temperature change that exceed ±1.0°C/hr.

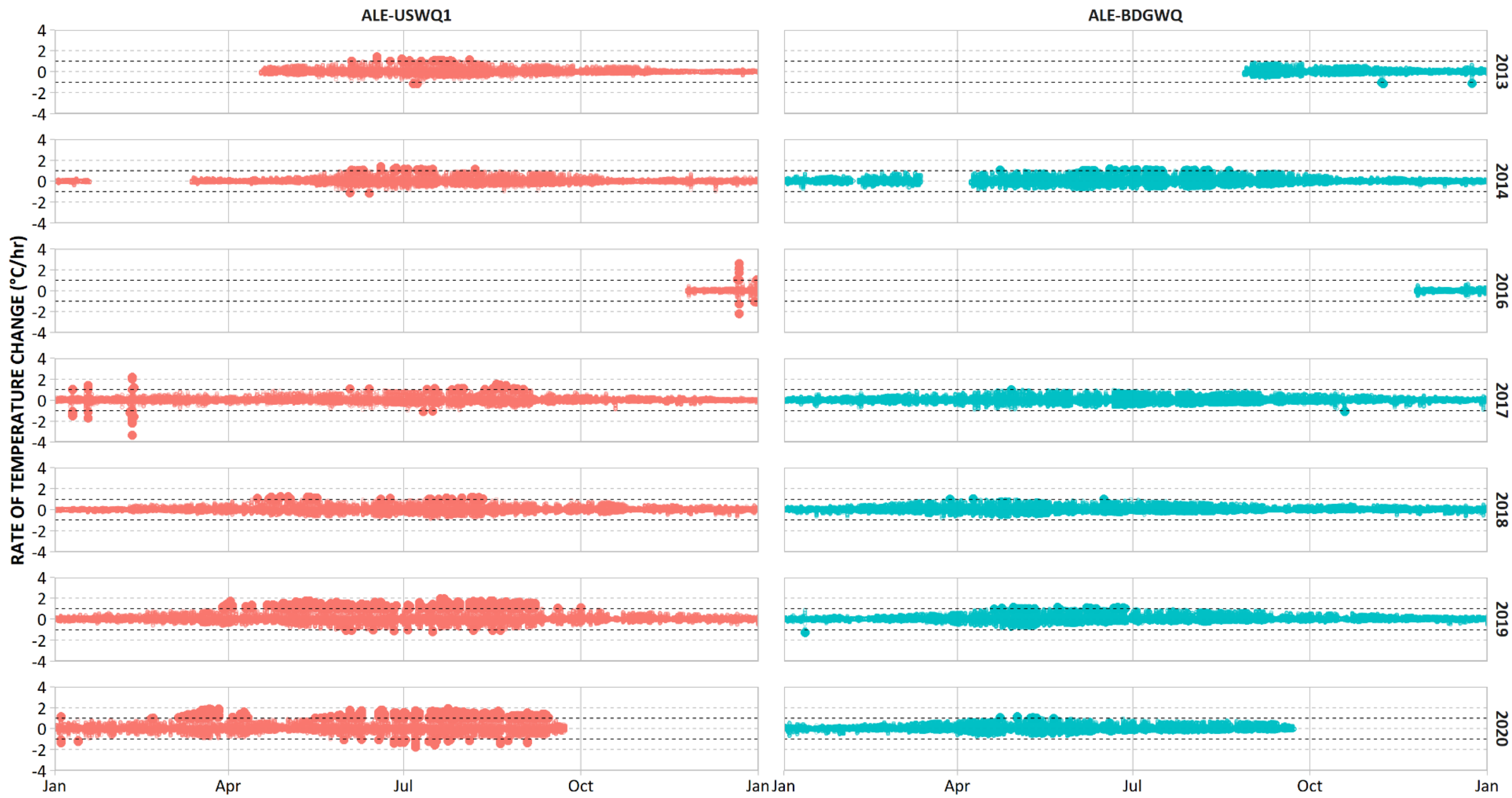
During pre- and post-construction of the FHEP, the percentage of record where exceedances were observed was low (≤1.03%). Exceedances occurred less often post-construction at the downstream site (0.06% post-construction compared to 0.23 % pre-construction); however more exceedances (1.03%) were observed at the upstream site post-construction in comparison to pre-construction (0.17%) (Table 19). The magnitude of the water temperature increase/decrease was highest during the summer months at the upstream site post-construction (Figure 31).

Table 19. Hourly rate of change (°C/hr) summary statistics and occurrence of rate of change in exceedance of ± 1.0°C/hr in Alena Creek at the upstream site (ALE USWQ1) and downstream site (ALE-BDGWQ).

Site	Project Phase	Period of Record		n	Occurrence		Max -ve	Percentile				Max+ ve
		Start Date	End Date		No.	% of Record		1st	5th	95th	99th	
ALE-USWQ1	Pre-Construction	17-Apr-13	30-Dec-14	54,395	80	0.15	-1.15	-0.44	-0.25	0.32	0.77	1.45
	Post-Construction	23-Nov-16	21-Sep-20	134,199	1386	1.03	-3.32	-0.63	-0.33	0.44	0.98	2.63
ALE-BDGWQ	Pre-Construction	27-Aug-13	30-Dec-14	44,075	102	0.23	-1.15	-0.61	-0.40	0.55	0.88	1.23
	Post-Construction	23-Nov-16	21-Sep-20	134,174	83	0.06	-1.28	-0.52	-0.33	0.52	0.78	1.17

n = number of datapoints.

Figure 31. **Hourly rate of water temperature change (°C/hr) for each year pre-construction (2013 and 2014) and post-construction (2016 to 2020) in Alena Creek at the upstream site (ALE USWQ1) and downstream site (ALE-BDGWQ).**



4.4.5. Daily Temperature Extremes

Alena Creek is a cool stream with no days with average water temperatures >18°C observed in either pre- or post-construction conditions (Table 20). Considering all sites and dates, the maximum monthly water temperature was 14.0°C pre-construction (July 2014) and 14.5°C post-construction (August 2019), both of which occurred at the downstream site (Table 15, Table 16).

At the upstream site, there were no days when the daily average temperature was <1°C pre- or post-construction. In contrast, at the downstream site, daily average temperatures were <1°C on one day pre-construction (2014) and from three to 19 days post-construction (2017-2020). The coolest temperatures measured to date at the downstream site were observed in 2019.

Table 20. Summary of daily average water temperature extremes (number of days >18°C and <1°C) in Alena Creek at ALE-USWQ1 and ALE-BDGWQ.

Site	Project Phase	Year[1]	n (days)	Days T_{water} > 18°C	Days T_{water} < 1°C
ALE-USWQ1	Pre-construction	2013	256	0	0
		2014	305	0	0
	Post-construction	2016	38	-	-
		2017	364	0	0
		2018	365	0	0
		2019	364	0	0
		2020	264	0	0
ALE-BDGWQ	Pre-construction	2013	125	0	0
		2014	328	0	1
	Post-construction	2016	38	-	-
		2017	364	0	3
		2018	365	0	5
		2019	365	0	19
		2020	264	0	8

n is the number of days that have observations for at least 23 hours.

[1] Data gaps occurred in the February 2014 dataset due to suspected ice conditions in the river.

A dash "-" indicates that there were not enough data to calculate the metric.

4.4.6. Mean Weekly Maximum Temperatures (MWMxT)

A comparison of MWMxT temperature data collected at the upstream site and the downstream site to optimum temperature ranges for Coho Salmon (Table 21, Table 22), Cutthroat Trout (Table 23, Table 24), and Bull Trout (Table 25, Table 26) was completed using pre- and post-construction data.

Each of the tables provides the percent complete of the data record for each life stage along with the minimum and maximum MWMxT range in each period. The percentage of data within each optimum temperature range is provided to evaluate the overall suitability of the temperate range for each fish species life stage. Exceedance of the BC WQG range (greater than ±1°C outside the optimum ranges) are highlighted in each summary table (blue indicates MWMxTs are cooler than the lower guideline and red indicates temperatures are higher than the upper guidelines). The year-round range in MWMxT temperature corresponds to the rearing life stage for all the fish species. In 2020, MWMxT values fell within the range observed in previous post-construction monitoring years.

At the upstream site, post-construction, MWMxT ranged from 3.5°C to 11.5°C, while pre-construction MWMxTs ranged from 4.4°C to 9.9°C (Table 21, Table 23, Table 25). During February 2014 data were not included due to icing concerns, therefore the minimum MWMxT value may not be representative of the pre-construction period. In 2019, the highest MWMxT value of 11.5°C was recorded.

At the downstream site, post-construction, MWMxT ranged from 0.6°C to 14.0°C, while pre-construction MWMxTs ranged from 1.7°C to 13.7°C. In 2019, both the lowest and the highest MWMxT values were recorded (0.6°C to 14.0°C)(Table 22, Table 24, Table 26).

MWMxT values in relation to species-specific optimal temperature ranges differed by species and location. Bull Trout prefer cooler temperatures overall in comparison to Cutthroat Trout and Coho Salmon (Table 3), therefore fewer exceedances of the cooler temperature limits are observed for this species. In general, the exceedances of the cooler temperature limits were more prevalent at the downstream site (ALE-BDGWQ). The upstream location (ALE-USWQ) was warmer during the winter months, likely due to the influence of groundwater at this location. General trends for each species are discussed below.

4.4.6.1. Coho Salmon

During pre- and post-construction periods, at the upstream site, MWMxT values for Coho Salmon were largely within optimal temperature ranges during spawning and incubation but were sub-optimally cool on occasion during migration and rearing (blue shading in Table 21). During pre - and post-construction periods at the downstream site, exceedances of the cooler temperature limits (blue shading) were observed during all life stages, while no exceedances of the upper temperature limits were observed (Table 22).

4.4.6.2. Cutthroat Trout

During pre- and post-construction periods, at the upstream site, MWMxT values for Cutthroat Trout were sub-optimally cool on occasion during spawning, incubation, and rearing (blue shading in

Table 23). During pre- and post-construction periods at the downstream site, exceedances of the cooler temperature limits were observed during all life stages; however, exceedances were generally observed less often during incubation and occasional exceedances of the higher temperature limits (red shading) were observed during incubation and spawning (post-construction only; Table 24).

4.4.6.3. Bull Trout:

During pre- and post-construction periods, at the upstream site, MWMxT values were largely within optimal ranges with exceedances of the upper limit during incubation and occasionally during spawning (post-construction only). Occasionally, exceedances of the lower limits were observed during rearing (Table 25). During pre- and post-construction periods at the downstream site, exceedances of the cooler temperature limits were observed during all life stages; however, exceedances were observed less often during incubation (none during pre-construction) and exceedances of the higher temperature limits (red shading) were observed during incubation and spawning (Table 26).

Warmer surface waters during Bull Trout incubation at the upstream site may be partially mitigated by groundwater upwelling, which would result in lower temperature within potential redds during the warmer months (Table 25).

Cooler and warmer MWMxTs occurred in 2019 than in previous years; however in 2020 MWMXT's fell within the post-construction range. Evaluation of any increased heating or cooling attributable to the FHEP will be completed following five years of data collection. Overall, no substantial change in the range of MWMxTs were observed between pre- and post-construction phases considering natural inter-annual variability in water temperature and considering that there were data gaps during the cooler months in the pre-construction data set.

Table 21. Coho Salmon periodicity and life stage MWMxT ranges during pre-construction (2013-2014) and post-construction (2016-2020) water temperature monitoring in Alena Creek at ALE-USWQ1.

Species	Life Stage Data			Year	% Complete[1]	MWMxT		% of MWMxT		
	Periodicity	Optimum Temperature Range (°C)	Duration (days)			Min. (°C)	Max. (°C)	Below Lower Bound by >1°C	Within Optimum Range	Above Upper Bound by >1°C
Coho Salmon (ALE-USWQ1)	Migration (Sep. 01 to Dec. 31)	7.2-15.6	122	2013	100.0	5.6	9.4	6.6	63.1	0.0
			122	2014	95.1	4.4	9.3	21.6	62.9	0.0
			122	2016	28.7	-	-	-	-	-
			122	2017	100.0	3.5	10.5	43.4	44.3	0.0
			122	2018	100.0	5.3	9.3	23.8	55.7	0.0
			122	2019	100.0	6.4	10.3	0.0	68.0	0.0
			122	2020	14.8	-	-	-	-	-
	Spawning (Oct. 15 to Jan. 01)	4.4-12.8	79	2013	100.0	5.6	8.5	0.0	100.0	0.0
			79	2014	91.1	4.4	7.9	0.0	98.6	0.0
			79	2016	45.6	-	-	-	-	-
			79	2017	100.0	3.5	7.8	0.0	84.8	0.0
			79	2018	100.0	5.2	8.6	0.0	100.0	0.0
			79	2019	100.0	6.4	8.2	0.0	100.0	0.0
			79	2020	0.0	-	-	-	-	-
	Incubation (Oct. 15 to Apr. 01)	4.0-13.0	169	2013	67.5	5.6	8.5	0.0	100.0	0.0
			169	2014	42.6	-	-	-	-	-
			169	2016	74.6	4.6	6.3	0.0	100.0	0.0
			169	2017	100.0	3.5	7.8	0.0	91.1	0.0
			169	2018	99.4	4.8	8.6	0.0	100.0	0.0
			170	2019	100.0	4.9	8.2	0.0	100.0	0.0
			169	2020	0.0	-	-	-	-	-
	Rearing (Jan. 01 to Dec. 31)	9.0-16.0	365	2013	70.1	5.6	9.9	35.9	23.4	0.0
			365	2014	83.0	4.4	9.7	53.5	18.5	0.0
			366	2016	9.6	-	-	-	-	-
			365	2017	99.7	3.5	10.6	70.3	11.3	0.0
			365	2018	100.0	3.5	10.4	56.7	20.8	0.0
			365	2019	99.7	4.7	11.5	54.4	27.7	0.0
			366	2020	71.6	4.9	10.3	53.4	22.5	0.0

Blue shading indicates provincial guideline exceedance of the lower bound of the optimum temperature range by more than 1°C (Oliver and Fidler 2001).
Red shading indicates provincial guideline exceedance of the upper bound of the optimum temperature range by more than 1°C (Oliver and Fidler 2001).
[1] If less than 50 % of the data are available for the life stage period, the statistics are not calculated and data are not included in the summary table.

Table 22. Coho Salmon periodicity and life stage MWMxT ranges during pre-construction (2013-2014) and post-construction (2016-2020) water temperature monitoring in Alena Creek at ALE BDGWQ.

Species	Life Stage Data			Year	% Complete[1]	MWMxT		% of MWMxT		
	Periodicity	Optimum Temperature Range (°C)	Duration (days)			Min. (°C)	Max. (°C)	Below Lower Bound by >1°C	Within Optimum Range	Above Upper Bound by >1°C
Coho Salmon (ALE-BDGWQ)	Migration (Sep. 01 to Dec. 31)	7.2-15.6	122	2013	99.2	2.1	12.5	43.0	49.6	0.0
			122	2014	96.7	3.5	11.7	39.0	59.3	0.0
			122	2016	29.5	-	-	-	-	-
			122	2017	100.0	1.6	12.9	50.0	44.3	0.0
			122	2018	100.0	2.3	11.5	43.4	54.9	0.0
			122	2019	100.0	2.6	12.8	42.6	45.1	0.0
			122	2020	13.9	-	-	-	-	-
	Spawning (Oct. 15 to Jan. 01)	4.4-12.8	79	2013	98.7	2.1	8.8	9.0	70.5	0.0
			79	2014	93.7	3.5	9.1	0.0	75.7	0.0
			79	2016	46.8	-	-	-	-	-
			79	2017	100.0	1.6	8.1	19.0	45.6	0.0
			79	2018	100.0	2.2	8.1	38.0	59.5	0.0
			79	2019	100.0	2.6	8.1	21.5	53.2	0.0
			79	2020	0.0	-	-	-	-	-
	Incubation (Oct. 15 to Apr. 01)	4.0-13.0	169	2013	83.4	1.7	8.8	15.6	48.9	0.0
			169	2014	43.8	3.5	9.1	0.0	90.5	0.0
			169	2016	75.1	2.8	5.7	1.6	58.3	0.0
			169	2017	100.0	1.6	8.1	14.2	53.3	0.0
			169	2018	100.0	0.6	8.1	50.9	38.5	0.0
			170	2019	100.0	0.6	8.1	15.9	47.6	0.0
			169	2020	0.0	-	-	-	-	-
	Rearing (Jan. 01 to Dec. 31)	9.0-16.0	365	2013	33.7	-	-	-	-	-
			365	2014	89.6	1.7	13.7	44.6	49.8	0.0
			366	2016	9.8	-	-	-	-	-
			365	2017	99.7	1.6	13.1	56.3	37.6	0.0
			365	2018	100.0	1.8	13.4	53.2	41.9	0.0
			365	2019	100.0	0.6	14.0	53.7	43.0	0.0
			366	2020	71.3	0.6	13.0	47.1	51.7	0.0

Blue shading indicates provincial guideline exceedance of the lower bound of the optimum temperature range by more than 1°C (Oliver and Fidler 2001).

Red shading indicates provincial guideline exceedance of the upper bound of the optimum temperature range by more than 1°C (Oliver and Fidler 2001).

[1] If less than 50 % of the data are available for the life stage period, the statistics are not calculated and data are not included in the summary table.

Table 23. Cutthroat Trout periodicity and life stage MWMxT ranges during pre-construction (2013-2014) and post-construction (2016-2020) water temperature monitoring in Alena Creek at ALE-USWQ1.

Species	Life Stage Data			Year	% Complete[1]	MWMxT		% of MWMxT		
	Periodicity	Optimum Temperature Range (°C)	Duration (days)			Min. (°C)	Max. (°C)	Below Lower Bound by >1°C	Within Optimum Range	Above Upper Bound by >1°C
Cutthroat Trout (ALE-USWQ1)	Spawning (Apr. 01 to Jul. 01)	9.0-12.0	92	2013	79.3	5.9	8.9	42.5	0.0	0.0
			92	2014	98.9	5.0	9.3	58.2	6.6	0.0
			92	2016	0.0	-	-	-	-	-
			92	2017	98.9	3.5	8.4	87.9	0.0	0.0
			92	2018	100.0	5.3	9.7	44.6	26.1	0.0
			92	2019	100.0	4.7	10.4	35.9	35.9	0.0
			92	2020	100.0	5.0	8.8	55.4	0.0	0.0
	Incubation (May. 01 to Sep. 01)	9.0-12.0	124	2013	100.0	6.9	9.9	16.1	35.5	0.0
			124	2014	99.2	6.3	9.7	18.7	37.4	0.0
			124	2016	0.0	-	-	-	-	-
			124	2017	99.2	6.2	10.6	40.7	22.8	0.0
			124	2018	100.0	7.3	10.4	10.5	58.9	0.0
			124	2019	100.0	7.6	11.5	2.4	73.4	0.0
			124	2020	100.0	6.3	10.3	16.9	37.9	0.0
	Rearing (Jan. 01 to Dec. 31)	7.0-16.0	365	2013	70.1	5.6	9.9	3.1	78.1	0.0
			365	2014	83.0	4.4	9.7	13.9	66.0	0.0
			366	2016	9.6	-	-	-	-	-
			365	2017	99.7	3.5	10.6	40.4	46.7	0.0
			365	2018	100.0	3.5	10.4	33.7	55.1	0.0
			365	2019	99.7	4.7	11.5	21.7	62.9	0.0
			366	2020	71.6	4.9	10.3	11.5	60.3	0.0

Blue shading indicates provincial guideline exceedance of the lower bound of the optimum temperature range by more than 1°C (Oliver and Fidler 2001).
Red shading indicates provincial guideline exceedance of the upper bound of the optimum temperature range by more than 1°C (Oliver and Fidler 2001).
[1] If less than 50 % of the data are available for the life stage period, the statistics are not calculated and data are not included in the summary table.

Table 24. Cutthroat Trout periodicity and life stage MWMxT ranges during pre-construction (2013-2014) and post-construction (2016-2020) water temperature monitoring in Alena Creek at ALE-BDGWQ.

Species	Life Stage Data			Year	% Complete[1]	MWMxT		% of MWMxT		
	Periodicity	Optimum Temperature Range (°C)	Duration (days)			Min. (°C)	Max. (°C)	Below Lower Bound by >1°C	Within Optimum Range	Above Upper Bound by >1°C
Cutthroat Trout (ALE-BDGWQ)	Spawning (Apr. 01 to Jul. 01)	9.0-12.0	92	2013	0.0	-	-	-	-	-
			92	2014	92.4	5.8	12.7	24.7	60.0	0.0
			92	2016	0.0	-	-	-	-	-
			92	2017	98.9	4.4	12.2	38.5	41.8	0.0
			92	2018	100.0	5.7	12.6	23.9	60.9	0.0
			92	2019	100.0	5.1	13.1	26.1	45.7	4.3
			92	2020	100.0	5.5	11.3	34.8	62.0	0.0
	Incubation (May. 01 to Sep. 01)	9.0-12.0	124	2013	2.4	-	-	-	-	-
			124	2014	99.2	8.5	13.7	0.0	61.0	13.8
			124	2016	0.0	-	-	-	-	-
			124	2017	99.2	7.5	13.1	4.1	58.5	0.8
			124	2018	100.0	8.8	13.4	0.0	59.7	12.1
			124	2019	100.0	9.8	14.0	0.0	35.5	18.5
			124	2020	100.0	7.4	13.0	1.6	65.3	0.0
	Rearing (Jan. 01 to Dec. 31)	7.0-16.0	365	2013	33.7	-	-	-	-	-
			365	2014	89.6	1.7	13.7	34.3	59.9	0.0
			366	2016	9.8	-	-	-	-	-
			365	2017	99.7	1.6	13.1	46.4	50.5	0.0
			365	2018	100.0	1.8	13.4	40.0	55.6	0.0
			365	2019	100.0	0.6	14.0	41.9	51.8	0.0
			366	2020	71.3	0.6	13.0	35.6	56.7	0.0

Blue shading indicates provincial guideline exceedance of the lower bound of the optimum temperature range by more than 1°C (Oliver and Fidler 2001).

Red shading indicates provincial guideline exceedance of the upper bound of the optimum temperature range by more than 1°C (Oliver and Fidler 2001).

[1] If less than 50 % of the data are available for the life stage period, the statistics are not calculated and data are not included in the summary table.

Table 25. Bull Trout periodicity and life stage MWMxT ranges during pre-construction (2013-2014) and post-construction (2016-2020) water temperature monitoring in Alena Creek at ALE-USWQ1.

Species	Life Stage Data			Year	% Complete[1]	MWMxT		% of MWMxT		
	Periodicity	Optimum Temperature Range (°C)	Duration (days)			Min. (°C)	Max. (°C)	Below Lower Bound by >1°C	Within Optimum Range	Above Upper Bound by >1°C
Bull Trout (ALE-USWQ1)	Spawning (Aug. 01 to Dec. 08)	5.0-9.0	130	2013	100.0	5.6	9.9	0.0	73.8	0.0
			130	2014	98.5	5.8	9.7	0.0	71.1	0.0
			130	2016	9.2	-	-	-	-	-
			130	2017	100.0	5.2	10.6	0.0	71.5	9.2
			130	2018	100.0	5.7	10.3	0.0	76.9	1.5
			130	2019	100.0	6.4	11.5	0.0	67.7	27.7
			130	2020	37.7	-	-	-	-	-
	Incubation (Aug. 01 to Mar. 01)	2.0-6.0	213	2013	79.3	5.6	9.9	0.0	5.9	64.5
			213	2014	69.0	4.4	9.7	0.0	14.3	78.2
			213	2016	44.6	-	-	-	-	-
			213	2017	100.0	3.5	10.6	0.0	50.7	41.3
			213	2018	99.5	4.8	10.3	0.0	41.0	47.6
			214	2019	100.0	4.9	11.5	0.0	5.1	54.2
			213	2020	23.0	-	-	-	-	-
	Rearing (Jan. 01 to Dec. 31)	6.0-14.0	365	2013	70.1	5.6	9.9	0.0	96.9	0.0
			365	2014	83.0	4.4	9.7	3.0	86.1	0.0
			366	2016	9.6	-	-	-	-	-
			365	2017	99.7	3.5	10.6	9.9	59.6	0.0
			365	2018	100.0	3.5	10.4	15.1	66.3	0.0
			365	2019	99.7	4.7	11.5	3.8	78.3	0.0
			366	2020	71.6	4.9	10.3	0.4	88.5	0.0

Blue shading indicates provincial guideline exceedance of the lower bound of the optimum temperature range by more than 1°C (Oliver and Fidler 2001).
Red shading indicates provincial guideline exceedance of the upper bound of the optimum temperature range by more than 1°C (Oliver and Fidler 2001).
[1] If less than 50 % of the data are available for the life stage period, the statistics are not calculated and data are not included in the summary table.

Table 26. Bull Trout periodicity and life stage MWMxT ranges during pre-construction (2013-2014) and post-construction (2016-2020) water temperature monitoring in Alena Creek at ALE-BDGWQ.

Species	Life Stage Data			Year	% Complete[1]	MWMxT		% of MWMxT		
	Periodicity	Optimum Temperature Range (°C)	Duration (days)			Min. (°C)	Max. (°C)	Below Lower Bound by >1°C	Within Optimum Range	Above Upper Bound by >1°C
Bull Trout (ALE-BDGWQ)	Spawning (Aug. 01 to Dec. 08)	5.0-9.0	130	2013	76.9	2.1	12.5	6.0	47.0	25.0
			130	2014	99.2	3.5	13.3	3.9	29.5	48.1
			130	2016	10.0	-	-	-	-	-
			130	2017	100.0	3.3	13.1	6.2	26.9	43.8
			130	2018	100.0	2.4	13.4	5.4	36.9	34.6
			130	2019	100.0	2.6	14.0	10.0	39.2	43.1
			130	2020	36.9	-	-	-	-	-
	Incubation (Aug. 01 to Mar. 01)	2.0-6.0	213	2013	83.1	1.7	12.5	0.0	54	36.2
			213	2014	69.5	3.5	13.3	0.0	31	67.6
			213	2016	45.1	-	-	-	-	-
			213	2017	100.0	1.6	13.1	0.0	51.6	40.8
			213	2018	100.0	0.6	13.4	3.3	45.5	46.0
			214	2019	100.0	0.6	14.0	1.9	46.7	40.7
			213	2020	22.5	-	-	-	-	-
	Rearing (Jan. 01 to Dec. 31)	6.0-14.0	365	2013	33.7	-	-	-	-	-
			365	2014	89.6	1.7	13.7	30.0	65.4	0.0
			366	2016	9.8	-	-	-	-	-
			365	2017	99.7	1.6	13.1	42.3	53.6	0.0
			365	2018	100.0	1.8	13.4	30.7	60.0	0.0
			365	2019	100.0	0.6	14.0	34.2	57.5	0.0
			366	2020	71.3	0.6	13.0	31.0	64.4	0.0

Blue shading indicates provincial guideline exceedance of the lower bound of the optimum temperature range by more than 1°C (Oliver and Fidler 2001).

Red shading indicates provincial guideline exceedance of the upper bound of the optimum temperature range by more than 1°C (Oliver and Fidler 2001).

[1] If less than 50 % of the data are available for the life stage period, the statistics are not calculated and data are not included in the summary table.

4.4.7. Bull Trout Temperature Guidelines

Bull Trout specific water temperate guidelines (see Section 3.4.1.1) were applied to the pre- and post-construction water temperature records by calculating the number of days of exceedance of the minimum and maximum temperature thresholds (Table 27). In BC, Bull Trout are considered to have the highest thermal sensitivity of the native salmonids evaluated in Oliver and Fiddler (2001); therefore, more restrictive guidelines are applied to streams with this species. In 2020, the number of days of exceedance of the minimum and maximum temperature thresholds were within the range observed in previous post-construction years.

During both pre- and post-construction monitoring periods, the highest maximum daily temperatures did not exceed the prescribed threshold for rearing (15°C) at either site (Table 27).

The number of days where daily maximum water temperatures were outside the Bull Trout thresholds for spawning and incubation (i.e., >10°C) were higher at the downstream site (ALE-BDGWQ) than at the upstream site (ALE-USWQ1) during both pre- and post-construction monitoring periods. This is due to warmer temperatures in August and September at the downstream site (Table 27, Figure 29), which is likely before the spawning period for Bull Trout on Alena Creek based on data collected to date (Faulkner *et. al* 2021).

The number of days where the minimum temperature was less than the incubation threshold (i.e., <2°C) was also higher at the downstream site due to cooler temperatures at this site during the winter months in comparison to the upstream site which exhibits a warmer temperature regime in the winter likely due to the groundwater input (Figure 29). These results suggest that the temperature regime may be more suitable for Bull Trout at the upper end of the FHEP during spawning and incubation where there are fewer days with temperatures >10°C and <2°C. (Table 27).

Table 27. Summary of the number of days where the daily minimum or maximum water temperature (°C) exceeds the Bull Trout thresholds BC WQG (MOE 2019) in Alena Creek at the upstream site (ALE USWQ1) and downstream site (ALE-BDGWQ).

Site	Project Phase	Year	n (days)[1]	Temperature Thresholds			
				Rearing (Year Round)	Spawning (Aug.1 - Dec. 8)	Incubation (Aug. 1 - Mar. 1)	
				$T_{water} > 15°C$	$T_{water} > 10°C$	$T_{water} < 2°C$	$T_{water} > 10°C$
ALE-USWQ1[2]	Pre-construction	2013	256	0	0	0	0
		2014	305	0	0	0	0
	Post-construction	2016	38	-	-	-	-
		2017	364	0	14	0	14
		2018	365	0	9	0	9
		2019	364	0	28	1	28
		2020	264	0	20	0	20
ALE-BDGWQ	Pre-construction	2013	125	0	28	44	28
		2014	328	0	57	0	57
	Post-construction	2016	38	-	-	-	-
		2017	364	0	52	48	52
		2018	365	0	46	76	46
		2019	365	0	54	46	54
		2020	264	0	51	0	51

[1] n is the number of days that have observations for at least 23 hours.

T_{water} is the total number of days where the minimum or maximum water temperature is outside the BC WQG (MOE 2019) for the Bull Trout incubation period: August 1 - March 1, spawning period: August 1 to December 8, and rearing period: January 1 to December 31.

[2] Pre-construction data collected at the upstream site excludes February 2014 data based on suspected ice/frozen temperature loggers.

A dash "-" indicates that there were not enough data to calculate the metric.

5. SUMMARY AND RECOMMENDATIONS

The success of the FHEP will be evaluated according to the criteria in the *Fisheries Act* Authorization, namely that the habitat enhancement is physically stable, maintains suitable flows, has been demonstrated to provide spawning and rearing habitat for Coho Salmon and Cutthroat Trout of not less than 2,310 m^2, and supports equivalent or greater fish usage relative to pre-project densities in Alena Creek. Year 4 monitoring results suggest the FHEP is meeting criteria outlined in the *Fisheries Act* Authorization, however this will be further evaluated following Year 5 monitoring. Details of the monitoring to be conducted to evaluate the effectiveness of the FHEP are described in the Project's OEMP (Harwood *et al.* 2017); however, based on the results of Year 4 monitoring, we recommend that the adjustments outlined below are made.

5.1. Fish Habitat

The overall function and quality of the FHEP remains high, despite the flood event that occurred a few months after construction. In both Reach 1 and Reach 3, we recommend continued monitoring of the channel in through an annual walk of the full channel length to examine any locations that pose risk of avulsion or excessive erosion. Recording visual documentation through repeated photos of the surveyed transects should also be continued each year. Specific areas to focus on are described below.

In Reach 1 (downstream), the log jam and associated bank erosion at 0+185 m just upstream of ALE-XS1 should be examined to ensure it does not grow. If it begins to cause backwatering of upstream riffles and associated fine sediment deposition, then it should be removed.

In Reach 3 (upstream), the reconstructed weir at the downstream extent of the reach should be monitored to ensure that it successfully prevents further erosion and associated incision upstream. New beaver activity was observed in the lower end of Reach 3 near ALE-XS5 and upstream of ALE-XS6 and ALE-XS7. The newly formed dams created moderate backwatering in the lower portion of Reach 3 which has been managed in accordance with best management practices for dam removal provided by a licensed trapper from EBB Environmental Consulting Inc. Although the beaver complex upstream of Reach 3 was considered to be inactive in 2020, we recommend ongoing management of beaver dams; in particular, we recommend ensuring that the beaver dam complex above Reach 3 does not grow or further redirect flows around the constructed channel, and removal of the dams in the lower section of Reach 3.

Establishment of herbaceous plants along the constructed channel banks has been successful in protecting the channel banks. Installing additional live stakes was considered but is not recommended at this time since it could increase local beaver activity.

5.2. Fish Community

The fish community component of the Alena Creek FHEP monitoring was successfully implemented in 2020. The 2020 monitoring documented the highest abundance of adult Coho Salmon to date and high minnow trapping CPUE of juvenile Coho Salmon and Cutthroat Trout. The capture of fish in the enhanced sites in 2020 (average CPUE 65.9 Coho/100 trap hours and 3.8 Cutthroat/100 trap hours) provides evidence of use and suggests high quality habitat in the enhanced sites. However, the unenhanced sites had higher CPUE (average CPUE 94.4 Coho/100 trap hours and 4.9 Cutthroat/100 trap hours) indicating that these unenhanced sites also provide high quality habitat. No adult Bull Trout were observed in 2020 and no juveniles were captured during minnow trapping. The limited observations of spawning Bull Trout in 2020 follows a general trend observed in Alena Creek and in nearby 29.2 km reference stream (Faulkner *et. al.* 2021). We recommend that the monitoring program continue in 2021 following the methods used in 2020.

5.3. Hydrology

We recommend that the hydrology monitoring program continue for another year, for a total of five years post-construction as per the OEMP (Harwood *et al.* 2017).

5.4. Water Temperature

The 2020 water temperature regime was within the temperature ranges observed in previous post-construction monitoring (2016 to 2019) and 2019 remains the year with the highest (11.7°C) and lowest (1.2°C) monthly average temperatures on record both occurring at the downstream water temperature monitoring site. To date, no substantial changes in the instantaneous temperature range across the FHEP were observed in the pre- (0.0°C to 14°C) and post-construction (0.0°C to 14.5°C) periods.

Results to date indicate that the FHEP provides water temperatures typical of the area, with beneficial moderating effects due to groundwater inflow upstream of the habitat. Overall temperatures are more suitable for Bull Trout than Coho Salmon and Cutthroat Trout due to the generally cooler optimum temperature ranges for Bull Trout.

Considering inter-annual variability, no substantial differences were observed in the pre- and post-construction temperature regimes. We recommend that the monitoring program continue for another year for a total of five years post-construction based on the methodologies and schedule prescribed in the Project OEMP (Harwood *et al.* 2017).

6. CLOSURE

The monitoring objectives for Year 4 monitoring of the Alena Creek FHEP were achieved, as described in the OEMP (Harwood *et al.* 2017).

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PROJECT MAPS

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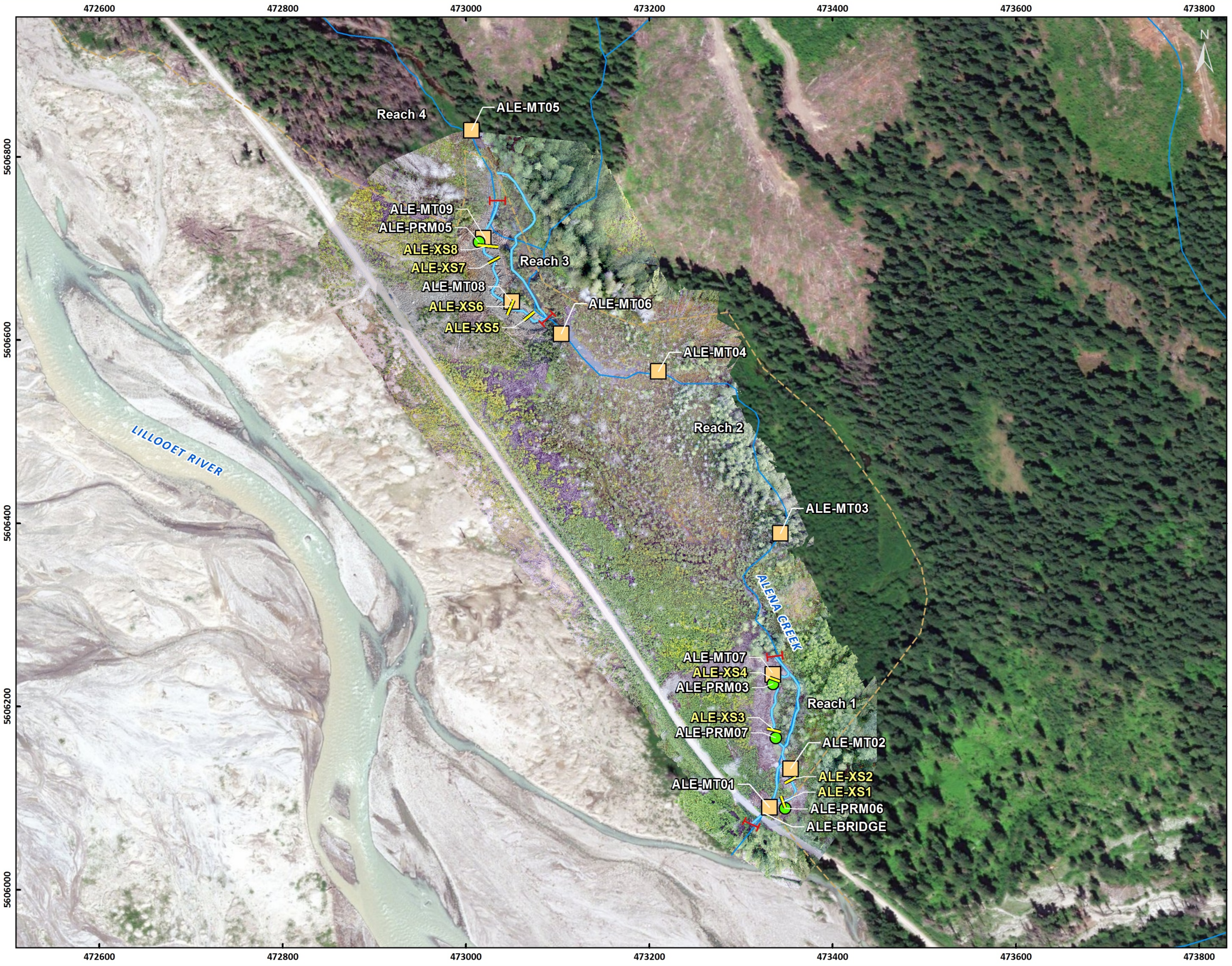

UPPER LILLOOET HYDRO PROJECT

Alena Creek Fish Abundance Sampling and Riparian Monitoring Sites

Legend

- Minnow Traps
- Permanent Vegetation Monitoring Plots
- Reach Break. The extent of enhanced habitat is delineated by Reach 1 (downstream) and Reach 3 (upstream)
- Transect Sites
- Meager Creek Slide Extent
- Enhanced Reaches
- Streams (Hedberg)

MAP SHOULD NOT BE USED FOR LEGAL OR NAVIGATIONAL PURPOSES

0 25 50 100 150 200 m

Scale: 1:4,000

NO.	DATE	REVISION	BY
1	24/04/2019	1095_ALN_FishAbundanceRipMonSites_2019Mar26	SPK
2			
3			
4			
5			

Date Saved: 24/04/2019
Coordinate System: NAD 1983 UTM Zone 10N

ECOFISH RESEARCH

Map 3

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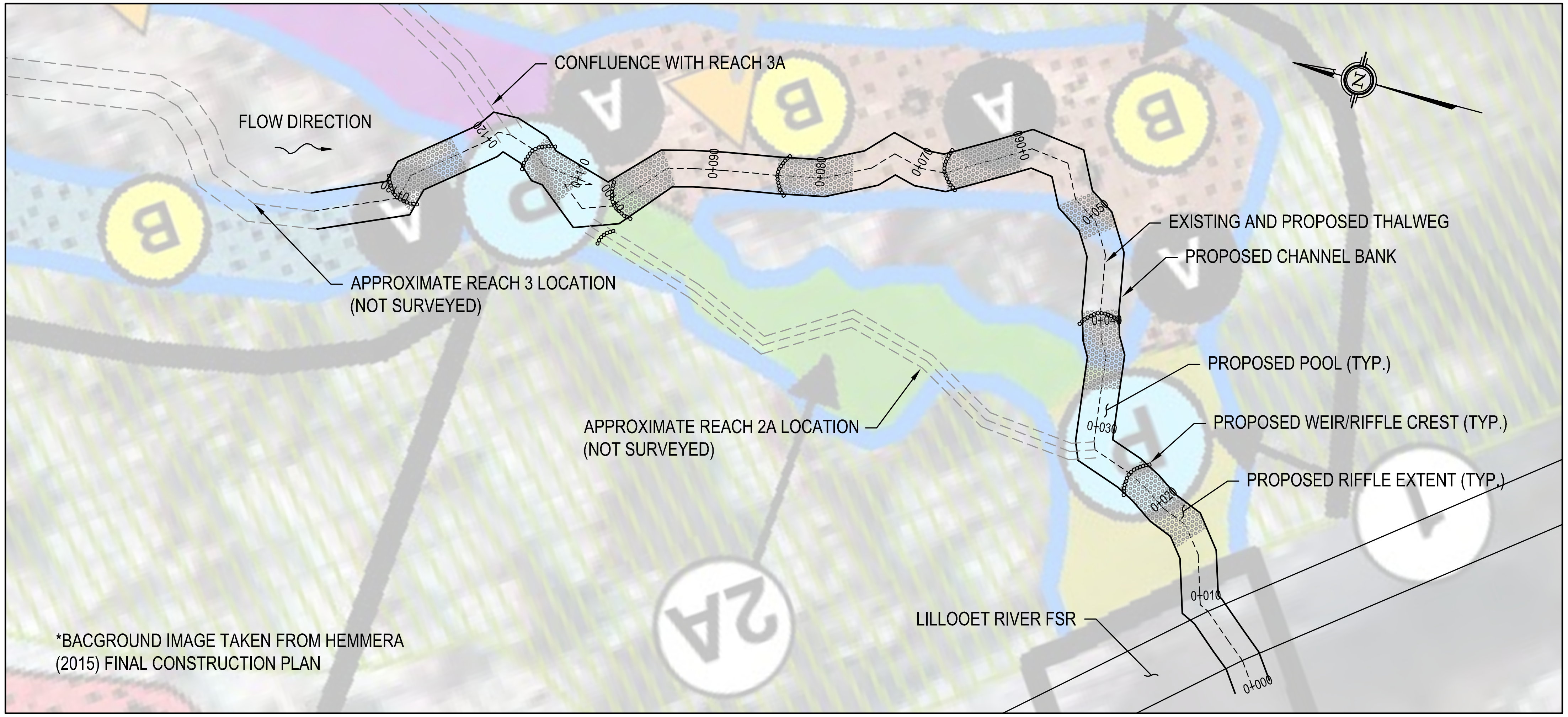
APPENDICES

Appendix A. Final Design Drawings of the Alena Creek Fish Habitat Enhancement Project



REACH 1, 2, & 2A PLANVIEW

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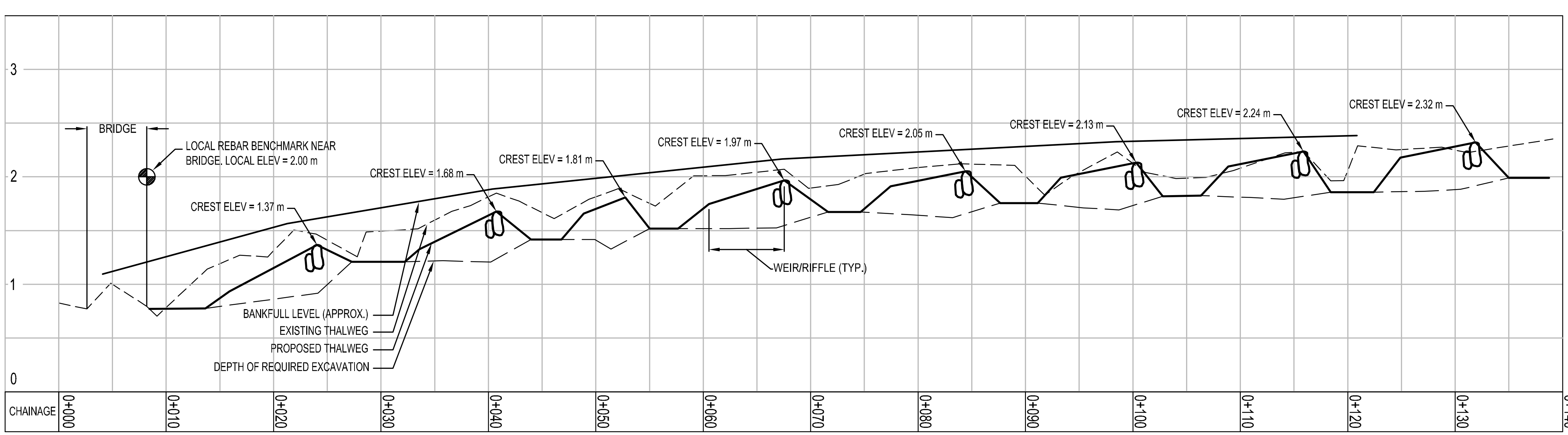


REACH 1, 2, & 2A PROFILE

1:500

GENERAL NOTES

1. THE CONTRACTOR SHALL PROVIDE THE CONSULTING ENGINEER OR GEOMORPHOLOGIST 48 HOURS NOTICE PRIOR TO COMMENCING WORK.
2. THIS SET OF DRAWINGS SHALL BE READ IN CONJUNCTION WITH ACCOMPANYING FINAL CONSTRUCTION PLAN (HEMMERA, 2015).
3. ALL DRAWINGS SHALL BE USED FOR CONSTRUCTION. DO NOT SCALE FROM PLANFORM DRAWING.
4. ALL MEASUREMENTS FOR THIS PROJECT ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE INDICATED.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LAYOUT, SURVEY AND LOCATION OF ALL UTILITIES.
6. LOCATION OF FEATURES AND EXTENT OF WORKS SHALL BE REVIEWED AND APPROVED BY ENVIRONMENTAL MONITOR.
7. ALL WORKS SHALL BE SUPERVISED, INSPECTED AND APPROVED BY A ENVIRONMENTAL MONITOR.
8. ALL WORKS AND MATERIALS SHALL BE IN ACCORDANCE WITH APPLICABLE MUNICIPAL AND/OR PROVINCIAL STANDARD SPECIFICATIONS AND DRAWINGS.
9. ALL GENERAL BACKFILL SHALL BE APPROVED MATERIAL COMPACTED TO 85% STANDARD PROCTOR DENSITY.
10. ALL UNSUITABLE AND/OR EXCESS MATERIALS SHALL BE DEPOSITED IN A SPOIL AREA DETERMINED BYENVIRONMENTAL MONITOR.
11. IMMEDIATELY AFTER CONSTRUCTION, ALL DISTURBED AREAS SHALL BE STABILIZED AND/OR RESTORED TO ORIGINAL CONDITION.
12. THE CONTRACTOR SHALL REMOVE ALL SEDIMENT CONTROLS AFTER VEGETATION HAS ESTABLISHED. WORKS WILL NOT BE CONSIDERED COMPLETE UNTIL ALL TEMPORARY SEDIMENT CONTROLS ARE REMOVED.

WATERCOURSE PROTECTION

1. MITIGATION MEASURES SECTION OF HEMMERA (2015) FINAL CONSTRUCTION PLAN TO BE REVIEWED AND ADHERED TO.
2. ALL EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED AS PER APPLICABLE PLANS.
3. ADDITIONAL EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED IF IT IS DETERMINED THAT APPROVED CONTROLS DO NOT ADEQUATELY PREVENT EROSION AND RELEASE OF SEDIMENT.
4. WHERE WORK IN A WATERCOURSE OR ON WATERCOURSE BANKS IS NOT REQUIRED, EQUIPMENT SHALL NOT BE OPERATED IN SUCH AREAS.
5. WHERE WORK IN A WATERCOURSE OR ON WATERCOURSE BANKS IS REQUIRED, THE USE OF EQUIPMENT WITHIN THE WATERCOURSE SHALL BE MINIMIZED.
6. WORK IN A WATERCOURSE AND ON WATERCOURSE BANKS SHALL BE COMPLETED IN THE DRY IN AN ISOLATED WORK AREA DURING LOW-FLOW CONDITIONS.
7. THE WEATHER FORECAST SHALL BE CONTINUALLY MONITORED TO ENSURE THAT CONSTRUCTION ACTIVITIES MAY PROCEED UNDER FAVOURABLE CONDITIONS.
8. EXCAVATION OF THE WATERCOURSE BED AND PLACEMENT OF MATERIALS SHALL BE STAGED SO THAT NO EXCAVATED AREAS REMAIN EXPOSED AT THE END OF EACH WORKING DAY.
9. IF FLOWS WITHIN A WATERCOURSE ARE OBSERVED TO RISE TO A LEVEL APPROACHING THE PUMPING CAPACITY, PLACEMENT OF MATERIALS IN EXCAVATED AREAS MUST BE COMPLETED AS SOON AS POSSIBLE, AFTER WHICH WORK MUST BE SHUT DOWN UNTIL THE FLOW RETURNS TO A LEVEL WITHIN THE PROVIDED PUMPING CAPACITY.
10. ALL EQUIPMENT SHALL BE CLEAN AND FREE OF PETROLEUM PRODUCTS.
11. ALL MAINTENANCE, REFUELING AND STORAGE OF EQUIPMENT SHALL BE CONTROLLED SO AS TO PREVENT ANY DISCHARGE OF PETROLEUM PRODUCTS. VEHICULAR MAINTENANCE AND REFUELING SHALL BE CONDUCTED AWAY FROM WATERCOURSES AND WATERCOURSE BANKS.
12. CONSTRUCTION MATERIAL, EXCESS MATERIAL, CONSTRUCTION DEBRIS AND EMPTY CONTAINERS SHALL BE STORED AWAY FROM WATERCOURSES AND WATERCOURSE BANKS.

07-10-16	D.W.	ISSUED FOR CONSTRUCTION
DATE	BY	REVISIONS

DESIGNED BY:	D.W.	CHECKED BY:	D.W.
DRAWN BY:	D.W.	DATE:	AUGUST 10, 2015

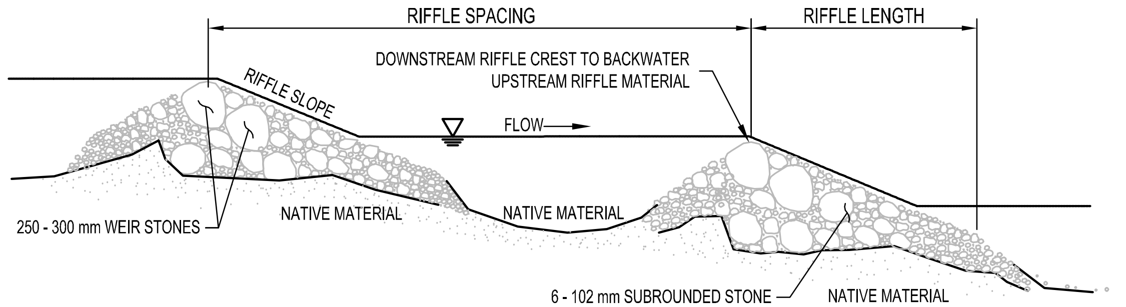
July 10, 2016
PROFESSIONAL
PROVINCE OF
D. T. WEST
41242
BRITISH COLUMBIA
ENGINEER

ECOFISH RESEARCH

ALENA CREEK FHEP DETAILED CONSTRUCTION PLAN

REACH 1 AND 2
PLANFORM AND PROFILE

PROJECT No.:	1095.16	DRAWING No.:	GEO-1
SCALE:	AS SHOWN	SHEET 1 OF 3	

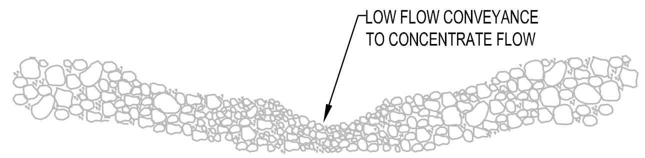


TYPICAL RIFFLE SEQUENCE PROFILE

N.T.S.

CONSTRUCTION NOTES

1. CREST TO CREST CHANNEL GRADIENT IN REACHES 3 TO 6 TO MATCH EXISTING UNLESS OTHERWISE INSTRUCTED BY ENVIRONMENTAL MONITOR.
2. DIG DEPRESSIONS INTO THE BED TO STABILIZE RIFFLE MATERIALS.
3. PLACE LARGEST MATERIAL (KEY STONE) AT RIFFLE CREST (HIGHEST POINT).
4. ENSURE THAT LARGEST ROCKS PROTRUDE INTO FLOW.
5. THICKNESS OF RIFFLE SUBSTRATE AT CREST IS APPROXIMATELY 400 mm.
6. FILL VOIDS IN RIFFLE WITH NATIVE MATERIALS.
7. TAPER GRAIN SIZE AND BED THICKNESS DOWNSTREAM AND UPSTREAM OF CREST.
8. RIFFLE MATERIALS SHOULD EXTEND OVER LIP OF THE DEPRESSION.
9. SPREAD REMAINING ROCK ON RIFFLE TO ATTAIN RIFFLE ANGLE.
10. RIFFLE LENGTH IS DETERMINED FROM PROFILE WHERE SHOWN.
11. SUBSTRATE TO BE MECHANICALLY COMPACTED WITH EXCAVATOR BUCKET TO MINIMIZE INTERSTITIAL SPACING.

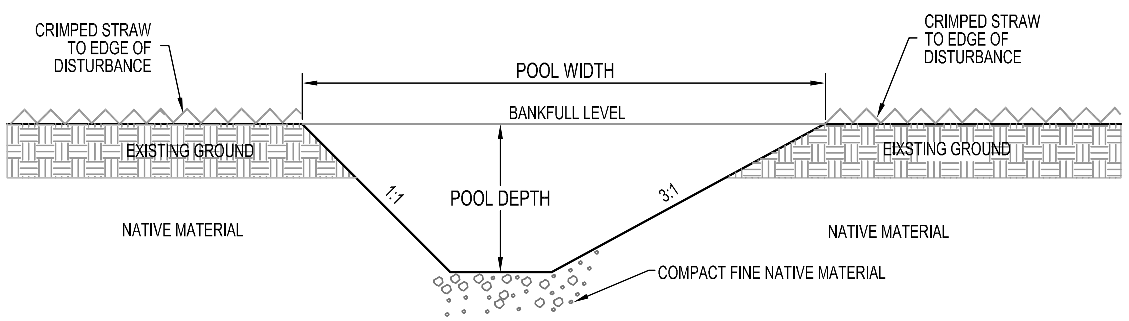


CROSS-SECTION

N.T.S.

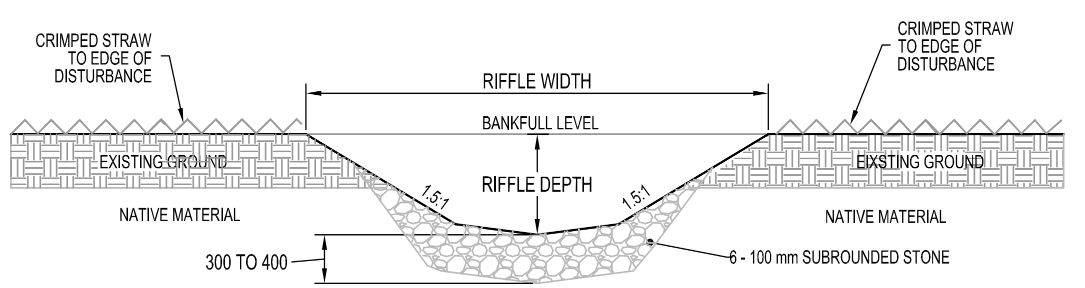
WEIR/RIFFLE CONSTRUCTION DETAILS

N.T.S.



TYPICAL POOL CROSS SECTION

N.T.S.



TYPICAL RIFFLE CROSS SECTION

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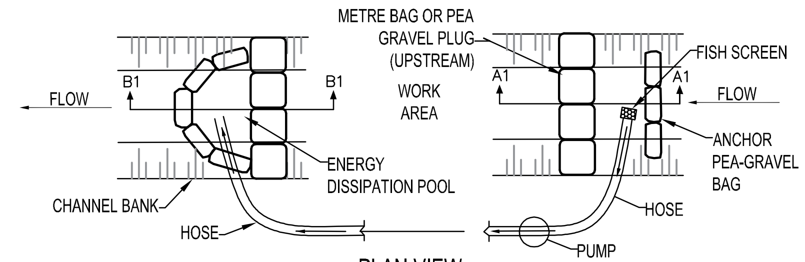
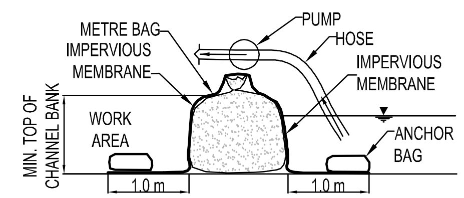
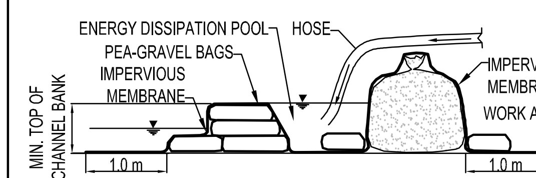


PLAN VIEW



SECTION A1-A1



SECTION B1-B1

NOTES

1. COFFERDAM BARRIER BAGS TO BE FILLED WITH PEA GRAVEL OR SAND IF PEA GRAVEL IS UNAVAILABLE.
2. IMPERVIOUS MEMBRANE SHALL COVER THE METRE BAGS TO LIMIT WATER ENTRY INTO WORK AREA.
3. PUMPING CAPACITY TO BE A MINIMUM OF 2 - 75 mm (3 in) DIAMETER PUMPS.
4. SCREEN TO BE INSTALLED AT INTAKE END OF HOSE TO LIMIT FISH MORTALITY. FISH SCREEN TO BE 1.25 m^2 WITH A 15 mm MESH SIZE/OPENING.
5. PUMPED WATER SHALL BE DISCHARGED INTO THE ENERGY DISSIPATION POOL.
6. A BACKUP PUMP AND HOSE SHALL BE KEPT ONSITE IN THE EVENT THAT INCREASED FLOWS CANNOT BE PUMPED IN THE PRIMARY SYSTEM.
7. THE CONTRACTOR SHALL MONITOR WEATHER CONDITIONS AND WILL NOT PROCEED WITH WORKS IN THE EVENT OF A STORM EVENT, OR IF IT IS ANTICIPATED THAT FLOWS CANNOT BE PUMPED AROUND AS REQUIRED.

COFFERDAM BARRIER

N.T.S.

CHANNEL GEOMETRY FOR EACH REACH

REACH	RIFFLE SLOPE	RIFFLE LENGTH	RIFFLE SPACING	RIFFLE WIDTH (m)	MAX. RIFFLE DEPTH (m)	POOL WIDTH (m)	MAX. POOL DEPTH (m)
1	SEE GEO-1	SEE GEO-1	SEE GEO-1	2.7	0.35	4.1	0.7
2	SEE GEO-1	SEE GEO-1	SEE GEO-1	2.7	0.35	4.1	0.7
3	2 TO 3 %	5 - 10 m	15 - 18 m	2.7	0.35	4.1	0.7
4	2 TO 3 %	5 - 10 m	15 - 18 m	2.7	0.35	4.1	0.7
5	2 TO 3%	3 - 6 m	10 - 14 m	2.0	0.30	2.9	0.6
6	2 TO 3 %	4 - 8 m	13 - 16 m	2.5	0.35	3.6	0.7

GENERAL NOTES

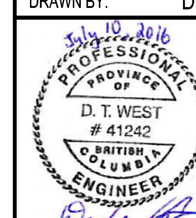
1. THE CONTRACTOR SHALL PROVIDE THE CONSULTING ENGINEER OR GEOMORPHOLOGIST 48 HOURS NOTICE PRIOR TO COMMENCING WORK.
2. THIS SET OF DRAWINGS SHALL BE READ IN CONJUNCTION WITH ACCOMPANYING FINAL CONSTRUCTION PLAN (HEMMERA, 2015).
3. ALL DRAWINGS SHALL BE USED FOR CONSTRUCTION. DO NOT SCALE FROM PLANFORM DRAWING.
4. ALL MEASUREMENTS FOR THIS PROJECT ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE INDICATED.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LAYOUT, SURVEY AND LOCATION OF ALL UTILITIES.
6. LOCATION OF FEATURES AND EXTENT OF WORKS SHALL BE REVIEWED AND APPROVED BY ENVIRONMENTAL MONITOR.
7. ALL WORKS SHALL BE SUPERVISED, INSPECTED AND APPROVED BY A ENVIRONMENTAL MONITOR.
8. ALL WORKS AND MATERIALS SHALL BE IN ACCORDANCE WITH APPLICABLE MUNICIPAL AND/OR PROVINCIAL STANDARD SPECIFICATIONS AND DRAWINGS.
9. ALL GENERAL BACKFILL SHALL BE APPROVED MATERIAL COMPACTED TO 85% STANDARD PROCTOR DENSITY.
10. ALL UNSUITABLE AND/OR EXCESS MATERIALS SHALL BE DEPOSITED IN A SPOIL AREA DETERMINED BYENVIRONMENTAL MONITOR.
11. IMMEDIATELY AFTER CONSTRUCTION, ALL DISTURBED AREAS SHALL BE STABILIZED AND/OR RESTORED TO ORIGINAL CONDITION.
12. THE CONTRACTOR SHALL REMOVE ALL SEDIMENT CONTROLS AFTER VEGETATION HAS ESTABLISHED. WORKS WILL NOT BE CONSIDERED COMPLETE UNTIL ALL TEMPORARY SEDIMENT CONTROLS ARE REMOVED.

WATERCOURSE PROTECTION

1. MITIGATION MEASURES SECTION OF HEMMERA (2015) FINAL CONSTRUCTION PLAN TO BE REVIEWED AND ADHERED TO.
2. ALL EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED AS PER APPLICABLE PLANS.
3. ADDITIONAL EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED IF IT IS DETERMINED THAT APPROVED CONTROLS DO NOT ADEQUATELY PREVENT EROSION AND RELEASE OF SEDIMENT.
4. WHERE WORK IN A WATERCOURSE OR ON WATERCOURSE BANKS IS NOT REQUIRED, EQUIPMENT SHALL NOT BE OPERATED IN SUCH AREAS.
5. WHERE WORK IN A WATERCOURSE OR ON WATERCOURSE BANKS IS REQUIRED, THE USE OF EQUIPMENT WITHIN THE WATERCOURSE SHALL BE MINIMIZED.
6. WORK IN A WATERCOURSE AND ON WATERCOURSE BANKS SHALL BE COMPLETED IN THE DRY IN AN ISOLATED WORK AREA DURING LOW-FLOW CONDITIONS.
7. THE WEATHER FORECAST SHALL BE CONTINUALLY MONITORED TO ENSURE THAT CONSTRUCTION ACTIVITIES MAY PROCEED UNDER FAVOURABLE CONDITIONS.
8. EXCAVATION OF THE WATERCOURSE BED AND PLACEMENT OF MATERIALS SHALL BE STAGED SO THAT NO EXCAVATED AREAS REMAIN EXPOSED AT THE END OF EACH WORKING DAY.
9. IF FLOWS WITHIN A WATERCOURSE ARE OBSERVED TO RISE TO A LEVEL APPROACHING THE PUMPING CAPACITY, PLACEMENT OF MATERIALS IN EXCAVATED AREAS MUST BE COMPLETED AS SOON AS POSSIBLE, AFTER WHICH WORK MUST BE SHUT DOWN UNTIL THE FLOW RETURNS TO A LEVEL WITHIN THE PROVIDED PUMPING CAPACITY.
10. ALL EQUIPMENT SHALL BE CLEAN AND FREE OF PETROLEUM PRODUCTS.
11. ALL MAINTENANCE, REFUELING AND STORAGE OF EQUIPMENT SHALL BE CONTROLLED SO AS TO PREVENT ANY DISCHARGE OF PETROLEUM PRODUCTS. VEHICULAR MAINTENANCE AND REFUELING SHALL BE CONDUCTED AWAY FROM WATERCOURSES AND WATERCOURSE BANKS.
12. CONSTRUCTION MATERIAL, EXCESS MATERIAL, CONSTRUCTION DEBRIS AND EMPTY CONTAINERS SHALL BE STORED AWAY FROM WATERCOURSES AND WATERCOURSE BANKS.

	07-10-16	D.W.	ISSUED FOR CONSTRUCTION
	DATE	BY	REVISIONS

DESIGNED BY:	D.W.	CHECKED BY:	D.W.
DRAWN BY:	D.W.	DATE:	AUGUST 10, 2015

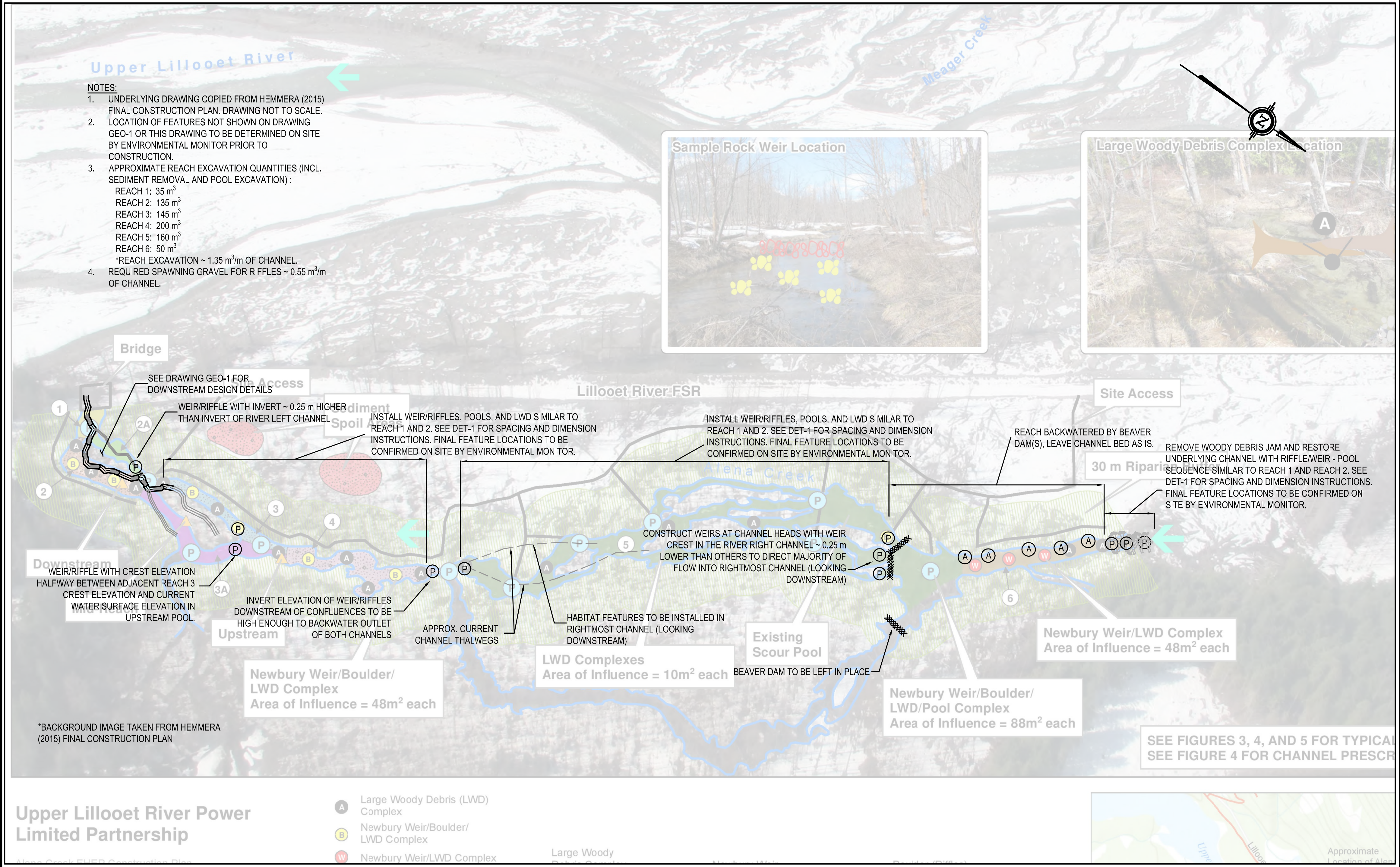


ECOFISH RESEARCH

ALENA CREEK FHEP DETAILED CONSTRUCTION PLAN

CHANNEL GEOMETRY DETAILS

PROJECT No.:	1095.16	DRAWING No.:	DET-1
SCALE:	AS SHOWN	SHEET 2 OF 3	



PLANVIEW

N.T.S.

RECOMMENDED CONSTRUCTION SEQUENCE

* MITIGATION MEASURES SECTION OF HEMMERA (2015) FINAL CONSTRUCTION PLAN TO BE ADHERED TO. IF AN APPARENT INCONSISTENCY IS IDENTIFIED, THE ENVIRONMENTAL MONITOR IS TO BE CONSULTED.

PHASE 1 (REACH 1):

1. ISOLATE REACH 1 BY INSTALLING COFFERDAM AND PUMPING OR FLUMING FLOW AROUND SITE.
2. FISH RESCUE OF REACH 1 TO BE COMPLETED BY A QUALIFIED PROFESSIONAL.
3. COMPLETE CHANNEL WORKS IN REACH 1 AND REACTIVATE FLOW BY DISMANTLING COFFERDAM.

PHASE 2 (REACH 2 & 2A):

4. ISOLATE REACH 2 BY INSTALLING COFFERDAM AT UPSTREAM EXTENT TO DIVERT FLOW THROUGH REACH 2A.
5. FISH RESCUE OF REACH 1 TO BE COMPLETED BY A QUALIFIED PROFESSIONAL.
6. COMPLETE CHANNEL WORKS IN REACH 2 AND REACTIVATE CHANNEL BY SLOWLY DISMANTLING COFFERDAM.
7. ISOLATE REACH 2A BY INSTALLING COFFERDAM AT UPSTREAM EXTENT TO DIVERT FLOW THROUGH REACH 2.
8. CONSTRUCT RIFFLE/WEIR AT HEAD OF REACH 2A WITH CREST ~ 0.25 m HIGHER THAN ADJACENT REACH 2 CREST.

PHASE 3 (REACH 3 & 3A):

9. FEATURE LOCATIONS TO BE ESTABLISHED ON SITE BY ENVIRONMENTAL MONITOR.
10. ISOLATE REACH 3 BY INSTALLING COFFERDAM AT UPSTREAM EXTENT TO DIVERT FLOW THROUGH REACH 3A.
11. FISH RESCUE OF REACH 3 TO BE COMPLETED BY A QUALIFIED PROFESSIONAL.
12. COMPLETE CHANNEL WORKS IN REACH 3 BY FOLLOWING INSTALLATION INSTRUCTIONS ON DRAWING DET-1 IN CONSULTATION WITH ECOFISH TECHNICIAN.
13. REACTIVATE REACH 3 BY SLOWLY DISMANTLING COFFERDAM.
14. ISOLATE HEAD OF REACH 3A BY INSTALLING COFFERDAMS ABOVE AND BELOW PROPOSED WEIR LOCATION.
15. FISH RESCUE OF ISOLATED AREA TO BE COMPLETED BY A QUALIFIED PROFESSIONAL.
16. PUMP FLOW FROM REACH 4 FORK INTO REACH 3A AT A NATURAL RATE.
17. CONSTRUCT RIFFLE/WEIR AT HEAD OF REACH 3A WITH CREST ELEVATION HALFWAY BETWEEN ADJACENT REACH 3 CREST ELEVATION AND CURRENT WATER SURFACE ELEVATION IN UPSTREAM POOL.
18. REACTIVATE ISOLATED AREA BY DISMANTLING COFFERDAM.

PHASE 4 (REACH 4):

19. FEATURE LOCATIONS TO BE ESTABLISHED ON SITE BY ENVIRONMENTAL MONITOR.
20. ISOLATE FEATURE LOCATIONS ONE AT A TIME BEGINNING AT DOWNSTREAM BY INSTALLING COFFERDAM ABOVE AND BELOW EXTENTS OF FEATURE AND PUMPING OR FLUMING FLOW AROUND ISOLATED AREA.
21. FISH RESCUE OF ISOLATED AREAS TO BE COMPLETED BY A QUALIFIED PROFESSIONAL.
22. PHASE 5 (REACH 5):
23. FEATURE LOCATIONS TO BE ESTABLISHED ON SITE BY ENVIRONMENTAL MONITOR.
24. ISOLATE FEATURE LOCATIONS ONE AT A TIME BEGINNING AT DOWNSTREAM BY INSTALLING COFFERDAM ABOVE AND BELOW EXTENTS AND PUMPING OR FLUMING FLOW AROUND. DIVERSION OF FLOWS INTO ADJACENT CUTOFF CHANNELS MAY ALSO BE FEASIBLE AND WILL BE DISCUSSED WITH ENVIRONMENTAL MONITOR PRIOR TO DIVERSION.
25. FISH RESCUE OF ISOLATED AREAS TO BE COMPLETED BY A QUALIFIED PROFESSIONAL.
26. FOR EACH CUTOFF CHANNEL OF REACH 5, COMPLETE STEPS 28 TRHOUGH 32.
27. ISOLATE HEAD OF CUTOFF CHANNEL BY INSTALLING COFFERDAMS ABOVE AND BELOW PROPOSED WEIR LOCATIONS ONE BY ONE.
28. PUMP FLOW AROUND ISOLATED AREA AT A NATURAL RATE.
29. FISH RESCUE OF ISOLATED AREA TO BE COMPLETED BY A QUALIFIED PROFESSIONAL.
30. INSTALL RIFFLE/WEIR NEAR HEAD OF CUTOFF CHANNEL DOWNSTREAM OF BEAVERDAM. CREST ELEVATION OF RIGHTMOST CHANNEL TO BE LOWEST. CREST ELEVATIONS TO BE DETERMINED IN FIELD BY ENVIRONMENTAL MONITOR.
31. REACTIVATE ISOLATED AREA BY DISMANTLING COFFERDAM.

PHASE 6 (REACH 6):

32. ISOLATE WOODY DEBRIS JAM BY INSTALLING COFFERDAM ABOVE AND BELOW EXTENTS AND PUMPING OR FLUMIING AROUND.
33. FISH RESCUE OF ISOLATED AREAS TO BE COMPLETED BY A QUALIFIED PROFESSIONAL.
34. REMOVE WOODY DEBRIS PIECES AND DEPOSIT IN SPOIL AREA APPROVED BY ENVIRONMENTAL MONITOR.
35. FEATURES TO BE INSTALLED AT LOCATIONS SPECIFIED BY ENVIRONMENTAL MONITOR ON SITE.
36. REACTIVATE ISOLATED AREA BY DISMANTLING COFFERDAM.

	07-10-16	D.W.	ISSUED FOR CONSTRUCTION
	DATE	BY	REVISIONS

DESIGNED BY:	D.W.	CHECKED BY:	D.W.
DRAWN BY:	D.W.	DATE:	AUGUST 10, 2015

July 10 2016
PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D. T. WEST # 41242

ECOFISH RESEARCH

ALENA CREEK FHEP DETAILED CONSTRUCTION PLAN

FULL SITE PLANFORM AND PHASING

PROJECT No.:	1095.16	DRAWING No.:	PESC-1
SCALE:	AS SHOWN	SHEET 3 OF 3	

Appendix B. Representative Water Temperature Site Photographs

LIST OF FIGURES

Figure 1. Looking downstream at ALE-BDGWQ on September 21, 2020.

Figure 2. Looking upstream at ALE-BDGWQ on September 21, 2020.

Figure 3. Looking RR-RL at ALE-USWQ1 on September 21, 2020.

Figure 4. Looking at ALE-USWQ1 Tidbits on September 21, 2020.

Appendix C. Water Temperature Guidelines and Data Summary.

LIST OF FIGURES

LIST OF TABLES

1. WATER TEMPERATURE GUIDELINES

Table 1. Water temperature guidelines for the protection of freshwater aquatic life (Oliver and Fidler 2001).[1]

Category	Guideline
All Streams	the rate of temperature change in natural water bodies not to exceed 1°C/hr.
	temperature metrics to be described by the mean weekly maximum temperature (MWMxT)
Streams with Known Fish Presence	mean weekly maximum water temperatures should not exceed ±1°C beyond the optimum temperature range for each life history phase of the most sensitive salmonid species present
Streams with Bull Trout or Dolly Varden	maximum daily temperatures should not exceed 15°C
	maximum spawning temperature should not exceed 10°C
	preferred incubation temperatures should range from 2°C to 6°C
	±1°C change from natural condition[1]
Streams with Unknown Fish Presence	salmonid rearing temperatures not to exceed MWMxT of 18°C
	maximum daily temperature not to exceed 19°C
	maximum temperature for salmonid incubation from June until August not to exceed 12°C

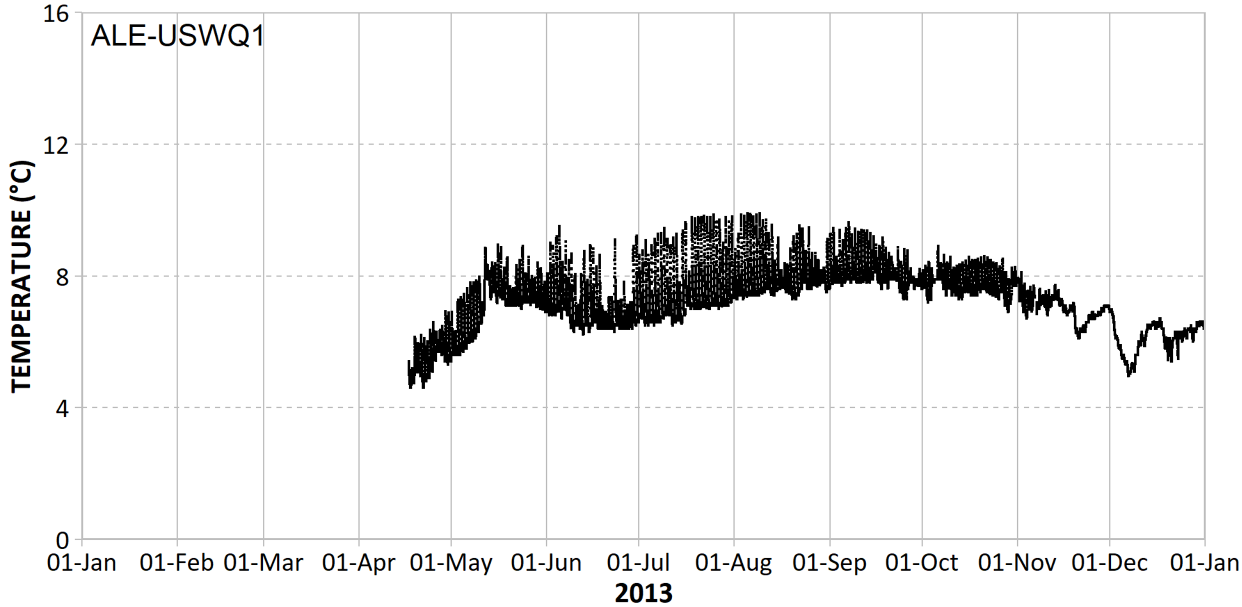
[1] Provided natural conditions are within these guidelines, if they are not, natural conditions should not be altered (Deniseger, pers. comm. 2009).

[1] Deniseger, J. 2009. Section Head, Environmental Quality, Ministry of Environment, Nanaimo, BC. Personal Communication. Telephone conversation with Kevin Ganshorn, June 2009.

2. ANNUAL WATER TEMPERTURE PLOTS

2.1. ALE-USWQ1

Figure 1. ALE-USWQ1 Pre-Construction annual plots (2013 to 2014).



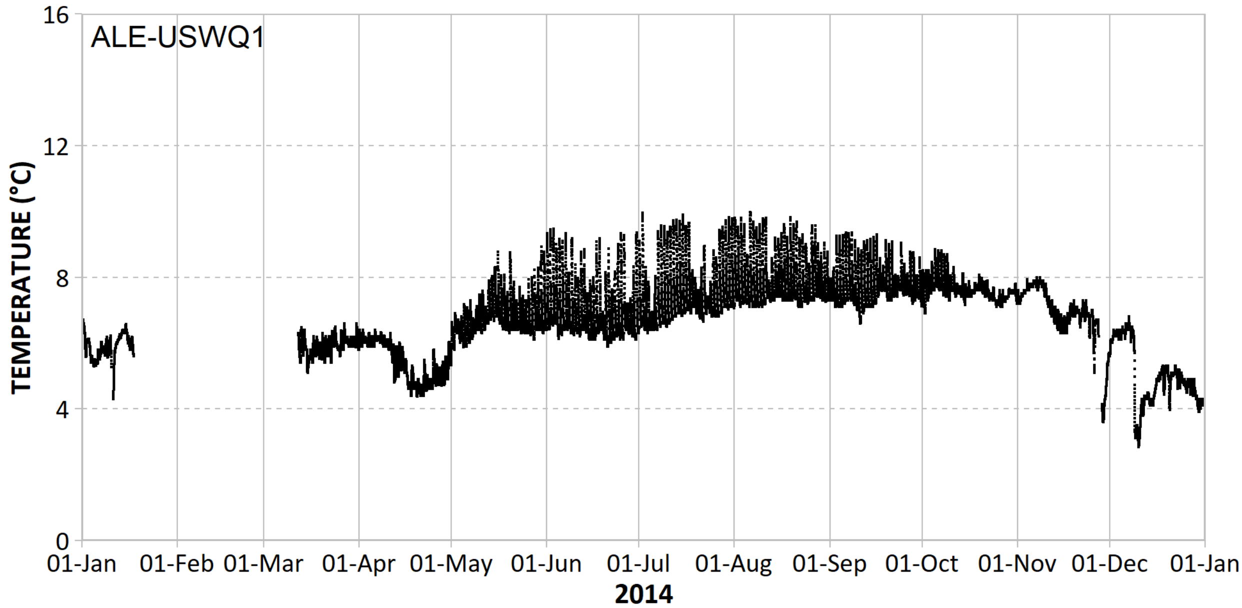
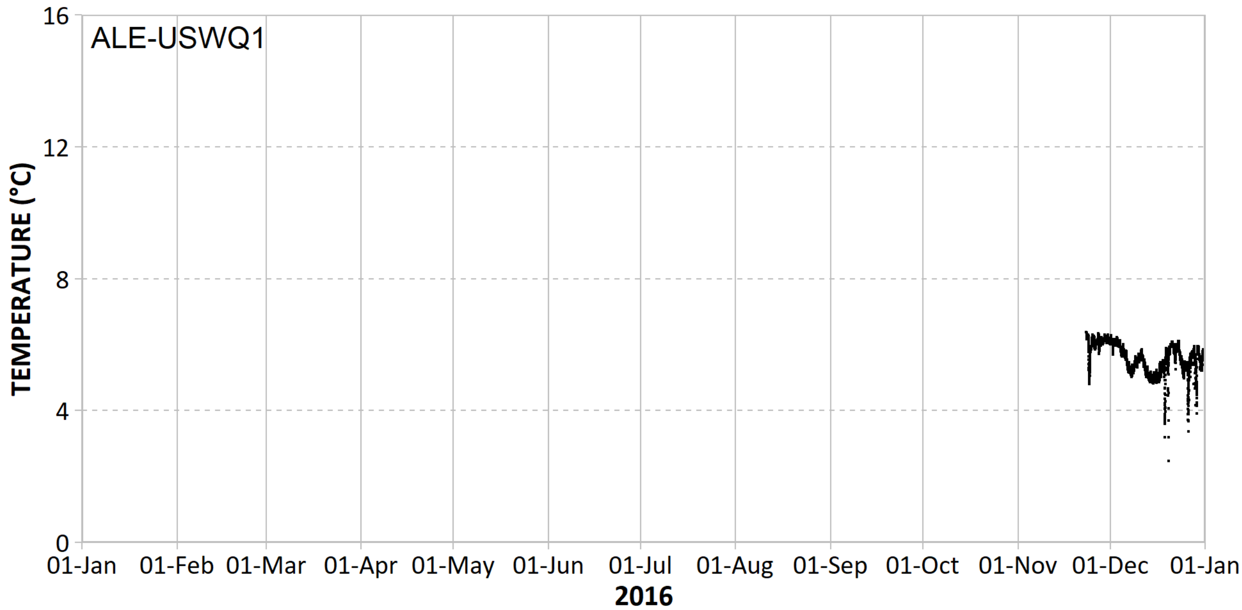


Figure 2. ALE-USWQ1 Post Construction annual plots (2016 to 2020).



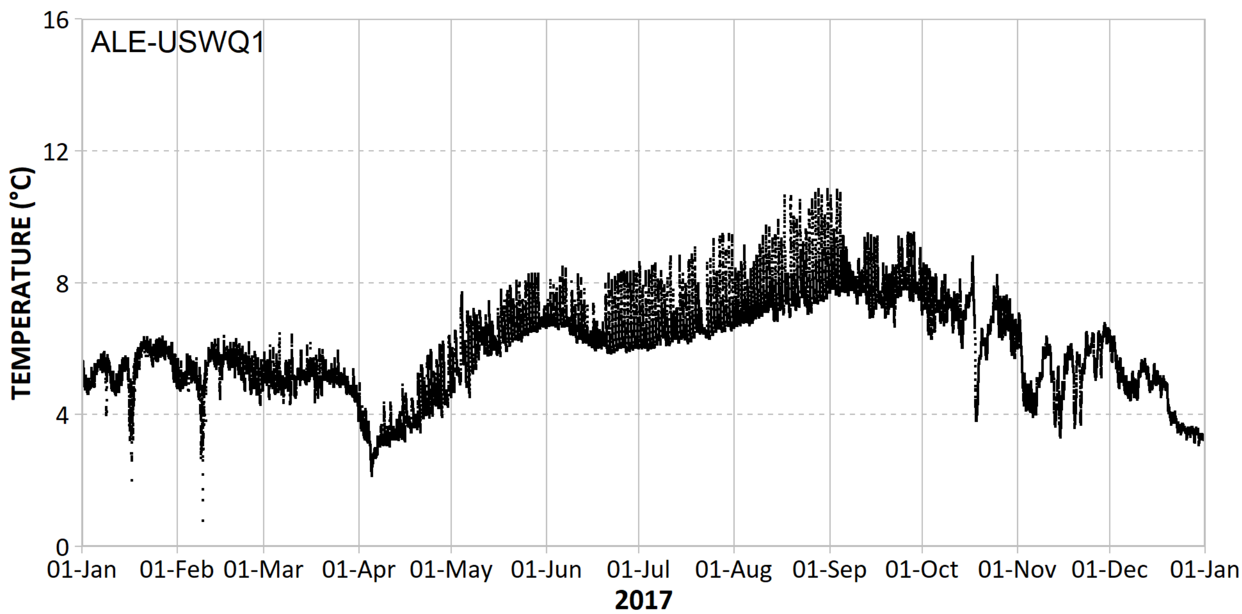
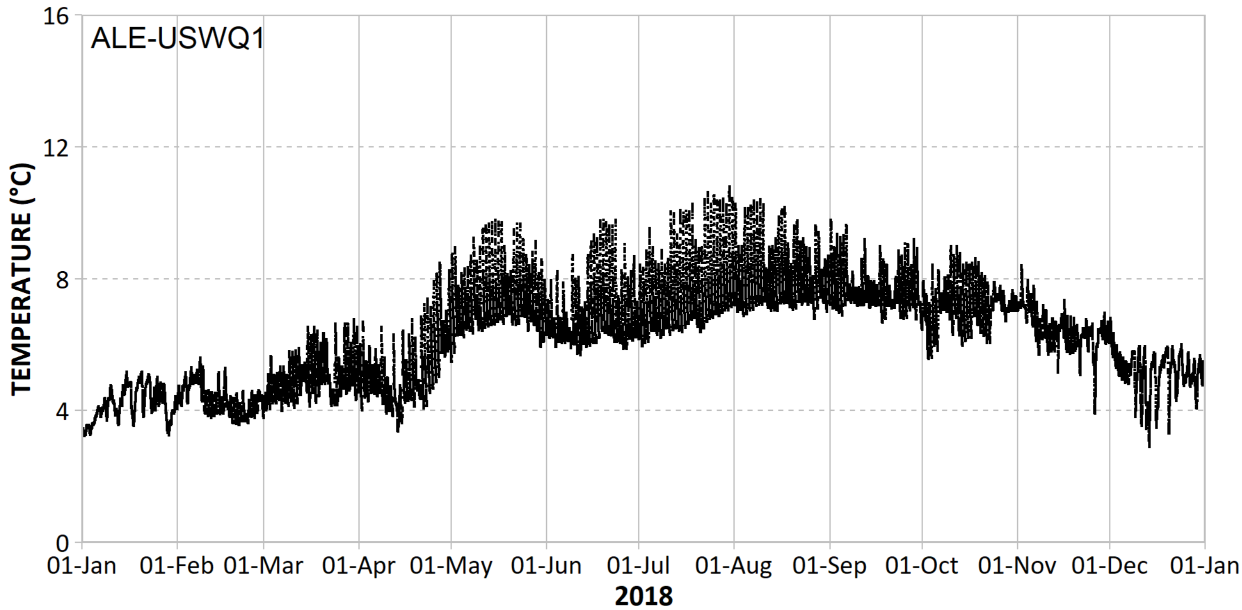


Figure 2. Continued.



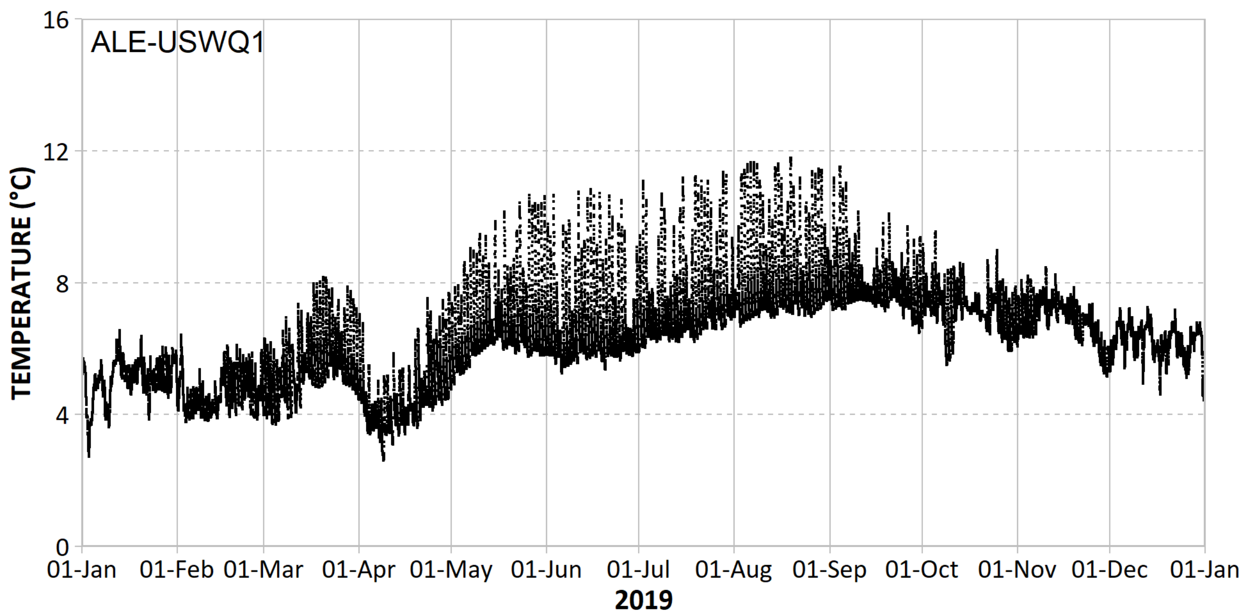
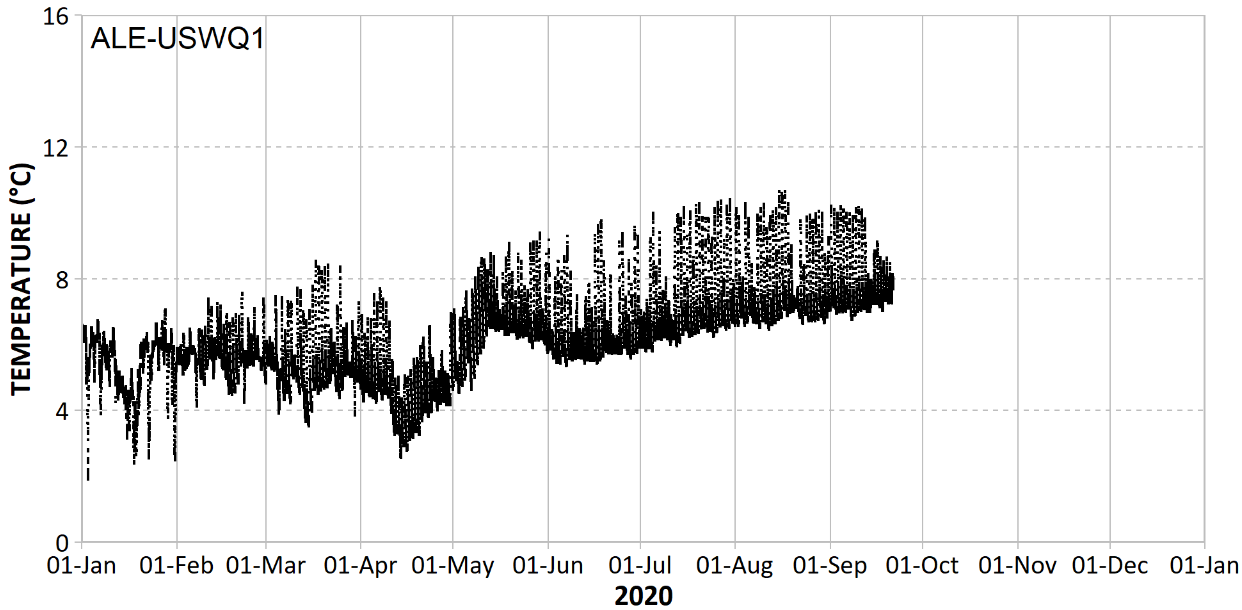


Figure 2. Continued.



2.2. ALE-BDGWQ

Figure 3. ALE-BDGWQ Pre-Construction annual plots (2013 to 2014).

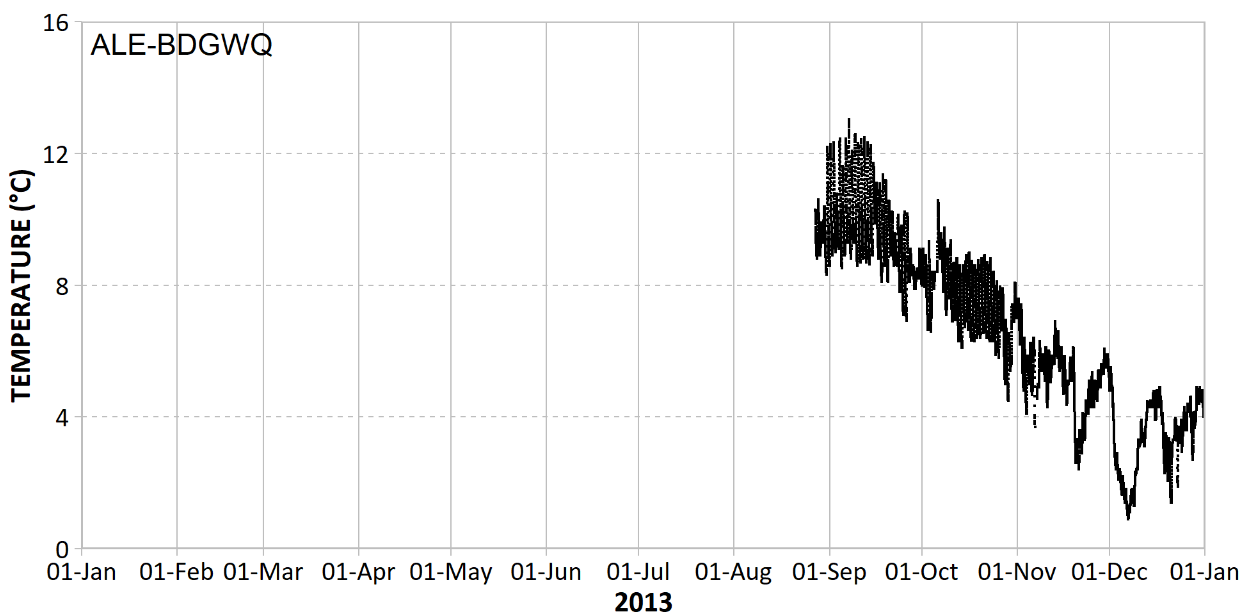


Figure 3. Continued.

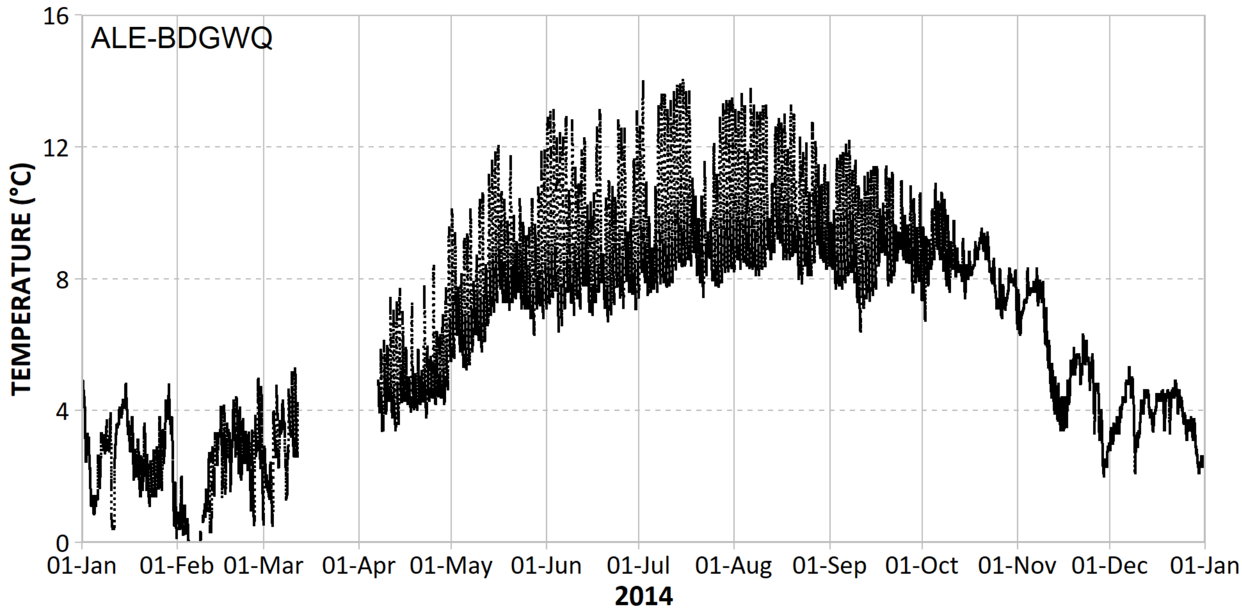


Figure 4. ALE-BDGWQ Post Construction annual plots (2016 to 2020).

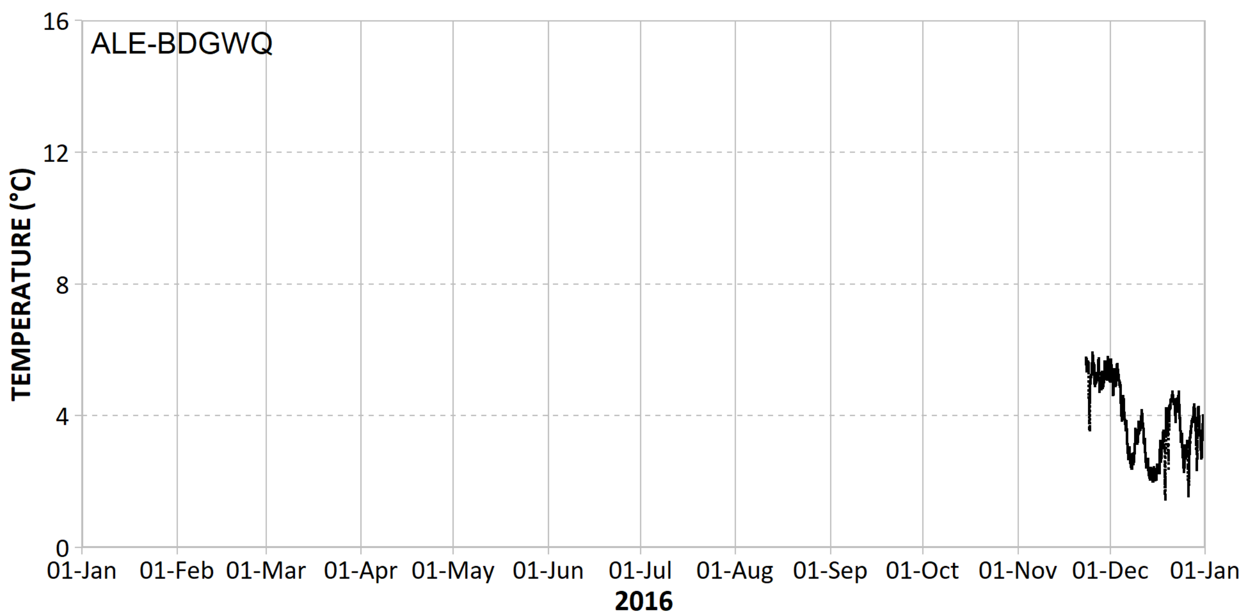
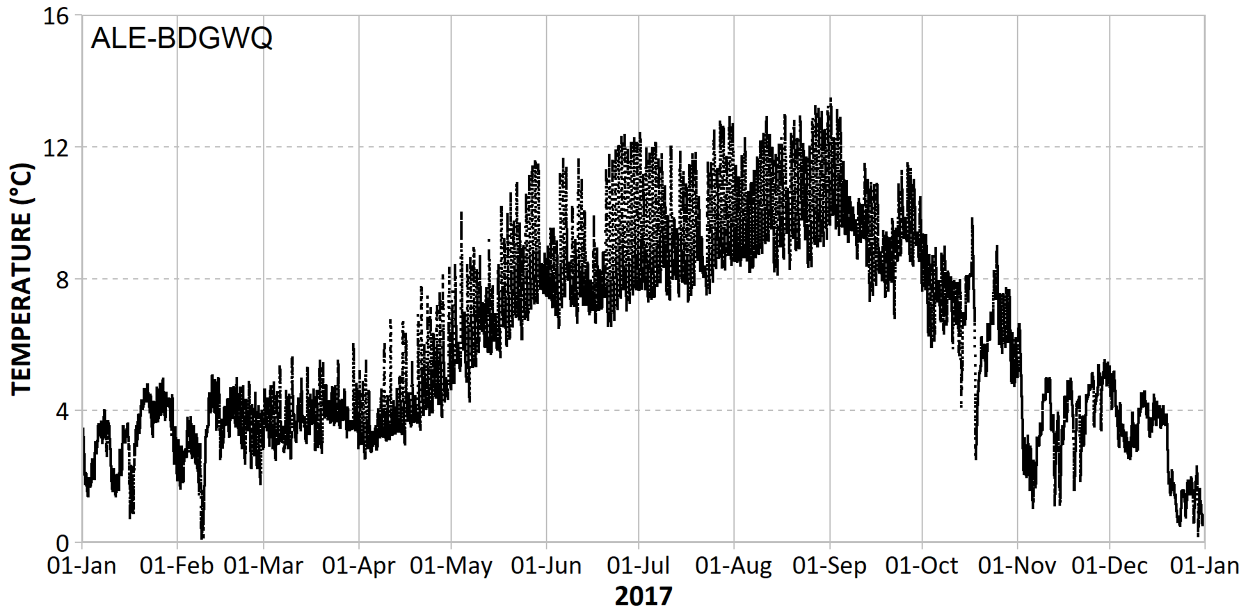


Figure 4. Continued.



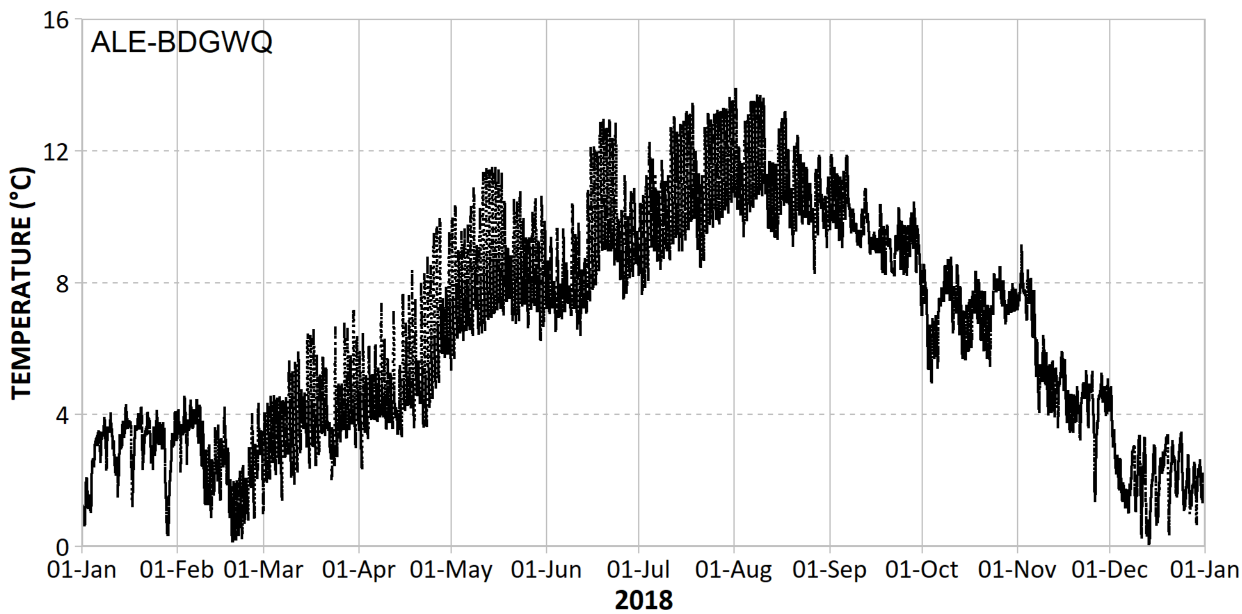
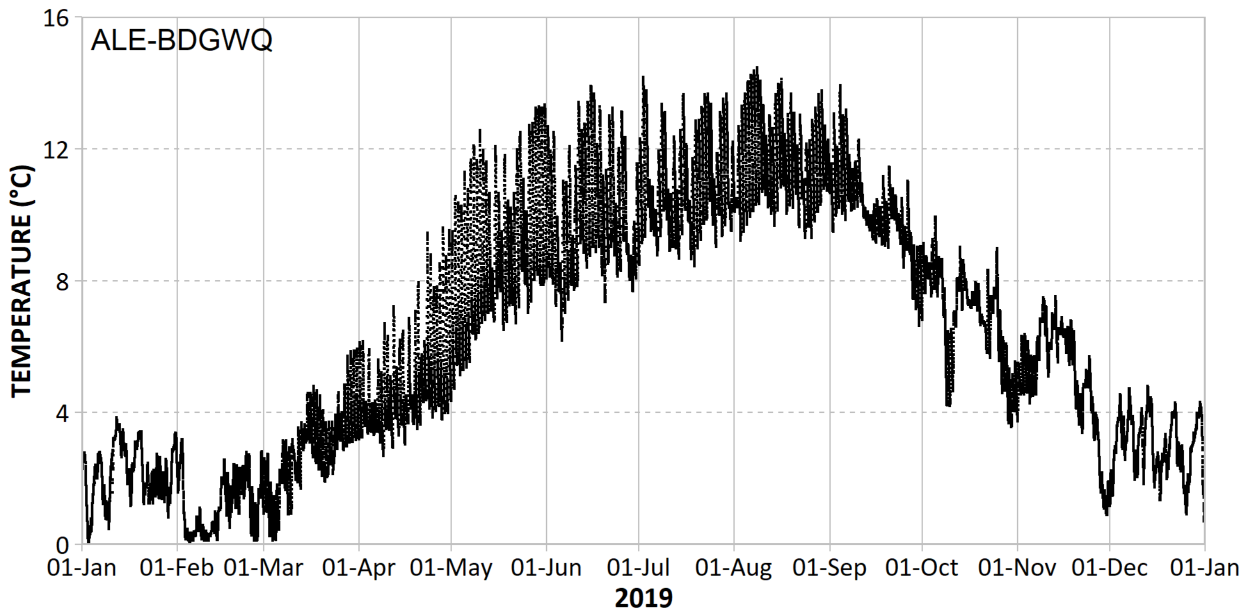
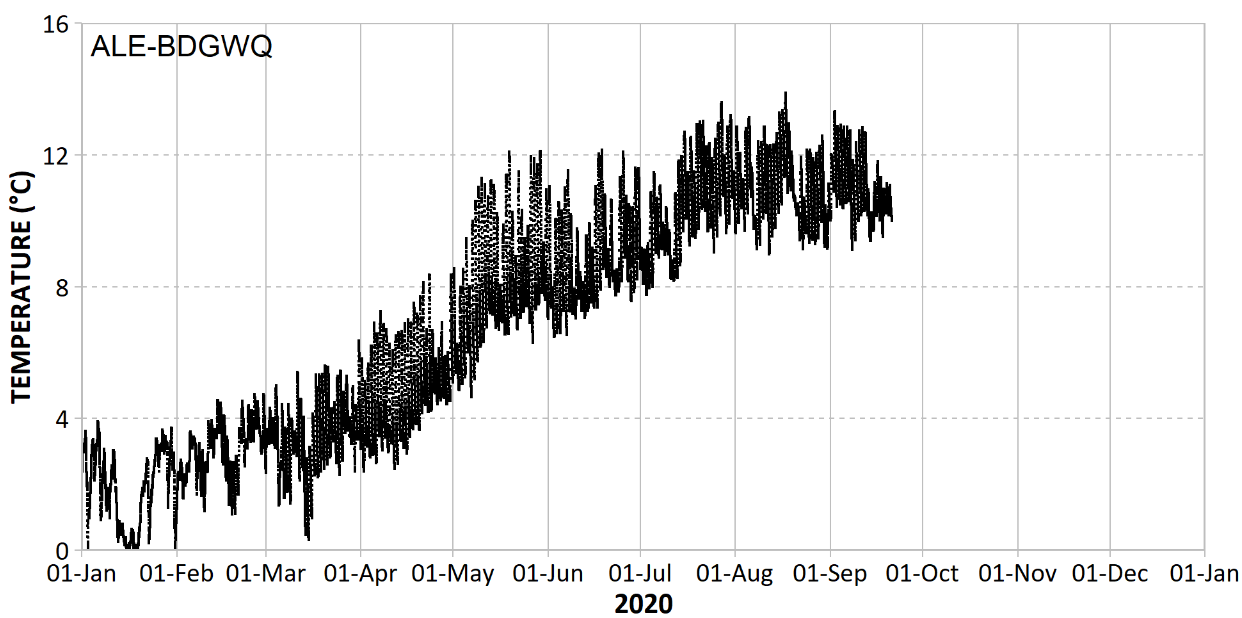


Figure 4. Continued.





Appendix D. Photographs of Alena Creek Fish Habitat Enhancement Project Stability Assessment Year 4 Monitoring

LIST OF FIGURES

Figure 1. ALE-XS1 on September 19, 2016.

a) Looking upstream.

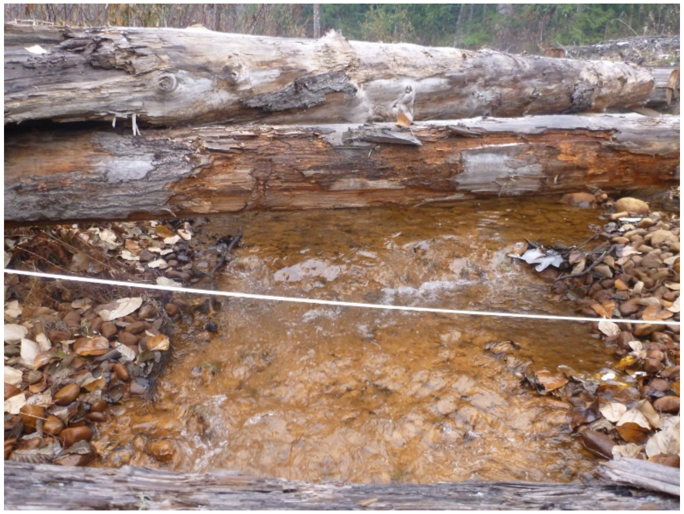
c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 2. ALE-XS1 on November 10, 2017.

a) Looking upstream.



c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 3. ALE-XS1 on November 05, 2018.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 4. ALE-XS1 on November 13, 2019.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 5. ALE-XS1 on November 07, 2020.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 6. ALE-XS2 on September 19, 2016.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 7. ALE-XS2 on November 10, 2017.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 8. ALE-XS2 on November 05, 2018.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 9. ALE-XS2 on November 13, 2019.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 10. ALE-XS2 on November 07, 2020.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 11. ALE-XS3 on September 19, 2016.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 12. ALE-XS3 on November 10, 2017.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 13. ALE-XS3 on November 05, 2018.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 14. ALE-XS3 on November 13, 2019.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 15. ALE-XS3 on November 07, 2020.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 16. ALE-XS4 on September 19, 2016.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 17. ALE-XS4 on November 10, 2017.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 18. ALE-XS4 on November 05, 2018.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 19. ALE-XS4 on November 13, 2019.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 20. ALE-XS4 on November 07, 2020.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 21. ALE-XS5 on September 19, 2016.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 22. ALE-XS5 on November 10, 2017.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 23. ALE-XS5 on November 05, 2018.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 24. ALE-XS5 on November 13, 2019.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 25. ALE-XS5 on November 07, 2020.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 26. ALE-XS6 on September 19, 2016.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 27. ALE-XS6 on November 10, 2017.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 28. ALE-XS6 on November 05, 2018.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 29. ALE-XS6 on November 13, 2019.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 30. ALE-XS6 on November 07, 2020.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 31. ALE-XS7 on September 19, 2016.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 32. ALE-XS7 on November 10, 2017.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 33. ALE-XS7 on November 05, 2018.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 34. ALE-XS7 on November 13, 2019.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 35. ALE-XS7 on November 07, 2020.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 36. ALE-XS8 on September 19, 2016.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 37. ALE-XS8 on November 10, 2017.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 38. ALE-XS8 on November 05, 2018.

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Figure 39. ALE-XS8 on November 13, 2019.

a) Looking upstream.

b) Looking downstream.

c) Looking from river right to river left.

d) Looking from river left to river right.

Figure 40. ALE-XS8 on November 07, 2020

a) Looking upstream.

c) Looking from river right to river left.

b) Looking downstream.

d) Looking from river left to river right.

Appendix E. Raw Data Tables and Representative Photographs from Fish Community Surveys

LIST OF FIGURES

LIST OF TABLES

Figure 1. Minnow trap #3 at sampling site ALE-MT01 on September 20, 2020.

Figure 2. Minnow trap #5 at sampling site ALE-MT02 on September 20, 2020.

Figure 3. Minnow trap #4 at sampling site ALE-MT03 on September 20, 2020.

Figure 4. Minnow trap #2 at sampling site ALE-MT05 on September 20, 2020.

Figure 5. Minnow trap #10 at sampling site ALE-MT06 on September 20, 2020.

Figure 6. Minnow trap #1 at sampling site ALE-MT07 on September 20, 2020.

Figure 7. Minnow trap #2 at sampling site ALE-MT08 on September 20, 2020.

Figure 8. Minnow trap #4 at sampling site ALE-MT09 on September 20, 2020.

Table 1. Summary of minnow traps soak times and capture data at each site.

Site	Trap #	Mesh Size (mm)	Date In	Time In	Date Out	Time Out	Trap Depth (m)	Soak Time (hrs)	Catch[1]		
									CO	CT	BT
ALE-MT01	1	3	20-Sep-20	09:55	21-Sep-20	08:00	0.30	22.08	8	4	0
	2	3	20-Sep-20	09:55	21-Sep-20	08:00	0.35	22.08	1	0	0
	3	3	20-Sep-20	09:55	21-Sep-20	08:00	0.40	22.08	13	1	0
	4	3	20-Sep-20	09:55	21-Sep-20	08:00	0.25	22.08	0	0	0
	5	3	20-Sep-20	09:55	21-Sep-20	08:00	0.30	22.08	8	0	0
ALE-MT02	1	3	20-Sep-20	10:46	21-Sep-20	09:25	0.18	22.65	0	0	0
	2	3	20-Sep-20	10:46	21-Sep-20	09:25	0.45	22.65	20	2	0
	3	3	20-Sep-20	10:46	21-Sep-20	09:25	0.50	22.65	0	0	0
	4	3	20-Sep-20	10:46	21-Sep-20	09:25	0.40	22.65	5	2	0
	5	3	20-Sep-20	10:46	21-Sep-20	09:25	0.20	22.65	0	1	0
ALE-MT07	1	3	20-Sep-20	11:15	21-Sep-20	10:48	0.20	23.55	15	0	0
	2	3	20-Sep-20	11:15	21-Sep-20	10:48	0.30	23.55	1	0	0
	3	3	20-Sep-20	11:15	21-Sep-20	10:48	0.70	23.55	2	2	0
	4	3	20-Sep-20	11:15	21-Sep-20	10:48	0.40	23.55	18	1	0
	5	3	20-Sep-20	11:15	21-Sep-20	10:48	0.35	23.55	18	0	0
ALE-MT03	1	3	20-Sep-20	11:50	21-Sep-20	12:05	0.65	24.25	23	0	0
	2	3	20-Sep-20	11:50	21-Sep-20	12:05	0.45	24.25	16	2	0
	3	3	20-Sep-20	11:50	21-Sep-20	12:05	0.55	24.25	7	2	0
	4	3	20-Sep-20	11:50	21-Sep-20	12:05	0.35	24.25	4	1	0
	5	3	20-Sep-20	11:50	21-Sep-20	12:05	0.20	24.25	7	0	0
ALE-MT06	1	6	20-Sep-20	13:40	21-Sep-20	14:10	0.80	24.50	66	2	0
	2	6	20-Sep-20	13:40	21-Sep-20	14:10	1.00	24.50	51	2	0
	3	6	20-Sep-20	13:40	21-Sep-20	14:10	0.40	24.50	44	0	0
	4	6	20-Sep-20	13:40	21-Sep-20	14:10	0.90	24.50	25	3	0
	5	6	20-Sep-20	13:40	21-Sep-20	14:10	1.40	24.50	27	4	0
	6	6	20-Sep-20	13:40	21-Sep-20	14:10	0.90	24.50	27	2	0
	7	6	20-Sep-20	13:40	21-Sep-20	14:10	0.60	24.50	48	0	0
	8	6	20-Sep-20	13:40	21-Sep-20	14:10	1.10	24.50	16	1	0
	9	6	20-Sep-20	13:40	21-Sep-20	14:10	1.40	24.50	15	3	0
	10	6	20-Sep-20	13:40	21-Sep-20	14:10	0.70	24.50	35	1	0
ALE-MT08	1	3	20-Sep-20	14:10	21-Sep-20	16:10	0.70	26.00	29	0	0
	2	6	20-Sep-20	14:10	21-Sep-20	16:10	0.95	26.00	19	2	0
	3	6	20-Sep-20	14:10	21-Sep-20	16:10	1.10	26.00	24	0	0
	4	3	20-Sep-20	14:10	21-Sep-20	16:10	1.10	26.00	12	0	0
	5	3	20-Sep-20	14:10	21-Sep-20	16:10	0.85	26.00	20	1	0
ALE-MT09	1	6	20-Sep-20	14:42	21-Sep-20	17:00	0.20	26.30	24	2	0
	2	6	20-Sep-20	14:42	21-Sep-20	17:00	0.35	26.30	14	4	0
	3	6	20-Sep-20	14:42	21-Sep-20	17:00	0.32	26.30	14	0	0
	4	6	20-Sep-20	14:42	21-Sep-20	17:00	0.40	26.30	17	2	0
	5	6	20-Sep-20	14:42	21-Sep-20	17:00	0.25	26.30	34	1	0
ALE-MT05	1	6	20-Sep-20	15:10	21-Sep-20	17:25	0.42	26.25	47	0	0
	2	6	20-Sep-20	15:10	21-Sep-20	17:25	0.40	26.25	85	0	0
	3	6	20-Sep-20	15:10	21-Sep-20	17:25	0.35	26.25	5	1	0
	4	6	20-Sep-20	15:10	21-Sep-20	17:25	0.35	26.25	38	0	0
	5	6	20-Sep-20	15:10	21-Sep-20	17:25	0.45	26.25	30	0	0

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout.

Table 2. Detailed fish capture, fork length and aging data.

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT01	20-Sep-20	1	CO	59		2.5	1.22					0
ALE-MT01	20-Sep-20	1	CO	66		2.8	0.97					0
ALE-MT01	20-Sep-20	1	CO	73		4.3	1.11					1
ALE-MT01	20-Sep-20	1	CO	74		4.3	1.06					1
ALE-MT01	20-Sep-20	1	CO	78		5.7	1.20					1
ALE-MT01	20-Sep-20	1	CO	85		7.0	1.14	SC	8			1
ALE-MT01	20-Sep-20	1	CO	88		8.4	1.23					1
ALE-MT01	20-Sep-20	1	CO	89		7.3	1.04					1
ALE-MT01	20-Sep-20	1	CT	86								1
ALE-MT01	20-Sep-20	1	CT	88		6.0	0.88	SC	7			1
ALE-MT01	20-Sep-20	1	CT	119		15.3	0.91	SC	5			2
ALE-MT01	20-Sep-20	1	CT	109		11.9	0.92	SC	6			1
ALE-MT01	20-Sep-20	2	CO	59		3.0	1.46					0
ALE-MT01	20-Sep-20	3	CO	54		2.4	1.52					0
ALE-MT01	20-Sep-20	3	CO	55								0
ALE-MT01	20-Sep-20	3	CO	55		2.4	1.44					0
ALE-MT01	20-Sep-20	3	CO	57		2.5	1.35					0
ALE-MT01	20-Sep-20	3	CO	63		3.0	1.20					0
ALE-MT01	20-Sep-20	3	CO	63		3.4	1.36					0
ALE-MT01	20-Sep-20	3	CO	65		3.2	1.17					0
ALE-MT01	20-Sep-20	3	CO	69		3.9	1.19					0
ALE-MT01	20-Sep-20	3	CO	77		5.8	1.27					1
ALE-MT01	20-Sep-20	3	CO	79		5.8	1.18					1
ALE-MT01	20-Sep-20	3	CO	80		6.2	1.21					1
ALE-MT01	20-Sep-20	3	CO	84		7.0	1.18					1
ALE-MT01	20-Sep-20	3	CO	84		8.7	1.47					1
ALE-MT01	20-Sep-20	3	CT	92		7.7	0.99					1
ALE-MT01	20-Sep-20	4	NFC									
ALE-MT01	20-Sep-20	5	CO	46		1.0	1.03	SC	3			0
ALE-MT01	20-Sep-20	5	CO	50		1.4	1.12					0
ALE-MT01	20-Sep-20	5	CO	52		1.5	1.07					0
ALE-MT01	20-Sep-20	5	CO	56		2.2	1.25					0
ALE-MT01	20-Sep-20	5	CO	60		2.5	1.16	SC	4			0
ALE-MT01	20-Sep-20	5	CO	64		2.8	1.07	SC	1			0
ALE-MT01	20-Sep-20	5	CO	70		4.4	1.28	SC	2			0
ALE-MT01	20-Sep-20	5	CO	70		3.8	1.11					0
ALE-MT02	20-Sep-20	1	NFC									
ALE-MT02	20-Sep-20	2	CO	43		1.1	1.38					0
ALE-MT02	20-Sep-20	2	CO	44		1.6	1.88	SC	3	FC	3	0
ALE-MT02	20-Sep-20	2	CO	45		1.3	1.43					0
ALE-MT02	20-Sep-20	2	CO	49		1.3	1.10					0
ALE-MT02	20-Sep-20	2	CO	50		1.6	1.28					0
ALE-MT02	20-Sep-20	2	CO	51		1.6	1.21					0
ALE-MT02	20-Sep-20	2	CO	51		1.8	1.36					0
ALE-MT02	20-Sep-20	2	CO	54		2.2	1.40					0
ALE-MT02	20-Sep-20	2	CO	54		1.8	1.14					0
ALE-MT02	20-Sep-20	2	CO	55		1.9	1.14	SC	5	FC	5	0
ALE-MT02	20-Sep-20	2	CO	56		2.1	1.20					0
ALE-MT02	20-Sep-20	2	CO	58		1.7	0.87					0
ALE-MT02	20-Sep-20	2	CO	62		3.2	1.34					0
ALE-MT02	20-Sep-20	2	CO	63		3.0	1.20					0
ALE-MT02	20-Sep-20	2	CO	63		3.4	1.36	SC	2	FC	2	0
ALE-MT02	20-Sep-20	2	CO	64		3.4	1.30					0
ALE-MT02	20-Sep-20	2	CO	69		3.4	1.03					0
ALE-MT02	20-Sep-20	2	CO	78		5.6	1.18	SC	4	FC	4	1
ALE-MT02	20-Sep-20	2	CO	80		6.4	1.25	SC	7	FC	7	1
ALE-MT02	20-Sep-20	2	CO	82		8.4	1.52	SC	6	FC	6	1
ALE-MT02	20-Sep-20	2	CT	135		24.6	1.00	SC	1	FC	1	2
ALE-MT02	20-Sep-20	2	CT	99		8.6	0.89					1
ALE-MT02	20-Sep-20	3	NFC									

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (2 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT02	20-Sep-20	4	CO	60		2.3	1.06					0
ALE-MT02	20-Sep-20	4	CO	66		3.1	1.08					0
ALE-MT02	20-Sep-20	4	CO	67		3.5	1.16					0
ALE-MT02	20-Sep-20	4	CO	81		7.5	1.41	SC	10	FC	10	1
ALE-MT02	20-Sep-20	4	CO	83		6.2	1.08					1
ALE-MT02	20-Sep-20	4	CT	74		4.1	1.01	SC	9	FC	9	1
ALE-MT02	20-Sep-20	4	CT	83		6.9	1.21					1
ALE-MT02	20-Sep-20	5	CT	112		14.1	1.00	SC	8	FC	8	1
ALE-MT07	20-Sep-20	1	CO	41		0.9	1.31					0
ALE-MT07	20-Sep-20	1	CO	44		1.2	1.41					0
ALE-MT07	20-Sep-20	1	CO	47		1.2	1.16					0
ALE-MT07	20-Sep-20	1	CO	52		1.7	1.21					0
ALE-MT07	20-Sep-20	1	CO	55		2.0	1.20					0
ALE-MT07	20-Sep-20	1	CO	57		2.1	1.13					0
ALE-MT07	20-Sep-20	1	CO	59		2.4	1.17					0
ALE-MT07	20-Sep-20	1	CO	59		2.3	1.12					0
ALE-MT07	20-Sep-20	1	CO	60		2.1	0.97					0
ALE-MT07	20-Sep-20	1	CO	60		2.6	1.20					0
ALE-MT07	20-Sep-20	1	CO	61		2.6	1.15					0
ALE-MT07	20-Sep-20	1	CO	66		3.5	1.22					0
ALE-MT07	20-Sep-20	1	CO	79		5.4	1.10					1
ALE-MT07	20-Sep-20	1	CO	85		7.1	1.16					1
ALE-MT07	20-Sep-20	1	CO	88		8.3	1.22					1
ALE-MT07	20-Sep-20	2	CO	60								0
ALE-MT07	20-Sep-20	3	CO	55		2.1	1.26					0
ALE-MT07	20-Sep-20	3	CO	91		9.1	1.21					1
ALE-MT07	20-Sep-20	3	CT	82		5.3	0.96					1
ALE-MT07	20-Sep-20	3	CT	83		6.1	1.07	SC	8	FC	8	1
ALE-MT07	20-Sep-20	4	CO	45		1.3	1.43	SC	3	FC	3	0
ALE-MT07	20-Sep-20	4	CO	51		3.0	2.26	SC	5	FC	5	0
ALE-MT07	20-Sep-20	4	CO	52		1.8	1.28					0
ALE-MT07	20-Sep-20	4	CO	55		2.1	1.26					0
ALE-MT07	20-Sep-20	4	CO	60		2.2	1.02					0
ALE-MT07	20-Sep-20	4	CO	64		3.5	1.34					0
ALE-MT07	20-Sep-20	4	CO	64		3.1	1.18					0
ALE-MT07	20-Sep-20	4	CO	65		3.5	1.27					0
ALE-MT07	20-Sep-20	4	CO	70		4.6	1.34					0
ALE-MT07	20-Sep-20	4	CO	73		4.7	1.21					1
ALE-MT07	20-Sep-20	4	CO	79		6.8	1.38					1
ALE-MT07	20-Sep-20	4	CO	79		5.9	1.20					1
ALE-MT07	20-Sep-20	4	CO	84		7.4	1.25					1
ALE-MT07	20-Sep-20	4	CO	85		7.9	1.29	SC	2	FC	2	1
ALE-MT07	20-Sep-20	4	CO	85		6.7	1.09					1
ALE-MT07	20-Sep-20	4	CO	87		7.4	1.12					1
ALE-MT07	20-Sep-20	4	CO	96		10.2	1.15	SC	4	FC	4	1
ALE-MT07	20-Sep-20	4	CO	92		10.0	1.28					1
ALE-MT07	20-Sep-20	4	CT	113		13.8	0.96	SC	1	FC	1	1
ALE-MT07	20-Sep-20	5	CO	41		0.9	1.31					0
ALE-MT07	20-Sep-20	5	CO	42		1.1	1.48					0
ALE-MT07	20-Sep-20	5	CO	44		1.4	1.64					0
ALE-MT07	20-Sep-20	5	CO	44		1.6	1.88					0
ALE-MT07	20-Sep-20	5	CO	45		1.5	1.65					0
ALE-MT07	20-Sep-20	5	CO	49		1.7	1.44					0
ALE-MT07	20-Sep-20	5	CO	49		1.2	1.02					0
ALE-MT07	20-Sep-20	5	CO	50		1.5	1.20					0
ALE-MT07	20-Sep-20	5	CO	50		2.1	1.68					0
ALE-MT07	20-Sep-20	5	CO	52		2.2	1.56					0
ALE-MT07	20-Sep-20	5	CO	54		2.3	1.46					0
ALE-MT07	20-Sep-20	5	CO	55		2.0	1.20					0
ALE-MT07	20-Sep-20	5	CO	55		3.1	1.86	SC	6	FC	6	0

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (3 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT07	20-Sep-20	5	CO	57		3.2	1.73					0
ALE-MT07	20-Sep-20	5	CO	59		2.8	1.36					0
ALE-MT07	20-Sep-20	5	CO	59		2.5	1.22					0
ALE-MT07	20-Sep-20	5	CO	59		4.1	2.00					0
ALE-MT07	20-Sep-20	5	CO	83		7.1	1.24	SC	7	FC	7	1
ALE-MT03	20-Sep-20	1	CO	46		1.3	1.34					0
ALE-MT03	20-Sep-20	1	CO	49		1.5	1.27					0
ALE-MT03	20-Sep-20	1	CO	49		1.3	1.10					0
ALE-MT03	20-Sep-20	1	CO	50		1.4	1.12					0
ALE-MT03	20-Sep-20	1	CO	50		1.4	1.12					0
ALE-MT03	20-Sep-20	1	CO	52		1.4	1.00					0
ALE-MT03	20-Sep-20	1	CO	54		1.9	1.207					0
ALE-MT03	20-Sep-20	1	CO	54		1.9	1.207					0
ALE-MT03	20-Sep-20	1	CO	54		2.3	1.461					0
ALE-MT03	20-Sep-20	1	CO	60		2.5	1.157					0
ALE-MT03	20-Sep-20	1	CO	63		2.8	1.12					0
ALE-MT03	20-Sep-20	1	CO	64		3.0	1.144					0
ALE-MT03	20-Sep-20	1	CO	64		3.1	1.183	SC	6	FC	6	0
ALE-MT03	20-Sep-20	1	CO	65		2.9	1.056					0
ALE-MT03	20-Sep-20	1	CO	85		6.9	1.124					1
ALE-MT03	20-Sep-20	1	CO									
ALE-MT03	20-Sep-20	1	CO									
ALE-MT03	20-Sep-20	1	CO									
ALE-MT03	20-Sep-20	1	CO									
ALE-MT03	20-Sep-20	1	CO									
ALE-MT03	20-Sep-20	1	CO									
ALE-MT03	20-Sep-20	1	CO									
ALE-MT03	20-Sep-20	1	CO									
ALE-MT03	20-Sep-20	2	CO	55		1.7	1.022					0
ALE-MT03	20-Sep-20	2	CO	58		2.4	1.23					0
ALE-MT03	20-Sep-20	2	CO	59		2.4	1.169					0
ALE-MT03	20-Sep-20	2	CO	64		2.9	1.106					0
ALE-MT03	20-Sep-20	2	CO	67		2.9	0.964					0
ALE-MT03	20-Sep-20	2	CO	70		4.0	1.166	SC	3	FC	3	0
ALE-MT03	20-Sep-20	2	CO	73		4.2	1.08					1
ALE-MT03	20-Sep-20	2	CO	74		4.3	1.061					1
ALE-MT03	20-Sep-20	2	CO	74		4.7	1.16					1
ALE-MT03	20-Sep-20	2	CO	75		4.7	1.114					1
ALE-MT03	20-Sep-20	2	CO	80		5.0	0.977					1
ALE-MT03	20-Sep-20	2	CO	83		6.3	1.102					1
ALE-MT03	20-Sep-20	2	CO	84		6.10	1.029	SC	2	FC	2	1
ALE-MT03	20-Sep-20	2	CO	85		7.60	1.238					1
ALE-MT03	20-Sep-20	2	CO	85		6.60	1.075					1
ALE-MT03	20-Sep-20	2	CO	90		8.10	1.111	SC	4	FC	4	1
ALE-MT03	20-Sep-20	2	CT	77		4.60	1.008	SC	5	FC	5	1
ALE-MT03	20-Sep-20	2	CT	89		5.80	0.823	SC	1	FC	1	1
ALE-MT03	20-Sep-20	3	CO	81		6.70	1.261					1
ALE-MT03	20-Sep-20	3	CO									
ALE-MT03	20-Sep-20	3	CO									
ALE-MT03	20-Sep-20	3	CO									
ALE-MT03	20-Sep-20	3	CO									
ALE-MT03	20-Sep-20	3	CO									
ALE-MT03	20-Sep-20	3	CO									
ALE-MT03	20-Sep-20	3	CT	77		4.90	1.073					1
ALE-MT03	20-Sep-20	3	CT	120		16.20	0.938	SC	8	FC	8	2
ALE-MT03	20-Sep-20	4	CO	54								0
ALE-MT03	20-Sep-20	4	CO	54		1.90	1.207					0
ALE-MT03	20-Sep-20	4	CO	56		1.1	0.63					0
ALE-MT03	20-Sep-20	4	CO	70		4.10	1.195					0
ALE-MT03	20-Sep-20	4	CT	99		9.00	0.928					1

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (4 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT03	20-Sep-20	5	CO	47		1.30	1.252	SC	7	FC	7	0
ALE-MT03	20-Sep-20	5	CO	53		1.70	1.142					0
ALE-MT03	20-Sep-20	5	CO	55		2.00	1.202					0
ALE-MT03	20-Sep-20	5	CO	55		1.40	0.841					0
ALE-MT03	20-Sep-20	5	CO	56		1.90	1.082					0
ALE-MT03	20-Sep-20	5	CO	63		2.80	1.12					0
ALE-MT03	20-Sep-20	5	CO	79		5.00	1.014					1
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (5 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CO									
ALE-MT06	20-Sep-20	1	CT									
ALE-MT06	20-Sep-20	1	CT									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	1	CT									
ALE-MT06	20-Sep-20	1	CT									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (6 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CO									
ALE-MT06	20-Sep-20	2	CT									
ALE-MT06	20-Sep-20	2	CT									
ALE-MT06	20-Sep-20	3	CO	48		2.20	1.989					0
ALE-MT06	20-Sep-20	3	CO	52		1.70	1.209					0
ALE-MT06	20-Sep-20	3	CO	57		2.00	1.08					0
ALE-MT06	20-Sep-20	3	CO	59		2.50	1.217					0
ALE-MT06	20-Sep-20	3	CO	80		5.50	1.074					1
ALE-MT06	20-Sep-20	3	CO		45							0
ALE-MT06	20-Sep-20	3	CO		50							0
ALE-MT06	20-Sep-20	3	CO		50							0
ALE-MT06	20-Sep-20	3	CO		55							0
ALE-MT06	20-Sep-20	3	CO		55							0
ALE-MT06	20-Sep-20	3	CO		55							0
ALE-MT06	20-Sep-20	3	CO		60							0
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (7 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO									
ALE-MT06	20-Sep-20	3	CO		52							0
ALE-MT06	20-Sep-20	4	CO	52		2.60	1.849					0
ALE-MT06	20-Sep-20	4	CO	63		3.60	1.44					0
ALE-MT06	20-Sep-20	4	CO	78		5.50	1.159					1
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CO									
ALE-MT06	20-Sep-20	4	CT	55		1.90	1.142					0
ALE-MT06	20-Sep-20	4	CT	81		5.00	0.941	SC	10	FC	10	1
ALE-MT06	20-Sep-20	4	CT	128		18.30	0.873					2
ALE-MT06	20-Sep-20	5	CO	75		4.30	1.019					1
ALE-MT06	20-Sep-20	5	CO	80		5.70	1.113					1
ALE-MT06	20-Sep-20	5	CO	81		6.20	1.167					1
ALE-MT06	20-Sep-20	5	CO	81		5.50	1.035					1
ALE-MT06	20-Sep-20	5	CO	90		9.40	1.289					1
ALE-MT06	20-Sep-20	5	CO		45							0
ALE-MT06	20-Sep-20	5	CO		50							0
ALE-MT06	20-Sep-20	5	CO		50							0
ALE-MT06	20-Sep-20	5	CO		60							0
ALE-MT06	20-Sep-20	5	CO		65							0
ALE-MT06	20-Sep-20	5	CO		70							0
ALE-MT06	20-Sep-20	5	CO		70							0
ALE-MT06	20-Sep-20	5	CO		75							1
ALE-MT06	20-Sep-20	5	CO		75							1
ALE-MT06	20-Sep-20	5	CO		78							1
ALE-MT06	20-Sep-20	5	CO		78							1
ALE-MT06	20-Sep-20	5	CO		80							1
ALE-MT06	20-Sep-20	5	CO		85							1
ALE-MT06	20-Sep-20	5	CO		85							1
ALE-MT06	20-Sep-20	5	CO		90							1

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (8 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT06	20-Sep-20	5	CO		90							1
ALE-MT06	20-Sep-20	5	CO		90							1
ALE-MT06	20-Sep-20	5	CO		90							1
ALE-MT06	20-Sep-20	5	CO		100							1
ALE-MT06	20-Sep-20	5	CO		100							1
ALE-MT06	20-Sep-20	5	CO		52							0
ALE-MT06	20-Sep-20	5	CO		72							0
ALE-MT06	20-Sep-20	5	CT		75							1
ALE-MT06	20-Sep-20	5	CT		80							1
ALE-MT06	20-Sep-20	5	CT	120		16.30	0.943					2
ALE-MT06	20-Sep-20	5	CT	120		17.10	0.99					2
ALE-MT06	20-Sep-20	9	CO	59		2.30	1.12					0
ALE-MT06	20-Sep-20	9	CO	60		2.50	1.157					0
ALE-MT06	20-Sep-20	9	CO	62		3.00	1.259					0
ALE-MT06	20-Sep-20	9	CO	70		3.60	1.05					0
ALE-MT06	20-Sep-20	9	CO	73		5.10	1.311					1
ALE-MT06	20-Sep-20	9	CO	75		4.90	1.161					1
ALE-MT06	20-Sep-20	9	CO	84		6.40	1.08					1
ALE-MT06	20-Sep-20	9	CO	86		7.20	1.132					1
ALE-MT06	20-Sep-20	9	CO	89		7.60	1.078					1
ALE-MT06	20-Sep-20	9	CO		80							1
ALE-MT06	20-Sep-20	9	CO		90							1
ALE-MT06	20-Sep-20	9	CO		82							1
ALE-MT06	20-Sep-20	9	CO		81							1
ALE-MT06	20-Sep-20	9	CO	92		8.30	1.066					1
ALE-MT06	20-Sep-20	9	CO	92		9.40	1.207					1
ALE-MT06	20-Sep-20	9	CT	94		8.60	1.035	SC	7	FC	7	1
ALE-MT06	20-Sep-20	9	CT	157		34.50	0.891	SC	5	FC	5	3
ALE-MT06	20-Sep-20	9	CT	140		27.30	0.995	SC	6	FC	6	2
ALE-MT06	20-Sep-20	10	CO	45		1.00	1.097					0
ALE-MT06	20-Sep-20	10	CO	45		0.80	0.878					0
ALE-MT06	20-Sep-20	10	CO	50		1.40	1.12					0
ALE-MT06	20-Sep-20	10	CO	52		2.00	1.422					0
ALE-MT06	20-Sep-20	10	CO	52		1.50	1.067					0
ALE-MT06	20-Sep-20	10	CO	58		2.20	1.128					0
ALE-MT06	20-Sep-20	10	CO	59		2.20	1.071					0
ALE-MT06	20-Sep-20	10	CO	69		4.30	1.309					0
ALE-MT06	20-Sep-20	10	CO	73		4.30	1.105					1
ALE-MT06	20-Sep-20	10	CO	74		4.50	1.11	SC	1	FC	1	1
ALE-MT06	20-Sep-20	10	CO	75		4.70	1.114					1
ALE-MT06	20-Sep-20	10	CO	76		4.80	1.093					1
ALE-MT06	20-Sep-20	10	CO	82		6.40	1.161					1
ALE-MT06	20-Sep-20	10	CO	84		6.00	1.012					1
ALE-MT06	20-Sep-20	10	CO	85		6.50	1.058					1
ALE-MT06	20-Sep-20	10	CO	90		8.40	1.152					1
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (9 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CO									
ALE-MT06	20-Sep-20	10	CT	103		11.20	1.025	SC	2	FC	2	1
ALE-MT06	20-Sep-20	7	CO	43		0.90	1.132					0
ALE-MT06	20-Sep-20	7	CO	44		1.00	1.174					0
ALE-MT06	20-Sep-20	7	CO	45		1.00	1.097					0
ALE-MT06	20-Sep-20	7	CO	45		0.90	0.988					0
ALE-MT06	20-Sep-20	7	CO	45		0.90	0.988					0
ALE-MT06	20-Sep-20	7	CO	46		1.00	1.027					0
ALE-MT06	20-Sep-20	7	CO	46		1.20	1.233					0
ALE-MT06	20-Sep-20	7	CO	47		1.00	0.963					0
ALE-MT06	20-Sep-20	7	CO	47		1.00	0.963					0
ALE-MT06	20-Sep-20	7	CO	48		1.30	1.175					0
ALE-MT06	20-Sep-20	7	CO	48		1.20	1.085					0
ALE-MT06	20-Sep-20	7	CO	50		1.30	1.04					0
ALE-MT06	20-Sep-20	7	CO	50		1.70	1.36					0
ALE-MT06	20-Sep-20	7	CO	51		1.30	0.98					0
ALE-MT06	20-Sep-20	7	CO	52		1.50	1.067					0
ALE-MT06	20-Sep-20	7	CO	52		1.40	0.996	SC	3	FC	3	0
ALE-MT06	20-Sep-20	7	CO	52		1.80	1.28					0
ALE-MT06	20-Sep-20	7	CO	53		1.70	1.142					0
ALE-MT06	20-Sep-20	7	CO	55		1.70	1.022					0
ALE-MT06	20-Sep-20	7	CO	59		1.70	0.828					0
ALE-MT06	20-Sep-20	7	CO	59		2.30	1.12					0
ALE-MT06	20-Sep-20	7	CO	62		2.60	1.091					0
ALE-MT06	20-Sep-20	7	CO	76		4.90	1.116					1
ALE-MT06	20-Sep-20	7	CO	80		6.00	1.172					1
ALE-MT06	20-Sep-20	7	CO	80		5.80	1.133					1
ALE-MT06	20-Sep-20	7	CO	80		5.60	1.094					1
ALE-MT06	20-Sep-20	7	CO	80		5.90	1.152					1
ALE-MT06	20-Sep-20	7	CO	81		6.40	1.204					1
ALE-MT06	20-Sep-20	7	CO	81		6.60	1.242					1
ALE-MT06	20-Sep-20	7	CO	82		6.30	1.143					1
ALE-MT06	20-Sep-20	7	CO	86								1
ALE-MT06	20-Sep-20	7	CO	86		7.20	1.132					1
ALE-MT06	20-Sep-20	7	CO	95		10.60	1.236	SC	4	FC	4	1
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	7	CO									
ALE-MT06	20-Sep-20	8	CO	52								0
ALE-MT06	20-Sep-20	8	CO	65		3.10	1.129	SC	9	FC	9	0
ALE-MT06	20-Sep-20	8	CO	69		4.30	1.309					0
ALE-MT06	20-Sep-20	8	CO	76		7.00	1.595					1
ALE-MT06	20-Sep-20	8	CO	78		5.30	1.117					1
ALE-MT06	20-Sep-20	8	CO	79		5.70	1.156					1
ALE-MT06	20-Sep-20	8	CO	80		5.50	1.074					1

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (10 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT06	20-Sep-20	8	CO	82		7.80	1.415					1
ALE-MT06	20-Sep-20	8	CO	83		6.10	1.067					1
ALE-MT06	20-Sep-20	8	CO	84		5.90	0.995					1
ALE-MT06	20-Sep-20	8	CO									
ALE-MT06	20-Sep-20	8	CO									
ALE-MT06	20-Sep-20	8	CO									
ALE-MT06	20-Sep-20	8	CO									
ALE-MT06	20-Sep-20	8	CO									
ALE-MT06	20-Sep-20	8	CO									
ALE-MT06	20-Sep-20	8	CT	150		32.0	0.95	SC	8	FC	8	3
ALE-MT06	20-Sep-20	6	CO		50							0
ALE-MT06	20-Sep-20	6	CO		50							0
ALE-MT06	20-Sep-20	6	CO		60							0
ALE-MT06	20-Sep-20	6	CO		70							0
ALE-MT06	20-Sep-20	6	CO		75							1
ALE-MT06	20-Sep-20	6	CO		75							1
ALE-MT06	20-Sep-20	6	CO		80							1
ALE-MT06	20-Sep-20	6	CO		80							1
ALE-MT06	20-Sep-20	6	CO		80							1
ALE-MT06	20-Sep-20	6	CO		85							1
ALE-MT06	20-Sep-20	6	CO		90							1
ALE-MT06	20-Sep-20	6	CO		90							1
ALE-MT06	20-Sep-20	6	CO		90							1
ALE-MT06	20-Sep-20	6	CO		95							1
ALE-MT06	20-Sep-20	6	CO		100							1
ALE-MT06	20-Sep-20	6	CO		110							1
ALE-MT06	20-Sep-20	6	CO		110							1
ALE-MT06	20-Sep-20	6	CO		110							1
ALE-MT06	20-Sep-20	6	CO									
ALE-MT06	20-Sep-20	6	CO									
ALE-MT06	20-Sep-20	6	CO									
ALE-MT06	20-Sep-20	6	CO									
ALE-MT06	20-Sep-20	6	CO									
ALE-MT06	20-Sep-20	6	CO									
ALE-MT06	20-Sep-20	6	CO									
ALE-MT06	20-Sep-20	6	CO									
ALE-MT06	20-Sep-20	6	CO		52							0
ALE-MT06	20-Sep-20	6	CT		110							1
ALE-MT06	20-Sep-20	6	CT	160		36.7	0.90					3
ALE-MT08	20-Sep-20	1	CO	45		1.3	1.43					0
ALE-MT08	20-Sep-20	1	CO	50		1.8	1.44					0
ALE-MT08	20-Sep-20	1	CO	51		1.7	1.28					0
ALE-MT08	20-Sep-20	1	CO	51		1.8	1.36					0
ALE-MT08	20-Sep-20	1	CO	55		2.0	1.20					0
ALE-MT08	20-Sep-20	1	CO	55		2.1	1.26					0
ALE-MT08	20-Sep-20	1	CO	60		2.9	1.34					0
ALE-MT08	20-Sep-20	1	CO	61		3.5	1.54					0
ALE-MT08	20-Sep-20	1	CO	62								0
ALE-MT08	20-Sep-20	1	CO	62		3.2	1.34					0
ALE-MT08	20-Sep-20	1	CO	65		3.6	1.31					0
ALE-MT08	20-Sep-20	1	CO	85		7.0	1.14					1
ALE-MT08	20-Sep-20	1	CO	88		8.4	1.23	SC	1	FC	1	1
ALE-MT08	20-Sep-20	1	CO		50							0
ALE-MT08	20-Sep-20	1	CO		50							0
ALE-MT08	20-Sep-20	1	CO		50							0
ALE-MT08	20-Sep-20	1	CO		50							0
ALE-MT08	20-Sep-20	1	CO		54							0
ALE-MT08	20-Sep-20	1	CO		60							0
ALE-MT08	20-Sep-20	1	CO		60							0
ALE-MT08	20-Sep-20	1	CO		65							0

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (11 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT08	20-Sep-20	1	CO		65							0
ALE-MT08	20-Sep-20	1	CO		65							0
ALE-MT08	20-Sep-20	1	CO		70							0
ALE-MT08	20-Sep-20	1	CO		80							1
ALE-MT08	20-Sep-20	1	CO		85							1
ALE-MT08	20-Sep-20	1	CO		85							1
ALE-MT08	20-Sep-20	1	CO		90							1
ALE-MT08	20-Sep-20	1	CO		100							1
ALE-MT08	20-Sep-20	2	CO	51		1.5	1.13	SC	3	FC	3	0
ALE-MT08	20-Sep-20	2	CO	90		8.6	1.18	SC	4	FC	4	1
ALE-MT08	20-Sep-20	2	CO		45							0
ALE-MT08	20-Sep-20	2	CO		50							0
ALE-MT08	20-Sep-20	2	CO		50							0
ALE-MT08	20-Sep-20	2	CO		50							0
ALE-MT08	20-Sep-20	2	CO		50							0
ALE-MT08	20-Sep-20	2	CO		50							0
ALE-MT08	20-Sep-20	2	CO		50							0
ALE-MT08	20-Sep-20	2	CO		50							0
ALE-MT08	20-Sep-20	2	CO		50							0
ALE-MT08	20-Sep-20	2	CO		50							0
ALE-MT08	20-Sep-20	2	CO		55							0
ALE-MT08	20-Sep-20	2	CO		60							0
ALE-MT08	20-Sep-20	2	CO		60							0
ALE-MT08	20-Sep-20	2	CO		70							0
ALE-MT08	20-Sep-20	2	CO		80							1
ALE-MT08	20-Sep-20	2	CO		80							1
ALE-MT08	20-Sep-20	2	CO		85							1
ALE-MT08	20-Sep-20	2	CT	75		4.10	0.972	SC	5	FC	5	1
ALE-MT08	20-Sep-20	2	CT		90							1
ALE-MT08	20-Sep-20	3	CO	79		5.50	1.116	SC	2	FC	2	1
ALE-MT08	20-Sep-20	3	CO		50							0
ALE-MT08	20-Sep-20	3	CO		55							0
ALE-MT08	20-Sep-20	3	CO		60							0
ALE-MT08	20-Sep-20	3	CO		60							0
ALE-MT08	20-Sep-20	3	CO		65							0
ALE-MT08	20-Sep-20	3	CO		70							0
ALE-MT08	20-Sep-20	3	CO		70							0
ALE-MT08	20-Sep-20	3	CO		70							0
ALE-MT08	20-Sep-20	3	CO		70							0
ALE-MT08	20-Sep-20	3	CO		70							0
ALE-MT08	20-Sep-20	3	CO		75							1
ALE-MT08	20-Sep-20	3	CO		75							1
ALE-MT08	20-Sep-20	3	CO		75							1
ALE-MT08	20-Sep-20	3	CO		75							1
ALE-MT08	20-Sep-20	3	CO		77							1
ALE-MT08	20-Sep-20	3	CO		80							1
ALE-MT08	20-Sep-20	3	CO		80							1
ALE-MT08	20-Sep-20	3	CO		85							1
ALE-MT08	20-Sep-20	3	CO		90							1
ALE-MT08	20-Sep-20	3	CO		90							1
ALE-MT08	20-Sep-20	3	CO		95							1
ALE-MT08	20-Sep-20	3	CO		95							1
ALE-MT08	20-Sep-20	3	CO		100							1
ALE-MT08	20-Sep-20	4	CO		50							0
ALE-MT08	20-Sep-20	4	CO		70							0
ALE-MT08	20-Sep-20	4	CO		75							1
ALE-MT08	20-Sep-20	4	CO		80							1
ALE-MT08	20-Sep-20	4	CO		80							1
ALE-MT08	20-Sep-20	4	CO		85							1
ALE-MT08	20-Sep-20	4	CO		85							1

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (12 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT08	20-Sep-20	4	CO		85							1
ALE-MT08	20-Sep-20	4	CO		90							1
ALE-MT08	20-Sep-20	4	CO		95							1
ALE-MT08	20-Sep-20	4	CO		95							1
ALE-MT08	20-Sep-20	4	CO		100							1
ALE-MT08	20-Sep-20	5	CO		45							0
ALE-MT08	20-Sep-20	5	CO		50							0
ALE-MT08	20-Sep-20	5	CO		50							0
ALE-MT08	20-Sep-20	5	CO		55							0
ALE-MT08	20-Sep-20	5	CO		60							0
ALE-MT08	20-Sep-20	5	CO		60							0
ALE-MT08	20-Sep-20	5	CO		60							0
ALE-MT08	20-Sep-20	5	CO		65							0
ALE-MT08	20-Sep-20	5	CO		70							0
ALE-MT08	20-Sep-20	5	CO		75							1
ALE-MT08	20-Sep-20	5	CO		78							1
ALE-MT08	20-Sep-20	5	CO		78							1
ALE-MT08	20-Sep-20	5	CO		80							1
ALE-MT08	20-Sep-20	5	CO		90							1
ALE-MT08	20-Sep-20	5	CO		90							1
ALE-MT08	20-Sep-20	5	CO		90							1
ALE-MT08	20-Sep-20	5	CO		95							1
ALE-MT08	20-Sep-20	5	CO		95							1
ALE-MT08	20-Sep-20	5	CO		100							1
ALE-MT08	20-Sep-20	5	CO		110							1
ALE-MT08	20-Sep-20	5	CT		80							1
ALE-MT09	20-Sep-20	1	CO		60							0
ALE-MT09	20-Sep-20	1	CO		70							0
ALE-MT09	20-Sep-20	1	CO		80							1
ALE-MT09	20-Sep-20	1	CO		90							1
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CO									
ALE-MT09	20-Sep-20	1	CT		100							1
ALE-MT09	20-Sep-20	1	CT		130							2
ALE-MT09	20-Sep-20	2	CO		45							0
ALE-MT09	20-Sep-20	2	CO		50							0
ALE-MT09	20-Sep-20	2	CO		50							0
ALE-MT09	20-Sep-20	2	CO		60							0
ALE-MT09	20-Sep-20	2	CO		60							0
ALE-MT09	20-Sep-20	2	CO		60							0
ALE-MT09	20-Sep-20	2	CO		65							0
ALE-MT09	20-Sep-20	2	CO		65							0

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (13 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT09	20-Sep-20	2	CO		70							0
ALE-MT09	20-Sep-20	2	CO		70							0
ALE-MT09	20-Sep-20	2	CO		75							1
ALE-MT09	20-Sep-20	2	CO		75							1
ALE-MT09	20-Sep-20	2	CO		80							1
ALE-MT09	20-Sep-20	2	CO		90							1
ALE-MT09	20-Sep-20	2	CT		50							0
ALE-MT09	20-Sep-20	2	CT		70							1
ALE-MT09	20-Sep-20	2	CT		80							1
ALE-MT09	20-Sep-20	2	CT		100							1
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	3	CO									
ALE-MT09	20-Sep-20	4	CO		50							0
ALE-MT09	20-Sep-20	4	CO		50							0
ALE-MT09	20-Sep-20	4	CO		50							0
ALE-MT09	20-Sep-20	4	CO		55							0
ALE-MT09	20-Sep-20	4	CO		55							0
ALE-MT09	20-Sep-20	4	CO		60							0
ALE-MT09	20-Sep-20	4	CO		60							0
ALE-MT09	20-Sep-20	4	CO		60							0
ALE-MT09	20-Sep-20	4	CO		65							0
ALE-MT09	20-Sep-20	4	CO		65							0
ALE-MT09	20-Sep-20	4	CO		68							0
ALE-MT09	20-Sep-20	4	CO		70							0
ALE-MT09	20-Sep-20	4	CO		75							1
ALE-MT09	20-Sep-20	4	CO		80							1
ALE-MT09	20-Sep-20	4	CO		85							1
ALE-MT09	20-Sep-20	4	CO		85							1
ALE-MT09	20-Sep-20	4	CO		90							1
ALE-MT09	20-Sep-20	4	CT		70							1
ALE-MT09	20-Sep-20	4	CT		95							1
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (14 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CO									
ALE-MT09	20-Sep-20	5	CT									
ALE-MT05	20-Sep-20	1	CO	85		6.9	1.12	SC	1	FC	1	1
ALE-MT05	20-Sep-20	1	CO		40							0
ALE-MT05	20-Sep-20	1	CO		50							0
ALE-MT05	20-Sep-20	1	CO		50							0
ALE-MT05	20-Sep-20	1	CO		60							0
ALE-MT05	20-Sep-20	1	CO		60							0
ALE-MT05	20-Sep-20	1	CO		60							0
ALE-MT05	20-Sep-20	1	CO		60							0
ALE-MT05	20-Sep-20	1	CO		65							0
ALE-MT05	20-Sep-20	1	CO		65							0
ALE-MT05	20-Sep-20	1	CO		65							0
ALE-MT05	20-Sep-20	1	CO		70							0
ALE-MT05	20-Sep-20	1	CO		70							0
ALE-MT05	20-Sep-20	1	CO		70							0
ALE-MT05	20-Sep-20	1	CO		70							0
ALE-MT05	20-Sep-20	1	CO		70							0
ALE-MT05	20-Sep-20	1	CO		73							1
ALE-MT05	20-Sep-20	1	CO		75							1
ALE-MT05	20-Sep-20	1	CO		80							1
ALE-MT05	20-Sep-20	1	CO		80							1
ALE-MT05	20-Sep-20	1	CO		80							1
ALE-MT05	20-Sep-20	1	CO		80							1
ALE-MT05	20-Sep-20	1	CO		80							1
ALE-MT05	20-Sep-20	1	CO		85							1
ALE-MT05	20-Sep-20	1	CO		85							1
ALE-MT05	20-Sep-20	1	CO		85							1
ALE-MT05	20-Sep-20	1	CO		85							1
ALE-MT05	20-Sep-20	1	CO		85							1
ALE-MT05	20-Sep-20	1	CO		85							1
ALE-MT05	20-Sep-20	1	CO		90							1
ALE-MT05	20-Sep-20	1	CO		90							1
ALE-MT05	20-Sep-20	1	CO		90							1
ALE-MT05	20-Sep-20	1	CO		90							1
ALE-MT05	20-Sep-20	1	CO		90							1
ALE-MT05	20-Sep-20	1	CO		90							1
ALE-MT05	20-Sep-20	1	CO		90							1
ALE-MT05	20-Sep-20	1	CO		90							1
ALE-MT05	20-Sep-20	1	CO		95							1
ALE-MT05	20-Sep-20	1	CO		95							1
ALE-MT05	20-Sep-20	1	CO		95							1
ALE-MT05	20-Sep-20	1	CO		95							1
ALE-MT05	20-Sep-20	1	CO		95							1

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (15 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT05	20-Sep-20	1	CO		95							1
ALE-MT05	20-Sep-20	1	CO		95							1
ALE-MT05	20-Sep-20	1	CO		100							1
ALE-MT05	20-Sep-20	1	CO		100							1
ALE-MT05	20-Sep-20	1	CO		100							1
ALE-MT05	20-Sep-20	2	CO	51		1.40	1.055	SC	3	FC	3	0
ALE-MT05	20-Sep-20	2	CO		50							0
ALE-MT05	20-Sep-20	2	CO		50							0
ALE-MT05	20-Sep-20	2	CO		60							0
ALE-MT05	20-Sep-20	2	CO		65							0
ALE-MT05	20-Sep-20	2	CO		65							0
ALE-MT05	20-Sep-20	2	CO		65							0
ALE-MT05	20-Sep-20	2	CO		70							0
ALE-MT05	20-Sep-20	2	CO		80							1
ALE-MT05	20-Sep-20	2	CO		85							1
ALE-MT05	20-Sep-20	2	CO		90							1
ALE-MT05	20-Sep-20	2	CO		90							1
ALE-MT05	20-Sep-20	2	CO		95							1
ALE-MT05	20-Sep-20	2	CO		100							1
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									

[1] CO = Coho Salmon, CT = Cutthroat Trout, BT = Bull Trout, NFC = No Fish Captured.

Table 2. Continued (16 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	2	CO									
ALE-MT05	20-Sep-20	3	CO									
ALE-MT05	20-Sep-20	3	CO									
ALE-MT05	20-Sep-20	3	CO									
ALE-MT05	20-Sep-20	3	CO									
ALE-MT05	20-Sep-20	3	CO									
ALE-MT05	20-Sep-20	3	CT									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									

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Table 2. Continued (17 of 17).

Site	Date	Trap #	Species[1]	Measured Fork Length (mm)	Estimated Fork Length (mm)	Weight (g)	K	Age Sample Type	Age Sample Number	DNA Sample Type	DNA Sample Numer	Age Assigned
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	4	CO									
ALE-MT05	20-Sep-20	5	CO	105		11.50	0.993	SC	2	FC	2	1
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									
ALE-MT05	20-Sep-20	5	CO									

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