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Technical Memorandum

DATE: June 27 2025

TO: Gulraiz Cheema, Senior Project Manager
ENV Flood Debris Management Secretariat

FROM: Spencer Roberton, P.Eng.

RE: **CR-33 LORENZETTA CREEK FLOOD RECOVERY PROJECT**
Operation and Maintenance of Lorenzetta Creek Flood Recovery Works
Our File 3427.023-300

1. Introduction

1.1 Purpose

This memo has been prepared for BC Ministry of Environment and Parks (ENV) to provide guidance on activities for operation and maintenance of the flood recovery works at Lorenzetta Creek near Laidlaw, BC.

The phrase operation and maintenance in this memo refers to all activities needed to effectively operate and maintain the flood recovery works. This includes inspection and repair, management of sediment and/or debris, and restoration of the works following creek events.

1.2 Location and Access

The Lorenzetta Creek flood recovery project is located in Laidlaw, BC, a small community located approximately 15 km west of Hope, BC that is within the Fraser Valley Regional District. The project site is shown on Figure 1. The north side of the project site is located on private property at 58480 Laidlaw Road and the south side of the site on private property at 58431 McKay Road. Access to the site is off of the private property at 58480 Laidlaw Road. The creek channel is located on the two noted private properties.

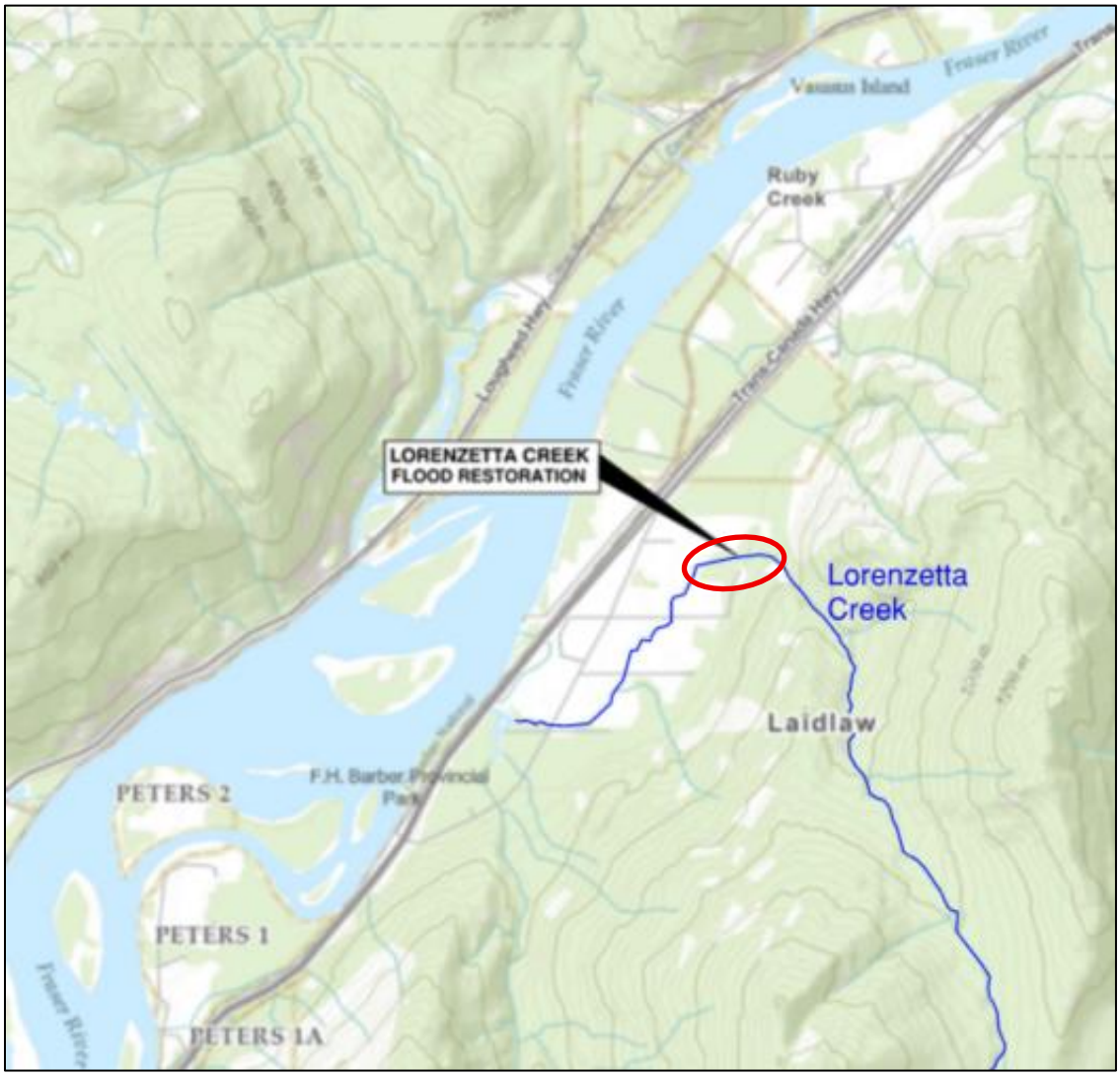


Figure 1: Location Map

1.3 Background

Flood damage occurred in this area during the November 2021 Atmospheric River Event (ARE) flood. This was a regional flood event resulting from multiple atmospheric rivers through southwest BC. The rainfall data collected at the Hope Airport climate station showed the approximate return period to be 100 years.

During this event, a significant amount of sediment and debris material was transported down Lorenzetta Creek. This material caused an overtopping of the creek bank. Avulsion channels were formed on the north side of the creek, causing damage to the adjacent agricultural property and the Trans Mountain Pipeline expansion construction site. This is similar to an event that occurred in 1984.

Table 1 below provides an overview of the history of the site, from the initial 2021 ARE event to the completion of the most recent works. The Phase 2 – Emergency Response works were completed in January-February 2022 to remove accumulated sediments and re-establish the creek to near pre-flood conditions. The Phase 3A – Restoration and Recovery works were completed in August-September 2022 to partly address the long-term recommendations provided in the qualified professional assessment report. The occurrence of two rainfall events in late 2023 necessitated some emergency repairs. The Phase 3B – Restoration and Recovery works were completed between August-November 2024 and is the focus of this Operation and Maintenance Guideline.

Table 1: Lorenzetta Creek Rainfall Events, Assessments and Restoration

Date	Activity	Description
November 14, 2021	ARE Rainfall Event	191 mm 24-hour rainfall at the Hope Airport climate station. 100-year return period event. Significant sediment deposition and channel avulsion at Lorenzetta Creek, resulting in impact to private property.
December 6, 2021	Phase 1 – Field Assessment	KWL assessed the Lorenzetta Creek site to determine the damage and provide FVRD with recommendations on required emergency response works following the 2021 ARE.
January – February 2022	Phase 2 – Emergency Response Works	Phase 2 emergency response works to remove accumulated sediments and debris and direct creek back to the previous alignment.
July 8, 2022	Phase 1 – Assessment Report	KWL prepared a technical memorandum to document the need for the Phase 3 recovery works based on the 2021 site assessment and Phase 2 emergency response works.
August – September 2023	Phase 3A – Restoration and Recovery	Phase 3A restoration work was completed to increase the capacity of the channel to allow recovery from the 2021 ARE event. Work included sediment removal and creation of a widened deepened section of channel near the upper section of the reach.
November 5, 2023	Rainfall Event	120 mm 24-hour rainfall at the Hope Airport climate station, approximately a 10-year return period.
December 4, 2023	Rainfall Event	69 mm 24-hour rainfall at the Hope Airport climate station, greater than 2-year return period event.

Date	Activity	Description
January 2024	Emergency Repairs	Minor repairs were conducted to restore the creek following the channel avulsion due to the 2023 rainfall events.
September 2024	Phase 3B – Restoration and Recovery	Phase 3B restoration work was completed in September 2024 to increase capacity of the creek and provide long-term flood mitigation. Work included creating deepened and widened sections of creek, excavating deep habitat pools, sediment removal, bank armouring, fish habitat development and willow staking.

1.4 Safety

It should be recognized that several safety hazards may be encountered in operating and maintaining the Lorenzetta Creek flood recovery works. These include, but are not limited to:

- Swift flowing water.
- High water level and waves.
- Remote conditions.
- Wildlife and domestic pet encounters.
- Slippery surfaces.
- Uneven and unstable surfaces (such as rock armour).

It is important that personnel conducting site inspections and maintenance work are appropriately trained and follow safe work procedures. Ultimately, the responsibility for worker safety rests with the worker's employer.

At any time that a contractor is hired to perform maintenance work, specific responsibility for site safety should be assigned to the appropriate party.

2. Description of Flood Recovery Works

2.1 Design

Following discussions between the KWL project team and the Task Force, the design objective for Phase 3B was to restore channel capacity to a level equal to the pre-flood 2021 ARE conditions, with minimal disturbance to existing creek banks, riparian areas, and in-stream fish habitat. This restoration required sediment removal throughout the project reach, as well as construction of a deepened and widened channel section near the upper reach and excavation of large pools to accommodate future sediment deposition without increasing downstream flood risk. The design also incorporated fish habitat features to offset riparian impacts associated with the channel modifications.

It is important to note that the Phase 3B recovery and restoration works were not intended to provide long-term or comprehensive flood protection for the surrounding area. Rather, the project scope was limited to creek restoration, bank stabilization, and capacity improvements in areas affected by the 2021 flood event. In areas downstream that remain prone to overtopping, future measures such as bank raising raising or riprap armouring could be considered to further reduce flood risk.

Key elements of the Phase 3B works are as follows:

- Deepened and widened upper channel section to increase capacity of the creek to handle future high flows and sediment accumulation.
- Deep habitat ponds for increased channel capacity and fish habitat.
- Excavated material placed in low spots along the lower channel in selected locations to repair damaged banks reduced overland flooding of adjacent farmland.
- Armoured banks using instream boulder material at locations where erosion and avulsions occurred.
- Live willow staking of disturbed banks to improve bank stability and added riparian vegetation.
- Large woody debris installation within the channel to improve fish habitat.
- Widening and deepening of a historic side channel to increase overall capacity and add additional fish habitat.

2.2 Construction

The construction contactor, Timbro, mobilized to site on August 19, 2024. Between August 19 and September 1, the site activity included layout of the works, fish salvage and flow diversion. A fish salvage commenced by KWL on August 14. Minnow trapping was conducted daily until a heavy rainfall event between August 23-25 created high flows that broke the fish isolation fence. Once water levels dropped to a workable level, the fish isolation fence was re-installed, and fish salvage was restarted on August 29, and an upstream reach of the creek was deemed to be fish free on August 30. The remainder of the fish salvage within the project footprint was started on September 3 and was deemed complete on September 11. The channel restoration portion of construction, including sediment removal, channel widening and deepening, and large woody debris installation was completed between August 31 and September 25. The remaining work on the site included live staking, and tree and shrub installations which were completed between November 5 and November 26, 2024.

The Record drawings for Phase 3B are located in Enclosure A of this report. Table 2 below provides the type, location and description of the completed works. Refer to the Record drawings in Enclosure A for the location stationing.

Table 2: Description of Completed Works

Type	Location (STA)	Description
Earthworks – Channel Widening and Deepening	0+010 to 0+070	Removal of sediments from the channel and pulling back the right bank of the creek. The creek banks were constructed to a 1.5:1 slope and rock armour was installed on the right bank.
Earthworks – Habitat Pool	0+070 to 0+125	Removal of sediment from the channel for increased capacity for future flood events and sediment deposition. Creek banks were constructed to 1.5:1 slope. Up to 4 m of sediment was removed from the channel.
Earthworks – Channel Widening and Deepening	0+125 to 0+390	Removal of sediments from the channel and pulling back the right bank of the creek by approximately 5 m. The creek banks were constructed to a 1.5:1 slope. Up to 2.5 m of sediment was removed from the channel.
Earthworks – Habitat Pool	0+390 to 0+465	Removal of sediment from the channel for increased capacity for future flood events and sediment deposition. Creek banks were constructed to 1.5:1 slope. Up to 4.5 m of sediment was removed from the channel. Left bank of the creek was pulled back to create the large pool. Rock armour was installed along the right bank.
Earthworks – Bank Repair	0+640 to 0+710	Right bank of the creek was repaired using excavated sediments to fill in low sections and raise the elevation of the top of bank. The creek bank was constructed to a 1.5:1 slope.
Earthwork – Side Channel	5+170 to 5+310	Existing side channel was widened and deepened by removing sediments. The channel was lowered by up to 0.5 m and widened up to 4 m. The banks were constructed to 1.5:1 slopes.
Invasive Vegetation Removal	0+440 to 0+710 5+160 to 5+320	Invasive blackberry bushes were removed from the right and left banks and between the main channel and side channel to allow native vegetation to survive.
Large Woody Debris (LWD)	0+420 to 0+630 5+190 to 5+280 (See as-built drawings for exact locations)	11 LWD structures were installed in the main channel below the downstream habitat pond and 5 LWD structures in the side channel.
Plantings – Live Staking	0+050 to 0+710 – Left Bank 0+050 to 0+610 – Right Bank 5+170 to 5+310	1.5 m wide strip of live stakes were planted from creek edge to top of bank. A total of 6140 live stakes were planted.
Plantings – Trees and Shrubs	Right Overbank - 0+150 to 0+400 and 0+440 to 0+660 Left Overbank – 0+440 to 0+610	A total of 1340 trees and 447 shrubs were planted in the overbank areas.

3. Inspections

This section summarizes an appropriate level of inspections for the Lorenzetta Creek Flood Recovery Works. A high level cost estimate of the engineering and environmental inspection is included in Enclosure D of this memo.

3.1 Suggested Inspections

Table 3 summarizes the types of inspections that would be appropriate for the Lorenzetta Flood Recovery Works. All inspections should be appropriately documented in an inspection report. The report should note any proposed repairs including priority and anticipated time of completion. Any other deficiencies noted during inspections should also be identified and prioritized. Consideration should also be given to access to the creek channel to enable inspection and repair of the works. Repairs and deficiencies noted in inspection reports should be addressed as soon as reasonably possible to maintain the integrity of the works.

Table 3: Types of Inspections

Inspection Type	Frequency/Timing	Description	Qualified Person
Annual Inspection	Once per year, usually during summer low flow conditions.	Overall inspection of flood restoration works.	Professional Engineer
Post High Water Inspection	Following occurrence of a significant high-water event.	Assess flood damage and identify restoration work that may be required. May include a boat or drone inspection.	Professional Engineer
Vegetation and Aquatic Monitoring	Once per year, preferably at same time as annual inspection.	Monitor the effectiveness of planted vegetation and aquatic health.	Qualified Environmental Professional

The following sections provide additional details pertinent to each type of inspection.

3.2 Annual Inspection

Annual inspections should be carried out each year. The creek should be inspected from the upper fan (STA 0+000) to McKay Road bridge to monitor the rate of sediment deposition, and identify any bank erosion or instability, and any significant channel obstructions (such as logjams). Table 4 below provides an inspection observation list.

Table 4: Categorization of Creek Inspection Observations

Category	Observation Type
1.Creek Access	Adequacy of creek access across adjacent private property (obstruction, deterioration, surface condition).
2. Deterioration or Damage	Condition of berm crest and side slopes (e.g., ruts, loss of surfacing material, obstructions, slumping, cracking).
	Condition of creek banks including rock armour works (loss of rock, settlement, slumping).
	Signs of obstructions or logjams within creek channel
	Degree of sediment aggradation within creek channel.
	Occurrence of any significant floods since the previous inspection.
3. Fish Habitat	Condition of the large woody debris features and riparian health
6. General [1]	General condition observations related to the banks, channel conditions, overbank, or landside area.
1. General observations should be taken approximately every 100 to 200 m or as necessary to document typical conditions	

An annual inspection report should document the site observations, any information received during the inspection, any need for repairs or maintenance, and any other issues arising from the inspection. Relevant photographs should be included in the inspection report.

In the event that an inspection report identifies excessive sediment deposition, in addition to sediment removal, an inspection report may recommend a supplemental watershed assessment to identify the sediment source and provide pertinent mitigative recommendations.

3.3 Post High-Water Inspection

Inspection of berms and associated rock armour works should be carried out as soon as practical following a high flow event. The inspection observation list outlined in Table 3 should be used, paying particular attention to any sediment and/or debris accumulation, and impact to the large woody debris structures in the creek.

3.4 Vegetation and Aquatic Monitoring

The Ministry of Water, Land and Resource Stewardship Water Sustainability Act permit requires a 10-year riparian monitoring plan and a 5-year aquatic monitoring plan. The Department of Fisheries and Oceans Fisheries Act Authorization requires a 10-year effectiveness monitoring plan that has both aquatic and riparian components. Both permits have been appended to Enclosure B. To address these monitoring requirements, a detailed Environmental Monitoring Plan is in Enclosure C. The construction contractor of the Phase 3B works is responsible for monitoring and ensuring the survival of planted vegetation during a two-year warranty period (to December 16, 2026). After this period, the vegetation and aquatic monitoring must be completed to ensure its effectiveness over the required timeline.

4. Maintenance and Repair

This section provides a brief description of maintenance and repair work that may be needed in the future. All maintenance and repair work should be appropriately documented (including photographs). In order to complete maintenance work, it will be necessary to obtain access permission from adjacent property owners.

4.1 Sediment/Debris Removal

When the need for sediment and/or debris removal within the creek channel is identified by an inspection report, a sediment and/or debris removal program should be initiated for the following year instream fisheries work window. Considerations for sediment and/or debris removal in the channel may include the following assessment, as determined by a professional engineer:

- Conduct a field survey of the creek channel within the project area, and preparation of cross-section drawings to compare the current and previous channel geometry at surveyed cross sections.
- Determine whether the capacity of the creek channel has been significantly reduced, typically 2 m average deposition in a reach.
- Determine whether the channel is overly (greater than 50%) obstructed by downed trees or a logjam.
- Determine if a debris obstruction is causing flow diversion leading to bank erosion, sediment accumulation upstream or ponding water.

This assessment should involve a channel survey and preparation of a short technical report with design drawings for the sediment and/or debris removal. An environmental professional should work in tandem with the QP to address environmental questions, issues and environmental permitting questions. Consideration should also be given to restoring, improving or expanding upon the environmental features that were constructed during the flood restoration project.

Any required maintenance work in and about the creek is subject to environmental approvals. This may further underscore the need to retain an environmental professional to prepare application forms and supporting documentation. Implementation of the work may require oversight by an environmental monitor, and preparation of a completion report. Unless the need for maintenance work is identified very early in the year, the need for environmental approvals will dictate when work is performed in the following year summer fisheries work window unless it is considered an emergency.

In designing the sediment removal, the following objectives should be considered:

- Generally restore pre-existing channel conditions (in terms of capacity) in the upper section of creek above the downstream habitat pond.
- Provide a relatively uniform level of flow conveyance (avoid constructed low-capacity sections).
- Maintain fish passage.
- Sediment removal should not be undertaken in a manner which may jeopardize creek bank stability.

Sediment removal work will require heavy equipment (excavator and dump trucks) access along the existing access roads. Access to the site is off private property owned at 58480 Laidlaw Road. Land use consent was obtained for the Phase 3B works but a new agreement would be needed for future work. Excavated sediments should be removed from the creek corridor.

4.2 Berm Crest and Slope Repair

An inspection report may identify the need for berm crest and slope repair. To repair the berm crest and slope affected by ruts, surface material loss, obstructions, slumping, or cracking, begin with clearing any debris or blockages to restore proper drainage. Ruts and eroded areas should be regraded and filled with compacted, well-draining material to restore the original berm shape and slope stability. Cracks or slumps may require deeper excavation and recompaction to prevent further failure. The berm surface should then be resurfaced ensuring proper compaction and a consistent crown or slope for drainage. The top of the berm and side slopes should be re-seeded to ensure vegetation growth to maintain long term stability.

4.3 Rock Armour Repair

An inspection report may identify the need for rock armour repair. To repair these areas, begin by removing any debris, vegetation or sediment from the affected area and regrade the bank to a stable slope. New rock armour, imported riprap, if possible, otherwise round rock harvested from site, should be placed carefully on the bank and keyed into the toe and edges of the bank to prevent undermining. The size of rocks and thickness of the layer should match the specifications of the original design. Compact the area behind the placement and ensure the stones are tightly interlocked.

4.4 Large Woody Debris Repair

An inspection report may identify the need for repair of a large woody debris structure. This may involve repositioning or replacing the logs to restore their intended function for fish habitat. Begin by assessing the site to determine the extent of movement or damage. If possible, recover and reuse existing logs, anchoring them securely using driven ballast boulders and cable, if required. Ensure the structure is embedded properly into the creek bed and banks to prevent future displacement. Refer to the Record drawings for the burial length and depth required at that location. The alignment should mimic the original design to maintain flow patterns and habitat benefits. Regular monitoring after high flows is recommended to ensure continued stability.

4.5 Bank Repair

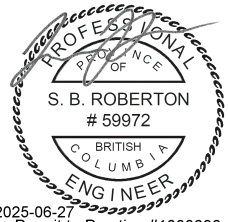
An inspection report may identify the need for bank repair where the bank has been undermined or where the bank slope is greater then 1:1. Repair should begin by regrading the banks to a maximum slope of 1.5:1 or less steep where possible. Remove any loose soil or debris from the bank and rebuild the bank with compacted material and reinforce with live staking or rock armour at the toe to protect against future scour. The site should be monitored after high flows to assess performance and identify any additional repair needs.

5. Closing

We trust this memo adequately summarizes the monitoring, maintenance, and costs required for the Lorenzetta Creek flood recovery project. If you have any questions, please contact the undersigned.

KERR WOOD LEIDAL ASSOCIATES LTD.

Prepared by:



2025-06-27
Permit to Practice #1000696

Spencer Roberton, P.Eng.
Water Resource Engineer

Reviewed by:

Brad Minnes, P.Eng., MBA
Project Manager

SBR/BWM

Encl.: Enclosure A: Record Drawings
Enclosure B: Regulatory Approval Documents
Enclosure C: Environmental Monitoring Plan
Enclosure D: Inspections Cost Estimate

Statement of Limitations

This document has been prepared by Kerr Wood Leidal Associates Ltd. (KWL) for the exclusive use and benefit of the intended recipient. No other party is entitled to rely on any of the conclusions, data, opinions, or any other information contained in this document.

This document represents KWL's professional judgement based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by members of the engineering profession currently practising under similar conditions. No warranty, express or implied, is made.

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Revision History

Revision #	Date	Status	Revision Description	Author
0	June 27, 2025	Final		SBR
A	June 13, 2025	Draft	For client review	SBR

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Enclosure A

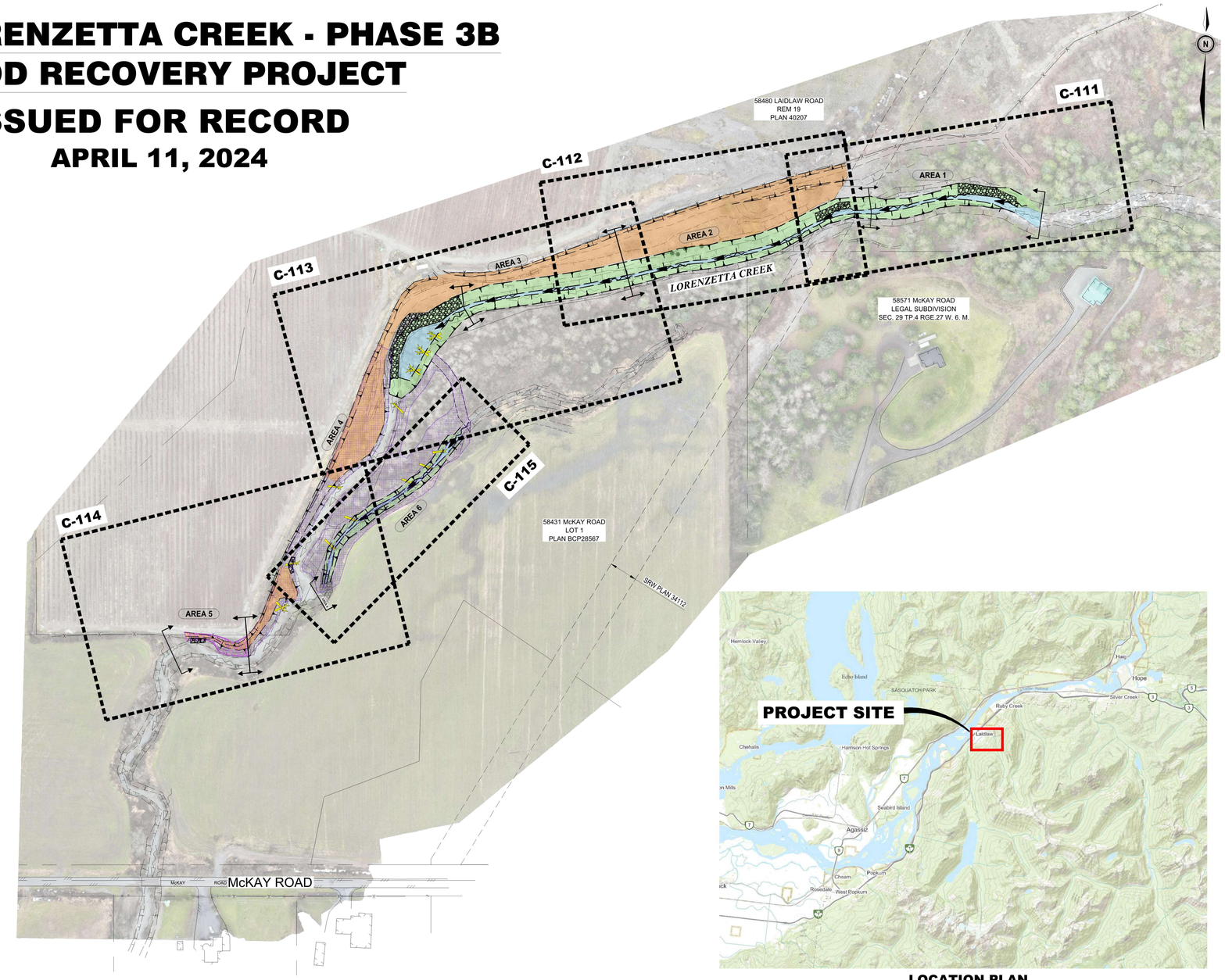
Record Drawings

BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

CR-33 LORENZETTA CREEK - PHASE 3B FLOOD RECOVERY PROJECT

ISSUED FOR RECORD

APRIL 11, 2024



KEY PLAN
Scale: 1:1500

0 20 (1:1,500) 80 m

LOCATION PLAN
Scale: N.T.S.

SURVEY CONTROL INFORMATION

HORIZONTAL COORDINATES ARE NAD83(CSRS) EPOCH 2002, UTM ZONE 10.
TO COMPUTE GROUND LEVEL COORDINATES, MULTIPLY BY CSF OF 0.99972352 ABOUT 0,0.

VERTICAL DATUM IS CGVD 28 (HTV2.0).

SURVEY CONTROL ESTABLISHED BY DUAL FREQUENCY DIFFERENTIAL CARRIER PHASE GNSS OBSERVATIONS PROCESSED USING PRECISE POSITIONING SERVICE OF NATURAL RESOURCES CANADA.

STATION	NORTHING	EASTING	ELEVATION	DESCRIPTION
4458	5464421.096	601041.572	28.910	UGL-REBAR
4459	5464433.784	601394.033	29.530	UGL-REBAR
4460	5464821.729	601237.206	29.000	UGL-REBAR
4461	5464925.864	601499.624	34.240	UGL-REBAR
7200	5464812.834	601285.714	30.927	KWL-SPIKE-7200
7201	5464849.612	601363.080	30.435	KWL-SPIKE-7201
7202	5464903.046	601524.719	35.387	KWL-SPIKE-7202
7203	5464844.043	601511.026	34.087	KWL-SPIKE-7203
7204	5464844.705	601439.362	33.578	KWL-SPIKE-7204
7205	5464917.174	601599.738	40.101	KWL-SPIKE-7205

THESE RECORD DRAWINGS WERE COMPILED USING INFORMATION FROM SOURCES INCLUDING:

PRIME CONTRACTOR: TIMBRO CONTRACTING LTD.
SURVEYOR: LANDFORM GEOMATICS LTD.
DATE OF SURVEY: OCTOBER & NOVEMBER 2024

OTHER SOURCE(S): KWL FIELD INSPECTORS (SPENCER ROBERTON, BRANDON VOLLMER & MATT SANDERS) WITH FIELD INSTRUCTIONS, MEASUREMENTS & PHOTOS

THESE RECORD DRAWINGS ARE AN UPDATED VERSION OF THE ISSUED FOR CONSTRUCTION (IFC) DRAWINGS, WITH ADDITION OF KEY AS-BUILT SURVEY INFORMATION AND SOME EXPLANATORY NOTES. IN GENERAL WHERE THE WORK WAS CONDUCTED IN ACCORDANCE WITH THE IFC DRAWINGS, THE DRAWING INFORMATION AND NOTES ARE UNCHANGED.

CR-33 LORENZETTA CREEK - PHASE 3B	
DWG No.	DRAWING TITLE
General	
G-001	Location Plan, Key Plan, Drawing List & Survey Control
G-002	Legend & General Notes
Civil	
C-101	Existing Conditions & Site Access Plan
C-102	General Arrangement Site Plan
C-111	Lorenzetta Creek - Plan and Profile (STA 0+000 to 0+160)
C-112	Lorenzetta Creek - Plan and Profile (STA 0+160 to 0+320)
C-113	Lorenzetta Creek - Plan and Profile (STA 0+320 to 0+490)
C-114	Lorenzetta Creek - Plan and Profile (STA 2+732 to 2+800)
C-115	Side Channel Habitat Restoration - Plan and Profile (STA 5+160 to 5+330)
C-301	Cross Sections - Area 1 & 6 - (STA 0+050 to 0+120)
C-302	Cross Sections - Area 2 - (STA 0+130 to 0+280)
C-303	Cross Sections - Area 3 - (STA 0+300 to 0+460)
C-304	Typical Sections
C-501	Typical Details
Environmental	
E-101	Planting Plan

KERR WOOD LEIDAL
consulting engineers

BRITISH COLUMBIA | Ministry of Environment and Climate Change Strategy

Info:

RECORD DRAWING DISCLAIMER

THE SEAL AND SIGNATURE OF THE UNDERSIGNED ON THIS DRAWING CERTIFIES THAT THE DESIGN INFORMATION CONTAINED IN THESE DRAWINGS ACCURATELY REFLECTS THE ORIGINAL DESIGN AND THE MATERIAL DESIGN CHANGES MADE DURING CONSTRUCTION THAT WERE BROUGHT TO THE UNDERSIGNED'S ATTENTION. THESE DRAWINGS ARE INTENDED TO INCORPORATE ADDENDA, CHANGE ORDERS AND OTHER MATERIAL DESIGN CHANGES, BUT NOT NECESSARILY ALL SITE INSTRUCTIONS.

THE UNDERSIGNED DOES NOT WARRANT OR GUARANTEE, NOR ACCEPT ANY RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE AS-CONSTRUCTED INFORMATION SUPPLIED BY OTHERS CONTAINED IN THESE DRAWINGS, BUT DOES, BY SEALING AND SIGNING, CERTIFY THAT THE AS-CONSTRUCTED INFORMATION, IF ACCURATE AND COMPLETE, PROVIDES AN AS-CONSTRUCTED SYSTEM WHICH SUBSTANTIALLY COMPLIES IN ALL MATERIAL RESPECTS WITH THE ORIGINAL DESIGN INTENT.

Seal:
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
S. B. ROBERTON
59972
2025-04-16
Permit to Practice #1000696

Rev	Date	Des	Dwn	Chk	Description
0	2024-08-14	SBR	T2	MVC	ISSUED FOR CONSTRUCTION
1	2025-04-11	SBR	PAC	MVC	ISSUED FOR RECORD

Rev	Date	Des	Dwn	Chk	Description

BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY
CR-33 LORENZETTA CREEK - PHASE 3B
LOCATION PLAN, KEY PLAN, DRAWING LIST & SURVEY CONTROL

Project No.	3427-023	Drawing No.	G-001	Rev.	1
Group	GENERAL				

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THESE NOTES ARE AS PER THE ISSUED FOR CONSTRUCTION DRAWINGS, NOT UPDATED FOR THE RECORD DRAWINGS

GENERAL:

1. ALL ELEVATIONS AND DIMENSIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
2. DURING CONSTRUCTION, ENSURE ALL OCCUPATIONAL HEALTH AND SAFETY (OH&S) REGULATIONS ARE FOLLOWED. CONTRACTOR SHALL PROVIDE THE CONTRACT ADMINISTRATOR WITH BC OCCUPATIONAL HEALTH AND SAFETY REPORTS, IF APPLICABLE.
3. RESTORE ALL AREAS AFFECTED BY CONSTRUCTION WORKS TO THEIR ORIGINAL CONDITION OR BETTER.

ENVIRONMENTAL:

1. COMPLY WITH PHASE 3 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (APRIL, 2024).
2. FOR DETAILED PLANTING PLAN INDICATING EXACT SPECIES AND LOCATIONS REFER TO DWG E-101.
3. SIDE CAST MATERIAL: ALL SIDE CAST MATERIAL FROM THE CHANNEL EXCAVATION WILL BE PLACED IN AREAS NOTED ON THE DRAWINGS AND APPROVED BY THE CONSULTANT. CARE MUST BE TAKEN TO NOT IMPACT EXISTING LARGE TREES IN THE AREA. WHERE LARGE TREES ARE PRESENT, MATERIAL MUST NOT BE PLACED AROUND THE BASE OF THE TREE.

CONSTRUCTION:

1. LOCATION AND ELEVATION OF EXISTING UTILITIES SHOWN ON DRAWINGS ARE APPROXIMATE ONLY. CONTRACTOR IS RESPONSIBLE TO DETERMINE EXACT LOCATION AND ELEVATION PRIOR TO CONSTRUCTION.
2. ENSURE ALL EXISTING WATER SYSTEMS REMAIN IN USE DURING CONSTRUCTION.
3. IF GAS MAINS ARE PRESENT WITHIN THE PROJECT AREA, FORTIS AND OCCUPATIONAL HEALTH AND SAFETY (OH&S) REGULATIONS SHALL BE FOLLOWED. FORTIS REPRESENTATIVE MY BE REQUIRED TO BE PRESENT WHEN WORKING ADJACENT TO GAS MAINS (ESPECIALLY HIGH PRESSURE).
4. THE CONTRACTOR SHALL PROVIDE 72 HRS NOTICE PRIOR TO CONSTRUCTION NEAR FORIS UTILITY BOXES. A REPRESENTATIVE FROM FORTIS MAY BE SCHEDULED TO BE PRESENT DURING EXCAVATION.
5. WHERE HEAVY WORK IS REQUIRED WITHIN THE EXCAVATION ZONE SURROUNDING UTILITY POLES, AND A POLE HOLD IS REQUIRED, THE CONTRACTOR MUST BE AUTHORIZED AND BE ABLE TO PULL A LIVE LINE PERMIT.
6. BANK ARMOURING: APPROXIMATE LOCATIONS OF BANK ARMOURING AND BANK ARMOUR RELOCATION HAVE BEEN INDICATED ON THE DRAWINGS. EXACT LOCATIONS AND QUANTITIES WILL BE DIRECTED BY THE CONTRACT ADMINISTRATOR. BANK ARMOUR WILL UTILIZE EXISTING LARGE BOULDERS ON SITE OF AT LEAST 0.6 m DIAMETER. ONE ROW OF ROCKS MUST BE KEYED IN AT THE BOTTOM OF THE SLOPE.

REFERENCES:

1. EXISTING TOPOGRAPHY CONTOURS GENERATED FROM UNDERHILL GEOMATICS LTD. SURVEY. SURVEY COMPLETED BY DRONE SURVEY AND GROUND SURVEY BY UNDERHILL IN MAY 01, 2023.
2. ADDITIONAL SURVEY PROVIDED AS AN ASBUILT SURVEY FROM MISSION CONTRACTORS IN SEPTEMBER 7, 2023.
3. ADDITIONAL GROUND SURVEY BY KWL DONE IN OCTOBER 12, 2024.
4. PRE-FLOOD CONTOURS GENERATED FROM BCLIDAR. RANGE OF ACQUISITION DATES: 2016-06-20-2016-09-12, NON - VEGETATED VERTICAL ACCURACY 0.078 m.
5. ORTHOPHOTO OBTAINED BY STIRLING GEOSCIENCE LTD., FEB 2024, 5 cm ACCURACY.
6. ADDITIONAL SURVEY PROVIDED AS AN ASBUILT SURVEY FROM LANDFORM GEOMATICS LTD. IN OCTOBER & NOVEMBER, 2024.

LEGEND

- LEGAL LOT BOUNDARY
- EASEMENT / RIGHT-OF-WAY
- EDGE OF PAVED ROADS / PATHWAYS
- EDGE OF GRAVEL ROADS / PATHWAYS
- FENCE LINE
- TOP OF BANK
- TOE OF BANK
- ELECTRICAL MAIN
- OVERHEAD HYDRO & UTILITY POLE
- ADD LARGE WOODY DEBRIS TO PROVIDE ADDITIONAL INSTREAM FISH HABITAT. (2 ROOT WADS ANCHORED WITH BOULDERS)
- RIPARIAN OFFSET AREA (INVASIVE VEGETATION REMOVAL)
- CREEK BED & SEDIMENT REMOVAL AREA
- CHANNEL MODIFICATION & SEDIMENT REMOVAL AREA
- BANK ARMOURING
- EXCAVATED MATERIAL AREA
- BANK RESTORATION AREA
- SURVEYED TREE LOCATION
- RIVER CENTRELINE STATIONING
- IRON PIN, SURVEY MONUMENT & SURVEY TAG

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2025-04-16
Permit to Practice #1000696

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0	2024-08-14	SBR	T2	MVC	ISSUED FOR CONSTRUCTION
1	2025-04-11	SBR	PAC	MVC	ISSUED FOR RECORD

Rev	Date	Des	Dwn	Chk	Description

BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY

CR-33 LORENZETTA CREEK - PHASE 3B

GENERAL NOTES & LEGEND

Project No.	3427-023	Drawing No.	G-002	Rev.	1
Group	GENERAL				

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Page Size = ANSI D
At Full Scale, this border measures 520 mm x 800 mm

0 10 50 100 millimetres

NOTE:

1. DATE OF ORTHOPHOTO: FEBRUARY, 2024 BY STIRLING GEOSCIENCE LTD.

0 10 (1:1,000) 50 m

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Rev	Date	Des	Dwn	Chk	Description

BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY

CR-33 LORENZETTA CREEK - PHASE 3B
EXISTING CONDITIONS & SITE ACCESS PLAN

Project No.	3427-023	Drawing No.	C-101	Rev.	1
Group	CIVIL				

\\kwl.ca\projects\3400-3499\3427-023\501-Drawings\a_Production Dwgs\3427-023_C101_ExistingConditions.dwg

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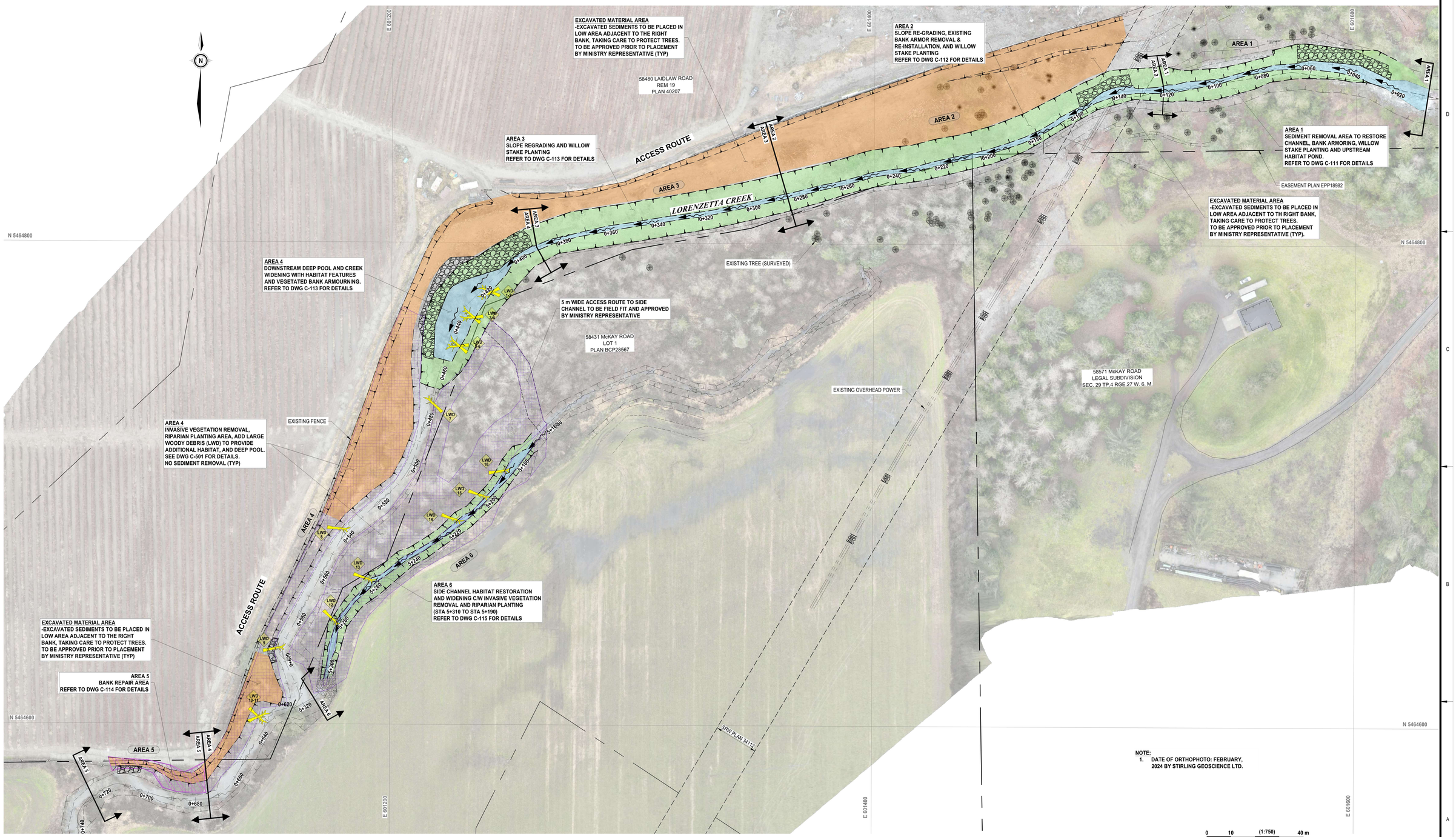

NOTE:
1. DATE OF ORTHOPHOTO: FEBRUARY, 2024 BY STIRLING GEOSCIENCE LTD.

0 10 (1:750) 40 m

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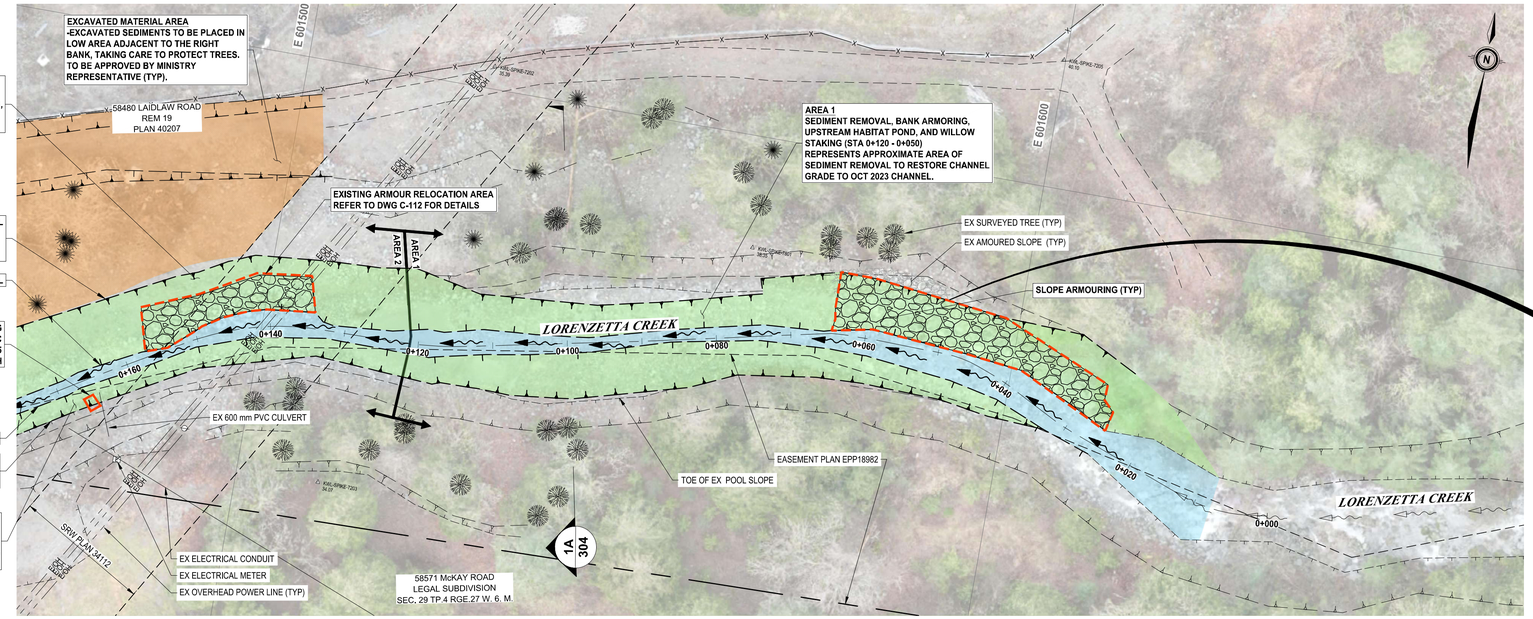
Rev	Date	Des	Dwn	Chk	Description

BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY
CR-33 LORENZETTA CREEK - PHASE 3B
GENERAL ARRANGEMENT SITE PLAN

Project No. 3427-023
Group CIVIL
Drawing No. C-102
Rev. 1

\\kwl.ca\projects\3400-3499\3427-023\01-Drawings\a_Production Dwgs\3427-023_C100s_SitePlans.dwg



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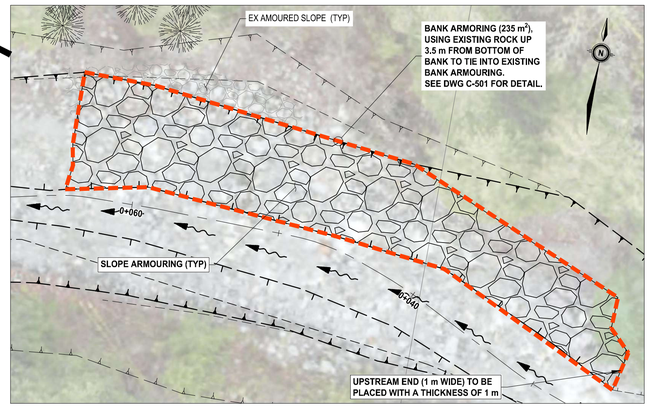

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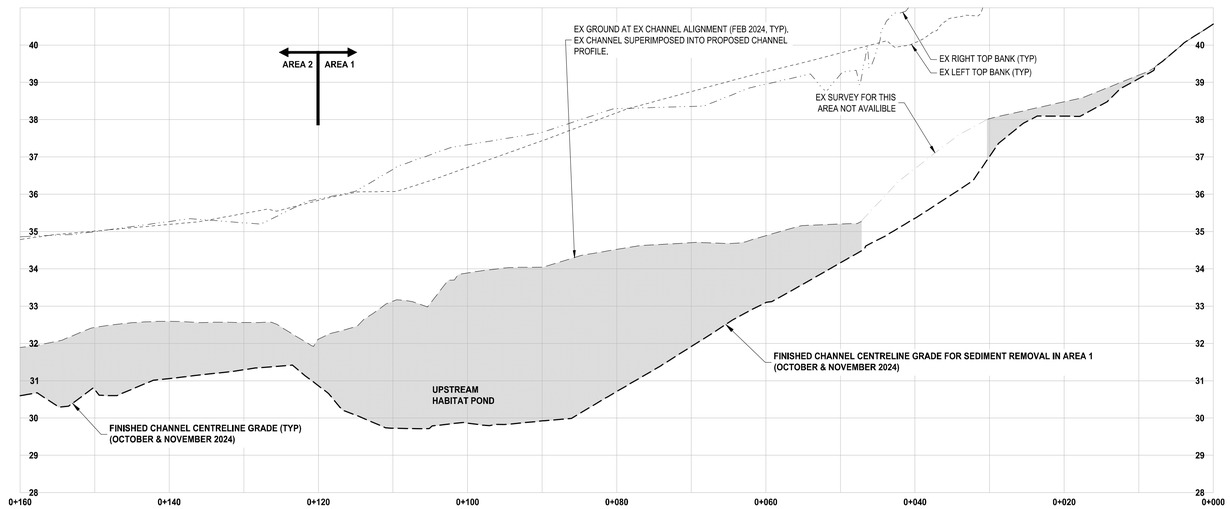

PROFILE
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0 5 (1:400) 20 m

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1. DATE OF ORTHOPHOTO: FEBRUARY, 2024 BY STIRLING GEOSCIENCE LTD.

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CR-33 LORENZETTA CREEK - PHASE 3B
LORENZETTA CREEK (STA 0+000 TO 0+160)
PLAN AND PROFILE

Project No. 3427-023 | Drawing No. C-111 | Rev. 1
Group CIVIL

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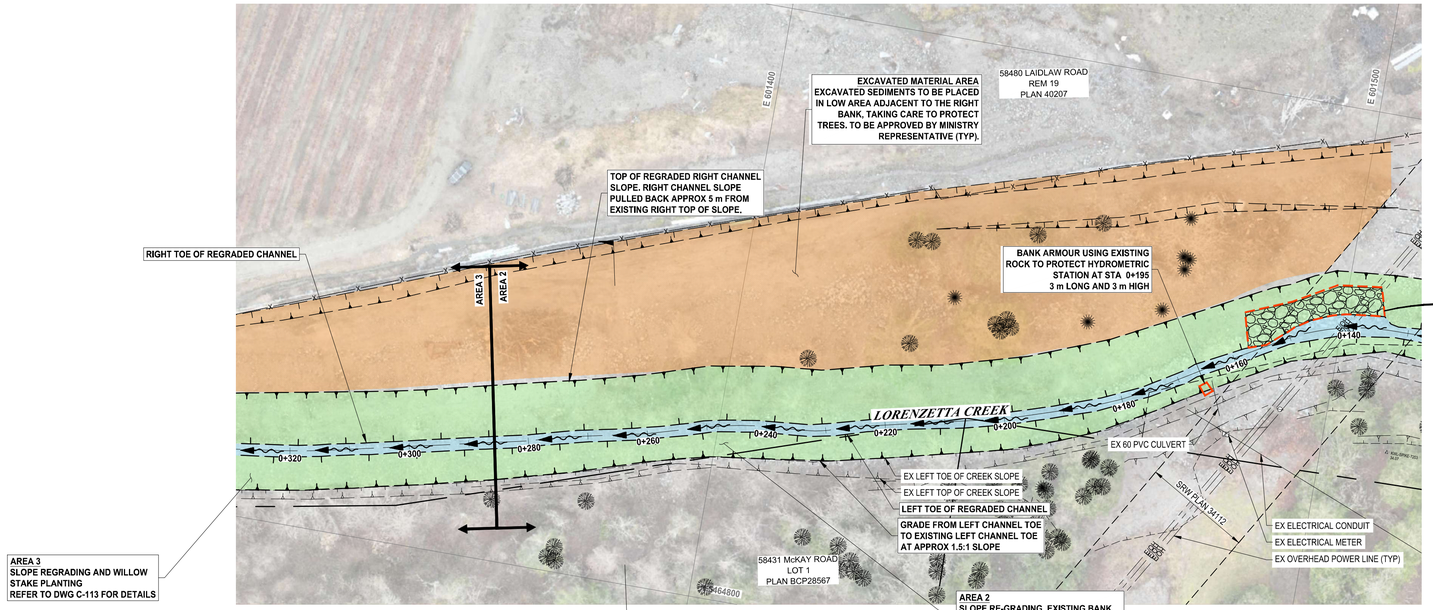

PLAN
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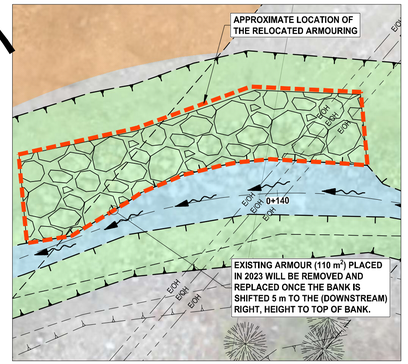

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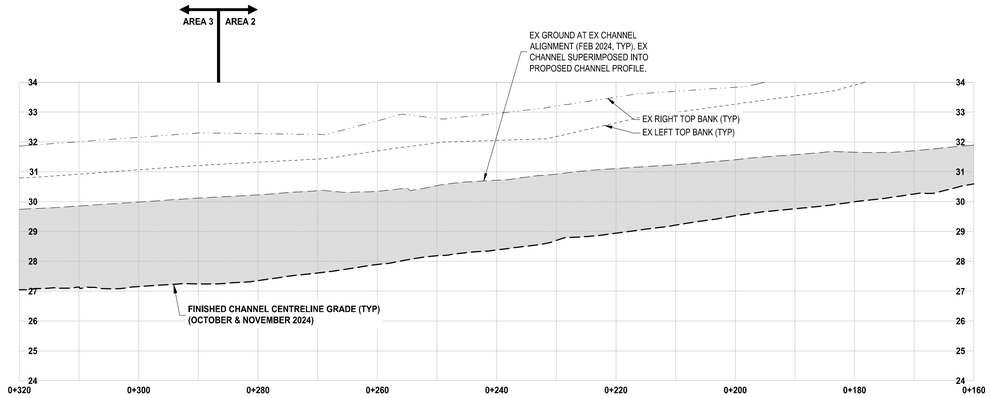

PROFILE
Scale H 1:500, V 1:50

0 5 (H 1:500) 25 m
0 0.5 (V 1:50) 2.5 m

NOTE:
1. DATE OF ORTHOPHOTO: FEBRUARY, 2024 BY STIRLING GEOSCIENCE LTD.
2. PROPOSED LORENZETTA CREEK (2024) STATIONING 0+018.374 TO 0+465.621.

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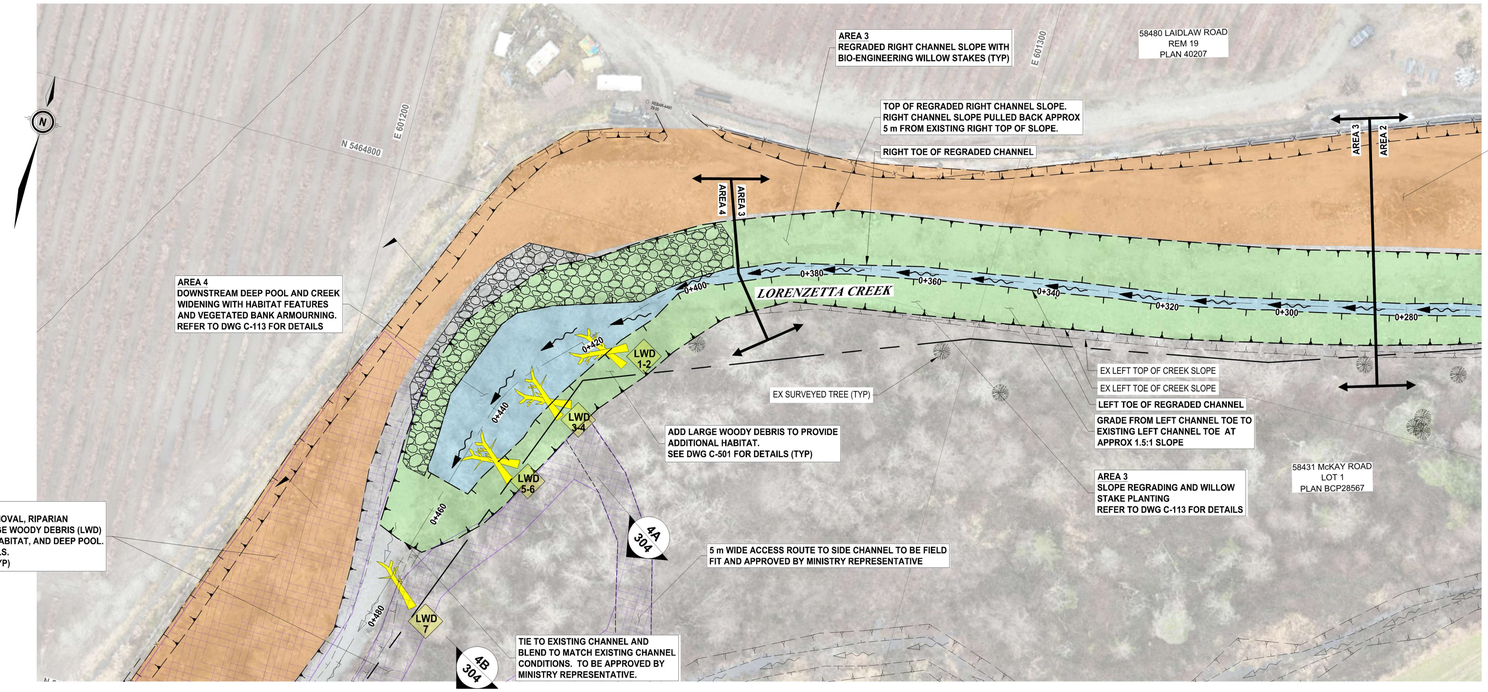
BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY

CR-33 LORENZETTA CREEK - PHASE 3B
LORENZETTA CREEK (STA 0+160 TO 0+320)
PLAN AND PROFILE

Project No.	3427-023	Drawing No.	Rev.
Group	CIVIL	C-112	1



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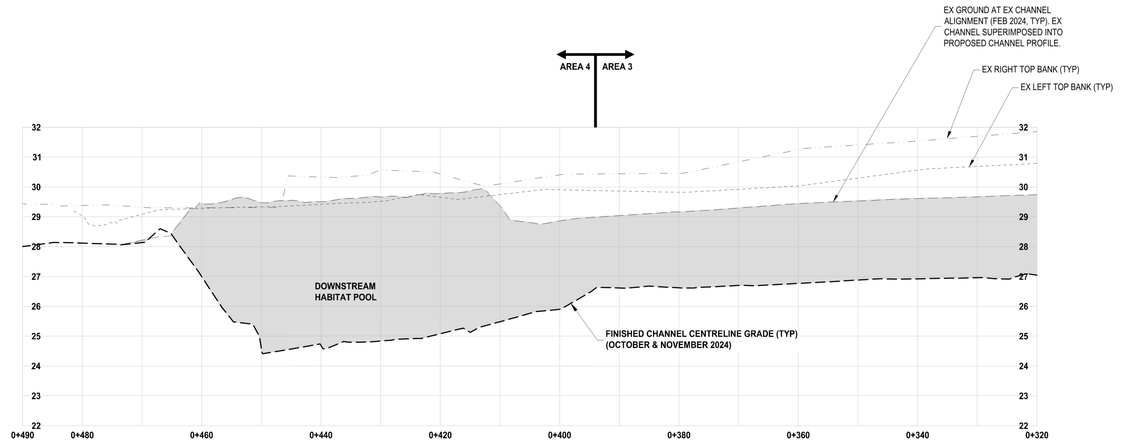

PROFILE
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0 0.5 (V 1:50) 2.5 m

NOTE:
1. DATE OF ORTHOPHOTO: FEBRUARY, 2024 BY STIRLING GEOSCIENCE LTD.
2. PROPOSED LORENZETTA CREEK (2024) STATIONING 0+018.374 TO 0+465.621.

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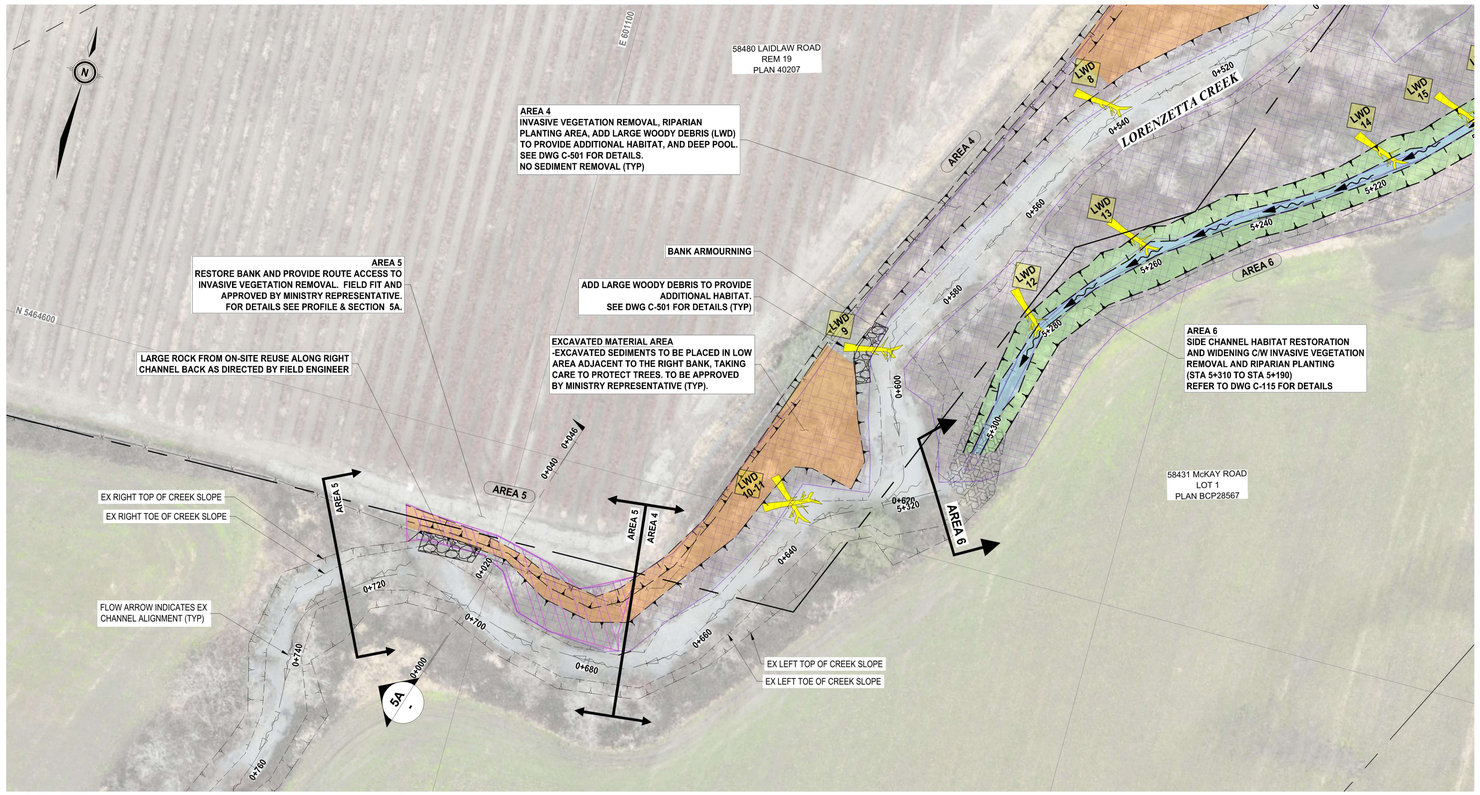
BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY

CR-33 LORENZETTA CREEK - PHASE 3B

LORENZETTA CREEK (STA 0+320 TO 0+490)

PLAN AND PROFILE

Project No.	3427-023	Drawing No.	Rev.
Group	CIVIL	C-113	1



PLAN
Scale 1:500

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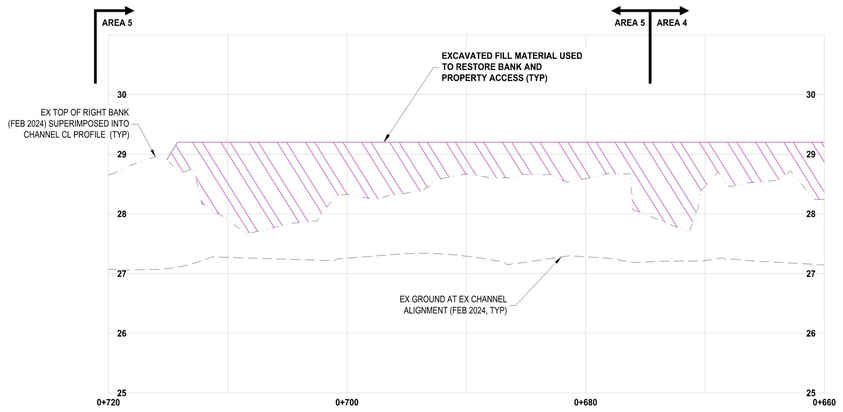

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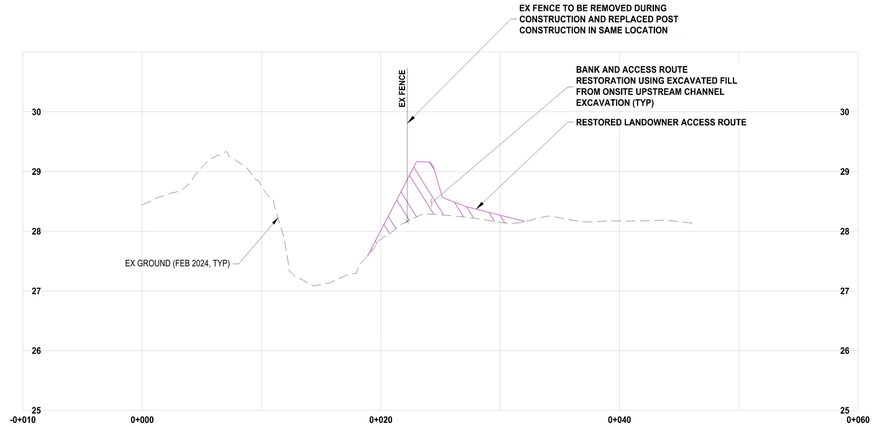

CROSS SECTION 5A
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0 0.5 (V 1:50) 2 m

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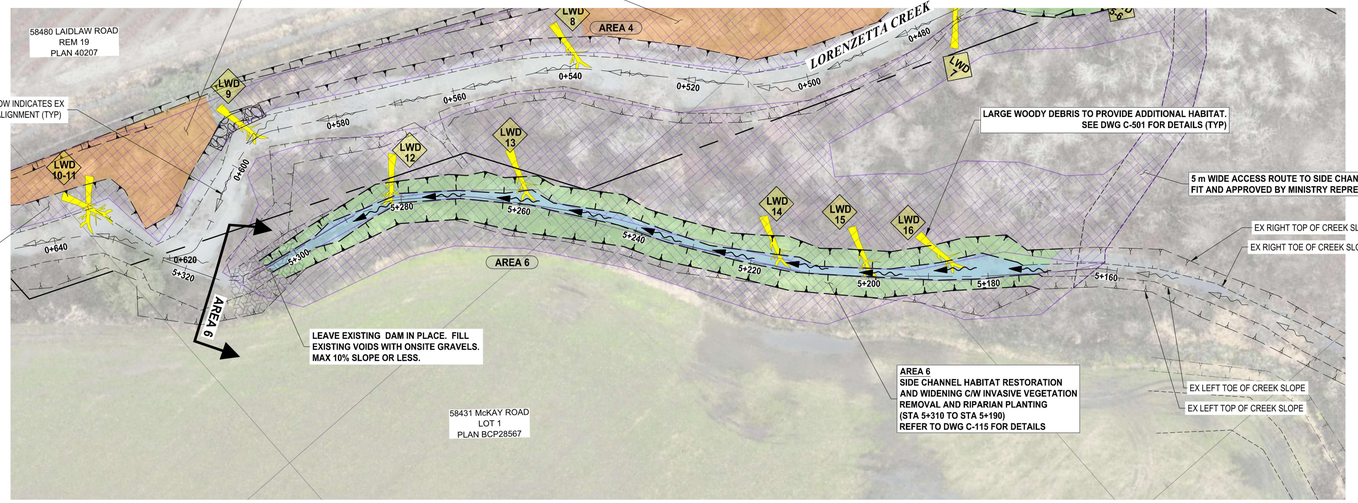
Rev	Date	Des	Dwn	Chk	Description

BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY
CR-33 LORENZETTA CREEK - PHASE 3B
LORENZETTA CREEK (STA 0+660 TO STA 0+720)
PLAN, PROFILE AND CROSS SECTION

Project No.	3427-023	Drawing No.	C-114	Rev.	1
Group	CIVIL				



PLAN
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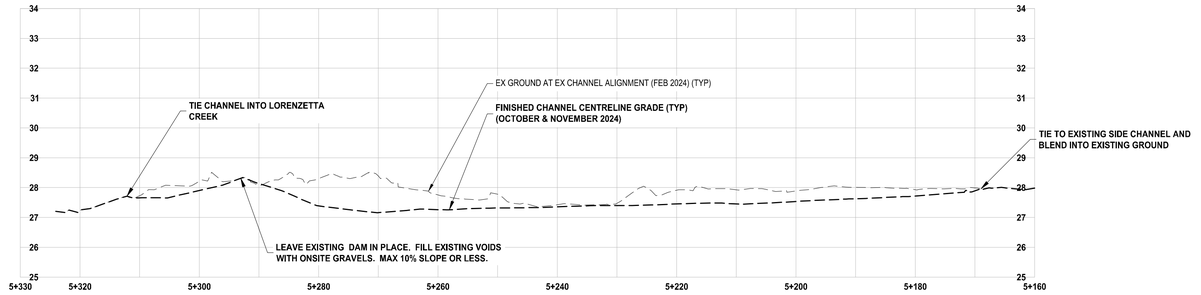

PROFILE
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NOTE:
1. DATE OF ORTHOPHOTO: FEBRUARY, 2024 BY STIRLING GEOSCIENCE LTD.
2. EXISTING LORENZETTA CREEK CENTERLINE (2023) STATIONING 2+000 TO 3+000.
3. PROPOSED SIDE CHANNEL CENTRELINE STATIONING 5+160 TO 5+330.

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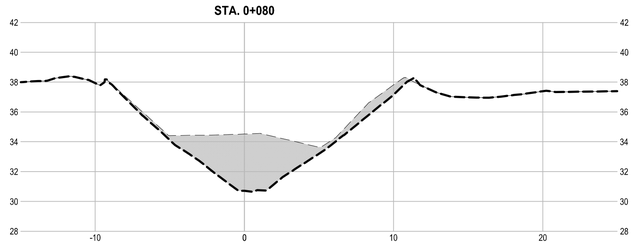
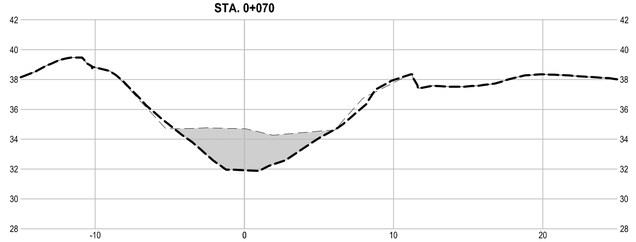
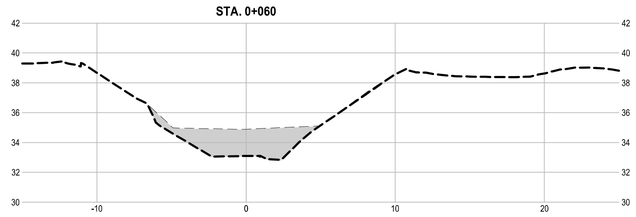
BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY
CR-33 LORENZETTA CREEK - PHASE 3B
SIDE CHANNEL HABITAT RESTORATION (STA 5+160 TO STA 5+330)
PLAN AND PROFILE

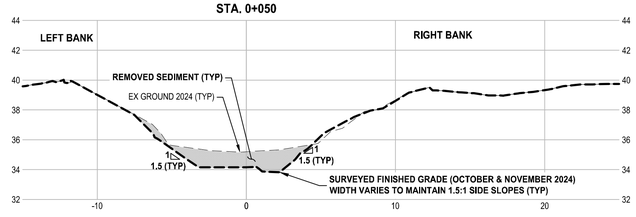
Project No.	3427-023	Drawing No.	Rev.
Group	CIVIL	C-115	1

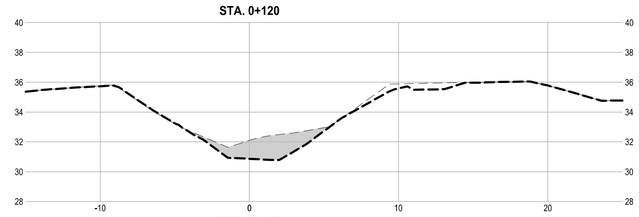
AREA 1

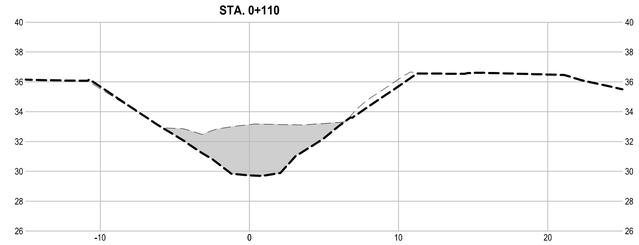


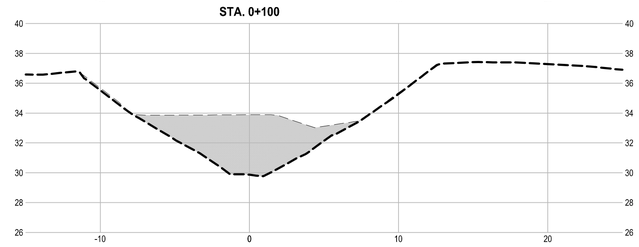


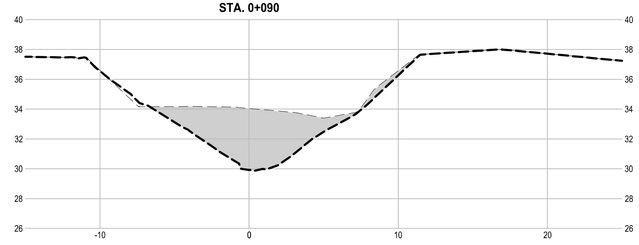




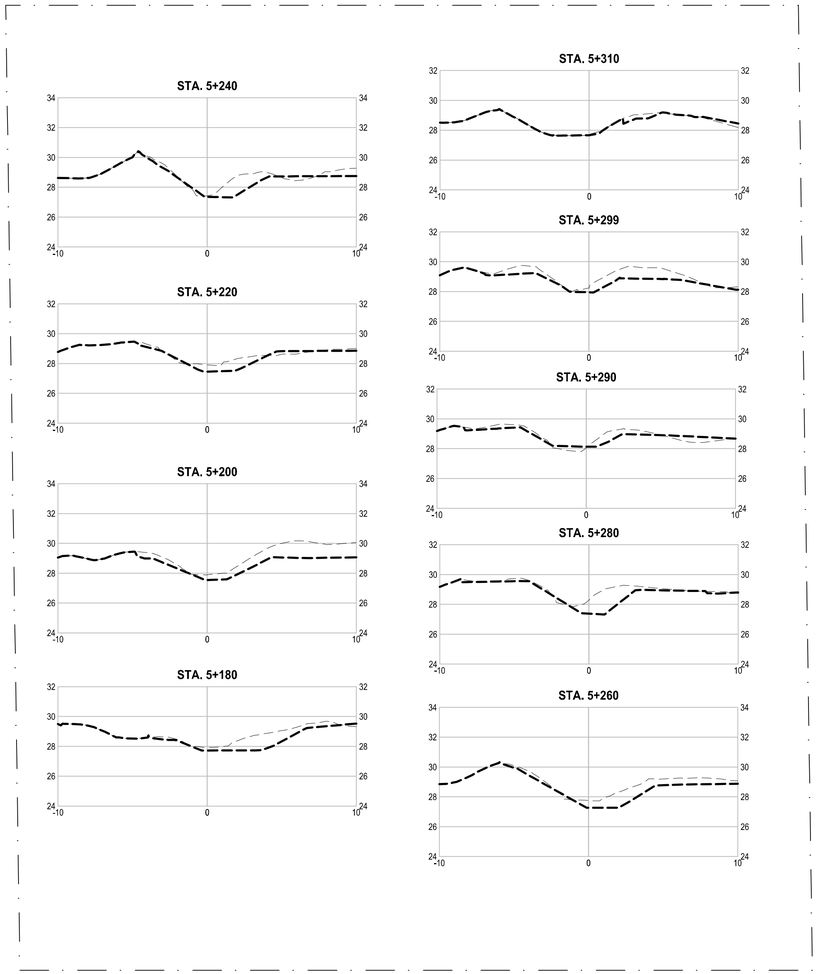








AREA 6



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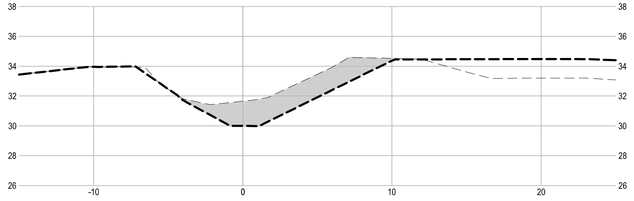
BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY

CR-33 LORENZETTA CREEK - PHASE 3B
CROSS SECTIONS - AREA 1 & 6
STA 0+050 TO 0+120

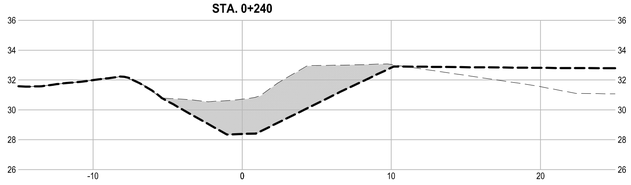
Project No.	3427-023	Drawing No.	Rev.
Group	CIVIL	C-301	1

AREA 2

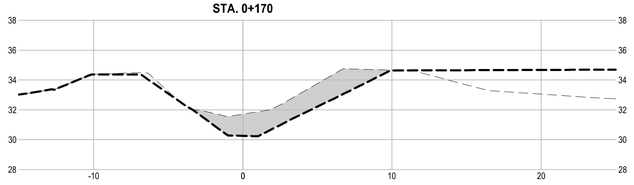
STA. 0+180



STA. 0+240



STA. 0+170



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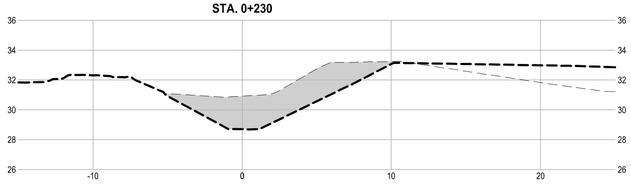

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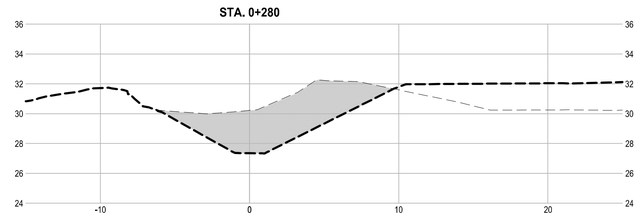

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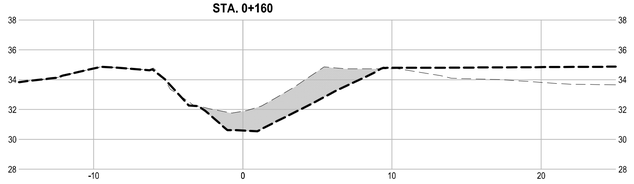

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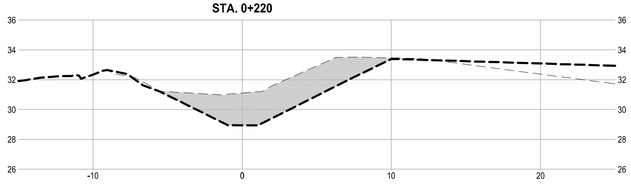

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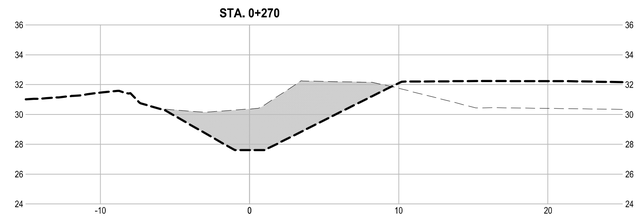

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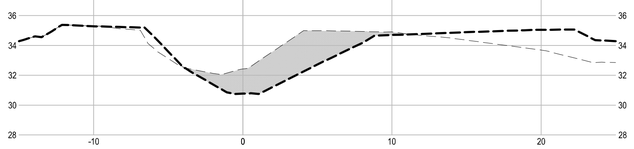

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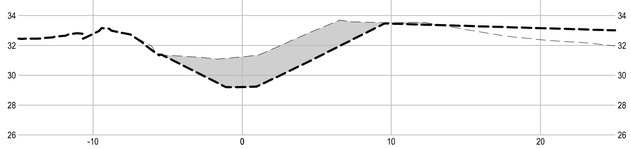

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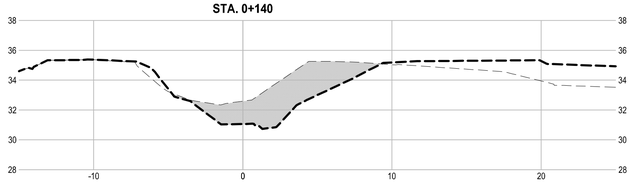

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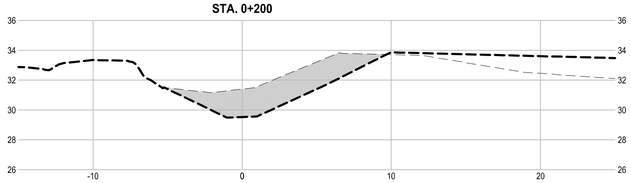

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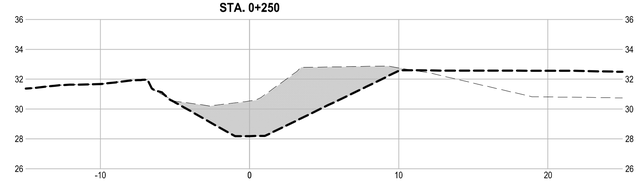

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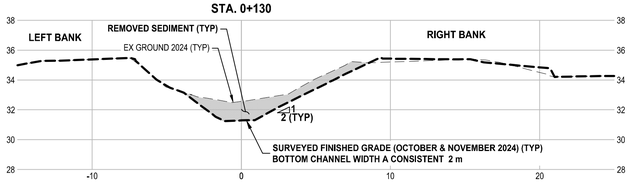

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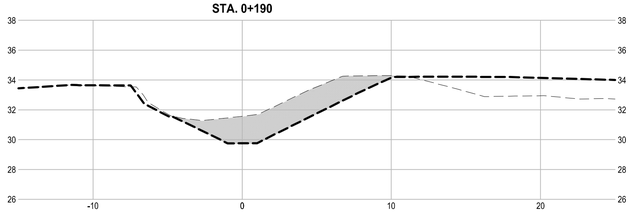

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Ministry of Environment and Climate Change Strategy

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59972
2025-04-16
Permit to Practice #1000696

Rev	Date	Des	Dwn	Chk	Description
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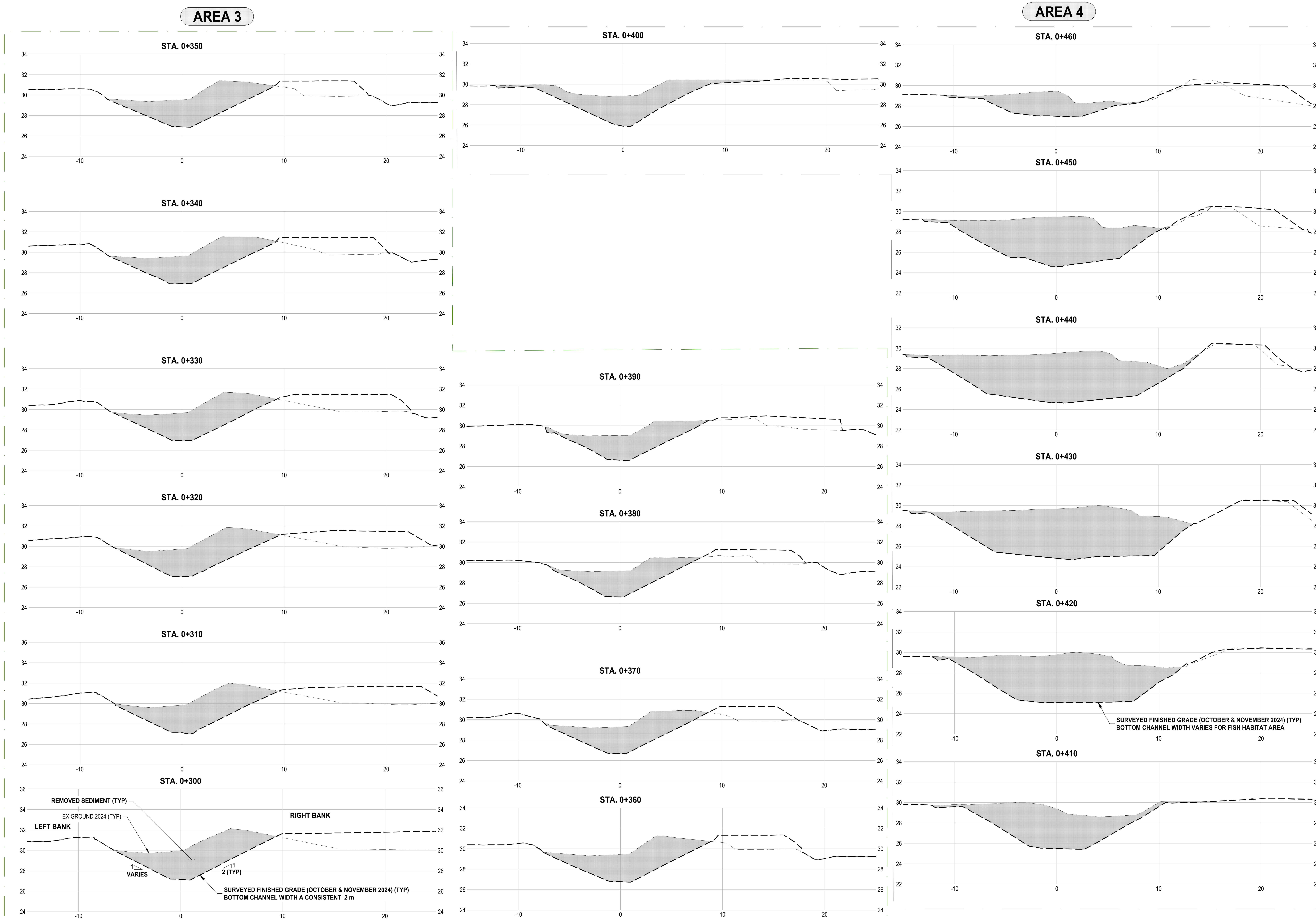
Rev	Date	Des	Dwn	Chk	Description

BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY

CR-33 LORENZETTA CREEK - PHASE 3B
CROSS SECTIONS - AREA 2
STA 0+130 TO 0+280

Project No.	3427-023	Drawing No.	Rev.
Group	CIVIL	C-302	1



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BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY
CR-33 LORENZETTA CREEK - PHASE 3B
CROSS SECTIONS - AREA 3
STA 0+300 TO 0+460

Project No. 3427-023
Group: CIVIL
Drawing No. C-303
Rev. 1

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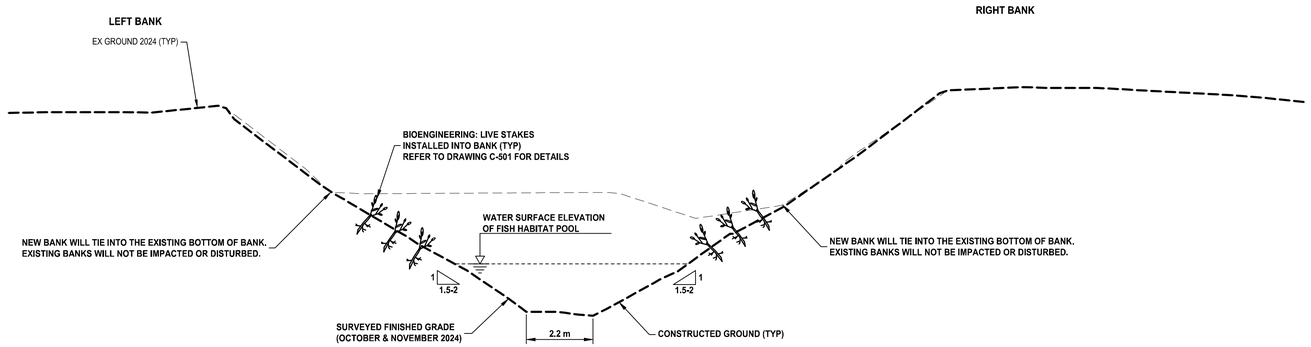
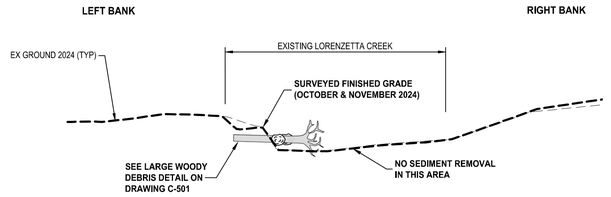


UPSTREAM HABITAT POND AREA 1 - TYPICAL SECTION

1A

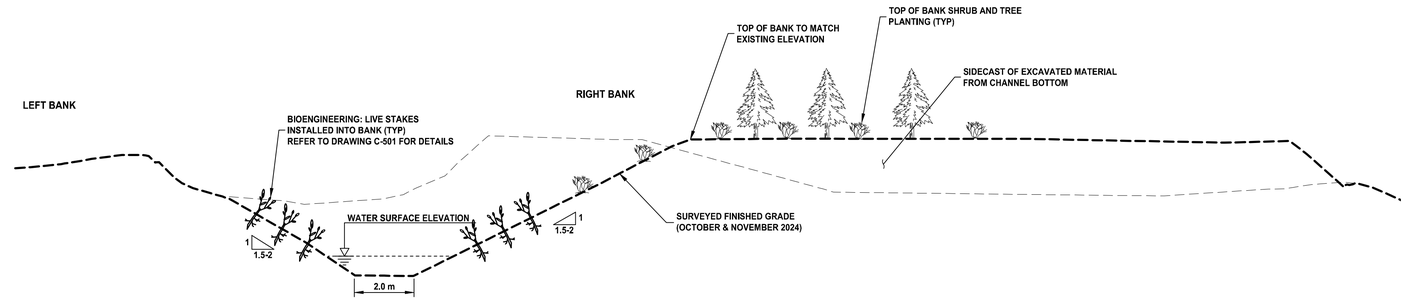
Scale 1:100



HABITAT RESTORATION AREA 4 - TYPICAL SECTION

4B

Scale 1:100



CHANNEL DEEPENING AND WIDENING AREA 2 & 3 - TYPICAL SECTION

2A

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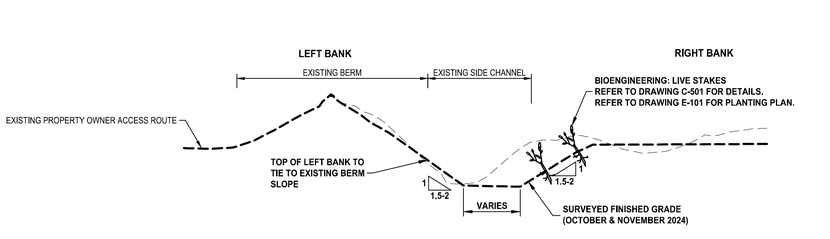
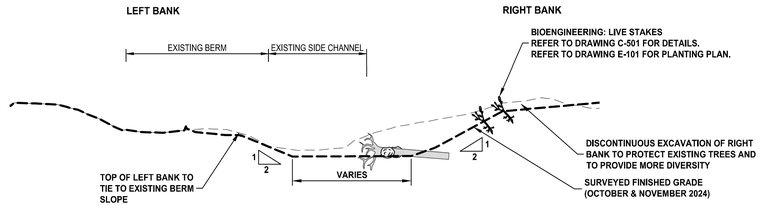


SIDE CHANNEL HABITAT RESTORATION AREA 6 - TYPICAL SECTION

6A

Scale 1:100



SIDE CHANNEL HABITAT WIDENING AREA 6 - TYPICAL SECTION

6B

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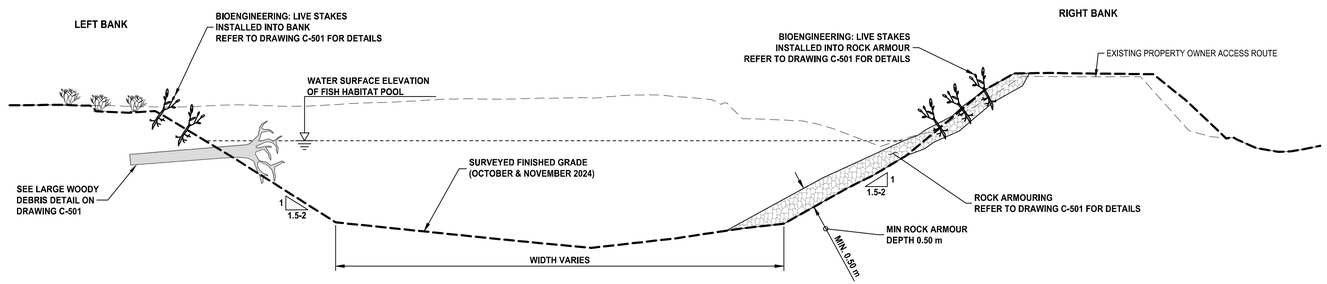

DOWNSTREAM HABITAT POND AREA 4 - TYPICAL SECTION

4A

Scale 1:100

0 1 (1:100) 5 m

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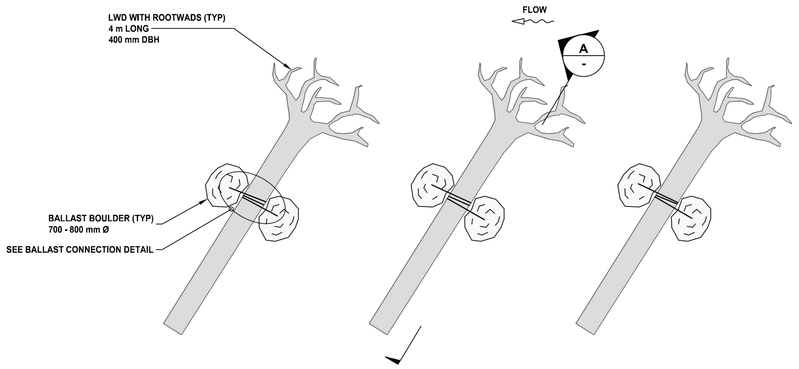
BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY

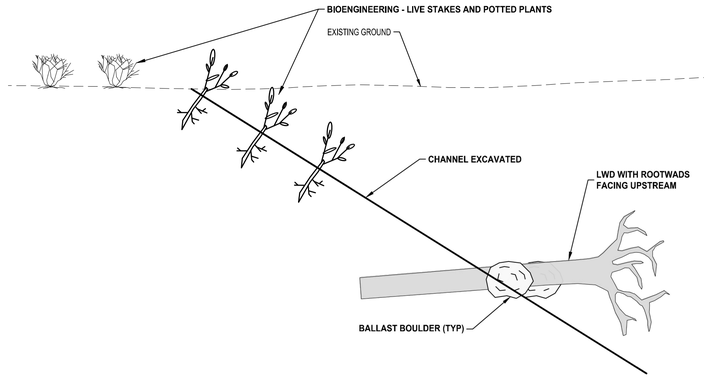
CR-33 LORENZETTA CREEK - PHASE 3B
TYPICAL SECTIONS

Project No.	3427-023	Drawing No.	Rev.
Group	CIVIL	C-304	1



LARGE WOODY DEBRIS STRUCTURE - PLAN

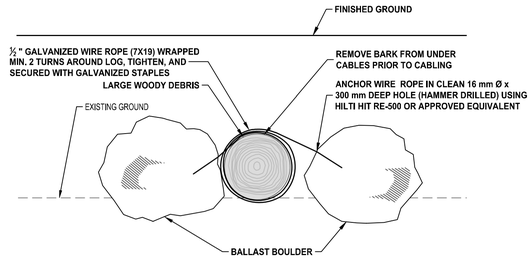
Scale NTS



LARGE WOODY DEBRIS STRUCTURE - SECTION

A
-

Scale NTS



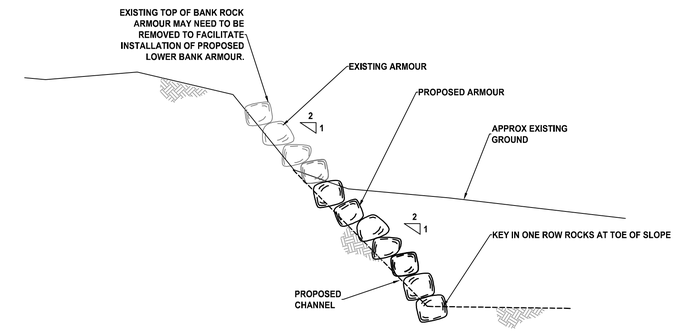
BALLAST CONNECTION DETAIL

Scale NTS

LOG SCHEDULE						Ballast Boulders	
RIVER STATION AND BANK	LWD Location	TRUNK ø (MM)	TRUNK LENGTH (m)	BURIAL LENGTH (m)	INVERT ELEVATION (m) (@point of Embedment)	Quantity	Diameter (m)
STA 0+420 LB	LWD 1 (under)	650	4.7	3.5	27.3	0	0
STA 0+420 LB	LWD 2 (over)	450	6.3	4.5	27.9	0	0
STA 0+435 LB	LWD 3 (under)	580	6.3	4.0	27.4	0	0
STA 0+435 LB	LWD 4 (over)	400	6.5	4.5	27.9	0	0
STA 0+450 LB	LWD 5 (under)	500	4.5	3.0	27.5	0	0
STA 0+450 LB	LWD 6 (over)	400	5.0	4.5	27.9	0	0
STA 0+480 LB	LWD 7	300	7.0	5.5	28	2	0.7
STA 0+545 RB	LWD 8	240	5.4	4.0	28	1	1
STA 0+595 RB	LWD 9	280	5.0	3.8	27.7	0	0
STA 0+630 RB	LWD 10 (under)	250	4.2	3.1	27.3	0	0
STA 0+630 RB	LWD 11 (over)	300	5.8	4.4	27.5	0	0
STA 5+280 RB	LWD 12	300	5	4.0	27.5	0	0
STA 5+260 RB	LWD 13	300	5	3.8	27.6	0	0
STA 5+210 RB	LWD 14	300	5	3.5	27.8	0	0
STA 5+200 RB	LWD 15	300	5	3.5	27.8	0	0
STA 5+190 RB	LWD 16	300	5	3.5	27.8	0	0

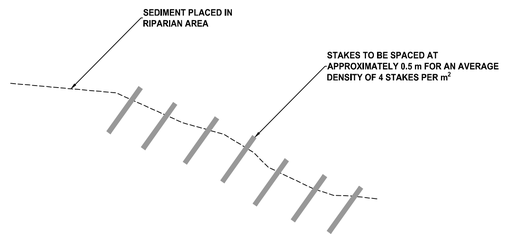
*Invert elevation is approximate. LWD should be installed so it is partly below the water surface during low flows

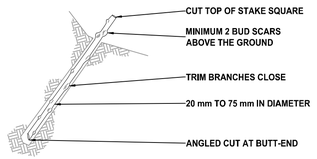
TABLE - LARGE WOODY DEBRIS (LWD)



BANK PROTECTION DETAIL

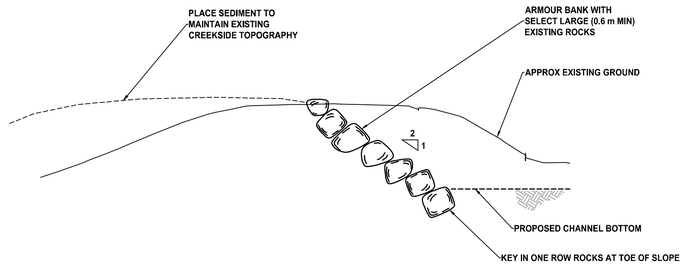
Scale NTS





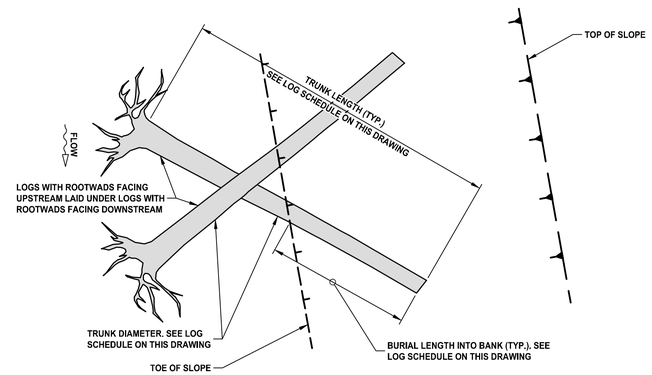
WILLOW STAKING DETAIL

Scale NTS



BANK RELOCATION DETAIL

Scale NTS



MULTIPLE LARGE WOODY DEBRIS STRUCTURE - PLAN

Scale NTS

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S. B. KOBERTON
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Rev	Date	Des	Dwn	Chk	Description

BC MINISTRY OF ENVIRONMENT & CLIMATE CHANGE STRATEGY

CR-33 LORENZETTA CREEK - PHASE 3B

TYPICAL DETAILS

Project No.	3427-023	Drawing No.	C-501	Rev.	1
Group	CIVIL				

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Enclosure B

Regulatory Approval Documents

Paragraphs 34.4(2)(b) and 35(2)(b) *Fisheries Act* Authorization

Authorization issued to:
BC Ministry of Environment and Climate Change Strategy *(hereafter referred to as the "Proponent")*

Attention to: Gulraiz Cheema
PO Box 9337 Stn Prov Gov't
Victoria, BC V8W 9M1
Gulraiz.Cheema@gov.bc.ca

Location of Proposed Project

Municipality: Laidlaw
Province: British Columbia
Name of watercourse: Lorenzetta Creek
Longitude and latitude: 49.328090, -121.602057 (upstream) to 49.325402, -121.608990 (downstream)

Valid Authorization Period

This Authorization remains in force from the **Date of Issuance** until **December 31, 2035.**

Please note that this Authorization may contain more specific timing requirements and limitations. These are set out in the Conditions of Authorization section.

Description of Proposed Project

The proposed project of which the works, undertakings or activities authorized are a part of involves:

- Flood protection works to address sediment accumulation and erosion concerns in Lorenzetta Creek to mitigate risks to adjacent properties. The works are part of BC Ministry of Environment and Climate Change Strategy's response to the 2021 Atmospheric River Event.

The project is described in the following documents (*hereafter referred to as the "Project Plan"*):

- *Application Form for the Issuance of an Authorization under Paragraphs 34.4(2) (b) and 35(2)(b) of the Fisheries Act (Non-Emergency Situations)* prepared by Kerr Wood Leidal Associates Ltd., dated February 6, 2024;
- *Lorenzetta Creek ARE Flood Recovery Works - Environmental Assessment and Offsetting Plan* prepared by Kerr Wood Leidal Associates Ltd., dated June 10, 2024;
- *ARE Flood Recovery Works – Lorenzetta Creek Sediment Removal – Phase 3 Construction Environmental Management Plan – Draft* prepared by Kerr Wood Leidal Associates Ltd., dated April 16, 2024.

- *Table Summary Response To DFO Information Request,* prepared by Kerr Wood Leidal Associates Ltd., dated April 19, 2024; and,
- *Technical Memorandum,* prepared by Kerr Wood Leidal Associates Ltd., dated January 11, 2024.

Description of Authorized works, undertakings or activities likely to result in the harmful alteration, disruption or destruction (HADD) of fish habitat:

- Clearing and grubbing of riparian vegetation within the project footprint;
- Establishment of access routes and a sediment stockpile location;
- Excavation of sediment from and regrading of approximately one (1) kilometre of Lorenzetta Creek; and
- Bank stabilization using excavated sediments and bio-engineering (i.e., vegetated armouring).

The authorized works, undertakings or activities are likely to result in the following impacts to fish and fish habitat:

- Harmful alteration, disruption or destruction of not more than 4,341 m^2 of aquatic habitat and not more than 4,622 m^2 of riparian habitat in Lorenzetta Creek.

The works, undertakings or activities associated with the proposed project described above, are not expected to result in the death of fish provided that avoidance and mitigation measures described in the Project Plan and outlined in the Conditions of Authorization below are effectively implemented. Any death of fish resulting from this project should be demonstrated to have been unavoidable or accidental. DFO should be notified immediately in such circumstances via an email to DFO.PACViolations-InfractionsPAC.MPO@dfo-mpo.gc.ca and to Observe, Record, Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca.

Conditions of Authorization

The above described works, undertakings or activities must be carried on in accordance with the following conditions.

1. **Conditions that relate to the period during which the works, undertakings or activities can be carried on**

   The works, undertakings or activities that are authorized to be carried on during the following period:

   From: **Date of Issuance** To: **September 15, 2024.**

   If the Proponent cannot complete the works, undertakings or activities during this period, Fisheries and Oceans Canada (DFO) must be notified in advance of the expiration of the above time period. An application for amendment, suspension or cancellation of the authorization should be submitted to DFO.

   The periods during which other conditions of this Authorization must be complied with are provided in their respective sections below.

2. Conditions that relate to measures and standards to avoid and mitigate impacts to fish and fish habitat

2.1 The Proponent shall adhere to all designs and avoidance and mitigation measures outlined in the Project Plan for the protection of fish and fish habitat. In the event of a conflict between those measures and the conditions of this Authorization, the more precautionary condition shall prevail, so long as conditions of this Authorization are not contravened. The specific measures and standards to avoid and mitigate impacts to fish and fish habitat are outlined in the Project Plan.

2.2 Environmental Monitoring: The Proponent shall retain an appropriately Qualified Environmental Professional (QEP) to oversee measures and standards to avoid and mitigate impacts to fish and fish habitat. The QEP (or Environmental Monitors working under the direction of the QEP) shall monitor the implementation of the conditions of this Authorization and shall be onsite at all times during all works, undertakings or activities below the high water mark. The QEP shall ensure the measures and standards to avoid and mitigate impacts to fish and fish habitat are effective, and that no additional harm to fish and fish habitat occurs other than what is authorized herein.

2.3 Erosion and sediment control (ESC) measures: ESC measures must be in place and shall be monitored and maintained, such that release of sediment to fish and fish habitat is minimized or avoided at the location of the authorized works, undertakings or activities.

2.3.1 The QEP shall carry out routine quantitative (e.g., turbidity or total suspended solids) monitoring to detect increased suspended sediment in fish habitats both within and in areas adjacent to the project footprint. Monitoring shall occur during works below the high water mark (e.g., sediment excavation), and/or at any time suspended sediment from the project site and/or authorized works, undertakings or activities may exceed aquatic guidelines. The QEP shall provide direction on appropriate corrective actions as needed (e.g., suspend works, maintain or improve erosion and sediment control measures, etc.).

2.3.2 All riparian areas that have been disturbed during works shall be restored to a stable condition and protected against erosion as soon as works are completed with native species suitable for the site.

2.4 Works below the high water mark: Works within Lorenzetta Creek shall be conducted under dry conditions. If the work area is not naturally dry at the start of construction, instream works, undertakings or activities shall be conducted in accordance with applicable measures and standards from DFO's interim standard for in-water site isolation. Ensure pumps are screened to prevent entrainment or impingement of fish according to DFO's Interim Code of Practice for End-of-pipe Fish Protection Screens for Small Water Intakes. It is the Proponent's responsibility to obtain the necessary Federal and Provincial fish collection permits for fish salvage and follow the conditions therein.

2.4.1 Maintain hydrological conditions (e.g., depth and flow) downstream of the work area during all phases of the project.

2.5 Avoid deposit of deleterious substances: All equipment and machinery working on site shall be in good working order and maintained free of fluid leaks. Hydraulic machinery will use non-toxic, readily biodegradable hydraulic fluids where mechanically feasible. Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water. Develop and implement a spill prevention and emergency response plan to avoid a spill of deleterious substances into a watercourse.

2.6 Drought mitigation: Monitor current drought conditions as per the Provincial Drought Level Classification system (Level 0 – 5, Drought information – Province of British Columbia (gov.bc.ca)) during all instream works, undertakings or activities. If the Drought Level Classification is at Level 5, and works involve the loss of habitat that provides cold water refugia habitat for fish (e.g., deep pools), the QEP shall ensure salvaged fish are relocated to an area that provides similar habitat conditions (e.g., well-shaded habitat, habitat with known ground-water upwelling, pools, or undercut banks), and evaluate current on-site conditions and apply additional avoidance and mitigation measures as needed.

2.7 Contingency measures: Additional measures shall be put in place if the monitoring required in Section 3 below indicates that the measures and standards to avoid and mitigate impacts to fish and fish habitat are not successful.

2.8 Dates by which these measures and standards shall be implemented: The measures and standards to avoid and mitigate impacts to fish and fish habitat in Section 2 of this Authorization shall be implemented prior to, and where appropriate, during, and after the works, undertakings or activities.

3. Conditions that relate to monitoring and reporting of measures and standards to avoid and mitigate impacts to fish and fish habitat

3.1 Monitoring of avoidance and mitigation measures: The Proponent shall retain an appropriate QEP to monitor the implementation of avoidance and mitigation measures referred to in section 2 of this Authorization and report to DFO **within 90 days** following completion of the works. The report shall indicate whether the measures and standards to avoid and mitigate impacts to fish were conducted according to the conditions of this Authorization. This shall be done, by:

3.1.1 Demonstration of effective implementation and functioning:

3.1.1.1 A description of the completed works, undertakings or activities, including dimensions (e.g. regraded channel dimensions, habitat features incorporated, etc.);

3.1.1.2 A comparison of the completed works, undertakings or activities with the design dimensions or design drawings provided in the Project Plan; and

3.1.1.3 Dated photographs and inspection reports to demonstrate implementation and results of effectiveness monitoring of mitigation measures and standards referred to above, to limit the impacts to fish and fish habitat to what is authorized herein. Provide a figure illustrating the locations of mitigation measures and monitoring locations (e.g., ESC measures, total suspended solids, monitoring points).

3.1.2 Contingency measures: Provide details of any contingency measures that were followed, to prevent impacts greater than those covered by this Authorization in the event that mitigation measures did not function as described; and

3.1.3 As-builts: Provide georeferenced ‘as-built’ drawings and geospatial polygons that accurately represent the completed HADD footprints. Geospatial polygon data should be collected using WGS 1984 to four (4) decimal places (e.g., 28.5234°N, 80.6830°W). Geospatial polygon data must be supplied in Shape File (.shp, .shx, .dbf) format and .xml or .kmz format.

In addition, the following data must also be supplied in an Excel file (i.e., metadata):

- HADD area per habitat type (based on the high water mark);
- Dates when HADD of fish habitat was completed;
- Brand name and model of the GPS unit, the coordinate system used, and guaranteed accuracy of the GPS unit.

3.2 Report Submission: All required reports and geospatial polygons (.shp files) are to be submitted to ReferralsPacific@dfo-mpo.gc.ca, with reference to DFO File Number: 24-HPAC-00116.

4. **Conditions that relate to the offsetting plan**

4.1 Scale and description of offsetting measures: The offsetting measures shall be carried out in accordance with the measures set out in the Proponent's offsetting plan, as described in the Project Plan. The offsetting measures include:

- Enhancement of not less than 1,148 m^2 of rearing habitat through the regrading of channel dimensions and incorporation of large woody debris throughout an existing off-channel; and
- Removal of invasive species and planting of native trees and shrubs throughout not less than 5,397 m^2 of riparian habitat.

4.2 Implementation of offsetting measures: Construction of all offsetting measures shall be completed by **December 31, 2024**. The proponent shall retain a QEP to monitor the implementation and effectiveness of the offsetting measures. Effectiveness monitoring shall be conducted for a period of ten (10) years post-completion of the offsetting measures described herein. The final monitoring report is due by **December 31, 2034**, at the end of the ten (10) year monitoring period.

4.3 Offsetting criteria to assess the implementation and effectiveness of the offsetting plan: The Proponent will be considered to have met the requirements of this Authorization as it pertains to fish habitat offsetting measures once they are able to demonstrate fulfilment of the criteria described in Section 8 of the Proponent's offsetting plan, which is part of the Project Plan, and summarized in the following table:

Component	Monitoring Metric	Performance Measures
Fish Habitat	Water Quality	Water quality will be consistent with BC Water Quality Guidelines for the Protection of Aquatic Life and within typical ranges of water temperatures suitable for target fish species and life stages.
	Water Quantity/Flow	Habitat continuously wetted with average target water depths and velocities for target fish species and life stages.
	Habitat Quantity/Quality	Habitat areas consistent with as-builts. Large woody debris structures are to be in sufficient condition; normal wear and tear with limited localized damage.
Fish Community	Diversity	Assemblage composed of some or all of the predicted fish species (i.e., Pacific Salmon and Trout) and life stages (i.e., juvenile and adult).

	Relative Abundance	Catch per unit effort of juvenile salmonids is consistent with, or greater, than the reference sites identified in the Proponent's offsetting plan.
Riparian Habitat	Vegetation Cover	80% cover, stable to increasing native plant composition and cover, and less than 5% invasive species plant coverage.
	Density and Survival	100% survival of planted trees and at least 80% survival of planted shrubs.
	Riparian Stability	Stable site conditions, improved vegetation success, and continued succession.

4.4 Contingency measures: If the results of monitoring as required in Section 5 indicate that the offsetting measures are not completed by the date specified and/or are not functioning according to the above criteria in Section 4.3, the Proponent shall give written notice to DFO and retain a QEP to implement contingency measures and associated monitoring measures to ensure the offsetting is completed and functioning as required by this Authorization.

4.4.1 Scale and description of contingency measures: If the results of the monitoring determine that offsetting measures are not functioning appropriately, the QEP will determine the cause(s) for failure, develop a contingency plan to address the failure, and implement corrective actions within one calendar year. The contingency offsetting measures shall be approved by DFO, in an amendment to this Authorization, prior to implementation. Final determination of the suitability and sufficiency of the contingency measures to offset for the harmful alteration, disruption or destruction of fish habitat, account for time lag, and development of criteria to assess the effectiveness of contingency offsetting, is at the discretion of DFO.

4.4.2 Monitoring measures to ensure offsetting contingency is completed and/or functioning as required: Contingency measures shall be monitored per the requirements described in the DFO approved Contingency Offsetting Plan.

4.5 The Proponent shall not carry on any works, undertakings or activities that will adversely impact the offsetting measures.

5. **Conditions that relate to monitoring and reporting of implementation of the offsetting plan (described in section 4)**

5.1 Schedule(s) and criteria: The Proponent shall retain a QEP to monitor the implementation and effectiveness of offsetting measures according to the timeline and criteria below:

5.1.1 Effectiveness monitoring shall commence in 2025, the year after offsetting measures have been constructed, and shall be carried out over a period of 10 years, with monitoring occurring in years 1, 2, 3, 5, 7, and 10, at a time during each monitoring year that allows for the criteria described in Condition 4.3 of this Authorization to be assessed.

5.1.2 In the event of the implementation of contingency measures, monitoring of contingency measures shall occur according to a frequency described in the DFO approved Contingency Offsetting Plan.

5.2 Reporting of the offsetting measures: The QEP shall report to DFO on whether the offsetting measures were implemented and functioning according to the conditions of this Authorization by providing the following:

5.2.1 Offsetting Construction: **Within 90 days** of the completion of offsetting construction, provide a written assessment to DFO on whether the offsetting measures were constructed in accordance with the conditions of this Authorization. The report shall include, at a minimum, the following:

5.2.1.1 Geo-referenced 'as-built' drawing(s) of the completed offsetting measures, including areal footprints;

5.2.1.2 A description of the completed offsetting measures, including dimensions (e.g., area, elevation, slope, etc.) and materials used;

5.2.1.3 A comparison of the completed offsetting measures with the proposed offsetting measures described in the Proponent's offsetting plan and in Condition 4.1 of this Authorization;

5.2.1.4 Dated photographs of the offsetting measures post-offset construction;

5.2.1.5 Establishment of fixed photo points that will be used to document changes of the offsetting measures over time;

5.2.1.6 A summary of the effectiveness of mitigation measures and standards implemented during construction of the offsetting measures; and

5.2.1.7 Recommendations as to whether additional offsetting measures are required to meet the requirements of the Authorization.

5.2.2 Offsetting Effectiveness: The QEP, on behalf of the Proponent, shall report on the effectiveness of the offsetting measures in accordance with the conditions of this Authorization. Monitoring reports are required for each year of monitoring following construction of offsetting measures. The reports are to be submitted to DFO by **December 31** of each monitoring year. The reports shall include, at a minimum, the following:

5.2.2.1 A description of the methods used to assess the offsetting measures.

5.2.2.2 Updates to the geo-referenced 'as-built' drawing(s) delineating the area of the offsetting measures, including areal footprints, if there have been any changes to the offsetting habitats;

5.2.2.3 An assessment of the success of the offsetting measures (to date) in accordance with the criteria listed in the Proponent's offsetting plan and in Condition 4.3 of this Authorization;

5.2.2.4 An assessment of the stability of the offsetting measures, identifying any signs of potential erosion, accretion, failure, movement or other physical alteration that may affect the stability and long-term success of the offsetting measures;

5.2.2.5 Geo-referenced and dated photographs or video documenting the offsetting measures for the respective monitoring period (including at fixed photo points to document changes over time);

5.2.2.6 Identification of any function concerns related to the offsetting measures and a description of any remedial measures taken; and

5.2.2.7 The final Offsetting Effectiveness Monitoring Report (Year 10), shall include an evaluation of whether the offsetting measures undertaken counterbalanced the authorized impacts to fish and fish habitat resulting from the authorized works, undertakings or activities.

5.2.3 Geospatial Polygons and Data: The Proponent shall provide a geospatial polygon that accurately represents the completed offset footprint(s). Geospatial polygon data should be collected using WGS 1984 to four (4) decimal places (e.g., 28.5234°N, 80.6830°W). Geospatial polygon data must be supplied in Shape File (.shp, .shx, .dbf) format and .xml or .kmz format.

In addition to the geospatial polygon, the following data must also be supplied in an Excel file (i.e. metadata):

- Area of the offset per habitat type (based on high water mark);
- Target species of offset habitat;
- Dates offsetting completed, date of maintenance, and date monitored;
- Brand name and model of GPS unit, the coordinate system used, and guaranteed accuracy of GPS unit.

5.3 Report Submission: All required reports and geospatial polygons (Shape files) are to be submitted to ReferralsPacific@dfo-mpo.gc.ca, with reference to DFO File Number: 24-HPAC-00116**.**

Authorization Limitations and Application Conditions

The Proponent is solely responsible for plans and specifications relating to this authorization and for all design, safety and workmanship aspects of all the works associated with this authorization.

The holder of this authorization is hereby authorized under the authority of Paragraphs 34.4(2)(b) and 35(2)(b) of the *Fisheries Act*. R.S.C., 1985, c.F-14, to carry on the works, undertakings or activities that are likely to result in impacts to fish and fish habitat as described herein.

This authorization does not purport to release the Proponent from any obligation to obtain permission from any private landowner or to comply with the requirements of any other regulatory agencies.

This authorization does not permit the deposit of a deleterious substance in water frequented by fish. Subsection 36(3) of the *Fisheries Act* prohibits the deposit of any deleterious substances into waters frequented by fish unless authorized by regulations made by Governor in Council.

At the date of issuance of this authorization, no individuals of aquatic species listed under the *Species at Risk Act* (SARA) were identified in the vicinity of the authorized works, undertakings or activities.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to (http://www.dfo-mpo.gc.ca/pnw-ppe/CONTACT-eng.html) or to the DFO-Pacific Observe, Record and Report at 1-800-465-4336 or DFO.ORR-ONS.MPO@dfo-mpo.gc.ca.

The failure to comply with any condition of this authorization constitutes an offence under Paragraph 40(3)(a) of the *Fisheries Act* and may result in charges being laid.

A copy of this authorization will be kept on site while the work is in progress and upon request be provided to relevant federal or provincial officials. The authorization holder is responsible for ensuring work crews are familiar with, and able to adhere to, the conditions.

This authorization cannot be transferred or assigned to another party. If the works, undertakings or activities authorized to be conducted pursuant to this authorization are expected to be sold or transferred, or other circumstances arise that are expected to result in a new Proponent taking over the works, undertakings or activities, the Proponent named in this authorization shall advise DFO in advance.

Date of Issuance: August 14, 2024

Approved by: Chambers, Susan

Digitally signed by Chambers, Susan
DN: C=CA, O=GC, OU=DFO-MPO, CN="Chambers, Susan"
Reason: I am approving this document with my legally binding signature
Location:
Date: 2024.08.14 16:01:49-07'00'
Foxit PDF Editor Version: 13.1.2

Susan Chambers
Regional Director General Pacific Region
Fisheries and Oceans Canada

September 13, 2024 File Number: 2011227

Ministry of Environment and Climate Change Strategy
PO BOX 9337 Provincial Government
Victoria, BC V8W 9M1
Sent via email: Gulraiz Cheema | Gulraiz.Cheema@gov.bc.ca

Dear Gulraiz Cheema,

RE: Order for Change Approval # 2011227

For reasons set out in the enclosed order, the Ministry of Water, Land and Resource Stewardship, Surface Water Authorizations, has deemed it appropriate to amend the Approval under Section 26(1) of the Water Sustainability Act.

This new documentation should be attached to your copy of Approval # 2011227.

All other conditions of the original Approval dated July 30, 2024, still apply.

Section 105 of the Water Sustainability Act gives the recipient of this notice the right to appeal my decision. You may file an appeal within 30 days of the date indicated on this letter. Information on filing an appeal can be found on the Environmental Appeal Board website at http://www.eab.gov.bc.ca/.

Sincerely,

Barbara Sutherland

Barbara Sutherland
Assistant Water Manager

cc: Matt Sanders, KWL, Email: msanders@kwl.ca
Pradeep Poudel, Ministry of Water, Land and Resource Stewardship, Email: Pradeep.1.Poudel@gov.bc.ca

Enclosure(s): Section 26 Order

Ministry of Water, Land and Resource Stewardship
Stream Management Authorizations – South Coast
Website: www.gov.bc.ca/water
Suite 200, 10428 - 153 St
Surrey, BC V3R 1E1
Phone: (604) 586-4400
Fax: (604) 586-4444

September 13, 2024 File Number: 2011227

O R D E R
WATER SUSTAINABILITY ACT
Section 26 (1)

Approval File Number: 2011227

The Province of British Columbia *Water Sustainability Act* having received an amendment application for change of works and extension of time on 29 August 2024 to allow the completion of works, and being satisfied that no person's rights will be injuriously affected, I hereby amend the following Clause (h) and Clause (i) to read as follows and add clause (bb):

(h) Work in the stream and stream channel must only occur during the periods outlined below, so that the fisheries interests are protected:

1. Instream work during the reduced risk instream work window must occur during the period of August 1 to September 15; or
2. Based on project justification and risk, instream work outside of the reduced risk instream work window (as stated above) must occur subject to the following:
   - i. An appropriately Qualified Professional must provide advice to the holder of this Approval on the timing of the work based on: the nature of the works, environmental values (including fish, amphibians, wildlife, any listed species present), water quality, channel stability, weather conditions, water levels, and any other relevant factors);
   - ii. The Qualified Professional must also provide additional construction mitigation advice to prevent adverse environmental impacts, and daily or full-time supervision of all work in or near the stream;
   - iii. Work must be timed and planned appropriately, the stream must be completely dry or have marginal flows (naturally or achieved through appropriate isolation and diversion) for the duration of the construction activities; and
   - iv. The advice of the Qualified Professional on construction timing (as per (i) above) and mitigation measures (as per (ii) above), as well as the timing of work and the presence of the Qualified Professional, must be documented in writing. This documentation must be submitted as part of the post construction reporting for this project.

Ministry of Water, Land and Resource Stewardship
Stream Management Authorizations – South Coast
Website: www.gov.bc.ca/water
Suite 200, 10428 - 153 St
Surrey, BC V3R 1E1
Phone: (604) 586-4400
Fax: (604) 586-4444

(i) All works must comply with the following documents, and any minor changes hereafter. All mitigation measures outlined in the following documents must be implemented for the protection of aquatic habitat. Any major changes to the design must be submitted to the Water Manager for written authorization.

1. Draft report "ARE Flood Recovery Works- Environmental Assessment and Offsetting Plan" prepared by Kerr Wood Leidal Associates Ltd. for the Ministry of Environment and Climate Change Strategy dated February 6, 2024, and updated on April 19, 2024, and revised on June 10, 2024.
2. Draft report "ARE Flood Recovery Works- Lorenzetta Creek Sediment Removal- Phase 3 Construction Environmental Management Plan" prepared by Kerr Wood Leidal Associates Ltd. for the Ministry of Environment and Climate Change Strategy dated February 6, 2024, and updated on April 16, 2024 and revised on May 29, 2024.
3. Final Report (Living Document) " ARE Flood Recovery Works- Lorenzetta Creek Sediment Removal- Phase 3 Construction Environmental Management Plan" prepared for BC ministry of Environment and Climate Change Strategy by Kerr Wood Leidal Associates dated August 16, 2024.
4. Engineering drawings Issued for Review CR-33 Lorenzetta Creek- Phase 3 B (Project No. 3427- 023) " G-001 Location Plan, Key Plan, Drawing List and Survey Control"; " G-002 General Notes and Legend"; "C-101 Existing Conditions and Site Access Plan"; "General Arrangement Site Plan"; "C-111 Plan and Profile STA0+000 To 0+160"; "C-112 Plan and Profile STA 0+160 to 0+320"; "C-113 Plan and Profile STA 0+280 To 0+480"; " C-114 Profile 5A and Cross Section"; "C-301 Cross Sections- Area 1 STA 0+050 to 0+120"; " C-302 Cross Sections- Area 2 STA 0+180 to 0+300"; " " C-303 Cross Sections- Area 3 and 4 STA 0+360 to 0+430"; "C-304 Typical Sections"; "C-501 Typical Details" prepared by Kerr Wood Leidal for BC Ministry of Environment and Climate Change Strategy dated April 4, 2024.
5. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B " G-001 Location Plan, Key Plan, Drawing List and Survey Control" prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
6. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B " G-002 General Notes and Legend" prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
7. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B "C101- Site Access Plan" prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
8. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B "C102- General Arrangement Site Plan" prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.

9. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B “C111- Lorenzetta Creek (STA 0+000 to STA0+160) Plan and Profile” prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
10. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B “C112- Lorenzetta Creek (STA 0+160 to STA0+320) Plan and Profile” prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
11. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B “C113- Lorenzetta Creek (STA 0+280 to STA 0+480) Plan and Profile” prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
12. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B “C114- Lorenzetta Creek (STA 0+660 to STA 0+720) Plan and Profile, and Cross Section” prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
13. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B “C115- Lorenzetta Creek (STA 5+160 to STA 5+310) Plan and Profile, and Cross Section” prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
14. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B “C-301 Cross Sections- Area 1 and 6 STA 0+050 to 0+120” prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
15. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B “C-302 Cross Sections- Area 2 STA 0+180 to 0+300” prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
16. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B “C-303 Cross Sections- Area 3 STA 0+360 to 0+430” prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
17. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B “C-304 Typical Sections” prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
18. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B “C-501-Typical Details” prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.
19. Engineering Drawing Issued for Construction for CR-33 Lorenzetta Creek-phase 3 B “E-101 Planting Plan” prepared for Ministry of Environment and Climate Change Strategy dated August 14, 2024.

(bb) A full time environmental monitor must be on site during all in-stream works occurring after September 15 to monitor the downstream reaches for migrating salmonids. In the event that adult salmonoids are observed, all in-stream work must stop immediately.

All other conditions of Approval 2011227 remain unchanged.

Dated at Surrey, BC this 13th day of September 2024.

Sincerely,

Barbara Sutherland

Barbara Sutherland
Assistant Water Manager

July 30, 2024 File Number: 2011227

Gulraiz Cheema
Ministry of Environment and Climate Change Strategy
PO BOX 9337 Provincial Government
Victoria, BC V8W 9M1
Sent via email: Gulraiz.Cheema@gov.bc.ca

Dear Gulraiz Cheema,

Re: Application for approval to make changes in Lorenzetta Creek Within Lot 1,District Lot 8, Group 1, Lot 19 Except: Part Subdivided By Plan BCP28567 & Plan 40207, And Legal Subdivision 2 Section 29 Township 4 Range 27 West Of The 6th Meridian Yale Division Yale District New Westminster Together With Unsurveyed Crown foreshore or Land Covered by Water Being Part of the Bed of Lorenzetta Creek under PCL #29875.

A Change Approval for the above application has been granted and a *Water Sustainability Act* Section 11(1) Changes In and About a Stream Approval document verifying this is attached.

This Change Approval does not authorize entry onto private or Crown owned land. Permission of the affected landowner must be obtained and should be in writing for your protection.

This Approval does not constitute authority of any other agency. The holder of this Approval shall have the necessary permits from other agencies concerned prior to the commencement of the works authorized herein. The permit holder is required to adhere to all other applicable Provincial and Federal Regulations.

A copy of this Approval (and associated plans/drawings listed on this Approval) must be available for inspection, upon request, at any location where the authorized changes in and about a stream are being undertaken.

The holder of this Approval must advise Water Authorizations at SouthCoastWSAReporting@gov.bc.ca with the Approval number in the subject line, five (5) working days prior to commencement and five (5) working days following completion of the authorized work to facilitate the timing of auditing.

Ministry of Water, Land and Resource Stewardship
Stream Management Authorizations – South Coast
Website: www.gov.bc.ca/water
Suite 200, 10428 - 153 St
Surrey, BC V3R 1E1
Phone: (604) 586-4400
Fax: (604) 586-4444

The holder of this Approval must have permits or other written consent from any affected property/right-of-way holders before commencing work that could affect utilities or other structures within the property or rights-of-way.

This Approval requires the oversight of an appropriately Qualified Professional. For the purposes of this authorization, that professional must be registered with one of the five professional regulatory bodies named under the *Professional Governance Act* of British Columbia. They must be in good standing and acting under that professional regulatory body's code of ethics and subject to disciplinary action by that professional regulatory body.

Please ensure that machinery is free of invasive plant material that could potentially be transported throughout or between sites. In addition, ensure that invasive species removed from a site are disposed of appropriately.

When choosing compensation/restoration locations, it is encouraged to avoid areas that are isolated or are discontinuous from existing habitat, to avoid creating habitat sinks, and enable wildlife access.

For the protection of wildlife species, the Qualified Professional is responsible for planning and implementing fish and wildlife salvages prior to any instream and riparian works. *Wildlife Act* permits must be obtained from the Ministry of Water Land and Resource Stewardship. (https://portal.nrs.gov.bc.ca/web/client/home).

The holder of this Approval shall ensure that any proposed development and/or changes do not impact traditional or special sites in accordance with the *Heritage Conservation Act* or the ability of First Nation community members to participate in traditional activities on the land and water.

Archaeological sites (both recorded and unrecorded) are protected under the *Heritage Conservation Act* and must not be altered or damaged without a permit from the Archaeology Branch. The holder of this Approval must advise everyone who will be involved in ground-disturbance and construction that if archaeological materials are encountered, activities must be halted, and the Archaeology Branch contacted at 250-953-3334 for direction.

Section 105 of the Water Sustainability Act gives the recipient of this notice the right to appeal my decision. You may file an appeal within 30 days of the date indicated on this letter. Information on filing an appeal can be found on the Environmental Appeal Board website at http://www.eab.gov.bc.ca/ .

If you have any questions or concerns regarding the document issued or the content of this letter, please contact the South Coast Office at WaterActReferrals.LowerMainland@gov.bc.ca.

Sincerely,

Michael Currie
Assistant Water Manager

Cc: Christy Juteau, KWL, Email: cjuteau@kwl.ca
Pradeep Poudel, Ministry of Water, Land and Resource Stewardship, Email: Pradeep.1.Poudel@gov.bc.ca
Nooaitch Indian Band
Peters First Nation
Popkum First Nation
People of the River Referral Office (PRRO)
Union Bar First Nation

Province of British Columbia
Water Sustainability Act

PERMIT# 29875 AUTHORIZING THE OCCUPATION OF CROWN LAND

The holder of this permit, Ministry of Environment and Climate Change Strategy (29875), whose Change Approval authorizes changes in and about a stream (Lorenzetta Creek), is hereby authorized to occupy Crown Land by constructing, maintaining and operating the works as authorized in the Change Approval (2011227).

(a) The Crown land which is authorized to be occupied under this permit is a portion of Unsurveyed Crown foreshore or Land Covered by Water Being Part of the Bed of Lorenzetta Creek , the location of which is shown approximately on the plans associated with said Change Approval.

(b) The approximate dimensions of the Crown Land authorized to be occupied under this permit, are for approximately 0.4861 hectares.

(c) Prior to cutting, destroying or clearing of any timber necessary to construct, maintain and operate the said works or the clearing of the said lands which may be flooded, the permittee shall apply for and obtain a licence to cut timber from the Ministry of Forests, District Manager. The amount of stumpage, royalty and/or compensation payable to the Crown in respect of trees, including merchantable or young growth, cut, removed, damaged, or destroyed by the permittee, shall be the sum or sums fixed by the Forest Service of the Province of British Columbia.

(d) This permit is appurtenant to the land, mine, or undertaking to which the aforesaid Change Approval is appurtenant.

(e) This permit shall become void if the Change Approval with respect to which the permit is issued should terminate, be abandoned or cancelled, or amended so as to render this permit unnecessary.

(f) This permit is issued and accepted on the understanding that the permittee shall indemnify and save harmless the Government of the Province of British Columbia for all loss, damage to works, cost or expense suffered by the permittee by reason of the Crown land or any portion thereof being submerged or damaged by erosion or otherwise affected by flooding.

(g) The holder of this permit shall not be entitled to compensation if the Crown grants permits to other persons to occupy the land affected by this permit.

(h) In the event of a dispute at any time with respect to the area or boundaries of the land affected by this permit, the holder shall, at his own expense, have the said land surveyed by a duly authorized surveyor.

Michael Currie
Assistant Water Manager

July 30, 2024 File Number: 2011227

APPROVAL

WATER SUSTAINABILITY ACT - Subsection 11(1) and 11(2)
(Changes in and about a stream)

Ministry of Environment and Climate Change Strategy

is hereby authorized to make changes in and about a stream as follows:

(a) The name of the stream is Lorenzetta Creek.

(b) The Changes to be made in and about the stream are:

1. Within Area 1:
   - i) Remove sediment accumulation from the channel bottom to restore the deep end of the pool area to condition before the 2023 flood event, impacting an area over approximately 1064 square metres.
   - ii) Riparian planting along bank slopes and on the top of bank over approximately 222 square metres.

2. Within Area 2:
   - i) Pull back the right bank by approximately 5 m to increase channel capacity.
   - ii) Lower channel bottom by approximately 1.5 m to increase channel capacity and regrade bank slopes to 2H:1V while retaining the existing 2 m bottom channel width.
   - iii) Riparian planting.

3. Within Area 3:
   - i) Pull back the top of bank by up to 5 m along the right bank and 3 m along the left bank to increase channel capacity.
   - ii) Lower channel bottom by approximately 1.5 m to increase channel capacity and regrade bank slopes from a 1:5H:1V to a 2H:1V while retaining the existing 2 m bottom channel width.
   - iii) Armor banks with existing large river boulders to mitigate increased erosion.
   - iv) Riparian planting.

Ministry of Water, Land and Resource Stewardship
Stream Management Authorizations – South Coast
Website: www.gov.bc.ca/water
Suite 200, 10428 - 153 St
Surrey, BC V3R 1E1
Phone: (604) 586-4400
Fax: (604) 586-4444

4. Within Area 4- Downstream pool
    i) Pull the left bank back up to 20 m to facilitate the construction of a deepened and widened pool.
    ii) Excavate pool to up to 2.5 m below the existing grade.
    iii) Remove approximately 1100 square metres of riparian vegetation to facilitate authorized works.
    iv) Plant native riparian trees and shrubs along the constructed bank to provide shading for the constructed fish habitat.
    v) Install large woody debris clusters along the inside bend of the pool to provide instream habitat complexity and cover without compromising flow conveyance.

5. Within Area 5- Downstream Bank Repair
    i) Regrade bank, including excavated materials and large boulders from on-site, at the location of past avulsions over an area of approximately 590 square metres.
    ii) Remove invasive vegetation and plant the area with willow stakes to provide shade and improve riparian habitat.
    iii) Plant native live willow stakes above the high-water mark.

6. Within Area 4- Mainstem Offsetting Area:
    i. Install large woody debris (LWD) and remove invasive vegetation.
    ii. Plant native trees, shrubs and live willow stakes.

7. Within Area 6 – Side Channel Offsetting Area
    i) Excavation of sediments over approximately 1148 square metres to a maximum depth of approximately 2 metres.
    ii) Placement of large woody debris.
    iii) Removal of invasive riparian vegetation.
    iv) Planting of native vegetation.

Within Lot 1, District Lot 8, Group 1, Lot 19 Except: Part Subdivided By Plan BCP28567 & Plan 40207, And Legal Subdivision 2 Section 29 Township 4 Range 27 West Of The 6th Meridian Yale Division Yale District New Westminster Together with Unsurveyed Crown foreshore or Land Covered by Water Being Part of the Bed of Lorenzetta Creek held under PCL # 29875.

(c) The location of the works is at the following coordinates, as provided by the applicant: 49.3279360, -121.6034970.

(d) The works authorized in this Approval shall be completed on or before. December 31, 2024.

(e) The holder of this Approval shall take reasonable care to avoid damaging any land, works, trees or other property and shall make full compensation to the owners for any damage or loss resulting from the exercise of rights granted hereunder.

(f) All works associated with the Effectiveness Monitoring Plan, as outlined in clause (z) below, shall be completed by December 1, 2028, ten years after the works are completed.

(g) As much as is practicable, the construction area(s) and access routes must be marked on-site prior to starting groundwork. Any vegetation removal must be minimized and limited only to the areas required for active construction, with consideration for the timing and scheduling of work.

(h) Work in the stream and stream channel shall occur only during the period of August 1 to September 15 so that the fisheries interests are protected.

(i) All works shall be completed within the designed project footprint and in accordance with the following:

1. "ARE Flood Recovery Works- Environmental Assessment and Offsetting Plan" prepared by Kerr Wood Leidal Associates Ltd. for the Ministry of Environment and Climate Change Strategy, dated February 6, 2024, and updated on April 19, 2024.
2. "ARE Flood Recovery Works- Lorenzetta Creek Sediment Removal- Phase 3 Construction Environmental Management Plan", prepared by Kerr Wood Leidal Associates Ltd. for the Ministry of Environment and Climate Change Strategy, dated February 6, 2024, and updated on April 16, 2024.
3. Engineering Drawings Issued for Tender CR- 33 Lorenzetta Creek- Phase 3 B (Project No. 3427- 023) Prepared by Kerr Wood Leidal Prepared for Ministry of Environment and Climate Change Strategy dated June 13, 2024, including:
   3.1. G-001- G002 General
   3.2. C-101 Existing Conditions and Site Access Plan
   3.3. C-102 General Arrangement Site Plan
   3.4. C-111 Lorenzetta Creek (STA 0+000 To STA 0+160) Plan and Profile
   3.5. C-112 Lorenzetta Creek (STA 0+160 To STA 0+320) Plan and Profile
   3.6. C-113 Lorenzetta Creek (STA 0+280 To STA 0+480) Plan and Profile
   3.7. C-114 Lorenzetta Creek (Area 5) Plan and Profile
   3.8. C-115 Side Channel Habitat Restoration (STA 5+160 to STA 5+310) Plan and Profile
   3.9. C-301 Cross Sections – Area 1 and 5 STA 0+050 to 0+120
   3.10. C-302 Cross Sections – Area 2 STA 0+180 to 0+300
   3.11. C-303 Cross Sections – Area 3 STA 0+360 to 0+430
   3.12. C-304 Typical Sections
   3.13. C-501 Typical Details

(j) The holder of this Approval must hire an appropriately Qualified Professional to conduct Environmental Monitoring on all in-stream works authorized under this Approval. The Qualified Professional is responsible for observing the methods of construction and preparing information and reports on the compliance of the construction activities. The Qualified Professional shall:

1. Ensure all best management practices and mitigation measures are in place to avoid and minimize environmental impact on the land and on fish and fish habitat of the stream.
2. Where applicable, assist in the isolation of the stream prior to the commencement of works.
3. Implement and ensure erosion and sediment control measures are constructed, installed, and maintained appropriately for the full duration of instream works.
4. Supervise all instream works authorized under this Approval.
5. When the works involve temporary diversions to isolate the work site,
    i) Monitor all diversion works daily to ensure pumps & flow bypasses are in proper working condition;
    ii) Ensure diversion works that include pump intakes be screened for fish and aquatic species in accordance with the "Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater" (Fisheries and Oceans Canada, 2020); and
    iii) Ensure fish are prevented from entering the works.
6. When the works involve dewatering or isolation of flow and the stream is known or suspected to contain fish and/or amphibians,
    i) Attend the site prior to conducting any instream works to complete fish and wildlife search and salvage(s);
    ii) Obtain any permits needed prior to undertaking the salvage(s); and
    iii) Inspect the extraction area for fish stranding at least once after water levels have declined.
    iv) Protect the species at risk and salvage under the direction of a Qualified Environmental Professional in the event of discovery of species at risk. The works shall not result in harm to species at risk.
7. Be granted authority to stop the work authorized under this Approval if deemed necessary to address risks to the environment. The Qualified Professional or their designate (specified in writing) must be on site during all phases of construction in and around the stream to ensure this component is upheld.
8. In the event of an environmental incident or non-compliance with any of the terms or conditions of this Approval, an appropriately Qualified Professional must immediately mitigate the situation. Within 48 hours, each incident must be reported to the Water Manager at SouthCoastWSAReporting@gov.bc.ca with the approval number in the subject line. The incident report shall describe mitigation measures employed and a rationale as to why works have resumed, or the next steps required before works may resume. The holder of this approval must follow the advice of the appropriately Qualified Professional.

(k) All work shall be carried out in accordance with the Provincial "Requirements and Best Management Practices for Making Changes In and About A Stream in British Columbia" (2022). The Provincial guidance document can be found at the following link: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/wsa-cias-requirements-bmps.pdf .

(l) The holder of this Approval must provide as-built drawings post-construction within 60 days of completion of the works. The drawings shall include all modifications made from the initial drawings during the construction process and include justification for the modifications. The drawings must be labelled with this Approval file number and labelled in the subject line of the email and submitted to SouthCoastWSAReporting@gov.bc.ca.

(m) Upon commencement of the project, work shall be pursued to completion as quickly as possible.

(n) All proposed works shall be completed in isolation of the stream flows.

(o) All equipment and machinery used in or near the stream channel:

1. Be in good operating condition and free of leaks, excess oil and grease.
2. Have a spill containment kit readily accessible on-site with operators and/or staff on site trained in handling and applying a spill kit appropriately to any spills/incidents.
3. Be refueled a minimum of 30 meters away from all streams.
4. Use environmentally sensitive hydraulic fluids which are non-toxic to aquatic life and which are readily or inherently bio-degradable.
5. Any spill of a substance that is toxic, polluting, or deleterious to aquatic life of reportable quantities must be reported to the Dangerous Goods Incident Report 24-hour phone line at 1-800-663-3456.

(p) Sediment and Erosion Control plans must be developed, designed, implemented and monitored by an appropriately qualified person. The plans, implementation and monitoring must also address stormwater pollution prevention for the duration of construction.

(q) Sediment and Erosion Control measures to prevent the release of silt, sediment or sediment-laden water must be in place before starting works that may result in sediment mobilization. Care shall be exercised during all phases of the work to prevent the release of silt, sediment, sediment-laden water, raw concrete, concrete leachate, or any deleterious substances. All control measures must meet or surpass the Requirements and Best Management Practices for Making Changes in and About a Stream in British Columbia (2022) and the "Land Development Guidelines for the Protection of Aquatic Habitat" (Fisheries and Oceans Canada and the British Columbia, 1993).

(r) Discharge and runoff water from the site into any watercourse(s) must comply with the BC Approved Water Quality Guidelines for the Protection of Aquatic Life (https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines) and/or the applicable Local Government Bylaw(s) .

Water quality monitoring must be conducted by an appropriately Qualified Professional or a designate (in writing) Environmental Monitor on every day in which instream works are being conducted. Measurements must be taken upstream of any works taking place and within the extent of the sedimentation downstream of where instream work is actively occurring. Measurements are to be taken immediately prior to works beginning, and then at regular intervals until the works are completed and may require additional frequency during wet weather conditions. Wet weather conditions will be defined as being equal to or greater than 25 millimetres of rainfall within a 24-hour period. All excavated material and debris shall be removed from the site or placed in a stable area above the high water mark of the stream. Mitigative measures must be applied to protect the excavated material and debris from erosion and reintroduction into the watercourse. These measures may include covering the material with erosion blankets, seeding and planting with native vegetation, or as otherwise directed by a Qualified Professional.

(s) All excavated material and debris shall be removed from the site or placed in a stable area above the high-water mark of the stream. Mitigative measures must be applied to protect the excavated material and debris from erosion and reintroduction into the watercourse.

(t) The holder of this Approval shall ensure that instream works are designed and installed so as not to restrict fish passage and/or lead to fish stranding. The works shall not result in depressions that have the ability to trap fish and other aquatic life.

(u) All temporary works (including a ford, stream crossing, flow bypass, and erosion and sediment control measures) shall be removed on completion of the project, and the stream channel restored to its natural condition.

(v) All disturbed areas of the banks of the stream shall be restored using native vegetation suitable for the site conditions.

(w) All rock used in the works must be clean and free of sediment producing material, durable, non-acid generating and suitably graded. Any other engineering material required for the construction of the works shall be clean of any substances deleterious to aquatic life.

(x) Drought mitigation: Monitor current drought conditions as per the Provincial Drought Level Classification system (Level 0 – 5, Drought information – Province of British Columbia (gov.bc.ca)) during all instream works, undertakings and activities. Instream works shall cease if the Drought Level Classification is at Level 5. The proponent shall contact WLRS under this circumstance to evaluate current on-site conditions and

additional avoidance and mitigation measures. Instream works may commence only after receiving written permission from WLRS.

1. If instream works are occurring during a period of drought or the dry summer period when the Drought Level Classification is below Level 5, and works involve the loss of habitat that provides cold water refugia for fish (e.g., deep pools), the QEP must ensure salvaged fish are relocated to an area that provides similar habitat conditions (e.g., well-shaded habitat, habitat with known ground-water upwelling, pools, or undercut banks).

2. Site isolation and fish salvage(s): Instream works, undertakings and activities where there is potential for fish presence shall only be carried out within previously isolated and salvaged areas. Incorporate applicable measures and standards from DFO's Interim standard: in-water site isolation and ensure pumps are screened to prevent entrainment or impingement of fish according to DFO's Interim Code of Practice for End-of-pipe Fish Protection Screens for Small Water Intakes. It is the Proponent's responsibility to obtain the necessary Federal and Provincial fish collection permits for fish salvage and follow the conditions therein. The isolation areas shall be inspected regularly and maintained throughout the project.

(y) The holders of water licence C045273, located downstream of the proposed works, are to be advised as soon as practicable prior to commencement of construction. If the proposed works cause or are expected to cause an adverse impact to quality of quantity of water available to the licence holders, the license holders are to be provided with an alternate supply of fresh water during the periods when water quality or availability will be adversely affected by the works.

(z) The holder of this Approval must retain an appropriately Qualified Professional to develop and implement a Five- Year Effectiveness Monitoring Plan for aquatic habitat and a Ten-Year Effectiveness Monitoring Plan for riparian habitat that includes:

1. Maintenance and monitoring of plantings (including watering);
2. Replacement of plantings, where necessary, to ensure 100% tree survival and minimum 80% shrub and other vegetation survival rate.
3. Invasive species management;
4. Monitor fish utilization of offsetting side channel habitat;
5. Monitoring function of habitat enhancements (e.g. large woody debris); and
4. Monitoring water flow and stream channel function with proposed adaptive management strategies to address shortfalls.

Annual reports must be submitted by December 1 of each calendar year following completion of construction to SouthCoastWSAReporting@gov.bc.ca. The reports and subject line of the email must be labelled with this Approval file number.

(aa) The holder of this Approval must provide a detailed post-construction report no later than December 1 of the year works were completed. The report must be submitted by email to SouthCoastWSAReporting@gov.bc.ca with the approval file number listed in

the subject line of the email and the title of the report. The report shall include a signed statement from an appropriately Qualified Professional summarizing:

1. The in-stream works undertaken;
2. The timing of those works;
3. The total in-stream area directly affected;
4. The pre-construction and post-construction surveys if undertaken;
5. The quantity of gravel removed;
6. Representative site photographs;
7. Whether or not they observed or were otherwise aware of any non-compliance with the terms and conditions of this Approval; and
8. A description of any environmental incidents, non-compliance or other difficulties, and how these were addressed and reported.

Sincerely,

Michael Currie
Assistant Water Manager

Innovation. Integrity.
Employee-Owned.

Enclosure C

Environmental Monitoring Plan

KERR WOOD LEIDAL
consulting engineers

Greater Vancouver
200 - 4185A Still Creek Drive
Burnaby, BC V5C 6G9
T 604 294 2088
F 604 294 2090

Technical Memorandum

DATE: April 10, 2025

TO: Gulraiz Cheema
BC Ministry of Environment and Climate Change Strategy

FROM: Matt Sanders, BIT, BC-CESCL
Christy Juteau, R.P.Bio.

RE: **Lorenzetta Creek Flood Recovery Project**
Effectiveness Monitoring Plan
Our File 3427.023

1. Introduction

1.1 Project Background

The Ministry of Environment and Climate Change Strategy (ENV) and the Fraser Valley Regional District (FVRD) have collaborated to address the impacts of sedimentation in Lorenzetta Creek due to the November 2021 atmospheric river event (ARE). A significant amount of sediment and gravel washed downstream, resulting in multiple avulsions, flooding of adjacent agricultural fields, and deposition of sediments within the creek itself and throughout the floodplain, causing damage to adjacent blueberry crops, septic system overflow, flooding of a Transmountain Pipeline expansion construction site, loss of farming equipment, and flooding of neighboring residential and agricultural properties downstream. Based on an initial hazard assessment, it was recommended that immediate work be undertaken to restore the creek alignment and reduce the risk of further flooding to adjacent agricultural land.

The FVRD undertook emergency works in early 2022, which involved rebuilding the banks where the avulsions occurred. The banks impacted by the avulsion were re-contoured and then armored as a short-term solution. In 2023, works included strategic removal of instream sediments to add more capacity by widening and deepening the upper reach of the Project area and deepening the lower reach. Excavated material was distributed along the banks to fill low spots within the riparian area.

In 2024, project work was continued to implement long-term flood protection solutions such as sediment removal, riparian planting prioritizing areas that were disturbed during 2023 works to build flood capacity, channel widening (~1-5 m on both sides), and construction of a widened and deepened channel pool. Offsetting was required to mitigate the impact of the work conducted in the channel mainstem. An existing side channel of the Lorenzetta mainstem was improved through removal of invasive vegetation, planting of riparian vegetation, widening and deepening the channel, and complexing the channel with large woody debris (LWD). Timbro Contracting is required to provide site maintenance for two years following completion of the project. This includes maintenance of the irrigation, watering the plants, and replacing plants that die to ensure the plant survival goals are met.

As part of 2024 works, a ten-year effectiveness monitoring plan was developed as required under the Water Sustainability Act Change Approval for Works in and About a Stream (Approval No. 2011227) and the Fisheries Act Authorization (File No. 24-HPAC-00116). The ten-year monitoring plan must be implemented to assess the effectiveness of the offsetting plan and the function of aquatic and riparian

habitat features, including vegetation survival, cover, and composition; fish species diversity and abundance; and water quality, flow and function. This technical memorandum outlines the monitoring objectives, protocol and schedule to be adhered to for the effectiveness monitoring plan.

2. Monitoring Objectives

The purpose of effectiveness monitoring is to ensure offsetting works are functioning as designed. The objectives of the offsetting will be used to identify metrics of success for the proposed works. The offsetting objectives were as follows:

- Improve rearing habitat for juvenile salmonids (LWD placement and side channel improvements), and
- Increase riparian plant biodiversity and density.

These components will be used to frame metrics of success for the effectiveness monitoring, as described below.

3. Monitoring Protocol

Effectiveness monitoring of offsetting measures will be conducted by appropriate Qualified Environmental Professional (QEP) or a team of QEPs. Generally, it is expected that monitoring will be completed by (or under supervision of) a Registered Professional Biologist (RPBio). It is anticipated that each monitoring visit will require two person days of work and one person day of reporting. KWL will conduct the monitoring until December 31, 2025. After December 31st, 2025, ENV will reassign the effectiveness monitoring duties for the remainder of the monitoring duration for the project.

The effectiveness monitoring study design will follow a Before, After, Control, Impact (BACI) experimental design. Aquatic habitat effectiveness monitoring will be conducted for five years following construction and riparian monitoring will occur for ten years following construction. This will allow sufficient time to ensure the vegetation has become established, and that all Project components are functioning as intended. Monitoring will occur twice a year during the monitoring years outlined below in Table 3-1, once in late summer (July/August) when plants are leafed out and water levels are lowest, and once in the late fall during Coho spawning season. This will facilitate accurate assessment of plant growth and survival, assessment of low-flow stream conditions, assessment of high-flow stream conditions, and fish usage. The fish sampling and water sampling locations are presented in Figure 3-1 below.

Table 3-1: Effectiveness Monitoring Schedule

	Year 1	Year 2	Year 3	Year 5	Year 7	Year 10
Aquatic Habitat Monitoring[1]	S/F	S/F	S/F	S/F	-	-
Riparian Restoration Monitoring	S	S	S	S	S	S
S = Summer, F= Fall						
[1] Scientific fish collection permits are required from the following regulatory agencies: Department of Fisheries and Oceans Canada (DFO) and the Ministry of Water, Land, and Resource Stewardship (WLRS).						

During each monitoring visit, the QEP will utilize the Effectiveness Monitoring Assessment Criteria (Table 3-2) to assess effectiveness of each offsetting component. Evaluation criteria results and associated comments will be compiled into the Monitoring Report Card (Enclosure A).

Path: \\kwl.ca\projects\3400-3499\3427-023\430-GIS\Pro Projects\3427023_Figures\3427023_Figures.aprx\3427023_Figure_3-1_Effectiveness | Date Saved: 3/28/2025 6:19 PM | Author: JLau

BC Ministry of Environment and Climate Change Strategy

Lorenzetta Creek Sediment Removal

KERR WOOD LEIDAL consulting engineers

Legend

- Large Wood Debris
- Fish Sampling Control Site
- Fish Sampling Reference Site
- Fish Sampling Treatment Site
- Before & After Fish Abundance & Water Quality Sampling Point
- Planting Area

Note:
Ten 10 m² circular plots will be randomly selected within the planting areas following planting.

Service Layer Credits:

Coordinate System: NAD 1983 CSRS UTM Zone 10N

Scale Disclaimer: The map scale of 1:2,000 is only valid on a 11"x17" print.

Project No. 3427.023
Date March 2025
Scale 1:2,000
0 20 40 80 m

Effectiveness Monitoring Plan

Figure 3-1

3.1 Rearing Habitat

Monitoring Question: Is the offsetting side channel habitat providing moderate to high quality habitat for rearing salmonids?

Rearing habitat will be assessed using a modified Fish Habitat Assessment Protocol[1]. This will include collection of data such as physical stream measurements (wetted width, mean depth, and maximum pool depth), assessments of available instream cover (LWD, deep pools, boulders, in stream vegetation, etc.), and canopy cover. Suitability surveys will be conducted in Areas 4, 5, & 6 at Fish Sampling Treatment sites (Figure 3-1).

In-situ water quality measurements will be collected in the mainstem of Lorenzetta Creek and the offsetting side channel. Measurements will include pH, temperature, turbidity, and dissolved oxygen. Values will be compared to provincial Approved or Working Water Quality Guidelines for the Protection of Aquatic Life.

Criteria for success: Side channel habitat assessment results of moderate to high quality and mean water quality results meet Approved or Working guidelines for the protection of aquatic life across the five years of monitoring.

Monitoring Question: Are juvenile salmon utilizing the offsetting side channel?

Abundance of juvenile salmonids (catch per unit effort) will be conducted in the offsetting side channel. This data will be compared with abundance data collected prior to enhancement works (July 2024) within the side channel as well as two reference sites within the mainstem of Lorenzetta Creek. Presence of juvenile salmon in the offsetting side channel will determine if rearing habitat enhancement has been successful.

Criteria for success: Annual juvenile salmonid abundance (catch per unit effort) within the side channel increases over pre-enhancement condition when standardized based on year-over-year abundances in the mainstem reference sites, on average over the five-year monitoring period.

Monitoring Question: Is fish abundance higher in the areas where large wood has been placed in the Lorenzetta Creek mainstem and the offsetting side channel?

Abundance of juvenile salmonids (catch per unit effort) will be assessed in the offsetting side channel, and in the Lorenzetta Creek mainstem using minnow traps. Fish abundance data near the installed LWD in Lorenzetta Creek will be compared to baseline data and reference sites with no woody debris on the bank of Lorenzetta Creek and the bank of the offsetting side channel. Six fish sampling locations have been selected (Figure 3-1). In the mainstem of Lorenzetta Creek, two treatment sampling locations will be located directly adjacent to LWD, and two reference sampling locations will be placed in areas with no LWD, downstream of the project area. In the side channel, one treatment sampling location will be located directly adjacent to LWD, and one control sampling location will be located within the side channel in an area with no LWD. Since there was no suitably similar habitat to the side channel near to the project site, no reference site was selected. For each sample point, two gee minnow traps should be set instream for a minimum of four hours.

[1] Johnston, N.T. and Slaney, P.A. 1996. Fish Habitat Assessment Procedures. British Columbia Ministry of Environment, Lands and Parks, and British Columbia Ministry of Forests, Watershed Restoration Program, Technical Circular No. 8. Victoria, BC

The Project will aim to increase the juvenile abundance from baseline conditions. Several published papers were reviewed to determine a suitable target increase. Impacts of LWD installation ranged from no effect on juvenile salmon[2] to resulting in 7.9 times increase in juvenile salmon abundance[3]. A study conducted in Washington and Oregon, LWD increased juvenile Coho density by 1.8 to 3.2 times over reference reaches[4]. Based on this study, the metric of success for the LWD installation will be increasing the density of salmon by 2 times over baseline conditions.

Criteria for success: Juvenile salmonid abundance (catch per unit effort) approximately 2 times greater than pre-construction results and/or reference sites with no LWD enhancement, on average over the five-year monitoring period.

Monitoring Question: Are the installed habitat structures structurally stable?

LWD and habitat boulders in the mainstem and side channel will be assessed for structural stability. Structural stability will be based on qualitative observations based on the criteria outlined in Table 3-2.

3.2 Riparian Habitat

Riparian monitoring will occur in the summer when plants are leafed out. Ten circular plots with an area of 10 m^2 will be placed randomly throughout the planting areas (approximately 2% of the total riparian planting area). These locations will be randomly selected following completion of the riparian planting. The functionality and success of the planted areas will be determined based on the following metrics.

Monitoring Question: Is the planted stock surviving and healthy?

Assessment of the success of plantings based on the proportion of plant survivorship and plant health. Planted shrubs should have a survival rate of 80% and planted trees should have a survival rate of 100%. Plant health will be assessed qualitatively by observing evidence of yellowing, grazing (i.e., uniform height reduction, widespread absence of leaf tips, waterfowl observed grazing on site), and/or other physical damage (e.g., smothering by logs or garbage).

Replacement planting, when deemed necessary, should be tracked to ensure appropriate adjustments to plant numbers and species for future years of monitoring of plant stock health and survivorship.

Quantitative assessment of the mean percent cover of invasive plants in each plant plot. Himalayan blackberry has been identified as an invasive plant of note.

Criteria for success: planted shrubs have a survival rate of 80% and planted trees have a survival rate of 100% at end of 10-year monitoring period.

[2] Walls, Caroline J., "The Effectiveness of Large Woody Debris Placement at Improving Freshwater Rearing Habitat and Enhancing Juvenile Salmon (Oncorhynchus spp.) Production" (2020). WWU Graduate School Collection. 937. https://cedar.wwu.edu/wwuet/937
[3] C. J. Cederholm, R. E. Bilby, P. A. Bisson, T. W. Bumstead, B. R. Fransen, W. J. Scarlett, J. W. Ward. 1997. Response of Juvenile Coho Salmon and Steelhead to Placement of Large Woody Debris in a Coastal Washington Stream. North American Journal of Fisheries Management. 17(4). 947-963. https://doi.org/10.1577/1548-8675(1997)017<0947:ROJCSA>2.3.CO;2
[4] P. Roni and T. Quinn. 2001. Density and size of juvenile salmonids in response to placement of large woody debris in western Oregon and Washington streams. Canadian Journal of Fisheries and Aquatic Sciences. 58(2). https://doi.org/10.1139/f00-246

Table 3-2: Effectiveness Monitoring Assessment Criteria

Components	Evaluation	
	Success Criteria are Met	Success Criteria are Not Met
Fish Rearing Habitat		
Water Quality	Mean of all targeted parameters (temperature, dissolved oxygen, pH and turbidity) meet Approved or Working BC Water Quality Guidelines for the Protection of Aquatic Life suitable for target fish species and life stages.	Mean of one or more targeted parameters does not meet Approved or Working BC Water Quality Guidelines for the Protection of Aquatic Life suitable for target fish species and life stages.
Water Quantity/Flow	Habitat continuously wetted with average target water depths and velocities for target fish species and life stages.	Habitat not continuously wetted with average target water depths and velocities for target fish species and life stages.
Fish Habitat Condition	Habitat areas consistent with as-builts. Side channel habitat assessment results of fair to good quality[5].	Side channel habitat assessment results of poor quality.
LWD Structure	LWD in sufficient condition; normal wear and tear with limited localized damage.	LWD in poor condition; evidence of LWD decay or movement.
Fish Community		
Diversity	Assemblage composed of some or all of the predicted fish species (i.e., Pacific Salmon and Trout) and life stages (i.e., juvenile and adult).	No salmonids observed.
Side Channel - Juvenile Salmonid Abundance	Annual juvenile salmonid abundance (catch per unit effort) within the side channel increases over pre-enhancement condition when standardized based on year-over-year abundances in the mainstem reference sites, on average over the five-year monitoring period.	Annual juvenile salmonid abundance within the side channel is lower than pre-enhancement condition results.
LWD - Juvenile Salmonid Abundance	Juvenile salmonid abundance (catch per unit effort) approximately 2 times greater than pre-construction results and/or reference sites with no LWD enhancement, on average over the five year monitoring period.	Juvenile salmonid abundance (catch per unit effort) less than 2 times greater than pre-construction results and/or reference sites with no LWD enhancement, on average over the five year monitoring period.
Riparian Habitat		
Vegetation Cover	80% cover, stable to increasing native plant composition and cover, and less than 5% invasive species plant coverage.	<80% native vegetation cover, >5% invasive species cover.
Planted Stock Density and Survival	100% tree survival and 80% shrub survival at the end of the 10-year monitoring period.	Less than 100% tree survival and 80% shrub survival at the end of the 10-year monitoring period.
Riparian Stability	Stable site conditions, improved vegetation success, and continued succession.	Unstable site conditions, decreased vegetation success.

[5] Table 5 from Johnston, N.T. and Slaney, P.A. 1996. Fish Habitat Assessment Procedures. British Columbia Ministry of Environment, Lands and Parks, and British Columbia Ministry of Forests, Watershed Restoration Program, Technical Circular No. 8. Victoria, BC

3.3 Photo Stations

Photo stations have been established to document the offsetting measures. Geo-referenced photos will be taken during each monitoring session (Table 3-3).

Table 3-3. Photo Station Locations listed Upstream to Downstream

Station Name	Location Description	Direction	Coordinates
Station 1 – downstream Lorenzetta Creek	Right bank, at the North end of Area 4 deep pool feature	Downstream	UTM Zone 10 601217.00 m E 5464807.00 m N
Station 1 – LWD Lorenzetta Creek	Right bank, at the North end of Area 4 deep pool feature	Across the creek, towards the LWD structures	UTM Zone 10 601217.00 m E 5464807.00 m N
Station 2 – upstream Lorenzetta Creek	Right bank, at the confluence of the side channel	Upstream	UTM Zone 10 601150.00 m E 5464623.00 m N
Station 2 – towards side channel confluence	Right bank, at the confluence of the side channel	Towards side channel confluence	UTM Zone 10 601150.00 m E 5464623.00 m N
Station 3 – side channel downstream	Top end of side channel	Downstream	UTM Zone 10 601253.00 m E 5464717.00 m N

3.4 Routine Maintenance and Contingency Measures

Routine maintenance is likely to be needed in the years following construction to ensure native vegetation are well established and functioning as intended. Maintenance activities may include:

- Watering of planted stock, especially in the first growing season.
- Replacement planting.
- Invasive plant management (especially in the first few growing seasons).

Further assessment and maintenance may be needed depending on the results of the effectiveness monitoring assessment. All components that do not meet the success criteria will require maintenance to bring the component up to target conditions. However, if multiple components do not meet the identified success criteria, a site diagnostic may be warranted. A site diagnostic can be used to determine the potential underlying causes of poor performance of the restoration prescription and recommend potential solutions.

If the results of monitoring indicate that the offsetting measures are not completed by the date specified (December 31, 2035) and/or are not functioning according to the criteria in Table 3-2, the Proponent shall give written notice to DFO and retain a QEP to implement contingency measures and associated monitoring measures to ensure the offsetting is completed and functioning as required by the Fisheries Authorization.

3.5 Reporting

A monitoring memo will be prepared following the last site visit of each monitoring year. The memo will include:

- A description of the methods used to assess the offsetting measures;
- Updates to the geo-referenced 'as-built' drawing(s) delineating the area of the offsetting measures, including areal footprints, if there have been any changes to the offsetting habitats;
- Assessment of the success of the offsetting measures (to date) in accordance with the criteria listed in Table 3-2;
- An assessment of the stability of the offsetting measures, identifying any signs of potential erosion, accretion, failure, movement or other physical alteration that may affect the stability and long-term success of the offsetting measures;
- Geo-referenced and dated photographs or video documenting the offsetting measures for the respective monitoring period (including at fixed photo points to document changes over time);
- Identification of any function concerns related to the offsetting measures and a description of any remedial measures taken; and
- The final Offsetting Effectiveness Monitoring Report (Year 10) shall include an evaluation of whether the offsetting measures undertaken counterbalanced the authorized impacts to fish and fish habitat resulting from the authorized works, undertakings or activities.

All reports are to be submitted to ReferralsPacific@dfo-mpo.gc.ca, with reference to DFO File Number: 24-HPAC-00116 and to SouthCoastWSAReporting@gov.bc.ca with reference to WSA Approval Number: 2011227, by December 31 of each monitoring year.

Closing

We trust the above meets the need of the project at this time. If you have any further questions regarding this technical memorandum, please do not hesitate to contact the undersigned.

KERR WOOD LEIDAL ASSOCIATES LTD.

Prepared by:

Matt Sanders, BIT, BC-CESCL
Junior Biologist

Reviewed by:

Christy Juteau, M.A., R.P.Bio
Senior Biologist

Encl.: Enclosure A: Monitoring Report Card

Statement of Limitations

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Revision History

Revision #	Date	Status	Revision Description	Author
0	March 27, 2025	Final		MLS/CMJ

Enclosure A

Monitoring Report Card

KERR WOOD LEIDAL ASSOCIATES LTD.
consulting engineers

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Annual Report Card

DATE: April 10, 2025

TO: Gulraiz Cheema
Ministry of Environment and Climate Change Strategy

FROM: Matt Sanders, BIT, BC-CESCL
Christy Juteau, R.P.Bio.

RE: **Lorenzetta Creek Effectiveness Monitoring Report**
Summer/Fall Reporting XXXX
Our File 3427.023

1. Introduction

This report outlines annual effectiveness monitoring results for flood recovery and offsetting project works undertaken in Lorenzetta Creek (Aug 2024 – Feb 2025) in response to the November 2021 Atmospheric River Event. As part of the Water Sustainability Act Change Approval (No. 2011227) and the DFO Fisheries Authorization (No. 24-HPAC-00116), a ten-year effectiveness monitoring plan was developed to ensure riparian and rearing habitat improvements function as intended. Reports will be submitted annually in Years 1, 2, 3, 5, 7, and 10 in accordance with the provincial and federal permits. Regulatory approvals are included in Enclosure A and the Effectiveness Monitoring Plan is included in Enclosure B.

2. Monitoring Methods

Include information on effectiveness monitoring methods, i.e., who conducted the monitoring, when, sample locations, equipment, weather conditions (update all highlighted text for each report).

3. Updates to As-Built Drawings

If Necessary.

4. Effectiveness Monitoring Results

4.1 Effectiveness Monitoring Report Card – Year X

Table 1 outlines Year X SUMMER/FALL effectiveness monitoring results, including an assessment of offsetting measures in terms of function, and a description of remedial actions taken.

Table 1. Effectiveness Monitoring Report Card

Monitoring Report Card				
Offsetting Measures	**Success Criteria**	**Success Criteria Met/Not Met**	**Comments**	**Recommended Maintenance**
Water Quality	Mean of all targeted parameters (temperature, dissolved oxygen, pH and turbidity) meet Approved or Working BC Water Quality Guidelines for the Protection of Aquatic Life suitable for target fish species and life stages.			
Water Quantity/Flow	Habitat continuously wetted with average target water depths and velocities for target fish species and life stages.			
Fish Habitat Condition	Habitat areas consistent with as-builts. Side channel habitat assessment results of fair to good quality[1].			
LWD Structure	LWD in sufficient condition; normal wear and tear with limited localized damage.			
Fish Community	**Success Criteria**	**Success Criteria Met/Not Met**	**Comments**	**Recommended Maintenance**
Diversity	Assemblage composed of some or all the predicted fish species (i.e., Pacific Salmon and Trout) and life stages (i.e., juvenile and adult).			
Side Channel - Juvenile Salmonid Abundance	Annual juvenile salmonid abundance (catch per unit effort) within the side channel increases over pre-enhancement condition when standardized based on year-over-year abundances in the mainstem reference sites, on average over the five-year monitoring period.			

[1] Table 5 from Johnston, N.T. and Slaney, P.A. 1996. Fish Habitat Assessment Procedures. British Columbia Ministry of Environment, Lands and Parks, and British Columbia Ministry of Forests, Watershed Restoration Program, Technical Circular No. 8. Victoria, BC

Monitoring Report Card				
LWD - Juvenile Salmonid Abundance	Juvenile salmonid abundance (catch per unit effort) is approximately 2 times greater than pre-construction results and/or reference sites with no LWD enhancement, on average over the five-year monitoring period.			
Riparian Planting	**Success Criteria**	**Success Criteria Met/Not Met**	**Comments and Mitigation**	**Recommended Maintenance**
Vegetation Cover	80% cover, stable to increasing native plant composition and cover, and less than 5% invasive species plant coverage.			
Planted Stock Density and Survival	100% tree survival and 80% shrub survival at the end of the 10-year monitoring period.			
Riparian Stability	Stable site conditions, improved vegetation success, and continued succession.			

5. Photo Log

Include photo point monitoring results in addition to geo-referenced and dated photos documenting offsetting measures.

PHOTOGRAPHS	
Photo 1:	**Photo 2:**
Photo 3:	**Photo 4:**
Photo 5:	**Photo 6:**

PHOTOGRAPHS	
Photo 7:	**Photo 8:**

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Enclosure D

Inspections Cost Estimate

Enclosure D – Inspection Cost Estimate

Monitoring Component	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Engineering - Annual Inspection - 1 per year	$6,800	$6,800	$6,800	$6,800	$6,800	$6,800	$6,800	$6,800	$6,800	$6,800	$204,000
Engineering - Post High Water Inspections - 2 per year	$13,600	$13,600	$13,600	$13,600	$13,600	$13,600	$13,600	$13,600	$13,600	$13,600	
Environmental - Annual Aquatic and Riparian Monitoring Two visits during years 1,2,3, and 5 One visit during years 7 and 10	$11,600	$11,600	$11,600		$11,600		$5,500			$5,500	$57,400
Yearly Totals	**$32,000**	**$32,000**	**$32,000**	**$20,400**	**$32,000**	**$20,400**	**$25,900**	**$20,400**	**$20,400**	**$25,900**	**$261,400**