Planning Application Information Sheet

Application Type: Agricultural Land Reserve
File Number: 3015-20/B20250051
ALR Application Type: Subdivision 21(2)
Electoral Area: B
Date of Referral: February 11, 2026
Date of Application: September 09, 2025

Property Owner's Name(s): Ambrus Investments Ltd.

Applicant's Name: McElhanney Consulting Services c/o Bryce Whitehouse

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SECTION 1: Property Summary

Legal Description(s): Lot A, District Lots 83 and 319, Cariboo District, Plan PGP40531 Except Plan EPP56753

Property Size(s): 114.85 ha (283.8 ac)

Area of Application: 0.974 ha (2.407 ac)

Current Designation:
Agricultural and Resource

Min. Lot Size Permitted:
32.0 hectares (79.07 acres)

Current Zoning:
Resource /Agricultural (RA 1)

Min. Lot Size Permitted:
32.0 hectares (79.07 acres)

Proposal: The Ministry of Transportation and Transit is proposing the registration of a 0.974 ha (2.407 ac) Right of Way on the subject property to allow habitat enhancement work in Bouchie Creek.

As the proposal is not for transportation work in a dedicated transportation corridor the Agricultural Land Commission requires a subdivision application with a non-farm use component instead of a Transportation and Utility Use application.

Existing Buildings: Two farm buildings

Proposed Buildings: None

Road Name: Blackwater Road, Yargeau Road
Road Type: Paved
Within the influence of a Controlled Access Highway: N/A

Within the confines of the Agricultural Land Reserve: Yes - partially within

Required to comply with the Shoreland Management Policy: N/A
Name of Lake/Contributing River: Bouchie Creek, Unnamed Watercourse, Fraser River
Lake Classification: High

Within Development Permit Area: Yes
Development Permit Area Name: Aquatic Habitat Development Permit Area

Geotechnical Hazards Development Permit Area - Moderate risk area

Adjoining Properties: (Source: B.C.A.A.)

	Land Use:	Lot Sizes:
(a) North	Grain & Forage (Vacant)	27.9 ha (68.939 ac)
	Beef (Vacant)	64.75 ha (160 ac)
(b) South	2 Acres Or More (Single Family Dwelling, Duplex)	14.1 ha (34.84 ac)
	2 Acres Or More (Single Family Dwelling, Duplex)	58.68 ha (145 ac)
(c) East	N/A	N/A
(d) West	Golf Courses (Includes Public & Private)	42.96 ha (106.15 ac)
	2 Acres Or More (Vacant)	42.3 ha (104.522 ac)

Agricultural Capability Classification:

Canada Land Inventory: Class 1 = Best, Class 7 = Worst

% of parcel	Unimproved rating	Improved rating
100%	70% Class 3 – Moisture limitation 30% Class 4 – Moisture limitation and Stoniness	No improved class rating

The agricultural capability classifications of the properties are Class 3 and Class 4. The limiting factors are noted to be moisture limitation and stoniness.

Class 3 land has limitations that are more severe than for Class 2 land and management practises are more difficult to apply and maintain. The limitations may restrict the choice of suitable crops or affect one or more of the following practises: timing and ease of tillage, planting and harvesting, and methods of soil conservation.

Land in Class 4 has limitations which make it suitable for only a few crops, or the yield for a wide range of crops is low, or the risk of crop failure is high, or soil conditions are such that special development and management practises are required. The limitations may seriously affect one or more of the following practises: timing and ease of tillage, planting and harvesting, and methods of soil conservation.

note: the information above is an interpretation of the British Columbia Soil Information Finder Tool – B.C. Agricultural Capability Map. An on-site visit of the property has not been conducted.

PLANNING COMMENTS

Background:

The Cariboo Regional District has received an Agricultural Land Commission (ALC) application for subdivision. The Ministry of Transportation and Transit is proposing the registration of a 0.974 ha (2.407 ac) statutory right of way on the subject property to allow required habitat enhancement work in Bouchie Creek as part of the Blackwater Road at Knickerbocker Road Cariboo Road Recovery Project. The ALC considers the establishment of statutory right of way for habitat enhancement outside a dedicated transportation corridor a form of subdivision. The proposed works are to provide adequate habitat enhancement in Bouchie Creek as well as providing access and maintenance to the site.

The 114.85 ha (283.8 ac) subject property is zoned Resource Agricultural (R/A) in the Quesnel Fringe Area Zoning Bylaw No. 3504, 1999 and designated Agricultural and Resource in the Quesnel Fringe Area Official Community Plan Bylaw 4844, 2014. The applicant notes the property is currently used for cattle grazing and forage production. It currently contains two farm buildings.

Location and Surrounding:

The subject property is adjacent to the Fraser River west of Quesnel as seen in Appendix B. The subject property is bisected by Yargeau Rd and it is fully within the Agricultural Land Reserve. It contains partially cleared fields and is partially treed with both Bouchie Creek and an unnamed creek running through it into the Fraser River.

CRD Regulations and Policies:

Cariboo Regional District Agricultural Policy, 2016

4.0 GENERAL POLICIES

(b) To support the Agricultural Land Commission in its mandate of protecting agricultural lands and agricultural opportunities.

Rationale for Recommendations:

Planning staff are supportive of the proposed ALR application. The ALC considers the establishment of a statutory right of way for habitat enhancement outside a dedicated transportation corridor a form of subdivision. The planned improvements to the creek will help ensure longer term resiliency from the effects of the recent geotechnical activity in the area. The right of way is unlikely to have further impact on the parcel. As the CRD does not consider a statutory right of way a form of subdivision, planning staff do not have any concerns.

The Electoral Area 'B' Advisory Planning Commission (APC) has responded in support. They state they support the repairs to Blackwater Rd and Knickerbocker Rd and the offsetting is required to do the project. They also state the backchannel for fish habitat is important for the Fraser River watershed.

The Ministry of Agriculture and Food (MAF) has responded stating they do not have any concerns with the CRD forwarding the application to the ALC for a decision.

In summary, planning staff are supportive of the proposed subdivision application.

Recommendation:

That the Provincial Agricultural Land Commission application for subdivision pertaining to Lot A, District Lots 83 and 319, Cariboo District, Plan PGP40531 Except Plan EPP56753 be authorized for submission to the Provincial Agricultural Land Commission with a recommendation for approval.

REFERRAL COMMENTS

Ministry of Agriculture and Food: March 10, 2026
Ministry staff have reviewed the proposed subdivision and note that the parcel to be subdivided is located in close proximity to the Fraser River and adjacent non-ALR land and is not under agricultural production; likely because there are two watercourses running through it. Ministry staff have no concerns with the CRD forwarding the application to the ALC for decision.

Advisory Planning Commission: March 2, 2026
See attached

ATTACHMENTS

Appendix A:	Application
Appendix B:	General Map
Appendix C:	Specific Map
Appendix D:	Orthographic Map
Other:	Applicants Supporting Documents
	Advisory Planning Commission Comments

Provincial Agricultural Land Commission - Applicant Submission

Application ID:	105446
Application Type:	Subdivide Land in the ALR
Status:	Submitted to L/FNG
Name:	AMBRUS INVESTMENTS LTD., INC.NO. BC184211
Local/First Nation Government:	Cariboo Regional District

1. Parcel(s) Under Application

Parcel #1

Parcel Type	Fee Simple
Legal Description	LOT A DISTRICT LOTS 83 AND 319 CARIBOO DISTRICT PLAN PGP40531 EXCEPT PLAN EPP56753
Approx. Map Area	106.67 ha
PID	023-607-220
Purchase Date	May 9, 2016
Farm Classification	Yes
Civic Address	Yargeau Road, Quesnel BC
Certificate Of Title	TITLE-FB501857-PID-023-607-220.pdf

Land Owner(s)	Organization	Phone	Email	Corporate Summary
Ciril Norvok	AMBRUS INVESTMENTS LTD., INC.NO. BC184211	[redacted]	[redacted]	Corprate Summary Ambrus Investments BC0184211.pdf

2. Other Owned Parcels

Do any of the land owners added previously own or lease other parcels that might inform this application process?	No

3. Primary Contact

Type	Third-Party Agent
First Name	Bryce
Last Name	Whitehouse
Organization (If Applicable)	McElhanney Ltd.
Phone	[redacted]
Email	[redacted]

4. Government

Local or First Nation Government:	Cariboo Regional District

5. Land Use

Land Use of Parcel(s) under Application

Describe all agriculture that currently takes place on the parcel(s).	The only agricultural activity within the affected parcel (Lot 023-607-220) is a cattle pasture and hay/forage production, occupying approximately 70% of the lot. The remainder of the land is unutilized and is composed of forested lands.
Describe all agricultural improvements made to the parcel(s).	The portion of the parcel is used for agricultural purposes, with both cattle grazing and forage production. Satellite imagery confirms the presence of the following agricultural uses:

Cattle Pasture: Approximately 5.5 hectares of the parcel is fenced and maintained as open pasture for cattle grazing, including a small livestock shelter or barn.

Forage/Hay Production: Approximately 36 ha of the land is actively used for hay production.

Drainage feature: A small stream, approximately 1 kilometre in length, runs through the parcel. The upstream reach—measuring approx. 220 m—has minimal to no riparian vegetation. In contrast, the downstream reach is vegetated and provides riparian function, contributing to erosion control and overall stream stability.

The land is actively managed but remains low-impact, with no visible signs of large-scale infrastructure such as irrigation systems or intensive farming facilities in place.

Describe all other uses that currently take place on the parcel(s).

The parcel also includes a forested area and an unnamed tributary, which extends for 1.5 km within the parcel.

Land Use of Adjacent Parcels

	Main Land Use Type	Specific Activity
North	Agricultural / Farm	Directly north of the project is a Beef Pasture/ forage production (PID 023-607-220). West of the PID 023-607-220 is a golf course (PID: 012827347).
East	Other	Directly East of the site is the Fraser River. There is a Tree farm across the Fraser River.
South	Other	Forest, single family dwelling, and Blackwater Road (PID 015065197).
West	Agricultural / Farm	Mostly forest. Similar to the 'South' land use -> Forest, single family dwelling, and Blackwater Road (PID 015065197).

6. Proposal

Proposed Lot Areas

#	Type	Size
1	Lot	105.696
2	Lot	0.974

What is the purpose of the proposal?

The application is required to provide adequate habitat enhancement as well as access and maintenance to the site.
The habitat offsetting design will focus on the 120 m downstream reach of Bouchie Creek. The project aims to enhance the in-stream and riparian area to increase the quality and quantity of rearing habitat for resident fish species and juvenile salmonids.
This project is a required habitat offsetting for the Blackwater project, which aims to improve and provide access to agricultural lands (see application ID 100690).

This unnamed tributary currently has poor habitat quality due to its lack of overhanging vegetation, suitable rearing substrate, flow, and minimal complexity. The project aims to improve the fish habitat by:
• Widening the downstream reach to increase the wetted area in the channel for all season
• Addition of the weir-riffle structure along the downstream reach to increase water depth during low flows
• The partial excavation of silt material and addition of gravel/cobble substrate to increase the productive capacity of the substrate by increased production of benthic invertebrates that would provide a food source for fish, and potentially provide spawning habitat in suitable flow conditions.
• The addition of instream structures such as boulders and LWD to provide cover, refuge and complexity where it is currently lacking.
• Planting and live staking of vegetation on the side channel banks such as willow and black cottonwood would provide more direct benefit to fish in the form of shade, aquatic cover and refuge habitat during higher flows, and allochthonous carbon input during other times of the year.

The benefits of the proposed enhancements for juvenile and adult fish of all species will be immediate. The downstream reach would provide clean flow during high sediment conditions in the Fraser River, as well as refuge for all life stages and species of locally present fish during higher flows. Year-around rearing habitat for juveniles will also be available.

The stream is groundwater-fed during low flows. Increasing the channel depth may increase flow within the creek (through additional groundwater interception). This would help flush out the fine sediments deposited by the Fraser River and help maintain better substrate more suitable for spawning and rearing. It would also contribute cold-water inputs into the Fraser River.

The benefit of the addition of vegetation for allochthonous carbon input to the system and instream shade will take longer (predicted to take two years post-installation) and is based on the time for live stakes to stabilize and grow. Riparian planting will also provide habitat for other terrestrial wildlife species when not inundated.

The proposed enhancements are intended to address poor existing refuge habitat within a tributary to the Fraser River, providing suitable refuge habitat for fish year-round. Additional benefits of the proposed works are cover (instream and riparian), coarser substrate, habitat complexities (i.e., weir riffle) and water quality improvements (i.e., dissolved oxygen from riffle structures, cooler temperatures from groundwater inputs and cover). Each of the enhancements contribute to providing good refuge habitat, suitable rearing conditions, and increased food provisions.

The enhancement of the instream and riparian areas will positively impact both the land and water quality. Consequently, this improvement will benefit the agricultural lands.

Why do you believe this parcel is suitable for subdivision?

We believe the identified smaller parcel proposed for subdivision is primarily located within a natural watercourse and riparian buffer zone. As a result, the majority of the proposed lot is unsuitable for viable agricultural development. However, the subdivision as proposed, could be used to support aquatic environmental enhancement with minimal impact to agriculturally viable land. Furthermore, as of the date of this application (August 2025), the proposed subdivided area is not currently in agricultural production, so on the larger remaining parce, the property owner's existing operations should remain unaffected.

Does the proposal support agriculture in the short or long term? Please explain.

The proposed subdivision and its subesquent improvment will not directly support agriculture in the short or long term. However, the goal of the project is to enhance the preexisting ecosystem by adding beneficial features and complexity to the proposed creek channel, there by supporting the surrounding environment. This will not directly benefit agriculture but by developing a more diverse ecosystem in the area there could be indirect benefits to the area in general.

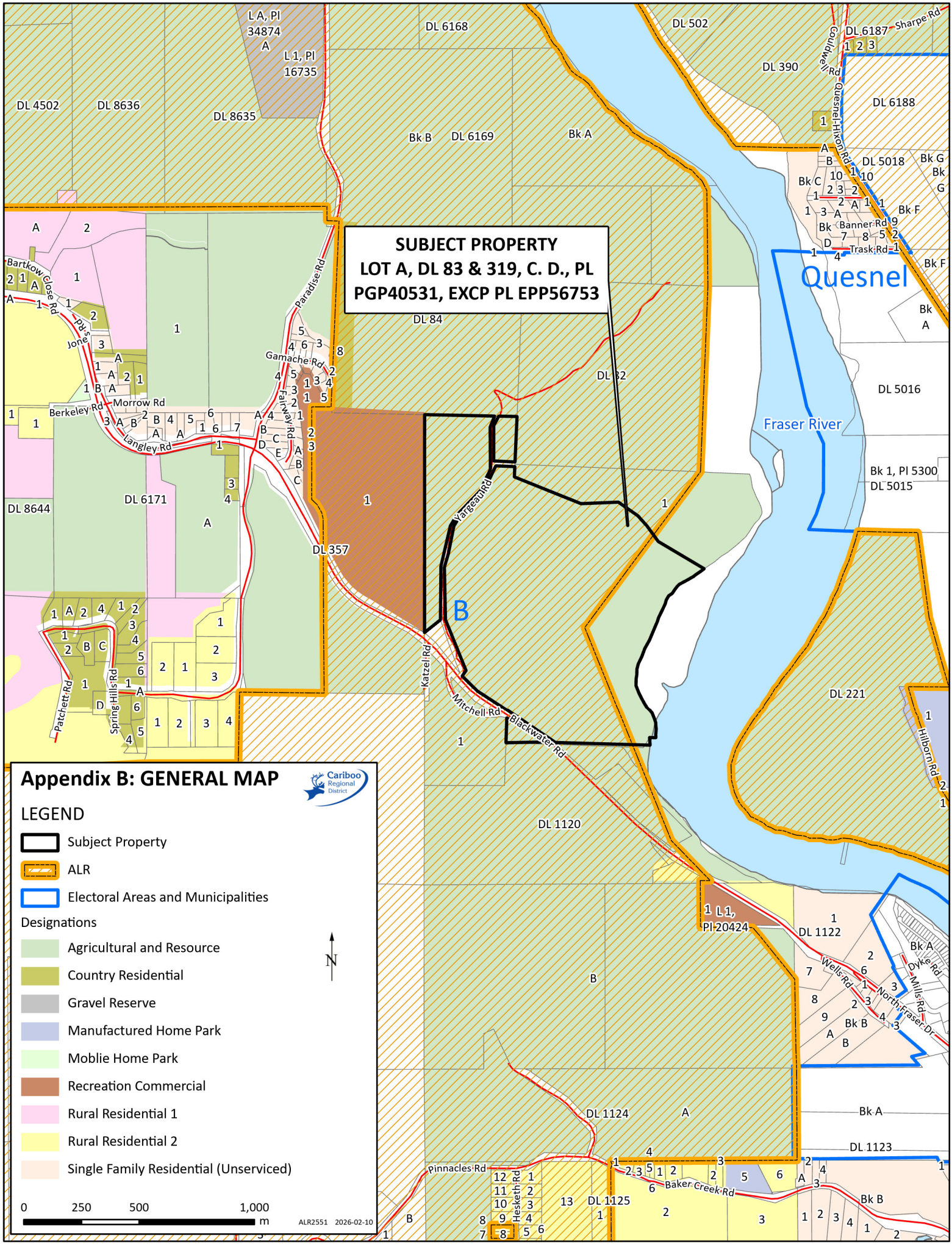
Proposal Map / Site Plan

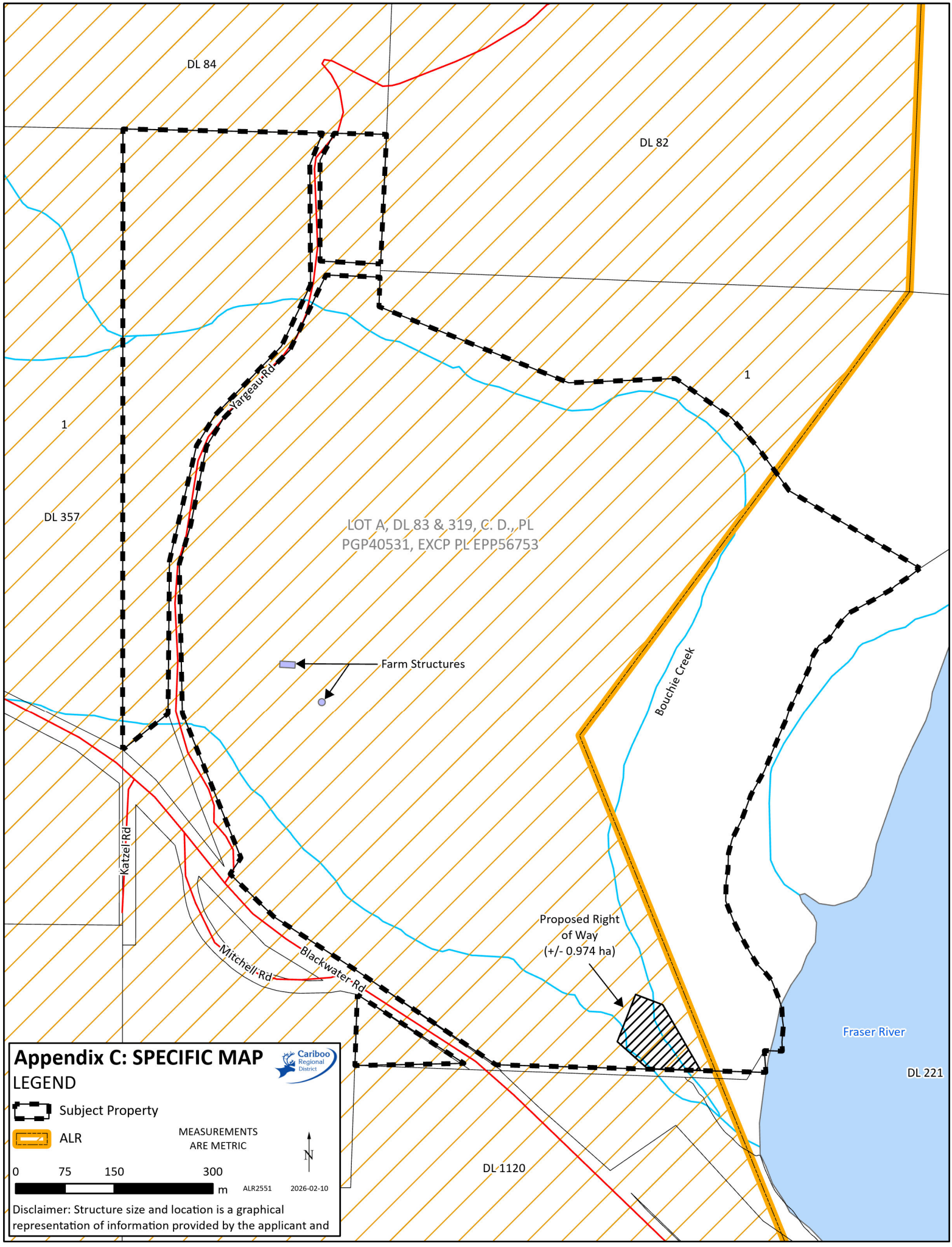
20260123 - PID 023-607-220 - Site Layout.pdf

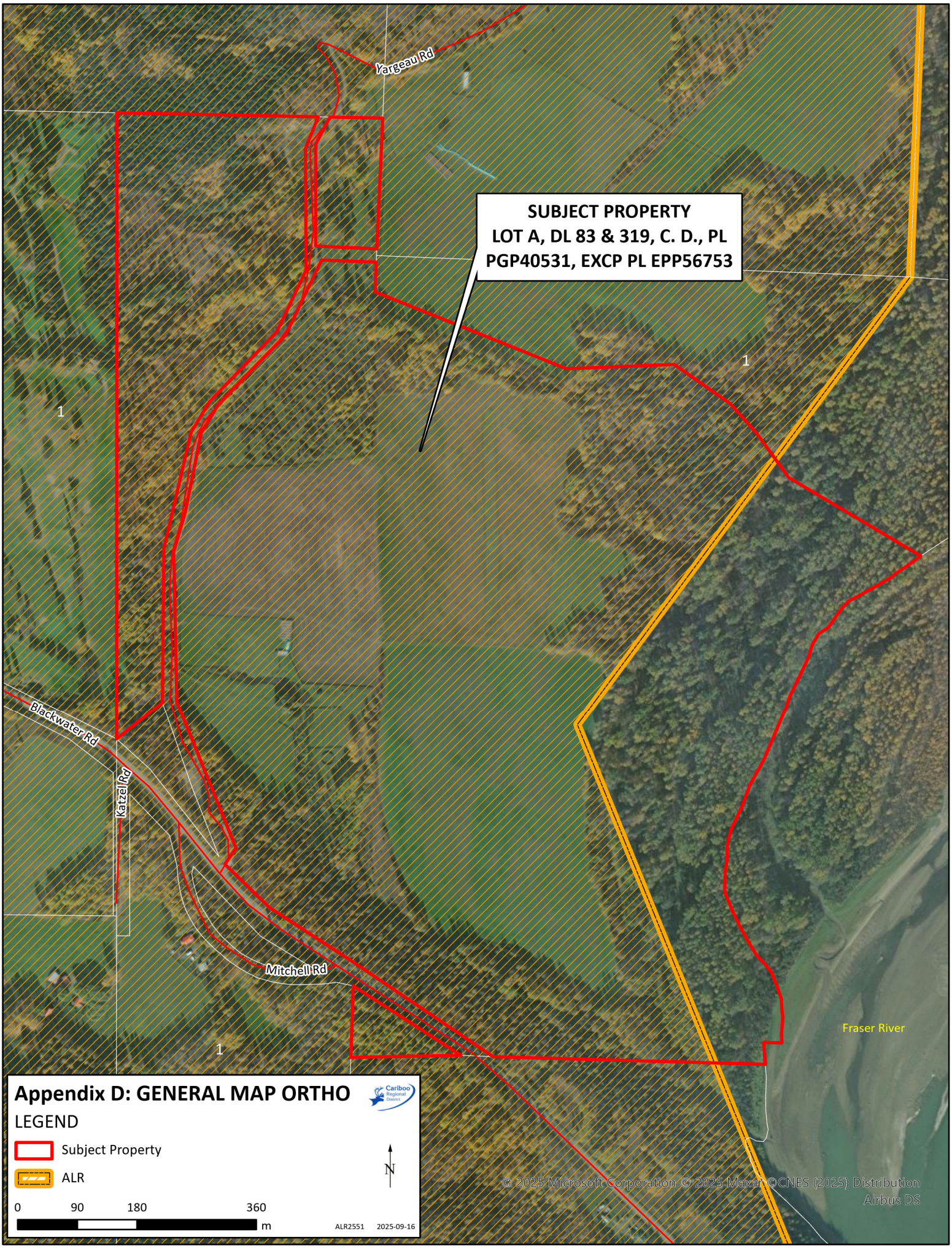
Are you applying for subdivision pursuant to the ALC Homesite Severance Policy?	No

7. Optional Documents

Type	Description	File Name
Professional Report	Related Blackwater Road Slope Stabilization Project - Bank Protection	Blackwater Road Slope Stabilization Project - Draft Bank Protection Design Memo_RevC.pdf
Other files that are related	CAD file For Proposed Right-of-Way	20250616-PID 023-607-220.shp
Other files that are related	KMZ Shapefile For Proposed Project Right-of-Way	20250616 - PID 023-607-220.kmz
Other files that are related	Related ALC Decision on the Blackwater Road Application	ALC Application Decision - 100690d1.pdf
Professional Report	Blackwater Rd - Habitat Offsetting Report	blackwater_hydraulic_enviro_offsets_20241122.pdf


SUBJECT PROPERTY
LOT A, DL 83 & 319, C. D., PL
PGP40531, EXCP PL EPP56753
Quesnel
Fraser River
DL 84
DL 82
DL 357
DL 6171
DL 8644
DL 4502
DL 8636
DL 8635
DL 6168
DL 6169
DL 502
DL 390
DL 6187
DL 6188
DL 5018
DL 5016
DL 5015
DL 221
DL 1120
DL 1122
DL 1123
DL 1124
DL 1125
L A, Pl 34874
L 1, Pl 16735
L 1, Pl 20424
Bk A
Bk B
Bk C
Bk F
Bk G
Bk 1, Pl 5300
B
Bartkow Close Rd
Paradise Rd
Gamache Rd
Fairway Rd
Morrow Rd
Berkeley Rd
Langley Rd
Vargeau Rd
Katzel Rd
Mitchell Rd
Blackwater Rd
Patchett Rd
Spring Hills Rd
Quesnel-Hixon Rd
Coulthard Rd
Sharpe Rd
Banner Rd
Trask Rd
Hilborn Rd
Wells Rd
Dyke Rd
Mills Rd
North Fraser Dr
Pinnacles Rd
Hesketh Rd
Baker Creek Rd
Appendix B: GENERAL MAP
Cariboo Regional District
LEGEND
Subject Property
ALR
Electoral Areas and Municipalities
Designations
Agricultural and Resource
Country Residential
Gravel Reserve
Manufactured Home Park
Moblie Home Park
Recreation Commercial
Rural Residential 1
Rural Residential 2
Single Family Residential (Unserviced)
N
0 250 500 1,000 m
ALR2551 2026-02-10


DL 84
DL 82
1
1
Yargeau Rd
DL 357
LOT A, DL 83 & 319, C. D., PL
PGP40531, EXCP PL EPP56753
Farm Structures
Bouchie Creek
Katzel Rd
Mitchell Rd
Blackwater Rd
Proposed Right
of Way
(+/- 0.974 ha)
Fraser River
DL 221
DL 1120
Appendix C: SPECIFIC MAP
LEGEND
Subject Property
ALR
MEASUREMENTS
ARE METRIC
N
0
75
150
300
m
ALR2551
2026-02-10
Disclaimer: Structure size and location is a graphical
representation of information provided by the applicant and



Appendix D: GENERAL MAP ORTHO

LEGEND

Subject Property

ALR

N

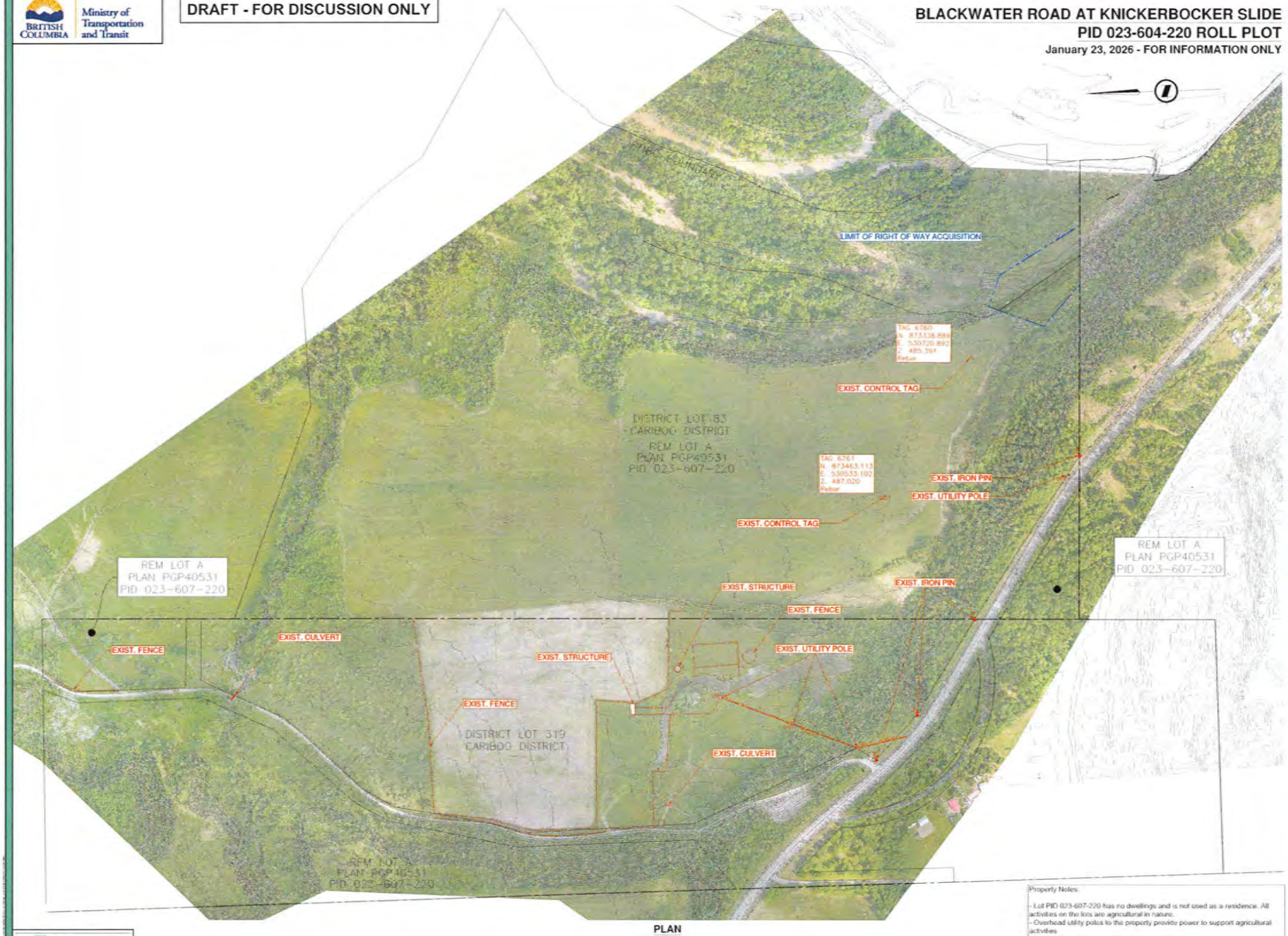
0 90 180 360 m

ALR2551 2025-09-16

Ministry of Transportation and Transit

DRAFT - FOR DISCUSSION ONLY

BLACKWATER ROAD AT KNICKERBOCKER SLIDE
PID 023-604-220 ROLL PLOT
January 23, 2026 - FOR INFORMATION ONLY



PLAN

Property Notes:

- Lot PID 023-607-220 has no dwellings and is not used as a residence. All activities on the lots are agricultural in nature.
- Overhead utility poles to the property provide power to support agricultural activities.
- The lot does not have public water, or sanitary service.
- No well is located on the lot

BINNIE
The people behind your infrastructure.

Our File: McElhanney Project #2121-00924-00

TECHNICAL MEMO

To	From
Maurizio Ponzini, P.Eng CRRP Design Lead, Binnie and Associates Ltd.	Luc Harvey, P.Eng. – Lead Hydrotechnical Engineer Doug Johnston, P.Eng. Senior Hydrotechnical Reviewer
Re	**Date**
Blackwater Road Slope Stabilization - North Fraser Slide Bank Protection Detailed Design - DRAFT	April 5, 2024

1. Introduction

The following memorandum is a brief description of the erosion protection design for the right (southwest) bank of the Fraser River immediately adjacent to the North Fraser Slide that occurred on Blackwater Road, just upstream of the Fraser River and Quesnel River confluence. This memorandum is intended to be read in conjunction with the 100% detailed design drawings for this project. In addition, a detailed hydrotechnical report was completed as a precursor to the design. That document provides a detailed description and analysis of the project, the study area, the hydrologic analysis of the Upper Fraser River watershed, and the hydraulic modeling of the Fraser River though the study area.

1.1. BACKGROUND

The Blackwater Road Slope Stabilization project site is located approximately 3.7 km north of Quesnel, BC on the west side of the Fraser River. Two geotechnical instabilities, referred to as the North Fraser Slide (to the north) and the Knickerbocker Slide (to the south), are impacting an 800m stretch of Blackwater Road. The North Fraser Slide is characterised by a large slide mass that has separated from the upper hillslope. The current slide crest is approximately 400m long and runs relatively parallel to Blackwater Road towards the north end of the project site, with its closest point coming within 10m of the existing asphalt edge. The proposed slope stabilization design for the North Fraser Slide includes the following elements:

- Realign a 350m portion of Blackwater Rd to the west away from the North Fraser Slide to unload the top of the slide mass.

- Provide bank armouring along the toe of the North Fraser Slide to protect the slide mass from continued erosion by the Fraser River.

No bank protection is proposed for the Knickerbocker Slide. The Knickerbocker slide is creeping in nature and any bank armouring placed at the river would be pushed into the river as the slide creeps forward. This memorandum provides a summary of the bank protection design for the North Fraser Slide.

2. Design Considerations

2.1. DESIGN CRITERIA

Design Flow

The design flow used for the bank protection design was the 200-year peak instantaneous flow. A climate change factor was applied on the design flow to account for potential changes to climatic conditions anticipated by 2100.

Freeboard

We also adopted a freeboard of 300 mm above the predicted water surface elevation under the 200-year event (peak instantaneous flow with climate change). This value is adopted as the minimum freeboard typically used for flood mitigation projects when using the peak instantaneous flow value to determine the design water surface elevation.

Slope Stability

Geotechnical investigations of the North Fraser Slide indicated that the landslide mass that has separated from the upper slope is currently buttressing the slide complex. The bank protection design should therefore generally avoid cutting into the existing landslide mass to avoid impacting the stability of the slope. Extensive loading of the landslide mass with rip rap (or bulk fill) must also be avoided.

Riprap slopes prescribed generally matched the existing slope angles along the length of the revetment. This reduces the riprap volume required and limits disturbance of the soil mass. A maximum revetment slope of 1.5H:1V was used to limit the size of rock required for stability under the design flow and maintain constructability of the slope.

A minimum revetment slope of 50% (2H:1V) was used to limit the resulting footprint of the revetment to reduce morphological changes to the riverbed and environmental impacts of the works.

3. Proposed Design

3.1. RIPRAP BANK PROTECTION

The design riprap revetment is 325 m long. There are five distinct sections:

- **Section 1:** The first (upstream-most) 150-m section will be constructed of Class 500 kg riprap at a design slope of 2H:1V; this riprap size is required as it is located at the sharpest point of the river bend and is expected to have higher erosive forces than the sections of the bank further downstream.
- **Section 2:** The second 90-m section will be constructed of Class 1000 kg riprap at a design slope of 1.5H:1V and will be located along the first half of the toe of the main slide mass; the steep natural slope of the bank in this area requires the steeper riprap revetment which results in the larger required rock size.
- **Section 3:** The third 30-m section will be constructed of Class 500 kg riprap at a design slope of 2H:1V as the natural bank slope becomes shallower towards the downstream end of the slide mass. The shallower riprap slope allows for a reduction in size.
- **Section 4:** The fourth 20-m section will be constructed of Class 500 kg riprap at design slopes varying between 1.5H:1V and 3H:1V to mimic the shape of the natural weathered rock outcropping in this location. This will limit the amount of unloading that occurs in this section.
- **Section 5:** The final 35-m section will be constructed of Class 500kg riprap at a design slope of 2H:1V as the riprap revetment curves to tie-in to the existing bank at the end of the main slide mass.

The difference in rip rap size reflects the variations in the predicted water velocities along the bank and the change in the revetment slope. Riprap sizing calculations for Sections 1 and 2 are included as examples in **Appendix A**.

3.2. RIPRAP DESIGN VELOCITIES

The installation of the riprap revetment along the toe of the North Fraser Slide is expected to cut off the supply of erodible material to the Fraser River. The thalweg of the Fraser River is currently located approximately 80m from the toe of the slide. We have posited that a potential reason for the location of the thalweg in the middle of the bend, as opposed to the outside of the bend (i.e. closer to the bank) is due to landslide material being deposited in the river. However, following installation of the revetment, the supply of landslide material may be reduced and may allow the thalweg to shift closer to the bank. This would subject the revetment to the larger velocities currently present at the thalweg. As a result, the riprap was sized for the peak modelled velocity in each channel section for the design event.

3.3. RIPRAP THICKNESS

The minimum thickness of the riprap is limited to the D100 dimension of the riprap class for each section. Additional riprap thickness or fill volume is provided in areas where the design revetment surface is further away from existing ground than the minimum thickness, to fill the void space. Fill volume is used instead of riprap only in elevated void pockets that would generally not be submerged during annual Fraser River flows.

For areas where the design revetment surface is closer to existing ground than the minimum thickness, or below existing ground, soil will be removed to achieve the required riprap thickness. To avoid impacting the stability of the slide mass, all excavation of the slide mass should be done in the presence of a geotechnical engineer. Excavation and replacement of the slide mass is recommended to be done in sections to limit the amount of unloading of the slide toe that occurs at any given time. Additional guidance for monitoring of slide movement during construction of the revetment will be provided by BGC in a separate document.

3.4. SCOUR PROTECTION

Additional rip rap incorporated into the design to provide scour protection must account for both potential thalweg migration towards the revetment and scour forces at the revetment. The elevation of the existing thalweg is approximately 264 m geodetic. To guard against both this erosion and possible channel scour, which is estimated to be up to 3.4 m, a launch has also been added to the toe of the revetment. The launch provides additional volume at the toe of the revetment to fill scour holes as they form and protect against undermining of the revetment. The launch will be built above the existing ground surface to limit the amount of excavation required below the Fraser River water level during construction. The cross-sectional area of the launch toe is estimated to be 9.3m^2 for the entire revetment.

Scour estimate calculations for the revetment are included in **Appendix B.**

3.5. SLOPE PREPARATION

Removal of all vegetation within the footprint of the riprap is required. Portions of the site were used as a dumping ground, primarily for old cars. Rusted automobile parts are visible on the surface and embedded in the slope and channel along a portion of the proposed revetment. Some of the contaminated material within the riprap footprint may need to be removed and replaced with competent imported fill before installation of the proposed revetment. Non-woven geotextile will be required between the riprap and the subgrade material on the upper revetment slope only. No geotextile should be placed beneath the riprap launch volume.

3.6. CONSTRUCTION ACCESS

The study area, between Blackwater Road and the Fraser River, is vegetated with established trees, brush and shrubs on a steep slope. Access to the toe of the North Fraser Slide will require construction of an access road to get machinery and material down to the revetment location. The access road will act as the single point of access for the supply of rock to the proposed revetment location. The design basis for

the access road design is included in a separate memorandum and is not discussed further in this document.

The proposed revetment is anticipated to be constructed by building up the riprap in stages to create intermediate platforms that can support equipment traffic at several elevations throughout the revetment. Finer material will be placed on the surface of the riprap at each temporary platform to fill the voids and provide an appropriate driving surface. These platforms will be constructed over the entire length of the revetment before starting on the next platform level. The proposed revetment design includes an intermediate platform along the entire revetment on top of the toe launch volume. This should be used as the first or second intermediate platform with additional temporary platforms included as required to construct the upper revetment slope.

The first intermediate platform will be located above the Fraser River water surface elevation at the time of construction and will be constructed from north to south. We assume that a pull out will be constructed near the north end of the revetment so that rock trucks can turn around at the start of the revetment and then reverse to the location of the excavator. Compliance with the applicable environmental permits will be required.

3.7. MATERIAL QUANTITIES

Riprap quantities for the proposed revetment were calculated based on the 100% design drawings prepared for this submission. Based on experience, we recommend that an additional 30% of that volume be added to those estimates. A summary of the riprap quantities is provided in **Table 1**.

Table 1: Riprap Volume Estimates

Aggregate Type	Volume Estimate (m^3)	30% Increase in Volume (m^3)	Total Volume for Costing Purposes (m^3)
Cut / Excavation	1,540	462	2,002
500kg Riprap	12,025	3,608	15,633
1000kg Riprap	7,420	2,226	9,646
Native / Imported Fill Material	2,165	650	2,815

4. Closing

The assessment has been prepared by McElhanney for the benefit of the Ministry of Transportation and Infrastructure. The information and data contained herein must be read in conjunction with the *Statement of Limitations* presented in **Appendix A.**

We thank you for the opportunity to work on this project. Please do not hesitate to contact us if you have any questions.

Prepared by:

DRAFT

Luc Harvey, P.Eng.
lharvey@mcelhanney.com
604-219-6387

Reviewed by:

DRAFT

Doug Johnston, P.Eng.
dajohnston@mcelhanney.com
778-388-6360

APPENDIX A

Riprap Sizing Calculations

McElhanney

Riprap (USACE 1991) Ditch

Project Title:	**Caribou Road Recover Projects - Blackwater Rd Slope Stabilization**
Project #:	**2121-00924-00**
Purpose:	**USACE, 1991 riprap sizing calculation for 200-year climate-change-adjusted design flow and velocities for Section 1 along North Fraser Slide toe along the Fraser River**
Channel Location	**At the end of the failure slope**

Legend

Input

Output

Riprap Calculation for Weir Berm

Inputs	Value	Units	Source
Design Flood	200-year		
Design Flow	6866	m^3/s	200-year climate-change-adjusted design flow from report
V_{avg} Average Channel Velocity	3.80	m/s	Water depth based on HECRAS Model
Flow Depth, d	11.50	m	Water depth based on HECRAS Model
Bend Radius, R	243	m	Measured from GIS
Water Surface Width at upstream of bend, W	300	m	Measured from GIS
Side slope with horizontal	2	H:1V	

Calculation Method (D_{50})

USACE (1994) for reference only

$$D_m = S_f C_s C_v C_t d \left[\left(\frac{\gamma_w}{\gamma_s - \gamma_w} \right)^{1/2} \frac{V}{\sqrt{K_1 g d}} \right]^{2.5} \quad (3\text{-}3)$$

USCAE (1991) Presented in MOE

$$\frac{D}{y} = S C_s C_v C_T \left[\frac{V^2}{(s-1) K_1 (g y)} \right]^{1.25} \quad \text{Eq. [2A-1]}$$

This method has been superceded by the 1994 method but provides more reasonable side slope correction factor values

HEC23. For reference only - These are functionally the same

$$d_{50} = \gamma (S_f C_s C_v C_T) \left[\frac{(V_{bss})}{\sqrt{K_1 (S_s - 1) g y}} \right]^{2.5} \quad (4.1)$$

USCAE (1991) - Method

Variable	Parameter Description	Value		Comments
y	Local flow depth near bank at 20% up slope	9.20	m	Used Design Max Flow Depth from Hydraulic Inputs. depth taken at 20% up sloped bank to calculate height. Depth does not change values significantly but a shallower depth increases rock size
S_f	Safety Factor	1.30		Higher safety factor used to account for added uncertainty at the sharpest point on the Fraser River bend
C_s	Stability Coefficient	0.30		for angular rock
C_v	velocity distribution coefficient	1.00		1.0 for straight channels
C_T	Thickness coefficient	1.00		1.0 for normal blanket thickness either D100 or 1.5 X D50
R/W	Ratio of radius of curvature to water surface width	0.81		
V_{ss}/V_{avg}	Velocity scaling factor	1.33		Assume 4/3 scaling factor as recommended by MoTI for flow impingement at the outside of a bend (R/W scaling factor is too large)
V_{ss}	Local (depth-averaged) flow velocity	5.07	m/s	Vss = Vavg * (Vss/Vavg)
g_w	Unit weight of water	1000	kg/m3	
g_s	Unit weight of stone	2640	kg/m3	Lafarge riprap spec - see reference material
K_1	Side slope correction factor	0.90	see chart	empirical

Calculation	Formula			Comments
	$y S C_s C_v C_T$	3.5680		
	$\left[\frac{V^2}{(s-1) K_1 (g y)} \right]^{1.25}$	0.1277		
	$D = y S C_s C_v C_T \left[\frac{V^2}{(s-1) K_1 (g y)} \right]^{1.25}$	0.458	m	For D30
	Riprap D_{50} = 1.25 x D30	0.573	m	
	Riprap class	**Class 250kg**		Automatically selects min class category for calculated D50
	Riprap Thickness	1.00	m	per MoTI Standard Specifications (2019)

McElhanney

Riprap (USACE 1991) Ditch

Project Title:	**Caribou Road Recover Projects - Blackwater Rd Slope Stabilization**
Project #:	**2121-00924-00**
Purpose:	**USACE, 1991 riprap sizing calculation for 200-year climate-change-adjusted design flow and velocities for Section 2 along North Fraser Slide toe along the Fraser River**
Channel Location	**At the end of the failure slope**

Legend

Input

Output

Riprap Calculation for Weir Berm

Inputs	Value	Units	Source
Design Flood	200-year		
Design Flow	6866	m^3/s	200-year climate-change-adjusted design flow from report
V_{avg} Average Channel Velocity	4.03	m/s	Water depth based on HECRAS Model
Flow Depth, d	12.20	m	Water depth based on HECRAS Model
Bend Radius, R	243	m	Measured from GIS
Water Surface Width at upstream of bend, W	300	m	Measured from GIS
Side slope with horizontal	1.5	H:1V	

Calculation Method (D_{30})

USACE (1994) for reference only	$D_{30} = SC_vC_tC_rd\left[\left(\frac{\gamma_w}{\gamma_r-\gamma_w}\right)^{0.5}\frac{V}{\sqrt{K_1gd}}\right]^{2.5}$ (3-3)	
USCAE (1991) Presentad in MOE	$\frac{D}{y} = SC_vC_t\left[\frac{V^2}{(s-1)K_1gy}\right]^{1.25}$ ..... Eq. [2A-1]	This method has been superceded by the 1994 method but provides more reasonable side slope correction factor values
HEC23. For reference only - These are functionally the same	$d_{30} = y/S_fC_SC_vC_T\left[\frac{(V_{dss})}{\sqrt{K_1(S_g-1)gy}}\right]^{2.5}$ (4.1)	

USCAE (1991) - Method

Variable	Parameter Description	Value		Comments
y	Local flow depth near bank at 20% up slope	9.76	m	Used Design Max Flow Depth from Hydraulic Inputs. depth taken at 20% up sloped bank to calculate height. Depth does not change values significantly but a shallower depth increases rock size
S_f	Safety Factor	1.10		1.1 minimum, increase for uncertainties, extreme freeze thaw etc..
C_v	Stability Coefficient	0.30		for angular rock
C_v	velocity distribution coefficient	1.00		1.0 for straight channels
C_t	Thickness coefficient	1.00		1.0 for normal blanket thickness either D100 or 1.5 X D50
R/W	Ratio of radius of curvature to water surface width	0.81		
V_{ss}/V_{avg}	Velocity scaling factor	1.33		Assume 4/3 scaling factor as recommended by MoTI for flow impingement at the outside of a bend (R/W scaling factor is too large)
V_{ss}	Local (depth-averaged) flow velocity	5.37	m/s	Vss = Vavg * (Vss/Vavg)
g_w	Unit weight of water	1000	kg/m3	
g_s	Unit weight of stone	2640	kg/m3	Lafarge riprap spec - see reference material
K_1	Side slope correction factor	0.70	see chart	empirical

Calculation	Formula			Comments
	$ySC_vC_tC_r$	3.2208		
	$\left[\frac{V^2}{(s-1)K_1gy}\right]^{1.25}$	0.1881		
	$D = ySC_vC_t\left[\frac{V^2}{(s-1)K_1gy}\right]^{1.25}$	0.606	m	For D30
	Riprap D_{100} = 1.25 x D30	0.757	m	
	Riprap class	**Class 1000kg**		Automatically selects min class category for calculated D50
	Riprap Thickness	1.50	m	per MoTI Standard Specifications (2019)

APPENDIX B

Channel Scour Calculations

McElhanney

Project Title:	**Caribou Road Recover Projects - Blackwater Rd Slope Stabilization**
Project No.:	**2121-00924-00**
Purpose:	**Estimation of Scour by Regime Equations. Summarize scour depth estimates for each method and select appropriate scour depth for design (USBR, 1984)**
Location:	**Centre of channel**
Equation Type:	**A, B**
Case:	**Using Q2 as bankfull, Q200 as design flow**

Legend

Input

Output

Common Inputs					Value	Unit	Notes
Q_f	Design Flow	=		=	6866	m^3/s	Q200 + CC
W_f	Design Width	=		=	500.0	m	HEC-RAS water surface width contributing to 200yr design flow
D_{50}	Mean Grain Size of Bed Material	=		=	20	mm	Medium sized gravel assumed based on site observations
q_f	Design Flood Discharge Per Unit Width	=	Q_f/W_f	=	13.7	m^2/s	

Neill Equation (1973)					Value	Unit	Notes
Inputs							
Q_i	Bankfull Flow			=	3946	m^3/s	Q2 Existing
W_i	Bankfull Width			=	240	m	HEC-RAS cross sections
d_i	Average Depth at Bankfull Discharge in Incised Reach				6.00	m	HEC-RAS cross sections
m	Exponent Varying from 0.67 for Sand to 0.85 for Coarse Gravel			=	0.85		USBR 1984 - gravel
Output							
q_i	Bankfull Discharge in Incised Reach Per Unit Width	=	Q_i/W_i	=	16.44	m^2/s	
d_f	Scoured Depth Below Design Floodwater Level	=	$d_i(q_f/q_i)^m$	=	5.15	m	USBR Eqn. 25

Lacey Equation (1930)					Value	Unit	Notes
Output							
f	Lacey's Silt Factor	=	$1.76D_{50}^{1/2}$	=	7.9		
d_m	Mean Depth at Design Discharge	=	$0.47(Q_f/f)^{1/3}$	=	4.49	m	USBR Eqn. 26

Blench Equation (1969)					Value	Unit	Notes
Output							
f_{b0}	Blench's "Zero Bed Factor"	=	$0.75(D_{50}/3.05)^{0.2525}$	=	1.21	m/s^2	Eqn. derived from USBR Fig. 9
d_{f0}	Depth for Zero Bed Sediment Transport,	=	$(q_f^2/f_{b0})^{1/3}$	=	5.39	m	USBR Eqn. 27

Empirical Multiplying Factors, Z					Value	Unit	Notes
Z_N	Z Factor for Neill Equation			=	0.7		USBR Table 7
Z_L	Z Factor for Lacey Equation			=	0.75		USBR Table 7
Z_B	Z Factor for Blench Equation			=	0.6		USBR Table 7

Estimation of Scour Depth					Value	Unit	Notes
d_s	Depth of Scour Below Pool Water Surface (Neill)	=	$Z_N d_f$	=	3.60	m	USBR Eqn. 28
d_s	Depth of Scour Below Pool Water Surface (Lacey)	=	$Z_L d_m$	=	3.37	m	USBR Eqn. 29
d_s	Depth of Scour Below Pool Water Surface (Blench)	=	$Z_B d_{f0}$	=	3.23	m	USBR Eqn. 30
d_s	Average Depth of Scour Below Pool Water Surface	=	average of above	=	**3.40**	m	

APPENDIX C

Statement of Limitations

Statement of Limitations

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Our File: 2121-00924-00

TECHNICAL MEMO

To	From
Brendan Reddington , Environmental Coordinator BC Ministry of Transportation and Infrastructure	Anna Vu, EIT (McElhanney) Luc Harvey, P.Eng (McElhanney) Doug Johnston, P.Eng. (McElhanney) Noelle Richardson, M.Sc., GIT (Stantec)
Re	**Date**
Blackwater Road at **Knickerbocker Slide** Environmental Offset Options Analysis	November 22, 2024

Blackwater Road provides access to Quesnel for communities northwest of the city. Geotechnical instabilities are inherent to the region. Two such instabilities are the Knickerbocker Slide and the North Slide which are impacting an 800 m stretch of Blackwater Road. Due to the road's proximity to the Fraser River, fluvial erosion contributes to these instabilities.

As part of the Ministry of Transportation and Infrastructure's (MOTI) Cariboo Road Recovery Project, the Binnie-led multi-disciplinary design team, including BGC Inc. (geotechnical) and McElhanney Ltd (hydrotechnical and drainage) was tasked with developing options to mitigate the risk of further failures destroying Blackwater Road. The proposed design aims to:

1. relocate the section of road above the North Slide to the west to unload the slide mass,
2. manage surface and groundwater around the section of road within the Knickerbocker Slide to slow slide movement, and
3. provide erosion protection at the toe of the North Slide to protect against river induced erosion.

The surface water management for the Knickerbocker Slide will require that two fully-fused HDPE stormwater and groundwater pipes be installed above ground down the slide from Blackwater Road to the Fraser River. The erosion protection work for the North Slide consists of a 310m long riprap revetment placed along the toe of the instability. The total instream and riparian permanent and temporary impact footprints are detailed in the Fisheries Act Authorization Application.

The surface water management and bank protection work described above will require environmental habitat offsetting to compensate for the alteration to riparian and aquatic habitat. This memo highlights habitat offsetting options the project team has identified near the project site.

PROJECT LOCATION

The project site is located along Blackwater Road, approximately 3.7 km north of Quesnel, BC, on the west side of the Fraser River. The site is situated approximately 4.7 km upstream of the Quesnel River's confluence with the Fraser River. A detailed description and analysis of the Fraser River watershed, including its hydrology, hydraulics at the site, and the proposed erosion protection design for the North Slide are presented in the Hydrotechnical Report and the Blackwater Road Bank Protection Design Memo, which were completed and issued for the project. A detailed description of the proposed drainage infrastructure including the stormwater and groundwater HDPE pipes for the Knickerbocker Slide are presented in the Drainage Report which was completed and issued for the project.

HABITAT DESCRIPTION

Project Site

Stantec completed aquatic habitat condition assessments of the revetment site and potential offsetting sites in July and August 2023 (revetment site and Site A - Bouchie Creek), and in October 2024 (Site B - Baker Creek). The habitat conditions at the revetment site and Bouchie Creek were detailed in the *Environmental Impact Assessment - Blackwater Road Landslides* (Stantec 2024). The habitat conditions at each site are summarized in the ***Potential Offsetting Sites*** section below.

The Fraser River mainstem near the revetment and the City of Quesnel provides a migratory corridor for upper Fraser River salmon stocks, including sockeye (*Oncorhynchus nerka*), pink (*O. gorbuscha*), Chinook (*O. tshawytscha*), coho *O. kisutch),* chum *(O. keta*), and steelhead/rainbow trout (*O. mykiss*). At the revetment site, lack of cover and refuge areas coupled with higher velocity and fine material highly embedding gravel/cobble substrates indicate poor spawning or rearing habitat for salmon. No gravel areas were observed within the revetment location that would support spawning.

Tributaries to the Fraser River provide important habitat characteristics essential for salmonid production – small, low gradient, clear flows, and cold-water refuge (DFO, 1997). Loss of stream complexities and riparian vegetation have contributed to impacts to water quality, water quantity, and fish habitat in the watershed (DFO 1997). Bouchie Creek (Site A), upstream of the revetment, and Baker Creek (Site B), a larger tributary to the Fraser River downstream of the revetment, have an important function in providing the habitat necessary to support salmon in critical life stages. Bouchie Creek has limited fish presence records (rainbow trout and longnose sucker [*Catostomus catostomus*]), with recent records of juvenile Chinook salmon approximately 1.8 km upstream of its confluence of the Fraser River despite dry channel sections observed each site visit. Baker Creek has a more extensive record of fish presence (see ***Site B – Baker Creek***) but habitat conditions in the downstream reach have been impacted and modified by urban development.

POTENTIAL OFFSETTING SITES

The project team has identified three potential sites for habitat enhancement. These include habitat features that can be incorporated in or immediately adjacent to the revetment, and two sites (Site A and Site B) with strong potential to develop quality off-channel habitat that are located within 4.2 km of the project site ***Figure 1*** summarizes the project site, including the revetment location and potential offsetting sites.

Site Assessment

A site assessment was carried out by Luc Harvey and Anna Vu of McElhanney on September 27 and 28, 2024 to assess existing conditions and explore potential offsetting designs for the three identified habitat enhancement sites. Water levels in the Fraser River were observed to be relatively low at the time of the assessment, with limited backwatering of the connecting watercourses. The following sections describe the observed instream and riparian habitat conditions at each site. Photos taken during the site visit are included in ***Appendix A*** and referenced in the text to support the observations described below.

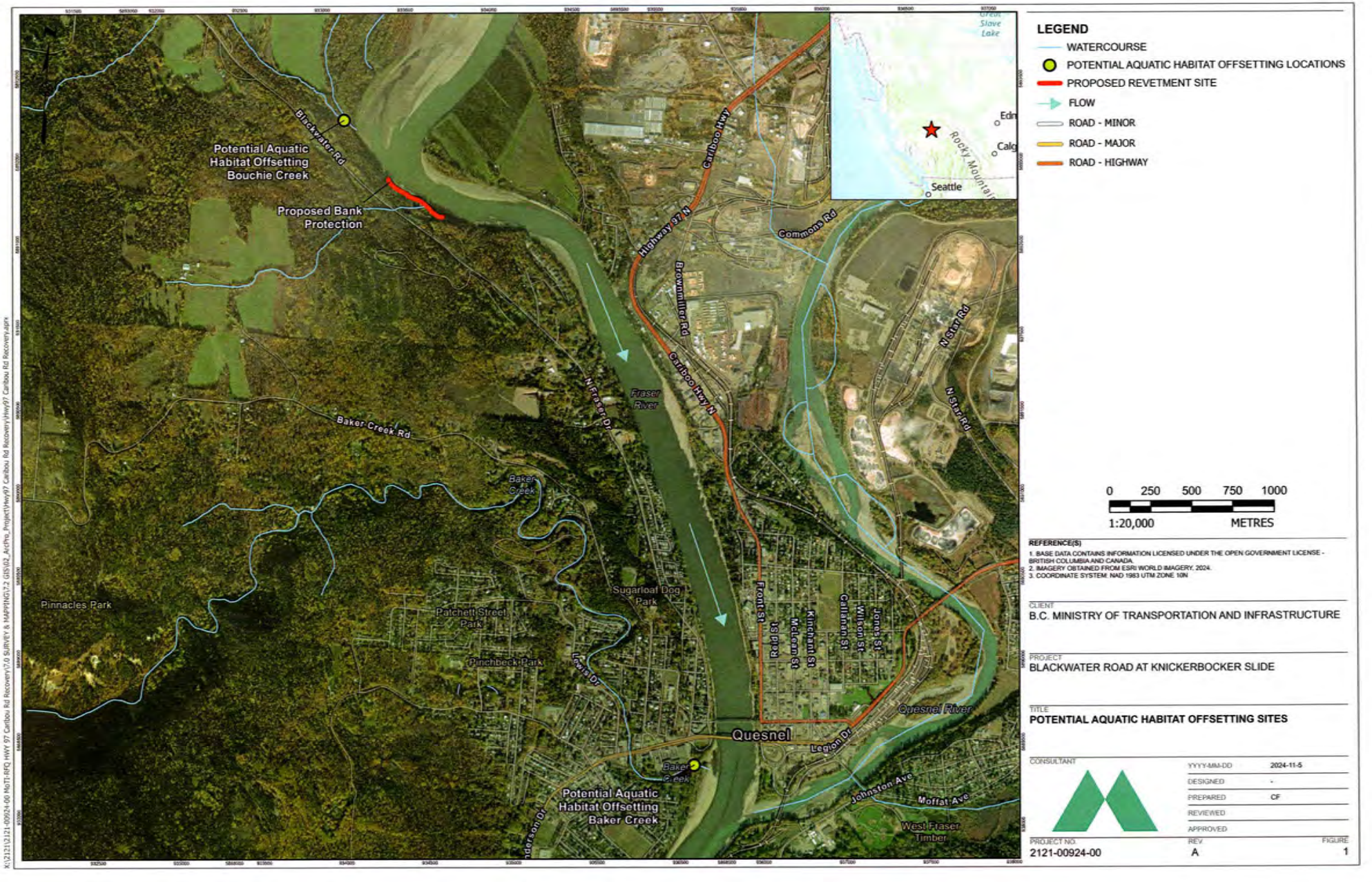
Revetment Site

The right bank of the Fraser River along the toe of the proposed riprap revetment is mostly composed of material deposited by the North Slide that has remained stable during high flows in the river. This is mainly comprised of cobbles, gravels and embedded fines. There is some woody debris present along this bank due to the limited supply of dead trees from the North Slide area. However, most of this wood is located higher up on the bank and does not interact with the Fraser River at low flows (***Photo 1 and Photo 2***).

There are no pools, boulders, undercut banks, instream or riparian vegetation present in this area due to the ongoing movement of the slide mass. In general, the Fraser River aquatic habitat at the revetment location was deemed poor for overwintering, spawning, and rearing and good for migration.

Site A – Bouchie Creek

The project team identified a small ephemeral tributary to the Fraser River, Bouchie Creek (Fresh Water Atlas, Watershed Code 100-461949-000000), approximately 0.60 km upstream of the revetment location (Figure 2). The confluence of Bouchie Creek is located at the outer bend of the Fraser River and is subject to annual backwatering from the Fraser River during higher flows. An unnamed, mapped tributary (Fresh Water Atlas, Watershed Code 100-461949-011100), joins Bouchie Creek approximately 120 m upstream of its confluence with the Fraser River. A portion of this 120 m downstream section of Bouchie Creek is situated within the proposed MOTI property acquisition right-of-way for the Blackwater Road at Knickerbocker Slide project (PID # 015065197). Additional property acquisition would be required if this site is selected for habitat offsetting.



LEGEND

- WATERCOURSE
- POTENTIAL AQUATIC HABITAT OFFSETTING LOCATIONS
- PROPOSED REVETMENT SITE
- FLOW
- ROAD - MINOR
- ROAD - MAJOR
- ROAD - HIGHWAY

0 250 500 750 1000

1:20,000 METRES

REFERENCE(S)

1. BASE DATA CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE - BRITISH COLUMBIA AND CANADA.
2. IMAGERY OBTAINED FROM ESRI WORLD IMAGERY, 2024.
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
B.C. MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE

PROJECT
BLACKWATER ROAD AT KNICKERBOCKER SLIDE

TITLE
POTENTIAL AQUATIC HABITAT OFFSETTING SITES

CONSULTANT

YYYY-MM-DD	2024-11-5
DESIGNED	-
PREPARED	CF
REVIEWED	
APPROVED	

PROJECT NO. 2121-00924-00 | REV A | FIGURE 1

K:\2121\2121-00924-00 MoTI-RFQ HWY 97 Caribou Rd Recovery\7.0 SURVEY & MAPPING\7.2 GIS\02_Archs_Project\Hwy97 Caribou Rd Recovery\Hwy97 Caribou Rd Recovery.aprx

At the time of the environmental assessments (July and August 2023), the unnamed tributary displayed flow, presumably from a groundwater source (***Photo 3 and Photo 4***). The flow in the downstream section of Bouchie Creek was shallow (0.02 m) and narrow (0.2 m) despite the channel width measuring up to 11 m wide (***Photo 6***). Channel substrate consisted of fine material with no suitable spawning gravels or coarser materials; there were also limited features to provide instream cover or pool refuge with no boulders, woody debris, or undercut banks (***Photo 5*** to ***Photo 6***).

In contrast, the upstream reach of Bouchie Creek, above its confluence with the unnamed tributary, lies within private land (PID # 023607220) and was dry at the time of the assessment. The upstream reach exhibited minimal signs of flow, with an undefined bed consisting of scattered gravel and cobble, overgrown with grass (***Photo 4***). This suggests that Bouchie Creek may occupy multiple channels and discharge to the Fraser River, at multiple locations. It is likely that the assessed alignment conveys Bouchie Creek flow during high flows.

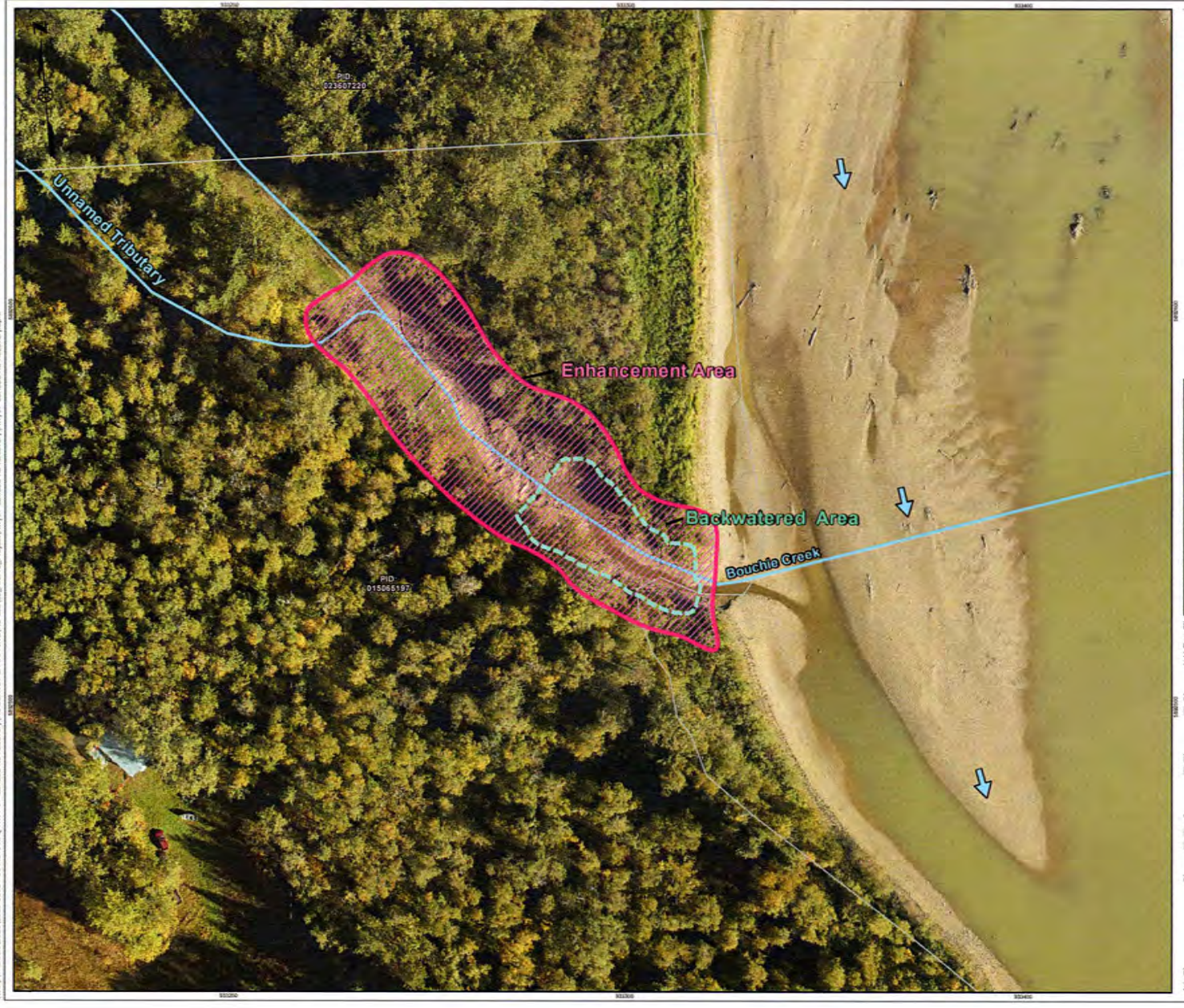
The channel is bordered by limited riparian vegetation on both banks. Riparian vegetation included deciduous trees, mainly black cottonwood (*Populus trichocarpa*), paper birch (*Betula papyrifera*), and mountain alder (*Alnus Incana*) as well as understories typical of water-receiving environments (i.e., horsetails [*Equisetum pratense*], willow seedlings [*Salix* spp.]. Hybrid white spruce (*Picea engelmannii x glauca*) and Douglas fir (*Pseudotsuga menziesii*) were present, increasing in abundance further from the confluence with the Fraser River.

Fish species previously documented in the Bouchie Creek include rainbow trout and longnose sucker. A recent record (July 2022) of a rearing juvenile Chinook salmon was recorded by DWB Consulting Ltd. in Bouchie Creek, approximately 1.8 km upstream of its confluence of the Fraser River. Fish were not observed in Bouchie Creek during Stantec's August 2023 survey.

The 120 m downstream section of Bouchie Creek lacks structural complexity like undercut banks or instream and overhead cover. Although some woody debris is present, additional complexity to the stream would be beneficial to create quality off-channel and potential rearing habitat for Fraser River fish.

Site B – Baker Creek

Site B is located approximately 4.2 km downstream of the riprap revetment on Baker Creek (Fresh Water Atlas, Watershed Code 100-460500-000000) which flows through the City of Quesnel, discharging just south of the Moffat Bridge (***Figure 3***). The creek lies within Crown land and boarders several private property parcels. The proposed habitat enhancement for this site will target the downstream-most reach between the Marsh Drive Bridge crossing and the creek's confluence with the Fraser River (approximately 600 m long).



LEGEND

- BACKWATERED AREA
- ENHANCEMENT AREA
- WATERCOURSE
- FLOW

PROPERTY

- Private

0 5 10 20 30 40

1:960 METRES

REFERENCE(S)

1. BASE DATA CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE - BRITISH COLUMBIA AND CANADA.
2. IMAGERY OBTAINED FROM MOTI, DATED SEPTEMBER 2021
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
B.C. MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE

PROJECT
BLACKWATER ROAD AT KNICKERBOCKER SLIDE

TITLE
POTENTIAL AQUATIC HABITAT OFFSETTING AREAS: BOUCHIE CREEK SITE

CONSULTANT

YYYY-MM-DD	2024-11-6
DESIGNED	-
PREPARED	CF
REVIEWED	
APPROVED	

PROJECT NO.	REV.	FIGURE
2121-00924-00	A	2

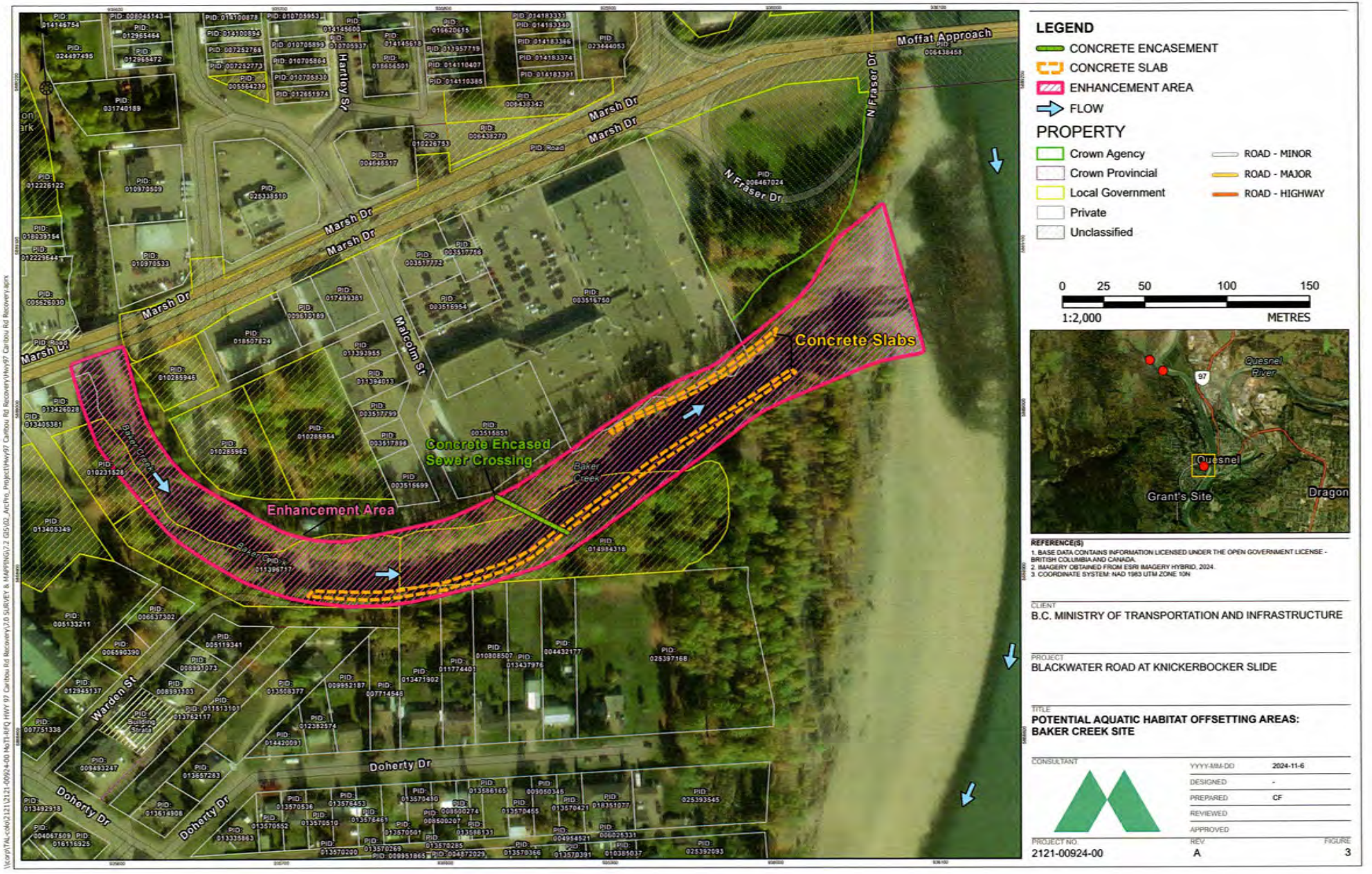
\\corp\TAL-code\2121\2121-00924-00 MoTI-RFQ HWY 97 Caribou Rd Recovery\7.0 SURVEY & MAPPING\7.2 GIS\02_ArcPro_Project\Hwy97 Caribou Rd Recovery\Hwy97 Caribou Rd Recovery.aprx

This reach of Baker Creek was observed to be generally riffle/run habitat, although lacking in pool habitat. The streambed in this reach is well-defined, with sands and small-sized cobbles present throughout the channel and near the confluence (***Photo 7***). Downstream of the Marsh Drive Bridge, the channel banks are armoured with concrete slabs and large riprap (***Photo 8***). A few pieces of large wood with root wads were observed along the banks in this reach (***Photo 9 and Photo 10***) and a concrete encased sewer pipe crosses the watercourse approximately 70 m upstream of its confluence with the Fraser River (***Photo 11***). The top of the encasement is exposed in the channel bottom. The lower reach of the creek has very few pools, shallow water depth during low flows, and few refuge areas during higher flows. Upstream of the Moffat Bridge, deeper water, overhanging riparian vegetation, and higher quantities of large wood were observed (***Photo 12***).

The lower reach is bordered by a thin band of riparian vegetation along both banks, consisting mainly of deciduous trees (i.e., cottonwood, birch) with a patchy understory of unidentified grasses and the occasional shrub. Riparian vegetation was heavily modified by surrounding developments.

Fish species that have previously been observed within the Extended Assessment Area (EAA) of Baker Creek include Chinook salmon, lake chub (*Couesius plumbeu*), Lamprey (general) (*Petromyzontiformes* sp.), largescale sucker (*Catostomus macrocheilus*), Longnose Dace (*Rhinichtys cataractae*), longnose sucker, mountain whitefish (*Prosopium williamsoni*), northern pikeminnow (*Ptychocheilus oregonensis*), peamouth chub (*Mylcheilus caurinus*), pink salmon, rainbow trout, redside shiner (*Richardsonius balteatus*), and white sucker (*Catostomus commersonii*) (Ministry of Environment 2024). Fish were not observed in Baker Creek during Stantec's October 2024 survey, nor was there evidence of disturbed substrate to indicate fish use by fall spawning species (material was embedded). Also noted was the lack of habitat for rearing.

Similar to Bouchie Creek, the section of Baker Creek downstream of the Marsh Drive Bridge has a lack of structural complexity with shallow water depths, limited overhead cover, limited sections of undercut banks, and only a few pieces of large wood that provide limited environmental benefit. The large number of concrete slabs lining the creek banks further reduces the habitat quality. Adding complexity to the stream would be beneficial to create quality rearing, and potentially spawning, habitat for Fraser River fish.



LEGEND

- CONCRETE ENCASEMENT
- CONCRETE SLAB
- ENHANCEMENT AREA
- FLOW

PROPERTY

- Crown Agency
- Crown Provincial
- Local Government
- Private
- Unclassified
- ROAD - MINOR
- ROAD - MAJOR
- ROAD - HIGHWAY

0 25 50 100 150

1:2,000 METRES

REFERENCE(S)

1. BASE DATA CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE - BRITISH COLUMBIA AND CANADA.
2. IMAGERY OBTAINED FROM ESRI IMAGERY HYBRID, 2024.
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
B.C. MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE

PROJECT
BLACKWATER ROAD AT KNICKERBOCKER SLIDE

TITLE
POTENTIAL AQUATIC HABITAT OFFSETTING AREAS: BAKER CREEK SITE

CONSULTANT

YYYY-MM-DD	2024-11-6
DESIGNED	-
PREPARED	CF
REVIEWED	
APPROVED	

PROJECT NO. 2121-00924-00 | REV. A | FIGURE 3

\\Ceryl\TAL-cdw\2121\2121-00924-00 MoTI-RFQ HWY 97 Caribou Rd Recovery\7.0 SURVEY & MAPPING\7.2 GIS\02_ArcPro_Project\Hwy97 Caribou Rd Recovery\Hwy97 Caribou Rd Recovery.aprx

PROPOSED OFFSETTING DESIGNS

The following section summarizes the instream and riparian enhancements envisioned for each potential offsetting site.

Revetment Site

Opportunities for instream habitat enhancements were identified at the revetment location, consisting of large boulder clusters placed at intervals at or near the toe of the proposed revetment. The boulder clusters will provide instream habitat complexity and encourage scour of native riverbed material around the margins of the clusters. To maintain the structural integrity of the habitat, boulders will be spaced appropriately to prevent overlap of their respective scour holes, avoiding the risk of destabilization or undermining. The boulder clusters themselves will provide instream cover in the interstitial spaces for young of year and juvenile life stages of all native fish species to use as feeding, and refuge habitat during high flow events. The irregular and complex shapes of the boulder clusters will provide habitat in a section of river that currently has minimal cover or complexity. Along the sides of the boulder clusters, the higher water velocities will promote bed scour resulting in holding areas for adult and juvenile salmonids. Along the downstream side, the boulder clusters will also provide feeding habitat for salmonid species at the flow margin of the zone of influence.

Riparian habitat can be provided on the revetment surface, above the high-water mark in the form of topsoil and plantings in the riprap voids. Due to the size of riprap that is proposed for the revetment, the riprap voids are anticipated to be relatively large and should provide sufficient volume to support the necessary topsoil for riparian planting. Clusters of willow stakes will be planted within topsoil-filled voids at 1 to 2 m spacing to provide extensive cover across the length of the revetment. Given the groundwater conditions at the site and the exposed condition of the revetment (due to the lack of trees), the planting area is expected to support growth of riparian plants (i.e., moisture and sunlight).

The proposed enhancements at the revetment site are intended to provide good refuge habitat as well as moderate-good cover (instream and riparian), supporting food sources for fish and assisting with thermal refuge areas.

Site A – Bouchie Creek

The offsetting design for Site A focuses on the downstream 120-meter reach of Bouchie Creek, downstream of the confluence with the unnamed tributary. Enhancements will focus on creating rearing and refuge habitat for resident fish species as well as juvenile salmonids.

The downstream 30 m of channel is backwatered by the Fraser River under higher flows. This area had a wetted channel width between 2 and 11 m at the time of the site visit (September 2024). This section currently provides poor rearing opportunities under low flow conditions in the Fraser River. Upstream of this section, the wetted channel width narrowed to approximately 0.2 m. This narrower V-shaped channel extends upstream to the confluence with the unnamed tributary and supports shallow flows (0.02m) during baseflow conditions. There is limited rearing habitat even if larger fish could access this area.

The following habitat enhancements are proposed to increase the quality and quantity of rearing habitat along the downstream 120-meter reach of Bouchie Creek:

- Widening the downstream reach of Bouchie Creek to the mainstem of the Fraser River. This would include excavating the channel bottom to increase the wetted area in the channel during all seasons.
- The addition of weir-riffle structures along the downstream reach to increase water depth during low flows.
- The partial excavation of silt material and addition of gravel/cobble substrate to increase the productive capacity of the substrate by increased production of benthic invertebrates that would provide a food source for fish, and potentially provide spawning habitat in suitable flow conditions.
- The addition of instream structures such as boulders and LWD to provide cover, refuge and complexity where it is currently lacking.
- Planting and live staking of vegetation on the side channel banks such as willow and black cottonwood would provide more direct benefit to fish in the form of shade, aquatic cover and refuge habitat during higher flows, and allochthonous carbon input during other times of the year.

The benefits of the proposed enhancements for juvenile and adult fish of all species will be immediate. The downstream reach would provide clean flow during high sediment conditions in the Fraser River, as well as refuge for all life stages and species of locally present fish during higher flows. Year-around rearing habitat for juveniles will also be available.

The stream is groundwater fed during low flows. Increasing the channel depth may increase flow within the creek (through additional groundwater interception). This would help flush out the fine sediments deposited by the Fraser River and help maintain better substrate more suitable for spawning and rearing. It would also contribute cold-water inputs into the Fraser River.

The benefit of the addition of vegetation for allochthonous carbon input to the system and instream shade will take longer (predicted to take two years post-installation) and is based on the time for live stakes to stabilize and grow. Riparian planting will also provide habitat for other terrestrial wildlife species when not inundated.

The proposed enhancements at Site A are intended to address poor existing refuge habitat within a tributary to the Fraser River, providing suitable refuge habitat for fish year-round. Additional benefits of the proposed works are cover (instream and riparian), coarser substrate, habitat complexities (i.e., weir riffle) and water quality improvements (i.e., dissolved oxygen from riffle structures, cooler temperatures from groundwater inputs and cover). Each of the enhancements contribute to providing good refuge habitat, suitable rearing conditions, and increased food provisions.

Site B – Baker Creek

Habitat offsetting efforts for Site B will prioritize enhancing the ecological value of the lower 600-meter reach of Baker Creek. This section of the creek provides some habitat features such as root wads and small to medium sized woody debris. However, additional complexity and naturalization of the stream would increase the quantity and quality of rearing habitat.

The following habitat enhancements are proposed:

- Removal of the concrete bank armoring and addition of riprap or natural rock (boulder) bank armoring to create a less uniform linear streambank. Live staking would be provided through the riprap voids to improve vegetative cover along the creek banks.
- The additional of weir riffle structures at select locations increase pool habitat and promote local scour, leading to increased water depth during low flows and formation of deep pools during high flows. This is expected to support fish passage throughout the year.
- The addition of instream structures such as boulders, anchored LWD, and root wads will increase habitat complexity. Existing in-stream LWD and root wads are likely to be mobilized during higher flow events but placing larger woody debris or properly anchoring the LWD and root wads will enhance the long-term benefits of these structures. These features will create pools, provide refuge for juvenile fish and generally improve habitat quality.
- Stabilize and build up gravel bars to support vegetation throughout the year. This would narrow the main and side channel in some areas and provide greater opportunity for riparian cover over the wetted channel sections.
- Planting and live staking of vegetation on the channel banks and gravel bars such as willow and black cottonwood would provide more direct benefit to fish in the form of shade, aquatic cover and refuge habitat during higher flows, and allochthonous carbon input during other times of the year.

The proposed enhancements at Site B are similar those proposed at Site A, increasing instream complexities with the addition of weir riffles and LWD, leading to the formation of deeper pools for refuge, as well as the addition of riparian vegetation on gravel bars, existing banks, and naturalized banks. As a major tributary to the Fraser River, Baker Creek provides considerable opportunity for good quality refuge, spawning, and rearing habitat for salmonids. Existing substrate is generally good for spawning; therefore, efforts have focused on naturalizing the creek where habitat is lacking (i.e., concrete banks, poor riparian) and creating good rearing / refuge habitat.

POTENTIAL CONSTRAINTS / CONSIDERATIONS

Potential constraints and constructability challenges that should be considered for each site are described in the following sections.

Access

Access considerations for each site are described below:

- Revetment:
  - Access to the revetment area is provided via the proposed construction access road as part of the revetment works. Installation of the habitat boulders will occur during construction of the revetment.
- Site A:
  - Access and staging/laydown area can be established via the proposed MOTI right-of-way with little additional access construction required to reach the offsetting site.
  - The offsetting site will be accessed either from the section of access road along the Fraser River right bank or from the section of temporary gravel road above the site. To provide access,

some tree and vegetation removal may be required in the riparian area on the hillslope above Bouchie Creek if that access route is selected.

- Effectiveness monitoring/maintenance would require continued access (potentially over multiple years). This could be provided via a pedestrian trail down the hillslope from section of temporary gravel road above Bouchie Creek if a road access is not provided along this route.

- Site B:
  - Permission (i.e., a temporary Licence to Construct) would be required to access City of Quesnel and/or Crown land property with equipment and trucks to work on the creek.
  - A staging/laydown area can be established on the Cown land property (PID # 006467024) beside the North Fraser Drive off ramp (southwest of Moffat Bridge).
  - To provide access, some tree and vegetation removal may be required.

Material Supply and Disposal

General material supply and disposal considerations for key habitat enhancement features are described below:

- Boulder Supply:
  - Sourcing suitable, clean, rock material from a nearby riprap supply yard.
  - Testing of boulder material for acid rock drainage.
- LWD Supply:
  - LWD may be available in the work area or from the North Slide area; this is the best option. However, if LWD cannot be sourced from these locations, then additional pieces may be salvaged from nearby tree removal associated with ongoing adjacent work at the Blackwater Road project area.
- Substrate Supply:
  - It is recommended to source as much substrate material from the downstream deposition area rather than sourcing from off-site. Selectively resourcing the material from the immediate area will be most efficient and cost effective with minimal disturbance.
  - Any imported material will require testing for acid generating potential prior to use.
- Live Staking:
  - Materials for live staking should be sourced from local areas, as close to the Site as possible. Shrubs will be native species similarly sourced from regional nurseries.
  - There will be varying lag times to effectiveness, depending on the benefit being conferred to the environment. The benefit of the addition of vegetation for allochthonous carbon input to the system and instream shade is predicted to take two years post-installation and is based on the time for live stakes to generate and drop-leaf material. Existing riparian vegetation will be maintained and continue to function, with the exception of small areas where access will be established.

- Disposal of Material:
  - Disposal of excess material excavated from Bouchie Creek will need to be completed offsite, at a location without risk of re-entering the Fraser River. Suitable gravel/cobble substrate may be reused on site as applicable and under guidance of an environmental professional.
  - Material excavated from Baker Creek, such as the concrete structures, will need to be properly disposed of offsite, at a location without risk of re-entering the Fraser River.

Timing

The proposed offsetting works should be conducted as follows to limit impacts to local fish and bird species:

- Instream work should be conducted in and around the least risk window for fish, which is July 15 to July 31 in Baker Creek and July 22 to Aug 1 in Bouchie Creek, or during low flow conditions.
- If tree and vegetation removal is required for access this may require bird nest surveys for breeding birds and year-round protected nests/cavities (i.e., raptors, osprey, great blue heron [*Ardea herodias*], and pileated woodpecker [*Dryocopus pileatus*]).

CLOSING

We trust this memorandum meets your present requirements. Please contact the undersigned with any questions or comments.

Sincerely,
McElhanney Ltd.

Prepared by:

Anna Vu, E.I.T.
Project Engineer
avu@mcelhanney.com
778-357-1298

Prepared by:

Noelle Richardson, M.Sc., G.I.T.
Environmental Lead
noelle.richardson@stantec.com
250-575-4706

Prepared by:

Luc Harvey, P.Eng.
Hydrotechnical Engineer
lharvey@mcelhanney.com
604-219-6387

Reviewed by:

Doug Johnston, P.Eng.
Hydrotechnical Lead
dajohnston@mcelhanney.com
604-424-4756

Appendix A
Site Photos

Photo 1. Top-down view of the proposed riprap revetment location at the toe of the North Fraser slide looking downstream. Photo taken on October 11, 2023.

Photo 2. View of the proposed revetment location at the toe of the North Fraser slide, looking upstream showing woody debris and substrate material along the banks. Photo taken on October 11, 2023.

Photo 3. View of the confluence of Bouchie Creek and the unnamed triburary, looking downstream. Photo taken on September 27, 2024.

Photo 4. View of Bouchie Creek's dry upstream reach, above the unnamed tributary confluence (looking upstream). Photo taken on September 27, 2024.

Photo 5. View of Bouchie Creek's stream bed downstream of the unnamed tributary confluence, looking upstream. Photo taken on September 27, 2024.

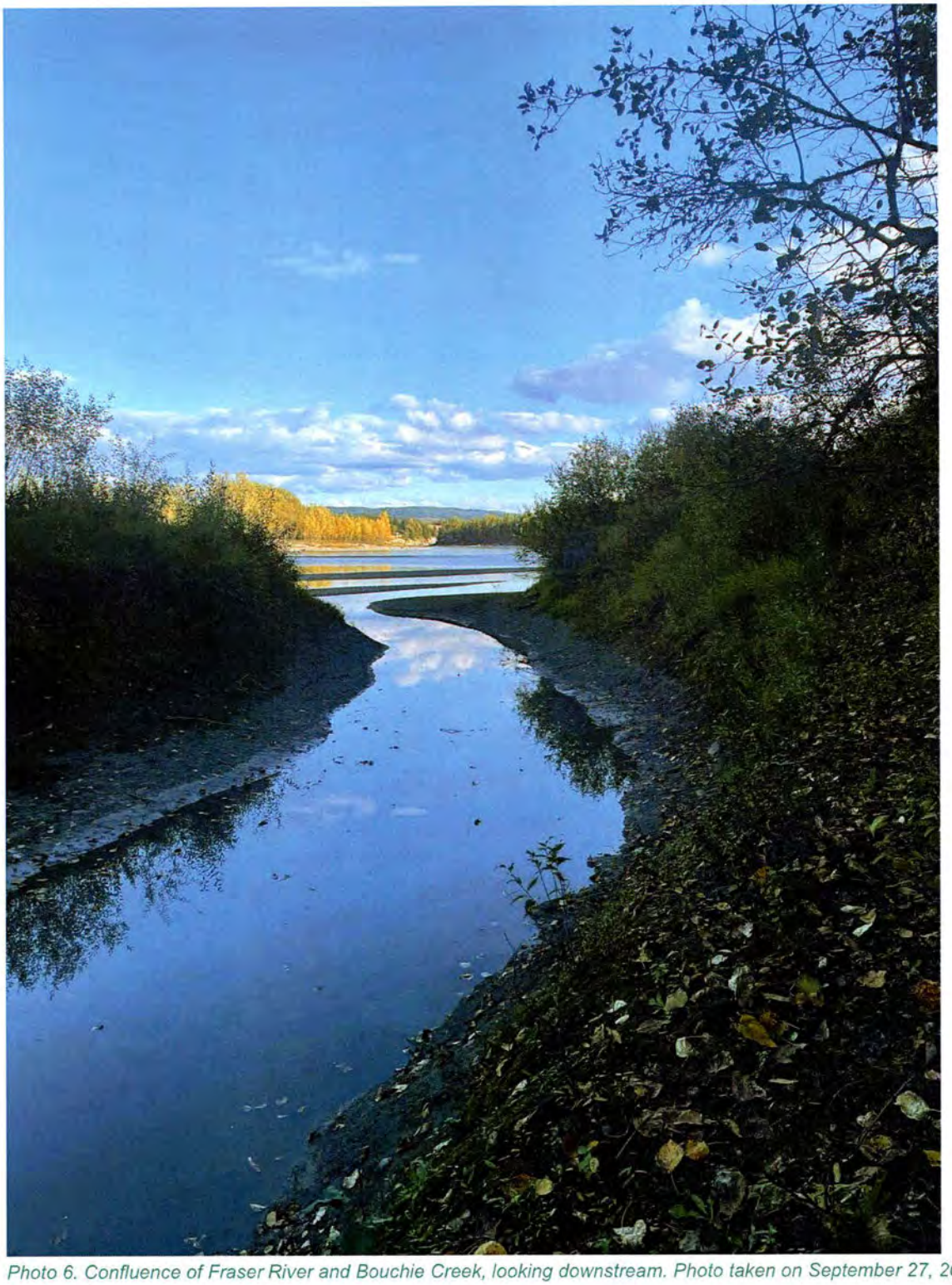


Photo 6. Confluence of Fraser River and Bouchie Creek, looking downstream. Photo taken on September 27, 2024.

Photo 7. Confluence of Baker Creek and the Fraser River, looking downstream. Photo taken on September 28, 2024.

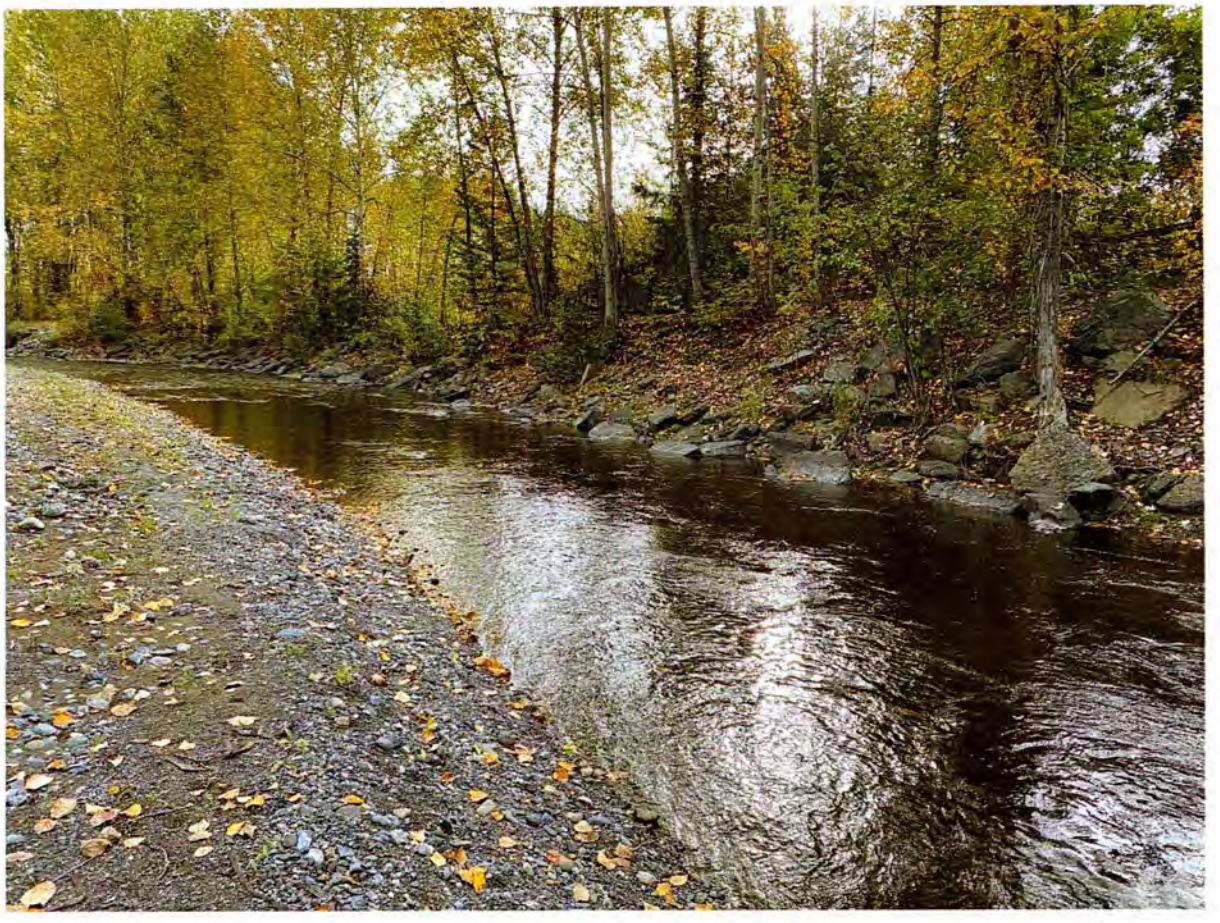


Photo 8. Concrete slabs along the right bank of Baker Creek, looking downstream. Photo taken on September 28, 2024.

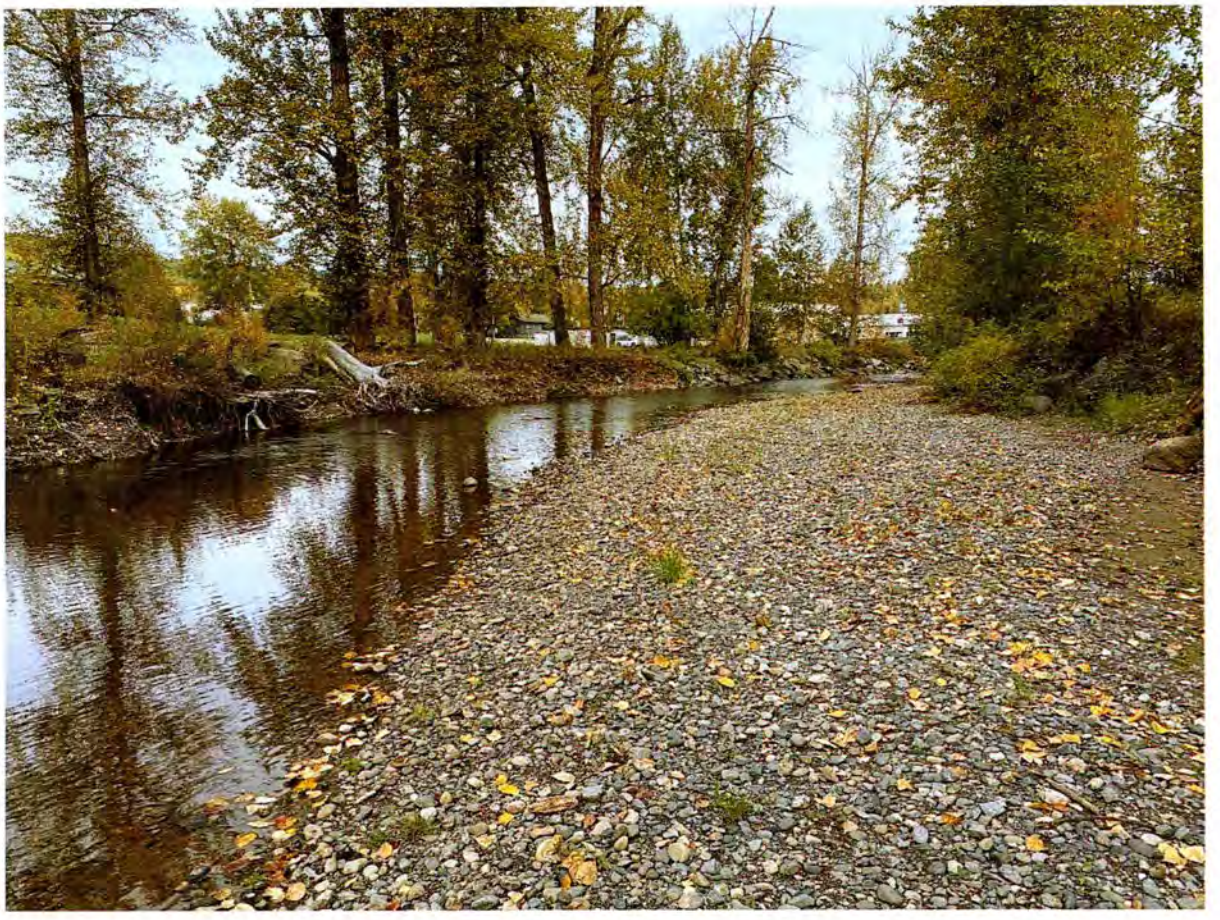


Photo 9. Thin riparian cover and a single large wood member with root wad along the right bank of Baker Creek, looking upstream. Photo taken on September 28, 2024.

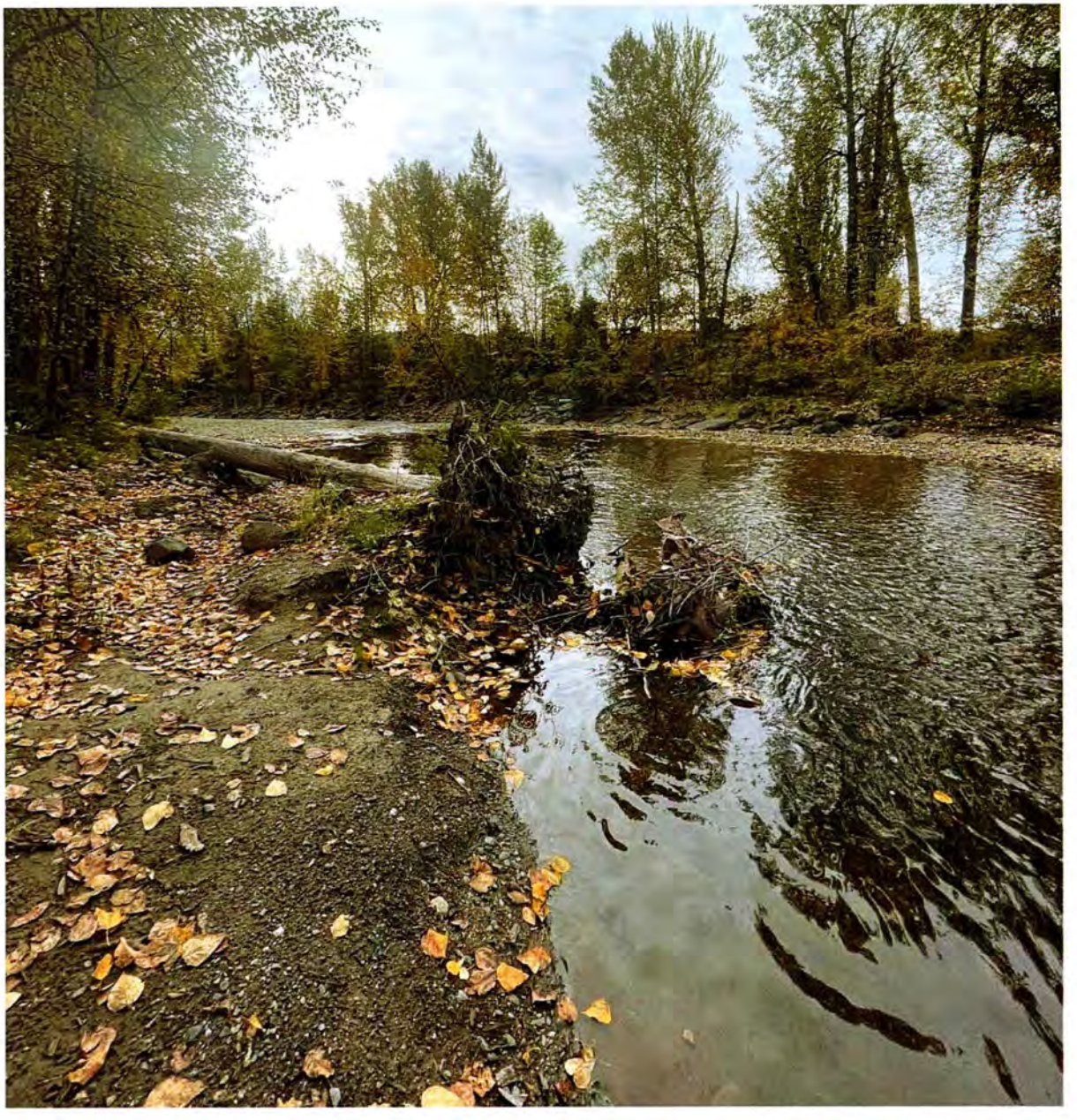


Photo 10. Single large wood member with root wad on Baker Creek left bank, looking downstream. Photo taken on September 28, 2024.

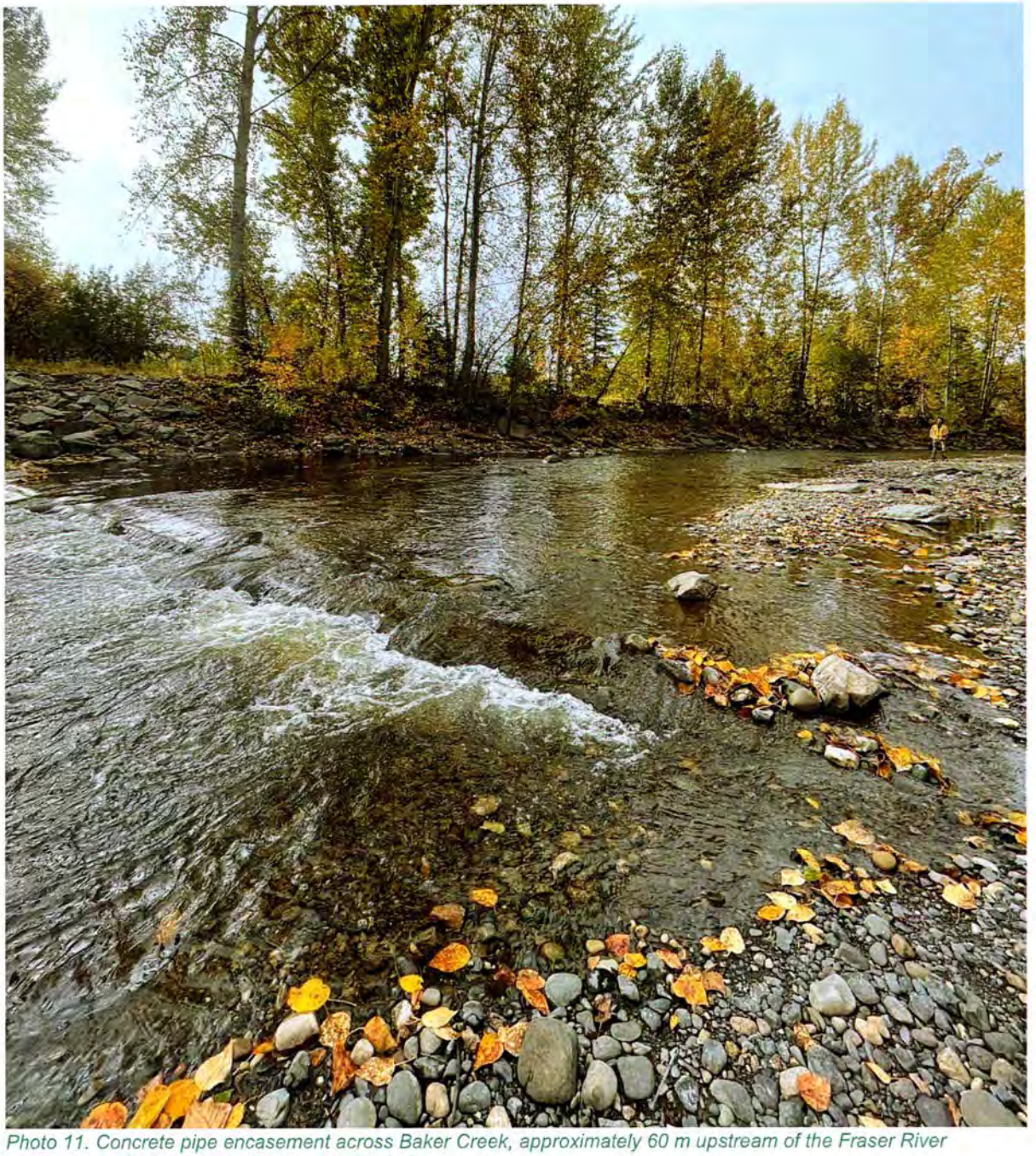


Photo 11. Concrete pipe encasement across Baker Creek, approximately 60 m upstream of the Fraser River confluence. Photo taken on September 28, 2024.

Photo 12. Baker Creek upstream of the Marsh Drive Bridge, looking upstream. Photo taken on September 28, 2024.

Appendix B
Statement of Limitations

Statement of Limitations

Use of this Report. This report was prepared by McElhanney Ltd. ("**McElhanney**") for the particular site, design objective, development and purpose (the "**Project**") described in this report and for the exclusive use of the client identified in this report (the "**Client**"). The data, interpretations and recommendations pertain to the Project and are not applicable to any other project or site location and this report may not be reproduced, used or relied upon, in whole or in part, by a party other than the Client, without the prior written consent of McElhanney. The Client may provide copies of this report to its affiliates, contractors, subcontractors and regulatory authorities for use in relation to and in connection with the Project provided that any reliance, unauthorized use, and/or decisions made based on the information contained within this report are at the sole risk of such parties. McElhanney will not be responsible for the use of this report on projects other than the Project, where this report or the contents hereof have been modified without McElhanney's consent, to the extent that the content is in the nature of an opinion, and if the report is preliminary or draft. This is a technical report and is not a legal representation or interpretation of laws, rules, regulations, or policies of governmental agencies.

Standard of Care and Disclaimer of Warranties. This report was prepared with the degree of care, skill, and diligence as would reasonably be expected from a qualified member of the same profession, providing a similar report for similar projects, and under similar circumstances, and in accordance with generally accepted engineering/planning/etc. and scientific judgments, principles and practices. McElhanney expressly disclaims any and all warranties in connection with this report.

Information from Client and Third Parties. McElhanney has relied in good faith on information provided by the Client and third parties noted in this report and has assumed such information to be accurate, complete, reliable, non-fringing, and fit for the intended purpose without independent verification. McElhanney accepts no responsibility for any deficiency, misstatements or inaccuracy contained in this report as a result of omissions or errors in information provided by third parties or for omissions, misstatements or fraudulent acts of persons interviewed.

Effect of Changes. All evaluations and conclusions stated in this report are based on facts, observations, site-specific details, legislation and regulations as they existed at the time of the site assessment/report preparation. Some conditions are subject to change over time and the Client recognizes that the passage of time, natural occurrences, and direct or indirect human intervention at or near the site may substantially alter such evaluations and conclusions. Construction activities can significantly alter soil, rock and other geologic conditions on the site. McElhanney should be requested to re-evaluate the conclusions of this report and to provide amendments as required prior to any reliance upon the information presented herein upon any of the following events: a) any changes (or possible changes) as to the site, purpose, or development plans upon which this report was based, b) any changes to applicable laws subsequent to the issuance of the report, c) new information is discovered in the future during site excavations, construction, building demolition or other activities, or d) additional subsurface assessments or testing conducted by others.

Cariboo Regional District

Planning Application Advisory Planning Commission Comment Form

Date of Meeting: March 2nd, 2026
Start Time: 1 PM
Location of Meeting: Bouchie Lake Hall

File Number: 3015-20/B20250051
Application Type: Subdivision
Electoral Area: B
Legal Description: Lot A, District Lots 83 and 319, Cariboo District, Plan PGP40531 Except Plan EPP56753
Property Location: N/A

ATTENDANCE

Present:
Chair: Dean Caine
Members: Robert Ross
Stan Hall

Recording Secretary: Sybille Meschik
Owners/Agent: Reid Drummond
☐Contacted but declined to attend

Absent: Stephanie Hanes
Susan Joyce

Also Present:
Electoral Area Director: Barbara Bachmeier
Staff Support:

RESOLUTION

THAT application with File Number 3015-20/B20250051 be **SUPPORTED** / **REJECTED**
for the following reasons:

4 in favour.

1) We want the Blackwater / Knickerbocker Road to be fixed.
- DFO OFFSETTING is Required to do the Project

2) Back-channel for fish habitat is important for the Fraser River Watershed.

For: 4 Against: 0

CARRIED / DEFEATED

Termination:
That the meeting terminate.
Moved: Stan Hall
Seconded: Robert Ross

CARRIED

Time: 1:45pm

[redacted]
Recording Secretary

[redacted]
Chair