Pacific Salmon Strategy Initiative | Initiative de la Stratégie relative au saumon du Pacifique

Operational Fund Year-End Report
2023-24

Salmon Habitat Restoration Center of Expertise

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Executive Summary

This document summarizes the projects implemented through the Salmon Habitat Restoration Center of Expertise (RCOE) Operational Fund for 2023-24. This internal fund, developed as a 3-year investment through the Pacific Salmon Strategy Initiative (PSSI), offers a unique opportunity to demonstrate meaningful advancements in applying innovative restoration designs and testing emerging practices in watersheds across BC and the Yukon for salmon conservation and recovery. This Region-wide fund recognizes the importance of the processes that create the form and function of habitats important to salmon, with over 60% of the projects directed to process-based approaches. While all of the projects in this report are led by Fisheries and Oceans Canada's RCOE team, 94% of the projects are implemented with partners leveraging resources and capacity to complete restoration activities.

Some key Operational Fund program highlights for 2023-24 include:

A total of $445,000 was spent under the Operational Fund in 2023-24 with an average cost of $25,000 over 18 projects.

Projects funded in 2023-24 included:

- Restoration assessment and monitoring (50%)
- Restoration implementation (33%)
- Maintenance of priority restoration infrastructure (17%)

Key outcomes from the Operational Fund contributing to the Salmon Habitat Restoration Program include:

- 6875 m^2 of fish habitat restored
- 5 restoration plans developed
- 8 novel and innovative monitoring techniques implemented

Innovations and emerging practices piloted under the Operational Fund in 2023-24 have contributed to technical capacity building. Two Technical Bulletins have been published for the restoration community and seven emerging practices and technologies have been trialed for broader implementation.

There were nearly 40 Implementing Partners in 2023-24 including: Indigenous groups and First Nations (35%), community and stewardship groups (58%), and government agencies (7%).

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Introduction

Healthy and productive fish habitat is critical to maintaining and rebuilding salmon stocks throughout the Pacific Region. Many of the pressures on aquatic ecosystems today are different from those experienced in the past, and changing pressures are likely to continue into the future. Fish habitat restoration efforts must adapt and focus on building aquatic ecosystems that are resilient to current and emerging conditions. While information on new and adaptive approaches in fish habitat restoration exists, tools and techniques are often applicable to specific geographic areas. It is critical to pilot new approaches and develop restoration techniques to meet the diversity of landscapes in Pacific Region.

Past fish habitat restoration efforts in Pacific Region have focused on increasing the amount of limiting habitat in a specific area or stream reach. Most of these projects created static, engineered habitats features. In contrast, over the past two decades many restoration practitioners throughout North America have shifted to process-based restoration solutions. Process-based restoration focuses on re-establishing normative rates and magnitudes of physical processes within a system to restore ecological function and productivity, thereby improving a system's resiliency to changing climate and land-use pressures[1]. Applying these principles to new restoration designs reduces the maintenance required to sustain engineered habitats, improves project effectiveness over a range of environmental conditions, and increases the longevity of restoration solutions. Although the Salmon Enhancement Program in Pacific Region has supported restoration planning and projects for more than 40 years, progress towards applying process-based restoration solutions has been slow.

The Salmon Habitat Restoration Centre of Expertise (RCOE), developed under the Pacific Salmon Strategy Initiative (PSSI), is building upon past restoration efforts in Pacific Region and expanding techniques, including process-based solutions, to meet current and future restoration challenges. New techniques are being trialed and innovations to traditional methods are being applied. While habitat restoration in Pacific Region is largely delivered through external partners, the RCOE plays a pivotal role in providing expertise in restoration planning and design, directing restoration activities on key priorities, advancing large scale projects, demonstrating new techniques, and developing new tools to meet changing environmental conditions. The Operational Fund provides the means for the RCOE to build on existing expertise, leveraging capacity and resources to achieve these objectives. The fund is a 3-year annual commitment of $500,000 to advance RCOE-supported salmon habitat restoration initiatives.

[1] Beechie, T.J. et al. 2010. Process-based principles for restoring river ecosystems. *BioScience* 60(3) 209–222.

Year-One Highlights

In Year One of the Operational Fund, program staff delivered a diverse set of projects, widely distributed throughout the Pacific Region. Project delivery was made possible through the collaborative work of RCOE staff in both area and regional teams. Growing RCOE teams were able to use Operational Fund projects as a conduit to connect with other program staff and immediately contribute to supporting the development of tools, advancing restoration priorities, piloting experimental techniques, and disseminating new and emerging restoration science.

Year-One Operational Fund highlights include:

- 18 projects delivered
- 80% RCOE staff participating in Operational Fund project delivery
- Expanded collaborative work across area and regional work teams
- Nearly 40 collaborative partnerships
- Utilization of new equipment and innovative techniques to support restoration initiatives
- Advancing priority projects through leveraged funding and technical capacity

With internal funding to develop projects within the RCOE, there has significant opportunity for cross-area collaboration and innovation. For example, the following are four 2023-24 Operational Fund projects with results being applied more broadly to new restoration initiatives.

- Silver Salmon (*Gaat Heeni*) Obstruction, *Yukon Transboundary Area*: This project required gathering velocity data in a highly remote and challenging area to design a restoration plan for fish passage. RCOE Regional Fluvial Geomorphologist Matteo Saletti obtained these data by carrying out large-scale particle image velocimetry (LSPIV) analysis from drone imagery. The methodology has been recently published as a DFO Salmon Habitat Restoration Technical Bulletin and is being applied to a new 2024-25 Operational Fund project with similar accessibility obstacles and data requirements.
- Eelgrass Seeding Trial, *South Coast Area*: Angela Spooner, RCOE Regional Marine Restoration Biologist, piloted the Buoy Deployed System (BuDS) for eelgrass seeding at three sites on eastern Vancouver Island. This innovative method has both ecological and cost advantages, and germination success was observed at the pilot sites during visual surveys this spring. BuDS seeding is now being applied to other coastal areas in BC, focusing on Burrard Inlet and Haida Gwaii, and with plans to expand to sites on the west

coast of Vancouver Island. The methodology is being published as a DFO Salmon Habitat Restoration Technical Bulletin.

- Jacobsen Creek Bank Stabilization Pilot Project, *Lower Fraser Area*: Using a process-based approach to improve fish passage, the Lower Fraser Area team designed a rock ramp to improve fish passage through a perched culvert. They applied nature-based techniques with bioengineered soil wraps to stabilize the banks and accelerate riparian plant establishment. Based on high project success, this innovative technique has since been applied at other restoration sites in the Lower Fraser Area and the methodology will be published as a Technical Bulletin.
- Constructed Side Channel Effectiveness Evaluation and Climate Adaptation Project, *BC Interior Area*: Historically the DFO Resource Restoration Unit (RRU) constructed a number of side channels for salmon enhancement using hard-engineered methods. The BC Interior team has developed a Rapid Assessment Tool, tailored to these RRU legacy projects, to assess the functional state of each channel and determine next steps for restoration. This Rapid Assessment Tool is now being applied to other legacy projects in the South Coast Area that are in need of assessment.

Projects At A Glance

Salmon populations are distributed throughout incredibly complex and diverse habitats in the Pacific Region. While it is desirable to support projects that are broadly applicable across the region to maximize benefits to the RCOE program, the diversity of the landscape limits projects that are regional in scope. The 18 Operational Fund projects selected in 2023-24 demonstrate a recognition that the diverse geographic areas across the region have different restoration needs and projects must be tailored to meet those needs. The locations of the 2023-24 projects are shown in Map 1, and project summary information is listed in Table 1.

With relatively small investment of $5,000 - $80,000 for each project, a number of priority projects and innovations were advanced across all four Areas of the Pacific Region. Two pilot restoration techniques, riparian soil wraps and eelgrass seeding, were advanced through the Operational Fund and positive monitoring results have led to the techniques being applied at other sites.

The Regional Operational & Technical Support Team brings highly valued skills and expertise in the areas of geomorphology, engineering, geomatics and geospatial analysis to support area-led projects. With this diverse range of expertise, there has been opportunity to use new software and technologies to advance restoration practices. An example is the use of LIDAR (Light Detect and Ranging) for geospatial analysis and DEMs (Digital Elevation Models) for

hydraulic modelling and project design. New geomorphic expertise is being incorporated into restoration assessments and solutions incorporating climate change projections, modelling for an extended range of environmental conditions, and assessing effectiveness of past efforts to inform future activities.

Map 1. Location of 2023-24 Operational Fund Projects in Pacific Region.

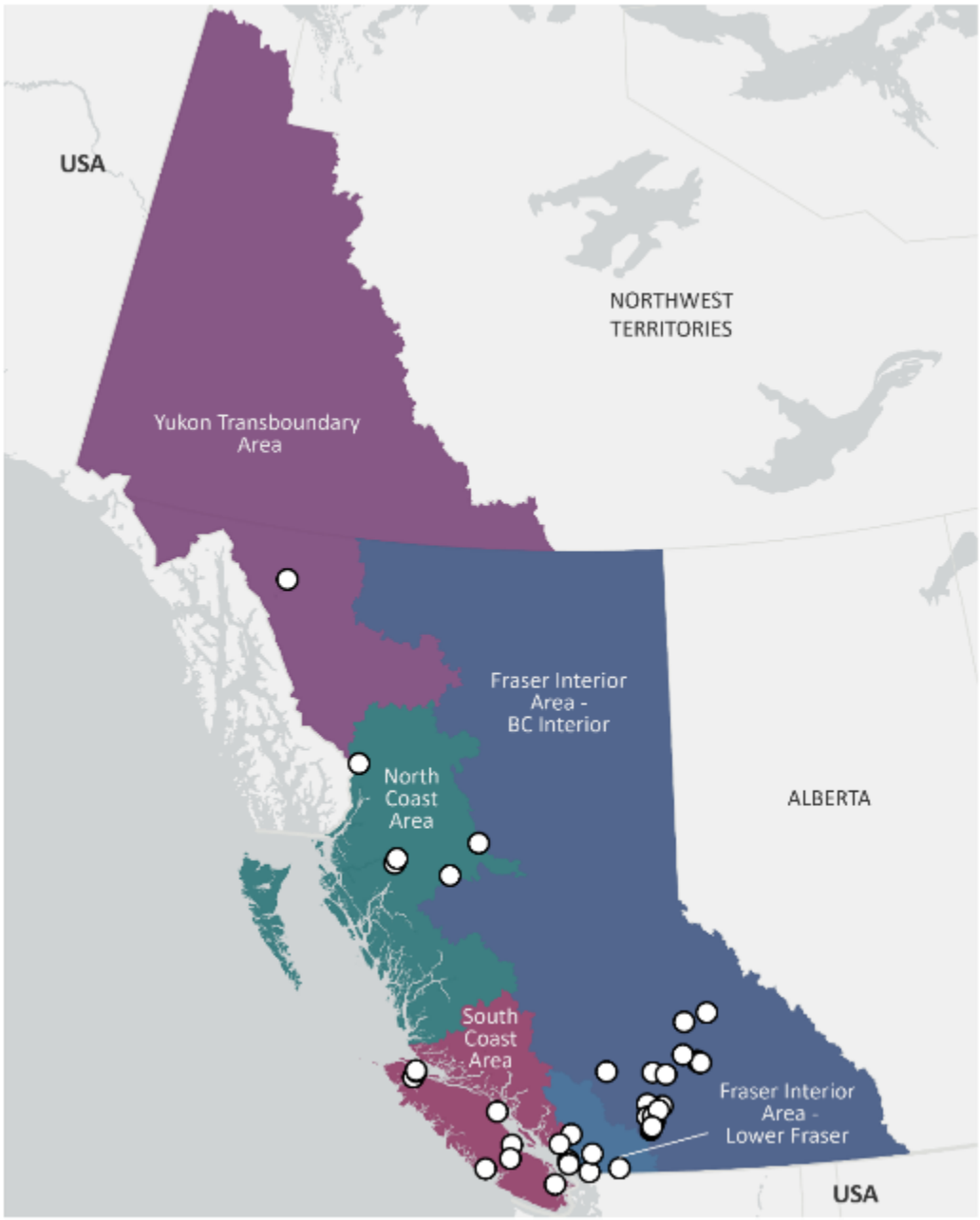
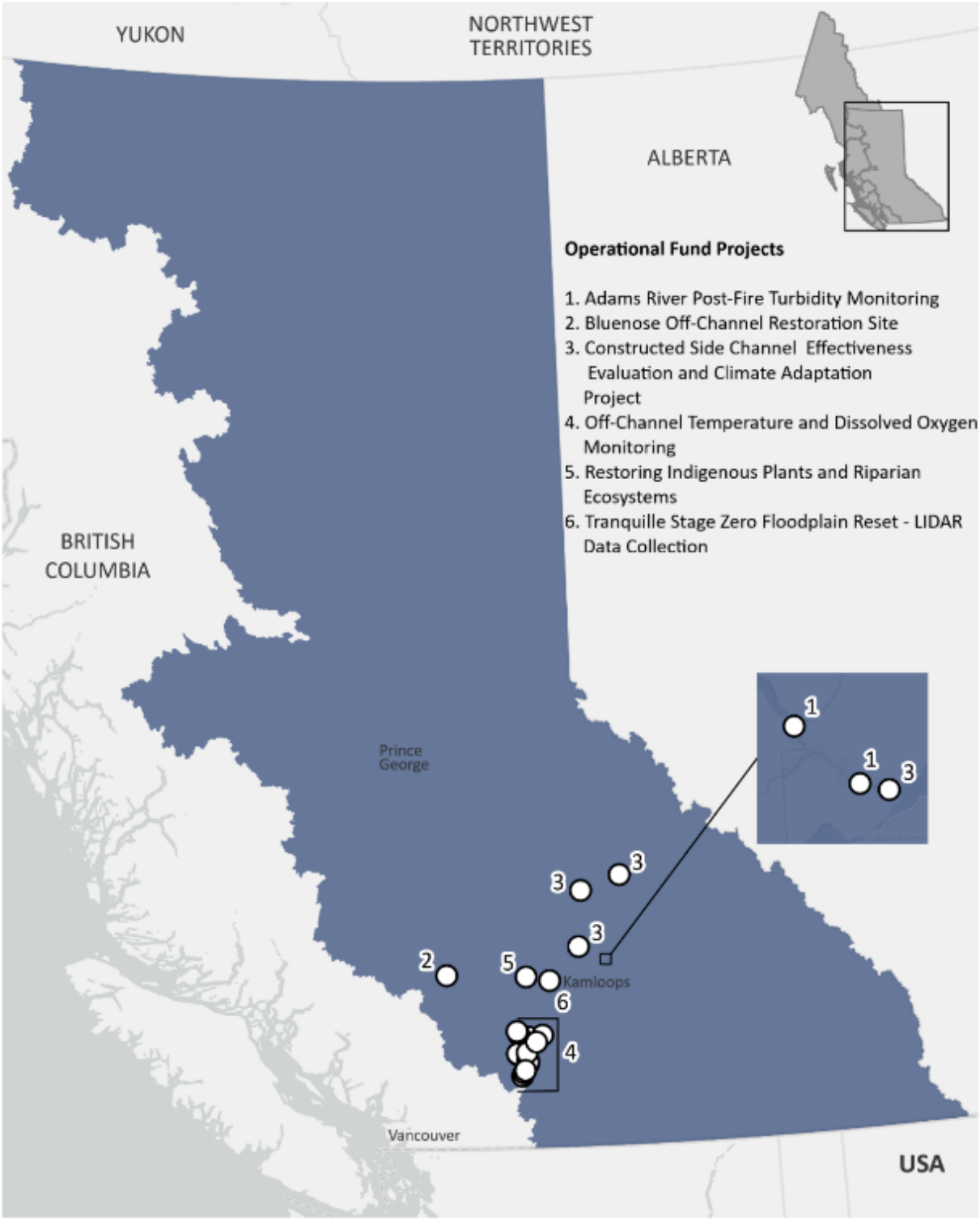


Table 1. List of the 18 Operational Fund projects for 2023-24.

Project No.	Area	Location	Restoration Stage	Restoration Activity	Habitat
1. Adams River Post Fire Turbidity Monitoring	BC Interior	Lower Adams River and Nikwikaia Creek	Pre-Implementation	Baseline Monitoring	Freshwater - in-channel/in-stream
2. Bluenose Off Channel Restoration Site	BC Interior	Bridge River	Implementation	Instream Structure	Freshwater - off-channel
3. Constructed Side Channel Effectiveness Evaluation and Climate Adaptation Project	BC Interior	North Thomson- Raft River, Louis Creek South Thomson – Adams River	Post-Implementation	Effectiveness Monitoring	Freshwater -off-channel
4. Off-Channel Temperature and Dissolved Oxygen Monitoring	BC Interior	Nicola and Coldwater River	Post-Implementation	Effectiveness Monitoring	Freshwater -off-channel
5. Restoring Indigenous Plants and Riparian Ecosystems (RIPARE)	BC Interior	Deadman and Thomson River	Implementation	Riparian Restoration	Freshwater riparian
6. Tranquille Stage Zero Floodplain Reset: LIDAR Data Collection	BC Interior	Tranquille River	Pre-Implementation	Assessment	Freshwater riparian
7. Deer Creek Intake Replacement	Lower Fraser	Deer Creek	Implementation	Instream Structure	Freshwater -in-channel/in-stream
8. Estuarine Circulation Study	Lower Fraser	Fraser and Squamish Rivers	Post-Implementation	Functional Monitoring	Marine -estuary
9. Jacobsen Creek Bank Stabilization Pilot Project	Lower Fraser	Jacobsen Creek	Implementation	Instream Structure	Freshwater - streamside

Project No.	Area	Location	Restoration Stage	Restoration Activity	Habitat
10. Large Scale Floodplain Reconnection Planning for Pitt-Addington (Katzie) Marsh	Lower Fraser	Pitt River	Pre-Implementation	Assessment	Freshwater - wetlands/ floodlands
11. Access Management	North Coast	Lake Babine, Scully Creek and Clements Creek	Pre-Implementation	Assessment	Freshwater - riparian
12. Bii Wenii Kwa Watershed Restoration	North Coast	Bii Wenii Kwa (Owen Creek)	Pre-Implementation	Restoration Planning and Coordination	Freshwater - off-channel
13. Williams Creek Valve Replacement	North Coast	Williams Creek	Implementation	Instream Structure	Freshwater - off-channel
14. Derelict Dam Decommissioning	South Coast	Dakota, Stephens, Glenlion, Tsulquate Creeks	Pre-Implementation	Restoration Planning and Coordination	Freshwater - riparian
15. Eelgrass Seeding Trial	South Coast	East Coast Vancouver Island	Implementation	Estuarine Restoration	Marine - nearshore
16. GIS Modelling for Assessing Process-Based Restoration Potential on Vancouver Island (BRAT RCAT)	South Coast	All of Alberni Inlet; Barkley Sound and Clayoquot Sound watersheds	Pre-Implementation	Assessments	Freshwater - off-channel
17. Somass Estuary Action Plan	South Coast	Somass Watershed	Pre-Implementation	Restoration Planning and Coordination	Marine -estuary
18. Silver Salmon River (*Gaat Héeni)* Obstruction	Yukon Transboundary	Silver Salmon River	Pre-Implementation	Assessment	Freshwater- off-channel

Map 2. BC Interior Area Operational Fund Project Locations.



1. Adams River Post-Fire Turbidity Monitoring

Project Lead

David Reid

Implementing Partners

Skwlax te Secwepemculecw

DFO Area

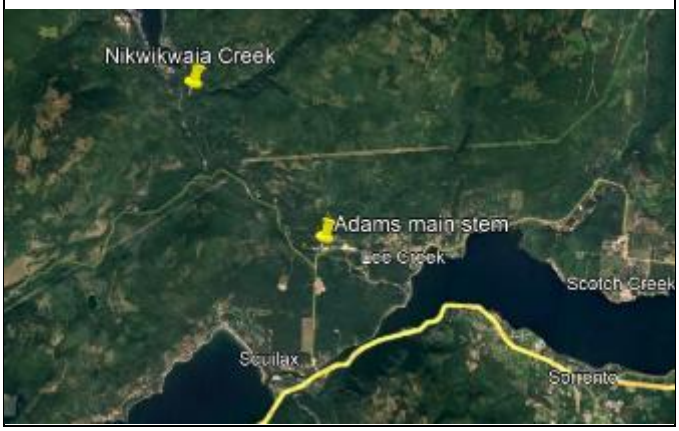
BC Interior

Stream/Watershed

Nikwikwaia Creek, Lower Adams River

Location

Turbidity Monitoring Site Coordinates
Nikwikwaia Creek, Adams Lake 50.94031, -119.65262
Lower Adams River, Roderick Haig-Brown Prov. Park 50.90258, -119.59029



Introduction

The Lower Adams River represents one of the most productive and iconic sockeye salmon spawning rivers in southern British Columbia. In mid-August 2023, the Lower East Adams Lake wildfire burned much of the forested region on both sides of the river. Given the productive spawning areas adjacent to and downstream from the fire, monitoring of fine sediment was carried out to understand post-fire impacts to the river system and fish habitat.

Objectives

This project has three objectives:

1. Determine response of Nikwikwaia Creek water quality, namely turbidity, to the 2023 wildfire.
2. Evaluate how the Adams River main stem below Nikwikwaia Creek responds to any additional turbidity/fine sediment addition.
3. Estimate the downstream extent of influence of fire impacts.

Project Summary

Following the 2023 wildfire event, suspended sediment dynamics were assessed along the Lower Adams River given the significant fisheries values in the watershed. Water quality sondes and data loggers for continuous turbidity monitoring were to be installed at key locations along the Lower Adams River. Due to procurement challenges, equipment delivery was delayed to the end of the 2023-24 fiscal year, and hence the monitoring equipment has only recently been deployed. Data collection and analysis will continue through 2024-25. The photographs depict locations where water quality monitoring is occurring.

Pacific Salmon Conservation Units

- Chinook – South Thompson Summer
- Coho – South Thompson
- Pink – Fraser River
- Sockeye – Shuswap Early Summer
- Sockeye – Shuswap Late
- Sockeye – Kamloops Early Summer

Cost Summary

Equipment	$26,900
Total Cost	$26,900

Outputs

Outputs of the project include an improved understanding of how the Lower Adams River is responding to the 2023 wildfire event, particularly in terms of water quality and sediment input.

Proposed Work

Following continuous turbidity monitoring and analysis of the data, additional measurement stations may be added. Sediment sampled from the channel bed may be collected to evaluate the presence of fine sediment infiltrating into the gravel substrate and impacting spawning habitat conditions.

Further Information

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2. Bluenose Off-Channel Restoration Site

Project Lead

Colin McGregor

Implementing Partners

- Bridge River Indian Band (Xwísten)
- BC Hydro

DFO Area

BC Interior

Stream/Watershed

Bridge River

Location

The project site is located 39.5 km upstream from the Fraser River confluence on river left.

Coordinate: 50.790812, -122.197127

Introduction

Provincial records indicate the Bluenose off-channel site was used as a quarry for the construction of the Terzaghi Dam between 1959-60. The dam and associated works eliminated flow downstream following its completion in 1960. Since August 2000, BC Hydro has implemented flow trials to increase downstream flows and has monitored the effects on fish and wildlife in an adaptive management program. Habitat complexing works were undertaken at the Bluenose site circa 2000, and further complexing and maintenance works have been ongoing. A river intake was also added to increase wetted area within the Bluenose off-channel habitat (Figure 1).

Objectives

Project objectives are to improve hydrologic connectivity and fish passage between the Bluenose off-channel site and the Bridge River mainstem, and to increase available off-channel habitat.

Project Summary

This project was carried out in February 2024 and involved construction services and monitoring. Specifically, the Bluenose off-channel river intake was removed, the berm separating the channel from Bridge River was breached, and a new 25-m connector channel was created to directly connect the mainstem Bridge River to the Bluenose off-channel habitat (Figure 2).

Figure 1: Downstream view of the Bluenose off-channel site prior to 2024 restoration works (photo taken February 5, 2024).

Figure 2: View downstream of the newly constructed connection channel (dashed yellow line) for the Bluenose off-channel project site adjacent to the Bridge River mainstem (photo taken February 7, 2024)

Pacific Salmon Conservation Units

- Chinook – COSEWIC Threatened Middle Fraser
- Coho – COSEWIC Threatened Interior Fraser
- Pink – Fraser River (odd year)
- Sockeye – Middle Fraser Summer
- Sockeye – Middle Fraser Late
- Steelhead – COSEWIC Endangered Middle Fraser Summer

Cost Summary

Project Management	$ 2,310
Construction Services	$15,090
Project Monitoring	$11,126
Total Cost	$28,526

Outputs

The Bluenose off-channel river intake was removed, the berm separating the channel from the river was breached, and a new 25-m long connector channel was created. The connector channel created approximately 75 m² of habitat and improved habitat conditions in approximately 1000 m^2 of existing side channel habitat. Xwísten has documented COSEWIC Endangered Middle Fraser Summer Steelhead spawning in the new connector channel during early project monitoring.

Adaptive Management

Time constraints resulted in some project components not being complete as originally designed. Final decisions on design criteria were made on-site during construction by the project lead with input from the equipment operator and Xwísten Fisheries Technicians.

COSEWIC Endangered Western Screech Owls were present at the site, which prompted changes to the scope of work including constructing only one connector channel instead of two and completing the work earlier than scheduled.

Proposed Work

DFO RCOE and Xwísten will continue monitoring the site. There may be future opportunity to further increase the wetted off-channel habitat and/or alter the channel and floodplain habitats to better compliment the flow regime.

Further Information

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3. Constructed Side Channel Effectiveness Evaluation and Climate Adaptation Project

Project Lead

Melissa Hack

Implementing Partners

- Skeetchestn Indian Band
- Skwlāx te Secwepemcúl̓ecw
- Secwepemc Fisheries Commission
- Simpcw First Nation
- BC Parks
- The Adams River Salmon Society

DFO Area

BC Interior

Stream/Watershed

Raft River, Louis Creek - North Thompson
South Thompson River, Adams River

Location

Site	Coordinate	Watercourse
Cottonwood Channel	50.89684,-119.55317	Adams River
Avola Ponds	51.78191,-119.31963	N. Thompson River
Pawloff Channel	51.05890 ,-120.03999	Louis Creek
Raft Channel	51.63632,-119.97367	Raft River

Introduction

Historically, the DFO Resource Restoration Unit and partners constructed a number of side-channel projects for salmon habitat enhancement using hard-engineered methods including intakes, berms, and culverts. Since construction, a number of factors such as land use development and changing climatic conditions have altered watershed dynamics and may be affecting these project sites. Assessment and monitoring are required to ensure they continue to operate optimally for salmon.

Objectives

Project objectives are to evaluate constructed side-channel sites and determine restoration opportunities to increase habitat value, adapt to watershed and climate change conditions, and reduce long-term maintenance requirements.

Project Summary

Four sites were identified as high priority for assessment by DFO RCOE staff and Indigenous partners. A Rapid Assessment Tool was created, tailored to legacy restoration projects in the BC Interior, to assess the current state of each channel. Assessment with the tool included biophysical aspects of the channel as they relate to fish, as well as the operating condition of installed infrastructure.

The project included procurement of water quality monitoring equipment and data loggers that were installed at each site for continuous measurement (Fig. 1). Water quality monitoring was intended to assess habitat quality through the year and inform appropriate next steps at each site. Three

outcomes are possible. Functioning channels would continue to be routinely monitored. Restoration prescriptions would be developed for sub-optimally functioning channels to increase productivity. Lastly, plans for decommissioning would be developed for channels that do not present viable options for habitat improvement or that may be detrimental to fish populations.

Restoration prescriptions will focus on design criteria to meet climate and watershed conditions, and reduced maintenance. Where feasible, restoration prescriptions will follow process-based restoration principles.

Figure 1: The BC Interior restoration team installing monitoring equipment in Raft River (left) and the Pawloff Channel (right).

Pacific Salmon Conservation Units

- Coho – North Thompson
- Coho – South Thompson

Cost Summary

Equipment	$25,568
Total Cost	$25,568

Outputs

Monitoring equipment was installed in the four priority channels and a total of 18,250 m^2 of habitat was assessed using the Rapid Assessment Tool.

Adaptive Management

There were substantial delays in equipment procurement and delivery to meet project objectives in 2023-2024. As a result, assessment was not completed at all locations this fiscal year. BC Interior RCOE staff have prioritized completion of data collection in 2024 and will initiate restoration design components of the project.

Proposed Work

Data compiled from the Rapid Assessment Tool and monitoring equipment will be analyzed to determine the effectiveness of each side-channel project. The results will inform whether the channel is functioning as productive fish habitat; requires restoration, or should be completely decommissioned.

Further Information

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4. Off-Channel Temperature and Dissolved Oxygen Monitoring

Project Lead

David Reid

Implementing Partners

- Lower Nicola Indian Band
- Scw'exmx Tribal Council

DFO Area

BC Interior

Stream/Watershed

Nicola River, Coldwater River

Locations (subset)

Location	Coordinates
Shulus Gardens 1	50.13612,-120.85935
Shulus Gardens 2	50.14063,-120.86964
Guichon Confluence	50.14467,-120.89054
Clapperton Confluence	50.16173,-120.67027
Shackelly Creek	50.19061,-121.06317
Nuaitch Creek	50.16578,-121.05263
Nooaitch side Channel	50.18985,-121.06391
MOTI compensation site	50.20725,-121.08147
Spius Creek	49.96696,-121.08061
Patchett Rd (spius)	49.97706,-121.08326
Coldwater Big Bend	49.86849,-120.91176
Juliette off-channel	49.74430,-121.00786
Voght Creek Confluence	49.90750,-120.91557
Gillis Creek confluence	49.91303,-120.91835
Brookmere	49.88956,-120.90561
Paul's Basin Bridge	49.98342,-120.92851
Moonshadows RV	50.09095,-120.7721
Bottletop cluster	49.77738,-120.99060
Juliette Ponds	49.80284,-120.95855

Introduction

During severe drought conditions experienced over the summer and early fall of 2023, a need was identified to better document conditions in connected and disconnected off-channel habitat in drought-prone systems. Temperature and dissolved oxygen values were identified as key metrics to record in order to evaluate habitat suitability for rearing juvenile coho salmon.

Objectives

This project had three objectives:

1. Undertake periodic spot measurements of temperature and dissolved oxygen in identified off-channel habitats.
2. Undertake continuous temperature monitoring in select locations where potential drought response work may take place.

3. Use the spot measurements to validate off-channel thermal refugia identified by drone imagery.

Project Description

This project involved acquiring a dissolved oxygen and temperature sensor to enable assessment and monitoring of off-channel habitat in the Nicola watershed. A total of 38 individual sites were sampled for water quality measurements during drought conditions (Figure 1-3). Monitoring results are intended to provide insight into the function of off-channel habitat during drought, and also guide potential actions to improve habitat in select locations.

Figure 1. Shulus Gardens near Merritt, BC.

Figure 2. Off-channel habitat along the Nicola River.

Figure 3. Nuaitch Creek near the confluence of the Nicola River.

Pacific Salmon Conservation Units

- Chinook – Lower Thompson
- Coho – Lower Thompson

Cost Summary

Equipment	$5,000
Total Cost	$5,000

Outputs

This project served to evaluate habitat suitability among off-channel sites and identify locations requiring intervention. In a handful of locations (notably the Bottletop cluster of sites), continuous temperature monitoring and repeat thermal imagery was collected to evaluate the impact of small-scale drought response intervention in these off-channel areas.

Further Information

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5. Restoring Indigenous Plants and Riparian Ecosystems (RIPARE)

Project Lead

Sarah Ostoforoff

Implementing Partners

- Skeetchestn Indian Band
- Kasey Moran, UBC Forestry
- Okanagan Nation Alliance

DFO Area

BC Interior

Stream/Watershed

Deadman River, Thompson River

Location

Lower 3 km of the Deadman River downstream of the Highway 1 bridge. Access requires permission from Skeetchestn Indian Band.

Coordinate: 50.76392, -120.91391

Introduction

The project aims to explore innovative techniques to restore black cottonwood (*Populus trichocarpa)* ecosystems in the hot and arid climate of BC Interior using knowledge of cottonwood biology and ecology.

Objectives

This project had two objectives:

1. Pilot novel riparian restoration techniques to advance restoration science.
2. Increase riparian vegetation cover along the lower portions of the Deadman River, in particular black cottonwood.

Project Summary

This project included desktop review, baseline vegetation monitoring, site surveys, conceptual design and modeling and construction. A desktop review was conducted to determine possible root causes behind loss of cottonwood ecosystems in the lower Deadman River. Cottonwood expert Kasey Moran was consulted to learn about habitat requirements for black cottonwood.

Monitoring was carried out at sites with high, medium, and low cottonwood coverage to assess riparian cover, composition, and structure. Cottonwood recruitment/floodplain processes were also assessed. Low coverage sites served as candidates for restoration.

Three sites were chosen to develop restoration prescriptions. Prescriptions included increasing active floodplain area through floodplain excavation and riffle building, as well as experimental planting with solar-drip irrigation. Cross-sectional surveys were carried out at candidate restoration sites to support modeling. Detailed modeling was conducted to support construction at one of the three sites.

A low-bench floodplain was excavated at a berm originally constructed to protect an irrigation intake channel (Figure 1). The low bench was designed to be inundated at a 2-year bankfull flood flow, and designed to widen bankfull width, reduce bed erosion, and encourage natural recruitment of cottonwoods and willows. Cottonwood stakes were planted along the low bench.

Figure 1: Excavator constructing a low bench.

Pacific Salmon Conservation Units

- Chinook – Lower Thompson
- Coho – Lower Thompson
- Pink – Fraser River (odd)
- Steelhead – Thompson Summer

Cost Summary

Professional Services	$29,842
Supplies	$ 5,113
Equipment	$ 4,941
Total Cost	$39,896

Construction was completed with in-kind support from Skeetchestn Natural Resources Corporation.

Outputs

A total of 375 m^2 of floodplain habitat was created and 120 cottonwood stakes were planted.

Adaptive Management

A second day of construction was conducted in spring 2024 to complete construction of the low bench to design specifications.

Proposed Work

The project received funding from Pacific Salmon Foundation for 2024-25 to construct the remaining two sites that were conceptually designed during year 1 of the project.

A solar drip irrigation system was installed at irrigation intake berm during the spring of 2024 to water the cottonwood stakes.

Further Information

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6. Tranquille Stage Zero Floodplain Reset: LIDAR Data Collection

Project Lead

Matteo Saletti

Implementing Partners

Secwepemc Fisheries Commission

DFO Area

BC Interior

Stream/Watershed

Tranquille River, Thompson River

Location

Tranquille fan at Kamloops Lake (Coordinate: 50.72026, -120.53577) upstream to the Tranquille Farms water diversion (Coordinate: 50.743807, -120.51467).

Introduction

The Tranquille River is situated 15 km northwest of Kamloops and is located on the traditional unceded land of the Secwépemc Nation. The river was subject to intense gold-mining in the mid-19th and 20th centuries and the upper watershed has had extensive logging. Channelization and loss of floodplain connectivity are evident as a result of historic activities. Tranquille River near its confluence with Kamloops Lake has been identified as a candidate for Stage Zero process-based restoration that aims at creating more resilient and self-sustaining habitat for Pacific Salmon.

Objectives

Project objectives are to gather necessary data to evaluate and design viable habitat restoration options.

Project Summary

The area of interest for this project is the Tranquille River bounded by the Lac Du Bois Grassland Protected Area and private property. Topographic data and corresponding ortho-imagery were collected, and a Digital Elevation Model (DEM) was constructed based on the LiDAR. These data will be used for hydraulic modelling and geomorphic assessments to evaluate the suitability of Stage Zero floodplain restoration on the lower Tranquille River to support Pacific Salmon recovery.

Considering its depositional character and the extent of its floodplain, lower Tranquille River near its delta in Kamloops Lake is a candidate site for floodplain connectivity restoration to create resilient and self-sustaining habitat for Pacific Salmon. Through all stages of the project the RCOE intends to work collaboratively with the Secwepemc Fisheries Commission (SFC). Using the acquired LiDAR and DEM, Geomorphic Grade Line Relative Elevation Model Analysis will proceed in order to evaluate suitability of the Stage Zero approach.

Pacific Salmon Conservation Units

- Chinook – South Thompson Summer
- Coho – Lower Thompson
- Pink – Fraser River (odd)
- Sockeye – Kamloops Early Summer

Cost Summary

Professional Services	$7,261.07
Total Cost	$7,261.07

Outputs

Project outputs are LiDAR and a DEM covering an area of approximately 1.25 km^2, including the delta fan in Cooney Bay and about 3.25 km of the watercourse upstream of the delta (Figure 1).

Proposed Work

The project team is currently planning next steps for design and proof of concept for Stage-Zero restoration on Tranquille River. Drought emergency works may also be considered as needed.

Further Information

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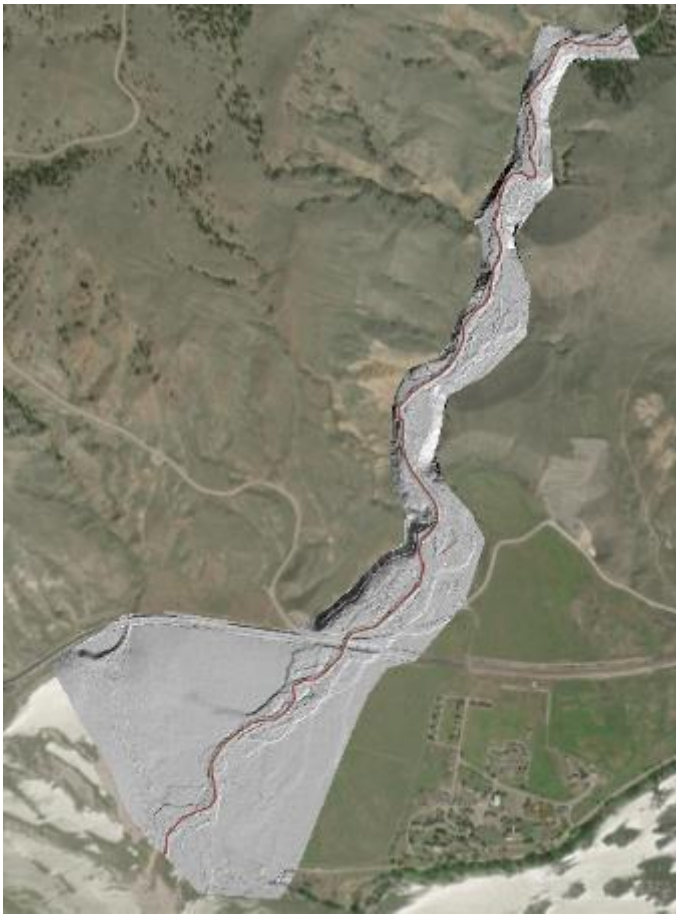
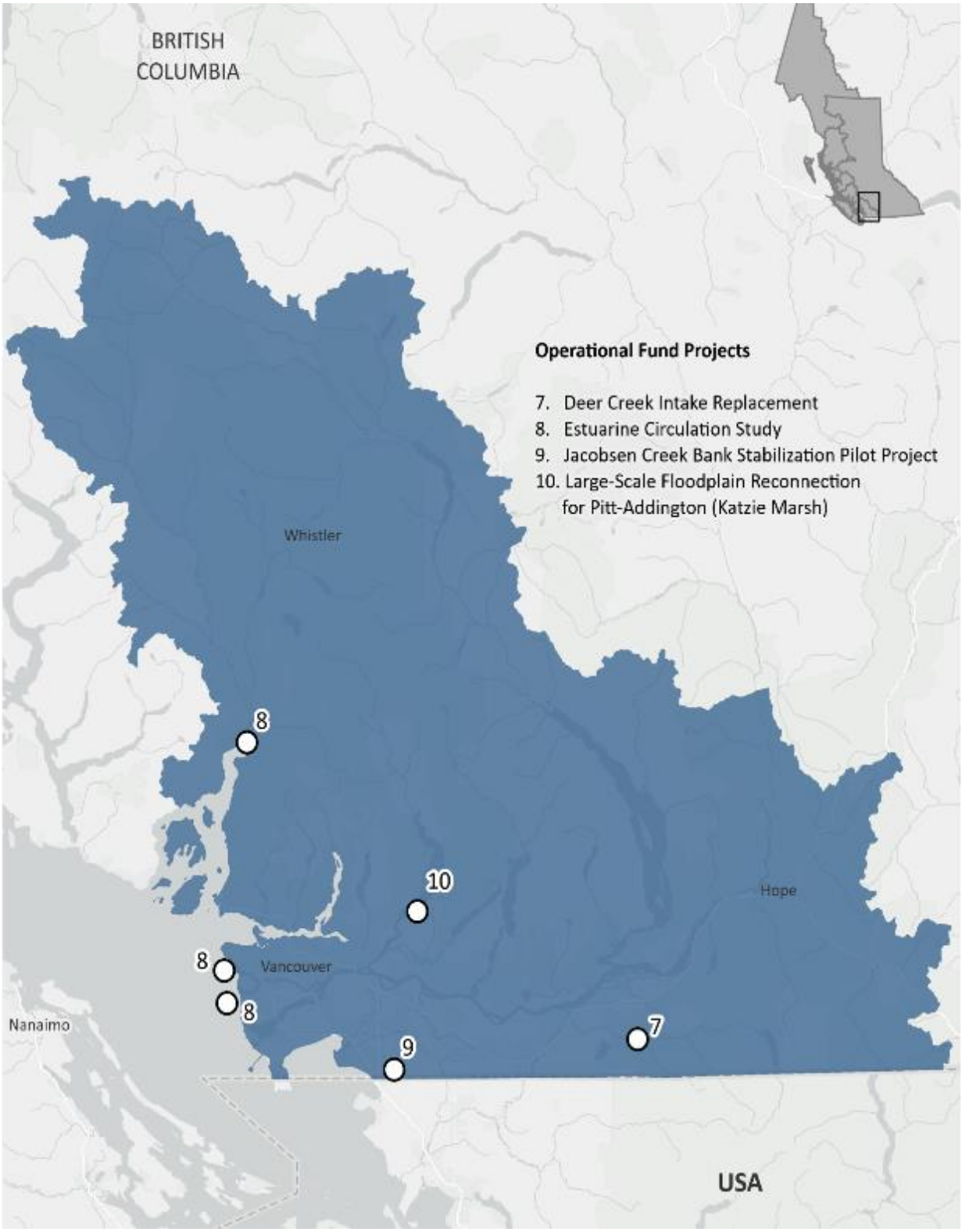


Figure 1. Image of the Hillshade created from the Digital Elevation Model, a product of the LiDAR collected.

Map 3. Lower Fraser Area Operational Fund Project Locations.



7. Deer Creek Intake Replacement

Project Lead

Jan Bielenberg

Implementing Partners

N/A

DFO Area

Lower Fraser

Stream/Watershed

Deer Creek, Chilliwack River

Location

The Project site is accessed via Tamihi Forest Liumchen Service Road.

Coordinates: 49.07563, -121.86970

Introduction

In 1996, the Steelhead Society of BC, Forest Renewal BC, Province of BC and DFO constructed the Deer Creek off-channel spawning and rearing habitat complex as part of the Watershed Restoration Program. In 2000, an intake on Deer Creek was added to convey surface flows to the system.

Deer Creek is a steep tributary to the Chilliwack River with high bedload, thus the current intake is prone to clogging and requires substantial maintenance to provide consistent flows to the habitat complex (Figure 1).

Figure 1. Maintenance for the existing intake using a vacuum truck to remove accumulated bedload.

Objectives

The project objective is to replace a non-functional intake on Deer Creek with a new, innovative intake that will require less maintenance from sediment clogging, and will maintain consistent flows to the spawning channel and rearing pond complex.

Project Summary

The DFO RCOE has designed a new intake for custom fabrication based on a required flow of 0.085 m^3/s. Design calculations were based on guidelines for design of Tyrolean weirs. The angle of the intake grates was chosen as a balance between flow performance and the ability of the grate to self-clean. Standard grating was chosen as a performance trial. Intake fabrication was completed per DFO RCOE designs by a metal fabricator (Figure 2).

The installation will be completed during the summer 2024 instream work window. Once

installation is complete in summer 2024, DFO RCOE will continue to monitor the Deer Creek intake and habitat complex to understand its functioning and make improvements where necessary. Particular focus lies on the performance of intake grates and monitoring will inform the design of future intake maintenance and construction projects.

Figure 2. The newly fabricated intake for Deer Creek.

Pacific Salmon Conservation Units

Coho – Lower Fraser

Cost Summary

Supplies	$11,500
Total Cost	$11,500

Outputs

The replacement of the intake will re-establish surface flows to 500 m^2 of coho spawning habitat and 5,000 m^2 of rearing habitat.

The new intake design could potentially be adapted for use in similar steep, high bedload creeks.

Adaptive Management

Some project delays prevented intake installation as scheduled. The installation will be completed during the summer 2024 instream work window.

Proposed Work

This project has continued support from the operational fund for 2024-25. Intake installation is scheduled for August 2024. Installing the intake on site will require a vacuum truck to flush the culvert that conveys water from the intake into the channel, an excavator to prepare the site and install the intake box, and concrete formwork to create the headwalls surrounding the intake. DFO RCOE will oversee the installation and complete environmental monitoring, during and following construction.

Further Information

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8. Estuarine Circulation Study

Project Lead

Morgan Tidd

Implementing Partners

- Pacific Science Enterprise Centre
- Raincoast Conservation Society
- Squamish River Watershed Society

DFO Area

Lower Fraser

Stream/Watershed

Fraser River and Squamish River

Location

The project sites are the Squamish Estuary, and Sturgeon Bank near both the Stevenston North Jetty and North Arm Jetty (Figure 1).

Location	Coordinates
Squamish Estuary	49.68753, -123.17718
North Sturgeon Bank	49.22113, -123.25146
South Sturgeon Bank	49.15469, -123.24206

Introduction

Several recent projects have involved breaching river training dikes and jetties to support Pacific salmon recovery. Most breach efficacy monitoring focuses on the presence/absence of fish species of interest, and ignores potential changes in physical processes that support habitat recovery. This project looks specifically at the circulation of freshwater and sediment being delivered to estuaries where breaches have occurred.

Objectives

The main objective of the study is to develop a greater understanding of sediment delivery to estuaries. Results will help to determine the contribution of the breaches towards restoring physical processes of sediment and water exchange, as well as building estuary resilience to climate change.

Project Summary

The project accomplished the procurement of specialized equipment as well as testing field data collection methods. Equipment procurement contributed significant delays to the initiation of the project, which limited data collection and equipment testing to the fall, high flow data collection period only (December 2023). This data collection period identified several issues with equipment and software compatibility, as well as operational limitations to data collection during various tidal cycles. Based on these valuable lessons learned, modifications to the sampling schedule and locations have been made for future data collection events, and alternative equipment procurement has been secured to ensure efficient and smooth data collection and operation.

Pacific Salmon Conservation Units

Squamish

- Chum – Howe Sound-Burrard Inlet
- Chinook – Southern Mainland-Georgia Strait
- Coho – Howe Sound-Burrard Inlet
- Pink – East Howe Sound-Burrard Inlet, Georgia Strait

Fraser

- Chum – Lower Fraser
- Chinook – all Fraser CUs
- Coho – Lower Fraser, Thompson, Fraser Canyon, Interior Fraser, Lillooet
- Pink – Fraser River

Cost Summary

Supplies	$ 7,100
Equipment	$ 6,210
Total Cost	$13,310

Outputs

Project outputs are as follows:

- Preliminary results for North Arm and Squamish River Estuary (Figure 2, Figure 3)
- Revised work plan for future
- Revised equipment and supply requirements for future data collection.

Adaptive Management

Adaptive management techniques that may have been implemented include a more streamlined procurement plan, as well as the identification of alternate equipment in case of malfunction or incompatibility between equipment and logging technologies.

Proposed Work

Continued data collection is proposed to determine circulation and sediment delivery in the Squamish and Fraser River estuaries.

Further Information

Morgan Tidd
Regional Coastal Geomorphologist
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Figure 1. Sampling locations at the North Arm Jetty (left), Steveston North Jetty (middle), and Squamish Jetty (right).

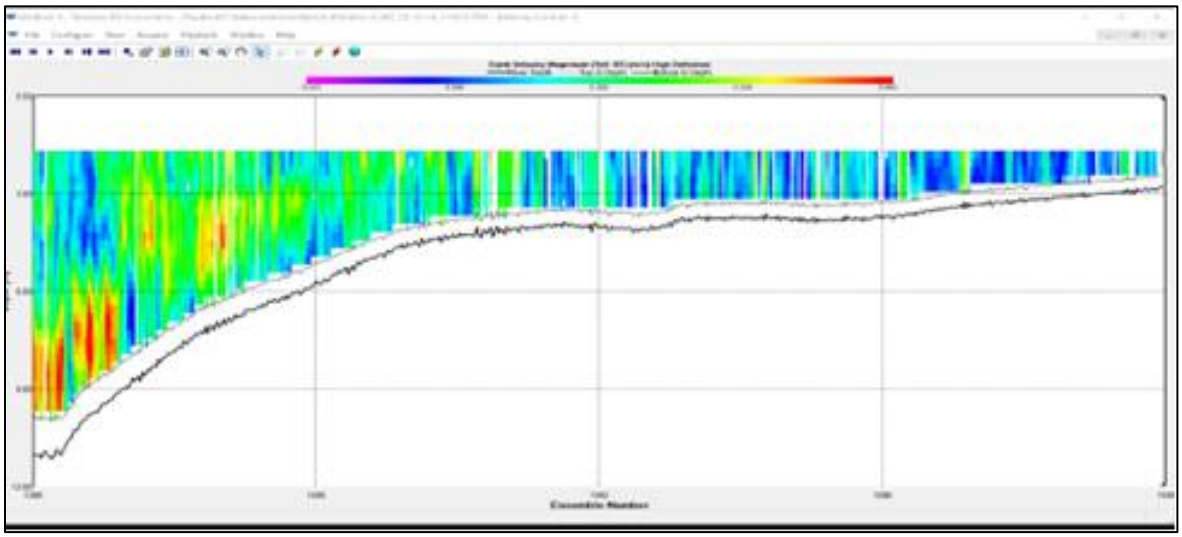

Figure 2. Example of velocity profile across the Squamish River Estuary from south to north.

Figure 3. CTD profile cast and selection (left), and ADCP set up (right).

9. Jacobsen Creek Bank Stabilization Pilot Project

Project Lead

Jan Bielenberg

Implementing Partners

- A Rocha Canada
- Pacific Salmon Foundation

DFO Area

Lower Fraser

Stream/Watershed

Jacobsen Creek, Campbell River

Location

Site is within the Puesta del Sol strata complex in South Surrey. Entry with gate code only.

Project Coordinate: 49.01928, -122.68319

Introduction

Jacobsen Creek is a tributary to the Little Campbell/Tatalu River flowing through the Township of Langley and the City of Surrey. The creek supports coho and chum salmon, as well as steelhead trout. Twin culverts where a private road crosses Jacobsen Creek were perched 1.5 m above the tailwater pool, representing a fish passage barrier. Reinstating fish passage through the culvert crossing would open access to up to 2.3 km of quality salmon habitat.

Objectives

The main project objective was to restore fish passage through the private road culvert. A secondary goal was testing the soil wrap method for bank stabilization.

Project Summary

DFO RCOE designed a rock ramp to improve fish access into the culvert, combined with bioengineered bank treatments (soil wraps). The soil wraps provide a softer bank stabilization treatment while providing cover and food sources for fish. The rock ramp was designed to allow upstream passage of coho spawners between October and January and safe conveyance of flood flows, with a low flow channel for fish passage in late summer and early fall.

Construction took place in August 2023, with the DFO RCOE Area team providing project oversight and environmental monitoring services. Both creek banks were built up with granular material to prepare for rock and soil wrap installation. Subsequently, the rock ramp was built to design gradient. Large toe boulders were installed along the banks, and a low flow channel was rock-lined along the length of the rock ramp. The areas between the low flow channel and bank rocks were backfilled with coarse granular material to promote channelization of low flows. A pool immediately downstream of the culverts was established using large rock as a control and a pool liner to avoid seepage loss to groundwater. The pool was designed to for adequate depth to allow fish to rest

and to pick up speed for a small jump into the culverts.

Soil wraps are composed of an outer layer of biodegradable matting, in this case coir matting, and fill material made up of a planting medium, and crushed rock. The biodegradable matting stabilizes the soil until plant roots have established. While soil wraps have previously been applied for bank stabilization on small creeks, this design provides an innovative solution. Under flood conditions, the rock ramp will be exposed to high flow velocities. The design ensures that the flow velocities and associated shear stresses against the soil wraps remain within the allowed range. Rather than focusing solely on fish passage criteria, the rock ramp also provides habitat cover and complexity. Finally, culvert baffles were installed to create low velocity areas for salmon to rest while passing through the culvert.

In fall 2023, DFO RCOE biologists observed coho spawners using the reach upstream of the rock ramp, demonstrating that fish passage is now possible through the formerly perched culverts.

Pacific Salmon Conservation Units

Coho – Boundary Bay

Cost Summary

Supplies	$11,000
Equipment	$ 9,000
Total Cost	$20,000

This project leveraged significant partner funds (A Rocha $70,000 and PSF $15,000) to support project implementation.

Outputs

45 m^2 of channel improvement and restored access of up to approximately 5,000 m^2 of salmon habitat

Adaptive Management

DFO RCOE will continue to monitor the project for successful fish passage upstream, stability of the rock ramp, and success of the soil wraps. Changes and repairs will be implemented as needed if identified by the monitoring efforts.

Proposed Work

Small scale repairs are planned, funded by Lower Fraser Area team's operational budget. Soil wrap performance was high, and the method is being applied to other Lower Fraser restoration sites.

Further Information

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Figure 1. Before (top) and after (bottom) construction; upstream view(left) and downstream view (right).

10. Large-Scale Floodplain Reconnection Planning for Pitt-Addington (Katzie) Marsh

Project Lead

Justin Barbati

Implementing Partners

- Katzie First Nation
- Resilient Waters
- Ducks Unlimited

DFO Area

Lower Fraser

Stream/Watershed

Pitt River

Location

The project site is Pitt-Addington Marsh (15.5 km^2), within the unceded traditional territory of Katzie First Nation. Access is from Rannie Road.

Coordinates: 49.34180, -122.60307

Introduction

Pitt-Addington Marsh was originally floodplain of the Pitt River. The contemporary marsh is totally enclosed by dikes and the Province of BC and Ducks Unlimited have shared responsibility for management of the property. Three top-hinged flood gates control drainage and the marsh represents the largest wetland in the Fraser Valley with significant wildlife, birding and recreational values. The site represents an extraordinary habitat restoration opportunity to reestablish floodplain connection between the marsh and Pitt River for juvenile Pacific salmon.

Objectives

Project objectives were to acquire geospatial data, specifically airborne LiDAR and color digital imagery. These data will be used for hydraulic modelling and to assist in designing a restoration plan for marsh floodplain reconnection to the Pitt River in order to support Pacific salmon recovery.

Project Summary

Terra Remote Sensing was contracted to conduct an aerial survey of Pitt-Addington marsh (43 km^2) and including Widgeon Slough and Addington Point Marsh (Figure 1). Data acquisition operations occurred from Pitt Meadows Airport. The aerial survey data were collected on February 26 and 27, 2004 and the Ground GPS control survey was completed on February 23 and 26, 2024. Data collection included LiDAR, color digital imagery and static GPS control. LiDAR point density is 35 ppsm and the orthophoto resolution is 10-cm. The resulting Digital Elevation Model (DEM)/Digital Surface Model (DSM) resolution is 1-m.

Pacific Salmon Conservation Units

- Chinook – Lower Fraser River-Upper Pitt
- Sockeye – Pitt Early Summer Timing
- Sockeye – Widgeon

Cost Summary

Professional Services	$20,300
Total Cost	$20,300

Outputs

Project outputs include LiDAR, a DEM and ortho-imagery covering 43.2 km^2 of the Pitt River and historic floodplain including Pitt-Addington Marsh, Widgeon Slough, and Addington-Point Marsh.

Figure 1. Project area within which LiDAR and aerial imagery were collected.

Proposed Work

Next steps for the project involve collaborative scoping of restoration opportunities with partners including Katzie First Nation, Ducks Unlimited, City of Pitt Meadows, and Resilient Waters.

Further Information

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Laura Weatherly
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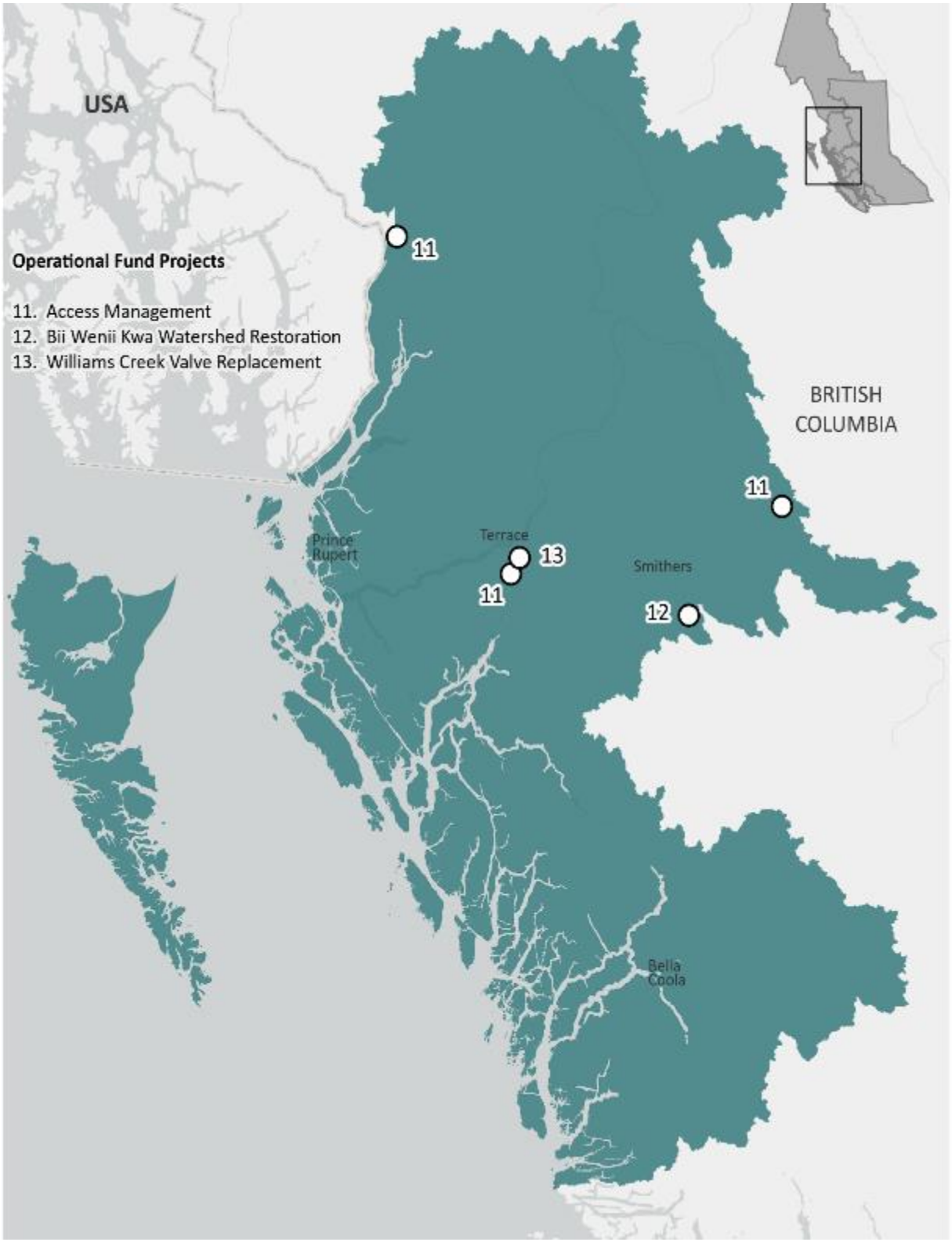
Map 4. North Coast Area Operational Fund Project Locations.



11. Access Management

Project Lead

Natalie Newman

Implementing Partners

Lake Babine Nation

DFO Area

North Coast

Stream/Watershed

- Lake Babine, Scully Creek - Skeena Watershed
- Clements Creek – Bear River Watershed

Location

Coordinates	
Lake Babine (Multiple Locations)	Approximately 54.7967,-126.0272
Scully Creek	54.35269, -128.54936
Clements Creek	56.05188, -129.91036

Introduction

More frequent annual drought conditions have raised the need for monitoring barriers to sockeye passage to Babine Lake. While natural to the landscape, beaver dams in low water conditions can pose a barrier to passage. In addition to beaver dams, sockeye migration may be blocked due to lack of flow into Babine Lake. Monitoring for these barriers has traditionally occurred by foot or boat. This project explored innovative methods to monitor problem areas. Options for monitoring included using remote cameras to monitor problem areas, GIS mapping on a landscape scale to develop a drought tool, helicopter flights, and use of satellite imagery to monitor creek mouths/dams.

Objectives

Project objectives are to implement short term mitigation measures to promote fish passage at sites of known beaver activity, identify areas of concern for salmon access, and explore mitigation and monitoring options.

Project Summary

Beaver trapping was carried out by local trappers on two streams with identified fish access issues, Scully Creek and Clements Creek. Beaver were removed and a series of dams were modified to allow fish passage.

A helicopter flight was taken with members of Lake Babine Nation and DFO RCOE to evaluate connectivity of tributaries to Lake Babine, and to identify areas needing future monitoring or intervention. Lake Babine Nation identified a location for a camera that will provide continuous monitoring. The location at the mouth of Cross Creek will be pointed at a staff gauge simultaneously to monitor water levels and connectivity.

Exploration of a drought tool is in progress for improved assessment and monitoring.

Pacific Salmon Conservation Units

Lake Babine

- Chinook – Middle Skeena-Large Lakes
- Coho – Middle Skeena
- Pink – Middle-Upper Skeena (even, odd)
- Sockeye – Babine

Scully Creek

- Chinook – Lakelse
- Coho – Lower Skeena
- Pink – Lower Skeena
- Sockeye – Lakelse

Clements Creek

- Sockeye – Clements

Cost Summary

Professional Services	$14,975
Equipment	$ 8,924
Total Cost	$23,899

Outputs

Beaver trapping and dam modification in Scully and Clements Creek resulted in increase fish passage to over 4 kilometers of critical habitat that without access would have resulted in extirpation of sockeye populations.

Adaptive Management

Additional helicopter flights were needed to identify access issues throughout the year and inform future priority monitoring locations. We identified one creek mouth disconnected from the creek and also surveyed the extent of the Pinkut Creek Fire. Satellite imaging was explored as an option to assist in monitoring creek mouths and beaver dams. This flight also helped understand the fire and need to ground truth in the summer/liaise with provincial government and Lake Babine Nation.

Proposed Work

Continued monitoring of fish passage issues from beaver dams in Clements and Scully Creeks is required. Further monitoring of stream connectivity in Lake Babine tributaries will be conducted with the installation of a remote camera system on Cross Creek in 2024. Additional monitoring methods have been explored for Lake Babine area, including high resolution satellite imagery.

Figure 1. Measuring water and ice depth at a priority creek mouth (left) and Pinkut Creek Fire 2023 (right).

For Further Information

Natalie Newman
Area Restoration Biologist
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12. Bii Wenii Kwa Watershed Restoration

Project Lead

Natalie Newman

Implementing Partners

- Wet'suwet'en Treaty Office Society (WTOS)
- BC Ministry of Water Land and Resource Stewardship
- Morice Watershed Monitoring Trust (MWMT)
- Northwest Monitoring and Research (NWMR)

DFO Area

North Coast

Stream/Watershed

Bii Wenii Kwa (Owen), Widzin Kwah (Morice), Skeena Watershed

Location

The Bii Wenii Kwa watershed is 40 km south of Houston, BC.
Coordinates: 54.20231, -126.85908

Introduction

Bii Wenii Kwa is a culturally important watershed. It supports coho, pink and steelhead, and historically supported sockeye salmon, now extirpated. The watershed is an important gathering place for the Wet'suwet'en people.

A 2005 watershed-based fish sustainability plan identified the Bii Wenii Kwa as one of the most human modified watersheds in the Morice watershed. It has been identified as a candidate Fish Sensitive Watershed (FSW) by the Province of BC due to its significant fisheries values and watershed sensitivity. A report commissioned in 2011 prioritized watersheds in Morice and Upper Bulkley for designation as FSW's. The Bii Wenii Kwa was listed in the top 5 watersheds for additional watershed conservation and restoration.

Objectives

The overall goal of the restoration plan is to accelerate the rate of recovery of aquatic and terrestrial attributes in the watershed. Project objectives for this year were to:

1. Develop an Ecosystem Restoration Prioritized Plan for the Bii Wenii Kwa to restore aquatic ecosystem function.
2. Build relationships and develop draft TOR amongst working group.

Project Summary

The Bii Wenii Kwa Restoration project is a multi-phased project with the initial phase developing the plan and subsequent phases conducting restoration work and gathering the necessary funding for further restoration. The initial phase includes a detailed restoration plan and a Phase 1 restoration specific plan to be developed in Years 2 and 3. Subsequent phases will develop specific restoration plans as funding becomes available.

A processed-based approach to restoration is recommended to increase the likelihood of success. Restoration should increase the amount of high value stream habitat by restoring access to historically available stream habitat, improve the

quality of riparian habitat, and reduce road-related sedimentation deleterious to aquatic species. The DFO RCOE is involved in feasibility and potential subsequent design of channel relocation near the mouth.

Pacific Salmon Conservation Units

- Coho – Upper Skeena
- Pink – Middle-Upper Skeena

Cost Summary

Professional Services	$29,960
WTOS	$ 9,960
NWRM/MWMT	$10,000
Don Morgan	$10,000
Total Cost	$29,960

Outputs

The project team met twice, developed a draft TOR and completed 3 contracts for the following:

1) WTOS – hire project manager to lead communication with House Territory and House Territory Hereditary Chief, site visits, meetings and review documents.
2) NWMR – provide project administration, team communication and meeting coordination.
3) Don Morgan/MWMT – drafting recovery/watershed plan, incorporating changes, edits and updates as needed.

Site visits occurred in 2023-24, including the Bii Wenii Kwa site tour by project partners and house group.

Proposed Work

To understand the feasibility of channel reconnection at Bii Wenii C'eek, we propose to develop a 2-D hydraulic model to model flows in the reconnected historic channel and understand potential benefits and impacts to fish and habitat related to restoration actions. The model requires a detailed surface model created from stitching together LiDAR and Bathymetric data. We also propose to conduct manual channel cross-sections using RTK GPS or total station. A geomorphic assessment will be completed to understand factors controlling creek form and to feed into the development of process-based restoration. To validate model predictions we propose to install a water level gauge. The RCOE plans to supplement previous fish sampling in early summer near the proposed Riddeck Crossing replacement.

Further Information

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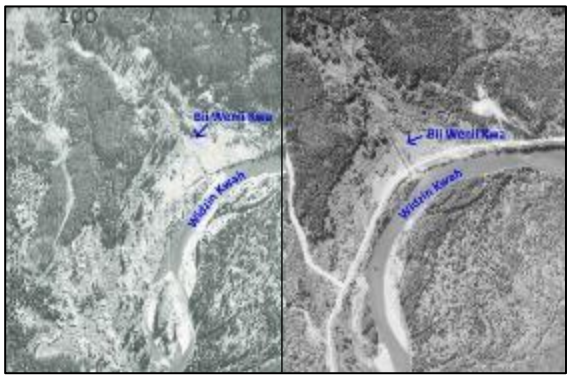

Figure 1.Bii Wenii Kwa - Left: 1949 aerial imagery, flow at the confluence appears to occupy 2-3 channels. Right: mid-1950s, channelization at the confluence with all channels consolidated to one.

13. Williams Creek Valve Replacement

Project Lead

Michael Gull

Implementing Partners

N/A

DFO Area

North Coast

Stream/Watershed

Skeena Watershed, Williams Creek

Location

Williams Creek Bridge - Old Lakelse Lake Dr
Coordinates: 54.44222 , -128.47954

Introduction

The Williams Creek Side Channel was constructed by DFO in 2012/13 with funding from the Pacific Salmon Commission. The channel provides surface water flows to a constructed side channel and off-channel habitat to ensure year-round flow and connectivity with Williams Creek. The channel supports stable spawning/incubation and rearing habitat for salmonids, including coho, sockeye and other resident species. Surface water from Williams Creek is delivered to the side channel habitat through an intake, pipe and valve to control flows. In 2017, a flood damaged an upstream bridge and the side channel intake. DFO replaced the intake grate and reinforced the rip rap wall, but was unable to remove all the rock that had accumulated at the valve in the pipe. This compromised valve function, flow and flow control to the side channel.

Objectives

To replace the butterfly valve and concrete manhole access with a gate valve and pipe/key control structure in order to restore flow and flow control to the Williams Creek Side Channel.

Project Summary

The intake screen was removed and a bladder was used to plug the intake. The broken valve was excavated and replaced, along with sections of broken pipe (Figure 1). Access to the new valve was improved by replacing the confined space concrete manhole with a pipe and long metal key. The valve and pipes were reburied and reinforced with a rip rap wall (Figure 2).

Figure 1. Partially excavated flooded manhole with broken valve (left). Buried replacement valve with new access pipe (right).

Figure 2. View of rip rap wall, exit pipe and valve access pipe.

Pacific Salmon Conservation Units

- Chinook – Lakelse
- Coho – Lower Skeena
- Pink – Lower Skeena River (odd)
- Pink – Nass-Skeena Estuary (even)
- Sockeye – Lakelse

Cost Summary

Professional Services	$13,587
Supplies	$ 8,644
Environmental Monitoring	$ 3,062
Total Cost	$25,293

Outputs

This project restored flow and flow control to Williams Creek spawning channel, ensuring 700 m of constructed habitat and ~1km of natural ephemeral habitat has adequate flows for spawning and juvenile rearing, plus year-round connectively to Williams Creek mainstem. The new access pipe has improved safety and ease of valve/flow adjustment.

Adaptive Management

The original infrastructure that functioned for many years needed to be replaced and the extent of damage to infrastructure could not be fully assessed until excavation of the site. Project plans were adapted during construction activities based on the site assessment.

Proposed Work

Williams Creek mainstem is a relatively unstable system due to the geology and years of industrial logging. Continued monitoring of flow and water levels is needed at this site, in order for DFO to extend the interim water license and meet original flow requirements/restrictions. Additional monitoring of salmonid usage of this side channel is also recommended for effectiveness monitoring.

Further Information

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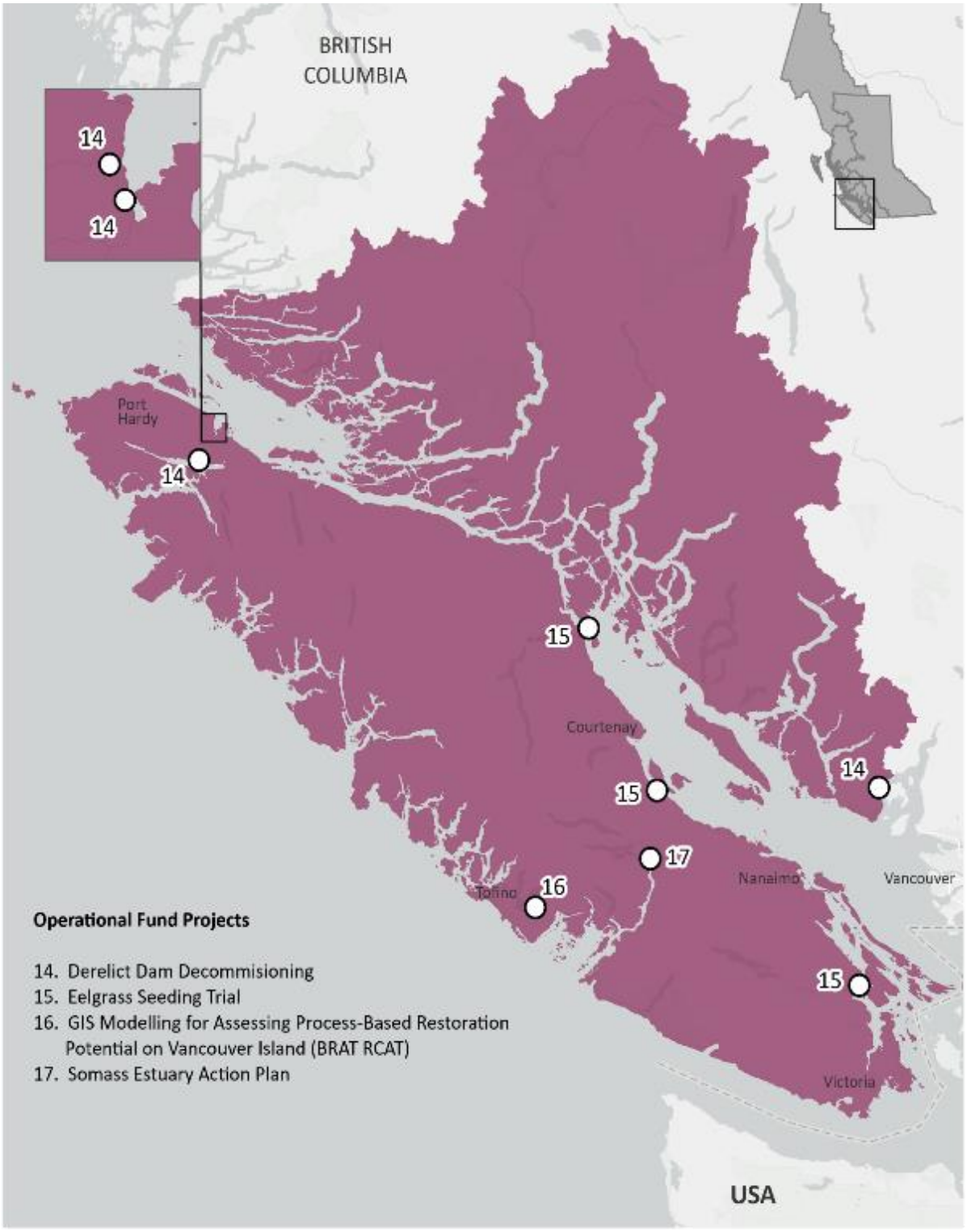
Map 5. South Coast Area Operational Fund Project Locations.



14. Derelict Dam Decommissioning Assessment

Project Lead

Kirby Rietze

Implementing Partners

Quatsino First Nation

DFO Area

South Coast

Stream/Watershed

Dakota Creek, Stephens Creek, Glenlion Creek, Tsulquate Creek

Location

Site	Coordinate
Dakota	49.51015,-123.49619
Stephens	50.60514,-127.57163
Glenion	50.71075,-127.49003
Tsulquate	50.73104,-127.50661

Introduction

Dam construction throughout the Pacific Region has significantly altered and impacted fish habitat and migration. Many historic dams are abandoned and no longer serving their intended purpose. This project investigated derelict or abandoned dams and determined if decommissioning would be beneficial. Pre project information gathering had identified a few sites and habitat assessments were required to help inform decision making.

Objectives

The project objective in this phase was to perform habitat assessments to evaluate whether old dam sites should be considered for decommissioning to remove barriers to migration and restore fish habitat.

Project Summary

Work done internally in 2022-23 had identified a number of candidate sites for dam removal (see Figures 1-3). Further desktop analysis identified four sites for further consideration. Habitat assessments were necessary to help guide decision making as to whether each respective site should be considered further for decommissioning.

The project was divided in two different areas based on geography. Three of the dam sites were on the north end of Vancouver Island and were grouped together for a single assessment due to their close proximity to each other. The fourth site was a larger watershed on the Sunshine Coast that had two potential barriers on it.

Two habitat assessment contracts were issued to evaluate the watersheds for barriers, and the quality of upstream habitat that could be made available by removal of the structures. Draft Habitat Assessment reports were issued at the end of March 2024. A bit of additional work is to be undertaken by both contractors in the spring of 2024 to fill in missing information.

Further review of habitat assessment reports will guide next steps if any of the dams pose a significant barrier for migrating salmonids, and

whether the watershed has habitat to support increased capacity. If dams are a significant barrier, future work could include dam removal if it meets approval of other stakeholders in the watershed.

Pacific Salmon Conservation Units

- Chum – Howe Sound-Burrard Inlet, Northeast Vancouver Island, Northwest Vancouver Island
- Coho-Howe Sound-Burrard Inlet, Nahwitti Lowland
- Pink – Northwest Vancouver Island, East Vancouver Island-Johnstone Strait, Nahwitti

Cost Summary

Professional Services	$80,000
Total Cost	$80,000

Outputs

Two habitat status reports have been produced by the project. The two habitat status reports are

1. Dam Decommissioning: Habitat Assessment for North Vancouver Island
2. Assessment of Barriers to Fish Migration in Dakota Creek

Proposed Work

No project funding is being accessed for 2024/25. Review and assessment of the reports may lead to decommissioning work in future years.

Further Information

Kirby Rietze
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Figure 1.Glenlion dam.

Figure 2. Stephens Creek dam.

Figure 3. Tsulquate dam.

15. Eelgrass Seeding Trial

Project Lead

Angela Spooner

Implementing Partners

- Hakai Institute
- Quadra Island Conservancy & Stewardship Society
- Mid Vancouver Island Habitat Enhancement Society

DFO Area

South Coast

Stream/Watershed

Nearshore Marine – East Coast Vancouver Island

Location

Seeding Site Location	Coordinate
Gowlland Harbour, Quadra Island	50.06661, -125.21551
Ships Point, Fanny Bay	49.48608, -124.79117
Maple Bay	48.79356, -123.60168

Introduction

Coastal eelgrass beds and estuarine meadows provide valuable habitat for Pacific salmon, prevent shoreline erosion, and sequester carbon from greenhouse gases. However, eelgrass is declining globally due to anthropogenic activities and climate change. Conventional restoration by transplanting eelgrass has mixed success, is costly and labor intensive. This project trialed the Buoy Deployed System (BuDS) eelgrass seeding method on the east coast of Vancouver Island and is the first known seeding project in the Pacific Region. Eelgrass seeding is an innovative technique to restore salmon habitat in the nearshore environment.

Objectives

Project objectives were to test the BuDS seeding technique and adapt the methodology based on lessons learned at three sites on east Vancouver Island. Sites were selected based on input from local First Nations, community groups and restoration experts.

Project Summary

Project methodology was modified from that of several BuDS projects in the US. The BuDS sets, consisting of a weight, lines and floats (Figure 1), were deployed at low tide in May/June. Two deployment methods were trialed: 1) surface deployment and 2) 1.5-m depth deployment of the BuDS net bags (Figure 2). At each site, two plots were delineated corresponding to each deployment method. Within each plot, four BuDS were set out in a 5-m x 5-m square (Figure 3).

To prepare the BuDS sets, reproductive shoot collection took place once the eelgrass seeds were ripe in late July and early August at low tide. The field crew, consisting of volunteers and DFO-RCOE staff, used snorkel gear and mesh laundry bags, to snap off the reproductive shoots near the substrate without disturbing or pulling up the rhizomes. The reproductive shoots were transported in coolers

filled with fresh seawater with rechargeable bubble aerators.

All reproductive shoots were weighed and divided equally among the BuDS sets (Figure 4), plus one additional set. This extra set was needed to estimate germination rate under controlled conditions. The divided shoots were placed into mesh onion bags for deployment (4-mm mesh, Figure 5). Reproductive shoot net bag deployment was carried out either by small metal Jon boat (using oars, electric motor or 5hP gas motor), kayak or stand-up paddleboard (SUP), with the net bags transported in a tote of sea water.

The germination rate was determined by keeping an equal mass of reproductive shoots in suitable, controlled conditions for 60 days. Seawater was replaced regularly and rechargeable aerators ran throughout the germination period. The vegetative matter was then sorted from the negatively buoyant seeds and all seeds counted. When monitoring the following spring, the germination rate is determined (seedlings/seeds per BuDS).

The seeding restoration cost per site (100-m^2) was approximately $1500 excluding water quality sampling equipment and travel-related expenses. Plot sizes will be larger for 2024-25 trials, which will provide a more accurate cost per area estimate for this innovative restoration method. This innovative pilot project will include education and community outreach to build awareness for the value of higher genetic diversity by way of eelgrass seeding to increase habitat resiliency. Based on results of this trial, and as more seeding restoration projects occur in the Pacific Region, methods will become more refined based on lessons learned.

Pacific Salmon – Conservation Units

Various CUs across the Salish Sea and east coast Vancouver Island

Cost Summary

Supplies	$2,100
Equipment	$34,739.40
Total Cost	$36,839.40

Outputs

Three sites of 110 m^2 each = 330 m^2 seeded. Approximately 1000 eelgrass seeds were released at each site. Monitoring will determine germination rates at each site.

Proposed Future Work (next steps)

Funding has been approved to expand the BuDS method to 4 larger pilot projects across the Pacific Region (2400 m^2 total), working with four First Nations. The utility of the BuDS method will be published as a Technical Bulletin in 2024.

For Further Information

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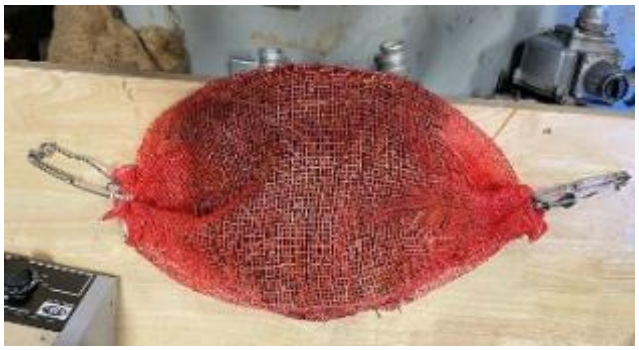
Figure 1. BuDS set-up.

Figure 2. BuDS set method at surface (left) and 1.5 m depth BuDS set (right).

Figure 3. Four BuDS sets in 5-m X 5-m plots

Figure 4. Weighing and bagging the harvested reproductive eelgrass shoots.

Figure 5. Mesh bag ready for deployment.



16. GIS Modelling for Assessing Process-Based Restoration Potential on Vancouver Island

Project Lead

Peter deKoning

Implementing Partners

Ducks Unlimited Canada

DFO Area

South Coast

Stream/Watershed

All of Alberni Inlet, Barkley Sound and Clayoquot Sound watersheds

Location

This is modelling exercise applied to West Coast Vancouver Island (Approximate Coordinate 49.05, -125.48°)

Introduction

Two existing GIS-based spatial modelling tools were adapted for use in West Coast Vancouver Island watersheds to assess condition and recovery potential of watersheds. The Beaver Restoration Assessment Tool (BRAT) was used to evaluate where within a watershed beavers could be used as an agent for restoration and stream conservation. The Riparian Condition Assessment Toolbox (R-CAT) was used to assess a watershed's riparian condition and opportunities for recovery. This mapping is being used to guide future process-based restoration implementation.

Objectives

Project objectives were to use GIS modelling tools to assess the geomorphic condition and recovery potential of watersheds on the West Coast of Vancouver Island.

Project Summary

Ducks Unlimited Canada utilized two GIS-based modelling tools to assess restoration opportunities in the Alberni Inlet and Clayoquot Sound regions. Watersheds were chosen based on interest for Chinook salmon rebuilding efforts, available data, and density of streams. Stream network, land use, topography, vegetation, precipitation and hydrology data were then pre-processed and the BRAT and R-CAT model toolboxes were run. Outputs from BRAT include existing and historic beaver dam capacity, infrastructure constraints to restoration, and stream suitability for beaver dams (Figure 1). Outputs from R-CAT include stream confinement, riparian condition assessment, and change in vegetation from 1984-2019. Outputs are being used to inform restoration planning in focal watersheds.

Pacific Salmon Conservation Units

- Chinook – West Vancouver Island-South_FA_0.x
- Chum – SW Vancouver Island, West Vancouver Island
- Coho – Clayoquot
- Coho – West Vancouver Island
- Pink – West Vancouver Island (even, odd)
- Sockeye – Great Central, Kennedy, Maggie, Sproat, West Vancouver Island

Cost Summary

Professional Services	$9,675
Total Cost	$9,675

Outputs

Maps identifying existing and historic beaver dam capacity, beaver dam complex size (existing and historic), suitability of streams to beaver dam restoration, risk to infrastructure from beaver

dams, changes in vegetation patterns from 1984-2019.

Adapted GIS tools with associated code to be used in other Vancouver Island watersheds as needed.

Proposed Work

Results from this project are being used to inform more detailed watershed restoration planning in the Tranquil Creek watershed in 2024-25 (Figure 2).

Further Information

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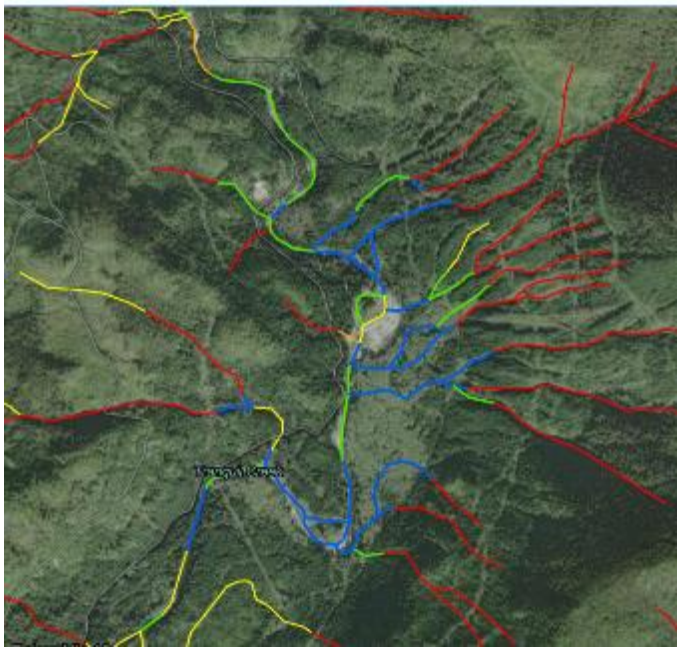

Figure 1. Existing beaver dam capacity in Tranquil Creek. Blue = 15-40 dams/km, Green = 5-15 dams/km, Yellow = 1-5 dams/km, Orange = 0-1 dams/km, Red = 0 dams/km.

Figure 2: Reaches of Tranquil Creek with high recovery potential (green) using beaver-based restoration options.

17. Somass Estuary Action Plan

Project Lead

Jenna Sutherst

Implementing Partners

West Coast Aquatic Society.

DFO Area

South Coast

Stream/Watershed

Somass Watershed

Location

Somass Estuary - Port Alberni, B.C.

Coordinate: 49.23875, -124.82151

Introduction

Healthy estuaries foster diversity and support unique fish communities through interconnected habitats such as mudflats, brackish marshes, and tidal forests. West Coast Vancouver Island (WCVI) Chinook salmon have declined in abundance since the 1980s and restoring degraded estuary habitats is important for reversing trends in WCVI Chinook populations. Located adjacent to the Somass River estuary, the community of Port Alberni is going through a process of economic diversification and transitioning away from a largely resourced-based economy. This transition provides an opportunity to highlight the significance of the Somass Estuary as an ecological asset. The timing for this project is key as the City has recently purchased the Western Forest Products sawmill lands alongside the Estuary and has decommissioned their old sewage lagoon infrastructure (improving the water quality in the Estuary). Hence there are restoration opportunities to capitalize on with the redevelopment of the sawmill lands on the east side of the Estuary and the rehabilitation and reconnection of the old sewage lagoon on the west side.

Objectives

The long-term goal of the project is development of a Somass Estuary Action Plan, which will serve as a blueprint for the implementation of values-led and community driven high priority restoration, enhancement, and conservation activities that maintain or enhance the natural functioning condition of the Estuary.

As an initial step to this achieving this goal, DFO RCOE delivered a knowledge sharing symposium, bringing stakeholders and rightsholders together to highlight the significance of the Somass Estuary.

Project Summary

In November 2023, DFO RCOE hosted a 2-day symposium in Port Alberni facilitated by West Coast Aquatic. Participants with a diversity of expertise and interests were invited to attend. Day 1 of the symposium included eight presentations that served as a foundation for discussions on Day 2. Topics included the history of the Estuary, a snapshot of its status, and a look at restoration challenges and opportunities. Day 2 included a series of participatory exercises to elicit participant knowledge on the geographic location of various values, as well as participant perspectives on the

desired future state of the estuary and possible ways of achieving that state.

The symposium closed with an acknowledgement of the contribution of all the speakers and those who gave of their time to contribute to this work. Dylan Cunningham and Jenna Sutherst of the South Coast RCOE team outlined the process for moving forward toward an Action Plan for the estuary.

Pacific Salmon Conservation Units

Sockeye, summer and fall Chinook, Chum, Coho, Pink, and Steelhead.

Cost Summary

Contract services	$33,875.00
Rental and Material	$ 749.91
Total	$34,624.91

Outputs

Project outputs are as follows:

1. Somass Estuary Symposium Summary Report.
2. Development of the Somass Estuary Action Plan working group.
3. Fostering relationships and building a common understanding of the ecological significance of the Somass River estuary.

Adaptive Management

As the symposium could not be attended by all interested and stakeholder groups, the South Coast Area RCOE team will be working with implementing partners to identify options to engage with these individuals and groups.

Proposed Work

Project work initiated with the symposium will continue via the development of the Somass Estuary Action Plan.

Further Information

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Tim Hawkins
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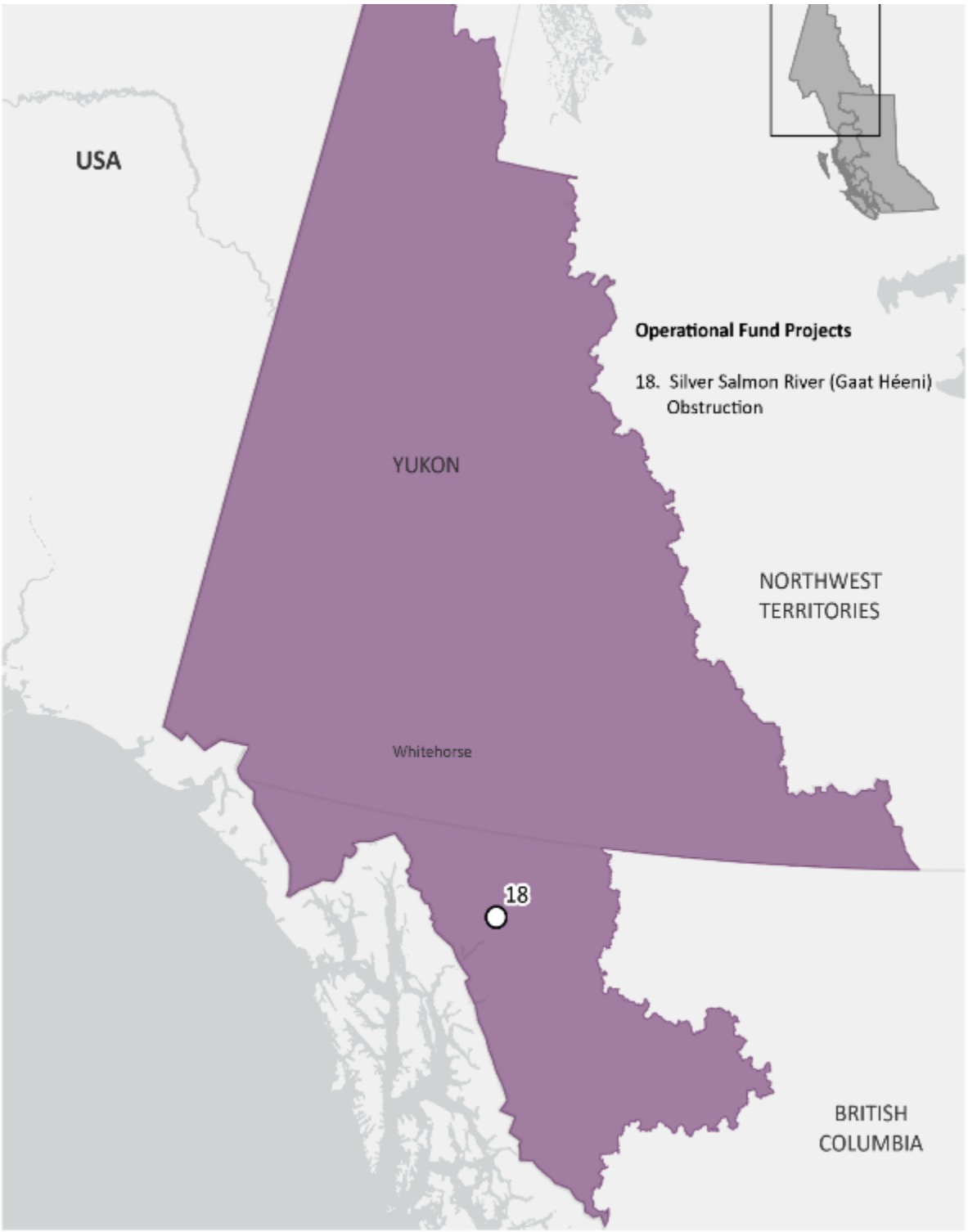
Figure 1. Somass Estuary in Port Alberni.

Map 6. Yukon Transboundary Area Operational Fund Project Locations.



18. Silver Salmon River *(Gaat Héeni)* Obstruction

Project Lead

Robin Brand

Implementing Partners

Taku River Tlingit First Nation (TRTFN)

DFO Area

Yukon Transboundary

Stream/Watershed

Silver Salmon River

Location

Helicopter access from Atlin, BC (1-hr flight).

Coordinate: 59.11518, -133.0035

Introduction

Within the headwaters of the Taku River Watershed, the Silver Salmon River is a migration corridor for sockeye salmon destined for Kuthai Lake. Kuthai historically supported an average of 2000 - 10,000 sockeye per year. Since 2007, however, returns have been markedly lower than the historical average, with as few as 13 individuals returning in 2018 and 126 in 2023. Climate change and atmospheric rivers have increased flows through the lower 700 m of the canyon (Figure 1), and shifted a series of large boulders which present a migration barrier to Kuthai Lake sockeye and contribute to the decline of this stock. Previous work and long-term observations by Taku River Tlingit (TRT) Fisheries has determined that the passage obstructions in the canyon are the main cause of the reduced returns. This canyon obstruction has been known to limit 1000-3000 sockeye per year.

Objectives

Characterize flow velocities through Silver Salmon Canyon to inform a mitigation and restoration plan in order to improve access to Kuthai Lake spawning habitat for sockeye salmon through the Silver Salmon Canyon obstruction.

Project Summary

In 2023-24, the Area team used unmanned aerial vehicle (UAV-drone) imagery to conduct surface velocity analyses of the main obstruction (Figure 2). Analysis was conducted by RCOE Fluvial Geomorphologist Matteo Saletti using large-scale particle image velocimetry methods (LSPIV, Figure 3). The LSPIV methodology was recently published as a Salmon Habitat Restoration Technical Bulletin. Gathering velocity data in this remote and highly challenging terrain was a necessary first step to developing a restoration plan to improve fish passage through Silver Salmon Canyon.

Pacific Salmon Conservation Units

- Sockeye – Kuthai
- Chinook – Taku-Mid Timing

Cost Summary

Air Charter Services	$4,500
Equipment	$1,805
Total Cost	$6,305

Outputs

Surface velocities were estimated using UAV imagery at the main obstruction and applying the large-scale particle image velocimetry analysis technique.

Future Work

This project has continued Operational Fund support for 2024-25. The team will continue to use UAVs (drones), helicopters, and remotely sensed data to assess this system. Additionally, several water level loggers and a remote weather station will be installed this spring to determine weather, water levels, and flows throughout the year. Over the next year, the team hopes to gain understanding of the range of flows under which the obstacle acts as a barrier to salmon migration, then develop and trial a remote emergency response plan and continue to support climate change vulnerability studies led by the TRTFN.

Further Information

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Figure 1. TRTFN staff accessing the Silver Salmon Canyon, 2021

Figure 2. Project crew at Silver Salmon Canyon, November 2022.

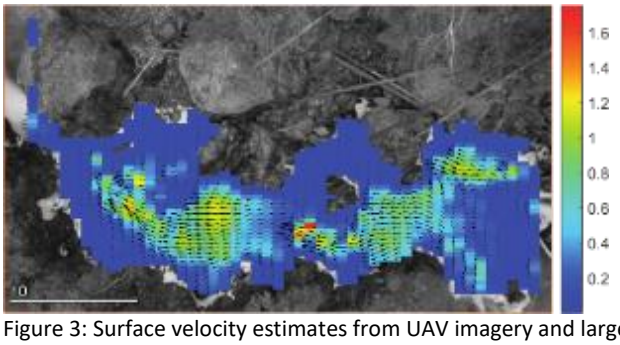

Figure 3: Surface velocity estimates from UAV imagery and large-scale particle image velocimetry analysis.