

# hiłsyaqłis

## (Tranquil Creek) Estuary

### Background:

- Tla-o-qui-aht First Nation Territory
- 30 years of industrial logging throughout watershed / log handling and storage in estuary / foreshore hardening + salt marsh dredging

### Work to Date:

- Bathymetric mapping by sonar
- ROV surveys of AOIs - log booming impact zones prioritized
- Follow up SCUBA surveys of AOIs - focus on habitat break mapping, biodiversity monitoring, assessing wood waste impacts
- Salt marsh vegetation classification and mapping
- Estuary LiDAR acquisition (2019 + 2024)
- Juvenile salmon outmigration snorkel surveys
- Water quality monitoring in estuary channels / CTD in nearshore
- Building restoration prescriptions 2025 - onward

### Contact:

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emily@reddfish.org



# səlilwətał (Tsleil-Waututh Nation) Eco-Cultural Estuary Restoration

Installment of temporary 'eco-cultural' goose enclosure fencing to prevent overgrazing and grubbing on estuarine marsh vegetation. Planting and transplanting of *Carex lyngbyei* and *Potentilla anserina* into the enclosures.

Additional building and planting of a traditional estuarine root garden focused on *Trifolium wormskioldii*, *Potentilla anserina*, and *Fritillaria camschatcensis*.

Graham Nicholas

Senior Environmental Specialist

Treaty, Lands and Resources Dept.

Tsleil-Waututh Nation

Gnicholas@twnation.ca



xʔəlilwətał (Indian River Estuary), North Vancouver, British Columbia

# West Oakland Bay – Saltmarsh Restoration (2C)

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This phased saltmarsh restoration project, with the South (bottom left) and West Lobes constructed in 2019, will see construction of the North Lobe in 2025-27. The harbor has been heavily modified for industrial purposes.

- Saltmarsh vegetation has been slow to establish
  - Lessons Learned study is informing future construction and saltmarsh veg. planting

Casey Allen

Salmon Restoration Project Manager

South Puget Sound Salmon Enhancement  
Group (SPSSEG)

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Shelton Harbor, Kennedy/Goldsborough Watershed (WRIA 14), Shelton, WA



# Estuarine Circulation study of Jetty Breaches

The main objective of the study is to develop a greater understanding of freshwater and sediment delivery to estuaries which will help to determine the efficacy of the breaches on contributing to estuary resilience to climate change. Data collection has occurred from 2023 to present with an attempt to capture seasonal flow and tidal variations and their impact on freshwater and sediment delivery.

Morgan Tidd, Geomorphologist, Salmon  
Habitat Restoration, DFO

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Sturgeon Bank – North Arm Jetty and Steveston North Jetty, Squamish River Estuary

# Eelgrass Seeding: Buoy Deployed System (BuDS)

DFO Operational Fund project over 2 years: 2023-25.

Worked with Pacheedaht, Tsleil-Waututh səliłwətał, Ka:yu:'k't'h' / Che:k'tles7et'h' (Kyuquot / Checleset) First Nations and Council of Haida Nation as well as Hakai, Quadra Island Conservancy & Stewardship Society and Mid Vancouver Island Habitat Enhancement Society. Technical Bulletin published.

DFO PSSI RCOE Coastal Habitat Restoration Biologist Contact:

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Technical Bulletin publication:

[https://publications.gc.ca/collections/collection\\_2025/mpo-dfo/Fs23-760-2025-eng.pdf](https://publications.gc.ca/collections/collection_2025/mpo-dfo/Fs23-760-2025-eng.pdf)



Seeding plots at Gordon River - Port Renfrew, BC / Gowlland Harbour - Quadra Island, BC





# Whiteman Cove Estuary Restoration Monitoring

**Background:** Whiteman Cove was reopened to the sound in early 2025 after being closed off to tidal exchange for over 70 years. The WDNR Aquatic Science Team is tracking return of functional salmon habitat to this restored pocket estuary in the Puget Sound.

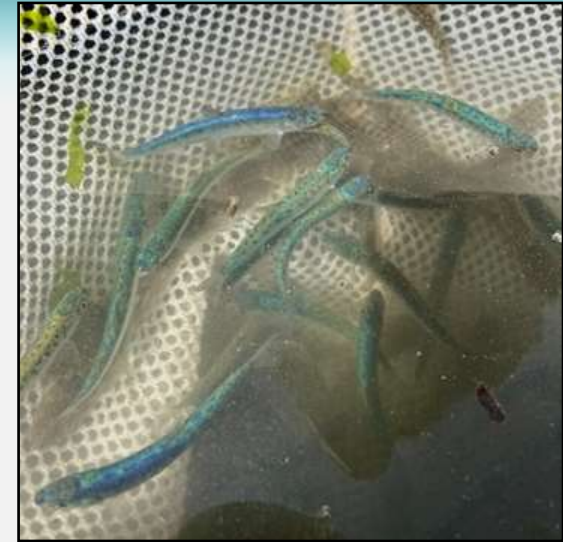
## Importance:

- Generates a reusable toolkit for tracking changes in restored habitats
- Builds partnerships (Squaxin Tribe, YMCA)
- Provides educational, outreach, and workforce development opportunities

## Monitoring toolkit:

- Sediment collection
- In/epifauna collection
- Fish seining
- Vegetation sampling
- Water quality
- Bathymetric and aerial mapping
- eDNA sampling

**Contact:** Rachel  
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## Project Timeline

Time	Condition	Monitoring	Processing
Fall 2024	Pre	Complete	x
Channel Restoration			
Winter 2025	Post	Complete	x
Spring 2025-2030	Post	Planned	x

# Duckabush Estuary Restoration

Stemming from the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP), this project restores natural estuarine process and function via **removal of anthropogenic stressors** including highway, fill, bridges, and training berms. **Reconnection of historic channels, topography restoration** and **revegetation** will occur after construction of an estuary-spanning 1,600-ft-long (490m) bridge.

Theresa Mitchell,  
Environmental Planner

Washington Department of Fish & Wildlife

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Western shore of Hood Canal near Brinnon, Washington, USA

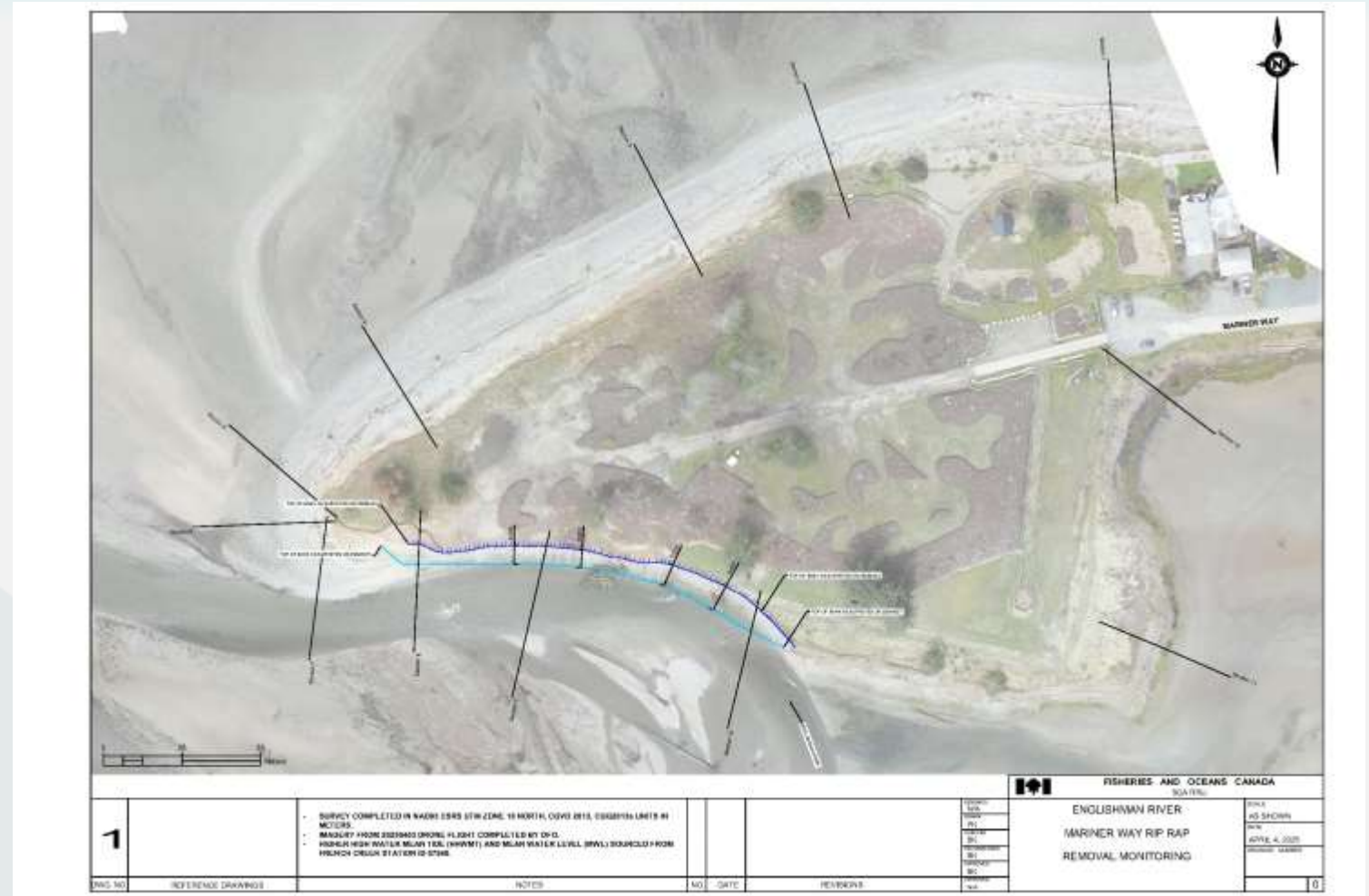


# Monitoring Englishman River Spit Restoration

DFO Restoration Specialists provided technical support to The Nature Trust at their Mariner Way Seawall removal site at the mouth of the Englishman River. The year 2 monitoring results show that the main beach and intertidal along the spit have regenerated and are stable after riprap and seawall removal. On the river side, the Englishman River is migrating into the spit, causing erosion of the right bank at a rate of 6 to 9 m per year.

Morgan Tidd, Geomorphologist, Salmon Habitat Restoration, DFO

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Mariner Way, Englishman River Estuary, Parksville, BC



# Three Crabs Estuary Restoration Project

In 2014 project partners performed a massive restoration project in the Dungeness River and Meadowbrook Creek estuary. By removing a shoreline restaurant, a derelict creosote pier, realigning a County Road, replacing and undersized County Bridge, and restoring tidal prism, the project restored fish access and tidal hydrology to 55 acres while reducing the duration of storm driven flooding on adjacent properties.



Kevin Long, Project Manager

North Olympic Salmon  
Coalition

[Projectmanager@nosc.org](mailto:Projectmanager@nosc.org)



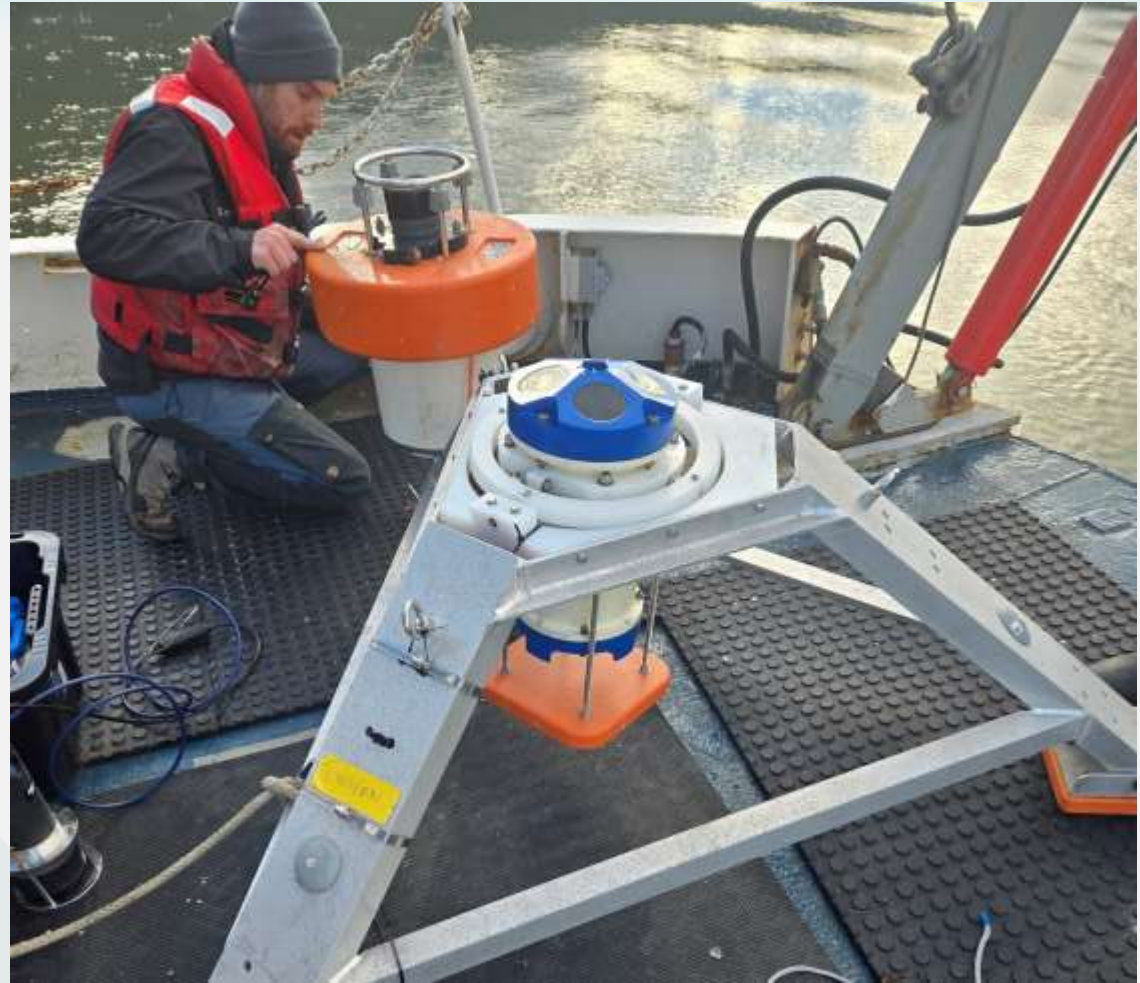
Meadowbrook Creek Estuary, Sequim, Washington

# Squamish Spit Velocity Study

This project was initiated to understand the relationship between water overtopping the Squamish Spit breach and the resulting increased currents and their impact to navigation in the Squamish Estuary. A seabed frame was deployed with a 1200 kHz Teledyne RDI Workhorse ADCP and an RBR CTD in the western vessel berth at the Squamish Terminals Port Facility for 6 months over the winter and spring months. A water level logger and barologger were also deployed at the breach.

Morgan Tidd, Geomorphologist, Salmon Habitat Restoration, DFO

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Squamish Estuary, Squamish, BC



# Vigor Urban Estuary Restoration

Vigor created a 2.64 acre “pocket estuary” along their shipyard on Harbor Island in Seattle. Long Live the Kings is partnering with Vigor and the University of Washington’s Wetland Ecosystem Team to monitor fish and insect use to evaluate the effectiveness of creating functional estuary habitat for juvenile salmon along working shorelines. Lessons learned from this project can support future restoration projects within urban waterways.

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Shaara Ainsley, Long Live the Kings,  
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Harbor Island/Duwamish Estuary, Seattle, WA

# Somass Estuary Restoration

Both Regional and Area DFO restoration staff are supporting the Somass Estuary restoration efforts. Through our OP fund internal G&C, we were able to provide funding and technical support to West Coast Aquatics to develop and update the Somass Estuary Action Plan. Technical staff have contributed to conducting LiDAR and bathymetry surveys, eelgrass mapping, geomorphic assessment of poorly function estuary channels, and advice on future restoration work.

Morgan Tidd, Geomorphologist, Salmon Habitat Restoration, DFO

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Somass River Estuary, Port Alberni, BC



# Sturgeon Bank Sediment Enhancement Pilot Project

Ducks Unlimited Canada and partners are beneficially re-using dredged sediment to restore tidal marsh and support coastal flood protection in Richmond, BC. This pilot project aims to demonstrate how to re-use dredged sediment, with potential broader application throughout the Fraser Delta. Three years of sediment addition have been complete, with a fourth addition planned for fall/winter 2025.

Eric Balke  
Ducks Unlimited Canada  
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Sturgeon Bank, Fraser River Estuary, British Columbia

# Smith Island Restoration Project

Setback dike construction and removal of old dike to re-establish historic tidal marshlands that provide critical habitat for threatened Chinook salmon and other salmon species.

## **Snohomish County Department of Conservation and Natural Resources**

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Smith Island, Snohomish River Estuary, Everett, WA



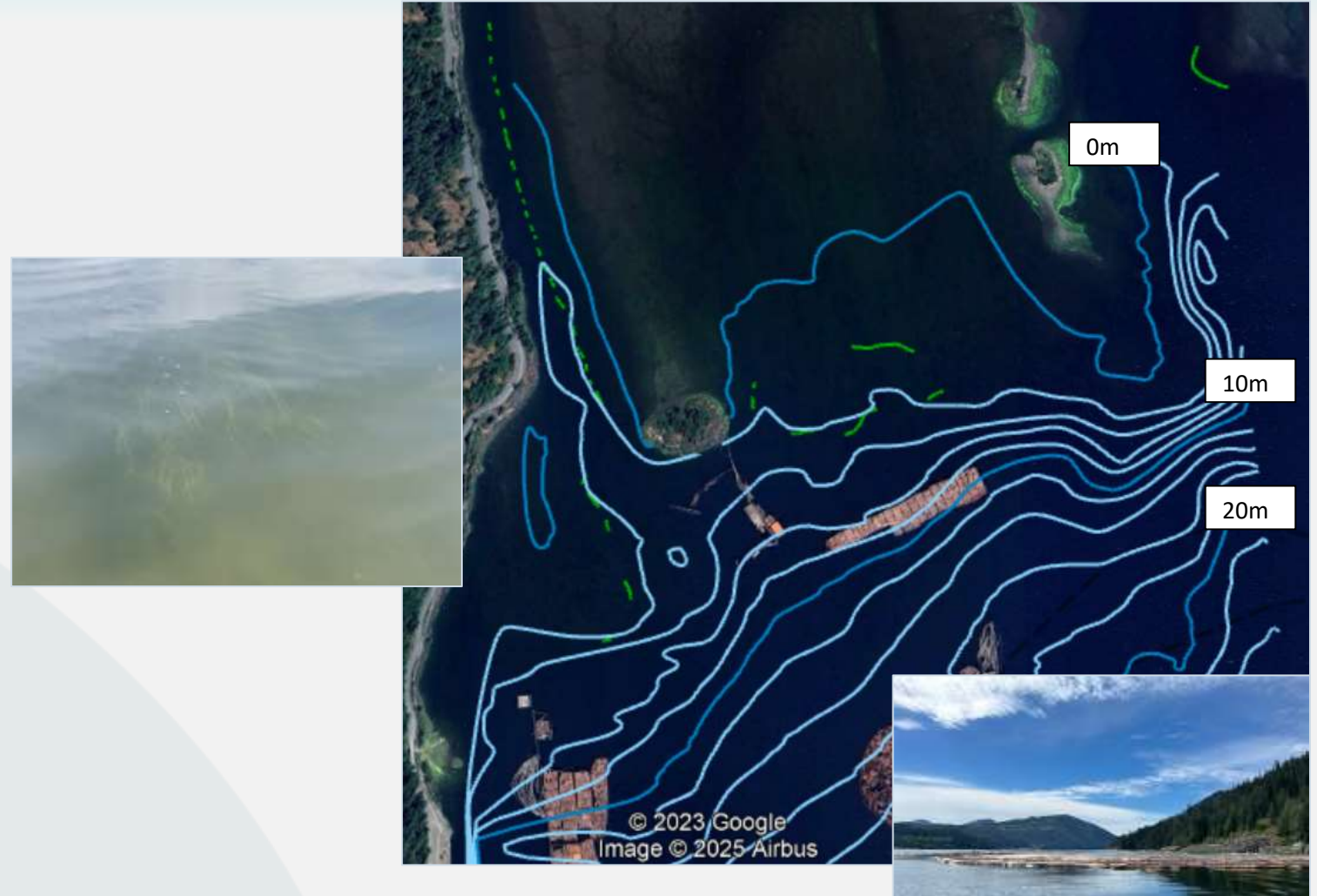
# Somass Estuary Action Plan: Eelgrass Mapping

The Somass Estuary Action Plan Working Group co-developed the Somass Estuary Restoration Action Plan. One priority action was eelgrass mapping.

Goal to document bed extent changes and identify log booming lease areas in eelgrass prone areas that can be retired or exchanged. Water clarity has challenged mapping; to date only bed shallow boundaries mapped.

DFO PSSI RCOE South Coast Area Contact:

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Port Alberni - Somass Estuary, Vancouver Island, BC

# Frenchies Island Invasive Cattail Management

From 2019 to 2022, Ducks Unlimited Canada and Asarum Ecological Consulting implemented a 4-year 2 ha adaptive management experiment to determine effective ways in which to eradicate non-native cattails (*Typha angustifolia*, *T. x glauca*) in a previously restored tidal marsh island.

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Frenchies Island, South Arm Marshes Wildlife Management Area, Richmond, BC



# Stavis NRCA Pocket Estuary

A bulkhead and buildings were removed and tidal marsh habitat was restored to naturalize the creek and shoreline.

Tom Smayda PE  
SEA Inc.  
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Stavis Natural Resource Conservation Area, Hood Canal, Washington, USA  
Before and after construction



# Nanaimo River Chinook Rebuilding Plan Early Action: Eelgrass Mapping & Restoration

Work involved Snuneymuxw First Nation, SeaChange Marine Conservation Society & DFO funded by Salish Sea Initiative.

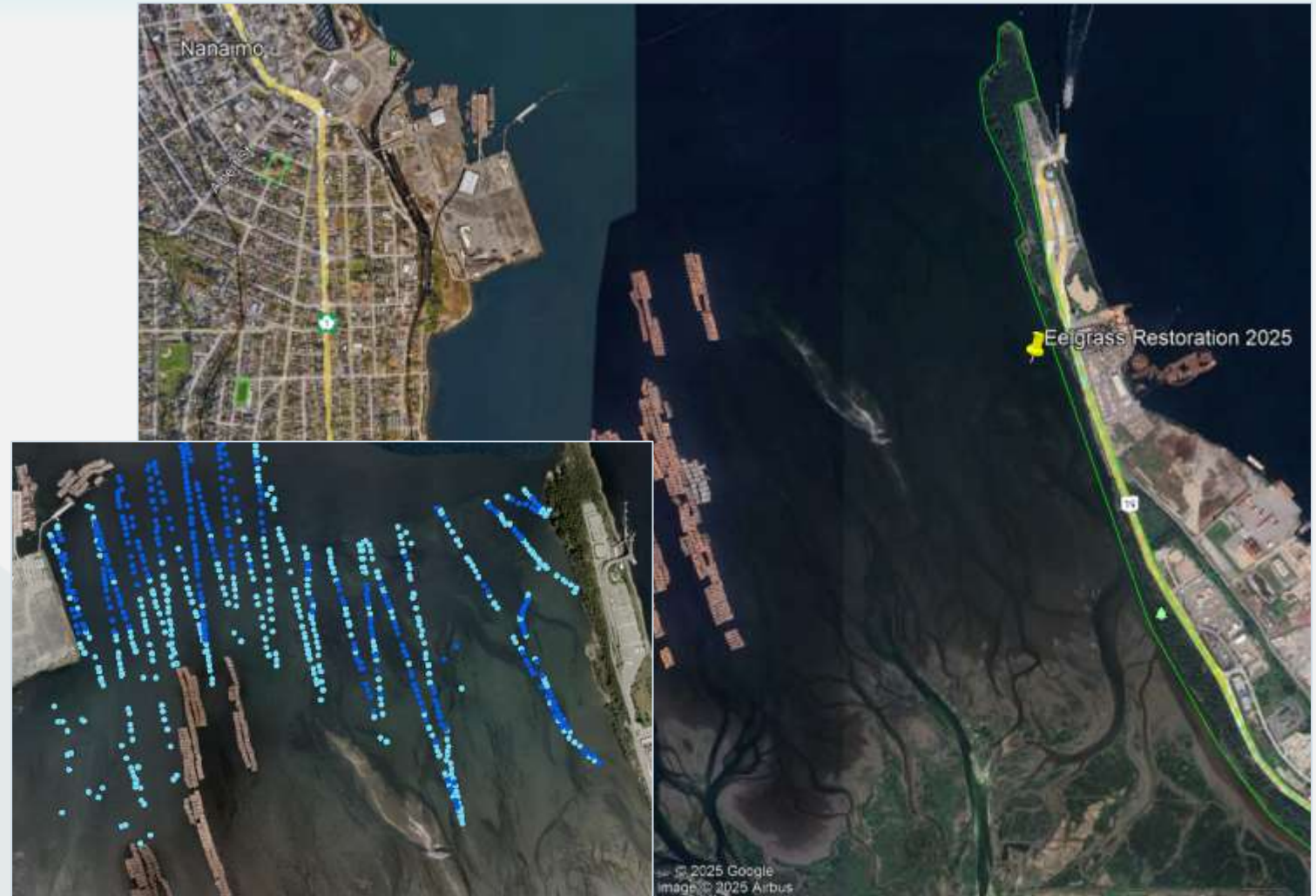
**Addressing Historical Habitat Loss & Cultural Identity** - The estuary has experienced decades of industrial impact. This work helps reverse that legacy and aligns with Snuneymuxw's priorities for ecosystem healing and support the Nation's longstanding connection to the estuary, a place of deep cultural, ecological, and spiritual significance.

Snuneymuxw First Nation Contact:

John White or Kali Brauckmann

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Nanaimo River Estuary, BC



# Lower Fraser Centre for Collaboration and Cooperation

The Fraser River Estuary is in **crisis** because of major industrialization and urbanization in the last century, and current restoration efforts amount only to a managed decline of what's left. **The only way to bring the ecosystem back to the way it was is by establishing a coordinated, fully-funded, regional management model** that brings together First Nations, all levels of government, NGOs, industry, stakeholders and academia.

**Contact:**

Murray Ned, Executive Director, Lower Fraser Fisheries Alliance.

Murray.Ned@lffa.ca



For more information go to: [lffa.ca/centre-for-collaboration](https://lffa.ca/centre-for-collaboration)

# Dianne Sanford

## Sunshine Coast Friends of Forage Fish

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We are a volunteer citizen science group, a part of the Coastal Forage Fish Network, and are located on the lower Sunshine Coast.

Our goal is to find Pacific Sand Lance or Surf Smelt eggs, thus identifying their spawning grounds for mapping.



Volunteers sampling at a beach in Sechart, using the vortex unit for the final stage of winnowing down our sample size. From that, the reduced sample is checked via microscope for actual eggs.



# Blue Heron Slough Estuary/Conservation Bank

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ESA continues to help the Wildlands and the Port of Everett in monitoring this estuary restoration project completed in 2022. This is a Natural Resources Damages mitigation offset site and is approved for Chinook Conservation Credits. It is a 364-acre site with four breaches and a distributary channel.

Sky Miller, PE and Habitat Engineer of Record  
Environmental Science Associates (ESA)  
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smiller@esassoc.com



Snohomish River Delta  
Everett, WA

# Woods Island Marsh Habitat Restoration

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Tidal marsh habitat has been better connected to the Fraser River by widening existing channels, removing invasive cattail, and planting native riparian species to improve habitat for outmigrating juvenile salmon and other fish.

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Raincoast Conservation Foundation Contact:  
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Fraser River, Richmond, British Columbia



# San Juan Estuary Restoration for Juvenile Salmonids

Restoration of salt marsh and eelgrass elevations that were altered by the forest industry.

2.1 hectares of marsh restored in seven locations

0.2 hectares of eelgrass restored in three locations.

Tidal connectivity restored in four locations

Helen Jones

Fisheries Manager

Pacheedaht First Nation

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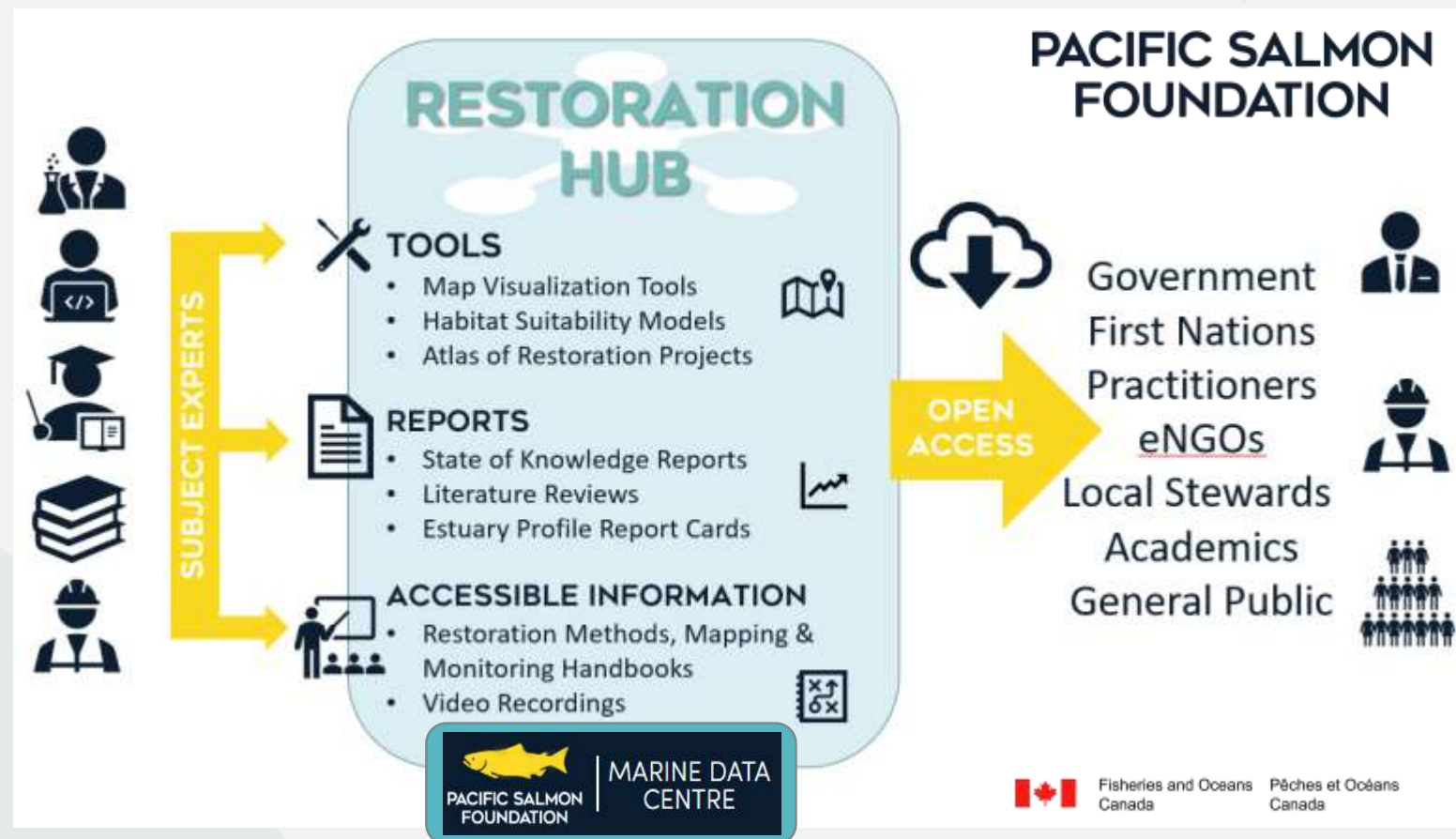


San Juan and Gordon River watersheds, Port Renfrew, BC

## Greening the Salish Sea: Decision Support Tools for Successful Pacific Salmon Habitat Recovery

PSF's Marine Science Program is leading a project to create a **Restoration Resource Hub** of open-access informative resources and decision-support tools to guide and help co-ordinate adaptive nearshore habitat restoration approaches and strategies. The program is supported by DFO's Aquatic Ecosystem Research Fund.

Nicole Christiansen, Project Manager  
Pacific Salmon Foundation  
nchristiansen@psf.ca



An online resource hub for restoration practitioners that is accessible to all!

Key products include State of Knowledge and practitioner guidebooks for kelp, salt marsh, and eelgrass, habitat suitability maps and more to foster better informed restoration.



# Sturgeon Bank Sediment Enhancement: Wave Monitoring

Led by Ducks Unlimited Canada, sediment was placed along Sturgeon Bank using a nature-based approach to restore tidal marsh habitat.

Wave data will help understand natural sedimentation processes and inform future phases of the project.



DFO Restoration Centre of Expertise contact:  
[max.scruton@dfo-mpo.gc.ca](mailto:max.scruton@dfo-mpo.gc.ca)



Sturgeon Bank, Fraser River Estuary



Fisheries and Oceans  
Canada

Pêches et Océans  
Canada



Pacific Salmon  
Strategy Initiative

Initiative de la Stratégie  
relative au saumon du Pacifique

# Restoring tidal marshes degraded by Canada Goose herbivory

Focus on channel-edge Lyngbye's sedge marsh (*Carex lyngbyei*)

Installing fences using natural materials to protect degraded areas and plantings (*Carex* transplants and nursery pots) from grazing

Working in partnership with First Nations for restoration and goose mitigation, including egg addling and food harvests

## Guardians of our Salish Estuaries (GooSE)

- Tim Clermont, Executive Director  
timclermont@shaw.ca
- Dominic Janus, Project Manager  
dominic.janus@gmail.com
- Jay Baker-French (Restoration Ecologist)  
jaybakerfrench@gmail.com



Locations: Salish Sea estuaries (Campbell River, K'omoks, Qualicum, Parksville, Nanaimo, Chemainus, Esquimalt, Victoria, Tla'amin)



# Boundary Bay Tidal Marsh Restoration Project

In 2023, Ducks Unlimited Canada with the support of Asarum Ecological Consulting restored ~1.5 ha of tidal marsh in Boundary Bay by removing large accumulations of human-modified woody debris and garbage that smothered vegetation. Non-contaminated wood was repurposed as biofuel and mulched for landscaping.

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Eric Balke  
Ducks Unlimited Canada  
[e\\_balke@ducks.ca](mailto:e_balke@ducks.ca)



Boundary Bay, Delta, BC

# Dyke Road Park Shoreline Restoration

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Lead by Comox Valley Project Watershed & CVRD with K'omoks Nation and GooSe partnerships. This is a DFO Aquatic Ecosystem Restoration Funded project.

DFO Aquatic Ecosystem Restoration Contact:  
Patty Menning@dfo-mpo.gc.ca

Comox Valley Project Restoration Contact:  
Caitlin Pierzchalski  
caitlin.pierzchalski@projectwatershed.ca



Comox Estuary, Vancouver Island, BC



# Monitoring of the Morrison Creek Tributary Barrier Removal Project

The Monitoring and Evaluation of Salmonid Habitat Restoration team conducted pre-treatment and post-treatment (3 years post-project) monitoring at Rawson Creek, tributary to Morrison Creek, tributary to the Smith River. A culvert was replaced with a bridge with natural channel bottom. Juvenile Coho Salmon were observed above the project after construction validating successful passage.

Christine Ramsey, California Department of Fish and Wildlife [ChrisRamsey@wildlife.ca.gov](mailto:ChrisRamsey@wildlife.ca.gov)



Before: Undersized culvert blocking Coho Salmon passage.

Photo Credit: N. Harris, Fishery Biologist, Pacific States Marine Fisheries Commission



After: Thirty-foot spanning bridge with a natural channel bottom.

Photo Credit: K. Roberts, Fishery Biologist, Pacific States Marine Fisheries Commission



Map from Smith River Alliance

Smith River, Crescent City, California

# Capitol Lake - Deschutes Estuary Restoration

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The project will:

- Remove 5<sup>th</sup> Ave Dam & replace with new bridge to restore Capitol Lake to a tidal estuary
- Dredge the historic river channel
- Use fill to create wetland habitat edges and islands
- Build a horizontal levee or habitat berm to protect downtown from sea level rise

Lindsey Sheehan, ESA,  
[Lsheehan@esassoc.com](mailto:Lsheehan@esassoc.com)



Deschutes Estuary, Olympia, WA



# Spartina Eradication Program

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DUC leads the ongoing *Spartina* Eradication Program, which is working towards the eradication of three species of non-native perennial, salt-tolerant cordgrasses invasive to the Pacific Northwest:

- *Spartina anglica* (English cordgrass)
- *Spartina densiflora* (dense-flowered cordgrass)
- *Spartina patens* (salt meadow cordgrass)

Taylor Marriott  
Ducks Unlimited Canada  
t\_marriott@ducks.ca



*Spartina anglica* is marked by a survey crew in the southern Mud Bay salt marsh, Fraser River Estuary, BC.

# Discovery Bay Estuary Restoration Project

Since 2008 project partners have implemented multiple projects to address the impacts of abandoned railroad grade infrastructure from the Salmon and Snow Creek Estuaries. A large scale “undevelopment project”, the work has restored over, 65 acres and nearly 2 miles of shoreline.



Kevin Long, Project Manager

North Olympic Salmon  
Coalition

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Discovery Bay, Port Townsend, Washington



# zis a ba Estuary Restoration

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ESA continues to help the Stillaguamish Tribe lead estuary restoration for the delta. Phase 1 was a complete success with native revegetation within the first year and immediate salmon use. Phase 2 is under construction this summer. The final Phase 3 is under design.

Daniel Elefant, PE

Environmental Science Associates (ESA)

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Stillaguamish River Delta, Stanwood, WA

# Woodward Dam Breaches

In 2021, Ducks Unlimited Canada led the construction of three breaches in the Woodward Training Dam to enhance access for migrating juvenile salmon to critical intertidal marsh habitat in the South Arm Marshes Wildlife Management Area in the Fraser Estuary.

Eric Balke  
Ducks Unlimited Canada  
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Woodward Island, South Arm Marshes Wildlife Management Area, Richmond, BC



# Resilient Coasts for Salmon

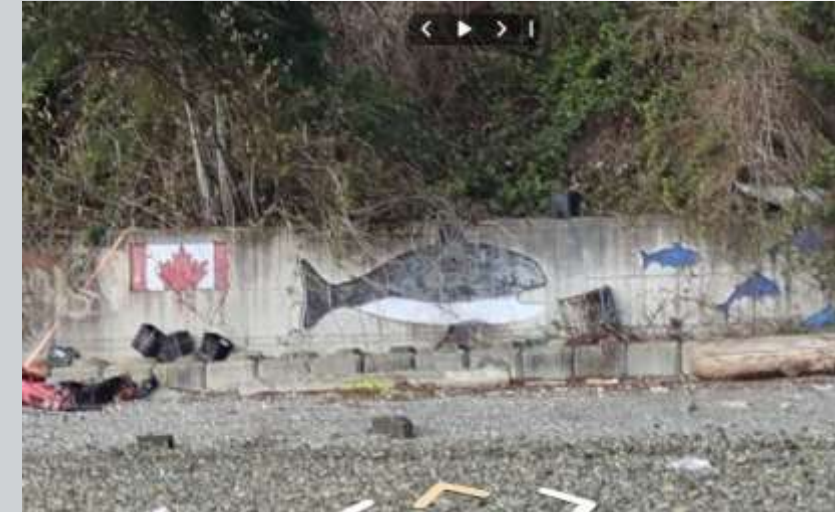
The Resilient Coasts team has collected shoreline data on the east coast of Vancouver Island, specifically focusing on tracking the extent of hard modifications (e.g. sea walls, groynes, docks), overwater structures (e.g. residential docks, ferry terminals, marinas) and log accumulation on the beaches of coastal communities. Data will be released publicly in December 2025.

Resilient Coasts is funded in part by the Government of Canada.

Kyla Sheehan (she/her)  
Pacific Salmon Foundation

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[Resilientcoasts.ca](https://Resilientcoasts.ca)



East coast of Vancouver Island (Victoria to Port McNeill), B.C.

# Duwamish River People's Park and Shoreline Habitat

~14 acres (5.6 ha) of estuarine marsh, intertidal mudflat, shoreline restoration, and public access.

Largest estuarine restoration project on the Duwamish River to-date.

Provides off-channel foraging during high tide for Pacific salmonids and other migratory and resident fish species.

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Jenn Stebbings, Port of Seattle  
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Lower Duwamish River; Green-Duwamish River Watershed; Seattle, Washington



# Little Squalicum Park Estuary Restoration

- Reclaimed lost aquatic land near heavily developed industrial waterfront - through creating a new estuary
- Very near Nooksack River mouth in Bellingham Bay
- Newly created 2.4-acre estuary with increased riparian and saltmarsh habitats
- Juvenile salmon have been observed in the estuary in first year after construction
- Included beneficial reuse of sediment for forage fish beach spawning enhancement

Gabriel García Medina, PhD, PE

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North Bellingham Bay, Washington, USA



# Ghost Gear Fund: Lower Fraser River fishing gear retrieval projects

From 2021-2023 DFO's Ghost Gear Fund supported 4 projects in the Lower Fraser River to survey, recover, and responsibly recycle and/or dispose of abandoned, lost or discarded fishing gear (ALDFG or ghost gear).

Lower Fraser Fisheries Alliance (LFFA) surveyed the river by vessel and retrieved visible in-water nets by hand, and subtidal crab traps by grapple.

Fraser River Sturgeon Conservation Society conducted overhead surveys of the river by helicopter and retrieved visible nets from vessel.

Lisa Hedderson, Regional Ghost Gear Coordinator (DFO),

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[www.Canada.ca/ghostgear](http://www.Canada.ca/ghostgear)



Lower Fraser Fisheries Alliance

Lower Fraser River (from the estuary upstream to Hell's Gate, British Columbia)



# Klamath Basin Integrated Fisheries Restoration and Monitoring Plan

Seven years of **process-based, science-driven** and **participatory restoration planning** to answer:

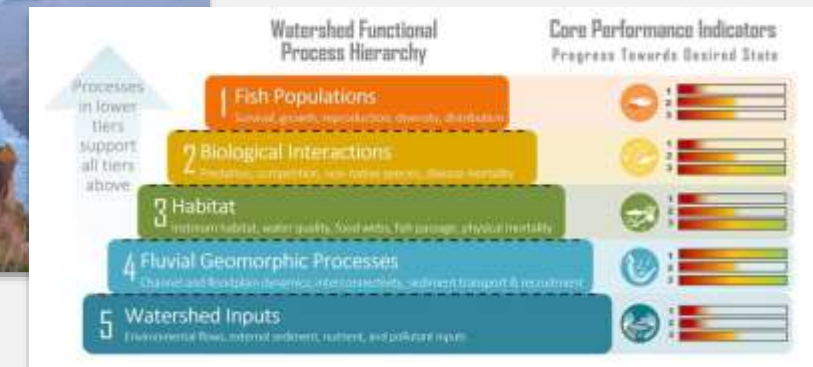
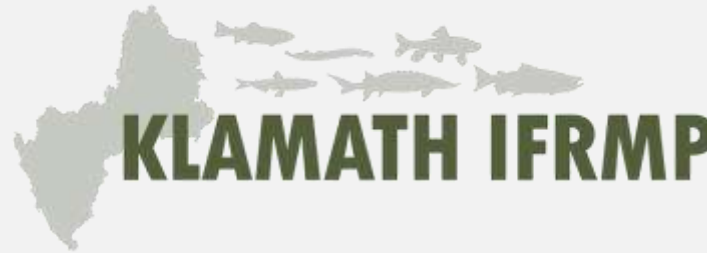
- Which restoration actions will provide the **broadest possible benefits** to functional watershed processes and native focal fish species, including coho and Chinook salmon and steelhead?

Developed and applied a **reproducible, transparent** and **systematic** multi-criteria restoration prioritization tool and provided monitoring recommendations

Nataschia Tamburello, Mairin Deith  
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ESSA technologies Ltd.



Klamath Basin, south-central Oregon and northern California

# Factors Influencing the Resilience of Created Tidal Marshes in the Fraser Estuary

Ducks Unlimited Canada and Asarum Ecological Consulting surveyed 78 tidal marsh creation projects throughout the Fraser Estuary and determined some of the underlying factors that determine project outcomes. This study offers insight into the role that site design and location play in the outcome of marsh creation projects, and the challenges presented by stressors and environmental change in the estuary. Findings were summarized in a technical report and journal publication in *Wetlands*.

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Eric Balke  
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Technical report (2022) and journal publication (2024) that resulted from this collaborative study.



# Port Susan Bay Restoration Project

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Project improves connectivity between river and tidal marsh, access to habitat for juvenile salmonids, and establishment of a diverse set of brackish estuary plant species.

Contact:

Haley Tupen, PE

Environmental Science Associates

Htupen@esassoc.com



Active delta of Stillaguamish River (Hat Slough) at Port Susan Bay, near Stanwood, WA

# Duwamish River People's Park and Shoreline Habitat

~14 acres (5.6 ha) of estuarine marsh, intertidal mudflat, shoreline restoration, and public access.

Largest estuarine restoration project on the Duwamish River to-date.

Provides off-channel foraging during high tide for Pacific salmonids and other migratory and resident fish species.

Kathleen Hurley, Port of Seattle  
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Jenn Stebbings, Port of Seattle  
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Lower Duwamish River; Green-Duwamish River Watershed; Seattle, Washington



## Elevation Targets for Intertidal Plant Communities in the Comox Estuary

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The Dyke Road Park project in Comox Valley Regional District followed a design process to identify elevation targets for intertidal plant communities (sedge, rush, and riparian). Elevation is critical for supporting intertidal marshes and restoring fish habitat values.

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Dyke Road Park, Comox, BC



# Duckabush Estuary Restoration Project

This project will reconnect the Duckabush River to adjacent wetlands by replacing the US 101 causeway with an elevated bridge, and restoring estuarine habitat.

Combining a major infrastructure project with habitat restoration involves a complex partnership between Federal, State, and local agencies.

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Duckabush River, Hood Canal - Brinnon, WA, USA