Photo source: (NHC, 2017)

Endako River Weir
Detailed Design Report

Prepared by:

Northwest Hydraulic Consultants Ltd.
30 Gostick Place
North Vancouver, BC V7M 3G3
Tel: (604) 980-6011
www.nhcweb.com

NHC Project Contact:
Barry Chilibeck, M.A.Sc., P.Eng.

Prepared for:

Upper Fraser Fisheries Conservation Alliance
298A Mission Road
Williams Lake, BC, V2G 5K9

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Report prepared by:

Andrew Twining
Project Engineer

Ned Atkins, P.Eng.
Hydrotechnical Engineer

Report reviewed by:

Barry Michael Chilibeck -- P. Eng. - EGBC

Digitally signed by Barry Michael Chilibeck -- P. Eng. - EGBC
Date: 2021.04.16 12:21:07 -07'00'

Barry Chilibeck, M.A.Sc., P.Eng.
Principal

Notification

This report has been prepared by **Northwest Hydraulic Consultants Ltd.** for the benefit **of Upper Fraser Fisheries Conservation Alliance** for specific application to the **Endako River Weir and Fishway Design**. The information and data contained herein represent **Northwest Hydraulic Consultants Ltd.** best professional judgment in light of the knowledge and information available to **Northwest Hydraulic Consultants Ltd.** at the time of preparation, and was prepared in accordance with generally accepted engineering and geoscience practices.

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Contents

Tables

Figures

Appendices

1 Introduction

1.1 Background

For several years, there has been discussion regarding the construction of small storage dams on Burns, Tschesinkut, and Hanson lakes to provide late summer flows to improve fish habitat (FISS, 2017). The initial review for a possible dam on Burns Lake was started by the Carrier Sekani Tribal Council (CSTC) with the goal to improve spawning conditions for Chinook salmon in the Endako River watershed (ARL, 2001). This work is continued by the Upper Fraser Fisheries Conservation Alliance (UFFCA).

The Endako River watershed is located within the Central Mountains Hydrological Zone in the interior of British Columbia and is a tributary to the Stellako / Fraser Lake system and finally the Nechako and Fraser Rivers. Burns Lake is at an approximate elevation of 701 m above sea level with a surface area of 1,180 ha. The watershed area upstream of the proposed weir location is 788.2 km^2.

Key fish species present in Burns Lake and the Endako River include anadromous Chinook salmon, Kokanee, Rainbow trout, and Mountain Whitefish. There is also a small population of anadromous Sockeye salmon. Because of the watershed setting and topography, fish habitats in the Endako River are generally low gradient with an abundance of meandering channels, slough, and wetland habitat. The relatively small watershed with little topography limits the snowpack and ensuing freshet. Rainfall provides much of the annual runoff.

Late summer and early fall periods often lack precipitation and low discharges have been documented as limiting upstream adult Chinook migration (ARL, 2001; AMEC, 2002; FISS, 2017). Beaver dams are notable obstacles in the Endako River and, in some locations, are removed in the fall to improve salmon and Kokanee access to spawning areas.

1.2 Scope of Work

Northwest Hydraulic Consultants Ltd. (NHC) was contracted by the UFFCA to prepare a detailed engineering design for a passive weir at the outlet of Burns Lake on the Endako River. To complete the detailed design, NHC created a hydraulic model to calculate lake level and lake outflows to optimize the design parameters of the hydraulic structure. This report is a continuation of the work previously completed by NHC, and provides the most up-to-date analysis and detailed design.

1.3 Design Objectives

The objective of building a weir on the Endako River is to provide live storage in Burns Lake for later release during the Chinook and Kokanee spawning window from the last week of August to the end of September. These flow releases are expected to improve habitat conditions during the Chinook and Kokanee spawning period, while not limiting Kokanee fry migration in the spring or affecting Burns Lake's maximum or minimum annual water elevations.

1.4 Previous Reporting

Previous reporting on the Endako River weir prepared by NHC includes:

- Endako Weir Design Update (2021)
- Endako River Weir Preliminary Design Update (2019)
- Endako River Weir Design Draft Report (2018).

2 Hydrology

Two locations are of interest for flow and water level for this project: Reach 1 on the Endako River at the outlet of Burns Lake, which is the location of the proposed weir site through which Kokanee migrate downstream to spawn and later upstream as fry into Burns lake (**Figure 2.1**); and Reach 2 on the Endako River downstream of the confluence with Shovel Creek, the location of Chinook spawning (**Figure 2.2**).

Figure 2.1 Location of weir at the outlet of Burns Lake, Reach 1 (base image Google Earth, 2017)

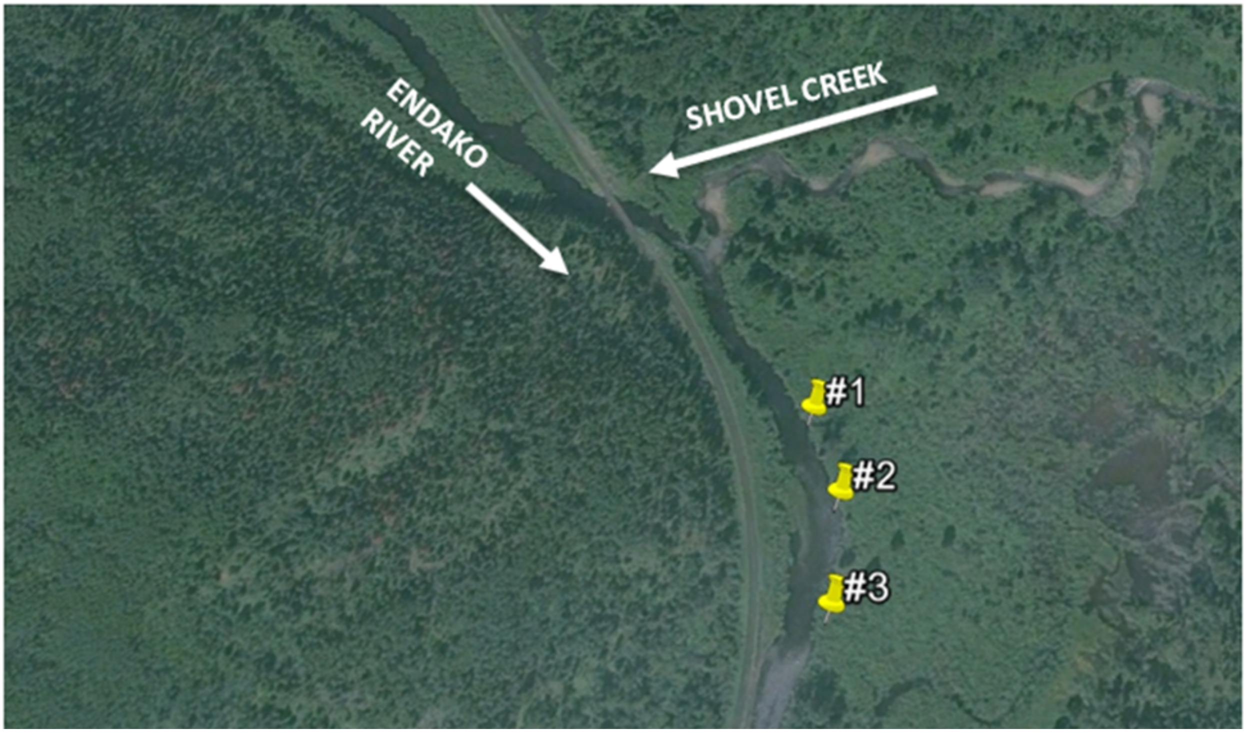

Figure 2.2 Approximate location of Reach 2 cross sections (base image Google Earth, 2017)

2.1 Lake Inflow, Outflow and Level Time Series

The lake outflow record from the Water Survey of Canada *Endako River at Outlet of Burns Lake* (WSC 08JB012) gauge was used in assessing the inflows, outflows, and water surface elevations of Burns Lake. This gauge was in operation from 1996 to 2004 before being decommissioned, leaving a 9-year historical record[1]. The lake outflow record and water surface elevations for the WSC 08JB012 are shown in **Figure 2.3** and **Figure 2.4**, respectively.

[1] The period of record spans 9 years from 1996 – 2004, however the last measurement before the WSC station was discontinued was taken on July 29, 2004.

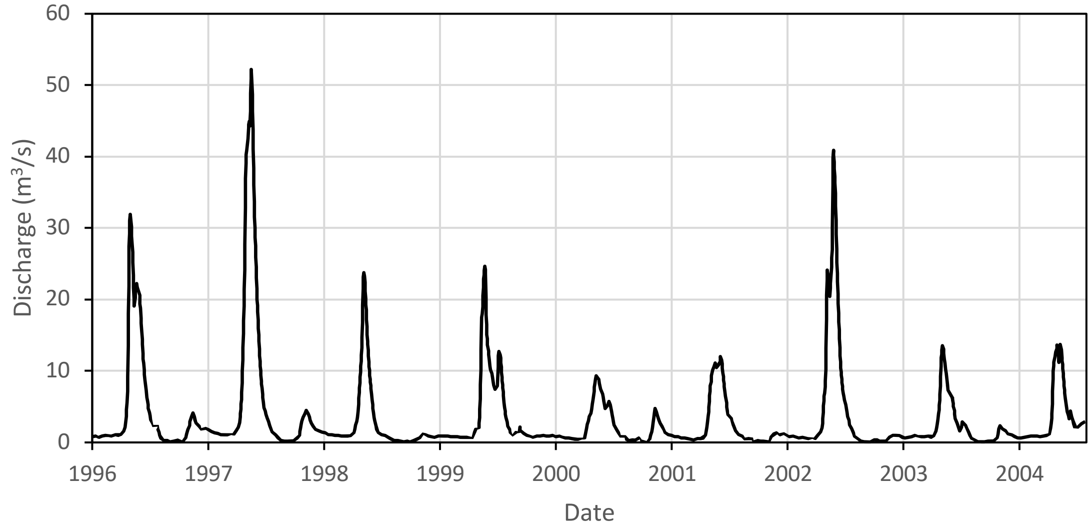

Figure 2.3 Historical discharge at *Endako River at Outlet of Burns Lake* (WSC 08JB012)

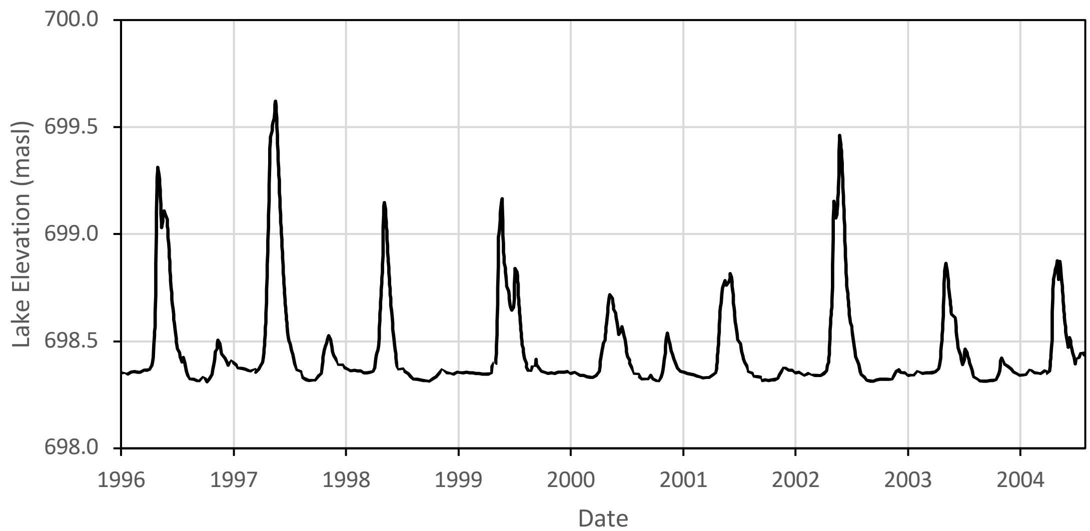

Figure 2.4 Historical water elevations at *Endako River at Outlet of Burns Lake* (WSC 08JB012)

Using a routing model, a synthetic inflow series was calculated based on the observed 9-year outflow time series and calculated inflows mirrored the observed outflows. As a result, it is assumed that the flows into Burns Lake are equal to the outflows, and this assumption was carried through into the flood routing and hydraulic design.

2.2 Peak Flows and Low Flows

The historical record of WSC 08JB012 is relatively short and not suitable for estimating larger return period events; therefore, an area scaling method was used to estimate peak flows. The area scaling method is used to correlate the ratio of drainage areas of a gauged watershed and an ungauged watershed of interest with the ratio of peak flows in the two watersheds.

NHC reviewed the network of WSC gauges near Burns Lake searching for area-scaling candidates that were proximal to the subject tributaries and had similar watershed area, land cover, land use, and topography. The best candidate was WSC 08EC004 gauge at *Pinkut Creek Near Tintagel* (UTM 10U 342408 E 6031362 N), which has a drainage area of 808 km^2 and a 55-year continuous record. This station is consistent with the reservoir routing work done by AMEC (2002) and EDI (2017).

Peak flow return periods on the Endako River for Reach 1 and Reach 2 from area scaling to the WSC gauge at Pinkut Creek are shown in **Table 2.1**.

Table 2.1 Endako River estimated peak flows by area scaling to *Pinkut Creek Near Tintagel* (WSC 08EC004)

Peak Flow Condition	Estimated Flow (m^3/s)	
	Reach 1 Burns Lake Outlet	Reach 2 Downstream of Confluence with Shovel Creek
	Catchment area: 788.2 km^2	Catchment area: 1286.0 km^2
2-year	33	48
5-year	49	70
10-year	61	86
20-year	72	103
50-year	89	126
100-year	104	147
200-year	118	166

The area scaling method can also be used to estimate low flows; however, in comparing the flood duration curve of the synthetic period of record against the observed period of record (**Figure 2.5**), the Pinkut Creek gauge overestimates low flows.

The flood duration curve validates the use of Pinkut Creek to estimate peak flow conditions because the flows above 30 m^3/s are similar; however, using Pinkut Creek to extend the observed period of record to a 20-year synthetic time series would result in overestimating water available for mitigating low flows.

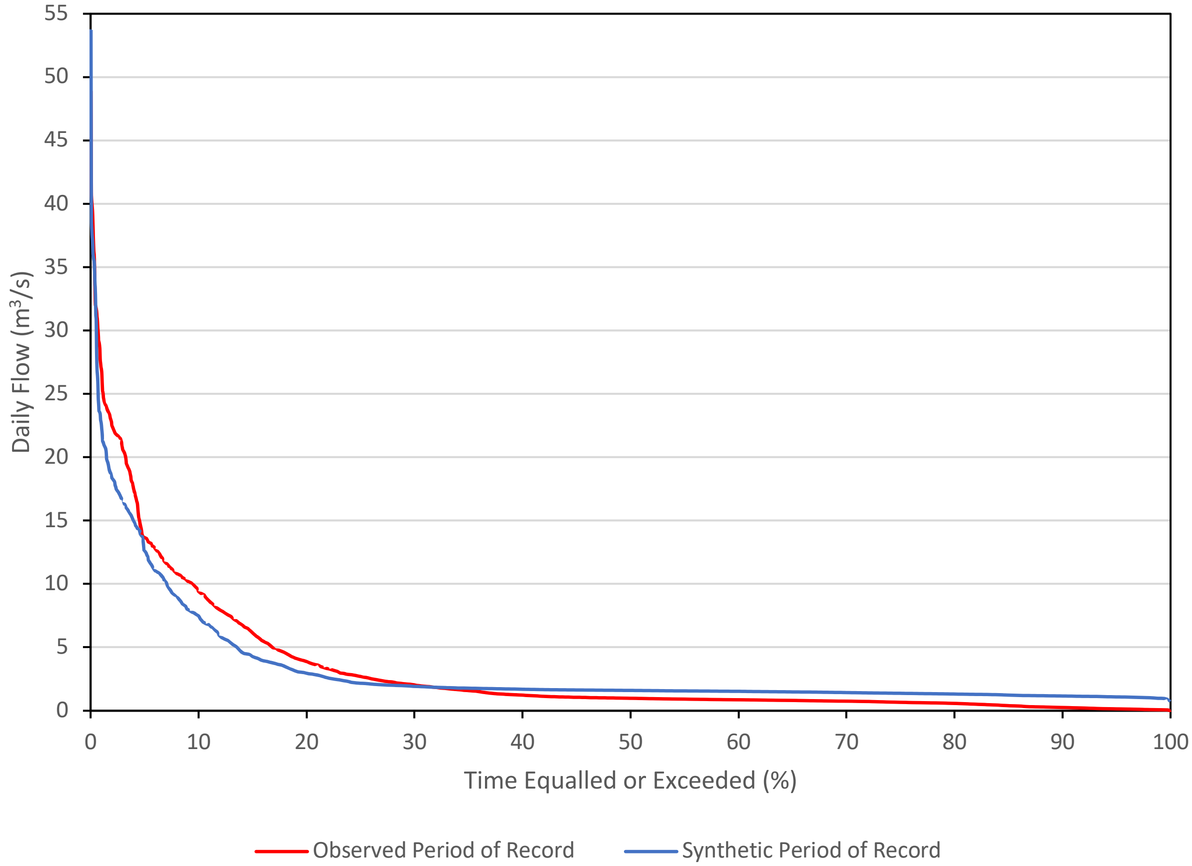

Figure 2.5 Flood duration curve of Pinkut Creek Near Tintagel (Synthetic Period of Record) and Endako River at Outlet of Burns Lake (Observed Period of Record)

3 Weir Design

The design of the control structure at the outlet of Burns Lake consists of a curved rock weir and side-channel slotted-fishway. The weir provides both storage and a discharge section, while the slotted fishway controls the releases of water during the seasonal low flow periods when the lake level is below the crest of the weir. The design is a passive structure with no mechanical or operable components.

The hydraulics were evaluated by creating a 1D HEC-RAS program and a customized flood routing model. The model was run using the inflows determined in the hydrological analysis. The flood routing model was run for various scenarios to optimize the parameters of the weir structure.

Design drawings of the weir and fishway are shown in **Appendix A**.

3.1 Rock-fill Control Weir

A weir crest height of 0.7 m above the current assumed invert elevation (±698.1 m) with a curved crest length of 42 m produced the optimal flood routing results in the hydraulic model.

On the south bank of the Endako River, the weir will tie into the existing shoreline. On the north bank of the river, the weir will tie into the embankment of an island or large berm that separates the main river channel from the fishway channel. The length of the weir across the river will curve upstream.

Rock will be used for weir construction. The weir section will be constructed on compacted native subgrade. The upstream face of the weir will slope at a 3:1 H:V gradient and the downstream face at a 5:1 H:V gradient. Both upstream and downstream toes will be keyed in at a depth of 0.5 m below the existing riverbed. The final crest elevation of the rock weir is 689.8 m. Both the roughened rock weir surface and mild slope are designed to allow fish passage while flows are passing over the weir crest.

The existing riverbed material appears permeable, and losses due to seepage under the weir are expected. Compacted subgrade and engineered structural fill through the core of the weir will reduce seepage.

3.2 Nature-like Slot Fishway Channel

A side-channel nature-like slot fishway will ensure upstream passage of migrating Kokanee and other fish species during low flow periods when the water surface elevation of the lake is below the weir crest. The fishway will run along the north side, parallel to the main river channel, separated by a berm or remaining section of riverbank. This nature-like fishway will resemble a pool and weir-type fishway except that water passes between the vertical rock column slots.

Energy or head is dissipated by the multiple rows of slots along the channel, creating favourable hydraulic conditions for migrating fish. The velocity in the pools in-between slots will be much less than the slot velocity, providing resting zones and energy dissipation.

The fishway channel is 40 m in length with 12 vertical slots that separate the channel into 11 pools. Each slot of the fishway will be constructed with a pair of basalt rock columns spaced 1 m apart (slot width), embedded at the sides into the sloped embankments of the channel and secured at the base into a 0.3 m lift of embedment material. Stacked rock will protect the embankment of the fishway channel, backed by drain rock and rock backfill.

Construction of the fishway will require excavation of a trapezoidal channel down to an elevation of 697.0 m at the upstream end and 696.55 m at the downstream end of the fishway. The base of the channel will have a 0.3 m lift of compacted structural fill beneath the 0.3 m lift of embedment material securing the columns. The invert at the upstream end of the fishway will be at an elevation of 697.6 m, 0.5 m below the current assumed lake invert.

3.3 Recommended Project Monitoring

It is recommended that a hydrometric gauging station be established at the outlet of Burns Lake on the Endako River weir and fishway to monitor lake level and outflows. UFFCA currently has two station installed at the lake outlet, above and below the proposed weir location.

Reliable hydrometrics at the weir site will help to assess the hydraulic and hydrologic performance of the weir and fishway structure with a changing climate. A hydrometric station will also provide the needed data for generating a rating curve for the weir and fishway and will help identify if any modifications need to be made to the design in the future. The station should measure water surface elevations upstream and downstream of the weir, as well as water temperature.

In addition to a hydrometric station, a remote cellular-based research camera should be installed to provide primary surveillance and photo point monitoring of the weir site.

4 Hydraulic MODELLING

4.1 Summary

The modelling and analysis of the weir and fishway structure have produced the following findings:

1. Extreme high-water lake level is unchanged[2] with the weir constructed
2. Extreme low-water level is higher because the weir will store water in Burns Lake for the purpose of increasing releases during summer / fall
3. Summer / fall releases 200% greater than pre-project flows, enhancing fish habitat downstream
4. Average lake level is approximately 32 cm higher due to the stored water throughout the year
5. Average velocity through the slotted fishway is under 0.6 m/s during April when upstream migration of Kokanee juveniles is expected.

4.2 Model Results

Two sources of hydrometric data are available for model inputs and calibration: the Water Survey of Canada (WSC) station (08JB012, 1996-2004); and the UFFCA stations on Burns Lake and the Endako River (15NW002, 15NW003; 2015-2020). The WSC dataset was selected for use as the model input due to the longer continuous flow record. The more recent UFFCA datasets are affected by a large beaver dam, data gaps and station stability which require more cautious interpretations. The UFFCA data was used for comparative and quality checking purposes.

[2] The model produced a high-water lake level 4 cm greater with the weir in place over the period of record (see **Table 4.1**). Because of uncertainties in the modelling, a difference of 4 cm is negligible.

The design flow record was run through a flow routing model with and without the proposed outlet structure and analyzed in terms of the changes to the lake level and outflow over the past period of record. The flow routing model calculated the following outcomes over the 9-year flow WSC record (1996-2004).

A weir height of 0.7 m above the current lake invert (±698.1 m geodetic) is proposed to produce the needed storage to maximize flows.

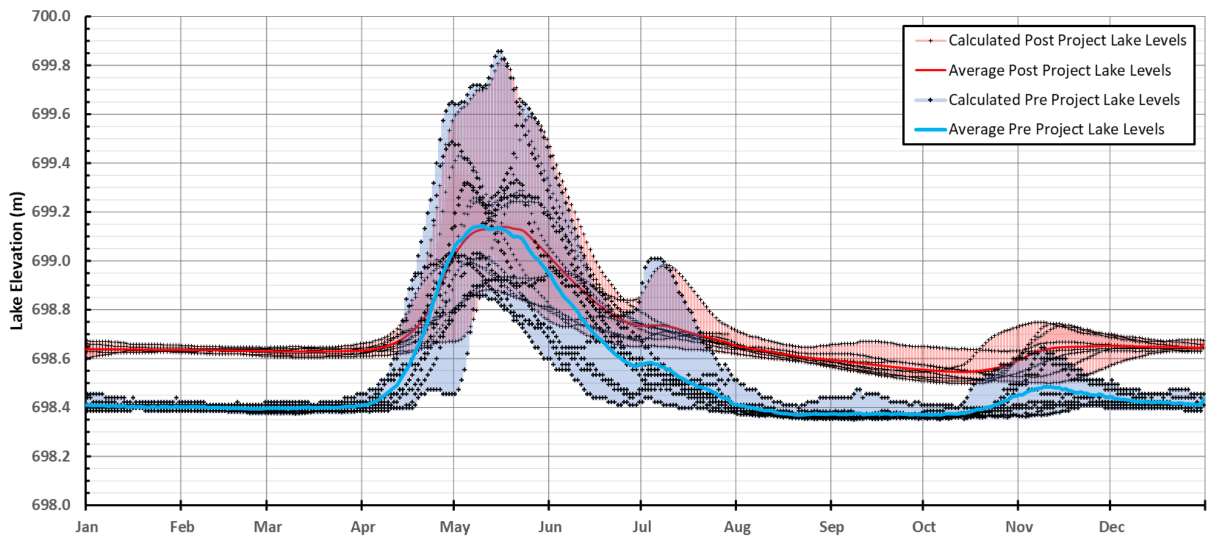

Figure 4.1 and

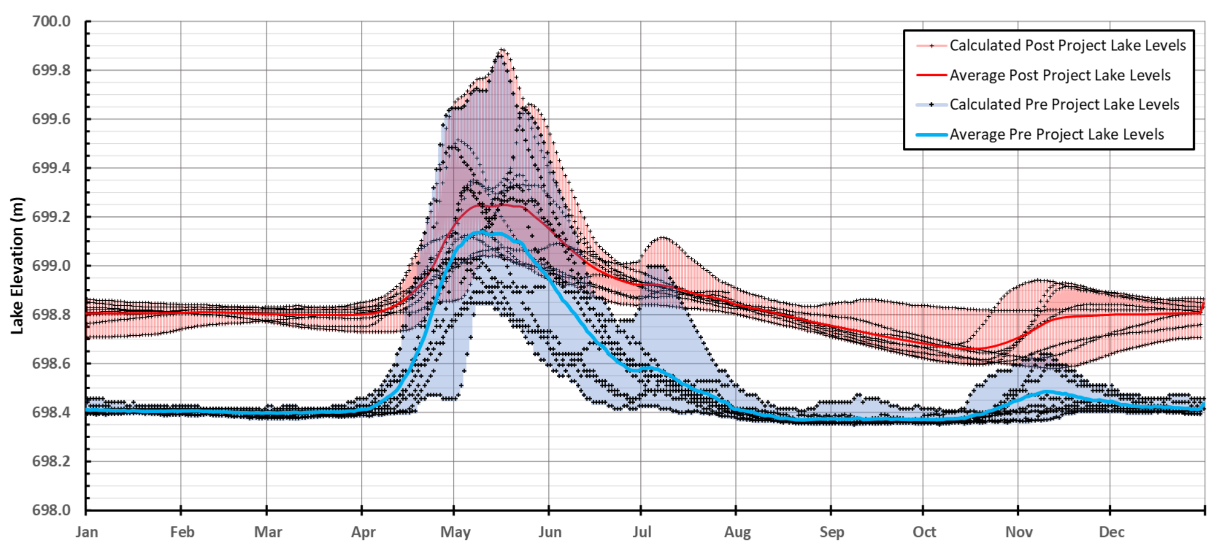

Figure 4.2 show the hydraulic model results of a 0.5 m high weir versus a 0.7 m high weir, respectively. Both weir heights provide storage without exceeding the extreme maximum lake elevation. However, due to a higher hydraulic head differential, the 0.7 m high weir produces nearly double the outflows of

the 0.5 m weir during low-flow periods in August and September, shown in

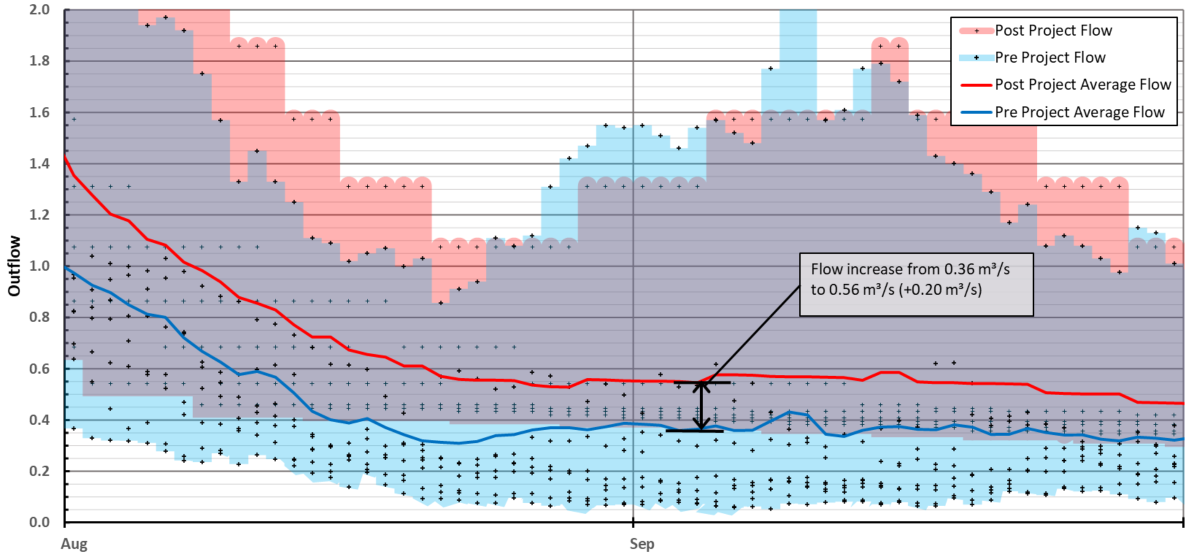

Figure 4.3 and

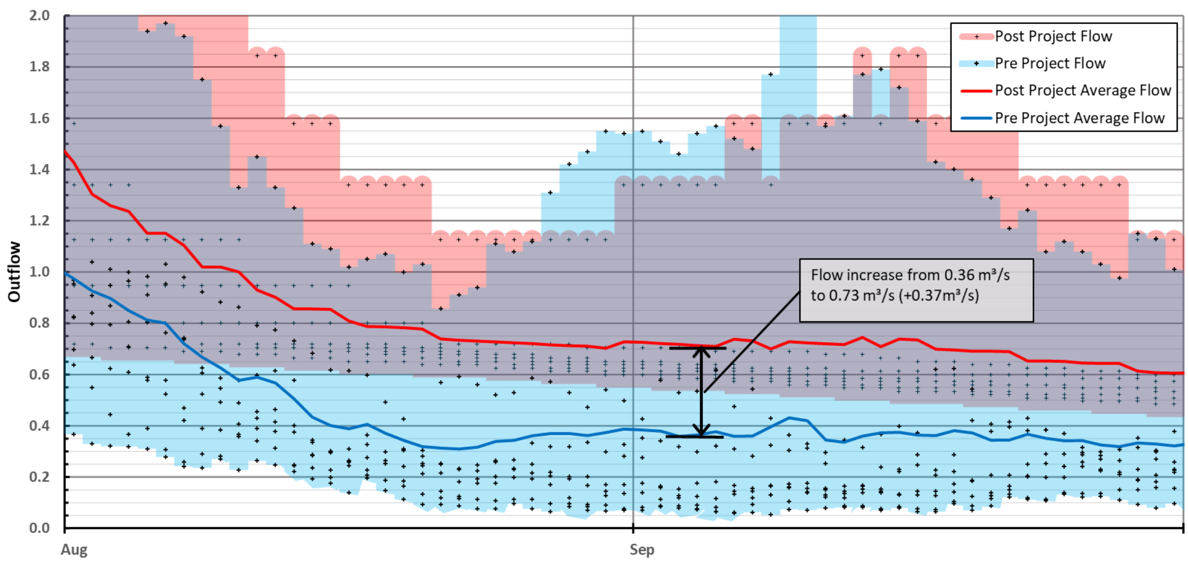

Figure 4.4.

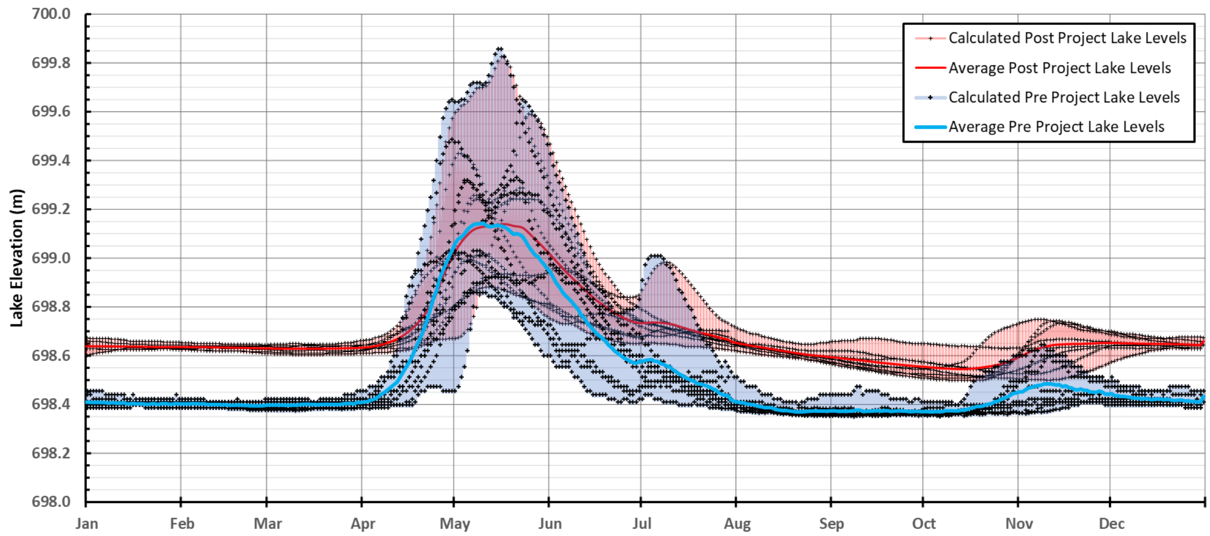

Figure 4.1 Modelled Burns Lake water surface elevations with a 0.5 m high weir

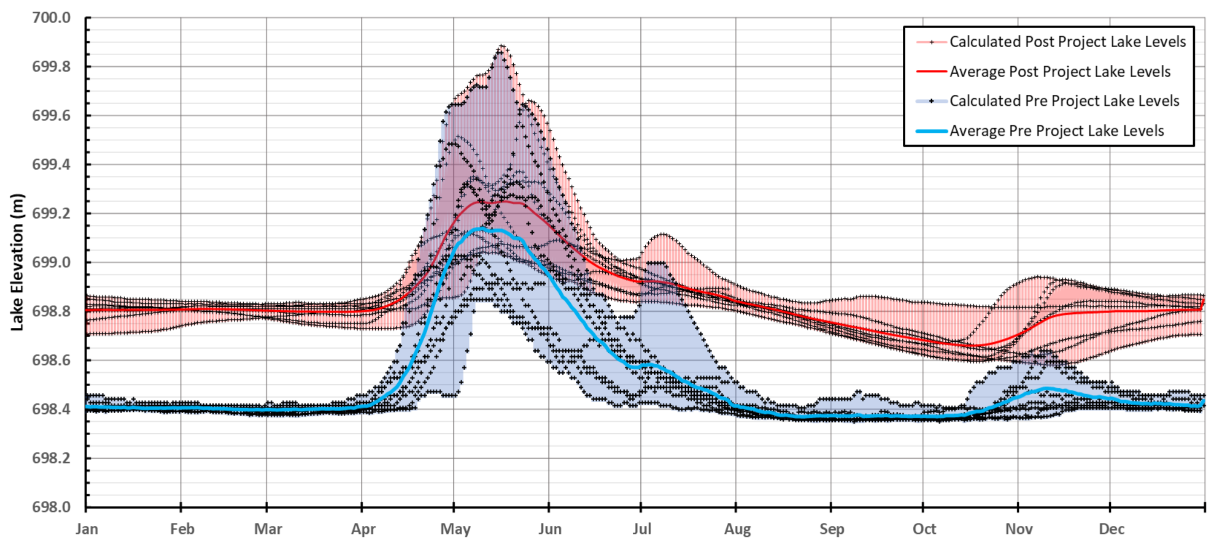

Figure 4.2 Modelled Burns Lake water surface elevations with a 0.7 m high weir

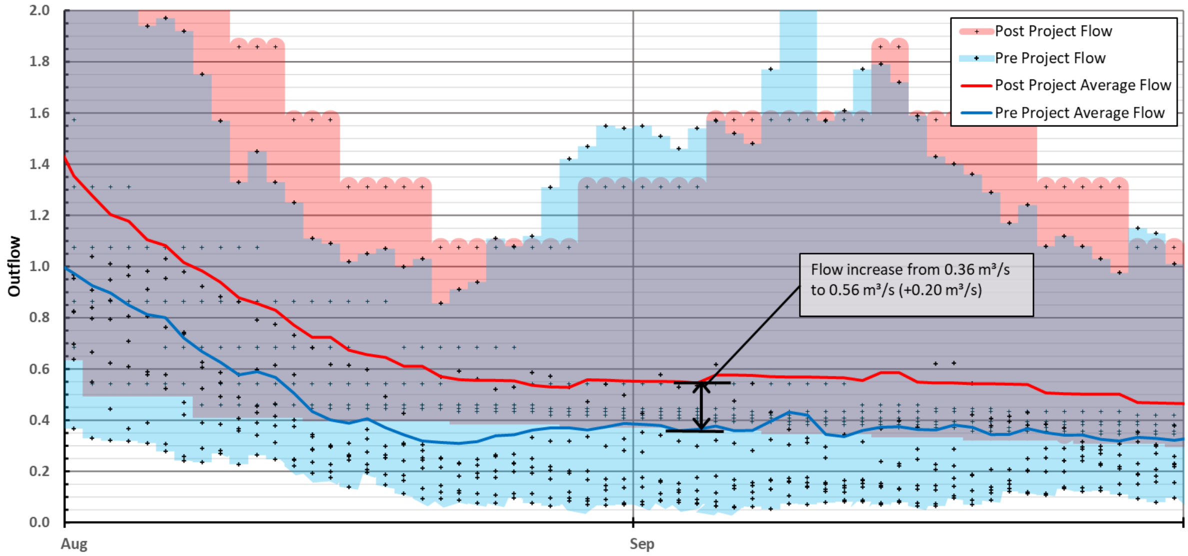

Figure 4.3 Modelled weir and fishway discharge in August and September with a 0.5 m high weir

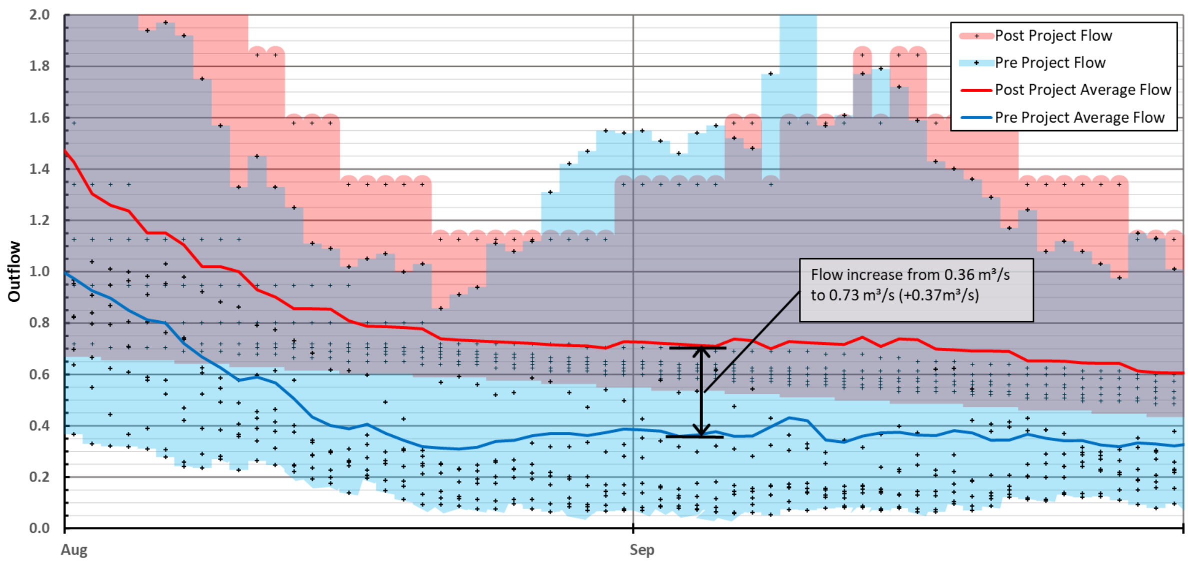

Figure 4.4 Modelled weir and fishway discharge in August and September with a 0.7 m high weir

4.2.1 Lake Elevations

With the design 0.7 m high weir in place the:

1. Maximum lake elevation for the entire period of record essentially remained the same (up by 4 cm according to the calculations). The average annual high-water level was calculated to be 8 cm higher

2. Minimum lake elevation over the period of record was 20 cm higher. The average annual low-water level was 26 cm higher
3. Average lake elevation over the whole period of record went from 698.54 m to 698.86 m, up by 32 cm.

A more detailed summary of the lake elevations is shown in **Table 4.1**.

Table 4.1 Burns Lake water surface elevations before and after completion of the project

Year	Average Lake Elevation			Maximum Lake Elevation			Minimum Lake Elevation		
	Before Weir	After Weir	Difference in Lake Level	Before Weir	After Weir	Difference in Lake Level	Before Weir	After Weir	Difference in Lake Level
	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)
1996	698.58	698.89	0.31	699.51	699.52	0.01	698.39	698.62	0.23
1997	698.63	698.94	0.31	699.85	699.89	0.04	698.40	698.67	0.28
1998	698.50	698.82	0.31	699.32	699.34	0.02	698.39	698.61	0.22
1999	698.55	698.89	0.34	699.33	699.37	0.03	698.43	698.77	0.35
2000	698.50	698.83	0.34	698.82	699.04	0.22	698.39	698.65	0.26
2001	698.50	698.82	0.32	698.93	699.09	0.16	698.39	698.63	0.24
2002	698.56	698.85	0.28	699.67	699.67	0.00	698.39	698.59	0.20
2003	698.49	698.81	0.32	699.00	699.12	0.13	698.39	698.60	0.21
2004	698.56	698.90	0.33	699.01	699.13	0.12	698.42	698.80	0.38
Average	698.54	698.86	0.32	699.27	699.35	0.08	698.40	698.66	0.26

Figure 4.5 is an example of the 1997 lake levels before and after the structure is in place to help illustrate the annual variance in lake level over one full calendar year. 1997 was the year with the highest maximum flow over the period of record, 52 m^3/s, which roughly corresponds to the 1:5-year return period peak daily flow.

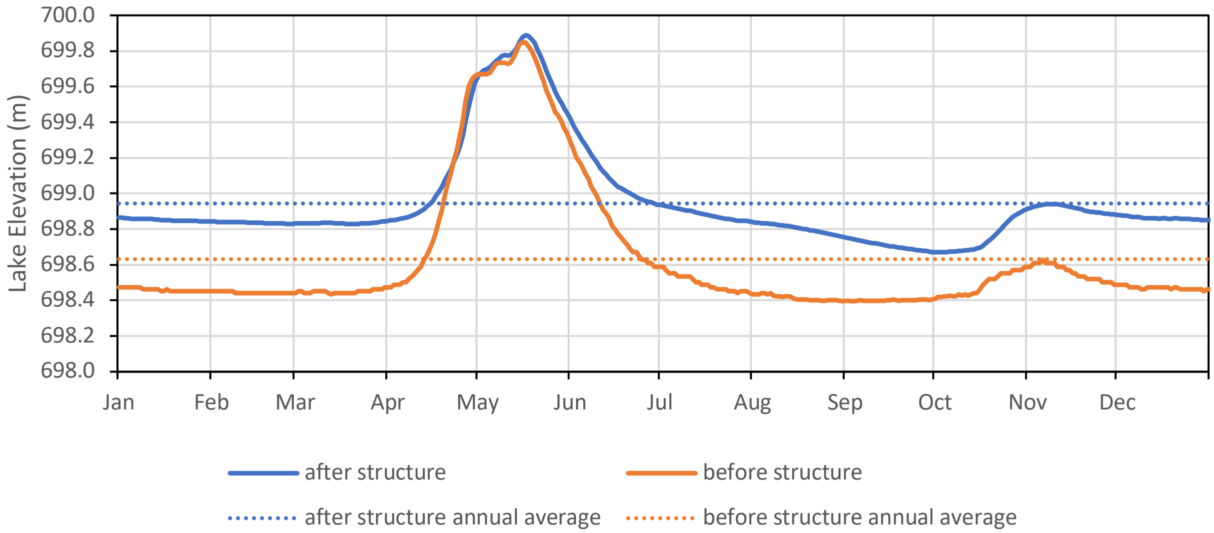

Figure 4.5 Calculated lake levels on Burns Lake before and after completion of the project for the calendar year 1997

The modelled lake levels for the estimated peak flow conditions are listed in **Table 4.2**. With the construction of the weir, the model generated an increase in lake level of 8 cm and 10 cm for the estimated 100-year and 200-year flows, respectively[3].

[3] The hydraulic model created in designing the weir is not suitable for accurately estimating the lake levels for peak flow conditions because it does not consider flood plain storage, overland flow, and several other key factors. The model is limited to the available survey data downstream of the lake.

Table 4.2 The lake level model results for the estimated peak flow conditions of the Endako River at the Outlet of Burns Lake

Peak Flow Condition	Estimated Flow	Before Wier Lake Level	After Weir Lake Level	Difference in Lake Level
	(m^3/s)	(m)	(m)	(cm)
2-year	33	699.53	699.56	3
5-year	49	699.81	699.85	4
10-year	61	699.99	700.04	5
20-year	72	700.14	700.20	6
50-year	89	700.38	700.45	7
100-year	104	700.57	700.65	8
200-year	118	700.70	700.80	10

4.2.2 Outflows

With the design 0.7 m high weir in place the:

1. Extreme minimum flow over the 9-year period of record was calculated to increase from 0.02 m^3/s to 0.41 m^3/s
2. Average minimum flows in August were calculated to increase from 0.23 m^3/s to 0.69 m^3/s
3. Average minimum flows in September were calculated to increase from 0.20 m^3/s to 0.60 m^3/s
4. Average minimum flows in October were calculated to increase from 0.22 m^3/s to 0.51 m^3/s.

A more detailed summary of the lake releases is shown in **Table 4.3** and **Table 4.4**. It is important to note that **Table 4.3** compares the annual minimum flows in Reach 1 and **Table 4.4** compares the monthly minimum flows in Reach 1 during the period of interest.

These tables are not comparing the measured flows from the same day side by side, but rather the minimum flow over the year or the month. With the weir in place, the lowest daily flow shifted from October 1996 (0.02 m^3/s) to November 2002 (0.41 m^3/s); however, the day that 0.02 m^3/s was observed, flow through the weir was calculated to increase to 0.50 m^3/s. Looking at the seasonal averages and seasonal minimums is a better measure of the performance of the weir.

Table 4.3 Annual minimum flows in Reach 1

Year	Before Weir Minimum Flow (m³/s)	After Weir Minimum Flow (m³/s)	Difference in Minimum Flow (m³/s)
1996	0.02	0.46	0.44
1997	0.11	0.53	0.42
1998	0.08	0.44	0.36
1999	0.69	0.66	-0.03
2000	0.11	0.50	0.39
2001	0.07	0.46	0.39
2002	0.05	0.41	0.36
2003	0.07	0.44	0.37
2004	0.64	0.70	0.07
Average	0.20	0.51	0.31

Table 4.4 Minimum flows in August, September, and October in Reach 1

Year	August			September			October		
	Before Weir Min. Flow (m³/s)	After Weir Min. Flow (m³/s)	Difference in Min. Flow (m³/s)	Before Weir Min. Flow (m³/s)	After Weir Min. Flow (m³/s)	Difference in Min. Flow (m³/s)	Before Weir Min. Flow (m³/s)	After Weir Min. Flow (m³/s)	Difference in Min. Flow (m³/s)
1996	0.07	0.62	0.55	0.06	0.53	0.47	0.02	0.46	0.44
1997	0.13	0.65	0.52	0.11	0.53	0.42	0.38	0.53	0.15
1998	0.17	0.59	0.43	0.08	0.48	0.40	0.10	0.44	0.34
1999	0.86	1.11	0.26	0.98	1.11	0.14	0.69	0.79	0.09
2000	0.23	0.63	0.41	0.19	0.57	0.38	0.11	0.50	0.39
2001	0.28	0.69	0.41	0.07	0.59	0.52	0.08	0.48	0.40
2002	0.07	0.62	0.55	0.05	0.50	0.45	0.21	0.44	0.23
2003	0.08	0.59	0.52	0.07	0.48	0.41	0.15	0.44	0.28
Average	0.23	0.69	0.45	0.20	0.60	0.40	0.22	0.51	0.29

Figure 4.6 is an example of the 1996 releases before and after the design structure is in place. The graph is zoomed-in to capture the increased minimum releases from August through October. Discharge in 1996 observed a minimum flow of 0.02 m^3/s, the year on record with the lowest minimum flow.

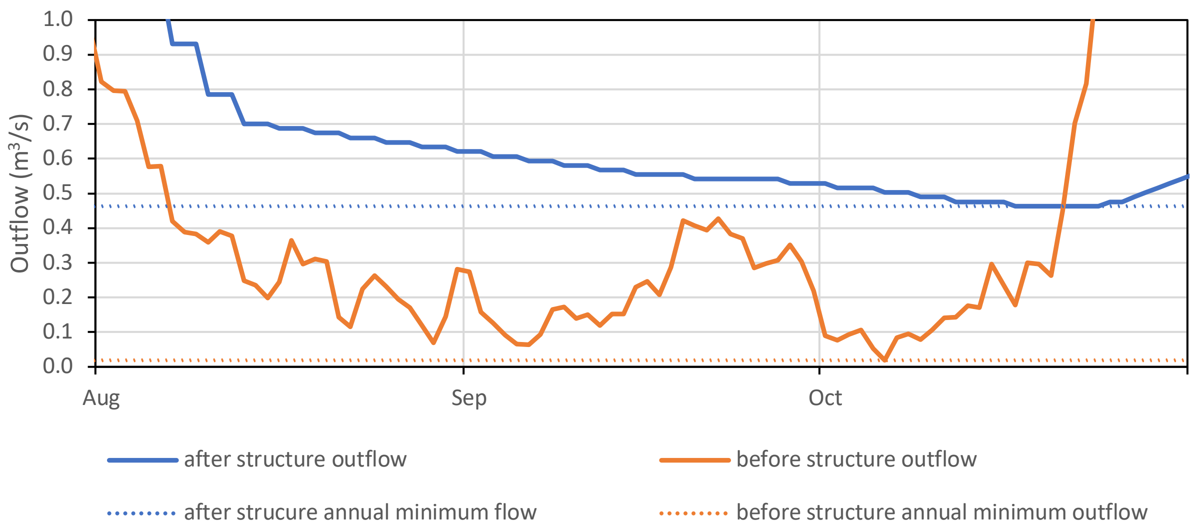

Figure 4.6 Calculated flows from August to October through the proposed weir before and after the structure is in place for the calendar year 1996

5 Flow and Fish Habitat Improvements

The proposed weir improves low flow regimes through the release of stored water in both Reach 1, below the weir, and Reach 2, below Shovel Creek. It is important to note that Shovel Creek is unregulated and provides approximately 40% of the flow in Reach 2 based on catchment area.

In Reach 1, significant Kokanee spawning occurs downstream of the proposed weir during fall, and historically low discharges from the lake likely limited habitat utilization, spawning and incubation success. This is based on the observed historical low flow record and location of spawning habitats. In Reach 2, low discharges from both Shovel Creek and below the lake (Reach 1) can limit the amount and suitability of spawning habitat for Chinook salmon.

Any improvements in the fish habitat hydraulics in Reach 2 is influenced by the proposed project but cannot wholly be dependent on the discharges from Reach 1.

The proposed weir improves the fish habitat hydraulics by:

1. Increasing the late summer-fall flow regime for Chinook spawning in Reach 2
2. Increasing and stabilizing the late fall winter flow regime for Chinook egg-alevin incubation in Reach 2

3. Increasing the late summer-fall flow regime in Reach 1 for Kokanee spawning and incubation in Reach 1.

The quality of habitat and utilization of Reach 2 by Chinook salmon is detailed in ARL (2001), referencing both personal communications (D. Ableson, 2000) and previous work (Fielden, 1995). However, specific depth-velocity results were not developed from the data, and there are still uncertainties with respect to the likely distinct spawning habitat use and preferences of Endako Chinook salmon.

It is more likely that this run of Chinook have uniquely adapted to hydrological and morphological conditions in the Endako River, and this may result in a range of habitat use outside of reported values. As such, the reporting and use of minimum depth requirements for both spawning and incubation from the literature is not likely of value in the current analysis. Incubation flows are often markedly reduced from spawning flows, and there are other factors that affect incubation and emergence success.

The implied design objective is not to design to a specific target depth or target flow, but rather maximize the available storage under the given constraints of the project that will increase and stabilize historical low flows that may be limiting habitat quality and availability in Reach 1 and Reach 2.

The design and modelling completed to date has met this objective.

6 Identified Project Risks and uncertainties

The project can only address identified risks and issues. There may be unforeseen issues that arise as consultation, investigation, and design of the project proceeds. During construction, there are risks related to environment, climate, supply and labour issues, accidents, and emergency conditions.

A risk register should be developed as part of the project record to document these issues and ensure they are addressed to the extent possible in the consultation, technical design, approvals and permitting, construction, operations, and maintenance.

7 References

AMEC Earth and Environmental Ltd. 2002. Revised reservoir routing analysis and design of Endako River low flow augmentation works. Prepared for Carrier Sekani Tribal Council c/o Aquatic Resources Limited, Vancouver, BC. Prepared for AMEC Earth and Environmental Ltd, Calgary, Alberta.

Aquatic Resources Limited (ARL). 2001. Flow Augmentation in the Endako River to enhance Chinook and Kokanee. Prepared for Burns Lake Band, Burns Lake, BC. Prepared by Aquatic Resources Limited, Vancouver, BC.

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Fisheries Information Summary System (FISS). BC Ministry of Environment. Accessed September 2017. http://www.env.gov.bc.ca/fish/fiss/

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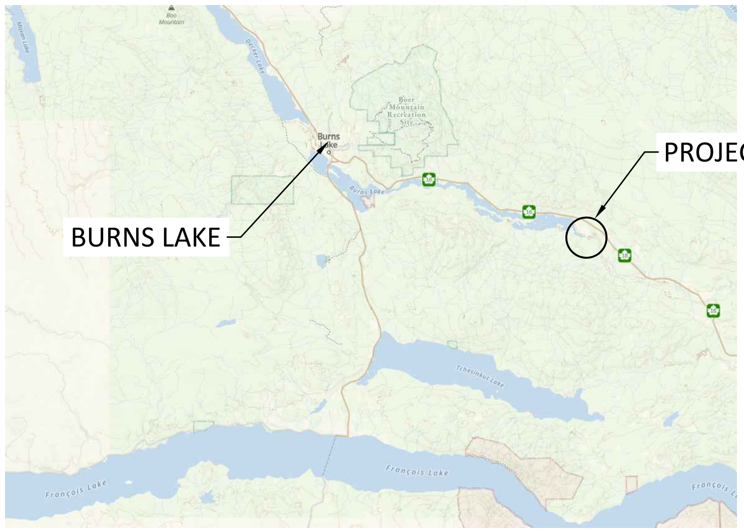
Taylor, E.B. and C.J. Foote. 1991. Critical swimming velocities of juvenile sockeye salmon and Kokanee, the anadromous and non-anadromous forms of Oncorhynchus nerka, Walbaum. J.Fish. Bioi. 38:407-419. http://onlinelibrary.wiley.com/doi/10.1111/j.1095-8649.1991.tb03130.x/abstract

APPENDIX A

ENDAKO WEIR AND FISHWAY DESIGN DRAWINGS

UPPER FRASER FISHERIES CONSERVATION ALLIANCE

ENDAKO RIVER WEIR AND FISHWAY

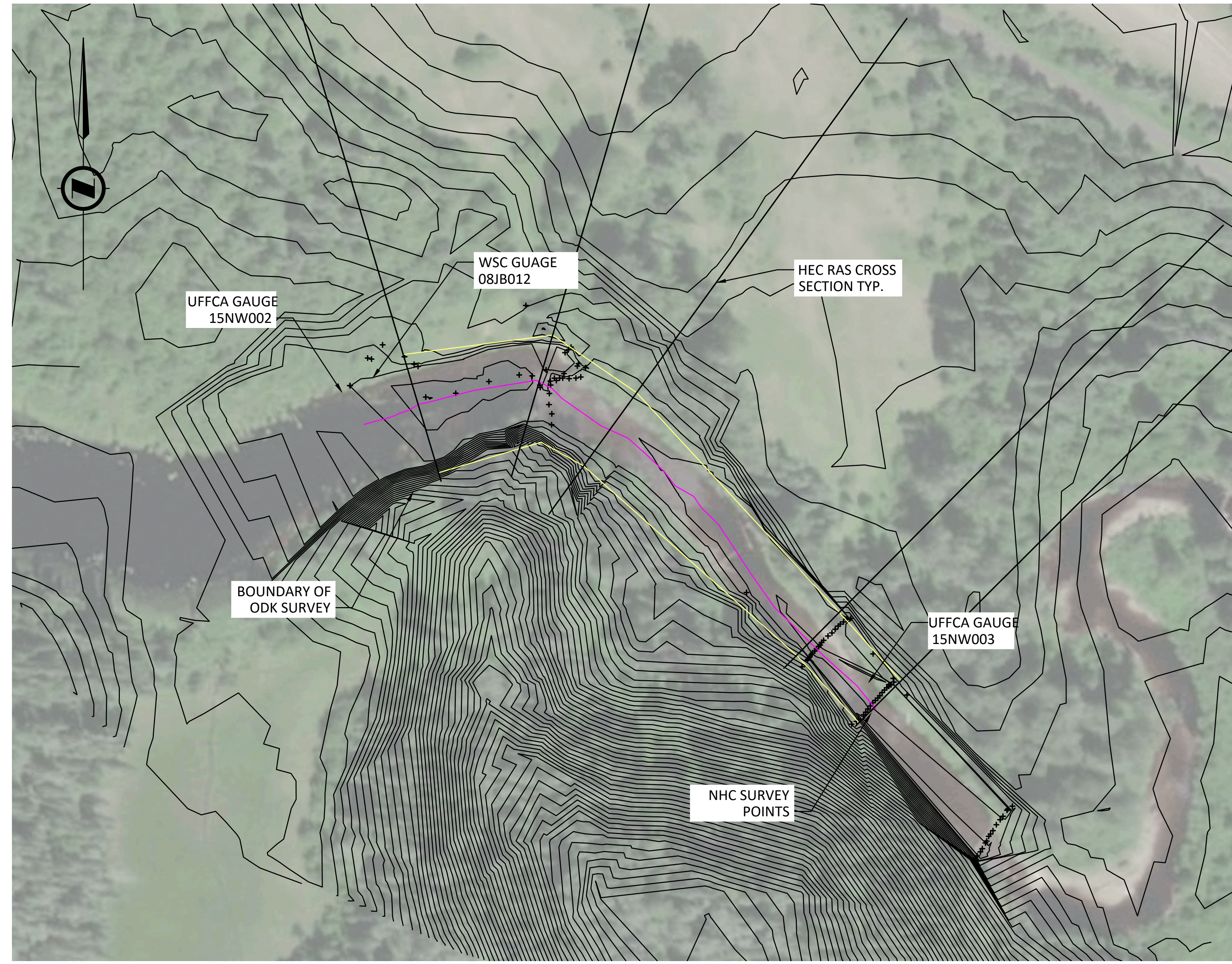


LOCATION MAP
nts

UFFCA - ENDAKO WEIR AND FISHWAY - DRAWING INDEX		
SHEET NO.	SHEET DESCRIPTION	REVISION
1	COVER SHEET, EXISTING CONDITION PLAN AND DRAWING INDEX	A
2	NOTES	A
3	PROPOSED WEIR AND FISHWAY - PLAN	A
4	PROFILE 1 AND SECTIONS 2, 3 AND 4	A
5	DETAIL A AND TYPICAL SECTIONS 5, 6 AND 7	A

NOTES

1. IMAGE FROM GOOGLE EARTH
2. PROJECT COORDINATE SYSTEM:
   - 2.1. EPOCH: 2010.00
   - 2.2. VERTICAL DATUM: CGVD28
   - 2.3. GEOID: HT2.0
   - 2.4. PROJECTION: UTM ZONE 11
   - 2.5. UNITS: Meters
3. SURVEY DATA IS A COMBINATION OF THE FOLLOWING SOURCES:
   - 3.1. NHC TERRIESTRIAL SURVEY
   - 3.2. OPUS TERRESTRIAL SURVEY
   - 3.3. GOOGLE EARTH SPOT ELEVATIONS



PLAN VIEW - EXISTING CONDITION
1:2000

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30 Gostick Place
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Canada V7M 3G3
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Fax: 604.980.9264
www.nhcweb.com

REVISIONS		
A	13 APRIL 2021	ISSUED FOR REVIEW WITH DESIGN REPORT

DRAWING INFORMATION	
DATE	12 Apr 2021
DESIGNED BY	AWT
DRAWN BY	KEH
CHECKED BY	NRA
SHEET SIZE	B (11" x 17")

UPPER FRASER FISHERIES CONSERVATION ALLIANCE
ENDAKO RIVER WEIR AND FISHWAY
DRAWING INDEX, LOCATION MAP AND EXISTING PLAN

PROJECT NUMBER	03004643
DRAWING NUMBER	03004643-001
SHEET NUMBER	1
REVISION	A

Filename: \\mainfile-van\Projects\Active\3004643 Endako Weir Preliminary Design\96 CAD\02_Production\000_Set\3004643 Endako Weir_IFR_rc.dwg, 4/12/2021 2:39:30 PM

NOTES AND SPECIFICATIONS

PLACEHOLDER DRAWING

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Canada V7M 3G3
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UPPER FRASER FISHERIES CONSERVATION ALLIANCE
ENDAKO RIVER WEIR AND FISHWAY

NOTES AND SPECIFICATIONS

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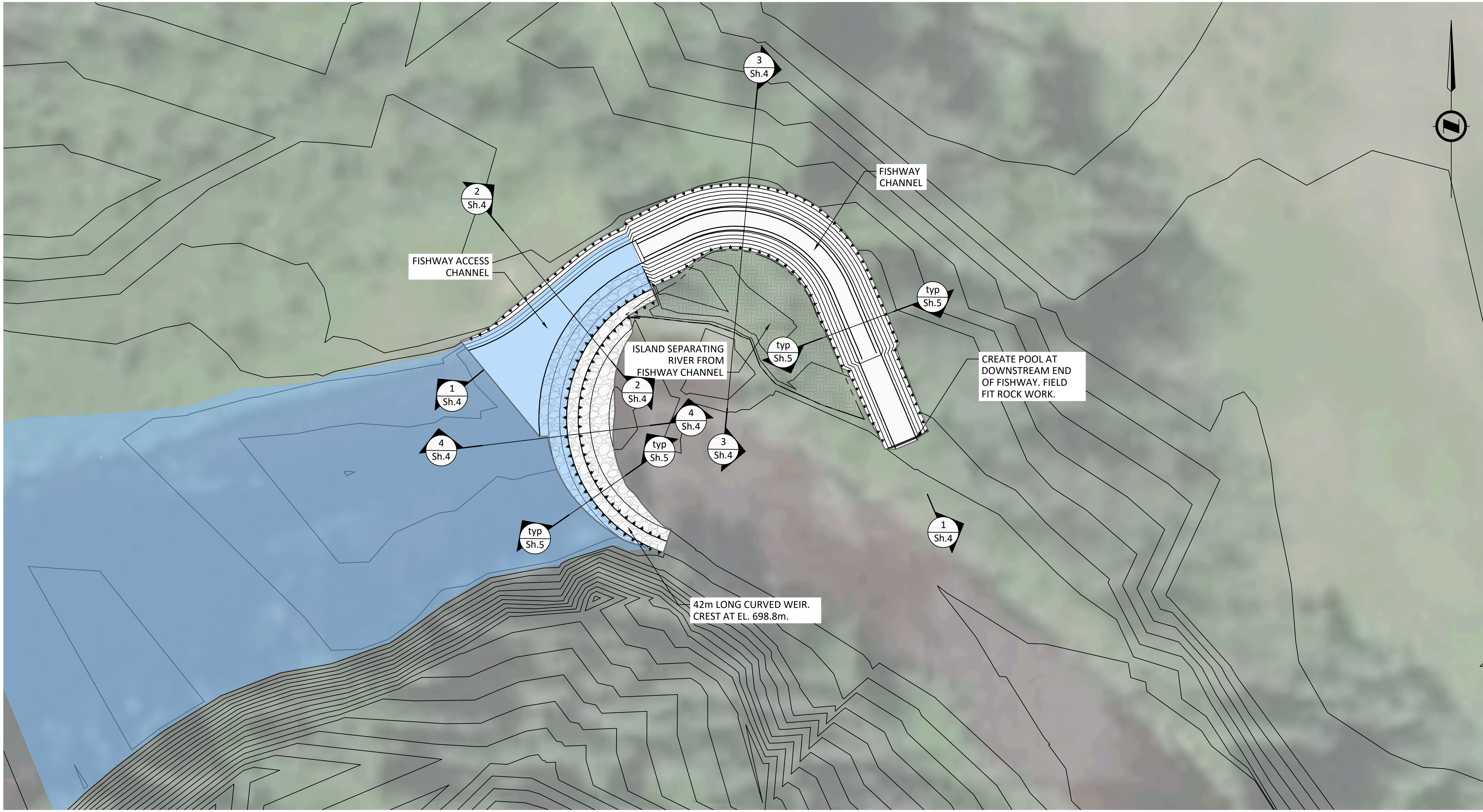
DRAWING NUMBER	03004643-002
SHEET NUMBER	2
REVISION	A



PLAN VIEW - PROPOSED STRUCTURE
1:500

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North Vancouver, BC
Canada V7M 3G3
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DRAWN BY	KEH
CHECKED BY	NRA
SHEET SIZE	B (11" x 17")

UPPER FRASER FISHERIES CONSERVATION ALLIANCE

ENDAKO RIVER WEIR AND FISHWAY

PROPOSED WEIR AND FISHWAY - PLAN

PROJECT NUMBER	03004643
DRAWING NUMBER	03004643-003
SHEET NUMBER	3
REVISION	A

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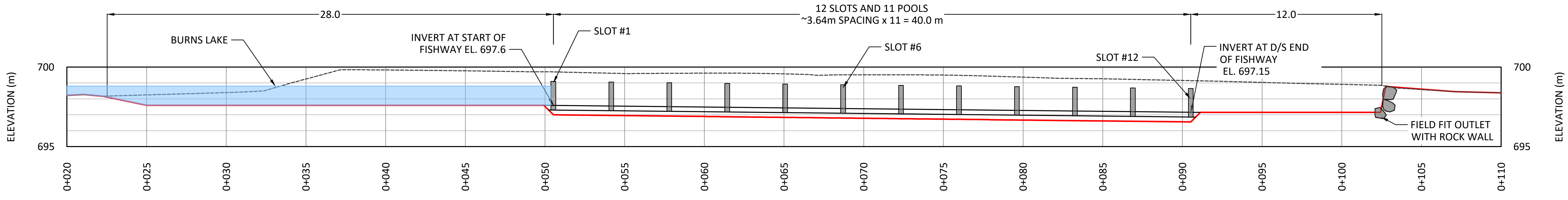
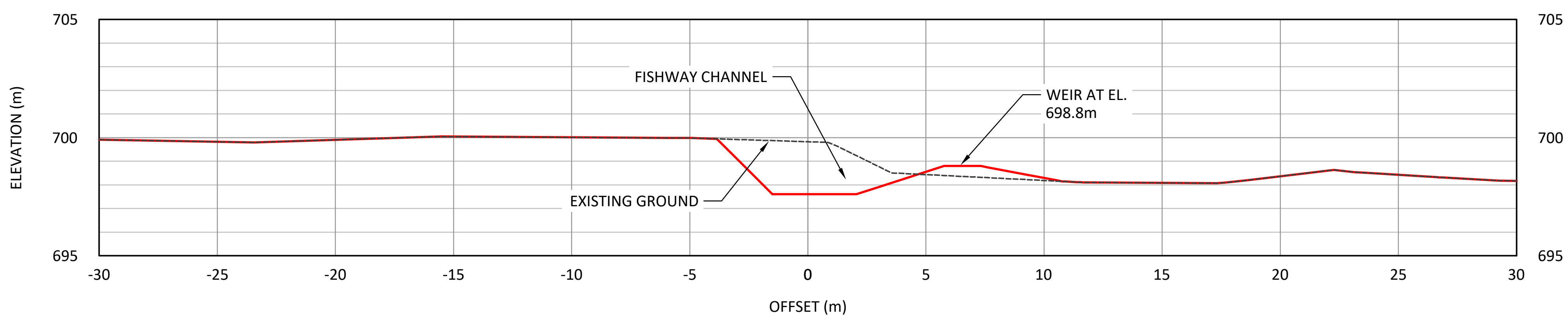
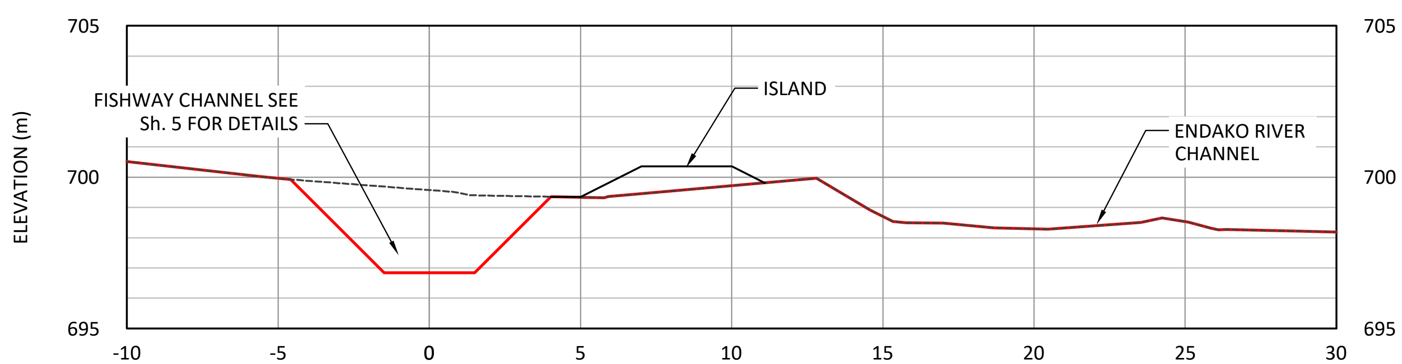


PROFILE 1 - FISHWAY
1:250



SECTION 2
1:250



SECTION 3
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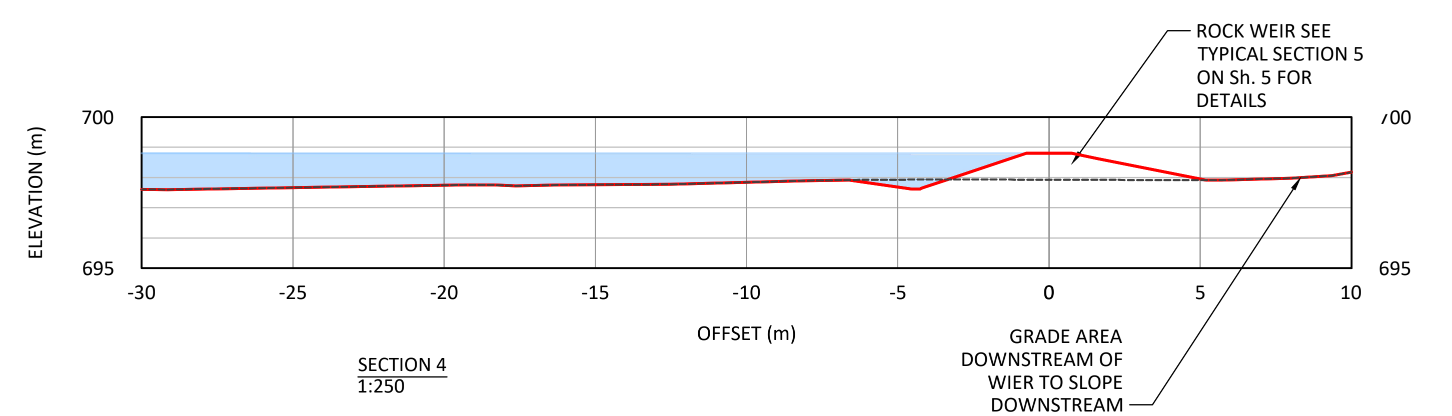

SECTION 4
1:250

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30 Gostick Place
North Vancouver, BC
Canada V7M 3G3
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Fax: 604.980.9264
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DRAWN BY	KEH
CHECKED BY	NRA
SHEET SIZE	B (11" x 17")

UPPER FRASER FISHERIES
CONSERVATION ALLIANCE

ENDAKO RIVER WEIR AND FISHWAY

SECTIONS, PROFILE AND DETAILS

PROJECT NUMBER	03004643
DRAWING NUMBER	03004643-004
SHEET NUMBER	4
REVISION	A

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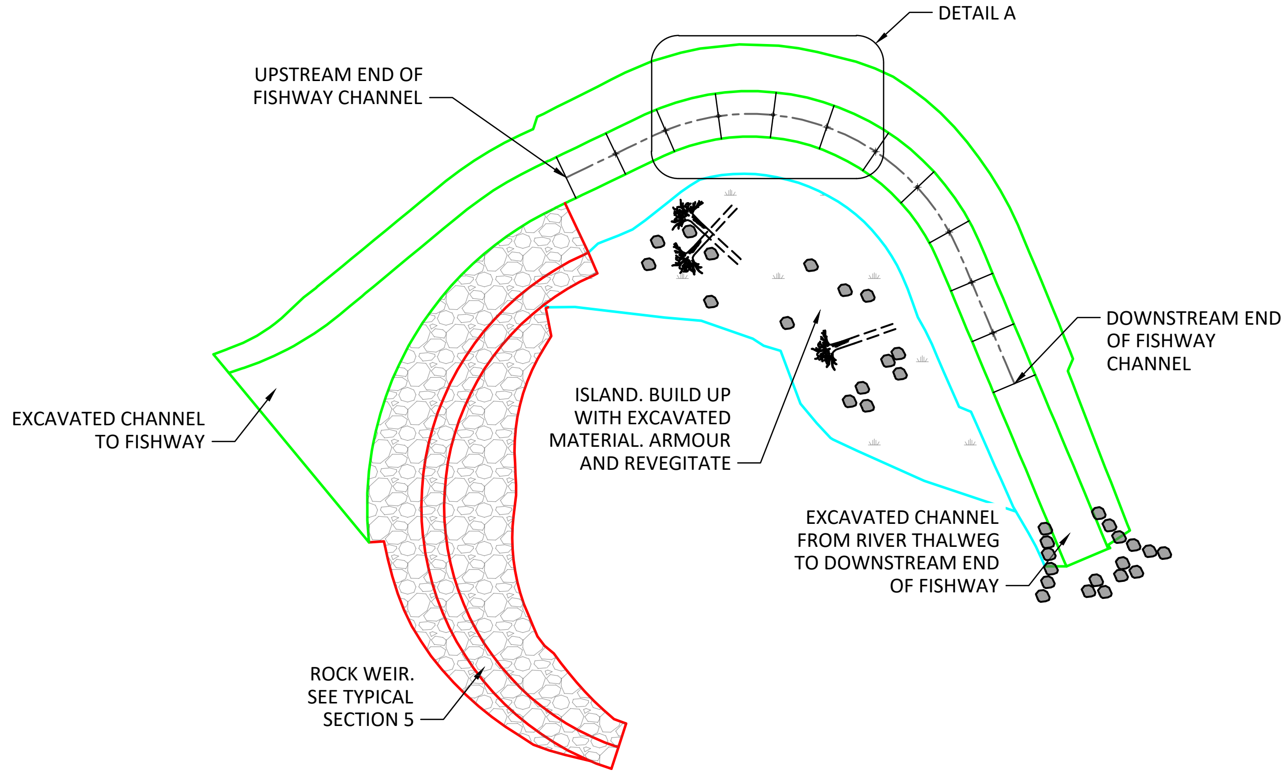
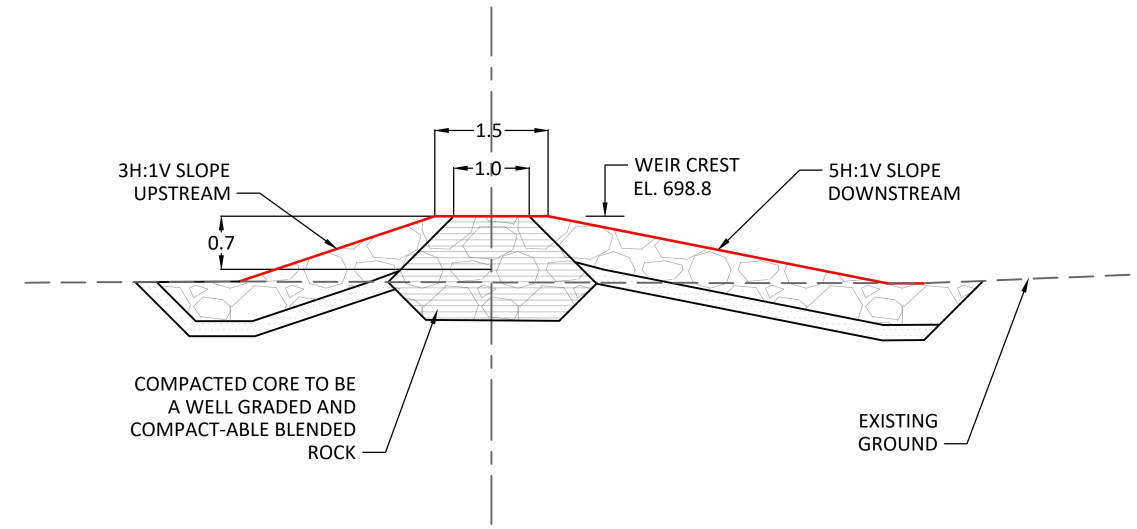


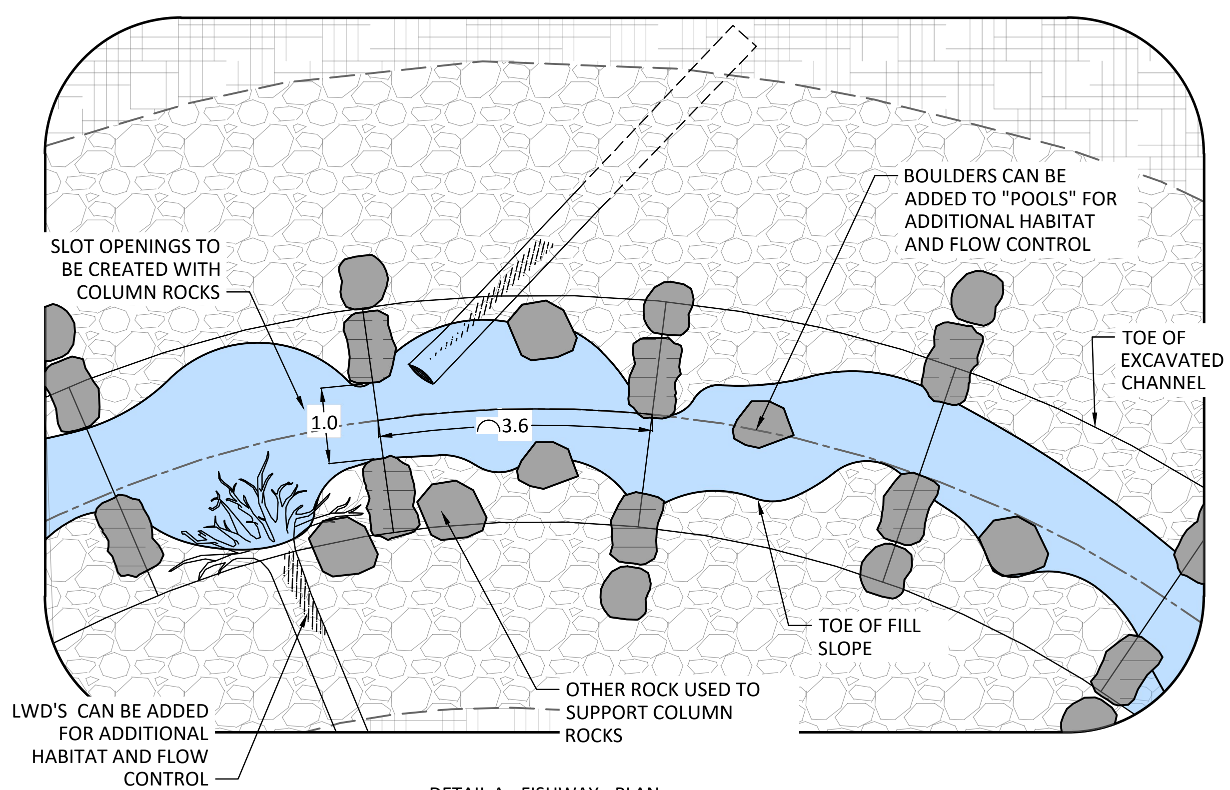
SIMPLIFIED KEY PLAN OF PROPOSED STRUCTURE
1:500



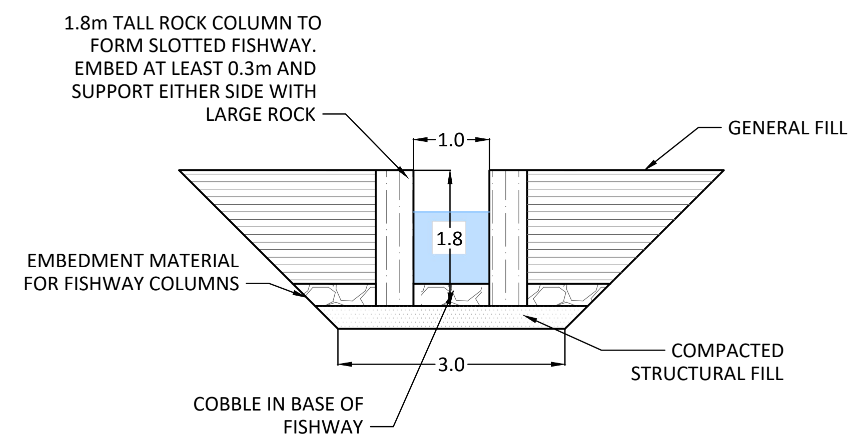
TYPICAL SECTION 5 - ROCK WEIR
1:100

ENDAKO SLOT FISHWAY - SLOT ELEVATION AND ROCK SIZE REQUIREMENT		
SLOT NUMBER	INVERT ELEVATION	TOP ELEVATION
1	697.60	699.10
2	697.56	699.06
3	697.52	699.02
4	697.48	698.98
5	697.44	698.94
6	697.40	698.90
7	697.35	698.85
8	697.31	698.81
9	697.27	698.77
10	697.23	698.73
11	697.19	698.69
12	697.15	698.65

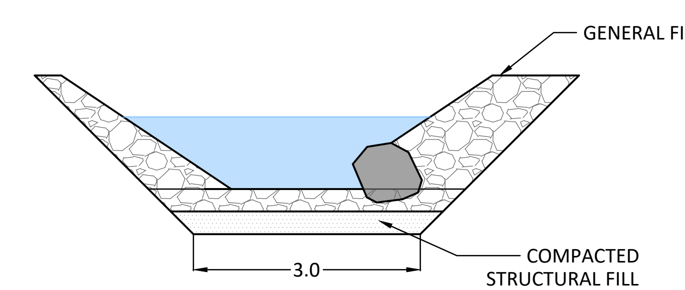
TABLE 1 - SLOT FISHWAY ELEVATION SPECIFICATIONS



DETAIL A - FISHWAY - PLAN
1:100



TYPICAL SECTION 6 - FISHWAY SLOT
1:100



TYPICAL SECTION 7 - FISHWAY POOL
1:100

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UPPER FRASER FISHERIES CONSERVATION ALLIANCE

ENDAKO RIVER WEIR AND FISHWAY

DETAILS AND TYPICAL SECTIONS

PROJECT NUMBER	03004643
DRAWING NUMBER	03004643-005
SHEET NUMBER	5
REVISION	A

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