# Alena Creek Fish Habitat Enhancement Project

## Year 2 Monitoring Report

Prepared for:

**Upper Lillooet River Power Limited Partnership**
**200 – 666 Burrard Street**
**Vancouver, BC, V6C 2X8**

April 25, 2019

Prepared by:

**Ecofish Research Ltd.**

ECOFISH RESEARCH

Published by Ecofish Research Ltd., Suite F, 450 8th St., Courtenay, B.C., V9N 1N5

For inquiries contact: Technical Lead documentcontrol@ecofishresearch.com 250-334-3042

**Citation:**

Harwood, A., S. Sharron, T. Hicks, S. Faulkner, T. Jensma, K. Ganshorn, A. Newbury, and D. Lacroix. 2019. Alena Creek Fish Habitat Enhancement Project: Year 2 Monitoring Report. Consultant's report prepared for Upper Lillooet River Power Limited Partnership by Ecofish Research Ltd., April 25, 2019.

**Certification:** *stamped version on file.*

**Senior Reviewers:**

Sean Faulkner, M.Sc., R.P.Bio. No. 2242

Fisheries Scientist/Project Manager

Kevin Ganshorn, M.Sc., R.P.Bio. No. 2448

Biologist/Project Manager

Deborah Lacroix, M.Sc., R.P. Bio. No. 2089

Wildlife Biologist/Project Manager

**Technical Leads:**

Andrew Harwood, Ph.D., R.P.Bio. No. 1652

Fisheries Scientist/Project Manager

Deborah Lacroix, M.Sc., R.P. Bio. No. 2089

Wildlife Biologist/Project Manager

**Disclaimer:**

This report was prepared by Ecofish Research Ltd. for the account of Upper Lillooet River Power Limited Partnership. The material in it reflects the best judgement of Ecofish Research Ltd. in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. Ecofish Research Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions, based on this report. This numbered report is a controlled document. Any reproductions of this report are uncontrolled and may not be the most recent revision.

# EXECUTIVE SUMMARY

Ecofish Research Limited (Ecofish) was retained by the Upper Lillooet River Power Limited Partnership (ULRPLP) to conduct monitoring for the fish habitat enhancement constructed on Alena Creek (also known as Leanna Creek). The Fish Habitat Enhancement Project (FHEP) was designed to offset the footprint and operational habitat losses incurred by the Upper Lillooet Hydro Project (ULHP, the Project). Alena Creek is a tributary to the Upper Lillooet River located approximately 4.1 km downstream of Boulder Creek confluence with the Upper Lillooet River.

Historical fish and fish habitat data from Alena Creek and long-term monitoring requirements for the enhancement habitat were originally described in the Alena Creek Long-Term Monitoring Program (LTMP) (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). Results of Year 1 and 2 of Alena Creek baseline monitoring are documented in Harwood et al. (2016). Results of Year 1 (2017) of post-construction monitoring are presented in Harwood et al. (2019). The purpose of this report is to provide results of Year 2 (2018) of the long-term monitoring program to evaluate the effectiveness of the FHEP as per the Fisheries Act Authorization issued for the ULHP.

*Hydrology*

Post-construction monitoring of water levels in Alena Creek was conducted at the Lillooet River Forest Service Road (FSR) crossing at the downstream end of the Fish Habitat Enhancement Project (FHEP). Seasonal trends in the Alena Creek hydrograph in 2018 are consistent with that of a coastal, snow dominated watershed. Stage remained relatively low throughout the winter (January to mid-March) when precipitation was snow dominated, and increased through March and April during snow melt. The stage then decreases at late-summer and early fall (mid-July to the end of September) when precipitation was minimal. This is consistent with observations at the baseline monitoring.

The daily peak in stage during the 2018 monitoring period was recorded on April 27, 2018 (0.44 m), which corresponded with spring snowmelt. This is similar to baseline monitoring when daily peak stage was measured in May 2014. However, it is unknown if a larger peak may have occurred later because an equipment malfunction resulted in data gap from May 3 to August 23, 2018. Overall mean daily stage in 2018 was 0.23 ± 0.07 m, and did not drop below 0.16 m, which was consistent with Year 1 post-construction monitoring from November 2016 to September 2017.

Based on recommendations from the Year 1 Monitoring Report (Harwood *et al.*, 2018), a second gauge (R1) was installed on August 23, 2018 approximately 125 m upstream of the gauge at the FSR bridge to assess any influence of backwatering effects that may be caused by the Upper Lillooet River side channel during high flows. However, these effects could not be accurately assessed in this monitoring period because stage data was only collected during low flow conditions when backwatering was not evident and diurnal fluctuations were minimal. We recommend continued stage monitoring at both the FSR bridge and the upstream R1 gauge.

*Water Temperature*

The objective of water temperature monitoring is to ensure that conditions within the enhancement habitat support functional use for spawning, incubation, and rearing by the fish species in Alena Creek. To achieve this, water temperature will be monitored continuously for the first five years post-construction and compared to the pre-construction data using a BACI design.

Water temperature data were collected at the two water quality sites: ALE-USWQ1 located immediately upstream of the instream works, and ALE-BDGWQ located at the downstream end of the works. Pre-construction monitoring occurred from April 2013 to December 2014 and post-construction monitoring to date has occurred from November 23, 2016 to present (data up to January 1, 2019 are included in this report). No significant water temperature data gaps were observed during post-construction monitoring.

Analysis of the data included computing 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, >20°C, and <1°C), the length of the growing season, exceedance of Bull Trout temperature thresholds, and mean weekly maximum temperature (MWMxT). These metrics are compared to water temperature BC WQG (Oliver and Fidler 2001, MOE 2018) to assess suitability of the water temperature for aquatic life and specifically, Coho Salmon, Cutthroat Trout, and Bull Trout.

Alena Creek is classified as a cool stream based on there being no days with mean daily water temperatures >18°C in either pre- or post-construction conditions at both sites, and only a few days at the downstream site when the mean daily temperature was <1°C. Despite the short distance (~1 km) and small elevation (11 m) difference 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. The water temperature at the upstream site is moderated by groundwater inflow and there is a tributary that enters Alena Creek between the two sites which may account for some of the cooler temperature downstream in the winter and warmer temperature downstream in the summer.

Overall, considering inter-annual variably in temperature, no substantial change in monthly temperature statistics has been observed in Year 2 in comparison to Year 1 and pre-construction data. 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. No pre-construction data are available for the upstream site from mid-January to mid-March, therefore the monthly minimum of 5.0°C measured in December 2014 may not be representative of 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 2.5°C to 11.1°C post-construction. Minimum monthly temperatures in each year occurred in December or February.

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 Cutthroat Trout incubation 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 across the stated periodicity for this species. Fewer cool temperature exceedances of the BC WQG occurred upstream during the winter months and overall fewer exceedances of the warm temperature BC WQG in the summer months. Warm surface waters at the upstream site, during incubation stages may be partially mitigated by the groundwater upwelling, such that temperature within the redds may be lower than that measured at the temperature logger.

Results to date indicate that the enhancement habitat 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.

Overall, no substantial differences were observed in the pre- and post-construction temperature regimes. We recommend that the monitoring program continue for 5 years post-construction based on the methodologies and schedule prescribed in the Project OEMP (Harwood *et al.* 2017). It is recommended that post-construction water temperature data from the water level sensor at the upstream site be obtained should it exist in order to provide additional QA for the single Tidbit sensor present at this site. It is recommended that a second Tidbit be installed at this site for data redundancy as fully submerged Tidbits are less susceptible to icing issues compared to water level sensors that are housed in standpipes that are exposed to the atmosphere.

*Fish Habitat*

**Stability Assessment**

A stability assessment was conducted to monitor the structural integrity and functionality of each of the enhancement habitat features and ensure that any remedial action required to maintain the effectiveness of habitat features is taken in a timely manner. To assist in the stability assessments, photo-points were established during the as-built survey in 2016 at a total of eight survey transects. At each of the transects a panorama of photographs was taken to facilitate an evaluation of changes in habitat conditions over time. Qualitative observations were also made along the entire FHEP enhanced reaches.

There appears to be the potential for channel migration in the upper reach as a result of previous beaver dam activity, which will be assessed by a QP in 2019, with repairs completed as recommended during the August 2019 instream work window. There were no immediate stability issues observed in the downstream enhanced reach. Generally, the on-site assessments and photo-point assessments show a healthy watercourse with stable complex fish habitat. Beaver activity impacts on the enhancement reaches will continue to be monitored in 2019.

*Fish Community*

Fish community in Alena Creek was assessed by bank walk spawner surveys focusing on Coho Salmon, the dominant species within Alena Creek, completed over three surveys between November and December in 2018. The peak count of adult spawning Coho Salmon was 130 in 2018, which was slightly higher than the baseline years (127 and 111), less than 2016 (192) but similar to 2017 (132). A comparison of the results across years highlights the variability in run timing between years, with the peak live count recorded on November 14 in 2016, December 5 in 2017, and November 5 in 2010 and 2018. Although surveys are not conducted at a frequency to allow total spawner abundance to be compared among years (i.e., peak counts may be influenced by survey timing and spawner residence time and predation), the counts provide an indication of use and demonstrate that Alena Creek supports equivalent or greater use by Coho Salmon spawners relative to pre-enhancement.

Minnow trapping surveys were conducted at eight sites in Alena Creek on September 24, 2018. The objective of minnow trapping was to measure catch-per-unit-effort (CPUE) by species and life history stage to continue monitoring juvenile fish abundance and compare to CPUE prior to enhancement. Of the eight sites, five are in the enhanced reaches of Alena Creek, including three new sites. All fish captured by minnow trapping were identified to species, enumerated, measured with scale samples collected for aging. Biological data from Cutthroat Trout and Coho Salmon were analyzed to define the age structure, size structure, length-weight relationship, length at age, and condition factor by species.

In 2018, 13 Cutthroat Trout were captured representing an increase compared to 2017, but similar to 2013 and 2014. The average Cutthroat Trout CPUE was 1.4 fish per 100 trap hours (S.D. = 0.9 fish per hundred trap hours). In all sampling years, the most abundant age class of Cutthroat Trout captured was 1+, with a general lack of fry. The lack of Cutthroat Trout fry captured during sampling is likely a result of the timing of emergence and the small size of fry in late September / early October when sampling occurs.

In 2018, 850 Coho Salmon were captured, representing a large increase from 2017 but similar to 2013 and 2014. The average CPUE across all sites was 74.5 fish per 100 trap hours, the highest of all years. The majority of Coho Salmon captured in all years are 0+; however, 1+ have also been detected in Alena Creek each year. The relatively high captures in the newly established site in the enhanced reach supports the notion that the enhanced reach is high quality habitat for both juvenile Cutthroat trout and Coho Salmon.

# TABLE OF CONTENTS

## LIST OF FIGURES

## LIST OF TABLES

## LIST OF MAPS



## LIST OF APPENDICES

# 1. INTRODUCTION

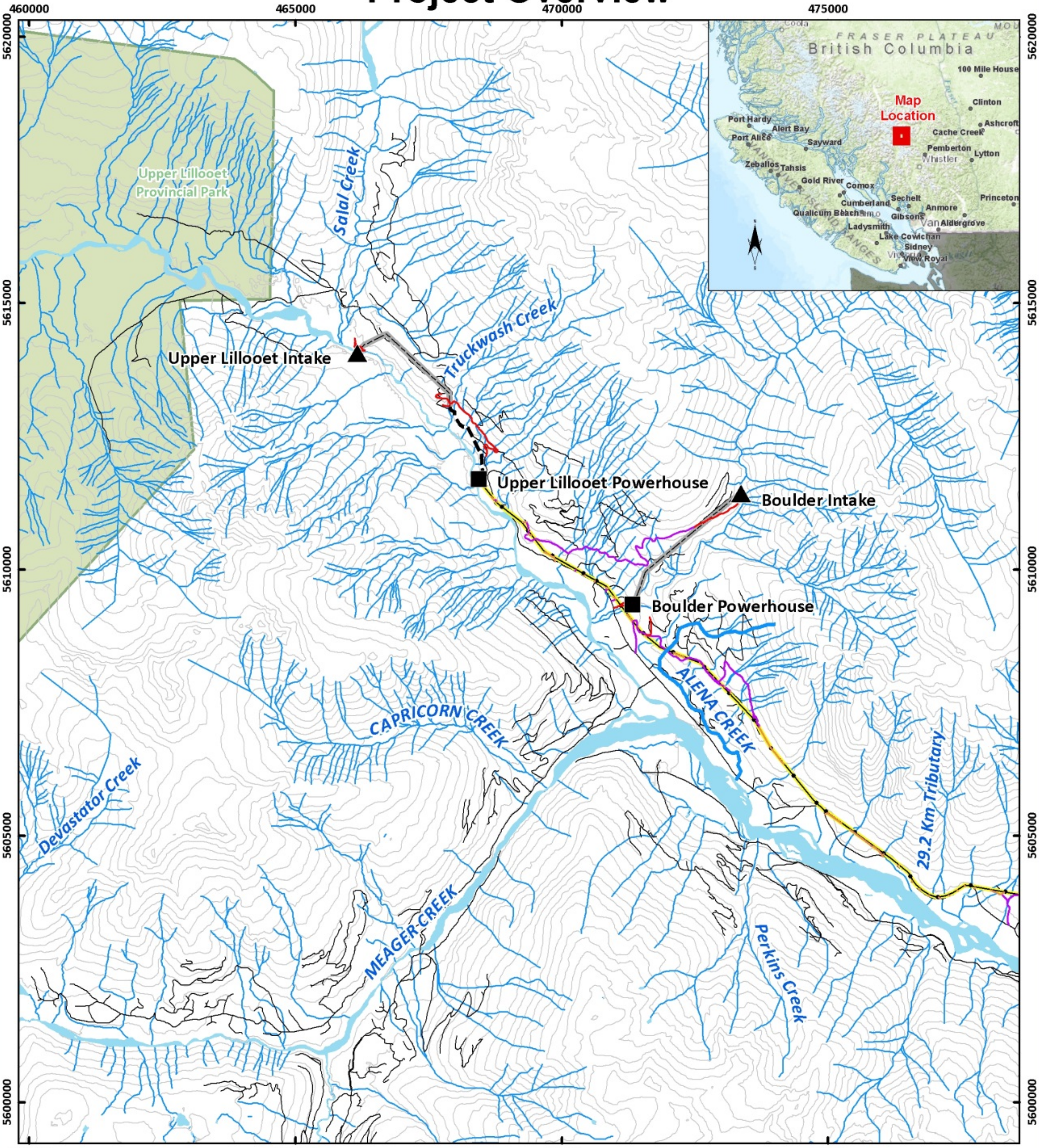
Ecofish Research Limited (Ecofish) was retained by the Upper Lillooet River Power Limited Partnership (ULRPLP) to conduct monitoring for the fish habitat enhancement constructed on Alena Creek (also known as Leanna Creek). The Fish Habitat Enhancement Project (FHEP) was designed by Hemmera Envirochem Inc. (Hemmera 2015) and Ecofish (Appendix A) to offset the footprint and operational habitat losses incurred by the Upper Lillooet Hydro Project (ULHP, the Project), which 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 Boulder Creek confluence 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. There were no offset requirements associated with construction and operation of the Boulder Creek HEF or impacts to riparian habitat under the amended Authorization.

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); a natural, catastrophic event that occurred on August 6, 2010 and deposited a large amount of woody debris and thick heavy sediment in and around Alena Creek. In addition to heavily impacting aquatic habitat, the slide affected riparian habitat either by uprooting trees or by smothering root systems with heavy sediment. The FHEP constructed in the summer of 2016, created a new section of channel and enhanced both the aquatic and riparian habitat of Alena Creek and will therefore benefit Coho Salmon (*Oncorhynchus kisutch*), Cutthroat Trout (*Oncorhynchus 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 design features constructed 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 enhancement habitat were originally described in the Alena Creek Long-Term Monitoring Program (LTMP) (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). Results of Years 1 and 2 of Alena Creek pre-construction monitoring are documented in Harwood *et al.* (2016). Results of Year 1 (2017) of post-construction monitoring are presented in Harwood *et al.* (2019). The purpose of this report is to provide results of Year 2 (2018) of the long-term monitoring program to evaluate the effectiveness of the FHEP as per the *Fisheries Act* Authorization issued for the ULHP.

# 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. 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). The hydrological monitoring program in Alena Creek was undertaken by Knight Piésold Ltd (KPL).

## 2.2. Water Quality

The purpose of the long-term monitoring of water chemistry is to ensure the maintenance of suitable water quality for the protection of aquatic life, and monitor any improvements in water quality resulting from the construction of the habitat compensation features. Concerns were raised by DFO over potentially elevated concentrations of metals, particularly iron and arsenic, thus these parameters were included in pre-construction monitoring and the Year 1 of the LTMP (Harwood *et al.* 2013, Harwood *et al.* 2018). Water chemistry data were collected at two sites; a control site (ALE-USWQ/ALE-USWQ1), upstream of the enhancement habitat, and at a second site (ALE-BDGWQ) located at the downstream end. The OEMP for the Upper Lillooet Hydro Project (Harwood *et al.* 2017) specified quarterly sampling for the first year followed by biannual sampling of a reduced list of parameters in subsequent years and evaluation of the suitability of the sampling program by the QP.

Pre-construction water chemistry data were collected quarterly for general water quality parameters, nutrients and anions, dissolved oxygen, total metals and dissolved metals in 2013 and 2014. Pre-construction water quality data met the applicable BC Water Quality Guidelines (BC WQG) for the protection of aquatic life (MOE 2018) for all parameters with the exception of dissolved oxygen (applicable to buried life stages only), total iron (T-Fe) and dissolved iron (D-Fe), which exceeded the BC WQG at both the upstream control site and the downstream bridge site during pre-construction sampling (Harwood *et al.* 2016). Dissolved arsenic was below the applicable BC WQG during pre-construction sampling and post-construction monitoring.

As presented in the Alena Creek Year 1 monitoring report (Harwood *et al.* 2019), water quality in Alena Creek has generally improved since pre-construction sampling began in 2013 (Harwood *et al.* 2013, Harwood *et al.* 2018). In Year 1 (2016 and 2017) following completion of the habitat enhancement on Alena Creek, no exceedances of the minimum BC WQG for dissolved oxygen were observed at the site in the enhancement habitat (ALE-BDGWQ), with data indicating a well aerated condition (dissolved oxygen concentrations ranging from 10.38 mg/L to 10.81 mg/L).

Concentrations of dissolved iron exceeded the short-term maximum BC WQG of 0.35 mg/L at the site in the enhancement habitat during all sampling periods, with the range of concentrations similar between pre-construction and Year 1 monitoring. Total iron exceeded the short-term maximum BC WQG of 1 mg/L at one or both sites on all sampling dates during pre-construction sampling. However, only one exceedance occurred during Year 1 sampling at the site in the enhancement habitat, and concentrations at this site in Year 1 sampling were on average lower than observed during pre-construction sampling.

Considering these observations and that instream habitat enhancement is not expected to result in adverse effects on water quality, it was recommended in the Alena Creek Fish Habitat Enhancement Project Year 1 Monitoring Report that water quality monitoring on Alena Creek be ceased (Harwood *et al*. 2018). Accordingly, water quality sampling was not conducted in Year 2 of monitoring.

## 2.3. 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 between species and life-history stages and dependent on existing conditions. The objective of water temperature monitoring is to ensure that conditions within the enhancement habitat support functional use for spawning, incubation, and rearing by the fish species present. Collection of continuous water temperature data will allow for a comparison of pre- and post-construction temperature data to track changes within the compensation habitat over time. Water temperature may be influenced by the instream enhancement features and/or maturation of the riparian habitat restoration.

The OEMP for the Upper Lillooet Hydro Project (Harwood *et al*. 2017) calls for five years of water temperature monitoring. A revised version of the OEMP (Harwood *et al*. 2018) was presented to MFLNRORD in February 2018 which included the recommendation to hold off reporting on water temperature results after Year 1 if no issues were identified, with final results reported following Year 5. This report provides a summary of Year 2 post-construction water temperature results, and evaluation of the need for additional annual reporting of the water temperature component.

## 2.4. Fish Habitat

### 2.4.1. Stability Assessment

A stability assessment was conducted to annually monitor the structural integrity and functionality of each of the enhancement habitat features and ensure that any remedial action required to maintain the effectiveness of habitat features is taken in a timely manner.

## 2.5. Fish Community

The goal of enhancing Alena Creek aquatic and riparian habitat was to provide spawning and rearing habitat for Coho Salmon and Cutthroat Trout and support equivalent or greater fish usage relative to pre-project densities in Alena Creek. Fish habitat use in Alena Creek was assessed by comparing adult Coho Salmon spawner abundance and juvenile Cutthroat Trout and Coho Salmon abundance under baseline and post-enhancement conditions. The adults were sampled by spawning bank walks during the Coho Salmon spawning season, early November to early December. The juveniles were sampled by minnow trap at eight sites in Alena Creek. The catch per unit effort (CPUE) for minnow trapping can be compared among years to assess the fish community health over time.

# 3. METHODS

## 3.1. Hydrology

KPL began monitoring water level 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 3). For post-construction monitoring, water level data were collected at the Alena Bridge site in 2016, 2017 and 2018. A second gauge (R1) was installed based on recommendation by Harwood *et al.* (2018) on August 23, 2018 at approximately 125 m upstream from the Alena Bridge gauge. The purpose of the second gauge 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 are representative of Alena Creek water levels.

## 3.2. Water Temperature

### 3.2.1. Study Design

The objective of water temperature monitoring is to ensure that conditions within the enhancement habitat support functional use for spawning, incubation, and rearing by the fish species in Alena Creek. To achieve this, water temperature will be monitored continuously for the first five years of post-construction and compared to the pre-construction data using a BACI design.

Water temperature data were collected at the two water temperature sites: ALE-USWQ1, located immediately upstream of the enhancement works, and ALE-BDGWQ, located at the downstream end of the works (Table 1, Appendix B, Map 3). Pre-construction monitoring occurred from April 17, 2013 to December 31, 2014 at the upstream site and from August 27, 2013 to December 31, 2014 at the downstream site. Post-construction monitoring to date commenced at both sites on November 23, 2016. Data were available up to January 30, 2019 for the upstream site and to November 1, 2018 for the downstream site.

**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 2018).**

| Type | Site | UTM Coordinates (10U) | | Elevation (masl)[1] | Project Phase[2] | Periods of Record | | No. of Datapoints | Logging Interval (min.) | No. of Days with Valid Data | Data Gaps in Record (%)[3] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Easting | Northing | | | Start Date | End Date | | | | |
| Upstream | ALE-USWQ1 | 472,976 | 5,606,870 | 391 | Pre-construction | 17-Apr-13 | 31-Dec-14 | 13,627 | 60 | 568 | 8.9 |
| | | | | | Post-construction | 23-Nov-16 | 30-Jan-19 | 76,624 | 15 | 799 | 0 |
| Downstream | ALE-BDGWQ | 473,336 | 5,606,095 | 382 | Pre-construction | 27-Aug-13 | 31-Dec-14 | 11,049 | 60 | 460 | 6.3 |
| | | | | | Post-construction | 23-Nov-16 | 1-Nov-18 | 67,984 | 15 | 709 | 0 |

[1] Estimated from Google Earth.

[2] Pre-construction (2013-2014) water temperature was monitored via hydrometric gauges maintained by KPL.

[3] The pre-construction data gap at the upstream site occurred between mid January and mid March 2014 due to icing concerns, therefore a complete month of data (i.e., more than three weeks) for February is not available during this phase.

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.

### 3.2.2. Fish Species Distribution

The fish community in Alena Creek consists of Coho Salmon, Cutthroat Trout and Bull Trout. (Table 2, Table 3). The BC WQG for water temperature specify optimum temperature ranges for rearing, spawning, incubation, and migration as applicable for these fish species (Table 2). The timing of life history stages in Alena Creek (Harwood *et al.* 2016) is used to define the start and end dates for each of the applicable life stages for Coho Salmon, Cutthroat Trout, and Bull Trout (Table 3).

**Table 2. Optimum water temperature ranges for Coho Salmon, Cutthroat Trout, and Bull Trout life history stages (MOE 2018).**

| Species | Optimum Water Temperature (°C) Range (MOE 2018)[1] | | | |
|---|---|---|---|---|
| | Incubation | Rearing | Migration | Spawning |
| Coho Salmon | 4.0-13.0 | 9.0-16.0 | 7.2-15.6 | 4.4-12.8 |
| Cutthroat Trout | 9.0-12.0 | 7.0-16.0 | — | 9.0-12.0 |
| Bull Trout | 2.0-6.0 | 6.0-14.0 | — | 5.0-9.0 |

[1] Optimal temperature ranges for water quality guideline application are provided in the BC WQG for the protection of aquatic life (MOE 2018). The water quality guideline range is ± 1 °C change beyond optimum temperature range for each life history phase of the most sensitive salmonid species present.

**Table 3. Fish species periodicity.**

| 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) | - | - |

### 3.2.3. Quality Assurance / Quality Control

Pre-construction temperature data were recorded at 60-minute intervals using hydrometric gauges. The temperature sensors that were incorporated into the gauges had a temperature accuracy of ±0.3°C, a resolution of ±0.001°C, and were installed in aluminum standpipes. 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 single Tidbit logger was installed at ALE-USWQ1.

Temperature data were carefully inspected and QA'd to ensure that any suspect or unreliable data were excluded from data analysis and presentation. Excluded data included instances where the water temperature sensor was suspected of being out-of-water/dry, affected by snow/ice or buried in sediment.

During the pre-construction period of monitoring, there are gaps in the datasets from January 18 to March 12, 2014 at ALE-USWQ1, and from the end of March through early April 2014 at ALE-BDGWQ (Table 1). Considering that the data from January 18 to March 12, 2014 at the upstream site were excluded from the analysis due to the suspected build-up of ice (McCarthy, pers. comm. 2014), winter minimum temperatures were likely not captured at this site during pre-construction monitoring.

There were sufficient data to calculate February statistics at the downstream location and pre-construction winter minimum temperatures were recorded, however pre-construction data for March are missing at this site.

#### 3.2.4. Data Analysis and Collection

Processing of water and air 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.

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 were presented in plots that were generated from temperature data collected at, or interpolated to, 15 minute intervals. Analysis of the data involved computing the following summary statistics for data collected at, or interpolated to, intervals of 15 minutes: 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, and the accumulated thermal units in the growing season (i.e., degree days), hourly rates of temperature change, and mean weekly maximum temperature (MWMxT). Table 4 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 4) was modified from 4°C (as per Coleman and Fausch 2007) to 5°C, because the mean weekly maximum water temperatures at the upstream site were >4°C in the winter data set for the first year of pre-construction monitoring (due to a data gap caused by ice conditions).

#### 3.2.4.1. Applicable Guidelines

Water temperature BC WQG for the protection of aquatic life (as per Oliver and Fidler 2001, MOE 2018) are discussed below.

*Hourly Rates of Water Temperature Change*

Large, rapid changes in water temperature (greater than ±1.0°C/hr) can affect fish growth and survival (Oliver and Fidler 2001). 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 (MOE 2018).

*Daily Temperature Extremes*

Extreme cold or warm temperatures are monitored as part of the water temperature component. The number of days when the daily mean temperature was <1°C was calculated, along with the number of days when the daily mean temperature >18°C and >20°C. 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 2)

*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 water temperature 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 2018). Accordingly, MWMxT values were compared to the optimum temperature ranges or the fish species present based on the life history and periodicity (Table 2, Table 3).

Within each life history period, the completeness of the temperature data record (% complete) is calculated and results are only included if at least 50% of the data for the period is available. The minimum and maximum MWMxT values, exceedance of the upper and lower bounds of the optimal temperature range and exceedance of the ±1.0°C of the optimal temperature range is calculated 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 2018) 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 incubation temperature is 10°C;

- minimum incubation temperature is 2°C; and
- maximum spawning temperature is 10°C.

The number of days where these thresholds are exceeded are calculated using the appropriate daily maximum or minimum temperature values for each site where Bull Trout are present (Table 4).

**Table 4. 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 | 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;<br># days maximum incubation temperature is >10°C;<br># days minimum incubation temperature is <2°C; and<br># 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. |

* See text in Section 3.2.3 discussing modification to the temperature criteria that defines the end of growing season.

## 3.3. Fish Habitat

### 3.3.1. Stability Assessment

Reach 1 and 3 of Alena Creek were enhanced as a part of the FHEP. To assess the stability in the enhanced reaches, photos were taken at photo-points established during the as-built survey (completed immediately following the construction in 2016). A total of eight transects were surveyed at that time. At each transect a panorama of photographs were taken to facilitate an evaluation of changes in habitat conditions over time. Photographs were taken looking downstream, upstream, from river left (RL) to river right (RR), and from river right to river left. The photograph 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 line to aid with analysis of the topographic transect surveys. Photos were used for a visual comparison.

## 3.4. Fish Community

### 3.4.1. Adult Spawner Abundance

Coho Salmon (*Oncorhynchus kisutch*), Bull Trout (*Salvelinus confluentus*) and Cutthroat Trout (*O. clarkii*) were captured in Alena Creek during the monitoring studies. However, spawner surveys in Alena Creek focused on Coho Salmon, the dominant species within Alena Creek. Spawner surveys consisted of bank walks conducted every two weeks between November 5 and December 5, 2018 (a total of three surveys). Consistent with previous years, bank walks to count both live fish and carcasses 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 FSR crossing (~36.5km). Due to the meandering nature of the Upper Lillooet River, the downstream confluence with Alena Creek has varied over the survey years by up to ~1km. It is important to note that the carcasses counted in Alena Creek, are quickly consumed by wildlife in the area, as evidenced by the fact that they are not often whole and show signs of being eaten by wildlife. Often only the pyloric caeca, which animals prefer not to eat, is left behind. Carcasses are therefore easily distinguishable and double counting during the surveys is not a concern.

### 3.4.2. Juvenile Abundance

#### 3.4.2.1. Minnow Trapping

Minnow trapping surveys were conducted in Alena Creek commencing on September 24, 2018. The objective of minnow trapping was to monitor the relative abundance by using catch-per-unit-effort (CPUE) by species and life stage so that the relative juvenile abundance could be tracked and compared between years.

A total of eight sites were selected in 2018, compared to six in previous years. Four to 10 traps were installed at each site. At ALE-MT06 site, 10 traps were set because it was a large pool that required a higher level of sampling effort. Sampling was conducted in five of the 6 sites sampled in previous years (ALE-MT01, ALE-MT02, ALE-MT03, ALE-MT05 and ALE-MT06); however, due to beaver activity in previous years sampling at ALE-MT04 was discontinued in 2018 as recommended in the Year 1 report (Harwood *et al.* 2019). Additionally, a total of three new sites were established in 2018 in enhanced habitat, specifically one site in Reach 1 (ALE-MT07) and two sites in Reach 3 (ALE-MT08 and ALE-09; Map 4). 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 enhancement 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.

##### 3.4.2.2. Biological Information

All captured fish were enumerated and identified to species using standard field keys. The fork length of each captured fish was determined using a measuring board (±1.0 mm); after which each fish was weighed using a field scale (±0.1 g). Aging samples were taken from a sub-sample of captured fish and these were aged at the Ecofish laboratory in Squamish.

Scale samples collected in the field were examined under a dissecting microscope for aging purposes: three representative scales were 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.

##### 3.4.2.3. 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 classes were defined for fry (0+), parr (1+), parr (2+) and adult (3+). These discrete classes allowed all fish to be assigned an age class based on fork length. Based on a review of the aging data and length-frequency histograms, discrete fork length ranges were defined for each age class.

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, in this instance, the condition of fish was calculated separately for each age classes so violations of this assumption were not expected. The condition of fish was consequently 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 grams, *L* is the length in millimeters, 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.

## 4. RESULTS

### 4.1. Hydrology

Seasonal trends in the Alena Creek hydrograph in 2018 were consistent with a coastal, snow dominated watershed. Seasonal hydrograph patterns remained broadly consistent with observations from baseline and Year 1 post-construction monitoring. Stage readings in 2018 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 23 to October) when precipitation was minimal (Figure 1).

The daily peak in stage during 2018 was recorded on April 27, 2018 (0.44 m) corresponding with the rising hydrograph limb during spring snowmelt. This was below the largest peak recorded on November 9, 2016 (0.95 m) during a 1-in-20 year probability flood event on the Upper Lillooet River (McCoy, pers. comm. 2016), but consistent with peak values recorded during baseline monitoring (Figure 1). Several higher stage values were also recorded in 2017 between mid-May to early-July (Figure 1), however a malfunction with the logger's vent tube resulted in missing data from May 3 to August 23, 2018. As a result, it is unknown if a larger peak event may have occurred during this time. Overall mean daily stage at the FSR bridge measured in January to May and August-October of 2018 was 0.23 ± 0.07 m, and did not drop below 0.16 m consistent with previous monitoring from November 2016 to September 2017. However, these results are likely skewed by missing data and the continued effect of backwatering caused by the Upper Lillooet River side channel.

High stage readings at the FSR Bridge site on Alena Creek in June and July of 2017 were suggested to be a possible result of backwatering caused by a new side channel of the Upper Lillooet River just downstream of the hydrometric gauge because there was little precipitation during this period (Harwood *et al.*, 2018). The new side channel was formed during the peak flow event in November 2016. Evidence that backwatering caused exaggerated stage readings at the bridge on Alena Creek during high flows in the Upper Lillooet River can be seen in Figure 2, which shows the Alena Creek stage readings responding to the diurnal fluctuation in stage experienced by the Upper Lillooet River during snow melt in summer. A second gauge (R1) installed on August 23, 2018 approximately 125 m upstream of the Alena Bridge gauge for comparison to assess the backwater effects, but was not effective in the 2018 monitoring period because data were only collected during later summer/early fall low flow conditions when backwatering was not evident and diurnal fluctuations were minimal. Water level readings at the upstream R1 site location were referenced to a different datum than those at the bridge, so a stage adjustment value was calculated using the initial difference in stage between the two points measured on August 23, 2018 to directly compare the two time series. After the adjustment, data show that stage reading at each gauge are highly similar, although appear to fluctuate more greatly at the Bridge (Figure 1). Continued monitoring at both gauges during seasonal high flow periods is necessary to evaluate the degree to which stage at the FSR bridge site is affected by from backwatering from the Upper Lillooet River side channel.

**Figure 1. Stage in Alena Creek at the Lillooet River FSR bridge during baseline (Apr 2013 to Nov 2014), and Year 1 and Year 2 of post-construction monitoring (Nov 2016 to Oct 2018).**

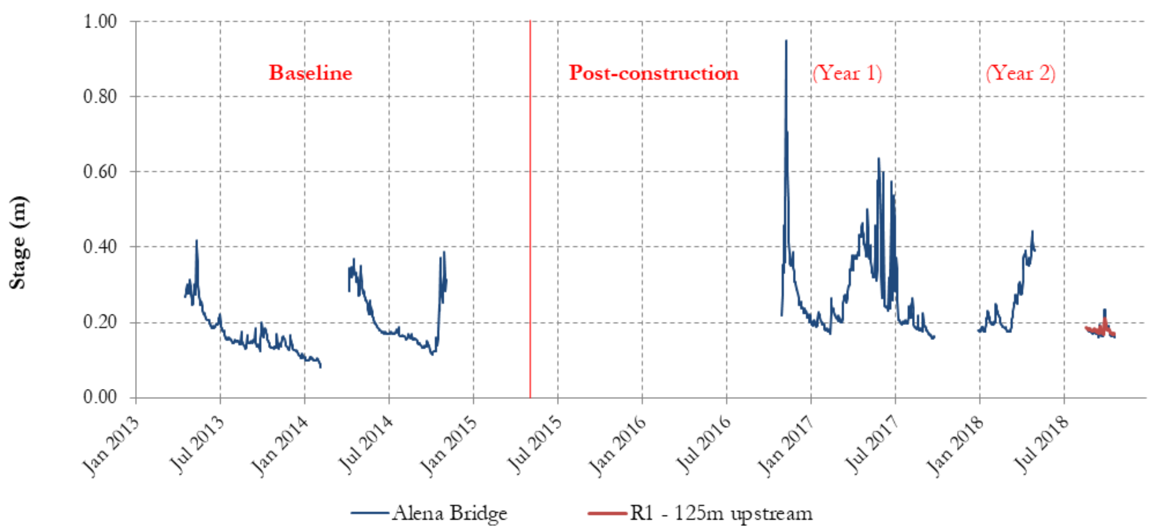
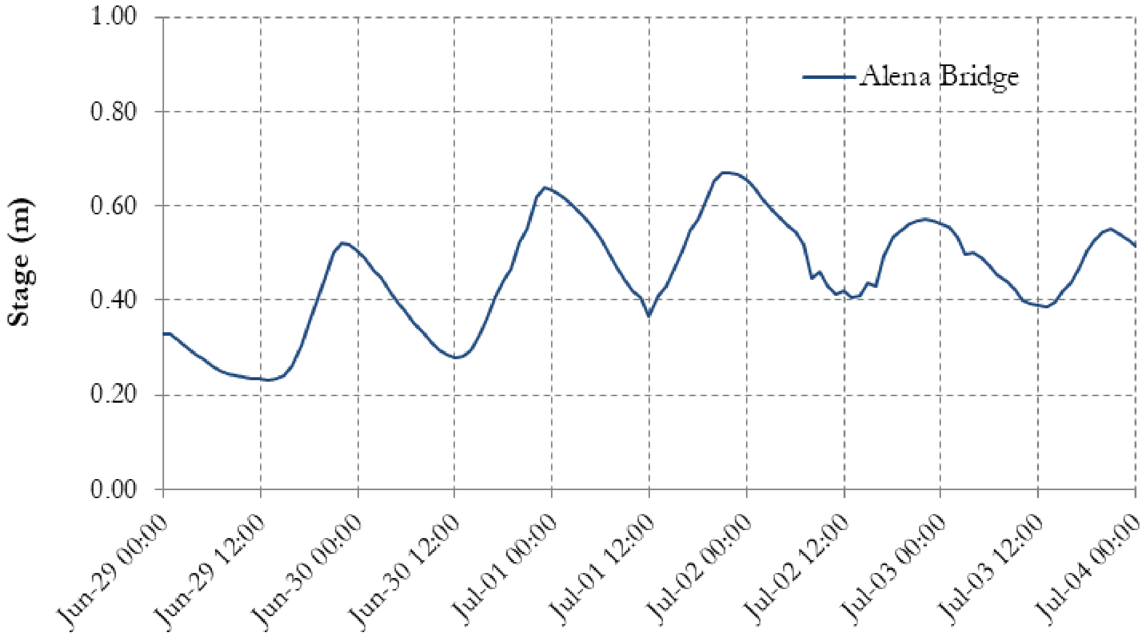


**Figure 2. Stage in Alena Creek at the Lillooet River FSR bridge in late June and early July 2017 showing the diurnal fluctuation experienced by the Upper Lillooet River during snow melt in summer.**




4.2. Water Temperature

4.2.1. Overview

Year 1 (2017) and Year 2 (2018) data complete two full years of post-construction water temperature data collection at the upstream site and nearly two full years of data collection at the downstream site; the period of record for post-construction analysis was from November 23, 2016 to January 30, 2019 (Table 1). Data availability is based on the most recent download of water temperature loggers. Data gaps occurred pre-construction due to icing issues and out of water events. There are no data gaps in the post-construction data set to date (Table 1).

The temperature regime is presented for the pre-construction and post-construction monitoring using a) daily average temperature data, b) daily maximum temperature data and c) daily minimum temperature data (Figure 3). In general, water temperature upstream (ALE-USWQ1) varied over a narrower range than observed downstream (ALE-BDGWQ) (Figure 3). The moderation of the water temperature regime upstream is attributed to the presence of groundwater inflow at this site. The daily average temperatures recorded at both sites were higher post-construction than pre-construction in the warmer months suggesting this increase is due to natural inter-annual temperature variation (Figure 3).

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 depicted in the cumulative frequency distribution between the sites (Figure 4). Despite the short distance (~1 km) and small difference in elevation (11 m) between the sites, the downstream site is generally warmer than the upstream site in the summer and cooler in the winter (Figure 3, Figure 4).

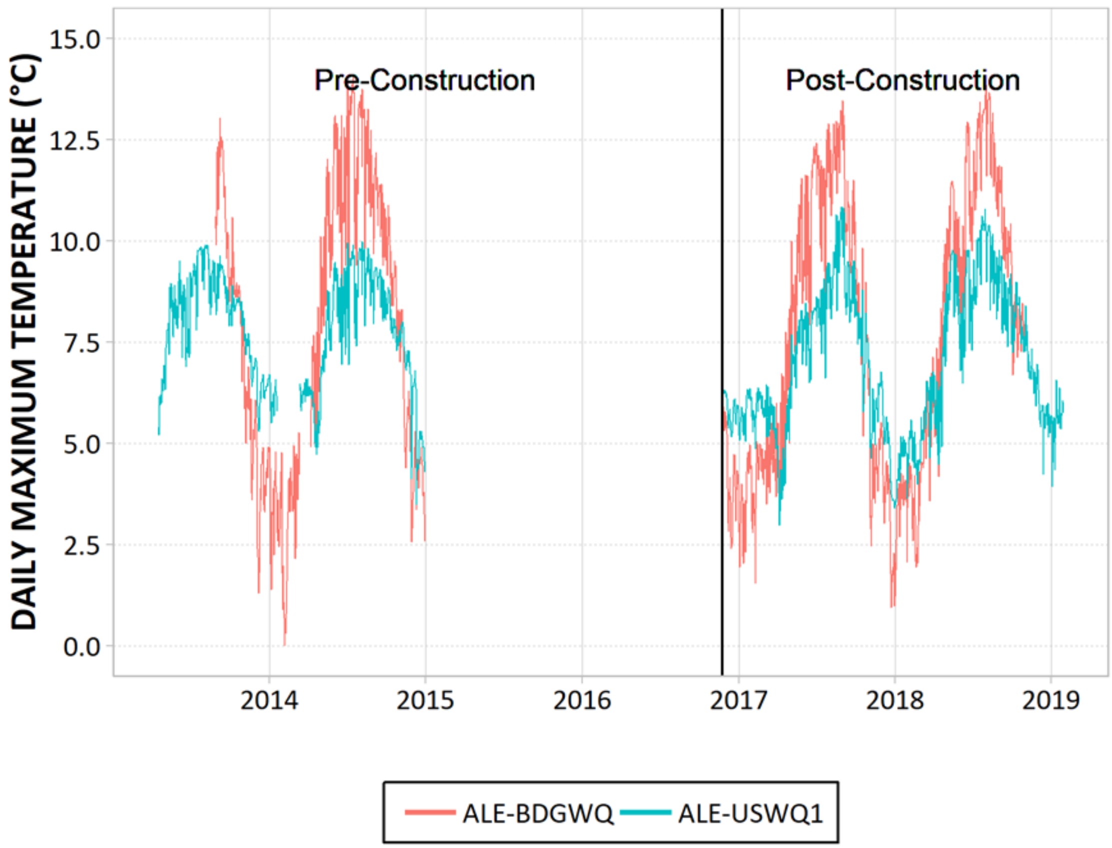
In addition to the influence of groundwater upstream, there is a tributary that enters Alena Creek between the two sites which may account for some of the cooler temperatures downstream in the winter and warmer temperatures downstream in the summer (Figure 3, Figure 4, Map 3).

Overall, no substantial difference is observed in the overall temperature regime (Figure 3) or the cumulative frequency distribution between sites (Figure 4). Data will be evaluated with a BACI analysis following 5 years of post-construction data collection.

**Figure 3. Overall average, maximum and minimum temperature regime in Alena Creek pre-construction (2014 to 2015) and post-construction (2017 to 2019).**

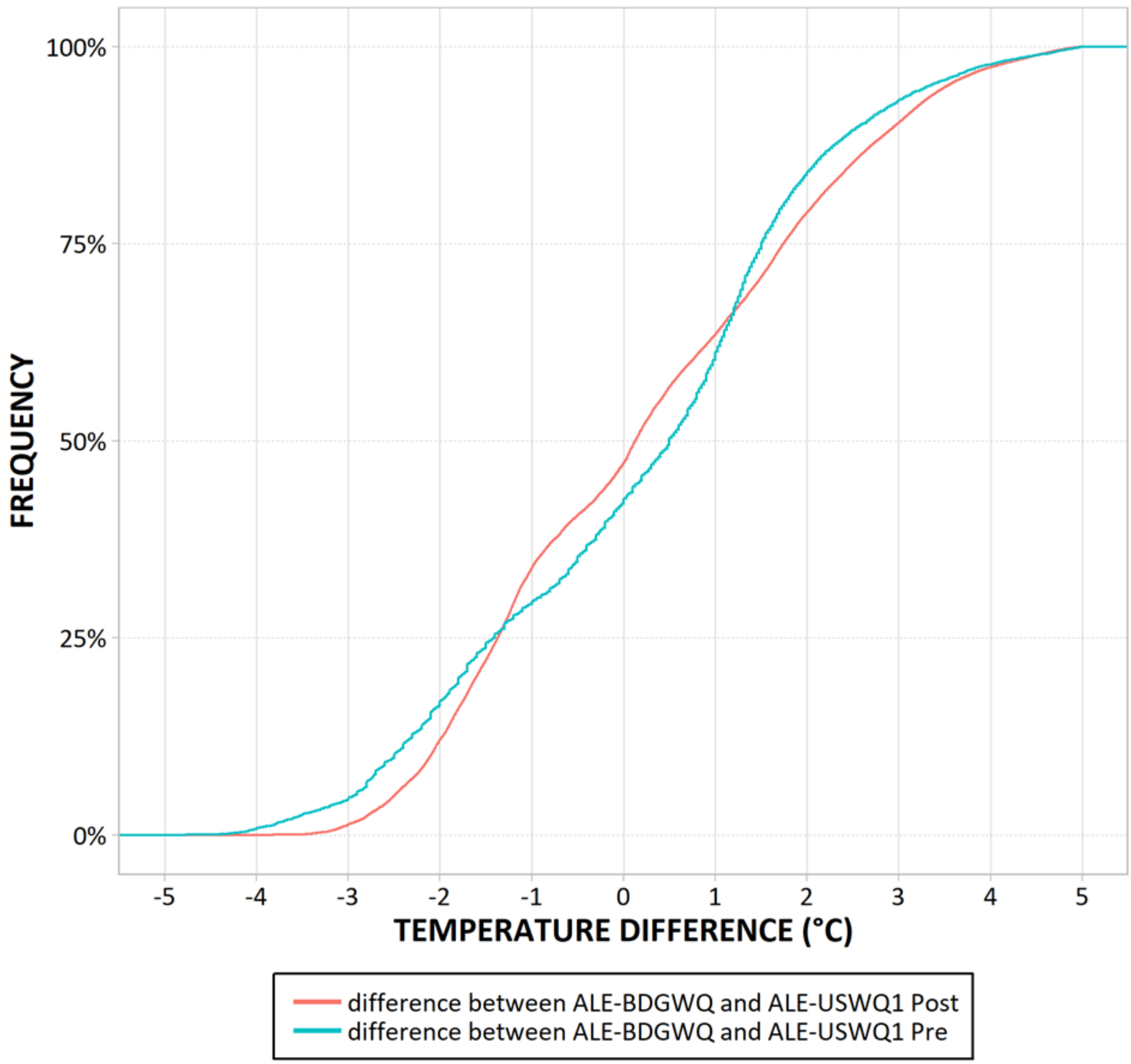
**(a) Daily Average**

**(b) Daily Maximum**



**(c) Daily Minimum**

**Figure 4. Cumulative frequency distribution of differences in pre-construction and post-construction instantaneous water temperature between the downstream site (ALE-BDGWQ) and the upstream site (ALE-USWQ1) (positive values indicate colder temperatures at ALE-USWQ1).**




4.2.2. Monthly Summary Statistics

The mean, instantaneous minimum, instantaneous maximum, and standard deviation for water temperature for each month of the record are summarized in Appendix C.

Overall, no substantial change in monthly temperature statistics has been observed in Year 2 in comparison to Year 1 and the available pre-construction data. 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. No data are available for February or March 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 (Appendix C).

At the downstream site monthly average temperatures ranged from 2.2°C to 10.1°C pre-construction, and from 2.5°C to 11.1°C post-construction (Appendix C). Minimum monthly temperatures in each year occurred from December to February.

Pre-construction minimum and maximum instantaneous temperatures ranged from 2.8°C to 10°C at the upstream site, and 0.0°C to 14°C at the downstream site. Post-construction, instantaneous minimum and maximum temperatures ranged from 0.8°C to 10.8°C at the upstream site and 0.1°C to 13.9°C at the downstream site (Appendix C).

#### 4.2.3. Growing Season Degree Days

The fall, early winter (October to December 31) weekly and maximum average temperatures upstream of the enhancement area are relatively mild, remaining above 4°C during the pre- and post-construction monitoring periods. Therefore, the growing season end date was calculated based on weekly average temperatures reaching 5°C rather than 4°C (see Section 3.2.4).

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 5). The growing season end dates varied from early November to the end of December.

Considering both sites which define the downstream and upstream extent of the enhanced habitat, the growing season varied from 1,667 to 1,836 degree days pre-construction to 1,375 to 1,799 degree days post-construction. The shortest growing season occurred upstream in 2017 (1,375 days: Table 5).

**Table 5. Growing season length and degree days upstream and downstream of the enhancement habitat in Alena Creek pre- and post-construction.**

| Site | Project Phase | Year | No. of days with valid data | Growing Season[1,2] | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Start Date | End Date | Length (day) | Gap (day) | Degree Days |
| Upstream (ALE-USWQ1) | Pre-construction | 2013 | 256 | 18-Apr | 31-Dec | 258 | 2 | 1,836 |
| | | 2014 | 306 | 24-Apr | 12-Dec | 233 | 3 | 1,667 |
| | Post-construction | 2017 | 364 | 26-Apr | 7-Nov | 196 | 1 | 1,375 |
| | | 2018 | 365 | 17-Apr | 13-Dec | 241 | 0 | 1,704 |
| Downstream (ALE-BDGWQ) | Pre-construction[1] | 2013 | 125 | - | 21-Nov | - | - | - |
| | | 2014 | 329 | 20-Apr | 16-Nov | 211 | 1 | 1,833 |
| | Post-construction | 2017 | 364 | 20-Apr | 4-Nov | 199 | 1 | 1,674 |
| | | 2018 | 304 | 14-Apr | 1-Nov | 202 | 1 | 1,799 |

[1] Days with less than 23 hours of data are considered data gaps. Degree days are accumulated thermal units.

[2] We defined the start of the growing season as the beginning of the first week that average stream temperatures exceeded and remained above 5°C for the season; the end of the growing season was defined as the last day of the first week that average stream temperature dropped below 5°C (modified from Coleman and Fausch (2007)).

#### 4.2.4. Hourly Rates of Water Temperature Change

Large, rapid temperature changes in temperature (greater than ±1.0°C/hr) can affect fish growth and survival (Oliver and Fidler 2001). 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 6).

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, the percentage (%) of record where exceedances were observed was low (<0.50%), and exceedances occurred less often post-construction at both sites. Post-construction, the % exceedances varied from 0.01% at the downstream site to 0.20% at the upstream site (Table 6).

The magnitude of the water temperature increase/decrease was highest at the upstream site post-construction, which may be a consequence of groundwater inflow at this location or the possible influence of ice conditions at low flows. Only data that were definitively ice-affected were removed prior to analysis, and there is some uncertainty about ice effects in the data set from December 2016 to January 2017, which is included in the analysis.

**Table 6. Hourly rate of change statistics and frequency of occurrence of rates of temperature change exceeding a magnitude of 1.0°C/hr in Alena Creek.**

| Site | Project Phase | Period of Record | | n | Occurrence | | Max-ve | Percentile | | | | Max+ve |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Start | End | | No. | % of Record | | 1st | 5th | 95th | 99th | |
| ALE-USWQ1 | Pre-Construction | 17-Apr-13 | 31-Dec-14 | 13627 | 47 | 0.34 | -1.15 | -0.48 | -0.27 | 0.33 | 0.85 | 1.45 |
| | Post-Construction | 23-Nov-16 | 30-Jan-19 | 76608 | 151 | 0.20 | -3.32 | -0.48 | -0.25 | 0.35 | 0.73 | 2.63 |
| ALE-BDGWQ | Pre-Construction | 27-Aug-13 | 31-Dec-14 | 11049 | 52 | 0.47 | -1.15 | -0.63 | -0.40 | 0.57 | 0.90 | 1.23 |
| | Post-Construction | 23-Nov-16 | 1-Nov-18 | 67973 | 9 | 0.01 | -1.09 | -0.52 | -0.33 | 0.50 | 0.75 | 1.06 |

n = number of datapoints.

### 4.2.5. Daily Temperature Extremes

Alena Creek is classified as a cool stream based on the lack of days with average water temperatures >18°C observed in either pre- or post-construction conditions (Table 7). Considering all sites and dates, the maximum temperature was 14.0°C, which occurred in July 2014 at the downstream site (Appendix C). A similar maximum temperature of 13.9°C at the downstream site post-construction in August 2018.

Upstream of the enhancement habitat, there were no days when the daily average temperature was <1°C pre- or post-construction. Downstream of the enhancement habitat between 1-3 days per year with temperatures <1°C were observed during pre-construction (1 day per year in 2014) and post-construction (3 days per year in 2017 and 2018).

**Table 7. Summary of daily average water temperature extremes (number of days >20°C, >18°C and <1°C) at ALE-USWQ1 and ALE-BDGWQ.**

| Site | Project Phase | Year[1] | n (days) | Days $T_{water}$ > 18°C | Days $T_{water}$ > 20°C | Days $T_{water}$ < 1°C |
|---|---|---|---|---|---|---|
| ALE-USWQ1 | Pre-construction | 2013 | 256 | 0 | 0 | 0 |
| | | 2014 | 306 | 0 | 0 | 0 |
| | Post-construction | 2016 | 38 | 0 | 0 | 0 |
| | | 2017 | 364 | 0 | 0 | 0 |
| | | 2018 | 365 | 0 | 0 | 0 |
| ALE-BDGWQ | Pre-construction | 2013 | 125 | 0 | 0 | 0 |
| | | 2014 | 328 | 0 | 0 | 1 |
| | Post-construction | 2016 | 38 | 0 | 0 | 0 |
| | | 2017 | 364 | 0 | 0 | 3 |
| | | 2018 | 304 | 0 | 0 | 3 |

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.

#### 4.2.6. Mean Weekly Maximum Temperatures (MWMxT)

MWMxT is an important indicator of prolonged periods of warm water temperatures that fish are exposed to. The guideline for the protection of aquatic life (Oliver and Fidler 2001) states "Where fish distribution information is available, then mean weekly maximum water temperatures should only vary + or – 1 degrees C beyond the optimum temperature range of each life history phase (incubation, rearing, migration and spawning) for the most sensitive salmonid species present".

A comparison of MWMxT temperature data to optimum temperature ranges for Coho Salmon, Cutthroat Trout, and Bull Trout was completed for each species using pre- and post-construction data collected for the upstream site (Table 8, Table 9) and the downstream site (Table 10, Table 11).

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 the optimum temperature ranges 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.

The year-round range in MWMxT temperature corresponds to the rearing life stage for all the fish species (Table 10, Table 11). During 2018, the MWMxT values ranged from 3.5°C to 10.4°C at the upstream site, which is similar to the 2017 range (3.5°C to 10.5°C) and also similar to the pre-construction range of 4.4°C to 9.8°C if we consider that the lower range does not include the February 2014 data (Table 8, Table 9). At the downstream site, during 2018, the MWMxT values ranged from 1.8°C to 13.4°C, similar to the 2017 range (1.6°C to 12.9°C) and also similar to the pre-construction range of 2.1°C to 13.7°C.

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 2), therefore fewer exceedances of the cooler temperature limits are observed for this species. At the upstream site MWMxT values were generally sub-optimally cool for all species and life history stages except spawning and incubation for Coho Salmon and Bull Trout (Table 8, Table 9). At the downstream site MWMxT values were sub-optimally cool with the exception of Cutthroat Trout and Bull Trout incubation periods where no exceedances were observed (Table 10, Table 11)

The exceedances of the cooler temperature limits were generally more prevalent at the downstream site (ALE-BDGWQ); the upstream location (ALE-USWQ) was somewhat warmer during the winter months likely due to the influence of groundwater at this location.

Considering exceedances of the higher temperature ranges, exceedances are observed for Bull Trout spawning and incubation periods at both sites, while the other species do not encounter any exceedances of the higher temperature range with the exception of Cutthroat Trout during the incubation period (2018 only) at the downstream site. Warmer surface waters during Bull Trout incubation at the upstream site may be partially mitigated by the groundwater upwelling which would result in lower temperature within the redds (Table 8, Table 9).

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 8. Pre-construction MWMxT for Bull Trout, Cutthroat Trout, and Coho Salmon life stages 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 | Below Lower Bound | Between Bounds | Above Upper Bound | Above Upper Bound by >1°C |
| **Coho Salmon** | Migration (Sep. 01 to Dec. 31) | 7.2-15.6 | 122 | 2013 | 98.4 | 5.6 | 9.4 | 6.7 | 37.5 | 62.5 | 0.0 | 0.0 |
| | | | | 2014 | 98.4 | 4.4 | 9.3 | 25.0 | 39.2 | 60.8 | 0.0 | 0.0 |
| | Spawning (Oct. 15 to Jan. 01) | 4.4-12.8 | 79 | 2013 | 97.5 | 5.6 | 8.5 | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 |
| | | | | 2014 | 96.2 | 4.4 | 7.9 | 0.0 | 1.3 | 98.7 | 0.0 | 0.0 |
| | Incubation (Oct. 15 to Apr. 01) | 4.0-13.0 | 169 | 2013 | 53.8 | 5.6 | 8.5 | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 |
| | Rearing (Jan. 01 to Dec. 31) | 9.0-16.0 | 365 | 2013 | 70.1 | 5.6 | 9.8 | 36.3 | 77.3 | 22.7 | 0.0 | 0.0 |
| | | | | 2014 | 83.8 | 4.4 | 9.7 | 53.9 | 81.7 | 18.3 | 0.0 | 0.0 |
| **Cutthroat Trout** | Spawning (Apr. 01 to Jul. 01) | 9.0-12.0 | 92 | 2013 | 81.5 | 5.8 | 8.9 | 45.3 | 100.0 | 0.0 | 0.0 | 0.0 |
| | | | | 2014 | 100 | 5.0 | 9.2 | 56.5 | 94.6 | 5.4 | 0.0 | 0.0 |
| | Incubation (May. 01 to Sep. 01) | 9.0-12.0 | 124 | 2013 | 100 | 6.8 | 9.8 | 16.9 | 65.3 | 34.7 | 0.0 | 0.0 |
| | | | | 2014 | 100 | 6.3 | 9.7 | 17.7 | 62.9 | 37.1 | 0.0 | 0.0 |
| | Rearing (Jan. 01 to Dec. 31) | 7.0-16.0 | 365 | 2013 | 70.1 | 5.6 | 9.8 | 3.5 | 22.7 | 77.3 | 0.0 | 0.0 |
| | | | | 2014 | 83.8 | 4.4 | 9.7 | 16.0 | 34.6 | 65.4 | 0.0 | 0.0 |
| **Bull Trout** | Spawning (Aug. 01 to Dec. 08) | 5.0-9.0 | 130 | 2013 | 98.5 | 5.6 | 9.8 | 0.0 | 0.0 | 75.0 | 25.0 | 0.0 |
| | | | | 2014 | 98.5 | 5.7 | 9.7 | 0.0 | 0.0 | 71.1 | 28.9 | 0.0 |
| | Incubation (Aug. 01 to Mar. 01) | 2.0-6.0 | 213 | 2013 | 77.9 | 5.6 | 9.8 | 0.0 | 0.0 | 6.0 | 94.0 | 64.5 |
| | | | | 2014 | 70.9 | 4.4 | 9.7 | 0.0 | 0.0 | 18.5 | 81.5 | 76.2 |
| | Rearing (Jan. 01 to Dec. 31) | 6.0-14.0 | 365 | 2013 | 70.1 | 5.6 | 9.8 | 0.0 | 3.5 | 96.5 | 0.0 | 0.0 |
| | | | | 2014 | 83.8 | 4.4 | 9.7 | 4.2 | 16.0 | 84.0 | 0.0 | 0.0 |

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

Red shading indicates exceedance of the upper bound of the BC WQG 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 9. Post-construction MWMxT for Bull Trout, Cutthroat Trout, and Coho Salmon life stages at ALE-USWQ1.**

| Species | Life Stage Data | | | Year | % | MWMxT | | % of MWMxT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Periodicity | Optimum Temperature Range (°C) | Duration (days) | | Complete[1] | Min. (°C) | Max. (°C) | Below Lower Bound by >1°C | Below Lower Bound | Between Bounds | Above Upper Bound | Above Upper Bound by >1°C |
| Coho Salmon | Migration (Sep. 01 to Dec. 31) | 7.2-15.6 | 122 | 2017 | 100 | 3.5 | 10.4 | 43.4 | 56.6 | 43.4 | 0.0 | 0.0 |
| | | | | 2018 | 100 | 5.3 | 9.3 | 23.8 | 44.3 | 55.7 | 0.0 | 0.0 |
| | Spawning (Oct. 15 to Jan. 01) | 4.4-12.8 | 79 | 2017 | 100 | 3.5 | 7.8 | 0.0 | 15.2 | 84.8 | 0.0 | 0.0 |
| | | | | 2018 | 100 | 5.2 | 8.5 | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 |
| | Incubation (Oct. 15 to Apr. 01) | 4.0-13.0 | 169 | 2016 | 76.3 | 4.6 | 6.3 | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 |
| | | | | 2017 | 100 | 3.5 | 7.8 | 0.0 | 8.9 | 91.1 | 0.0 | 0.0 |
| | | | | 2018 | 62.1 | 4.8 | 8.5 | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 |
| | Rearing (Jan. 01 to Dec. 31) | 9.0-16.0 | 365 | 2017 | 99.7 | 3.5 | 10.5 | 71.4 | 89.0 | 11.0 | 0.0 | 0.0 |
| | | | | 2018 | 100 | 3.5 | 10.4 | 57.0 | 80.5 | 19.5 | 0.0 | 0.0 |
| Cutthroat Trout | Spawning (Apr. 01 to Jul. 01) | 9.0-12.0 | 92 | 2017 | 98.9 | 3.5 | 8.3 | 90.1 | 100.0 | 0.0 | 0.0 | 0.0 |
| | | | | 2018 | 100.0 | 5.3 | 9.6 | 45.7 | 78.3 | 21.7 | 0.0 | 0.0 |
| | Incubation (May. 01 to Sep. 01) | 9.0-12.0 | 124 | 2017 | 99.2 | 6.2 | 10.5 | 43.9 | 77.2 | 22.8 | 0.0 | 0.0 |
| | | | | 2018 | 100.0 | 7.3 | 10.4 | 10.5 | 45.2 | 54.8 | 0.0 | 0.0 |
| | Rearing (Jan. 01 to Dec. 31) | 7.0-16.0 | 365 | 2017 | 99.7 | 3.5 | 10.5 | 40.9 | 54.9 | 45.1 | 0.0 | 0.0 |
| | | | | 2018 | 100.0 | 3.5 | 10.4 | 33.7 | 44.9 | 55.1 | 0.0 | 0.0 |
| Bull Trout | Spawning (Aug. 01 to Dec. 08) | 5.0-9.0 | 130 | 2017 | 100 | 5.2 | 10.5 | 0.0 | 0.0 | 72.3 | 27.7 | 8.5 |
| | | | | 2018 | 100 | 5.7 | 10.2 | 0.0 | 0.0 | 77.7 | 22.3 | 1.5 |
| | Incubation (Aug. 01 to Mar. 01) | 2.0-6.0 | 213 | 2017 | 100.0 | 3.5 | 10.5 | 0.0 | 0.0 | 50.7 | 49.3 | 41.3 |
| | | | | 2018 | 84.5 | 4.8 | 10.2 | 0.0 | 0.0 | 30.6 | 69.4 | 56.1 |
| | Rearing (Jan. 01 to Dec. 31) | 6.0-14.0 | 365 | 2017 | 99.7 | 3.5 | 10.5 | 9.9 | 40.9 | 59.1 | 0.0 | 0.0 |
| | | | | 2018 | 100.0 | 3.5 | 10.4 | 15.3 | 33.7 | 66.3 | 0.0 | 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 10. Pre-construction MWMxT for Bull Trout, Cutthroat Trout, and Coho Salmon life stages 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 | Below Lower Bound | Between Bounds | Above Upper Bound | Above Upper Bound by >1°C |
| Coho Salmon | Migration (Sep. 01 to Dec. 31) | 7.2-15.6 | 122 | 2013 | 99.2 | 2.1 | 12.5 | 43.8 | 49.6 | 50.4 | 0.0 | 0.0 |
| | | | | 2014 | 99.2 | 3.2 | 11.7 | 40.5 | 42.1 | 57.9 | 0.0 | 0.0 |
| | Spawning (Oct. 15 to Jan. 01) | 4.4-12.8 | 79 | 2013 | 98.7 | 2.1 | 8.8 | 10.3 | 30.8 | 69.2 | 0.0 | 0.0 |
| | | | | 2014 | 97.5 | 3.2 | 9.1 | 3.9 | 28.6 | 71.4 | 0.0 | 0.0 |
| | Incubation (Oct. 15 to Apr. 01) | 4.0-13.0 | 169 | 2013 | 82.2 | 2.1 | 8.8 | 13.7 | 52.5 | 47.5 | 0.0 | 0.0 |
| | Rearing (Jan. 01 to Dec. 31) | 9.0-16.0 | 365 | 2014 | 89.9 | 2.2 | 13.7 | 44.8 | 50.3 | 49.7 | 0.0 | 0.0 |
| Cutthroat Trout | Spawning (Apr. 01 to Jul. 01) | 9.0-12.0 | 92 | 2014 | 92.4 | 5.9 | 12.7 | 24.7 | 31.8 | 60.0 | 8.2 | 0.0 |
| | Incubation (May. 01 to Sep. 01) | 9.0-12.0 | 124 | 2014 | 99.2 | 8.5 | 13.7 | 0.0 | 3.3 | 61.0 | 35.8 | 13.8 |
| | Rearing (Jan. 01 to Dec. 31) | 7.0-16.0 | 365 | 2014 | 89.9 | 2.2 | 13.7 | 34.5 | 40.2 | 59.8 | 0.0 | 0.0 |
| Bull Trout | Spawning (Aug. 01 to Dec. 08) | 5.0-9.0 | 130 | 2013 | 78.5 | 2.1 | 12.5 | 5.9 | 13.7 | 46.1 | 40.2 | 26.5 |
| | | | | 2014 | 99.2 | 3.5 | 13.3 | 3.9 | 11.6 | 30.2 | 58.1 | 48.1 |
| | Incubation (Aug. 01 to Mar. 01) | 2.0-6.0 | 213 | 2013 | 83.1 | 2.1 | 12.5 | 0.0 | 0.0 | 55.4 | 44.6 | 37.9 |
| | | | | 2014 | 70.9 | 3.2 | 13.3 | 0.0 | 0.0 | 32.5 | 67.5 | 66.2 |
| | Rearing (Jan. 01 to Dec. 31) | 6.0-14.0 | 365 | 2014 | 89.9 | 2.2 | 13.7 | 30.2 | 34.5 | 65.5 | 0.0 | 0.0 |

Blue shading indicates exceedance of the lower bound of the BC WQG optimum temperature range by more than 1°C (Oliver and Fidler 2001).
Red shading indicates exceedance of the upper bound of the BC WQG 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 11. Post-construction MWMxT for Bull Trout, Cutthroat Trout, and Coho Salmon life stages at ALE-BDGWQ.**

| Species | Life Stage Data | | | Year | % | MWMxT | | % of MWMxT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Periodicity | Optimum Temperature Range (°C) | Duration (days) | | Complete[1] | Min. (°C) | Max. (°C) | Below Lower Bound by >1°C | Below Lower Bound | Between Bounds | Above Upper Bound | Above Upper Bound by >1°C |
| Coho Salmon | Migration (Sep. 01 to Dec. 31) | 7.2-15.6 | 122 | 2017 | 100 | 1.6 | 12.8 | 50.0 | 55.7 | 44.3 | 0.0 | 0.0 |
| | Spawning (Oct. 15 to Jan. 01) | 4.4-12.8 | 79 | 2017 | 100 | 1.6 | 8.1 | 19.0 | 55.7 | 44.3 | 0.0 | 0.0 |
| | Incubation (Oct. 15 to Apr. 01) | 4.0-13.0 | 169 | 2016 | 76.3 | 2.8 | 5.7 | 1.6 | 41.9 | 58.1 | 0.0 | 0.0 |
| | | | | 2017 | 100.0 | 1.6 | 8.1 | 14.2 | 47.9 | 52.1 | 0.0 | 0.0 |
| | Rearing (Jan. 01 to Dec. 31) | 9.0-16.0 | 365 | 2017 | 99.7 | 1.6 | 12.9 | 56.6 | 62.4 | 37.6 | 0.0 | 0.0 |
| | | | | 2018 | 82.7 | 1.8 | 13.4 | 44.4 | 49.7 | 50.3 | 0.0 | 0.0 |
| Cutthroat Trout | Spawning (Apr. 01 to Jul. 01) | 9.0-12.0 | 92 | 2017 | 98.9 | 4.3 | 12.2 | 39.6 | 52.7 | 42.9 | 4.4 | 0.0 |
| | | | | 2018 | 100.0 | 5.7 | 12.6 | 23.9 | 33.7 | 59.8 | 6.5 | 0.0 |
| | Incubation (May. 01 to Sep. 01) | 9.0-12.0 | 124 | 2017 | 99.2 | 7.4 | 12.9 | 4.9 | 14.6 | 61.8 | 23.6 | 0.0 |
| | | | | 2018 | 100.0 | 8.7 | 13.4 | 0.0 | 3.2 | 58.9 | 37.9 | 10.5 |
| | Rearing (Jan. 01 to Dec. 31) | 7.0-16.0 | 365 | 2017 | 99.7 | 1.6 | 12.9 | 47.0 | 49.7 | 50.3 | 0.0 | 0.0 |
| | | | | 2018 | 82.7 | 1.8 | 13.4 | 31.8 | 35.4 | 64.6 | 0.0 | 0.0 |
| Bull Trout | Spawning (Aug. 01 to Dec. 08) | 5.0-9.0 | 130 | 2017 | 100 | 3.3 | 12.9 | 7.7 | 23.8 | 26.9 | 49.2 | 41.5 |
| | | | | 2018 | 69.2 | 7.5 | 13.4 | 0.0 | 0.0 | 32.2 | 67.8 | 48.9 |
| | Incubation (Aug. 01 to Mar. 01) | 2.0-6.0 | 213 | 2017 | 100.0 | 1.6 | 12.9 | 0.0 | 5.2 | 51.6 | 43.2 | 40.8 |
| | Rearing (Jan. 01 to Dec. 31) | 6.0-14.0 | 365 | 2017 | 99.7 | 1.6 | 12.9 | 42.3 | 47.0 | 53.0 | 0.0 | 0.0 |
| | | | | 2018 | 82.7 | 1.8 | 13.4 | 22.5 | 31.8 | 68.2 | 0.0 | 0.0 |

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

Red shading indicates exceedance of the upper bound of the BC WQG 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.

#### 4.2.7. Bull Trout Temperature Guidelines

Bull Trout specific water temperate guidelines (see Section 3.2.4.1) 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 12). 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.

During both pre- and post-construction monitoring periods, the highest maximum daily temperatures did not exceed the prescribed thresholds for rearing (15°C) at either site (Table 12).

The number of day where daily maximum water temperatures were outside the Bull Trout thresholds for spawning and incubation (i.e., >10°C) were higher overall at the downstream site (ALE-BDGWQ) in comparison to the upstream site (ALE-USWQ1), due to warmer temperatures in August and September at the downstream site (Table 12, Figure 3). In general, water temperatures at the downstream site do not cool below 10°C until late September/October (Section 3 in Appendix C). Warmer temperatures (i.e., more days with exceedances of the 10°C limit) post-construction in comparison to pre-construction were observed at both the upstream and downstream sites suggesting this is due to natural inter-annual variability.

The number of days where the minimum temperature was less than the incubation threshold (i.e., <2°C) were also higher at the downstream site due to cooler temperatures during the winter months (Figure 3). These results suggest that temperature regime may be more suitable for Bull Trout at the upper end of the enhancement habitat area during spawning and incubation (Table 12).

**Table 12. Summary of incidence (number of days) where the daily minimum or maximum water temperature exceeds the Bull Trout BC WQG (MOE 2018).**

| Site | Project Phase | Year | n (days)[1] | 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 | Pre-construction | 2013 | 256 | 0 | 0 | 0 | 0 |
| | | 2014[2] | 306 | 0 | 0 | 0 | 0 |
| | Post-construction | 2017 | 364 | 0 | 14 | 2 | 14 |
| | | 2018 | 365 | 0 | 10 | 0 | 10 |
| ALE-BDGWQ | Pre-construction | 2013 | 125 | 0 | 28 | 9 | 28 |
| | | 2014 | 329 | 0 | 58 | 33 | 58 |
| | Post-construction | 2017 | 364 | 0 | 53 | 39 | 53 |
| | | 2018 | 304 | 0 | 47 | 26 | 47 |

[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 (2018).

[2] Value excludes February 2014 data based on suspected ice conditions.

## 4.3. Fish Habitat

### 4.3.1. Stability Assessment

Photos were taken at established photo-point locations in the enhanced reaches (Reach 1 and Reach 3) of Alena Creek on November 5, 2018. A comparison of all photos is available in Appendix D; however, a selection of comparison photos is presented below. Overall, the riparian vegetation has increased since 2016 and the channel has remained stable over this time. No substantial changes to the stream channel where noted that were not anticipated as part of the dynamic stability criteria of the design. Some erosion of the right channel bank was noted as a result of a water bar that has been installed to convey run-off across and away from the Lillooet River FSR. The run-off flows to toward Reach 3 and has eroded a section of bank at the discharge point.

#### 4.3.1.1. Reach 1

Reach 1 is the most downstream reach of Alena Creek and was enhanced under the FHEP and starts at the Lillooet River Forest Service Road (FSR, Map 4) bridge. In 2016, thirteen riffles and more than 120 pieces of large woody debris were installed in Reach 1 with total creation of 1,387 $m^2$ of enhanced fish habitat. The stream channel at ALE-XS1 has widened slightly with wetted access to the constructed floodplain on river left, as seen in 2017 and as intended in the design (Figure 5 to Figure 7). There were no other significant changes along Reach 1.

**Figure 5. Looking from river right to river left at ALE-XS1 on September 19, 2016.**

**Figure 6. Looking from river left to river right at ALE-XS1 on November 10, 2017.**

**Figure 7. Looking from river left to river right at ALE-XS1 on November 5, 2018.**

#### 4.3.1.2. Reach 3

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 this reach as under the FHEP. However, a mid-channel bar formed in 2017 just upstream of the ALE-XS6 as the result of erosion along the right bank (Figure 8 to Figure 10). In 2018, the mid-channel bar was still present but did not appear to impede flows or limit the potential fish habitat. Bank erosion has also caused channel widening and down-cutting in section at the riffle-crest downstream of ALE-XS5 (Figure 11). Repairs are recommended in Section 5.3.

Beaver activity has created significant damming upstream of both Reach 1 and Reach 3 but these dams were removed in accordance with dam removal best management practices by a licensed trapper from EBB Environmental Consulting Inc. in September 2018. Reconstruction of beaver dams at these locations may restrict fish migration and downstream gravel migration and will be monitored in 2019. Beaver dams that temporarily created backwatered areas, appear to have caused new channel formation at the upper enhanced reach and have the potential to affect both enhanced reaches in the future.

**Figure 8. Looking upstream at ALE-XS6 on November 10, 2016.**

**Figure 9. Looking upstream at ALE-XS6 on November 10, 2017**

**Figure 10. Looking upstream of ALE-XS6 on November 5, 2018.**

**Figure 11. Looking upstream at the riffle crest located downstream of ALE-XS5 showing band erosion (yellow arrow) and down-cutting. The red arrow shows dewatered riffle crest. November 10, 2017.**

## 4.4. Fish Community

### 4.4.1. Adult Spawner Abundance

The peak count of Coho Salmon spawners observed in 2018 was 126 alive and 4 carcasses on November 5, 2018 (Table 13). The peak count was similar to that of 2017 but lower than 2016 (Table 14). A comparison of observations among years also highlights the variability in run timing, with the peak live count recorded on November 14 in 2016, December 5 in 2017, and November 5 in 2010 and 2018. Although surveys are not conducted at a frequency to allow total spawner abundance to be compared among years (i.e., peak counts may be influenced by survey timing and spawner residence time and predation), the counts provide an indication of use and demonstrate that Alena Creek supports equivalent or potentially greater use by Coho Salmon spawners compared to pre-enhancement. An example photograph of a Coho Salmon on a redd in enhanced habitat during 2018 is provided in Figure 12.

**Table 13. Summary of adult fish observed during fall spawner surveys in 2018.**

| Stream | Date | Survey Time (hrs) | Survey Distance (m) | # of Live Adults Observed[1] | | | # of Adult Carcasses Observed[1] | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | CO | BT | CT | CO | BT | CT |
| Alena Creek | 05-Nov-18 | 2.7 | 1,703 | 126 | 1 | 1 | 4 | 0 | 0 |
| Alena Creek | 15-Nov-18 | 2.4 | 1,911 | 49 | 0 | 0 | 18 | 0 | 0 |
| Alena Creek | 05-Dec-18 | 1.9 | 584 | 10 | 0 | 0 | 4 | 0 | 0 |
| **Alena Creek Total:** | | **6.9** | **4,197** | **185** | **1** | **1** | **26** | **0** | **0** |

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

**Table 14. Peak Coho Salmon spawner counts during baseline (2010, 2011) and post-construction monitoring (2016, 2017 and 2018).**

| | 2010 Peak Count (05-Nov-10) | | 2011 Peak Count (02-Dec-11) | | 2016 Peak Count (27-Nov-16) | | 2017 Peak Count (05-Dec-17) | | 2018 Peak Count (05-Nov-18) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Live | Dead | Live | Dead | Live | Dead | Live | Dead | Live | Dead |
| | 127 | 0 | 110 | 1 | 174 | 18 | 110 | 22 | 126 | 4 |
| **Total** | **127** | | **111** | | **192** | | **132** | | **130** | |

**Figure 12. Spawning Coho Salmon observed in the enhanced habitat in Reach 1 on November 5, 2018.**



ECOFISH RESEARCH

### 4.4.2. Juvenile Abundance

In September 24, 2018, 44 minnow traps were set overnight in riffle, pool, and glide habitat ranging in depth from 0.2 to 1.0 m (Table 15). A total of 866 fish were captured during minnow trap sampling consisting of 850 Coho Salmon and 16 Cutthroat Trout (Table 15). No juvenile Bull Trout were captured in 2018. Due to the high number of captured fish, at some sites a subsample of the captured fish were measured. Raw data tables and representative photographs of minnow trapping sites are presented in Appendix E.

**Table 15. Summary of minnow trapping habitat characteristics and fish captures in Alena Creek on September 24, 2018.**

| Site | Date | Enhancement Status | # of Traps | Total Soak Time (hrs) | Mesh Size (mm) | Trap Depth Range (m) | Total Captures | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | BT | CO | CT |
| ALE-MT01 | 24-Sep-18 | Enhanced | 5 | 110.5 | 6 | 0.2 - 0.4 | 0 | 47 | 2 |
| ALE-MT02 | 24-Sep-18 | Enhanced | 5 | 113.2 | 6 | 0.2 - 0.3 | 0 | 53 | 2 |
| ALE-MT07 | 24-Sep-18 | Enhanced | 5 | 117.4 | 6 | 0.2 - 1.0 | 0 | 162 | 3 |
| ALE-MT03 | 24-Sep-18 | Unenhanced | 4 | 97.1 | 6 | 0.2 - 0.6 | 0 | 135 | 2 |
| ALE-MT06 | 24-Sep-18 | Unenhanced | 10 | 242.6 | 3-6 | 0.3 - 1.0 | 0 | 134 | 2 |
| ALE-MT08 | 24-Sep-18 | Enhanced | 5 | 128.6 | 3-6 | 0.2 - 0.4 | 0 | 122 | 0 |
| ALE-MT09 | 24-Sep-18 | Enhanced | 5 | 127.5 | 3 | 0.2 - 0.3 | 0 | 98 | 2 |
| ALE-MT05 | 24-Sep-18 | Unenhanced | 5 | 128.8 | 3-6 | 0.5 - 0.7 | 0 | 99 | 3 |
| **Grand Total:** | | | **44** | **1,065.6** | | | **0** | **850** | **16** |
| **Grand Average:** | | | **5.5** | **133.2** | | | **0** | **106** | **2** |

#### 4.4.2.1. Cutthroat Trout

A total of 13 Cutthroat Trout, ranging in length from 85 to 140 mm in length, were captured during the 2018 sampling program (Table 18). Based on a review of the length-frequency histogram (Figure 13) and aging data from scale analysis (Figure 15), discrete fork length ranges were defined for each age class (Table 18). Summary statistics of fish length, weight, and condition factor are presented for each age class in Table 19. Catch per unit effort (CPUE) ranged from 0 fish per 100 trap hours at ALE-MT08 to 2.6 fish per 100 trap hours in ALE-MT07 in the enhanced reach (Table 20). The average CPUE was 1.6 fish per 100 trap hours and the standard deviation was 0.8 fish per 100 trap hours.

*Cutthroat Trout Fry (0+)*

No Cutthroat Trout fry (0+) were captured at any of the sampling sites in 2018.

*Cutthroat Trout Parr (1+)*

Cutthroat Trout parr (1+) were distributed throughout Alena Creek and were captured at all sites except for ALE-MT06 and ALE-MT08, both in unenhanced reaches (Table 20). A total of 11 Cutthroat Trout 1+ parr were captured, with the highest captures in ALE-MT07.

*Cutthroat Trout Parr (2+)*

Only two Cutthroat Trout 2+ parr were captured in 2018, both of which captured in ALE-MT06 in Reach 2 (unenhanced reach).

**Figure 13. Fork length frequency for juvenile Cutthroat Trout captured (minnow trapping) in Alena Creek in 2018.**

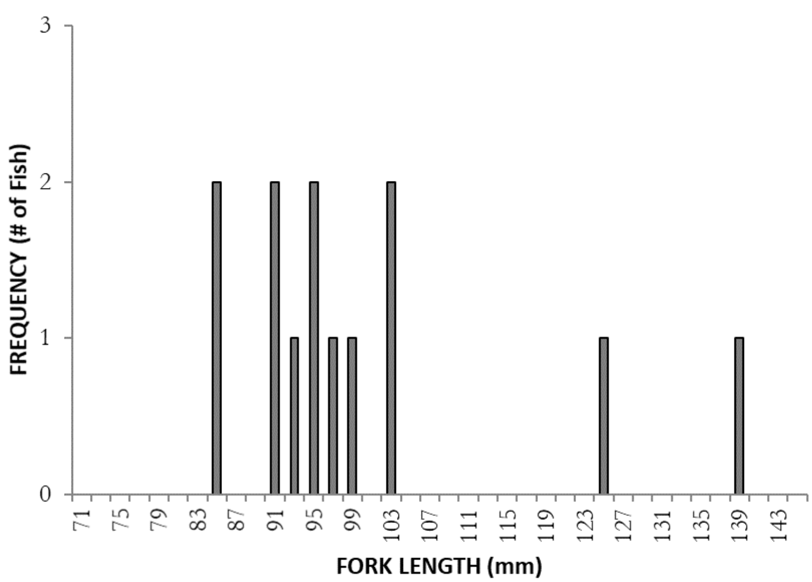


**Figure 14.** **Fork length versus age for juvenile Cutthroat Trout captured in Alena Creek in 2018.**

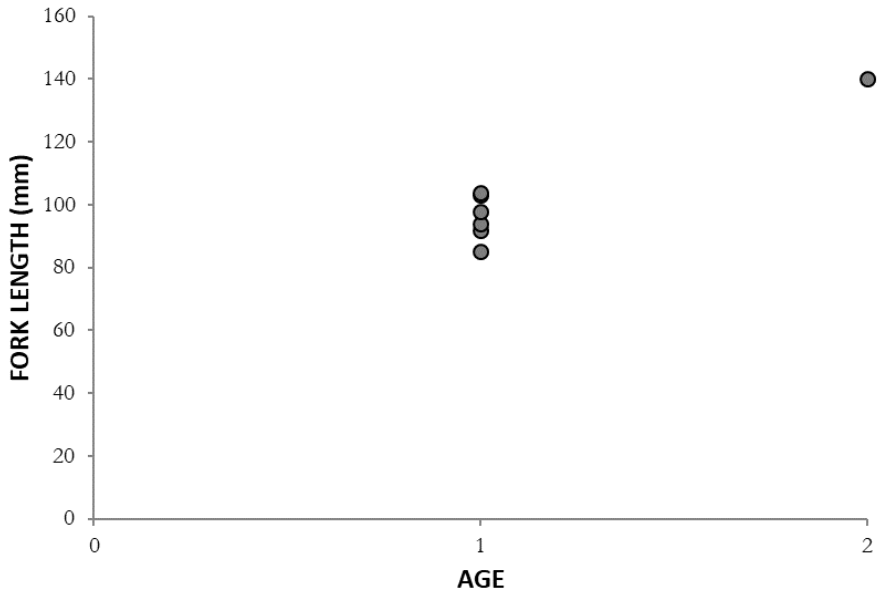



**Table 16.** **Age size bins for juvenile Cutthroat Trout captured in Alena Creek in 2018.**

| Age Class | Fork Length Range (mm) |
|---|---|
| Fry (0+) | - |
| Parr (1+) | 85-104 |
| Parr (2+) | 125-140 |

**Table 17.** **Summary of fork length, weight and condition for juvenile Cutthroat Trout captured in Alena Creek in 2018.**

| Age Class | Fork Length (mm) | | | | Weight (g) | | | | Condition Factor (K) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | Average | Min | Max | n | Average | Min | Max | n | Average | Min | Max |
| Fry (0+) | 0 | - | - | - | 0 | - | - | - | 0 | - | - | - |
| Parr (1+) | 11 | 95 | 85 | 104 | 11 | 9.1 | 6.0 | 11.0 | 11 | 1.06 | 0.94 | 1.17 |
| Parr (2+) | 2 | 133 | 125 | 140 | 2 | 25.5 | 21.0 | 30.0 | 2 | 1.08 | 1.08 | 1.09 |
| **All** | **13** | **101** | **85** | **140** | **13** | **11.6** | **6.0** | **30.0** | **16** | **1.06** | **0.94** | **1.17** |

**Table 18. Catch and CPUE for Cutthroat Trout captured by minnow trapping in Alena Creek in 2018.**

| Site | Date | Enhancement Status | # of Traps | Total Soak Time | Total CT Catch (# of Fish)[1] | CPUE (# of Fish/100 Trap hrs) | Aged CT Catch (# of Fish)[2] | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 0+ | 1+ | 2+ | All |
| ALE-MT01 | 24-Sep-18 | Enhanced | 5 | 110.5 | 2 | 1.8 | 0 | 2 | 0 | **2** |
| ALE-MT02 | 24-Sep-18 | Enhanced | 5 | 113.2 | 2 | 1.8 | 0 | 1 | 0 | **1** |
| ALE-MT07 | 24-Sep-18 | Enhanced | 5 | 117.4 | 3 | 2.6 | 0 | 3 | 0 | **3** |
| ALE-MT03 | 24-Sep-18 | Unenhanced | 4 | 97.1 | 2 | 2.1 | 0 | 2 | 0 | **2** |
| ALE-MT06 | 24-Sep-18 | Unenhanced | 10 | 242.6 | 2 | 0.8 | 0 | 0 | 2 | **2** |
| ALE-MT08 | 24-Sep-18 | Enhanced | 5 | 128.6 | 0 | 0.0 | 0 | 0 | 0 | **0** |
| ALE-MT09 | 24-Sep-18 | Enhanced | 5 | 127.5 | 2 | 1.6 | 0 | 2 | 0 | **2** |
| ALE-MT05 | 24-Sep-18 | Unenhanced | 5 | 128.8 | 3 | 2.3 | 0 | 1 | 0 | **1** |
| **Grand Total:** | | | **44** | **1,065.6** | **16** | **1.5** | **0** | **11** | **2** | **13** |
| **Grand Average:** | | | **5.5** | **133.2** | **2** | **1.6** | **0** | **1** | **0** | **2** |
| **Grand Standard Deviation:** | | | | **45.5** | **1** | **0.8** | **0** | **1** | **1** | **2** |

[1] Includes all captured fish in the minnow traps

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

#### 4.4.2.2. Coho Salmon

A total of 850 juvenile Coho Salmon were captured during minnow trap sampling in Alena Creek on September 24, 2018. Based on a review of the length-frequency histogram (Figure 15) and aging data from scale analysis (Table 19), discrete fork length ranges were defined for each age class (Table 20). Summary statistics of fish length, weight, and condition factor are presented for each age class in Table 20. CPUE ranged from 42.5 fish per 100 trap hours at ALE-MT01 (Reach 1, enhanced reach) to 139 fish per 100 trap hours in ALE-MT03 (Reach 2, unenhanced, Table 21). The total average CPUE was 83.8 fish per 100 trap hours and the standard deviation was 38 fish per 100 trap hours (Table 21).

*Coho Salmon Fry (0+)*

Coho Salmon fry (0+) were captured at all sampling sites in 2018 and are distributed throughout the sampled reaches of Alena Creek (Table 21). Coho Salmon fry were most abundant at ALE-MT03 in the unenhanced reach (Reach 2) and ALE-MT07 in the enhanced reach (Reach 1). In total, 68 Coho Salmon fry were processed in the field but it is likely that most of the Coho salmon released without processing were also fry.

*Coho Salmon Parr (1+)*

Coho Salmon 1+ parr were captured at all sites in 2018 except for ALE-MT09 (Table 21). They were most abundant in ALE-MT06, in the unenhanced reach (Reach 2).

**Figure 15. Fork length frequency for juvenile Coho Salmon captured (minnow trapping) in Alena Creek in 2018.**

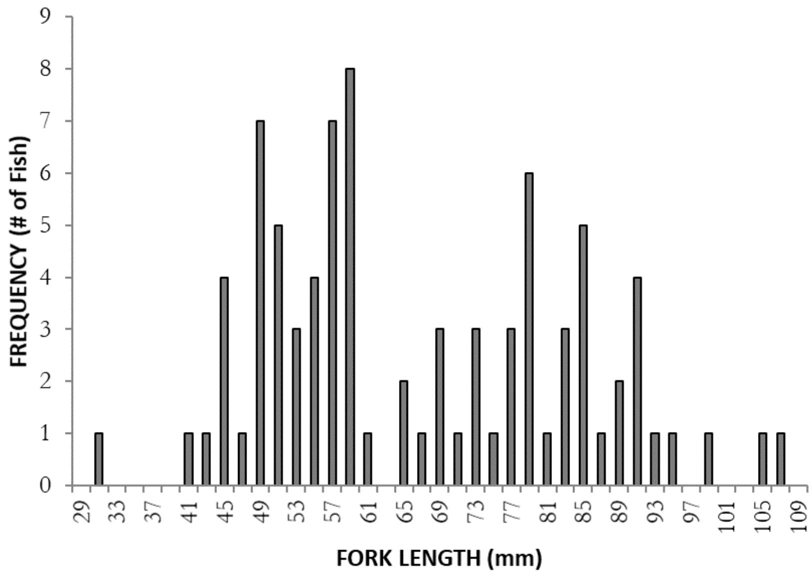



**Figure 16. Fork length versus age for Coho Salmon captured in Alena Creek in 2018.**

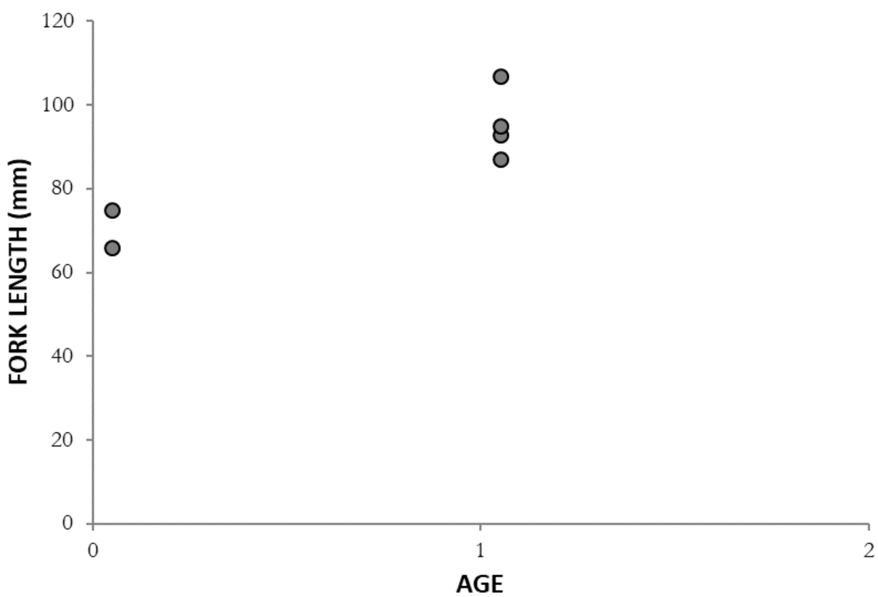


**Table 19. Age size bins for Coho Salmon captured in Alena Creek in 2018.**

| Age Class | Fork Length Range (mm) |
|---|---|
| Fry (0+) | 31-85 |
| Parr (1+) | 86-107 |

**Table 20. Summary of fork length, weight and condition for Coho Salmon captured in Alena Creek in 2018.**

| Age Class | Fork Length (mm) | | | | Weight (g) | | | | Condition Factor (K) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | Average | Min | Max | n | Average | Min | Max | n | Average | Min | Max |
| Fry (0+) | 68 | 61 | 31 | 85 | 49 | 3.1 | 1.0 | 7.0 | 68 | 1.05 | 0.34 | 1.42 |
| Parr (1+) | 16 | 92 | 86 | 107 | 15 | 8.8 | 6.5 | 15.0 | 16 | 1.12 | 0.76 | 1.41 |
| **All** | **84** | **67** | **31** | **107** | **64** | **4.4** | **1.0** | **15.0** | **850** | **1.06** | **0.34** | **1.42** |

**Table 21. Catch and CPUE for Coho Salmon captured in Alena Creek in 2018.**

| Site | Date | Enhancement Status | # of Traps | Total Soak Time | Total CO Catch (# of Fish)[1] | CPUE (# of Fish/100 Trap hrs) | Aged CO Catch (# of Fish)[2] | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 0+ | 1+ | All |
| ALE-MT01 | 24-Sep-18 | Enhanced | 5 | 110.5 | 47 | 42.5 | 11 | 2 | **13** |
| ALE-MT02 | 24-Sep-18 | Enhanced | 5 | 113.2 | 53 | 46.8 | 15 | 1 | **16** |
| ALE-MT07 | 24-Sep-18 | Enhanced | 5 | 117.4 | 162 | 138.0 | 5 | 1 | **6** |
| ALE-MT03 | 24-Sep-18 | Unenhanced | 4 | 97.1 | 135 | 139.0 | 8 | 3 | **11** |
| ALE-MT06 | 24-Sep-18 | Unenhanced | 10 | 242.6 | 134 | 55.2 | 4 | 6 | **10** |
| ALE-MT08 | 24-Sep-18 | Enhanced | 5 | 128.6 | 122 | 94.9 | 9 | 1 | **10** |
| ALE-MT09 | 24-Sep-18 | Enhanced | 5 | 127.5 | 98 | 76.9 | 10 | 0 | **10** |
| ALE-MT05 | 24-Sep-18 | Unenhanced | 5 | 128.8 | 99 | 76.9 | 6 | 2 | **8** |
| **Grand Total:** | | | **44** | **1,065.6** | **850** | **79.8** | **68** | **16** | **84** |
| **Grand Average:** | | | **5.5** | **133.2** | **106** | **83.8** | **9** | **2** | **11** |
| **Grand Standard Deviation:** | | | | **45.5** | **40** | **38.0** | **4** | **2** | **3** |

[1] Includes all captured fish in the minnow traps

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

#### 4.4.2.3. Bull Trout

No Bull Trout were captured in Alena Creek minnow traps in 2018.

#### 4.4.2.4. Comparison between Years

*Cutthroat Trout*

The 13 Cutthroat Trout captured in minnow traps in 2018 represents an increase from the seven captured in 2017, but a decrease from the 27 captured in 2013 and the 16 captured in 2014. While there were more sites sampled in 2018 (eight sites versus six sites in previous years), the average CPUE across sites in 2018 (1.6 fish per 100 trap hours) was greater than that of 2017 (0.8 fish per 100 trap hours) and similar to 2013 (1.8 fish per 100 trap hours) (Figure 17). The average CPUE in 2014 (7.2 fish per 100 trap hours) was much higher than other years; however, the 2014 CPUE results are biased high by the short daytime sets and the likelihood that catchability is not constant throughout the trap's soak time, with a high initial catch rate that diminishes over time (Harwood *et al*. 2016).

In 2018, Cutthroat Trout were relatively evenly distributed in relatively low numbers throughout Alena Creek, similar to previous years (Figure 18). The standard deviation of CPUE among sites was 0.8 fish per 100 trap hours compared to 0.7 fish per 100 trap hours in 2017 and 2013.

In all sampling years, the most abundant age class of Cutthroat Trout captured was 1+ parr. No Cutthroat Trout fry were captured in 2017 and 2018. Only three fry were captured during two sampling events in September 2013 and only one fry was captured in October 2014. The lack of Cutthroat Trout fry captured during sampling is likely a result of the timing of emergence and the size of fry in late September / early October.

**Figure 17. Comparison of minnow trap CPUE for Cutthroat Trout during baseline (2013 and 2014) and post-construction (2017 and 2018). 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.**

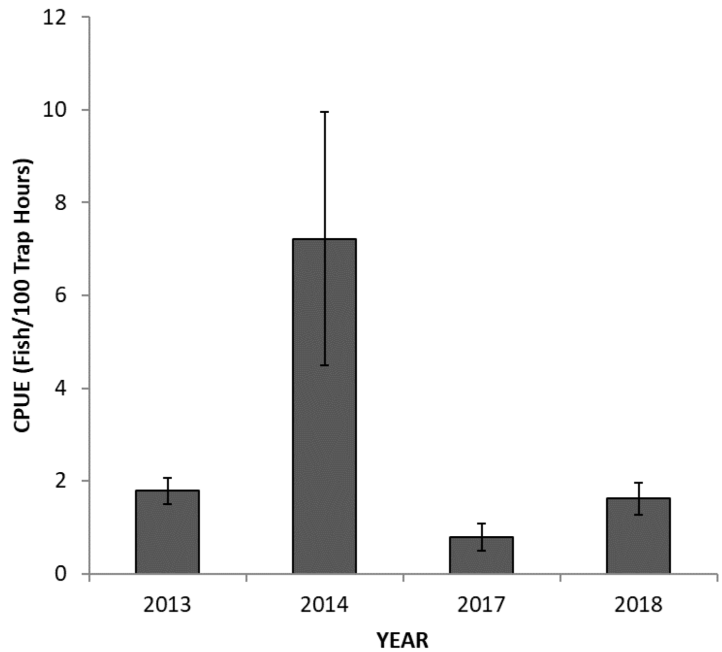
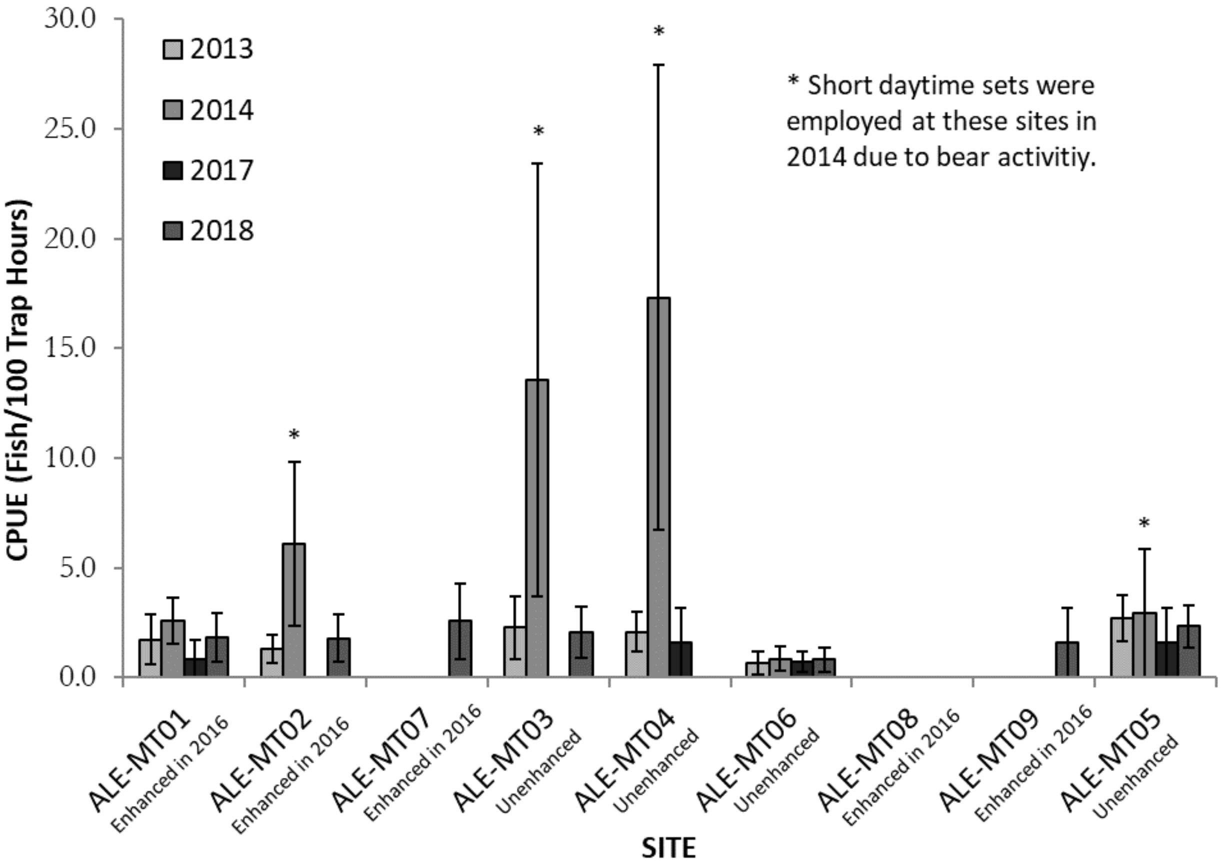


**Figure 18. Comparison of minnow trap CPUE for Cutthroat Trout at each site during baseline (2013 and 2014) and post-construction (2017 and 2018). Error bars represent standard error.**




*Coho Salmon*

The 850 Coho Salmon fry and parr captured in minnow traps in 2018 is higher than all previous sampling years (Figure 19). While there were more sites sampled in 2018 (eight sites versus six sites in previous years), the average CPUE across sites in 2018 (83.8 fish per 100 trap hours) was higher than all previous years (Figure 20).

In 2018, Coho Salmon fry and parr were found in all sites and were roughly distributed throughout Alena Creek similar to previous years (Figure 20). The standard deviation of CPUE among sites was 38.0 fish per 100 trap hours compared to 17.7 fish per 100 trap hours in 2013, 34.1 fish per 100 trap hours in 2014, and 20.4 fish per 100 trap hours in 2017.

**Figure 19. Comparison of minnow trap CPUE for Coho Salmon during baseline (2013 and 2014) and post-construction (2017 and 2018). 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.**

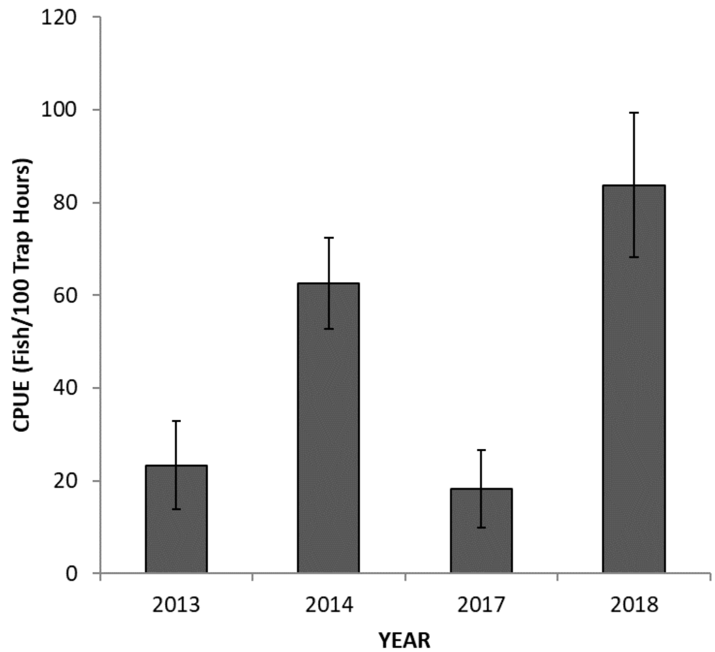
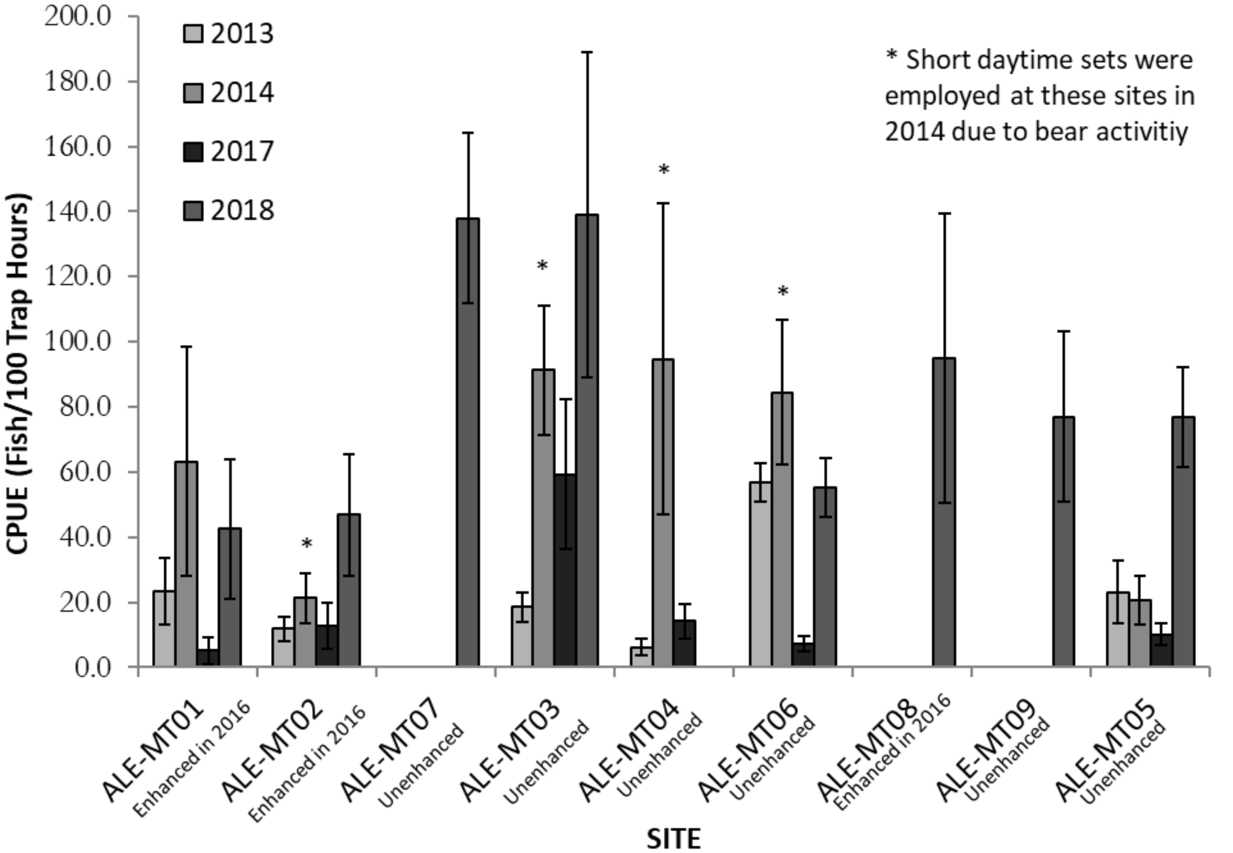


**Figure 20. Comparison of minnow trap CPUE for Coho Salmon at each site during baseline (2013 and 2014) and post-construction (2017 and 2018). Error bars represent standard error.**




## 5. RECOMMENDATIONS

The success of the enhancement habitat will be judged 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. Details of the monitoring to be conducted to evaluate the effectiveness of the enhancement habitat were described in the Project's OEMP (Harwood *et al.* 2017), but based on the results of year 2 monitoring we recommend the following adjustments be made.

### 5.1. Hydrology

Simultaneous monitoring of stage at FSR bridge and R1 upstream locations during spring and summer (April to the end of July) is needed to accurately account for the backwatering of the gauge at the FSR bridge over Alena Creek when flows in the Upper Lillooet River are high, and to ensure the stage data collected are representative of Alena Creek water levels. We recommend continuing hydrometric monitoring at both locations. Future monitoring efforts should also include standard practice of gauge maintenance recommended by RISC (2009) prior to spring snowmelt and throughout monitoring period to avoid future issues with missing data during this critical period.

### 5.2. Water Temperature

Close to two full years (2017 and 2018) of water temperature data have been collected post-construction upstream and downstream of the enhancement habitat. Results to date indicate that the enhancement habitat 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.

Overall, no substantial differences were observed in the pre- and post-construction temperature regimes. We recommend that the monitoring program continue for 5 years post-construction based on the methodologies and schedule prescribed in the Project OEMP (Harwood *et al.* 2017). It is recommended that post-construction water temperature data from the water level sensor at the upstream site be obtained should it exist in order to provide additional QA for the single Tidbit sensor present at this site. It is recommended that a second Tidbit be installed at this site for data redundancy as fully submerged Tidbits are less susceptible to icing issues compared to water level sensors that are housed in standpipes that are exposed to the atmosphere.

### 5.3. Fish Habitat

The overall function and quality of the constructed habitats remains high despite the flood events experienced in Alena Creek since construction. In the downstream reach, Reach 1, we recommend continued monitoring of the bank erosion at 0+185 just upstream of ALE-XS1. In Reach 3, we recommend undertaking instream repairs during the least risk timing window in August 2019; however, we recognize that cutting and live-staking should be completed in late September. We anticipate that all repairs can be completed by hand, utilizing a crew of four over 1-2 days of work. At ALE-XS5, material from the constructed riffle crest that is currently dewatered can be utilized to reconstruct the weir in the wetted width. This will alleviate all upstream concerns with further channel incision. The erosion issues upstream of both ALE-XS6 and ALE-XS7 should also be repaired. It may be possible to complete the repairs utilizing materials on site, or it may need to be sourced locally and brought into site. This could be done using small equipment, such as an ATV with a trailer and manual labor. In addition to using materials like cobble and small boulder, locally cut willow and red-osier stakes should be planted at select bank sites to aid in short-term stability.

Beavers were trapped within the Alena Creek enhancement area and dams were removed in the fall of 2018 by a licensed trapper from EBB Environmental Consulting Inc. We recommend that beaver activity continue to be monitored and assessed to ensure the enhancement habitat remains functional. Recommendations for further beaver and beaver dam management will be provided following the 2019 channel stability assessment.

### 5.4. Fish Community

The fish community component of the Alena Creek FHEP monitoring was successfully implemented in 2018, which included an increase in the number of minnow trapping sites compared to previous years. We recommend that the monitoring program continue in 2019 following the methods used in 2018.

## REFERENCES

Ashley, K. I., and P. A. Slaney. 1997. Accelerating recovery of stream, river and pond productivity by low-level nutrient replacement (Chapter 13). In P. A. Slaney & D. Zaldokas (Eds.), Fish Habitat Rehabilitation Procedures. Watershed Restoration Technical Circular No. 9. Watershed Restoration Program, Ministry of Environment, Lands and Parks and Ministry of Forests. Retrieved from http://www.env.gov.bc.ca/wld/documents/wrp/wrtc_9.pdf

Blackwell, B.G, Brown, M.L., and D.W. Willis. 2000. Relative Weight (Wr) Status and Current Use in Fisheries Assessment and Management. Rev. Fish. Sci., 8: 1-44.

Buchanan, S., A. Newbury, S. Faulkner, A. Harwood, and D. Lacroix. 2013a. Upper Lillooet Hydro Project: Upper Lillooet River Hydroelectric Facility Summary of Aquatic and Riparian Footprint Impacts. Consultant's report prepared for Upper Lillooet River Power Limited Partnership by Ecofish Research Ltd., May 2, 2013.

Buchanan, S., A. Harwood, A. Newbury, and D. Lacroix. 2013b. Upper Lillooet Hydro Project: Boulder Creek Hydroelectric Facility Summary of Aquatic and Riparian Footprint Impacts. Consultant's report prepared for Boulder Creek Power Limited Partnership by Ecofish Research Ltd., May 2, 2013.

Clark, M.J.R.E. 2013. Part E Water and Wastewater Sampling of the British Columbia Field Sampling Manual. Water, Air and Climate Change Branch, Ministry of Water, Land and Air Protection, Victoria, BC, Canada. Available online at: https://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/monitoring/emre/bc_field_sampling_manual_part_e.pdf. Accessed on December 12, 2017.

Coleman, M.A. and K.D. Fausch. 2007. Cold summer temperature limits recruitment of age-0 cutthroat trout in high-elevation Colorado streams. Transactions of the American Fisheries Society 136(5):1231-1244.

DFO and MELP (Fisheries and Oceans Canada and Ministry of Environment, Land and Parks). 1998. Riparian Revegetation. Available online at: http://www.dfo-mpo.gc.ca/Library/315523.pdf. Accessed on November 24, 2014.

Gregory, S.V., F.J. Swanson, W.A. McKee, and K.W. Cummins. 1991. An ecosystem perspective of riparian zones. Bioscience 41: 540–51

Harwood, A., A. Yeomans-Routledge, S. Faulkner, and A. Lewis. 2013. Upper Lillooet Hydro Project: Pre-construction and LTMP Report for Alena Creek Compensation Habitat. Consultant's report prepared for Upper Lillooet River Power Limited Partnership by Ecofish Research Ltd. August 15, 2013.

Harwood, A. E. Smyth, D. McDonnell, A. Newbury, P. Dinn, A. Baki, T. Jensma, and D. Lacroix. 2016. Alena Creek Fish Habitat Enhancement Project: Pre-construction Aquatic Report Years 1 & 2. Consultant's report prepared for Upper Lillooet River Power Limited Partnership by Ecofish Research Ltd., July 14, 2016.

Harwood, A., S. Faulkner, K. Ganshorn, D. Lacroix, A. Newbury, H. Regehr, X. Yu, D. West, A. Lewis, S. Barker and A. Litz. 2017. Upper Lillooet Hydro Project: Operational Environmental Monitoring Plan. Consultant's report prepared for the Upper Lillooet River Power Limited Partnership and the Boulder Creek Power Limited Partnership. March 17, 2017.

Harwood, A., S. Faulkner, K. Ganshorn, D. Lacroix, A. Newbury, H. Regehr, X. Yu, D. West, A. Lewis, S. Barker and A. Litz. 2018. Upper Lillooet Hydro Project: Operational Environmental Monitoring Plan. Consultant's report prepared for the Upper Lillooet River Power Limited Partnership and the Boulder Creek Power Limited Partnership. February 8, 2018.

Harwood, A., V. Woodruff, A. Parsamanesh, S. Faulkner, A. Baki, S. Buchanan, T. Jensma, K. Ganshorn, A. Newbury, and D. Lacroix. 2019. Alena Creek Fish Habitat Enhancement Project: Year 1 Monitoring Report. Consultant's report prepared for Upper Lillooet River Power Limited Partnership by Ecofish Research Ltd., March 12, 2019.

Hemmera (Hemmera Envirochem Inc.). 2015. Upper Lillooet Hydro Project Offsetting Plan. Consultant's report prepared for the Upper Lillooet River Power Limited Partnership by Hemmera Envirochem Inc. January 2015.

Johnston, N.T. and P.A. Slaney. 1996. Fish habitat assessment procedures. Watershed Restoration Technical Circular No. 8. Lewis, A.F., T. Hatfield, B. Chilibeck and C. Robert. 2004. Assessment methods for aquatic habitat and instream flow characteristics in support of applications to dam, divert, or extract water from streams in British Columbia. Prepared for BC Ministry of Water, Land and Air Protection and BC Ministry of Sustainable Resource Management.

Lewis, A., T. Hatfield, B. Chilibeck and C. Roberts. 2004. Assessment methods for aquatic habitat and instream flow characteristics in support of applications to dam, divert, or extract water from streams in British Columbia. Report prepared for the Ministry of Water, Land and Air Protection and the Ministry of Sustainable Resource Management. Available online at: http://www.env.gov.bc.ca/wld/documents/bmp/assessment_methods_instreamflow_in_bc.pdf. Accessed on February 18, 2014.

MFR (Ministry of Forests and Range). 2000. Tree Species Ecological and Silvical information. Available online at: http://www.for.gov.bc.ca/hfp/silviculture/TSS/tree_species/tree_species.html. Accessed on November 12, 2014.

MOE (B.C. Ministry of Environment). 2017. Approved Water Quality Guidelines. Available online at: http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines. Accessed on May 3, 2017.

MOE (B.C. Ministry of Environment). 2018. Summary of Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture. Available online at: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed on April 19, 2018.

MOF (BC Ministry of Forests). 2009. Silviculture Surveys Procedures Manual: stocking and free-growing. Forest Practices Branch, Ministry of Forests Lands, and Natural Resource Operations. Available online at: http://www.for.gov.bc.ca/hfp/publications/00099/Surveys/Silviculture%20Survey%20Procedures%20Manual-April%201%202009.pdf. Accessed on October 30, 2014.

MOF (BC Ministry of Forests). 2011. FREP Stand Development Monitoring Protocol. Ministry of Forests, Lands, and Natural Resource Operations. Available online at: http://www.for.gov.bc.ca/ftp/HFP/external/!publish/FREP/Indicators/SDM%20Protocol%202011.pdf. Accessed on October 30, 2014.

Naiman, R.J. and H. Decamps. 1997. The ecology of interfaces: riparian zones. Annual Review of Ecology and Systematics. 28: 621-658

Naiman, R.J., R.E. Bilby, and P.A. Bisson. 2000. Riparian Ecology and Management in the Pacific Coastal Rainforest. Bioscience. 50: 996-1011.

Nordin, R.N. and L.W. Pommen. 1986. Water quality criteria for nitrogen (nitrate, nitrite, and ammonia): technical appendix. Water Quality Unit, Water Management Branch, British Columbia Ministry of Environment and Parks. Victoria, BC. Available online at: http://www.env.gov.bc.ca/wat/wq/BCguidelines/nitrogen/nitrogentech.pdf. Accessed on December 3, 2013.

Oliver, G.G. and L.E. Fidler. 2001. Towards a water quality guideline for temperature in the Province of British Columbia. Prepared for Ministry of Environment, Lands and Parks, Water Management Branch, Water Quality Section, Victoria, B.C. Prepared by Aspen Applied Sciences Ltd., Cranbrook, B.C., 53 pp + appnds. Available online at: http://www.env.gov.bc.ca/wat/wq/BCguidelines/temptech/index.html. Accessed on May 23, 2012.

Phippen, B., C. Horvath, R. Nordin, N. Nagpal. 2008. Ambient Water Quality Guidelines for Iron. Prepared for: Science and Information Branch Water Stewardship Division Ministry of Environment. Available online at: http://www.env.gov.bc.ca/wat/wq/BCguidelines/iron/iron_tech.pdf. Accessed on April 7, 2015.

Richardson, J.S. 2004. Meeting the conflicting objectives of stream conservation and land use through riparian management: another balancing act. Pp. 1 - 6 In: G. J. Scrimgeour, G. Eisler, B. McCulloch, U. Silins and M. Monita (Eds.) Forest-Land-Fish Conference II - Ecosystem Stewardship Through Collaboration. Proc. Forest-Land-Fish Conf. II, April 26-28, 2004, Edmonton, Alberta.

RISC (Resources Information Standards Committee). 1998a. Ambient Fresh Water and Effluent Sampling Manual. Prepared by the Resource Inventory Standards Committee. Available online at: https://www.crownpub.bc.ca/Product/Details/7680000559_S. Accessed on April 19, 2018.

RISC (Resources Information Standards Committee). 1998b. Guidelines for Interpreting Water Quality Data. Prepared by the BC Ministry of Environment, Lands and Parks for the Resource Inventory Commission. Available online at: http://archive.ilmb.gov.bc.ca/risc/pubs/aquatic/interp/index.htm. Accessed on December 3, 2013.

RISC (Resources Information Standards Committee). 2009. Manual of British Columbia Hydrometric Standards. Prepared by the BC Ministry of Environment, Science and Information Branch. Available online at: https://www.for.gov.bc.ca/hts/risc/pubs/aquatic/hydrometric/man_BC_hydrometric_stand_V1.0.pdf. Accessed on December 3, 2013.

Slaney, P. A. and B. R. Ward. 1993. Experimental fertilization of nutrient deficient streams in British Columbia. In G. S. et S. Asselin (Ed.), Le developpement du Saumon atlantique au Quebec: connaitre les regles du jeu pour reussir. Colloque international de la Federation quebecoise pour le saumon Atlantique. Quebec, decembre 1992. Collection Salmo salar no 1 (p. 201).

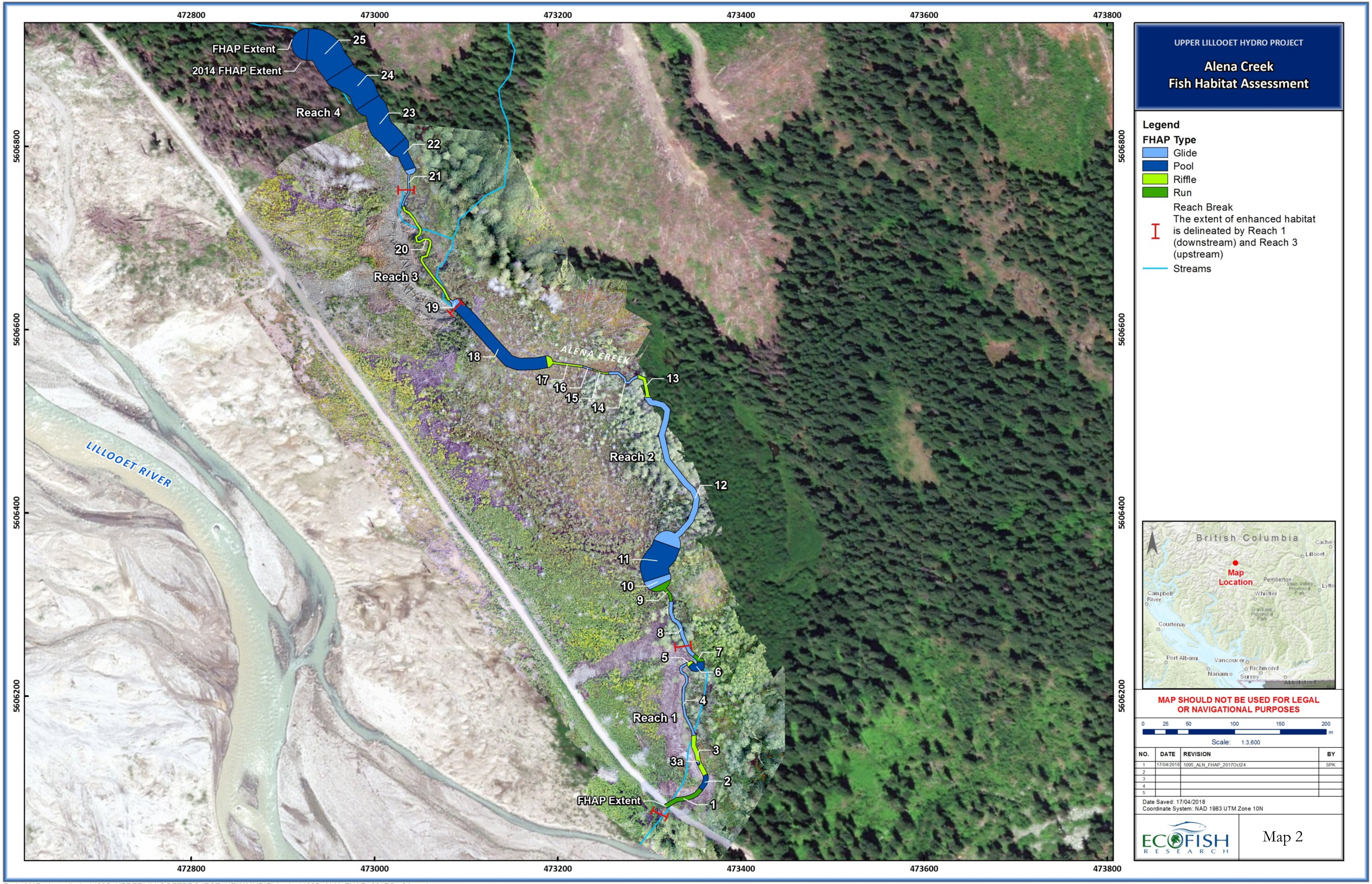
West. D, V. Woodruff and A. Harwood. 2017. Alena Creek Fish Habitat Enhancement Project As-Built Survey. Consultant's report prepared for Upper Lillooet River Power Limited Partnership and Boulder Creek Power Limited Partnership by Ecofish Research Ltd. March 7, 2017.

## Personal Communications

McCarthy, C. 2014. Senior Engineer, Knight Piésold Ltd., Vancouver, BC. Email communication with J. Mancinelli, Innergex Renewable Energy Inc., March 31, 2014

McCoy, D. 2016. Engineering Manager, Innergex Renewable Energy Inc. Email communication with J. Mancinelli, Innergex Renewable Energy Inc., November 14, 2016.

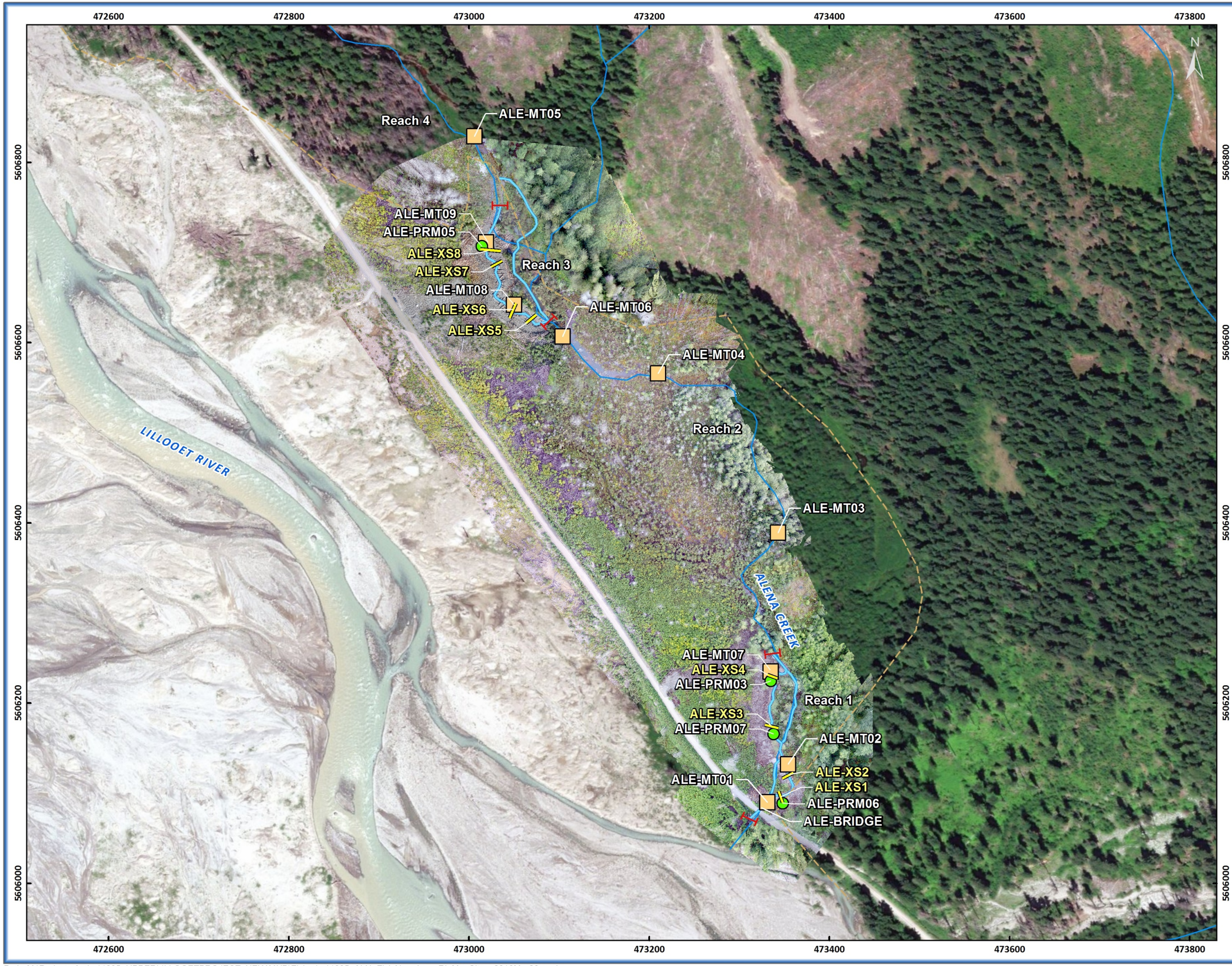
# PROJECT MAPS




Path: M:\Projects-Active\1095_UPPERLILLOOETPROJECT_NEW\MXD\Fisheries\1095_ALN_FHAP_2017Oct24.mxd


Path: M:\Projects-Active\1095_UPPERLILLOOETPROJECT_NEW\MXD\WaterQuality\1095_ALN_WT_MonitoringSites_2019Feb25.mxd

## 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

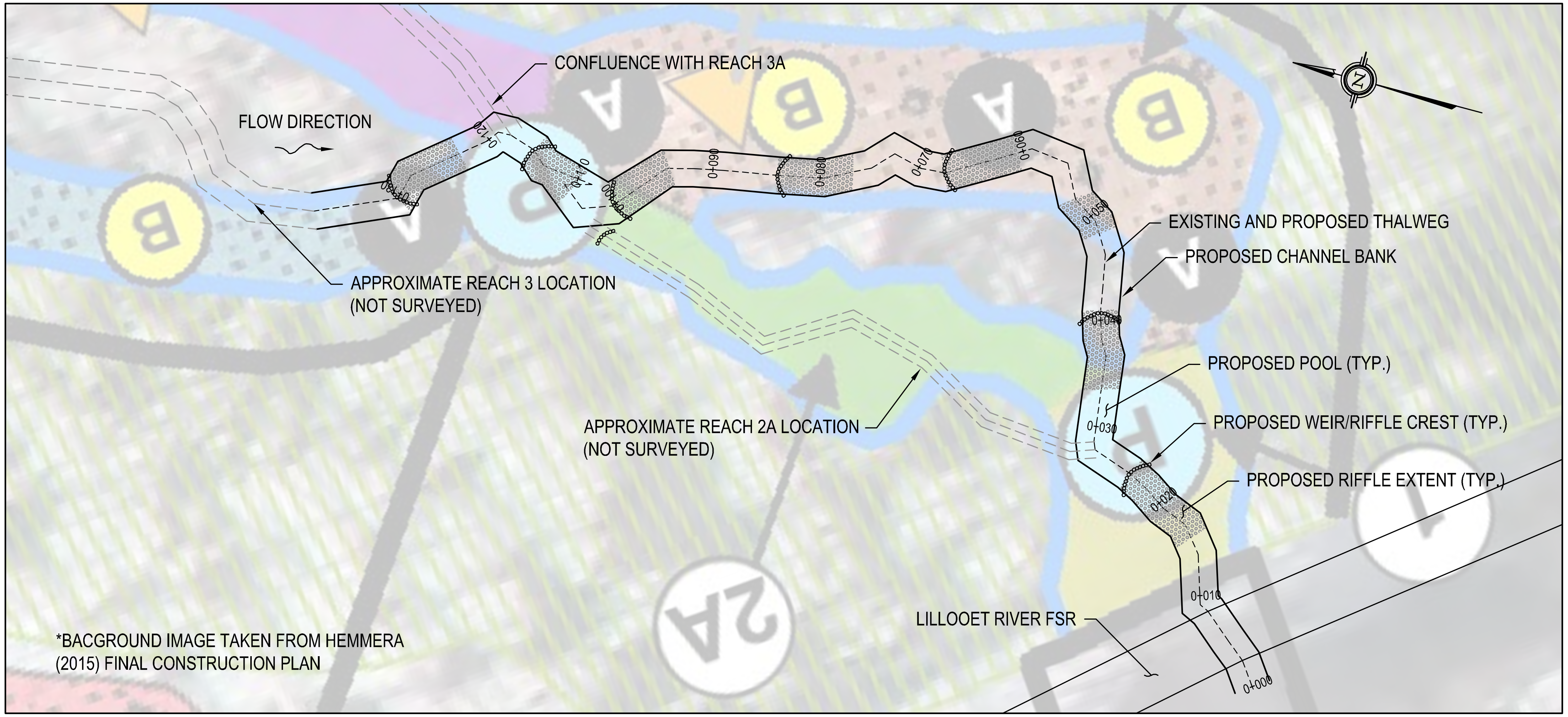
ECOFISH RESEARCH

Map 4

Path: M:\Projects-Active\1095_UPPERLILLOOETPROJECT_NEW\MXD\Fisheries\1095_ALN_FishAbundanceRipMonSites_2019Mar26.mxd

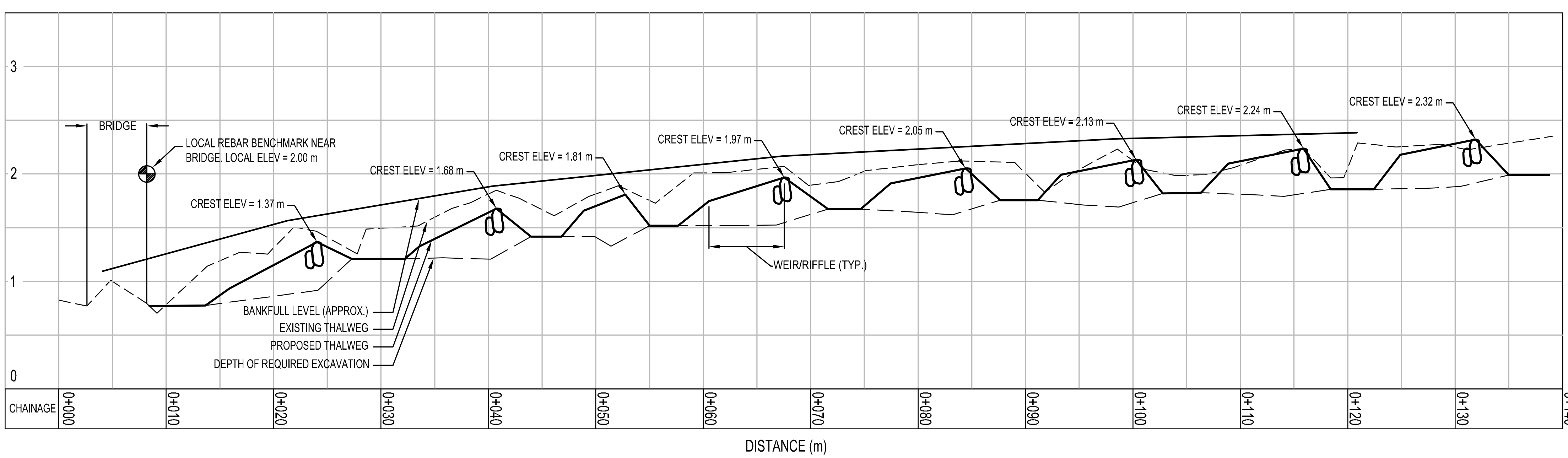
# APPENDICES

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




REACH 1, 2, & 2A PLANVIEW

1:500




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.

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

| | | | |
|---|---|---|---|
| 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

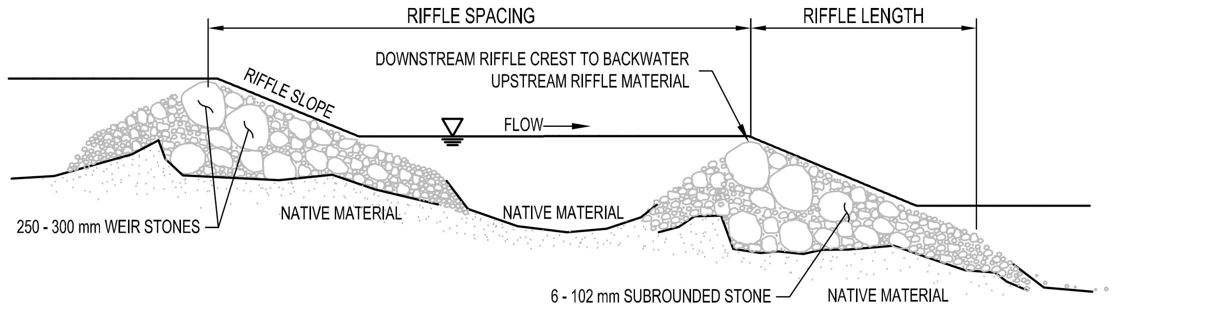
ECOFISH RESEARCH

ALENA CREEK FHEP DETAILED CONSTRUCTION PLAN

REACH 1 AND 2
PLANFORM AND PROFILE

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

## WEIR/RIFFLE CONSTRUCTION DETAILS

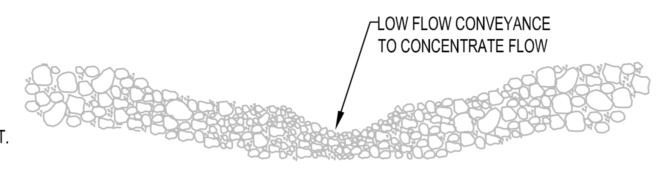



TYPICAL RIFFLE SEQUENCE PROFILE

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.

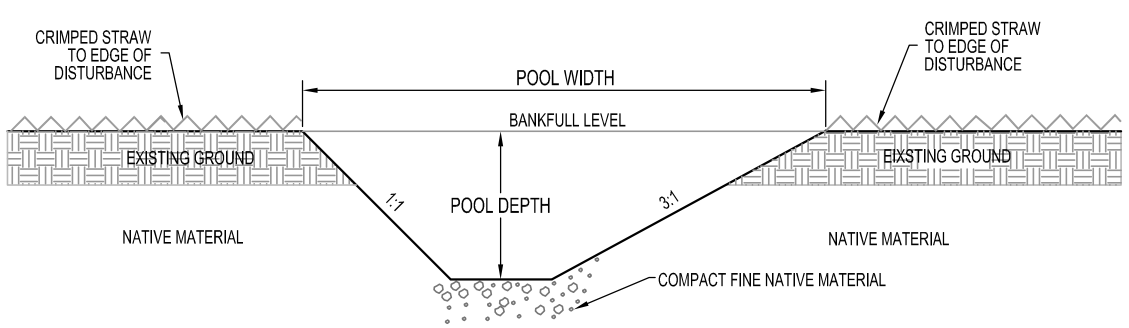



CROSS-SECTION

N.T.S.

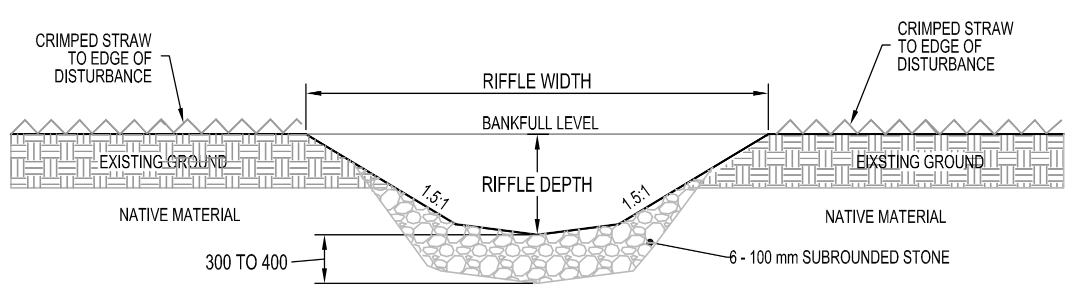
WEIR/RIFFLE CONSTRUCTION DETAILS

N.T.S.




## TYPICAL POOL CROSS SECTION

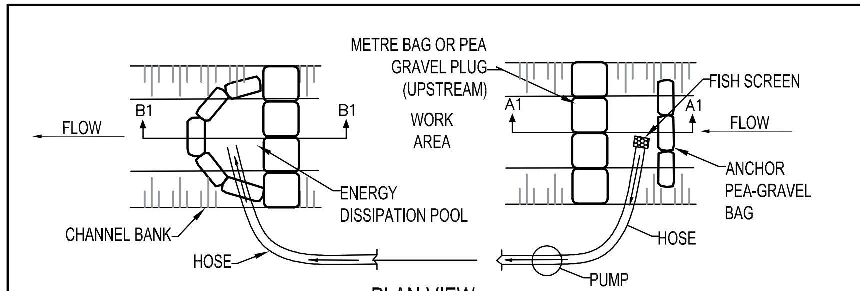
N.T.S.



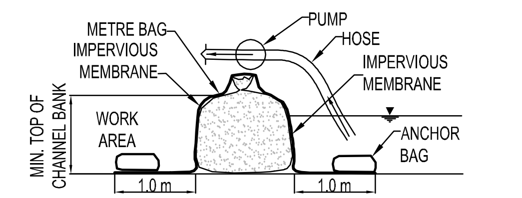

## TYPICAL RIFFLE CROSS SECTION

N.T.S.

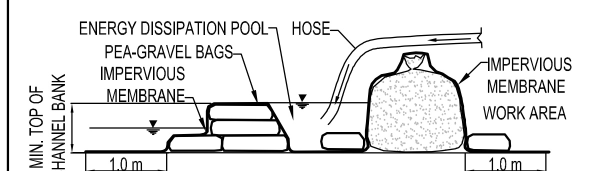
## COFFERDAM BARRIER




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.

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

DESIGNED BY: D.W. CHECKED BY: D.W.

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

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

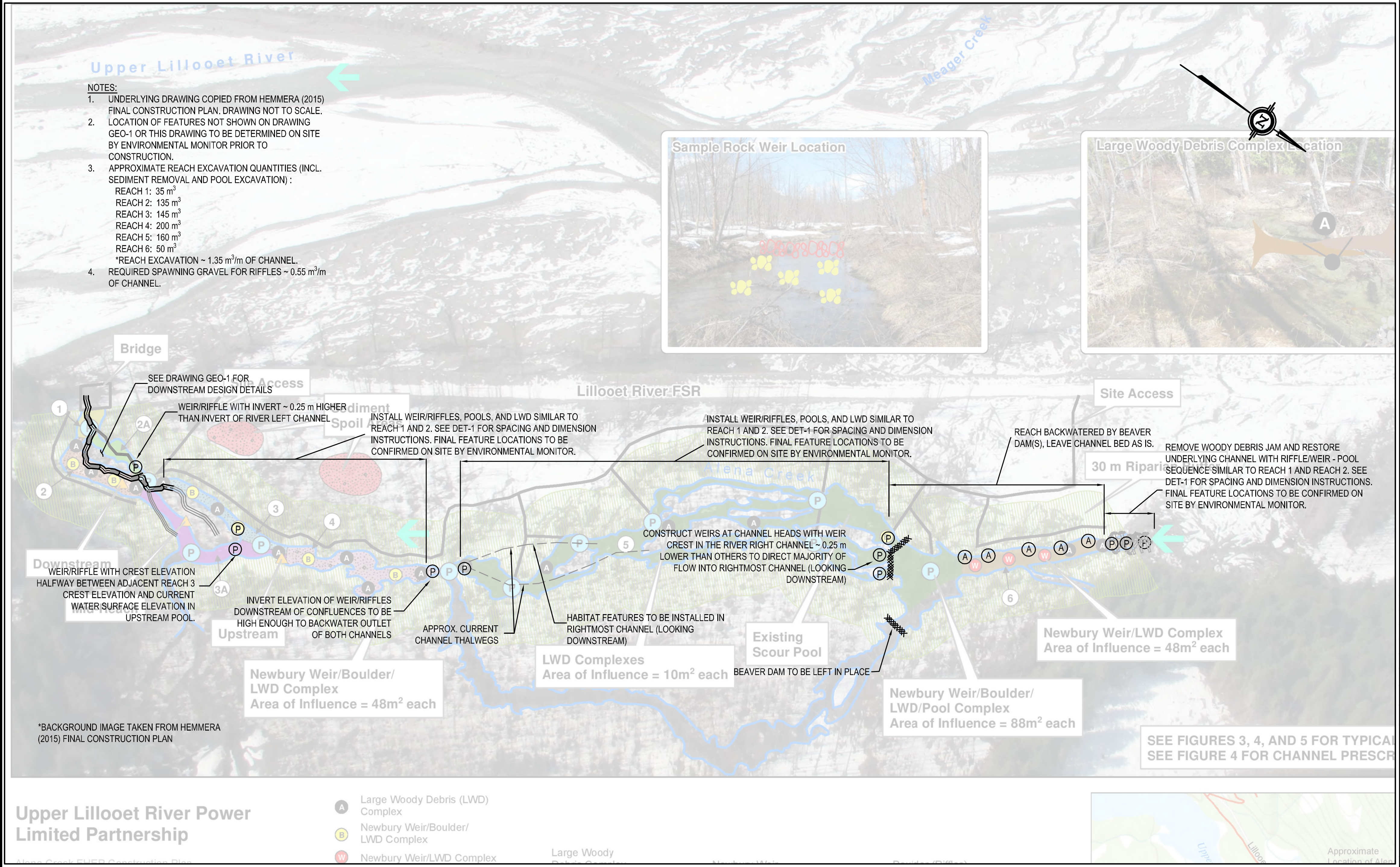
ECOFISH RESEARCH

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.

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

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 RR to RL at ALE-USWQ1 on January 30, 2019.

Figure 2. Looking RR to RL at ALE-USWQ1 on January 30, 2019.

Figure 3. Looking downstream at ALE-BDGWQ on September 13, 2017.

Figure 4. Looking upstream of ALE-BDGWQ on September 13, 2017.

# Appendix C. Water Temperature Guidelines and Data Summary.

## 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. MONTHLY SUMMARY STATISTICS

**Table 2. Pre-construction (2013-2014) water temperature monthly statistics in Alena Creek. Blue and red shadings highlight minimum and maximum temperatures, respectively.**

| Year | Month | Water Temperature[1] (°C) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ALE-USWQ1 | | | | ALE-BDGWQ | | | |
| | | Avg | Min | Max | SD | Avg | Min | Max | SD |
| 2013 | Apr | - | - | - | - | - | - | - | - |
| | 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 | 5.8 | 4.2 | 6.5 | 0.5 | 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 | 8.1 | 0.9 | 5.4 | 2.0 | 8.3 | 1.6 |
| | Dec | 5.0 | 2.8 | 6.8 | 0.9 | 3.8 | 2.1 | 5.3 | 0.7 |

[1] Statistics based on hourly data and were not generated for months with less than three weeks of data.

**Table 3. Post-construction (2016-2019) water temperature monthly statistics in Alena Creek. Blue and red shadings highlight minimum and maximum temperatures, respectively.**

| Year | Month | Water Temperature[1] (°C) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ALE-USWQ1† | | | | ALE-BDGWQ† | | | |
| | | Avg | Min | Max | SD | Avg | Min | Max | SD |
| 2016 | Nov | - | - | - | - | - | - | - | - |
| | 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 | - | - | - | - |
| | Dec | 5.2 | 2.9 | 6.8 | 0.6 | - | - | - | - |
| 2019 | Jan | 5.0 | 2.7 | 6.6 | 0.6 | - | - | - | - |

[1] Statistics based on 15 minutes data were not generated for months with less than three weeks of data.

# Appendix D. Photographs of Alena Creek Fish Habitat Enhancement Project Stability Assessment Year 2 Monitoring.

## LIST OF FIGURES

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

**a) Looking upstream.**

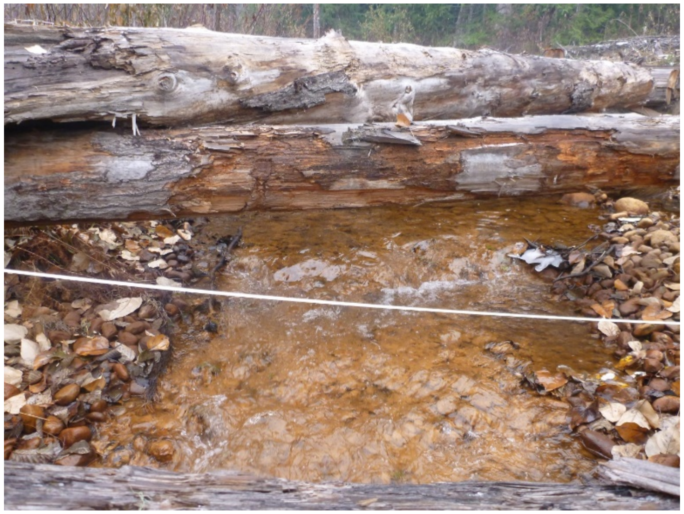
**c) Looking from river right to river left.**

**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-XS2 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 5. 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 6. 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 7. ALE-XS3 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 8. ALE-XS3 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 9. 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 10. ALE-XS4 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 11. 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 12. 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 13. ALE-XS5 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 14. 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 15. 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 16. ALE-XS6 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.**



ECOFISH RESEARCH

**Figure 17. 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 18. 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 19. ALE-XS7 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 20. ALE-XS7 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 21. 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.



ECOFISH RESEARCH

Figure 22. ALE-XS8 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 23. 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 24. ALE-XS8 on November 05, 2018.**

**a) Looking upstream.**

**b) Looking downstream.**

**c) Looking from river right to river left.**

**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

**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 | 6 | 24-Sep-18 | 10:10 | 25-Sep-18 | 08:20 | 0.40 | 22.17 | 1 | 0 | 0 |
| | 2 | 6 | 24-Sep-18 | 10:10 | 25-Sep-18 | 08:20 | 0.36 | 22.17 | 24 | 0 | 0 |
| | 3 | 6 | 24-Sep-18 | 10:10 | 25-Sep-18 | 08:12 | 0.35 | 22.03 | 0 | 0 | 0 |
| | 4 | 6 | 24-Sep-18 | 10:10 | 25-Sep-18 | 08:12 | 0.27 | 22.03 | 17 | 1 | 0 |
| | 5 | 6 | 24-Sep-18 | 10:10 | 25-Sep-18 | 08:10 | 0.21 | 22.00 | 5 | 1 | 0 |
| ALE-MT02 | 1 | 6 | 24-Sep-18 | 10:32 | 25-Sep-18 | 09:10 | 0.26 | 22.63 | 12 | 0 | 0 |
| | 2 | 6 | 24-Sep-18 | 10:32 | 25-Sep-18 | 09:10 | 0.31 | 22.63 | 7 | 1 | 0 |
| | 3 | 6 | 24-Sep-18 | 10:32 | 25-Sep-18 | 09:10 | 0.25 | 22.63 | 7 | 0 | 0 |
| | 4 | 6 | 24-Sep-18 | 10:32 | 25-Sep-18 | 09:10 | 0.22 | 22.63 | 1 | 1 | 0 |
| | 5 | 6 | 24-Sep-18 | 10:32 | 25-Sep-18 | 09:10 | 0.24 | 22.63 | 26 | 0 | 0 |
| ALE-MT03 | 1 | 6 | 24-Sep-18 | 11:28 | 25-Sep-18 | 11:45 | 0.58 | 24.28 | 64 | 1 | 0 |
| | 3 | 6 | 24-Sep-18 | 11:28 | 25-Sep-18 | 11:45 | 0.38 | 24.28 | 5 | 0 | 0 |
| | 4 | 6 | 24-Sep-18 | 11:28 | 25-Sep-18 | 11:45 | 0.21 | 24.28 | 36 | 0 | 0 |
| | 5 | 6 | 24-Sep-18 | 11:28 | 25-Sep-18 | 11:45 | 0.22 | 24.28 | 30 | 1 | 0 |
| ALE-MT05 | 1 | 6 | 24-Sep-18 | 13:55 | 25-Sep-18 | 15:40 | 0.59 | 25.75 | 27 | 0 | 0 |
| | 2 | 3 | 24-Sep-18 | 13:55 | 25-Sep-18 | 15:40 | 0.74 | 25.75 | 7 | 1 | 0 |
| | 3 | 6 | 24-Sep-18 | 13:55 | 25-Sep-18 | 15:40 | 0.49 | 25.75 | 22 | 2 | 0 |
| | 4 | 3 | 24-Sep-18 | 13:55 | 25-Sep-18 | 15:40 | 0.55 | 25.75 | 15 | 1 | 0 |
| | 5 | 6 | 24-Sep-18 | 13:55 | 25-Sep-18 | 15:40 | 0.54 | 25.75 | 28 | 0 | 0 |
| ALE-MT06 | 1 | 3 | 24-Sep-18 | 12:58 | 25-Sep-18 | 13:15 | 0.66 | 24.28 | 7 | 0 | 0 |
| | 2 | 3 | 24-Sep-18 | 12:59 | 25-Sep-18 | 13:15 | 0.40 | 24.27 | 3 | 0 | 0 |
| | 3 | 6 | 24-Sep-18 | 13:00 | 25-Sep-18 | 13:15 | 0.80 | 24.25 | 22 | 1 | 0 |
| | 4 | 6 | 24-Sep-18 | 13:02 | 25-Sep-18 | 13:15 | 0.50 | 24.22 | 12 | 0 | 0 |
| | 5 | 3 | 24-Sep-18 | 12:58 | 25-Sep-18 | 13:15 | 0.90 | 24.28 | 7 | 0 | 0 |
| | 6 | 3 | 24-Sep-18 | 12:58 | 25-Sep-18 | 13:15 | 0.95 | 24.28 | 8 | 0 | 0 |
| | 7 | 3 | 24-Sep-18 | 12:59 | 25-Sep-18 | 13:15 | 1.00 | 24.27 | 17 | 1 | 0 |
| | 8 | 3 | 24-Sep-18 | 12:59 | 25-Sep-18 | 13:15 | 1.00 | 24.27 | 22 | 0 | 0 |
| | 9 | 3 | 24-Sep-18 | 12:59 | 25-Sep-18 | 13:15 | 0.94 | 24.27 | 21 | 0 | 0 |
| | 10 | 6 | 24-Sep-18 | 13:00 | 25-Sep-18 | 13:15 | 0.26 | 24.25 | 15 | 0 | 0 |
| ALE-MT07 | 1 | 6 | 24-Sep-18 | 10:55 | 25-Sep-18 | 10:24 | 0.20 | 23.48 | 34 | 0 | 0 |
| | 2 | 6 | 24-Sep-18 | 10:55 | 25-Sep-18 | 10:24 | 0.90 | 23.48 | 34 | 0 | 0 |
| | 3 | 6 | 24-Sep-18 | 10:55 | 25-Sep-18 | 10:24 | 0.90 | 23.48 | 25 | 2 | 0 |
| | 4 | 6 | 24-Sep-18 | 10:55 | 25-Sep-18 | 10:24 | 0.90 | 23.48 | 16 | 1 | 0 |
| | 5 | 6 | 24-Sep-18 | 10:55 | 25-Sep-18 | 10:24 | 0.95 | 23.48 | 53 | 0 | 0 |
| ALE-MT08 | 1 | 6 | 24-Sep-18 | 12:33 | 25-Sep-18 | 14:16 | 0.24 | 25.72 | 69 | 0 | 0 |
| | 2 | 6 | 24-Sep-18 | 12:33 | 25-Sep-18 | 14:16 | 0.20 | 25.72 | 9 | 0 | 0 |
| | 3 | 6 | 24-Sep-18 | 12:33 | 25-Sep-18 | 14:16 | 0.26 | 25.72 | 20 | 0 | 0 |
| | 4 | 6 | 24-Sep-18 | 12:33 | 25-Sep-18 | 14:16 | 0.42 | 25.72 | 17 | 0 | 0 |
| | 5 | 3 | 24-Sep-18 | 12:33 | 25-Sep-18 | 14:16 | 0.25 | 25.72 | 7 | 0 | 0 |
| ALE-MT09 | 1 | 3 | 24-Sep-18 | 13:30 | 25-Sep-18 | 15:00 | 0.22 | 25.50 | 59 | 0 | 0 |
| | 2 | 3 | 24-Sep-18 | 13:30 | 25-Sep-18 | 15:00 | 0.30 | 25.50 | 0 | 2 | 0 |
| | 3 | 3 | 24-Sep-18 | 13:30 | 25-Sep-18 | 15:00 | 0.26 | 25.50 | 34 | 0 | 0 |
| | 4 | 3 | 24-Sep-18 | 13:30 | 25-Sep-18 | 15:00 | 0.30 | 25.50 | 33 | 0 | 0 |
| | 5 | 3 | 24-Sep-18 | 13:30 | 25-Sep-18 | 15:00 | 0.21 | 25.50 | 9 | 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 Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT01 | 24-Sep-18 | 1 | CO | 70 | | | | | | | 0 | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | 45 | | | | | | | 0 | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | 49 | 1.0 | 0.85 | FC | 7 | FC | 7 | 0 | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | 60 | | | | | | | 0 | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | 70 | | | | | | | 0 | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | 90 | | | | | | | 1 | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 3 | NFC | | | | | | | | | |
| ALE-MT01 | 24-Sep-18 | 4 | CO | 73 | 3.0 | 0.77 | SC | 6 | FC | 6 | 0 | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | 91 | 7.2 | 0.96 | SC | 4 | FC | 4 | 1 | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT01 | 24-Sep-18 | 4 | CT | 92 | 7.3 | 0.94 | SC | 5 | FC | 5 | 1 | No |
| ALE-MT01 | 24-Sep-18 | 5 | CO | 46 | 1.2 | 1.23 | SC | 3 | FC | 3 | 0 | No |
| ALE-MT01 | 24-Sep-18 | 5 | CO | 57 | 1.4 | 0.76 | SC | 2 | FC | 2 | 0 | No |
| ALE-MT01 | 24-Sep-18 | 5 | CO | 57 | | | | | | | 0 | No |
| ALE-MT01 | 24-Sep-18 | 5 | CO | 57 | | | | | | | 0 | No |
| ALE-MT01 | 24-Sep-18 | 5 | CO | 57 | | | | | | | 0 | No |
| ALE-MT01 | 24-Sep-18 | 5 | CT | 95 | 9.0 | 1.05 | SC | 1 | FC | 1 | 1 | No |
| ALE-MT02 | 24-Sep-18 | 1 | CO | 49 | 1.0 | 0.85 | | | | | 0 | No |
| ALE-MT02 | 24-Sep-18 | 1 | CO | 51 | 1.6 | 1.21 | | | | | 0 | No |
| ALE-MT02 | 24-Sep-18 | 1 | CO | 52 | 1.6 | 1.14 | | | | | 0 | No |
| ALE-MT02 | 24-Sep-18 | 1 | CO | 62 | 2.6 | 1.09 | | | | | 0 | No |
| ALE-MT02 | 24-Sep-18 | 1 | CO | 75 | 5.0 | 1.19 | SC | 2 | FC | 2 | 0 | No |
| ALE-MT02 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 2 | CO | 60 | 2.0 | 0.93 | | | | | 0 | No |
| ALE-MT02 | 24-Sep-18 | 2 | CO | 60 | 2.0 | 0.93 | | | | | 0 | No |
| ALE-MT02 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 2 | CT | 85 | 6.0 | 0.98 | SC | 6 | FC | 6 | 1 | No |
| ALE-MT02 | 24-Sep-18 | 3 | CO | 58 | 2.3 | 1.18 | | | | | 0 | No |
| ALE-MT02 | 24-Sep-18 | 3 | CO | 60 | 2.5 | 1.16 | | | | | 0 | No |
| ALE-MT02 | 24-Sep-18 | 3 | CO | 78 | 3.8 | 0.80 | SC | 1 | FC | 1 | 0 | No |
| ALE-MT02 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 4 | CO | 86 | 6.5 | 1.02 | | | | | 1 | No |
| ALE-MT02 | 24-Sep-18 | 4 | CT | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | 50 | 1.6 | 1.28 | | | | | 0 | No |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT02 | 24-Sep-18 | 5 | CO | 54 | 1.7 | 1.08 | SC | 4 | FC | 4 | 0 | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | 59 | 2.0 | 0.97 | SC | 5 | FC | 5 | 0 | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | 73 | 4.0 | 1.03 | | | | | 0 | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | 80 | 5.1 | 1.00 | SC | 3 | FC | 3 | 0 | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT02 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT03 | 24-Sep-18 | 1 | CO | 92 | 7.0 | 0.90 | | | | | 1 | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | 95 | 7.8 | 0.91 | SC | 5 | FC | 5 | 1 | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | 100 | 8.4 | 0.84 | | | | | 1 | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |

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

**Table 2. Continued.**

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |

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

**Table 2. Continued.**

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 1 | CT | 103 | 11.0 | 1.01 | SC | 4 | FC | 4 | 1 | |
| ALE-MT03 | 24-Sep-18 | 3 | CO | 41 | | | | | | | 0 | |
| ALE-MT03 | 24-Sep-18 | 3 | CO | 51 | | | | | | | 0 | |
| ALE-MT03 | 24-Sep-18 | 3 | CO | 56 | 2.0 | 1.14 | | | | | 0 | |
| ALE-MT03 | 24-Sep-18 | 3 | CO | 57 | 2.0 | 1.08 | | | | | 0 | |
| ALE-MT03 | 24-Sep-18 | 3 | CO | 66 | 3.3 | 1.15 | SC | 1 | FC | 1 | 0 | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | 54 | 2.0 | 1.27 | | | | | 0 | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | 68 | | | | | | | 0 | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | 70 | 3.0 | 0.87 | SC | 3 | FC | 3 | 0 | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |

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

**Table 2. Continued.**

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT03 | 24-Sep-18 | 5 | CT | 95 | 10.0 | 1.17 | SC | 2 | FC | 2 | 1 | |
| ALE-MT05 | 24-Sep-18 | 1 | CO | 52 | 1.0 | 0.71 | | | | | 0 | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | 85 | 6.0 | 0.98 | | | | | 0 | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 2 | CO | 80 | 5.0 | 0.98 | | | | | 0 | No |
| ALE-MT05 | 24-Sep-18 | 2 | CO | 92 | 10.0 | 1.28 | | | | | 1 | No |
| ALE-MT05 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 2 | CO | | | | | | | | | No |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT05 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 2 | CT | 92 | 9.0 | 1.16 | | 1 | FC | 1 | 1 | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | 80 | 6.0 | 1.17 | | | | | 0 | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | 86 | 9.0 | 1.41 | | | | | 1 | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT05 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT05 | 24-Sep-18 | 3 | CT | 135 | 25.0 | 1.02 | | 4 | FC | 4 | 2 | No |
| ALE-MT05 | 24-Sep-18 | 3 | CT | | | | | | | | | |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 4 | CT | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | 54 | 1.0 | 0.64 | | 2 | FC | 2 | 0 | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | 83 | 5.0 | 0.87 | | 3 | FC | 3 | 0 | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT05 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 1 | CO | | | | | | | | | No |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT06 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 3 | CT | 125 | 21.0 | 1.08 | | | | | 2 | No |
| ALE-MT06 | 24-Sep-18 | 4 | CO | 31 | | | | | | | 0 | No |
| ALE-MT06 | 24-Sep-18 | 4 | CO | 43 | 1.0 | 1.26 | | | | | 0 | No |
| ALE-MT06 | 24-Sep-18 | 4 | CO | 78 | 5.0 | 1.05 | | | | | 0 | No |
| ALE-MT06 | 24-Sep-18 | 4 | CO | 86 | 7.0 | 1.10 | | | | | 1 | No |
| ALE-MT06 | 24-Sep-18 | 4 | CO | 91 | 10.0 | 1.33 | | | | | 1 | No |
| ALE-MT06 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 5 | CO | | | | | | | | | No |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT06 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 6 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 6 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 6 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 6 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 6 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 6 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 6 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 6 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 7 | CT | 140 | 30.0 | 1.09 | SC | 3 | FC | 3 | 2 | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | 79 | 6.0 | 1.22 | | | | | 0 | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | 86 | 8.0 | 1.26 | | | | | 1 | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | 89 | 9.0 | 1.28 | | | | | 1 | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | 106 | 9.0 | 0.76 | | | | | 1 | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | 107 | 15.0 | 1.22 | SC | 1 | FC | 1 | 1 | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 8 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 9 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |

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

## Table 2. Continued.

| Site | Date | Trap # | Species¹ | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT06 | 24-Sep-18 | 10 | CO | | | | | | | | | No |
| ALE-MT07 | 24-Sep-18 | 1 | CO | 55 | 2.0 | 1.20 | | | | | 0 | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | 59 | 2.2 | 1.07 | | | | | 0 | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | 73 | 5.0 | 1.29 | | | | | 0 | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 1 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | 71 | 1.7 | 0.47 | SC | 1 | FC | 1 | 0 | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | 84 | 2.0 | 0.34 | SC | 2 | FC | 2 | 0 | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 2 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 3 | CT | 94 | 9.0 | 1.08 | SC | 4 | FC | 4 | 1 | |
| ALE-MT07 | 24-Sep-18 | 3 | CT | 98 | 11.0 | 1.17 | SC | 3 | FC | 3 | 1 | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |

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

**Table 2. Continued.**

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 4 | CT | 85 | 7.0 | 1.14 | | | | | 1 | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | 93 | 10.0 | 1.24 | SC | 5 | FC | 5 | 1 | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT07 | 24-Sep-18 | 5 | CO | | | | | | | | | |
| ALE-MT08 | 24-Sep-18 | 1 | CO | 46 | | | | | | | 0 | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | 56 | | | SC | 5 | FC | 5 | 0 | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | 79 | 6.0 | 1.22 | SC | 4 | FC | 5 | 0 | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |

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

**Table 2. Continued.**

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 2 | CO | 56 | 2.0 | 1.14 | | | | | 0 | No |
| ALE-MT08 | 24-Sep-18 | 2 | CO | 57 | 1.0 | 0.54 | | | | | 0 | No |
| ALE-MT08 | 24-Sep-18 | 2 | CO | 60 | 3.0 | 1.39 | SC | 1 | FC | 1 | 0 | No |
| ALE-MT08 | 24-Sep-18 | 2 | CO | 84 | 7.0 | 1.18 | SC | 2 | FC | 2 | 0 | No |
| ALE-MT08 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 2 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | 45 | | | | | | | 0 | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | 78 | 6.0 | 1.26 | | | | | 0 | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | 87 | 8.0 | 1.21 | SC | 3 | FC | 3 | 1 | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |

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

**Table 2. Continued.**

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT08 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |

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

**Table 2. Continued.**

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 1 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 2 | CT | 100 | 10.0 | 1.00 | SC | 3 | FC | 3 | 1 | No |
| ALE-MT09 | 24-Sep-18 | 2 | CT | 104 | 11.0 | 0.98 | SC | 2 | FC | 2 | 1 | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | 50 | | | | | | | 0 | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | 66 | | | | | | | 0 | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | 80 | 7.0 | 1.37 | | | | | 0 | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |

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

## Table 2. Continued.

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 3 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | 47 | 1.0 | 0.96 | | | | | 0 | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | 50 | | | | | | | 0 | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | 50 | | | | | | | 0 | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | 50 | | | | | | | 0 | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | 52 | 2.0 | 1.42 | | | | | 0 | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | 60 | 3.0 | 1.39 | | | | | 0 | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | 81 | 7.0 | 1.32 | SC | 1 | FC | 1 | 0 | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 4 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 5 | CO | | | | | | | | | No |

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

**Table 2. Continued.**

| Site | Date | Trap # | Species[1] | Measured Length (mm) | Weight (g) | K | Age Sample Type | Age Sample Number | DNA Sample Type | DNA Sample Numer | Age Assigned | Recapture (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALE-MT09 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 5 | CO | | | | | | | | | No |
| ALE-MT09 | 24-Sep-18 | 5 | CO | | | | | | | | | No |

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

**Figure 1. Minnow trap #3 at sampling site ALE-MT01 on September 24, 2018.**

**Figure 2. Minnow trap #3 at sampling site ALE-MT02 on September 24, 2018.**

**Figure 3. Minnow trap #1 at sampling site ALE-MT03 on September 24, 2018.**

**Figure 4. Minnow trap #5 at sampling site ALE-MT05 on September 24, 2018.**

Figure 5. Minnow trap #7 at sampling site ALE-MT06 on September 24, 2018.

Figure 6. Minnow trap #4 at sampling site ALE-MT07 on September 24, 2018.

Figure 7. Minnow trap #2 at sampling site ALE-MT08 on September 24, 2018.

Figure 8. Minnow trap #3 at sampling site ALE-MT09 on September 24, 2018.