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Chemainus River Sediment Removal and Temporary Flood Barrier

2023 Construction Completion Report

Final Report
December 11, 2025
KWL Project No. 3427.025

Prepared for:
BC Ministry of Environment and Climate Change



Contents

Executive Summary	i
1. Introduction	1-1
1.1 Background	1-1
1.2 Location.....	1-2
1.3 Project Team	1-4
2. 2023 Chemainus River Projects	2-1
2.1 Gravel Bar Sediment Removal – Site 4	2-1
2.2 Temporary Flood Barrier – Site 3	2-2
3. Permitting and Approvals	3-1
3.1 Water Sustainability Act – Change Approval	3-1
3.2 Fisheries Act – Request for Review	3-1
3.3 Species at Risk Act	3-2
3.4 Land Access	3-2
3.5 Ministry of Transportation and Transit	3-2
3.6 First Nations Consultation	3-2
4. Construction	4-1
4.1 Construction Team.....	4-1
4.2 Construction Methodology.....	4-2
4.3 Construction Schedule and Sequence	4-3
4.4 Sediment Removal Quantity	4-5
4.5 Environmental Monitoring.....	4-6
4.6 Engineering Field Reviews.....	4-6
4.7 Site Completion	4-6
4.8 Operations and Maintenance	4-7
5. Cost Summary and Payment Documents.....	5-1
5.1 Construction Cost Summary	5-1
6. Post Construction.....	6-1
6.1 Chemainus River Flood Management Plan	6-1
6.2 Final Progress Payment and Closeout Documents.....	6-1
7. Closure	7-1

Report Submission



Figures

Figure 1-1: Site Location	1-3
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Tables

Table 1-1: Summary of Works Completed at Areas of Concern.....	1-2
Table 4-1: Sediment Removal Construction Schedule.....	4-4
Table 4-2: Temporary Flood Barrier Construction Schedule.....	4-5
Table 4-3: Sediment Removal Quantity.....	4-5
Table 4-4: Sediment Stockpile Locations	4-5
Table 5-1: Summary of Contract Costs.....	5-1

Appendices

Appendix A: Preliminary Site Assessment of Potential Area of Concern – Revised (KWL Sep 25, 2023)
Appendix B: Record Drawings
Appendix C: NHC Preliminary Hydraulic Results
Appendix D: Environmental Monitoring Completion Report – Sediment Removal (KWL, Dec 12, 2023)
Appendix E: Environmental Review – Temporary Flood Barrier – Draft (KWL, Oct 11, 2023)
Appendix F: Private Property Access Agreements
Appendix G: License of Occupation Agreement for Temporary Flood Barrier
Appendix H: CCDC 4 Unit Price Contract for the Works
Appendix I: Engineering Field Reviews
Appendix J: Contract Progress Payments
Appendix K: Temporary Flood Barrier Inspection Checklist Template



Executive Summary

In November 2021 an atmospheric river rainfall event soaked southern British Columbia, resulting in widespread flooding, damage to homes, evacuations, loss of life, and significant damage to critical infrastructure. Erosion and debris flows in rivers and creeks across the province contributed to and exacerbated this damage. In the community of Halalt IR2 and the surrounding area, the rainfall and extreme flows in the Chemainus River flooded homes and transported large amounts of sediment and debris down the river and floodplain, leading to material deposition and bank erosion at several reaches of the Chemainus River. Accumulation of sediment and debris along the Chemainus River has reduced the river's total conveyance capacity and increased the potential for further localized bank erosion and overtopping. In response to this, multiple projects were identified to alleviate public health and safety concerns and protect adjacent infrastructure. These projects were completed between 2022 to 2024 with separate completion reports prepared for each year. The following report summarizes works completed in 2023.

In 2023, approximately 9,190 m³ of sediment was removed from a gravel bar northeast of Halalt IR2 on the Chemainus River between the Chemainus Road Bridge and the E&N Railway Bridge. Due to several identified sediment sources upstream and the highly erodible material along the riverbanks, the incremental risk to river capacity was considered high and sediment removal was recommended.

In addition, an 830 m long temporary flood barrier (Hesco Wall) and 80 m riprap floodplain cut-off berm were constructed upstream on the Chemainus River floodplain to protect Halalt First Nation lands and adjacent private property from overland flooding due to overtopping of the right bank downstream of the Highway #1 Bridge.

Construction work for the sediment removal, temporary flood barrier and cut-off berm were completed by Ts'uubaa Pacific Civil Project LP from September 6 to November 10, 2023 under a CCDC 4 construction contract administered by Halalt First Nation. A competitive bid process was undertaken in August 2023 and two bids were received.

Sediment removed from the gravel bar was hauled to offsite locations within Halalt IR2 and the District of North Cowichan and was used in the construction of the temporary flood barrier and associated access road. The temporary flood barrier and cut-off berm were constructed under the sediment removal CCDC 4 Unit Price Contract as Change Orders due to the proximity of the projects and limited time available for a procurement process prior to the onset of wet weather and the potential for high river flows. The total construction cost was \$888,649 (excluding GST).

Recommendations for further flood protection and recovery works for Halalt First Nation and the surrounding area include the Right Bank Recovery Works which were constructed in summer of 2024. In addition to the flood recovery measures, recommendations for long term holistic solutions should be further developed meet the objectives of the Chemainus River Integrated Watershed Management Plan.



1. Introduction

Kerr Wood Leidal Associates Ltd. (KWL) is working with the Ministry of Environment and Climate Change Strategy (ENV) to assess and address the impacts of sediment introduced during the November 2021 Atmospheric River Event (ARE). Funding by the Province of British Columbia (BC) was approved to help remove deposited sediment in the waterways of the Chemainus River. KWL has been retained by ENV to manage the removal of sediment from high impact areas.

The scope of work includes removal of accumulated gravel and sediments within the main channel of the Chemainus River between the Chemainus Road Bridge upstream and the Esquimalt and Nanaimo (E&N) Railway bridge as shown as Site 4 in Figure 1-1. Sediment has accumulated at a gravel bar in the river resulting in reduced channel capacity. The gravel bar consists of gravel, cobble, and fine material, and has become vegetated at its upstream end with shrubs and saplings. In the centre of the gravel bar there was a large log jam of woody debris.

In addition, the construction of a temporary flood barrier was included in the scope of work as emergency work funded by the Ministry of Emergency Management and Climate Readiness (EMCR). Sediment removed from the gravel bar was used to create an access road and fill Hesco baskets to form an 860 m flood barrier along the right bank of the Chemainus river downstream of the Trans-Canada Highway (TCH) bridge on private property and on Halalt IR2.

1.1 Background

The Chemainus River is a salmon-bearing stream on the east coast of Vancouver Island with its estuary located approximately 10 km north of the City of Duncan. The watershed has an area of approximately 360 km² and the mainstem of the river is approximately 64 km long (Wightman et al. 1998).

An extreme rainfall event on November 15, 2021, resulted in one of the highest (468 m³/s) daily peak flows on record for the Chemainus River since 1953 (Water Survey of Canada Hydrometric Station 08HA001 – Chemainus River near Westholme). Note that during high flow events, overland flow occurs into the floodplain upstream of the 08HA001 hydrometric gauge, circumventing the gauge, resulting in an under reporting of the total flow of the Chemainus River at this location. Further details on the flow split upstream is discussed by Northwest Hydraulic Consultants in the Chemainus River Floodplain Mapping Program¹.

As a result of this extreme rainfall event and others that have occurred in the past, Halalt First Nation, Penelakut First Nation (Tsussie) and surrounding land within the District of North Cowichan experience flooding as the Chemainus River overtops its banks.

A preliminary site assessment was performed by KWL on September 7, 2022 that established project and design objectives. This assessment was updated on September 25, 2023 and is included as Appendix A. The field reconnaissance of the Chemainus River focused on the channel between the TCH Bridge and the Chemainus Road Bridge as well as additional areas of flooding concern within Halalt IR2 and surrounding areas in the Municipality of North Cowichan. The preliminary risk assessment was carried out considering the incremental change in risk to public health and safety, river channel capacity, environment, and infrastructure because of accumulation of sediment and debris from the November 2021 flood.

¹ Chemainus River Floodplain Mapping Program Part 1, Appendix B – Hydrology, May 2022



As shown in Figure 1-1, the site visit focused on four primary areas of sediment and debris accumulation introduced by the November 2021 flood event along the Chemainus River between Highway 1 and the Chemainus Road bridge.

Since the preliminary site assessment on September 7, 2022, KWL and ENV have worked together on recovery projects to address the areas of concern as listed in Table 1-1. A brief description of the works completed and status with references to the completion reports prepared for each site is also provided.

Table 1-1: Summary of Works Completed at Areas of Concern

Location	Name	Description of Work	Status
Site 1	Left Bank Side Channel	Sediment removal at the left bank dry side channel and point bar downstream of the Highway 1 Bridge	Completed November 2022 (See 2022 KWL completion report)
Site 2	Right Bank Downstream of TCH Bridge	Recovery of the right bank downstream of Highway 1 Bridge and construction of bendway weirs	Completed in September 2024 (See 2024 KWL completion report)
Site 3	Right Bank Side Channels	Temporary flood protection from the right bank side channels (Hesco flood barrier)	Completed November 2023 (this report)
Site 4	Gravel Bar Between E&N Railway Bridge and Chemainus Road Bridge	Sediment removal at the gravel bar	Completed September 2023 (this report)

1.2 Location

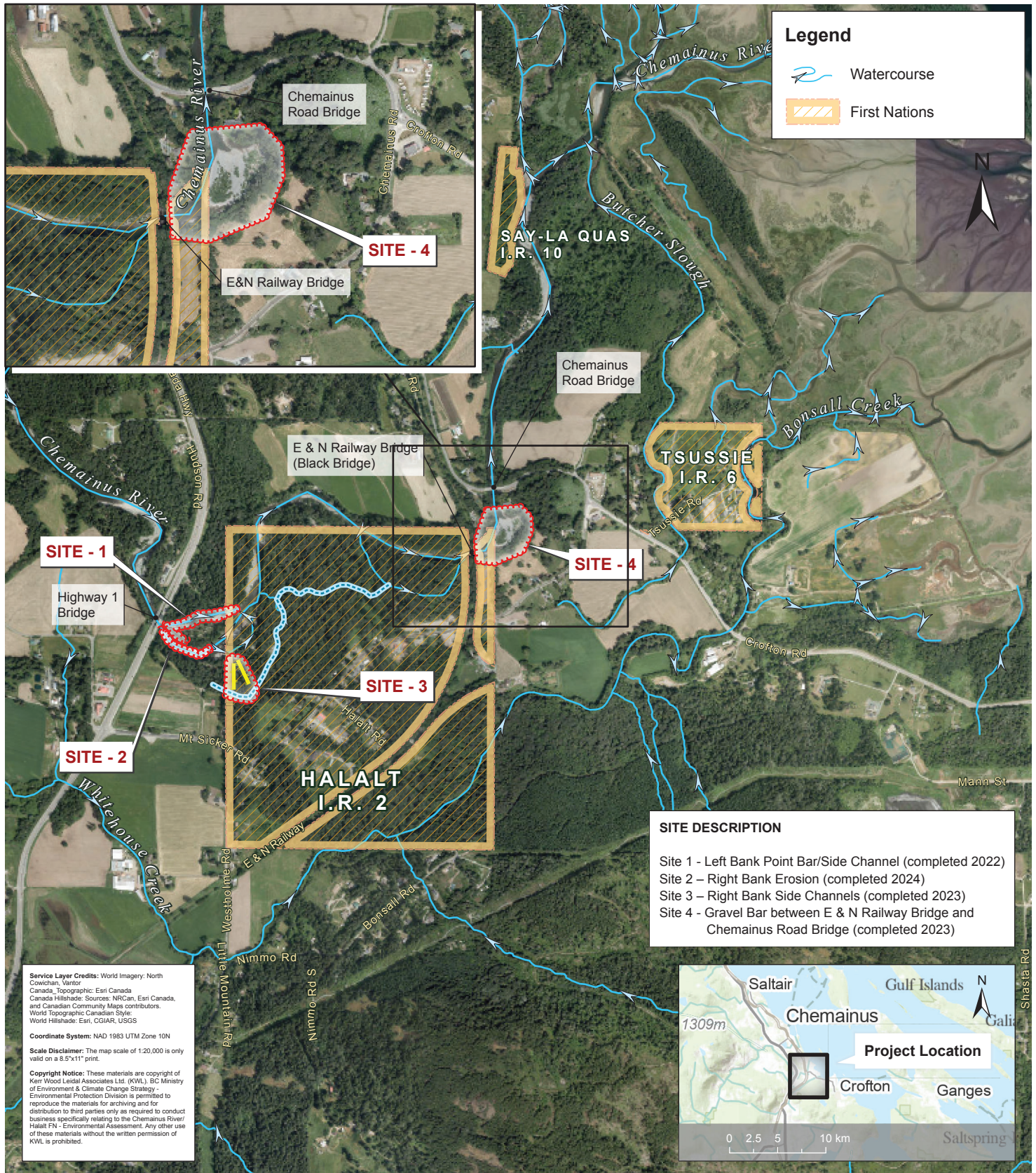
The project locations are the mainstem of the Chemainus River between the E&N Railway Bridge and Chemainus Road Bridge and downstream of the TCH bridge at the Russell Farm Market property into the Halalt IR2.

Site ID	S-CM-1
Site Description	Chemainus River @ HWY1 near Halalt IR 2
Location	UTM Zone 10 U N 5,414,521 m, E 449,675 m
Local Government Agency	Halalt First Nation, District of North Cowichan
Waterbody	Chemainus River

BC Ministry of Environment & Climate Change Strategy - Environmental Protection Division Chemainus River/Halalt FN - Environmental Assessment



KERR WOOD LEIDAL
consulting engineers



Project No. 3427.025

Date December 2025

Scale 1:20,000

0 125 250 500 m

Project Location

Figure 1-1



1.3 Project Team

The KWL project team includes:

- Craig Sutherland, MSc., P.Eng., Senior Water Resources Engineer/Qualified Professional
- Stephen Bridger, P.Eng., Senior Civil Engineer/Project Manager/Contract Administrator
- Dave Murray, P.Eng., Senior Technical Specialist
- Liam Mackle, P.Eng., Water Resources Engineer
- Andrea Kerr, EIT, Junior Civil Engineer
- Chad Davey, Fluvial Geomorphologist
- Jamie Dimillo, Junior Biologist
- Northwest Hydraulic Consultants (NHC) – Subconsultant
- Cowichan Engineering Services (Survey) – Subconsultant
- Turner and Associates Land Surveying – Subconsultant

KWL gratefully acknowledges the assistance and input of the following individuals, particularly the following:

Halalt First Nation

- Chief James Thomas
- Caroline Gladstone, Director
- Annie Cossey, Finance Director
- Tony George Sr., Archaeological Monitor

District of North Cowichan

- David Conway, P.Eng., Director Engineering Projects

Contractors – Ts'uubaa Pacific Civil Project LP

- Greg Stone, Project Manager/Superintendent
- Ken Ramwell, Foreman/Operator
- Mark Hansen, Operator
- Jerry Janik, Surveyor

Subcontractors

- Cheri Ayers, BioAyers Consulting (Environmental Consultant to Halalt First Nation)



2. 2023 Chemainus River Projects

The Chemainus River is a dynamic system that is subject to rapid changes in flow and water level following rain events. This results in several high-risk areas for overland flooding within Halalt IR2 and surrounding areas in the Municipality of North Cowichan. Following the initial site assessment, four projects were identified (as per Table 1-1) to alleviate public health and safety concerns and protect adjacent housing and infrastructure as well as restore local channel conveyance capacity. The following two projects were identified for design and implementation in 2023 and are summarised in this report:

- Site 3 – Construction of a Temporary Flood Barrier along the right bank of the river downstream of the TCH Bridge.
- Site 4 – Gravel Bar Sediment Removal between the Chemainus Road Bridge and the E&N Railway Bridge.

In addition, funding for the Site 2 Right Bank Recovery works located downstream of the TCH Bridge was received in late 2023. The project was constructed in 2024 and is summarized in a separate completion report.

2.1 Gravel Bar Sediment Removal – Site 4

This gravel bar was identified as a primary area for sediment and debris accumulation during the preliminary site assessment field review undertaken by KWL on September 7, 2022. This site has also been actively managed by the Municipality of North Cowichan in the past, with the most recent sediment removal occurring in 2007.

The scope of the 2023 works at this site included the following:

- Establishing machine and vehicle access to the river by constructing an access road through private property, removing a tree and vegetation at the river access point, moving existing bank riprap, and building an access ramp from the top of bank to the gravel bar.
- Removing vegetation and accumulated woody debris on the gravel bar.
- Excavating, removing, and stockpiling deposited sediment within the design footprint with a 2 m setback from the active channel and to a final grade elevation of approximately 3.2 m.
- Restoration of the riverbank, riprap armouring, and access road.

The workplan included preserving the upstream third of the gravel bar in order to maintain stability of the deposit and local river geomorphology.

The potential for additional sediment for removal was identified during construction and upon review by the project team it was determined that it would be beneficial to continue the removal given there was adequate time remaining in the fish construction window and budget available. As a result, the amount of sediment removal to increase from 5,000 m³ to 9,190 m³. Record drawings for these works are included in Appendix B-1.



2.2 Temporary Flood Barrier – Site 3

Installation of a temporary flood barrier was identified as a priority project and mitigative solution to local overland flooding in the October 2022 Preliminary Site Assessment.

The concept was further refined during design team meetings between KWL and Parsons (consultant to Penelakut First Nation on a separate coastal flood project) and later with NHC as a subconsultant to KWL. An alignment was ultimately selected for the temporary flood barrier to reduce the risk of overland flooding occurring during extreme flow events where the right bank side channels are activated. This alignment was built into a one-dimensional hydraulic model by NHC to assess the impacts and effectiveness under several flood scenarios. A selection of the results of the hydraulic modelling exercise and the associated temporary flood barrier impacts are included in Appendix C.

The alignment traverses the right bank of the Chemainus River and spans approximately 860 m including an approximately 500 m section through Halalt First Nation reserve land and approximately 360 m along the edge of a field on private property at 2587 Mt Sicker Road (owner of Russell Farm Market). The barrier ties into the TCH embankment immediately downstream of the Chemainus River Bridge crossings.

This work was added to the Site 4 Gravel Bar Sediment Removal project through a contract Change Order. The scope of work included:

- Tree and vegetation removal, stripping and grubbing, and ground preparation along the proposed alignment within a 5 m wide corridor that includes the flood barrier and a land side access road.
- Establishment of a new gravel access road for approximately two thirds of the total barrier length, and improvement of an existing section of access road along a section of the alignment within Halalt IR2.
- Installation and filling of approximately 188 Hesco baskets to complete the flood barrier.
- Installation of a riprap cutoff berm through the floodplain and perpendicular to streamflow, including a woody debris structure on the upstream side and a low swale to direct overtopping flow into one of the existing relic floodplain channels downstream of the berm.
- Construction of an earth fill ramp over the Hesco wall to provide access to the floodplain and riprap berm.
- Supply of two steel swing gates to demarcate property lines.
- Site restoration.

The alignment is shown in the record drawings in Appendix B-2.



3. Permitting and Approvals

Sediment removal at the gravel bar involved works in and around a stream and as such required permits and approvals under the Water Sustainability Act and Fisheries Act prior to commencing works.

A Construction Environmental Management Plan (CEMP) was developed for project that set out the requirements and measures to avoid, minimize, and mitigate any potential adverse environmental impacts. The CEMP provided overarching guidance for how environmental considerations were implemented and monitored during the construction phase of the Project. A copy of the CEMP is attached in Appendix D appended to the Environmental Monitoring Completion Report.

During the gravel removal construction, additional silt fencing was added to protect amphibian and fry habitat within wetted pools on site.

The temporary flood barrier did not require formal approval from the Province or Federal Government but was reviewed by the District of North Cowichan as it pertains to the District's Development Permit process for works within an environmentally sensitive area. A copy the Environmental Review completed by KWL for the temporary flood barrier works is attached in Appendix E.

3.1 Water Sustainability Act – Change Approval

The sediment removal works were within the Chemainus River and submitted to the Ministry of Forests under the Water Sustainability Act as a Change Approval for Works In and About a Stream for review. Approval was issued on September 1, 2023 (file: 1005901) and a copy is attached in Appendix D appended to the Environmental Monitoring Completion Report.

The Ministry of Environment and Climate Change Strategy was authorized to make changes in and about a stream as follows:

- Removal of one broadleaf maple tree to facilitate site access.
- Removal of approximately 2,502 square meters of shrubbery on the existing gravel bar.
- Excavation and removal of approximately 5000 cubic meters of gravel and sediment from the existing gravel bar for storage by Halalt First Nation and District of North Cowichan.
- Restoration of roads, driveways and other surfaces disturbed due to the works.
- Revegetation and restoration of all disturbed areas.

3.2 Fisheries Act – Request for Review

A Request for Review was submitted to Fisheries and Oceans Canada (DFO) for the sediment removal project and a Letter of Advice was received from DFO dated August 17, 2023. Implementation measures to avoid and mitigate the potential for prohibited effects to fish and fish habitat were provided and a copy of the DFO letter is attached in Appendix D appended to the Environmental Monitoring Completion Report.

KWL had a full-time environmental monitor on site during construction works to mitigate risk to aquatic species and habitats.



3.3 Species at Risk Act

A Species at Risk Act (SARA) permit was not required for the sediment removal or the temporary flood barrier works.

Although the project location of the temporary flood barrier (Halalt IR2) was found to overlap with the habitat of the Oregon Forest Snail, the alignment was adjusted to avoid the critical habitat area. The alignment also overlapped with the Oregon Forest Snail habitat on a portion of private land; however, SARA permits are not applicable to private land.

3.4 Land Access

Halalt First Nation, private landowners, and the District of North Cowichan were contacted to provide consent for the Ministry of Environment and Climate Change Strategy to access their land for the purpose of completing Works In and About a Stream for both the sediment removal and temporary flood barrier project components. Consent was provided for both site access and to complete the works as shown in Appendix F.

In addition, a License of Occupation agreement was prepared and signed by the property owner at 2587 Mount Sicker Road to facilitate construction of the temporary flood barrier. A copy of the signed agreement is attached in Appendix G, note that this agreement was superseded in summer of 2024 with the Right Bank Recovery works project.

3.5 Ministry of Transportation and Transit

A works permit was not required for the works as access and egress to both sites were via private property. Ts'uubaa Pacific provided traffic control at the access points throughout the project. The Ministry was notified of the installation of project signage along the roadway. No approvals were required.

3.6 First Nations Consultation

KWL met with Chief Thomas and Joe Seward of Halalt First Nation on September 7, 2022 during the initial field reconnaissance of the Chemainus River. Halalt First Nation confirmed that they supported the project and understood the urgency in removing the sediment from the gravel bar, as well as the construction of the temporary flood barrier. Halalt also held the construction contract for the works.

Penelakut First Nation staff participated in the Chemainus Task Force and attended an open house on the Chemainus recovery projects that was held in December 2023.



4. Construction

In early August 2023 a CCDC 4 Unit Price Contract (2011) tender was prepared and issued by Halalt First Nation and KWL to four local contractors. The contractors included:

- EMCON
- Stone Pacific – as Ts'uubaa Pacific Civil Projects LP
- HG Excavating in collaboration with Coastal Wolf Construction
- Porlier Pass Contractors

The tender closed on August 31, 2023 and only two of the contractors submitted bids for the project which were Ts'uubaa Pacific and Coastal Wolf Construction. Ts'uubaa Pacific had the lowest price and was recommended for award of the contract.

Ts'uubaa Pacific provided a contract price of \$233,115.99 (exclusive of GST), met the technical requirements for the project. A copy of the signed CCDC 4 Unit Price Contract and the supporting construction documents are found in Appendix H.

4.1 Construction Team

Ts'uubaa Pacific Civil Projects LP

The construction team was led by Greg Stone of Ts'uubaa Pacific as the Project Manager along with the Site Superintendent Ken Ramwell, equipment operators, and laborers. Ts'uubaa Pacific also provided traffic control services throughout the project.

KWL

KWL was responsible for performing site inspections and Contract Administration duties. Stephen Bridger served as the Project Manager and Contract Administrator, Liam Mackle was the Engineer of Record for the works and completed the field reviews with Andrea Kerr, and Craig Sutherland was the Qualified Professional for the works. Additionally, KWL was responsible for full time Environmental Monitoring, which was carried out by Jamie Dimillo with support from Chad Davey and Matt Sanders.

Subconsultants

Cowichan Engineering Services was retained to perform the pre-construction topographic surveying during the design phase. The remainder of the project survey tasks were completed by Turner & Associates Land Surveying Inc for both the sediment removal and temporary flood barrier.

Archeological monitoring services were provided by Tony George Sr. of Halalt First Nation.



4.2 Construction Methodology

4.2.1 Gravel Bar Sediment Removal

Site Access

Access to the gravel bar was provided by two private landowners at 8282 and 8508 Chemainus Road. An existing access route to the River on 8282 Chemainus Road was used for heavy machinery and personnel access and hauling material off site. To get from the access road to the gravel bar, breaching of the armoured right bank of the River was required, as well as construction of a temporary access ramp from the top of bank to gravel bar. The existing riprap was used as a base for the access ramp and Ts'uubaa Pacific imported additional 150 mm rock material to build up the access ramp.

Sediment Removal from Gravel Bar

Once access to the gravel bar was established, the project area was laid out by the contractor, and environmental protection measures were implemented at the direction of the on-site Environmental Monitor.

The sediment removal contract amount was completed quickly and efficiently such that a decision was made to remove additional material for a total of 9,190 m³. The sediment material removed from the site was stockpiled at four locations as described in Section 4.4, below.

Site Clean Up

As part of the access agreement through private land, restoration of the access road was required. The access road through the farm field experienced a high level of compaction due to the weight and volume of heavy vehicles and machinery. Restoration was undertaken by a local farmer (at the request of the property owner) who provided the equipment required to restore the land for agricultural use and included placing a layer of topsoil over the affected areas, followed by tilling, and aerating of the compacted soil. Once the soil was tilled, a layer of seed and cereal crop was spread to reestablish growth and help maintain the restored area through the winter.

4.2.2 Temporary Flood Barrier

Site Access

Access to the alignment for the temporary flood barrier was provided by the private landowner at 2587 Mount Sicker Road (owner of Russell Farm Market) and Halalt First Nation. Once clearing and grubbing and an access road was completed along the entire flood barrier alignment where necessary, all vehicle access was achieved via Halalt IR2.

Flood Barrier Construction

Vegetation clearing and some tree removal was completed to achieve an approximately five m wide corridor along the full alignment of the temporary flood barrier, of which approximately 40% of the barrier was on private land, while the remaining 60% was on Halalt First Nation. The cleared area was levelled and filled with stockpiled sediment material from the recently completed gravel bar removal downstream to form an access road and base for the Hesco baskets.



Construction of the temporary flood barrier began at the north end tie into the TCH embankment. Some additional riprap and fill was placed around the upstream terminus of the flood barrier to reduce the risk of outflanking and fill the gap left between the vertical wall and angled embankment. The Hesco basket sections were placed, connected, and filled in accordance with the design drawings and manufacturer's specifications.

Additional work was added to the project scope to construct a riprap berm in the floodplain between the temporary flood barrier and Chemainus River. The purpose for the berm is to slow down overbank flood flows and redirect the water back into the main channel. It also provided vehicular access to the riverbank to be used for future phases of work (i.e. 2024 Right Bank Recovery Works). Woody debris was cabled to nearby trees on the upstream side of the berm to further reduce flow velocity of potential overbank flood water.

Site Clean Up

Removed vegetation was trucked offsite as was any construction waste. The access road was left in place such that limited site restoration was required. All trees that were cut remained on reserve for Halalt First Nation use.

4.3 Construction Schedule and Sequence

4.3.1 Gravel Bar Sediment Removal

Table 4-1 shows a daily construction schedule for the sediment removal. A total of 10 days were spent excavating the gravel bar.

The pre-construction meeting was held onsite on September 6, 2023 and works began on September 7, 2023.



Table 4-1: Sediment Removal Construction Schedule

Work Component	Sep 6	Sep 7	Sep 8	Sep 12	Sep 13	Sep 14	Sep 15	Sep 18	Sep 19	Sep 20	Sep 21	Sep 22
Construction Activities												
Pre-Construction Meeting												
Ts'uubaa Pacific Mobilization												
Site Layout and Environmental Measures												
Gravel Bar Excavation												
Quality Assurance												
Demobilization												



4.3.2 Temporary Flood Barrier

Table 4-2 shows a weekly construction schedule for the construction of the temporary flood barrier. The flood barrier construction was completed over six weeks.

Table 4-2: Temporary Flood Barrier Construction Schedule

Work Component	Oct 3	Oct 9	Oct 16	Oct 23	Oct 30	Nov 8
Ts'uubaa Pacific Mobilization						
Clearing and Site Preparation						
Access Road Construction						
Construction of Flood Barrier						
Construction of Floodplain Berm						
Demobilization						

4.4 Sediment Removal Quantity

The initial estimate for the quantity of sediment to be removed was based on engineering judgement and validated by the pre-construction survey information. The volume estimates are summarized in Table 4-3 below and includes a comparison with the actual quantities removed based on the pre and post construction survey information.

Table 4-3: Sediment Removal Quantity

Sediment Location ID	Pre-Construction Volume Estimate (m³)	Post Construction Volume Removed (m³)
Gravel Bar	5,000	9,190

During construction the sediment removal progress at the gravel bar was estimated using the number of truck loads hauled off site per day. It was assumed that each truck had a carrying capacity of 7.5 m³ based on conversations with Ts'uubaa Pacific and the maximum payload for the trucks in use. These quantities were refined using a drone survey completed by Ts'uubaa Pacific before and after the sediment removal. Material at the gravel bar was hauled off site to multiple sites in the surrounding area. Table 4-4 provides the estimated sediment volume deposited at each site.

Table 4-4: Sediment Stockpile Locations

Stockpile Location	Number of Trucks – Silt	Volume Estimate (m³) Using 8.5 m³ per Truck	Number of Trucks – River Rock	Volume Estimate (m³) Using 7.5 m³ per Truck	Total Estimated Volume Removed
DNC – Richards Mountain	28	238	590	4,425	4,663
Halalt FN	28	238	385	2,888	3,216
CJ Farm	50	425	-	-	425
Firewood Lot	28	238	-	-	238
Estimated Total Volume Removed (m³)					8,452
Volume Removed based on Post Construction Survey (m³)					9,190
% Difference in Estimated Excavation Volume					8.7 %



The majority of the excavated material hauled to Halalt IR2 was reused as road base and fill for the access road and Hesco basket temporary flood barrier.

4.5 Environmental Monitoring

Environmental monitoring was conducted by KWL as the Qualified Environmental Professional onsite. Responsibilities of the environmental monitor included, but were not limited to, the following:

- Inspect all mitigation measures and erosion and sediment control measures to ensure they are appropriate and working properly and recommend modifications and repairs when necessary.
- Have written authority to halt any construction activity if it is deemed necessary to protect fish, wildlife, and their habitat.
- Identify, monitor, and promptly report any situations of ongoing or potential damage to the environment.
- Ensure the EMP was implemented by the Contractor for the duration of the construction phase of the project.

A summary of the environmental monitoring for the project is provided in Appendix D appended to the Environmental Construction Completion Report.

4.6 Engineering Field Reviews

Engineering field reviews for both phases of the work were completed by Andrea Kerr and Liam Mackle. Site presence was not full time; however, construction progress reviews and field inspections occurred several times a week for the project's full duration. Weekly field inspection reports have been included in Appendix I.

4.7 Site Completion

4.7.1 Gravel Bar Sediment Removal

Ts'uubaa Pacific completed the sediment removal at the Chemainus River gravel bar between the Railway Bridge and Chemainus Road Bridge on September 22, 2023 and demobilized from site the same day.

Restoration of the access road through the landowner's property was required as part of the access agreement. Ts'uubaa Pacific worked with the landowner to complete the remedial work by October 27, 2023. Further restoration and remediation including erosion control matting and seeding was completed in September 2024 to address some minor erosion that occurred on the upper bank above the restored riprap.

4.7.2 Temporary Flood Barrier

Construction of the temporary flood barrier was completed on November 8, 2023, with site clean-up and demobilization completed by November 10, 2023.

The record drawings for the project are included in Appendix B.



4.8 Operations and Maintenance

4.8.1 Sediment Removal

An additional topographic survey of the gravel bar was completed in the summer of 2024 to enable an approximation of the sediment accumulation over the winter months. The results of the survey showed that some additional material was deposited during winter high flows, and suggests that additional accumulation may occur, ultimately resulting in the need for additional future removal.

Regular monitoring of sediment and debris at known locations of accumulation at Site 1, 2, and 4 on the Chemainus River is recommended to reduce risk to important transportation links and maintain channel conveyance. Additional topographic survey and monitoring of the sediment movement and accumulation should be undertaken on a bi-annual basis at the transects that have been established in past years.

4.8.2 Temporary Flood Barrier

The temporary flood barrier should be inspected by a qualified professional annually and following any high flow events where water levels reach the wall. Inspection should include an assessment of the structural integrity of the wall as well as the foundation conditions, the access ramp over the flood barrier and associated riprap areas, and any areas of potential undermining on the edge of the floodplain. An annual vegetation removal program should also be considered for the access road adjacent to the flood barrier and fill material on the top of the barrier to reduce plant establishment.

Maintenance of the flood barrier may include removal of vegetation that hampers access for inspection or has the potential to harm the fabric of the Hesco Basket. Sections of wall damaged by flood, tree fall, or other impacts should be replaced using the leftover Hesco baskets that were left onsite following construction completion. An inspection checklist template for the temporary flood barrier is provided in Appendix K.

The flood barrier is not intended to be a permanent structure, so a removal plan should be developed within 5-10 years and in concert with a long-term flood mitigation plan. A removal plan may include plans to stockpile and/or reuse the fill from the flood barrier, while the Hesco baskets will be disassembled and disposed of appropriately. The plan should also be developed with and approved by Halalt FN and the private landowner. The Class D (+/- 50%) estimate of cost for the removal and disposal of the temporary flood barrier is \$30,000. This estimate also includes mobilization and demobilization costs, traffic control, restoration and replanting, and assumes the work is completed in one week.



6. Post Construction

6.1 Chemainus River Flood Management Plan

An assessment of the impact of the improvements at Site 1 included another post construction survey in the spring of 2023 to measure the additional sediment deposition that occurred during winter high flow. This information can be used to inform the river and watershed modelling efforts in development of a long-term strategy for management of the flood concerns.

In the short term, further bank protection and flood mitigation measures could be implemented such as the recommended works at Sites 2, 3 and 4 as per the revised preliminary site assessment completed in September 2023 (Appendix A).

6.2 Final Progress Payment and Closeout Documents

Separate final progress payments and closeout documents were issued for each of the sediment removal and temporary flood barrier components of the contract works.

A Partial Substantial Performance of the contract works was achieved on September 22, 2023 for the sediment removal component of the project, which is documented in a November 22, 2023 letter from KWL to Halalt First Nation (see Appendix J) including release of the Lien Holdback associated with the sediment removal works.

The remainder of the contract works were deemed substantially complete on November 9, 2023 as documented on the December 13, 2023 letter for Progress Payment #4. The Lien Hold Back period for temporary flood barrier works ended on January 3, 2024 as documented on the January 18, 2024 letter from KWL to Halalt First Nation.

A Final Progress Payment was issued on May 29, 2024 for the supply and partial installation of two swing gates that were added to the contract as Change Order #4.



7. Closure

Sediment removal on the Chemainus River between the Chemainus Road bridge and the railway bridge was completed prior to the rainfall season and annual flooding. Approximately 9,190 m³ of sediment was removed from the gravel bar by Ts'uubaa Pacific Contracting. The sediment was removed and deposited at locations within Halalt IR2, and District of North Cowichan where material was desired for flood protection means.

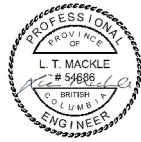
The full 830 m length of Hesco wall temporary flood barrier including the riprap floodplain berm was completed immediately following the sediment removal. The property gates along the access points were fabricated and delivered to site, however the installation was moved to become part of the 2024 work program pending additional cadastral survey work. Ts'uubaa Pacific demobilized from site, having completed the contracted work on November 8, 2023.



Report Submission

Prepared by:

KERR WOOD LEIDAL ASSOCIATES LTD.



Permit to Practice #1000696
2025-12-18

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Statement of Limitations

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This document represents KWL's best 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	Author
0	December 11, 2025	Final		LM/SAB
A	December 30, 2024	Draft	Draft Report	LM/SAB

Appendix A

**Preliminary Site Assessment of Potential Area of Concern
– Revised**

**Kerr Wood Leidal Associates Ltd.
September 25, 2023**

Technical Memorandum

DATE: September 25, 2023

TO: Amy Vallarino
Flood Debris Management Secretariat

FROM: Craig Sutherland, M.Sc., P.Eng.

RE: PRELIMINARY SITE ASSESSMENT OF POTENTIAL AREAS OF CONCERN – REVISED
Site S-CR-1 Chemainus River, Halat First Nation
Our File 3427.020-300

1. Introduction

The purpose of this high level and preliminary assessment of identified Areas of Concern is to allow the Province of BC to review and consider risks, potential consequences, and to prioritize urgent repair and mitigation measures to existing damaged waterway systems, including removal of sediments, introduced by the 2021 Atmospheric River Event (ARE).

The assessment, as summarized in this memorandum for the noted Area of Concern, follows the following general methodology and approach:

1. High level senior engineering experience and judgement, review of available relevant reference information, site visits and visual inspections, and communication with relevant stakeholders.
2. Risk assessment.
3. Identification and advice on prioritized and appropriate mitigation measures (if any), their required timing, and further work required to validate such advice.

Table 1: Site Information

Site ID	S-CM-1
Site Description	Chemainus River @ Halat IR 2
Location	UTM Zone 10 U N 5,435,217 m, E 489,484 m
Local Government Agency	Halat First Nation, District of North Cowichan
Waterbody	Chemainus River

This revised technical memorandum provides an update to the original preliminary site assessment for the Chemainus River (Site S-CM-1) dated October 20, 2022. This revised memo includes additional field information collected as well as improved understanding of Chemainus River channel and flood conditions based on further field visits and discussions with Halat First Nation (Halat FN), Municipality of North Cowichan (MNC) staff and other community that have occurred since the original memo was issued. In addition, the memo provides revised recommendation for remedial actions based on the work carried out since preparation of the original preliminary assessment completed in September 2022.



2. Background

Recent Flood Events

Two extreme rainfall events on February 1, 2020 and on November 15, 2021 resulted in the third highest (468 m³/s) and second highest (500 m³/s) daily peak flows on record for the Chemainus River since 1953. The highest peak daily flow record, 537 m³/s, was recorded on February 11, 1983.

As part of the recently completed Lower Chemainus Floodplain Mapping Project prepared by Northwest Hydraulic Consultants (NHC) for the Cowichan Valley Regional District (CVRD), a flood frequency analysis (FFA) was carried out using the peak flows recorded at the Chemainus River Bridge. The results of the FFA indicate that the February 2020 flood and the November 2021 flood correspond to a 15-year return period flood and a 10-year return period flood, respectively¹.

Community Flood and Erosion Risks

The Halalt FN community and neighbouring properties within the MNC are located within the Chemainus River, Bonsall Creek and Whitehouse Creek floodplains. Past flood events and recently completed hydraulic modelling carried out by NHC indicate that flow frequently spills over the riverbanks and across the floodplain of Chemainus River, Bonsall Creek and Whitehouse. These floods can have substantial long-term impacts to the local community in terms of life safety, impacts to infrastructure, and negative impacts to health. In addition, flooding can result in closure of Highway 1 and other local roads across the floodplain. As all the transportation corridors connecting Vancouver Island communities cross the Chemainus River floodplain and there are no alternative detour routes available, flooding can result in significant disruption to regional transportation system. Therefore, the underlying flood risks to the Halalt FN community, MNC community and the broader Cowichan Valley and Vancouver Island region are considered to be high to very high.

Mitigating these flood risks within the Chemainus River Floodplain will require an integrated approach involving strategies across the floodplain beyond that which can be assessed within the scope of this preliminary assessment. Reduction of flood risk within the floodplain is the focus of the Lower Chemainus River Integrated Flood Management Plan (IFMP) which is being led by the Cowichan Valley Regional District (CVRD) in partnership with Halat FN, the MNC and the local community.

As stated earlier, the purpose of this preliminary assessment is to consider risks and potential consequences resulting from accumulation of sediment and debris during recent flood events. Therefore, the assessment of risk in this high level and preliminary assessment considers:

1. How accumulation of sediment and debris during the recent 2020 and 2021 flood events in the Chemainus River between Highway 1 Bridge and Chemainus Road Bridge has changed the likelihood of flooding, channel erosion and channel avulsion across the floodplain.
2. What are the incremental changes in flooding and erosion impacts to the community resulting from sediment and debris accumulation that are beyond the underlying risks to communities in the floodplain.

Any measures to mitigate increased risks resulting from the recent 2020 and 2021 flood events are intended to help reduce risk in the interim while long term solutions to address underlying risks are developed and implemented.

¹ Northwest Hydraulic Consultants, Chemainus River Flood Mapping Program Part 1 – Floodplain Mapping Report, Prepared for Cowichan Valley Regional District, Draft Report – Rev 0. May 2022.



Geomorphological Context

The Chemainus River Geomorphic Atlas (Geomorphic Atlas) prepared by NHC for CVRD in May 2022² was reviewed to provide background on historical river processes and to provide context for this preliminary assessment. For consistency, reach numbering and references presented in this preliminary assessment are based on those presented in the Geomorphic Atlas.

The Geomorphic Atlas provides an overview of the watershed scale and reach scale geomorphic processes for the first seven reaches identified along the lower ~8km of the Chemainus River. Only reaches 3 to 5 are located within or adjacent to Halat FN and are the focus of this assessment. However, an understanding of the geomorphic conditions and processes upstream and downstream is important in assessing sediment, debris and erosion hazards within the study area.

For instance, the Geomorphic Atlas identified 17 log jams within the upstream reaches (Reach 6 and Reach 7), with 13 of the log jams and about 18,000 m² of surface area of unvegetated gravel bar located in the channel within Reach 6 which extends upstream of the Highway 1 bridge by about 1.4 km. The Geomorphic Atlas identified 13 log jams and about 17,000 m² of surface area of unvegetated gravel bar within Reach 5. This provides an indication of the potential upstream debris and sediment that could be mobilized in future events and could be deposited along the Chemainus River near the Halat FN in future.

The Geomorphic Atlas is based on field reconnaissance prior to the November 2021 event, therefore the amount of debris and gravel upstream likely would have changed and a new reconnaissance should be carried out to assess current conditions upstream. Assessment of debris and gravel deposits upstream could help identify areas where debris or gravel could be removed as a proactive measure to reduce future accumulation of debris within Halat FN as well as providing additional conveyance upstream to limit potential for bank erosion and avulsion.

2.1 Site Visit

On September 7, 2022, Craig Sutherland, P.Eng. of Kerr Wood Leidal Associates Ltd. (KWL) carried out field reconnaissance of the Chemainus River channel between the Highway 1 Bridge and Chemainus River Bridge (named the Highway 1A Bridge in the Geomorphic Assessment) and areas where flooding is a concern on Halat First Nation (Halat FN) lands. The reconnaissance was also attended by Chief Thomas and Joe Seward of Halat FN, Derek Masselink, Cody Anderson and Amanda Swift of Ministry of Emergency Management and Climate Readiness (EMCR), Cheri Ayers of BioAyers Consultants, and Kalena Chang of Price Waterhouse Coopers (PwC). Ms. Ayers and Ms. Chang had to leave early for other engagements and were only in attendance for the first half of the inspections at the upstream sites near the Highway 1 Bridge.

As shown in Figure 1, the site visit focused on four primary areas of sediment and debris accumulation along the Chemainus River between Highway 1 and Chemainus Road:

1. Left bank point bar and side channels downstream of Highway 1 Bridge – Reach 5.
2. Right bank erosion downstream of Highway 1 Bridge – Reach 5.
3. Right bank side channels – Reach 5.
4. Gravel bar between the E&N Railway Bridge (locally known as the Black Bridge) and Chemainus River bridge – Reach 3.

² Northwest Hydraulic Consultants, Chemainus River Flood Mapping Program Part 1 – Floodplain Mapping Report, Appendix C-Chemainus River Geomorphic Atlas, Prepared for Cowichan Valley Regional District, Draft Report – Rev 0. May 2022.



The sites roughly align with sites identified in the Chemainus River Geomorphic Atlas. However, due to the proximity of Sites 1, 2, and 3 they are interrelated and will be assessed together.

Halat FN also showed KWL/PwC/EMBC four additional sites where flooding is a concern including:

- A. Butcher Slough at Tsussie Road Bridge.
- B. Butcher Slough at Swallowfield Road/Ducks Unlimited Access Road culverts.
- C. Bonsall Creek at Tsussie Road.
- D. Drainage relief culverts at E&N railway near Halat FN community.

The naming of sites on the left and right bank follows standard naming conventions based on a viewer looking downstream along the channel.

Following the original site visit in September 2022, KWL has attended several additional field visits which have allowed for additional information to be collected and to provide an improved understanding of the impacts of the 2020 and 2021 flood events. A summary of these site visits is included in Table 2.

Table 2: List of Chemainus River Site Visits

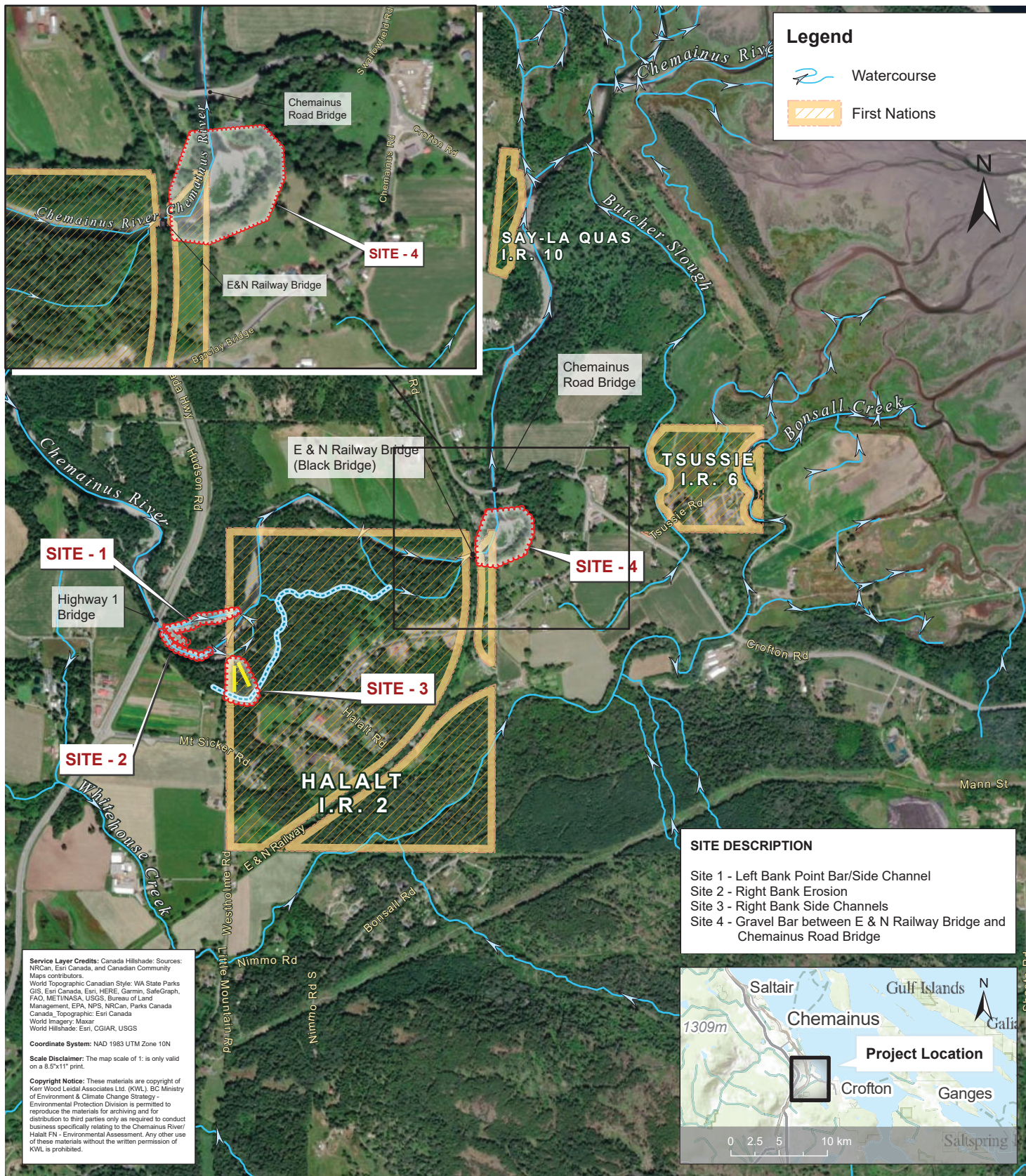
	Purpose/Location	Attended by
September 7, 2022	Initial site reconnaissance to review channel conditions and discuss flood implications. Site visit was limited to access across Halalt FN lands and MNC lands.	Chief Thomas, Halalt FN Joe Seward, Penelakut FN Cheri Ayers, Halalt FN (Consultant) Josh James, Penelakut FN Derek Masselink, EMCR Cody Anderson, EMCR Amanda Swift, EMCR Kalena Chang, PWC Craig Sutherland, KWL
December 15, 2022	Review Site 4 conditions and Discussion with adjacent landowners.	Craig Sutherland, KWL Liam Mackle, KWL Dave Conway, MNC Colin James, Property Owner Don Allingham, Property Owner
January 5, 2023	Review alignments for interim flood protection works and discussion of broader floodplain management issues.	Chief Thomas, Halalt FN Cheri Ayers, Halalt FN (Consultant) Josh James, Penelakut FN David Conway, MNC Jeff Morre, CVRD Corey Anderson, EMCR Hanah Swift, EMCR Craig Sutherland, KWL Shamsul Chowdhury, Parsons
January 19, 2023	Review of Chemainus River Right Bank (Site 2 and Site 3)	Chief Thomas, Halalt FN Cheri Ayers, Halalt FN Craig Sutherland, KWL David Conway, MNC France Bournazel, Property Owner

Additional site visits not listed above have occurred to address specific issues related to gravel/debris management planning as well as the design of interim flood protection work and Chemainus River right bank works have also taken place. However, these visits do not relate specifically to preliminary site assessment and so have not been included.

BC Ministry of Environment & Climate Change Strategy - Environmental Protection Division Chemainus River/Halalt FN - Environmental Assessment



KERR WOOD LEIDAL
consulting engineers



Project Location

Figure 1



3. Land Ownership

Land ownership along the Chemainus River between the Highway 1 Bridge and the Chemainus Road Bridge includes Halat IR 2, private property and property owned by the District of North Cowichan. Land ownership/jurisdiction of the additional sites A-D includes Halat IR 2, Tsussie IR 6, and property owned/managed by Catalyst Paper and Ducks Unlimited Canada (See Table 2).

Table 3: Land Ownership/Jurisdictions

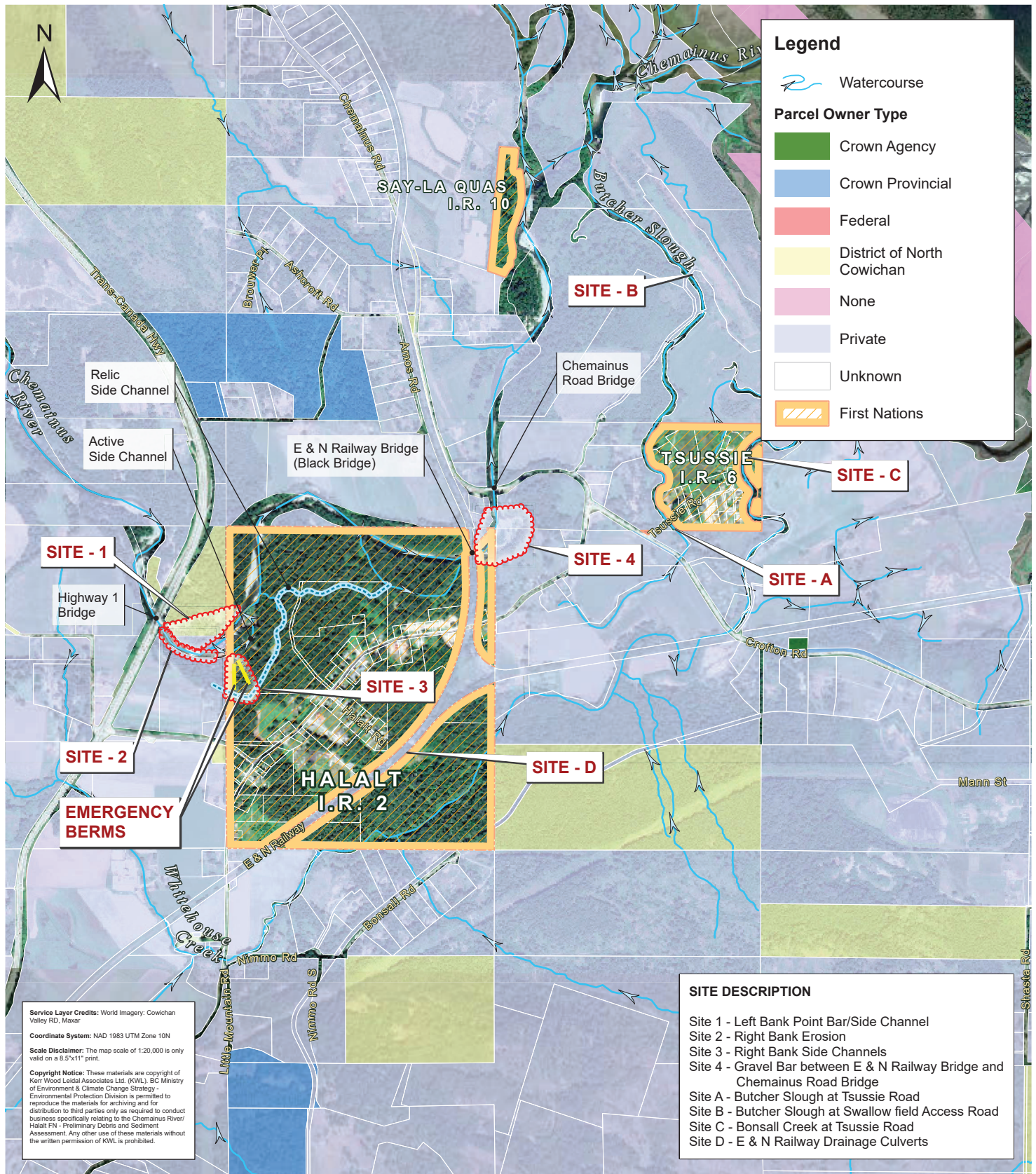
Site #	Site Description	Land Ownership/Jurisdiction
1	Chemainus River Left Bank Side Channel/Point Bar	District of North Cowichan
2	Chemainus River Right Bank Erosion	Private
3	Chemainus River Right Bank Side Channels	Private/Halat I.R. 2
4	Chemainus River gravel bar E&N Railway/ Chemainus Road Bridge	Private
A	Butcher Slough at Tsussie Road Bridge	Tsussie I.R. 6
B	Butcher Slough at Swallowfield Access Road	Private (Catalyst Paper/Ducks Unlimited)
C	Bonsall Creek at Tsussie Road	Tsussie I.R. 6
D	E&N Railway Drainage Relief Culverts	Halat I.R. 2

A map of the property and jurisdictional boundaries is shown in Figure 2.

Transportation infrastructure in the area is also owned and maintained by various jurisdictions including:

- Highway 1 Bridge & Highway 1 Island Highway – Ministry of Transportation and Infrastructure (MOTI)
- E&N Railway Bridge – Island Corridor Foundation/Southern Railway of Vancouver Island
- Chemainus River Bridge and Chemainus Road (north of Crofton Road) – District of North Cowichan
- Mt Sicker Road (west of Highway 1)/Chemainus Road (within Halat FN 2)/Crofton Road – MOTI

BC Ministry of Environment & Climate Change Strategy - Environmental Protection Division Chemainus River/Halalt FN - Preliminary Debris & Sediment Assessment



Project No. 3427.014
Date November 2022
Scale 1:20,000
0 125 250 500 m

Study Area - Land Ownership

Figure 2



4. Site Hazards

4.1 Inter-related Sites 1, 2, 3

Sites 1, 2, and 3 are adjacent to each other, are interrelated and will be assessed together. A plan showing Sites 1, 2 and 3 is included in Figure 3.

Site1 – Left Bank Point Bar/Side Channel d/s of Hwy 1 Bridge (Reach 5)

The point bar and side channel on the left bank of the Chemainus River downstream of the Highway 1 bridge consist of gravel/cobble material on the point bar in the mainstem of the river and finer gravel and sand in the side channel. Over time, sediment appears to have built up in the side channel such that now the side channel elevation is about 1 to 2 m higher than the mainstem channel elevation and is only activated during high flow events. Photos 1 and 2 below show the point bar and side channel.



Photo 1: Gravel Accumulation at U/S End of Point Bar on Right Bank of Chemainus River



Photo 2: Sediment Accumulated Inside Channel on Right Bank of Chemainus River
Note Highway 1 Bridge in background

Some of the trees growing on the point bar have eroded and are now partially spanning the channel (Photo 1).

Well heads for the District of North Cowichan (DNC) water supply system are located adjacent to the side channel and are protected by riprap (Photos 3 and 4). The depth of riprap below the channel is unknown.



Photo 3: DNC Water Supply Well Head Protected by Riprap Adjacent to Side Channel



Photo 4: DNC Water Supply Well Head Protected by Riprap Adjacent to Side Channel

Airphoto review in the Geomorphic Atlas indicates that the point bar and side channel area has become more vegetated since 1975 (see Photo 5) indicating the bar is becoming more stable and at higher elevation over time.



Photo 5: Changes in Vegetation Cover on Point Bar d/s of Highway 1 Bridge (Source: NHC, 2002)

Accumulation of sediment on the point bar and within the side channel on the left bank concentrates flow in the Chemainus River channel along the opposite right bank which tends to increase potential for erosion of the right bank and increase potential for channel avulsion across the right bank floodplain. This erosion is discussed further in Site 2 and Site 3.

Site 2 – Eroding Right Bank (Reach 5)

The second site along the Chemainus River is immediately across the main channel from Site 1 and consists of an eroding right bank on the outside of long sweeping bend downstream of the Highway 1 bridge. The bank is approximately 200 m long and consists of unconsolidated sand and gravel layers over cobble/gravel layer near the channel bed (see Photo 6). The upstream 40 m of the bank is protected by concrete slabs placed downstream of the Highway 1 bridge while the remainder is unprotected with varying degrees of root strength from riparian vegetation. The bank is well-vegetated with mature cottonwood trees and undergrowth.

Air photo interpretation in the Geomorphic Atlas indicates that the bank has been eroding at an average rate of about 0.9 m/year but with variations on year-to-year basis with changes in peak flow magnitude since 1950. For instance, the November 2021 flood event resulted in between 2.5 m to 6.3 m in lateral bank erosion based on pre and post-flood event survey carried out by NHC. Large woody debris and willow wattles installed along the bank in this location in late summer of 2021 failed during the November 2021 flood.



**Photo 6: Right Bank of Chemainus River
Downstream of Highway 1 Bridge Showing Mature
Riparian Trees and Exposed Roots**

Based on conversations on site with the owner of the property on which the erosion is occurring and Chief Thomas of Halalt FN, we understand that erosion of the right bank of the Chemainus River has result in loss of approximately 200 m of a berm which ran parallel to the river channel. This riverside berm connected from the end of the access road/berm from Halalt Land to the Highway 1 road embankment downstream of the highway bridge crossing (see Photo 7).



**Photo 7: Right Bank of Chemainus River
Downstream of Highway 1 Bridge Showing
Approximate Alignment of Original Berm**

No records of construction of the riverside berm have been provided to KWL but it is likely the riverside berm was constructed as part of the fisheries side channel work carried out on Halalt I.R. 2. Based on remaining evidence of the riverside berm observed on site, the crest of the original berm was at elevation approximately equal to the agricultural field elevation to the south of the site. According to floodplain mapping and recently completed hydraulic modelling studies, the original riverside berm would have been overtopped during extreme floods (200-year return period flood). However, the original riverside berm would have prevented overbank flow during more frequent flood events into the relic side channels located between the main river channel and the agricultural fields to the south.

Ongoing erosion of the right bank could result in additional loss of the original berm along the river channel in this location and further changes to the upstream end of the relic side channels on the right bank floodplain leading to:

1. Increased overbank flow into floodplain and relic side channels on right bank downstream of the Highway 1 bridge, this overbank flow follows side channels through the right bank floodplain across Halat FN IR 2 towards the Halalt FN community and a portion of the overbank flow passes through a culvert under the E&N railway embankment to the north of Chemainus Road leading to increased flooding to properties to the east of the E&N railway embankment during more frequent flood events.
2. Increased frequent flooding of floodplain and side channels leading to potential for avulsion of the main channel across the right bank floodplain and into the relic side channels (discussed further in Site 3 below).

Both an increased potential for overbank flow and channel avulsion increase risk to the Halat FN community and neighbouring communities as well as important off channel fish habitat discussed further in Site 3.

Site 3 – Right Bank Side Channels

Description

Two side channels are located on the right bank floodplain of the Chemainus River. The first side channel, which is an active side channel that is about 10 m wide and runs from the downstream end of the long eroding bend on the right bank (Site 2) to approximately 100 m downstream (into Reach 4). The upstream end of the active right bank side channel is partially blocked by a significant log jam located on the right bank as well as a constructed riprap/log groin which crosses the open portion of the side channel (Photo 8).



Photo 8: Entrance to Right Bank Side Channel Showing Eroding Bank, Riprap/Log Groin, and Log Jam

Both the logjam and the groin limit the amount of water that flows into the active side channel in this location. However, ongoing erosion upstream (Site 2) could outflank the groin structure and result in additional water flowing into the active right bank side channel during large flood events.

A second smaller relic side channel about 6 m to 8 m wide flows through the right bank floodplain is set back from the mainstem by about 100 m. The relic side channel meanders through the right bank floodplain for approximately 1.6 km before flowing back into the mainstem channel upstream of the E&N railway bridge at the downstream end of Reach 4. It flows through mature riparian vegetation and is at an elevation that is high enough not to be activated during all high flow events.

Two temporary gravel berms were constructed across the relic side channels in the floodplain within Halat FN reserve lands (see Photo 9). A trapezoidal channel has been left in the berm at the location of the relic side channel (see Photo 10). These were constructed as emergency measures during the 2021 flood. They limited flow across the floodplain and concentrated flow in the two side channels.

As a precaution, these temporary berms have now been removed on recommendation from KWL (see Photo 12). It should be noted that wood debris was observed along the alignment of the temporary berms. It is not clear if this wood debris was placed as part of construction of the berms or was in place before construction (see Photo 13). It is recommended that this material be removed and incorporated into future rehabilitation work.



Photo 9: Berm constructed within Halat FN across the relic floodplain side channels on right bank of Chemainus River



Photo 10: Opening Through the Berm for Smaller Right Bank Side Channel

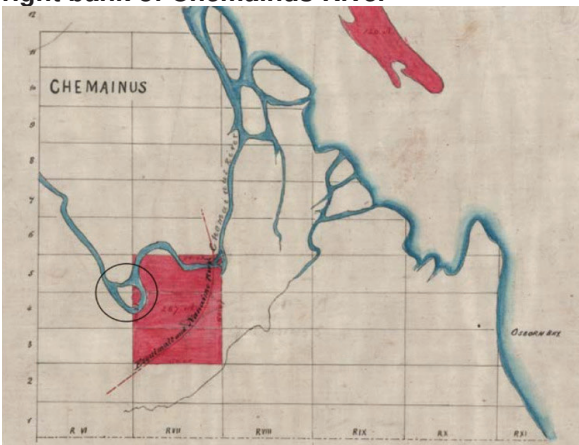


Photo 11: Map From 1877 Showing Two Active River Channels Near the Location of the Observed Side Channels
 (Source: NHC, 2022)

The downstream portion of the right bank relic side channel was excavated approximately 30 years ago to provide ground water rearing habitat for juvenile salmon. This habitat channel is approximately 1.6 km long. The habitat channel starts about 500 m downstream of the mainstem channel.

This relic side channel is a preferential pathway for potential channel avulsion. The potential for avulsion would be exacerbated by accumulation of LWD and bank erosion near the entrance of this channel at Site 2. The geomorphic hazard maps produced by NHC in 2022 show this area to be an avulsion hazard zone. In addition, maps prepared in 1877 (Indian Affairs Survey Records No. BC 220) suggest that the mainstem river was historically two channels in this location (Photo 11).



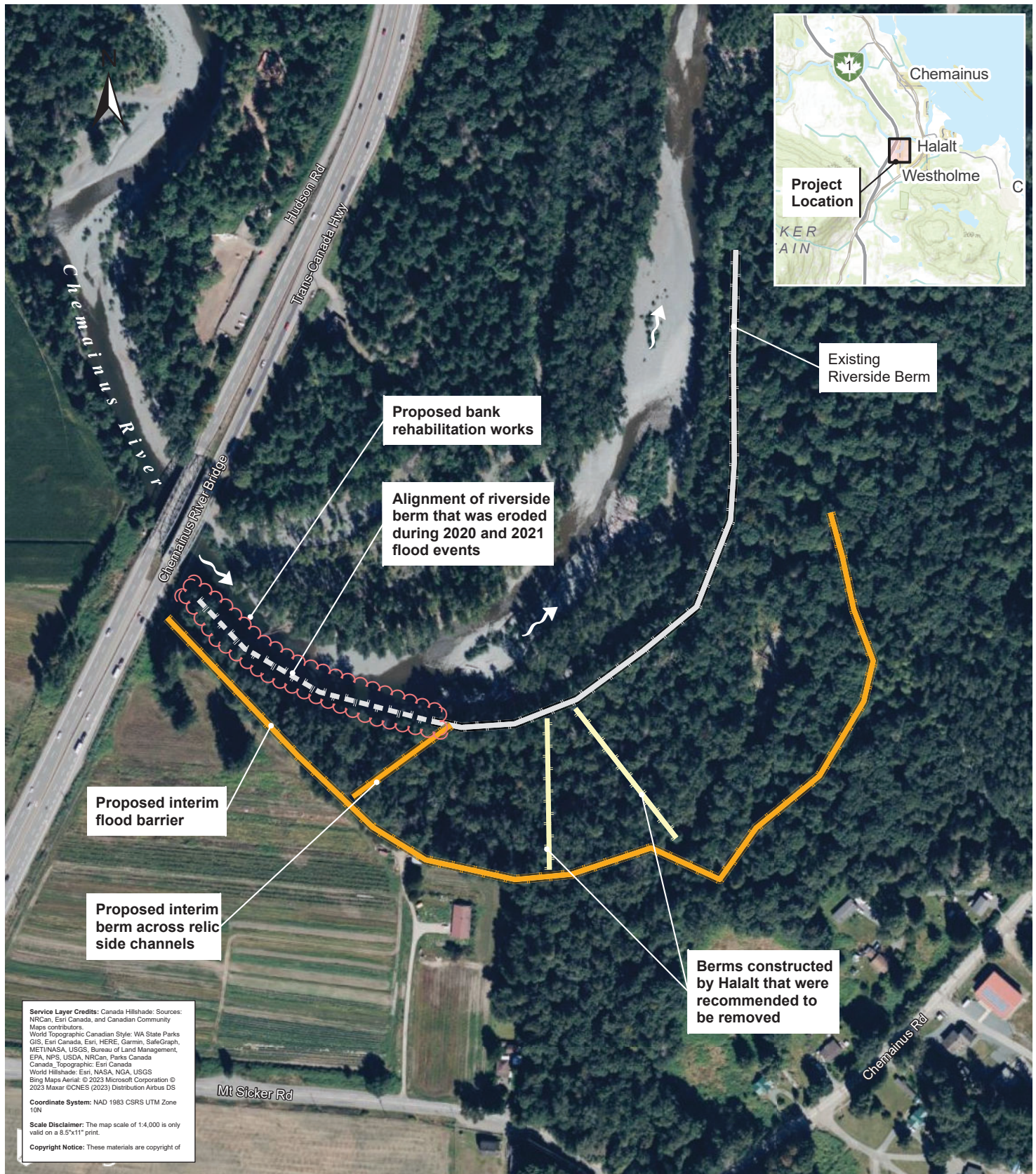
Photo 12: Temporary berm across floodplain within Halalt FN now removed.



Photo 13: Wood debris observed adjacent to alignment of temporary berm.

BC Ministry of Environment and Climate Change Strategy

Chemainus River Right Bank Protection below Highway#1 Bridge



Project No. 3427.025

Date September 2023

Scale 1:4,000

25 50 100 m

Site 1, Site 2 and Site 3
Plan

Figure 3



Preliminary Risk Evaluation – Site 1, Site 2, and Site 3

The Preliminary Qualitative Risk Evaluation is shown in Table 3. As the geomorphic processes at Sites 1, 2, and 3 work together to increase risk they have been evaluated together. The risk key is included in Enclosure A for ease of reference.

Table 3: Preliminary Risk Evaluation (Site1, Site 2, and Site 3)

Category	Preliminary Risk Evaluation	Consequence
Public Health and Safety	High	Ongoing accumulation of sediment on the left bank point bar (Site 1) and erosion of the right bank (Site 2) increases the potential for additional overbank flows onto the right bank floodplain during larger/less frequent flood events. This ongoing erosion has resulted in loss of approximately 200 m of a riverside berm that runs adjacent to the right bank of the Chemainus River mainstem channel. Loss of the riverside berm has resulted in increased overbank flow from the river into the upstream end of the relic side channels on the right bank. The loss of the berm has resulted in an increased likelihood of overbank flow and potential for avulsion. Given the increased frequency of overbank flow into the relic side channel, the potential of flooding within the Halalt Community and neighbouring community during relatively small flood events has increased. In addition, the increased potential for an avulsion of the main channel into the relic side channel results in further increase risk for potential for flooding within the Halat Community. Flooding results in significant long-term disruption to the Halat FN and neighbouring communities. Therefore, the incremental risk to public health and safety resulting from ongoing erosion of the right bank is considered to be High.
River Capacity	High	Ongoing accumulation of gravel/debris in the left bank point bar and side channel (Site 1) reduces river capacity and increases potential for bank erosion on right bank (Site 2) and avulsion into the relic side channel (Site 3). Due to gravel sources upstream and the highly erodible material on the right bank, the potential for deposition on left bank and continued erosion of the right bank is likely. Therefore, the risk of reduced river capacity is considered to be high.
Environmental	Medium	Potential avulsion of the mainstem flow into the relic side channel would result in significant impacts to the existing 1.6 km of rearing side channel habitat within Halalt FN which provides unique rearing and refuge habitat along this reach of the river. As the increased potential for avulsion is considered to be moderately likely the impact to environmental values is considered to be moderate.



Category	Preliminary Risk Evaluation	Consequence
Infrastructure	Medium	Due to gravel sources upstream and the highly erodible material on the right bank, the potential for further deposition on left bank and erosion of the right bank is likely. Given the increased frequency of overbank flow into the relic side channel, the potential of flooding within the Halalt Community and neighbouring community during relatively small flood events has increased. In addition, the increased potential for an avulsion of the main channel into the relic side channel results in further increase in risk for potential for flooding within the Halat Community. As, infrastructure (homes, roads, water system) within Halat FN are set back (300 m to 500 m) from both the mainstem and relic side channel the direct impact from bank erosion and potential channel avulsion is limited. However, increased potential for flooding due to loss of the riverside berm could result in increased likelihood of negative impacts to infrastructure within Halalt FN and neighbouring community. Given the limited potential for increased impacts to infrastructure due to bank erosion and potential channel avulsion and high potential for increased impacts due to increased likelihood of flooding, it is considered that increased risks to infrastructure are moderate within Halat FN and neighbouring community.

4.3 Site 4 – Debris and Gravel Accumulation (Reach 2)

Site 4 is located between the E&N Railway Bridge and the Chemainus River Bridge (Reach 2 in the NHC Geomorphic Atlas). This area is a depositional zone with a 10,000 m³ (approximate) gravel bar. The right bank of the channel is protected by riprap between the E&N bridge and a bedrock outcrop upstream of the Chemainus Road bridge. Since 1992, the channel has migrated from the right bank to the left bank (Photo 14).



Photo 14– Air photos from 1992 (left) and 2021 (right) showing how channel morphology has changed in the depositional area over time (Source: NHC 2022)

In November 2021, a large amount of wood debris accumulated on the right abutment of the Chemainus Road Bridge (Photo 15). This debris has since been removed. However, it remains a location where debris accumulates and may require removal at this location again in future.



Photo 15: Large woody debris on right abutment of Chemainus Road Bridge after November 2021 flood which has since been removed (Source: NHC 2022)



Table 4: Preliminary Risk Evaluation (Site 4)

Category	Preliminary Risk Evaluation	Consequence
Public Health and Safety	High	Ongoing accumulation of sediment within the reach between the E&N Railway Bridge and Chemainus River Bridge (Reach 3) will continue to reduce conveyance in the mainstem of the channel which could result in additional flow in the Butcher Slough and across private properties on the right bank floodplain. Increased overbank flow in Butcher Slough and across private properties on the right bank can lead to increase flood flows across Chemainus Road and into the Tussie I.R. 6. Although the peak water levels are not likely to change significantly as a result of sediment accumulation in the river channel at this location, the frequency of overbank flow is likely to increase which increases risk of flooding within these communities. The riverbanks along this reach of the river are protected from erosion by bedrock outcrops and riprap, sediment accumulation has limited potential for triggering bank erosion resulting in either further increased flows or potential for channel avulsion (such as at Site 2 which is not protected by riprap). However, the risk to public health and safety is still considered to be High due to the frequency of overbank flows.
River Capacity	High	Ongoing accumulation of sediment within the reach between the E&N Railway Bridge and Chemainus River Bridge (Reach 3) will continue to reduce conveyance in the mainstem of the channel which could result in additional flow in the Butcher Slough and across the right bank floodplain. Therefore, the risk to river capacity is considered to be High.
Environmental	Low	Accumulation of sediment in this reach of the river has promoted growth of bar top vegetation and collection of wood debris which provides additional complexity to habitat in this area.
Infrastructure	Medium	Past accumulation of wood debris on the E&N bridge and Chemainus River bridge indicate that these structures are susceptible to debris accumulation. However, recent removal of debris from these bridges has reduced the risk of impacting infrastructure. Ongoing monitoring will be required to assess accumulation of debris at these bridges.



5. Short-term Mitigation Options

5.1 Site1 – Left Bank Point Bar/Side Channel d/s of Hwy 1 Bridge (Reach 5)

Removal of sediment in the left bank side channel (Site 1) as outlined in the original preliminary assessment in September 2022 was completed during a period of unusually low water in November of 2022. Due to the risk of rainfall and potential for flooding of the construction site, the time window to carry out the work was limited. Therefore, only about 2,850 m³ of the original design amount of 5,000 m³ for sediment removal was carried out.

Comparison of topographic surveys carried out immediately after sediment removal including supplementary LiDAR from pre-2020 and in summer of 2022 indicates that a net volume of 560 m³ was transported out of the left bank side channel over the winter of 2022/23 (see Appendix B). The comparison of topographic surveys indicates that conveyance of the left bank side channel appears to have been maintained with left bank side channel invert elevations and channel widths measured in 2023 being approximately the same as those measured immediately after channel excavation in 2022. The only significant difference appears to be:

- Deposition in the upstream 70m of the excavated left bank side channel (between Stn 0+40 to Stn 0+110 as shown in Appendix B).
- Scour around tree trunks and tree roots (Section at Stn 0+080 and Stn 0+200 in Appendix B) that were not removed as part of the sediment removal program in 2022 due to time constraints for construction.

To maintain and improve conveyance through the left bank side channel (Site 1) and limit potential for ongoing erosion along the right bank (Site 2) over the winter of 2023/24, it is recommended that additional sediment removal be carried out along the left bank side channel to approximately match the surveyed post construction channel invert profile. It is also recommended to remove a small number of trees to limit the potential for scour holes to develop which appear to be the main source of sediment migrating from the left bank side channel.

Given the potential for ongoing sediment accumulation in the left bank side channel leading to limit effectiveness over time, we consider the option of improving conveyance in the left bank side channel (Site 1) to be a lower priority option compared to protecting the right bank from further erosion as discussed in more detailed in Site 2 below.

5.2 Site 2 – Eroding Right Bank (Reach 5)

Given the risks associated with ongoing erosion of the right bank downstream of Highway 1 Bridge (Site 2), reinstatement of a riverside berm and permanent protection of this highly erodible bank from further erosion is top priority. As the river channel has now moved into the alignment of the original riverside berm, reconstruction of the riverside berm at its original location is now not possible.

The proposed bank reinstatement work would be intended to reduce potential of overbank flows into the relic side channels on the right bank floodplain using a nature-based approach. The proposed bank reinstatement works would consist of a naturalized berm running parallel to the river channel that would be designed to be replanted with riparian vegetation. The proposed reinstated riverside berm would be set back from the river channel to maintain integrity of the existing riparian area.

To protect the natural berm from erosion, the proposed bank reinstatement works would also include hard points (spurs or bendway weirs) in the river channel to direct flow away from the erodible bank to allow the bank to restabilize over time as well as riparian and aquatic habitat features to protect and promote healthy fish habitat in the reach. An example of a site combining hard points with riparian habitat is shown in Photo 16).

The intent of the right bank reinstatement is to limit overbank flow into the relic side channel for smaller/relatively frequent flood events. Rehabilitating the right bank will reinstate a level of flood protection for the fish habitat side channel and the Halalt FN community similar to what was provided prior to erosion and loss of the original riverside berm. However, the proposed reinstatement will not protect the Halalt FN community and neighbouring properties within MNC during more extreme flood events. Therefore, an interim flood barrier has also been proposed to be installed shown in Figure 3. The proposed interim flood barrier is intended to provide a level of reduced flood risk for the Halalt FN community while the community carries out floodproofing measures in the community. The interim flood barrier is being constructed separately from the sediment and debris program but is provided here for context.

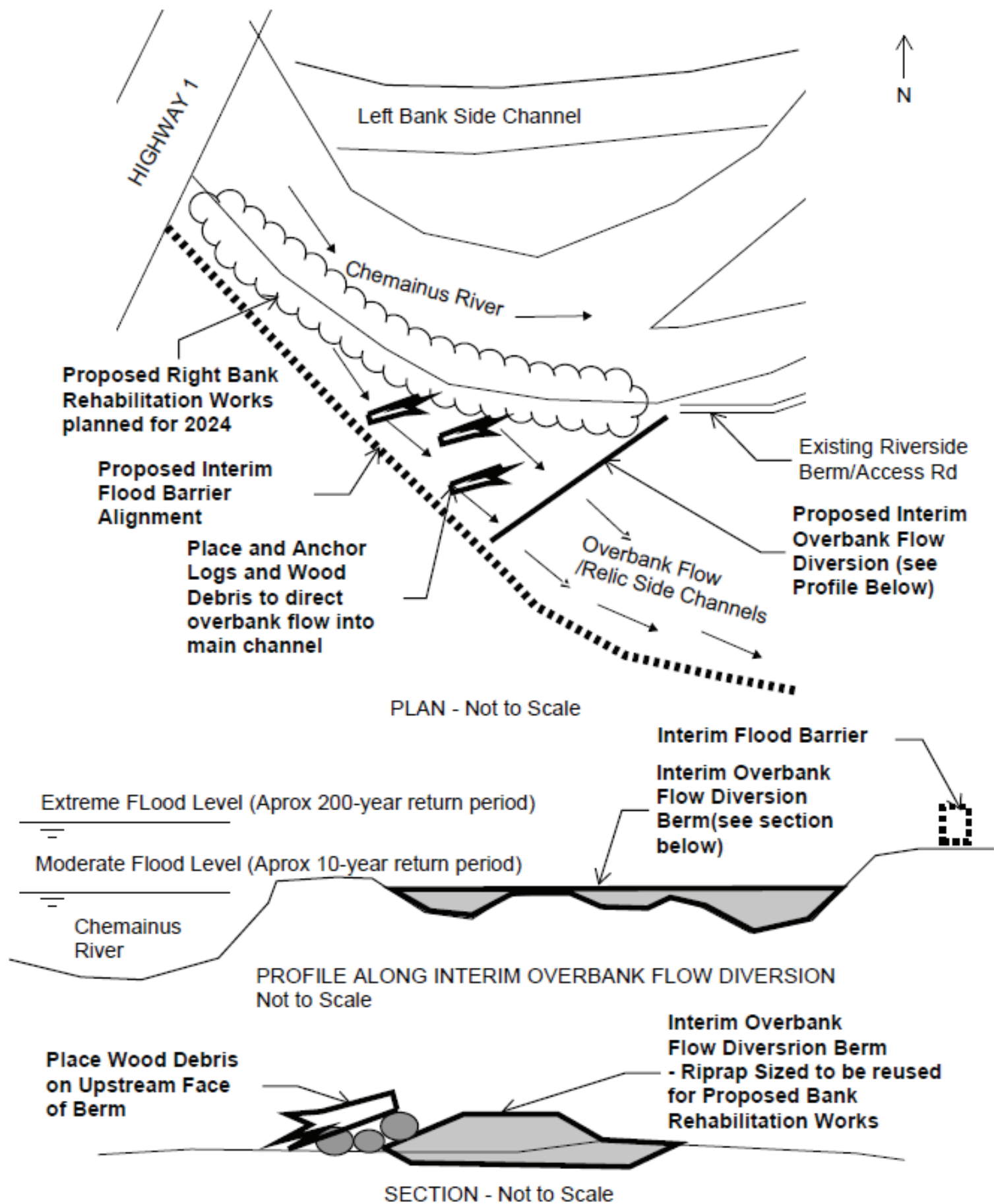


Photo 16: Example of Combination of Riparian Habitat with Rock Hard Points for Erosion

5.3 Site 3 – Right Bank Side Channels (Reach 5)

As work has not yet progressed on rehabilitation of the right bank (Site 2), the risk of overbank flow into the relic side channels on the right bank floodplain remains for the winter high flow season of 2023/24. In order to limit flow into the right bank relic side channels during lower/more frequent flood events, it is recommended that interim measures be carried out to partially block flow into the relic channels. The proposed interim overbank flow diversion would involve placement of riprap berms across the relic side channels (see Figure 4). Riprap should be sized such that it could be reused for construction of the hard points included in the design of the right bank rehabilitation works (Site 2).

In addition to the riprap berms, the work should also include rearrangement of the existing wood debris on and in the relic side channels to help direct flow away from the relic side channels and back into the main river channel during periods of high flow. The rearranged wood debris should be anchored (either to buried rock or mature riparian trees). Additional wood salvaged from the temporary berm alignment within Halalt FN and/or the sediment and debris removal projects (Site 1 and Site 4) could also be used to supplement the current wood debris in the floodplain.





5.4 Site 4 - Debris and Gravel Accumulation (Reach 2)

Given the risks associated with increased frequency of flooding resulting from sediment and debris accumulation in the Chemainus River Channel between the E&N Railway Bridge and Chemainus River Bridge, removal of sediment and debris on the gravel bar to help reestablish a portion of the river channel capacity at this location should be carried out during the low-risk fish window. The gravel removal should be designed as a gravel bar “trimming: to limit disturbance to the bar and limit potential for channel instability resulting from removal of the bar. The bar trimming should include removal of gravel above the low water level on the downstream two-thirds of the bar length. Any gravel, existing vegetation and wood debris located at the upstream third of the bar should also be left in place to help stabilize the bar. The gravel bar trimming should be graded to prevent formation of small pools which could lead to fish entrapment. Vegetation along the channel that has formed along the right bank riprap should also be protected.

It should be noted that this is a short-term solution and that further gravel removal should be planned in future until such time as long term solutions can be implemented (see Section 6). There should be a channel morphology monitoring program set up to measure effectiveness of gravel removal program. This should consist of a set of channel cross sections surveyed along the channel mainstem from upstream of the Highway 1 Bridge to downstream of the Chemainus Road bridge as well as sampling of riverbed sediment gradation (Wolman Sample). These could be located at transect locations established as part of the habitat assessment work carried out for Halat.

6. Site Opinion and Advice

Based on the hazard and risk assessment, Site 1, Site 2, Site 3 and Site 4 along the Chemainus River are Areas of Concerns, requiring further assessment, emergency work, and potential mitigation measures to be implemented as soon as possible.

Emergency Sediment and Debris Removal Works (2023/24):

- **Additional Sediment and Debris Removal (Site 1)** on left bank side channel downstream of Highway 1 Bridge involving trimming of sediment accumulation and removal of a small number of trees. This work should be completed based on regulatory permitting requirements and under direction of a Professional Engineer.
- **Design and Construct Right Bank Erosion Protection (Site 2):** given the risk of avulsion and increase in overbank flows into the floodplain associated with ongoing erosion of the right bank of the Chemainus River downstream of Highway 1 bridge, it is recommended that rehabilitation of the floodplain berm and bank restoration measures be designed and constructed. These measures can include riparian and habitat features but may have to also rely on hard points (such as spurs or bendway weirs) due to the higher flow velocities and scour associated with this location. This option will require detailed engineering design, negotiations with the private property owner to allow for construction access along the right bank of the Chemainus River as well as environmental regulatory approvals for working instream. Design and construction field review of this work should be completed under direction of a professional engineer and be carried out in accordance with regulatory permitting requirements and landowner permissions.
- **Remove Sediment and Debris (Site 4)** on Chemainus River between E&N Railway Bridge and Chemainus Road Bridge (Site 4) involving trimming of sediment accumulation and removal of minor wood debris to the low water level. This work should be completed based on regulatory permitting requirements and under direction of a Professional Engineer.



Long-term Holistic Solutions

- **Assess Flood Protection Improvements:** As part of the ongoing Lower Chemainus River IFMP process, flood improvement options should be identified and tested using the available hydraulic model. Some of the additional sites identified as part of this reconnaissance can be used to help guide options for improvements.
- **Develop a Watershed Management Plan:** A Chemainus River Watershed Management Plan process should be implemented with Halat FN, local government (CVRD and DNC), private forestry landowners (Mosaic) and other private landowners along the Chemainus River with support of senior governments. The goal would be to develop a community led plan which can provide guidance on management of watershed scale processes which impact sediment, flood, and debris risks in the lower watershed. The planning process should at a minimum address the sediment, debris and flood risk concerns but may also include broader and related concerns such as drought flows, ground water, etc.

Additional Recommendations to be Undertaken Outside this Sediment Program

- **Install Interim Overbank Flow Diversion** across the relic side channels on the right bank of the Chemainus River including riprap berms and wood debris. Wood debris adjacent to the alignment of the temporary berm (now removed) on Halalt FN and from sediment/debris removal projects (Site 1 and Site 4) could be reused at this site. This work should be completed based on regulatory permitting requirements, landowner permissions and under direction of a Professional Engineer.
- **Monitor Debris Accumulation:** Regular monitoring of debris at known locations of accumulation (downstream of the Highway 1 Bridge, E&N bridge and Chemainus Road bridge, etc.) is required to reduce risk to these important transportation links and maintain channel conveyance. This should be carried out by repeated channel cross section surveys at defined locations prior to and a year after sediment removal.
- **Install Interim Flood Protection Barrier:** The proposed interim flood barrier should be designed and installed to help reduce flood risk for the Halalt FN community while planned flood proofing measures are carried out.



Closure

Please contact Craig Sutherland at 250-889-2155 if there are any questions or concerns.

KERR WOOD LEIDAL ASSOCIATES LTD.

Prepared by:



Reviewed by:

Craig Sutherland, MSc., P.Eng.
Senior Water Resources Engineer

Stephen Bridger, M.A.Sc., P.Eng.
Project Manager

CS/SB/aah

Encl.: Enclosure A: Risk Evaluation Matrix
Enclosure B: Pre/Post Construction Ground Surface Comparison - Left Bank Side Channel Gravel Removal

Statement of Limitations

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Revision History

Revision #	Date	Status	Revision Description	Author
0	October 20, 2022	FINAL		CS/DNM
1	September 25, 2023	REVISED	Revised based on additional information and field reconnaissance	CS/SB



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Enclosure A

Risk Evaluation Matrix

Table A-1: Risk Evaluation Matrix

		Risk Evaluation and Response				
	Consequence Rating	Very Low	Low	Medium	High	Very High
Indices	Public Health and Safety	Minor disruption to few.	Minor, short term disruption to local community or moderate disruption to few.	Moderate disruption to local community, or substantial disruption to few.	Moderate, long term disruption to local community.	Substantial, long term disruption to region.
	River Capacity	Flow contained within the channel	Flow temporarily floods adjacent land	Flow floods adjacent lands resulting in prolonged flooding	Partial avulsion of flow resulting in flooding, erosion and scour damage to adjacent land and infrastructure	Full avulsion of flow resulting in flooding, erosion and scour damage to adjacent land and infrastructure
	Environmental	No noticeable loss or deterioration of habitat, species, unique landscapes, or culturally valued sites.	Small, short term loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites. Moderate recoverable loss or damage of less valued habitat, species, landscapes, or sites.	Moderate temporary or small permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites. Moderate loss or damage of less valued habitat, species, landscapes, or sites.	Moderate permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites.	Major permanent loss or deterioration of important, unique, rare, or endangered habitat, species, landscapes, or culturally valued sites.
	Infrastructure	No infrastructure impacted	Impacts to infrastructure (minor erosion or scour, some debris accumulation, partial infilling, etc.) are not expected to have an impact on the operation of the infrastructure.	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) leave infrastructure vulnerable	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) should be repaired post-freshet	Impacts to infrastructure (erosion or scour, debris accumulation, infilling, etc.) will likely result in failure or irreparable damage to the infrastructure - repairs should commence pre-freshet
	Annual Exceedance Probability	Very Low	Low	Medium	High	Very High
Likelihood						
Very Likely	>0.2	M	H	H	VH	VH
Likely	0.2-0.1	L	M	H	H	VH
Moderate	0.1-0.02	L	L	M	H	H
Unlikely	0.02-0.005	VL	L	L	M	H
Very unlikely	<0.005	VL	VL	L	L	M
Risk Key		VH	Very High	Risk is unacceptable short-term (before next flood season); Risk reduction required		
		H	High	Risk is unacceptable medium-term; Risk reduction plan must be developed and implemented in a reasonable time frame		
		M	Medium	Risk may be tolerable; more detailed review required		
		L	Low	Risk is tolerable; monitor		
		VL	Very Low	Risk is broadly acceptable; no further review needed		



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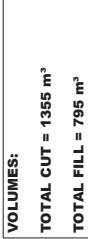
Enclosure B

Sediment Monitoring Survey - Left Bank Side Channel Gravel Removal



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NOTE: AB = AS BUILT AFTER 2022 GRAVEL REMOVAL WORKS



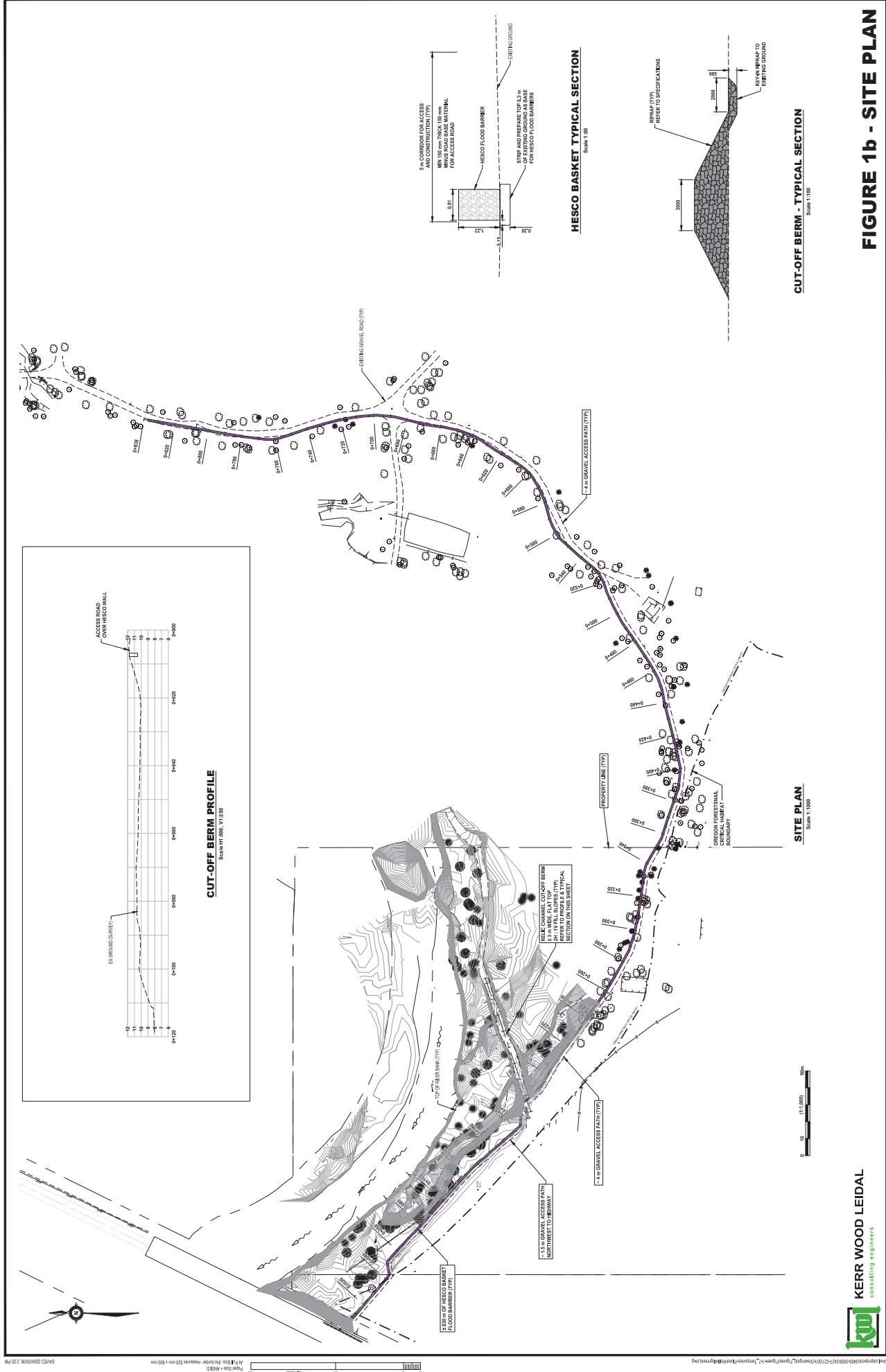
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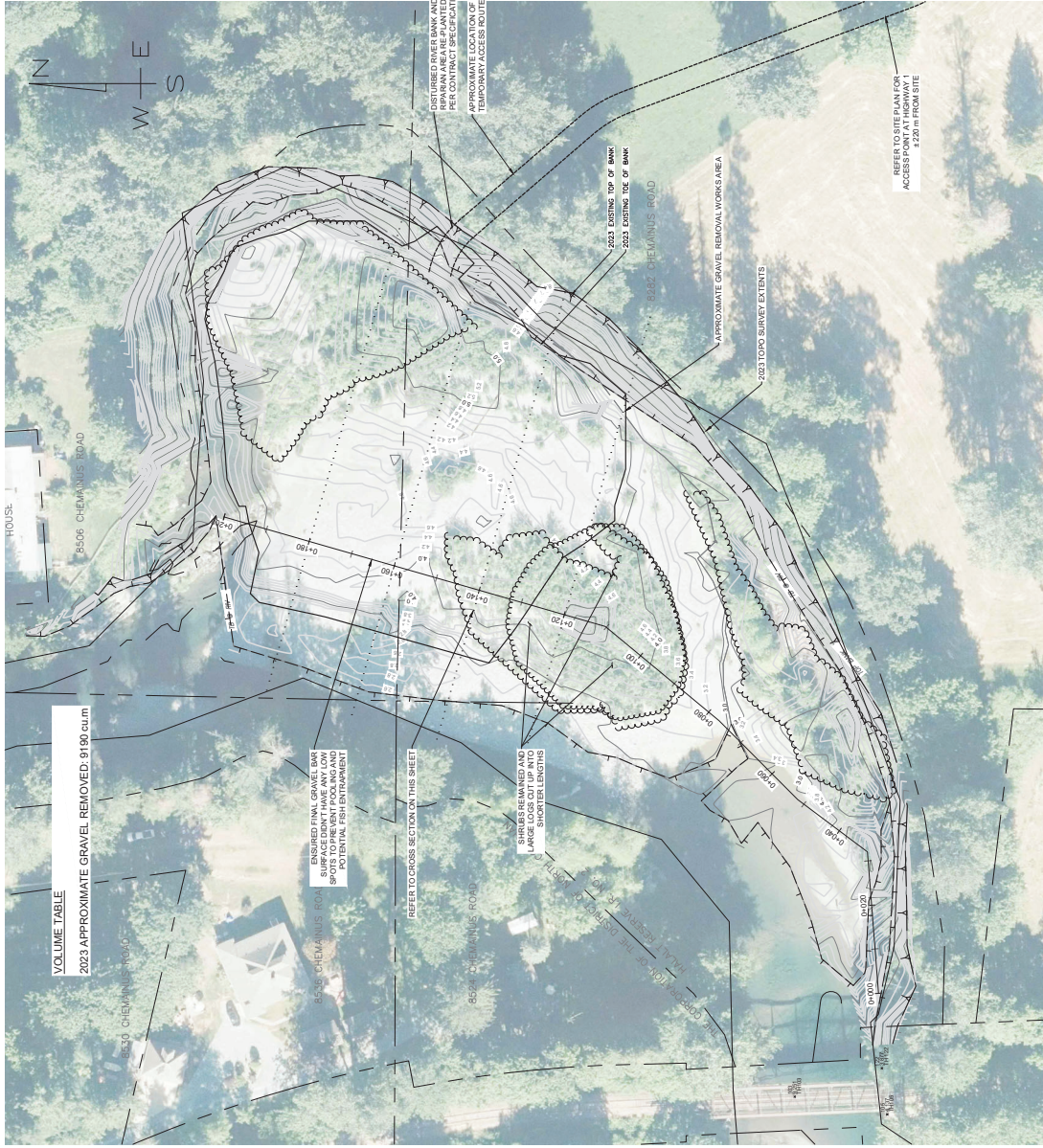
SEDIMENT MONITORING 2022 TO 2023 LEFT BANK SIDE CHANNEL

NOTE: AB = AS BUILT AFTER 2022 GRAVEL REMOVAL WORKS

Appendix B

Record Drawings





VOLUME TABLE

2023 APPROXIMATE GRAVEL REMOVED 9190 cu.m

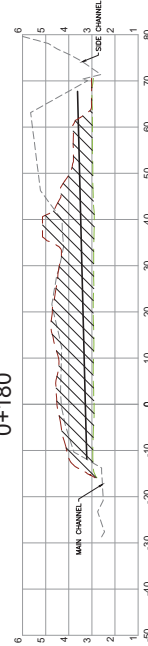
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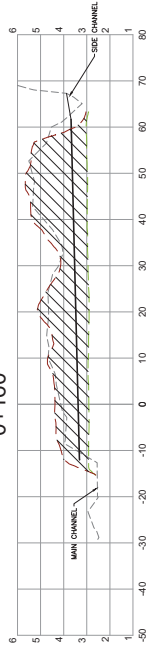
2023 GRAVEL BAR BEFORE REMOVALS

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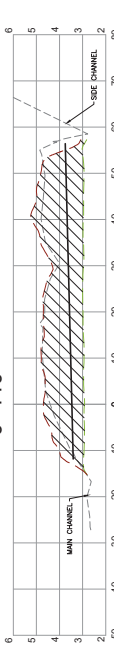
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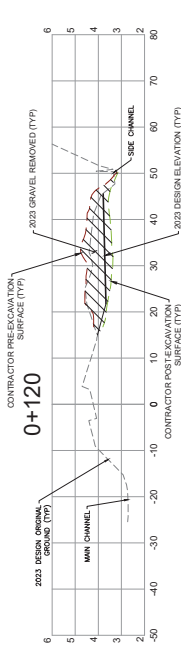
0+160



0+140



0+120



SECTIONS

Scale 1:5000 1:5000

0 5 10 20 m

0 5 10 20 m

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1000-1000
F (250) 884-4233
F (250) 884-4234
E 884-4234

**HALALT FIRST NATION
CHEMANUS RIVER GRAVEL BAR
SEDIMENT REMOVAL
PLAN & SECTIONS**

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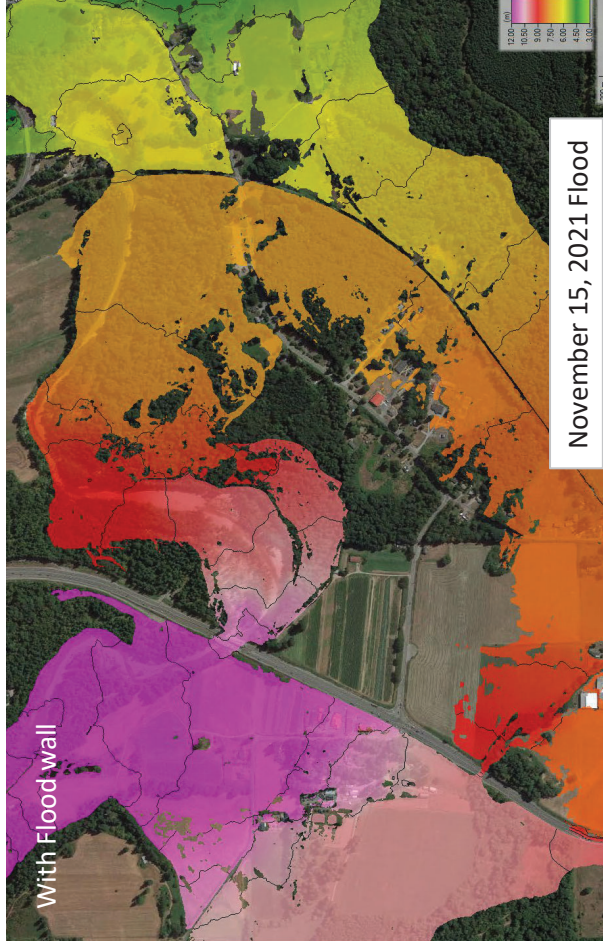
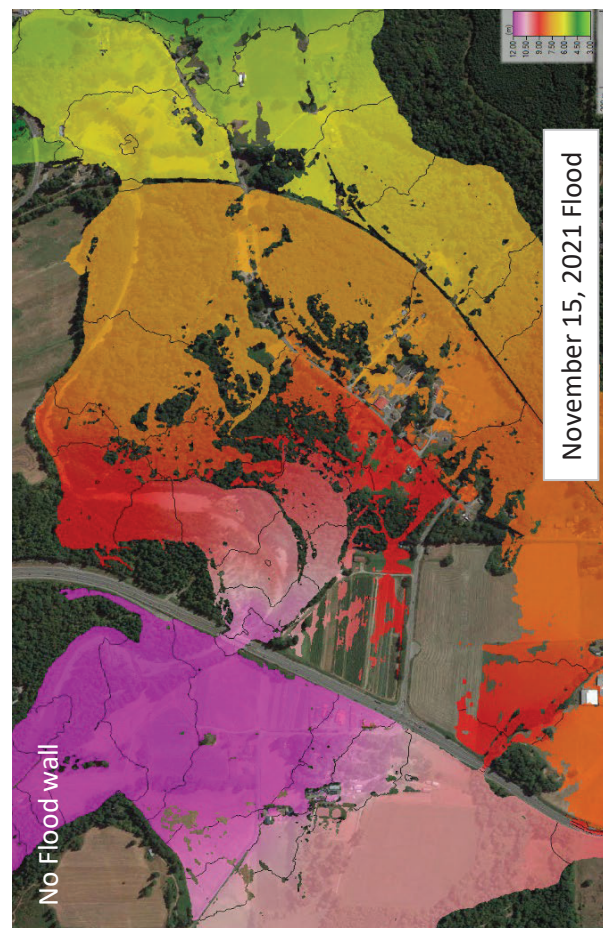
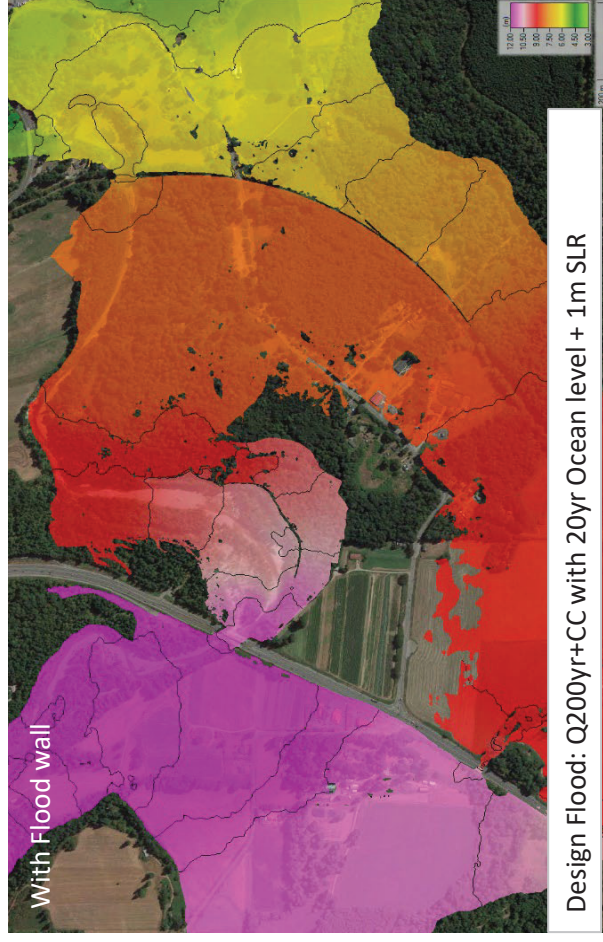
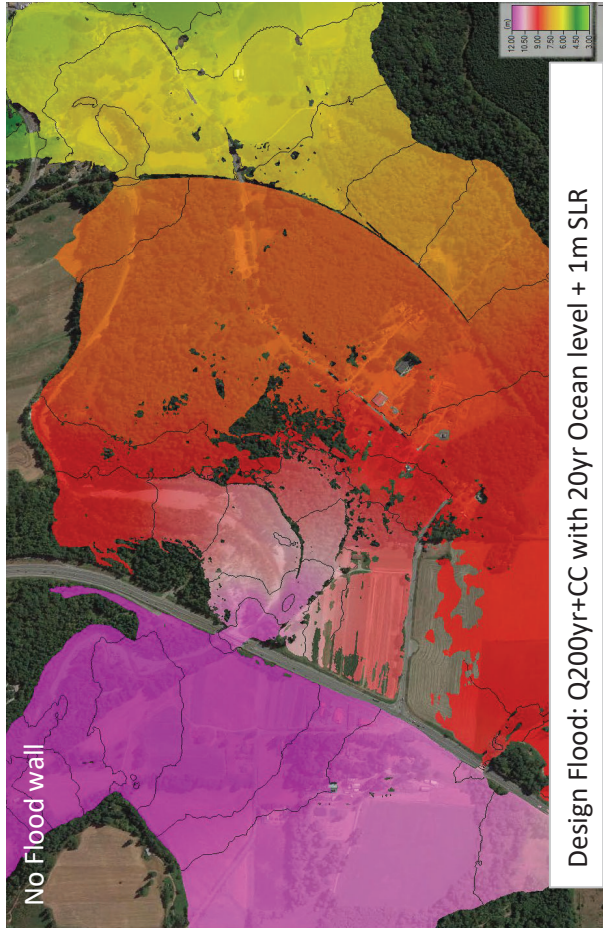
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Appendix C

NHC Preliminary Hydraulic Results



Appendix D

Environmental Monitoring Completion Report – Sediment Removal

Kerr Wood Leidal Associates Ltd.
December 12, 2023

Technical Memorandum

DATE: December 12, 2023

TO: Thyren Jacobs
Ministry of Environment and Climate Change Strategy

FROM: Jaime Dimillo, BIT, BC-CESCL
Chad Davey, M.Sc., R.P. Bio

RE: **CHEMAINUS RIVER SEDIMENT REMOVAL**
Environmental Monitoring Completion Report
Our File 3427.029-300

This technical memorandum summarizes environmental monitoring activities conducted for sediment removal within the Chemainus River in Summer 2023. Kerr Wood Leidal Associates Ltd. (KWL) is working with the Ministry of Environment and Climate Change Strategy (ENV) to assess and address the impacts of sediment introduced during the 2021 atmospheric river (AR) event. Funding by the Province of British Columbia (BC) was approved to help remove deposited sediment in the waterways of the Chemainus River. KWL has been retained by ENV to manage the removal of sediment from high impact areas.

The project team consisted of KWL, Halalt First Nation, Municipality of North Cowichan (MNC) and Stone Pacific Contracting. KWL acted as the Environmental Monitor (EM) for the project. The EM was present full-time during construction to ensure activities were conducted according to relevant Best Management Practices (BMPs), regulatory approvals, and permits, and to ensure potential for adverse environmental effects associated with the project were avoided and minimized.

1. Project Description

The Halalt First Nation community and neighbouring properties within the MNC are located within the Chemainus River, Bonsall Creek and Whitehouse Creek floodplains. The November 2021 Atmospheric River Event (ARE) caused substantial sediment movement, flooding and changes through BC's river and creek systems, including on the Chemainus River.

The floods can have substantial long-term impacts to the local community in terms of life safety, impacts to infrastructure, and negative impacts to health. Therefore, the underlying flood risks to the Halalt First Nation community, MNC community are considered to be high to very high.

Four sites have been identified for multi-phased recovery works on the Chemainus River. The locations of all four sites are illustrated on Figure 1. This memorandum summarizes environmental monitoring activities that occurred during the Site 4 works, specifically.

1. Site 1 – Left Bank Side Channel/Point Bar Sediment Removal (partially completed in 2022).
2. Site 2 – Right Bank Restoration (2024).
3. Site 3 – Temporary Flood Barrier and Right Bank Side Channels (Fall 2023).
4. **Site 4 – 2023 Sediment Removal at Gravel Bar between E&N Railway and Chemainus Road Bridge (Summer 2023).**



2. Permitting and Approvals

The project works were undertaken in compliance with best management practices, and in accordance with the terms of the following regulatory permits and approvals:

- Letter of Advice (23-HPAC-00700) issued by Fisheries and Oceans Canada (DFO) for works under the *Fisheries Act*, dated August 17, 2023 (Enclosure A).
- *Water Sustainability Act* Change Approval (File 1005901) dated September 1, 2023 and subsequent amendment dated September 12, 2023 (Enclosure A).

3. Summary of Works Undertaken

All works were undertaken by Stone Pacific (the Contractor). The specific construction sequence is outlined in Table 1.

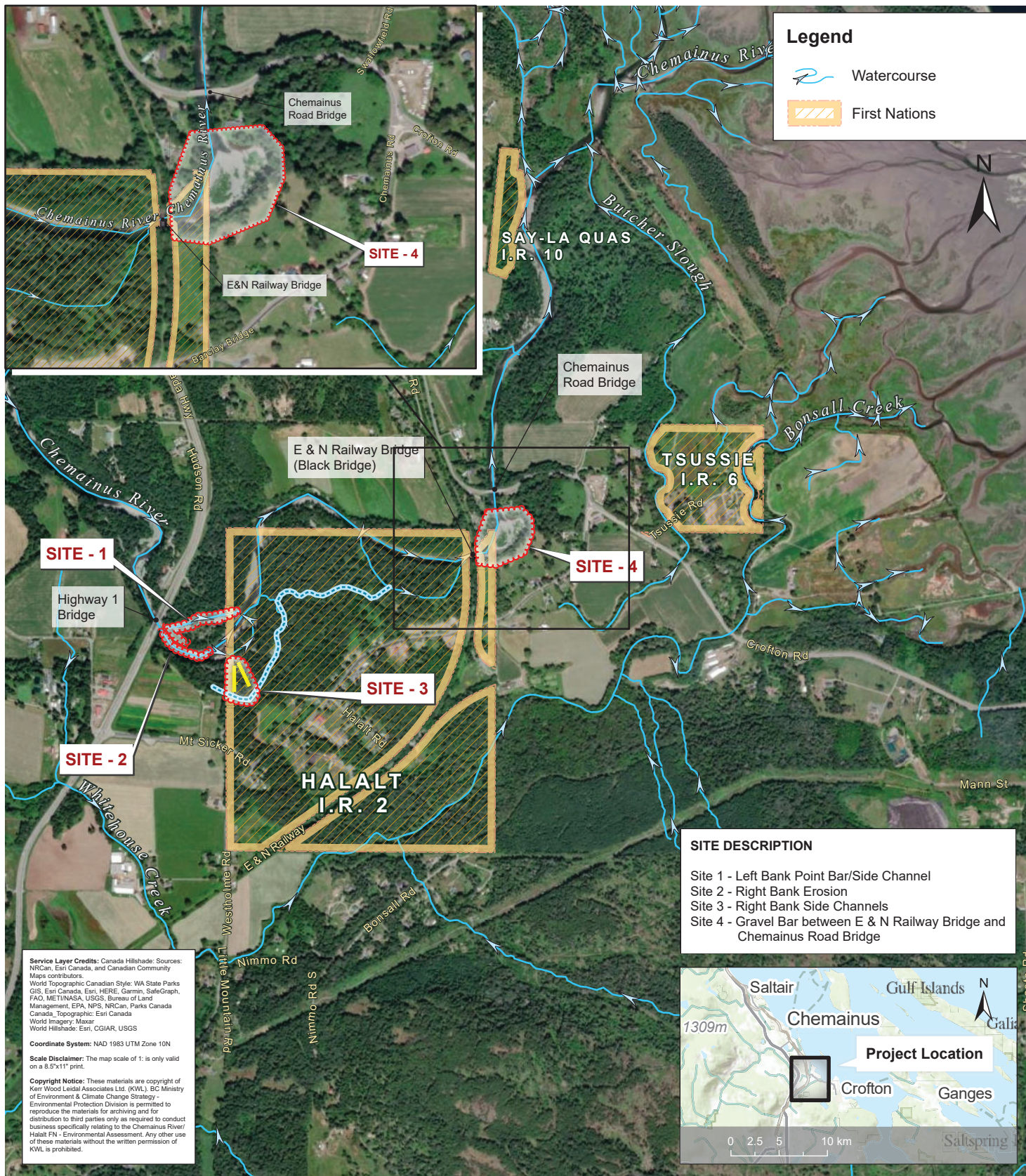
Table 1: Proposed Construction Methods

Stage	Activity	Description of Activity
Site Preparation	Site Access	Removed one (1) broadleaf maple tree to facilitate site access and built an access ramp for machinery onto the gravel bar.
	Site Clearing	Removed approximately 2,505 m ² of shrubbery on the existing gravel bar to facilitate sediment removal. Stockpiled pieces of Large Woody Debris (LWD).
	Amphibian Exclusion	Installed sediment fencing to prevent amphibian movement into the excavation area from adjacent ponds.
Construction	Sediment Removal	Excavated approximately 8,800 m ³ of gravel from the existing gravel bar. Hauled gravel off-site to two locations (Halalt First Nation – Side Channel and MNC – Richards Mountain).
	Large Woody Debris (LWD) Removal	Removed 15-20 pieces of LWD off the gravel bar to an off-site within Halalt First Nation.
Restoration	Demobilization and Access Restoration	Removed sediment fencing and access ramp. Replaced boulders on bank separating agricultural field and gravel bar. Restored agricultural field used for site access to pre-construction conditions. Removed machinery off-site.

BC Ministry of Environment & Climate Change Strategy - Environmental Protection Division Chemainus River/Halalt FN - Environmental Assessment



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Project Location

Figure 1



4. Project Timing

Although construction occurred entirely on a dry gravel bar of the Chemainus River. Due to proximity to the wetted channel, consideration was given to work within the reduced risk instream work window (September 1 to September 15) to minimize harm to nearby spawning salmonids. Project works on the gravel bar spanned from September 7 to September 22, 2023. The extension of works outside of the reduced risk instream work window was approved by a Qualified Environmental Professional (QEP) after consultation with DFO and Ministry of Forests (FOR).

5. Site Inspections and Monitoring

A KWL EM (Jaime Dimillo, BIT, BC-CESCL) conducted full-time on-site environmental monitoring during construction. Site inspections were completed to ensure that the project works were compliant with the conditions included in all applicable environmental legislation, permits, and approvals, and Best Management Practices (BMPs).

All works were undertaken outside the wetted width of the Chemainus River. As the work was deemed to be low risk, site inspections by a QEP were not undertaken during construction, but a KWL QEP was available and on call to provide advice, if required. Furthermore, no turbidity monitoring was undertaken as there was no disturbance within or directly adjacent to the water.

During inspections, the EM documented the following items related to compliance with the environmental permits and implementation of BMPs:

- Location(s) of maintenance activities;
- Weather conditions;
- Environmental protection measures and materials on site;
- Condition of site equipment and their set up;
- Storage and handling of fuel and hazardous/waste products;
- Discussions with construction supervisors and staff; and
- Any environmental deficiencies, incidents, concerns, recommendations, and/or required actions.

Site photographs were taken and included in daily monitoring reports for each site visit (Enclosure B).

6. Fish Salvage

As the Project planned to occur entirely in the dry, no fish salvage was anticipated. However, KWL submitted precautionary fish salvage permits to be used if fish stranding was observed or if there was an elevated risk to fish near the Project area. The following permits were received prior to construction and are included in Enclosure A:

- DFO License to Fish for Scientific, Experimental, or Educational Purposes (XHAB-388-2023) and;
- Fish Collection Permit (NA23-811476) issued by FOR.

A notification was submitted to DFO and FOR communicating that no fish salvage occurred as part of the works, as per the conditions of the permit.

7. Mitigation Measures

All construction activities were conducted following the Government of British Columbia's *Requirements and Best Management Practices for Making Changes In and About a Stream in British Columbia*. (Government of BC, 2022). The following mitigation measures were most relevant to project activities:

- Construction activities were monitored full-time under the direction of a QEP for the duration of construction.
- Silt fencing was installed around isolated pools to prevent movement of amphibians into the excavation area.
- All works occurred in the dry and over 5 m from the wetted portion of the Chemainus River.
- An adequately sized spill kit was on site throughout works and staff were trained in fuel management and spill response procedures.
- Construction materials, garbage, and debris were removed from the site following completion of works (to the greatest extent possible).

A comprehensive list of recommended mitigation measures was provided to the Contractor in the CEMP. The CEMP can be found in Enclosure C.

8. Non-Compliance Events

The following routine non-compliance events arose throughout the project:

- **Outstanding deficiencies in erosion and sediment control measures**, including excessive dust production from trucks driving on the agricultural field and subsequently a lack of consistent visits by water trucks to control dust. Non-compliance was first observed on Wednesday, September 13 and brought to the contractor's attention. The issue was resolved on Monday, September 18 when Stone Pacific provided a water truck to be on-site full time for dust control.



Photo 1: Dust generated from trucks driving on access road



Photo 2: Dust on gravel bar

- **Equipment condition and leaks**, including leaking of oil and grease onto gravel by excavators and/or dump trucks. The exact source was not determined. EM requested all contaminated gravel be removed off-site.



Photo 3: Rock with grease found adjacent Chemainus River



Photo 4: Rocks with oil or grease

- **Impacts to aquatic habitat**, Stone Pacific requested to remove several pieces of LWD near the access ramp above one of the isolated pools. EM requested that this LWD be removed carefully as there is potential for it to fall into the pools and/or damage existing amphibian exclusion fencing. When removing LWD with the excavator, debris fell into the isolated pools and damaged the amphibian exclusion fencing. EM believes this incident was not intentional and impacts were minimal.

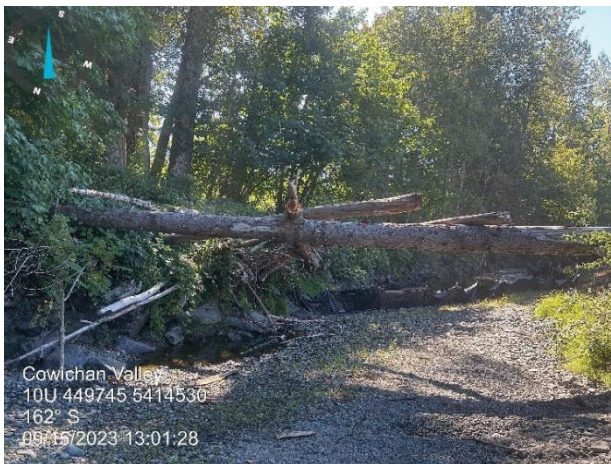


Photo 5: LWD to be removed above isolated pool



Photo 6: Fallen debris in isolated pools

Aside from routine non-compliance events, no environmental incidents occurred during the project works.



9. Closure

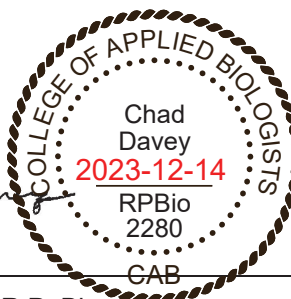
We trust this submission meets your requirements for documenting the construction activities for the Chemainus River Sediment Removal.

KERR WOOD LEIDAL ASSOCIATES LTD.

Prepared by:

Jaime Dimillo, BIT, BC-CESCL
Junior Biologist

Reviewed by:



Chad Davey, M.Sc., R.P. Bio
Technical Reviewer

JMD/aah

Encl.: Enclosure A: Environmental Permit and Approval Documents
Enclosure B: Daily Environmental Monitoring Reports
Enclosure C: Construction Environmental Management Plan

Statement of Limitations

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This document represents KWL's best 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	December 12, 2023	Final		JMD



Enclosure A

Permit and Approval Documents



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Pacific Region
Ecosystem Management Branch
417 2nd Avenue W
Prince Rupert, BC
V8J 1G8

Région du Pacifique
Direction de la gestion des écosystèmes
417, 2e Avenue Ouest
Prince Rupert, (C.-B.)
V8J 1G8

August 17, 2023

Our file Notre référence
23-HPAC-00700

BC Ministry of the Environment and Climate Change Strategy
ATTENTION: Thyren Jacobs
PO Box 9360 Stn Prov Govt
Victoria, BC V8W 9M2

Via email: thyrenjacobs@gov.bc.ca

Subject: Sediment Removal, Chemainus River, Halalt Reserve IR2 – Implementation of Measures to Avoid and Mitigate the Potential for Prohibited Effects to Fish and Fish Habitat

Dear Thyren Jacobs:

The Fish and Fish Habitat Protection Program (the Program) of Fisheries and Oceans Canada (DFO) received your proposal on **July 4, 2023**. We understand that you propose to remove sediment that has accumulated on a gravel bar in the Chemainus River between the E&N Railway Bridge and the Chemainus Road Bridge to create more channel capacity during future high flow events. Works are to be carried out entirely in the dry and will include:

- Establishing a road through an existing clearing on adjacent farmland to provide site access;
- Clearing and removing approximately 2,505 m² of shrubs on the gravel bar;
- Digging a siltation pit and leaving a berm of material between the gravel bar and downstream areas to collect and remove any rain or subsurface water generated on site;
- Excavation and removal of sediment from the gravel bar (area of removal is approximately 5,275 m²); and
- Cutting up a log jam into shorter lengths and leaving it in place.

Our review considered the following information:

- *Request for Review* form signed by Chad Davey of Kerr Wood Leidal Associates Ltd. on July 4, 2023;
- *Environmental Assessment Report with appended Engineering Drawings* submitted by Jaime Dimillo of Kerr Wood Leidal Associates Ltd. on July 4, 2023;
- *Letter of Appointment* signed by Thyren Jacobs of BC Ministry of Environment and Climate Change Strategy, dated October 19, 2022 and submitted on July 4, 2023; and
- *Email communication* between Erin Mutrie (the Program), and Sherri Jonkman of Kerr Wood Leidal Associates Ltd. in July 2023 regarding project details and site characteristics.

Canada

Your proposal has been reviewed to determine whether it is likely to result in:

- the death of fish by means other than fishing and the harmful alteration, disruption or destruction of fish habitat which are prohibited under subsections 34.4(1) and 35(1) of the *Fisheries Act*; and
- effects to listed aquatic species at risk, any part of their critical habitat or the residences of their individuals in a manner which is prohibited under sections 32, 33 and subsection 58(1) of the *Species at Risk Act*.

The aforementioned outcomes are prohibited unless authorized under their respective legislation and regulations. As of the date of this letter, no individuals of any aquatic species listed under the *Species at Risk Act* were identified in the vicinity of the proposed works.

To avoid and mitigate the potential for prohibited effects to fish and fish habitat (as listed above), we recommend implementing the measures listed below:

- Retain a Qualified Environmental Professional to provide services as an Environmental Monitor during all project activities that may result in negative effects on fish and fish habitat.
- Conduct works below the high water mark during the site-specific least risk timing window of August 15-September 15.
- Only conduct works below the high water mark during periods of low flow and within a period of good forecasted weather with minimal precipitation. Suspend works during high precipitation events or periods of increased flows.
- Limit the duration of any works, undertakings and activities below the high water mark.
- Delineate areas of excavation to ensure works are within the design footprint.
- Develop, implement, monitor and maintain an effective Erosion and Sediment Control plan to minimize sedimentation of the water body during all phases of the works, undertakings and activities.
- Avoid conducting any work, undertaking or activity in the active river channel. Maintain an adequate buffer/setback between the edge of the excavation/scalping footprint on top of the gravel bar and the wetted river channel at all times to avoid/minimize the release of sediments.
- Pump all sediment laden water to a vegetated area away from the watercourse so that it can dissipate into the ground.
- Dispose of and stabilize all excavated material above the ordinary high water mark and ensure sediment entry to the watercourse is prevented.
- Construction activities are not to result in the trapping or stranding of fish. Upon completion of the works, ensure that the finished top of the gravel bar is sloped in a manner to avoid future stranding and death of fish.
- Leave the cut logs in place on the gravel bar. Chainsaws should be lubricated with environmentally friendly oil to prevent the introduction of a deleterious substance into waters frequented by fish.
- Develop and implement a spill prevention and emergency response plan to avoid a spill of deleterious substances into fish habitat.
- Ensure appropriate gear is onsite in the event that deleterious substances are released into the water. Onsite personnel should be trained in spill prevention, containment and cleanup procedures.

- Ensure that all heavy equipment is inspected regularly and is free of dirt, leaks, or debris prior to conducting works in or near fish habitat.
- Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water.
- Limit vegetation removal, pruning and grubbing to the area required for accessing the project site. Clearly mark the areas of riparian vegetation to be retained.
- Avoid grubbing of riparian vegetation within temporary disturbances to enable quick recovery and ongoing soil stabilization.
- Remediate any disturbed areas to stabilize the site immediately following excavation works. Measures to incorporate include, but are not limited to seeding, planting, or live-staking of native vegetation suitable for the site.

Provided that you incorporate these measures into your plans, the Program is of the view that your proposal is not likely to result in the contravention of the above mentioned prohibitions and requirements.

Should your plans change or if you have omitted some information in your proposal, further review by the Program may be required. Consult our website (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>) or consult with a qualified environmental consultant to determine if further review may be necessary. It remains your responsibility to remain in compliance with the *Fisheries Act*, the *Species at Risk Act* and the *Aquatic Invasive Species Regulations*.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the 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 the DFO-Pacific Observe, Record and Report phone line at 1-800-465-4336 or by email at DFO.ORR-ONS.MPO@dfo-mpo.gc.ca.

Please notify the Program by email at Erin.Mutrie@dfo-mpo.gc.ca at least 10 days before starting your project, ensuring your file number and appropriate on-site contact information is included. We recommend that a copy of this letter be kept on site while the work is in progress. It remains your responsibility to meet all other federal, provincial and municipal requirements that apply to your proposal.

Please note that this Letter of Advice does not provide relief from the obligations set out in the government of British Columbia's Riparian Areas Protection Regulations (RAPR), and cannot be construed to provide authorization pursuant to section 3(2) of the RAPR, for any work, undertaking or activity within the Riparian Assessment Area. For more information on the RAPR, including contacts, please visit: <https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/aquatic-habitat-management/riparian-areas-regulation>.

Please note that the advice provided in this letter will remain valid for a period of one year from the date of issuance. If you plan to execute your proposal after the expiry of this letter, we recommend that you contact the Program to ensure that the advice remains up-to-date and accurate. Furthermore, the validity of the advice is also subject to there being no change in the relevant aquatic environment, including any legal protection orders or designations, during the one year period.

If you have any questions with the content of this letter, please contact Erin Mutrie at our Prince Rupert office at (778) 361-0546 or by email at Erin.Mutrie@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,

Smith,
Vanessa

Digitally signed by Smith, Vanessa
DN: C=CA, O=GC, OU=DFO-MPO,
CN="Smith, Vanessa"
Reason: I am the author of this
document
Location:
Date: 2023.08.17 14:54:57-07'00'
Foxit PDF Editor Version: 12.1.3

Vanessa Smith

A/Senior Biologist, Coastal Watershed Regulatory Operations
Fish & Fish Habitat Protection Program

cc: Chad Davey, Kerr Wood Leidal Associates Ltd., CDavey@kwl.ca
Jaime Dimillo, Kerr Wood Leidal Associates Ltd., JDimillo@kwl.ca
Sherri Jonkman, Kerr Wood Leidal Associates Ltd., SJonkman@kwl.ca



September 1, 2023

Job Number: 126312
vFCBC Tracking Number: 100420911

Ministry of Environment and Climate Change Strategy
PO BOX 9337 Provincial Government
Victoria, BC V8W 9M1

Dear Ministry of Environment and Climate Change Strategy,

Change Approval - Changes In and About a Stream (File 1005901)

The Ministry of Environment and Climate Change Strategy, PO Box 9337, Victoria, BC V8W 9M1 is hereby authorized to make changes in and about a stream as follows:

- 1) The name of the stream is the Chemainus River.
- 2) The changes to be made in and about the stream are:
 - Removal of 1 broadleaf maple tree to facilitate site access;
 - Removal of ~2505 m² of shrubbery on the existing gravel bar;
 - Excavation and removal of ~5000m³ of gravel from the existing gravel bar for storage by Halalt First Nation;
 - Restoration of roads, driveways and other surfaces disturbed due to the works; and
 - Revegetation and restoration of all disturbed areas.
- 3) The location of the works are at the following coordinates, as provided by the applicant: 48.8816470, -123.6865800
- 4) All works shall be completed in accordance with:
 - the Chemainus River Sediment Removal Environmental Assessment prepared by KWL Consulting Engineers and dated July 4, 2023; and
 - the Chemainus River Sediment Removal Construction Environmental Management Plan prepared by KWL Consulting Engineers and dated July 25, 2023.
- 5) All works shall take place between September 2, 2023 and September 15, 2023.
- 6) A Qualified Environmental Professional/Monitor with the authority to halt work shall be on site during all phases of construction.

- 7) All machinery and equipment operating within the stream shall be clean, free of external grease, oil or fluid leaks and shall use biodegradable grease, oil and fluids.
- 8) The works shall not result in depressions that have the ability to trap fish and other aquatic life.
- 9) 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 the rights granted with this approval.
- 10) The works completed under this approval shall be documented and a post-construction report shall be prepared by a Qualified Professional to the satisfaction of a Water Manager, as defined in the *Water Sustainability Act*. This post-construction report will be provided to Olivia Kampman, Water Officer, by December 31, 2023.
- 11) The activities authorized under this approval may be halted at any time by an Order in writing from a Water Manager under the *Water Sustainability Act* to ensure compliance with the terms and conditions authorized herein.
- 12) 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)*" <https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/wsa-cias-requirements-bmps.pdf?msclkid=295e67c4c1ae11ecadd4ff4606dd7f6e> and "*A Users' Guide for Changes In and About A Stream in British Columbia (2022)*" https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/wsa-cias-users_guide.pdf?msclkid=92f2e4dbc1b011ec95c005b94d9b874d.
- 13) Where there is a potential for silt runoff in the proximity of existing watercourses, control devices will be installed prior to construction activities commencing;
 - a) Filter fabric dams, rock check dams, and silt fencing will be used as needed on a site-specific basis to control erosion. Filtration should be accomplished using filter fabric keyed into substrates and banks, and elevated using stakes. Silt fencing is not an acceptable mitigation technique to control erosion in flowing ditches; however it is useful for containing slumping areas and for use as baffles to slow water velocities.
 - b) Excavation will be stopped during intense rainfall events or whenever surface erosion occurs affecting the watercourse.
 - c) Watercourses are not to be traversed by machinery at any time.
 - d) Soil stockpiles will be placed a minimum of 3 metres from any watercourse and in a location where erosion back into the watercourse cannot occur and will not impede any drainage.

- e) Soil stockpiles with the potential to erode into watercourses are to be covered with poly sheeting or mulch. Other techniques, such as terracing or surface roughening can greatly reduce surface erosion on steeper slopes.
- f) Permanent exposed soil areas and erosion-prone slopes that may potentially erode into the watercourse are to be seeded immediately, or covered with geotextile.
- g) Clearing will take place immediately prior to excavation and earthworks to minimize the length of time that soils are exposed. Vegetation in adjoining areas will not be disturbed.
- h) Site re-vegetation measures may be required to stabilize soils and stream banks and reduce erosion. The measures, including planting native vegetation, are to be implemented as directed by the biologist as construction is completed.

Sincerely,



Resource Manager

Cc:
Enclosure(s)

September 12, 2023

Job Number: 126312
vFCBC Tracking Number: 100420911

Ministry of Environment and Climate Change Strategy
PO BOX 9337
Victoria, BC V8W 9M1

Dear Ministry of Environment and Climate Change Strategy,

Extension for Change Approval - Changes In and About a Stream (File 1005901)

A Change Approval extension has been granted for the in-stream works previously authorized in the *Water Sustainability Act* Section 11 (1) Changes In and About a Stream Approval Document dated September 1st, 2023.

All conditions in the original Change Approval document will remain in effect.

This Change Approval Extension grants permission to conduct work between September 15th, 2023, and September 30th, 2023.

All works shall be completed in accordance with:

- The Chemainus River Sediment Removal Environmental Assessment prepared by KWL Consulting Engineers and dated July 4, 2023
- The Chemainus River Sediment Removal Construction Environmental Management Plan prepared by KWL Consulting Engineers and dated July 25, 2023.

A Qualified Environmental Professional/Monitor with the authority to halt work shall be on site during all phases of construction.

A Wet Weather Shutdown Procedure must be in place and utilized should a significant rainfall event occur.

All machinery and equipment operating within the stream shall be clean, free of external grease, oil or fluid leaks and shall use biodegradable grease, oil and fluids.

The works shall not result in depressions that have the ability to trap fish and other aquatic life.

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 the rights granted with this approval.

The works completed under this approval shall be documented and a post-construction report shall be prepared by a Qualified Professional to the satisfaction of a Water Manager, as defined in the *Water Sustainability Act*. This post-construction report will be provided to the Olivia Kampman, Water Officer, by December 31, 2023.

The activities authorized under this approval may be halted at any time by an Order in writing from a Water Manager under the *Water Sustainability Act* to ensure compliance with the terms and conditions authorized herein.

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)*" <https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/wsa-cias-requirements-bmps.pdf?msclkid=295e67c4c1ae11ecadd4ff4606dd7f6e> and "*A Users' Guide for Changes In and About A Stream in British Columbia (2022)*" https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/wsa-cias-users_guide.pdf?msclkid=92f2e4dbc1b011ec95c005b94d9b874d.

Where there is a potential for silt runoff in the proximity of existing watercourses, control devices will be installed prior to construction activities commencing;

a) Filter fabric dams, rock check dams, and silt fencing will be used as needed on a site-specific basis to control erosion. Filtration should be accomplished using filter fabric keyed into substrates and banks, and elevated using stakes. Silt fencing is not an acceptable mitigation technique to control erosion in flowing ditches; however it is useful for containing slumping areas and for use as baffles to slow water velocities.

b) Excavation will be stopped during intense rainfall events or whenever surface erosion occurs affecting the watercourse.

c) Watercourses are not to be traversed by machinery at any time.

d) Soil stockpiles will be placed a minimum of 3 metres from any watercourse and in a location where erosion back into the watercourse cannot occur and will not impede any drainage.

e) Soil stockpiles with the potential to erode into watercourses are to be covered with poly sheeting or mulch. Other techniques, such as terracing or surface roughening can greatly reduce surface erosion on steeper slopes.

f) Permanent exposed soil areas and erosion-prone slopes that may potentially erode into the watercourse are to be seeded immediately, or covered with geotextile.

g) Clearing will take place immediately prior to excavation and earthworks to minimize the length of time that soils are exposed. Vegetation in adjoining areas will not be disturbed.

h) Site re-vegetation measures may be required to stabilize soils and stream banks and reduce erosion. The measures, including planting native vegetation, are to be implemented as directed by the biologist as construction is completed.

If you have any questions or concerns regarding the document issued or this letter please feel free to contact Olivia Kampman, Water Officer, by email at olivia.kampman@gov.bc.ca or by phone at (778) 421-8735.

Sincerely,

 Date: 2023.09.12
11:50:26 -07'00'

Annette Bailey
Assistant Water Manager



This licence and/or permit is issued under the authority of SECTION 52 OF THE FISHERY (GENERAL) REGULATIONS.

This licence and/or permit authorizes the person(s) listed below, subject to the following terms and conditions, to collect the species and quantity of fish identified below for: Scientific purposes. Non-compliance with any condition of this licence and/or permit may result in the cancellation of this licence and/or permit.

Licence/Permit Activity Description:

Fish salvage activity in conjunction with instream work on the Chemainus River. The construction work is expected to occur from August 1 to September 15, within the least risk window for salmonids in the South Coast region. A fish salvage will be conducted opportunistically as deemed necessary by an onsite EM/QEP. This will involve dipnetting followed by minnow trapping and seining if necessary. Salvaged fish will be moved upstream of the work area to areas of similar or higher quality habitat in buckets filled with stream water and equipped with air pumps.

Licence Holder:

FIN: 148107
200-4185A STILL CREEK DRIVE
BURNABY BC V5C 6G9

KERR WOOD LEIDAL

Contact Number: 604-294-2088

Fax Number: 604-294-2090

Contact Party:

FIN: 149978 JONKMAN, SHERRI

Contact Number: 604-773-0434

Fax Number: 604-294-2090

Individuals or groups assisting with the authorized activity:

Kerr Wood Leidal Associates Ltd. employees.

Species, Quantity of Fish, Area(s) and Gear:

Species: COHO SALMON (*Oncorhynchus kisutch*); CHUM SALMON (*Oncorhynchus keta*); CHINOOK SALMON (*Oncorhynchus tshawytscha*); PINK SALMON (*Oncorhynchus gorbuscha*); SOCKEYE SALMON (*Oncorhynchus nerka*);

Gear: Dip Net
Trap, Gee/Minnow
Seine Net, Pole

Licence Area: CHEMAINUS RIVER

To be 0

Retained:

Reporting Requirements:**Scientific Licence Electronic Collection Report**

Due Date 01-Sep-24

See terms and conditions for reporting requirements, send completed report to:

DFO.SCA_SC_Licence_Applications-Applications_de_licence_SC_SCA.MPO@dfo-mpo.gc.ca



Terms and Conditions:

The DFO Office responsible for the area in which fishing takes place shall be notified on each occasion prior to the collection of samples. Notification shall occur by telephone during normal business hours. If you are unable to notify the local office on evenings or weekends, advise the DFO Radio Room at 1-800-465-4336 prior to sampling.

This licence authorizes collections to be made by the licensee and employees, volunteers and students of the licensee provided that all persons, other than minors who are engaged in activities under the authority of this licence, are carrying suitable photo identification to be produced upon request of a Fishery Officer or Guardian.

Copies of this licence must accompany the collecting personnel, be on board any collecting vessel and be carried by the transport vehicle at all times during collection and transport of samples. The licence must be produced upon the request of a Fishery Officer or Guardian.

It is the responsibility of the licence holder to ensure that samplers are experienced and competent in the fish collection methods authorized in this licence.

All gear left unattended must be clearly labelled with the Licence Number and must not interfere with the public right of navigation.

Release of fish: All specimens must be released unharmed into the water body or course from which they originated and as near as possible to the location from which they were captured.

This licence may be amended or revoked by the Department prior to the expiry date if deemed necessary

Electrofishing is not permitted in the vicinity of spawning salmon or redds. Electrofishing can be severely damaging to eggs and alevins and must be avoided where eggs and alevins may be present. A trained and certified electrofisher operator must be a part of the electrofishing crew. Electroshocking is not permitted in water with a temperature below 5 °C or above 20°C. All fish must be returned to the water, unharmed if possible. Electroshocking authorized as last method of collection.

Contact Province of BC for a licence to collect non-salmon species, (including Steelhead, Rainbow and Cutthroat Trout)

Section 32 (1) of the federal Species at Risk Act prohibits killing, harming, harassing, capturing or taking an individual of a wildlife species which is listed on Schedule 1 as an extirpated species, an endangered species or a threatened species. Refer to the SARA Public Registry at <http://www.sararegistry.gc.ca> to determine if species at risk may be in your research area and to apply for a permit if required.

10. A sampling report will be required by DFO within 30 days following expiration of this licence. This report must include

the data in the electronic spreadsheet provided by email, but is not limited to and may also include photocopied data sheets, field

notes and a final written report for the project. The spreadsheet, as supplied by DFO, must include the following:



- a. The Collection License number
- b. Site Location (e.g Site 1 or name if applicable)
- c. Pacific Fisheries Management Area (Subarea)
- d. The location(s) of the sampling with GPS coordinates (lat & long decimal degrees), where GPS coordinates were not possible a map or detailed described may be submitted;
- e. Names of all individuals engaged in sampling;
- f. The dates on which the sampling occurred;
- g. The time at which the sampling occurred;
- h. The number of fish sampled (retained/released), by species (including by-catch);
- i. Any mortalities

If no sampling takes place a "nil report" is required in the form of a letter or identified in the mandatory spreadsheet provided.

In addition to the sampling report, a final report that contains findings/results shall be submitted to DFO.

Please send these reports to DFO Resource Management by email to

DFO.SCA_SC_Licence_Applications-Applications_de_licence_SC_SCA.MPO@dfo-mpo.gc.ca



Higgins, Linda

Digitally signed by Higgins, Linda
Date: 2023.07.28 13:37:32 -07'00'

July 28, 2023

Issued by: Linda Higgins, South Coast Area Director
Fisheries and Oceans Canada

Date

Licence Printed: 21 July 2023

Licence Prepared By: Andrew Campbell

FISH COLLECTION PERMIT
Fish Salvage
Supersedes permit issued August 14, 2023

File: 34770-20

Permit No.: NA23-811476

Permit Holder: KERR WOOD LEIDAL ASSOCIATES LTD – (Jamie Dimillo)
200-4185A Still Creek Drive
Burnaby BC V5S6G9

Authorized Persons: Molly Duncan, Jeremiah Bain, Corinne Couture, Mikala Wheeler, Ardis Mellor-Laing, Jamie Godfrey, Dusty Silvester, Patrick Lilley, Sherri Jonkman, Dan Brown, Heather Kingcott, Sonya Oetterich, Alan Jonsson, Enrico Barbon, Christy Juteau, Andrew Baylis, Janice Kwo, Gadwyn Gan, Oskar von Wahl, Jaime Dimillo, Matt Sanders, Erica Havey and Justin Southam.

Pursuant to section 18 of the Angling and Scientific Collection Regulation, B.C. Reg. 125/90, the above-named persons are authorized to collect fish for scientific purposes (from non-tidal waters) subject to the terms set forth in this Permit:

Permitted Sampling Period: August 16, 2023 to October 31, 2024

Permitted Waterbodies: West Coast Region – Chemainus River (920-303500)

Permitted Sampling Techniques: AG, DN, EF, MT, SN (subject to permit terms)

Potential Species: TSB, SMB, CCT, RB, ST (subject to permit terms)

Provincial Terms: (Permit holder and authorized persons must be aware of all terms):

See Appendix A.

Region Specific Terms:

See Appendix A.

Authorized by: _____

Sean Pendergast
Deputy Regional Manager
Recreational Fisheries & Wildlife Programs
West Coast Region

Date: August 16, 2023

Permit Fee \$25

APPENDIX A FISH COLLECTION PERMIT TERMS

Any Variation of the following terms will require explicit authorization by the appropriate regional Fish & Wildlife Section Head.

PROVINCIAL TERMS

1. This collecting permit is **only** valid for species listed as threatened, endangered, or extirpated under the *Species at Risk Act* (SARA) **in conjunction with a permit issued under Section 73 of SARA from Fisheries and Oceans Canada.**

NOTE: Contact the Department of Fisheries and Oceans for fish collecting permits for salmon or eulachon <https://www.pac.dfo-mpo.gc.ca/fm-gp/licence-permis/forms/licence-sci-permis-eng.pdf> or for SARA listed species <https://www.dfo-mpo.gc.ca/species-especes/sara-lep/permits-permis/index-eng.html#apply>.

2. Any specimen's surplus to scientific requirements and any species not authorized for collection in this permit must be immediately and carefully released at the point of capture.
3. Fish collected under authority of this permit must not be used for food or any purpose other than the objectives set out in this permit. Dead fish must be disposed of in a manner that will not constitute a health hazard, nuisance, or a threat to wildlife.
4. No fish collected under authority of this permit must be transplanted unless separately authorized by the Federal/Provincial Introductions and Transfers Committee.
5. The permit holder must, within 90 days (120 days for the Kootenay/Boundary region and Peace region) of the expiry of this permit, submit a report of fish collection activities. Interim reports may also be required and must be submitted as required by the permit issuer. All submissions must be filed electronically to: <https://www2.gov.bc.ca/fish-data-submission-process>.

Reporting specifications, information and templates are available from this website and outline the mandatory information requirements. Prior notification of submission or questions regarding data report standards can be made to: fishdatasub@gov.bc.ca

6. The permit holder must comply with all Workers' Compensation Board requirements and other regulatory requirements. The permit holder is responsible for ensuring authorized persons listed on the permit are properly certified for specific sampling methods or activities (e.g., electroshocking).
7. Any workers not listed on the permit must be supervised by the permit holder or one of the authorized persons named on the permit.
8. All sampling equipment that has been previously used outside of B.C. must be cleaned of mud and dirt and disinfected with 100mg/L chlorine bleach before using in any water course to prevent the spread of fish pathogens (e.g., whirling disease) and/or invasive plant species. Any washed off dirt or mud must be disposed of in a manner such that it cannot enter a watercourse untreated.
9. No electrofishing is to take place in waters having a temperature less than five degrees C.
10. No sampling of fish in waters having a temperature greater than twenty degrees C.
11. Electrofishing must not be conducted in the vicinity of spawning gravel, redds, or spawning fish, or around gravels which are capable of supporting eggs or developing embryos of any species of salmonid at a time of year when such eggs or embryos may be present.
12. When work requires de-watering or isolation of the worksite in the stream, a permit for the salvage of fish and wildlife (Scientific Fish Collection permit) must be obtained prior to commencing work. All required salvage permits must be obtained from FrontCounter BC: <https://portal.nrs.gov.bc.ca/web/client/home>.

PROVINCIAL TERMS CONTINUED

13. Any fish or wildlife salvage must be carried out by a qualified environmental professional registered with a professional association (such as an RPBio). The qualified professional conducting salvage work must adhere to the conditions below in addition to those required in the Scientific Fish Collection permit.

- Salvage activities must be conducted to the Provincial Resource Information Standards Committee (RISC) standards for capture, data collection, handling, and release:

STREAM ISOLATION

- The QP must follow the standards and practices outlined in the Work Area Isolation Appendix found in the Standards and Best Practices for Instream Works.
<http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf>
- A QP must ensure that the worksite has been substantively isolated to prevent any fishes from entering the work area and efforts must be made to exclude fish from entrapment during installation of isolation works. (See section 14.2 of the Standards and Best Practices for Instream Works (MWLAP 2004).
- Dewatering must not result in HADD to fish habitat or the death of fish unless authorized by Fisheries and Oceans Canada.
- While dewatering the work site and dewatering during fish capture, all pump intakes are required to meet the federal COP for fish intake screening guidelines <https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html>.

FISH CAPTURE

- Qualified professionals must determine appropriate sampling methods from the RISC standards based on water body type and habitat conditions <https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/fishml04.pdf>.
- Qualified professionals must use a risk hierarchy of passive to active and low risk to higher risk in collection methods (e.g., minnow traps, fyke nets, beach pole seines, electroshocking, angling).
- Qualified professional must conduct a **minimum of three** non-lethal collection methods in all fish salvages.
- For active collection methods a minimum of two consecutive passes of each method that produces a zero catch must be completed as per total population removal methodology (at a minimum 95% fish removal must be achieved). (<https://www.wildsalmoncenter.org/resources/field-protocols-best-monitoring-practices/>).
- Where work site isolation cannot be fully achieved (e.g., fast flowing streams, imperfect seal due to substrate) additional efforts are needed to prevent harm to fish. At the end of each workday, a passive form of fish capture (e.g., baited minnow traps) are to be placed in the isolation site. If fish are captured overnight, you must restart isolation procedures at the start of the workday.
- If species at risk are captured, work must stop until proper permits are obtained.

DATA COLLECTION

- Sampling/data collection is a requirement of the Scientific Collection Permit. Sample size requirements are listed in the table below.
- Scientific Fish Collection Permits require a Fish Data Submission Template to be completed. Step 4 (Stream Site Data) of the Fish Data Submission Template must be filled out for the location where fish are salvaged from. <https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/fish-and-fish-habitat-data-information/fish-data-submission/submit-fish-data>.

FISH RELEASE

- Fish must be released following RISC standards.
- All species are to be released in the same watercourse downstream of the work areas or a sufficient distance upstream (5 channel widths to a maximum of 100 meters) into waters of equivalent baseline quality and habitat type (pool, riffle, run).

Minimum Standards During Salvage for Fish Collection Sampling Effort*

Fish Species	Age Class	Size range	Minimum Sampling Size for lengths	Sample column required (from Individual Fish Data form)	Notes
Salmonids, including RB, CT(CCT), DV, BT, GR, LT, KO	fry	20 to 80 mm	up to 30 after 30 count	J (if possible), K	
	juvenile	81 mm-250 mm	Measure all fish caught	J, K, L	
	adult	greater than 250 mm	Measure all fish caught	J, K, L, M, N	
Coarse Fish (cyprinids, stickleback, dace, shiner, carp, pikeminnow)		under 200 mm	up to 30 after 30 count	J, K	
	Adult	over 200 mm	All	J, K, L, M	
Sport other (bass, perch, sunfish, walleye, northern pike)		all	up to 30 after 30 count	J, K, L	
Sculpin sp.		0-150mm (total length)	up to 30 after 30 count	J, K	
		Over 150mm	All	J, K, L	
Burbot, Lamprey		0-150 mm (total length)	All	J, K, L, N	
Listed Species (salish sucker, sturgeon, etc.)		All	All		Refer to SAR permit for conditions
All fishes not listed above		All	minimum 10 of each then count only	J, K, L	

Abbreviations for salmonids

RB-Rainbow
 CT(CCT)-Cutthroat
 DV-Dolly Varden
 BT- Bull Trout
 GR- Arctic Grayling
 LT- Lake Trout
 KO- Kokanee

REGION SPECIFIC TERMS

West Coast Region

1. Within the boundaries of Management Units 1-1 through 1-13, there is no electrofishing in: (1) streams above 630 meters elevation, (2) in anadromous rivers from January 1 to June 30, (3) or any lake tributaries from January 1 to June 30.
2. All sampling gear follow Association of Professional Biologists' advisory practice bulletin #5. Practice Advisory – Dydimio, see:
<http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=9469>
3. The permit holder must advise the West Coast Region of sampling activities 24 hrs. prior to field operations. Please complete the following notification form: http://www.env.gov.bc.ca/pasb/reports/fish/permit_notify1.html

APPENDIX B ADVISORY

GENERAL

- It is the permit holder's responsibility to be aware of all applicable laws and the limits of this permit. For example,
 - This permit **does not** authorize the collection of fish in national or provincial parks.
 - This permit does **not** authorize the collection of fish in tidal waters.
 - This permit does not authorize the collection of eulachon or for salmon, other than kokanee.
 - This permit is NOT authority to angle for fish without a valid angling licence.
- It is the responsibility of the permit holder to obtain proper authorization.
- The Province is not liable for any illness contracted through fish handling. It is the responsibility of the permit holder to inform themselves of possible health hazards, and to ensure that all reasonably necessary safety measures are undertaken.
- If applicable, the permit holder is responsible for renewing this permit. The issuer is not obliged to send a reminder notice.

LEGISLATION

Below is a non-exhaustive list of provisions under the *Wildlife Act* and regulations that are relevant to this permit. It is the permit holder's responsibility to be aware of any provisions under the *Wildlife Act* or regulations that may apply to this permit.

Wildlife Act

Suspension and cancellation of permits

- 25** (1) A regional manager, for any cause he or she considers sufficient, and after providing an opportunity for the person to be heard, may suspend or cancel a permit held by a person, may order that the person is ineligible to obtain or renew a permit for a period and, if he or she does make an order, must inform the person of the period of ineligibility.
- (2) An officer may, without the necessity of holding a hearing, exercise the powers of a regional manager under this section to suspend a permit and, if a permit is suspended by an officer, the matter must be referred to the regional manager, who may confirm, reduce, extend or terminate the suspension.

Documents not transferable

- 81** Except as authorized by regulation or as otherwise provided under this Act, a licence, permit or limited entry hunting authorization is not transferable, and a person commits an offence if the person
- (a) allows his or her licence, permit or limited entry hunting authorization to be used by another person, or
 - (b) uses another person's licence, permit or limited entry hunting authorization.

Failure to pay fine

- 85** (1) This section applies if a person
- (a) fails to pay, within the time required by law, a fine imposed as a result of the person's conviction for an offence under this Act or the *Firearm Act*, and
 - (b) has been served with notice of this section.

(2) In the circumstances referred to in subsection (1),

- (a) the person's right to apply for or obtain a licence, permit or limited entry hunting authorization under this Act is suspended immediately and automatically on the failure to pay the fine,
- (b) all licences, permits and limited entry hunting authorizations issued to that person under this Act are cancelled immediately and automatically on the failure to pay the fine,
- (b.1) the person must not apply for employment as an assistant guide,
- (b.2) the person must not guide as an assistant guide, and
- (c) the person commits an offence if, before that fine is paid, the person
 - (i) applies for, or in any way obtains, a licence, permit or limited entry hunting authorization under this Act,
 - (ii) does anything for which a licence, permit or limited entry hunting authorization under this Act is required,
 - (iii) applies for employment as an assistant guide, or
 - (iv) guides as an assistant guide.

Proof of identity and authorization

97 (1) In this section, “**authorization**” means a licence, permit or limited entry hunting authorization issued under this Act.

- (2) Subject to subsection (5), a person who is required to hold an authorization must, on the request of an officer,
 - (a) state the person's name and address,
 - (b) produce prescribed photo identification, and
 - (c) demonstrate in accordance with subsection (3) that the person holds the authorization.
- (3) A person may demonstrate that the person holds an authorization by
 - (a) producing the authorization, or
 - (b) unless the regulations require that the original authorization be produced,
 - (i) producing a legible copy of the authorization, or
 - (ii) if authorized by the regulations, stating a number assigned to the person by the director as an identification number for the person.
- (4) Subject to subsection (5), a person who would be required to hold a licence or permit issued under this Act were the person not exempt under section 11 (9) or 12 (b) must, on the request of an officer,
 - (a) state the person's name and address, and
 - (b) produce prescribed photo identification.
- (5) Subsections (2) (b) and (4) (b) do not apply to a person in a prescribed class of persons.
- (6) A person who contravenes subsection (2) or (4) commits an offence.

Wildlife Act General Regulation

Proof of identity

21.01 (1) For the purposes of section 97 (2)(b) and (4)(b) of the Act, the following photo identification is prescribed:

- (a) valid photo identification issued to a person by any of the following:
 - (i) the government of Canada;
 - (ii) the government of a province or territory, or an agent of the government of a province or territory, in which the person has a current address;
 - (iii) the Nisga'a Nation, if the person is a Nisga'a citizen;
 - (iv) a treaty first nation, if the person is a treaty first nation member of the treaty first nation;
 - (b) in the case of a person who is a non-resident alien,
 - (i) valid photo identification in the form of
 - (A) a passport, or
 - (B) a driver's licence issued to the person by a foreign jurisdiction in which the person has a current address, or
 - (ii) a copy of a photo identification referred to in subparagraph (i) that has been certified as a true copy by
 - (A) a lawyer, or
 - (B) a notary who is a member in good standing under the *Notaries Act*
 - (c) in any case, a valid NEXUS card.
- (2) For the purposes of section 97 (5) of the Act, persons under 16 years of age are prescribed as exempt from the requirement to produce photo identification.

Freshwater Fish Regulation

Offences

- 2 A person commits an offence where the person
- (a) has in possession,
 - (b) transports, or
 - (c) traffics in
- live fish unless authorized by a permit or a licence.





Enclosure B

Daily Environmental Monitoring Reports

Environmental Monitoring Report

PROJECT: Chemainus River Sediment Removal

Client: Halalt First Nation (Halalt) / Ministry of Environment and Climate Change Strategy (ENV)

Contractor: Stone Pacific Contracting Ltd. (SPC)

KWL File No.: **3427.029**

PREPARED BY	Jaime Dimillo	ON SITE	7:00	OFF SITE	16:30
DATE	September 7, 2023				
WEATHER	24°C, sunny				
WORK AREA	Gravel bar adjacent the Chemainus River				
EQUIPMENT AND WORKFORCE ON SITE					
- KWL Environmental Monitor (EM) - Stone Pacific Contracting (SPC) - Halalt Archeology Monitor - 2 excavators (Hitachi 350LC and CAT 320C)					
SUMMARY OF ENVIRONMENTAL WORK ON DAY:					
- Environmental monitoring					
SUMMARY OF CONTRACTOR WORK ON DAY:					
- Delivery of two excavators - Constructed access through hedgerow onto gravel bar - Begin to stockpile (mostly fine) sediment for eventual removal - Grubbing of shrubbery - Stockpiling of large woody debris - Survey of sediment removal area					
DISCUSSIONS WITH CONTRACTOR:					
- EM suggested silt fencing be installed adjacent isolated pools which have Northern red legged frogs and tadpoles within them to prevent migration into the excavation area. - EM requested excavators have spill trays below when not in use. SPC did not have spill trays on site but will park excavators >50 m from the Chemainus River in the agricultural field.					
DISCUSSIONS WITH OTHERS:					
- Property owner had concerns about intention to leave 6 ft. pieces of large woody debris on the shore when project is complete. Solution in progress.					
ENVIRONMENTAL INCIDENTS:					
- None					
NOTES & COMMENTS					
- None					
UPCOMING WORK & ACTIONS REQUIRED:					
- Continue grubbing shrubbery from the excavation area - Build silt fencing adjacent isolated pools - Begin hauling sediment off-site					

Environmental Monitoring Report

PHOTOGRAPHS



Photo 1: Spill kit on-site



Photo 2: Constructing access to gravel bar



Photo 3: Steel plates placed over irrigation line at request of property owner



Photo 4: Construction access progressing

Environmental Monitoring Report

Environmental Site Conditions (NC= Non-Compliant, N/A= Not Applicable)						
Erosion and Sediment Control	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Access points	X					
Laydown area	X					
Water diversion			X			
Instream isolation			X			
Other:						
Fuel and Oil Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Spill Kits/Spill Response Plan	X			Spill kits placed in proximity to working equipment.		
Fuel Storage	X					
Refueling Location	X			Fueling done in a careful manner well away from Chemainus River.		
Equipment Condition (e.g.leaks)	X					
Spill trays			X	Machinery parked in field >50m from river. Spill tray not crucial.		
Other:						
Waste Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Deleterious substance use and storage	X					
Waste disposal	X					
Other:						
Habitat Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Sensitive habitat features	X					
Riparian area	X					
Other:						
Incident Report Required?	Yes		No	X	Reason:	No concerns.

Environmental Monitoring Report

PROJECT: Chemainus River Sediment Removal

Client: Halalt First Nation (Halalt) / Ministry of Environment and Climate Change Strategy (ENV)

Contractor: Stone Pacific Contracting Ltd. (SPC)

KWL File No.: **3427.029**

PREPARED BY	Jaime Dimillo	ON SITE	7:00	OFF SITE	16:30
DATE	September 8, 2023				
WEATHER	25°C, sunny				
WORK AREA	Gravel bar adjacent the Chemainus River				
EQUIPMENT AND WORKFORCE ON SITE					
- KWL Environmental Monitor (EM) - KWL Engineering Monitor - Stone Pacific Contracting (SPC) - Halalt Archeology Monitor - 2 excavators (Hitachi 350LC and CAT 320C)					
SUMMARY OF ENVIRONMENTAL WORK ON DAY:					
- Environmental monitoring					
SUMMARY OF CONTRACTOR WORK ON DAY:					
- Continued access road building - Import of 3-inch gravel for access road - Continued grubbing of shrubs within excavation area - Separation of grubbing debris from large woody debris - Stockpiling of large woody debris - Constructed silt fencing adjacent isolated pools to prevent frog migration into excavation area - Stockpiled fine material					
DISCUSSIONS WITH CONTRACTOR:					
- EM instructed SPC laborer where to place silt fencing for amphibian protection					
DISCUSSIONS WITH OTHERS:					
- Property owner raised concern about large woody debris. Solution forthcoming. - Property owner allowed for stockpile of fine material to be used on his property. SPC will transport the material from the gravel bar to the owner's preferred location for use on-site. - EM had a discussion with Halalt Fisheries biologist who had concerns about adult chinook and chum holding in the pool upstream of the works by the E&N railway bridge. Halalt biologist to potentially visit the site for further discussion on Monday, Sept 11.					
ENVIRONMENTAL INCIDENTS:					
- None					
NOTES & COMMENTS					
- None					
UPCOMING WORK & ACTIONS REQUIRED:					
- Transport fine material from gravel bar to location on farm. - Begin hauling gravel off-site - Determine solution to dispose of large woody debris. - Continue to maintain amphibian exclusion fencing - Monitor weather for any large amounts of rain.					

Environmental Monitoring Report

PHOTOGRAPHS



Photo 1: Spill kit on-site



Photo 2: Grubbed gravel bar

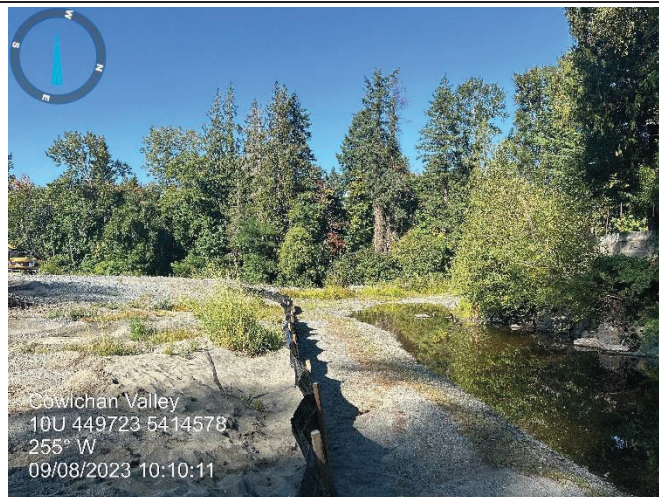


Photo 3: Silt fencing acting as amphibian exclusion fencing adjacent isolated pools



Photo 4: Northern Red-legged frog adjacent isolated pool



Photo 5: Excavator sorting large woody debris from clearing brush



Photo 6: Stockpile of large woody debris

Environmental Monitoring Report



Photo 7: Excavator prepping property owner's determined area for fine material placement



Photo 8: Gravel bar adjacent to Chemainus River (estimated distance >17m)

Environmental Monitoring Report

Environmental Site Conditions (NC= Non-Compliant, N/A= Not Applicable)						
Erosion and Sediment Control	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Access points	X					
Laydown area	X					
Water diversion			X			
Instream isolation			X			
Other:						
Fuel and Oil Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Spill Kits/Spill Response Plan	X			Spill kit placed in proximity to working equipment.		
Fuel Storage	X					
Refueling Location	X			Fueling done in a careful manner well away from Chemainus River.		
Equipment Condition (e.g.leaks)	X					
Spill trays			X	Machinery parked in field >50m from river. Spill tray not crucial.		
Other:						
Waste Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Deleterious substance use and storage	X					
Waste disposal	X					
Other:						
Habitat Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Sensitive habitat features	X					
Riparian area	X					
Other:						
Incident Report Required?	Yes		No	X	Reason:	No concerns.

Environmental Monitoring Report

PROJECT: Chemainus River Sediment Removal

Client: Halalt First Nation (Halalt) / Ministry of Environment and Climate Change Strategy (ENV)

Contractor: Stone Pacific Contracting Ltd. (SPC)

KWL File No.: **3427.029**

PREPARED BY	Jaime Dimillo	ON SITE	7:00	OFF SITE	16:30
DATE	September 11, 2023				
WEATHER	25°C, sunny				
WORK AREA	Gravel bar adjacent the Chemainus River				
EQUIPMENT AND WORKFORCE ON SITE					
- KWL Environmental Monitor (EM) - KWL Engineering Monitor - Stone Pacific Contracting (SPC) - Halalt Archeology Monitor - 2 excavators (Hitachi 350LC and CAT 320C) - 2 dump trucks and drivers - 2 traffic control personnel					
SUMMARY OF ENVIRONMENTAL WORK ON DAY:					
- Environmental monitoring					
SUMMARY OF CONTRACTOR WORK ON DAY:					
- Utilized two dump trucks to removal stockpile of fine material to two locations. First location was on the property for use by property owner, second location was off-site to a community member in need of fill. - Continued stockpiling of large woody debris. - Constructed silt fencing adjacent isolated pools to prevent frog migration into excavation area					
DISCUSSIONS WITH CONTRACTOR:					
- Discussed with contractor EM's ideal work plan for Sept 12 anticipated rain. EM requested berm of material be left to create an additional physical barrier between the excavation area and the Chemainus River. - Discussed sediment track out from trucks at Chemainus Road and asked contractor's plan to reduce/clean up track out. Contractor to utilize broom or if conditions warrant, bring in a sweeper truck. - EM requested that dump trucks turn around on the field and back into the gravel bar instead of turning around close to the Chemainus River.					
DISCUSSIONS WITH OTHERS:					
- Internally discussed potential for District of North Cowichan to take large woody debris for restoration purposes.					
ENVIRONMENTAL INCIDENTS:					
- While removing fine material, excavation went low enough to reach the water table. A small patch of groundwater infiltrated into the excavation area. Excavation moving forward was careful not to reach that depth again. See photo below.					
NOTES & COMMENTS					
- Access from Chemainus Road to excavation area became very dusty. Dust was concentrated in the agricultural area and was not seen being transported towards the Chemainus River.					
UPCOMING WORK & ACTIONS REQUIRED:					
- Begin removing gravel off-site - Continue to maintain amphibian exclusion fencing - Monitor site conditions during anticipated rain on Sept 12.					

Environmental Monitoring Report

PHOTOGRAPHS



Photo 1: Spill kit on-site



Photo 2: Fine material stockpile being removed



Photo 3: Small groundwater infiltration



Photo 4: Dust within field from access road



Photo 5: Fine material pile removed

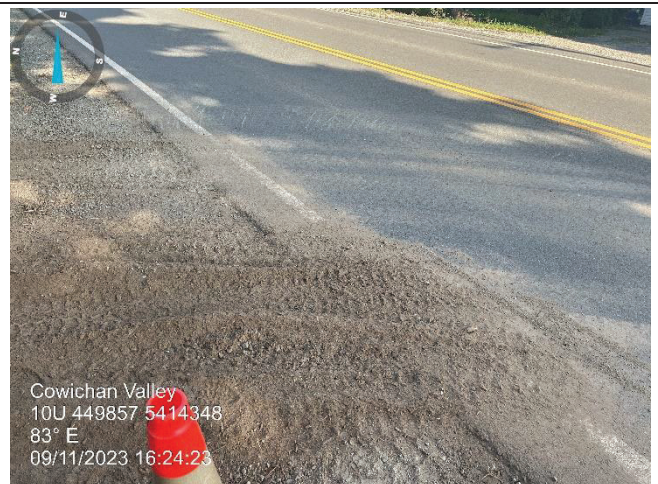


Photo 6: Sediment track out on Chemainus Road

Environmental Monitoring Report

Environmental Site Conditions (NC= Non-Compliant, N/A= Not Applicable)						
Erosion and Sediment Control	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Access points	X					
Laydown area	X					
Water diversion			X			
Instream isolation			X			
Other:						
Fuel and Oil Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Spill Kits/Spill Response Plan	X			Spill kit placed in proximity to working equipment.		
Fuel Storage	X					
Refueling Location	X			Fueling done in a careful manner well away from Chemainus River.		
Equipment Condition (e.g.leaks)	X					
Spill trays			X	Machinery parked in field >50m from river. Spill tray not crucial.		
Other:						
Waste Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Deleterious substance use and storage	X					
Waste disposal	X					
Other:						
Habitat Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Sensitive habitat features	X					
Riparian area	X					
Other:						
Incident Report Required?	Yes		No	X	Reason:	No concerns.

Environmental Monitoring Report

PROJECT: Chemainus River Sediment Removal

Client: Halalt First Nation (Halalt) / Ministry of Environment and Climate Change Strategy (ENV)

Contractor: Stone Pacific Contracting Ltd. (SPC)

KWL File No.: **3427.029**

PREPARED BY	Jaime Dimillo	ON SITE	7:00	OFF SITE	16:30
DATE	September 12, 2023				
WEATHER	18°C, cloudy with periods of rain				
WORK AREA	Gravel bar adjacent the Chemainus River				
EQUIPMENT AND WORKFORCE ON SITE					
- KWL Environmental Monitor (EM) - KWL Engineering Monitor - Stone Pacific Contracting (SPC) - Halalt Archeology Monitor - 2 excavators (Hitachi 350LC and CAT 320C) - 5 dump trucks and drivers - 2 traffic control personnel					
SUMMARY OF ENVIRONMENTAL WORK ON DAY:					
- Environmental monitoring					
SUMMARY OF CONTRACTOR WORK ON DAY:					
- Utilized five dump trucks to remove gravel off-site to the District of North Cowichan dump site. - Second excavator worked to remove vegetation from gravel to be removed.					
DISCUSSIONS WITH CONTRACTOR:					
- Repeated discussion about leaving berm of material to create an additional physical barrier between the excavation area and the Chemainus River. - Based on observed elevations and site conditions, discussed potential to remove additional sediment beyond pre-determined 3.2 m elevation if time and budgets permit.					
DISCUSSIONS WITH OTHERS:					
- None.					
ENVIRONMENTAL INCIDENTS:					
- None.					
NOTES & COMMENTS					
- Anticipated rain was not significant enough to raise river water levels nor initiate overland flow within the excavation area. - Observed Green Frog (<i>Lithobates clamitans</i>) in very small, isolated pool adjacent Chemainus River.					
UPCOMING WORK & ACTIONS REQUIRED:					
- Continue removing gravel off-site. - Continue to maintain amphibian exclusion fencing. - Monitor weather for significant rain events.					

Environmental Monitoring Report

PHOTOGRAPHS



Photo 1: Spill kit on-site



Photo 2: Gravel being removed off-site



Photo 3: Brush pile to be removed off-site



Photo 4: Sediment track out on Chemainus Road

Environmental Monitoring Report

Environmental Site Conditions (NC= Non-Compliant, N/A= Not Applicable)						
Erosion and Sediment Control	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Access points	X					
Laydown area	X					
Water diversion			X			
Instream isolation			X			
Other:						
Fuel and Oil Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Spill Kits/Spill Response Plan	X			Spill kit placed in proximity to working equipment.		
Fuel Storage	X					
Refueling Location	X			Fueling done in a careful manner well away from Chemainus River.		
Equipment Condition (e.g.leaks)	X					
Spill trays			X	Machinery parked in field >50m from river. Spill tray not crucial.		
Other:						
Waste Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Deleterious substance use and storage	X					
Waste disposal	X					
Other:						
Habitat Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Sensitive habitat features	X					
Riparian area	X					
Other:						
Incident Report Required?	Yes		No	X	Reason:	No concerns.

Environmental Monitoring Report

PROJECT: Chemainus River Sediment Removal

Client: Halalt First Nation (Halalt) / Ministry of Environment and Climate Change Strategy (ENV)

Contractor: Stone Pacific Contracting Ltd. (SPC)

KWL File No.: **3427.029**

PREPARED BY	Jaime Dimillo	ON SITE	7:00	OFF SITE	16:30
DATE	September 13, 2023				
WEATHER	21°C, sunny				
WORK AREA	Gravel bar adjacent the Chemainus River				
EQUIPMENT AND WORKFORCE ON SITE					
- KWL Environmental Monitor (EM) - KWL Engineering Monitor - Stone Pacific Contracting (SPC) - Halalt Archeology Monitor - 2 excavators (Hitachi 350LC and CAT 320C) - 8-10 dump trucks and drivers - 2 traffic control personnel					
SUMMARY OF ENVIRONMENTAL WORK ON DAY:					
- Environmental monitoring					
SUMMARY OF CONTRACTOR WORK ON DAY:					
- Removed gravel off-site to two different dump sites.					
DISCUSSIONS WITH CONTRACTOR:					
- Continued discussion about potential to remove additional 30 cm of sediment. - Discussed regarding increased amount of dust from access road. Solution forthcoming.					
DISCUSSIONS WITH OTHERS:					
- None.					
ENVIRONMENTAL INCIDENTS:					
- None.					
NOTES & COMMENTS					
- None.					
UPCOMING WORK & ACTIONS REQUIRED:					
- Continue removing gravel off-site. - Continue to maintain amphibian exclusion fencing. - Monitor weather for significant rain events. - Determine if extra 30 cm of sediment will be removed. - Ensure dust is controlled on-site.					

Environmental Monitoring Report

PHOTOGRAPHS



Photo 1: Spill kit on-site



Photo 2: Gravel being removed off-site



Photo 3: Brush pile to be removed off-site



Photo 4: Sediment track out on Chemainus Road

Environmental Monitoring Report

Environmental Site Conditions (NC= Non-Compliant, N/A= Not Applicable)						
Erosion and Sediment Control	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Access points	X					
Laydown area	X					
Water diversion			X			
Instream isolation			X			
Other: Dust		X		Dust is beginning to become an issue.		N
Fuel and Oil Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Spill Kits/Spill Response Plan	X			Spill kit placed in proximity to working equipment.		
Fuel Storage	X					
Refueling Location	X			Fueling done in a careful manner well away from Chemainus River.		
Equipment Condition (e.g.leaks)	X					
Spill trays			X	Machinery parked in field >50m from river. Spill tray not crucial.		
Other:						
Waste Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Deleterious substance use and storage	X					
Waste disposal	X					
Other:						
Habitat Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Sensitive habitat features	X					
Riparian area	X					
Other:						
Incident Report Required?	Yes		No	X	Reason:	No concerns.

Environmental Monitoring Report

PROJECT: Chemainus River Sediment Removal

Client: Halalt First Nation (Halalt) / Ministry of Environment and Climate Change Strategy (ENV)

Contractor: Stone Pacific Contracting Ltd. (SPC)

KWL File No.: **3427.029**

PREPARED BY	Jaime Dimillo	ON SITE	7:00	OFF SITE	16:30
DATE	September 14, 2023				
WEATHER	22°C, sunny				
WORK AREA	Gravel bar adjacent the Chemainus River				
EQUIPMENT AND WORKFORCE ON SITE					
- KWL Environmental Monitor and Engineering Monitor (EM) - Stone Pacific Contracting (SPC) - Halalt Archeology Monitor - 2 excavators (Hitachi 350LC and CAT 320C) - 6-8 dump trucks and drivers - 2 traffic control personnel					
SUMMARY OF ENVIRONMENTAL WORK ON DAY:					
- Environmental monitoring					
SUMMARY OF CONTRACTOR WORK ON DAY:					
- Removed gravel off-site to two different dump sites. - Brought water truck on-site to control dust. - Swept road at end of shift.					
DISCUSSIONS WITH CONTRACTOR:					
- Continued discussion about potential to remove additional 30 cm of sediment. KWL told on-site crew that from an environmental and engineering perspective, additional sediment removal is ok but crew had not received instruction to go ahead yet from SPC. - Discussion about how to control dust on site without making the road too muddy.					
DISCUSSIONS WITH OTHERS:					
- Property owner was not pleased with Contractor's efforts to control dust. Also, he requested an additional plate be placed over the irrigation line, as the current plate is being shifted from trucks driving over it. In addition, the property owner has concerns about the plan for site restoration when the works are complete.					
ENVIRONMENTAL INCIDENTS:					
- Rock with grease found adjacent Chemainus River. EM removed rock off-site. See photos. - Excessive dust on-site. Contractor eventually brought in a water truck once in the afternoon for one pass to suppress dust. Contractor also supplied a sweeper machine to clean the road at end of shift. KWL Env Monitor and Engineering Monitor requested Contractor utilize the water truck again at end of shift, however the water truck did not return.					
NOTES & COMMENTS					
- None.					
UPCOMING WORK & ACTIONS REQUIRED:					
- Continue removing gravel off-site. - Continue to maintain amphibian exclusion fencing. - Monitor weather for significant rain events. - Determine if extra 30 cm of sediment will be removed. - Ensure dust is controlled on-site.					

Environmental Monitoring Report

PHOTOGRAPHS



Photo 1: Spill kit on-site

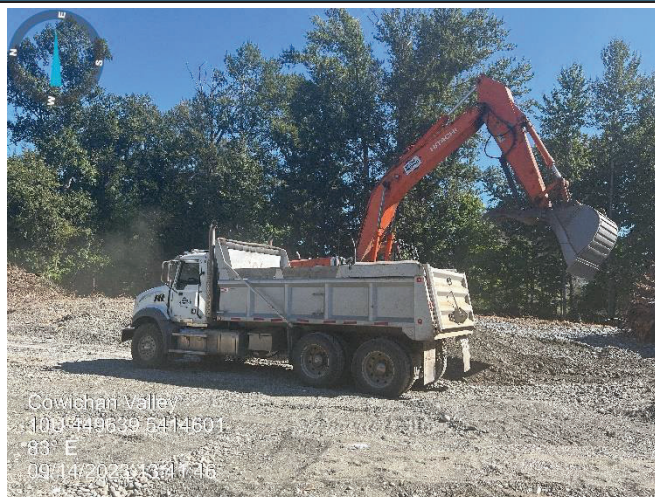


Photo 2: Gravel being removed off-site



Photo 3: Rock with grease found adjacent Chemainus River. Removed off-site.



Photo 4: Dust generated from trucks driving on access road



Photo 5: Chemainus Road after water truck had come



Photo 6: Machine used to clean road at end of shift

Environmental Monitoring Report



Photo 7: Access road conditions at end of shift



Photo 8: Road being cleaned at end of shift

Environmental Monitoring Report

Environmental Site Conditions (NC= Non-Compliant, N/A= Not Applicable)						
Erosion and Sediment Control	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Access points	X					
Laydown area	X					
Water diversion			X			
Instream isolation			X			
Other: Dust		X		Dust is not being adequately managed. A thorough application of water should be performed at the end of each day. If this does not prove to be effective in managing dust, multiple applications per day should be performed.		N
Fuel and Oil Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Spill Kits/Spill Response Plan	X			Spill kit placed in proximity to working equipment.		
Fuel Storage	X					
Refueling Location	X			Fueling done in a careful manner well away from Chemainus River.		
Equipment Condition (e.g.leaks)	X					
Spill trays			X	Machinery parked in field >50m from river. Spill tray not crucial.		
Other:						
Waste Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Deleterious substance use and storage	X					
Waste disposal	X					
Other:						
Habitat Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Sensitive habitat features	X					
Riparian area	X					
Other:						
Incident Report Required?	Yes		No	X	Reason:	No concerns.

Environmental Monitoring Report

PROJECT: Chemainus River Sediment Removal

Client: Halalt First Nation (Halalt) / Ministry of Environment and Climate Change Strategy (ENV)

Contractor: Stone Pacific Contracting Ltd. (SPC)

KWL File No.: **3427.029**

PREPARED BY	Jaime Dimillo	ON SITE	7:00	OFF SITE	16:45
DATE	September 15, 2023				
WEATHER	21°C, sunny				
WORK AREA	Gravel bar adjacent the Chemainus River				
EQUIPMENT AND WORKFORCE ON SITE					
- KWL Environmental Monitor (EM) - KWL Engineering Monitor - Stone Pacific Contracting (SPC) - Halalt Archeology Monitor - 2 excavators (Hitachi 350LC and CAT 320C) – CAT 320 replaced with John Deere in PM - 6-8 dump trucks and drivers - 2 traffic control personnel					
SUMMARY OF ENVIRONMENTAL WORK ON DAY:					
- Environmental monitoring					
SUMMARY OF CONTRACTOR WORK ON DAY:					
- Removed gravel off-site to two different dump sites. - Brought water truck on-site to control dust.					
DISCUSSIONS WITH CONTRACTOR:					
- Contractor requested to remove several pieces of large piece of woody debris that is close to the access road covering one of the isolated pools. EM requested that this LWD be removed carefully as there is potential to fall into the pools and/or damage existing amphibian exclusion fencing. See photo below. Contractor to potentially utilize chains to remove LWD without significantly impacting pools and fencing below. - Water truck on-site at approximately 9:30. Dust significantly improved after water application but conditions quickly deteriorated afterwards. Informed Contractor that current approach for dust control was not satisfactory. EM requested that water truck come at end of shift to soak the access road and once in the middle of the workday if required.					
DISCUSSIONS WITH OTHERS:					
- Property owner still not pleased with Contractor's efforts to control dust and previous request for additional plate over irrigation line has not been satisfied.					
ENVIRONMENTAL INCIDENTS:					
- Pacific tree frog observed within excavation area. EM quickly removed the frog from the work area and released away from work area into vegetation within variable habitat.					
NOTES & COMMENTS					
- EM observed excessive dust on the gravel bar as a result of gravel removal and trucks driving on gravel bar. Previously, dust was exclusively in the agricultural field. EM has concerns about excessive amounts of dust being transported towards Chemainus River.					
UPCOMING WORK & ACTIONS REQUIRED:					
- Ensure dust is controlled on-site. Water truck should come at end of shift and once throughout the day if required. - Continue removing gravel off-site. - Continue to maintain amphibian exclusion fencing. - Monitor weather for significant rain events. - Determine if extra 30 cm of sediment will be removed.					

Environmental Monitoring Report

PHOTOGRAPHS

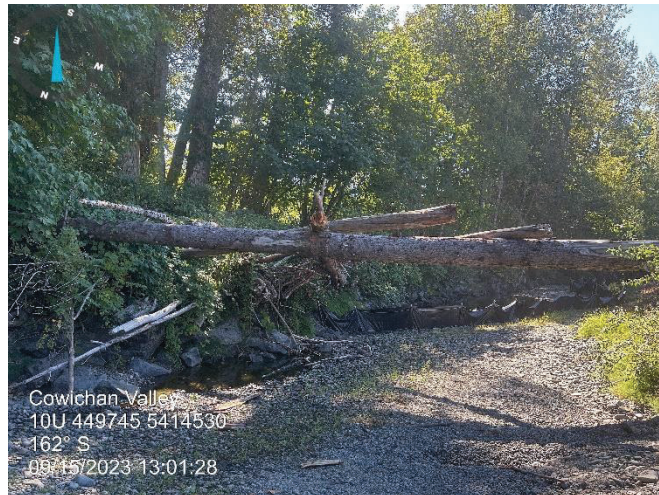


Photo 1: LWD to be removed above isolated pool



Photo 2: Gravel being removed off-site



Photo 3: Chemainus Road clean at start of shift

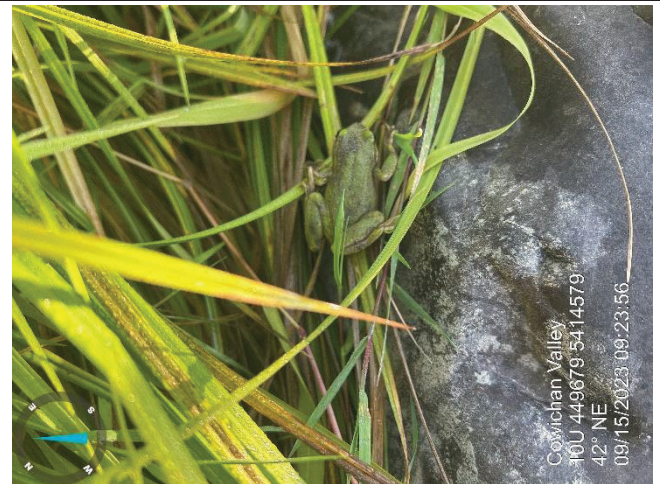


Photo 4: Released Pacific tree frog

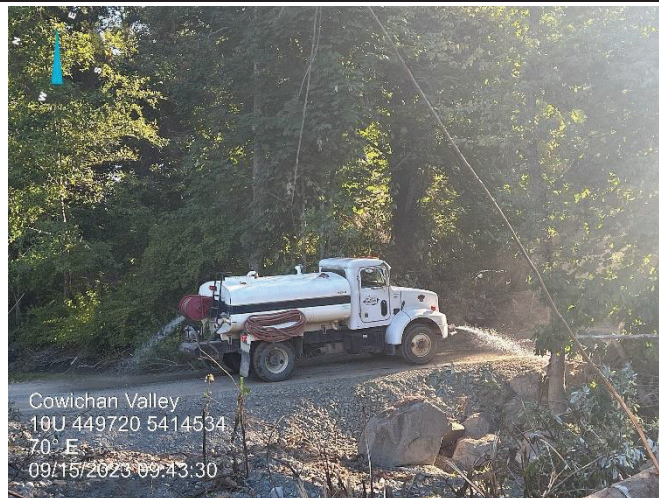


Photo 5: Water truck on-site



Photo 6: Track out on Chemainus Road after water application

Environmental Monitoring Report



Photo 7: Dust on gravel bar

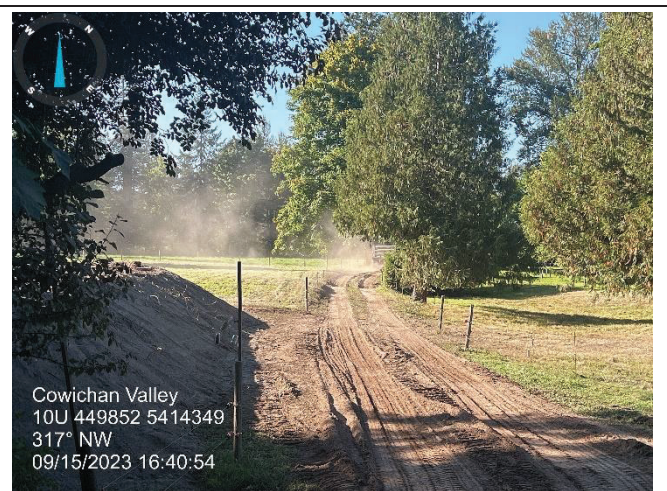


Photo 8: Dust in agricultural field

Environmental Monitoring Report

Environmental Site Conditions (NC= Non-Compliant, N/A= Not Applicable)						
Erosion and Sediment Control	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Access points	X					
Laydown area	X					
Water diversion			X			
Instream isolation			X			
Other: Dust		X		Dust is not being adequately managed. A thorough application of water should be performed at the end of each day. If this does not prove to be effective in managing dust, multiple applications per day should be performed.		N
Fuel and Oil Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Spill Kits/Spill Response Plan	X			Spill kit placed in proximity to working equipment.		
Fuel Storage	X					
Refueling Location	X			Fueling done in a careful manner well away from Chemainus River.		
Equipment Condition (e.g.leaks)	X					
Spill trays			X	Machinery parked in field >50m from river. Spill tray not crucial.		
Other:						
Waste Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Deleterious substance use and storage	X					
Waste disposal	X					
Other:						
Habitat Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Sensitive habitat features	X					
Riparian area	X					
Other:						
Incident Report Required?	Yes		No	X	Reason:	No concerns.

Environmental Monitoring Report

PROJECT: Chemainus River Sediment Removal

Client: Halalt First Nation (Halalt) / Ministry of Environment and Climate Change Strategy (ENV)

Contractor: Stone Pacific Contracting Ltd. (SPC)

KWL File No.: **3427.029**

PREPARED BY	Jaime Dimillo	ON SITE	7:00	OFF SITE	17:30
DATE	September 18, 2023				
WEATHER	18°C, sunny				
WORK AREA	Gravel bar adjacent the Chemainus River				
EQUIPMENT AND WORKFORCE ON SITE					
- KWL Environmental Monitor (EM) - KWL Engineering Monitor - Stone Pacific Contracting (SPC) - Halalt Archeology Monitor - 2 excavators (Hitachi 350LC and John Deere) - 8 dump trucks and drivers - 1 water truck - 2 traffic control personnel					
SUMMARY OF ENVIRONMENTAL WORK ON DAY:					
- Environmental monitoring					
SUMMARY OF CONTRACTOR WORK ON DAY:					
- Removed gravel off-site to two different dump sites. - Brought and left water truck on-site to control dust. - Installed an additional metal plate on top of the property owner's irrigation line. - Began removal of berm of sediment between excavation area and the Chemainus River. - Began removing additional 30 cm of sediment to an elevation of 2.9 mASL. - Cleaned sediment track out from Chemainus Road at end of day.					
DISCUSSIONS WITH CONTRACTOR:					
- Discussed frequency of water truck usage to control dust on-site. Contractor provided the water truck all day. Dust was controlled well. - Contractor requested to begin removing berm of material. EM agreed that timing and weather permitted for the removal of the berm.					
DISCUSSIONS WITH OTHERS:					
- None.					
ENVIRONMENTAL INCIDENTS:					
- When removing logs that were above an isolated pool, debris fell into the isolated pools and damaged the amphibian exclusion fencing. EM believes this incident was not intentional and impacts were minimal.					
NOTES & COMMENTS					
- Dust control on-site is much improved.					
UPCOMING WORK & ACTIONS REQUIRED:					
- Continue to control dust. - Continue removing gravel off-site. - Continue to maintain amphibian exclusion fencing. - Determine path of action for large logs and woody debris. - Monitor weather for significant rain events.					

Environmental Monitoring Report

PHOTOGRAPHS



Photo 1: Spill kit on-site



Photo 2: Street cleaning at end of day



Photo 3: Water truck on-site

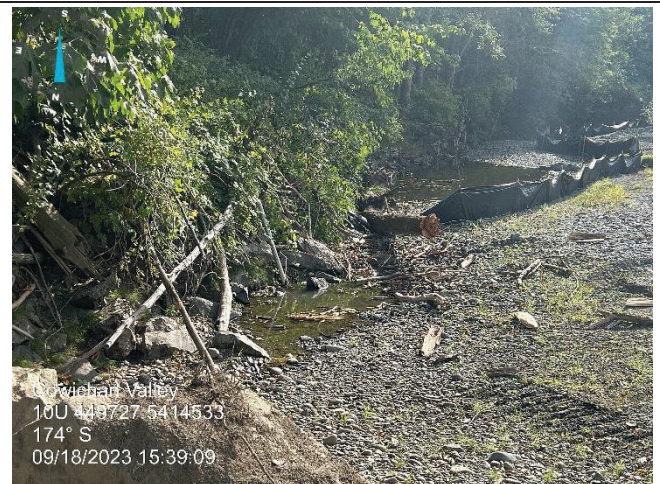


Photo 4: Debris in isolated pools and damaged exclusion fencing

Environmental Monitoring Report

Environmental Site Conditions (NC= Non-Compliant, N/A= Not Applicable)						
Erosion and Sediment Control	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Access points	X					
Laydown area	X					
Water diversion			X			
Instream isolation			X			
Other: Dust	X			Water truck utilized multiple times throughout the day to control dust.		
Fuel and Oil Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Spill Kits/Spill Response Plan	X			Spill kit placed in proximity to working equipment.		
Fuel Storage	X					
Refueling Location	X			Fueling done in a careful manner well away from Chemainus River.		
Equipment Condition (e.g.leaks)	X					
Spill trays			X	Machinery parked in field >50m from river. Spill tray not crucial.		
Other:						
Waste Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Deleterious substance use and storage	X					
Waste disposal	X					
Other:						
Habitat Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Sensitive habitat features	X					
Riparian area	X					
Other:						
Incident Report Required?	Yes		No	X	Reason:	No concerns.

Environmental Monitoring Report

PROJECT: Chemainus River Sediment Removal

Client: Halalt First Nation (Halalt) / Ministry of Environment and Climate Change Strategy (ENV)

Contractor: Stone Pacific Contracting Ltd. (SPC)

KWL File No.: **3427.029**

PREPARED BY	Jaime Dimillo	ON SITE	7:00	OFF SITE	17:00
DATE	September 19, 2023				
WEATHER	16°C, cloudy some periods of light rain				
WORK AREA	Gravel bar adjacent the Chemainus River				
EQUIPMENT AND WORKFORCE ON SITE					
- KWL Environmental Monitor (EM) - Stone Pacific Contracting (SPC) - Halalt Archeology Monitor - 2 DFO representatives - 2 excavators (Hitachi 350LC and John Deere) - 8 dump trucks and drivers - 1 water truck - 2 traffic control personnel					
SUMMARY OF ENVIRONMENTAL WORK ON DAY:					
- Environmental monitoring					
SUMMARY OF CONTRACTOR WORK ON DAY:					
- Removed gravel off-site to two different dump sites. - Utilized water truck on-site to control dust. - Continued removing sediment berm between excavation area and the Chemainus River. - Continued removing additional 30 cm of sediment to an elevation of 2.9 mASL. - Cleaned sediment track out on Chemainus Road at end of day.					
DISCUSSIONS WITH CONTRACTOR:					
- EM requested that machine operators use utmost caution when removing sediment berm to prevent any sediment from entering the Chemainus River.					
DISCUSSIONS WITH OTHERS:					
- Two representatives from DFO visited the site. DFO requested that large spill kit be placed on the gravel bar instead of in the agricultural field. Contractor complied. - Chief Thomas discussed with EM that large logs could be cut into 14-foot lengths and brought to Halalt. Fir and cedar trees to be used for firewood. All other species to be put with vegetation pile from grubbing.					
ENVIRONMENTAL INCIDENTS:					
- EM observed multiple patches of rocks within the excavation area covered in black grease or oil. EM removed these rocks off-site. Exact truck that was leaking was not determined, EM to remain vigilant on Sept 20.					
NOTES & COMMENTS					
- None.					
UPCOMING WORK & ACTIONS REQUIRED:					
- Cut up and remove large logs off-site. - Continue removing gravel off-site. - Ensure grade between remaining gravel bar and the excavated area is a gentle slope. - Begin demobilization					

Environmental Monitoring Report

PHOTOGRAPHS



Photo 1: Spill kit on-site



Photo 2: Rocks with oil or grease



Photo 3: Water truck on-site



Photo 4: Removal of sediment berm

Environmental Monitoring Report

Environmental Site Conditions (NC= Non-Compliant, N/A= Not Applicable)						
Erosion and Sediment Control	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Access points	X					
Laydown area	X					
Water diversion			X			
Instream isolation			X			
Other: Dust	X			Water truck utilized multiple times throughout the day to control dust.		
Fuel and Oil Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Spill Kits/Spill Response Plan	X			Spill kit placed in proximity to working equipment.		
Fuel Storage	X					
Refueling Location	X			Fueling done in a careful manner well away from Chemainus River.		
Equipment Condition (e.g.leaks)		X		EM observed patches of oil on the gravel bar that presumably leaked from one of the dump trucks. Specific dump truck yet not identified.		Y
Spill trays			X	Machinery parked in field >50m from river. Spill tray not crucial.		
Other:						
Waste Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Deleterious substance use and storage	X					
Waste disposal	X					
Other:						
Habitat Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Sensitive habitat features	X					
Riparian area	X					
Other:						
Incident Report Required?	Yes		No	X	Reason:	No concerns.

Environmental Monitoring Report

PROJECT: Chemainus River Sediment Removal

Client: Halalt First Nation (Halalt) / Ministry of Environment and Climate Change Strategy (ENV)

Contractor: Stone Pacific Contracting Ltd. (SPC)

KWL File No.: **3427.029**

PREPARED BY	Jaime Dimillo	ON SITE	7:00	OFF SITE	17:00
DATE	September 20, 2023				
WEATHER	18°C, sunny				
WORK AREA	Gravel bar adjacent the Chemainus River				
EQUIPMENT AND WORKFORCE ON SITE					
- KWL Environmental Monitor (EM) - KWL Engineering Monitor - Stone Pacific Contracting (SPC) - Halalt Archeology Monitor - 2 excavators (Hitachi 350LC and John Deere) - 8 dump trucks and drivers - 1 water truck - 2 traffic control personnel					
SUMMARY OF ENVIRONMENTAL WORK ON DAY:					
- Environmental monitoring					
SUMMARY OF CONTRACTOR WORK ON DAY:					
- Removed gravel to Halalt dump site. - Utilized water truck on-site to control dust. - Began to cut up and remove large pile of logs off site. - Utilized excavator to grade and smooth out excavated area. - Compacted gravel bar access as multiple dump trucks got stuck.					
DISCUSSIONS WITH CONTRACTOR:					
- Discussed plans for site clean up and demobilization in the coming days. Contractor to begin final grading on Sept 21. Possible wrap up of operations on the gravel bar on Sept 22.					
DISCUSSIONS WITH OTHERS:					
- None.					
ENVIRONMENTAL INCIDENTS:					
- None.					
NOTES & COMMENTS					
- None.					
UPCOMING WORK & ACTIONS REQUIRED:					
- Continue to cut up and remove large logs off-site. - Continue removing gravel off-site. - Ensure grade between remaining gravel bar and the excavated area is a gentle slope. - Begin demobilization					

Environmental Monitoring Report

PHOTOGRAPHS



Photo 1: Spill kit moved to gravel bar as per DFO request on Sept 19



Photo 2: Large logs being removed off-site



Photo 3: Logs to be removed on Sept 21



Photo 4: Dump truck stuck on gravel bar

Environmental Monitoring Report

Environmental Site Conditions (NC= Non-Compliant, N/A= Not Applicable)						
Erosion and Sediment Control	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Access points	X					
Laydown area	X					
Water diversion			X			
Instream isolation			X			
Other: Dust	X			Water truck used at end of day to control dust.		
Fuel and Oil Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Spill Kits/Spill Response Plan	X			Spill kit placed in proximity to working equipment.		
Fuel Storage	X					
Refueling Location	X			Fueling done in a careful manner well away from Chemainus River.		
Equipment Condition (e.g.leaks)	X			No leaks observed.		
Spill trays			X	Machinery parked in field >50m from river. Spill tray not crucial.		
Other:						
Waste Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Deleterious substance use and storage	X					
Waste disposal	X					
Other:						
Habitat Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Sensitive habitat features	X					
Riparian area	X					
Other:						
Incident Report Required?	Yes		No	X	Reason:	No concerns.

Environmental Monitoring Report

PROJECT: Chemainus River Sediment Removal

Client: Halalt First Nation (Halalt) / Ministry of Environment and Climate Change Strategy (ENV)

Contractor: Stone Pacific Contracting Ltd. (SPC)

KWL File No.: **3427.029**

PREPARED BY	Jaime Dimillo	ON SITE	7:00	OFF SITE	16:45
DATE	September 21, 2023				
WEATHER	19°C, sunny				
WORK AREA	Gravel bar adjacent the Chemainus River				
EQUIPMENT AND WORKFORCE ON SITE					
- KWL Environmental Monitor (EM) - KWL Engineering Monitor - Stone Pacific Contracting (SPC) - Halalt Archeology Monitor - 2 excavators (Hitachi 350LC and John Deere) - 4 dump trucks and drivers - 1 water truck (AM only) - 2 traffic control personnel					
SUMMARY OF ENVIRONMENTAL WORK ON DAY:					
- Environmental monitoring					
SUMMARY OF CONTRACTOR WORK ON DAY:					
- Removed gravel to Halalt dump site. - Removed large pile of logs off site. - Utilized excavator to grade and smooth out excavated area. - Sloped transition from remaining gravel bar to excavated area at 2:1 slope.					
DISCUSSIONS WITH CONTRACTOR:					
- EM discussed with Contractor the importance of sloping the remaining gravel bar to the excavated area to prevent fish stranding. A decision was made to slope at 2:1.					
DISCUSSIONS WITH OTHERS:					
- None.					
ENVIRONMENTAL INCIDENTS:					
- Final grading caused slope beside the amphibian exclusion fence to collapse and thus impact the efficacy of one section of fencing. EM did not instruct crew to repair the fence as work is almost complete, machines are no longer in that area and few amphibians have been observed out of the water during the works. Risk to amphibians is minimal.					
NOTES & COMMENTS					
- None.					
UPCOMING WORK & ACTIONS REQUIRED:					
- Finish grading of gravel bar and remove any gravel that remains off-site to Halalt dump site - Remove access ramp - Remove amphibian exclusion fencing and all construction materials from site. - Demobilize					

Environmental Monitoring Report

PHOTOGRAPHS



Photo 1: Damaged section of amphibian exclusion fencing



Photo 2: Large logs being removed off-site



Photo 3: Transition between gravel bar and excavated area before sloping



Photo 4: Transition between gravel bar and excavated area at 2:1 slope

Environmental Monitoring Report

Environmental Site Conditions (NC= Non-Compliant, N/A= Not Applicable)						
Erosion and Sediment Control	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Access points	X					
Laydown area	X					
Water diversion			X			
Instream isolation			X			
Other: Dust	X			Water truck used at end of day to control dust.		
Fuel and Oil Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Spill Kits/Spill Response Plan	X			Spill kit placed in proximity to working equipment.		
Fuel Storage	X					
Refueling Location	X			Fueling done in a careful manner well away from Chemainus River.		
Equipment Condition (e.g.leaks)	X			No leaks observed.		
Spill trays			X	Machinery parked in field >50m from river. Spill tray not crucial.		
Other:						
Waste Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Deleterious substance use and storage	X					
Waste disposal	X					
Other:						
Habitat Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Sensitive habitat features	X					
Riparian area	X					
Other:						
Incident Report Required?	Yes		No	X	Reason:	No concerns.

Environmental Monitoring Report

PROJECT: Chemainus River Sediment Removal

Client: Halalt First Nation (Halalt) / Ministry of Environment and Climate Change Strategy (ENV)

Contractor: Stone Pacific Contracting Ltd. (SPC)

KWL File No.: **3427.029**

PREPARED BY	Jaime Dimillo	ON SITE	7:00	OFF SITE	13:45
DATE	September 22, 2023				
WEATHER	21°C, sunny				
WORK AREA	Gravel bar adjacent the Chemainus River				
EQUIPMENT AND WORKFORCE ON SITE					
- KWL Environmental Monitor (EM) - KWL Engineering Monitor - Stone Pacific Contracting (SPC) - North Cowichan Environmental Specialist - 2 excavators (Hitachi 350LC and John Deere) - 3 dump trucks and drivers - 2 traffic control personnel					
SUMMARY OF ENVIRONMENTAL WORK ON DAY:					
- Environmental monitoring					
SUMMARY OF CONTRACTOR WORK ON DAY:					
- Removed gravel and fine sediment to Halalt dump site. - Removed brush to Halalt dump site. - Smoothed and graded excavated area. - Removed access ramp. - Restored riprap that was moved to build access ramp - Removed fallen trees that were previously removed to build the access ramp - Began demobilization					
DISCUSSIONS WITH CONTRACTOR:					
- EM discussed with Contractor that area below the access ramp should be excavated to below 2.9 m as the pre-existing elevation was not that high and to prevent fish stranding. - EM allowed for the removal of the amphibian exclusion fencing to remove extra material adjacent the isolated pools.					
DISCUSSIONS WITH OTHERS:					
- Property owner concerned about timing of restoration works given upcoming forecasted rain and lower temperatures.					
ENVIRONMENTAL INCIDENTS:					
- None.					
NOTES & COMMENTS					
- Work on the gravel bar is complete. All machinery off the gravel bar when EM left. Only work that remains is restoration of property owner's field to previous state.					
UPCOMING WORK & ACTIONS REQUIRED:					
- Restore field to previous state.					

Environmental Monitoring Report

PHOTOGRAPHS



Photo 1: Final sediment being removed



Photo 2: Amphibian fencing removed and smoothing of slopes



Photo 3: Access ramp removed



Photo 4: Boulders put back into place

Environmental Monitoring Report

Environmental Site Conditions (NC= Non-Compliant, N/A= Not Applicable)						
Erosion and Sediment Control	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Access points	X					
Laydown area	X					
Water diversion			X			
Instream isolation			X			
Other:			X			
Fuel and Oil Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Spill Kits/Spill Response Plan	X			Spill kit placed in proximity to working equipment.		
Fuel Storage	X					
Refueling Location	X			Fueling done in a careful manner well away from Chemainus River.		
Equipment Condition (e.g.leaks)	X			No leaks observed.		
Spill trays			X	Machinery parked in field >50m from river. Spill tray not crucial.		
Other:						
Waste Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Deleterious substance use and storage	X					
Waste disposal	X					
Other:						
Habitat Management	OK	NC	N/A	Comments and Mitigation		Action Corrected?
Sensitive habitat features	X					
Riparian area	X					
Other:						
Incident Report Required?	Yes		No	X	Reason:	No concerns.



Enclosure C

Construction Environmental Management Plan



KERR WOOD LEIDAL
consulting engineers

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Chemainus River Sediment Removal

Construction Environmental Management Plan

Final Report
July 25, 2023
KWL Project No. 3427.029

Prepared for:
BC Ministry of Environment and Climate Change Strategy



Contents

1.	Introduction	1-1
1.1	Project Description	1-1
1.2	Purpose of the Construction Environmental Management Plan.....	1-1
1.3	Roles and Responsibilities.....	1-1
1.4	Guiding Documents	1-3
2.	Project Location and Scope of Work	2-1
2.1	Project Location and Physical Setting.....	2-1
2.2	Scope of Proposed Works.....	2-3
2.3	Construction Timeline	2-3
3.	Environmental Setting	3-1
3.1	Environmental Setting	3-1
4.	Regulatory Requirements	4-1
4.1	Permits and Approvals	4-1
5.	Construction Environmental Management Plan	5-1
5.1	Environmental Monitoring.....	5-1
5.2	Timing of Works	5-1
5.3	Protection of Fish and Fish Habitat.....	5-2
5.4	Tree Protection and Vegetation Management.....	5-2
5.5	Invasive Plant Management	5-3
5.6	Erosion and Sediment Control Plan.....	5-3
5.7	Deleterious Substance Control and Spill Management	5-4
5.8	Clean up and Restoration.....	5-5

Report Submission

References

Figures

Figure 2-1: Chemainus River Sediment Removal Project Location.....	2-2
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Tables

Table 2-1: Proposed Construction Methods.....	2-3
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1. Introduction

1.1 Project Description

The Ministry of Environment and Climate Change Strategy (ENV) is working to address the impacts of sedimentation in the Chemainus River that resulted from significant precipitation and flooding during the November 2021 Atmospheric River Event (ARE). Kerr Wood Leidal Associates Ltd. (KWL) has been retained by ENV to provide water resources engineering, environmental approvals support, and construction services for sediment removal and channel restoration within Chemainus River.

KWL has prepared this document as an updated Construction Environmental Management Plan (CEMP) for Phase 2 works. This CEMP includes general guidance on the following topics:

- Environmental monitoring;
- Timing of works;
- Protection of fish and fish habitat;
- Protection of birds and wildlife;
- Tree protection and vegetation management;
- Invasive Plant Management;
- Erosion and sediment control;
- Deleterious substance control and spill management; and
- Clean up and restoration.

1.2 Purpose of the Construction Environmental Management Plan

This Construction Environmental Management Plan (CEMP) provides overarching guidance and sets out the requirements and measures that will be adopted to avoid, minimize, and mitigate the potential adverse environmental impacts of the Project. This plan is to be implemented by the Contractor throughout the duration of the Project and applies to the construction phase.

The CEMP is a living document and will be updated over the course of construction as planning and sequencing for work activities are adjusted and finalized, and as observations made by environmental monitors warrant changes in environmental management.

1.3 Roles and Responsibilities

The parties involved in the Project have the following roles and responsibilities with respect to environmental management:

1. The Consultant, KWL, shall:
 - a. ensure that the appropriate resources are available to establish, implement, maintain, and improve environmentally responsible construction practices;
 - b. liaise with the EM about potential impacts to environmental components during construction;
 - c. contract Qualified Professionals¹ (QPs) with specific expertise required for the Project liaise with all QPs as needed; and

¹ QPs will have the expertise or knowledge needed to advise and/or support the Consultant, the EM, the Contractor, and KWL with respect to environmental or other engineering concerns.



- d. provide resources required for environmental awareness and protection training, environmental documents specific to the Project, and financial resources.
- 2. The Environmental Monitor (EM), shall:
 - a. advise the Contractor of environmental protection and monitor environmental protection measures;
 - b. identify deficiencies of the Contractor and communicate with the Contractor on how to address deficiencies;
 - c. have written authority to halt or modify any construction activity if it is deemed necessary in order to protect fish and wildlife populations or their habitats; and
 - d. report to the Consultant.
- 3. The Engineer of Record, KWL, shall:
 - a. have specific expertise or knowledge needed to advise and/or support the Consultant, the EM, and the Contractor where specific engineering input is required related to environmental concerns;
 - b. liaise with the EM about potential impacts to environmental components during construction; and
 - c. liaise with any other QPs involved with the project as needed.
- 4. On behalf of the Ministry Representative (ENV), KWL will provide independent Quality Assurance (QA) throughout construction. Independent QA activities include but are not limited to:
 - a. Preparation of daily construction summary reports for record;
 - b. Visual inspection of earthworks construction progress and conditions;
 - c. Visual inspection of planted vegetation;
 - d. Review of progress surveys to confirm compliance with design lines;
 - e. Inspection of QA sampling and/or testing activities and review of QA test results;
 - f. Request for QA sampling and/or testing at specific locations of interest, where appropriate;
 - g. Request for re-work or replacement of as-placed material should visual assessment suggest poor workmanship and/or test results indicate non-compliance. The full cost of repairs relating to the non-compliance and additional QA sampling and testing shall be borne by the Contractor; and
 - h. ENV may provide their own independent QA inspections, where appropriate.
- 5. The Contractor (to be determined) includes any company and its field staff retained by the Contract Administrator, Engineer of Record, or ENV to construct a component of the Project. The Contractor shall:
 - a. plan and conduct activities in compliance with the CEMP and all applicable legislation, approvals, and best management practices;
 - b. report directly to the Consultant regarding all site activities;
 - c. ensure that there is no release of deleterious substances into Chemainus River or any other nearby watercourses or waterbodies;



- d. ensure all staff, including subcontractors, are familiar with the CEMP and know their responsibilities in meeting the outcomes of the plan;
- e. communicate changes in construction plans or activities that could impact the implementation of the CEMP to the Consultant, the EM, and KWL as quickly as possible; and
- f. keep a copy of the CEMP on-site at all times.

1.4 Guiding Documents

The following guidance documents were used to develop the CEMP:

- *Requirements and Best Management Practices for Making Changes In and About a Stream in British Columbia*. Version 2022.01. Government of British Columbia, 2022.
- *Measures to Protect Fish and Fish Habitat*, Fisheries and Oceans Canada, 2019.
- *A Field Guide to Fuel Handling, Transportation and Storage*, Ministry of Water, Land and Air Protection, 3rd Edition, 2002.
- *B.C. Approved Water Quality Guidelines*, Ministry of Environment and Climate Change Strategy Updated 2018.
- *Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia*, Ministry of Water, Land and Air Protection, 2004.
- *Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia*, Ministry of Environment and Climate Change Strategy, 2014.
- *Land Development Guidelines for the Protection of Aquatic Habitat, Fisheries and Oceans*, 2nd Edition, 1993.
- *New Migratory Birds Regulations*, Environment and Climate Change Canada, 2022.



2. Project Location and Scope of Work

2.1 Project Location and Physical Setting

The Chemainus River is a salmon-bearing stream found on the southeast coast of Vancouver Island with its estuary located approximately 10 km north of the City of Duncan. Two extreme rainfall events on February 1, 2020, and November 15, 2021, resulted in the second-highest and the third-highest daily peak flows on record for the Chemainus River since 1953. As a result of these recent extreme rainfall events, Halalt First Nation, Penelakut First Nation (Tsussie) and surrounding land within the District of North Cowichan experienced flooding as the Chemainus River overtopped its banks.

Sediment deposits were removed from two locations on the Chemainus River in 2022 as emergency works to address the impacts of introduced fine-grained sediment during the ARE: One point bar along the natural mainstem channel south of the Trans-Canada Highway Bridge and the other located along the dry side channel on the left bank floodplain of the Chemainus River. In addition to this work, several hazard trees on the right bank of the Chemainus River were topped and delimbed to reduce wind loading and potential windfall into the river resulting in disturbance to root systems and the riverbank material; these works to remove accumulated sediment will be continued in the Summer and Fall of 2023.

During the initial site assessment after the November 2021 flood event, four primary areas of concern for sediment and debris accumulation along the Chemainus River between the Trans Canada Highway (TCH) Bridge and Chemainus Road were identified (as shown in Figure 2-1):

- Site 1 – Left bank point bar and dry side channels downstream of TCH Bridge.
- Site 2 – Right bank erosion downstream of TCH Bridge.
- Site 3 – Right bank side channels downstream of TCH Bridge.
- Site 4 – Gravel bar between the E&N Railway bridge (Black Bridge) and Chemainus Road Bridge (current project).

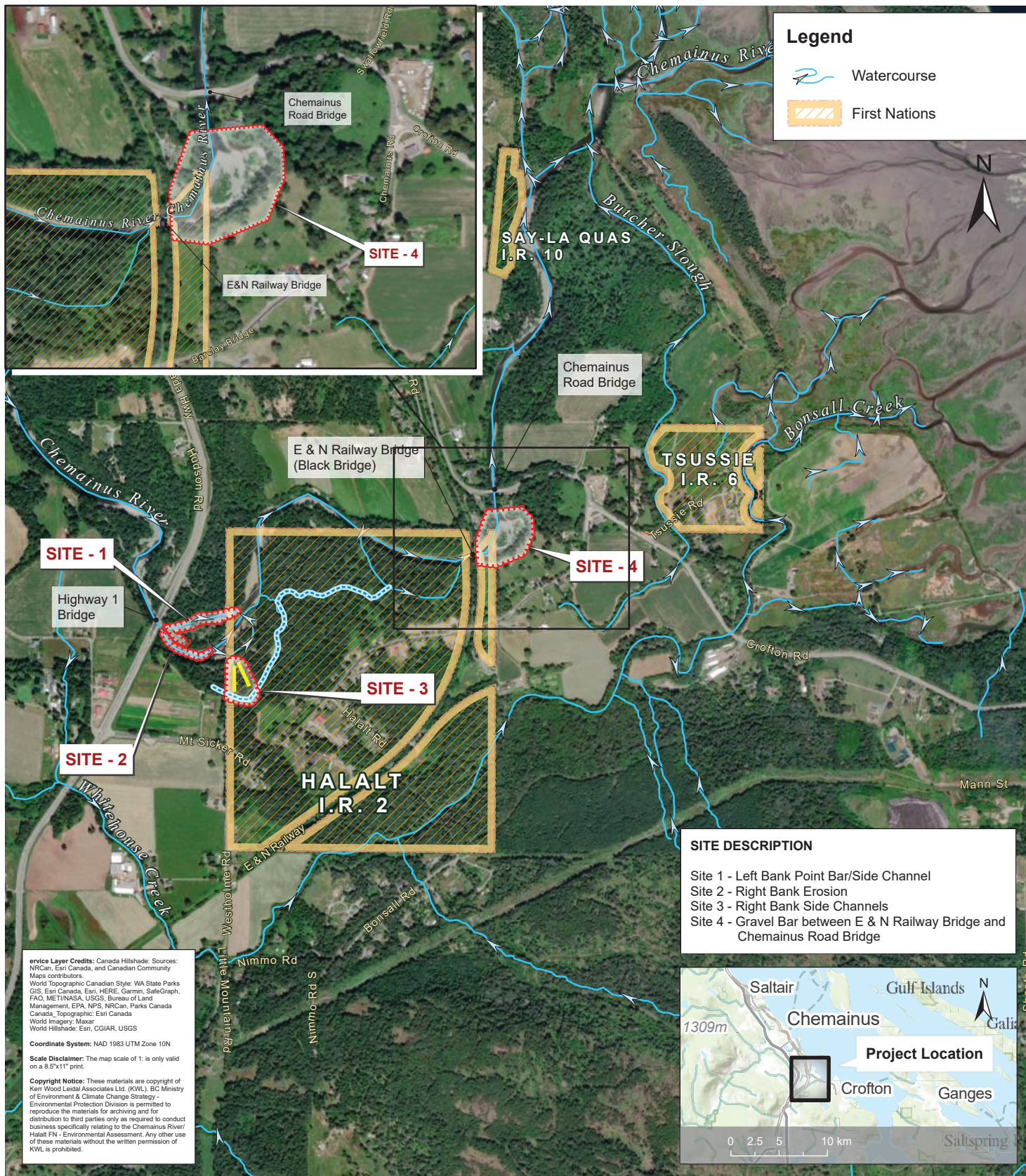
Of these four sites, Site 1 was determined as high priority for sediment removal in the fall of 2022, and Site 4 was identified as a priority for design and construction in 2023. The remainder of this report focuses on the proposed 2023 works at Site 4. This area is a depositional zone with a 5,000 m³ (approximate) gravel bar. The right bank of the channel is protected by riprap between the E&N bridge and a bedrock outcrop upstream of the Chemainus Road bridge.

More details about construction are provided in subsequent sections of the CEMP.

BC Ministry of Environment & Climate Change Strategy - Environmental Protection Division Chemainus River/Halalt FN - Environmental Assessment



KERR WOOD LEIDAL
consulting engineers



Project No. 3427.029

Date July 2023

Scale 1:20,000

0 125 250 500 m

Project Location

Figure 2-1



2.2 Scope of Proposed Works

The construction stage, activity, and description of activity for construction works are described in Table 2-1 below.

Table 2-1: Proposed Construction Methods

Stage	Activity	Description of Activity
Site Preparation	Clearing and Grubbing	Remove one (1) broadleaf maple tree to facilitate site access. Remove approximately 2,505 m ² of shrubbery on the existing gravel bar.
	Site Isolation (Precautionary)	The gravel bar is perched well above the current water level. The machine on site will dig a siltation pit leaving a berm of materials between the gravel bar and the river at the downstream end of the gravel bar that will be used to collect any rainwater or groundwater that is generated on site during construction. A pump will be installed to pump dirty water, if necessary, away from the river as a precaution but it is expected that the gravel berm that is left will provide filtration. A berm of material will also be left at the upstream end of the gravel bar to prevent water from entering the site directly from the river.
Construction	Erosion and Sediment Control	Install erosion control measures such as silt fences and bank protection. Cover any exposed soils.
	Sediment Removal	Excavate approximately 5,000 m ³ of gravel from the existing gravel bar. Haul removed sediment off-site for use by Halalt First Nation for future flood protection works.
Restoration	Surface Restoration	Restore roads, driveways, and other surfaces disturbed due to the works.
	Site Restoration and Bank Stabilization	Revegetate work areas with native riparian plant species, taking advantage of opportunities for enhancing bank stabilization and biodiversity.

2.3 Construction Timeline

Construction is likely to begin on September 5, 2023 and take approximately 2 weeks to complete. Although all work is intended to occur in the dry, the work will still occur within the reduced risk window for fish documented in recent years in the Chemainus River, from August 1 to September 15 (MoE 2006). Historical observations of Dolly Varden do exist in the Chemainus River but have not been recorded since 1993.



3. Environmental Setting

3.1 Environmental Setting

The Chemainus River is located on southeastern Vancouver Island; its headwaters begin roughly north of the Cowichan River. This fish-bearing river travels southeast to outflow in the Strait of Georgia, passing through the town of Chemainus approximately 10 km north of the City of Duncan. Chemainus River is susceptible to sediment accumulation, which reduces the habitat quality for spawning salmonids and other aquatic species.

The Chemainus River supports runs of Coho (*Oncorhynchus kisutch*), Chinook (*Oncorhynchus tshawytscha*), and Chum Salmon (*Oncorhynchus keta*) as well as Cutthroat (*Oncorhynchus clarkii*) and Steelhead/Rainbow Trout (*Oncorhynchus mykiss*). Pink (*Oncorhynchus gorbuscha*) and Sockeye Salmon (*Oncorhynchus nerka*) are infrequently reported. Other recorded salmonid species include Atlantic Salmon (*Salmo salar*) and Dolly Varden (*Salvelinus malma*) although records for these species are more than thirty years old. The assessed area does not contain critical habitat for any aquatic species under Schedule 1 of Canada's *Species at Risk Act*. No fish monitoring was conducted by KWL, but juvenile salmonids were observed near the E&N Railway bridge just upstream of the project site.

At the time of the site visit, the large gravel bar along Site 4 was roughly 1.5 m above the current river level. The mainstem of the Chemainus River runs along the left side of the gravel bar, while an intermittent side channel runs along the right side of the gravel bar. Cobble size material is present along the upstream portion of the gravel bar while gravel/sand size material comprises the remainder of the gravel bar. A very large piece of large woody debris (LWD) sits on the right side of the gravel bar surrounded by other logs.

The riparian vegetation within the assessed area of Chemainus River is an early successional stage mixed forest primarily composed of red alder (*Aldus rubra*), Douglas fir (*Pseudotsuga menziesii*), broadleaf maple (*Acer macrophyllum*), and Pacific ninebark (*Physocarpus capitatus*). Native plants along the gravel bar include Sitka willow (*Salix sitchensis*), red alder saplings, and trace bulrush (*Scirpus* sp.). Invasive Himalayan blackberry (*Rubus armeniacus*) is a major component to the vegetation cover on the gravel bar.

The project area does not contain critical habitat for any aquatic or terrestrial species listed under Schedule 1 of Canada's *Species at Risk Act*.



4. Regulatory Requirements

4.1 Permits and Approvals

As all institutional projects are not subject to the Riparian Areas Protection Regulation (RAPR), an RAPR assessment is not required for the Project. Work within a regulatory riparian setback cannot be avoided as the sediment to be removed is within the creek bed. Therefore, this Project was submitted to both Fisheries and Oceans Canada (*Fisheries Act* Request for Review) and the Ministry of Forests (*Water Sustainability Act* Change Approval for Works In and About a Stream) for review:

- Fisheries and Oceans Canada (DFO) Fisheries Protection Program project review
- *Water Sustainability Act* Change Approval Application for Changes in and About a Stream
- Fisheries and Oceans Canada (DFO) Scientific License (for fish salvage)
- Ministry of Forests (FOR) Scientific Fish Collection Permit (for fish salvage)

A *Species at Risk Act* permit is not required as no critical habitat for listed species is found onsite.



5. Construction Environmental Management Plan

The following measures will be used to avoid, minimize, and mitigate potential environmental impacts of the Project and to ensure compliance with all environmental legislation, permits, and approvals.

5.1 Environmental Monitoring

Environmental monitoring will be conducted to ensure appropriate measures are being taken to protect the environment. The Environmental Monitor (EM) must be an appropriate Qualified Environmental Professional (QEP). The EM will regularly inspect the work site for compliance with the environmental requirements of the Project. Observations will be recorded and reported to the Consultant and the Contractor. The EM must be familiar with the regulatory requirements of the Project and has the responsibility to report all non-compliance events and stop work if necessary. The EM will be on-site at the project start-up and during any sensitive activity. A copy of this document will be kept on-site for the duration of the Project. Responsibilities of the EM will include, but are not limited to, the following:

- Review all permits, best management practices, and the CEMP.
- Be on site for Project start-up and critical instream works and works adjacent to sensitive areas.
- Meet with the Contractor before construction to explain all mitigation and environmental protection measures.
- Monitor project compliance with the CEMP, address changes with the Contractor and Consultant to ensure CEMP is continuously updated, as needed.
- Inspect all mitigation and erosion and sediment control (ESC) measures to ensure they are appropriate and working properly and recommend modifications and repairs when necessary.
- Have written authority to halt any construction activity if it is deemed necessary to protect fish, wildlife, and their habitat.
- Identify, monitor, and promptly report any situations of ongoing or potential damage to the environment.
- Report to the Consultant and relevant regulatory agencies on environmental issues encountered during construction.
- Prepare and submit a monitoring summary report after the Project's completion to the Consultant and any regulatory agencies, as required.

5.2 Timing of Works

- Project activities will be scheduled for dry weather conditions whenever possible.
- All works will be completed during the least-risk window for fish species documented in the Chemainus River (August 1 – September 15).
- Unless absolutely necessary to proceed with project works, tree removal and vegetation clearing is to take place outside the regional bird nesting period (March 1 to August 30) to avoid impacts to migratory birds. In certain areas with low habitat complexity (e.g., unvegetated, sparsely vegetated, isolated trees), bird nest searches may be considered at the discretion of a QEP. In the event that a bird nest search is conducted, the following will apply:



- if an active nest is identified, a no-work zone buffer will be established and maintained around the active nest to minimize access and sensory disturbance;
- the buffer distance will vary depending on the species of bird. Therefore, the buffer distance will be determined based on best management practices and the professional judgement of the QEP;
- nests will be monitored to assess nest activity and effectiveness of the buffer. Clearing (disturbance) can continue once the EM has determined that the nest is no longer active;
- if no active nests are found in surveyed areas, vegetation clearing (disturbance) can commence, but must be complete within 36 hours of the pre-disturbance nest survey being conducted; and
- nests of birds in Schedule 1 of the Migratory Birds Regulations (2022) will be reported as required by the regulations and will be protected for the duration of time required by the regulations (e.g., 36 months for pileated woodpecker).

5.3 Protection of Fish and Fish Habitat

- Where instream works are isolated using a flow bypass or other similar means (if necessary), fish salvage will be undertaken before and during dewatering of the isolated area.
- All pump intakes will be equipped with fish screens (mesh width < 2.54 mm) to prevent entrainment and impingement of fish, in accordance with the DFO Interim Code of Practice for End-of-pipe fish protection screens.
- Slow commencement of in-water activities is recommended to encourage mobile aquatic species to leave the construction area.
- The duration of in-water work and activity will be minimized so that it does not diminish the ability of fish to carry out one or more of their life processes.
- Minimal disturbance will occur to natural materials (e.g., embedded logs) and vegetation that contributes to habitat or stream channel stability.
- Minimal disturbance will occur to existing vegetation on and adjacent to the stream banks.

5.4 Tree Protection and Vegetation Management

- Professional arborists and biologists will be consulted throughout the site clearing and construction phases to minimize impacts to vegetation communities.
- Clearing will be limited to areas necessary for the works. Existing roads, trails, and other access points will be used where possible.
- A tree or other structure containing a nest of eagles, peregrine falcons, gyrfalcons, ospreys, and herons must not be felled, even outside of the breeding season for these species. This is in accordance with Section 34(b) of the *Wildlife Act*.
- Wildlife trees will be retained if possible. They provide essential habitat to birds and other wildlife.
- Where topping or removing dead limbs of dangerous trees will remove the hazard, this option is preferred over removing the entire tree.
- Cleared areas will be revegetated with native trees and shrubs when work is complete.



5.5 Invasive Plant Management

- All machinery will be inspected by the QEP before entering or leaving the construction site to remove any invasive plant propagules.
- All invasive vegetation removed will be disposed of off site at an appropriate facility.
- All material used on site (e.g., straw, hydroseeding, etc.) must be certified weed-free.
- Upon Project completion, native shrubs and trees will be planted in disturbed areas (excluding gravel bar) within the footprint to maintain soil stability and to minimize the potential for invasive species colonization.
- If patches of knotweed or hogweed are encountered during site clearing or other works in the Project area, they will be flagged off and reported to the QEP immediately. Knotweed must be managed carefully as it is able to reproduce from rhizomes and stem fragments. The following procedures will be adhered to:
 - all plant and soil material must be removed from site in a way as to minimize transfer of plant parts to other areas;
 - all plant parts must be removed, potentially by hand with appropriate personal protective equipment, sealed in plastic bags, and disposed of appropriately off site; and
 - topsoil within 10 m of the extent of the knotweed patch may not be used as backfill. The soil should be disposed off site at an appropriate waste management facility experiences in dealing with knotweed-contaminated soils.

5.6 Erosion and Sediment Control Plan

The purpose of erosion and sediment control (ESC) is to prevent the introduction of sediment (e.g., silt, clay, or sand) into watercourses. The ESC Plan prescribes methods to prevent the erosion and mobilization of sediment of exposed areas by rainfall or water flow through the work site, to intercept and manage sediment-laden runoff from works before leaving the work site and entering the watercourse, and/or manage the risk of a sediment discharge.

The ESC measures can be adapted or added to before, during, and after construction as required based on the recommendations of the EM. ESC measures will be set up before starting work. Measures will be monitored regularly and maintained until all disturbed ground has been stabilized.

ESC measures include the following:

1. Undertake works during dry weather where possible.
2. Deposit all spoil materials above the high-water mark, ensuring sediment re-entry into watercourses or waterbodies is prevented.
3. Cover all disturbed areas and spoil piles with poly sheeting or a reasonable alternative under the direction of the Consultant and/or if inclement weather is expected.
4. Minimize vegetation disturbance on banks to the furthest extent possible.
5. Deploy perimeter ESC measures such as silt fences, berms, and check dams as necessary.



6. All ESC measures will be monitored regularly by both the Contractor and the EM and maintained until all disturbed ground has been stabilized.
7. Any other measures needed to prevent erosion of a watercourse and work site, or sediment from entering any watercourse, as determined by the QEP, EM or Engineer.

5.7 Deleterious Substance Control and Spill Management

- Instream works will be carried out in accordance with the *Requirements and Best Management Practices for Making Changes In and About a Stream in British Columbia*. (Government of British Columbia, 2022) and *Best Management Practices for Site Restoration or Maintenance* (Government of BC 2022).
- Construction activities will follow Fisheries and Oceans Canada's *Land Development Guidelines* (DFO, 1993) to maintain the quantity and quality of fish habitat at the productive level present before development activities occurred.
- Machinery and equipment shall not be operated below the high-water mark of the Chemainus River unless it has been converted to use biodegradable hydraulic fluid and grease.
- All fueling of vehicles and equipment will be done off-site or onsite in a designated fueling area over a spill containment tray at least 30 m from Chemainus River.
- All equipment washing must be done off-site or onsite in a designated area at least 30 m from any watercourse or in a manner that will prevent wash from reaching any waterway.
- Generators, pumps, and other stationary equipment will be placed on spill trays or equipped with other secondary containment. Where possible, generators will be located at least 30 m from Chemainus River. Noise from generators will be suppressed using a suitable method (e.g., enclosing generators in plywood).
- All machinery will be clean, in good working condition and free of excess oil and grease. Equipment will be inspected daily and documented.
- Containers will be labelled according to the *Transportation of Dangerous Goods Act* and *Workplace Hazardous Materials Information Systems* (WHMIS) regulations.
- Oil waste, filters, absorbent pads, and cartridges will be collected and disposed of off-site at an appropriate facility in accordance with federal, provincial, and municipal regulatory requirements.
- To prevent the release of substances toxic to fish, there will be no use of treated wood products within a watercourse.
- A spill response plan and spill kit will be on site and suitable for all substances on-site, and staff trained in its use.



Spill Response

- The contractor will prepare a spill management plan which includes notification procedures, contact telephone numbers and spill report forms.
- A spill kit will remain on site during construction. The kit will be stocked with appropriate supplies for the site size and conditions (e.g., absorbent pads, booms, granular absorbent). Staff will be trained in the proper use of the kit.
- Any spill of a toxic or deleterious substance over the reportable limits as outlined in the Ministry of Environment and Climate Change Strategy Spill Reporting Factsheet (MOE, 2021)² will be reported immediately to the BC Provincial Emergency Program 24-hour phone line at 1-800-663-3456.
- If a spill of toxic or deleterious substances occurs within a watercourse or waterbody both FOR and DFO will be notified immediately. All spills will be reported to the EM immediately.

5.8 Clean up and Restoration

- All construction materials, recyclables and garbage will be removed from site and responsibly disposed of after the Project is complete.
- Erosion and sediment control devices and measures will be removed following the stabilization of all disturbed areas.
- The contractor will be responsible for leaving the site in compliance with all Permits, Approvals, and Authorizations.

² https://www2.gov.bc.ca/assets/gov/environment/air-land-water/spills-and-environmental-emergencies/docs/materials/fact_sheet_spill_reporting.pdf



Report Submission

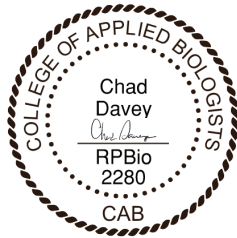
Prepared by:

KERR WOOD LEIDAL ASSOCIATES LTD.

A handwritten signature in black ink, appearing to read 'Janice Kwo', is written over a horizontal line.

Janice Kwo, R.P.Bio,
Biologist

Reviewed by:



Chad Davey, M.Sc., R.P.Bio.
Fluvial Geomorphologist and Aquatic Biologist



BC MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY

Chemainus River Sediment Removal
Construction Environmental Management Plan
Final Report Rev 1
July 25, 2023

Statement of Limitations

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This document represents KWL's best 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	Author
1	July 25, 2023	Final		JVK
0	July 20, 2023	Final		JVK

KERR WOOD LEIDAL ASSOCIATES LTD.
consulting engineers



References

- Fisheries and Oceans Canada (DFO). 1993. *Land Development Guidelines for the Protection of Aquatic Habitat*. URL http://www.sxd.sala.ubc.ca/9_resources/fed_%20files/fed%20land%20development%20guidelines.pdf
- Fisheries and Oceans Canada (DFO). 2019. *Measures to Protect Fish and Fish Habitat*. URL <https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html>
- Government of British Columbia. 2022. *Requirements and Best Management Practices for Making Changes In and About a Stream in British Columbia*. Version 2022.01. URL <https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/wsa-cias-requirements-bmps.pdf>
- Ministry of Environment (MOE). 2006. *Guidelines for Reduced Risk Instream Work Windows*. URL: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/working-around-water/work_windows_low_main.pdf
- Ministry of Environment (MOE). 2014. *Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia*. URL <https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/best-management-practices/develop-with-care>
- Ministry of Environment and Climate Change Strategy (MOE). 2021. B.C. Approved Water Quality Guidelines: Aquatic Life, Wildlife, and Agriculture. URL https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf
- Ministry of Water, Land, and Air Protection (WLAP). 2002. *A Field Guide to Fuel Handling, Transportation and Storage*. URL https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/oilandgas/fuel_handle_guide.pdf

Appendix E

Environmental Review – Temporary Flood Barrier – Draft

Kerr Wood Leidal Associates Ltd.

October 11, 2023



Draft Technical Memorandum

DATE: October 11, 2023

TO: David Conway
Director, Subdivision and Environmental Services
Municipality of North Cowichan

FROM: Jaime Dimillo, BIT
Chad Davey, R.P.Bio.

RE: **CHEMAINUS RIVER TEMPORARY FLOOD BARRIER**
Environmental Review and Field Visit
Our File 3427.030-300

1. Introduction

1.1 Background

Ministry of Environment and Climate Change Strategy (ENV) is working to review and consider risks, potential consequences and prioritize urgent repair and mitigation measures to existing damaged waterway systems as a result, or exacerbated by, the 2021 Atmospheric River Event (ARE).

On November 15, 2021 the ARE resulted in the third highest (468 m³/s) daily peak flow on record for the Chemainus River since 1953 (Chemainus River near Westholm WSC 08HA001). Halalt First Nation, Penelakut First Nation (Tsussie), and surrounding land within the Municipality of North Cowichan experienced flooding as the Chemainus River overtopped its banks.

During the initial site assessment after the ARE, areas of concern for sediment and debris accumulation and future flood risk were identified. One area of concern for future flood risk is the south bank of the Chemainus River downstream of the Trans-Canada Highway (TCH) Bridge that could threaten agricultural lands in the Municipality of North Cowichan (Russel Farms) and Halalt First Nation reserve lands.

Permanent bank protection and flood mitigation works are planned for this area in 2024; however, an interim flood protection solution for the 2023/24 wet season is proposed to temporarily protect these lands. The interim flood protection works involves the following tasks:

- Construction of an approximately 600 m temporary berm using Hesco flood barriers filled with gravel.
- Reorientation of several pieces of large woody debris to direct overbank flow back into the main channel.
- Placement of the Hesco barriers filled with earth materials to block flood water from entering relic side channels of the Chemainus River.

Kerr Wood Leidal Associates Ltd. (KWL) has been retained by ENV to provide water resources engineering, environmental support, and construction services for the project.



1.2 Objectives

The goal of this environmental review technical memorandum is to identify the environmental constraints of the project area and provide mitigation measures to protect identified environmental values during construction. The scope of this assessment included the following:

1. Desktop assessment to identify potentially relevant regulatory requirements including but not limited to identifying critical species/habitats that may be within or adjacent to the project area that are federally protected by the *Species at Risk Act* (SARA).
2. Summary of field observations conducted in the project area.
3. A review of potential mitigation options to be considered during the construction phase of the project.

2. Desktop Review

The following section provides details on occurrences of critical habitat and/or species at risk within or near the project area.

A review of the following databases was completed to identify critical habitat/species that are likely to be present on or adjacent to the project area:

- CDC iMap (B.C. Conservation Data Centre); ¹
- BC Species & Ecosystems Explorer (B.C. Conservation Data Centre); and ²
- Species at Risk Public Registry (SARA) (Government of Canada). ³

Table 1 below describes the findings from the desktop review of the provincial and federal databases of known or likely occurrences of critical habitat and/or SARA species in or within 1 km of the project area.

Table 1: Occurrences of Critical Habitats/Species at Risk

English/Latin Names	BC Status	Federal Status (SARA)	Probability of Occurrence On-Site	Rationale
Invertebrates				
Oregon Forestsnail <i>Allogona townsendiana</i>	Red	Endangered	Medium	Three occurrences of Oregon forestsnail are recorded within 750 m of the project area. Critical habitat is present immediately south of the project area. This species can occur in mixed wood or deciduous forests, most often dominated by Bigleaf Maple (<i>Acer macrophyllum</i>) and with considerable amounts of coarse woody debris and low herbaceous cover. May be present in project area.

¹ CDC iMap, 2023. B.C. Conservation Data Centre, <https://maps.gov.bc.ca/ess/hm/imap4m/>, accessed on September 25, 2023.

² BC Systems Explorer, 2023. B.C. Conservation Data Centre, <https://a100.gov.bc.ca/pub/eswp/>, accessed on September 25, 2023.

³ Government of Canada, 2023. Species at Risk Registry, <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html>, accessed on September 25, 2023.



English/Latin Names	BC Status	Federal Status (SARA)	Probability of Occurrence On-Site	Rationale
Ecological Communities				
red alder/salmonberry/ common horsetail	Blue	N/A	High	This ecological community experiences prolonged annual flooding and is mapped within the project area.
Black cottonwood/red alder/salmonberry	Blue	N/A	Medium	This ecological community is present approximately 275 m east of the project area. The canopy is comprised of black cottonwood (<i>Populus trichocarpa</i>), red alder (<i>Alnus rubra</i>), Western red cedar (<i>Thuja plicata</i>) and Sitka spruce (<i>Picea sitchensis</i>). Shrubbery in this community is dense and is typically dominated by Salmonberry (<i>Rubus spectabilis</i>).

The Chemainus River is a salmon-bearing stream found on the southeast coast of Vancouver Island with its estuary located approximately 10 km north of the City of Duncan. The watershed has an area of approximately 360 km² and the mainstem of the river is approximately 64 km long (Wightman et al. 1998). The Chemainus River supports runs of Coho (*Oncorhynchus kisutch*), Chinook (*Oncorhynchus tshawytscha*), and Chum Salmon (*Oncorhynchus keta*) as well as Cutthroat (*Oncorhynchus clarkii*) and Steelhead/Rainbow Trout (*Oncorhynchus mykiss*). Pink (*Oncorhynchus gorbuscha*) are infrequently reported. Other recorded salmonid species include Atlantic Salmon (*Salmo salar*) and Dolly Varden (*Salvelinus malma*) although records for these species are more than thirty years old. The assessed area does not contain critical habitat for any aquatic species under Schedule 1 of Canada's *Species at Risk Act*. No impacts to fish are anticipated as part of the project as most of the work will extend beyond the riparian area (> 30 m) of the Chemainus River.

3. Field Assessment

On September 6, 2023 a field visit by KWL staff was conducted within the project area. The field visit consisted of walking the proposed alignment, performing a preliminary assessment of trees slated for removal and noting any other potential environmental constraints. The section below details the observations made during the field assessment.

3.1 Temporary Flood Berm

Figure 1b illustrates the proposed berm alignment. The proposed flood berm alignment occurs within varying habitat types, including heavily disturbed agricultural land (Photo 1), lowland forest habitat (Photo 2), and an existing access road (Photo 3). The temporary flood berm is situated outside the riparian area of the Chemainus River (defined as 30 m or less from top of bank), apart from a 100 section along the northeast part of the alignment (Figure 1b). While this section is within 30 m of the Chemainus River, the flood berm alignment is situated along disturbed agricultural land and does not impact the riparian area.

The lowland forest is comprised of Bigleaf maple (*Acer macrophyllum*), Black cottonwood (*Populus trichocarpa*), Douglas Fir (*Pseudotsuga menziesii*), Western red cedar (*Thuja plicata*), and Red alder (*Alnus rubra*). Invasive herbaceous vegetation was pervasive within the work area. Ground cover and trunks of trees were almost entirely covered with English Ivy (*Hedera helix*) as seen in Photo 4. Other sub-canopy and herbaceous vegetation present consisted of Himalayan blackberry (*Rubus armeniacus*), Common holly (*Ilex aquifolium*), Bigleaf maple saplings, Salal (*Gaultheria shallon*), Scotch broom (*Cytisus scoparius*), and wood fern (*Dryopteris sp.*)



Photo 1: Agricultural land hedgerow dominated by Himalayan Blackberry



Photo 2: Lowland Forest habitat



Photo 3: Pre-existing access road



Photo 4: English Ivy and other herbaceous cover

3.2 Relic Side Channels and Large Woody Debris

As part of the project, several pieces of large woody debris (Photo 5) will be reorientated to deflect future flood debris back into the main channel of the Chemainus River. In addition, relic side channels that are no longer hydraulically connected to the Chemainus River except for low frequency, large floods, are to be filled in with riprap. No flowing water or fish were observed in these relic channels (Photo 6). The location of the large woody debris to be orientated and the location of the riprap placement in the relic channels are shown on Figure 1a.

This work will take place within the riparian area of the Chemainus River as illustrated on Map 4 – Environmentally Sensitive Areas of the Municipality of North Cowichan Official Plan (2022). No trees are anticipated to be removed in this area and disturbance will be kept to a minimum.



Photo 5: Large woody debris to be re-oriented

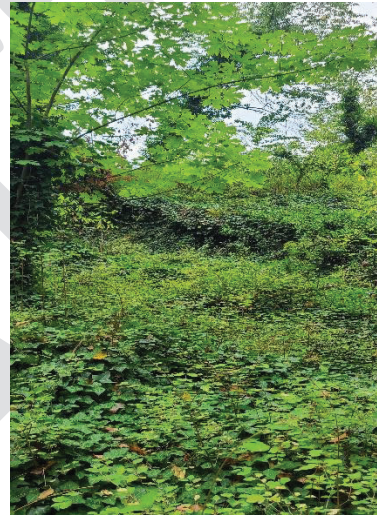
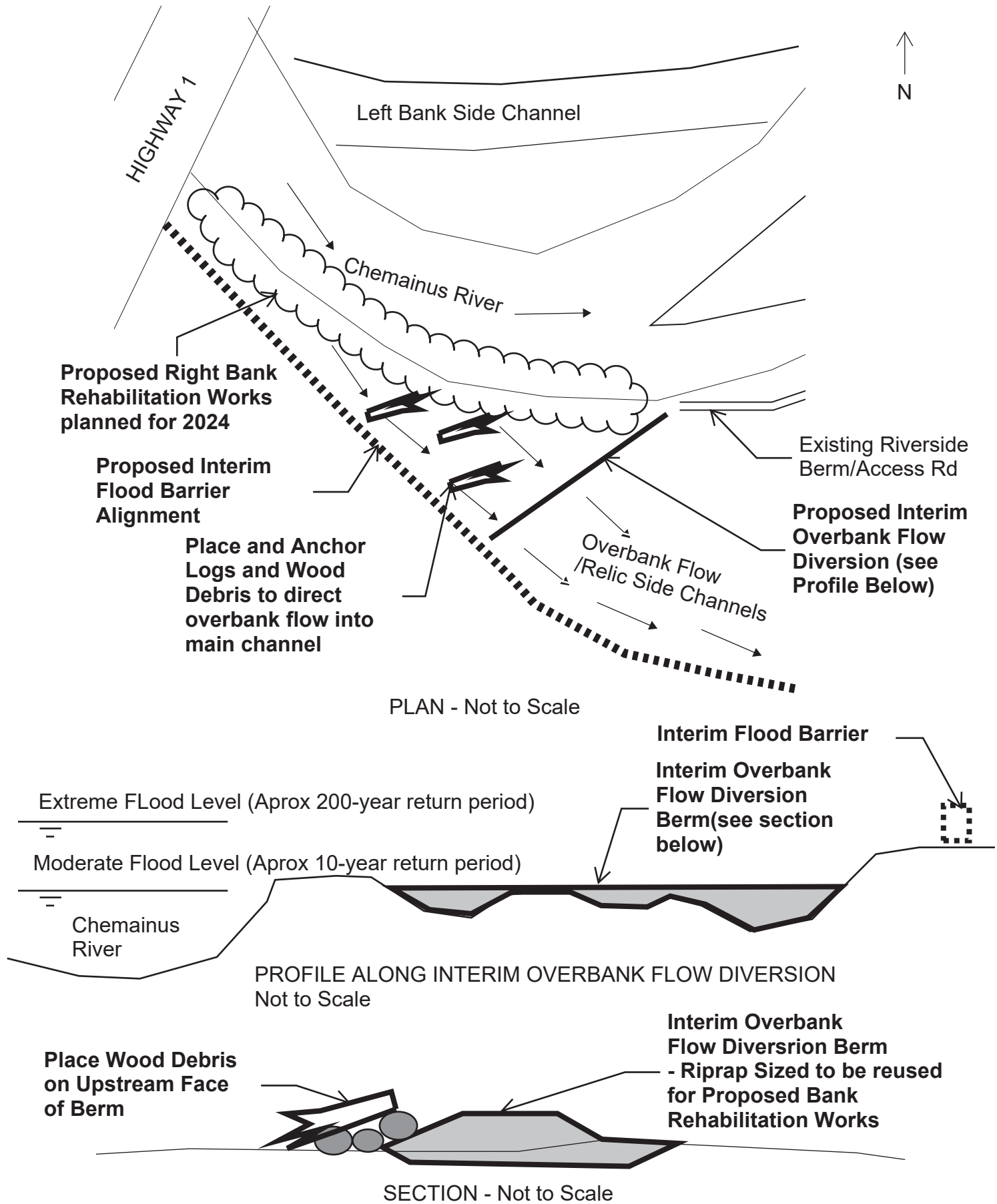
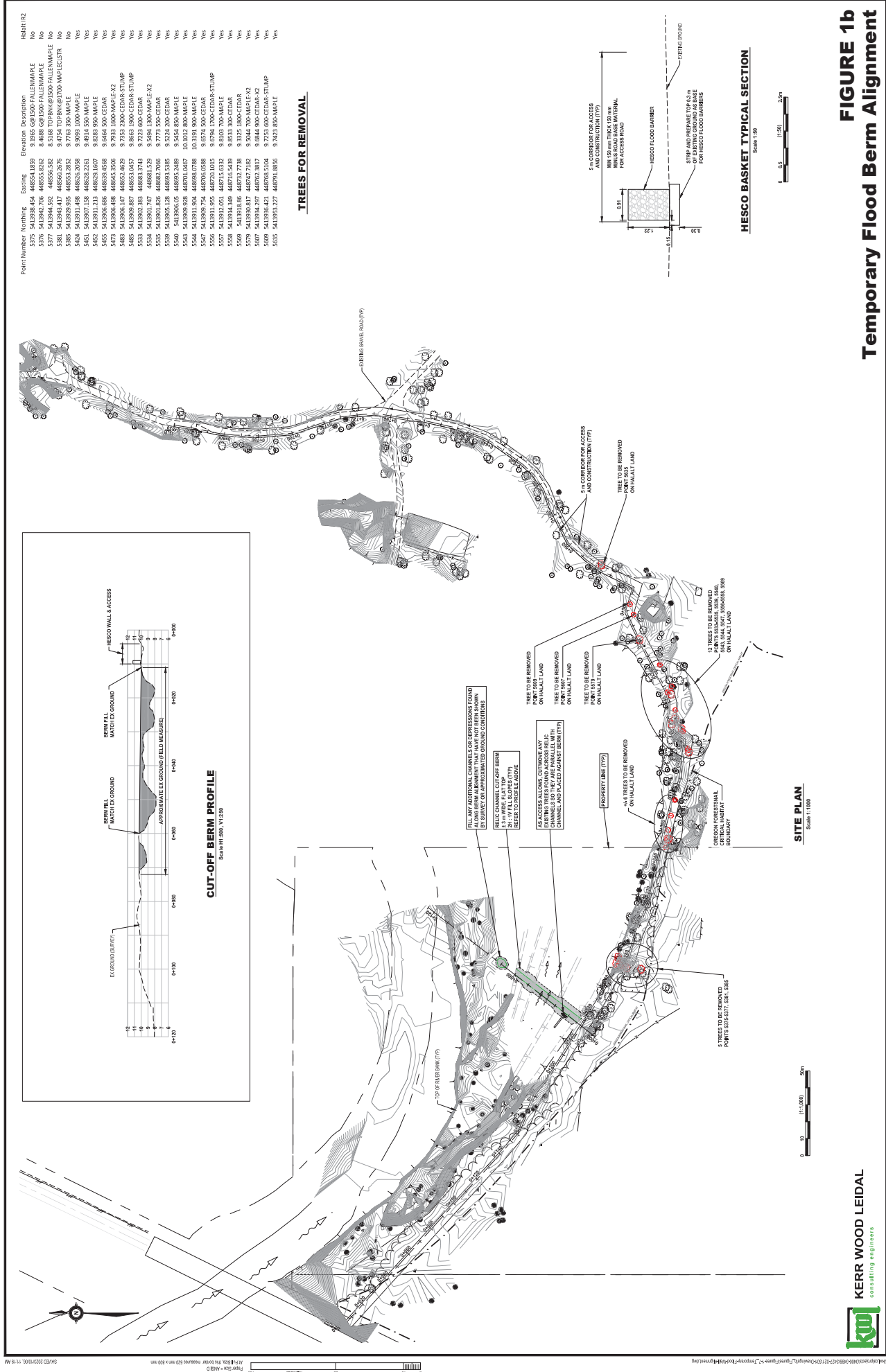


Photo 6: Relic channel that is overgrown with ivy







4. Regulatory Requirements

As the project occurs on both private and federal, reserve land, several regulations have been considered as part of this memorandum.

Table 2:

Legislation	Approvals/Restrictions	Regulatory Body	Applies to the Project?
Federal			
<i>Migratory Birds Convention Act:</i> Protects all migratory birds, their active nests, and eggs.	Vegetation clearing should occur outside breeding bird period for the region (March 1 to August 31)	Environment and Climate Change Canada (ECCC)	No. Vegetation clearing will occur outside breeding bird period for the region (March 1 to August 31). All trees to be removed assessed for nesting cavities of Pileated Woodpecker.
<i>Fisheries Act:</i> Requires an authorization for Harmful Alteration, Disruption or Destruction (HADD) of fish habitat or potential death of fish. A licence is required for scientific collection of fish (including fish salvage).	Request for Review and potential Authorization under the <i>Fisheries Act</i>	Fisheries and Oceans Canada (DFO)	No in stream work occurring. Project will occur away from the Chemainus River and is not anticipated to result in a HADD. No fish salvage occurring.
	Scientific Collection Licence for Fish Salvage		
	Unless authorized, work must occur during the least risk window		
<i>Species at Risk Act:</i> Protects species designated on Schedule 1 of the act (endangered, threatened, or special concern) and their Critical Habitat on federal lands (includes First Nation reserves).	Section 73 permit (aka SARA permit)	ECCC	No. The portion of the flood berm on federal land has been shifted to avoid critical habitat of Oregon Forestsnail. There is overlap with critical habitat on private land portion, however SARA does not apply on private land. No permitting required.
<i>Impact Assessment Act (SC 2019)</i>	Reviewable projects need to go through Impact Assessment process	Impact Assessment Agency of Canada	Not required. The project is not considered a reviewable project.
Provincial			
<i>Wildlife Act (RSBC 1996)</i>	Permit to Possess, Take or Destroy Bird Nest and/or Egg	Ministry of Forests (MoF)	Yes, trees to be removed were assessed for presence of birds, their eggs and nests of eagle, peregrine falcon, gyrfalcon, osprey, heron, or burrowing owl. No nests observed. No permitting required.



Legislation	Approvals/Restrictions	Regulatory Body	Applies to the Project?
	Scientific Fish Collection Permit		No in stream work occurring. Project will occur away from the Chemainus River. No fish salvage required.
	General Wildlife Permit		No targeted wildlife salvage required. Incidental interactions with wildlife will be handled by an Environmental Monitor and/or QEP on a case-by-case basis.
<i>Water Sustainability Act (SBC 2014)</i>	Change Approval/ Notification for Works In and About a Stream	MoF	Not expected at this time. Project is not considered in or about a stream due to considerable distance from Chemainus River.
<i>Environmental Assessment Act (SBC 2018)</i>	Reviewable Projects	BC Environmental Assessment Office	Not expected at this time. Does not meet standard requirements for the process.
Municipal			
<i>Local Government Act – Municipality of North Cowichan Official Plan Bylaws</i> And in part provincially mandated: <i>Riparian Areas Protection Regulation (RAPR)</i>	Development Permit for works within the Riparian Area as illustrated on Map 4 – Environmentally Sensitive Areas of the Municipality of North Cowichan Official Plan (2022).	Municipality of North Cowichan	Federal land portion is not subject to this regulation. For the private land portion, a development permit is not currently expected. The project may be eligible for an exemption from clause 2.2c as the works are considered emergency works to prevent flooding. In addition, the Project aims to protect the integrity of the farmland and may be eligible for an exemption to RAPR under the <i>Farm Practices Protection (Right to Farm) Act</i> .



5. Impact Assessment

It is anticipated that no significant adverse impacts to fish, riparian area, or wildlife will occur as a result of this activity so long as mitigation measures provided in Section 6 are adhered to.

As mentioned in Section 3, a 100 m section of the alignment is within 30 m of the top of bank of the Chemainus River. However, the 100 m section is within already disturbed agricultural land and is not anticipated to result in permanent impacts to the riparian area of the Chemainus River. Outside of the riparian area, twenty-one trees (15 on Halalt reserve land and 6 on private land) will need to be removed to facilitate site access and temporary flood berm placement.

When assessing trees for removal, the alignment has been shifted to avoid wildlife trees and large trees in favor of smaller trees, where possible. All trees to be removed as part of the project have been assessed for presence of migratory bird nests, raptor nests and nesting cavities of Pileated woodpecker. No nests or nesting cavities were observed in the trees to be removed. As such, no permanent impacts to birds are anticipated as part of this project.

As outlined in Section 2, the project area is directly adjacent Critical Habitat for Oregon Forestsnail. The alignment has been shifted to avoid overlapping the Critical Habitat. Herbaceous cover within the project area was dominated by invasive English Ivy, as such, the presence of Oregon Forestsnail is unlikely. Nevertheless, as further explained in Section 6, an environmental monitor will continuously monitor the project area for evidence of Oregon Forestsnail and a Qualified Environmental Professional (QEP) will be contacted should they be observed.

6. Mitigation Measures

To minimize the potential environmental impacts related to the proposed construction activities associated with the proposed temporary flood berm construction, large woody debris reorientation, and riprap placement in the relic side channels, the following mitigation measures must be employed:

1. An environmental monitor will be on-site full-time during vegetation clearing then at regular intervals after clearing is complete during regular construction.
2. Any evidence or presence of Oregon Forestsnail will be reported to the Environmental Monitor and/or the QEP immediately.
3. The contractor shall develop an erosion and sediment control plan to mitigate potential harmful effects of sediment deposition into the existing ditches and the Chemainus River during construction.
4. Prior to any vegetation clearing, a bird nesting survey and wildlife sweep will be conducted to avoid injury and/or death to birds and other wildlife:
 - a. All clearing will occur outside of the regional bird nesting window to protect migratory birds and avoid contravening the *Migratory Birds Convention Act*.
 - b. As part of the wildlife sweep, the work area will be assessed for presence of Oregon Forestsnail. If Oregon Forestsnail is present, vegetation cannot be cleared and consultation with a qualified professional (e.g., R.P. Bio) for next steps is to occur.
 - c. Although unlikely given the time of year for the project, if active migratory bird nests are found, buffers will be established around those nests and clearing within the buffers will be postponed until young birds have fully fledged and the nest has been abandoned.



- d. For certain species such as bald eagles, peregrine falcons, osprey, heron and pileated woodpecker, nests are protected year-round. If a nest of any of these species are found, the tree cannot be removed, and the alignment will have to be shifted.
- e. Wildlife trees and large conifers will be retained when possible. Topping or removing dead limbs of a tree is preferred to removing the entire tree.
5. Trees to be removed will be indicated with flagging tape. If during the course of the works, the contractor wishes to remove any additional trees, a QEP and/or Environmental Monitor must be consulted and pre-approve any additional trees with diameter at breast height (DBH) larger than 30 cm.
6. Increased spread of invasive plant species is a concern. To mitigate this, the contractor should ensure boots, equipment and machinery are free from plant fragments. All invasive vegetation removed will be properly disposed of as to not allow for increased spread on-site or off-site.
7. All machinery will be clean, in good working condition and free of excess oil and grease. Equipment will be inspected daily and documented.
8. The contractor shall prepare a spill response plan and a spill kit which is suitable for all substances on-site, and staff trained in its use.

7. Closing

Please contact the undersigned should you require any additional information.

KERR WOOD LEIDAL ASSOCIATES LTD.

Prepared by:

Reviewed by:

Jaime Dimillo, BIT
Junior Biologist

Chad Davey, M.Sc., R.P.Bio
Project Biologist



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Revision History

Revision #	Date	Status	Revision Description	Author
A	October 11, 2023	Draft		JMD

Appendix I

Engineering Field Reviews

Project Name:	Chemainus River Sediment Removal 2023	Date:	September 7, 2023
KWL Project Number:	3427.029	Report No.:	001
Contractor:	Stone Pacific	Prepared By:	Andrea Kerr
Subcontractor:	N/A		
Weather:	Sunny, 20 degrees		

Remarks:

Site Safety Incidents: No safety or near-miss incidents observed or reported on-site this week.

Personnel Onsite:

Jamie Dimillo
Tony George

Stone Pacific:

Ken
Mark
2 x traffic control

Equipment Observed on-site:

Hitachi 350LC
CAT 320C

Site Activities Observed and Discussions:

- Stone Pacific mobilized to site.
- Established entry road to gravel bar.
- Surveyor on site to lay out extents of work zone. Final elevation set at 3.2m.
- Installation of silt fencing around site under the supervision and guidance of the onsite environmental monitor.
- Large amounts of silt were uncovered. Landowner to take a portion.
- No sediment removal occurred this week.
- Stone Pacific delivered one truck of 3-inch material to build entry road.
- Discussion on the elevation of the water level and depth of excavation. KWL to determine if additional sediment removal is possible within the project timeline and budget.
- Discussion with property owner regarding the size and location of the steel plate covering his irrigation line.
- Additional dumpsite for silty sediment required.

Quality Control / Action Items:

- Installation of project signage.
- Disposal site for large woody debris.
- Additional steel plate to cover irrigation line.
- Additional disposal site for silty sediment.

Construction Progress

- No sediment removal occurred this week.

Archaeology:

- No issues this day.

Environmental:

- No issues this week.

Site Photos:

Photo 1
Arrival on
site
2023-09-07



Photo 2
Steel Plate
placed over
irrigation
line
2023-09-07



Photo 3
Clearing
location of
river access
2023-09-07



Photo 4
Breaking
through
riprap
2023-09-07



Photo 5
Breaking
through
riprap
2023-09-07



Photo 6
Access road
progress at
end of day
2023-09-07



Photo 7
Start of
clearing and
grubbing
2023-09-08



Photo 8
Installation
of silt
fencing as
directed by
KWL
Environmen
tal monitor.
2023-09-08





Photo 9 Silt fencing continued 2023-09-08		Photo 10 Silt fencing continued 2023-09-08	
Photo 11 Imported 3- inch material to build access road. 2023-09-08			



Andrea Kerr
Observer Name

Signature

2023/09/09
Date

Project Name:	Chemainus River Sediment Removal 2023	Date:	September 11, 2023
KWL Project Number:	3427.029	Report No.:	002
Contractor:	Stone Pacific	Prepared By:	Andrea Kerr
Subcontractor:	N/A		
Weather:	Sunny, 20 degrees		

Remarks:

Site Safety Incidents: No safety or near-miss incidents observed or reported on-site this week.

Personnel Onsite:

Jamie Dimillo
Tony George

Stone Pacific:

Ken
Mark
2 x traffic control

Equipment Observed on-site:

Hitachi 350LC
CAT 320C
Water Truck

Site Activities Observed and Discussions:

- Silty sediment removal started.
- Silty sediment is stockpiled on landowners' property for his own use. An additional stockpile location for silty sediment is available – Firewood John.
- Discussion on the elevation of the water level and depth of excavation. KWL to determine if additional sediment removal is possible within the project timeline and budget.
- Dust control is an issue. KWL request action from Stone Pacific.
 - Dust control was an issue for a majority of the week. Stone Pacific brought a water truck to site mid-day on September 14th.
 - On September 15th the water truck was left on site for use as needed.
- Approximately 3,330 m³ of sediment removed this week.

Quality Control / Action Items:

- Installation of project signage.
- Disposal site for large woody debris.
- Still waiting for additional steel plate to cover irrigation line.

Construction Progress

Dumpsite Location	Trucking Counts (Sep. 11-15)	Estimated Volume ¹ m ³ (Sep. 11-15)
Halalt	129	903
District of North Cowichan	347	2,429

Notes:

1. Estimated sediment volume was calculated using an assumed volume of 7.0 m³ per dump truck.

Archaeology:

- No issues this day.

Environmental:

- No issues this week.

Site Photos:

Photo 1
Silt deposit
2023-09-11



Photo 2
Silt deposit
continued
2023-09-11



Photo 3
Clearing
location of
river access
2023-09-11



Photo 4
Groundwater
infiltration from
overexcavation
of silt.
2023-09-11



Photo 5
Stockpiling
of silt at
landowners'
property
2023-09-11



Photo 6
Stockpile of
woody debris.
Disposal site
TBD.
2023-09-12



Photo 7
Gravel
removal
starts.
2023-09-12



Photo 8
Sediment
Removal
progress
midday.
2023-09-13





Photo 9 Progress EOD 2023-09-13		Photo 10 Progress EOD 2023-09-13	
Photo 11 Berm left at edge of excavation to maintain separation from river. 2023-09-14		Photo 12 Dust cloud on access road. 2023-09-14	
Photo 13 Dust cloud on access road. 2023-09-14		Photo 14 Access road after one pass of water truck. Road swept at end of shift. 2023-09-14	
Photo 15 Gravel removal progress EOD 2023-09-14		Photo 16 Brush removal starts. 2023-09-15	



Photo 17
Gravel
removal
progress.
2023-09-15



Photo 18
Dust EOD
2023-09-15



Andrea Kerr

Andrea Kerr
Observer Name

Signature

2023/09/11
Date

Project Name:	Chemainus River Sediment Removal 2023	Date:	September 18, 2023
KWL Project Number:	3427.029	Report No.:	003
Contractor:	Stone Pacific	Prepared By:	Andrea Kerr
Subcontractor:	N/A		
Weather:	Sunny, 20 degrees		

Remarks:

Site Safety Incidents: No safety or near-miss incidents observed or reported on-site this week.

Personnel Onsite:

Jamie Dimillo
Tony George

Stone Pacific:

Ken
Mark
2 x traffic control

Equipment Observed on-site:

Hitachi 350LC
CAT 320C
Water Truck

Site Activities Observed and Discussions:

- Sediment removal continued.
- Silty sediment removed and stockpiled at Firewood John's.
- Additional steel plate delivered and installed over irrigation line.
- Additional sediment removal to of 30 cm across project area. Excavation to an elevation of 2.9m. Water elevation at approximately 2.4m.
- Brush removal and silty sediment removal continued this week.
- Woody debris to be stockpiled on Halalt land. Wood that can be used for firewood to be kept separate from rotten wood.
- Approximately 4,473 m³ of sediment removed this week.

Discussion with Owner

- Discussion with Colin James regarding restoration of his property.
 - Stone Pacific to import additional riprap to build up existing riprap at entry point.
 - Secure the log berm by building it up with material. Must be covered with topsoil to allow for vegetation to grow.
 - After riprap and log are complete, Stone Pacific will import topsoil to buildup low spots created during trucking.
 - After topsoil is placed, the field will be tilled by Don and then seeded.
- Colin to check his irrigation line after restoration is complete. Irrigation lines must be spread out before he can test otherwise they will burst due to water hammer at high pressure.

Quality Control / Action Items:

- Installation of project signage.

Construction Progress

Stockpile Location		Trucking Counts (Sep. 18-22)	Estimated Volume ¹ m ³ (Sep. 18-22)
Halalt		302	2,114
District of North Cowichan		337	2,359
Notes:			
1. Estimated sediment volume was calculated using an assumed volume of 7.0 m ³ per dump truck.			
Archaeology:			
No issues this day.			
Environmental:			
One tree frog rescued from work zone by EM. Returned to appropriate habitat.			
Site Photos:			
Photo 1 Additional steel plate placed across irrigation line 2023-09-18		Photo 2 Water truck midday application for dust control 2023-09-18	
Photo 3 Start of final grading to 2.9m elevation. 2023-09-18		Photo 4 Start of final grading to 2.9m elevation 2023-09-18	
Photo 5 Cleaning of road at EOD 2023-09-18		Photo 6 Sediment removal continued 2023-09-19	



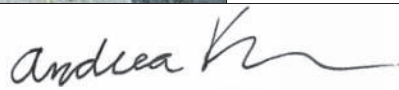
Photo 7 Sediment removal continued 2023-09-19		Photo 8 Sediment removal progress EOD 2023-09-19	
Photo 9 Start of woody debris removal 2023-09-20		Photo 10 Continued sediment removal and woody debris removal 2023-09-20	
Photo 11 Woody debris removal progress EOD 2023-09-20		Photo 12 Woody debris removal 2023-09-21	
Photo 13 Grading at edge of excavation 2023-09-21		Photo 14 Grading at edge of excavation 2023-09-21	



Photo 15 Grading continued 2023-09-21		Photo 16 Grading progress 2023-09-21	
Photo 16 Grading progress EOD 2023-09-21		Photo 17 Sediment removal progress 2023-09-22	
Photo 17 Removal of silt fencing and final grading around edges 2023-09-22		Photo 18 Removal of silt fencing and final grading around edges 2023-09-22	
Photo 19 Removal of access road and reinstatement of riprap 2023-09-22		Photo 20 Removal of access road and reinstatement of riprap 2023-09-22	

Andrea Kerr

Observer Name



Signature

2023/09/23

Date



Project Name:	Chemainus River Temporary Flood Barrier	Date:	October 3 – 6, 2023
KWL Project Number:	3427.030	Report No.:	001
Contractor:	Ts'uubaa Pacific Civil Projects LP	Prepared By:	Liam Mackle
Subcontractor:	N/A		
Weather:	Typically sunny, 9 to 24 degrees, minimal precipitation		

Remarks:

Site Safety Incidents: No safety or near-miss incidents observed or reported on-site this week.

Personnel Onsite:

Liam Mackle
Matt Sanders

Stone Pacific:

Ken
Natalie
Tree faller
Additional operators/labourers as needed

Site Activities, Construction Progress, and Discussions:

- Wall alignment and access footprint was flagged by LM and MS with minor adjustments made to avoid some trees.
- Clearing, stripping, and grubbing of the entire length was completed.
- Material trucking to site began for ground preparation for the Hesco baskets.
- Trees for removal were documented and flagged – trees along Russell Farms property were confirmed by the landowner.
- Tree felling began.

Archaeology:

- N/A.

Environmental:

- Trees for removal documented and assessed for raptor nests/woodpecker cavities.
- Scan for the presence of Oregon Forest Snails
- Additional information available in the Environmental Monitoring Reports



Site Photos:

Photo 1
Barrier
alignment
cleared,
stripped,
and grubbed

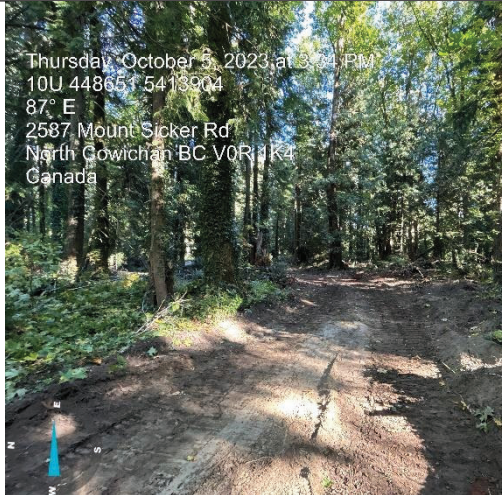


Photo 2
Excavator
clearing along
barrier
alignment



Photo 3
Clearing
completed
from Halalt
to Russell
Farms
property

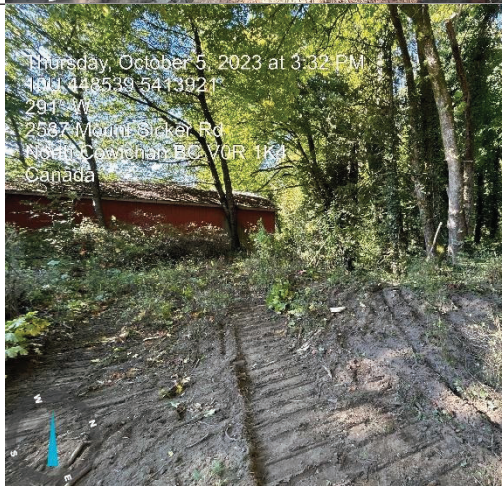


Photo 4
Completed
alignment
stripping and
grubbing on
Russell Farms
property



Liam Mackle

2023/10/6

Observer Name

Signature

Date



Project Name:	Chemainus River Temporary Flood Barrier	Date:	October 9 – 13, 2023
KWL Project Number:	3427.030	Report No.:	002
Contractor:	Ts'uubaa Pacific Civil Projects LP	Prepared By:	Liam Mackle
Subcontractor:	N/A		
Weather:	Typically overcast and rainy, 5 to 18 degrees		

Remarks:

Site Safety Incidents: No safety or near-miss incidents observed or reported on-site this week.

Personnel Onsite:

Liam Mackle
Matt Sanders

Stone Pacific:

Ken
Natalie
Tree faller
Additional operators/labourers as needed

Site Activities, Construction Progress, and Discussions:

- Additional tree falling was completed to remove some danger trees and finish removal of all required trees.
- The gravel base for the Hesco baskets and access road was imported and installation began on Russell Farms property, moving east from the Highway 1 road embankment.
- A walkthrough was completed with forestry representatives to assess timber value of removed trees.
- A small adjustment was made to the upstream end of the alignment after a fence was found following vegetation clearing.
- The design no longer requires access through or over the barrier for Halalt at the crossroads.
- Work was stopped at the end of the week due to issues at Russell Farms with the vibrating roller used for compaction.

Archaeology:

- N/A.

Environmental:

- Environmental monitoring and a scan for the presence of Oregon Forest Snails.
- Additional information available in the Environmental Monitoring Reports



Site Photos:

Photo 1
Material
being
trucked in
for access
road and
wall base



Photo 2
Alignment
cleared and
grubbed before
base material
placement near
upstream
terminus at
Highway 1.



Liam Mackle

2023/10/13

Observer Name

Signature

Date



Project Name:	Chemainus River Temporary Flood Barrier	Date:	October 16 – 20, 2023
KWL Project Number:	3427.030	Report No.:	003
Contractor:	Ts'uubaa Pacific Civil Projects LP	Prepared By:	Liam Mackle
Subcontractor:	N/A		
Weather:	Typically overcast and rainy with some significant rain events, 5 to 21 degrees		

Remarks:

Site Safety Incidents: No safety or near-miss incidents observed or reported on-site this week.

Personnel Onsite:

Liam Mackle
Matt Sanders
Peter Collins
Craig Sutherland

Stone Pacific:

Ken
Natalie
Additional operators/labourers as needed

Site Activities, Construction Progress, and Discussions:

- Ground preparation resumed with a plate compactor to be used on Russell Farms property instead of the vibrating roller compactor.
- Hesco basket placement began at the upstream end of the alignment and Highway 1 embankment.
- The design grade of the temporary barrier was confirmed, and variations in height due to ground contours were approved.
- Construction of the riprap floodplain berm began, with some adjustments made to its alignment late in the week.
- Heavy precipitation caused high flows in the Chemainus River that began to overtop the bank but did not impact construction.
- Following discussions with the landowner, the access road width along Russell Farms property was reduced to minimize impacts to the farm land. Excess material previously placed was removed.
- Cleared brush removal began from Russell Farms property.
- Locations were flagged where the barrier could be at risk of undermining and additional riprap will be imported and installed at each location.
- Logs in the relic side channel were removed and placed along the bank.
- Material was placed at the upstream end of the barrier to tie it into the highway embankment.

Archaeology:

- N/A.

Environmental:

- Environmental monitoring and a scan for the presence of Oregon Forest Snails.
- Additional information available in the Environmental Monitoring Reports



Site Photos:

Photo 1
Cleared
vegetation
collected for
removal



Photo 2
Construction of
riprap floodplain
berm underway

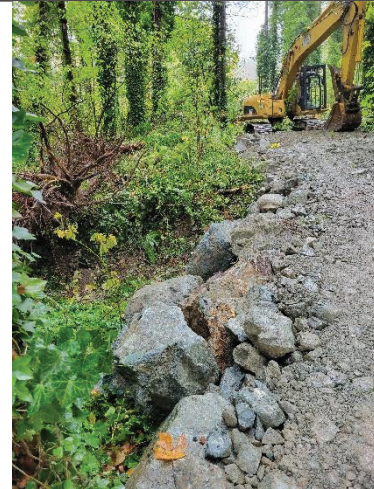


Photo 3
Hesco
baskets
placed and
ready for
filling



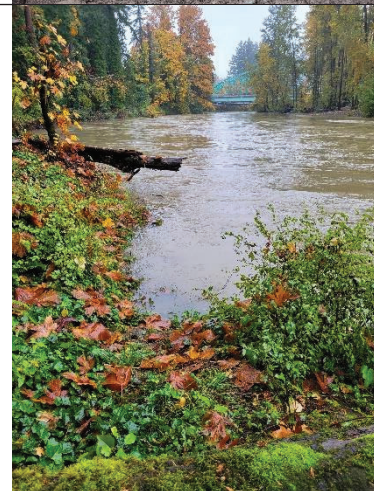
Photo 4
Upstream
terminus where
barrier ties into
Highway 1
embankment



Photo 5
Material
being
removed to
narrow
access road
and restore
farm
property



Photo 6
High river level
during heavy
rain event



Liam Mackle

Liam Mackle

2023/10/20

Observer Name

Signature

Date



Project: Chemainus River Sediment/Debris Removal Project -
Client: Ministry of Environment and Climate Change Strategy
Job No.: 3427.029
Contractor: Stone Pacific

Prepared By	Craig Sutherland	On Site	8:00 am	Off Site	10:30 am
Date	October 20, 2023				
Weather	Partly Sunny				
Equipment and Workforce on Site 2 x Excavator Tandem Truck Rock Truck					
Construction Progress HESCO Baskets constructed to approximately chainage 0+220 (to west of relic channel berm). Relic Channel Berm Constructed					
Reviewer's Observations HESCO basket barrier is being constructed at constant slope which has started to require excavation into original ground near station 0+220 (Photo 1). No excavation is necessary and the wall should follow ground level with the design grade as a minimum elevation. Constructed berm alignment does not follow the alignment discussed on site originally with John (Photo 2). Constructed berm appears to follow alignment on drawing and past direction. However, it does not follow the original alignment discussed on site with John. This original alignment was selected to: 1. limit disruption to trees 2. provide smooth hydraulic transition from Relic channel back into main channel. Constructing in this manner will allow berm to be used as part of future offset berm alignment. There are some locations along the HESCO barrier alignment that are close to banks of the relic channel. Erosion of these banks could lead to undermining of the HESCO wall (these have been flagged with Pink Ribbon) (Photo 3). These are at approx. chainage 0+360 and There should be consideration of installation of riprap in these locations. Logs in the relic side channel near the barn were removed and placed on the relic side channel bank (Photo 4).					
Discussions with Others Reviewed alignment of relic channel berm with John and Greg Stone. Confirmed that it was not along alignment discussed originally on-site. Revised alignment has been flagged with pink ribbon (centerline) and blue ribbon (edges).					



Discussions with Contractor

Approved to go ahead with realignment of berm.

Confirmed that design grade is a minimum elevation for the HESCO wall and that it can rise and fall with ground contour provided the crest is no less than the design grade.

Confirmed to move the log in the relic channel near the barn.

Confirmed that gravel being removed along the constructed HESCO wall is being reused to construct gravel pad for the HECO barrier on Halalt lands.

Action Required

Discuss access over the HESCO baskets with John/Frances on Monday. They require access in the event something happens on their property that needs equipment. They would also like to discuss preventing access along the access road at their property boundary (a gate or rocks)

Recommend large rock be placed at downstream end of log placed on bank near the barn (Photo 4).

Photographs



Photo 1: End of constructed HECO baskets at chainage 0+220. Note excavation into original ground.



Photo 2: Original Agreed Alignment of Relic Channel Berm



Photo 3: Potential location for riprap (aprox Chainage 0+340)



Photo 4: Log placed on bank near barn.



Project Name:	Chemainus River Temporary Flood Barrier	Date:	October 23 – 27, 2023
KWL Project Number:	3427.030	Report No.:	004
Contractor:	Ts'uubaa Pacific Civil Projects LP	Prepared By:	Liam Mackle
Subcontractor:	N/A		
Weather:	Typically overcast and/or rainy with some significant rain events, -2 to 12 degrees		

Remarks:

Site Safety Incidents: No safety or near-miss incidents observed or reported on-site this week.

Personnel Onsite:

Liam Mackle
Peter Collins

Stone Pacific:

Ken
Natalie
Additional operators/labourers as needed

Site Activities, Construction Progress, and Discussions:

- Riprap floodplain berm was completed, tying into the existing unregulated riverside berm.
- Riprap armouring was placed along the banks of the relic side channel in the areas identified last week.
- Placement of the riprap for the berm and bank armouring was approved by KWL.
- Ground preparation was completed along the entire barrier alignment.
- An access ramp was built over the temporary barrier to connect to the floodplain berm and allow access to the floodplain by the landowners.

Archaeology:

- N/A.

Environmental:

- none



Site Photos:

Photo 1
Completed
riprap
floodplain
berm



Photo 2
Completed
riprap bank
armouring
along relic side
channel



Photo 3
Access
ramp over
wall being
constructed



Photo 4
High water
during rain
event



Liam Mackle

2023/10/27

Observer Name

Signature

Date



Project Name:	Chemainus River Temporary Flood Barrier	Date:	October 30 – November 3, 2023
KWL Project Number:	3427.030	Report No.:	005
Contractor:	Ts'uubaa Pacific Civil Projects LP	Prepared By:	Liam Mackle
Subcontractor:	N/A		
Weather:	Typically overcast with some rain, -2 to 18 degrees		

Remarks:

Site Safety Incidents: No safety or near-miss incidents observed or reported on-site this week.

Personnel Onsite:

Liam Mackle

Stone Pacific:

Ken

Matt

Natalie

Additional operators/labourers as needed

Site Activities, Construction Progress, and Discussions:

- Hesco basket placement and filling continued from Russell Farms property into Halalt land.
- Logs on the upstream side of the riprap floodplain berm were collected and arranged to be cabled together per discussions between KWL and the landowner.

Archaeology:

- N/A.

Environmental:

- none



Site Photos:

Photo 1
Ongoing
barrier
construction



Photo 2
Logs placed in
advance of
cabling



Photo 3
Barrier
extent as of
November 2,
2023



Photo 4
Completed
access ramp



Liam Mackle

Observer Name

Signature

2023/11/3

Date



Project Name:	Chemainus River Temporary Flood Barrier	Date:	November 6 – 10, 2023
KWL Project Number:	3427.030	Report No.:	006
Contractor:	Ts'uubaa Pacific Civil Projects LP	Prepared By:	Liam Mackle
Subcontractor:	N/A		
Weather:	Typically overcast with light rain, 3 to 14 degrees		

Remarks:

Site Safety Incidents: No safety or near-miss incidents observed or reported on-site this week.

Personnel Onsite:

Liam Mackle

Stone Pacific:

Ken

Matt

Natalie

Additional operators/labourers as needed

Site Activities, Construction Progress, and Discussions:

- Hesco basket placement and filling completed (November 8).
- Logs on the upstream side of the riprap floodplain berm were cabled together and to standing trees as per direction from KWL.
- Site clean up and demobilization by end of week.
- Gates are to be installed at the property line between Halalt and Russell Farms in two locations – the barrier access road, and along the existing unregulated berm at the river's edge.
- Gate quotes are anticipated by next week.
- A final walkthrough and substantial completion site visit is planned for next week.

Archaeology:

- N/A.

Environmental:

- none



Site Photos:

Photo 1
End of
temporary
barrier



Photo 2
Cabled logs



Liam Mackle

Observer Name

Liam Mackle

Signature

2023/11/10

Date

Appendix K

Temporary Flood Barrier Inspection Checklist Template

CHEMAINUS RIVER TEMPORARY FLOOD BARRIER INSPECTION CHECKLIST

Primary Contact:	Inspected by:
Date Inspected:	Signed:

- A. This inspection template is based on the BC “Flood Protection Works Inspection Guide” (2000). Has the person inspecting the barrier reviewed the guide, or is familiar with its contents?

☐ Yes ☐ No

If not, please refer to the detailed guide at the following link:

http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/fld_prot_insp_gd.pdf

- B. Was the barrier notably damaged in a high flow event this year?

☐ Yes ☐ No

Did the barrier damage result in imminent threat of flooding?

☐ Yes ☐ No

If yes to any of the 2 questions above, please briefly describe the damage (location and damage description)

Please describe the actions that were taken to address the damage. If no actions were taken yet, what is the plan?

** When referring specific locations, please use either:

- Major landmarks (roads, intersections, bridges, etc.), DO NOT use local property names
- GPS coordinates (where possible)
- Chainages from the O&M manual drawings

*** Even if NO DEFICIENCY, still add confirmation (e.g., no deficiencies observed during field visit) under “Summary of Issues”

1. ACCESS

☐ Attached photos or sketch with corresponding reference in the checklist (e.g., Photo 1, etc.) for deficiencies observed – Section 1

- Major landmarks (roads, intersections, bridges, etc.), DO NOT use local property names
- GPS coordinates (where possible)
- Chainages from the O&M manual drawings

*** Even if NO DEFICIENCY, still add confirmation (e.g., no deficiencies observed during field visit) under "Summary of Issues"

*** Even if NO DEFICIENCY, still add confirmation (e.g., no deficiencies observed during field visit) under “Summary of Issues”

CHEMAINUS RIVER TEMPORARY FLOOD BARRIER INSPECTION CHECKLIST

3. VEGETATION MANAGEMENT

Vegetation hampers or prevents access?	YES	NO***	N/A
Location(s): Summary of Issues: Maintenance Recommendations: When will Recommendations be Completed:			
Vegetation reduces visibility to inspect barrier on each side?	YES	NO***	N/A
Location(s): Summary of Issues: Maintenance Recommendations: When will Recommendations be Completed:			
Trees near barrier (within 2 m) with potential for uprooting?	YES	NO***	N/A
Location(s): Summary of Issues: Maintenance Recommendations: When will Recommendations be Completed:			

** When referring specific locations, please use either:

- Major landmarks (roads, intersections, bridges, etc.), DO NOT use local property names
- GPS coordinates (where possible)
- Chainages from the O&M manual drawings

*** Even if NO DEFICIENCY, still add confirmation (e.g., no deficiencies observed during field visit) under "Summary of Issues"