Salmon Recovery Funding Board Meeting Agenda

WASHINGTON STATE
RECREATION AND CONSERVATION OFFICE
Salmon Recovery Funding Board

Update 5/11/2023
May 23-24, 2023
Hybrid

Location In-Person: Room 172, First Floor, Natural Resources Building, 1111 Washington Street, SE, Olympia, WA. This public meeting location will allow for the public to provide comment and listen to the meeting as required by the Open Public Meeting Act. This requirement can be waived via HB 1329 if there is declaration of emergency or if an agency determines that a public meeting cannot safely be held. If an emergency occurs, remote technology will be used instead.

Location Virtually: https://us06web.zoom.us/webinar/register/WN_1y2diV2QnKygMoQzZN5fQ

Phone Option: (669) 900-6833 – **Webinar ID:** 895 4992 6523

**Additionally, RCO will record this meeting and would be happy to assist you after the meeting to access the recording.*

Order of Presentation: In general, each agenda item will include a staff presentation, followed by board discussion. The board only makes decisions following the public comment portion of the agenda decision item.

Public Comment: General public comment is encouraged to be submitted in advance to the meeting in written form. Public comment on agenda items is also permitted. If you wish to comment, you may e-mail your request or written comments to Julia.McNamara@rco.wa.gov. Comment for these items will be limited to 3 minutes per person.

COVID Precautions: Masking is not required at this meeting. Masks and hand sanitizer will be available. The meetings rooms will be set to allow for as much social distancing as possible and air purifiers will be placed throughout.

Special Accommodations: People with disabilities needing an accommodation to participate in RCO public meetings are invited to contact Leslie Frank by phone (360) 902-0220 or e-mail Leslie.Frank@rco.wa.gov.

Tuesday, May 23, 2023

SALMON RECOVERY FUNDING BOARD SITE TOUR- NISQUALLY WATERSHED LEAD ENTITY

8:15 a.m.	**Meet at the DoubleTree by Hilton** *415 Capitol Way N, Olympia, WA 98501* • Review and Approval of Agenda • Van Loading • Drive to next site • 8:30 Departure	*Chair Breckel*
9:00 a.m.	**Nisqually Culture Center, sxʷ daʔ dəb** *18815 Old Mounts Road SW, Dupont, WA 98327* • Welcome and Introductions • Overview of Nisqually Estuary Restoration • Depart at 10 a.m.	*David Troutt &* *Willie Frank* *Christopher Ellings*
10:20 a.m.	**Nisqually Tribe Kalama Creek Hatchery** *Church Kalama Road* • Overview of Facility Update and Rebuild • Depart at 10:50 a.m.	*David Troutt*
11:20 a.m.	**Miller Property** *22012 Hobson Road SE, Yelm, WA 98597* • Overview of Nisqually River Protection and Restoration • Depart at 11:50 a.m.	*Jeanette Dorner*
12:30 p.m.	**Mill Pond Park and Smallwood Park** *101 Alder Street E, Eatonville, WA 98328* • Working Lunch • Overview of Nisqually Community Forest • Overview of Mashel Logjams • Depart Destination at 2:10 p.m.	*Kirk Hanson* *Brian Combs* *& Kyle* *ODriscoll*
2:00 p.m.	**Ohop Creek** *Peterson Road, Eatonville, WA 98328* • Overview of the Ohop Creek Restortation • Adaptive Management Process	*Brian Combs &* *Kyle ODriscoll* *David Troutt*

	• Closing Remarks • Depart Destination at 3:00	
4:00 p.m.	**RECESS** *415 Capitol Way N, Olympia, WA 98501* • **Arrive at DoubleTree Hotel and Recess meeting**	*Chair Breckel*

Wednesday, May 24, 2023

OPENING AND MANAGEMENT REPORTS		
9:00 a.m.	**Call to Order** • Roll Call and Determination of Quorum • Review and Approval of Agenda ***(Decision)*** • Approval of March Meeting Minutes ***(Decision)*** • Remarks by the Chair	*Chair Breckel*
9:15 a.m.	**1. Director's Report** A. Director's Report B. Legislative and Policy Update C. Fiscal Update (written only) D. Performance Report (written only)	 *Megan Duffy* *Brock Milliern* *Mark Jarasitis* *Bart Lynch*
9:45 a.m.	**2. Salmon Recovery Management Report** A. Governor's Salmon Recovery Office Report B. Salmon Section Report	 *Erik Neatherlin* *Jeannie Abbott* *Tara Galuska* *Marc Duboiski*
10:15 a.m.	**General Public Comment for items not on the agenda:** *Please limit comments to 3 minutes.*	
10: 30 a.m.	**BREAK**	
10:45 a.m.	**3. Partner Reports** • Council of Regions • WA Salmon Coalition • Regional Fisheries Enhancement Groups	 *Alex Conley* *Mike Lithgow* *Lance Winecka*
BOARD BUSINESS: DECISION		
11:15 a.m.	**4. Targeted Investment Policy Decision**	*Nick Norton*
12:00 a.m.	**LUNCH**	
BOARD BUSINESS: REQUEST FOR DIRECTION		
1:00p.m.	**5. Match Policy Options Assessment**	*Nick Norton*
BOARD BUSINESS: DECISION		
2:00 p.m.	**6. Monitoring Update** • Monitoring Panel • Adaptive Management Process	*Keith Dublanica &* *Pete Bisson*

2:30 p.m.	**BREAK**	
2:45 p.m.	**7. Funding Allocations** • 2023 Grant Round • 2023-2024 Capacity Funding • 2023 Targeted Investment Funding Allocation • 2023 Monitoring Funding Allocation • 2023-2025 Cost Increase Fund	*Marc Duboiski, Jeannie Abbott, Keith Dublanica*

BOARD BUSINESS: BRIEFING

3:45 p.m.	**8. Watershed Restoration and Enhancement Plan Update**	*Lauren Burnes, Kat Moore, Watershed Review Member*
4:30 p.m.	**9. Partner Reports** • Conservation Commission • Department of Ecology • Department of Natural Resources • Department of Fish and Wildlife • Department of Transportation	 *Ron Schultz* *Annette Hoffmann* *Tom Gorman* *Jeremy Cram* *Susan Kanzler*
5:00 p.m.	**ADJOURN**	

Next meeting: September 13-14, 2023, Room 172 Natural Resources Building, 1111 Washington Street SE, Olympia, WA 98501

Related PRISM Projects

Nisqually Estuary Restoration, #00-1857
Nisqually Est/Red Salmon Slough Rest, #02-1552
Nisqually NWR Restoration, #07-1901
Red Salmon Slough Levee Removal, #09-1775
Nisqually Estuary Restoration Monitoring, #13-1583

Investments

SRFB Funded: $2.7 million
Leverage/Match: $3.6 million

ESA/Tribally Important Species

Chinook salmon
Chum salmon
Coho salmon
Pink salmon

Project Funders

Ducks Unlimited
EPA
Estuary & Salmon Restoration Program
National Fish and Wildlife Foundation
Nisqually Indian Tribe
NOAA
Puget Sound Acquisition and Restoration
Salmon Recovery Funding Board

Project Partners

Nisqually Indian Tribe
US Fish & Wildlife Service
National Refuge System
Ducks Unlimited

Nisqually River Delta

Recovery and Resilience

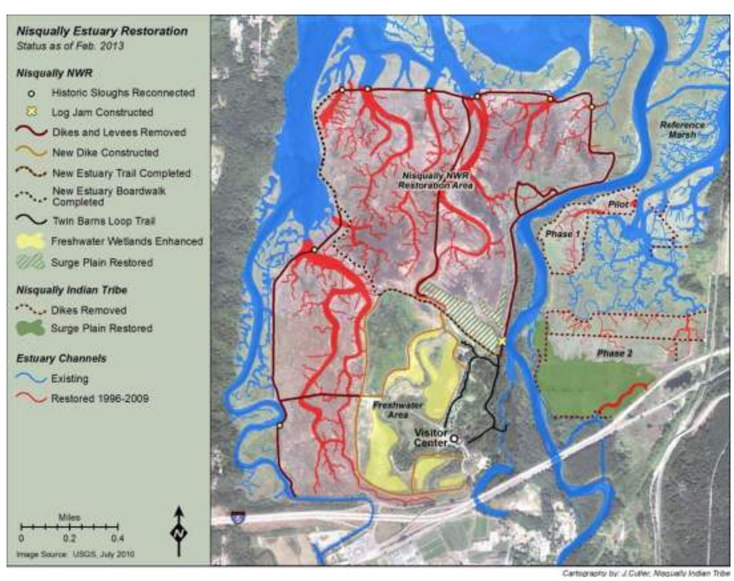
The historical Nisqually River Delta totaled approximately 3000 acres and was comprised of diverse estuarine habitats like salt marsh and freshwater that was the backbone of Nisqually salmon productivity and the Nisqually Indian Tribe's fisheries. The estuary was forever altered in the 1900s by the construction of miles of dikes to keep out the tides in order to change salt marsh meadows into pasture. Additionally, the construction of the I-5 causeway through the heart of the Nisqually Delta effectively disconnected large portions of the delta from the Nisqually River floodplain. Despite the impairments, the Nisqually Delta was saved from large scale industrialization by a grassroots movement in the 1970s and was eventually included in the the US Fish and Wildlife Service, National Wildlife Refuge System. This effectively stopped the threat of irreparable development in the Delta and allowed for a re-envisioning of the future of the Nisqually River Delta and it's critical estuarine habitats. With the listing of Puget Sound Chinook as threatened under the Endangered Species Act in 1999 and the development of the Nisqually Chinook Recovery Plan by the Nisqually Indian Tribe, renewed focus spurred one of the most ambitious estuary recovery efforts to date in the Salish Sea.

The return of tidal inundation to over 750 acres of the Billy Frank Jr. Nisqually National Wildlife Refuge in fall of 2009 was the crowning moment in the effort to protect and restore the Nisqually Delta. The Nisqually NWR project complemented three earlier restoration projects completed by the Nisqually Indian Tribe to restore over 900 acres of the estuary, representing one of the most significant advances to date towards the recovery of Puget Sound.

The Nisqually Indian Tribe and U.S. Geological Survey (USGS) have been monitoring the response of the Nisqually Delta to estuary restoration for nearly 20 years. The projects have effectively increased the carrying capacity for juvenile salmon, especially Chinook salmon, by increasing space and prey resources. Surprisingly, these capacity benefits have accrued to not only Nisqually Chinook but also Chinook from as far away as North Puget Sound with over 25% of the tagged hatchery Chinook captured coming from outside the Nisqually River.

Ultimately, the long-term outlook for the Nisqually River Delta and it's estuarine habitats depends on continued sediment supply from the watershed and the wetland response to sea level rise. In order to better connect the Delta with the Nisqually River to increase sediment delivery and climate resilience, the Nisqually Indian Tribe is working with Washington Department of Transportation and others on a plan to elevate large portions of I-5. This will enable the River to spread it's invaluable sediment throughout the Delta during flood flows while also enabling estuarine habitats to migrate up-valley as sea levels continue to rise. The project will also decrease flood risk to I-5 and area residents.

The broad based partnerships led by the Nisqually Indian Tribe to implement science based restoration plans will ensure that the Nisqually River Delta continues to be productive and resilient for generations to come.



Ohop Valley Recovery

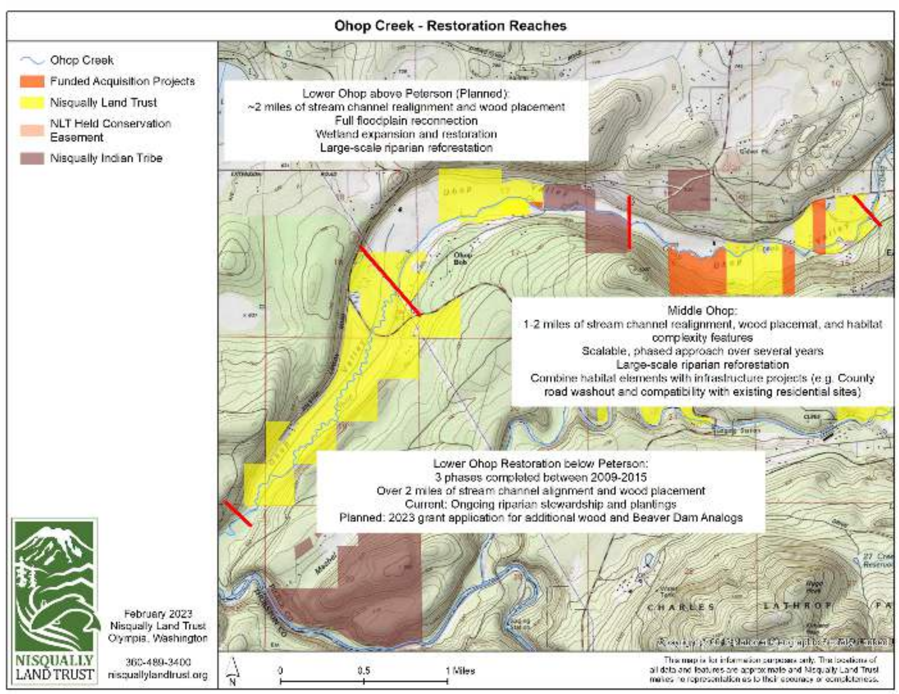
Protection and Restoration

In the 1930's Ohop Creek was channelized with an approximately 3.5 mile long ditch dug to drain the wetlands and various hillside seeps, diverting the flow into the main channel. The channel was excavated to improve drainage of farm fields, while old growth forests and vegetation was cleared and grasses were planted (Liddle 1998). Due to channelization, ditching, and agricultural practices, the channel lacked diversity of habitat types and experienced high summertime stream temperatures, suffered impacts of agricultural runoff, and was physically disconnected from the floodplain and adjacent wetland habitats.

Restoration of Ohop Creek was identified as a high priority action in the Nisqually Chinook Recovery Plan completed in 2001. Projects to implement this high priority action began in the first regular SRFB round in 2000 when the Nisqually Land Trust (NLT) proposed the first property acquisition on the creek to make it available for restoration. Eighteen subsequent SRFB projects have been funded over the last 22 years to acquire properties, design restoration, and restore the creek to implement this large scale vision.

Since that first acquisition NLT has used SRFB funds and matching funds to purchase 36 different parcels along Ohop Creek to protect and make available for restoration 669 acres and almost 10 shoreline miles.

The ground first broke for the Ohop Creek restoration in 2009 when the South Puget Sound Salmon Enhancement Group re-meandered and reconnected to the floodplain 1 mile of the historically channelized stream on NLT owned lands (Phase I/II). The next phase of construction, Lower Ohop Creek Restoration Phase III, continued this effort downstream resulting in an additional 1.4 miles of restored stream suitable for salmon.



Related PRISM Projects

Burwash Ohop Acquisition, #11-1538
Lower Ohop Creek Restoration Ph I, #05-1503
Lower Ohop Creek Restoration Ph 2, #07-1908
Lower Ohop Creek Restoration Ph 3, #13-1144
Middle Ohop Creek Protection Ph 1, #14-1929
Middle Ohop Creek Protection Ph 2, #18-1368
Middle Ohop Creek Pro/Rest Ph 3, #16-1453
Middle Ohop Creek Protection Ph 4, #19-1321
Middle Ohop Creek Protection Ph 5, #20-1029
Middle Ohop Creek Protection 2022, #22-1057

Investments

SRFB Funded: $6.8 million
Leverage/Match: $5 million

ESA/Tribally Important Species

Steelhead trout
Chinook salmon
Chum salmon
Coho salmon
Pink salmon

Project Funders

Natural Resource Conservation Service
Nisqually Indian Tribe
NFWF—Community Salmon Fund
Pierce Conservation District
Pierce Conservation Futures
Puget Sound Acquisition & Restoration
Salmon Recovery Funding Board
US Fish & Wildlife Service
WA Dept of Ecology Centennial Program
WA Dept of Ecology Streamflow Restoration Program
WA Dept of Ecology Water Quality Program
WA Dept of Ecology/EPA National Estuary Program

Project Partners

Eatonville School District
Nisqually Indian Tribe
Nisqually Land Trust
Nisqually River Foundation
Pierce Conservation District
South Puget Sound Salmon Enhancement Group

Nisqually River Mainstem

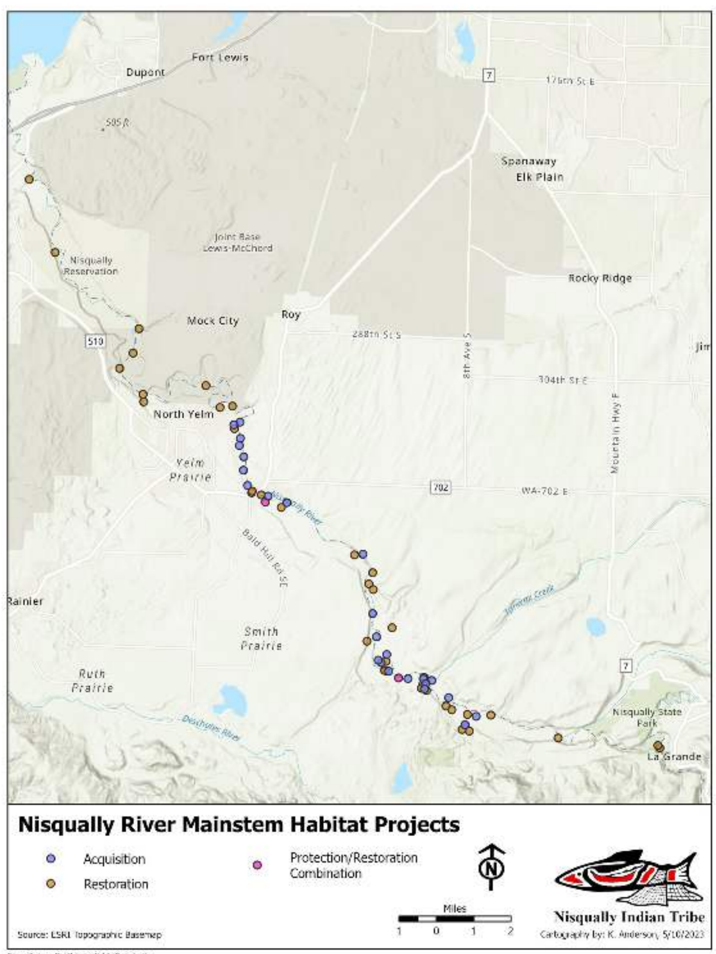
Riparian/Floodplain Protection and Restoration

Unlike most rivers draining into Puget Sound, the Nisqually has large protected stretches with intact floodplains, low human development, and high densities of functional off-channel habitat. This is not just good fortune but is the result of decades of work by Nisqually partners to protect the Nisqually river corridor.

In 1989 the percentage of the shoreline of the Nisqually River below Tacoma Power's hydroelectric project that was in protected status was just three percent. Today 78 percent of the shoreline is protected. This is due to the work of the Nisqually Tribe and its partners to gain commitments from public landowners to protect the mainstem and to buy and put into protection much of the remaining shoreline.

The Nisqually Land Trust has been working to buy and protect Nisqually River shorelines for 3 decades. This work significantly accelerated when the SRFB funds became available to do this work. NLT has protected 2010 acres and 14.6 shoreline miles of the mainstem river, much of that funded by a series of SRFB and PSAR grants over the last two decades.

Some of these properties when acquired still had intact riparian forests while others were in need of restoration. The Land Trust has worked with partners, including the Nisqually Tribe's native plant restoration crew and countless schoolkids organized by the Nisqually River Education Project, and other community volunteers to plant thousands of native trees and shrubs and control invasives on its river shoreline properties.



Related PRISM Projects

Ceja Nisqually Shoreline Acquisition, #10-1867
Elledge Shoreline Protection, #06-2278
McKenna Reach and Brighton Creek Protection, #20-1025
McKenna Reach Protection, #21-1030
Middle Nisqually Riparian Enhancement, #12-1366
Middle Reach Protection/Restoration RM 33, #18-1375
Miller Shoreline Protection, #04-1658
Nisqually/Powell Protection & Restoration, #04-1637
Tatrimima Shoreline Protection, #09-1400
Whitewater Reach Protection, #15-1238
Wilcox Reach—North Shoreline Protection, #16-1450
Wilcox Reach–Small Lots Acquisition, #16-1451

Investments

SRFB Funded: $4.3 million
Leverage/Match: $4.3 million

ESA/Tribally Important Species

Steelhead trout
Chinook salmon
Coho salmon
Chum salmon
Pink salmon

Project Funders

City of Centralia
Department of Ecology
Natural Resource Conservation Service
National Fish and Wildlife Foundation
Nisqually Indian Tribe
Thurston Conservation Futures
Pierce Conservation Futures
Puget Sound Acquisition & Restoration
Salmon Recovery Funding Board

Project Partners

Nisqually Indian Tribe
Nisqually Land Trust
Nisqually River Foundation
South Puget Sound Salmon Enhancement Group

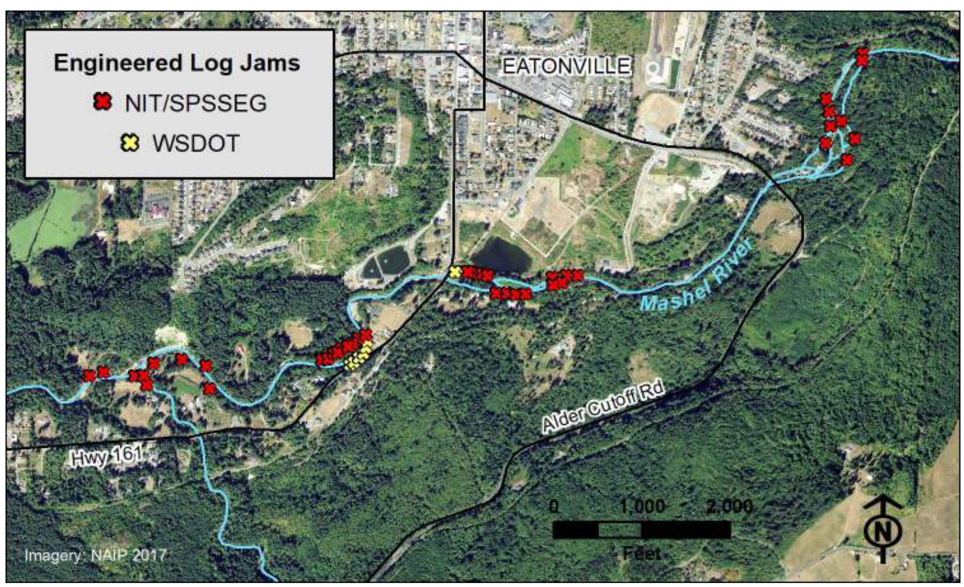
Mashel Engineered Logjams

Construction and Maintenance

Known for its timber production, the upper Mashel Basin has been subject to logging and other timber-related activities for many years. Not only have legacy effects of past logging practices limited the age of existing stands, but they have greatly decreased the input of large wood into the Mashel Basin. The hardening of banks and introduction of logging roads have led to unstable slopes, increased erosion, and introduced more fine and large sediments into the system. For ESA-listed Chinook salmon and steelhead, this means their habitat is less diverse, in-stream flows are much flashier, and they have fewer places to rest and feed.

To reduce these effects, watershed partners have taken to installing a number of engineered logjams on the Mashel River. These large structures, paired with riparian plantings of native trees and shrubs, have not only added more wood to the system, but have improved channel stability and complexity and decreased the amount fine sediment moving through the system. Engineered logjams also create pools, add cover for shade, and sort gravel needed for spawning salmon. Since 2006, 52 ELJs have been installed in the Mashel River by multiple watershed partners.

Though the ELJs have added habitat complexity to basin, it has been noticed that these structures are not accruing natural wood as hoped. Until protection of upstream habitat can be guaranteed and forests are given the opportunity to mature, there will be a constant need to introduce wood into the system. To address this, the Salmon Recovery Program endeavors to have a minimum of 75 functioning logjams within the Lower Mashel Reach at any given time.



Related PRISM Projects

Mashel Restoration Assessment, Ph 1, #01-1303
Lower Mashel Enhancement Project, #01-1411
Mashel Restoration Project, #04-1437
Mashel Shoreline Protection Ph 1, #08-2019
Mashel Eatonville Restoration Ph 2, #09-1393
Mashel Eatonville Restoration Ph 3, #15-1231
Mashel River Habitat Designs RM 0-3, #21-1032

Investments

SRFB Funded: $4.9 million
Leverage/Match: $2.8 million

ESA/Tribally Important Species

Steelhead trout
Chinook salmon
Coho salmon
Pink salmon

Project Funders

EPA Tribal Implementation Grants
Family Forest Fish Passage Program
Puget Sound Acquisition & Restoration
Nisqually Indian Tribe
Salmon Recovery Funding Board
WA Wildlife & Riparian Program

Project Partners

Nisqually Indian Tribe
Nisqually Land Trust
Pierce Conservation District
South Puget Sound Salmon Enhancement Group
Town of Eatonville

Nisqually Community Forest

Mashel River Protection and Recovery

The upper Mashel River, the main tributary to the Nisqually River, remains in intensive commercial forestry while still in a state of recovery from massive clear cut logging operations in the early and mid-1900s. The Mashel has been severely damaged by landslides and extensive sediment loads filling pools and spawning gravel, reduced water retention, elevated stream temperatures, and poor large woody debris recruitment.

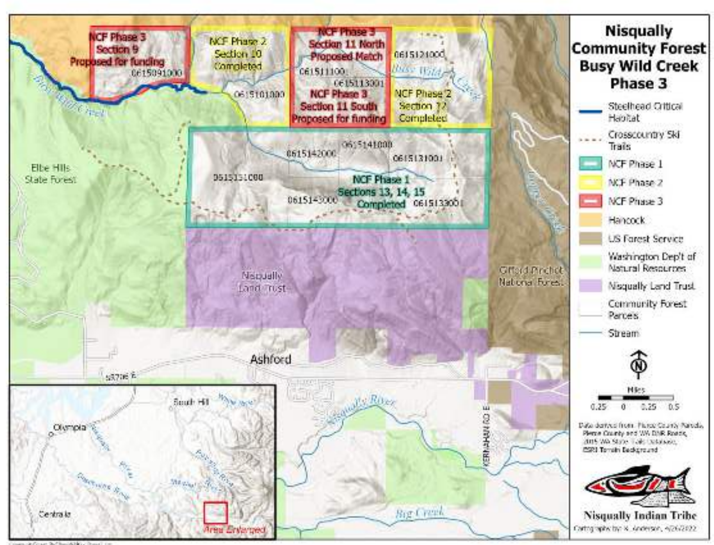
And over the last fifteen years, with increased domestic and export demand for timber, the Busy Wild sub-basin, the headwaters of the Mashel, has undergone another era of intensive logging, threatening the recovery of critical watershed processes and further degrading federally designated critical habitat for ESA-listed Chinook salmon and steelhead trout.

Currently, the vast majority of commercial Mashel basin forestlands are owned by out-of-state investors who prioritize shareholder return over all other benefits and impacts. A priority goal of the Mashel Watershed Recovery Initiative has been to help restore, to the greatest extent possible, local ownership and management of these forestlands and to prioritize salmon recovery first and foremost in forest management.

To this end the Mashel Initiative laid the foundation for creation of the nonprofit Nisqually Community Forest (NCF). In partnership with the Nisqually Indian Tribe and Nisqually Land Trust, NCF is now the largest nonprofit community forest in the Pacific Northwest, totaling 4,120 acres, including 15.8 miles of Busy Wild Creek shoreline.

The heart of NCF's mission remains permanent protection of habitat for threatened Nisqually steelhead trout and Chinook salmon through acquisition of sensitive properties under immediate threat of clear-cut logging. Acquisition of these forestlands and protection against erosion triggered by intensive commercial forestry is particularly important for recovery of an area of the Nisqually Watershed that is critical for sediment-supply processes.

Local nonprofit ownership of these forestlands also safeguards against damage from future logging activities and provides opportunities for active forestland restoration, including ecological forestry, road abandonment and riparian enhancement, which create reliable family-wage jobs for local contractors. And local ownership has also greatly expanded opportunities for education, research, and recreation, including hosting of the most popular trails in the nation's largest no-fee hut-to-hut cross-country ski trail network.



Related PRISM Projects

Mashel Ph 4/Busy Wild Protection, #14-1480
Busy Wild Creek Protection Planning, #14-2282
Busy Wild Creek Protection Phase 2, #17-1086
Nisqually Community Forest Phase 2, #20-2446
Nisqually Community Forest Phase 3, #22-1535

Investments

SRFB Funded: $7.2 million
Leverage/Match: $17.2 million

ESA/Tribally Important Species

Steelhead trout
Chinook salmon
Coho salmon
Pink salmon

Project Funders

Dept of Ecology Revolving Fund Loan for Green Infrastructure
EPA Tribal Implementation Grants
National Park Service
Pierce Conservation Futures
PSE Foundation
Puget Sound Acquisition & Restoration
RCO Community Forest Program
Russell Foundation
Salmon Recovery Funding Board
U.S Forest Service
WA Ecology Clean Water Revolving Fund
WA Ecology Streamflow Restoration Program
WA Wildlife & Recreation Program
Weyerhaeuser Family Foundation

Project Partners

Nisqually Community Forest
Nisqually Indian Tribe
Nisqually Land Trust
Nisqually River Foundation
Northwest Natural Resources Group

Kalama Creek Hatchery

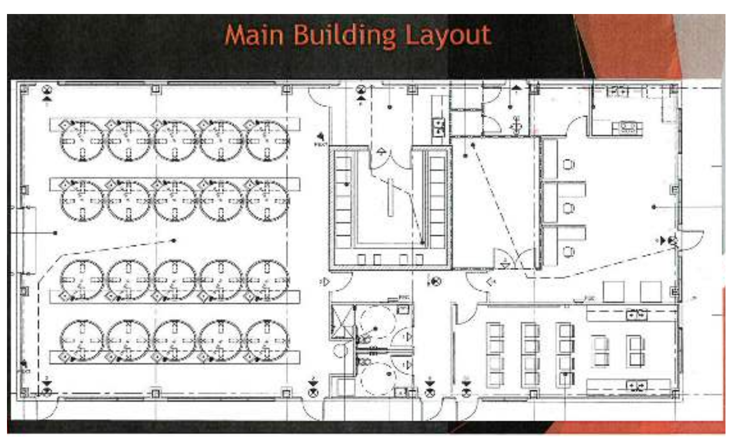
Facility Update and Rebuild to Support Salmon Recovery

The Nisqually Indian Tribe owns and operates two hatchery facilities in the watershed. Kalama Creek, the smaller of the two, was built in the 1970s on the Tribe's reservation and has produced chinook and coho salmon for over 50 years. The Tribe is also the lead for developing and implementing salmon recovery plans in the Nisqually Watershed which includes integrating habitat, harvest, and hatchery actions (all 'H' integration) to support recovery and protect Nisqually Indian Tribe Treaty Rights. In an ambitious step towards advancing all 'H' integration, the Tribe has begun a total rebuild of the Kalama Creek hatchery which will enable state of the art conservation-based hatchery practices.
The Kalama Creek hatchery rebuild includes replacing large concrete 'raceways' where young salmon are raised in 20 circular tanks. This will allow for small batches to be raised with unique characteristics, encouraging variable stages of growth. This will allow managers to support salmon population diversity which increases the population's resilience to environmental changes.

The facility is being built with potential climate change impacts in mind, such as reduced water flow in Kalama Creek. Though flow is not currently an issue, water filtration and use of UV light to kill all parasites harmful to fish will allow the facility to reuse water, reducing the overall water use. There will be six larger tanks where adult salmon can be kept while preparing for spawning, as well as for fish that outgrow the smaller circular tanks. An existing asphalt raceway will also be retrofitted with a new liner, reducing the chances of water leaks.

In addition to the update to the hatchery operations, the rebuild will include a classroom to accommodate the many school groups, kindergarten though college, that come to Nisqually to learn about salmon and their life cycle, as well as the history and culture of the Nisqually Tribe. Future plans will include a salmon viewing trail along Kalama Creek with interpretive signage.

The Kalama Creek hatchery updates will enable the Tribe to ensure that the detrimental aspects of hatchery operations like reduced diversity and domestication are minimized by enabling science-based, small-batch rearing practices. Theses changes will better support recovery of Nisqually Chinook and coho while also enhancing the Nisqually Indian Tribe's Treaty Right.



Related PRISM Projects

Nisqually Chinook Recovery Monitoring, #15-1261

Investments

Phase 1 Project costs: $8 million
Phase 2 Project costs: $4.3 million

ESA/Tribally Important Species

Chinook salmon
Coho Salmon

Project Funders

American Rescue Plan Act Funding (ARPA)
Federal Economic Development Administration
Nisqually Indian Tribe
NOAA Fisheries Disaster Funding
Pacific Coast Salmon Recovery Funding
WA State Legislature

SALMON RECOVERY FUNDING BOARD SUMMARY MINUTES

Date: March 8, 2023

Place: Hybrid - Room 172, Natural Resources Building, 1111 Washington Street SE; Olympia, WA and online via Zoom

Salmon Recovery Funding Board Members:

Jeff Breckel, Chair	Stevenson	**Annette Hoffman**	Designee, Washington Department of Ecology
Jeromy Sullivan	Kingston	**Tom Gorman**	Designee, Department of Natural Resources
Kaleen Cottingham	Olympia	**Chris Pettit**	Designee, Washington State Conservation Commission
Chris Endresen-Scott	Conconully	**Jeremy Cram**	Designee, Department of Fish and Wildlife
Joe Maroney	Spokane	**Susan Kanzler**	Designee, Washington Department of Transportation

This summary is to be used with the materials provided in advance of the meeting. The Recreation and Conservation Office retains a recording as the formal record of the meeting.

Call to Order:

Chair Breckel called the Salmon Recovery Funding Board (board) meeting to order at 9:00 AM and requested roll call, determining quorum. **Julia McNamara**, Recreation and Conservation Office (RCO) Board Liaison, performed roll call and determined quorum, noting **Member Jeremy Cram** was attending online and **Member Jeromy Sullivan** was absent.

Motion: Move to Approve the **March 8, 2023,** Agenda
Moved By: Member **Kaleen Cottingham**
Seconded by: Member **Chris Endresen Scott**
Decision: Approved

Motion: Move to Approve the **December 7, 2022,** Meeting Minutes
Moved by: Member **Chris Endresen Scott**
Seconded by: Member **Kaleen Cottingham**
Approved: Approved

Member Kaleen Cottingham recognized International Women's Day, highlighting the equality of women displayed on board and their contribution to salmon recovery. After supporting Member Cottingham's recognition, **Chair Breckel** spoke about the passing of former and original board member, Larry Cassidy, and his many accomplishments in salmon recovery.

Item 1: Director's Report

Director Megan Duffy noted that legislature if over halfway through session, with riparian habitats being a continued topic of discussion among stakeholders and legislators.

She also noted RCO's ongoing examination of its internal structure to ensure it has the best structure in place for the number of programs and funding sources it supports; Jeannie Abbott's, Governor's Salmon Recovery Office's (GSRO) Program Coordinator, continuing planning of the April 2023 Salmon Recovery Conference; the May Puget Sound on the Hill event; and staff updates.

Finally, Director Duffy highlighted Governor Jay Inslee's upcoming visit to Mill Creek to look at that project with the local Regional Fisheries Enhancement Group (RFEG), Tri-State Steelheaders, and John Foltz, Executive Director of the Snake River Salmon Recovery Board.

Legislative and Policy Update

Brock Milliern, Policy and Legislative Director, said that Legislative session commenced on January 9, and will run through April 23. The next revenue forecast is March 20, and the House and Senate budgets will be released shortly after. RCO is currently tracking around 65 bills and several budget provisos that may have impacts to RCO programs.

Concerning salmon recovery, RCO has been tracking riparian work/funds that may be included in the Capital Budget Committee's budget and two bills, including Senate Bill 5371 regarding protecting the Southern Resident Killer Whales (SRKW) from vessels and changing the distance that boats must stay from SRKW from 300 yards to 1000 yards; and House Bill 1686 regarding establishing a joint committee on salmon recovery. Mr. Milliern also provided an update on the agency's budget and budget requests, which is available below.

Recreation and Conservation Office Capital Funding 2023-2025

RCO 4670-New Appropriations	Agency Request	Governor Request
As of	09/20/2022	01/09/2023
Bond Funds		
Estuary and Salmon Restoration	$25,512,000	$25,492,000
Family Forest Fish Passage Program	$10,870,000	$10,870,000
Puget Sound Acquisition and Restoration	$65,419,000	$50,000,000
Salmon Recovery	$82,000,000	$40,000,000
Springwood Ranch	$14,000,000	$14,000,000
Washington Coastal Restoration and Resiliency Initiative	$17,593,000	$17,563,000
Brian Abbott Fish Barrier Removal Board	$96,600,000	$48,146,000
Upper Quinault River Restoration	---	$2,000,000
Federal Funds:		
Pacific Coast Salmon Restoration Fund	$75,000,000	$75,000,000
Total	$384,994,000	$283,071,000

Member Pettit asked about the integration of the Climate Commitment Act (CCA) auction revenues into the capital budget, and Mr. Milliern explained that the outcome of the auction was unlikely to change the projected CCA funds available. Mr. Milliern said that the Brian Abbot Fish Barrier Removal Board (BAFBRB) and the Family Forest Fish Passage Program (FFFPP) both received CCA funding in the Governor's proposed budget.

Mr. Milliern then discussed the operating requests. The largest request was support for lead entities and the salmon recovery regions at $4.7 million, which was fully funded in the Governor's proposed budget. Item 2: Salmon Recovery Management Report

Governor's Salmon Recovery Office Report

Erik Neatherlin, GSRO Director, summarized the work done over the last quarter.

Legislative and partner activities include GSRO testifying for key bills and accepting an invitation to present at the Governor's office with the Washington Department of Fish and Wildlife (WDFW) at a panel discussion providing an overview of salmon recovery. **Katie Knight-Pruit**, GSRO Salmon Recovery Coordinator, has been meeting with leaders from other agencies to discuss what is being moved through the legislature, which has been a great exercise in keeping communication open between agencies.

Mr. Neatherlin discussed the federal items noting Puget Sound Day on the Hill will be held in Washington DC the week of May 8; a letter addressed to Secretary Raimondo from the Pacific Salmon Recovery State (WA, AK, CA, ID, OR) highlighting the opportunities for collaboration associated with the Bipartisan Infrastructure Law (BIL) and the Inflation Reduction Act (IRA) and providing a combined message from the west coast; and that **Jeannie Abbott** submitted the Pacific Coast Salmon Recovery Fund (PCSRF) application ahead of schedule on March 1.

Mr. Neatherlin provided an update on the newest and 26th lead entity, the Spokane Tribe. The focus is on habitat protection and restoration associated with the reintroduction of salmon, steelhead, and resident red-band trout above the blocked area of Chief Joseph and Grand Coulee Dams. The tribe is in the process of formalizing the lead entity and a limiting factors analysis is also underway and expected to be complete in 2024. The Spokane Tribe will provide an update at a future board meeting.

Board members asked about funding for the limiting factor analysis, when the lead entity would receive funding through RCO's grant round, and which region the lead entity would be in. RCO staff explained that the tribe contracted out the limiting factors analysis. Additionally, conversations regarding allocation will be ongoing as the lead entity gets organized, completes its limiting factors analysis and is formally established, meeting statutory lead entity requirements.

Jeannie Abbott provided information on the upcoming Salmon Recovery Conference scheduled for April 18-19 in Vancouver, Washington, with a theme of "A Shared Future". There are 690 people registered, with 634 registered to attend in-person.

The opening session will include a blessing and drum song by the Cowlitz Tribe as well as a pre-recorded message from Governor Inslee. There will be a panel of researchers from the 2022 Pan-Pacific Expedition, an international collaboration of the US, Canada, Russian Federation, Republic of Korea, and Japan studying the winter ecology of Pacific salmon. **Chair Breckel** and **Director Duffy** will be emceeing the event, which includes 25 sessions with 112 presentations throughout the two-day conference.

Tara Galuska, GSRO Orca Recovery Coordinator, shared information about an upcoming event honoring Billy Frank Junior's birthday and commitment to salmon recovery at River Ridge High School. She and Katie Pruit will represent GSRO.

In relation to SRKW and orca, Ms. Galuska highlighted Senate Bill 5371, adding that not only will it require 1000 feet vessel distance, but it also requires the creation of a diverse workgroup to implement the provisions of the bill; Washington Department of Ecology's (ECY) inclusion of the Orca checklist in the State Environment Policy Act (SEPA).

The federal Save Our Sound bill passed and will create a Puget Sound Office in the EPA and give greater attention to the region, positively affecting SRKW. Additionally, the National Defense Act passed with provisions that include a Cetacean Desk (i.e., marine mammal office) to inform large vessels on the presence of whales to help avoid ship strikes; Quiet Sound has been doing voluntary slow down trials that have been successful; the WDFW periodic review is underway and continues SRKW endangered status recommendation; and Ms. Galuska intends to establish an intergovernmental workgroup for SRKW to meet quarterly that includes NOAA, United States Coast Guard (USCG), EPA, and the three tribal commissions.

Salmon Section Report

Marc Duboiski, Salmon Grants Section Lead, provided an overview of the section's activities in the past quarter. This included the transferring of regional and lead entity areas to new staff, the upcoming retirement of Salmon Grants Manager Dave Caudill, 96 of the 133 board funded projects becoming active, Watershed Review Panel work, the review of 2023 projects, an overview of the newly staffed grant review panel, and project cost increases and potential decisions. Of note, there have been two meetings of the Watershed Review Panel since the December board meeting, where the panel decided to split the five plans into two different groups for review purposes, putting together Watershed Restoration Inventory Area (WRIA) 7 (Snohomish River) with WRIA 8 (Cedar Sammamish River), and combining WRIA 13 (Deschutes), WRIA 14 (Kennedy-Goldsborough in Mason County) and WRIA 15 (East Kitsap County).

Chair Breckel asked what the expectations for board feedback on the draft recommendations were. **Mr. Duboiski** clarified that draft recommendations will be available for the May meeting when the board can provide their comments and feedback, and approval will be requested at the September meeting to meet the October deadline for official recommendations to the Department of Ecology.

For the 2023 grant cycle, review of project applications from the Hood Canal, Stillaguamish, and Nisqually began. The annual application workshop was held virtually

January 24, with 65 attendees, and grant/project timelines, project eligibility, and policy changes were discussed.

In June 2022, the board approved adding $250,000 to the cost increase fund, bringing the total available funds to $1 million. Currently, $725,000 remains to be used between now and May 2023. In the Puget Sound Region, the lead entities can use returned PSAR funds for cost increases. In May, the board will be asked to participate in a discussion and decision on what to do with the remaining Cost Increase Fund for the 23-25 biennium.

General Public Comment

None.

Item 3: Partner Reports

Council of Regions

Mara Zimmerman, Executive Director of the Coast Salmon Partnership, reminded the board that the Council of Regions (COR) exists to bring together the state's seven salmon recovery regions to share information between regions. They continue to work with lead entities and RCO to ensure that the 2022 grant awards are contracted and to initiate the 2023 board grant round. They appreciate being involved in conversations surrounding the Targeted Investment and match policies. Several COR directors have ongoing dialogues with the Army Corps of Engineers about what can be done to faster implement Corps permits. The four Columbia River Regions continue to meet and discuss Columbia River policy.

Ms. Zimmerman acknowledged giving input on agenda Item 4 and thanked Nick Norton for his work facilitating discussions on Targeted Investment. She noted that agenda Item 6 aligns with the COR's goals of match policy. She thanked the GSRO for their dedication to the Item 8 State of Salmon Report, appreciating the chance to provide input on the final report.

Washington Salmon Coalition

Mike Lithgow, Chair of the Washington Salmon Coalition (WSC) and Lead Entity Coordinator for the Pend Oreille Lead Entity, shared that the first quarter of 2023 has been a busy time for lead entities, but everything is going well. The coordination between GSRO, RCO, COR, Regional Fish Enhancement Groups (RFEG), and the WSC has increased and is working well. He reiterated Mara Zimmerman's comments on Mr. Norton's work on Targeted Investment and match policies and is grateful for the work

RCO staff has done to increase funding capacity for lead entities. He described the documents that Cheryl Bowman of Klallam County submitted summarizing projects that are happening to help salmon.

Regional Fisheries Enhancement Groups

Lance Winecka, Executive Director of the South Puget Sound Salmon Enhancement Group, representing the Regional Fisheries Coalition, which is comprised of fourteen RFEGs across the state. He is excited for the upcoming Salmon Recovery Conference and will take time to meet with RFEGs, staff, and executive directors ahead of the conference. He appreciates all the work and coordination that goes into planning the conference, which allows salmon restoration practitioners to meet. He also thanked the board for the Manual 18 threshold updates that were approved last year and noted they have already been helpful in addressing projects across the landscape.

Mr. Winecka addressed the Army Corps of Engineers permit discussion, noting that the goal that has been agreed to is six months for a Nationwide Permit 27 authorization to be issued, which is important in allowing project sponsors to work one year ahead of time for construction, get more accurate bids, and start projects faster, compared with the previous two-year permit cycle.

Mr. Winecka commented on PRISM being a useful and efficient tool for the work the RFEGs are doing. He added that he and the RFEGs support match reform and recognize that match can come in many different forms, emphasizing that project sponsors are looking everywhere for funding to implement recovery projects.

Chair Breckel recognized the efforts the RFEGs contributed to making the last grant round a success.

BREAK: 10:10-10:25 AM

Item 4: Targeted Investment Staff Review Update

Nick Norton, Policy and Planning Specialist, summarized the progress of the board's December 2022 motion, directing staff to create a working committee to perform a comprehensive review of the Targeted Investments (TI) policy. The committee includes board members, RCO staff, and several partners.

When reviewing TI, the committee considered the current policy, the effects large funding allocations such as the $75 million from the 2022 supplemental session and potential future funding from the Infrastructure and Investment and Jobs Act, and how that funding can be effectively leveraged.

The four objectives established by the committee include:

1. Leveraging funds with potentially different directives.
2. Utilizing funds not directed towards regional allocations, reaffirming that this funding is separate from the process that goes through regional allocations.
3. Funding projects with significant regional recovery benefits.
4. Providing certainty and consistency across grant rounds.

Objective three is notably the most important based on feedback from staff and the working committee to fund projects with the most significant regional recovery benefits.

Current established priorities limit regional involvement, and so the working committee developed three draft investment priorities that each region could use:

1. Increasing on-the-ground scale of project implementation.
2. Reducing phases required to complete well-developed projects.
3. Allowing long-term, complex projects to get off the ground.

Mr. Norton noted that the priorities are not all confirmed and may change over the course of the conversation.

Overall, the new goal would be to establish investment priorities that focus on regional priorities as identified in recovery plans, with enough notice and clarity in order to create a more diverse pool of applicants and promote certainty for regions and project applicants.

Mr. Norton went on to explain the process changes of how a project is solicited, reviewed, ranked, and funded. The working committee is currently considering five changes:

1. Switch to board investment priorities that do not inherently limit the number of eligible regions and do not change every biennium.
2. Remove the limit on the number of projects per region.
3. Shift to a "biennial TI fund plan" to provide information about predicted amounts of funding from different sources and for different project types, and amount of funding from these sources that will be allocated to TI over a two-year period.
4. Switch to an evaluation process where applicants submit a letter of intent, and the board invites a subset of proposals to submit a full application for funding consideration. These intent letters could be invited to submit a full application during the second year if new or unexpected funds become available.
5. Full applications not funded in the first year would be rolled over to the second year and funded in order based on additional funds available.

There will be an additional meeting of the committee on March 13, to discuss refining recommendations. The goal is to have an update to TI policy language ready for discussion and approval at the May board meeting so that the updated policy can be used during the 2023-2025 biennium. The March committee meeting will allow for a more thorough discussion of the role of the regions in this process. Mr. Norton expects to have a draft policy by the end of March, followed by stakeholder outreach in early April, and a final request for board approval in May. This timeline will align with the board's funding decisions.

Chair Breckel was supportive of regions identifying and tailoring projects around the priorities of their regions. However, he highlighted the importance of ensuring projects are compelling, contributing in significant ways to address the regions' key barriers.

Members of the board discussed the benefits of both incrementally funded projects approach and those that can be fully funded all at once. **Member Cottingham** cited the Mill Creek Project as an example of how bigger funding can get a project done faster with less phases, while **Member Hoffman** acknowledged how a phased approach acts as a form of checks and balances to ensure projects are on track.

Chair Breckel shared concerns over creating another grant fund, and the complications that entails as some regions may be more resource-rich than other regions with equal recovery needs. A pre-application process could be used to provide a streamlined process without having to commit a large amount of energy before deciding that a project is or is not viable.

Member Hoffman suggested taking lessons and data from the Intensively Monitored Watershed work and relating it to the targeted investment conversation.

Member Maroney agreed with Chair Breckel that creating a level playing field among regions while also moving salmon recovery forward is the priority right now. He has concerns over the effort levels a project sponsor is expected to put into a project without knowing the funding outcome, and he would like to see projects start as soon as funding is approved. He confirmed with **Director Duffy** that there are three years left in the funding, and both the Infrastructure and Inflation Reduction Act (IRA) money are available, assuming the IRA will flow similar to the infrastructure bill.

Mr. Norton acknowledged that each region is unique in how they might want to approach the TI process, and initial concerns have been expressed about what level of information would be required in a pre-application and the technical expertise of the reviewers who would be charged with selecting final projects. Member Pettit, Member Gorman, and Mr. Norton discussed some of the challenges a two-step process could create, including the additional burden on capacity of sponsors to do additional work without knowing the return on investment and the pre-application review process slowing projects down. Chair Breckel suggested a biennium list structure be used to build a list for funding.

Item 5: Completed Salmon Recovery Funding Board Project Presentations

Chico Creek Fish Passage & Habitat Restoration #17-1417 & #19-1390

Kay Caromile, RCO Outdoor Grants Manager, introduced the Chico Creek Fish Passage and Habitat Restoration project (17-1417 and 19-1390), located in and sponsored by Kitsap County. This project replaced a triple box culvert that existed on Chico Creek. This watershed includes 10,000 acres and five stream channels that support one of the largest chum salmon runs in the Puget Sound. This specific project area is in both the Chico Salmon County Park and the Kitsap Golf and Country Club, on Chico Creek, 0.6 miles upstream of the mouth and upstream of State Route 3. This project builds on previous watershed work. The historic removal of riparian forests, development in floodplain, and accelerated peak flows have all worked to incise the channel and disconnect it from its floodplain.

These two projects built a bridge and restored the surrounding habitat, resulting in 16 miles of quality spawning habitat upstream of the bridge. The floodplain was also widened downstream and about two acres of riparian environment was planted, creating a restored channel that has pools, sorted gravel, and is now connected better to its floodplain.

Record low water flow during the spawning season, along with the channel shifting to flow through a log structure created an impediment to fish passage. As a result, the county worked with the Squamish Tribe and WDFW to install sandbags to revive fish passage around the log structure, which will be monitored to determine if additional changes need to be made.

Member Cottingham asked about the status of a similar project on Highway 3 and **Member Kanzler** explained that Washington State Department of Transportation (WSDOT) is currently replacing four box culverts with two bridges, which are on track to be completed by October.

Ruby Creek Fish Passage and Habitat Enhancement #18-1972

Sandy Dotts, RCO Outdoor Grants Manager, presented a summary of the recently completed Ruby Creek Fish Passage and Habitat Enhancement Project (18-1972), a WDFW project in partnership with the Colville National Forest.

The objective of Ruby Creek Fish Passage Project was to remove two fish passage barriers, restoring access to seven miles of bull trout and cutthroat trout habitat in the Colville National Forest, as well as resurfacing 12.5 miles of Ruby Creek Road to reduce sediment loads entering the stream and its associated wetlands. This project, in addition to two others previously funded, successfully removed all fish passage barriers from the drainage.

The total funding for this project was $477,500 from SRFB and $98,180 from sponsor match, for a total of $575,680.

Member Maroney commented that the Corps got $68.1 million to complete work on Albeni Falls dam, which is located on the Pend Oreille River near the completed project, by the first of next year. Several years ago, the Kalispel Tribe hired the United States Geological Survey (USGS) to do mapping within the Pend Oreille River, which identified the mouth of Ruby Creek as being significantly cold and potentially creating a new project to enhance the signature of the area at the mouth of Ruby Creek. Two similar projects have been funded in other drainages where cold water effuse exists with temperatures below 24 degrees Celsius, to expand the cold temperatures by a hundred-fold. These projects will be monitored for fish response with radio telemetry by the USGS for temperature for the next couple of years and may set the stage for future projects. He will be presenting on these projects at the Salmon Recovery Conference in April.

Lones Levee Restoration & Construction #19-1155

Bridget Kaminski, RCO Outdoor Grants Manager, summarized the Levee at Čakwab which will be referred to as Lones Levee, Restoration Construction project (19-1155), located on the Green River in King County. The Green River supports Coho, Chinook, chum, pink, sockeye, steelhead, and cutthroat trout.

LiDAR imagery shows the pre-restoration floodplain hydrology, indicating static downstream hydrology beginning at the existing levee, which contrasts with the dynamic upstream floodplain hydrology, and illustrates how the levee cuts offside channels from entering the historical floodplain. Aerial photos from the 1930s show multiple channels in the area prior to the completion of the levee. The removal of the levee allows for the establishment of new channels, which gives juvenile fish the opportunity to properly develop over three or four more months before traveling downstream to the Puget Sound where they will be 3-4 inches long, doubling their previous length and increasing survival rates. Studies of the Green River indicate that 97 percent of salmon that return are the ones that entered the Puget Sound at these larger sizes.

Additionally, the levee removal reconnected off-channel habitat, increased channel migration, flow splitting and wood recruitment and contributed to natural processes critical to the formation of high-quality salmon habitat. The expected result of this project is increased productivity, diversity, and abundance of Green River Chinook salmon and steelhead populations. Expected response to the levee removal includes the recovery of ten acres of high-quality off-channel habitat with nearly year-round connection to the main channel, 35-45 acres of re-established floodplain both upstream and downstream of the project area, and 20-25 acres of active river channels and higher quality spawning habitat.

The total cost of this project was $6,527,973, of which the board's contribution, including sponsor match, was $1,137,147.

Director Duffy asked what the neighboring landowner's engagement was like on this project. Ms. Kaminski answered that King County had purchased an easement from the adjacent landowner, but outside of that she was not sure of their involvement.

LUNCH: 12:20 PM – 1:01 PM

Item 6: Board Match Policy: Analysis and Impacts

Nick Norton, Policy and Planning Specialist, shared his goal to provide a comprehensive, data-driven foundation for conversations moving forward on the issue of match. During the board's retreat in June 2021, board members expressed interest in understanding the role of the SRFB match in relation to overall project funding, examining whether match is variable by geography, project, type or entities, and learning about the impacts to other state programs that have eliminated match.

One of the explicit areas of interest expressed at the retreat was the difference between match and leverage. Leverage is all the non-board resources that are part of a project. However, a sponsor can elect to only use some of that funding as match toward a project. There is also leverage that is ineligible as match, including previous acquisitions to secure the site, contributions from a non-profit between project phases, and a stewardship endowment.

Whether or not an applicant chooses to call something match has implications for the workflow that becomes attached to those dollars, rather than choosing not to funnel those resources into the grant agreement. Reported match funds are subject to invoicing, reimbursement calculation, and long-term compliance. Applicants have the option to include match in the original application budget, and as of August 2021, to report additional funds spent as part of the final report.

In response to **Member Pettit's** question concerning in-kind match, Mr. Norton noted that most applicants avoid including in-kind match due to difficulties in tracking, estimating value, and reporting relative to how much it contributes toward match requirements.

Member Hoffman asked what benefit there is to report more than 15 percent match in application. During a listening session with applicants, Mr. Norton was informed that some lead entities consider leverage within their ranking criteria or build it into their readiness to proceed considerations, which means that reporting more than 15 percent match can have an informal influence on how lists are made based on how much money is coming in and if the match could be lost if that project is not funded.

Mr. Norton discussed that match and leverage may not be considered as strictly by the lead entities as by the board.

Mr. Norton provided a brief timeline of the board's match history:

- 2000: 15 percent match assigned
- 2007/2008: Puget Sound Acquisition and Restoration Fund and Salmon Recovery Funding Board adopt design-only match waiver
- 2009: Road Maintenance and Abandonment plan projects must provide match above 15 percent
- 2017: Match waiver for IMW restoration projects
- 2021/2022: Match waived for riparian buffer projects and increased match for riparian projects based on the amount of upland acreage included

The timeline shows that the board has been willing to adjust match for certain project types.

Member Cottingham noted that none of the board decisions to the match policy was about leverage but was focused on policy encouragement or discouragement. Mr. Norton could not find a record that talked about this distinction between match and leverage in previous board decisions.

Mr. Norton continued to discuss the desired outcomes, noting that individual grant programs are distinct and match requirements are generally used to drive the following outcomes:

1. Local Support (project level) – match serves to demonstrate local support and commitment to the projects. This was a key consideration in past board decisions on establishing match requirements.
2. Return on Investment (funding list level) – applicants who bring in additional resources allow the board to contribute to a greater scope of work and potentially fund more projects on a list.
3. Demonstrate Effectiveness (program level) – match is a piece of the puzzle that demonstrates a funding program is effective, that other funders view this as a program worth matching and shows the legislature that there is support for the funding via additional resources.

Mr. Norton provided a few anecdotal perspectives gathered from listening sessions that indicate in-kind and donated match are inefficient to secure and hard to track and qualify. Feedback also included that sponsors avoid bringing in cash from their operating budget. Additionally, much of landowners' involvement is ineligible as match, including prior conversations, work to secure easements or permissions, and support that goes into maintaining the project after completion.

Mr. Norton presented charts depicting the types of match included in the over 1,000 projects that reported match since the inception of the board. Monetary funds (86 percent) are reported most often, with federal resources being the most common source of reported match.

Mr. Norton clarified questions from the board regarding private land ownership projects, which are difficult for owners to start on their own, and donated land, the value of which can be utilized as match. Much like the board conversation, Mr. Norton heard in listening sessions that the work that it takes to secure multiple grants to complete large projects and the liability associated with doing that amount of work, is a truer measure of "skin in the game".

Mr. Norton summarized the data and anecdotes, stating that match policy does not drive the local commitment as was intended.

Addressing Return on Investment, Mr. Norton summarized that requiring a 15 percent match does not appear to assist in funding going further. This appears to be because the regional allocation model maintains a consistent ceiling on the amount requested, with the board being a minority funder on larger cost project types and sponsors often reporting over 15 percent match regardless of requirements. It is notable that whether match is required at 5 percent or 15 percent, the workload associated is similar, and any required match comes with administrative capacity.

Member Pettit asked how the board came up with a statistically relevant return on investment. Mr. Norton answered that in terms of recovery outcomes, there is no data to effectively look at this question. Instead, he analyzed it via two questions: is the match policy what brings in the 15 percent and is it causing more projects to be funded?

Addressing program effectiveness, **Mr. Norton** concluded that a significant amount of the "financial story" is not being captured or reported as most sponsors report close to the minimum amount of required match, strategically avoid claiming match when it is not required, and the amount of additional leveraged funds is often much larger than the match funding.

Members voiced different perspectives during the discussion. There was recognition that requiring match created additional administrative work, that it can be a useful method for technical leverage and project oversight, and that if sponsors are providing match when it is not required, there may be fewer obstacles. **Member Cottingham** expressed support for eliminating match for most project types during a trial period, and **Member Maroney** expressed support for finding ways to reduce the administrative burden of tracking and reporting match. There was concern from **Member Kanzler** that this would limit the number of funded projects. **Mr. Norton** went on to discuss how match has the potential to impact the three key parts of salmon recovery:

1. Development: direct, negative impact on where and what types of projects request funding. In areas where public funding is not widely available, sponsors end up relying heavily on volunteers to get the 15 percent match, which restricts the types of projects that can be done.
2. Scope: can lead to down-scoping before or after signing a grant agreement if enough match cannot be secured.
3. Implementation: can directly or indirectly impact timelines and sponsor capacity through cost increases, match-deferrals, and cash flow. A case study included in the board's meeting memo on this item demonstrates how using in-kind value of donated wood can lead to unintended consequences that result in project extensions.

Mr. Norton's final synthesis is that board match requirement appears to not be greatly affecting desired policy outcomes but can create a drag on the pace and scale of project implementation.

Mr. Norton provided five potential areas for consideration which can be combined if desired and analyzed based on the opportunities and risks perceived by the board:

1. if match is required;
2. how match is administered;
3. what is eligible as match;
4. who must have match; and,
5. where match is required.

For each option, he provided some recent examples of other funders that use that approach or have shifted match policy.

Mr. Norton requested direction from the board to answer:

1. Does the Board want to examine alternate options as a next step in the conversation?

2. If so, what opportunities and risks does the Board perceive in potentially changing match policy?

Public Comment

Vanessa Kritzer, Executive Director of the Washington Association of Land Trust, encouraged the board to take direction provided in the memo to direct staff to analyze and recommend alternatives to the current match policy. She expressed appreciation for the adjustments made to the current match policy based on stakeholder input, including the recent policy changes on upland acquisitions.

Chair Breckel thanked Ms. Kritzer for speaking and directed the board to provide Mr. Norton with some feedback and direction, sharing that it would be in the interest of the board to capture the full picture of funds, including what is currently being used as leverage.

Director Duffy summarized the main ideas of the board discussion:

1) Look at the type of project, considering the difference between acquisition and restoration.
2) Decide what counts as eligible match.
3) Consider a no-match trial period, between two and four grant rounds.
4) Consider requiring incentive-based match for specific types of projects and no-match for others.
5) Tracking match and/or "leverage".
6) Use new terminology "project funding cost-share summary" for telling the story of how funding is being used.

Member Maroney suggested considering a cap on project funding before match is required, and Member Endresen Scott would like the board to consider community equity.

Mr. Norton will continue to meet with the working groups to address what the board has asked for today and will provide an update with decisions at the May meeting.

BREAK: 2:45PM – 3:00

Item 7: Monitoring Update

Keith Dublanica, GSRO Science Coordinator, introduced the three contractors who will provide updates on their projects. Dr. Bob Bilby, Dr. Pete Bisson, and Dr. Phil Roni.

Intensively Monitored Watersheds Program Collaborative Synthesis

Dr. Robert Bilby provided an update of the Intensively Monitored Watershed (IMW) Synthesis. This work product, a Washington specific synthesis is a follow-up to the Pacific Northwest Aquatic Monitoring Partnership synthesis presented to the board in June 2022. At the June meeting, the board determined the value of an IMW synthesis specific to board funding both timely and opportune. In the early 2000s, the board agreed to support five IMWs to better understand the contributions habitat restoration has to salmon recovery. These actions were concentrated in five locations statewide and were part of the Comprehensive Forum for Monitoring Salmon and Watershed Health program. There are four freshwater IMWs and one estuary IMW. All board funded IMWs are ongoing. However, there is currently enough data to begin to help inform restoration efforts. This synthesis intends to provide an interim look at what has been learned so far and focus on the associated management implications.

Dr. Bilby provided an illustration of IMW design of the Strait of Juan de Fuca Complex, which is made up of three watersheds, East Twin, West Twin, and Deep Creek. The West Twin watershed was held as a reference with no implemented restoration projects. On top of the restoration treatments in Deep Creek and East Twin watersheds, extensive monitoring systems were established across all three to monitor habitat conditions, fish populations, and treatment response.

The synthesis report will consist of an introduction, review of results from each IMW and indication of key management implications to date, and answer the main questions derived from data collected from multiple IMWs:

1. Have we accurately identified the factors that are controlling fish populations? Can the IMWs help us do a better job? Factors that are controlling fish populations have not been accurately identified.
2. Can we better define the attribute of wood placement projects with the greatest probability of generating a positive fish response? While there are some positive fish response from wood placement projects, the response is highly inconsistent.
3. Is low spawner escapement limiting fish response to habitat restoration? In some watersheds there is strong evidence that there are not enough fish returning to utilize the available habitat.
4. The Skagit Bay IMW, the only estuarine system in the study, provided the requirements for successful delta habitat restoration when monitoring juvenile salmon population responses. Observations of demographic changes were consistent with restoration efforts increasing nursery habitat capacity.

Most elements of the IMW synthesis are drafted, including respective IMW summaries, evaluation of density dependence, wood additions, and estuarine/delta habitat findings. Evaluation of limiting factors at the western Washington freshwater IMWs are currently incomplete. Dr. Bilby anticipates having a draft report complete within a month for a monitoring panel and principal investigator (PI) review, and a final synthesis by end of April.

Chair Breckel would like to see this report included in the technical review process to help determine the way the board plans and implements projects in the future. **Member Hoffman** would like to have more details on connectivity and suggested a connectivity score to be used in evaluations, possibly in targeted investments.

Member Pettit stepped out of the room at 3:24 PM.

Remote Sensing of Floodplain

Phil Roni of Cramer Fish Sciences provided a comprehensive summary of the floodplain remote sensing pilot that included four sites, two in Eastern Washington and two in western Washington. The goal of the pilot study was "proof-of-concept" to confirm that the methods can be used to evaluate restoration response and are more cost effective than a purely field-based approach. There were nine study-plan questions having to do with the effect on floodplain area, active channel zone, morphology, fish habitat, sediment erosion and deposition, wood quantity, suitable habitat for juvenile and spawning salmonids, and riparian composition and function.

Of the four large floodplain projects included in the study, Dr. Roni focused on the White River County Line project. The project study methods included: obtaining Light

Detection and Ranging (LiDAR) images, development of a hydraulic model, collecting supplemental field data where needed, and calculating metrics before and after restoration. The LiDAR images of the White River County Line project indicate before and after images of changes to depth and side channels, and the increase of pools and slow water in fish habitat. He then showed Habitat Suitability Index (HSI) images, which were calculated using depth and velocity to determine the most suitable areas for juvenile Chinook (465 percent increase in suitable areas) and spawning Chinook (47 percent increase in suitable areas). The percentage changes of the metrics for geomorphology and habitat were substantially increased after the levee removal. Riparian and large wood metrics also had significant percent changes.

The results of the pilot study indicate that most monitoring metrics for changes in floodplain, in-channel, and riparian habitat and conditions can be efficiently and accurately measured using LiDAR, other remotely sensed data is also effective at measuring these metrics, and project effectiveness can also be measured with these methods. Dr. Roni mentioned that some limited field data collection is needed for validation of a small number of metrics and under specific site conditions, such as stream channel bathymetry and canopy coverage. Dr Roni provided recommendations for modifications to methodologies outlined in the original floodplain and riparian remote sensing study plan. The results from this project will be used to develop recommendations to the board at the May 2023 meeting.

Chair Breckel asked about the cost improvements of these projects and if any monitoring was happening around fish utilization of habitat suitability in these areas. Dr. Roni explained that doing these projects with traditional surveys, such as real time kinematics (RTK), or Total Station, would take a much longer time; however, for shorter projects, this kind of LiDAR might not have the same financial benefit. On the Middle Entiat, there is some fish monitoring happening that can be compared to a 2018 study.

Member Maroney wondered if any research was done in terms of stream channel connectivity and temperature. Dr. Roni clarified that there was no thermal imagery for these study sites, but it could be added and supplemented with data loggers in stream channels.

Adaptive Management Process

Dr. Pete Bisson provided an overview of the progress and content from the draft monitoring and adaptive management strategy, sharing with the board comments, feedback, and insights from the board monitoring subcommittee and the Council of Regions. The goals are to improve restoration actions, inform board investments, and inform board monitoring program priorities. The first phase of the project was to develop a conceptual framework (resist, accept, direct) for restoration that includes targeted and surveillance monitoring. The second phase of the project was to come up with a good example. The Adaptive Management Working Group decided to use the Grande Ronde Model Watershed, the longest running adaptive management program focused on salmon in the Pacific Northwest. The third phase was to perform a comparison on the three board monitoring programs for project effectiveness (both IMWs and regional monitoring projects), to answer: what has been learned from the board monitored programs; how can this information inform the board restoration funding decisions; and how can this information guide monitoring programs?

The final phase is in progress and addresses the processes, roles, and responsibilities of the monitoring panel, review panel and the SRFB. This phase will provide a summary of data and information and provide recommendations on processes for better communication and outreach and processes to inform board funding decisions.

Dr. Bisson hopes to provide specific examples at the May meeting for feedback from the board, and to have this project wrapped up by the end of August, with the understanding that this is an ongoing process.

Item 8: State of the Salmon Report Update

Eli Asher, GSRO Policy Specialist, gave a detailed overview of the 2022 State of Salmon in Watersheds biennial report, which takes two forms: a website and an executive summary that is printable or downloadable.

The Executive Summary is specific to statewide populations that are on the endangered species list, noting various challenges and progress the populations are experiencing.

Member Pettit returned at 4:05 PM.

Additionally, the website addresses the "Four H's" (Habitat, Hydro, Harvest and Hatchery) that continue to provide challenges to populations; prey impact; climate change; funding; and other topics.

Mr. Asher took a moment to recognize the passing of three influential leaders from the Northwest Indian Fish Commission during this biennium, Lorraine Loomis, Terry Williams, and Dale W. Johnson.

The website (www.stateofsalmon.wa.gov) has all the content from the report and more. Viewers can select a recovery region from around the state, and view stories, key takeaways, priorities, and progress. The website also includes interactive multimedia and content.

Chair Breckel commented on needing to pay more attention to how this report is used, noting that we are at a point where we should be asking why we are not seeing more progress. **Member Hoffman** asked for clarity on the analysis of productivity and the parameters used to determine those populations. Mr. Asher answered that they focused on abundance and not all Viable Salmon Population (VSP) parameters, with the caveat that other parameters are also being monitored.

Item 9: State Agency Partner Reports

State Agency Partner Reports were given after Item 5 due to being ahead of schedule.

Washington State Conservation Commission (SCC)

Chris Pettit provided an overview of Conservation Commission activities.

Discussing funding from the 2022 supplemental session funding, Mr. Pettit touched on the positive preliminary data received in association with recent riparian projects, funding being used to enhance nursery sites, and the demand for Sustainable Farms and Field funds, which assists with climate change resiliency via riparian buffers for carbon sequestration.

Additionally, the SCC has data management needs for collection and efficient dispersal of information.

During discussion, Chair Breckel inquired about private landowners' response to riparian projects. Member Pettit explained both positive and negative interactions occur. For those that are negative, more effective communication on the importance of riparian work is necessary.

Department of Ecology (ECY)

Annette Hoffmann stated that the Department of Ecology is tracking legislation related to 6PPD-Quinone (6PPD-Q). Additional funding could fill information gaps including laboratory methods to measure 6PPD-Q in sediment for baseline monitoring, developing new criteria for best management practices, expand coordination with stakeholders and state and federal partners, and continue the search for safer alternatives to 6PPD-Q to ultimately eliminate the use of this chemical.

Member Hoffman also mentioned the Cap-and-Invest program, which limits allowable carbon emissions by certain entities and industries, requiring those businesses to purchase allowances to cover their carbon footprint. The number of allowances will be gradually reduced over time, urging those businesses to invest in greener technologies to ultimately reduce state-wide greenhouse gas emissions and transition to being energy neutral. The first auction of the allowances occurred on February 28, and all the allowances were sold, creating critical revenue for the Legislature to invest in clean energy projects and support communities affected by poor air quality and climate pollution. Member Hoffman expects a final report on revenue from this auction by March 28.

For more information on this program, go to ecology.wa.gov, where you can sign up to be notified of future auctions, read revenue reports, and more.

While members asked about the program, Member Hoffman directed them to Ecology's air quality program for detailed answers and more information.

Department of Natural Resources (DNR)

Tom Gorman updated the board on the ongoing work with the statewide Kelp and Eelgrass Health and Conservation Plan mentioning there are some regional workshops occurring in March. This is related to Senate Bill 5619 that passed during the supplemental session, which provided additional funding for the planning and expansion of monitoring work. The workshops are a direct result of this funding; one will be hosted on the coast and one in Puget Sound, with positive engagement so far.

The Derelict Vessel Removal Program also received funds in the supplemental session, leading to additional staff and more vessel removal with sustained funding. Other states are looking to Washington as the leader in derelict vessel removal with this program that continues to improve over time.

In the 2023 legislative session, House Bill 1789, related to funding for natural climate solutions passed off the house floor yesterday.

Two companion bills were passed off the House and Senate floors related to derelict structure removal, which includes funding for removal and general restoration of wharfs, piers, pilings, and tire-pile reefs which would have strong benefits to near-shore environments.

During discussion, board members inquired about the magnitude of derelict structures population and the local government's role in the removal process. **Member Gorman** replied that four very large projects totaling $11 million within this bill are being targeted. However, there are 12-20 structures considered the "worst of the worst" and many more. If the bill passes, DNR would be looking at three biennia of support to target the worst sites they are aware of now. The bills would also provide grants to municipalities to conduct their own removal. Additionally, ECY is seeking funding to map derelict structures that DNR is maybe not aware of and would provide more tools to work with private landowners to complete removals.

Department of Fish and Wildlife (WDFW)

Jeremy Cram discussed how WDFW has launched the next phase in fish passage strategy implementation. A team is being assembled to integrate all the fish passage efforts that exist across the state with federal and local partners, including culverts but also expanding into other aspects of fish passage.

There has been more resolution on Fish-In Fish-Out (FIFO) proviso money, which has some implications for the board. WDFW was able to fund ongoing projects and initiate and focus on three new projects, including Fish In projects in the Samish River Basin, establishing a sonar team on the coast (both projects will focus on adult abundance), and a genetic project to better differentiate Chinook populations within the Skagit River. Because of the timeline, WDFW was able to upgrade infrastructure that needed improvement which included mostly smolt traps.

Member Cram acknowledged that WDFW is entering the North of Falcon season setting process, and that many of the forecasted salmon return reports are available.

Chair Breckel asked if WDFW is involved in NOAA's review of coastal steelhead. Member Cram replied that yes, there is a team assembled to provide a technical review related to the proposed listing utilizing data that exists, which will be informative to the process. The Steelhead at Risk report was cited in the requests to list this species, which acknowledged that more information is needed on coastal steelhead.

Department of Transportation

Susan Kanzler noted WSDOT has made funding requests related to fish passage, addressing the chronic environmental deficiencies and stormwater, all of which contribute to salmon recovery.

Addressing the Move Ahead Washington Funding, Member Kanzler noted that $500 million will be put toward stormwater retrofitting to enhance stormwater treatment from existing roads and infrastructure. The proviso directs WSDOT to prioritize cost effective projects that focus on benefits to salmon recovery and ecosystem health to reduce toxic pollution and address public health disparities. WSDOT, along with other agencies, recognizes the connection between stormwater management, salmon recovery, and the overall health of the state.

WSDOT will also dedicate these funds to ramping up their stormwater program by updating their project prioritization. This includes robust outreach to governments and local tribes, non-governmental organizations, researchers, partners, and community members with the goal of an equitable distribution of resources across the state. **Member Kanzler** noted there are many concerns and questions surrounding 6PPD-Q and WSDOT intends to make adjustments based on the best available science and input from the tribes and other partners. WSDOT is also working on other various projects where stormwater retrofit may include additional community ecosystem benefits.

Member Kanzler shared that WSDOT had recently hired Tammy Schmitt as their new Fish Passage Monitoring and Performance Lead and Erin Mathews as their new Fish Passage Coordinator.

Chair Breckel asked about the 6PPD-Q and what treatments are being used to mitigate the contamination, **Member Hoffman** answered that promising research indicates that dirt filters it out as well as implementing bioswales, but more information is needed.

ADJOURN: 4:21 PM

Next meeting will be May 23 and 24, 2023, with decisions on targeted investment and match policies.

Approved by:

Washington State Recreation and Conservation Office
Salmon Recovery Funding Board

Salmon Recovery Funding Board Briefing Memo

Item 1

APPROVED BY RCO DIRECTOR MEGAN DUFFY

Meeting Date: May 23-24, 2023

Title: Director's Report

Prepared By: Megan Duffy, Recreation and Conservation Office Director; Susan Zemek, Communications Manager; Brock Milliern, Policy Director; Mark Jarasitis, Fiscal Manager; and Bart Lynch, Data Specialist

Summary

This briefing memo describes staff and Director's activities and key agency updates including: a legislative update, new staff profiles, news from other Recreation and Conservation Office boards, and a fiscal and performance update.

Board Action Requested

This item will be a:

- ☐ Request for Decision
- ☐ Request for Direction
- ☒ Briefing

Agency Update

PRISM Has a New Contractor

Diane Rudeen, owner of Rudeen and Associates and creator of PRISM, will retire at the end of this year and has begun transitioning maintenance and development of PRISM and the Salmon Recovery Portal to a Virginia-based company. The Timmons Group has extensive knowledge of data systems and Geographic Information Systems (GIS). The company has worked with Washington State agencies for many years, and has a full array of staff, including project managers, business analysts, application developers, and GIS specialists. The Recreation and Conservation Office (RCO) will continue working with the current developers to ensure continuity of business functions. RCO staff met with the Timmons Group in Olympia in early April.

Invasive Species Awareness Week a Success

The Washington Invasive Species Council celebrated Invasive Species Awareness Week in February with a series of virtual and in-person events for the public and professionals. During the week, the council reached more than 40,000 people statewide and beyond through events, website visits, media coverage, and social media. Council executive director Justin Bush appeared on [Fox 13 Seattle](), among other media coverage.

After Invasive Species Awareness Week, council staff sprung into another series of workshops. The council hosted workshops for tribal audiences in March and April that included updates on priority species, impacts on cultural resources, invasive species management, funding resources, and deep dives into groups of invasive species. In early April, the council hosted a new event in Astoria, Oregon bringing together more than 80 natural resource professionals and invasive species managers from coastal counties to network, learn successes and challenges with management, and become familiar with new invasive species on the horizon. On April 27, the council and partners held a first-of-its-kind, virtual Invasive Snail and Slug Workshop.

RCO Starts Planning for Supplier Diversity

In 2022, the Legislature directed the Department of Enterprise Services to develop policies and procedures that encourage the purchase of goods and services from small, diverse, and veteran-owned businesses in Washington. Supplier diversity can increase innovation, product quality, and cost savings. Throughout 2023, RCO will be updating its contracting policies and procedures to meet this new statewide directive. RCO will also develop budget forecast plans that are shared publicly and new best practices for contract language and procurement procedures.

One of RCO's Salmon Programs Receives New Money

The Washington Department of Fish and Wildlife is receiving more than $23 million in federal funding for the Estuary and Salmon Restoration Program, of which RCO will award $8 million to specific acquisition and restoration projects in northern Puget Sound. In addition, the department is receiving $800,000 of other federal funding for its Shore Friendly program, which RCO will award to further develop the Shore Friendly Partnership Landowner Strategic Engagement program and advance additional restoration projects. The Shore Friendly program is a subprogram of the Estuary and Salmon Restoration Program and was new to RCO in 2019. It funds local programs that provide stewardship incentives to landowners to create healthy shorelines.

Orca Intergovernmental Work Group Forms

The Governor's Salmon Recovery Office (GSRO) is developing an intergovernmental workgroup on orca recovery that will meet quarterly to continue implementation of the Governor's Killer Whale Task Force recommendations. Participating Washington state agencies include the Conservation Commission, Department of Ecology, Department of Fish and Wildlife, Department of Natural Resources, Governor's Office, and Puget Sound Partnership. Three tribal fish commissions have been invited (Columbia River Inter-Tribal Fish Commission, Northwest Indian Fisheries Commission, and the Upper Columbia United Tribe), as have federal agencies (Coast Guard, Environmental Protection Agency, and National Oceanic and Atmospheric Administration.)

Legislative Update

Legislative session concluded on April 23. Staff will provide a summary of salmon-related bills that passed and overview of the final budget.

Here is a comparison of the agency request and final budgets:

Capital Budget:

Program	Agency Request	Final
Estuary and Salmon Restoration (ESRP)	$25,512,000	$14,309,000
Family Forest Fish Passage Program (FFFPP)	$10,870,000	$7,780,000
Springwood Ranch	$14,000,000	$14,000,000
Brain Abbott Fish Barrier Removal Board (BAFBRB)	$94,600,000	$48,407,000
Puget Sound Acquisition and Restoration (PSAR)	$65,419,000	$59,165,000
Salmon Recovery (SRFB-state)	$82,000,000	$20,000,000
Fish Barrier Removal Skagit	$0	$1,000,000
City of LaCenter Breezee Creek Culvert	$0	$1,000,000
Upper Quinault River Restoration	$0	$2,000,000
Riparian Grant Program	$0	$25,000,000
Washington Coastal Restoration and Resiliency Initiative	$17,500,000	$10,134,000
Federal Authority (PCSRF)	$75,000,000	$75,000,000

Operating Budget:

Program	Agency Request	Final
Salmon Recovery Organizations	$4,472,000	$3,428,000
Recreation Data	$372,000	$0

DEI Coordinator	$312,000	$312,000
Tribal Liaison	$312,000	$312,000
Deferred Maintenance Grants—Local Parks	$0	$5,000,000
Flowering Rush Cost Share	$50,000	$50,000
Connections Program	$0	$500,000
Hood Canal Bridge	$0	$3,600,000
Riparian Coordinator	$398,000	$398,000

Employee News

Monica Atkins joined RCO as the new administrative assistant for the Recreation and Conservation Grants Section in February. Monica was an administrative coordinator for Kitsap Community Resources. Monica earned her bachelor of science degree in multidisciplinary anthropology and nonprofit management from Appalachian State University in her home state, North Carolina. After graduating she worked as an employment specialist for Cape Fear Vocational Services, a barista for Starbucks, and a verification associate for Mediant Communications, before moving across the country to settle in the Pacific Northwest.

News from the Boards

The **Invasive Species Council** met in March and learned about the Washington Committee on Geographic Names, heard new perspectives on the language of invasive species, and discussed the role of the council to inform change. Among other updates, the council also elected new leadership on its executive committee and approved updated council bylaws. The next meeting of the council is June 15.

The **Recreation and Conservation Funding Board** met April 25 to make decisions about possible cost increase policy changes to the Washington Wildlife and Recreation Program and the Aquatic Lands Enhancement Account grant programs, additions to the Exceptions to Conversion policy, and preliminary approval of ranked project lists in the Boating Facilities, Recreational Trails Program, Nonhighway and Offroad Vehicles Activities program, and Firearms and Archery Range Recreation grant programs.

Fiscal Report

The fiscal report reflects Salmon Recovery Funding Board activities as of April 14, 2023.

Salmon Recovery Funding Board

For July 1, 2021-June 30, 2023, actuals through April 14, 2023 (FM 20). 87.5 percent of biennium reported.

PROGRAMS	BUDGET	COMMITTED		TO BE COMMITTED		EXPENDITURES	
	New and Re-appropriation 2021-2023	Dollars	% of Budget	Dollars	% of Budget	Dollars	% of Committed
State Funded							
2015-17	$1,746,440	$1,560,527	89%	$185,913	11%	$435,085	28%
2017-19	$6,230,576	$5,548,758	89%	$681,818	11%	$3,655,960	64%
2019-21	$14,669,777	$14,629,769	99%	$40,008	1%	$8,510,597	59%
2021-23	$26,682,800	$26,682,673	99%	$127	1%	$4,222,948	16%
2021-23 Supplemental	$95,880,000	$66,489,841	69%	$29,390,159	31%	$1,685,736	3%
Total	**$145,209,593**	**$114,911,568**	**79%**	**$30,298,025**	**21%**	**$18,510,326**	**16%**
Federal Funded							
2016	$389,018	$389,018	100%	$0	0%	$389,018	100%
2017	$3,804,630	$3,804,630	100%	$0	0%	$3,804,630	100%
2018	$7,627,453	$7,562,773	99%	$64,680	1%	$4,317,394	57%
2019	$10,867,938	$9,597,482	88%	$1,270,456	12%	$5,235,117	55%
2020	$16,530,979	$14,462,224	87%	$2,068,754	13%	$8,975,971	62%
2021	$17,848,000	$16,736,513	94%	$1,111,487	6%	$5,020,850	30%
2022	$23,280,000	$18,246,328	78%	$5,033,672	22%	$1,181,625	6%
Total	**$80,348,018**	**$70,798,969**	**88%**	**$9,549,049**	**12%**	**$28,924,605**	**41%**
Grant Programs							
Lead Entities	$6,926,575	$6,926,575	100%	$0	0%	$3,683,336	53%
PSAR	$107,036,152	$105,725,354	99%	$1,310,798	1%	$40,995,490	39%
Subtotal	**$113,962,727**	**$112,651,929**	**99%**	**$1,310,798**	**1%**	**$44,678,826**	**40%**
Administration							
Admin/ Staff	$8,117,810	$8,117,810	100%	$0	0%	$6,958,225	86%
Subtotal	**$8,117,810**	**$8,117,810**	**100%**	**$0**	**0%**	**$6,958,225**	**86%**
GRAND TOTAL	**$347,638,148**	**$306,480,275**	**88%**	**$41,157,872**	**12%**	**$99,071,982**	**32%**

Note: Activities such as smolt monitoring, effectiveness monitoring, and regional funding are combined with projects in the state and federal funding lines above.

Performance Update

The following data displays grant management and project impact performance measures for fiscal year 2023. Data included specific to projects funded by the board and current as of April 19, 2023.

Project Impact Performance Measures

The following tables provide an overview of the fish passage accomplishments funded by the board in fiscal year 2023. Grant sponsors submit the data for blockages removed, fish passages installed, and stream miles made accessible when a project is completed and in the process of closing. The Forest Family Fish Passage Program, Coastal Restoration Initiative Program, Chehalis Basin Strategy, Brian Abbott Fish Barrier Removal Board, and the Estuary and Salmon Restoration Program are not included in these totals.

So far, 13 salmon blockages were removed this fiscal year (July 1, 2022, to April 19, 2023), and 111 passageways installed (Table 1). These projects have cumulatively opened 71.02 miles of stream (Table 2).

Measure	FY 2023 Performance
Blockages Removed	13
Bridges Installed	3
Culverts Installed	1
Fish Ladders Installed	0
Fishway Chutes Installed	107

Table 1: Blockage Removal and Passage-way Installation projects

Project Number	Project Name	Primary Sponsor	Funding Program	Stream Miles
18-2086	Russell Creek Fish Barrier	Walla Walla Co Cons Dist	Salmon Federal Projects	5.00
18-1671	Pilchuck Dam Removal Restoration Project	Tulalip Tribes	Puget Sound Acq. & Restoration	37.00
18-1534	Middle Fork Nooksack Diversion Dam Removal	Bellingham City of	PSAR Large Capital Projects	16
19-1104	Wildcat Road Fish Barrier Correction	Chehalis Basin FTF	Salmon State Projects	7.29

20-1130	Middle Fork Hoquiam Tidal Restoration	Grays Harbor Conservation Dist	Salmon Federal Projects	0.35
21-1081	Geissler Cr at Geissler Rd Fish Passage Const 1	Chehalis Basin FTF	Salmon State Projects	2.00
21-1042	Black R Trib - Littlerock Rd. Fish Pass. Con.	Thurston County of	Salmon Federal Projects	1.65
19-1718	Mill Creek Fish Passage - Park to Roosevelt	Tri-State Steelheaders Inc	Salmon State Projects	0.38
18-1648	Cooke Creek Screening & Passage	Kittitas Co Conservation Dist	Salmon Federal Projects	1.35
		Total Miles		**71.02**

Table 2: Project that have opened 71.02 miles of stream.

Grant Management Performance Measures

The table below summarizes fiscal year 2023 operational performance measures as of April 19, 2023

Measure	FY Target	FY 2023 Performance	Indicator	Notes
Percent of Salmon Projects Issued Agreement within 120 Days of Board Funding	90%	**68%**	●	145 agreements for SRFB-funded projects were due to be mailed this fiscal year to date. Staff issued 98 agreements within 120 days, averaging 77 days.
Percent of Salmon Progress Reports Responded to On Time (15 days or less)	90%	**87%**	●	504 progress reports were due this fiscal year to date for SRFB-funded projects. Staff responded to 436 in 15 days or less. On average, staff responded within 9 days.

Percent of Salmon Bills Paid within 30 days	100%	**100%**	●	During this fiscal year to date, 1267 bills were due for SRFB-funded projects. All were paid on time.
Percent of Projects Closed on Time	85%	**78%**	●	73 SRFB-funded projects were scheduled to close. So far, this fiscal year 57 of them closed on time.
Number of Projects in Project Backlog	5	**10**	●	10 SRFB-funded projects are in the backlog and need to be closed out.
Number of Compliance Inspections Completed	125	**22**	●	Staff inspected 22 worksites this fiscal year to date. They have until June 30, 2023, to reach the target.

Salmon Recovery Funding Board Briefing Memo

Item 2

APPROVED BY RCO DIRECTOR MEGAN DUFFY

Meeting Date: May 23-24, 2023

Title: Salmon Recovery Management Report

Prepared By: Erik Neatherlin, GSRO Director; Jeannie Abbott, GSRO Program Coordinator; Tara Galuska, Orca Recovery Coordinator; Marc Duboiski, RCO Salmon Recovery Section Manager

Summary

This memo summarizes the recent work completed by the Governor's Salmon Recovery Office and the Recreation and Conservation Office's Salmon Recovery Grants Section, including work with regional salmon recovery boards, planning for the Salmon Recovery Conference, and an update on salmon grant programs.

Board Action Requested

This item will be a:
- ☐ Request for Decision
- ☐ Request for Direction
- ☒ Briefing

Governor's Salmon Recovery Office Report

Legislative and Partner Activities

The Governor's Salmon Recovery Office (GSRO) continued its engagement on state legislative affairs with the Governor's Office, and partner agencies to support salmon recovery policy and budget priorities; presented on the Southern resident killer whale (SRKW) recovery to Indigenous and Multi-agency groups; and met with tribal entities, regional salmon recovery directors, and other salmon related entities.

GSRO supported the Governor's Office on federal affairs including assisting Governor Inslee's Office in Washington, DC, and Congressional staff with federal Pacific Coastal Salmon Recovery Funding (PCSRF) Fiscal Year 2024 Appropriation letters of support.

GSRO is planning for annual visits to Washington DC, for Puget Sound Day on the Hill the week of May 8 and salmon days the week of November 13. GSRO is on the steering committee for the Puget Sound Day on the Hill.

GSRO continued its participation on the core planning team with Long Live the Kings, Pacific Salmon Foundation, Salmon Defense, and University of Washington for the international Pacific Coast Salmon and Climate Initiative. The initial scoping meeting was held on April 17, 2023 at the Lower Columbia Fish Recovery Board offices in Vancouver, WA and included 30 attendees from across the region including representatives from tribes and tribal organizations, Pacific Salmon Commission, and Canada. A larger workshop is being planned for the fall of 2023 with more details to come.

NOAA appointed Jennifer Quan as Regional Administrator for NOAA Fisheries West Coast Region.

Governor Inslee appointed Dr. Thomas L. Purce to the Northwest Power and Conservation Council.

Presentations and Meetings

GSRO attended the Nisqually Tribe and North Thurston public schools Billy Frank Jr. Day to commemorate the life and legacy of Billy Frank Jr. Staff hosted a Salmon Recovery Funding Board (board) display with an orca skull model and provided information on salmon and orca recovery needs. More than 400 community members attended the event.

GSRO attended a two-day killer whale health workshop with marine mammal veterinarians and killer whale experts from across the US and Canada to discuss collecting health metrics and a building a health database to assess individual Southern Resident killer whale (SRKW) health and trends.

GSRO traveled to the Snake River region to meet with the Confederated Tribes of Umatilla Indians Reservation tribal governments to learn about Snake River priorities and to the Makah Indian Reservation with the Coast Salmon Partnership to discuss restoration projects.

Governor's Salmon Strategy Update

GSRO continues implementation of the *2021 Governor's salmon strategy update*. Following the completion of the legislatively required 2023-25 biennial work plan, GSRO held bi-monthly legislative coordination meetings with designees of the Natural Resources Subcabinet. These meetings provided a forum to discuss known positions of agencies, tribal governments, stakeholders, and lawmakers for situational awareness and to identify coordination and communication needs.

GSRO convened the Natural Resources Subcabinet on May 17, 2023. The Subcabinet discussed implementing 2023 legislative policy and budget priorities and setting priorities for the 2024 supplemental legislative session that align with tribal priorities and regional salmon recovery plans. The Subcabinet meets biannually and includes the directors of state natural resource agencies. It is a forum to strengthen agency coordination, commitment, and accountability across separately elected agencies, cabinet agencies, and commissions to effectively implement the Governor's salmon strategy.

Salmon Recovery Network

The Salmon Recovery Network (SRNet) continues to meet virtually and most recently met on April 28, 2023 to discuss the state biennial budget and coordinate with partners on priorities around federal funding.

2023 Salmon Recovery Conference

The Salmon Recovery Conference was held April 18-19, 2023 in Vancouver, WA. There were 720 in-person registrants and approximately 100 virtual registrants. The opening and closing sessions were recorded live and presenters pre-recorded their talks. Recordings are available to all attendees until November 10.

2023 Salmon Recovery Conference

We are seeking the board's approval to hold the 2025 Salmon Recovery Conference and use conference revenue and PCSRF funds to hire Western Washington University Conference Services to assist with planning.

Southern Resident Orca Recovery

Senate Bill 5371 regarding extending vessel distance from SRKW from 300-400 yards to a thousand yards in 2025 and simplifying the commercial whale watching system, was passed by the legislature this session. The bill is based on recommendations in the Washington Department of Fish and Wildlife's (WDFW) first Southern Resident Killer Whale Vessel Adaptive Management 2022 Legislative Report, which is required every two years until 2026 on vessel regulations implemented by the legislature in 2019.

The Department of Ecology (ECY), finalized a supplemental orca checklist for use in the State Environmental Policy Act (SEPA) to support the Orca Recovery Task Force's recommendation 27, "Determine how permit applications in Washington State could be required to explicitly address potential impacts to orcas." The checklist will be used for projects that could have a vessel related impact to Southern Resident killer whales. The ECY developed guidance with the checklist found here. The GSRO and the Puget Sound Partnership held a series of public meetings to develop mitigation options and best practices for projects with vessel impacts to orcas. These mitigation options may be used in the SEPA process and are found here.

The Puget Sound Action Agenda includes orca as a vital sign as an indicator of the health of Puget Sound, orca population growth rates are being track. In addition, the GSRO is participating in the Puget Sound Environmental Monitoring Program marine mammal workgroup, which is developing an orca occupancy vital sign indicator for both Southern Resident orcas and Biggs (transient) orcas in Puget Sound, looking at the amount of time the whales are spending in Puget Sound. Indicators are intended as measures that monitor progress and evaluate the success of strategies and actions to improve Puget Sound.

State agency budget requests and the Governor's proposed budget to fund recommendations of the Governor's Southern Resident Orca Task Force by state agencies have been summarized to the Office of Financial Management and partners for the 2023-25 session. A final document with the passed budget will be available on the orca website once reviewed by agencies

The Governor's Salmon Recovery Office has invited broader participation and created and Intergovernmental Workgroup on Southern Resident killer whale recovery.

Salmon Recovery Section Report

2022 Grant Round

The board funded 133 projects at the September and December 2022 meetings. Staff will provide an update at the board meeting on grant agreement progress.

2023 Grant Round

The application site visits are complete with each lead entity and the board technical review panel. The full panel met with staff May 17-18 for their Track 2 evaluation of project proposals. Sponsors have the panel's initial comments to incorporate into their final applications and submit by June 26.

Salmon Recovery Funding Board Grant Administration

The following table shows projects funded by the board and administered by staff since 1999. The information is current as of April 19, 2023. This table does not include projects funded through the Brian Abbott Fish Barrier Removal Board, Family Forest Fish Passage Program, the Washington Coast Restoration and Resiliency Initiative, or Estuary and Salmon Restoration Program. Although RCO staff support these programs through grant and contract administration, the board does not review or approve projects under these programs.

Table 1. Board-Funded Projects

	Pending Projects	Active Projects	Completed Projects	Total Funded Projects
Salmon Projects to Date	25	475	2982	3482
Percentage of Total	1%	14%	86%	

Attachments

A: Closed Projects lists projects that closed between January 30, 2023, and April 19, 2023. Each project number includes a link to information about the project (e.g., designs, photos, maps, reports, etc.). Staff closed out 37 projects or contracts during this time.

B: Approved Amendments lists the major amendments approved between January 30, 2023, and April 19, 2023. Staff processed 25 cost change amendments during this period.

C: Five State PCSRF Letters

Salmon Projects Completed and Closed from January 30, 2023-April 19, 2023

Project Number	Sponsor	Project Name	Primary Program	Closed Completed Date
16-1306	Northwest Straits Marine Conservation Foundation	Seahorse Siesta Barge Removal	Puget Sound Acq. & Restoration	03/10/2023
17-1086	Nisqually Land Trust	Busy Wild Creek Protection Phase II	Salmon Federal Projects	04/13/2023
17-1138	South Puget Sound Salmon Enhancement Group	Fish Passage Inventory WRIA 14	Salmon State Projects	04/14/2023
17-1242	Chelan County Natural Resources Department	Nason Creek Roads De-Commissioning	Salmon State Projects	03/28/2023
18-1002	Environmental Science Associates	REVIEW PANEL - Paul Schlenger	Salmon Federal Activities	02/10/2023
18-1007	Waterfall Engineering, LLC	REVIEW PANEL - Pat Powers	Salmon Federal Activities	02/10/2023
18-1366	Skagit River System Cooperative	Crescent Harbor Creek Restoration	Salmon State Projects	04/12/2023
18-1416	Tulalip Tribes	Martha Creek Pocket Estuary Restoration	Salmon Federal Projects	03/30/2023
18-1471	Bainbridge Island Land Trust	Little Manzanita 1 2018	Puget Sound Acq. & Restoration	01/31/2023

Project Number	Sponsor	Project Name	Primary Program	Closed Completed Date
18-1742	Friends of the San Juans	Feeding Salmon Through Nearshore Rest Design	Salmon State Projects	03/30/2023
18-2086	Walla Walla County Conservation District	Russell Creek Fish Barrier	Salmon Federal Projects	03/28/2023
19-1210	Lower Columbia Fish Enhancement Group	SW Washington Nutrient Enhancement	Salmon Federal Projects	02/16/2023
19-1280	Lewis Conservation District	Hogue Fish Passage-Phase II 2019	Salmon State Projects	03/31/2023
19-1343	Skagit Fisheries Enhancement Group	Island County Culvert Prioritization - Area 2	Salmon State Projects	02/02/2023
19-1390	Kitsap County	Chico Creek Salmon Park Habitat Restoration	Salmon Federal Projects	04/06/2023
19-1414	Skagit Land Trust	Skagit Watershed Habitat Acquisition III	Puget Sound Acq. & Restoration	01/31/2023
19-1451	San Juan County Public Works	Crescent Beach restoration feasibility	Puget Sound Acq. & Restoration	03/27/2023
19-1461	Walla Walla County Conservation District	McCaw Restoration Phase C Construction	Salmon Federal Projects	03/29/2023
19-1467	Quileute Tribe	Rayonier 5050 Road Crossing Restoration	Salmon State Projects	02/17/2023

Project Number	Sponsor	Project Name	Primary Program	Closed Completed Date
19-1475	Chelan County Natural Resources Department	Wenatchee River-Monitor Side Channel Construction	Salmon Federal Projects	03/08/2023
19-1488	Methow Salmon Recovery Foundation	Fuller Side Channel Well Conversion	Salmon Federal Projects	04/11/2023
19-1596	Rudeen & Associates, LLC	PRISM Maintenance FY 2020 - 2022	Salmon Federal Activities	03/17/2023
19-1741	Department of Fish and Wildlife	Maximizing Natural Origin Recruitment 2019	Salmon Federal Activities	03/01/2023
19-1742	Department of Fish and Wildlife	2019 Chinook Mark-Select Fisheries Monitoring	Salmon Federal Activities	02/22/2023
20-1001	Quinault Indian Nation	Lower Quinault Invasive Plant Control (Phase 8)	Salmon Federal Projects	03/29/2023
20-1007	Great Peninsula Conservancy	Rocky Creek Estuary and Riparian Protection	Salmon Federal Projects	03/07/2023
20-1008	Great Peninsula Conservancy	Minter Creek Conservation Easement	Puget Sound Acq. & Restoration	02/07/2023
20-1018	Wild Fish Conservancy	Finn Creek Design	Puget Sound Acq. & Restoration	02/15/2023
20-1047	Pomeroy Conservation District	Upper Pataha Creek PALS Restoration	Salmon Federal Projects	03/09/2023

Project Number	Sponsor	Project Name	Primary Program	Closed Completed Date
20-1048	Pomeroy Conservation District	Tumalum Creek LTPBR Phase 2	Salmon State Projects	02/09/2023
20-1130	Grays Harbor Conservation District	Middle Fork Hoquiam Tidal Restoration	Salmon Federal Projects	02/03/2023
20-1204	The Lands Council	Mill Creek Design	Salmon State Projects	03/13/2023
21-1041	Puyallup Tribe	M-Puyallup River Juvenile Salmon Assessment FY21	Salmon Federal Activities	02/22/2023
21-1081	Chehalis Basin Fisheries Task Force	Geissler Cr at Geissler Rd Fish Passage Const 1	Salmon State Projects	02/15/2023
21-1279	Department of Fish and Wildlife	M-WDFW Fish Program IMW Monitoring 2022	Salmon Federal Activities	03/30/2023
21-1282	Department of Fish and Wildlife	M-WDFW Status and Trends Monitoring (Fi-Fo) 2022	Salmon Federal Activities	03/07/2023
22-1733	Luis Prado	State of Salmon Executive Summary 2022	Salmon Federal Activities	03/07/2023

Project Amendments Approved by the RCO Director

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
17-1177	North Fork Teanaway Large Wood Trapping	Mid-Columbia Fisheries Enhancement Group	Salmon Federal Projects	Cost Change	02/08/2023	to add salmon state to close project
18-1228	Dosewallips R Powerlines Acquisition and Design	Jefferson County Public Health	Puget Sound Acq. & Restoration	Cost Change	11/28/2022	Add $217,945 of 2022 Hood Canal LE Small Supplemental funds awarded by SRFB 9/22/2022. New Agreement total is $589,119.
18-1291	Elwha River Engineered Log Jams - Ranney Reach	Lower Elwha Klallam Tribe	Puget Sound Acq. & Restoration	Cost Change	11/04/2022	$79,064 cost increase using 2022 supplemental funding from NOPLE's allocation. Costs are for CLOMR revision, FEMA permitting requirements.
19-1116	Pacific Pointbar - Acquisition #2	City of Sumner	Salmon Federal Projects	Cost Change	03/15/2023	Correcting the funding source for previous cost increase amendment. Correct funding source for $1,082,940 is 21-23 PSAR.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
19-1346	Lower Horn Creek Fish Passage	South Puget Sound Salmon Enhancement Group	Salmon Federal Projects	Cost Change	03/14/2023	Add $92,000 return 2017-19 PSAR funding (PSP). Increase sponsor match to $56,000. New project total is $369,000. Director approved 3/9/2023; PSP approved 2/28/2023. Also, exchange $120,212.71 of 2019/2021 PCSRF between project 19-1346 and project 21-1032 (cost changed entered). Change PCSRF reporting year for project 19-1346 to 2021.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
19-1446	Ahtanum Village Restoration Design	Confederated Tribes and Bands of the Yakama Nation	Salmon Federal Projects	Cost Change	01/24/2023	In order to address SRFB Technical Review Panel comments on the preliminary design deliverables, and extend the performance period through the end of 2023, the Yakama Nation will contribute $50,000 in match, for design and cultural resources consultation, raising the Project Agreement total to $170,000. The Cultural Resources Consultation Special Condition is updated to reflect the addition of ground disturbing activities in this phase of the project.
19-1489	Lower Wenatchee Instream Flow Enhance Phase II	Trout Unlimited Inc.	Salmon Federal Projects	Cost Change	11/09/2022	Reduce match from 52% to 15% of the grant total. $33,231 added as the new match total. Adjusting AA&E to 30% based on new match/grant total.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
20-1008	Minter Creek Conservation Easement	Great Peninsula Conservancy	Puget Sound Acq. & Restoration	Cost Change	12/16/2022	This amendment will reduce match from $120,000 (53%) to $97,285 (48%) to reflect actual project costs, which were less than estimated. This amendment also raises the administrative cost limit from $10,000 to 10,878 to account for the time and expense necessary to negotiate the terms of the easement.
20-1018	Finn Creek Design	Wild Fish Conservancy	Puget Sound Acq. & Restoration	Cost Change	11/09/2022	This amendment adds $58,200 of the 2022 state SRFB funding awarded through 22-1098 and down-scopes 20-1018 from completing final designs to restore the Finn Cr estuary to instead completing preliminary designs. Final designs will be completed through project 22-1098.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
						Additionally, the original 20-1018 proposal included securing a title report and an acquisition purchase or option agreement for a park-adjacent 1.3 acre vacant private parcel. This amendment removes that landowner willingness component from the project since it is now being accomplished in-kind by the park-adjacent landowner and Kitsap County Parks who are working through a land exchange agreement.
20-1081	Camp Coweeman Restoration	Lower Columbia Fish Enhancement Group	Salmon Federal Projects	Cost Change	03/16/2023	Sponsor is $45,250 underbudget for completing the Baird Creek component of this project. They are requesting $12,250 be added to the AA&E budget and $33,000 be added to the construction budget. Adding $45,250 based on this request.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
20-1105	Skokomish RM 6.5 Restoration Phase 1	Mason Conservation District	Salmon State Projects	Cost Change	02/02/2023	Add 2022 Hood Canal LE SRFB funds of $1,100,000, allocated as $817,026 SRFB and $282,974 Small Supplemental). Sponsor match changes to $439,493. Agreement total is $2,412,283.
20-1113	Lower Big Quilcene River Acquisition	Hood Canal Salmon Enhancement Group	Salmon Federal Projects	Cost Change	11/10/2022	Add, by way of merger, $167,571 21-23 ESRP funds and project scope from agreement 20-1497 to 20-1113. ESRP Scope of Work is integrated and attached to the agreement. All other agreement funding remains the same, Increase Administration rate to 5%. New agreement total is $922,221.
20-1119	Snow Creek Uncas Preserve Restoration	Hood Canal Salmon Enhancement Group	Salmon State Projects	Cost Change	11/08/2022	Add $468,065 2022 Hood Canal LE State Supplemental Small funds awarded by SRFB 9/22/2022. The new agreement total is $1,373,844. Sponsor match is waived by RCO Director.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
20-1367	Debays Slough Feasibility Assessment	Skagit County	Puget Sound Acq. & Restoration	Cost Change	01/25/2023	Adding $85,741.90 returned 15-17 and 17-19 PSAR funds. PSP letter of approval 11/7/2022. Increase of funds is due to originally underestimated consultant costs and additional costs to finish work with the approved one-year time extension.
21-1002	Flaming Geyser State Park Riparian Revegetation	King County Water & Land Resources	Salmon Federal Projects	Cost Change	11/17/2022	WRIA 9 LE was awarded an additional $163,018 of 2022 SRFB funds to fully fund the application bringing the total grant amount to $295,895. Special Condition #2 relating to partial funding is removed and the new agreement total is $400,000. Using PCSRF 2022.
21-1032	Mashel River Habitat Designs RM 0-3	South Puget Sound Salmon Enhancement Group	Salmon Federal Projects	Cost Change	04/10/2023	PCSRF funding exchange: Exchange $120,212.71 of 2019/2021 PCSRF between project 19-1346 and project 21-1032 (cost changed entered). Change reporting year for 21-1032 to 2019.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
21-1062	Upper Dungeness R Large Wood Restoration Phase III	Jamestown S'Klallam Tribe	Salmon State Projects	Cost Change	11/07/2022	Cost increase to add $249,500 of the lead entity (NOPLE) 2022 supplemental allocation to the project.
21-1101	Dungeness Riparian Recovery Phase III	North Olympic Salmon Coalition	Salmon Federal Projects	Cost Change	11/07/2022	$25,935 cost increase using 2022 PCSRF funding. This project was partially funded in 2021 and was provided full funding in the 2022 NOPLE ranked list.
21-1138	Upper Deschutes Conceptual Design	South Puget Sound Salmon Enhancement Group	Salmon Federal Projects	Cost Change	03/31/2023	To add state funds used for advances
21-1144	Anton and Cedar Creeks Fish Passage Design	Trout Unlimited Inc.	Salmon Federal Projects	Cost Change	02/28/2023	Increase budget by $14,000 due to increased design engineering required for federal funds for construction. No additional match required.
21-1148	McArdle Bay Shoreline Conservation Easement	San Juan Preservation Trust	Salmon Federal Projects	Cost Change	11/10/2022	Adding $107,648 in 2022 PCSRF funding to fully fund a partially funded 2021 project. This project was included on the 2022 ranked list for San Juan County LE.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
21-1179	Restore Lower Peshastin Creek Ph 2 Final Design	Cascade Columbia Fisheries Enhancement Group	Salmon Federal Projects	Cost Change	11/21/2022	Adding $70,000 of BPA matching funds. Sponsor requested a time extension to allow for cultural resources delays and final wetland delineation and design work. Match needed to extend agreement end date.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
21-1197	Lower Cowiche Floodplain Restoration	Mid-Columbia Fisheries Enhancement Group	Salmon Federal Projects	Cost Change	02/01/2023	This cost increase adds $15,802 of Sponsor Match and $87,366 of Salmon State Supplemental awarded to project 22-1527 "Lower Cowiche Floodplain Rest Cost Increase" to fully fund this 21-1197 project. The Yakima Lead Entity included this cost increase on their 2022 SRFB ranked list which was approved for funding by the SRFB on September 22, 2022. The total sponsor match is now $43,880 and the total SRFB funding is $246,472, bringing the total Project Agreement amount to $290,352. The Special Condition pertaining to SRFB Technical Review Panel Design Review is expanded based on the 2022 application review, and the special condition relating to rescoping the project if full funding is not secured, is removed.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
22-1084	Johnson Ck Triple Culvert Restoration 2022	North Olympic Salmon Coalition	Salmon State Projects	Cost Change	03/07/2023	Adding $3,212,638 in 21-23 BAFBRB funding which will replace the majority of the match.
22-1132	Coal Creek Fish Passage Restoration	Trout Unlimited Inc.	Salmon Federal Projects	Cost Change	02/07/2023	Adding $45,000 in 21-23 ASRP opportunistic funds as match. The SRFB dollar amount remains unchanged while the match percentage increases from 15.01% to 15.29%. Project total increases slightly from $293,610.00 to $294,310.00. This amendment also adds ASRP special condition language regarding preliminary design review.

Salmon Projects Completed and Closed from January 30, 2023-April 19, 2023

Project Number	Sponsor	Project Name	Primary Program	Closed Completed Date
16-1306	Northwest Straits Marine Conservation Foundation	Seahorse Siesta Barge Removal	Puget Sound Acq. & Restoration	03/10/2023
17-1086	Nisqually Land Trust	Busy Wild Creek Protection Phase II	Salmon Federal Projects	04/13/2023
17-1138	South Puget Sound Salmon Enhancement Group	Fish Passage Inventory WRIA 14	Salmon State Projects	04/14/2023
17-1242	Chelan County Natural Resources Department	Nason Creek Roads De-Commissioning	Salmon State Projects	03/28/2023
18-1002	Environmental Science Associates	REVIEW PANEL - Paul Schlenger	Salmon Federal Activities	02/10/2023
18-1007	Waterfall Engineering, LLC	REVIEW PANEL - Pat Powers	Salmon Federal Activities	02/10/2023
18-1366	Skagit River System Cooperative	Crescent Harbor Creek Restoration	Salmon State Projects	04/12/2023
18-1416	Tulalip Tribes	Martha Creek Pocket Estuary Restoration	Salmon Federal Projects	03/30/2023
18-1471	Bainbridge Island Land Trust	Little Manzanita 1 2018	Puget Sound Acq. & Restoration	01/31/2023

Project Number	Sponsor	Project Name	Primary Program	Closed Completed Date
18-1742	Friends of the San Juans	Feeding Salmon Through Nearshore Rest Design	Salmon State Projects	03/30/2023
18-2086	Walla Walla County Conservation District	Russell Creek Fish Barrier	Salmon Federal Projects	03/28/2023
19-1210	Lower Columbia Fish Enhancement Group	SW Washington Nutrient Enhancement	Salmon Federal Projects	02/16/2023
19-1280	Lewis Conservation District	Hogue Fish Passage-Phase II 2019	Salmon State Projects	03/31/2023
19-1343	Skagit Fisheries Enhancement Group	Island County Culvert Prioritization - Area 2	Salmon State Projects	02/02/2023
19-1390	Kitsap County	Chico Creek Salmon Park Habitat Restoration	Salmon Federal Projects	04/06/2023
19-1414	Skagit Land Trust	Skagit Watershed Habitat Acquisition III	Puget Sound Acq. & Restoration	01/31/2023
19-1451	San Juan County Public Works	Crescent Beach restoration feasibility	Puget Sound Acq. & Restoration	03/27/2023
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19-1488	Methow Salmon Recovery Foundation	Fuller Side Channel Well Conversion	Salmon Federal Projects	04/11/2023
19-1596	Rudeen & Associates, LLC	PRISM Maintenance FY 2020 - 2022	Salmon Federal Activities	03/17/2023
19-1741	Department of Fish and Wildlife	Maximizing Natural Origin Recruitment 2019	Salmon Federal Activities	03/01/2023
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20-1001	Quinault Indian Nation	Lower Quinault Invasive Plant Control (Phase 8)	Salmon Federal Projects	03/29/2023
20-1007	Great Peninsula Conservancy	Rocky Creek Estuary and Riparian Protection	Salmon Federal Projects	03/07/2023
20-1008	Great Peninsula Conservancy	Minter Creek Conservation Easement	Puget Sound Acq. & Restoration	02/07/2023
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20-1047	Pomeroy Conservation District	Upper Pataha Creek PALS Restoration	Salmon Federal Projects	03/09/2023

Project Number	Sponsor	Project Name	Primary Program	Closed Completed Date
20-1048	Pomeroy Conservation District	Tumalum Creek LTPBR Phase 2	Salmon State Projects	02/09/2023
20-1130	Grays Harbor Conservation District	Middle Fork Hoquiam Tidal Restoration	Salmon Federal Projects	02/03/2023
20-1204	The Lands Council	Mill Creek Design	Salmon State Projects	03/13/2023
21-1041	Puyallup Tribe	M-Puyallup River Juvenile Salmon Assessment FY21	Salmon Federal Activities	02/22/2023
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Project Amendments Approved by the RCO Director

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18-1228	Dosewallips R Powerlines Acquisition and Design	Jefferson County Public Health	Puget Sound Acq. & Restoration	Cost Change	11/28/2022	Add $217,945 of 2022 Hood Canal LE Small Supplemental funds awarded by SRFB 9/22/2022. New Agreement total is $589,119.
18-1291	Elwha River Engineered Log Jams - Ranney Reach	Lower Elwha Klallam Tribe	Puget Sound Acq. & Restoration	Cost Change	11/04/2022	$79,064 cost increase using 2022 supplemental funding from NOPLE's allocation. Costs are for CLOMR revision, FEMA permitting requirements.
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19-1346	Lower Horn Creek Fish Passage	South Puget Sound Salmon Enhancement Group	Salmon Federal Projects	Cost Change	03/14/2023	Add $92,000 return 2017-19 PSAR funding (PSP). Increase sponsor match to $56,000. New project total is $369,000. Director approved 3/9/2023; PSP approved 2/28/2023. Also, exchange $120,212.71 of 2019/2021 PCSRF between project 19-1346 and project 21-1032 (cost changed entered). Change PCSRF reporting year for project 19-1346 to 2021.

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						Additionally, the original 20-1018 proposal included securing a title report and an acquisition purchase or option agreement for a park-adjacent 1.3 acre vacant private parcel. This amendment removes that landowner willingness component from the project since it is now being accomplished in-kind by the park-adjacent landowner and Kitsap County Parks who are working through a land exchange agreement.
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20-1113	Lower Big Quilcene River Acquisition	Hood Canal Salmon Enhancement Group	Salmon Federal Projects	Cost Change	11/10/2022	Add, by way of merger, $167,571 21-23 ESRP funds and project scope from agreement 20-1497 to 20-1113. ESRP Scope of Work is integrated and attached to the agreement. All other agreement funding remains the same, Increase Administration rate to 5%. New agreement total is $922,221.
20-1119	Snow Creek Uncas Preserve Restoration	Hood Canal Salmon Enhancement Group	Salmon State Projects	Cost Change	11/08/2022	Add $468,065 2022 Hood Canal LE State Supplemental Small funds awarded by SRFB 9/22/2022. The new agreement total is $1,373,844. Sponsor match is waived by RCO Director.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
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21-1032	Mashel River Habitat Designs RM 0-3	South Puget Sound Salmon Enhancement Group	Salmon Federal Projects	Cost Change	04/10/2023	PCSRF funding exchange: Exchange $120,212.71 of 2019/2021 PCSRF between project 19-1346 and project 21-1032 (cost changed entered). Change reporting year for 21-1032 to 2019.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
21-1062	Upper Dungeness R Large Wood Restoration Phase III	Jamestown S'Klallam Tribe	Salmon State Projects	Cost Change	11/07/2022	Cost increase to add $249,500 of the lead entity (NOPLE) 2022 supplemental allocation to the project.
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21-1138	Upper Deschutes Conceptual Design	South Puget Sound Salmon Enhancement Group	Salmon Federal Projects	Cost Change	03/31/2023	To add state funds used for advances
21-1144	Anton and Cedar Creeks Fish Passage Design	Trout Unlimited Inc.	Salmon Federal Projects	Cost Change	02/28/2023	Increase budget by $14,000 due to increased design engineering required for federal funds for construction. No additional match required.
21-1148	McArdle Bay Shoreline Conservation Easement	San Juan Preservation Trust	Salmon Federal Projects	Cost Change	11/10/2022	Adding $107,648 in 2022 PCSRF funding to fully fund a partially funded 2021 project. This project was included on the 2022 ranked list for San Juan County LE.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
21-1179	Restore Lower Peshastin Creek Ph 2 Final Design	Cascade Columbia Fisheries Enhancement Group	Salmon Federal Projects	Cost Change	11/21/2022	Adding $70,000 of BPA matching funds. Sponsor requested a time extension to allow for cultural resources delays and final wetland delineation and design work. Match needed to extend agreement end date.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
21-1197	Lower Cowiche Floodplain Restoration	Mid-Columbia Fisheries Enhancement Group	Salmon Federal Projects	Cost Change	02/01/2023	This cost increase adds $15,802 of Sponsor Match and $87,366 of Salmon State Supplemental awarded to project 22-1527 "Lower Cowiche Floodplain Rest Cost Increase" to fully fund this 21-1197 project. The Yakima Lead Entity included this cost increase on their 2022 SRFB ranked list which was approved for funding by the SRFB on September 22, 2022. The total sponsor match is now $43,880 and the total SRFB funding is $246,472, bringing the total Project Agreement amount to $290,352. The Special Condition pertaining to SRFB Technical Review Panel Design Review is expanded based on the 2022 application review, and the special condition relating to rescoping the project if full funding is not secured, is removed.

Project Number	Project Name	Sponsor	Program	Type	Date	Amendment Descriptions
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22-1132	Coal Creek Fish Passage Restoration	Trout Unlimited Inc.	Salmon Federal Projects	Cost Change	02/07/2023	Adding $45,000 in 21-23 ASRP opportunistic funds as match. The SRFB dollar amount remains unchanged while the match percentage increases from 15.01% to 15.29%. Project total increases slightly from $293,610.00 to $294,310.00. This amendment also adds ASRP special condition language regarding preliminary design review.

April 12, 2023

The Honorable Jeanne Shaheen
Chair, Subcommittee on Commerce,
Justice, Science, & Related Agencies
Committee on Appropriations
U.S. Senate
Washington, DC 20510

The Honorable Hal Rogers
Chair, Subcommittee on Commerce,
Justice, Science, & Related Agencies
Committee on Appropriations
House of Representatives
Washington, DC 20515

The Honorable Jerry Moran
Ranking Member, Subcommittee on Commerce,
Justice, Science, & Related Agencies
Committee on Appropriations
U.S. Senate
Washington, DC 20510

The Honorable Matt Cartwright
Ranking Member, Subcommittee on Commerce,
Justice, Science, & Related Agencies
Committee on Appropriations
House of Representatives
Washington, DC 20515

Dear Chair Shaheen, Chair Rogers, and Ranking Members Moran and Cartwright:

We are writing to express our support for robust federal investment in the Pacific Coastal Salmon Recovery Fund (PCSRF) in fiscal year 2024 (FY24). PCSRF is a critically important program aimed at recovering salmon and steelhead populations in Western states, and the economically and culturally-important commercial, recreational, and tribal fisheries that are dependent upon them. We have appreciated your subcommittees' past support for this program, and we request that you appropriate at least $70 million for PCSRF in FY24.

As you know, Pacific salmon play an essential role in the economy and habitat of Western states, dating back to long before the establishment of the United States. To this day, Pacific salmon fisheries provide jobs and support the livelihoods of thousands of Americans, and feed many more. Healthy salmon populations are essential to the health of these fisheries.

Pacific salmon populations, however, continue to face tremendous pressures. Today, 28 salmon and steelhead stocks face the threat of extinction on the West Coast. PCSRF was created to support the conservation and recovery of salmon across rivers, watersheds, and coastal habitats in Western states. Since 2000, this program has compelled effective, collaborative approaches to salmon recovery across federal, state, local, tribal, and private sector partners. In Washington, Oregon, Alaska, Idaho, California, and Nevada, PCSRF investments have contributed to over 15,379 projects, and have helped restore more than 11,842 miles of streams and over 1.18 million acres of fish habitat.

Furthermore, PCSRF directly supports economic activity and job creation, particularly in rural communities. Recent analysis shows that every $1 million invested through PCSRF and state matching funds supports more than 16 jobs and generates about $2.3 million in economic activity.

We are greatly appreciative of the additional funding you provided for PCSRF in the Infrastructure Investment and Jobs Act. However, a consistent and continued baseline federal investment of $70 million is crucial to maintaining this progress, and to achieving the goal of full recovery and a healthy, sustainable Pacific salmon fishery.

We thank your subcommittees for your past support and request your continued support for PCSRF. Thank you for your consideration of our request.

Sincerely,

Governor Mike Dunleavy
State of Alaska

Governor Gavin Newsom
State of California

Governor Brad Little
State of Idaho

Governor Tina Kotek
State of Oregon

Governor Jay Inslee
State of Washington

CC: Members of the Alaska Congressional Delegation
Members of the California Congressional Delegation
Members of the Idaho Congressional Delegation
Members of the Oregon Congressional Delegation
Members of the Washington State Congressional Delegation

United States Senate

WASHINGTON, DC 20510

April 5, 2023

The Honorable Jeanne Shaheen
Chairman
Senate Appropriations Subcommittee on
Commerce, Justice, Science and
Related Agencies
Washington, DC 20510

The Honorable Jerry Moran
Ranking Member
Senate Appropriations Subcommittee on
Commerce, Justice, Science and
Related Agencies
Washington, DC 20510

Dear Chair Shaheen and Ranking Member Moran:

Thank you for your continued support of the Pacific Coastal Salmon Recovery Fund ("PCSRF"). The PCSRF provides critical funding to facilitate the recovery of Pacific salmon populations and the commercial, recreational, and Tribal fisheries that rely on them. Since time immemorial, healthy salmon runs have sustained Tribal fisheries, built economies in coastal and inland towns, and become a central part of cultural practices and traditions. Due to the importance of salmon in our states, we ask that you support robust funding for the PCSRF in the Fiscal Year 2024 appropriations legislation.

Each year the commercial and recreational salmon fisheries are worth millions of dollars to the economies of both the United States and Canada. In Washington alone, the domestic commercial fisheries create nearly 23,000 jobs, with salmon harvest worth almost $14 million a year and recreational fishing generating more than $1.5 billion in economic activity annually. In order to maintain and grow these vital economic drivers, Pacific salmon ecosystems must be restored as 28 different salmon and steelhead stocks are facing extinction. The PCSRF supports restoration efforts for Pacific salmon across rivers, watersheds, and coastal habitats throughout Washington, Oregon, Alaska, Idaho, Nevada, and California. A recent analysis has shown that for every $1 million from the PCSRF that is invested in restoration, more than 16 jobs are created supporting about $2.3 million in economic activity.

Over the past 21 years, the NOAA National Marine Fisheries Service, states, Tribes, and local project managers have developed an integrated approach to track progress, measure performance, and ensure accountability of the PCSRF program. With PCSRF funding, states and tribes have undertaken more than 15,379 projects resulting in nearly 1.18 million acres of spawning and rearing habitat and 11,842 miles of previously inaccessible streams that have been restored and protected for salmon. Additionally, the jobs and economic benefits of salmon restoration activities are primarily seen in our local and rural communities, where these benefits are needed most.

We also ask for increased support for NOAA's Protected Resources Salmon Program. Providing adequate funds through the Pacific Salmon line for hatchery genetic management, supporting hatchery production, and other fishery-related activities is critical to ensuring the conservation of wild fish and the sustainability of the West Coast hatchery system. Further, we request that you support robust funding for the Salmon Management Activities line, which has been integral in salmon management and recovery. Salmon management activities support long-standing federal mitigation, legal, and international treaty obligations that could not be met without this important continued investment. As Pacific salmon are an economic driver in our states, insufficiently funding these accounts will have devastating consequences, placing further constraints on our salmon fisheries and the jobs that depend on them. PCSRF's recovery dollars help restore salmon runs and, in doing so, restore a larger ecosystem that is crucial to the region. We must continue to make these investments in salmon recovery not only for economic and cultural purposes, but also for the recovery of endangered Southern resident orcas that depend on healthy salmon populations.

Thanks to your strong support, we have already seen salmon recovery efforts start to pay off. In these challenging fiscal times, we greatly appreciate your continued efforts to maintain these critical programs which sustain the fisheries resources that are so important to our economies, our states, and to the nation.

Thank you for your consideration of this request.

Sincerely,

Maria Cantwell
United States Senator

Mike Crapo
United States Senator

Jeffrey A. Merkley
United States Senator

James E. Risch
United States Senator

Ron Wyden
United States Senator

Alex Padilla
United States Senator

Mazie K. Hirono
United States Senator

Congress of the United States
Washington, DC 20515

March 31, 2023

The Honorable Harold Rogers
Chair
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

The Honorable Matt Cartwright
Ranking Member
Subcommittee on Commerce, Justice, Science, and Related Agencies
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Chair Rogers and Ranking Member Cartwright:

We are writing to thank you for your long-standing support for the Pacific Coastal Salmon Recovery Fund (PCSRF), and to assure you these funds are being put to good use to restore a vital resource in our states. We ask you to continue this support by providing $70 million for this successful program in Fiscal Year 2024.

Pacific salmon and steelhead are more than essential elements of a healthy Pacific Coast ecosystem; they are cultural icons woven into the fabric of local communities and economies. Salmon runs tie the region's people to the landscape, but pressures from a changing environment and human activities have compromised the strength of these runs. Congress established the Pacific Coastal Salmon Recovery Fund (PCSRF) in 2000 to reverse the decline of Pacific salmon and steelhead and support conservation efforts in Washington, Alaska, California, Oregon and Idaho. The program is essential in the race to prevent the extinction of the 28 listed salmon and steelhead species on the West Coast and, in many cases, has stabilized the populations and contributed to their recovery course.

Your support for PCSRF has resulted in impressive accomplishments in local and state salmon recovery efforts. A true partnership between the federal government, states, localities, tribes and private citizens has helped boost thousands of restoration and conservation projects in the region. Under PCSRF, the National Marine Fisheries Service provides competitive funding to the states of Washington, Alaska, California, Oregon, Idaho, and Nevada, and tribes of the Pacific Coast region to implement habitat restoration and recovery projects that contribute to the sustainability of the species.

Over the evolution of PCSRF, the NOAA Fisheries Service, states, tribes and local project managers have developed an integrated approach to track progress, measure performance and ensure accountability. This program directly supports jobs and provides economic benefits to communities throughout the region. Congress must continue to invest in this essential program to achieve the overarching goal of full recovery and sustainability.

The restoration and protection of domestic fisheries are vitally important to local economies, states and the nation. We appreciate your continued support for PCSRF.

Sincerely,

Rick Larsen
Member of Congress

Marilyn Strickland
Member of Congress

Suzan K. DelBene
Member of Congress

Pramila Jayapal
Member of Congress

Kim Schrier, M.D.
Member of Congress

Suzanne Bonamici
Member of Congress

Jimmy Panetta
Member of Congress

Mark DeSaulnier
Member of Congress

Jared Huffman
Member of Congress

Earl Blumenauer
Member of Congress

William R. Keating
Member of Congress

Adam Smith
Member of Congress

Emanuel Cleaver, II
Member of Congress

Kevin Mullin
Member of Congress

Val Hoyle
Member of Congress

Andrea Salinas
Member of Congress

Anna G. Eshoo
Member of Congress

WASHINGTON STATE
RECREATION AND CONSERVATION OFFICE
Salmon Recovery
Funding Board

Salmon Recovery Funding Board Decision Memo

Item 4

APPROVED BY RCO DIRECTOR MEGAN DUFFY

Meeting Date: May 23-24, 2023

Title: Targeted Investment Policy Decision

Prepared By: Nicholas Norton, Policy and Planning Specialist

Summary
This memo summarizes proposed changes and updated policy language for *Manual 18, Appendix J: Targeted Investments Program*. These proposed changes were developed based on a staff review initiated by the Salmon Recovery Funding Board during their December 2022 meeting.

Staff are requesting board approval of the updated policy language, which will be used to update the targeted investments program for the 2023-2025 biennium.

Board Action Requested

This item will be a:
- ☒ Request for Decision
- ☐ Request for Direction
- ☐ Briefing

Introduction/Background

Board Motion

Appendix J of Manual 18 outlines the Salmon Recovery Funding Board's (board) Targeted Investment (TI) policy. This creates a structure, process, and criteria for the board to invest certain types of funding on specific priorities to accelerate salmon recovery. Specifically, if additional funds remain after allocating $18 million annually to the regional allocation, the board can allocate additional funds to TI and select from five different investment priorities to support with the additional funding. In 2022, the board used the TI policy to award funding to two projects that address Southern Resident orca recovery: zis a ba II final design and construction ($4,977,891) and the Gap-to-Gap Ecosystem restoration construction ($3,612,109).

Given the interests in adapting to lessons learned after the 2022 TI grant round, better accommodating unexpected funding, and proactively responding to potential increases in annual federal funding, the board passed the following motion during the December 2022 board meeting:

Move to recommend that staff review the goals, priorities, objectives, criteria, and processes of the Targeted Investment program. The review will include a working committee to support the review. Staff will provide updates to the SRFB at the March meeting.

Process

The TI review was led by Recreation and Conservation Office (RCO) staff with representation from management, the salmon grants section, the policy section, and the Governor's Salmon Recovery Office. This team was responsible for scoping and informing the review process, responding to recommendations from the working committee (see below), and providing final feedback on the proposed policy language provided in this memo.

RCO staff recruited a working committee of eight members, with representation from the board, staff, Washington Salmon Coalition, the Council of Regions, and project sponsors. The working committee held four meetings from January through April 2023 to develop policy recommendations for staff consideration. Additionally, working committee members provided feedback and edits on proposed policy language.

Staff provided briefings and held listening sessions with the Council of Regions to help understand their desired role in the TI process. In addition, the Council of Regions, the Washington Salmon Coalition, the Regional Fisheries Coalition, and specific members of the technical review panel gave feedback to inform final updated policy language.

Summary of Changes

The table below summarizes the proposed changes to the current TI policy and provides a brief rationale for each change. The final, proposed policy language for board approval can be found in Attachment A. These proposed changes have been developed to support the following desired policy outcomes:

- Provide more consistency and surety on statewide investment priorities to help support project development and decision-making; and
- Elevate the role of regional recovery plans and regional technical expertise in driving targeted, high-impact funding decisions;
- Embed additional flexibility into the application and funding process to take advantage of predicted and/or unforeseen funding opportunities;

- Adjust criteria to accommodate the diverse limiting factors, recovery priorities, and project approaches across regions.

TI Section	Proposed Policy Change	Rationale
Investment Priorities	**Adds** statement of intent to use targeted investments as a unified pathway for different types of funding.	Provides clearer directive to support board and staff decision-making.
Investment Priorities	**Changes** from five priorities chosen by the board each grant round to two standing priorities common to all regions.	Better supports long-term project development, decision-making, and capacity alignment for regions and applicants.
Project Eligibility	**Adds** a request minimum ($1M).	Helps to provide additional funding information to support applicant decision making.
Project Eligibility	**Changes** limit of one project from each region to a variable limit based on number of projects and total regional request.	Increases flexibility to accommodate pending or unexpected funding opportunities.
Project Eligibility	**Adds** a requirement for a letter of support from the regional recovery organization detailing how the project fits with recovery objectives and limiting factors.	Elevates the role of regional recovery plans and leverages regional technical capacity in driving targeted funding decisions.
Match	**Removes** the standing match requirement for projects, unless needed for a specific TI grant round.	Removes barriers to priority projects applying for funding where match is a limiting factor.

Application Information	**Adds** the option to include additional policy details such as grant maximums, regional request limits, or supplementary criteria as part of opening a TI grant round.	Provides flexibility to accommodate new or unexpected funding and gives more detailed up-front information to support applicant decision-making.
Application Information	**Adds** a sub-section describing the responsibilities and role of regional recovery organizations in recruiting projects to submit applications.	Helps improve understanding of roles and responsibilities and clarifies the application process.
Evaluation Criteria	**Adds** more detailed descriptions associated with specific point values for multiple criteria.	Helps review panel better apply criteria, provides more discernment between projects, and supports regional decision-making.
Evaluation Criteria	**Removes** priority benefit evaluation criteria.	Aligns criteria with new investment priorities.
Evaluation Criteria	**Reduces** the number of points associated with the "Species Benefits" criteria.	Better accommodates projects that have significant, targeted benefits to single species in alignment with new investment priorities.
Evaluation Criteria	**Combines** "Best Use of Public Funds" and "Leverage Additional Funds" criteria and **shifts** them to a "Cost-Benefit" tie-breaker.	Helps focus criteria more on recovery impacts.
Evaluation Criteria	**Separates** "Ecological Processes" and "Limiting Factors" criteria into separate sections and increases total associated points.	Better aligns criteria with new investment priorities and invites a higher diversity of project approaches across regions.
Evaluation Criteria	**Adds** a new "Funding Impact" criteria relating to the role of funding on reducing the timeline of project completion, increasing the scale of a project, taking advantage	Aligns criteria with new investment priorities.

	of time sensitive opportunities, or harnessing other implementation efficiencies.	
Funding Awards	**Adds** the authority of the board to fund projects in multiple phases or roll projects into a future TI grant round.	Helps to leverage annual federal funding and harness efficiencies in the list-building process.
Funding Awards	**Adds** meaningful engagement with underserved communities as a consideration for funding decisions.	Better aligns with ongoing federal funding directives.
Funding Awards	**Removes** the limit on number of partially funded projects per biennium.	Gives the board more discretion to negotiate with applicants and maximize the impact of funding decisions.

Next Steps

If approved by the board, the updated TI policy would be available for immediate use. Specifically, in Item 7 the board will make key decisions about funding allocations for the 2023-2025 biennium. This includes decisions on TI program funding allocation.

Strategic Plan Connection

These policy proposals support aspects of *Goal 1* and *Goal 2* of the board's strategic plan. Specifically, this process will help ensure that allocations best advance the salmon recovery effort, close gaps in current funding relative to overall salmon recovery efforts and support the economical and timely use of resources for projects.

Attachments:

A: Appendix J: Targeted Investment Program

Appendix J: Targeted Investments Program

The targeted investments program allows the SRFB to invest funding in specific regional priorities to accelerate salmon recovery.

Investment Priorities

It is the intent of the SRFB to use targeted investments to allocate different types of state and federal funding not dedicated to the regional allocation to support high-impact projects with significant salmon recovery benefits.

Specifically, the SRFB intends to target investments for projects that 1) drive significant population-scale benefits consistent with regional recovery priorities and 2) accelerate the on-the-ground pace and scale of project implementation.

Project Eligibility

In addition to the eligibility requirements found in Section 2: Eligible Projects, each targeted investment project must satisfy all the following eligibility criteria:

- Address both SRFB targeted investment funding priorities above
- Restore and/or acquire habitat, which may include design funding
- Request more than $1 million from SRFB, except as otherwise specified in a particular grant round
- Be supported by the lead entity where the project is located
- Not be fully funded by the current regional allocation or sub-allocation to lead entities
- Have a letter of support from the regional recovery organization where the project is located detailing the project's alignment with specific population-level recovery objectives and/or limiting factors prioritized for this funding by the regional recovery organization.

The SRFB may include additional eligibility requirements as part of opening a targeted investment grant round if needed to support the intent of the program.

Match

The SRFB waives the match requirement for targeted investment projects, unless otherwise required as part of a specific targeted investment grant round.

Application Information

Allocation and Funding

The SRFB may fund targeted investments only if funding remains after allocating annual statewide funding of $18 million from state capital budget appropriations and the Pacific Coastal Salmon Recovery Fund. A targeted investment grant round is initiated through the release of allocation and funding guidance to regional recovery organizations, which shall include the following information, at a minimum:

- Secured, requested, or pending funding that will be allocated to the targeted investment grant round
- Limits, if any, on the size of individual grant requests, as well as the number of projects and/or total grant requests that can come from a specific region. These limits must be the same across regions
- Supplementary eligibility criteria and ranking criteria as needed.

The SRFB also may actively use the targeted investments process to access and leverage new state and non-state funding as opportunities arise.

Regional Project Support

Regional recovery organizations are responsible for all the following:

- Working with lead entities, project sponsors, and other partners to identify specific population-level recovery objectives and/or limiting factors prioritized for targeted investments funding
- Recruiting proposed project(s) to apply for targeted investments funding in accordance with the guidelines and limitations included in this policy and associated with the targeted investments grant round.

Before final submission of a targeted investments application, regional recovery organizations must provide a letter of support with the application materials detailing the project's alignment with specific population-level recovery objectives and/or limiting factors prioritized for this funding by the regional recovery organization.

Submission

Applications for eligible projects typically will be accepted in conjunction with a regular SRFB grant round, however, the SRFB may elect to use alternate timelines as needed to support the intent of the targeted investments program.

Applicants must work with the lead entity coordinator for the area where the project is located to enter project information into the Salmon Recovery Portal and create an application in PRISM. Applicants must follow the application schedule, initial review timeline, and requirements for the grant round outlined in this manual and by the lead entity.

Applicants also must satisfy additional requirements described in this appendix and found in the application questions in PRISM. Applicants will follow Steps 1 through 4 established in Section 3: How to Apply. Applicants also will follow Section 4: SRFB Evaluation Process in this manual, including the review of projects by the SRFB Review Panel for technical merit.

Applications may have additional review as determined by the regional recovery organization. Targeted investments must be endorsed by the lead entity but are not part of the annual lead entity ranking process. However, partial funding for a targeted investments project may be received through a lead entity ranked list.

Technical Review

RCO grants managers will review applications to ensure they are complete and projects meet the minimum eligibility criteria. Applicants must ensure application materials are submitted at least two weeks before SRFB Review Panel site visits.

After the site visits, the SRFB Review Panel will indicate whether a project is *Clear, Conditioned, Needs More Information*, or a *Project of Concern*. Projects with statuses of *Needs More Information* or *Project of Concern* will be returned to applicants to answer questions and comments and resubmit as final applications.

Projects will then be re-reviewed. The SRFB Review Panel will indicate whether the project is cleared or conditioned for funding or whether it remains a *Project of Concern* and is not recommended for funding. See Sections 3 and 4 for more details on the technical review.

Scoring

The SRFB Review Panel will score all final applications using the evaluation criteria below, as well as any additional criteria included as part of the specific targeted investment grant round. The SRFB Review Panel will include a written evaluation with findings to support the scoring presented to the SRFB. Projects that remain a *Project of Concern* will not be scored or recommended for funding.

Funding Awards

The SRFB has the authority to fund targeted investments. The SRFB will determine which projects to fund by considering the following:

- Eligibility and evaluation criteria
- The review panel's technical evaluation and recommendations
- The degree to which a project addresses SRFB targeted investment funding priorities
- The extent to which a project leverages resources and partnerships and/or compliments broader recovery efforts
- The extent to which the project demonstrates meaningful engagement with underserved communities
- The extent to which the project will be resilient to climate change

To take advantage of funding secured after the opening of a grant round, the SRFB may elect to fund targeted investment projects in multiple phases or roll unfunded projects into future grant rounds.

Award Administration

Once approved for funding by the SRFB, targeted investment awards will be administered through contracts between project sponsors and RCO. Sponsors must follow the amendment process outlined in Section 6 and Appendix I.

Evaluation Criteria

Investment Priorities–10 points		
Limiting Factors	0-5	Projects that drive significant population-level benefits to address priority limiting factors identified in regional recovery plans will receive higher scores. Specifically, the highest scoring projects will do the following: • Clearly address priority limiting factor(s) specifically identified in regional recovery plans. • Be in a high-priority geographic area that maximizes project impact at the population level for target species or life stages. • Target priority habitat features or types known to limit productivity for the target species and/or life stage.

		Be identified as a priority through a documented habitat assessment, inventory, or other study. **5**=Uses recent inventories or assessments to target a specific geographic area or habitat feature that limits productivity for multiple species and life stages. **4-5**=Targets a geographic area or habitat feature known to limit productivity. May not be highest priority location or habitat type or may not be informed by inventories or assessments. **2-3**=Moderately addresses a priority limiting factor but may not have population-level impacts and is not informed by recent inventories or assessments. **0-1**=Tangentially addresses a priority limiting factor at some level but does not target a priority location or habitat type and/or does not consider known information and research.
Funding Impact	0-5	Projects that can demonstrate how targeted investment funding will increase the on-the-ground scale, reduce phases, and/or increase efficiencies will receive the highest score. Specifically, the highest scoring projects will demonstrate how funding will do the following: - Significantly increase the scale of the project in terms of miles of habitat accessed, acres protected, or acres restored - Significantly reduce the timeline necessary for full implementation of a larger, multi-phase project - Support critical financial or capacity efficiencies - Take advantage of time-sensitive opportunities to increase project cost-benefit **5**=Clearly demonstrated that targeted investment funding will play a key role in increasing project pace and scale, would support unique efficiencies and/or time-sensitive opportunities to implement innovative approaches, and that the project might not happen without this specific source of funding. **3-4**=Demonstrated that targeted investment funding will help increase pace and/or scale of the project relative to the regional allocation, but not clear that funding is uniquely important because of timing or specific nature of the project. **1-2**=Limited indication of funding impact, possibly because project needs significant additional unsecured funds or previously has received multiple grants from other sources for similar types of work. **0**=Application does not provide information that addresses the role of funding in supporting increased pace and scale, efficiencies, or unique opportunities.
Habitat and Species–15 points		

Scale of Benefit	0-6	Projects with significant, positive impacts on multiple measurable restoration metrics and/or species benchmarks will receive the highest score, including but not limited to metrics such as the following: • Salmon habitat gain in miles • Salmon habitat improved or protected in acres • Improvements in life-stage specific survival rates • Improvements in viability for focal populations • Improvements in fish passage percentage **6**=Large, positive impact on miles accessed or acres improved/protected, along with major potential impact on both life-stage survival rates and population viability for multiple target populations. **4-5**=Moderate habitat gain in miles accessed or acres improved/protected and moderate direct impact on improvements to salmonid survival rates, passage success, population viability, etc. **2-3**=Moderate habitat gain in miles accessed or acres improved/protected, or moderate direct impact on improvements to salmonid survival rates, passage success, population viability, etc. **0-1**=Very limited habitat gains in miles accessed or acres improved/protected, or no apparent direct impact on improvements to salmonid survival rates, passage success, etc.
Ecological Processes	0-6	Self-sustaining, resilient projects that recover habitat through process-based solutions will receive the highest scores. Specifically, the highest scoring projects will be characterized by the following: • Surrounding conditions that support the project • A site that is resilient to future degradation • Will restore or protect self-sustaining processes on the site, with naturally increasing benefit • Project is designed to be resilient to changes in sea level, flows, and species ranges due to climate change. • Avoids temporary fixes or new hardened infrastructure solutions where possible **6**=The project is wholly processed-based on a site resilient to degradation that is supported by surrounding conditions, with naturally increasing benefit involving limited temporary fixes, and that fully incorporates climate change into design. **4-5=**The project is mostly processed-based, on a site resilient to degradation that is supported by surrounding conditions, with limited temporary fixes, and that considers climate change in project design. May involve some hardened infrastructure that couldn't be avoided to achieve desired benefit. **2-3**=The project is somewhat process-based and may have surrounding conditions or approaches that limit the resilience or self-sustaining

		potential of the project or proposes some new hardened infrastructure solutions that could have been avoided. **0-1**=The project has no discernable process-based approaches and is focused primarily on temporary fixes involving installation of new hardened infrastructure solutions that could have been avoided.
Species	0-3	Proposal addressing multiple life history stages for multiple listed salmonid species/populations will receive the highest score as follows: **3**=Multiple life stages of multiple listed salmonid species/populations **2**=Multiple life stages of a single listed salmonid species/populations or single life stage of multiple listed salmonid species/populations **1**=Single life stage of a single listed salmonid species/population **0**=Does not address a listed salmonid species/population
Likelihood to Succeed–15 Points		
Scope, Goals, Objectives	0-5	Correctly sequenced projects with an appropriate scope and supporting goals and objectives will receive the highest score. Specifically, the highest scoring projects will do the following: • Address root cause of problem identified • Have objectives that support and refine biological goals • Have objectives that are specific quantifiable actions to achieve stated goal • Project is in the correct sequence and is independent of other actions being taken first **5**=The project clearly addresses the root cause of the identified problem; the project is sequenced correctly and independent of other needed action; goals and objectives support and refine biological goals and complement the project scope. **3-4**=Appears to address root cause of problem and be in sequence, but goals and objectives are not entirely clear or quantified, and/or may not all be achievable with implementation of the project. **1-2**=The extent to which the root cause of the problem is being addressed is unclear, objectives may be unquantified and don't support biological goals, and/or project is dependent on other actions that may influence timely completion of the full scope. **0**=Project clearly does not address root causes of identified problems, has no identified problem that is to be solved, and creates major outstanding questions of whether the scope can be achieved.
Readiness to Proceed	0-5	Proposals that demonstrate readiness to proceed will receive the highest score. Specifically, the highest scoring projects will do the following: • Have an appropriate and achievable time frame • Have completed all design requirements • Have made significant progress in permitting • Have established cultural resources compliance

		4-5=Project has near final designs, with permits and cultural resource compliance completed, and/or technical specifications and bid documents in hand. **2-3**=Project has completed preliminary design requirements and has made significant progress on additional design elements, cultural resources compliance, and/or permit review. **0-1**=Project has completed preliminary design requirements but there are significant outstanding issues related to sequencing, permitting, and/or cultural resources compliance.
Sponsor Experience	0-5	Experience with restoration and/or acquisition projects reflects a higher likelihood of future success. Proposal sponsors who have successfully implemented similar salmon restoration projects will receive the highest score. **5**=Project sponsor has extensive project implementation experience and successfully has implemented many projects similar in scope and scale to the one proposed. **3-4**=Project sponsor has moderate project implementation experience and/or has successfully implemented some projects similar in scope and scale to the one proposed. **1-2**=Project sponsor has limited experience with project implementation and/or limited experience with the type of project proposed. **0**=Project sponsor has no previous experience with salmon recovery project implementation.
Tie Breaker		
Cost Benefit	N/A	Tied projects that maximize the benefits of limited public funding will receive the higher ranking. Specifically, the higher-ranking projects will do the following: • Leverage significant additional funds • Have a clear, detailed budget and well-justified costs • Have a low-cost relative to the predicted benefits for the project type

WASHINGTON STATE
RECREATION AND CONSERVATION OFFICE
Salmon Recovery
Funding Board

Salmon Recovery Funding Board Decision Memo

Item 5

APPROVED BY RCO DIRECTOR MEGAN DUFFY

Meeting Date: May 23-24, 2023

Title: Match Policy Options Assessment

Prepared By: Nicholas Norton, Policy and Planning Specialist

Summary
This memo summarizes initial staff analysis of two alternate approaches to match for the Salmon Recovery Funding Board relative to their impacts on the program, salmon recovery projects, and internal operations. Additionally, this memo includes an assessment and staff recommendation on the potential use of five variations to the current match policy.

Staff are requesting board direction on initial preferences for alternate match options and/or variations, and topics of further assessment. .

Board Action Requested

This item will be a:
- ☐ Request for Decision
- ☒ Request for Direction
- ☐ Briefing

Introduction/Background

In June 2022, the Salmon Recovery Funding Board (board) held its biennial retreat. The board discussed several different issues, including match. There was interest among the board in:

- Understanding the role of board match in relation to overall project funding;
- Examining whether match is variable by geography, project type, or entity; and
- Learning about the impacts to other state programs that have eliminated match.

Staff researched these issues and in March 2023, presented the following information about the role of match in program delivery to the board:

- A description of how match is operationalized at the Recreation and Conservation Office (RCO), its connection to the overall funding of a project, and the progression of match-related policy decisions from the board.
- Identification of typical reasons for requiring match and an assessment of whether required board match supports those goals.
- A clear, detailed description of how match can impact different phases of board-funded projects.

The board encouraged staff to further define, assess, and identify alternate match policy pathways that might better support program goals and address current project barriers.

Below is a staff analysis of two alternate policy options, as well as a staff assessment and recommendation on the potential use of five variations to the current match policy.

Options Analysis and Comparison

At the last board meeting, staff described the three different types of funds used to complete a project and the workflows associated with them. Board funds and funds the sponsor elects to include as match both have administrative workflows that involve detailed substantiation of expenditures and reimbursement through RCO's e-billing process in PRISM. However, additional funds used to complete a project's scope of work are not required to be reported in PRISM and sponsors may elect not to do so.

After an initial internal assessment, staff is presenting two policy options ("no match" and "cost share") that represent alternate approaches to existing match policy and additional funds. These options have the potential to:

1) Improve the full financial picture of board-funded projects by requiring reporting on all funds used to complete a scope of work;
2) Remove known impacts to project development, scoping, and/or implementation that are created by current board match policy;
3) Reduce the project management burden for sponsors; and
4) Be operationalized without significant changes to our database or reporting structure.

A brief description and analysis of both options are provided below. Attachment A provides an overview of each option in practice, and Attachment B provides a comparison of their respective pros and cons.

Options were evaluated by their impacts on the three major desired policy outcomes typically associated with match (demonstrating local support, providing a return on funder investment, and supporting program effectiveness), their impacts on different project phases, and their impacts on RCO operations.

Option 1: No match

Brief Description	Projects would not require non-board funding to be used as match, but sponsors would be required to report on all funds used to complete the scope of work prior to closing the project.
Analysis Summary	**PROS:** Would help address most identified barriers to project development, scoping, and implementation, improve ability to track and report additional funds, and reduce the capacity burden for sponsors. **CONS:** May result in some isolated project down-scoping to avoid reporting requirements, could slightly increase size of requests depending on local context, and involves moderate up-front PRISM database work on the final reporting module.
Potential Next Steps	Stakeholder outreach and research to better understand potential impacts on sponsor project scoping and number of funded projects.

Option 2: Simpler Workflow

Brief Description	Projects would still require matching funds, but it would be subject to less detailed reporting requirements prior to closing.
Analysis Summary	**PROS:** Would help reduce some identified barriers to project development and scoping, improve ability to track and report additional funds, and reduce the capacity burden for sponsors. **CONS:** Creates a new concept/workflow with unresolved questions about policy enforcement and legal accountability, presents new risks relative to project implementation, and creates some compatibility issues with other RCO programs and policies.

Potential Next Steps	Further examine risks to project implementation, assess the feasibility of merged projects, and better understand how other funders using "cost-share" approaches address policy enforcement and legal accountability.

Synthesis

Though conceptually very similar, Option 1 (No Match) and Option 2 (Simpler Workflow) would likely have drastically different implications and outcomes for sponsors, projects, staff, and the program.

By virtue of not requiring additional funds from sponsors, Option 1 more holistically addresses project barriers and constraints on sponsor capacity, while also being much easier to implement and manage internally. However, it may shift how projects are scoped and funded within lead entity lists and show less leverage of other funding sources than Option 2 over time.

The most apparent potential benefit of Option 2 is maintaining the status quo as it relates to how sponsors scope projects relative to the amount of funding available, but still providing some targeted relief to sponsors in developing and managing projects. However, it would create some risks relative to timely project completion and complicate merging of projects using other RCO funding programs that wouldn't apply to Option 1.

Option 1 would be a better approach to examine further if the board is more focused on eliminating major barriers to funding priority salmon recovery projects and reducing the project management workload for sponsors. Option 2 may be a better approach to examine further if the board is more focused on maximizing demonstrated leverage or maintaining the number of funded projects over time.

Variations Assessment and Recommendation

If the board decides to retain match requirements in their current form, there is still the possibility of instituting smaller "variations" to current match policy depending on the board's desired outcomes and/or impacts. Staff assessed five different types of match variations; below is a summary of each type of policy variation and the associated staff recommendation.

Attachment A includes an in-depth table that summarizes any previous comments from board members relative to a certain policy variation and a brief assessment of what informed the staff recommendation.

Type of Variation	Staff Recommendation
Variable match by project type	**Staff Recommendation: Keep for consideration** depending on desired outcomes and/or impacts.
Variable match by request amount	**Staff Recommendation: Keep for consideration** depending on desired outcomes and/or impacts.
Variable match by entity type	**Staff Recommendation: Remove from consideration**.
Variable match by location	**Staff Recommendation: Remove from consideration**.
Adding to what counts as match	**Staff Recommendation: Remove from consideration**.

Discussion

Staff is requesting direction from the board on:

1) Clear board member preference for any recommended options presented; and

2) whether there are specific things the board would like staff to assess further prior to a request for approval.

Strategic Plan Connection

The issue of match is relevant to the board's Allocation Strategy in Goal 1: *Within the limits of the board's budget and priorities, fund projects, monitoring, and human capital in a way that best advances the salmon recovery effort.*

In addition, this issue connects directly with the board's Resource Strategy in Goal 2: *Confirm the value of efficiency by funding actions that result in economical and timely use of resources for projects, human capital, and monitoring.*

Attachments

A. Options Descriptions

B. Options Pros and Cons
C. Policy Variation Assessment

Attachment A - Options Descriptions

	Option 1: No Match	Option 2: Simpler Workflow
Brief Description	Projects would not require match, but sponsors would be required to report on all funds used to complete the scope of work prior to closing.	Projects would still require match, but it would be subject to less detailed and rigorous reporting requirements prior to closing.
Project Example	$500,000 requested from the board to support a $1,000,000 project to remove and replace two culverts in sequence. $500,000 in matching funds are secured for work on the downstream culvert. In this option, a sponsor could elect to request $500,000 from the board to remove the upstream culvert without any matching funds.	$500,000 requested from the board to support a $1,000,000 project to remove and replace two culverts. $500,000 in matching funds are secured for work on the downstream culvert. In this option, a sponsor would have to scope the project to include removal of both culverts to bring the required matching funds.
What amount would be in the grant agreement?	$500,000	The agreement would likely reference total project costs from $650,000 to $1,000,000, depending on how much the sponsor commits to bringing to meet requirements.
What would be included in the PRISM budget?	$500,000	$500,000

What would be reported in metrics?	Miles of fish accessible fish habitat associated with either one or both culvert replacements, depending on how the sponsor scoped the project.	Miles of fish accessible fish habitat associated with both culvert replacements.
What is in the scope of work?	The full project description, metrics, and milestones associated with either one or two culverts depending on how the sponsor scopes the project.	The full project description, metrics, and milestones associated with both culverts would form the scope of work.
How would match be tracked and/or administered?	Not applicable, though sponsors could use the PRISM e-billing process at any time to submit eligible additional resources to serve as "match" for the purposes of Pacific Coastal Salmon Recovery Fund (PCSRF) reporting. This would have no relationship with reimbursement rates.	Sponsors would no longer be required to use the current PRISM e-billing process to report matching funds but could do so at any time to submit eligible additional resources to serve as "match" for the purposes of Pacific Coastal Salmon Recovery Fund (PCSRF) reporting. This would have no relationship with reimbursement rates. Instead, as part of the final reporting module (see below), sponsors would be required to report the amount and sources of additional resources used to meet requirements and accomplish the scope of work. Sponsors would be required to keep more detailed records available if needed to verify how required additional funds were spent on the project.

How and when would other funds be captured?	The sponsor would be required to complete a detailed final report in PRISM to outline the amount and sources of additional resources that account for the actual total project costs needed to accomplish the full scope of work.	The sponsor would be required to complete a detailed final report in PRISM to outline the amount and sources of any additional outstanding resources needed to meet requirements and/or account for the actual total project costs needed to accomplish the full scope of work.

Attachment B - Options Pros and Cons

		Option 1: No Match	Option 2: Cost-Share
Desired Policy Outcomes	Pros	• Would likely increase the amount of leveraged funds RCO reports to the public. • Could allow for a broader set of resources to be captured rather than just what is eligible for match.	• Would likely increase the amount of leveraged funds RCO reports to the public. • Significantly reduces the disincentive to report all additional funds.
	Cons	• Might create a small incentive to down-scope projects when possible, to avoid final reporting requirements, depending on the detail requested by RCO. • Could create a small increase in average size of requests, depending on the local context. • Would eliminate ability to use match requirements as a carrot to bring local funders to the table.	• None currently identified.
Project Impacts	Pros	• Would eliminate most of the current barriers to project development, scoping, and implementation.	• Could help with some specific project barriers related to the timing of secured match and cost-carrying challenges.

		• Would increase sponsor capacity to develop other projects. • Would allow priority projects to move forward where match is a limiting factor.	• Could increase sponsor capacity to develop other projects.
	Cons	• None currently identified.	• Could increase the risk of extensions or incomplete projects depending on how policy is enforced. • Would keep priority projects from moving forward where match is a limiting factor.
RCO Operations	Pros	• Would significantly reduce work for grant managers and fiscal team.	• Could moderately reduce work for grant managers and fiscal team.
	Cons	• Would require some changes to PRISM final reporting modules. • Would not be able to report additional funds as formal "match" to PCSRF unless sponsor voluntarily submits them through the PRISM e-billing process. • Waiving match would no longer be available as an incentive to encourage certain types of projects.	• Would require some changes to PRISM final reporting modules. • Would not be able to report additional funds as formal "match" to PCSRF unless sponsor voluntarily submits them through the PRISM e-billing process. • Creates a separate workflow than current RCO match, which would heavily complicate merging board

			projects with other RCO funding. • Increased risk of needing to pay back money or find new match near closing.

Attachment C – Policy Variations Assessment

Type of Variation	March 2023 Board Comments	Assessment and Recommendation
Variable match by project type	Multiple board members had a different type they thought might be appropriate for a match waiver (acquisition, restoration, assessment, etc.). Chair Breckel mentioned the benefits of being able to use match as an incentive like the board has in the past.	Having different match requirements for different project types is something the board already does with design-only projects, riparian buffer projects, and acquisition projects with upland acreage. It is easy to implement, something that is familiar to sponsors and grant managers, and makes policy sense to keep as a lever to direct funds in ways that support salmon recovery. However, if additional project types are considered for match waivers, the board should consider how this policy could be operationalized for combination projects where not all project types have match waived. **Staff Recommendation: <u>Keep for consideration</u>** depending on desired outcomes and/or impacts.
Variable match by request amount	Member Maroney specifically mentioned having a threshold where the match requirement kicks in.	Having different match requirements for different funding request levels is done with design-only projects. It is easy to implement, familiar to sponsors and grant managers, and helps stretch limited funding to support salmon recovery. However, if match waivers based on request levels are more broadly applied, the board should consider the equity implications based on the variation in funding distributed to lead entities.

		Staff Recommendation: <u>Keep for consideration</u> depending on desired outcomes and/or impacts.
Variable match by entity type	Recognition of the general equity issues based on different entity capacities. Nothing specific proposed.	The board may not be a good fit for different match requirements for different types of entities. The diversity of applicants and local partnerships involved in addressing specific limiting factors might benefit from either a more nuanced approach to assessing "need" or a cleaner approach that addresses the underlying issues across all entities. This policy approach directly puts a hand on the scale of picking what types of entities could more easily submit projects in ways that might not directly connect to the actual, internal capacity of the organization and/or the specific recovery bottlenecks at the local level. **Staff Recommendation: <u>Remove from consideration</u>**.
Variable match by location	Recognition of general equity issues based on different project locations. Nothing specific proposed.	The board may not be a good fit for a need-based geographic match reduction policy. Specifically, the diversity of applicants and salmon recovery funding sources makes it difficult to assess "need" relative to other types of RCO grant programs that have implemented this approach. In addition, it would likely involve substantial analytical work for staff, with little guarantee that the policy would be well supported at the local level or directly address desired equity outcomes.

		Staff Recommendation: **Remove from consideration**.
Adding to what counts as match	Member Cottingham expressed opposition to expanding what could count as match, due to difficulties in defining and substantiating eligible costs for things like stewardship and/or endowments. Member Endresen-Scott expressed interest in prior acquisitions as a way of meeting match requirements.	The board may not be a good fit for expanding what types of resources can count as match. Most of the existing examples from other funding programs relate specifically to acquisition projects rather than to all project types. More importantly, RCO has a long-standing common definition of match across all funding programs. Adding specific things for the board puts it in conflict with other programs that could create confusion for sponsors and grant managers and would cause unintended complexities with project management on merged projects. **Staff Recommendation:** **Remove from consideration**.

Salmon Recovery Funding Board Briefing Memo

Item 6

APPROVED BY RCO DIRECTOR MEGAN DUFFY

Meeting Date: May 23-24, 2023

Title: Monitoring Update

Prepared By: Erik Neatherlin, GSRO Director

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Summary

This memo summarizes the work of the monitoring panel and the Salmon Recovery Funding Board (board) monitoring subcommittee for the IMW synthesis report, adaptive management strategy, and remote sensing pilot study. This memo also provides background information for the monitoring funding decision the board will make in item 7.

Board Action Requested

This item will be a:

☐ Request for Decision
☐ Request for Direction
☒ Briefing

Introduction/Background

The Salmon Recovery Funding Board (board) monitoring subcommittee was established in 2021 to help guide the board's monitoring programs. The subcommittee is comprised of board Chair Breckel and nonvoting Members Hoffman and Cram, and includes representatives from the Council of Regions (COR), Washington Salmon Coalition (WSC), the board's monitoring panel, the Governor's Salmon Recovery Office (GSRO), and the Recreation and Conservation Office (RCO). The monitoring subcommittee relies on key documents such as the board's strategic plan, the Washington State Comprehensive Monitoring Strategy, monitoring guidance from NOAA Fisheries, and the 2013 Stillwater Sciences Monitoring Investment Strategy for the board to guide its work and decisions.

In June 2022, the board directed the monitoring subcommittee to focus efforts on key projects to inform its monitoring program. These efforts include a synthesis report of results for the Washington State Intensively Monitored Watersheds (IMW) program, a monitoring adaptive management strategy, and the implementation of a remote sensing data pilot program to evaluate the effectiveness of large floodplain and riparian restoration.

Over the last year, the subcommittee has met several times to review progress and receive updates on the results of these efforts. Most of the work is complete and the reports are either finished or in the final stages of review. The adaptive management strategy executive summary and the remote sensing pilot program final reports are attached for reference. The IMW synthesis final report is expected in May 2023. These reports and deliverables are anticipated to be useful in guiding the board's restoration actions, deliberations, and funding decisions.

The IMW synthesis report, adaptive management strategy, and the remote sensing pilot projects are summarized below for convenience, followed by a summary of the subcommittee meeting discussions and suggestions for funding and next steps.

IMW Synthesis Report Summary

The IMWs were established in the early 2000s to determine the impact of habitat restoration projects on salmon recovery and to improve the effectiveness of habitat restoration programs in Washington. While the IMWs have been ongoing with annual reports and periodic summaries, there has not been a major in-depth analysis or synthesis of the Washington IMW program results to date. The purpose of this synthesis report was to examine IMW results, to identify opportunities to improve the procedures being used to prioritize, design, and implement restoration treatments. The report has two sections: (1) a summary of results that are unique to each Washington IMW, and (2) analyses of results across multiple IMWs that focus on addressing key questions identified in the recent Pacific Northwest Aquatic Monitoring Partnership (PNAMP) IMW review of 16 IMWs from California to British Columbia.

This report is focused on the five IMWs in Washington State supported by the board. Four are in western Washington: Lower Columbia, Hood Canal, Strait of Juan to Fuca and Skagit Bay. The first three are freshwater IMW complexes and Skagit is the only estuarine IMW. The Asotin IMW complex in eastern Washington's Snake recovery region was added to the board IMW portfolio in 2012. The Snake and Lower Columbia salmon recovery regions also receive support from Pacific States Marine Fisheries Commission (PSMFC).

The IMW synthesis report is in its final stages of review by the lead author and IMW lead scientists. The key findings reveal lessons learned and will inform both project level restoration actions and programmatic recovery actions at a regional or statewide scale.

Adaptive Management Strategy

The adaptive management strategy purpose is to set out a conceptual framework for guiding Washington's salmon habitat restoration efforts, including assisting the board and project sponsors in making any modifications and improvements to the board's recovery programs and restoration actions.

Adaptive management uses monitoring as a tool to help judge which restoration projects have succeeded in achieving program goals, and which actions have been less successful, so that resources can be focused on activities that provide the greatest benefits. Summarizing key results and findings, transferring this knowledge to the practitioners and sponsors, and adjusting activities as needed are fundamental steps in the adaptive management process.

The report compares the objectives and outcomes of the three primary types of monitoring programs that have been supported by the board: intensively monitored watersheds (IMWs), effectiveness monitoring, and regional monitoring projects.

For each monitoring category the report explores three main questions –

1) *What are we learning from board monitoring programs?*
2) *How can this information inform restoration funding decisions?*
3) *How can this information inform board monitoring programs?*

The report also explores five important restoration-related topics, including fish population status and trends, fish habitat status and trends, climate change, limiting factors, and emerging threats, for each of the monitoring categories. These questions and comparisons will be helpful to the board as it looks for strengths and weaknesses in the current monitoring portfolio.

Finally, the report offers specific suggestions for improving the board's adaptive management processes, which are meant to increase the transfer of information among restoration practitioners, scientists, monitoring panel and review panel, and board members. These include:

- Increase Interaction Between the Monitoring Panel and Review Panel
- Develop a Communication Plan
- Periodically Re-assess Limiting Factors
- Convene an annual Monitoring Project Workshop
- Develop an adaptive Management Report Card

Remote Sensing Pilot Project: Large Floodplain and Riparian Restoration

The board approved funding for the remote sensing pilot study in 2022. Its purpose was to evaluate the feasibility of using remote sensing and laser imaging, detection, and ranging (LiDAR) data to evaluate the effectiveness of large floodplain and riparian restoration projects.

Previous restoration effectiveness monitoring programs administered by the board and the Bonneville Power Administration have emphasized the need for better evaluation of large floodplain and riparian restoration projects. Recent technological advances have made it possible to use remote sensing data and LiDAR technology to monitor large restoration projects. With this past work as context, the monitoring panel recommended initiating a pilot program to evaluate the feasibility of remote sensing and LiDAR technology for board funded programs.

The remote sensing pilot has been completed and a final report is attached as Attachment C. The pilot demonstrated that LiDAR and other remote sensing tools and technology can be collected in a cost-effective manner, and that it can effectively and efficiently capture and measure habitat metrics at the appropriate scales to inform the effectiveness of large floodplains and riparian restoration projects. The project also highlighted a host of other applications or benefits summarized below:

- Cost effective and efficient method to detect change due to restoration.
- Does not require monitoring every year.
- Relies on remote sensing, methods and metrics, allowing for detailed mapping of an entire floodplain (traditional field-based methods do not allow spatial coverage or measurement intensity).
- Additional cost savings if work with project sponsors is done before or as project is being implemented.
- Can be implemented on small to large projects.
- If LiDAR is available, it can be implemented on previously completed projects.
- Opportunity to utilize other data layers from partners as additional leverage.

Monitoring Subcommittee Discussions and Direction

In addition to meeting several times over the last year to guide these monitoring efforts, the monitoring subcommittee met in April 2023 to discuss final results and key findings from the IMW synthesis, adaptive management strategy, and remote sensing pilot project.

At the April 2023 meeting, there was general agreement from the subcommittee that there has been significant progress on all initiatives, leaving the monitoring panel and the subcommittee in a good position to continue their work with findings from the reports outlined above.

There was also general agreement that the IMW synthesis report and adaptive management strategy will directly inform current and ongoing discussions between the monitoring panel, technical review panel, the board, and on the ground actions by the restoration practitioners and project sponsors.

To this end, members of the monitoring panel attended the May 2023 technical review panel meeting and had initial discussions about better incorporation of lessons learned from the board's monitoring programs into the technical review panel's project review processes at their May 2023 meeting. This initial joint meeting should be considered the first step in increased interaction between the monitoring panel and the technical review panel.

As previously mentioned, there was agreement among the subcommittee that the remote sensing pilot was successful and demonstrated encouraging results. However, there was also agreement that the subcommittee wanted to continue discussions to further digest the results of the pilot and determine what might be the most appropriate next steps given what was learned from the IMW synthesis and the adaptive management strategy. This demonstrates the inter-related nature and value of these monitoring initiatives.

The subcommittee recommends setting aside the unobligated monitoring funds so they can continue their dialogue over the summer to determine the best use of these monitoring funds.

The subcommittee will explore questions regarding the pilot such as: should there be additional pilot studies in other watersheds; should there be efforts to link the data with fish abundance metrics; are the current results scalable to larger or smaller watersheds; and finally, how will the information be used to improve restoration project or board funding decisions? These questions are only examples of the types of questions the subcommittee will explore.

During the summer they will also discuss the results and findings from the IMW synthesis report and adaptive management strategy and determine if there are other monitoring efforts that warrant additional funds, such as regional monitoring or limiting factors analyses.

This Item 6 memo should be considered background information to support the board's monitoring funding decision contained in Item 7.

Monitoring Category	Funding Level
Intensively Monitored Watersheds (IMW) Monitoring	$1,546,000

Monitoring Panel	$100,000
Monitoring Set Aside	$354,000
Total	**$2,000,000**

Attachments

A. IMW Synthesis Report Executive Summary
B. Adaptive Management Strategy
C. Evaluation the Effectiveness of Large Floodplain and Riparian Restoration Projects Using Remote Sensing by Cramer Fish Sciences

Review of Results to Date from the SRFB IMWs

Report Summary

May 2023

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The SRFB-supported Intensively Monitored Watersheds (IMWs) were established in the early 2000s to determine the contribution habitat restoration can make to salmon recovery and to improve the effectiveness of habitat restoration programs in Washington. IMWs concentrate restoration and monitoring efforts in a watershed, large stream reach or estuary. Concentration of effort enables enough data on physical and biological attributes of a system to be collected to develop a comprehensive understanding of fish and habitat response to the application of restoration treatments.

The purpose of this synthesis report is to examine IMW results to date to identify opportunities to improve the procedures being used to prioritize, design, and implement restoration treatments. The report consists of two sections; a summary of results and key findings to date of each IMW and analyses utilizing data from multiple IMWs to address key uncertainties identified in the recent PNAMP IMW review.

IMW Summaries and Key Results

Asotin IMW

The Asotin IMW includes three Asotin Creek tributaries: Charley Creek, North Fork Asotin Creek (North Fork), and South Fork Asotin Creek (South Fork; hereafter referred to together as “study creeks”). All study creeks all have low large wood and debris jam frequency.

This IMW is evaluating the extent to which greatly increasing wood abundance can enhance instream complexity, frequency of overbank flow, and extent and function of floodplains and fish response to these habitat changes. Each study creek has at least one 4 km long treatment section and one or more control sections. Initial restoration treatments were completed in 2012, 2013, 2014, and 2016 resulting in 650 large woody debris (LWD) structures over 14 km (39% of the study area at a frequency of 3-5 structures/100m). The treatments used post-assisted log structures (PALS), which are inexpensive and does not require heavy equipment.

To date, modest, statistically significant, positive responses in geomorphology, habitat, LWD, debris jam frequency and several fish metrics has been detected. The increase in wood is forcing significant increases in geomorphic diversity in treatment areas compared to control areas by increasing bar and pool frequency and area. The positive changes in habitat are leading to relatively consistent, statistically significant, small-moderate increases in juvenile steelhead abundance (fish/km) and biomass (g/km) at some study sites but no significant changes in growth or survival. The number of Steelhead smolts produced by the treated reaches has increased significantly relative to the reference reaches at two of the three study creeks.

Key Findings

- Repeated wood additions at restoration sites were key to maintaining and increasing LWD densities.
- Establishing and maintaining high densities of large wood enhanced the retention of naturally-produced wood in treated reaches. Therefore, the formation of natural log jams was promoted, increasing geomorphic complexity, improving fish habitat, and increasing juvenile steelhead productivity.
- Changes in habitat that have occurred to date are mainly within the channel. We hypothesize that with ongoing treatments, reconnection of disconnected floodplains will occur and provide enhanced access to floodplain

habitats, aid in the recharge of groundwater and contribute to higher summer base flows. Increased fish production may result. Additional monitoring will be required to evaluate this hypothesis.
- The PALS approach was an effective method of LWD placement at the Asotin IMW. This approach was less expensive than traditional methods of wood placement and avoided damage to riparian areas caused by heavy equipment.

Straits of Juan de Fuca IMW

The Strait of Juan de Fuca (SJF) IMW includes East Twin River, West Twin River (reference), and Deep Creek. The three contiguous watersheds are in the Lyre/Hoko basin (WRIA 19) and flow north into the SJF. They are relatively small watersheds (i.e., less than 45 km^2).

In-channel wood placement was the primary restoration approach because it influences many stream habitat-forming processes. Large wood forms pools, store gravels, and can reverse channel incision and improve floodplain connectivity. Increases in floodplain connectivity may also increase formation of floodplain habitats known to be critical over-winter habitats for juvenile Coho Salmon. Restoration treatments were implemented from 1998 to 2022 and focused on the lower portions of East Twin River and Deep Creek.

Repeated wood additions to sections of Deep Creek and East Twin River eventually resulted in observable habitat changes in some treated reaches. Deep Creek exhibited increased pool area, pool depth and increased sediment storage at several of the treated reaches. In addition, sections of lower Deep Creek developed side channels. Although habitat changes were generated at treated sites, significant trends in measured habitat attributes were not detected at the scale of the entire watershed. Unexpectedly high interannual variability in several habitat metrics were observed in all watersheds.

Parr-smolt survival for Coho Salmon and Steelhead has been greater in the treated watersheds than the control watershed. Deep Creek Coho Salmon smolt abundance tends to be greater than the other two watersheds. Steelhead smolt production estimates suggest similar levels for each of the watersheds.

Monitoring of Coho Salmon outmigrants using passive integrated transponder tags (PIT tags) revealed that many Coho Salmon left the study watersheds in the autumn. Some returning adult Coho Salmon were fall migrants rather than spring migrants. Our results indicate that traditional methods of spring-only smolt enumeration may underestimate juvenile survival and total smolt production, and overestimate spring smolt-to-adult return.

Key Findings

- Repeated, large-scale wood additions changed channel morphology, improving both spawning and rearing habitat, and had a positive effect on juvenile Coho Salmon survival.
- It was necessary to add wood multiple times to a stream to achieve the desired habitat response.
- Habitat and fish response to wood treatments took multiple years to be fully expressed. Therefore, long-term monitoring is required to evaluate restoration effectiveness.

Hood Canal IMW

Little Anderson, Big Beef, Stavis (reference watershed), and Seabeck creeks comprise the Hood Canal (HC) IMW. The four contiguous watersheds are in Kitsap County, Water Resource Inventory Area (WRIA) 15 and they flow north into Hood Canal.

Restoration efforts focus on improvement of salmon habitat by enhancing stream connectivity and complexity. Restoration projects typically have included more than one treatment type. For example, removal of an instream structure, bank contouring to increase floodplain connectivity, and large wood and engineered logjam placements may be implemented simultaneously at a treated reach. Disconnected floodplain habitats have been reconnected to the channel by removing dikes. LWD additions are intended to improve habitat complexity, resulting in more sinuous, multi-thread channels with a greater degree of variation in depth and velocity. The LWD also provides roughness to retain sediment.

Habitat conditions in the treated HC IMW watersheds have not changed as much as anticipated by restoration. Detecting changes in habitat condition was complicated by the discovery of high interannual variability in several habitat metrics. The interannual variability was often greater than changes anticipated from restoration treatments.

Reestablishing a dynamic equilibrium of sediment supply and transport appears to be a key need at several of the HC IMW watersheds. Severe bank erosion and subsequent deposition downstream frequently create barriers to migrating adult salmon and can bury placed and naturally recruited large wood.

Removal of a blocking culvert on Little Anderson Creek in 2002 was followed by a rapid increase in the production of smolts from this system. However, since 2014 smolt production in Little Anderson Creek has been variable and much lower than in the years immediately following barrier removal. Although replacement of an undersized culvert with a bridge represented a significant increase in passage over the former culvert, the bridge continues to limit salmon access. In recent years, a combination of substrate deposition near the bridge, low water and beaver activity underneath the bridge has limited fish passage upstream.

No fish population metric has responded positively to wood placements. Experiences at this and other IMWs suggest that effective treatment with LWD may require multiple placements and considerable time before habitat conditions improve. A single reach in Little Anderson Creek received LWD in both 2009 and 2016, providing some opportunity to test whether repeated treatments might generate an increase in smolt abundance. There was no fish response to the treatments. Perhaps despite the repeated wood additions, the treatments were not intense enough to elicit a fish response. Fish response also was impacted by the concurrent issues of low escapement and passage restriction at the bridge.

A large project implemented on Big Beef Creek from 2015 through 2017 appears, at least initially, to have had a positive effect on Coho Salmon parr to smolt survival. This project removed a levee, providing access to a large floodplain wetland and increased overwinter habitat. Relatively high overwinter survival in Big Beef Creek has been documented from 2019-2022.

Key observations from the HC IMW are that spawner abundance is frequently lower than the carrying capacity of the habitat and density-independent processes, such as scouring flows and migration barriers, often limit survival and production. In most years, there are too few fish to utilize available habitat. Therefore, providing additional habitat through restoration may have little effect on smolt production. However, restoration actions that address density-independent mortality factors, such as increased refugia from high flows or reduced frequency or intensity of scouring flows, might be effective.

Key Findings

- Increasing habitat quantity will likely only have modest effects on fish survival and production until escapement to these systems increases.
- Disruption of the movement of gravel and wood, often at undersized culverts, damaged and simplified salmon habitat in several of the HC IMW watersheds. In the near term, prioritizing projects that enhance connectivity and restore natural rates of transport of gravel and wood may have the most beneficial effect on salmon.
- Improving connectivity to floodplain habitats (Big Beef Creek) appears to have caused an increase in overwinter survival of Coho Salmon. This project was completed relatively recently, and additional monitoring is required to validate the response.
- The replacement of an undersized culvert with a channel spanning bridge near the mouth of Little Anderson Creek initially increased fish passage and generated a strong, positive response from Coho Salmon. However, after several years, fish passage under the bridge was restricted by sediment accumulation, low flow and beaver activity. Restoration treatments should be periodically revisited to ensure they are functioning as designed.

Lower Columbia River IMW

The Lower Columbia (LC) IMW includes Germany, Abernathy, and Mill (reference) creeks. The three contiguous watersheds are in Wahkiakum and Cowlitz counties in the Grays/Elochoman basin (WRIA 25) and flow south into the lower Columbia River between River Mile (RM) 53.8 and 56.2.

Restoration was initially planned for Abernathy and Germany creeks. However, in 2017, restoration planning, led by the Lower Columbia Fish Recovery Board (LCFRB), shifted the restoration focus solely to Abernathy Creek to reduce costs and enable concentrated restoration efforts. Thirteen projects were executed in the Abernathy Creek basin. Restoration efforts seek to improve salmon habitat by enhancing floodplain and stream connectivity and stream complexity. The prevalent restoration treatment has been the addition of wood to improve habitat complexity. Some undersized bridges and culverts have been replaced to improve passage of fish, wood, substrate, and water. All projects were completed by 2021.

Projects implemented in Abernathy Creek have impacted approximately 33% of accessible salmon and Steelhead habitat, including 11.8 kilometers (km) of instream habitat, 1.3 km of off-channel and side-channel habitat, 0.19 km^2 of riparian area, and 2.7 km of improved fish passage. These habitat treatments have occurred more recently than for other IMWs. Therefore, there have been only a few years of post-restoration monitoring. Other IMWs have found that full expression of habitat response to restoration treatments often requires multiple years. This fact, in combination with high interannual variability in habitat metrics, indicates that additional monitoring will be required at the LC IMW to determine habitat response to treatments.

Prior to the application of restoration treatments, Abernathy Creek, where most restoration has occurred, typically produced fewer Coho Salmon smolts than Mill Creek. Since 2018, however, Coho Salmon smolt production from Abernathy Creek has exceeded production from Mill Creek, suggesting a possible response to restoration treatments. Additional monitoring over the coming years will be required to verify this response. There has been no indication to date that restoration treatments have increased smolt production of Steelhead or Chinook Salmon.

A passage barrier removal on Sarah Creek, an Abernathy Creek tributary, in 2019 generated an immediate fish response. By 2021 this reach supported 64 spawning Coho Salmon. In 2020 and 2021 the area above the barrier supported 4% and 8%, respectively, of the watershed's Coho redds.

There is clear evidence that parr-smolt survival of Coho Salmon is density dependent, suggesting freshwater habitat is limiting productivity. Survival rates of juvenile Coho Salmon from parr to smolt decline sharply with increase in summer parr abundance. This pattern was observed in all three LC IMW watersheds.

Headwater reaches appear to be important rearing habitats for Coho Salmon in the LC IMW watersheds. Fish tagged in upper reaches of all 3 watersheds were more likely to emigrate as spring smolts than fish tagged lower in the watershed.

Nutrient enhancement treatments (i.e., Salmon Carcass Analogs), applied to Germany Creek, did not have a detectable effect on any fish population metric. Future evaluations of this technique should be implemented in watersheds with low nutrient levels and restoration treatments should include the development of features to help retain nutrients.

Key Findings

- Large-scale wood additions to improve spawning and rearing habitat concentrated in the headwaters of Abernathy Creek appear to be having a positive effect on juvenile Coho Salmon. Overwinter survival and smolt production both increased after restoration treatments, but further monitoring is needed as treatments were not completed until 2021. Steelhead and Chinook Salmon populations have not responded to treatments.
- Tributary and headwater reaches are important rearing habitat for Coho Salmon. Coho salmon tagged in upper reaches of the LC IMW watersheds were more likely be detected as spring smolts than Coho parr tagged lower in the watershed.
- Removal of a passage barrier on Sarah Creek implemented in 2019 in the Abernathy basin led to an immediate use of the blocked area by spawning Coho Salmon. By 2020- 2022, 4-8% of the basin's Coho Salmon redds were found in this previously blocked reach.
- There is strong evidence of density dependence for both Chinook and Coho salmon in the LC IMW, suggesting that, over time, both species should benefit from habitat improvements.
- The addition of salmon carcass analogs did not result in any improvement in Coho parr survival or smolt production. Future trials of nutrient enhancement should be implemented in nutrient-poor watersheds and in conjunction with restoration treatments that will help retain released nutrients in the watershed.

Skagit IMW

The Skagit IMW examines how Puget Sound Chinook Salmon use the Skagit tidal delta and how they respond to restoration. Estuary restoration projects have restored 255 hectares to tidal inundation since 2000. However, restoration gains have been partially offset by natural processes, resulting in only a net increase of 130 hectares to tidal inundation. Naturally occurring estuary habitats are not static and the area of Skagit tidal delta is exhibiting an overall decrease, primarily due to seaward edge erosion not being fully compensated by progradation.

The Skagit IMW demonstrated demographic changes associated with restoration actions that increase nursery habitat capacity. Restored areas in the delta supported lower juvenile densities overall than prior to treatment and restoration was associated with a decline in juvenile Chinook catches in nearshore marine waters. These findings suggest that greater nursery habitat capacity in the delta supported more juveniles but at lower densities, alleviating competitive effects on growth. The expanded habitat also accommodated more salmon when juvenile outmigrations were high, decreasing overflow of Chinook fry to nearshore environments. Thus, restoration appeared to reduce density-dependent constraints on rearing and growth.

Key Findings

- In the Skagit Delta, increasing connectivity expanded habitat capacity and enabled juvenile Chinook to utilize previously inaccessible areas of tidal marsh. Expansion of habitat led to multiple, positive fish responses. In this system, abundance of outmigrating Chinook Salmon fry exceeds habitat capacity. Therefore, increasing habitat capacity has been a successful strategy. In other systems outmigrants are not abundant enough to fully occupy available estuary habitat. In these estuaries restoration actions that focus on density-independent sources of mortality (e.g., predation) are likely to be more effective than actions intended to increase habitat capacity.
- Blind channels were found to be an important habitat for natural-origin Chinook Salmon. Increasing the availability of blind channels would be an effective restoration strategy.
- Our analyses suggest that large hatchery releases may increase the likelihood for systems to exceed capacity and increase competition for preferred prey. Further evaluation of the effect of various aspects of hatchery releases (e.g., number released, individual size, timing and location of releases) on natural origin juveniles is needed.

Cross-IMW Analyses

Fish and Habitat Responses to LWD at the Freshwater IMWs

Wood addition is often only one of several restoration actions implemented at a treated IMW site. However, the fact that wood placement was the dominant restoration action across all the SRFB freshwater IMWs provides an opportunity to contrast wood placements associated with a positive fish response with those that did not generate a detectable response. This comparison will help identify features associated with effective wood treatments.

Several of the IMWs reported that wood projects improved habitat conditions and generated positive responses in some salmon and Steelhead population metrics. The Strait of Juan de Fuca IMW found that the repeated wood additions enhanced capacity for some treated reaches to capture and retain wood and sediment being transported downstream. The result was increased wood loading and channel-spanning logjams, which contributed to deeper and more frequent pools, a reduction in streambed particle size, increases in sediment storage, reduced stream width, vegetation re-establishment in the riparian zone and increased development and maintenance of floodplain channels. The changes in habitat at Deep Creek increased juvenile Coho Salmon parr-smolt survival. There also are indications that Coho Salmon productivity (smolts per spawner) increased in Deep Creek.

Positive habitat and fish responses were also reported for the Asotin IMW. As with the SJF IMW, added wood was effective at capturing wood being transported downstream. The added and trapped wood formed new log jams within the treatment reach. The increase in wood is forcing significant increases in geomorphic diversity in treated areas compared to control areas by increasing bar and pool frequency and area. The positive changes in habitat are associated with relatively consistent, statistically significant, moderate increases in juvenile steelhead abundance (fish/km), biomass (g/km) and smolt production at some study sites.

At the LC IMW, LWD density increased at treated sites in Abernathy Creek following the application of treatments. Before wood additions, average annual production of Coho Salmon smolts was highest in Mill Creek, the reference watershed. After wood addition, Abernathy Creek produced 26% more Coho Salmon smolts than Mill Creek.

LWD addition has not been associated with a Coho Salmon response at the HC IMW. A LWD addition project was implemented in 2007 (25 structures total, mostly small wood) and 2 LWD projects placed wood within a 2 km reach upstream of the initial installation in 2009 and 2017. Wood treatments had no detectable effect on any monitored fish population metric.

The lack of fish response at the HC IMW is partially because there are insufficient numbers of Coho Salmon returning to these watersheds to produce enough offspring to occupy currently available habitat. Therefore, creating additional habitat by wood addition is unlikely to generate a fish response (see detailed discussion on this topic later in the report). Also, the wood projects at the HC IMW were not as intensive as those applied at the IMWs that did report a fish response.

Key Findings

- Intensive wood treatment appears to be often associated with a response in fish abundance. Positive fish responses achieved at the IMWs were all associated with intensive wood treatment (10s to 100s of wood structures) over a large area. Intensive treatment is required to ensure that sufficient wood is available to modify channel form and material transport and achieve floodplain connection. Achieving sufficient intensity of treatment often requires repeated wood additions at a site over several years. A large enough area must be treated in this manner to generate a fish response that can be detected at the watershed scale.
- Habitat and fish response to wood can require a significant amount of time. Wood treatments that are associated with fish responses create an area where transported materials (wood, sediment) can collect. Over time this accumulation of materials enhances in-channel habitat diversity and establishes a more continuous connection between the channel and floodplain. This result requires that wood treatments are applied in depositional reaches and avoid high energy transport reaches.
- Monitoring the response of habitat and fish to wood placement is a long-term proposition. Habitat response and biological response to changes in habitat can require multiple years to occur. The interannual variability in both habitat attributes and fish population metrics requires lengthy annual monitoring to be able to distinguish a response to treatment from natural variation.

Impact of low spawner escapement on fish response to habitat restoration

If escapement levels in a watershed are sufficiently low that not enough juvenile fish are produced to occupy available habitat, increasing habitat quantity through restoration may generate only small changes in abundance or survival. Therefore, detecting a fish response to restoration in watersheds with low salmon abundance can be very difficult. The IMW data provided the opportunity to analyze this issue. We based this analysis on the 7 watersheds in the HC IMW and LC IMW. Data at these two IMWs were the most suitable for this type of analysis.

We fit a series of stock-recruit models to describe variation in the strength of density dependence over time, between locations, and among life stages. We also utilized a series of hypothetical restoration response models to assess our ability to detect changes in fish productivity when density dependence is strong vs. when density dependence is weak.

Across all watersheds and years, we observed great variation in the strength of density dependence by year, stream and life stage. In the Hood Canal watersheds, we observed many years with weak density dependence, and few years with strong density dependence. The Lower Columbia watersheds had stronger density dependence than the Hood Canal watersheds in most years, and spawner values were typically in the range indicating enough juvenile fish were produced to occupy available habitat.

These results suggest that high adult abundance improves the likelihood of observing a measurable response to habitat restoration in Coho Salmon. When spawner abundances are consistently low, exhibiting weak density dependence, it reduces the potential mechanisms by which restoration can benefit salmon. For example, creating more rearing space for juvenile salmon through restoration is unlikely to help when abundances are too low to fully utilize habitat available prior to restoration. Implementing harvest management policies that ensure enough spawners to utilize available habitat would enhance effectiveness of habitat restoration efforts.

The strength of density dependence in a watershed should influence the restoration strategy. In systems with strong density dependence, restoration measures that increase the quantity of available habitat can increase smolt production. In systems with weak density dependence, however, implementing restoration treatments designed to increase habitat capacity are not likely to generate a detectable fish response. Rather, the goal in systems like these should be the implementation of measures that can reduce the severity of density independent mortality factors and, thus, enhance intrinsic productivity. Measures that improve water quality or reduce mortality from predation are examples treatments that could enhance intrinsic productivity. Therefore, determining the strength of density dependence for a watershed is an important foundational element for identifying limiting factors and developing an effective restoration strategy.

Key Findings

- Focus restoration efforts on watersheds that support enough adult salmon to benefit from an increase in habitat capacity. Many years the HC IMW watersheds do not have sufficient juvenile Coho Salmon to occupy available habitat. Increasing habitat quantity will likely only have modest effects on smolt abundance until escapement to these systems increases.
- In watersheds with weak density dependence restoration actions should focus on reducing the intensity of density-independent mortality factors.
- Determining juvenile capacity limits, and modifying restoration goals, accordingly, may be necessary to fully capture the benefits of habitat restoration.
- Integrating harvest and habitat actions in an “All-H” strategy remains a crucial goal for salmon recovery.

Correlations between habitat attributes and fish population metrics – Identification of limiting factors

1. Stream habitat restoration is usually preceded by efforts to identify the habitat conditions that limit the freshwater survival and productivity of salmon. The relatively modest fish response to restoration seen at many IMWs suggests that the factors that are controlling productivity and survival of fish populations are complex and not consistently addressed by restoration actions. The IMW studies provide a rare opportunity to directly assess relations between salmon productivity metrics (e.g., parr-smolt survival, smolt production) and fish habitat metrics (e.g., large wood density; pool frequency) over many years.

2. The analysis presented here is intended as an example of how these data might be used to investigate the relationships between habitat attributes and fish population performance. The habitat metrics we included in this analysis represent a subset of the attributes that might be influencing fish production and survival. There would be considerable value in a comprehensive evaluation of the relationship between survival and smolt production and the potential factors influencing fish. These factors are not limited to habitat condition. As discussed above, salmon and steelhead production in some watersheds may be limited by the number of returning adult fish.

3. We assessed relations between Coho Salmon parr-to-smolt survival and smolt abundance against four fish habitat metrics within each of the Hood Canal and Lower Columbia IMW streams from 2007 through 2022. Habitat metrics included instream very large wood density (LWD> 5 m long and > 0.3 m in diameter/100m), pool occurrence density, side channel occurrence density, and median wetted stream width.

4. As increasing wood, pools and floodplain habitats are common objectives of restoration efforts, positive correlations between salmon survival and productivity and these habitat metrics might be expected. Data pooled for all watersheds in each IMW revealed some fish-habitat correlations. Surprisingly, about half were negative, including some of the stronger correlations. Relationships for individual watersheds show some relatively strong correlations between parr-smolt survival and smolt production and habitat metrics. But there are also dramatic differences in fish-habitat relations among watersheds within IMW complexes.

This analysis was intended to be a preliminary evaluation of IMW data to help identify habitat features that are controlling salmon production. These results strongly indicate that limiting factors vary spatially (among watersheds) and temporally (among years). The weak, and sometimes counter-intuitive, relationships between parr-smolt survival and smolt production with the simple habitat metrics suggests that fish production is influenced by interactions among multiple habitat factors and this combination of factors changes through the period of freshwater rearing. Despite the apparent complexity of this problem, the comprehensive data sets compiled over the last two decades at the IMWs may enable us to develop more effective tools for identifying limiting factors. Additional attention should be focused on this task in the coming years as matching restoration actions with the key elements constraining salmon production and survival is the essence of an effective restoration strategy.

Key Findings

- The weak and inconsistent relationships found between fish population metrics and single habitat metrics suggest that fish are likely governed by complex, interacting habitat conditions that vary spatially and temporally. This complexity, coupled with complications related to strength of density-dependence, can make it difficult to accurately identify the habitat conditions with the greatest influence on salmon and Steelhead.

- Further analysis of the IMW data, possibly augmented with comparable data sets collected by other monitoring programs, could be used to develop more effective techniques for conducting limiting factors assessments.

Key Factors to Consider in Estuary Restoration

Greene et al (2021) examined fish-habitat relationships in four tidal river deltas of Puget Sound: the Nooksack, Skagit, Snohomish, and Nisqually with the goal of developing general principles characterizing rearing conditions for natural-origin juvenile Chinook Salmon that apply to other estuaries, The selected systems vary in landscape features and outmigrant population attributes (e.g., proportion of natural-origin vs. hatchery-origin juveniles) and thus represent the diverse characteristics expected in estuarine systems inhabited by juvenile Chinook Salmon across a broad geographic range within and beyond Puget Sound.

Greene et al (2021) found multiple lines of evidence for density dependence using stock recruit and bioenergetic modeling approaches. Specifically, estuary habitat capacity was often exceeded by juvenile Chinook Salmon cohorts in some estuaries and hatchery origin fish can contribute to density dependence. Density dependent responses can include reduced growth and prey selectivity. The study also found that landscape features within systems influence juvenile Chinook Salmon occurrence and density. In general, off channel habitats with higher landscape connectivity support higher fish abundance.

These findings provide a decision framework to help managers select appropriate estuary habitat strategies for any specific estuary system for Chinook Salmon.

- Strategy 1 - Maintain current habitat conditions: This approach applies to systems where (a) the current juvenile Chinook salmon outmigration is within the desired range, (b) the current outmigration does not exceed the indicators for density dependence derived from this study, and (c) the current estuary is well connected and diverse in terms of wetland and channel type complexity. Estuaries that fit this strategy would support high-quality habitats with Chinook salmon populations at levels where density dependence pressures are weak.
- Strategy 2 - Restore habitat connectivity and diversity: This strategy is appropriate for systems where (a) the current juvenile Chinook salmon (natural and hatchery) outmigration is within the desired range, (b) the current outmigration does not cause density dependence, but (c) the current estuary is not well connected and/or not diverse in terms of wetland and channel complexity. Estuaries that fit this strategy have reduced habitat extent but their Chinook salmon populations don’t exhibit regular density dependence pressures within the estuary. Because the current population generally does not express density dependence, habitat restoration within these estuaries should not focus on restoring vast areas (i.e., capacity) but should work toward restoring connectivity and the diversity of wetland types and channel types.
- Strategy 3 - Restore habitat capacity, connectivity, and diversity: This approach is appropriate for systems where the current outmigration levels cause density dependence. Estuaries that fit this strategy have reduced habitat extent and their Chinook Salmon populations regularly exhibit density dependence within the estuary. Because of this, habitat restoration within these estuaries needs to focus on restoring large areas (i.e., capacity) as well as connectivity and diversity of wetland types and channel types.

Key Findings

- Implement restoration that increases landscape connectivity, allowing juvenile Chinook Salmon to access areas of tidal marsh otherwise inaccessible.
- Emphasize restoration of blind channels, given their observed importance to natural origin fish.
- Develop a restoration portfolio of habitat types that provide various benefits for temperature and inputs of terrestrial, freshwater, and marine prey. A variety of wetland habitats contribute to growth and survival. Addressing restoration from a portfolio perspective may provide improved resilience to climate impacts such as sea level rise and temperature increases.
- Re-evaluate the concept of restoring estuary habitat capacity. Habitat restoration is often gauged from the perspective of increasing capacity, an important concept in estuaries where outmigrating fish exceed habitat capacity. Many systems may only rarely experience these high levels of density except in the context of large, hatchery releases.
- Investigate in more detail the potential role of various aspects of hatchery releases (e.g., number released, individual size, timing, and location of releases) in affecting natural origin juveniles. Our analyses suggest that large hatchery releases may increase the likelihood for systems to exceed capacity and increase competition for preferred prey, but better documentation of potential causes is warranted.

Conclusions

The SRFB IMWs have identified a number opportunities for improving the effectiveness of the processes being used to prioritize and implement salmon habitat restoration projects in Washington. The review of effectiveness of various wood placement projects provides new insights into how these wood projects can be better sited and designed. Wood projects need to be very intensive to produce a meaningful response by habitat and fish. The review also identified the need to base restoration strategies on escapement levels as the relative strength of density dependence in a watershed or estuary provides an indication of the habitat objectives most likely to generate a fish response.

The IMW monitoring also provides strong evidence that fully characterizing habitat and fish response at the IMWs will require additional monitoring. The western Washington freshwater IMWs at the inception of these projects generated an estimate of the length of time required to detect a fish response to habitat restoration. This estimate indicated that 10 years of post-treatment monitoring would be required to detect a 25% change in smolt production. However, the IMWs have found that habitat response to restoration treatments can take a long time to fully develop and fish response will not be fully expressed until several years after habitat changes are complete. This lag is especially evident with wood projects. Placement of wood in the channel can have short-term effects on channel form. But the IMW results suggest that biological response to these types of changes tend to be relatively modest. Over time treated reaches can aggrade, accumulating additional wood and sediment, enabling the channel to more consistently interact with floodplains. Floodplain reconnection has the potential to generate a much larger fish response than that associated with channel modification. At all four of the freshwater IMWs, reconnection of floodplains is just beginning to occur. Monitoring for several years after connection between channel and floodplain has been re-established will be required to determine the magnitude of the fish response to floodplain reconnection.

The IMW results indicate that identification of the factors controlling salmon and Steelhead production in a system can be very difficult. This understanding is necessary to implement effective restoration treatments. The evaluation of relationships between fish and habitat metrics included in this review was intended to determine if the IMW data could be used to help with this problem. The cursory assessment we conducted indicated that single habitat variables are not consistently related to fish population metrics. This finding suggests that factors controlling fish production are likely a combination of habitat attributes and probably vary both spatially and temporally. A more detailed investigation of this issue using the IMW data could provide a clearer understanding of the relationship between fish production and habitat condition.

An example of our incomplete understanding of the factors controlling salmon production is provided by comparing Coho Salmon smolt production across the ten watersheds in the western Washington freshwater IMWs. One watershed produces far more Coho Salmon smolts than the others (Fig. 1). Big Beef Creek from 2005 through 2019 produced an average of about 850 smolts/km^2 of watershed area. No other IMW watershed produced more 280 smolts/km^2. This result is somewhat surprising, given that the density-dependence analysis done for this review indicates that Big Beef Creek habitat is not fully utilized, suggesting that the capacity to produce smolts is even higher. The cause of the high production capacity in Big Beef Creek is not known. But understanding why this system is so much more productive could enable the identification of watersheds that have high productive potential and provide information useful to developing restoration priorities.

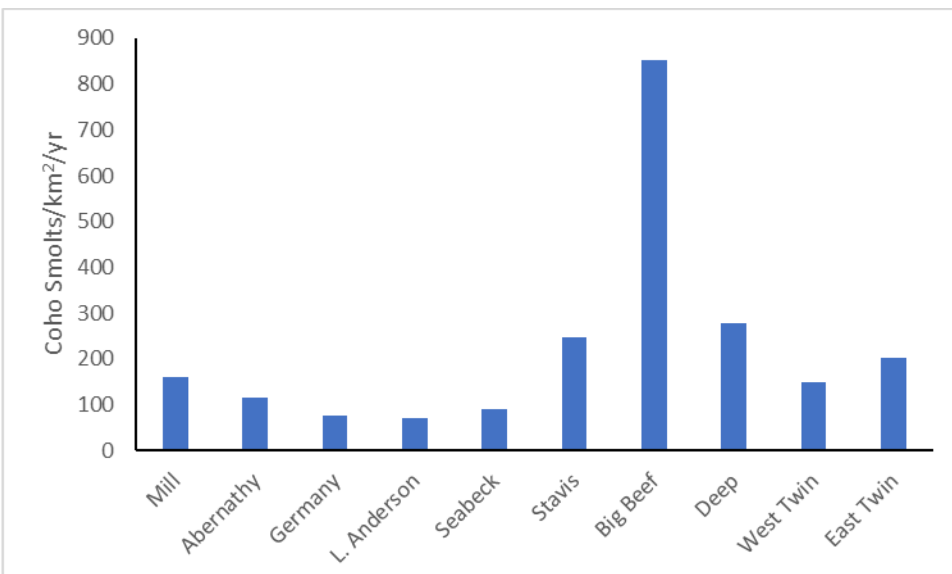


Figure 1. *Annual Coho Salmon smolt production form the 10 watersheds included in the western Washington IMWs. Data are from the years 2005 through 2019.*

The IMWs have documented that habitat restoration is contributing to salmon recovery. IMWs also have generated information that can help improve the effectiveness of habitat restoration efforts in Washington and suggest some new avenues for investigation that could further improve program effectiveness in the future.

STRENGTHENING THE SALMON RECOVERY FUNDING BOARD STRATEGIC PLAN FOR MONITORING THROUGH ADAPTIVE MANAGEMENT

Prepared by the SRFB Monitoring Panel and SRFB Monitoring Subcommittee

April 2023

Executive Summary

This report sets out a conceptual framework for guiding the restoration of salmon habitat in Washington state, a monitoring strategy that facilitates adaptive learning, a process for incorporating lessons from monitoring into new restoration projects using examples from a successful adaptive management plan in Oregon, and finally suggests some specific actions aimed at improving our ability to gain insight from previous experiences. In simple terms, adaptive management uses monitoring as a tool to help judge which restoration projects have succeeded in achieving program goals and which actions have been less successful, so that resources can be focused on activities that provide the greatest benefits.

We suggest that the Resist-Accept-Direct (RAD) paradigm, used by many organizations as a pragmatic approach to habitat restoration, is a useful way to view conservation actions. Where it is possible to avoid the pressures of human development through acquisition of remaining healthy habitats, the *resist* approach may be most appropriate. Where current and future anthropogenic impacts cannot be avoided, the *accept* approach can be used with restoration projects that take advantage of opportunities for habitat improvements at places where they would benefit target fish populations the most despite unavoidable losses at other locations.

Where resist and accept approaches together are incapable of achieving programmatic goals, the *direct* approach may be used to develop novel solutions such as actively developing habitat where none previously existed. The two types of monitoring used to track the effectiveness of each of these approaches are (1) *targeted monitoring*, which evaluates the effectiveness of individual restoration activities usually over a limited time span, and (2) *surveillance monitoring*, which follows the status and trends of fish and their habitats over larger geographic scales and longer time intervals.

This report compares the objectives and outcomes of the three types of monitoring projects supported by the SRFB – intensively monitored watersheds (IMWs), project effectiveness monitoring, and regional monitoring projects. For each monitoring category we ask three questions -- *What are we learning from board monitoring programs? How can this information inform restoration funding decisions?* and *How can this information inform board monitoring programs?* Each monitoring category's contribution to five important restoration-related topics is also compared: fish population status and trends, fish habitat status and trends, climate change, limiting factors, and emerging threats. These comparisons may be helpful to the SRFB as it looks for strengths and weaknesses in the current monitoring portfolio.

Finally, the report offers some specific suggestions for improving the board's adaptive management process. The suggestions are meant to increase the transfer of information among restoration practitioners, scientists engaged in conducting monitoring activities, technical review committees such as the Monitoring Panel and Review Panel, and SRFB members. They include:

- **Increase Interaction Between the Monitoring Panel and Review Panel**
- **Develop a Communication Plan**
- **Periodically Re-assess Limiting factors**
- **Annual Monitoring Project Workshop**
- **Adaptive Management Report Card**

We see adaptive management as a continually evolving process. While each of the suggestions above represents a step that could promote learning and lead to a stronger salmon recovery program, we acknowledge that some steps may work better than others. Therefore, any procedural changes enacted by the SRFB to improve adaptive management should themselves be monitored and evaluated, so appropriate adjustments can be made accordingly.

Part 1. Importance and Rationale for an Adaptive Management Plan

The Salmon Recovery Funding Board (SRFB) Strategic Plan has three goals:

Goal 1: Fund the best possible salmon recovery activities and projects through a fair process that considers science, community values and priorities, and coordination of efforts.

Goal 2: Be accountable for board investments by promoting public oversight, effective projects, and actions that result in the economical and efficient use of resources.

Goal 3: Build understanding, acceptance, and support of salmon recovery efforts.

The Strategic Plan is a general outline of the SRFB mission and does not specify in detail how these goals are to be achieved. It has been a decade since the SRFB formally adopted a monitoring strategy (Lando et al. 2013[1]) and it is therefore time to examine how the salmon recovery program is utilizing adaptive management principles to achieve the Strategic Plan's goals - specifically, how SRFB-funded monitoring projects can help achieve Goal 2 (build and maintain accountability).

"Monitoring Strategy: Provide accountability for board funding by ensuring the implementation of board-funded projects and assessing their effectiveness, participate with other entities in supporting and coordinating state-wide monitoring efforts, and use monitoring results to adaptively manage board funding policies."

An adaptive management plan should build on the Strategic Plan by providing a conceptual framework for implementing habitat improvements and additional guidance on specifying objectives, criteria for making decisions, the kinds of information needed to inform those criteria, how to communicate that information, and the roles of different SRFB groups in supporting these goals. This kind of guidance, which is incorporated in many strategic plans, would greatly strengthen the SRFB's work and the value the Review Panel, Monitoring Panel,

[1] Lando, J. B., D. B. Booth, and S. C. Ralph. 2013. Monitoring investment strategy for the Salmon Recovery Funding Board. Prepared by Stillwater Sciences, Portland, Oregon for Washington State Recreation and Conservation Office, Olympia.

and salmon recovery community can bring to that work. An updated adaptive management plan would help the monitoring project investigators and the two science panels (Review and Monitoring) provide the kind of information and interpretation the SRFB needs for making informed decisions. A detailed adaptive management plan would also increase transparency about how lessons from previous and ongoing projects are contributing to restoration actions and achieving salmon conservation and recovery goals. It would provide the continuity necessary to build a robust program as SRFB members, reviewing scientists, and RCO staff change. We recommend the following actions to increase communication between branches of the SRFB and improve effectiveness of funding mechanisms:

- Consistent evaluation of existing approaches and a process by which to change approaches if they are not yielding the desired outcomes
- Sharing monitoring results, even when they are negative or monitoring shows little expected response
- Regular opportunities for practitioners to share findings, receive feedback, and discuss lessons and opportunities

It is perhaps not surprising that much of the Monitoring Panel, SRFB Monitoring Sub- Committee, and staff efforts to inform funding strategies - most recently with a special interest in the SRFB's intensively monitored watersheds - have generated unanswered questions about habitat restoration effectiveness (e.g., the efficacy of large wood placement in streams).

Although we are working to provide the information the SRFB needs, we know these same questions will come up again and again. It makes sense for the SRFB to invest in building a guiding adaptive management framework to achieve the goals and values described in the Strategic Plan, rather than to reinvent a learning process each time.

What is the risk of not following an objective, structured process for using monitoring information in making management decisions?

Almost all management decisions are made with imperfect knowledge, i.e., less than complete certainty, but following a structured process for utilizing scientific information when weighing the pros and cons of different alternatives reduces the possibility of making misguided choices. A central question of the SRFB Strategic Plan for salmon recovery is "Are we doing the right things, at the right places, and at the right times, to recover fish populations and their
freshwater and estuarine habitats?" The current portfolio of projects supported by the SRFB includes (1) long-term studies of intensively monitored watersheds (IMWs) in which multiple restoration actions have taken place, (2) project effectiveness monitoring (individual project efficacy at the site being restored), (3) reach-scale effectiveness monitoring (currently focusing on remote sensing of floodplain restoration), and (4) regional monitoring projects - a diverse set of monitoring projects identified as regional priorities. Except for reach-scale effectiveness monitoring, now in a pilot testing phase with the floodplain reconnection study, the first two elements of the SRFB monitoring portfolio have been in place for more than a decade and the fourth has provided an opportunity for regional monitoring projects to fill data gaps.

How well are funded projects providing information to answer the central question, and how well has the information from these projects been used to plan and implement better restoration actions? Policy-makers need ready access to accurate information if they are to make the best funding decisions. However, if there is a risk that if the information used to inform decisions is biased in some way, choices are likely to reflect this bias and management decisions may result in unintended consequences. In many organizations there is a systemic tendency to pass along good news and suppress bad news, and this tendency can be especially harmful to monitoring efforts. An example is the failure of the O-rings that led to the explosion of the Challenger space shuttle rocket booster in 1986. Preliminary monitoring had shown that the O-rings were vulnerable to failure at low temperatures, but the evidence for this risk had not been convincingly transferred to command authorities. Bella (1987) reviewed the circumstances behind the Challenger disaster and attempted to show in the following general diagram how favorable information tends to be passed along to decision-makers while unfavorable information can be suppressed.

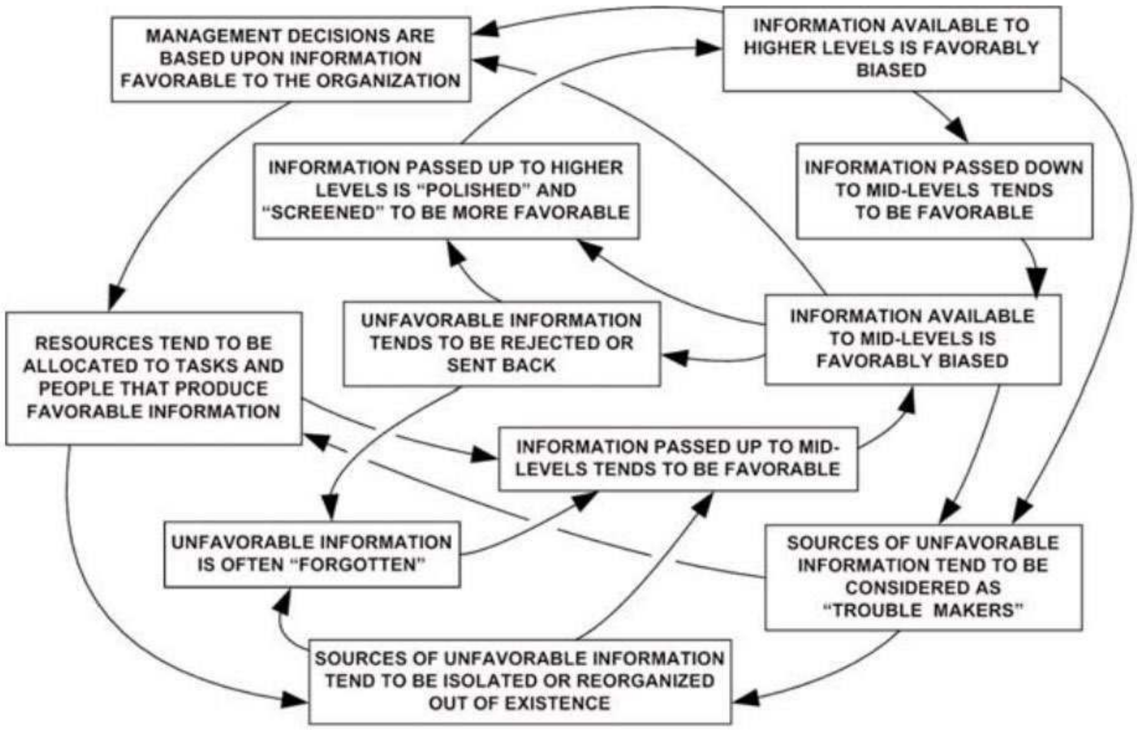


Figure 1. Start anywhere on this diagram. A forward direction on an arrow means "therefore" and backward on an arrow means "because". From Bella (1987)[2].

The risk is higher for this dynamic to affect SRFB's fish habitat improvement efforts without an adaptive management framework that identifies an objective, structured process for making management decisions. For example, monitoring results that confirm or validate desired project objectives or expectations may be considered successful monitoring, and monitoring results that do not confirm or validate desired objectives or expectations to be viewed as unsuccessful. This can lead to a bias towards monitoring efforts that report "positive" results and an unwillingness to equally embrace the monitoring efforts that suggest certain actions that make little contribution to salmon recovery. The danger is that continuing to support projects whose efficacy may be questionable will continue, along with the belief that programs are making best use of restoration funds.

[2] Bella, D. A. 1987. Organizations and systematic distortion of information. Journal of Professional Issues in Engineering 113(4):360-370.

In order to guard against the tendency to reward good news and downplay disappointing news it is important that information from monitoring programs be treated objectively and consistently while being communicated to policy-makers, project managers, and practitioners. Therefore, as stated above, we recommend that the SRFB adopt additional guidance on specifying objectives, criteria for making decisions, the kinds of information needed to inform those criteria, how to communicate that information, and the roles of different SRFB groups in supporting these goals.

Part 2. Proposed SRFB Adaptive Management Conceptual Framework

There are three elements that are important for a robust and effective habitat restoration program:

A. *A pragmatic conceptual framework for restoration*

We suggest adopting the Resist, Accept, and Direct (RAD) framework that has been embraced by many ecologists worldwide and is now being used in other areas to achieve restoration goals for a variety of species. The framework acknowledges that we are faced with a changing world, that some changes – climate and human population growth - are beyond our immediate control, and that a reasonable approach is to *resist* harmful changes where we can, *accept* and make the best of irreversible changes where we must, and *direct* novel changes to fit new circumstances and achieve realistic policy objectives.

Lynch et al. (2022) [3] present a useful description of the RAD framework. The approach assumes that, unlike some traditional management approaches, the future cannot be made to reflect the past. As watersheds are gradually transformed by climate change and human development, strong monitoring programs coupled with adaptive learning and novel experimentation are needed to minimize the risks of making ineffective restoration choices and improve our chances

[3] Lynch, A. J., Thompson, L. M., Morton, J. M., Beever, E. A., Clifford, M., Limpinsel, D., Magill, R. T., Magness, D. R., Melvin, T. A., Newman, R. A., Porath, M. T., Rahel, F. J., Reynolds, J. H., Schuurman, G. W., Sethi, S. A., and Wilkening, J. L. 2022. RAD adaptive management for transforming ecosystems. *BioScience 72*(1):45-56.

of achieving desired salmon recovery goals. As stated by Lynch et al. (2022, p. 46) “This involves revisiting assumptions about cause–effect relationships and adjusting management objectives to align with feasible outcomes”. In the case of salmon habitat restoration, adaptive management can mean periodically re-assessing the assumptions made about factors limiting the survival and growth of fish populations, and adjusting restoration actions to better address factors that monitoring results suggest are more important.

Traditional adaptive management consists of a cycle of assessing, designing, implementing, monitoring, evaluating, and adjusting that allows managers to work iteratively toward improved understanding and improved management over time. This is shown by the inner loop in Figure 2. In the inner loop, if monitoring shows the restoration actions are producing the desired effect, the preferred strategy is to stay the course. If, however, either management expectations or restoration approaches need adjustment, the course can be adjusted by modifying management objectives and/or altering restoration measures – the middle loop of Figure 2. Finally, if it becomes clear that management objectives are not feasible due to largely irreversible ecosystem transformations, alternative objectives that incorporate those changes into acceptable desired outcomes are needed. Including all stakeholders in developing RAD objectives can help identify the existing knowledge base and community values to determine feasible restoration outcomes, given ecological, economic, treaty commitments, and other constraints. An adaptive management strategy for reimagining the course is shown in green in the outer loop of Figure 2.

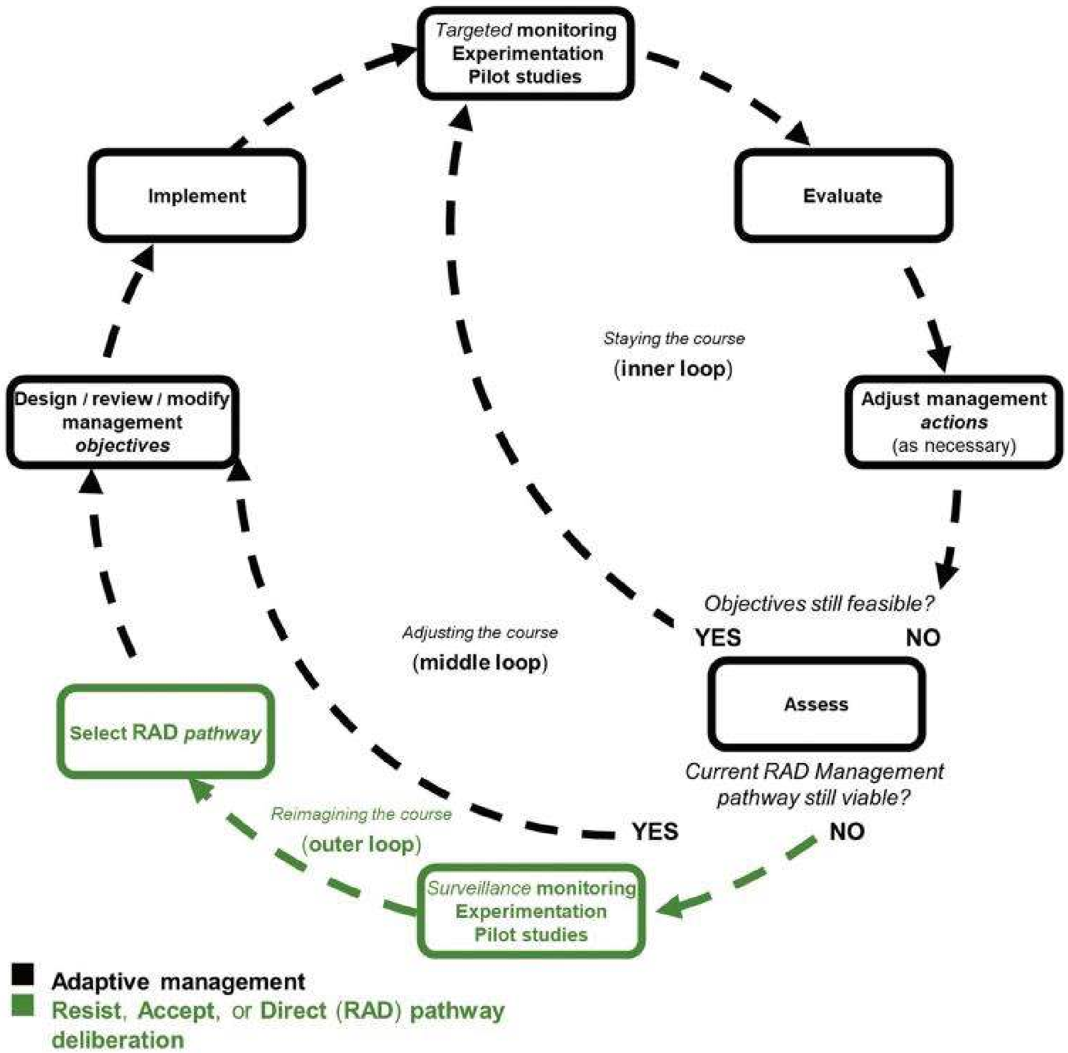


Figure 2. Adaptive management loops that include the Resist-Accept-Direct options (from Lynch et al. 2002).

B. *A monitoring strategy that includes adaptive learning*

Using monitoring to maximize learning opportunities includes ***targeted*** monitoring, which tracks changes in habitat and/or changes in fish populations following restoration, and ***surveillance*** monitoring, which examines long-term changes over large areas. Most of the monitoring projects funded by the SRFB are targeted monitoring; they aim to evaluate the effects of various types of habitat improvement actions on habitat quality or they continue to track the status and trends in fish populations by monitoring population attributes such as the number of adults returning to spawn or the number of smolts emigrating to sea over time.

Intensively monitored watersheds (IMWs) have elements of both targeted monitoring and surveillance monitoring. They were designed to assess the effectiveness of multiple habitat restoration projects on watersheds with salmon and steelhead populations, and they constitute part of a wider network of IMWs throughout the Pacific Northwest that together provide surveillance monitoring of long-term changes resulting from gradual regional transformations resulting from human development and climate change.

We believe that both targeted and surveillance monitoring are necessary for adaptive learning. Targeted monitoring can provide answers to cause-effect questions, e.g., if we remove barriers to fish migration will increase use of available habitat take place, leading to improvements in viable salmonid population (VSP) parameters? Surveillance monitoring is needed to improve our understanding of how trends in climate affect watershed processes and how increasing pressures from human development such as water needs, flood control, urbanization, and industries such as agriculture and forestry influence fish and their habitats. Currently, the SRFB- funded IMWs are being reviewed to determine their value as targeted monitoring studies, but we suggest that IMWs also serve important surveillance functions as barometers of long-term trends in watershed conditions and fish populations in different settings (forested, urban, rangeland, etc.), once their immediate monitoring questions have been answered. Long-term surveillance monitoring is one of the few available tools for determining whether habitat and population recovery expectations are realistic or if losses due to climate change, human development, or ocean conditions are outpacing gains resulting from habitat improvements. If this turns out to be the case in some areas, reimagining the course may be needed to establish more realistic recovery goals and to determine novel approaches to achieving these goals. An excellent example of using the RAD framework to implement a restoration program is presented in Lynch et al. (2002 – Box 2, pp 49-50), in which multi-stakeholder groups have collaborated to produce a coordinated plan for a national wildlife refuge in the Mojave Desert in which there are clear roles and responsibilities. The plan includes resist, accept, and direct strategies for aquatic habitat and fish population management, as well as a commitment to both targeted and surveillance monitoring.

C. *An efficient process for incorporating monitoring lessons into new projects*

Adaptive management faces two challenges: getting accurate and timely results from monitoring programs, and incorporating lessons learned from those programs into the planning process for future restoration funding. Oregon's Grande Ronde Model Watershed (GRMW) program has been underway since 1992 to provide a model for improving habitat for salmon and steelhead and for implementing adaptive management. A recent report (Roni et al. 2022)[4] has detailed progress in the GRMW that involves planning, doing, evaluating, learning, and ultimately adjusting restoration design and implementation. Although the GRMW has not formally adopted the RAD framework for its restoration program, elements of the adaptive management plan easily fit into the RAD design. Figure 3 is reproduced from their report (Fig. 10 in their report) and shows the steps in prioritizing, planning, monitoring, evaluating, reporting, and adjusting restoration activities.

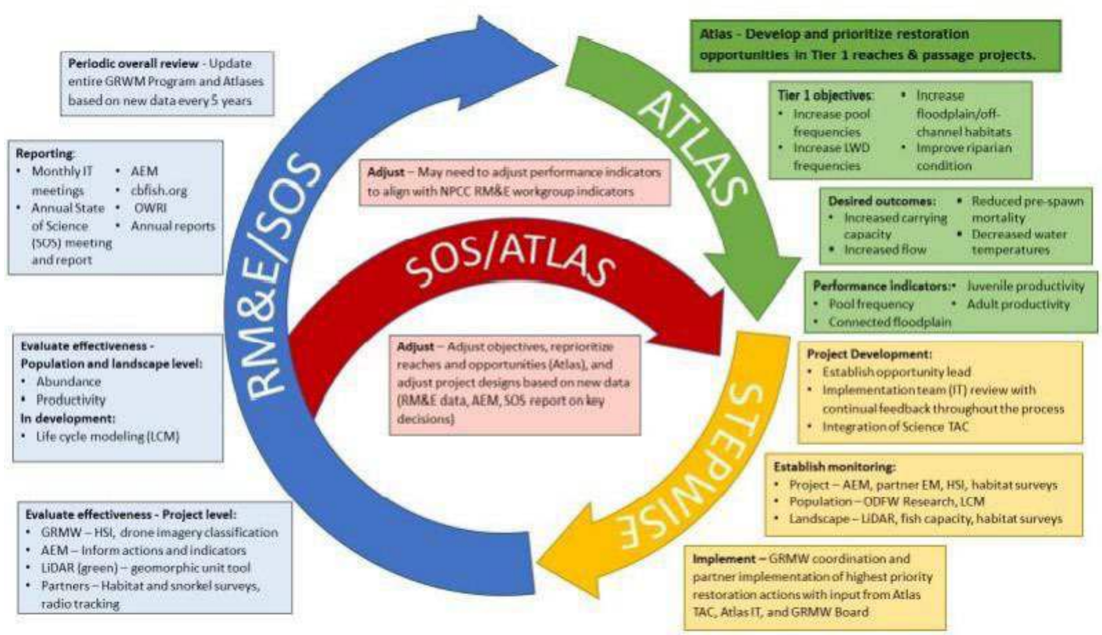


Figure 3. Adaptive management process (developed in 2021) used by the Grande Ronde Model Watershed (GRMW) that ties together existing processes into an annual cycle of monitoring and

[4] Roni, P., Steele, J., and A. Towne. 2022. The Grande Ronde Model Watershed: Integrating science into restoration implementation and adaptive management. Cramer Fish Sciences and Grande Ronde Model Watershed Report, Issaquah, Washington. More information: [GRMW Home]

adaptive management. The Atlas and Stepwise processes are where the assessment, identification, and implementation of projects occur. Effectiveness monitoring (RM&E) and the State of Science (SOS) meeting are where the results of ongoing monitoring and research are presented and incorporated into the Atlas and Stepwise processes to refine restoration opportunities, design, and implementation. NPCC = Northwest Power Conservation Council, TAC
= Technical Advisory Committee, IT = Implementation Team, HSI = habitat suitability index, AEM
= Action Effectiveness Monitoring Program, cbfish.org = BPA project management database, OWRI = Oregon Water Restoration Inventory.

Figure 4 displays the GRMW program's quantitative measures, actions, and outcomes that are used in the adaptive management process. Having objective, quantifiable goals and metrics of success is vital to determining whether objectives of the program are being met or if adjustments or new directions are needed.

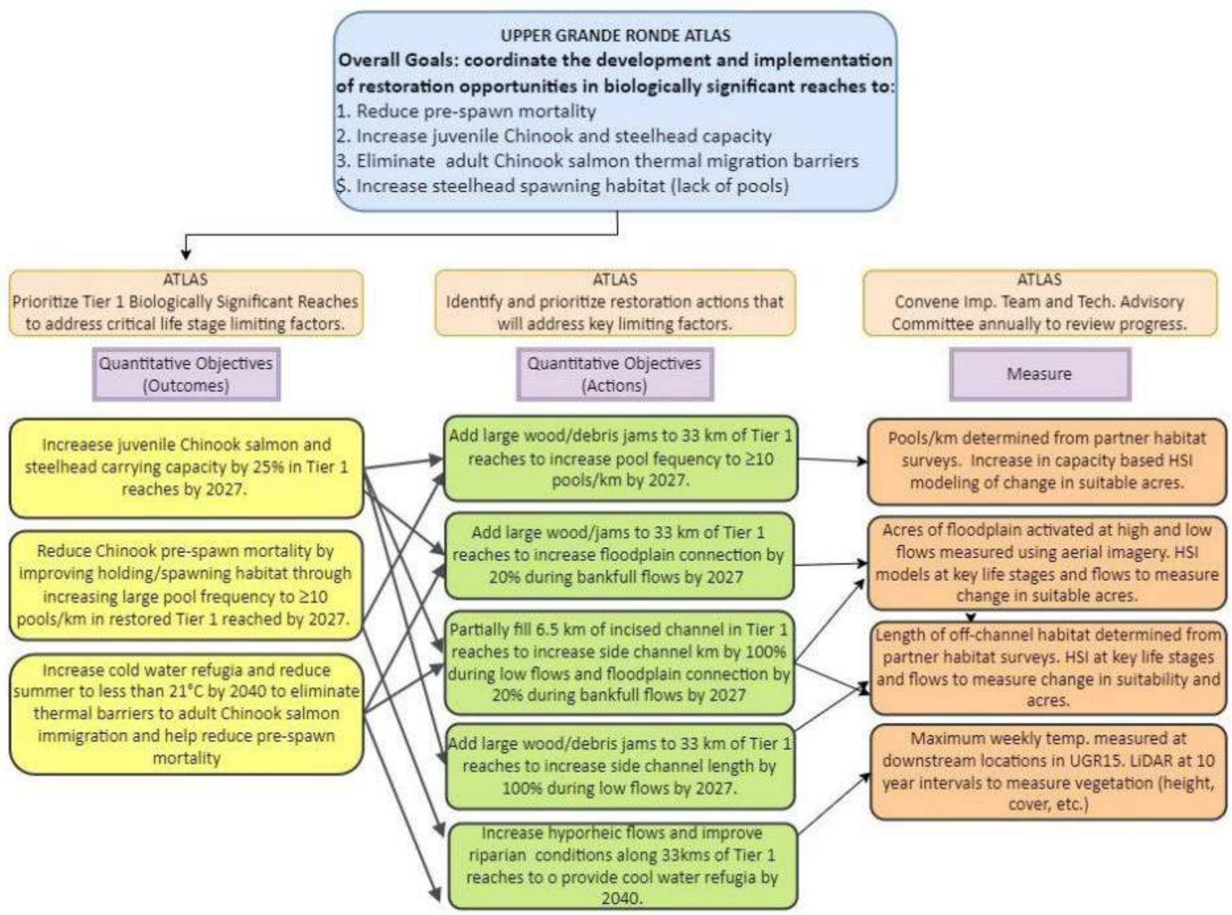


Figure 4. Example of multi-level goals and objectives identified for Tier 1 reaches in the Upper Grande Ronde Atlas to assist with the adaptive management process and overall GRMW program success at multiple scales (Atlas or watershed, BSR, restoration action).

Having a conceptual framework for restoration provides an enormous advantage in being able to learn from experience. The notion that we can “turn back the clock” to an arbitrary time in the past in setting habitat improvement objectives is not supported by current restoration science. Although we feel that the Resist-Accept-Direct framework embraces the idea that restoration should be compatible with a changing world, alternative approaches may achieve similar results provided they acknowledge and accommodate ecological and socioeconomic change. Having a framework that recognizes change also allows for new approaches to be tried and tested.

Current mechanisms for providing feedback and learning from monitoring projects can be improved. For IMWs, the principal feedback from monitoring has been annual reports that are reviewed each year by the Monitoring Panel. Study plans of regional monitoring proposals are reviewed by the panel, but results of regional monitoring projects are not. Lessons learned from the experiences of each project are largely left to restoration practitioners. The GSRO bi- annual Salmon Recovery Conferences help in communicating the experiences of restoration practitioners to each other, but beyond these meetings there is little structured process for transmitting and sharing information about project success or failure to other restoration practitioners, as well as to the SRFB. The forthcoming IMW synthesis report is likely to be very helpful, although many of the IMWs have not completed their post-treatment monitoring and will not yet have reached final conclusions. We believe that meetings (in person or virtual) are often the most efficient means of communicating and understanding information and lessons learned. It is possible that the requirement of an annual report from monitoring project leaders could be augmented by a yearly workshop in which project leads meet with each other, the Monitoring Panel, interested members of the Council of Regions, and select SRFB members to discuss findings and ideas for adjustments to restoration projects and monitoring techniques.
Additionally, links to reports, workshop recordings and other summaries of monitoring results could be posted on the SRFB website.

Part 3. SRFB Monitoring Programs

The current portfolio of SRFB-funded monitoring projects includes project effectiveness monitoring, intensively monitored watersheds, and regional monitoring projects. For each monitoring category, the following matrices show how those projects address three high level questions.

Question 1 - What are we learning from board monitoring programs?

Project Effectiveness Monitoring	Intensively Monitored Watersheds	Regional Monitoring Projects
Phase 1 of project effectiveness monitoring concluded in 2019 with variable results reported from different types of restoration. Some types of restoration were found to have few positive effects while others documented improved habitat conditions but failed to show statistical benefits to fish populations. The new effectiveness monitoring effort focuses on floodplain restoration using remote sensing techniques. A pilot study is underway and preliminary results appear to document measurable benefits to fish habitats. Results are communicated to the monitoring panel through periodic teleconferences and written reports.	The SRFB is funding 5 IMWs in Washington: Asotin, Skagit estuary, Strait of Juan de Fuca, Hood Canal, and Lower Columbia River. Most IMWs are evaluating restoration of stream channel complexity and improvements in fish passage at road crossings. Implementation of restoration actions has taken longer than expected at most sites and post-treatment monitoring is still underway. Preliminary results have shown fish populations benefit when passage barriers are removed, but evidence for habitat improvements and population benefits from large wood additions has been equivocal. Population improvements from estuary restoration have been more promising. A synthesis report on IMW findings is in preparation.	Regional projects are short- term monitoring efforts (usually 1-2 years) that address high priority regional monitoring needs and gaps. Most projects over the last 10 years have involved support for fish trapping, but some have covered aerial habitat surveys, non-native species impacts, genetic stock identification, and other topics identified as important regional data gaps. Results of regional monitoring projects are primarily communicated to local and regional stakeholders.

Question 2 - How can this information inform restoration funding decisions?

Project Effectiveness Monitoring	Intensively Monitored Watersheds	Regional Monitoring Projects
Monitoring restoration effectiveness at the individual site or stream/river reach scale can provide evidence of local improvements in the quantity and quality of available fish habitats, as well as evidence for the increased use of newly available habitats by target fish species. Monitoring success is aided by the establishment of quantitative objectives for both habitat improvements and fish usage. When quantitative objectives are set beforehand, targeted monitoring is used to determine whether objectives are being achieved within a reasonable (or pre-specified) time period. Having quantitative objectives specified before project initiation helps the board judge whether restoration goals are being met, and whether the original goals were based on realistic assumptions and expectations (see Fig. 2 above).	Studies of intensively monitored watersheds have a unique ability to evaluate the effects of multiple restoration actions on fish populations at the watershed scale. IMWs include elements of targeted and surveillance monitoring; they examine local improvements in habitat after specific restoration activities and track long-term trends in fish population distribution, abundance, and productivity. Most of the SRFB- funded IMWs have been in place for 15 years or more, making them part of a broader regional network of IMWs that have acted as barometers of the status and trends in both aquatic habitats and fish. Information provided by IMWs can assist the board in deciding which, if any, IMWs should receive continued funding, as well as whether new watershed-scale studies are needed to test assumptions about emerging threats and whether alternative restoration measures can produce acceptable results.	Regional projects satisfy the goal of filling data gaps that are needed for regional planning and setting restoration priorities. They can also be important in testing assumptions about limiting factors, although they are rarely used for this purpose at present. The short-term nature of most regional monitoring projects suggests that they are best suited for targeted monitoring, which in addition can include pre-restoration limiting factor assessments, evaluation of new threats (e.g., invasive species), and pilot-scale tests of novel restoration approaches. While decisions about which monitoring projects to propose for SRFB funding are made by local coordinating entities such as regional salmon recovery boards, the SRFB can provide input and guidance to the Council of Regions for projects that have implications for salmon restoration beyond regional boundaries.

Question 3 - How can this information inform board monitoring programs?

Project Effectiveness Monitoring	Intensively Monitored Watersheds	Regional Monitoring Projects
The Monitoring Panel believes that all three current programs	IMWs are the only monitoring tool we have that can assess	Regional monitoring projects are essential to regional and

Question 3 - How can this information inform board monitoring programs?

Project Effectiveness Monitoring	Intensively Monitored Watersheds	Regional Monitoring Projects
– Project Effectiveness, IMWs, and Regional Monitoring – should remain important components of the board's monitoring portfolio, and further that the programs deserve to be balanced in part by the potential information each program contributes to institutional learning. Project effectiveness monitoring will be one of the key cornerstones of the portfolio. These projects involve targeted monitoring of the effects of specific restoration actions. The panel believes that the emphasis of effectiveness monitoring should move from studies at the site scale (e.g., installation of an engineered log jam) to expanded studies of multiple actions at the scale of a stream or river reach (e.g., reconnecting side channels and improving off-channel habitats in floodplains). Remote sensing technology has great potential for characterizing habitat changes at the reach scale, and the pilot floodplain study currently underway uses remotely sensed data to parameterize habitat metrics that would be difficult or impossible to determine with ground surveys. Along with regional monitoring projects, effectiveness monitoring projects can help evaluate new restoration approaches as they are developed.	freshwater and estuarine restoration effects on salmon and steelhead at the population level, and they can help answer the question "Are we losing habitat to human impacts and climate change faster than habitat improvements are being made through restoration?" IMWs are also unique in that they utilize both targeted and surveillance monitoring, giving us long-term data sets that are essential to examining the assumptions made in broad recovery programs (e.g., Biological Opinions, regional restoration strategies). Current plans call for post-treatment monitoring of SRFB-funded IMWs to continue for approximately 3-7 years; however, this may change with the outcome of the IMW synthesis effort due in 2023, as well as board decisions on funding allocation. In any case, full termination of the SRFB- funded IMW program would result in the loss of long-term surveillance capability as well as the ability to evaluate the cumulative effects of multiple types of restoration on fish populations at the watershed scale.	local needs for filling data gaps, and as well for maintaining the continuity of existing monitoring programs such as operation of smolt traps where funding is temporarily unavailable. The reporting of results and lessons learned from regional monitoring projects is somewhat inconsistent. Where Project Effectiveness and IMWs have produced annual reports, final reports (e.g., Project Effectiveness Phase 1), and presentations to the SRFB, there does not appear to be a clear process for communicating results of regional monitoring projects to the Monitoring Panel or to the SRFB. Improving the transfer of results and lessons from regional monitoring projects to a broader salmon recovery audience would yield improved learning opportunities and opportunities to improve monitoring and implementation actions.

In terms of addressing specific issues relevant to the SRFB Strategic Plan, the following table shows where each of the monitoring programs have contributed or have the potential to contribute significant information and scientific insight.

Table 1. Topics for which SRFB monitoring programs have made significant contributions (bolded) or for which there is a potential for significant contributions (unbolded).

	Important Contributions		
	Project Effectiveness Monitoring	**Intensively Monitored Watersheds**	**Regional Monitoring Projects**
Fish population status and trends		**X**	**X**
Fish habitat status and trends	**X**	**X**	x
Climate change		x	x
Limiting factors	**X**	**X**	**X**
Emerging threats	x	x	x

Part 4. Adaptive Management Processes, Roles, and Responsibilities

Used here, adaptive management is the process of learning from experience in order:

1. to identify and prioritize restoration actions that most likely have significant impacts on target fish species,
2. to design and implement monitoring programs that address critical data gaps, and
3. to show how restoration projects contribute to the goals of the SRFB Strategic Plan.

While there is no rigid process that will ensure we are gathering the most broadly useful information from monitoring and habitat improvement projects, there are lessons from the previous two decades of project implementation and monitoring that can guide the ability to improve adaptive learning and decision making. Feedback from restoration practitioners and regional managers suggests that there is a need to show how habitat restoration activities contribute to measures undertaken to address the "all-Hs", i.e., to document how habitat improvements help resolve threats faced by salmon and steelhead throughout their life cycles in the context of harvest management, hatchery reform, hydroelectric production, climate change, and other key aspects of recovery. In addition, regional managers have expressed the need to test and verify current assumptions about factors limiting salmon productivity in their areas so that priority can be given to projects with the greatest potential restoration benefits. Monitoring, coupled with adaptive management, can help inform both issues.

The SRFB and associated oversight committees can help bolster four main types of capacities that are needed to reduce obstacles to implementation of adaptive management. These are shown below in Figure 5 from a recent review of the adaptive management process by Månsson et al. (2023) [5].

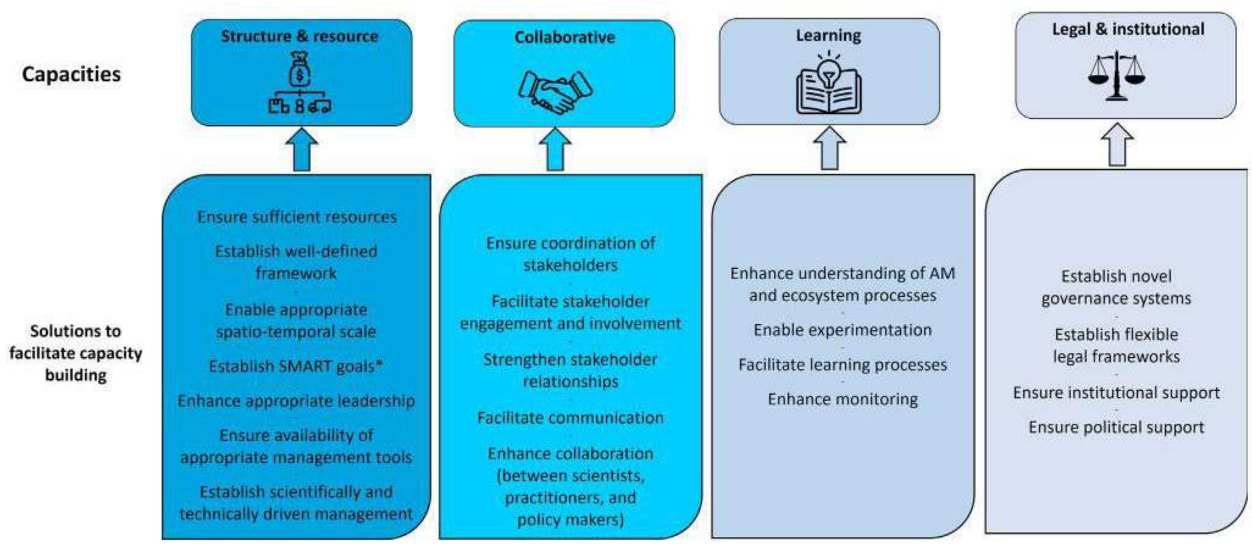


Figure 5. Solutions to overcoming obstacles to implementation of adaptive management. In the diagram, SMART stands for specific, measurable, achievable, realistic, and timely; AM refers to adaptive management (from Månsson et al. 2023).

[5] Månsson, J. L. Eriksson, I. Hodgson, J. Elmberg, N. Bunnefeld, R. Hessel, M. Johansson, N. Liljebäck, L. Nilsson, C. Olsson, T. Pärt, C. Sandström, I. Tombre, and S. M. Redpath. 2023. Understanding and overcoming obstacles in adaptive management. *Trends in Ecology and Evolution*. 38(1):55-71.

Below we offer suggestions for improving the process of learning and applying information from monitoring to restoration practitioners, regional managers, and SRFB members. The suggestions are organized by monitoring category and include recommendations for roles and responsibilities of the Monitoring Panel, Review Panel, Council of Regions, and the SRFB.

A. Effectiveness Monitoring

Effectiveness monitoring will be primarily targeted at evaluating the efficacy of restoration actions at the site and river reach scale. Examples of site-scale restoration include barrier removal and other habitat improvements that are concentrated at a single location. Reach- scale projects involve a suite of habitat improvements carried out over a segment of the river system up to several miles long. Quite often these measures include re-establishing connections with floodplain channels, large wood reintroductions, and riparian revegetation. In the past, reach-scale monitoring has been somewhat constrained by the difficulty in executing ground-based habitat surveys over large areas, but recently a project is underway to evaluate the use of remote sensing to determine the effectiveness of floodplain restoration. Remote sensing is a good example of using new technology to gather information on habitat development over large areas, and it can be used to track habitat change, potential limiting factors, and emerging threats. Additional effectiveness monitoring efforts that link restoration actions with habitat improvements using new technologies are needed as these projects can potentially reduce monitoring costs and provide quantitative measures of habitat development in all types of settings.

B. Intensively Monitored Watersheds

IMWs are currently the only monitoring category that can track both fish population and habitat status and trends at the watershed scale over extended periods and as such constitute the only surveillance tool in the SRFB portfolio. The IMW program has been underway for almost two decades and a synthesis report will be forthcoming, but the program has already yielded important insights into restoration effectiveness in addition to generating questions that can only be answered by continued investigations. In terms of providing new and important information to decision makers, IMWs have surpassed other monitoring categories in terms of peer-reviewed scientific publications and presentations at conferences. To date, however, the primary feedback mechanism between the IMWs and SRFB has been annual reports that are reviewed and summarized by the monitoring panel, with recommendations communicated to the board at its early summer meeting. There has been limited feedback between IMWs and the regions and other stakeholders. The PNAMP synthesis report due in 2023 will help, but an improved means of disseminating findings from IMW monitoring to interested parties is needed. It may be desirable to replace the current process of comprehensive annual reports with brief summaries of new learnings and challenges for the IMW, and supplement the summaries with a meeting in which IMW scientists can describe their findings and management implications to a broader audience. Without broader communication there is a risk that the information from the long-term IMW monitoring will be underutilized in the SRFB's adaptive management strategy.

C. Regional Monitoring Projects

Because regional monitoring projects are designed to fill critical data gaps that are identified as regional priorities they are targeted, short-term projects in nature and directed toward a specific task. For example, over the last decade many regional monitoring projects have facilitated the annual operation smolt traps to continue tracking migrant yield in river basins where funding was not otherwise available. A few projects have examined emerging threats, carried out a re-analysis of limiting factors in an area of interest, or used new or existing technology to provide information not otherwise available. Lessons learned from regional monitoring projects are usually not widely communicated. The monitoring panel reviews proposed projects for scientific quality but does not receive summaries of regional project findings when the work is completed, and it is unclear how results of monitoring projects are shared among regions. As with IMWs, there is a risk that the results of regional monitoring projects are not widely disseminated and opportunities to learn from the experiences of others may be foregone. We strongly recommend that results of regional monitoring projects be more widely disseminated.

D. Smaller Written Reports, More Presentations

Written progress reports and final reports are often viewed as a chore to write by restoration practitioners, and a chore to read in detail by managers and funding organizations. Rather, we suggest that less emphasis

be placed on annual written reporting and more emphasis be placed on yearly exchanges of information through venues such as virtual meetings. Verbal presentations where the audience has the opportunity to question/discuss findings and management implications may be a more effective and efficient means of learning than written reports. We acknowledge that the requirement of a written report is often a strong motivator for scientists to stay current in summarizing their monitoring results, but the give and take of a good discussion may in many cases lead to more effective information transfer. Annual meetings and workshops where presentations of effectiveness monitoring, IMWs, and regional monitoring projects are shared with the monitoring panel, regional managers, and SRFB members would allow all interested parties to learn from each other's experiences, and for SRFB members to communicate their priorities to regions and project managers. Written annual reports could be condensed into brief summaries of new findings and challenges to
long-term monitoring efforts, to be discussed at yearly meetings/workshops.

E. Monitoring Panel, Monitoring Subcommittee and SRFB Roles and Responsibilities

Following are some recommendations for specific actions that we believe would help reduce barriers to managing the SRFB portfolio of salmon recovery projects adaptively. These are not listed in order of importance, nor are they meant to encompass all possible measures that would increase learning. There is no fixed recipe for adaptive management; rather, improving our ability to incorporate lessons from monitoring should be considered a work in progress that will involve collaboration among stakeholders over time. Therefore, we envision the SRFB adaptive management plan as a continuing effort that will evolve as new information becomes available. We also regard the following recommendations as steps that should themselves be evaluated over time as part of the adaptive management process. Those steps that do not yield useful results should be modified or dropped, while those that contribute to better restoration projects can be retained and even enhanced.

➢ Increase Interaction Between the Monitoring Panel and Review Panel

The SRBF adaptive management process would benefit from increased communication and information exchange between the Monitoring Panel and Review Panel, which currently operate independently of each other. Each year before project application submission, the Monitoring Panel and Review Panel should jointly discuss the results and lessons learned from existing monitoring projects in order to increase the Review Panel's awareness of the latest information coming out of those efforts. It would be helpful for the Review Panel to track the latest science being incorporated into new acquisition and restoration proposals and the proposed measures of restoration success. The categories in Table 1 can provide a starting point for an assessment of both strengths and weaknesses in the monitoring portfolio, as well as identifying opportunities for how lessons from monitoring programs of other organizations can be incorporated into SRFB projects. The annual monitoring update at the summer SRFB meeting could include information and recommendations for managing existing monitoring programs along with recommendations for new types of restoration projects or new monitoring directions. The SRFB, in turn, can communicate new priorities and ideas for monitoring through the monitoring Sub-Committee.

- **Develop a Communication Plan**

Improved communication of monitoring results to SRFB members, project reviewers, and restoration practitioners was prioritized by many as this report was being developed. There are several ways communication and outreach could be accomplished, but specific suggestions included:

1. Recorded webinars prepared by individual monitoring project scientists giving an overview of their projects and summarizing important management-related takeaways. These webinars could be made available on the SRFB web site and updated as needed by RCO staff.
2. Recorded proceedings of salmon restoration conferences (e.g., the bi-annual Salmon Recovery Conference) could likewise be made available on the SRFB web site. Not all restoration practitioners have institutional funding to attend conferences and other scientific meetings, and recordings of key presentations could assist them in gaining access to the latest information.
3. Publication of a SRFB newsletter (both hardcopy and virtual) in which select monitoring highlights could be publicized. The frequency of the newsletter would need to be determined by budget considerations and availability of suitable content, but

newsletters produced by other organizations (e.g., the Forest Service's *Science Findings* newsletter was widely distributed throughout the Pacific Northwest) have been considered an effective means of disseminating scientific information in a clear, understandable manner. The SRFB newsletter could be coordinated by RCO.

- **Periodically Re-assess Limiting factors**

In many river basins, modeling tools such as Ecosystem Diagnosis and Treatment (EDT) have been used to assess habitat conditions and identify environmental factors limiting salmon productivity. In some river basins these analyses were carried out more than a decade ago, and additionally the modeling tools themselves may have been updated to incorporate new scientific findings. New information may have emerged that could alter the ranking of potential habitat limiting factors (e.g., stream temperature, sediment concentration, or lack of large wood in stream channels), or recent evidence may suggest that other factors not fully considered when modeling was originally performed (e.g., the number of adult salmon

returning to spawn) can strongly influence freshwater population abundance and productivity. Additionally, conditions in the river basin may have changed significantly over time such that what was limiting in the past may now be less important than other factors. Periodic re- assessment of limiting factors for salmon in river basins should take place at 5–10-year intervals so that restoration programs can focus on improving aspects of salmon environment that matter most.

- **Annual Monitoring Project Workshop**

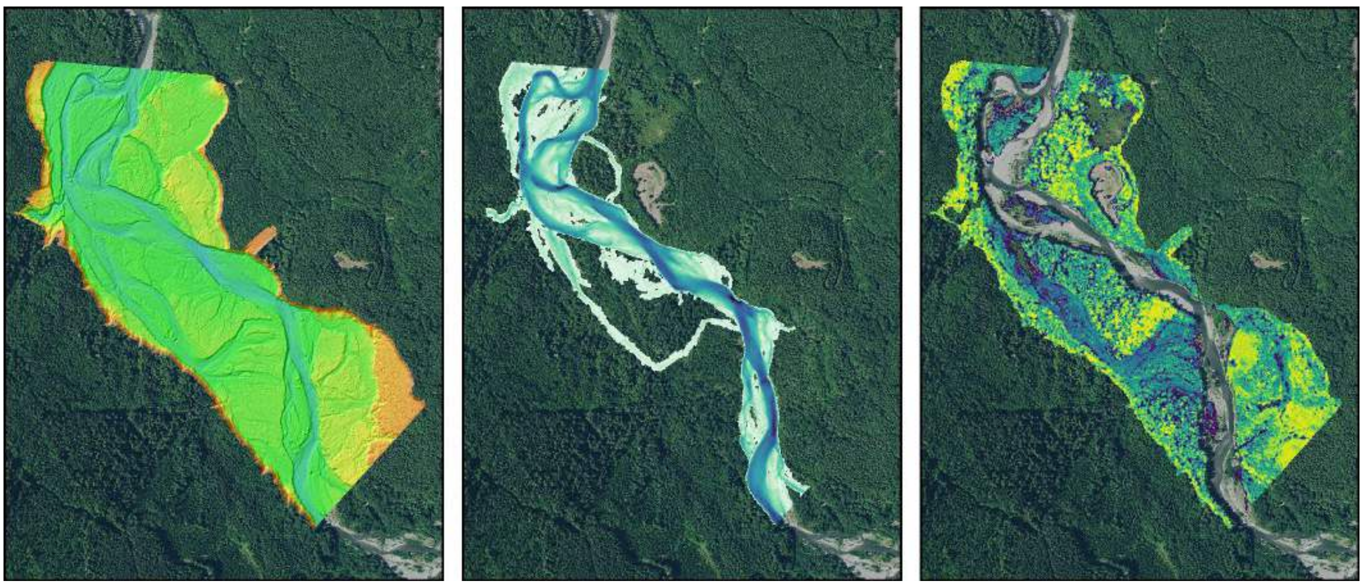
Each year, members of monitoring project staff (IMW, Effectiveness Monitoring, and Regional Monitoring) should join with members of the Monitoring Panel, Monitoring Subcommittee, and SRFB for a 1-day virtual workshop to discuss their progress over the year, share important conclusions, and describe how they handled challenges to their monitoring efforts. This would not replace written reports but rather allow for the exchange of information and for providing a catalyst for new and innovative monitoring directions. We have found that direct communication often results in more effective transfer of new ideas than relying solely on written reports, and holding the workshop virtually would lessen the time and financial burden of traveling to conferences.

- **Adaptive Management Report Card**

Each year the Monitoring Panel and Monitoring Subcommittee should brief the SRFB on progress with adaptive management. The briefing should highlight findings from the various types of monitoring projects, lessons that can be applied to future restoration work, opportunities for collaboration among monitoring groups, communication of results, and examples of restoration sites where new information has been incorporated into project designs. This annual report card could assist the SRFB in balancing its portfolio of monitoring projects and in setting priorities for future monitoring efforts.

REMOTE SENSING PILOT PROJECT:

EVALUATING THE EFFECTIVENESS OF LARGE FLOODPLAIN AND RIPARIAN RESTORATION PROJECTS USING REMOTE SENSING



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RCO Project 21-1328

March 31, 2023

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EXECUTIVE SUMMARY

Previous restoration effectiveness monitoring programs administered by the Salmon Recovery Funding Board (SRFB) and the Bonneville Power Administration have emphasized the need for better evaluation of large floodplain and riparian restoration projects. Moreover, recent technological advances have made it possible to monitor large restoration projects efficiently using remote sensing. The SRFB Monitoring Panel oversaw the development of a Study Plan to evaluate large floodplain and riparian restoration projects using remote sensing. Prior to implementing the plan, the Monitoring Panel recommended a pilot study on a limited number of sites to test, refine, and confirm the feasibility of the approach and methods in the Study Plan. This report documents the results of the pilot study. We worked closely with the SRFB Monitoring Panel to select sites that met specific criteria (e.g., project length, availability of pre-project LiDAR). Four sites were selected, two in western Washington and two in eastern Washington, which include Countyline (White River), Fobes (South Fork Nooksack River), Tucannon Project Area 3 (PA-3, Tucannon River), and Middle Entiat (Entiat River). The Countyline and Tucannon PA-3 sites represent completed projects where before and after LiDAR data were available, but not all the supplemental field data. The Fobes site is a new project where we were able to collect pre-project data and construction will be completed in 2023. We were able to map and calculate all but a handful of floodplain and riparian metrics on Countyline and Tucannon PA-3 with LiDAR and other remotely sensed data, coupled with hydraulic modeling. For the Fobes site, we were able to collect supplemental field data and calculate all metrics outlined in the Study Plan. The results of the Middle Entiat project, which is funded through Chelan County, are detailed in a separate report. Examination of the Countyline project, which was assessed before and 5 years after restoration (levee set back, large wood placement, side channel construction), showed increases in key floodplain, habitat, and habitat suitability metrics by 50 to several hundred percent, in some cases. For example, side channel metrics increased from 267% to 967% 5 years after restoration. Changes at the Tucannon PA-3 project, which was a wood placement project, were more modest, but we were still able to map and calculate all metrics and measure change before and after restoration. Based on data from these three sites as well as more detailed analysis on the Middle Entiat, the pilot study demonstrated that key monitoring metrics can be calculated at a finer resolution than field surveys using primarily remotely sensed data. Our analysis further demonstrates that, with a few minor modifications, the methods in the Study Plan are an appropriate, efficient, and cost-effective approach for monitoring changes before and after restoration for floodplain and riparian projects. The timing and quality of LiDAR acquisition are also important factors for calculating metrics.

There are a few metrics or methods that will continue to benefit from supplemental field data to validate estimates from remote sensing including bathymetry, large wood on the floodplain, riparian species, and instream fish-habitat classification. In addition, most pilot site projects had qualitative design criteria and we provide a suggested design matrix with specific design targets that would facilitate quantitative evaluation of engineering designs and help inform future projects. We provide the following recommendations based on the results of the pilot study:

- The quality and timing of green LiDAR collection are important for ensuring accuracy and consistency of metrics calculations before and after restoration.
- Supplemental bathymetric and fish-habitat field data collection will be needed at some sites due to depth, turbidity or large wood jams that may prevent accurate mapping of bathymetry with green LiDAR.
- The intensity of the riparian field survey proposed in the Study Plan can be reduced because some metrics can be mapped with LiDAR, but riparian field surveys are still needed for some riparian metrics.
- Large wood can be enumerated using remote sensing techniques, but mapping floodplain wood during riparian surveys should be used to correct remotely sensed wood counts.
- The collection of site-specific habitat preference data for key fish species and life stages could be used to improve HSI mapping at various flows.
- As-built surveys and evaluation of design criteria for each site would benefit from consistent design criteria and matrix across projects.
- In addition to standard reporting, a brief two page project report card should be developed for each project evaluated to quickly convey results and lessons learned to a broader audience.
- The methods in the Study Plan can be used on completed projects if appropriate data are available, but the pilot study demonstrated variability in data quality across project sponsors and years. Thus, ideally selection of new sites should focus on projects that are not yet implemented or will be implemented in 2023 or beyond to allow collection of data of consistent quality before and after restoration.
- Finally, while the methods are most efficient at large projects covering more than one or two kilometers, they could be used on smaller projects, though it may not be as efficient or cost-effective.

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BACKGROUND

The Salmon Recovery Funding Board (SFRB) has invested more than 1 billion dollars in salmon recovery and habitat restoration efforts since 2000. While previous efforts to evaluate the efficacy of SRFB-funded habitat restoration actions have provided some useful information on the effectiveness of instream structures, large wood placement, and barrier removal, they have provided limited information on two of the most important and common habitat restoration actions—floodplain and riparian planting projects. Other monitoring programs and recently published studies have emphasized the need to evaluate large restoration projects that cover several kilometers of stream. Moreover, recent technological advances have made it possible to monitor large restoration projects efficiently using remote sensing. Cramer Fish Sciences (CFS) was contracted by the Recreation and Conservation Office (RCO) to work with the SRFB Monitoring Panel to develop a Study Plan to monitor and evaluate large floodplain and riparian projects using remote sensing techniques coupled with limited field data (Roni et al. 2020b). To achieve this, we first worked closely with the Monitoring Panel to refine the objectives and questions to be answered by the Study Plan. The Monitoring Panel determined that the Study Plan should focus on monitoring project-level physical and riparian response, produce results within 5 to 10 years, and should avoid implementation issues seen in some other regional monitoring programs.

Monitoring questions to be answered by the study include:

1. What is the floodplain area in the reach before and after restoration and what is the extent and frequency of floodplain inundation at different flow levels over time?
2. Based on the underlying geomorphic processes and the outcomes expected at the site and reach, did the active channel zone change as predicted and did the project meet its geomorphic design objectives?
3. What is the effect of restoration on channel and floodplain morphology and complexity, seasonal and perennial side channel metrics (length, area, ratio), and the morphological quality index (MQI) in the reach, and how does it change over time?
4. What is the number and diversity of habitat types (i.e., pools, riffles, glides, etc.) within the main channel and side channels at different flows (low, bankfull) in the reach and how much do they change over time?
5. What is the abundance and distribution of large wood in the active channel, wetted channel, and on the floodplain within the reach and how do they change over time? What proportion of the wood is actively interacting with the channel?

6. Based on difference of digital elevation models (DEMs) of the reach before and after restoration, what is the areal extent and distribution of sediment erosion and deposition (storage) on the floodplain and how much do they change over time?
7. Based on modeled depths and velocities, what is the area of suitable habitat for juvenile (low, bankfull, flood flows) and spawning adult Chinook *Oncorhynchus tshawytscha*, steelhead *O. mykiss*, coho *O. kisutch*, or other target salmonid species and how has it changed before and after restoration?
8. What is the riparian vegetation areal extent by vegetation class (e.g., grasses, forbs, shrubs, trees, etc.), species composition, and density and how much do they change over time?
9. Has riparian/floodplain restoration led to restored riparian function including shade, bank stabilization, and organic matter following riparian restoration?

Given the challenges encountered by previous large habitat monitoring programs and the relatively new methods and analytical approaches proposed, the Study Plan recommended that a pilot study be conducted on a handful of sites. At the March 3, 2021 meeting, SRFB, a governing body within RCO, approved the investment of Pacific Coastal Salmon Recovery Funds for a pilot study to utilize remote sensing and other innovative survey techniques to assess the effectiveness of floodplain-scale and riparian restoration. This geographically limited model will serve as a "proof-of-concept," demonstrating the use of remote sensing of large river system reaches as a cost-effective alternative or supplement to traditional ground-based survey methods. If this pilot study is determined to be successful and satisfies the SRFB's needs, RCO may proceed with a larger, more comprehensive investigation of salmon habitat restoration effectiveness using remote sensing at other locations in Washington.

The Floodplain Scale Remote Sensing Pilot Project (Pilot Project) was initiated in August of 2021 to select sites and test the methods developed by CFS to evaluate large floodplain and riparian restoration projects (Roni et al. 2020; RCO Project 19-1757[1]). Initially, it was determined that two sites would be selected in western Washington and one site in eastern Washington to serve as a pilot study to test, refine, and confirm the feasibility of the approach and methods in the Study Plan (Roni et al. 2020b). The following report provides a summary of the results of the Pilot Project including site selection,

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[1] Henceforth referred to as "the Study Plan."

analysis and collection of data, and recommendations for future monitoring. The pilot study focuses on using remote sensing techniques to evaluate physical conditions, riparian habitat, and fish habitat suitability and was not designed to evaluate fish population response to restoration.

SITE SELECTION

The selection of pilot sites was overseen by the RCO SRFB Monitoring Panel. The RCO and the Monitoring Panel worked with recovery boards and lead entities in Washington State to develop a list of large floodplain and riparian restoration projects to be considered for the pilot study. To be considered, projects had to focus on floodplain and riparian restoration, cover more than 1 km of main channel length, and have pre-project green LiDAR[2]. A list of potential sites was initially provided by the Monitoring Panel. We screened the initial list to determine suitable sites and then contacted restoration project sponsors to confirm details of the restoration, data available, timing, as well as site access. The Study Plan initially called for selecting new projects so consistent pre-project data could be collected.
However, after discussion with the Monitoring Panel, it was determined that it would be worthwhile to include at least one completed project with pre- and post-restoration green LiDAR available to provide results sooner and demonstrate which metrics could be obtained from remote sensing alone.

Working closely with the Monitoring Panel, we selected two sites in western Washington: the Countyline Project on the White River in King County, and the Upper/Lower Fobes Project on the South Fork Nooksack River in Skagit County (Figure 1). The Countyline Project, completed in 2017, represents a completed project that has some pre-project data available, including green LiDAR, while Upper/Lower Fobes is a new project with the first construction phase completed in 2022 (Lower Fobes) and the second phase (Upper Fobes) planned for 2023 (Table 1).

In eastern Washington, the Middle Entiat Project was selected by the Monitoring Panel to serve as the pilot site for eastern Washington. The Middle Entiat Project represents a floodplain project completed in 2019 with pre-project monitoring data collected in 2018 using the same protocols as the Pilot Project[3]

[2] Green LiDAR is also referred to topo-bathymetric LiDAR as it maps both topography and the river bathymetry. In contrast, near-infrared LiDAR which only maps the topography and water surface.

[3] Pre-project monitoring in the Middle Entiat was conducted by CFS as an initial pilot study to test a variety of protocols for monitoring large floodplain projects.

(Table 1). The results of the Middle Entiat project, which is funded through Chelan County, are detailed in a separate report. A second completed eastern Washington site (Tucannon River PA-3) which had green LiDAR available before and after restoration as well as the needed hydraulic modeling outputs – was added in fall of 2022 when additional funding became available. The Tucannon PA-3 project was completed in 2017 with post-project data available in 2020 (Table 1).

Table 1. Summary of sites selected for the floodplain scale remote sensing pilot project. The results of the Middle Entiat project are reported in a separate report. LW = large wood. ELJ = engineered logjams

Project Details	Countyline – White River	Upper/Lower Fobes – South Fork Nooksack	Middle Entiat – Entiat River	PA-3 – Tucannon River
Approximate Length (km)	2.2	1.15/1.16 (Upper/Lower)	8.7	2.6
Year restored	2017	2022/2023	2019/2020	2014/2018
Restoration techniques	Levee removal/setback, LW, ELJs, riparian planting	LW, ELJs, riparian planting, pilot channels	Large wood, ELJs, constructed side channels, riparian planting	LW
Pre-project data collection	2011/2016 (LiDAR/ Bathymetry)	2017/2021 (LiDAR/ Bathymetry)	2018	2017
As-built data collection	NA	2022/2023	2019	NA
Post-project data collection	2022	TBD	2022	2020
Post-project monitoring trigger[4]	Time	Flow or time	Flow and time	Flow and time

[4] As described in the Study Plan, post project monitoring is triggered after either 1) a channel forming flow or 2) three or more years post-restoration has passed.

Figure 1. Map of the pilot study sites in western and eastern Washington. The Middle Entiat Project is being monitored under a contract with the Chelan County Department of Natural Resources and the findings are provided in a separate report.

METHODS

The Study Plan provides detailed information on the metrics and how each were calculated (Table 2, Table 3) We provide a summary here but refer the reader to (Roni et al. 2020b) for details. The Study Plan calls for a simple before-after design with data collection before restoration (ideally < 2 years before) and after restoration, with as-built surveys occurring the year restoration is completed to document design elements. The schedule for the pilot sites is provided in Table 1.

Table 2. List of monitoring questions and parameters or metrics to be measured or calculated to answer these questions for floodplain and riparian restoration sites. R = remote sensing, F = field data. From Roni et al. (2020b).

Question	Parameter/metric and data collection methods (R or F)
(1) What is the floodplain area before and after restoration and what is the extent and frequency of floodplain inundation at different flow levels over time?	Floodplain area (R, F), floodplain inundation index (R, F), area altered (R)
(2) Based on the underlying geomorphic processes and the outcomes expected at the site and reach, did the active channel zone (Beechie et al. 2017; Stefankiv et al. 2019) change as predicted and did the project meet its geomorphic design objectives?	Active channel zone, geomorphic unit tool (GUT) (R, F)
(3) What is the effect of restoration on channel and floodplain morphology and complexity (RCI [Brown 2002]), seasonal and perennial side channel metrics (length, area, ratio [Beechie et al. 2017]), and the morphological quality index (MQI [Rinaldi et al. 2013]) in the reach, and how does it change over time?	Side channel number, length, and area (R, F), pond/wetland number and area (R), sinuosity, bankfull width and depth, side channel ratio, RCI, MQI (R, F)
(4) What is the number and diversity of habitat types (i.e., pools, riffles, glides, etc.) within the main channel and side channels at different flows (low and bankfull) and how much do they change over time?	Shannon diversity index, habitat metrics (pool area, percentage,) (low flow R, bankfull R)
(5) What is the abundance and distribution of large wood in the active channel, wetted channel, and on the floodplain, and how do they change over time? What proportion of the wood is actively interacting with the channel?	Large wood (R)
(6) Based on difference of DEMs of the reach before and after restoration, what is the areal extent and distribution of sediment erosion and deposition (storage) on the floodplain and how much do they change over time?	Sediment deposition and storage, difference in DEM (R)
(7) Based on modeled depths and velocities, what is the area of suitable habitat for juvenile (low, bankfull, flood flows) and spawning adult Chinook *Oncorhynchus tshawytscha*, steelhead *O. mykiss*, coho *O. kisutch*, or other target salmonid species and how has it changed before and after restoration?	Amount of suitable habitat, weighted usable area (WUA based on habitat suitability index [HSI] model) (R, F)
(8) What is the riparian vegetation areal extent by vegetation class (e.g., grasses, forbs, shrubs, trees, etc.), species composition, and density and how much do they change over time?	Areal vegetation extent by class (R, F), riparian composition, richness, diversity, and density (R, F)
(9) Has riparian/floodplain restoration led to restored riparian function including shade, bank stabilization, and organic matter following riparian restoration?	Bank stability (F), shade (R, F), organic inputs (R), large wood (R)

Table 3. Floodplain and riparian metrics needed to answer monitoring questions, the flow or spatial extent at which each metric is calculated (LF = low flow wetted width, BF = bankfull width, FP = floodprone width, NA = not applicable), and a description of methods. All metrics except the light penetrating index and bankfull width to depth ratio are expected to increase following restoration. A decrease in the light penetrating index represents an increase in shade. Depending on the conditions before restoration, an increase or decrease in bankfull width to depth ratio could represent an improvement or degradation of channel conditions.

Metric	Flow/ Extent	Description
Floodplain geomorphology		
Floodplain area	FP	Floodprone area, which is determined using two times the average maximum bankfull depth.
Floodplain inundation index	FP	Floodprone area divided by the mainstem wetted centerline length.
Area altered		Delineate the project footprint from aerial imagery immediately after restoration. Use implementation documents as a guide as well.
Active channel zone[5]	BF	Delineate the active channel based on historical aerial imagery and LiDAR.
Pond/wetland number and area	LF	Delineate the isolated habitats at low flow using LiDAR and aerial imagery to count number and calculate total area.
Side channels		
Side channel number, length, area	LF, BF	Sum of the count, length, and area of all side channels at the wetted and bankfull flows.
Side channel nodes and node density	LF, BF	Count and density of junctions between side channels and the main channel or other side channels at bankfull (Stefankiv et al. 2019).
Side channel ratio	LF, BF	Ratio of the sum of the side channel lengths divided by the mainstem centerline length at bankfull (Beechie et al. 2017).
Channel morphology and instream habitat		
Sinuosity	LF	Divide the thalweg line length by the straight-line distance between the start and end points (i.e., top of site and bottom of site) of the thalweg (Rosgen 1994, 1996).
RCI (River complexity index)	BF	RCI = (S*(1 + J) / (reach length))*100, where S = sinuosity, J = # of side channel bankfull junctions, reach length = mainstem centerline length (Brown 2002).
Bankfull width to depth ratio	BF	For each bankfull transect, divide the bankfull width by the maximum bankfull depth and average this ratio across transects within a reach (Rosgen 1996).
MQI (Morphological quality index	NA	Extensive calculation using field data: confinement, sinuosity, anastomosing index, braiding index, mean bed slope, mean channel width, dominant bed sediment, and others (Rinaldi et al. 2013; Rinaldi et al. 2017).
Pool area and percentage	LF	Sum of pool habitat area, total pool area divided by total wetted area.
Residual pool depth	LF	Maximum pool depth minus the pool tail crest in pool habitats, averaged across a reach for pools that the thalweg runs through (Lisle 1987).
Shannon diversity index of habitat units	LF	Shannon diversity index (H) of the channel units in the mainstem and side channels with habitat units delineated (Shannon 1948).
Habitat Suitability Index (HSI)	LF	Sum of weighted usable area (WUA) and normalized WUA by species and life stage based on hydraulic and HSI modeling.

[5] This is similar to the channel migration zone, but there is not widespread agreement on delineating the CMZ and for this reason NOAA status and trends and other programs are monitoring the active channel zone rather than the CMZ (Beechie et al. 2017; Hall et al. 2019; Stefankiv et al. 2019).

Braiding parameter	BF	Sum of all channel lengths (mainstem and side channels) divided by the mainstem length (Friend and Sinha 1993).
Large wood and sediment storage		
Large wood	NA	Count of jams and individual pieces from aerial imagery or LiDAR (Roni et al. 2020a, Jarron et al. 2021; Kuiper et al 2022).
Sediment deposition and storage	NA	Create a DEM of Difference (DoD) for the years of interest and calculate the areas of deposition and storage.
Riparian		
Riparian, richness, density, diversity	NA	Richness – count of unique species across all transects. Density – count of individual species across all transects, divided by the aggregated area of all transects. Diversity – Shannon's diversity index using species abundance data (Shannon 1948).
Areal extent of riparian vegetation	NA	Ratio of LiDAR returns in different height bands representing vegetation classes to ground points multiplied by the cell area (Akay et al. 2012).
Bank stability	NA	Measure of length of eroding bank
Light penetration index	LF	Ratio of LiDAR ground returns to total returns. Can be interpreted as an indicator of riparian shade potential (Bode et al. 2014).
Organic inputs	LF	Volume of canopy that overhangs the active channel (Laslier et al. 2019).

Floodplain metrics: geomorphology, habitat, large wood, and sediment

To quantify changes in geomorphology, habitat, large wood, and sediment at each site, we used a combination of existing pre-project data and remote sensing techniques. Although the general methodology for our analysis was largely consistent across sites, idiosyncrasies in the available pre- and post-project data, project designs, or geographic contexts (e.g., heavily urbanized versus minimally disturbed watersheds) necessitated modification in some cases. Site-specific methodological details are discussed in greater detail under the individual site subheadings.

We used standard open-source geoprocessing tools implemented within geographic information systems software (QGIS Development Team 2022) to quantify changes in floodplain geomorphology. Floodplain physical metrics (Table 3) were largely obtained from bare earth DEMs. Digital elevation models for all sites were generated from LiDAR point clouds and/or supplemental bathymetric survey data and were provided by project sponsors. The bare earth DEMs were used as inputs into hydraulic models run at predetermined flows representing a low flow and a 2-year flood recurrence interval. A 2-year flood recurrence interval was used because it typically constitutes a "bankfull" flow (Williams 1978; Leopold 1994; Castro and Jackson 2001). In some cases (e.g., Fobes and Countyline), supplemental bathymetric surveys were available and combined with the LiDAR point cloud data to map the channel bed topography more accurately. Where possible, we relied on project sponsors to provide hydraulic model outputs at specified flows. Countyline did not have pre-project model outputs readily available; therefore, we developed our own hydraulic model (for details, see Hydraulic Modeling and Habitat Suitability Index Calculation). The resulting depth, velocity, and water surface extent rasters served as the foundations from which channel and floodplain geomorphological characteristics could be digitized and measured. In addition, we calculated the MQI score for each site, a high-level indicator of geomorphic functionality, artificiality, and channel adjustments (Rinaldi et al. 2013).

Instream habitat and large wood data from field surveys were supplied by some project sponsors and, where appropriate, we provide these along with our estimates from remote sensing. For projects where the habitat surveys were not available or available data were not compatible with our methods, we developed a habitat classification method using a series of algorithms to estimate meso-habitat units (pools, riffles, and glides) from the thalweg elevation profile alone. Our habitat classification methodology uses a three-step process that first identifies pools by interpolating points between troughs in the thalweg profile meeting a minimum residual pool depth criterion. The remaining sections are then broken into segments of consistent gradient and used as inputs to a random forest model to predict the riffles from glides. We used data from extensive habitat and long-profile data on more than 100 sites across 60 wadable streams in the Columbia Basin to develop and train the random forest model (Clark et al. 2019, 2020). Thalweg long profiles were extracted from the DEMs by running a flow accumulation algorithm and identifying the longest continuous flowlines within both the main channel and in the side channel. We are currently preparing formal descriptions and a critical evaluation of the habitat classification methodology with the intent to publish our results. Off channel and backwater habitats were also classified based on connection to mainstem and low water velocity. In addition, we also mapped and quantified finer-scale geomorphic units (Tier 3) using the geomorphic unit tool (GUT), which uses different a theoretical approach to classify geomorphic units based on 2-D topography (Bangen et al. 2017).

We estimated large wood abundance directly from the LiDAR point clouds. We used height-filtering criteria to remove the canopy, low shrubs, and grasses (Joyce et al. 2019; Jarron et al. 2021). We then filtered for only those points with intensity values in the 70th percentile or higher (Kuiper et al. 2022). Large wood is typically identifiable in a LiDAR point cloud as high-intensity linear segments (Figure 2). These linear segments can be extracted in vector format using linear feature extraction algorithms provided in the ‘lidR’ package (Roussel et al. 2020). To further separate true large features from small branches and artifacts in the LiDAR, we discarded linear features less than 3 m long. Large wood within the low flow, bankfull, and floodprone areas were summed and the number of large wood pieces per 100 m calculated. Jams were counted from aerial imagery within the visible portion of the active channel.

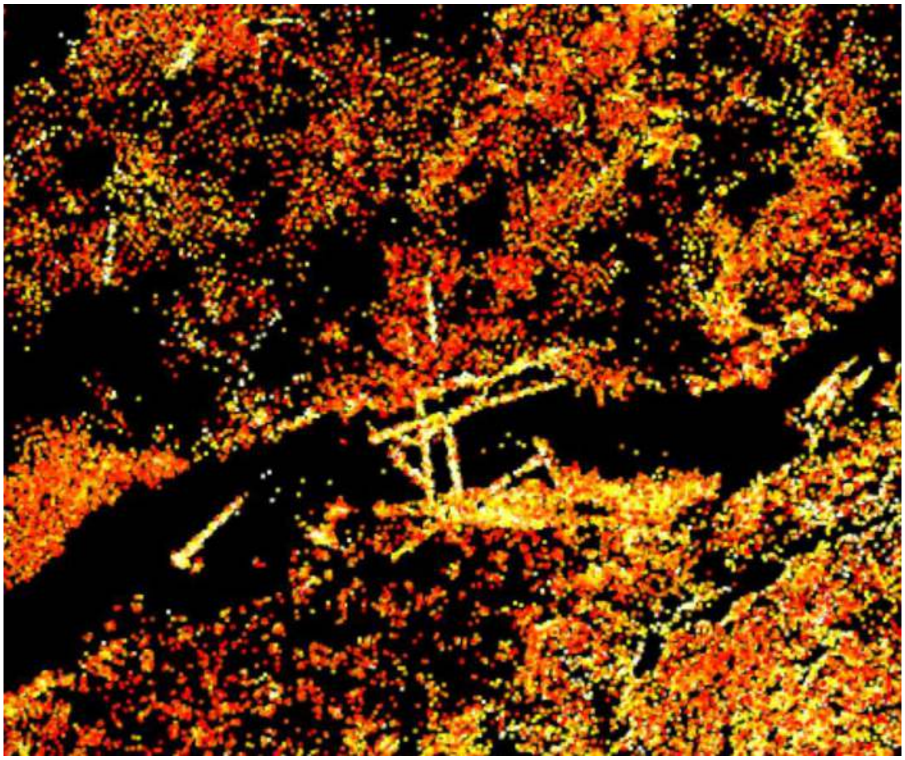


Figure 2. Example of a height filtered point cloud (0.3 m ≤ Z ≤ 1 m) from Tucannon PA-3 in 2017, colored by intensity. Large wood is identifiable as high intensity (brighter colors) linear segments.

Changes in sediment deposition and storage were evaluated by calculating the DEM of differences for each project site where before and after data were available. Areas of sediment aggradation and degradation can be mapped and quantified simply by subtracting the DEMs and identifying negative and positive changes in elevation. We defined areas of sediment aggradation/degradation based on a minimum elevation change threshold of ±0.5 m.

Methods for the calculation of each metric are listed in Table 3 and described in more detail in the original study proposal (Roni et al. 2020b) and in their respective citations. We also calculated side channel node density and the braiding parameter, which were not in the original Study Plan, but being used by project sponsors at Countyline and the Tucannon for other projects. Side channel node density is the sum of junctions between side channels, the main channel, and other side channels, divided by the site length (Stefankiv et al. 2019). Side channel node density is calculated at bankfull, unless indicated otherwise. The braiding parameter (BP) is a measure of channel complexity and is calculated as $BP = \frac{L_t}{}$, where L is the sum of the lengths of all channels (mainstem and side channels) and L is the length

L_m t m

of the mainstem (Friend and Sinha 1993). The braiding parameter has a range from 1 to ∞, such that a braiding parameter of 1 describes a single thread channel. The braiding parameter is also calculated at bankfull, unless indicated otherwise.

Hydraulic modeling and habitat suitability index

Hydraulic modeling

Depth and velocity rasters from hydraulic models built for each project site provided the basis for floodplain metric calculations and habitat suitability index modeling. We used low flow and bankfull flow (approximately a 2-year flood recurrence interval) modeled depth and velocity rasters provided by project sponsors or from our hydraulic model (Countyline). Site-specific flow conditions used to represent low flow and approximate bankfull conditions are presented in Table 4.

Table 4. Flow conditions used to generate depth and velocity from a hydraulic model for each site.

Flow (cfs)	White River – Countyline	South Fork Nooksack – Upper/Lower Fobes	Tucannon – PA-3
Low flow	500	250	45
2-year flow	6,907	10,332	738

Habitat suitability index

We modeled habitat suitability using depth and velocity preference curves for spawning and juvenile Chinook salmon and juvenile steelhead at all project sites. Habitat suitability index (HSI) values for depth and velocity were combined using the geometric mean to calculate a final HSI value. Exact HSI values vary slightly depending on the specific depth and velocity preference curves used. We used depth and velocity preference curves for Pacific Northwest streams presented in Maret et al. (2006) for juvenile Chinook, Kurko (1977) for spawning Chinook, and in Raleigh et al. (1984) for juvenile steelhead. Habitat suitability index values range from 0 (unsuitable) to 1 (most suitable). For each HSI raster, we calculated weighted usable area (WUA), WUA > 0.5, the geometric mean HSI value (equivalent to the normalized WUA), and the 50th and 90th percentile values. Methodological details for HSI calculations can be found in the Study Plan (Roni et al. 2020b).

Riparian metrics

Calculation of riparian monitoring metrics for all project sites required access to the raw LiDAR point cloud data, which were provided by project sponsors. The LiDAR point clouds were height normalized and clipped to the project study areas prior to any calculations. To ensure consistency in the riparian metric calculations across projects, we also reclassified the ground points using the cloth simulation filter algorithm (Zhang et al. 2016). Details for each of the riparian metrics we calculated (areal extent of vegetation by class, volume of overhanging canopy, and shade) are described individually in the following sections. Processing of the LiDAR point clouds and riparian metric calculations were performed in R using the 'lidR' package (R Core Team 2020; Roussel et al. 2020).

Areal extent of riparian vegetation by height class

We based our methods for calculating the areal extent of vegetation by class on methods described in Akay et al. (2012). LiDAR first returns that were not already classified as ground points within height ranges of interest were filtered and used to coarsely represent vegetation classes—less than 1 m for grasses and shrubs, between 1 and 5 m for mid-story vegetation, and greater than 5 m for trees. We then compared the number of points in each range of interest to the total number of points within grid cells of a predetermined size over the entire study area to obtain the proportion of each cell covered by vegetation in each respective height class. Finally, we computed the area of all cells weighted by the proportion of vegetation coverage to obtain the areal extent of vegetation by height class.

Volume of overhanging canopy (organic inputs)

Volume of overhanging canopy was calculated from a canopy height model, following the examples in Laslier et al. (2019). We segmented individual tree crowns using the Silva et al. (2016) segmentation algorithm. We then created convex hulls from the segmented LiDAR point cloud to obtain a 2D overhead representation of the canopy and calculated the area of the individual tree crowns. Volume of canopy overhanging the channel was then estimated by multiplying tree area by height and taking the intersection of the overhead canopy polygon with the channel boundary such that only trees directly overhanging the wetted channel were included in the calculation.

Shade

We calculated the light penetration index (LPI) as a proxy for riparian shade. Commonly used to quantify canopy openness in forestry applications, LPI can be interpreted as an index of the probability that a random ray of sunlight will penetrate to the forest floor in a given area (Bode et al. 2014). We computed LPI by comparing the number of first returns that were classified as ground points to the total number of points returned within grid cells of a pre-determined size over the entire study area. We took the resulting raster surface, clipped it to the wetted extent, and calculated the mean LPI such that final calculation reflects only the shaded cells within the wetted channel extent. Because the LPI measures light penetration, the lower the value the higher riparian shade.

Project specifics

The same general methods described in the preceding sections were applied to the analysis of all sites. However, specific details for each project analysis varied depending on data quality and availability. Therefore, we report project specific details here.

White River – Countyline

The White River and its tributaries provide important habitat for several species of Pacific salmonids, including Endangered Species Act (ESA) listed native spring run Chinook salmon. The heavily modified White River at Countyline, running through the city of Pacific, WA, experiences significant sedimentation, leading to reduced channel capacity and increased flood risk to nearby properties and infrastructure. The Countyline project, completed in fall 2017, was a levee setback and floodplain reconnection project (2.19 km stream length) designed to improve channel capacity, reduce future flood risk, and create new side and off-channel habitat to benefit native salmon (Figure 3).

King County, the project sponsor, provided a pre-project 1 m resolution DEM (2011) merged with a bathymetric survey (2016), which we used as the pre-project surface for hydraulic modeling. Post- project green LiDAR was collected in April 2022 using dual Riegl sensors in the green and near-infrared wavelengths at an average pulse density of 12 pulses/m^2 (NV5 2022). Preliminary inspection of the LiDAR suggested poor penetration to the riverbed in some areas. To fill gaps in the LiDAR, we conducted a supplemental bathymetric field survey in fall 2022. Field survey data were then merged with the LiDAR and reprocessed with the cloth simulation filter algorithm (Zhang et al. 2016) to produce new ground points. The reprocessed ground points were then used to create a new 1 m resolution DEM.

Habitat surveys provided by King County focused on edge habitat and did not cover the entire project area. Therefore, we used the habitat classification method to map and quantify instream fish-habitat units. We enumerated large wood abundance using the LiDAR data and the method described in the preceding section. King County surveyed large wood at Countyline in 2017 with a field survey supplemented with counts from digital ortho-imagery collected during leaf-off. However, King County was not able to conduct a large wood survey and ortho-imagery collection in 2022 because of sustained high-flows. Therefore, we estimated large wood for both the pre-project and post-project LiDAR years using the LiDAR point cloud filtering method.

Figure 3. Pre- (2011) and post-project (2022) aerial imagery of the Countyline project reach.

Hydraulic modeling

Depth and velocity rasters were not available for Countyline; therefore, we constructed a hydraulic model using HEC-RAS (v 6.0.0). We built a 2-D unsteady flow model using St. Venant shallow-water equations to simulate surface flow. The model uses triangular mesh computational surfaces generated from the pre- and post-project DEMs. The pre-project mesh contains 413,221 cells, ranging in size from 2 ft^2 to 4,922 ft^2. Likewise, the post-project computational mesh was comprised of 375,834 cells, again ranging from 2 ft^2 to 4,922 ft^2. The modeled boundary conditions and Manning's n roughness values were the same as reported in the original project assessment and hydraulic modeling report (Herrera Environmental Consultants Inc. 2012).

The original 2-year flow used in the Countyline restoration design documents and hydraulic assessment was 9,692 cfs (Herrera Environmental Consultants Inc. 2012, 2021). Preliminary evaluation of the project site and hydraulic model outputs indicated that the 2-year flow of 9,692 cfs would inundate nearly the entire project area and was incongruous with the calculation of floodplain metrics. In addition, flow at this site is regulated at Mud Mountain Dam, and the levee to the east and flood protection barriers to the west artificially confine the river. Therefore, in consultation with the project sponsor, we conducted a flood frequency analysis and computed an updated 2-year flow (6,907 cfs) based on gage data at the R Street bridge, which we then used to calculate bankfull metrics (Rockhill et al. 2022). Although the updated 2-year flow was 40% less than the flow reported in the project design reports, the hydraulic model output still showed nearly the entire floodplain between the levee and the flood protection barriers along the project reach. Therefore, we calculated most metrics at low flow for the Countyline site, including side channel metrics and river complexity index.

Supplemental bathymetric survey and post-project LiDAR concerns

Initial inspection of the post-project LiDAR at Countyline (collected in April 2022) had indicated good penetration in all except for a few relatively deep areas, mostly in the mainstem and in the excavated side channel (Figure 4). We conducted a supplemental bathymetric survey in September and October of 2022 to fill in the voids in the LiDAR. However, upon combining our bathymetric survey data with the LiDAR data, it was evident that the 2022 LiDAR had failed to penetrate to the river bottom over a much larger portion of the channel than indicated in the LiDAR report (NV5 2022). Although the White River is actively aggrading, the elevation difference between the pre-project and the post-project bathymetry (~ 1-1.5 m) in some places suggested measurement error in the post-project LiDAR. Unfortunately, we were unable to resurvey the bathymetry for the entire project reach given time and budget constraints. Consequently, some of the post-project monitoring metrics such as aggradation and degradation and residual pool depth for Countyline were affected and should be interpreted accordingly.

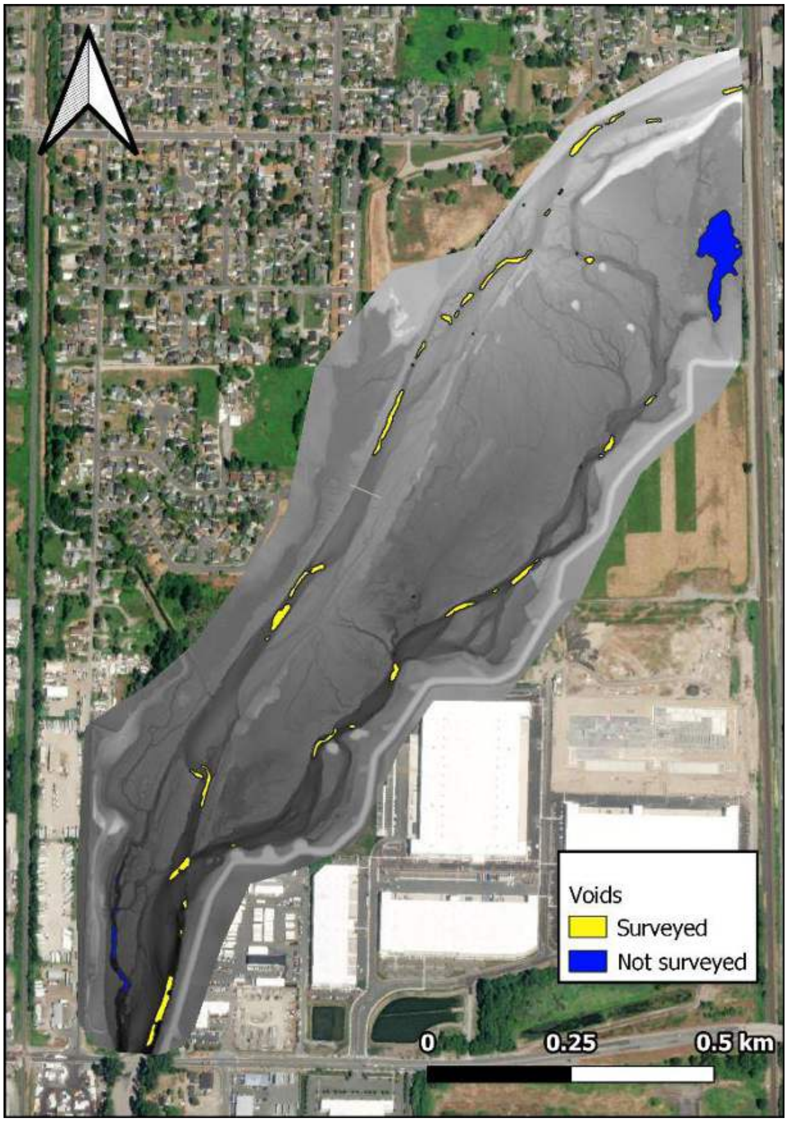


Figure 4. Preliminary DEM for the Countyline project created from the 2022 LiDAR with voids outlined.

South Fork Nooksack River – Upper/Lower Fobes

The Upper/Lower Fobes salmon habitat restoration project covers 2.31 km of the South Fork Nooksack. Commercial forestry is a major presence in the watershed and dominates local land use (Figure 5). Legacy timber harvest and road construction impacts have impaired habitat-forming processes, leading to degraded habitat conditions for threatened salmonids (Brown and Maudlin 2007). Restoration began at Lower Fobes 2022 and will continue at Upper Fobes in 2023. The project includes installation of 36 engineered logjams (ELJs), three channel-spanning ELJs, and 11 acres of riparian planting designed to restore geomorphic and habitat-forming processes (Washington State Recreation and Conservation Office 2022). The project goal is to restore early Chinook salmon spawning, holding, and rearing habitat in the South Fork Nooksack and promote self-sustaining Chinook salmon runs at harvestable levels

(Washington State Recreation and Conservation Office 2022). Post-project data collection is not anticipated until adequate high flows occur or time (3 years) passes (bankfull or higher flow event of at least 24 hours or 2026).

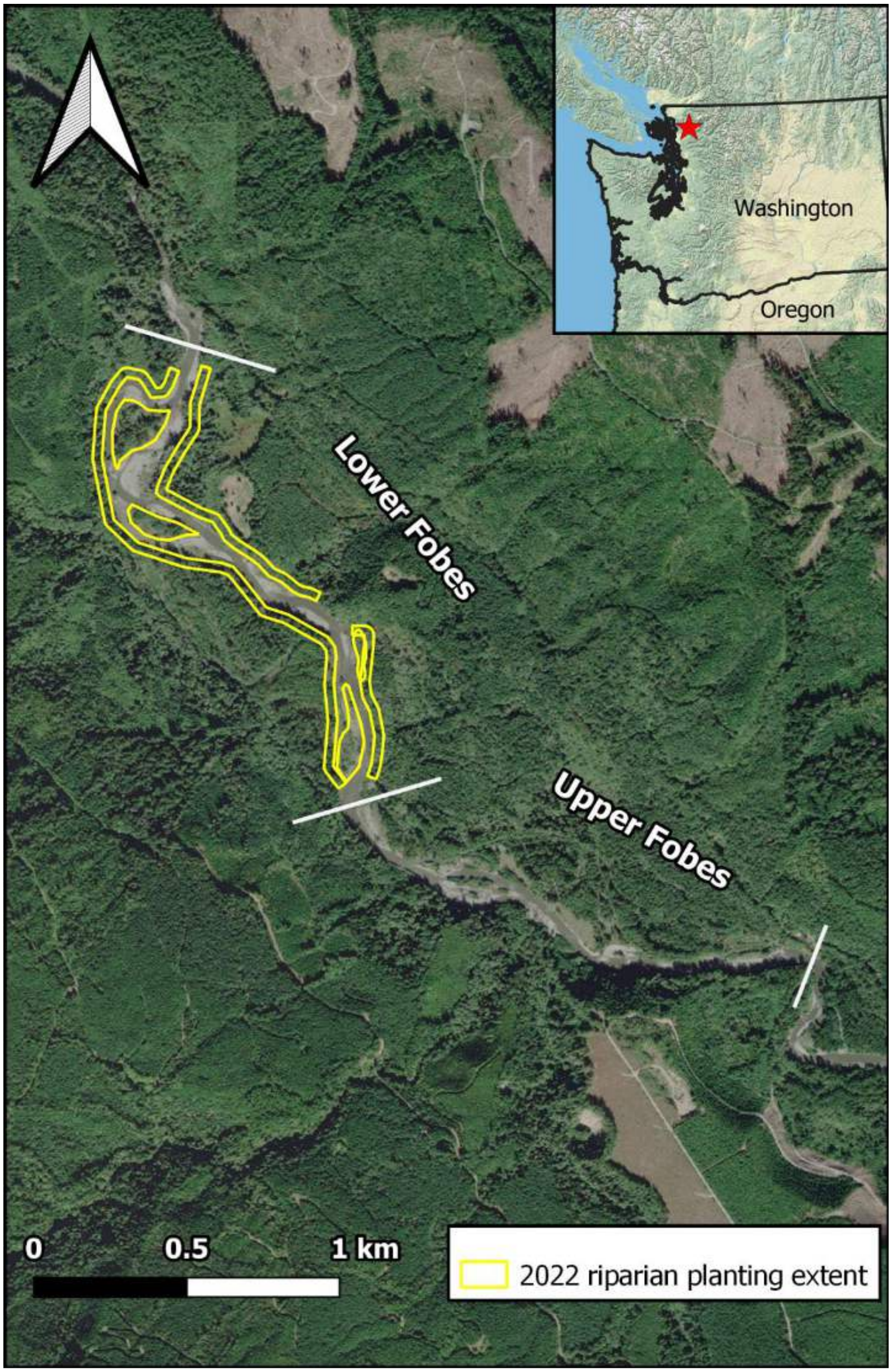


Figure 5. The Upper and Lower Fobes project reach boundaries (white lines) on the South Fork Nooksack River and areas planted in 2022Project construction at Lower Fobes was completed in 2022 and will continue at Upper Fobes in 2023.

Pre-project LiDAR was collected in 2017, followed by a supplemental bathymetric survey in 2021, which were composited and used to generate a 1 m resolution DEM, provided by the project sponsor (Lummi Nation). In addition, the Lummi Nation provided an instream habitat survey which was conducted in 2021 using methods consistent with our Study Plan (Pleus et al. 1999). Thus, we used the Lummi habitat data to map and quantify instream habitat metrics (Brown and Maudlin 2007). Large wood abundance was estimated using the LiDAR point cloud filtering method described in the preceding sections.

As only pre-project data has been collected at Upper/Lower Fobes thus far, no sediment change analysis was conducted (DEM of difference). However, we created a detrended DEM from the pre-project (2017) surface, which we display in the results section to provide a qualitative benchmark of the pre-project geomorphology. Detrending a DEM removes the downstream decreasing elevation trend from the model, accentuating finer details on the bare earth surface.

Upper/Lower Fobes as-built survey

An as-built survey was conducted shortly after construction of Upper Fobes to update the pre-project DEM and support evaluation of the effectiveness of key design elements over time. The as-built survey was conducted jointly by the Lummi Nation, Natural Systems Design (NSD), and CFS in August 2022. Topographic data was collected in the field using real-time kinematic (RTK) positioning on and around installed structures and on modified or disturbed terrain. In addition, Lummi Nation and NSD collected drone imagery of the project site and provided a digital surface model (DSM) created with structure from motion. Elevations from the DSM were used to supplement the RTK survey points. For each project design element, a triangular irregular network was interpolated from the RTK points and sampled elevations from the DSM, which were mosaicked (digitally stitched together) with the pre- project DEM to create a continuous surface representing the as-built topo-bathymetry (Figure 6).

Information on pieces of wood, structure height above streambed, anchoring, piles, percent buried, percent above streambed, percent above bankfull, and small wood filler was collected for all wood structures (Table 5). Each structure was also photographed from multiple angles and the characteristics listed in Table 5 were recorded.

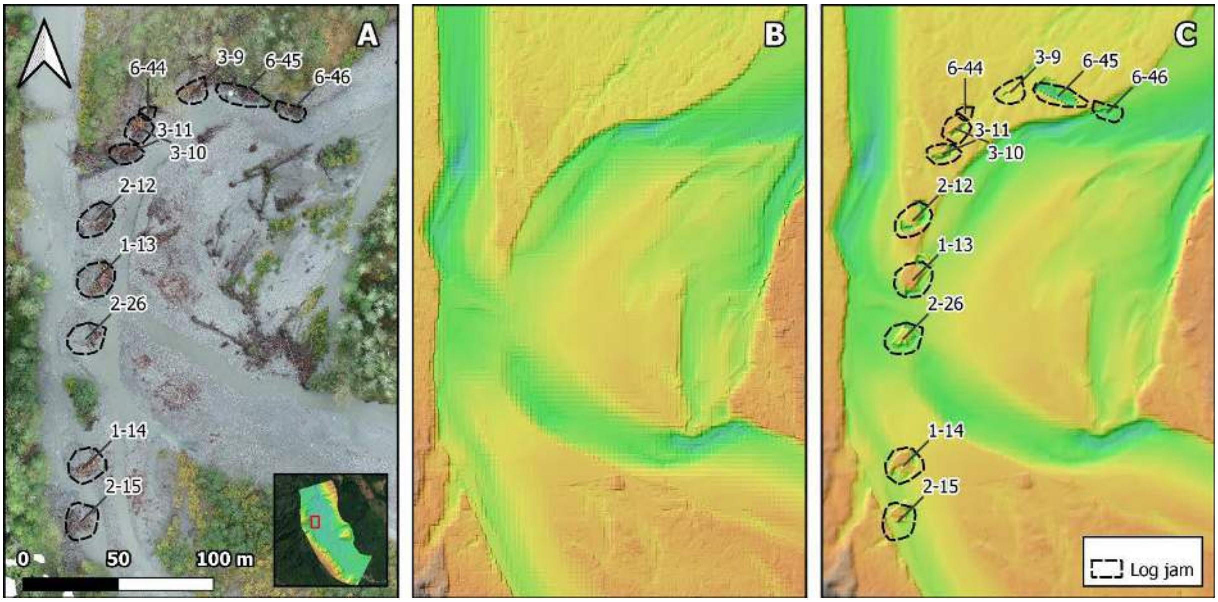


Figure 6. Example displaying how constructed log jams (A) were mosaicked with the pre-project LiDAR surface (B) to create an as-built DEM with project design elements included (C).

Table 5. As-built data collected at large wood structures at Upper Fobes. Similar data will need to be collected at Lower Fobes when construction is completed in 2023.

Characteristic	Definition
Large wood count	Number of qualifying pieces within structure as- built (40 cm diameter by 6 m).
Small wood filler used?	Was small wood/slash (does not qualify as large wood) used to fill in structure (e.g., racking)?
Structure height above streambed	Height of the structure above the streambed. Measurements are taken at the height of the bulk or majority of the structure material (not max height).
Anchoring mechanisms	Mechanisms used to anchor the wood or structure in place (e.g., pins, bolts, rock collar, cable, etc.).
Number of piles	Number of wood piles used to anchor wood and structure in place.
Percent buried	Percent of the whole structure that was buried into the streambed or channel margins (imagine looking at the structure from an aerial view, rough estimate).
Proportion of structure in contact with streambed	Percent of all structure materials in direct contact with the streambed, excluding piles. (e.g., logs directly on the channel substrate).
Proportion of structure below bankfull	Percent of the whole structure that is located below bankfull elevation (e.g., the ordinary high-water mark) (the full volume of the structure, look for visible bankfull cues).
GPS location	Latitude, longitude, elevation, and accuracy at structure location.

Riparian field survey

The purpose of the riparian field survey was to evaluate the pre-restoration riparian condition at the Upper/Lower Fobes reach on the South Fork Nooksack River. Specifically, our goals were to provide validation data for remotely sensed metrics and to characterize riparian metrics that cannot be derived from the remote sensing, including species richness and diversity, and understory cover and composition. Additionally, we aimed to test methods that could be used in post-project monitoring to evaluate change over time.

Surveys at the Upper/Lower Fobes reach were performed prior to construction, beginning at Lower Fobes, on July 7th and 25th 2022 and were completed at Upper Fobes on July 25th and August 17th. The Lummi Nation indicated planting would occur within a 30-m buffer of the active channel, so we targeted our surveys within that extent.

Site layout

We delineated 22 2-m wide transects, equally spaced at 200-m intervals throughout the Upper/Lower Fobes site (Figure 7; Merrit et al. 2017). Transects were placed at a 90-degree angle to the stream, measured using a compass at the active channel, and extended from the active channel to the edge of the planting project boundary, resulting in a minimum transect length of 17 m and maximum length of 130 m. We originally selected 30 m as the minimum transect length to cover the planting buffer width, provide adequate data to validate the LiDAR, and to be consistent with the forest practices riparian management zone buffer widths (Bigley and Deisenhofer 2006; Sweeney and Newbold 2014). However, at six transects we encountered side and tributary channels or changes in valley elevation before reaching 30 m from the active channel and those transects were terminated at that point. Additionally, transects were extended beyond 30 m if the transect angle was such that the planting boundary was not reached in the 30 m length.

For each belt transect, a tape was strung down the middle allowing delineation of a 1 m wide sampling area on either side of the tape. We originally planned to record transect coordinates using an RTK GPS, but dense canopy cover over most transects limited the accuracy of the RTK. Therefore, we used a Bad Elf GPS which provided sufficient accuracy (up to 1 m under open canopy, but typically between 3 and 5 m; Runkle 2016). We recorded the GPS coordinates of the transect start location at the active channel, the transect bearing, and the transect length in meters. Additionally, rebar benchmarks or flagging were placed at the start of transects to assist with relocation and sampling in subsequent sample years.

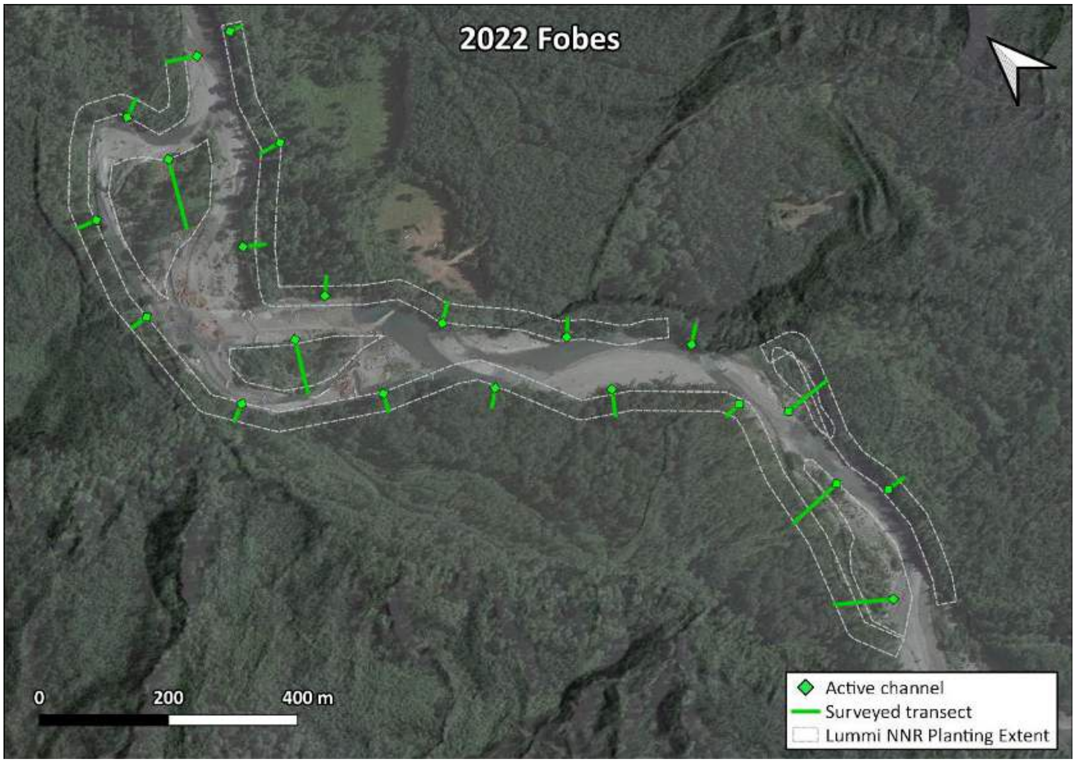


Figure 7. Site layout for the riparian field surveys at Upper/Lower Fobes. Transects were spaced 200 meters apart perpendicular to flow, started at the edge of the active channel, and extended 30 m into the riparian treatment zone (plantings).

Vegetation surveys

At each transect, all woody shrubs and trees were counted and identified to species, except willows and roses, which were identified to genus (*Salix* spp. and *Rosa* spp., respectively). We measured the height class of the first ten woody plants encountered followed by every 20^{th}; heights for all others were visually estimated. Height classes were binned as low (<1 m), mid-story (1–5 m), and canopy (>5 m) (Harris 2005). Additionally, the location of each woody plant along the transect was recorded if it was within the first meter of the transect and then within 3 m interval bins for the remaining transect length (e.g., 0–1 m, 1–3 m, 3–6 m, etc.). Surveys were intended to capture the pre-restoration condition; however, some restoration and planting had occurred at the site in 2010; therefore, if we encountered a planted woody species, identified by the presence of planting markers (e.g., planting tube, fence, tarp, tree marker), we recorded the type of marker present, the height, the location along the transect, and whether the planting was living or dead. Additionally, these methods could be utilized post-restoration to identify species present as the result of planting. If patchy and clumped vegetation in the 0-1 or 1-5 m height class was difficult to enumerate, such as Himalayan blackberry *Rubus armeniacus*, salmonberry *R. spectabilis*, and common snowberry *Symphoricarpos albus*, we recorded the continuous length of transect covered and estimated the number of individuals within the first meter to estimate total abundance (Harris 2005). Due to the complexities in identifying forbs and grasses, they were assigned to a single category (forbs and grasses), and the continuous length they occupied along the transect was recorded.

Vegetation cover was also assessed in the three different height classes (low vegetation (<1 m), mid- story vegetation (1–5 m), and canopy (>5 m)) following the line-intercept method (Elzinga et al. 2001; Merrit et al. 2017). The length of the transect centerline that was covered by each height class was measured by recording the point along the tape where the woody plant cover of a given height class began and ended. Native and invasive cover were recorded separately. The length of the centerline with no cover, by either woody or forb and grass vegetation, was also recorded as bare earth cover.

While riparian shade was calculated from remote sensing, some field data was useful to validate these estimates. Therefore, canopy cover (i.e., shading) was measured using a convex spherical densiometer. The densiometer was taped so there was a “V” at the bottom with 17 grid intersections visible (Mulvey et al. 1992). Densiometer readings were collected at the wetted edge of a stream and at the active channel boundary. At these locations, four readings were recorded, facing downstream, upstream, toward the center of the channel, and away from the main channel. The densiometer was held level 1 m above the water surface. The number of grid intersections covered by a tree, leaf, branch, or other vegetative shade providing feature was recorded (0–17).

Tucannon River – Project Area 3

The upper Tucannon River provides spawning and rearing habitat for federally listed salmonids, including Snake River summer steelhead, spring and fall Chinook, and bull trout *Salvelinus confluentus*. The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) leads a habitat restoration program in the Tucannon River watershed intended to improve instream habitat and floodplain connectivity, primarily through large woody debris supplementation and side channel excavation (Tetra Tech 2014). Restoration at Tucannon PA-3 began in 2014 with the construction of 42 large wood structures over approximately 2 km of stream (PA-3.2; Figure 8). Rapid habitat survey results for the 2014-2018 monitoring period showed >900% increase in large wood volume, 89% increase in pool frequency, 162% increase in pool area, and 44% increase in side channels (Foltz and Buelow 2018).
Adaptive management action was recommended in 2017 to maintain and improve stream conditions. Tucannon PA-3.2 was retreated with wood in 2018, including an additional area 0.6 km upstream (PA-3.1; Figure 8). In spring 2020, the Tucannon River experienced a greater than approximately 25-year flow (U. S. Geological Survey 2016), qualifying this site for inclusion in this study under our flow -

based criteria (Roni et al. 2020b). Our analysis focuses on measuring changes in floodplain and riparian metrics between 2017 and 2020 as a result of the 2018 restoration work. Unfortunately, LiDAR and hydraulic modeling data were not available prior to 2017 to examine changed due to the original treatment in 2014.

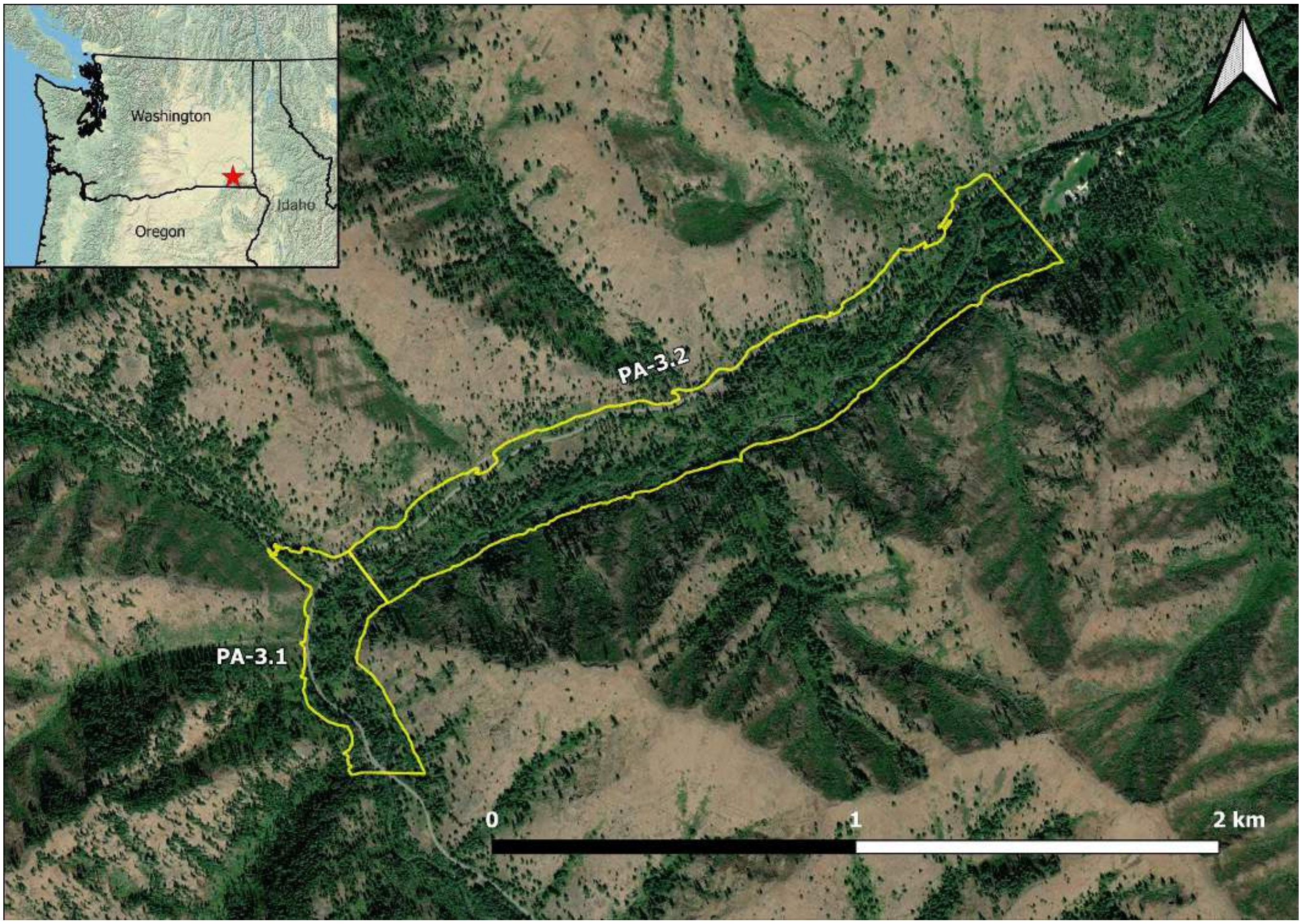


Figure 8. Tucannon PA-3 project boundary including sub-project areas PA-3.1 and 3.2.

Topo-bathymetric LiDAR was collected from a fixed-wing aircraft using a Riegl VQ-880-G laser scanner at an average density of 12 pts/m^2 in 2017 and again at 8 pts/m^2 in November 2020 following a 25-year flood event which occurred in the spring of 2020 (QSI 2018; NV5 2021). The project sponsor provided the raw LiDAR point cloud, which we used to generate 0.5 m resolution DEMs.

Large wood and pool survey data were provided by the project sponsor. Pre-project large wood and pool surveys were conducted in 2014 and 2018, and a post-project survey was conducted in 2020. However, the pool habitat surveys conducted by the project sponsor did not include all pool metrics originally included in the Study Plan; therefore, we also classified and characterized pools using previously described habitat classification method we developed. We present project sponsor large wood survey estimates alongside LiDAR derived estimates.

RESULTS

Results for each of the three project sites are presented separately.

Countyline

Geomorphology and habitat

The floodplain area and floodplain inundation index at Countyline increased by 16% and 14%, respectively (Table 6). The area altered (calculated at low flow) was 17.79 ha. Hydraulic modeling shows that the 2-year flow (6,907 cfs) would almost completely inundate the floodplain between the left bank levee and the right bank flood protection barriers (Figure 9).

Table 6. Summary of floodplain area and floodplain inundation metrics for Countyline.

Metric	Pre-project	Post-project	Percent Change
Question 1: What is the floodplain area before and after restoration and what is the extent and frequency of floodplain inundation at different flow levels over time?			
Floodplain area (ha)	58	67	+16%
Floodplain to bankfull area ratio	1.45	1.27	-12%
Floodplain inundation index	0.26	0.31	+14%

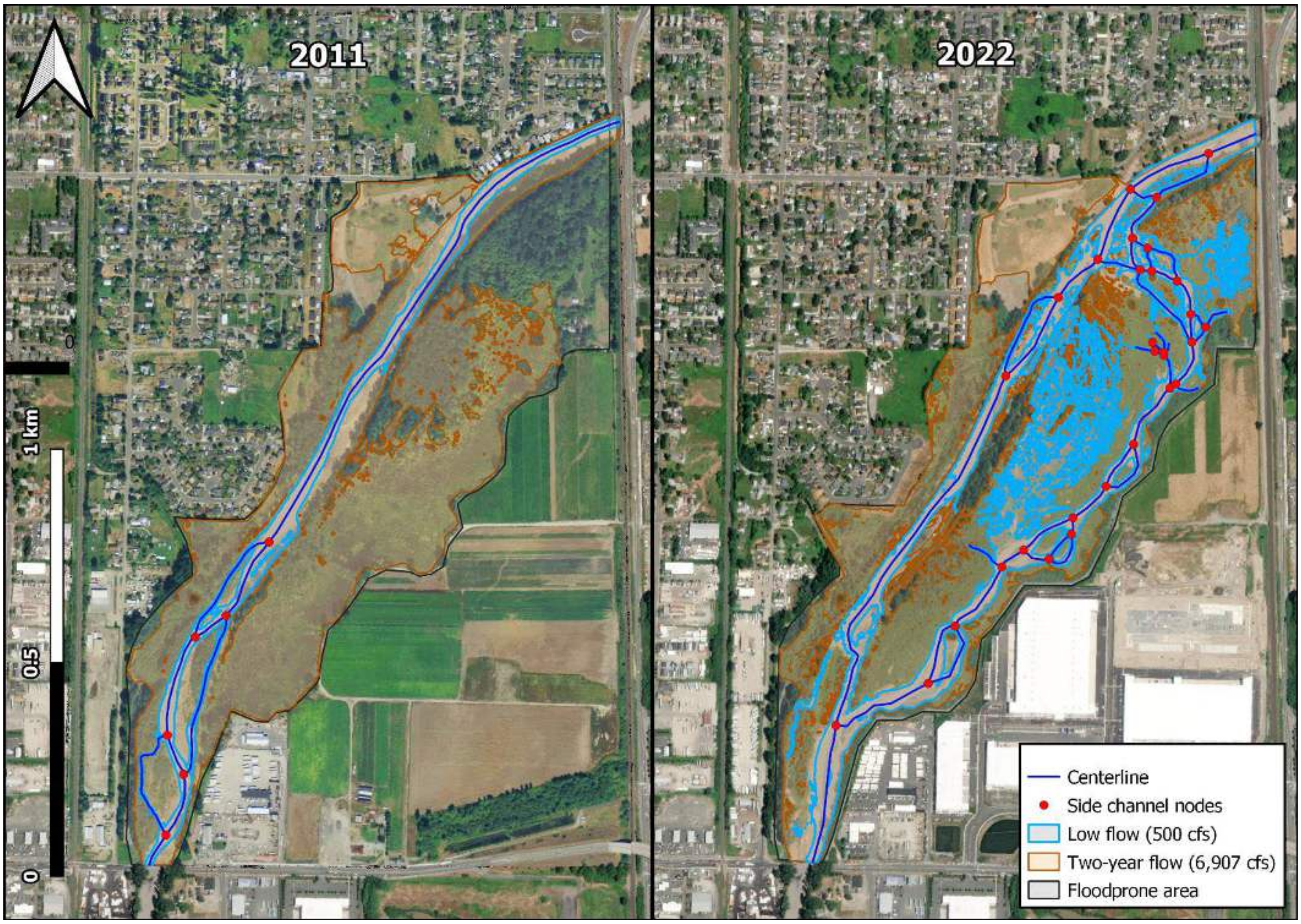


Figure 9. Comparison of the water surface extents at low flow and a 2-year flow at Countyline in 2011 and 2022. Side channel nodes are the junctions between the main channel and each side channel entrance. Base maps are 2011 (pre-project) and 2021 (post-project) NAIP imagery.

Fourteen out of fifteen metrics relating to the effect of restoration on channel and floodplain morphology increased between 2011 and 2022 (Table 7). Side channel metrics (e.g., length, area, ratio, node density, RCI) increased by 267 to 967%. The MQI, a multi-metric index of overall quality, showed moderate improvement (25%), in part because the site is constrained by setback levees. Depths in the main channel of the White River at Countyline decreased (Figure 10); however, it was evident that the LiDAR in 2022 likely did not penetrate through to the mainstem river bottom over much of the project area. Therefore, metrics relying on accurate estimates of channel depth, namely the bankfull width to depth ratio, residual pool depth, and sediment aggradation/degradation are probably biased.

Table 7. Summary of channel and floodplain morphology metrics for Countyline.

Metric	Pre-project	Post-project	Percent Change
Question 3: What is the effect of restoration on channel and floodplain morphology and complexity (RCI [Brown 2002]), seasonal and perennial side channel metrics (length, area, ratio [Beechie et al. 2017]), and the morphological quality index (MQI [Rinaldi et al. 2013]) in the reach, and how does it change over time?			
Sinuosity	1.53	1.51	-1%
Wetted area (ha)	7	23	+228%
Wetted width (m)	23.15	54.24	+134%
Bankfull area (ha)	58	71	+22%
Bankfull width (m)	281	341	+22%
Bankfull width to depth ratio	111.91	134.50[6]	+20%
Wetted side channel count	3	11	+267%
Wetted side channel nodes (density)	6 (2.74)	30 (13.70)	+400%
Wetted side channel length (km)	0.98	4.03	+311%
Wetted side channel area (ha)	0.70	7.63	+967%
Side channel ratio	0.45	1.89	+324%
Isolated ponds/wetlands	2	7	+250%
River Complexity Index (RCI)	0.49	2.14	+337%
Braiding parameter	1.45	2.84	+96%
Morphological Quality Index (MQI)	0.51	0.64	+25%

Instream habitat composition at Countyline in both 2011 and 2022 was largely dominated by glides and pools, with the total length of pool habitat increasing in 2022 (Table 8; Figure 11). The habitat classification method we developed indicated a 71% increase in pool length, a 166% increase in glide length, and a 23% decrease in riffle length.

[6] Poor LiDAR penetration at Countyline in 2022 may have resulted in artificially shallow depth estimates.

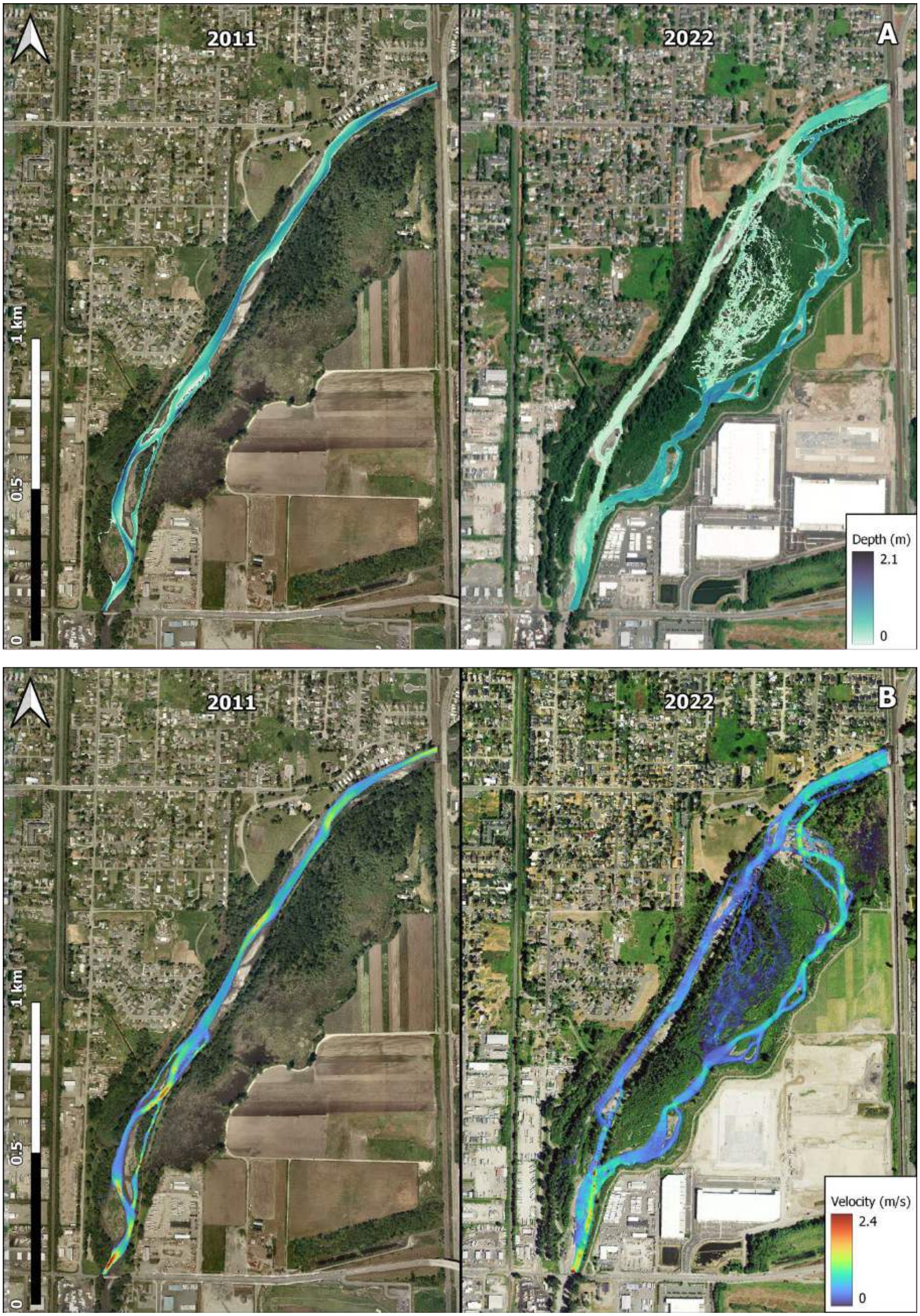


Figure 10. Modeled depths (A) and velocities (B) for Countyline at low flow (500 cfs). Base maps are 2011 (pre-project) and 2021 (post-project) NAIP imagery.

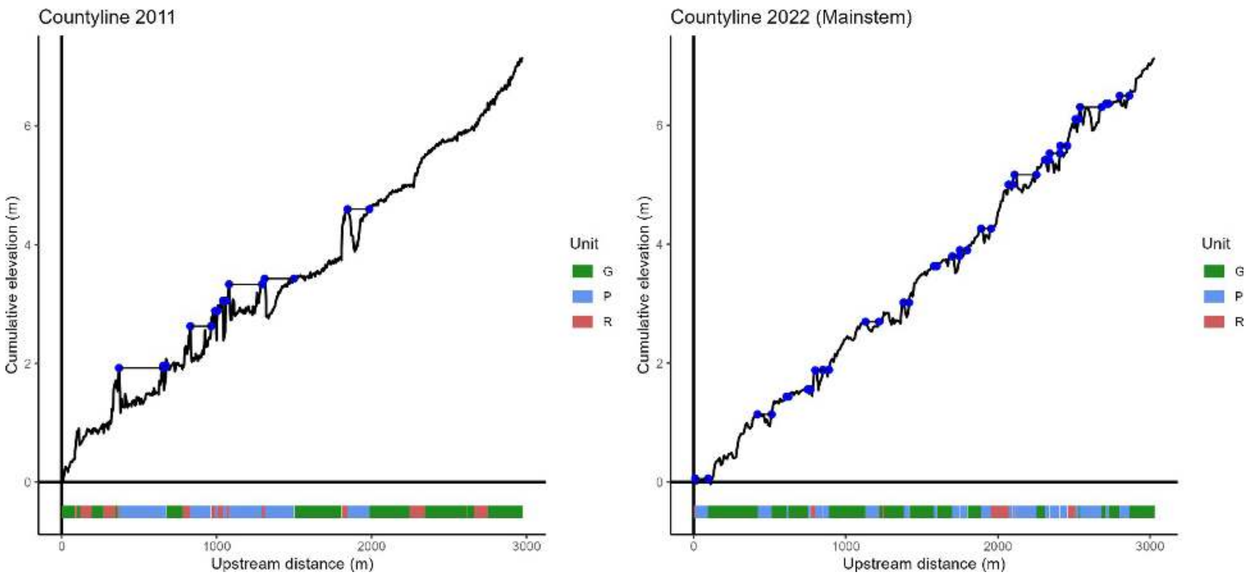


Figure 11. Thalweg long profile and results from habitat classification for Countyline (mainstem only). Habitat unit type definitions are as follows: G = Glide, P = Pool, R = Riffle.

Most of the additional glide length (56%) and the additional pool length (34%) in 2022 was in the large side channel (Figure 12). Within the main channel alone, pool length increased by 13%, glide length increased by 16%, whereas riffle length decreased by 58%. Similarly, the pool-riffle ratio increased nearly threefold following restoration. The Shannon diversity index of habitat units decreased slightly following restoration from 1.08 to 1.0.

Table 8. Summary of pool metrics and habitat diversity for Countyline. Habitat units and associated metrics were derived from the thalweg long profile.

Metric	Pre-project	Post-project	Percent Change
Question 4: What is the number and diversity of habitat types (i.e., pools, riffles, glides, etc.) within the main channel, and side channels at different flows (low and bankfull), and how much do they change over time?			
Shannon Diversity Index (habitat units)	1.08	1.00	-8%
Percent pool area	40%	68%	+70%
Number of pools	8	27	+238%
Pool to Riffle ratio	0.67	3.00	+347%
Residual pool depth	2.03	0.60[7]	-74%

[7] Poor LiDAR penetration at Countyline in 2022 may have resulted in artificially shallow depth estimates.

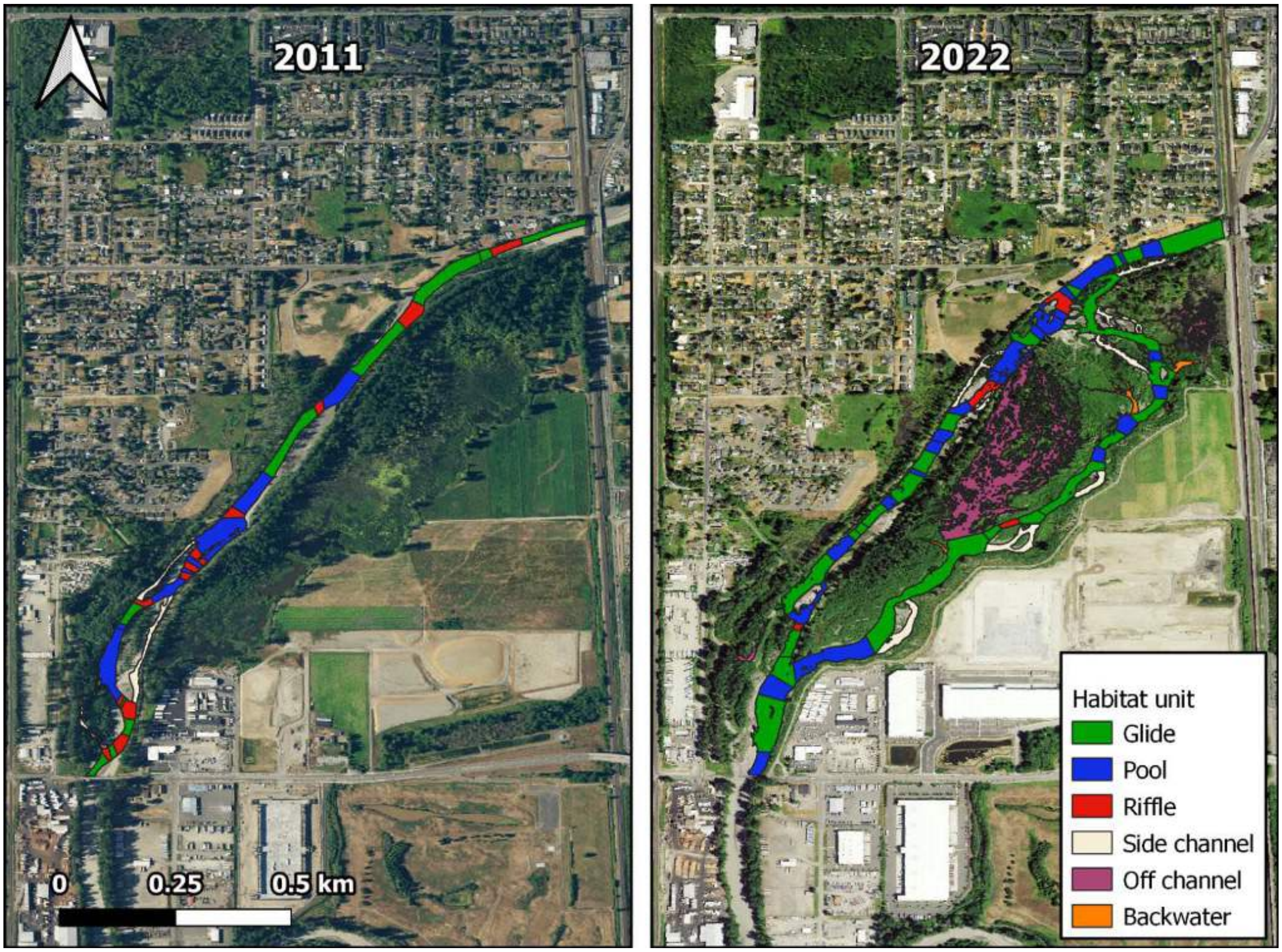


Figure 12. Low flow (500 cfs) fish habitat units classified using the thalweg long profile and aerial imagery. Pool, riffle, and glide unit boundaries were identified from the thalweg long profile, while side channels, off channels, and backwaters were mapped in GIS based on the hydraulic model output and aerial imagery. Base maps are 2011 (pre-project) and 2021 (post-project) NAIP imagery.

The GUT analysis, which maps fine-scale geomorphic units within the bankfull channel rather than fish habitat, also showed a large increase in pool habitat from 0.39 ha in 2011 to 2.87 ha in 2022 (Table 9). The GUT analysis of finer scale geomorphic units also showed an increase in glide-run habitat and slight decrease riffle area (Figure 13).

Table 9. Tier 3 geomorphic units summary for Countyline, calculated from the geomorphic unit tool (GUT) output.

	Area (ha)			Count		
	2011	**2022**	**Percent change**	**2011**	**2022**	**Percent change**
Bank	0.01	1.01	10,000%	31	425	1271%
Barface	0	0.01	NA	0	13	NA
Margin Attached Bar	1.36	3.98	193%	305	324	6%
Mid-channel Bar	0.35	1.74	397%	22	211	859%
Pocket Pool	0	0.01	NA	0	267	NA
Pool	0.39	2.87	636%	224	379	69%
Rapid	0	0.01	NA	0	1	NA
Riffle	0.09	0.08	-11%	7	7	0%
Transition	0.39	2.38	510%	57	5168	8967%
Glide-Run	4.49	11.83	163%	157	193	23%
Total	7.09	22.87	223%	803	6988	770%

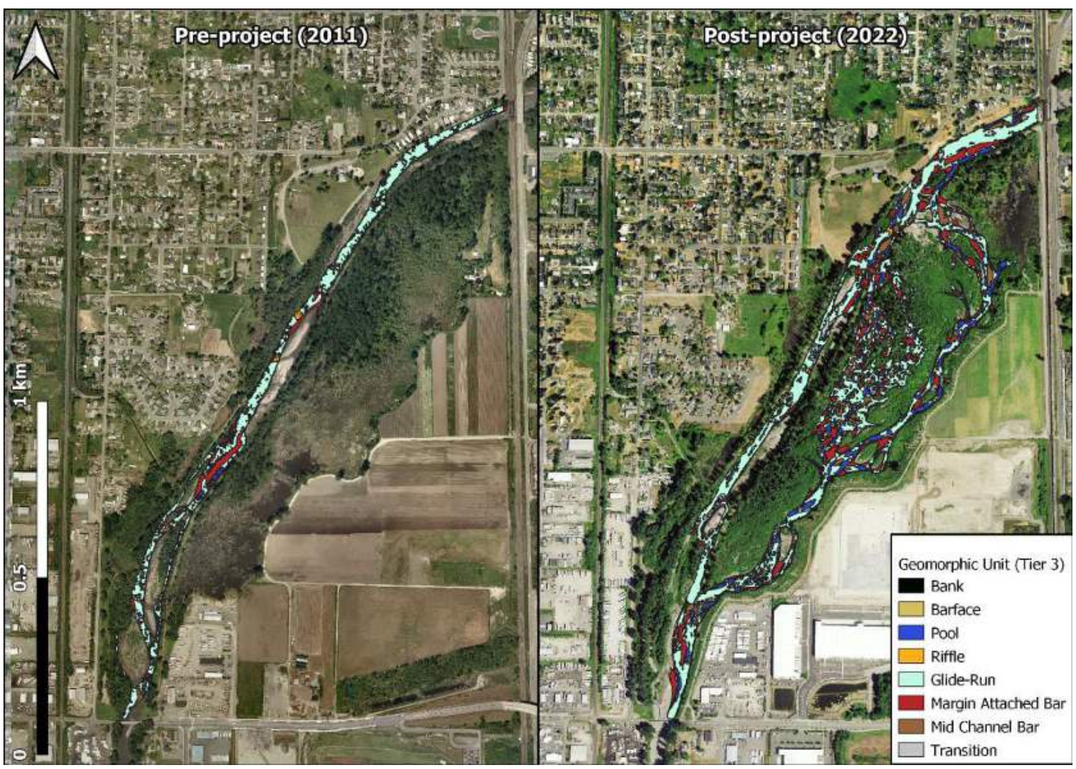


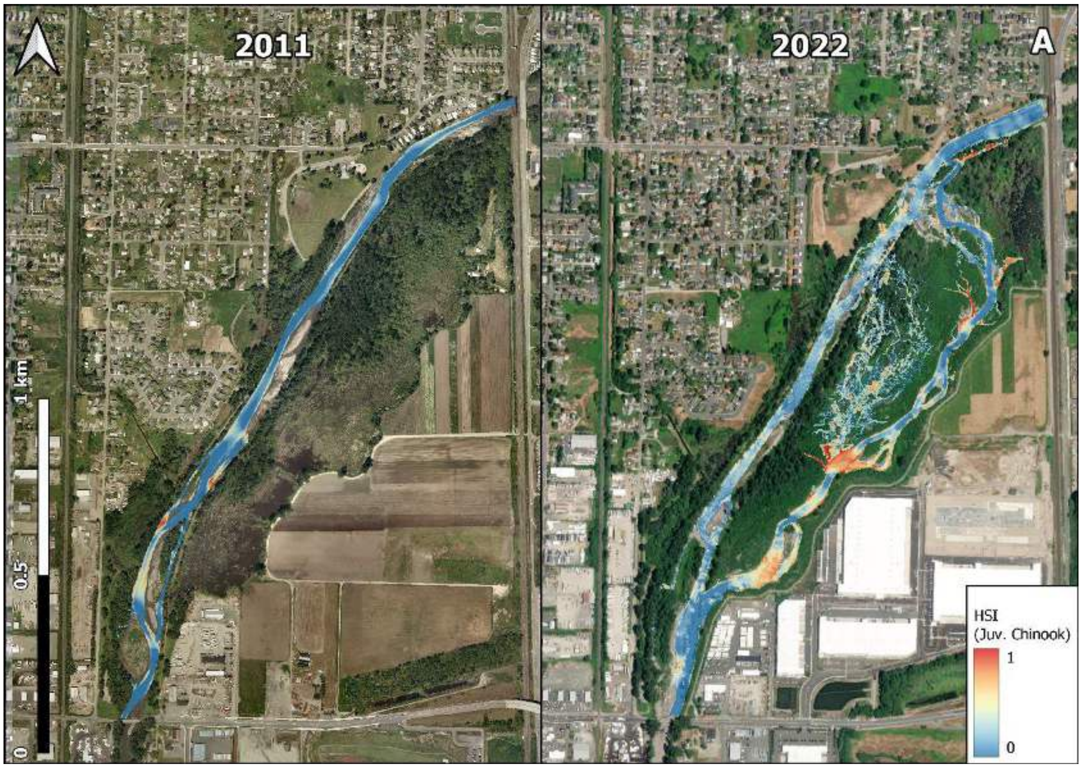
Figure 13. Tier 3 geomorphic units at Countyline at low flow (500 cfs), delineated using the Geomorphic Unit Tool (GUT). Base maps are 2011 (pre-project) and 2021 (post-project) NAIP imagery.

HSI

The total weighted usable area (WUA) at base flow increased for all species and life stages following restoration with the largest increases in juvenile Chinook and steelhead (465 and 353%, respectively). The geometric mean HSI value for juvenile Chinook salmon and steelhead both increased at Countyline between 2011 and 2022 at a base flow of 500 cfs (Table 10). Mean HSI decreased from 0.38 to 0.19 for spawning Chinook at base flow, with most of the high-quality spawning habitat shifting from the main channel to the side channel (Figure 14). The mean HSI values, total WUA, and WUA >0.5 decreased slightly for both juvenile Chinook (Figure 14) and steelhead (Figure 15) before and after restoration at a two-year flow, primarily due to the increase in velocity caused by the side channel, but also because the project remains constrained between two set-back levees.

Table 10. Geometric means, 50th and 90th percentiles, and amount of weighted usable area (WUA) of the habitat suitability index by species and life stage at Countyline at low flow(500 cfs).

Species and Life Stage	Year	Geometric Mean	50th percentile	90th percentile	WUA (ha)	WUA HSI >0.5
Juvenile Chinook	2011	0.13	0.04	0.40	0.92	0.28
	2022	0.25	0.20	0.61	5.20	0.22
Spawning Chinook	2011	0.38	0.38	0.82	2.71	1.75
	2022	0.19	0.09	0.55	4.00	1.79
Juvenile Steelhead	2011	0.24	0.19	0.50	1.69	0.46
	2022	0.37	0.50	0.69	7.65	3.29



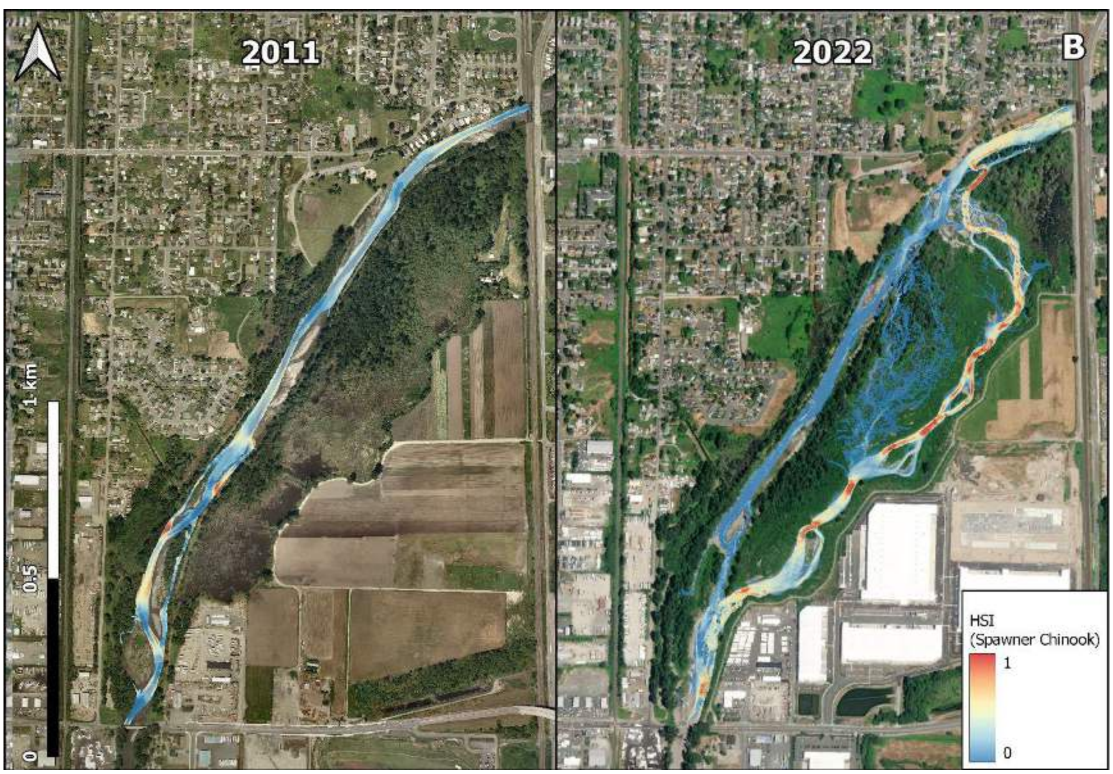


Figure 14. Habitat suitability index results for Countyline at low flow (500 cfs) for juvenile Chinook(A) and, spawning Chinook (B). Base maps are 2011 (pre-project) and 2021 (post-project) NAIP imagery.

Figure 15. Habitat suitability index results for Countyline at low flow (500 cfs) for juvenile steelhead. Base maps are 2011 (pre-project) and 2021 (post-project) NAIP imagery.

Large wood and sediment

Quantitative comparisons for large wood were made using metrics generated from the LiDAR/aerial imagery analysis; however, we also present results from the pre-project survey conducted by King County for comparison. Cumulative counts of individual large wood pieces increased from 2,405 to 4,730 piece between 2011 to 2022 with the total count of wood in the wetted channel increasing by more than 1000% (Table 11). The total count of jams increased from 9 to 38. The dramatic increase in large wood is not surprising given that large wood placement and construction of log jams was part of the restoration.

Table 11. Summary of large wood abundance and frequency at Countyline. Data from 2017 are from a field survey conducted by King County prior to project completion. The percent change is derived from the 2011 and 2022 LiDAR data.

Metric	Pre-project (King County)	Pre-project (CFS)	Post-project (CFS)	Percent Change
Question 5: What is the abundance and distribution of large wood in the active channel, wetted channel, and on the floodplain, and how do they change over time? What proportion of the wood is actively interacting with the channel?				
Year	2017	2011	2022	
Data source(s)	Field survey; aerial imagery	LiDAR; aerial imagery	LiDAR; aerial imagery	
Large wood pieces (wetted)	167	63	874	+1,287%
Large wood pieces (bankfull)	1,465	1,530	2,528	+65%
Large wood pieces (floodplain)	202	812	1,328	+64%
Cumulative count (pieces)	1,834	2,405	4,730	+95%
Count of jams	33	9	28	+311%
Large wood frequency (pieces; #/100 m)	74.52	109.82	155.34	+41%
Large wood frequency (jams; #/100 m)	1.51	0.41	1.28	+211%

The DEM of difference (2011 – 2022) at Countyline indicated that 81% of the project area (68.48 ha) has aggraded, for an estimated total sediment volume of 462,993 m^3 (Figure 16). Concurrently, 16% of the project area (13.86 ha) has degraded, or 55,830 m^3 of sediment. Thus, total aggradation at the site was 407,163 m^3 of sediment. However, poor LiDAR penetration in 2022 may have resulted in biased estimates of aggradation and degradation in deepest areas of the channel.

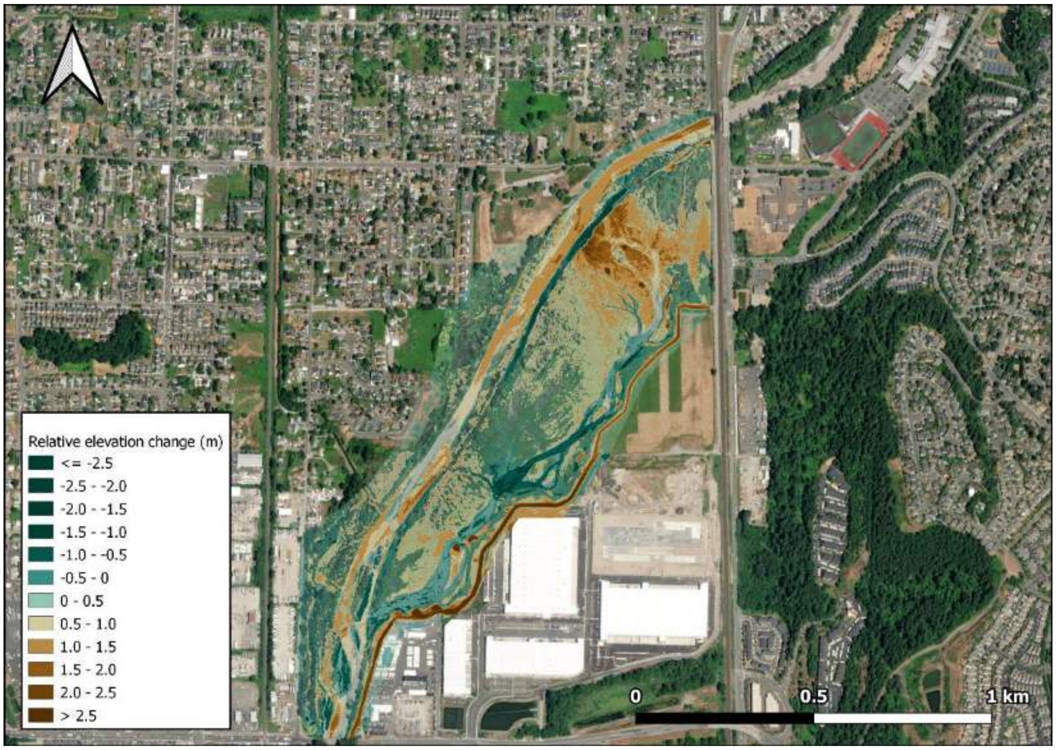


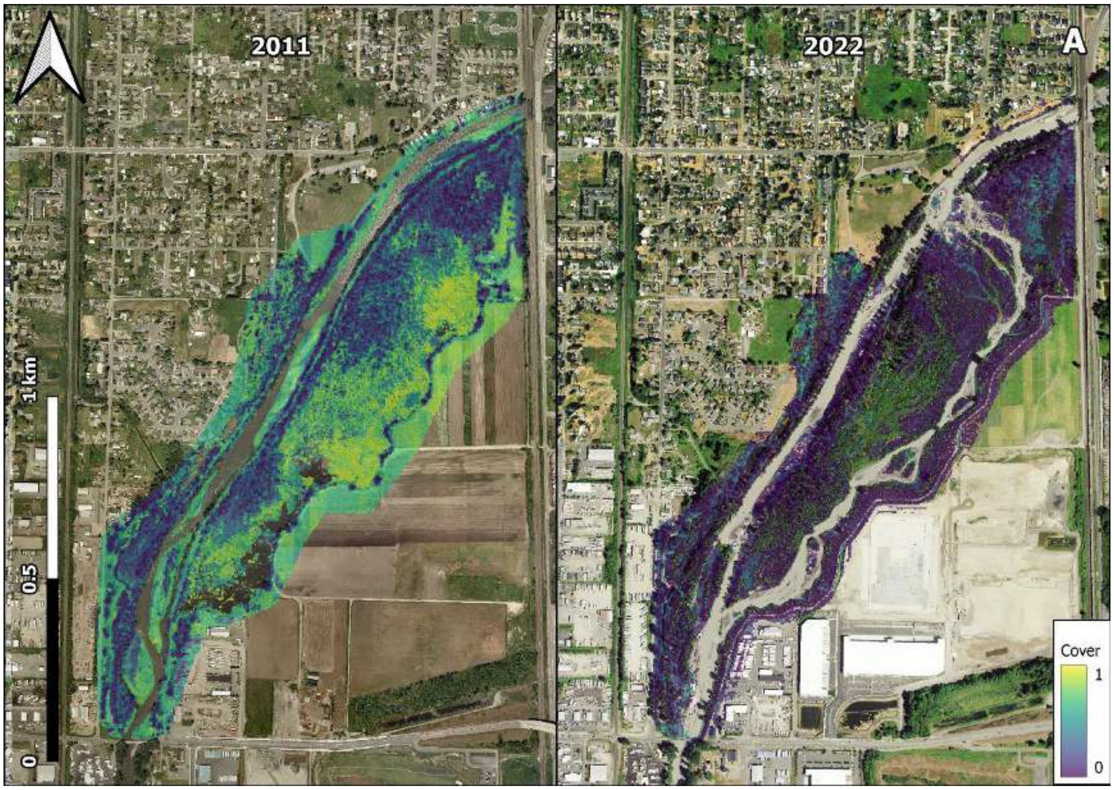
Figure 16. Relative elevation change at Countyline from 2011 to 2022 based on topo-bathymetric LiDAR.

Riparian

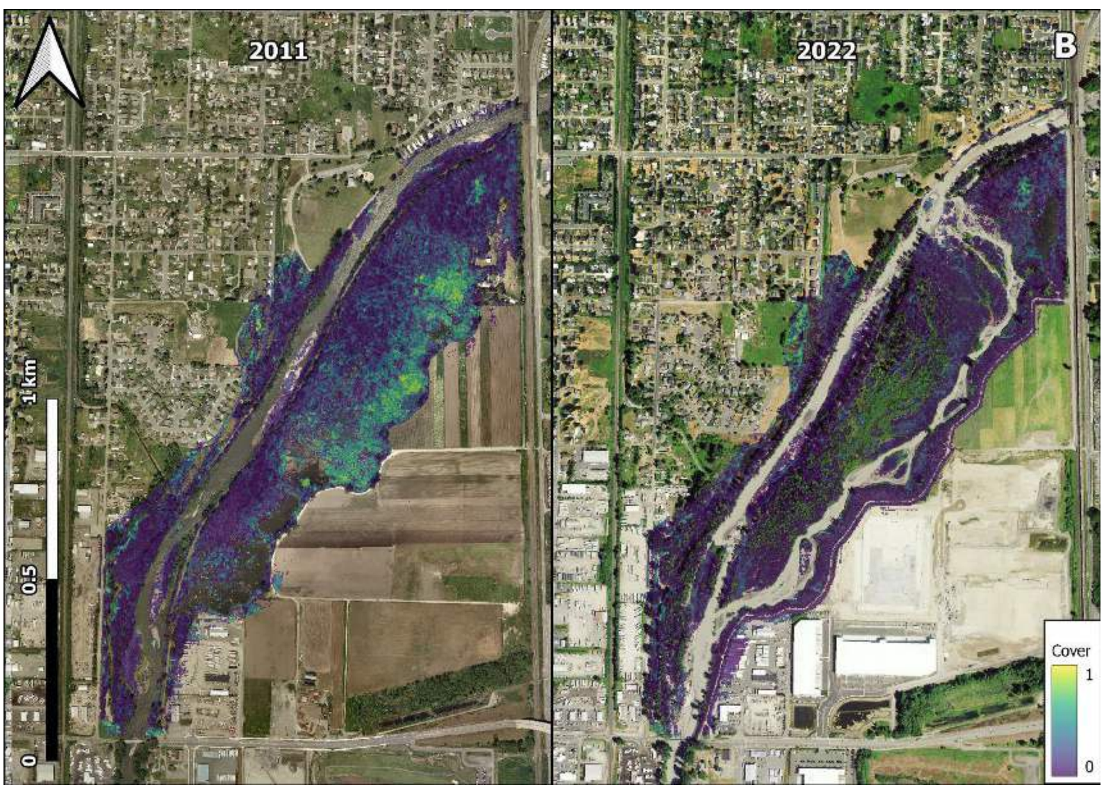
The areal extent of low (<1 m) and mid-story (1 – 5 m) vegetation decreased from the pre- to post- project periods from 37 to 5 ha and 10 to 4 ha, respectively, while the areal extent of canopy (>5 m) increased from 25 to 32 ha or more than 25% (Table 12). This appears largely due to increased tree cover as areal coverage maps based on LiDAR data show that the Countyline project was dominated by low vegetation in 2011, but trees were the dominant vegetation class in 2022 (Figure 17). Much of this is presumably due to the rapid growth of many of the planted trees.

Table 12. Summary of the areal extent of riparian vegetation by class at Countyline.

Metric	Pre-project	Post-project	Percent Change
What is the riparian vegetation areal extent by vegetation class (e.g., grasses, forbs, shrubs, trees, etc.), species composition, and density and how much do they change over time?			
Areal extent of low vegetation (ha)	37	5	-86%
Areal extent of mid-story vegetation (ha)	10	4	-60%
Areal extent of canopy (ha)	25	32	+28%



2011
2022
A
1 km
0.5
0
Cover
1
0



2011
2022
B
1 km
0.5
0
Cover
1
0

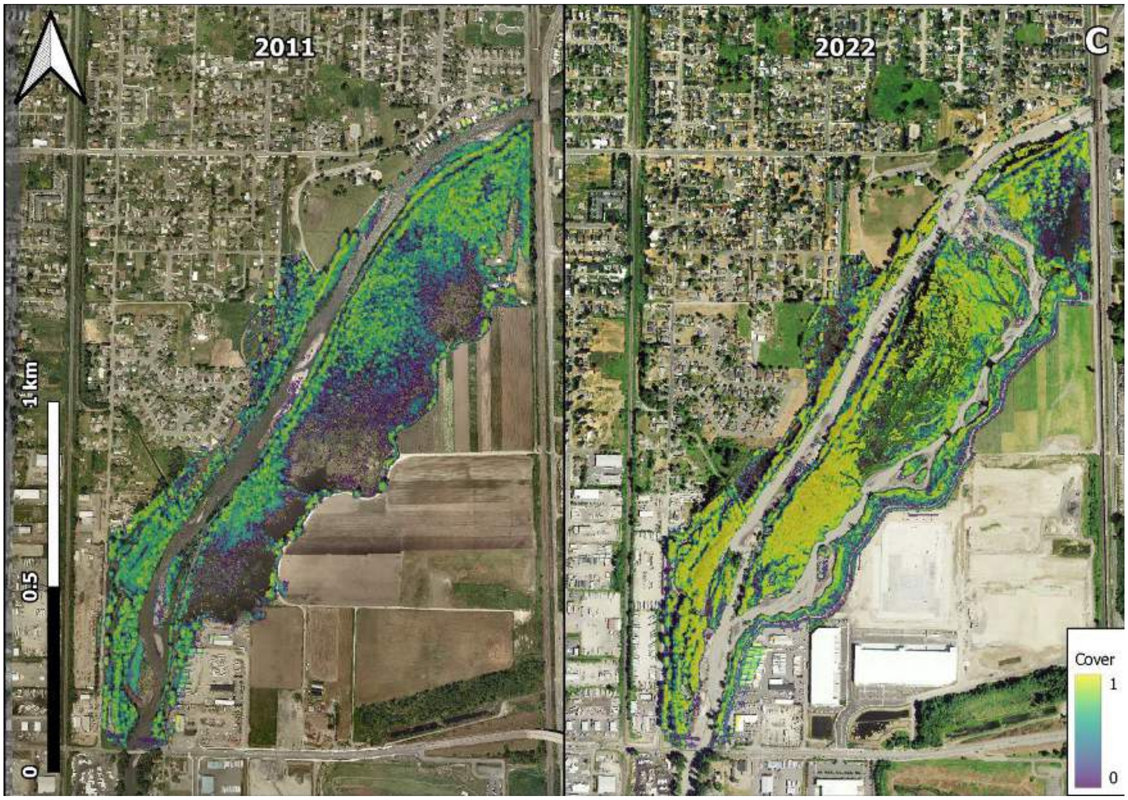


Figure 17. Areal extent of low vegetation (A; LiDAR returns < 1 m), mid-story vegetation (B; LiDAR returns ≥ 1 m and ≤ 5 m), and canopy (C; LiDAR returns > 5 m) at Countyline. Colors in each cell represent the proportion of the cell area covered by vegetation in each height class.

The mean LPI over the wetted channel decreased by 10% from 2011 to 2022, indicating an increase in riparian shade. The estimated volume of organic inputs also increased by more than 200% concomitant with the increase in the areal extent of canopy coverage (Table 13). The change in the spatial distribution of LPI before and after project implementation is shown in Figure 17.

Table 13. Summary of riparian function metrics at Countyline derived from LiDAR data.

Metric	Pre-project	Post-project	Percent Change
Question 9: Has riparian/floodplain restoration led to restored riparian function including shade, bank stabilization, and organic matter following riparian restoration?			
Light penetration index (LPI)	0.91	0.82	-10%
Organic inputs (m^3)	194,664	614,897	+216%

Figure 18. Light penetration index (LPI) proportion of first returns in each cell that are ground points) at Countyline.

Design objectives

The Countyline basis of design report lists three major project goals, each with three to four objectives (Herrera Environmental Consultants Inc. 2014). Most of the measurable objectives relevant to this study addresses Goal 1, which relates to riverine process restoration and salmonid rearing habitat enhancement (Table 14). One additional relevant objective (Objective 2.2) addresses Goal 2, related to flood storage capacity. The remaining objectives are related to flood hazard protection and infrastructure; therefore, we do not report them here. We did not have an as-built survey for the Countyline project which would allow us to evaluate specific design elements. However, we cross walked these objectives with the metrics we calculated before and after restoration to determine whether the project is meeting its design objectives. Based on our analysis and metrics we calculated, it appears the project is meeting all of its riverine process and fish habitat objectives (Table 14). For example, using the various side channel metrics we calculated (e.g., number, length, and RCI) it is clear that the project has met Objective 1.2 "Encourage the formation of off-channel rearing habitat (pool complexes and side-channels), through installation and future natural recruitment of large wood, that will promote the return of the complexity, diversity, and morphology found in an unconstrained floodplain."

Table 14. List of relevant goals and objectives listed in the Countyline basis of design report (Herrera et al. 2014), monitoring metrics we used to evaluate objectives, and whether the objective was met based on our analysis of pre- and post-data.

Goal and Objectives	Monitoring metric(s)	Objective met?
Goal 1: Restore riverine processes and functions to the lower White River and its floodplain within the project area (inside the proposed levees) in order to enhance salmonid rearing habitat, in particular for spring and fall Chinook, coho, and steelhead.		
Objective 1.1: Allow natural channel movement within the project area by removing and setting back the existing levee along the left bank.	Floodplain area, floodplain to bankfull area ratio, altered area	Yes
Objective 1.2: Encourage the formation of off-channel rearing habitat (pool complexes and side-channels), through installation and future natural recruitment of large wood, which will promote the return of the complexity, diversity, and morphology found in an unconstrained floodplain.	Side channel number, length, area, node density, and ratio, RCI, large wood, pool area/percentage	Yes
Objective 1.3: Provide off-channel flood refuge for salmonids by allowing a more natural frequency of inundation of the floodplain complex during flood events within the project boundaries.	Floodplain inundation index	Yes
Objective 1.4: Protect existing mature riparian buffer areas and restore a corridor of mature riparian vegetation within the project boundaries to provide, shoreline and stream channel shading, invertebrate prey supply, and large wood recruitment.	Areal extent of riparian vegetation classes, light penetration index, large wood	Yes
Goal 2: Prevent an increase in flood and geomorphic hazards outside of the project area from this restoration project and, if possible, reduce existing hazards.		
Objective 2.2: Increase flood storage along the length of the project, which will also have a net benefit on flood elevations in the immediate vicinity of the project, particularly the right bank.[8]	Floodplain area	Yes

[8] While floodplain area increased post-project, hydraulic model simulations still show significant inundation up to the flood protection barriers on the right bank though observations by King County staff indicate that it was predicted to become worse without the project. Thus, the project has likely reduced risk of overtopping right-bank flood protection barriers (Figure 9).

Upper/Lower Fobes

Geomorphology and habitat

Pre-project (2017) floodplain area, floodplain to bankfull ratio and floodplain inundation index were 58 ha, 2.41, and 0.42 respectively (Table 15). Prior to project construction in summer 2022, there were three low flow side channels at Upper/Lower Fobes, two of which were backwater channels, and two side channels at bankfull (Figure 19).

Table 15. Summary of floodplain area and floodplain inundation metrics for Upper/Lower Fobes.

Metric	Pre-project	Post-project	Percent Change
Question 1: What is the floodplain area before and after restoration and what is the extent and frequency of floodplain inundation at different flow levels over time?			
Floodplain area (ha)	58	TBD	TBD
Floodplain to bankfull area ratio	2.41	TBD	TBD
Floodplain inundation index	0.42	TBD	TBD

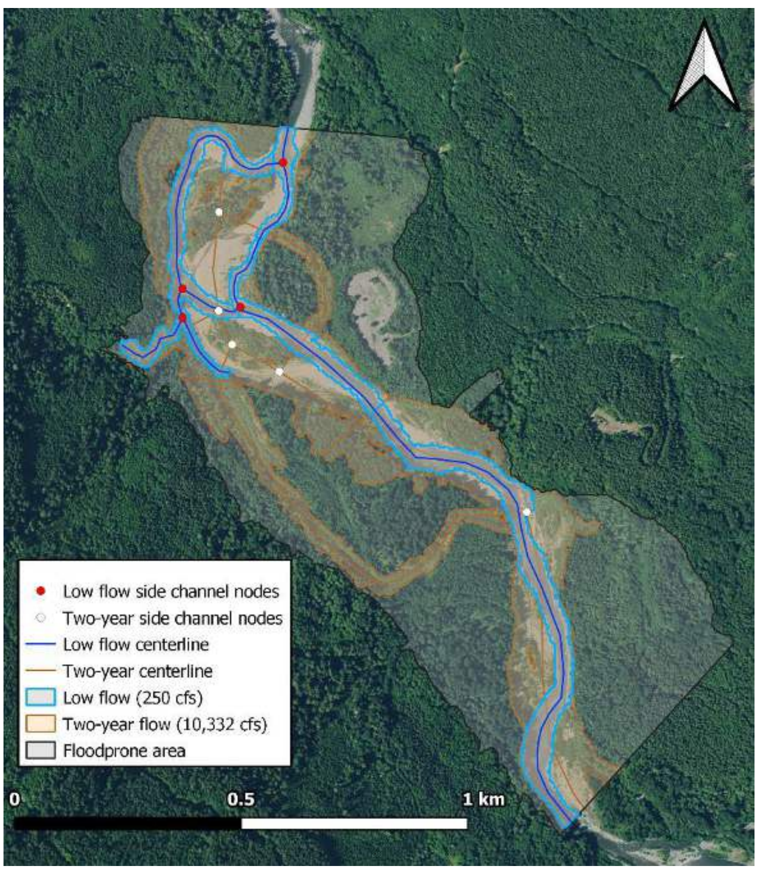


Figure 19. Comparison of the water surface extents at low flow, a 2-year flow, and the floodprone area at Upper/Lower Fobes in 2021 (pre-project). Side channel nodes are the junctions between the main channel and each side channel entrance. The base map is 2021 NAIP imagery.

Pre-project sinuosity was 1.36 with a bankfull width of 41 m and a river complexity index of 0.35 which reflects the low number of active side channels. A complete list of pre-project monitoring floodplain and channel morphology metrics are displayed in Table 16. Depth and velocity profiles and maps are displayed in Figure 20. All these metrics are expected to improve following project implementation and adequate flow events.

Table 16. Summary of channel and floodplain morphology metrics for Upper/Lower Fobes.

Metric	Pre-project	Post-project	Percent Change
Question 3: What is the effect of restoration on channel and floodplain morphology and complexity (RCI [Brown 2002]), seasonal and perennial side channel metrics (length, area, ratio [Beechie et al. 2017]), and the morphological quality index (MQI [Rinaldi et al. 2013]) in the reach, and how does it change over time?			
Sinuosity	1.36	TBD	TBD
Wetted area (ha)	11	TBD	TBD
Wetted width (m)	37.05	TBD	TBD
Bankfull area (ha)	41	TBD	TBD
Bankfull width (m)	212.08	TBD	TBD
Bankfull width to depth ratio	11.41	TBD	TBD
Wetted side channel count	3	TBD	TBD
Wetted side channel nodes	4	TBD	TBD
Wetted side channel length (km)	0.77	TBD	TBD
Wetted side channel area (ha)	1.60	TBD	TBD
Side channel ratio	0.94	TBD	TBD
Isolated ponds/wetlands	0	TBD	TBD
River Complexity Index (RCI)	0.35	TBD	TBD
Braiding parameter	1.78	TBD	TBD
Morphological Quality Index (MQI)	0.95	TBD	TBD

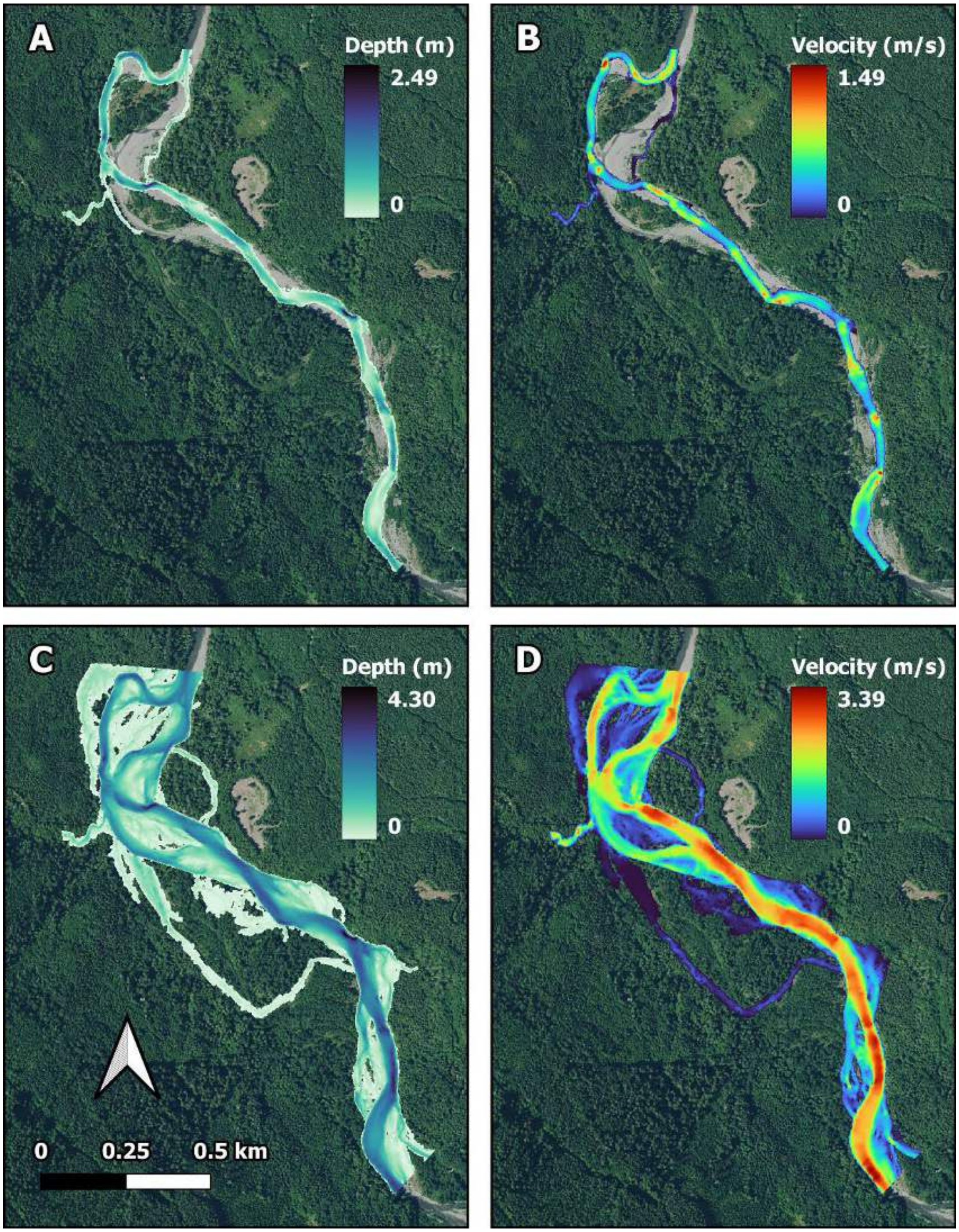


Figure 20. Depth and velocity for the Upper/Lower Fobes project site on the South Fork Nooksack River. Panels A and B show the low flow scenario (250 cfs) and panels C and D show the 2-year flow scenario (10,332 cfs).

Prior to restoration there were 18 pools with 38% of the habitat length classified as pools (Table 17 Figure 21). Similar to the field habitat survey, the GUT analysis, which covers the bankfull channel, showed that the reach was dominated by fast water geomorphic channel units, with the largest percent of bankfull channel area (26%) being classified as rapids (Figure 22; Table 18).

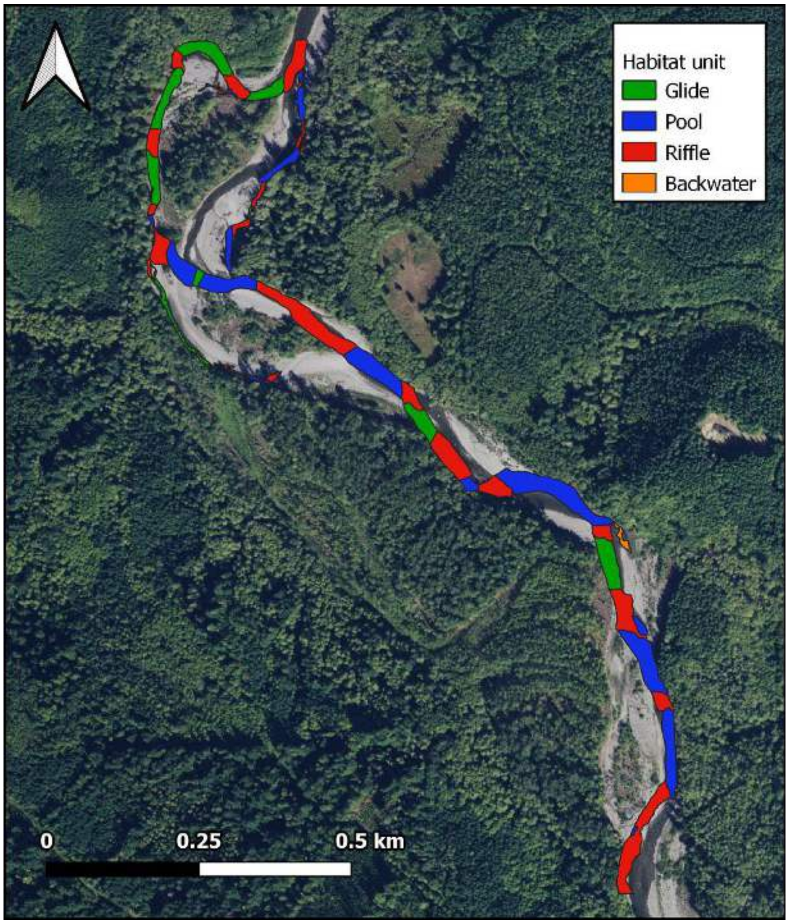


Figure 21. Fish habitat units at Upper/Lower Fobes from a 2021 field survey (data provided by Lummi Nation). The base map is 2021 (pre-project) NAIP imagery.

Table 17. Summary of pool metrics and habitat diversity for Upper/Lower Fobes. Post-project and percent change will be calculated after project completion and post-project monitoring.

Metric	Pre-project	Post-project	Percent Change
Question 4: What is the number and diversity of habitat types (i.e., pools, riffles, glides, etc.) within the main channel, and side channels at different flows (low and bankfull), and how much do they change over time?			
Shannon Diversity Index (habitat units)	1.12	TBD	TBD
Percent pool area	38%	TBD	TBD
Number of pools	18	TBD	TBD
Pool to Riffle ratio	0.78	TBD	TBD
Residual pool depth	2.7	TBD	TBD

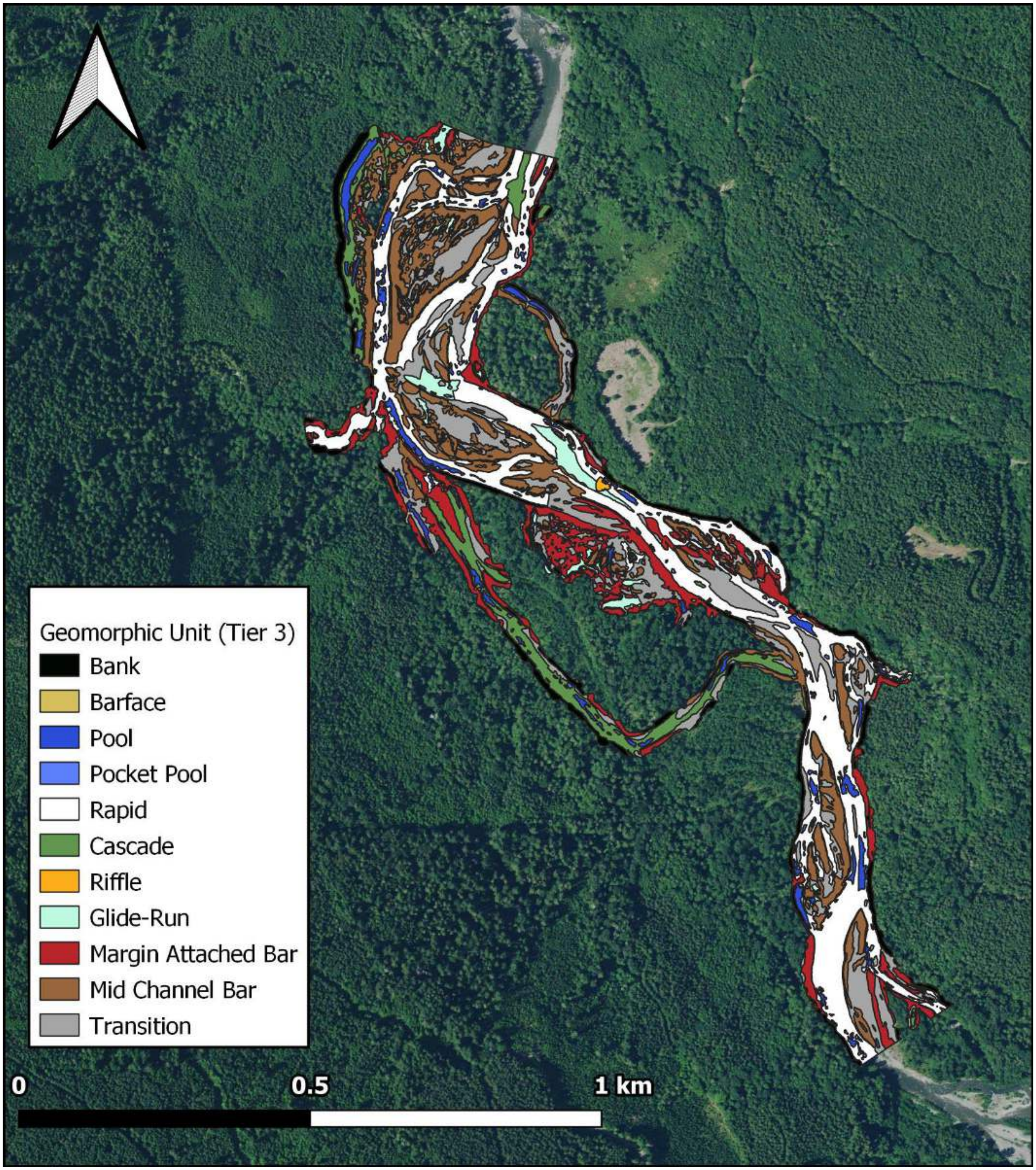


Figure 22. Tier 3 geomorphic units at Upper/Lower Fobes, delineated using the modeled 2-year water surface extent, 2021 bathymetry, and the Geomorphic Unit Tool (GUT)). The base map is 2021 (pre-project) NAIP imagery.

Table 18. Tier 3 geomorphic units summary for Upper/Lower Fobes calculated from the geomorphic unit tool (GUT) output. The percent of the total bankfull area is given in parentheses. Post-project and percent change will be calculated after project completion and post-project monitoring.

Unit Type	Area (ha)		Count	
	Pre-project	Post-project	Pre-project	Post-project
Bank	2.66	TBD	68	TBD
Barface	0.01	TBD	7	TBD
Cascade	2.55	TBD	12	TBD
Glide-Run	1.05	TBD	17	TBD
Margin Attached Bar	5.22	TBD	44	TBD
Mid-channel Bar	8.17	TBD	120	TBD
Pocket Pool	0.47	TBD	171	TBD
Pool	1.49	TBD	56	TBD
Rapid	11.04	TBD	2	TBD
Riffle	0.04	TBD	1	TBD
Transition	9.62	TBD	784	TBD
Total	42.32	TBD	1282	TBD

HSI

The total WUA (WUA >0.5) at low flow (250 cfs) was 3.64 (1.37) ha, 5.62 (2.29) ha, and 3.72 (1.27) ha for juvenile Chinook, spawning Chinook, and juvenile steelhead, respectively (Figure 23). The geometric mean (50^{th} – 90^{th} percentiles) HSI values at base flow were 0.22 (0.16 – 0.54) for juvenile Chinook, 0.23 (0.18 – 0.53) for spawning Chinook, and 0.34 (0.31 – 0.63) for juvenile steelhead.

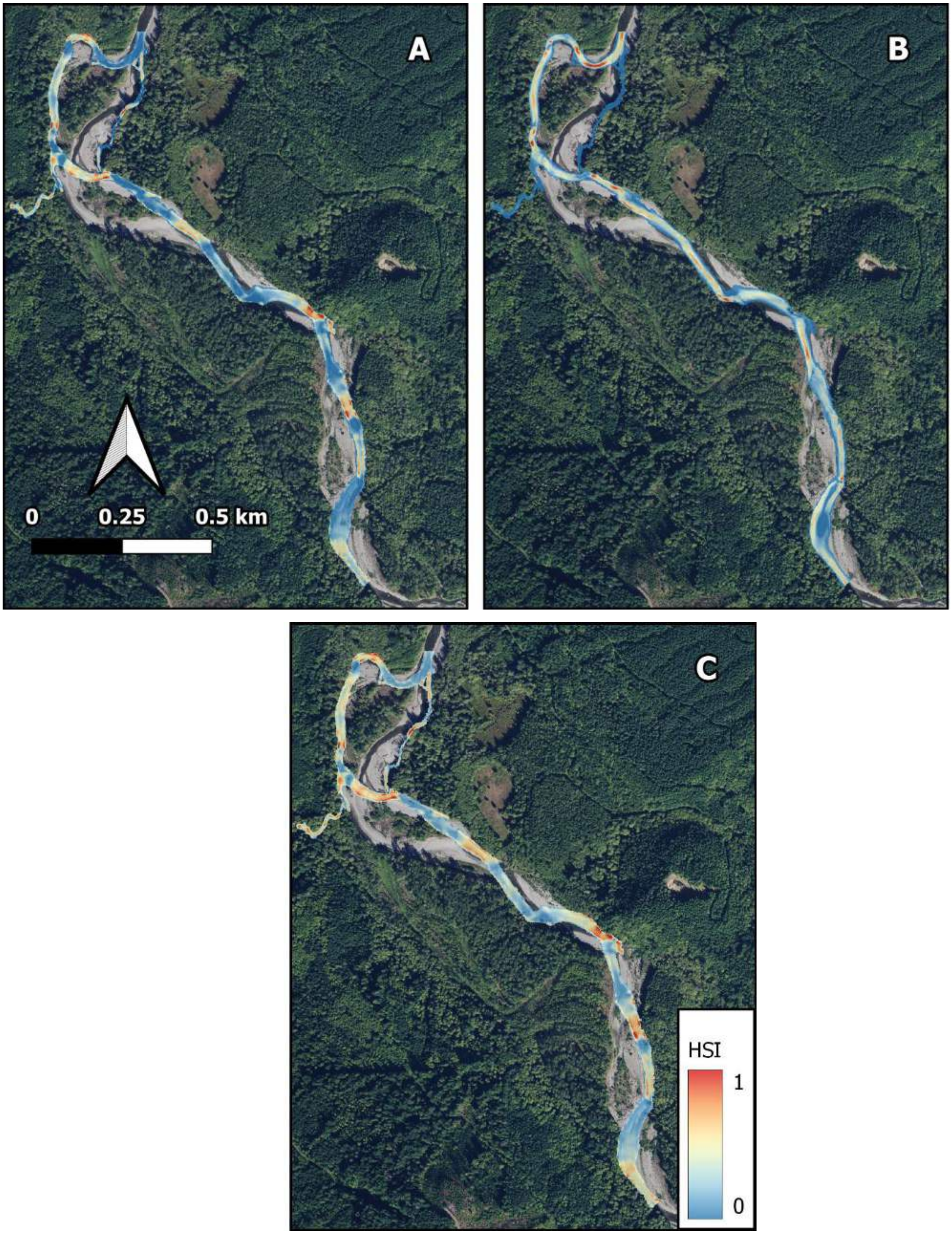


Figure 23. Habitat suitability index at low flow (250 cfs) at Upper/Lower Fobes for juvenile Chinook (A), spawning Chinook (B), and juvenile steelhead (C). The base map is 2021 (pre-project) NAIP imagery.

Large wood and sediment

There were a total of 1123 pieces of large wood pre-project (2017) and 12 jams, with the majority of the large wood being on the floodplain and 171 pieces being in the wetted channel (Table 19).

Table 19. Summary of large wood abundance and frequency at Upper/Lower Fobes. Post-project and percent change will be calculated after project completion and post-project monitoring.

Metric	Pre-project	Post-project	Percent Change[9]
Question 5: What is the abundance and distribution of large wood in the active channel, wetted channel, and on the floodplain, and how do they change over time? What proportion of the wood is actively interacting with the channel?			
Large wood pieces (wetted)	171	TBD	TBD
Large wood pieces (bankfull)	316	TBD	TBD
Large wood pieces (floodplain)	636	TBD	TBD
Cumulative count (pieces)	1123	TBD	TBD
Count of jams	12	TBD	TBD
Large wood frequency (pieces; #/100 m)	58.28	TBD	TBD
Large wood frequency (jams; #/100 m)	0.62	TBD	TBD

Aggradation and degradation after post-project data are collected (Date TBD). Therefore, there are no sediment change results to report. However, Figure 24 shows the detrended DEM derived from the 2017 LiDAR, which provides a snapshot overview of the geomorphic qualities of the reach and will function as the frame of reference in the eventual sediment change analysis.

[9] Percent change was calculated from the LiDAR derived numbers.

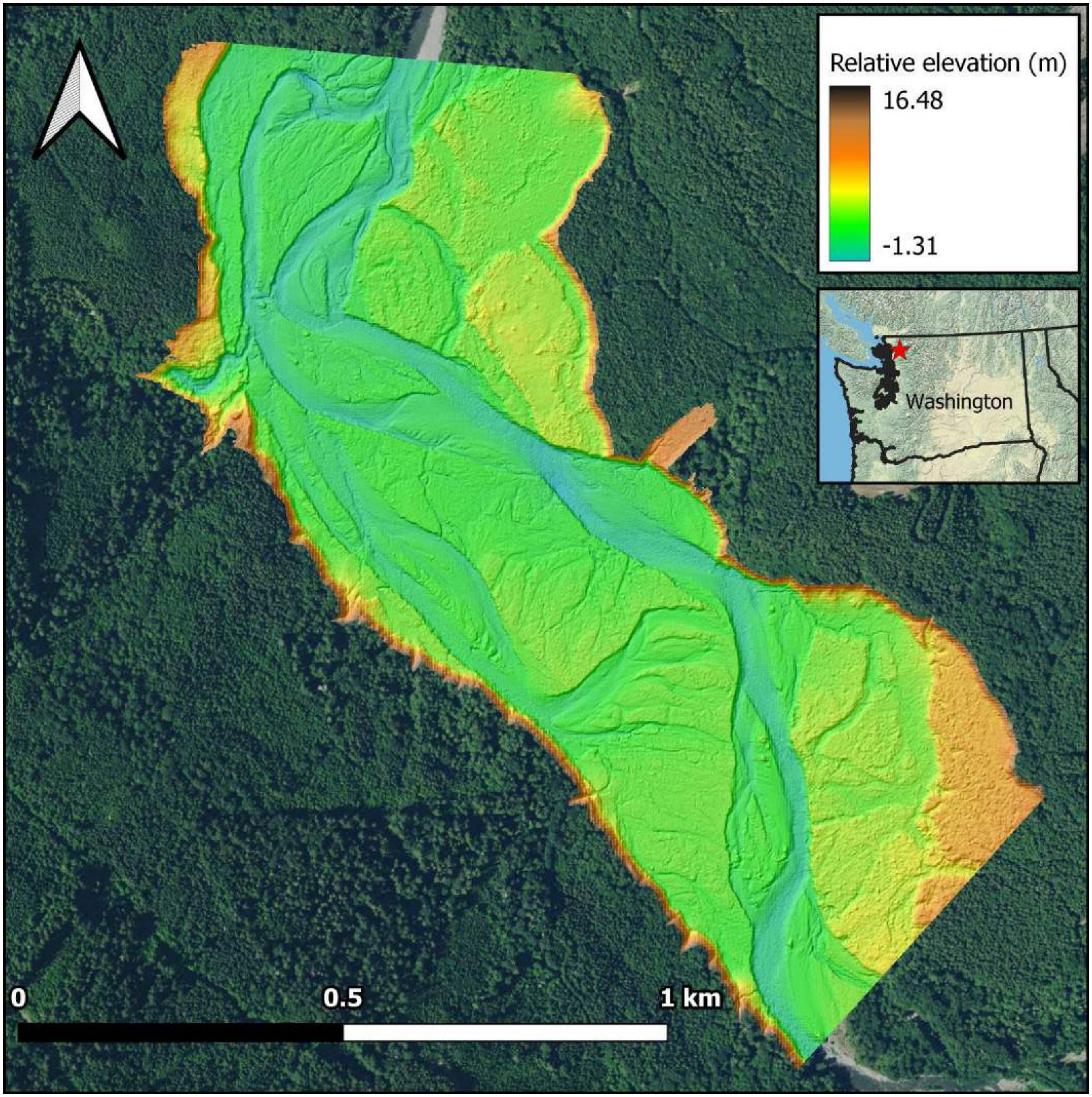


Figure 24. The detrended pre-project (2017) DEM at Upper/Lower Fobes clipped to the floodprone elevation contour.

Riparian

Riparian vegetation extent at Upper/Lower Fobes was greatest for the canopy and low vegetation height classes which covered 50% and 42% of the floodplain area, respectively, with the remaining 8% belonged to the mid-story vegetation class (Table 20; Figure 25). The riparian field survey identified 29 unique species. Himalayan blackberry was the most common in the low vegetation category (<1 m), *Salix* spp. was the most common mid-story (1-5 m) species, and red alder *Alnus rubra* was the most common canopy (>5 m) species (Figure 26). Native species comprised 71% of species, while invasive species made up 29% of species sampled. Invasive species prevalence was highest in the low vegetation (<1 m) category at 94%. Six percent of shrub species were classified as invasive and no invasive tree species were identified.

Table 20. Summary of the areal extent, richness, and diversity of riparian vegetation at Upper/Lower Fobes. Post-project and percent change will be calculated after project completion and post-project monitoring.

Metric	Pre-project	Post-project	Percent Change
What is the riparian vegetation areal extent by vegetation class (e.g., grasses, forbs, shrubs, trees, etc.), species composition, and density and how much do they change over time?			
Areal extent of low vegetation (ha)	9	TBD	TBD
Areal extent of mid-story vegetation (ha)	6	TBD	TBD
Areal extent of canopy (ha)	39	TBD	TBD
Species richness	29	TBD	TBD
Shannon diversity index	1.99	TBD	TBD

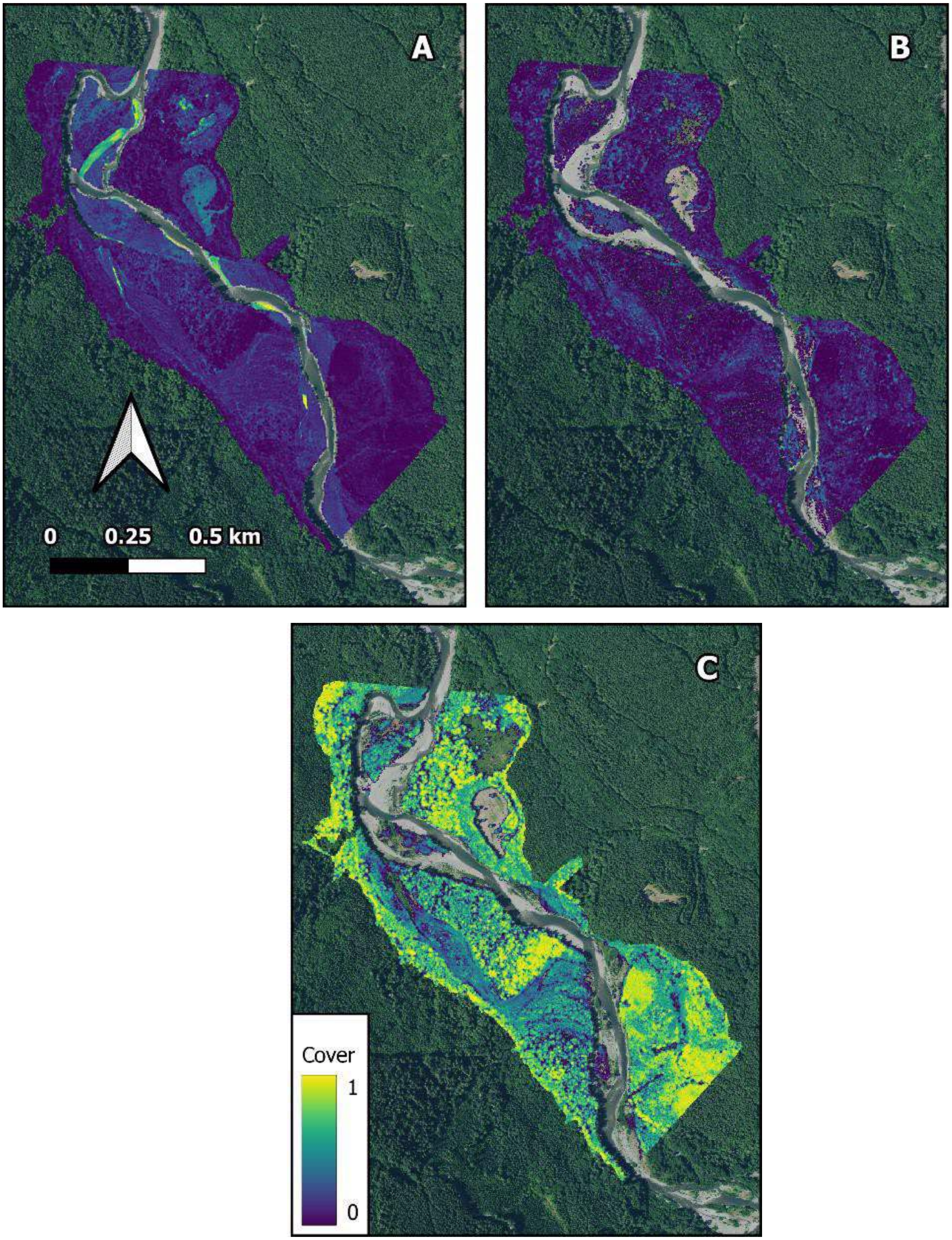


Figure 25. Areal extent of low vegetation (A; LiDAR returns <1 m), mid-story vegetation (B; LiDAR returns ≥ 1 m and ≤ 5 m), and canopy (C; LiDAR returns > 5 m) at Upper/Lower Fobes. Colors in each cell represent the proportion of the cell area covered by vegetation in each height class.

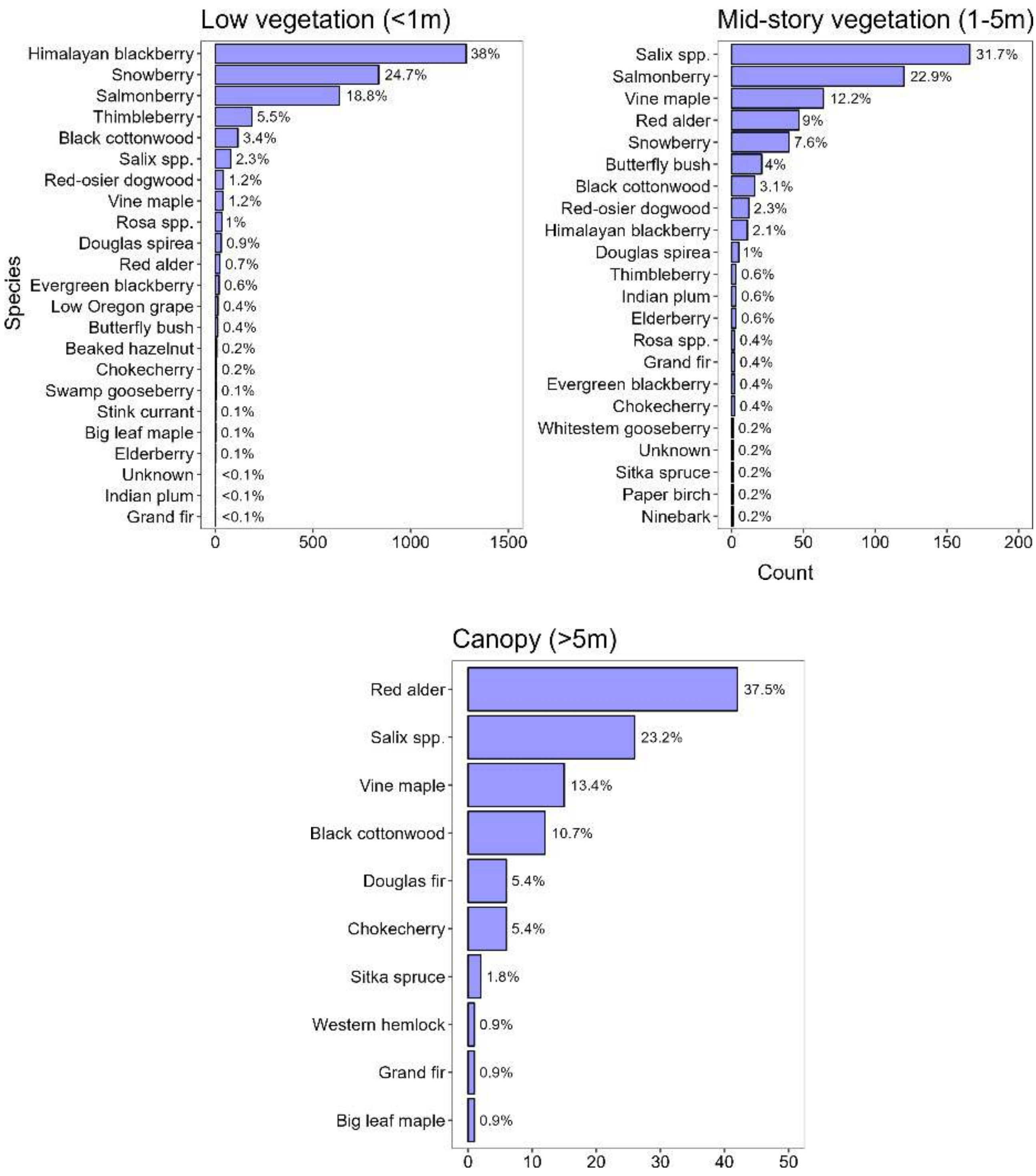


Figure 26. Count frequency plots of riparian vegetation species by height category encountered during the riparian field surveys (July/August 2022) at Upper/Lower Fobes.

The LPI indicated that Upper/Lower Fobes is highly shaded; however, it was evident in the LPI raster that the LiDAR did not penetrate to the thalweg (hence, the bathymetry survey conducted by NSD in 2016) (Figure 27). As such, the LPI value displayed in Table 21 may be biased low.

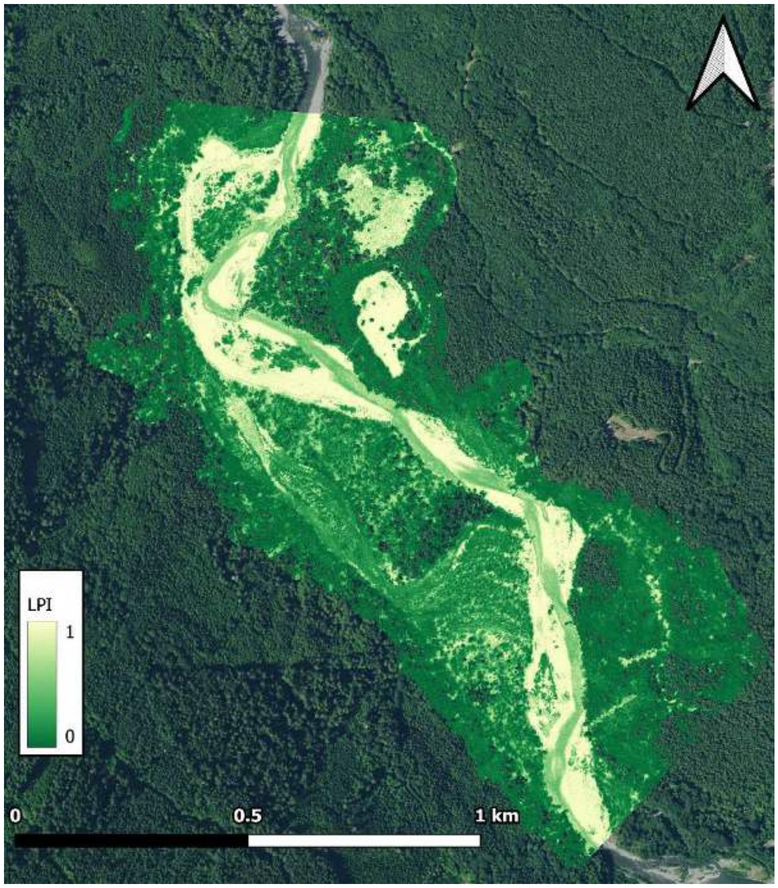


Figure 27. Light penetration index (LPI) proportion of first returns in each cell that are ground points) at Upper/Lower Fobes.

Table 21. Summary of riparian function metrics at Upper/Lower Fobes. Post-project and percent change will be calculated after project completion and post-project monitoring.

Metric	Pre-project	Post-project	Percent Change
Question 9: Has riparian/floodplain restoration led to restored riparian function including shade, bank stabilization, and organic matter following riparian restoration?			
Light penetration index (LPI)	0.57	TBD	TBD
Organic inputs (m^3)	1,190,592	TBD	TBD

Design objectives

The goal of the Upper/Lower Fobes habitat restoration project is to restore early Chinook spawning, rearing, and holding habitat by addressing limiting factors such as temperature, habitat diversity, and key habitat quantity (Washington State Recreation and Conservation Office 2022). In addition, the project is intended to encourage specific physical and biological outcomes and we extracted specific outcomes from the available documentation (Table 22). Upon completion of post-project monitoring, we will evaluate change in the relevant metrics and determine whether the anticipated outcomes were achieved.

Table 22. List of anticipated outcomes of the Upper/Lower Fobes restoration project and metric/analysis that will be used to assess those outcomes. Anticipated outcomes are paraphrased from the project webpage on the Salmon Recovery Funding Board website (Washington State Recreation and Conservation Office 2022).

Anticipated Outcome	Metric/Analysis
Combat incision and aggrade the channel.	DEM of difference
Encourage split flows and anabranching channel form.	RCI, MQI, side channel ratio, side channel nodes
Increase side channel habitat and floodplain connectivity.	Side channel count, side channel ratio, side channel area, floodplain area, floodplain inundation index
Create thermal refugia and low flow pool habitat.	Light penetration index, pool count, pool area, percent pool area
Promote forested island development.	Areal extent of mid-story and canopy vegetation on islands

Tucannon PA-3

Geomorphology and habitat

Floodplain area and the floodplain inundation index at Tucannon PA-3 both increased by 29% following the 2018 restoration (Table 23). The total area altered by the project (calculated at a 2-year flow [738 cfs]) was 11.36 ha. The spatial extent of the wetted, bankfull, and floodprone areas increased following restoration as displayed in Figure 28.

Table 23. Summary of floodplain area and floodplain inundation metrics for Tucannon PA-3.

Metric	Pre-project	Post-project	Percent Change
Question 1: What is the floodplain area before and after restoration and what is the extent and frequency of floodplain inundation at different flow levels over time?			
Floodplain area (ha)	24	31	+29%
Floodplain to bankfull area ratio	3.94	5.15	+31%
Floodplain inundation index	0.09	0.12	+29%

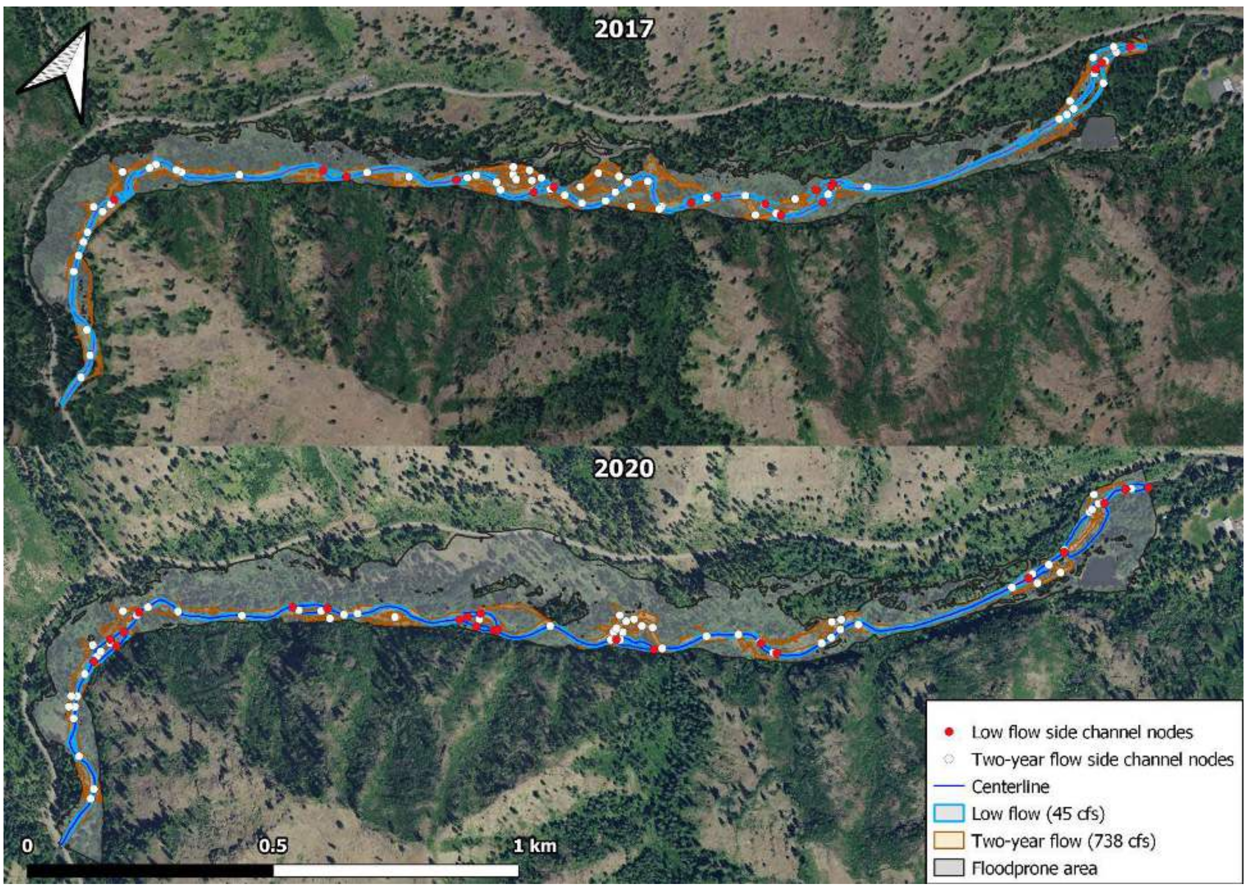


Figure 28. Comparison of the water surface extents at low flow, a 2-year flow, and the floodprone area at Tucannon PA-3 in 2017 (pre-project) and 2020 (post-project). Side channel nodes are the junctions between the main channel and each side channel entrance. Base maps are 2017 and 2020 NAIP imagery.

Bankfull area, sinuosity, and MQI increased slightly following restoration in 2018, though many other metrics decreased (Table 24). Figure 29 shows an example of the change in depth and velocity along a 600 m stretch of Tucannon PA-3.

Table 24. Summary of channel and floodplain morphology metrics for Tucannon PA-3.

Metric	Pre-project	Post-project	Percent Change
Question 3: What is the effect of restoration on channel and floodplain morphology and complexity (RCI [Brown 2002]), seasonal and perennial side channel metrics (length, area, ratio [Beechie et al. 2017]), and the morphological quality index (MQI [Rinaldi et al. 2013]) in the reach, and how does it change over time?			
Sinuosity	1.23	1.30	+6%
Wetted area (ha)	2.59	2.42	-6%
Wetted width (m)	7.71	7.24	-6%
Bankfull area (ha)	6.18	6.28	+2%
Bankfull width (m)	25.27	22.26	-12%
Bankfull width to depth ratio	8.67	7.3	-16%
Bankfull side channel count	22	19	-14%
Bankfull side channel nodes	64	59	-8%
Bankfull side channel length (km)	2.98	2.49	-16%
Bankfull side channel area (ha)	1.38	1.17	-15%
Side channel ratio	1.04	0.95	-9%
Isolated ponds/wetlands	1	1	No change
River Complexity Index (RCI)	3.03	2.96	-2%
Braiding parameter	1.26	1.29	+3%
Morphological Quality Index (MQI)	0.92	0.93	+1%

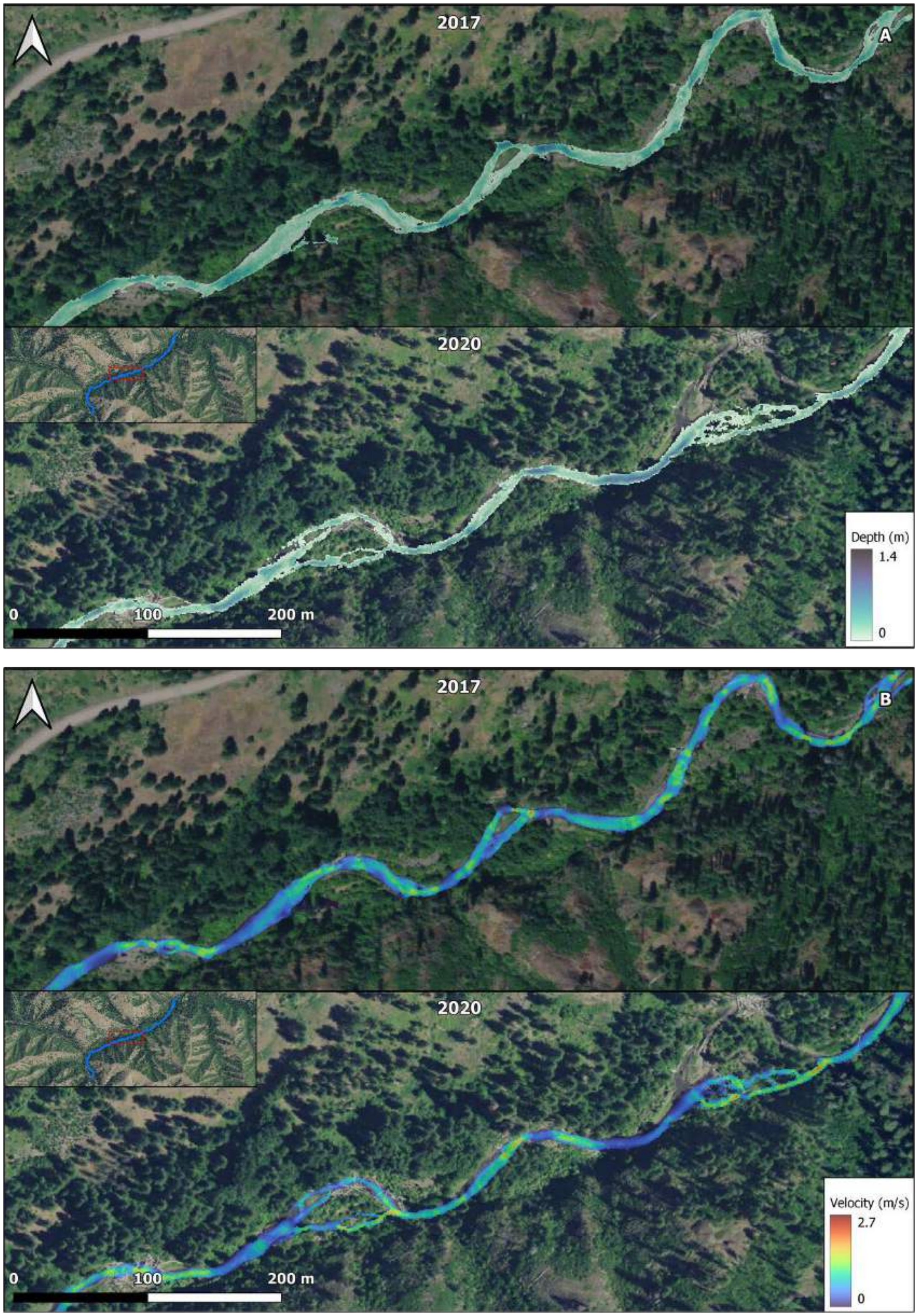


Figure 29. Modeled depths (A) and velocities (B) at a section of Tucannon PA-3 at low flow (45 cfs). Base maps are 2017 (pre-project) and 2020 (post-project) NAIP imagery.

Instream habitat composition at Tucannon PA-3 in 2017 based on our habitat classification methodology and the thalweg long profile was 83% riffle, 15% glide, and 2% pool. In 2020, instream habitat composition was 80% riffle, 19% glide, and <1% pool. Residual pool depth increased and the percentage of pool area increased from 16% to 19% (a 19% increase), The habitat classification method showed a reduction pools. By contrast, the field survey of pool habitat conducted by SNSRB found an increase in the total number of pools between 2017 and 2020 from 36 to 39 (Table 25). The GUT analysis of finer geomorphic units also suggested a decline in pool area though it is highly dependent on the quality of the bathymetric data (Table 26). A closer examination of the LiDAR data indicated that the green LiDAR did not map pools obscured by large wood. Therefore, the estimates of habitat and GUT metrics from the LiDAR data underestimated pools and other deep-water habitats and the field count of pools provided by the Snake River Salmon Recovery Board are likely more accurate.

Table 25. Summary of pool metrics and habitat diversity for Tucannon PA-3. SRSRB = Snake River Salmon Recovery Board. CFS = Cramer Fish Sciences. Number of pools (CFS) represent pools determined by the LiDAR derived thalweg profile and our habitat classification method, while the SRSRB data are based on a field survey of pools.

Metric	Pre-project	Post-project	Percent Change
Question 4: What is the number and diversity of habitat types (i.e., pools, riffles, glides, etc.) within the main channel, and side channels at different flows (low and bankfull), and how much do they change over time?			
Shannon Diversity Index (habitat units)	0.90	0.73	-19%
Percent pool area	16%	19%	+19%
Number of pools (CFS)	6	1	-83%
Number of pools (SRSRB)	36	39	+8%
Pool to Riffle ratio	0.20	0.03	-85%
Residual pool depth	0.16	0.82	+413%

Table 26. Tier 3 geomorphic units summary for Tucannon PA-3 calculated from the geomorphic unit tool (GUT) output before (pre-project, 2017) and after 2018 restoration (post-project: 2020). The percent of the total bankfull area is given in parentheses.

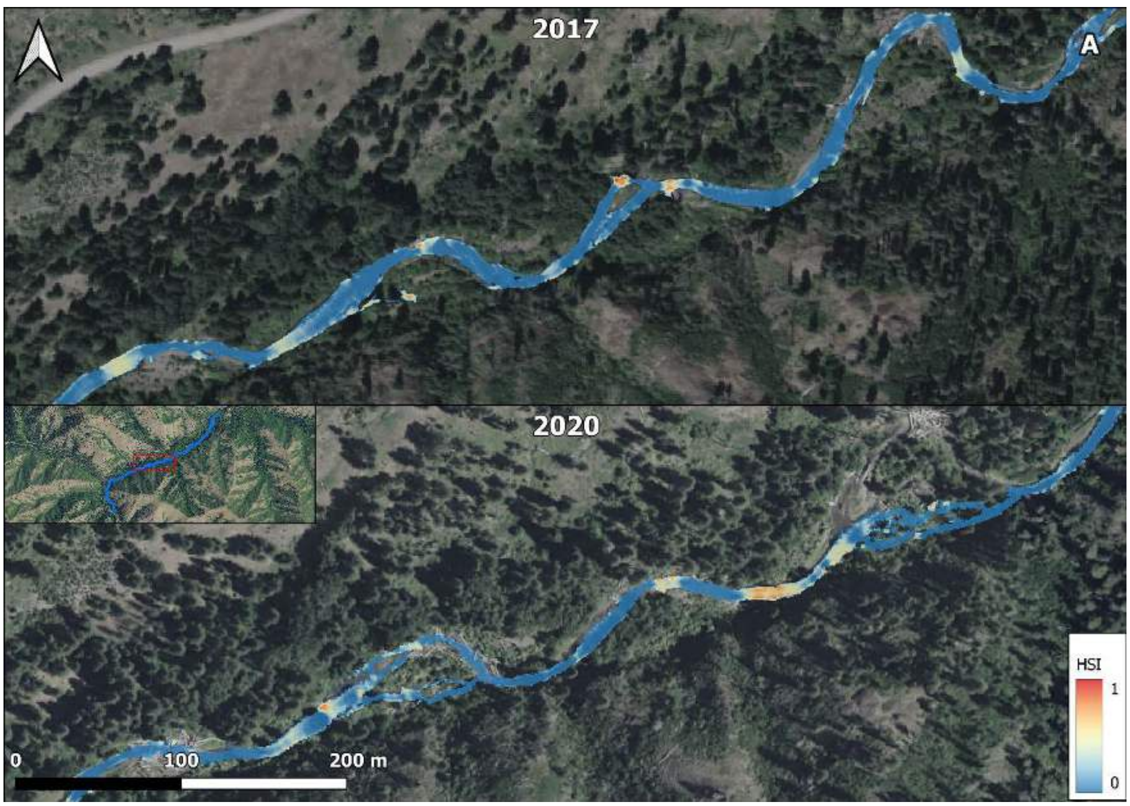
Unit Type	Area (ha)			Count		
	Pre-project	Post-project	Percent change	Pre-project	Post-project	Percent change
Bank	0.18	0.18	0%	283	291	3%
Barface	0.03	0.04	33%	145	158	9%
Cascade	0.01	0.79	7800%	2	173	8550%
Glide-Run	1.64	0.39	-76%	293	81	-72%
Margin Attached Bar	1.12	1.12	0%	497	512	3%
Mid-channel Bar	0.65	0.71	9%	198	188	-5%
Pocket Pool	0.06	0.09	50%	162	268	65%
Pool	0.79	0.59	-25%	229	201	-12%
Rapid	0.1	0.55	450%	41	125	205%
Riffle	0.03	0.01	-67%	7	3	-57%
Transition	1.68	1.8	7%	2348	2,148	-9%
Total	1.68	1.81	8%	803	6988	770%

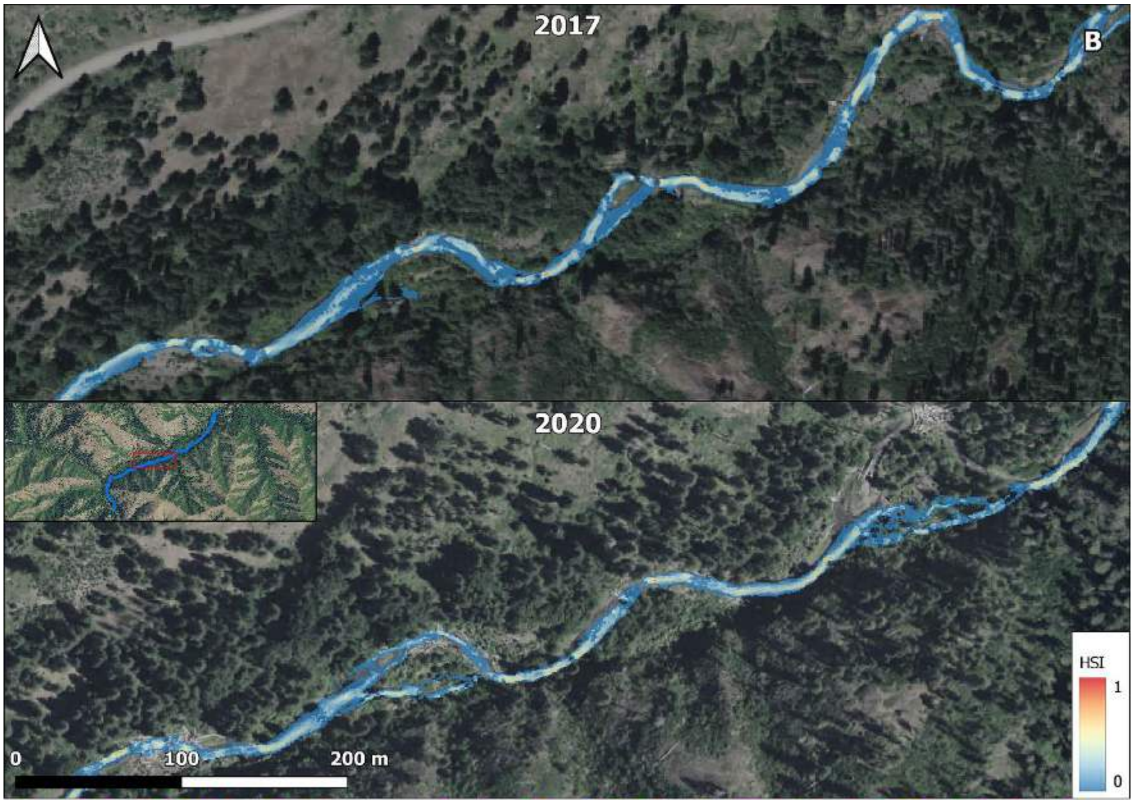
HSI

The geometric mean HSI value increased slightly at Tucannon PA-3 for all species at base flow (Table 27). The WUA at low flow (45 cfs) increased between 2017 and 2020 by 10% for juvenile Chinook, 4% for spawning Chinook, and 0.6% for juvenile steelhead Table 27; Figure 30). The WUA with high HSI values (>0.5) increased by 65%, 39%, and 140% for juvenile Chinook, steelhead, and Chinook spawning, respectively. The geometric mean, which approximates the total proportion of the reach that is suitable habitat, suggests that less than 10% of the habitat was suitable for juvenile Chinook in 2017 or 2020, while 17 or 18% is suitable for juvenile steelhead at low flows.

Table 27. Geometric mean HSI value, 50th and 90th percentiles, and amount of weighted usable area (WUA) of the habitat suitability index by species and life stage at Tucannon PA-3 at low and 2-year flow.

Species and Life Stage	Year	Geometric Mean	50th percentile	90th percentile	WUA (ha)	WUA HSI >0.5
		Low flow (45 cfs)				
Juvenile Chinook	2017	0.08	0.00	0.27	2.17	0.34
	2020	0.09	0.00	0.31	2.39	0.56
Spawning Chinook	2017	0.11	0.05	0.32	3.22	0.10
	2020	0.13	0.06	0.35	3.35	0.24
Juvenile Steelhead	2017	0.17	0.12	0.39	4.76	0.75
	2020	0.18	0.12	0.42	4.79	1.04





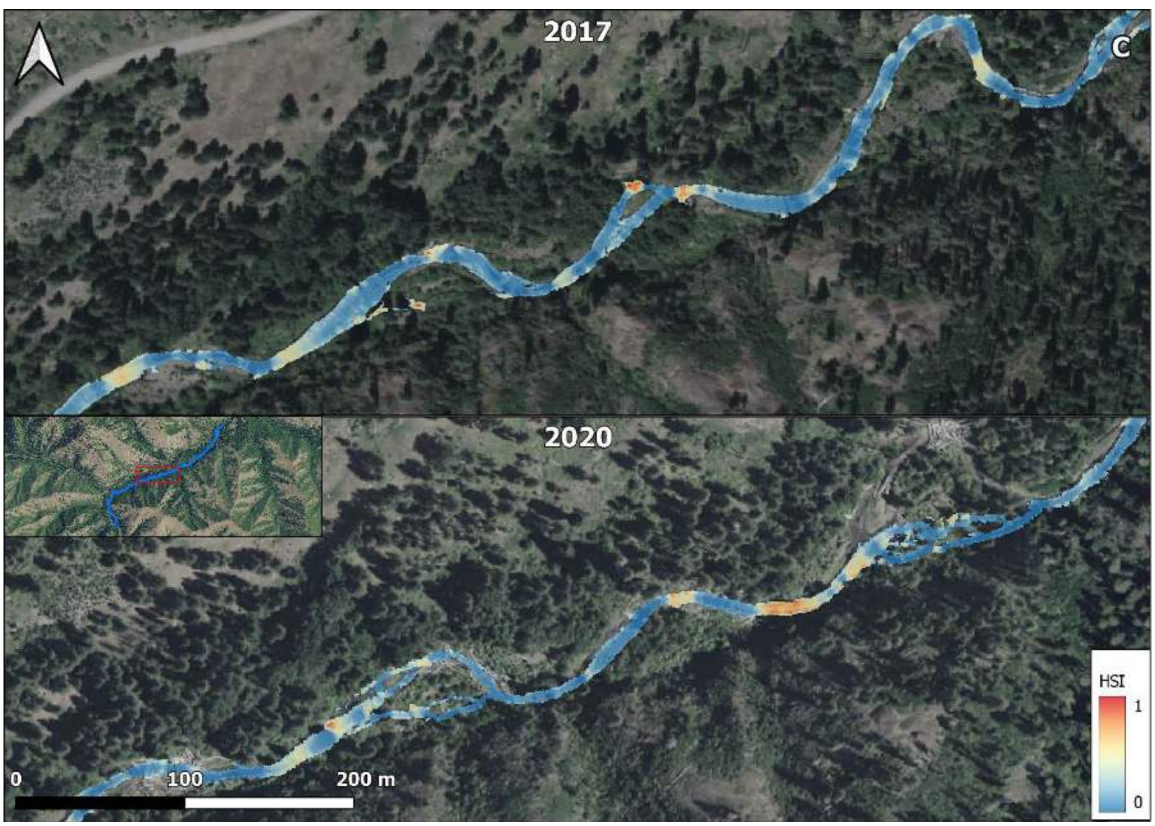


Figure 30. Habitat suitability index results for Tucannon PA-3 at low flow (45 cfs) for juvenile Chinook (A), spawning Chinook (B), and juvenile steelhead (C). Base maps are 2017 (pre-project) and 2021 (post-project) NAIP imagery.

Large wood and sediment

Large wood in the wetted channel increased from 56 to 595 pieces (116%) following restoration, with a slight decrease in wood in the bankfull channel (-7%), and considerable increase in the floodplain (45%) (Table 28). Because large wood placement was the main restoration technique these results are expected, and longer-term monitoring is needed to track wood transport in and out of the reach.

Table 28. Large wood metrics for Tucannon PA-3 estimated from LiDAR and aerial imagery. SRSRB = Snake River Salmon Recovery Board.

Metric	Pre-project (SRSRB)	Post-project (SRSRB)	Pre-project (CFS)	Post-project (CFS)	Percent Change
Question 5: What is the abundance and distribution of large wood in the active channel, wetted channel, and on the floodplain, and how do they change over time? What proportion of the wood is actively interacting with the channel?					
Year	2014	2020	2017	2020	
Data source(s)	Field survey	Field survey	LiDAR; aerial imagery	LiDAR; aerial imagery	
Large wood pieces (wetted)	56	595	38	82	+116%
Large wood pieces (bankfull)	74	441	151	140	-7%
Large wood pieces (floodplain)	142	1098	471	685	+45%
Cumulative count (pieces)	130	1036	189	222	+17%
Count of jams	32	39	15	41	+173%
Large wood frequency (pieces; #/100 m)	5.40	41.75	17.91	26.05	+673%
Large wood frequency (jams; #/100 m)	1.22	1.48	0.57	1.56	+21%

Tucannon PA-3 aggraded by an estimated sediment volume of 31,250 m^3 (Figure 31). The DEM of difference (2017 – 2021) at Tucannon PA-3 indicated that 56% of the project area (33.4 ha) has aggraded, for an estimated total sediment volume of 48,607 m^3. Concurrently, 12% of the project area (6.86 ha) has degraded, or 17,357 m^3 of sediment. The remaining 32% of the project area (19.2 ha) was stable (exhibiting no change in elevation difference). The spatial distribution of the relative elevation change is shown in Figure 31.

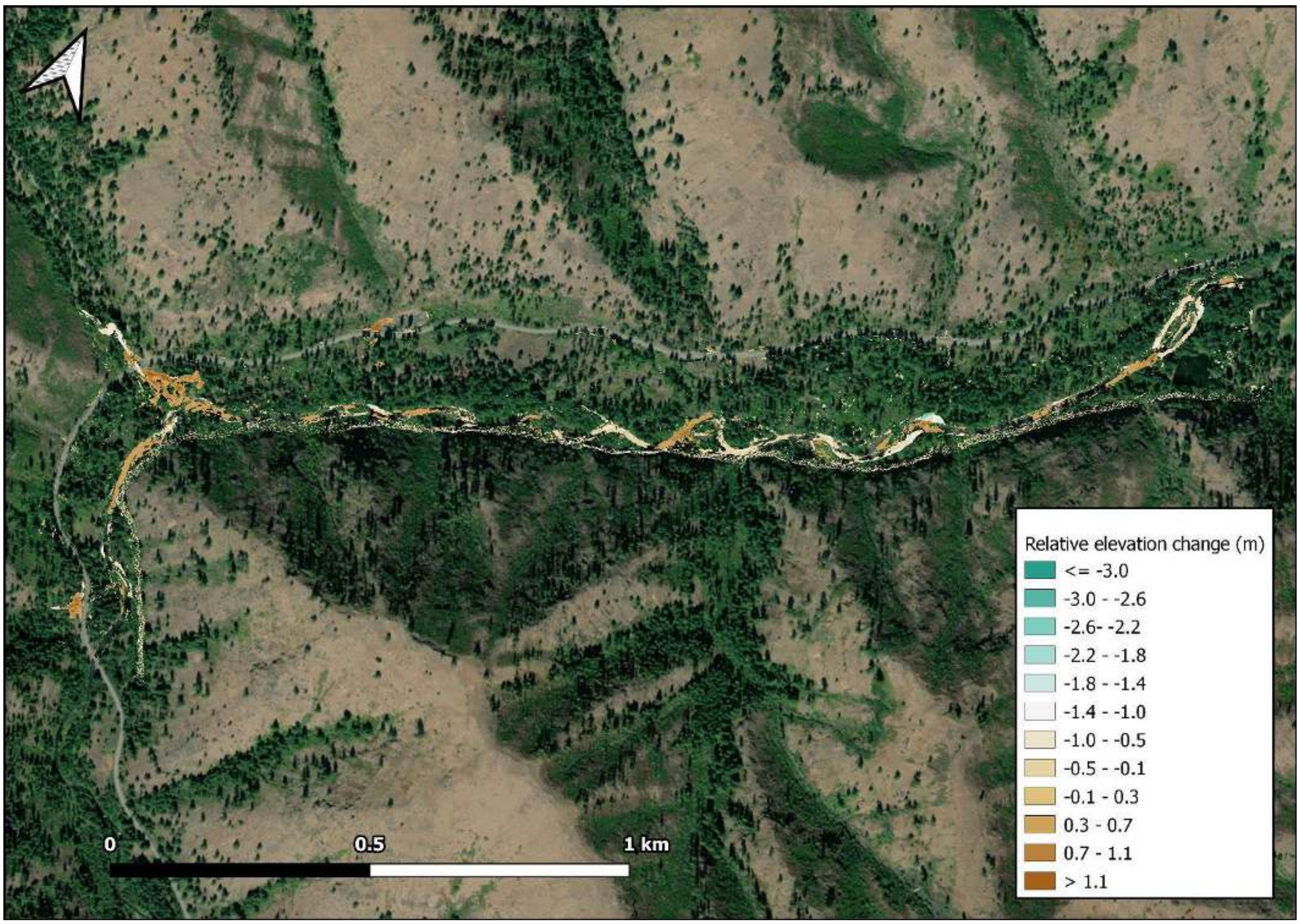


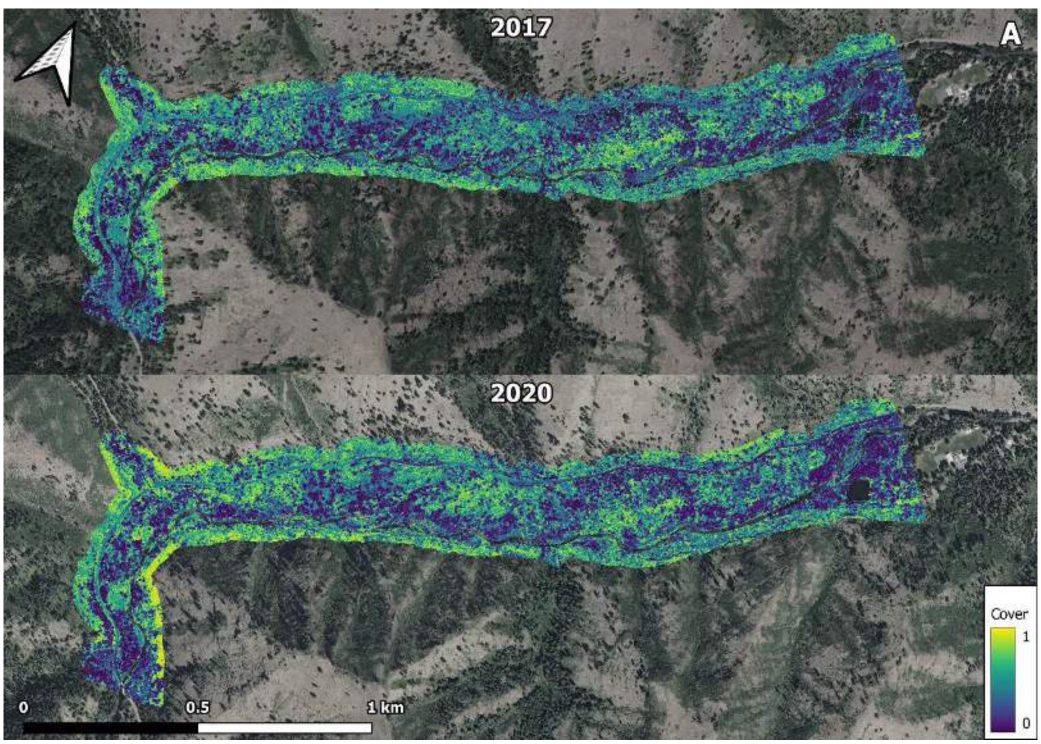
Figure 31. Relative elevation change at Tucannon PA-3 from 2017 to 2020 based on topo-bathymetric LiDAR.

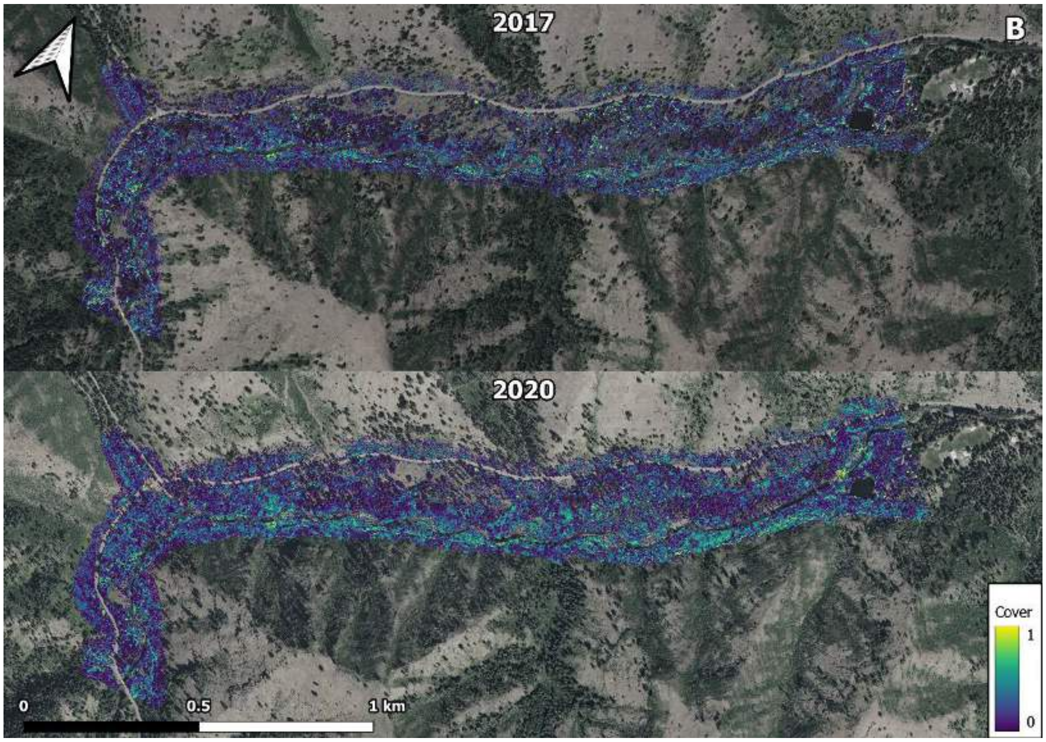
Riparian

The areal extent of riparian vegetation increased at Tucannon PA-3 from 2017 to 2020 across all size classes, with the largest increases occurring the low and mid-story vegetation (Table 29). For example, mid-story vegetation increased from 2.88 ha to 3.94 ha, a 37% increase. Low vegetation covered most of the project area in both years, while mid-story comprised the second largest height category (Figure 32).

Table 29. Summary table of the areal extent of riparian vegetation by class at Tucannon PA-3.

Metric	Pre-project	Post-project	Percent Change
What is the riparian vegetation areal extent by vegetation class (e.g., grasses, forbs, shrubs, trees, etc.), species composition, and density and how much do they change over time?			
Areal extent of low vegetation (ha)	2.88	3.94	+37%
Areal extent of mid-story vegetation (ha)	0.79	1.15	+46%
Areal extent of canopy (ha)	1.64	1.69	+3%





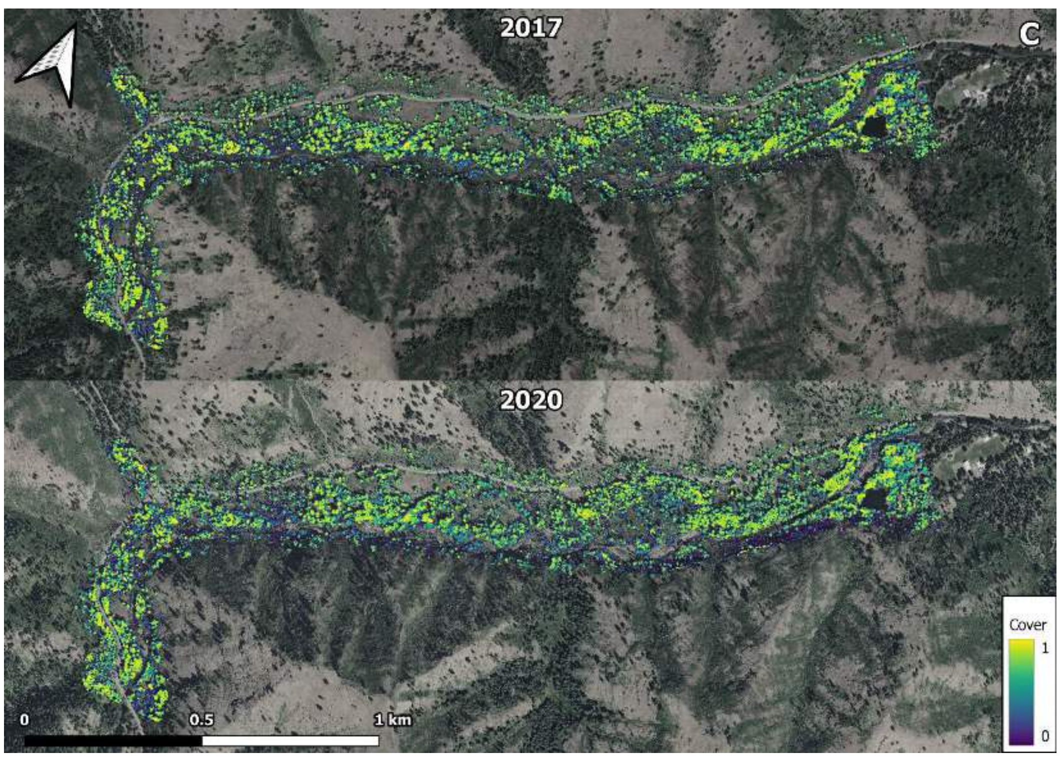


Figure 32. Areal extent of low vegetation (A; LiDAR returns < 1 m), mid-story vegetation (B; LiDAR returns ≥ 1 m and ≤ 5 m), and canopy (C; LiDAR returns > 5 m) at Tucannon PA-3. Colors in each cell represent the proportion of the cell area covered by vegetation in each height class.

The mean LPI over the wetted channel decreased from 0.71 to 0.62 or 13% from 2017 to 2020, indicating an increase in riparian shade, corroborated by an increase in organic inputs (Table 30). Figure 33 shows the change in the spatial distribution of LPI before and after project implementation.

Table 30. Summary of riparian function metrics at Tucannon PA-3.

Metric	Pre-project	Post-project	Percent Change
Question 9: Has riparian/floodplain restoration led to restored riparian function including shade, bank stabilization, and organic matter following riparian restoration?			
Light penetration index (LPI)	0.71	0.62	-13%
Organic inputs (m^3)	25,604	40,499	+58%

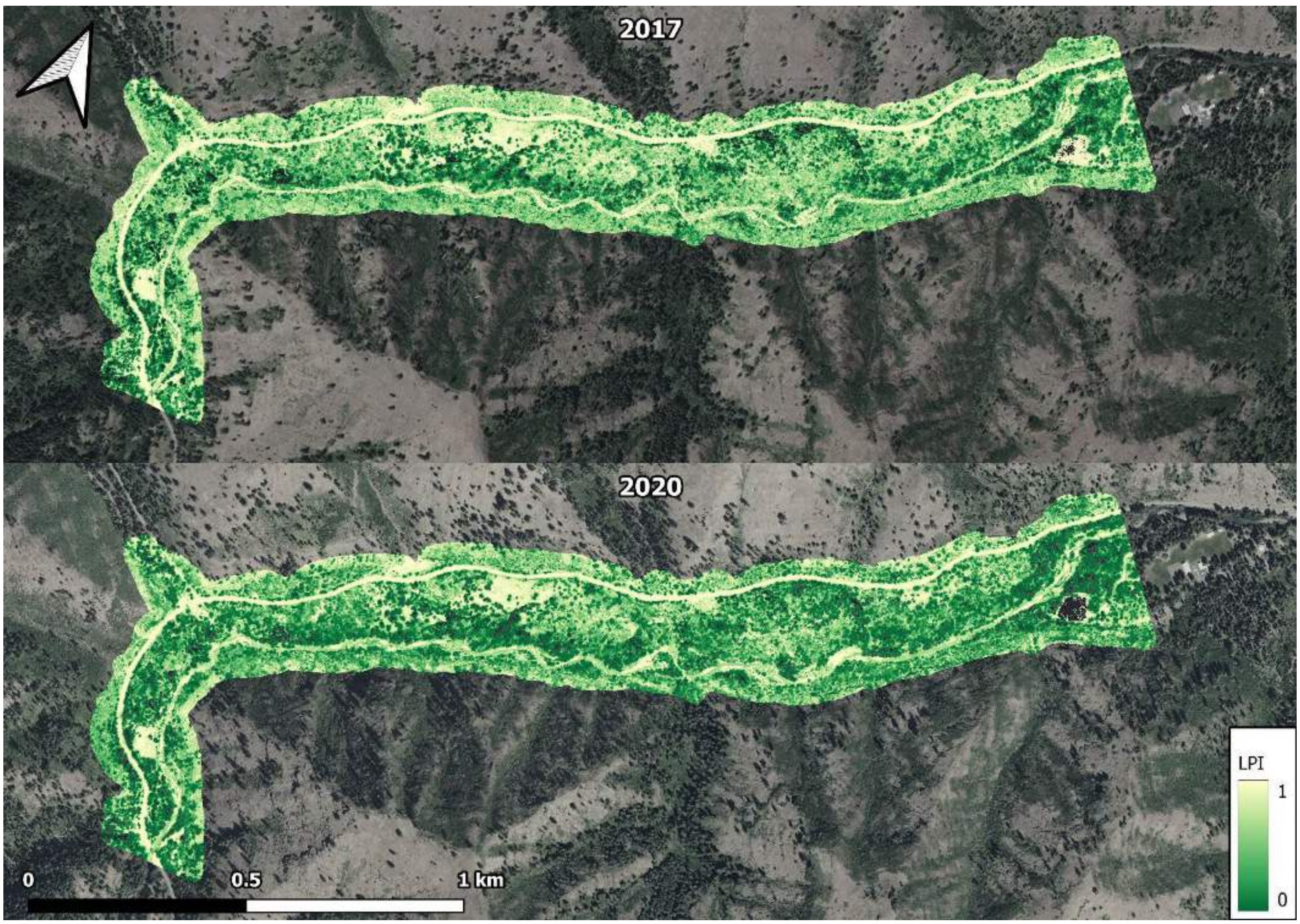


Figure 33. Light penetration index (LPI) proportion of first returns in each cell that are ground points) at Tucannon PA-3.

Design objectives

The restoration goals set for Tucannon PA-3 in the project design documents included two general goals, which were to increase LW to promote habitat complexity and improve stream channel form and function (CTUIR, unpublished data). The second major goal was to increase floodplain connectivity.
The stated goals and objectives lacked detailed quantitative targets in most cases (Table 31). We did not have an as-built survey for the Tucannon project which would have allowed us to evaluate specific design elements in more detail. Regardless, we were able to assess whether the general design objectives were met to date based on our above analysis and by assigning key metrics to each objective. The objective for large wood (Objective 1.1) has been met. It is less clear for pool counts and habitat diversity (Objective 2.1) because of some issues with the bathymetric LiDAR data. The other objectives have been partially met with clear increases in some of the metrics, but not in others (Table 31). While there was a 25-year flow in the spring of 2020, the data we had was only two years after treatment (2018). Thus, additional changes have likely occurred and will occur in the future, which may warrant additional data collection and analysis. As noted previously, our analysis does not examine changes for the 2014 restoration work, but only those changes for restoration work that occurred in 2018.

Table 31. List of relevant goals and objectives listed in the Tucannon PA-3 as-built design documents (CTUIR, unpublished data), monitoring metrics used to evaluate objectives, and whether the objective was fully met (Yes), partially met (Partial), or uncertain (Uncertain). LW = large wood.

Goals and Objectives	Monitoring Metric(s)	Objective Met?
Goal 1: Increase LW for habitat complexity and to improve stream channel form and function		
Objective 1.1: Increase LW densities to > 2/bankfull width.	Large wood counts, large wood frequency	Yes
Goal 2: Increase proper floodplain structure/connectivity through supplemental wood placements		
Objective 2.1: Force pools and hydraulic variability in plane-bed sections through wood placement.	Pool counts, habitat diversity	Uncertain
Objective 2.1: Decrease instream velocities, provide additional hydraulic complexity in deep incised sections, and promote a more complex channel.	Percent pool area, RCI	Partial
Objective 2.3: Restore habitat function, improve channel structure and complexity, promote floodplain connectivity, and reactivate historic side-channels.	HSI, braiding parameter, RCI, floodprone area, floodprone inundation index, side channel metrics.	Partial

Objective 2.4: Support retention of additional LW and induce aggradation of the bed over-time increasing floodplain connection, easing channel confinement, and promoting channel migration within the reconnected floodplain area during high flows.	Sediment aggradation/degradation, channel confinement, channel migration	Partial

DISCUSSION AND RECOMMENDATIONS

The results of this pilot study demonstrated that most of the floodplain monitoring metrics we proposed to calculate in the Study Plan can be obtained with remote sensing. For example, on the Countyline and Tucannon PA-3 projects, which were previously completed, all metrics were calculated with remote sensing, except those that currently require field data (i.e., riparian species richness and diversity). Out of 29 metrics outlined in the original Study Plan, 25 could be quantified using LiDAR, hydraulic modeling, and aerial imagery. Some metrics, including riparian species richness and diversity, will likely continue to require field surveys to obtain. Moreover, the resolution (typically ≥ 10 measurements per m^2) and spatial coverage of LiDAR (virtually the entire project area) offers clear advantages over field surveys for quantifying geomorphic, floodplain, and riparian conditions. While many floodplain and channel morphology metrics can be obtained with remote sensing, other metrics will benefit from limited field data to validate and refine calculations from remotely sensed data. These include fish- habitat, large wood, HSI modeling, and riparian species composition. Based on the pilot study, we also provide recommendations for LiDAR acquisition, as-built surveys, and site selection. Responses to questions posed by the monitoring panel in the original RFQQ are provided in Appendix 1.

Fish habitat

The Study Plan called for conducting fish-habitat surveys before and after restoration. Fish habitat unit surveys were requested from each of the project sponsors; however, only one project (Upper/Lower Fobes) had complete fish-habitat survey data similar to that outlined in the Study Plan. Classifying habitat units in small streams from thalweg field surveys is a well-known, replicable method (Mossop and Bradford 2006; Clark et al. 2019). Therefore, we developed a fish-habitat classification method that uses a series of algorithms to detect instream fish habitat units from the longitudinal profile of a DEM derived thalweg down the mainstem and side-channels. Our algorithms appear to accurately classify pools based on the shape of the longitudinal profile and a residual pool depth criterion. However, additional data and fine tuning to the algorithms are required to improve its ability to distinguish glides from riffles. Most notably, data from larger rivers are needed. Issues with the quality of the LiDAR, discussed below, can also limit the utility.

Large wood

Enumerating large wood using only remotely sensed data worked well on the Entiat River (Roni et al. 2020a) but presented challenges at other sites. The protocol in the Study Plan called for using aerial imagery, which is suitable for counting and measuring wood in the active channel or at sites with comparatively open tree canopy, such as some areas in eastern Washington. However, it is difficult to map wood from aerial imagery on the floodplain, particularly under dense canopy typical in western Washington and some areas of eastern Washington. Furthermore, high quality aerial imagery is not universally available at all sites for all years. For example, the National Agriculture Imagery Program (NAIP) collects 1 m^2 resolution imagery across the United States. Even at 1 m^2 resolution, the ability to accurately identify large wood, even under open canopy, can be hampered. Furthermore, imagery is collected on a 3-year cycle, meaning that pre- and post-project imagery may not always be available for the appropriate monitoring years.

To address these challenges, we tested a method that combines LiDAR and aerial imagery to detect and count large wood at each pilot site. While we successfully used methods described in Joyce et al. (2019) and Kuiper et al. (2022), we did not explicitly validate our wood counts against field observations. However, the ability for LiDAR to detect and count large wood is dependent on pulse density (i.e., the quality of the LiDAR) (Magnusson et al. 2007; Joyce et al. 2019). Pulse density is defined by the number of pulses emitted per unit area, as measured by the footprint spacing along scanning lines (Gatziolis and Andersen 2008). Distinct from the return density, which can vary depending on the target being scanned (e.g., canopy can result in a single pulse generating multiple returns), pulse density is the only consistent measure of LiDAR quality (Gatziolis and Andersen 2008). Pulse density can be affected by laser scanner specifications and choices made during the LiDAR acquisition. Increasing altitude or flight speed to save costs, for example, can result in a lower pulse density (Magnusson et al. 2007). For reference, the USGS 3D Elevation Program, a national repository for high quality LiDAR data, sets minimum standards for inclusion at ≥ 2 pulses/m^2 (Heidemann 2012). Low pulse densities can limit the ability to distinguish true large wood features from low brush and understory. Joyce et al. (2019) tested the ability of LiDAR to detect known large wood pieces in forest plots using high density ($\geq$24 pulses/m^2) LiDAR and successfully detected 23% of the large wood present; however, detection probability plateaued at 16 pulses/m^2. In a similar study, Jarron et al. (2021) successfully detected 64%

of measured large wood in circular forest plots from LiDAR (10 pulses/m^2 average pulse density). While most of the LiDAR used in our study exceeded 16 pulses/m^2, the pre-project pulse density at the Countyline reach was 1.2 pulses/m^2. Pre- and post-project LiDAR should be of similar quality to make valid comparisons; therefore, LiDAR derived pre-project floodplain wood counts at Countyline should be viewed with caution.

Given the challenges with using LiDAR to enumerate large wood, it may be more appropriate to view LiDAR derived large wood counts as an index of abundance rather than a true number. Nonetheless, LiDAR still provides some advantages over other methods, most notably is the ability to detect large wood instream and under canopy. Further, if the pre- and post-project LiDAR are of similar and acceptable quality, valid comparisons can still be made to assess the direction and magnitude of change. Supplemental field surveys, potentially done concomitantly with riparian vegetation surveys, could help validate and correct LiDAR counts. Wood counts could be incorporated into the riparian surveys as a method for validating remotely sensed estimates of large wood. Regardless, wood placement was a key design component in all projects we evaluated for this study; therefore, it should be expected that large wood counts will increase in the immediate years following restoration. Long-term monitoring of wood (>10 years) and its function (interaction with active channel) is ultimately required to determine success for wood loading projects.

Riparian surveys

We performed riparian surveys on the South Fork Nooksack in the summer of 2022, prior to restoration of the Lower Fobes site, with the primary goal of validating the remote sensing-derived riparian metrics and identifying species composition. We collected species and cover data to test and refine methods.
After analyzing and processing these data along with the remote sensing data, we have several recommendations for future data collection efforts. The Study Plan aimed to evaluate the impact of floodplain restoration on the total area of riparian vegetation, species composition, density, and function. We demonstrated that vegetation area and height can be derived from the LiDAR, with field surveys being used primarily for validation and to calculate species richness and diversity.

Given the goals of the riparian monitoring in the Study Plan and our observations at pilot sites, we recommend some modifications to the riparian monitoring protocol. Rather than one transect every hundred meters, which would have resulted in more than 20 transects on both sides of the river at the Upper/Lower Fobes site, we recommend delineating ten equally spaced transects, with equal transect lengths determined by the planting extent, throughout the project area. Within each 2 m belt transect, we recommend identifying the woody species present, estimating the dominant species, and evaluating the percent of transect covered by the three height classes of native and invasive vegetation. By streamlining field surveys to only collect data needed to validate LiDAR and identify species present, we can meet the goals of the study and subsequently allow for more time to perform in-depth analyses or additional monitoring visits. As noted in the large wood section, one addition to the protocol would be to enumerate large wood in each transect to use in validation of wood counts from LiDAR and aerial imagery. In addition, while bank stability was one of the riparian metrics, it was not available at Countyline or Tucannon PA-3. It is likely not an appropriate metric at most floodplain restoration sites as they are often promoting erosion deposition and channel migration. Thus, the inclusion of bank stability as a metric is likely only appropriate at sites with a history of agriculture or grazing.

Habitat suitability

The modeling of habitat suitability provides an index of the amount of suitable habitat for a given species and life-stage and is a useful tool for both designing and evaluating restoration. While HSI is correlated with fish abundance, it is not a direct measure (Gallagher and Gard 1999; Boavida et al. 2013; Railsback et al. 2017; Wheaton at al. 2018; Roni et al. *in press*). Furthermore, HSI results are both sensitive to, and carry forward, the assumptions of the hydraulic model and the habitat suitability curves used as inputs. Methods continue to be developed to improve hydraulic model representation of the channel and channel roughness (large wood), but most HSI modeling continues to use habitat preferences curves developed in other streams many decades ago. The selection of the preference curves in the HSI modeling process can influence the HSI values and amount of suitable habitat (Railsback 2017; Roni et al. In press). For our HSI modeling we used depth and velocity preference curves Maret et al. (2006) and Raleigh et al. (1984), which are some of the more commonly used curves. Ideally, one collects river-specific habitat preference data and develops sites specific criteria curves for HSI modeling, though it is rarely done. Thus, a simple recommendation to improve HSI modeling would be to collect site-specific depth and velocity preference data for species of interest and develop habitat suitability curves specific to each river or site. This would likely require a rather limited field effort to observe fish and collect depth, velocity, and other data at each site. Data could also be collected at a couple of key flows and seasons to improve the accuracy of HSI values; this has rarely been done (existing preference curves are not flow specific), but would require a larger field effort.

LiDAR acquisition

It is important that green LiDAR be collected under ideal conditions (Countyline case in point), otherwise many floodplain monitoring metrics will be biased or inaccurate. The ideal time for green LiDAR data collection is just after leaf-off and before any fall rains (western Washington). However, collecting LiDAR during leaf-off will underestimate the amount of canopy cover, shade, and organic inputs. The post-project LiDAR for Countyline was collected in April when flows were above 1500 cfs. Because the White River is glacially fed, winter and spring represent periods of potential high-water clarity and low flow, while summer flows are high and extremely turbid. However, it appears that slight turbidity during the 2022 LiDAR acquisition may have resulted in poor penetration through the water column. We also saw issues with LiDAR on the Tucannon where the LiDAR did not penetrate logjams and thus did not accurately map bathymetry and pools in areas with channel spanning logjams.

In general, LiDAR contractors do not collect bathymetric validation data in water deeper than 90 cm and while their models may appear accurate, additional ground truthing is often needed. The LiDAR report for the Countyline project had indicated good penetration in all but a few very deep locations, so our field survey focused on those areas. However, our field survey data suggested that the LiDAR based DEM was inaccurate for much of the deep (>1.5 m areas of the channel). Green LiDAR can accurately map the bathymetry in medium to large sized rivers with clear water at low flow and we have seen this on other larger rivers such as the Entiat and Bogachiel. However, for large and deep rivers with persistently high turbidity, a more exhaustive supplemental bathymetric field survey should be conducted. One option would be to continue to use field surveys to classify fish habitat data while collecting additional bathymetric data simultaneously to fill in any potential holes in the LiDAR data due to depth, turbidity, or logjams that cover entire channel in smaller channels.

As-built surveys

We did not have as-built surfaces for either Countyline or Tucannon PA-3. Moreover, the design criteria in the basis of design reports for these two projects was general and lacked specific targets Thus, we recommend that project sponsors define the expected change in key metrics (low, medium, or high) for each restoration project prior to or during the project implementation phase. This will ensure that specific design elements can be properly evaluated to determine if restoration targets were met and will provide guidance on future project designs (Table 32). Requesting that sponsors provide a list of specific project design criteria would support consistency among projects and allow for the development of a concise “report card” for each project. A one to two page report card could be prepared to quickly convey project results and successes and lessons learned to project sponsors, managers, and other interested parties. There are detailed design criteria for the Middle Entiat project and we will provide additional recommendations for as-built surveys in that report. We worked closely with the Lummi Tribe to collect as-built survey data for the Upper/Lower Fobes project, which was largely successful. However, it is important that as-built survey protocols are consistent among projects. Further, while many contracts for restoration projects require as-built design sheets, they do not provide the level of detail needed for monitoring. Therefore, the as-built surveys should be collected as part of the monitoring program, rather than relying on the sponsor or their contractor to collect the data.

Table 32. Example of setting project targets for monitoring metrics that will help coordinate goal setting at the design phase and allow evaluation of those targets during monitoring. L = < 25% change, M = 25% to 50% change, H = > 50% change. All metrics, except riparian metrics, are assumed to change within 3 to 5 years or following channel-forming high flow events (≥ 2-year flow for more than 24 hours). Riparian metrics may take 5 to 10 years or more. Monitoring questions were outlined in Table 2.

Metric (Monitoring question number)	Expected Change
Floodplain area (1)	M
Floodplain inundation index (1)	M
Area altered (1)	M
Active channel zone (2)	H
GUT (2)	H
Side channel metrics (3)	H
Pond/wetland area (3)	L
Sinuosity (3)	L
Bankfull width and depth (3)	M
RCI (3)	H
MQI (3)	M
Pool area, ratio, percentage (4)	H
Shannon diversity index (4)	H
Large wood metrics (5)	H
Sediment deposition and storage (6)	M
DEM of difference (6)	H
WUA spawning (7)	M
WUA rearing (7)	H
Areal vegetation extent by class (8)	M
Riparian composition, richness, diversity, and density (8)	M
Bank stability (9)	L
Shade (Light Penetration Index) (9)	H
Organic inputs (9)	M

Site selection

We worked closely with the Monitoring Panel to select pilot sites. The criteria we considered included: year of implementation; availability of pre-project green LiDAR, DEM, and hydraulic model; project size (> 1 km of mainstem), and landowner access or willingness. These are still key considerations in site selection. Based on our experience with the pilot project, we have several recommendations for selection of future sites. First, as far as the size of projects, one kilometer of mainstem channel length is sufficient, assuming that the entire length or project area is restored. If only parts of a reach are restored, which is fairly common, a mainstem length closer to two kilometers would be appropriate to justify the cost of acquiring the remotely sensed data. However, it should be noted that the methods detailed in this report can be used on almost any size project, including projects only a few hundred meters in length. Smaller projects may not warrant using a fixed winged aircraft to collect green LiDAR and it might be more cost effective to use a drone-based near-infrared LiDAR for small sites with a supplemental field survey to obtain bathymetry. The Study Plan provides a summary of cost trade-offs between drone based near infrared LiDAR and fixed wing green LiDAR acquisition and at what site size each is warranted (Roni et al. 2020b). Most drone-based LiDAR sensors emit on the near-infrared spectrum, which does not penetrate water. This may change in the next five years as it is likely that reliable and economical green LiDAR sensors that can be deployed with a drone will become available. Another consideration is the width of the project and floodplain. Again, almost any size project can be evaluated with remote sensing techniques, but projects with narrow floodplains or very small streams will show limited change in side channels and floodplain area.

Second, the original Study Plan calls for selection of yet to be implemented floodplain and riparian projects, with data collection before and after restoration and an abbreviated as built survey. We included two completed projects that had green LiDAR available. While we were able to calculate most metrics for these sites, considerable time was spent acquiring existing data including the LiDAR data, hydraulic model outputs, and other information. It would be easier to select sites that are scheduled for restoration so that we could work with project sponsors to acquire the necessary pre-project data, design documents, and goals. Further, by being involved throughout the entire project timeline, we could provide guidance and ensure collection of pre-project and as-built data will be suitable for addressing restoration goals. If additional completed projects are included in the program, allocating time for additional coordination and data summarization will be beneficial.

Moreover, many projects are using wood placement to improve instream conditions and reconnect the main channel with the floodplain. Thus, there is the potential for projects that are primarily wood placement and instream habitat projects to be classified as floodplain restoration projects when, in fact, there may be little actual effect on floodplain monitoring metrics. Confirming that a wood placement project is truly designed to restore the floodplain should occur during the site selection process.

Highly modified stream reaches (e.g., Countyline) presented some challenges for quantifying classic floodplain monitoring metrics. We relied on hydraulic models to simulate a bankfull flow and assumed a 2-year flood recurrence interval would represent bankfull flow. However, hydraulic modeling suggested that a 2-year flow at Countyline would overtop the banks and inundate most of the available floodplain. As such, many classic monitoring metrics (e.g., side channel metrics) could not be calculated at bankfull flow at the Countyline project. However, it should be noted this was not an issue on any of the other pilot sites, and unique to highly modified sites or sites with set-back levees. If additional sites with highly modified floodplains and hydrology are selected in the future, developing a consistent approach for selecting appropriate flows to calculate key floodplain metrics would be beneficial

SUMMARY

The pilot study demonstrated that, with minor modifications, the Study Plan metrics can be accurately calculated with remotely sensed data and limited field data. Moreover, the proposed metrics can be used to monitor and evaluate changes in floodplain, geomorphology, habitat, riparian, and fish-habitat conditions and suitability due to restoration. We provide the following recommendations based on the results of the pilot study:

- The quality and timing of green LiDAR collection are important for accurate and consistent calculation of metrics before and after restoration.
- Supplemental field data collection of bathymetric and fish-habitat data will be needed at some sites due to depth, turbidity or large wood jams that may prevent accurate mapping of bathymetry with green LiDAR.
- The intensity of the riparian field survey proposed in the Study Plan can be reduced because some metrics can be mapped with LiDAR, but riparian field surveys are still needed for some riparian metrics.
- Large wood can be enumerated using remote sensing techniques, but mapping floodplain wood during riparian surveys should be used to correct remotely sensed wood counts.

- The collection of site-specific habitat preference data for key fish species and life stages could be used to improve HSI mapping at various flows.
- As-built surveys and evaluation of design criteria for each site would benefit from consistent design criteria and matrix across projects.
- In addition to standard reporting, a brief two-page project report card should be developed for each project evaluated to quickly convey results and lessons learned to a broad audience.
- The methods in the Study Plan can be used on completed projects if appropriate data are available, but the pilot study demonstrated variability in data quality across project sponsors and years. Thus, ideally selection of new sites should focus on projects that are not yet implemented or will be implemented in 2023 or beyond to allow collection of data of consistent quality before and after restoration.
- Finally, while the methods are most efficient at large projects covering more than one or two kilometers, they could be used on smaller projects, though it may not be as efficient or cost-effective.

REFERENCES

Akay, A., M. Wing, and J. Sessions. 2012. Estimating structural properties of riparian forests with airborne lidar data. International Journal of Remote Sensing 33:7010–7023.

Bangen, S., N. Kramer, J. M. Wheaton, and N. Bouwes. 2017. The GUTs of the Geomorphic Unit Tool (GUT): what is under the hood. 2017 AGU Fall Meeting.

Beechie, T. J., O. Stefankiv, B. Timpane-Padgham, J. E. Hall, G. R. Pess, M. L. M. Rowse, K. Fresh, and M. J. Ford. 2017. Monitoring salmon habitat status and trends in Puget Sound: development of sample designs, monitoring metrics, and sampling protocols for large river, floodplain, delta, and nearshore environments. National Oceanic and Atmospheric Administration.

Bigley, R. E., and F. U. Deisenhofer. 2006. Implementation procedures for the habitat conservation plan riparian forest restoration strategy. DNR Scientific Support Section, Olympia, WA.

Boavida, I., J. M. Santos, C. Katopodis, M. T. Ferreira, and A. Pinheiro. 2013. Uncertainty in predicting the fish-response to two-dimensional habitat modeling using field data. River Research and Applications 29(9):1164-1174.

Bode, C. A., M. P. Limm, M. E. Power, and J. C. Finlay. 2014. Subcanopy solar radiation model: predicting solar radiation across a heavily vegetated landscape using LiDAR and GIS solar radiation models. Remote Sensing of Environment 154:387–397.

Brown, A. G. 2002. Learning from the past: paleohydrology and paleoecology. Freshwater Biology 47:817–829.

Brown, M., and M. Maudlin. 2007. Upper South Fork Nooksack River habitat assessment. Lummi Nation Natural Resources Department, 04-1487N, Bellingham, WA.

Castro, J. M., and P. L. Jackson. 2001. Bankfull discharge recurrence intervals and regional hydraulic geometry relationships: patterns in the Pacific Northwest, USA. Journal of the American Water Resources Association 37:1249–1262.

Clark, C., P. Roni, and S. Burgess. 2019. Response of juvenile salmonids to large wood placement in Columbia River tributaries. Hydrobiologia 842(1):173–190.

Clark, C., P. Roni, J. Keeton, and G. Pess. 2020. Evaluation of the removal of impassable barriers on anadromous salmon and steelhead in the Columbia River Basin. Fisheries Management and Ecology 27(1):102-110.

Elzinga, C. L., D. Salzer, J. W. Willoughby, and J. R. Gibbs. 2001. Monitoring plant and animal populations: a handbook for field biologists. Bureau of Land Management, Technical Document 1730–1, Denver, CO.

Foltz, J., and K. Buelow. 2019. Tucannon River programmatic annual report. Snake River Salmon Recovery Board, Annual Progress Report 2010-077–00, Dayton, WA.

Friend, P. F., and R. Sinha. 1993. Braiding and meandering parameters. Geological Society, London, Special Publications 75(1):105–111.

Gallagher, S. P., and M. F. Gard. 1999. Relationship between Chinook salmon (*Oncorhynchus tshawytscha*) redd densities and PHABSIM - predicted habitat in the Merced and lower American rivers, California. Canadian Journal of Fisheries and Aquatic Sciences 56(4):570-577.

Gatziolis, D., and H.-E. Andersen. 2008. A guide to LiDAR data acquisition and processing for the forests of the Pacific Northwest. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, General Technical Report PNW-GTR-768.

Göthe, E., A. Timmermann, K. Januschke, and A. Baattrup-Pedersen. 2016. Structural and functional responses of floodplain vegetation to stream ecosystem restoration. Hydrobiologia 769(1):79–92.

Harris, R. R. 2005. Monitoring the effectiveness of riparian vegetation restoration. College of Forestry, University of California, Berkeley, Agreement No. 09219566, Berkeley, CA.

Heidemann, H. K. 2012. Lidar base specification. Report 11-B4, Reston, VA.

Herrera Environmental Consultants Inc. 2012. Hydraulic modeling approach and initial modeling results technical memorandum: White River at Countyline Levee Setback Project. King County Department of Natural Resources and Parks, Seattle, WA.

Herrera Environmental Consultants Inc. 2014. Basis of design report: White River at Countyline Levee Setback Project. King County Department of Natural Resources and Parks.

Herrera Environmental Consultants Inc. 2021. Hydraulic modeling and geomorphic response assessment. King County Department of Natural Resources and Parks, Seattle, WA.

Jarron, L. R., N. C. Coops, W. H. MacKenzie, and P. Dykstra. 2021. Detection and quantification of coarse woody debris in natural forest stands using airborne LiDAR. Forest Science 67(5):550– 563.

Joyce, M. J., J. D. Erb, B. A. Sampson, and R. A. Moen. 2019. Detection of coarse woody debris using airborne light detection and ranging (LiDAR). Forest Ecology and Management 433:678–689.

Kuiper, S., N. C. Coops, P. Tompalski, S. G. Hinch, A. Nonis, J. C. White, J. Hamilton, and D. J. Davis. 2022. Characterizing stream morphological features important for fish habitat using airborne laser scanning data. Remote Sensing of Environment 272:112948.

Kurko, K. W. 1977. Investigations on the amount of potential spawning area available to chinook, pink, and chum salmon in the upper Skagit River, Washington. M.S. thesis, University of Washington, Seattle, WA.

Laslier, M., L. Hubert-Moy, and S. Dufour. 2019. Mapping riparian vegetation functions using 3D bispectral LiDAR data. Water 11:483.

Leopold, L. B. 1994. A view of the river. Harvard University Press, Cambridge, MA.

Lisle, T. E. 1987. Using "residual depths" to monitor pool depths independently of discharge. U.S. Forest Service, Pacific Southwest Forest and Range Experiment Station, Note PWN-RN-394, Berkeley, CA.

Magnusson, M., J. E. S. Fransson, and J. Holmgren. 2007. Effects on estimation accuracy of forest variables using different pulse density of laser data. Forest Science 53(6):619–626.

Maret, T. R., J. E. Hortness, and D. S. Ott. 2006. Instream flow characterization of upper Salmon River basin streams, central Idaho, 2005. U.S. Geological Survey, Scientific Investigations Report 2006–5230.

Merrit, D. M., M. E. Manning, and N. Hough-Snee. 2017. The national riparian core protocol: a riparian vegetation monitoring protocol for wadeable streams of the conterminous United States. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-367, Fort Collins, CO.

Mossop, B., and M. J. Bradford. 2006. Using thalweg profiling to assess and monitor juvenile salmon (*Oncorhynchus* spp.) habitat in small streams. Canadian Journal of Fisheries and Aquatic Sciences 63:1515–1525.

Mulvey, M., L. Caton, and R. H. Hafele. 1992. Oregon nonpoint source monitoring protocols and stream bioassessments field manual for macroinvertebrates and habitat assessment. Oregon Department of Environmental Quality, Laboratory Biomonitoring Section, Portland, OR.

NV5. 2021. Tucannon River, Washington topobathymetric LiDAR technical data report. NV5 Geospatial, Corvallis, OR.

NV5. 2022. Lower White and Middle Green rivers, Washington 2022. NV5 Geospatial, Corvallis, OR.

Pleus, A., D. Schuett-Hames, and L. Bullchild. 1999. TFW monitoring program method manual for the habitat unit survey. Washington State Department of Natural Resources, TWF-AM9-99003.

QGIS Development Team. 2022. QGIS geographic information system. QGIS Association.

QSI. 2018. Tucannon River, Washington topobathymetric LiDAR technical data report. Page 27. Quantum Spatial, Corvallis, OR.

R Core Team. 2020. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

Railsback, S. F. 2017. Why it is time to put PHABSIM out to pasture response to comments 1 and 2. Fisheries 42(10):517-518.

Raleigh, R. F., T. Hickman, R. C. Solomon, and P. C. Nelson. 1984. Habitat suitability information: rainbow trout. U.S. Fish and Wildlife Service, Biological Report 82(10.60).

Rinaldi, M., N. Surian, F. Comiti, and M. Bussettini. 2013. A method for the assessment and analysis of the hydromorphological condition of Italian streams: the morphological quality index (MQI). Geomorphology 180–181:96–108.

Rinaldi, M., B. Belletti, F. Bussettini, B. Comiti, B. Golfieri, E. Lastoria, E. Marchese, L. Nardi, and N. Surian. 2017. New tools for the hydromorphological assessment and monitoring of European streams. Journal of Environmental Management 202(Part 2):363–378.

Rockhill, T, J. Kvistad, and P. Roni. 2022. Updated hydrologic analysis - County Line levee setback project. Memo to King County Department of Natural Resources. Cramer Fish Sciences, Issaquah, WA.

Roni, P. M. J. Camp, K. Connelly, K. Ross, and H. Berge. In press. A comparison of methods for estimating juvenile salmon carrying capacity to assist with restoration planning and evaluation. Transactions of the American Fisheries Society.

Roni, P., C. Clark, R. Camp, and D. Arterburn. 2020a. Middle Entiat restoration effectiveness monitoring pilot project. Cramer Fish Sciences, Issaquah, WA.

Roni, P., C. Clark, K. Ross, M. Krall, J. Hall, and R. Brown. 2020b. Using remote sensing and other techniques to assess and monitor large floodplain and riparian restoration projects. State of Washington Recreation and Conservation Office, Olympia, WA.

Rosgen, D. L. 1994. A classification of natural rivers. Catena 22:169–199.

Rosgen, D. L. 1996. Applied river morphology, 2nd edition. Wildland Hydrology, Fort Collins, CO.

Roussel, J. R., D. Auty, N. C. Coops, P. Tompalski, T. R. H. Goodbody, A. S. Meador, J. F. Bourdon, F. de Boissieu, and A. Achim. 2020. lidR: An R package for analysis of airborne laser scanning (ALS) data. Remote Sensing of Environment 251:112061.

Runkle, E. 2016. Systematic approach to a GIS concluding with an accuracy approach. Geospatial Technologies Program, Mesa Community College, Mesa, AZ.

Shannon, C. E. 1948. A mathematical theory of communication. Bell System Technical Journal 27:379–423.

Silva, C. A., A. T. Hudak, L. A. Vierling, E. L. Loudermilk, J. J. O’Brien, J. K. Hiers, S. B. Jack, C. Gonzalez-Benecke, H. Lee, M. J. Falkowski, and A. Khosravipour. 2016. Imputation of individual longleaf pine (*Pinus palustris* Mill.) tree attributes from field and LiDAR data.
Canadian Journal of Remote Sensing 42(5):554–573.

Stefankiv, O., T. J. Beechie, J. E. Hall, G. R. Pess, and B. Timpane-Padgham. 2019. Influences of valley form and land use on large river and floodplain habitats in Puget Sound. River Research and Applications 35(2):133–145.

Sweeney, B. W., and J. D. Newbold. 2014. Streamside forest buffer width needed to protect stream water quality, habitat, and organisms: a literature review. JAWRA Journal of the American Water Resources Association 50(3):560–584.

Tetra Tech. 2014. Tucannon River habitat complexity, floodplain, and passage improvement project river miles 46.75-48.10 and 49.45-50.10. Tetra Tech, Volume I: Final Design (100%) Report, Bothell, WA.

U. S. Geological Survey. 2016. USGS Water Data for the Nation.

Washington State Recreation and Conservation Office. 2022. South Fork Upper and Lower Fobes ph 2 restoration. Government. https://srp.rco.wa.gov/project/360/82661.

Wheaton, J. M., N. Bouwes, P. McHugh, C. Saunders, S. Bangen, P. Bailey, M. Nahorniak, E. Wall, and C. Jordan. 2018. Upscaling site-scale ecohydraulic models to inform salmonid population-level life cycle modeling and restoration actions–Lessons from the Columbia River Basin. Earth Surface Processes and Landforms 43(1):21-44.

Williams, G. P. 1978. Bank-full discharge of rivers. Water Resources Research 14:1141–1154.

Zhang, W., J. Qi, P. Wan, H. Wang, D. Xie, X. Wang, and G. Yan. 2016. An easy-to-use airborne LiDAR data filtering method based on cloth simulation. Remote Sensing 8(6):501.

APPENDIX 1: RESPONSES TO RFQQ QUESTIONS

RFQQ Questions:

Did these techniques detect changes in habitat, as predicted?

The techniques were able to detect changes in habitat, floodplain, geomorphic, and riparian conditions. This is most apparent at Countyline where a levee and engineered logjams were placed, but also at Tucannon PA- 3, which focused on large wood placement. As noted previously field validation is still needed for a handful of metrics and to collect supplemental bathymetric data where LiDAR has difficulty mapping the stream bottom.

Did the focus on large-scale floodplain restoration efforts, whose actions aimed at reconnecting rivers with natural floodplains, improve off-channel spawning and rearing habitats and restore native riparian plant communities?

It is clear that the large floodplain projects, such as Countyline, improved spawning and rearing habitat, as is demonstrated by the change in fish habitat, geomorphic units, and more importantly, habitat suitability as demonstrated by HSI modelling.

What are the advantages to and/or limitations of using remote sensing to measure restoration-related habitat changes in floodplains following flood events? Can remote sensing provide a scientifically supported evaluation of restoration-related habitat changes in floodplains following flood events?

Remote sensing, specifically LiDAR, offers clear advantages for assessing floodplain restoration projects because it can rapidly map the entire floodplain with high degrees of precision and accuracy, provided a minimum pulse density threshold is met during acquisition (typically ≥ 8 pulses/m^2). However, for some metrics (e.g., large wood), a pulse density ≥ 10 pulses/m^2 would be ideal which is typical for current LiDAR but lacking for some older LiDAR data. Such level of spatial resolution is not possible with traditional field survey methods. Moreover, some supplemental field surveys are needed to ground truth green LiDAR particularly at sites with deep or turbid water (County Line) or dense large wood (Tucannon). As with any data collection method, LiDAR and aerial imagery are snapshots in time. Currently, the Study Plan outlines data collection either 3 years post-project or following any channel-forming flow (≥ 2-year flow). However, the methods we tested are scientifically robust and can be repeated after any high flow event, assuming updated topo-bathymetric data are collected.

How effective are the associated riparian improvements and verification of stream topographic profiles?

Currently, we only have extensive post-project riparian planting data for the Countyline site. It is evident from LiDAR analysis that planting has increased canopy cover in the 5 years after planting, particularly for taller shrubs and trees. Understory and shrubs decreased, in part because the river is reworking a large former isolated wetland, causing extensive aggradation following removal of the levee. Changes in topography were also evident from the LiDAR at all sites (Pre-project and as-built data only at Upper/Lower Fobes).

How well did other techniques that use fixed-wing or remote-controlled drone devices perform (i.e., thermal imaging, high resolution photography)? Should they also be evaluated?

Because of the size of the sites in question, fixed-winged aircraft was used to collect LiDAR. We know that drone-based near-infrared LiDAR coupled with a field bathymetric survey may be cost effective for smaller sites (sites covering less than 1 km of stream or 100 ha). We used satellite and 1 m resolution NAIP imagery to help identify large wood; however, higher resolution drone imagery would help improve in-channel large wood estimation and on the floodplain under open or semi-open canopy. Satellite or high-resolution imagery can be used to map vegetation types, condition, and some species, but cannot provide height, light penetration (shade), and other riparian metrics. We did not have or collect thermal imagery at any of the sites, but it is first necessary to determine if any specific questions or metrics require thermal imagery.

Salmon Recovery Funding Board Decision Memo

APPROVED BY RCO DIRECTOR MEGAN DUFFY

Meeting Date: May 23-24, 2023

Title: Funding Projection for the 2023-2025 Biennium and Funding Recommendations

Prepared By: Marc Duboiski, Salmon Grants Section Manager, Recreation and Conservation Office
Jeannie Abbott, Program Manager, Governor's Salmon Recovery Office
Keith Dublanica, Science Coordinator, Governor's Salmon Recovery Office

Summary

This memo provides information about the actual and projected funding for the 2023-25 biennium and provides information about specific activities and funding decisions that will advance the Salmon Recovery Funding Board's strategic plan.

Board Action Requested

This item will be a:

- ☒ Request for Decision
- ☐ Request for Direction
- ☐ Briefing

Background:

The Legislature recently approved the 2023-2025 biennial state budget that includes funding for salmon recovery. The 23-25 biennium begins July 1, 2023. The Recreation and Conservation Office (RCO) distributes the funding via an annual grant round for habitat projects and for project development by lead entities.

Each year, RCO submits a single Washington State application to the National Oceanic and Atmospheric Administration (NOAA) for Pacific Coastal Salmon Recovery Fund (PCSRF) grant funding. The application is prepared on behalf of the Salmon Recovery Funding Board (board), Washington Department of Fish and Wildlife (WDFW), and the Northwest Indian Fisheries Commission (NWIFC).

The board portion of the PCSRF application includes funding for habitat projects, monitoring (required by NOAA), administration, capacity, and activities. Capacity is described as the established organizational foundation that allows salmon recovery to take place at the grassroots level by maintaining a network of regional organizations. Activities include funding for hatchery reform projects and monitoring by NWIFC and

WDFW, SRFB monitoring projects, monitoring panel, review panel, Salmon Recovery Network, Salmon Recovery Conference, database updates, and cultural resources staff.

Available Funds

Budget for the Biennium

Federal Funding: NOAA has not yet informed RCO of the amount of Washington state's 2023 PCSRF award. This memo is based on the range between what was allocated in 2021 and 2022. The 2024 federal award will not be announced until approximately June 2024; therefore, we are using the range assumption of what was allocated in 2021 and what RCO will apply for in 2024 to project the funding likely available for the entire biennium. The board decided at the December 2022 board meeting that any increase in 2023 PCSRF would be incorporated into the 2023 grant round.

State Funding: The Legislature's adopted budgets for the 2023-25 biennium include:

- $4,402,000 in general state funds for lead entities and regions, an increase in the amount provided in the 2021-23 budget.
- $20 million in capital funds for salmon recovery, which includes:
  - $2,400,000 million in lead entity capacity funding
  - $640,000 to the Regional Fisheries Enhancement Groups (RFEG) for project development. (It is important to note that the funding provided to lead entities and RFEGs is only to develop projects – any other capacity costs are not eligible to be covered with these capital funds)
  - $16,136,000 for salmon recovery projects
  - $824,000 (4.12%) to RCO to administer these grants and contracts
- $25 million in capital funds for riparian projects, which includes:
  - $23,970,000 for riparian projects
  - $1,030,000 (4.12%) to RCO to administer these grants and contracts

Returned Funds

"Returned funds" refers to money allocated to projects/activities in previous biennia that is returned to RCO when projects/activities either close under budget or are not completed. These dollars return to the overall budget. These returned funds have historically been used for cost increases and to increase the funding available for projects in the upcoming grant round provided the Legislature re-appropriates the funds as part of either the regular capital budget or a stand-alone re-appropriation bill. The legislature has re-appropriated these unspent funds from earlier biennia.

Currently $4,070,114 in returned project funds are available for the 2023 grant round.

Funding Scenario

Table 1 displays the range of funding available for board decisions for the biennium. This scenario includes the state appropriation of $20 million and the potential $18.4-$24 million award for 2023 and 2024 NOAA PCSRF award to Washington State.

Table 2 outlines the range obligation of funding for each year of the biennium. The project funding displayed depicts the total project funding available split between FY24 and FY25. The board must determine how much funding to use for the 2023 and 2024 grant rounds.

Table 1. Available and Projected Funding for the Biennium

Funding for the 21-23 Biennium	State General Funds	State Capital Bond Funds	Federal PCSRF (projected)	Total
State (Lead Entities)		$2,400,000		$2,400,000
State Bond Funds (RFEG)		$640,000		$640,000
State (Lead Entities and Regions)	$4,402,000			4,402,000
SRFB State Bond funds		$16,136,000		$16,136,000
SRFB State Bond Funds Admin		$824,000		$824,000
Riparian State Bond Funds		$23,970,000		$23,970,000
Riparian State Bond Funds Admin		$1,030,000		$1,030,000
PCSRF* 2023 Projects			$9,037,815-$13,999,315	$9,037,815-$13,999,315
PCSRF* 2023 Activities and Regions			$8,760,185-$8,860,685	$8,760,185-$8,860,685
PCSRF* 2023 Admin			$552,000-$720,000	$552,000-$720,000
PCSRF* 2024 Projects			$9,037,815-$13,999,315	$9,037,815-$13,999,315

PCSRF* 2024 Activities and Regions			$8,760,185-$10,339,966	$8,760,185-$10,339,966
PCSRF* 2024 Admin			$552,000-$900,000	$552,000-$900,000
Project Return Funds Used/Available	-	$4,070,114		$4,070,114
PCSRF Unobligated Monitoring Funds			$354,000	$354,000
Total Funds Available	***$4,402,000***	***$49,07,0114***	***$18,754,000-24,354,000***	***$18,754,000-24,354,000***

Table 2: Potential Fund Uses for the 23-25 Biennium

	State Fiscal Year 2024	State Fiscal Year 2025
FUND USES		
Capacity (Lead Entities and Regional Organizations)		
State General funds (Lead Entities and regions	$2,201,000	$2,201,000
State Bonds (Lead Entities)	$1,200,000	$1,200,000
State Bonds (Regional Fisheries Enhancement Groups)	$320,000	$320,000
PCSRF (Regional Organizations)	$2,878,685	$2,878,685
Subtotal	**$6,599,685**	**$6,599,685**
PCSRF Activities		
Monitoring and Monitoring Panel	$2,000,000	$2,000,000
Monitoring unobligated	$354,000	N/A
Communications Strategy SRNet facilitation	$70,000	$70,000
SRFB Review Panel	$200,000	$200,000
Salmon Recovery Conference	$70,000	$70,000
Cultural Resources Staff	$300,000	$300,000
PCSRF Activities - Other	$3,331,500-$3,342,000	$3,331,500-$4,699,966

	State Fiscal Year 2024	State Fiscal Year 2025
Subtotal	**$6,262,500-6,234,000**	**$5,908,200-$7,339,966**
Projects		
State Bonds for projects	$7,818,000	$7,818,000
State Bonds Riparian		$23,970,000
Unobligated projects funds	$4,070,114	
PCSRF for grant round	$9,037,815-$13,999,315	$9,037,815-$13,999,315
Cost Increases for Projects	$675,000	$500,000
Regional Monitoring Projects	$350,000	$350,000
Subtotal	**$21,950,929-$26,912,429**	**$41,675,815-$46,637,315**
RCO Administration (State and Federal)	**$1,344,000-$1,544,000**	**$2,374,000-$2,754,000**
Total Uses for 2023-25 Biennium	**$39,008,799-$44,270,799**	**$59,409,685-$66,330,966**
TOTAL YEAR 1 and YEAR 2	**$98,418,484 - $110,607,765**	

2023 Grant Round Target (FY 2024)

Salmon Projects

The board funds salmon projects with state and federal money. The vast majority of funds received are dedicated to projects, capacity and monitoring. Funding is determined annually based on Washington State's annual PCSRF grant award and the state dollars appropriated by the Washington State Legislature each biennium as shown in Table 1. The board will be making decisions today to determine grant round amounts for year 1 and 2 of the biennium.

Technical Review Panel

To ensure that every project funded by the board is technically sound, the board's technical review panel evaluates projects to assess whether they have a high benefit to salmon, a high likelihood of success, and that project costs do not outweigh the anticipated benefits of the project. There is $200,000 specified in the PCSRF application to support the technical review panel for 2023. In addition, $250,000 will be used from PSAR funds to support the review panel.

Cost Increases

Each year, the board reserves $500,000 in addition to the grant round target for cost increase amendments requested by project sponsors for SRFB projects. These funds are available on a first come, first served basis to sponsors seeking additional funds for essential cost increases to accomplish their existing scopes of work. The RCO director has authority to approve cost increases or to request review and approval by the board. Amendments are reported to the board at each meeting.

In 2022, the board approved adding an additional $500,000 to the cost increase fund bringing the total to $1,000,000. As of April 24, 2023, $325,000 of the fund was used, leaving a $675,000 balance for cost increases the 2023 grant round.

Grant Round and Targeted Investment Alternatives

Alternatives for 2023 and 2024 Grant Rounds and Targeted Investments

There may be up to $54 million available for projects in the 23-25 biennium, including state funds, and the 2023 and projected 2024 PCSRF award amounts. Today the board is asked to set the amount for the current 2023 Grant Round which is underway and for the 2024 Grant Round.

At the December 2022 SRFB meeting, the board decided that any of the PCSRF Bipartisan Infrastructure Law (BIL) funds that RCO receives will be distributed via the allocation formula in the 2023 grant round. Staff estimate the 2023 grant round amount to be between $21.9 million to $26.9 million. RCO is expecting notification of the 2023 PCSRF award before the May 24, 2023, board meeting and will present the grant amount to board members at that meeting.

Riparian

In 2023, the legislature provided $25 million to RCO for riparian projects. Staff will be working on policy and implementation guidelines over the next few months. Funding will be available in the 2024 grant round.

Some of the items that need to be determined with staff, stakeholder and tribal input:

- Develop options for distribution of funds
- How is riparian defined
- What projects are eligible
- Should additional riparian-focused project selection criteria be identified

Targeted Investments

The board approved a Targeted Investment policy in September 2020 and staff presented proposed changes and updated policy language in Memo 4. As stated above, any additional PCSRF BIL funding in 2023 goes into the grant round.

Due to the uncertainty of how much funding RCO will receive from PCSRF in 2024, staff recommend that there is not a Targeted Investment grant round at this time. Staff may recommend that the riparian funds be incorporated into the Targeted Investment process at the September SRFB meeting.

Table 3. Regional Allocations for Project Funding at different grant round levels

Regional Salmon Area Allocation	Percent	Allocation Based on $21 million	Allocation Based on $26 million
Hood Canal Coordinating Council (2.4%)	2.4%	$504,000	$624,000
Lower Columbia Fish Recovery Board	20.00%	$4,200,000	$5,200,000
Northeast Washington	1.90%	$399,000	$494,000
Puget Sound Partnership (38%)	38%	$7,980,000	$9,880,000
Snake River Salmon Recovery Board	8.44%	$1,772,400	$2,194,400
Upper Columbia Salmon Recovery Board	10.31%	$2,165,100	$2,680,620
Washington Coast Sustainable Salmon Partnership	9.57%	$2,009,700	$2,488,200
Yakima Basin Fish and Wildlife Recovery Board	9.38%	$1,969,800	$2,438,800
TOTAL	100.00%	$21,000,000	$26,000,000

*Note that Puget Sound's allocation is 38% but they give 10% of their allocation to Hood Canal which makes the amount for Puget Sound 34.12% and the amount for Hood Canal 6.28%.

1 Federal Pacific Coastal Salmon Recovery Fund award for 2021 of $18.4 million and projected 2022 of $18.5 million.

Staff Recommendations

Staff recommends that the board uses the interim project allocation formula approved by the board at the March 2, 2017 board meeting to determine regional grant round amounts, which includes $350,000 for funding for regional monitoring projects.

Staff recommends that the board approve $200,000 for the Technical Review Panel.

Staff recommends that the board retains balance of $675,000 for cost increases.

Regional Organization and Lead Entity Capacity Contracts

Existing Lead Entity capacity grants will end on June 30, 2023. Most of the funding provides capacity for lead entity coordinators to coordinate their citizen and technical committees. A small portion of these funds are used for training, a stipend for the Washington Salmon Coalition (WSC) chair, and a facilitator for WSC activities.

Due to the timing of receiving the PCSRF allocation, RCO extended the regional organization grants until August 31, 2023.

RCO requested additional capacity funds for lead entities in the 23-25 operating ($3.186M) and capital ($2.4M) budgets. In addition, RCO requested capacity funds ($1.286M) for regions in the 23-25 operating budget. RCO received $2.4 million in capital funds for lead entity capacity and an increase of $3.4 million in operating funds for lead entity and region capacity, bringing the total amount of operating funds to $4.4 million and a grand total of $6.8 million for the biennium. The amount in fiscal year (FY) 24 was enough to fully fund the lead entity and region request. With the addition of Spokane Watershed Lead Entity in FY 25, the amounts available for capacity funds is reduced to 96.2% of the total need.by

Given the slightly reduced amount available for FY 25, RCO staff met with lead entity and region representatives to discuss options. The group consensus was to spread the reduction amongst all the funding recipients. The result is that all entities would receive 96.2% of the FY 24 amounts. (Table 4 reflects the amount each entity would receive.

RCO requested $2,818,685 for Regional Organizations in the 2023 PCSRF award. (Table 5)

Table 4. Proposed Lead Entity and Regional Organization Funding for Fiscal Years (FY) 2023-25

Organization	Current FY amount	Proposed Funding FY24	Proposed Funding FY25
Chehalis Basin LE	$60,000	$88,584	$86,852
Hood Canal LE	$80,000	$118,112	$115,802
Island County LE	$60,000	$88,584	$86,852
Klickitat LE	$60,000	$88,584	$86,852
Lower Columbia LE	$80,000	$200,000	$194,579
Nisqually LE	$62,500	$92,275	$90,470
N. Olympic Pen LE	$80,000	$118,112	$115,802
North Pacific Coast LE	$60,000	$88,584	$86,852
Willapa LE	$60,000	$88,584	$86,852
Pend Oreille LE	$60,000	$88,584	$86,852
Pierce County LE	$60,000	$88,584	$86,852
Quinault LE	$60,000	$88,584	$86,852
San Juan LE	$60,000	$88,584	$86,852
Skagit LE	$80,000	$118,112	$115,802
Snake River LE	$65,000	$175,000	$170,120
Snohomish LE	$62,500	$92,275	$90,402
Stillaguamish LE	$62,000	$91,537	$89,747
Upper Columbia LE	$135,000	$190,000	$186,456
West Sound LE	$60,000	$88,584	$86,852
WRIA 1 LE	$65,000	$95,966	$94,089
WRIA 13 LE	$60,000	$88,584	$86,852
WRIA 14 LE	$60,000	$88,584	$86,852
WRIA 8 LE	$60,000	$88,584	$86,852
WRIA 9 LE	$60,000	$88,584	$86,852
Yakima Basin LE	$65,000	$175,000	$170,120
Spokane LE	$0	$14,937	$96,200
Lead Entity Chair	$4,500	$4,500	$4,500
Lead Entity Training	$8,000	$8,000	$8,000
WSC Facilitator	$24,000	$24,000	$24,000
Lower Columbia Region	$0	$151,000	$145,262
Snake Region	$0	$130,000	$125,060
Yakima Region	$0	$160,000	$153,920
Upper Columbia Region	$0	$147,000	$141,414
Coast Region	$0	$55,000	$52,910

Table 5. PCSRF Capacity Funding for Salmon Recovery Regions

Regional Organization	Board Funding Adopted FY 2023	Proposed FY2024 PCSRF Funding	Proposed Funding FY 2025
Lower Columbia Fish Recovery Board	$456,850	$456,850	456,850
Hood Canal Coordinating Council	$375,000	$375,000	375,000
Puget Sound Partnership	$689,162	$689,162	689,162
Snake River Salmon Recovery Board	$333,588	$333,588	333,588
Upper Columbia Salmon Recovery Board	$435,000	$435,000	435,000
Coast Sustainable Salmon Partnership	$304,085	$304,085	304,085
Yakima Valley Fish & Wildlife Recovery Board	$285,000	$285,000	285,000
Total	**$2,878,685**	**$2,878,685**	**$2,878,685**

Staff Recommendations Capacity Funding Options

Staff recommends the board approve the operating funds as laid out in table 4. This includes funding for all the lead entities, capacity for regional organizations, funding for WSC training, funding for a WSC facilitator, and funding for a WSC facilitator.

Staff recommends Regional Organizations receive funding for fiscal year 2024 at $2,878,685 plus any returned funds from previous PCSRF awards.

Monitoring Contracts for Federal Fiscal Year (FFY) 2024

Board-Funded Monitoring Efforts

The following decisions are specific to the ongoing board-funded monitoring efforts included in the 2023 PCSRF application. These board-funded monitoring efforts have been reviewed and assessed by the monitoring panel and are addressed in its recommendations. These efforts currently include the intensively monitored watersheds program, and the effectiveness of the pilot / proof-of-concept transition to remote sensing of floodplains. If approved by the board, the new contracts will have an expected start date of October 1, 2023 (or sooner) and end December 31, 2024. A final product and potential options for a remote sensing proof-of-concept will be presented to the board for consideration.

Additionally, continued support is requested for the monitoring panel, which is entering its tenth year of objectively assessing the board's monitoring program for its scientific validity and providing recommendations to the board on its monitoring investments and other issues. The monitoring panel provides review of regional monitoring project proposals, is addressing an appropriate structure for adaptive management with input from the board's monitoring subcommittee (Item 6 Attachment B) and has reviewed the intensively monitored watershed's (IMW) synthesis (Item 6 Attachment B). Current contracts for the monitoring panel members terminate on December 31, 2023. There are currently three monitoring panel members providing pro bono services, and one providing subject matter expertise specific to IMWs. A request for qualifications and quotation (RFQQ) for monitoring panel participation is expected by Fall 2023 for panel membership and some current panel members are expected to submit materials. The panel is currently co-chaired by Pete Bisson and Jeanette Smith.

The total amount available for board-funded monitoring and related costs is $2,000,000.

Intensively Monitored Watersheds (IMW) $1,546,000

The IMW program continues to provide comprehensive validation monitoring for the four IMWs in western WA, as well as support for one IMW in eastern WA. These IMWs include the Straits, Skagit, and Hood Canal IMWs in the Puget Sound region, the Abernathy IMW in the Lower Columbia, and the Asotin IMW in the Snake region.

- NOAA, the Skagit River Systems Cooperative and the Lower Elwha S'Klallam Tribe $607,000
- WA Department of Fish and Wildlife for habitat monitoring in IMW worksites. $450,000
- WA Department of Fish and Wildlife for fish monitoring in IMW worksites. $489,000

Note: The Snake and Lower Columbia Salmon Recovery regions have access to IMW monitoring funds from an annual Pacific States Marine Fisheries Commission (PSMFC) allocation to RCO, not captured in this total. At this time, PSMFC supports funding through at least 2025.

Monitoring Panel $100,000

The monitoring panel is entering its tenth year of operation, implementing their objective review and assessment of all board-supported monitoring efforts: Status and Trends; Intensively Monitored Watersheds; and the anticipated "pivot" from reach-scale Project Effectiveness. In addition, the monitoring panel reviews regional monitoring projects, which are included in the regional funding allocation that the board will consider at the September 2023 meeting. Project sponsors must submit an application that meets the criteria established in Manual 18, and provide certification from the region these projects address data gaps as identified in regional recovery plans

This funding request supports the monitoring panel through December 31, 2024.

Staff Recommendations on Monitoring

Staff recommends that the board delegate authority to the RCO director to enter contracts for approved board-funded monitoring efforts: based on the response and results from request for proposals, as well as subsequent discussions about emerging gaps in existing monitoring programs (i.e., fish in/fish out, IMW, adaptive management).

Table 6: Board-Funded Monitoring Efforts

Intensively Monitored Watersheds - NOAA Skagit River Systems Cooperative, and Lower Elwha S'Klallam Tribe	$607,000
Intensively Monitored Watersheds - WDFW (fish)	$489,000
Intensively Monitored Watersheds - WDFW (habitat)	$450,000
Monitoring Panel	$100,000
Unobligated monitoring funds	$354,000
TOTAL FOR 203 GRANT ROUND	**$2,000,000**

Motions for Funding Decisions

Motions for Projects:

Move to use the interim project allocation formula approved by the board at the March 2, 2017 board meeting to determine regional grant round amounts, which includes $350,000 for funding for regional monitoring projects.

- **Move** to approve $200,000 for the SRFB Technical Review Panel.

Move to retain balance of $675,000 for SRFB project cost increases.

Motions for Capacity:

Move to delegate authority to the Director to enter contracts with the Lead Entities and Regional Organizations to fund capacity for the 2023-25 biennium utilizing the funding amounts in Table 4.

Move to delegate authority to the Director to enter contracts with the Regional Organizations for fiscal year 2024 at $2,818,685 plus any return funds from previous PCSRF awards.

Motions for Monitoring:

Move to delegate authority to the RCO director to enter contracts for the monitoring efforts displayed in Table 6. The contracts shall not to exceed $2,000,000 for fiscal year 2024.

Washington State Recreation and Conservation Office
Salmon Recovery Funding Board

Salmon Recovery Funding Board Briefing Memo

Item 8

APPROVED BY RCO DIRECTOR MEGAN DUFFY

Meeting Date: May 23-24, 2023

Title: Watershed Restoration and Enhancement Plan Update

Prepared By: Kat Moore, Senior Outdoor Grants Manager; Lauren Burnes, Special Assistant to the Director

Summary

This memo summarizes the technical review of the Watershed Restoration and Enhancement Plans for five watersheds.

Board Action Requested

This item will be a:
- ☐ Request for Decision
- ☐ Request for Direction
- ☒ Briefing

Introduction/Background

In January 2018, the Washington State Legislature passed the Streamflow Restoration law (Revised Code of Washington 90.94) to help support robust, healthy, and sustainable salmon populations while ensuring rural communities have access to water. Pursuant to that law, the Department of Ecology established watershed restoration and enhancement committees to develop and adopt plans in fifteen watersheds, or Water Resources Inventory Areas (WRIAs). The committees in WRIAs 7 (Snohomish), 8 (Cedar-Sammamish), 13 (Deschutes), 14 (Kennedy-Goldsborough), and 15 (Kitsap) developed watershed restoration and enhancement plans but did not unanimously approve the plans they developed.

Under the law, if a committee fails to approve its plan unanimously, the Salmon Recovery Funding Board is required to provide a technical review of the plan. The technical review should consider whether the actions in the plan, after accounting for new projected uses of water in the subsequent twenty years (2018–2038), will result in a net ecological benefit to instream resources in the WRIA. The board is to provide any recommendations to the director of the Department of Ecology to consider. Ecology may amend the plan without committee approval before adoption. After plan adoption, the director of Ecology will initiate rulemaking for the plans.

To meet this requirement, in 2022 the Recreation and Conservation Office (RCO) convened a science panel of six regional experts to review the five unapproved plans. Panel members Hans Berge, Annika Fain, and Adam Hill reviewed plans for WRIA 7 (Snohomish) and WRIA 8 (Cedar-Sammamish). Panel members Bob Montgomery, Bill Norris, and Phil Roni reviewed plans for WRIA 13 (Deschutes), 14 (Kennedy-Goldsborough), and 15 (Kitsap). The panel was supported by RCO staff members Kat Moore, senior outdoor grants manager, and Lauren Burnes, special assistant to the director. The full panel is providing this report to the board summarizing its review and recommendations. This includes specific technical information that the board may recommend Ecology add to the final draft plans.

Please see Attachment A: Watershed Restoration and Enhancement Plan Review Report. The review panel recommends minor revisions for each plan. For consumptive use, the panel concluded that across all five plans the consumptive use estimates are technically sound and the methodology applied consistently. The panel concluded that all plans identified actions that put water back into aquifers and streams, offsetting new consumptive water use. The panel also concluded that the plans would provide a net ecological benefit if implemented. The panel recommends some minor revisions to all five plans, and for WRIA 13, 14, and 15 it recommends revising or removing some water offset and habitat projects. See the attached report for more details.

Next Steps

RCO will accept comments and feedback from the board and the public on the Watershed Restoration and Enhancement Plan Review Report, update the plan, and then bring it back to the board for a decision at the September board meeting.

Attachment A

Watershed Restoration and Enhancement Plan Review Report

WASHINGTON STATE
RECREATION AND CONSERVATION OFFICE
Salmon Recovery
Funding Board

Watershed Restoration and Enhancement Plan Review Report

Executive Summary

The 2018 streamflow restoration law required planning groups in fifteen watersheds, or Water Resource Inventory Areas (WRIAs), to develop watershed plans that offset impacts from new domestic permit-exempt wells and identify actions that will provide a net ecological benefit. Only plans that were approved by all members of the local committees could be adopted. The Department of Ecology adopted plans in nine WRIAs and completed rulemaking in a tenth. Five plans were not approved including WRIA 7 (Snohomish), WRIA 8 (Cedar-Sammamish), WRIA 13 (Deschutes), WRIA 14 (Kennedy-Goldsborough), and WRIA 15 (Kitsap). Pursuant to the law, if a committee failed to approve its plan, the Salmon Recovery Funding Board must provide a technical review of the plan. To meet this requirement, the Recreation and Conservation Office convened a science panel to review the five plans and provide recommendations.

Consumptive Use

Watershed plans must include a new consumptive water use estimate for each subbasin and the technical basis for each estimate. Consumptive use is the estimated water consumption from permit-exempt domestic groundwater withdrawals during the next twenty years. The methods used to estimate consumptive use across the five watersheds reviewed varied. For WRIAs 7, 8, 13, and 15, data from their respective counties were used based upon patterns in development in basins with permit-exempt wells, although each county's method was different. In contrast, WRIA 14 relied upon data provided from the state Office of Financial Management. These estimates then were multiplied by an estimate provided by the Department of Ecology of the average consumption (acre-feet/well) of indoor and outdoor permit-exempt wells in the WRIAs. This resulted in an estimate of the total number of acre-feet of water consumed by permit-exempt wells in each WRIA from 2018-2038 (Table 1). In each of the five watersheds, the methods used to estimate consumptive use were technically sound.

Water Offsets

Once consumptive use was calculated, the five WRIAs identified projects to offset the impacts of permit-exempt wells on aquifers and streams. Each identified a large number of projects and asserted they would offset the consumptive use. Generally, the projects appeared to be overly optimistic about the offset value. Particularly, some project types, such as water right purchases, roof runoff, and low-impact development, used assumptions that likely were overestimated. A more conservative estimate for these project types is warranted, particularly in WRIAs 13, 14, and 15. For WRIAs 7 and 8, it appeared that many of the projects had relatively low feasibility and the water offsets would occur outside the basins with high or moderate water consumption.

Net Ecological Benefit

Once consumptive use was calculated and offsets accounted for, the plans needed to provide additional actions to benefit in-stream resources beyond those necessary to offset the consumptive water use in the WRIA. Each WRIA identified a large number of projects to provide those benefits. While the projects appear to be beneficial for aquatic resources, the certainty that the projects will be completed was lacking. It would be helpful to include information showing the stage of the project, its certainty and feasibility, funding source, technical reviews, prioritization, private or public land, and identified project sponsors. We believe this would help provide the certainty that these projects will occur.

Conclusions

A great deal of work went into these plans. Each plan has important information to document consumption, offsets, and additional benefits. While important progress has been made and many details provided, there are still key areas for improvement, which have been identified in the report below.

Introduction and Purpose

In January 2018, the Washington State Legislature passed the streamflow restoration law (Revised Code of Washington 90.94) to help support robust, healthy, and sustainable salmon populations while ensuring rural communities have access to water. The law directs the Department of Ecology to develop watershed restoration and enhancement plans for fifteen WRIAs that identify projects to offset potential consumptive impacts of new permit-exempt domestic groundwater withdrawals on in-stream flows during twenty years (2018–2038) and which provide a net ecological benefit to the watershed. Following the provisions of the law, Ecology collaborated with a committee composed of cities, counties, special interest groups, state agencies, and tribes in each WRIA to prepare a draft plan. The law requires all committee members to approve the plan before Ecology considers plan adoption. Ecology adopted nine plans and completed rulemaking for a tenth.

Five watershed plans were not approved unanimously by their committees including watershed plans for WRIA 7 (Snohomish), WRIA 8 (Cedar-Sammamish), WRIA 13 (Deschutes), WRIA 14 (Kennedy-Goldsborough), and WRIA 15 (Kitsap). For these unapproved plans, the streamflow restoration law requires Ecology to submit the draft plan for each WRIA to the Salmon Recovery Funding Board (SRFB) in the Recreation and Conservation Office for technical review. The SRFB review is designed to provide recommendations to Ecology about whether to amend the draft plan to ensure that actions identified in the plan, after accounting for new projected uses of water during the subsequent twenty years, will result in a net ecological benefit to in-stream resources in the WRIA. The law further states that the director of Ecology must consider the recommendations, may amend the plan before adoption, and must initiate rulemaking for the plan after adoption.

To meet this requirement, a science panel of six regional experts reviewed the five unapproved plans. Panel members Hans Berge, Annika Fain, and Adam Hill reviewed plans for WRIA 7 (Snohomish) and WRIA 8 (Cedar-Sammamish); panel members Bob Montgomery, Bill Norris, and Phil Roni reviewed plans for WRIA 13 (Deschutes), WRIA 14 (Kennedy-Goldsborough), and WRIA 15 (Kitsap). The panel was supported by Recreation and Conservation Office staff members Kat Moore, senior outdoor grants manager, and Lauren Burnes, special assistant to the director. The full panel is providing this report to the SRFB to summarize its review and recommendations. Our review and recommendations are limited to the technical aspects of the watershed plans, including the following:

- **Consumptive Use**: *Estimated water consumption from permit-exempt domestic groundwater withdrawals in the next twenty years.* Are the projections technically sound? Was the methodology applied consistently?

- **Water Offsets:** *Actions that put water back into aquifers and streams that offset new consumptive water use*. Will the planned projects and actions (if implemented), at a minimum, offset the total projected impacts to in-stream flows from new consumptive water use in all the subbasins in the WRIA?

- **Net Ecological Benefit**: *Actions in the plan provide additional benefits to aquifers and streams beyond the minimum to offset projected consumptive use*. Does the plan identify projects and actions that provide additional benefits to in-stream resources beyond those necessary to minimally offset the impacts from new consumptive water use in the WRIA?

Table 1. Summary Information from Plans

	Snohomish WRIA 7	Cedar-Sammamish WRIA 8	Deschutes WRIA 13	Kennedy-Goldsborough WRIA 14	Kitsap WRIA 15
o Area (square miles)	o 1,856	o 692	o 270	o 381	o 676
o County	o King, Snohomish	o King, Snohomish	o Lewis, Thurston	o Mason, Thurston	o King, Kitsap, Pierce, Mason
o Major Streams	o Skykomish, Snohomish, Snoqualmie Rivers	o Cedar and Sammamish Rivers; Bear, Coal, Evans, Issaquah, Little Bear, May, North, and Swamp Creeks	o Deschutes River and Percival, Woodard, and Woodland, Creeks	o Alderbrook, Cranberry, Deer, Goldsborough, Kennedy, Johns, Mill, Perry, Sherwood, Shumocher, and Skookum Creeks	o Dewatto, Tahuya, and Union Rivers, and numerous smaller streams
o Subbasins	o 16	o 12	o 13	o 8	o 7
o Permit-Exempt Wells	o 3,389	o 967	o 2,616	o 4,294	o 5,215
o Acre-Feet Per Year	o 797	o 425	o 434	o 760	o 718

	Snohomish WRIA 7	Cedar-Sammamish WRIA 8	Deschutes WRIA 13	Kennedy-Goldsborough WRIA 14	Kitsap WRIA 15
o Offset Acre-Feet Per Year	o 1,444	o 1,805	o 1,801	o 1,725	o 2,873
o Net Acre-Feet Per Year	o 647	o 1,380	o 1,367	o 965	o 2,155
o Water Offset Projects	o 11	o 10	o 9	o 8	o 15
o Habitat Projects	o 26	o 23	o 19	o 25	o 31
o Consumptive Water Use Method	o Appendix A of *Final Guidance for Determining Net Ecological Benefit* (Ecology, 2019)				
o Indoor Consumptive Uses	o Appendix A (Ecology, 2019)				
o Outdoor o Consumptive Uses	o 393 randomly selected parcels from recent building permits	o 153 randomly selected parcels from recent building permits	o 80 randomly selected parcels	o 80 randomly selected parcels	o 80 randomly selected parcels
o Members voting to approve/not support	o 21/1 (Snoqualmie Indian Tribe)	o 15/1 (Snoqualmie Indian Tribe)	o 11/1 (Building Industry	o 7/4 (BIAW, Department of Fish and Wildlife, Skokomish Indian	o 12/6 (City of Gig Harbor Department of Fish and

	Snohomish WRIA 7	Cedar-Sammamish WRIA 8	Deschutes WRIA 13	Kennedy-Goldsborough WRIA 14	Kitsap WRIA 15
			Association of Washington)	Tribe, Squaxin Island Tribe)	Wildlife, Port Gamble S'Klallam Tribe, Skokomish Indian Tribe, Squaxin Island Tribe, Suquamish Tribe)

WRIA 7

Introduction to the Watershed Plan

The Snohomish watershed, WRIA 7, is about 1,856 square miles and includes all the lands drained by the Skykomish, Snohomish, and Snoqualmie Rivers. It is divided into sixteen subbasins. The watershed is split about equally between King and Snohomish Counties. The WRIA includes the Snohomish River and its two main tributaries, the Skykomish and Snoqualmie Rivers. The watershed also contains the Tolt Reservoir and Spada Lake, which supply water to Seattle and Everett, respectively.

The WRIA watershed plan projects 3,389 new permit-exempt domestic well connections in the next twenty years, using 797 acre-feet per year or 1.1 cubic-feet per second. The watershed plan identifies eleven water offset projects that would provide an anticipated 1,444 acre-feet per year to benefit streamflows and enhance the watershed. The total offset yields a surplus offset of 647 acre-feet per year above the 797 acre-feet per year consumptive use estimate. The watershed plan identifies twenty-six habitat projects that could provide benefits to fish and other wildlife habitat through floodplain restoration, wetland reconnection, increased channel complexity, reduction of peak flow during storms, and increased groundwater levels and baseflow.

Technical Summary and Review Comments

Consumptive Use

Total offset is determined on an annual basis. King County consumptive use was based on 2000 to 2017 and Snohomish County was based on 2008 to 2018. The total consumptive use for the predicted 3,389 new wells is 797 acre-feet per year. Estimated consumptive use is shown in Table 2.

Table 2. Estimated Consumptive Use for WRIA 7

Wells and Consumptive Use	Quantity
o Projected number of permit-exempt wells in twenty-year planning horizon	o 3,389
o Indoor consumptive use, acre-feet per year/per well (average)	o 0.0184
o Outdoor consumptive use, acre-feet per year/per well (average)	o 0.22
o Total estimated consumptive use from 2018-2038, acre-feet per year	o 797

Note: average indoor consumptive use in the plan is listed as 0.00184 (page 48), rather than 0.0184

The method used to project the number of new permit-exempt wells and consumptive use estimates in WRIA 7 is based on recommendations from Appendix A of Ecology's *Final Guidance for Determining Net Ecological Benefit*. The method to calculate consumptive use assumes 90 percent of the indoor water use returns to groundwater via septic tanks and is not counted as a consumptive use. About 20 percent of the outdoor water use returns to groundwater or surface water and also is not counted as a consumptive use.

A Geographic Information System analysis was used on 393 randomly selected parcels with recent building permits throughout the watershed to estimate outdoor irrigated area. The average irrigated area was estimated to be 0.20 acre.

Consumptive use is much higher in the summer than winter, but the calculations used are based upon an annual average. If the summer consumptive use was broken out separately it would help guide the implementation of future water offset projects at the time when resources are most limiting. Additionally, the methods used to calculate the number of permit-exempt wells in King and Snohomish Counties were different, which may result in minor differences in consumptive use estimates across basins. Despite these limitations, WRIA 7 followed the methodology prescribed by Ecology, used the most accurate data available for each basin, and applied the methods consistently.

Water Offsets

The WRIA 7 committee identified eleven water offset projects across seven subbasins, which if implemented, would provide a total water offset of 1,444 acre-feet per year (Table 3). The total offset yields a surplus offset of 647 acre-feet per year above the 797 acre-feet per year consumptive use estimate. There will be a water deficit in ten of the sixteen subbasins but habitat projects are proposed in all subbasins.

Table 3. Estimated Water Offsets for WRIA 7

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Lake Shoecraft Outlet Modification	o Water storage and retiming	o Tulalip	o 62.5

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
Coho Creek Relocation and Streamflow Enhancement	Streamflow augmentation and floodplain restoration	Quilceda-Allen	362
Lake Stevens Outlet Structure and Lake Level Management	Water storage and retiming	Little Pilchuck	500
Lochaven Source Switch	Water right acquisition	Pilchuck	12.7
Lower Pilchuck Number 1	Water right acquisition	Pilchuck	2.8
Lower Pilchuck Number 11	Water right acquisition	Pilchuck	2.1
Raging River Number 1	Water right acquisition	Snoqualmie South	126
Patterson Number 1	Water right acquisition	Patterson	29.7
Patterson Number 4	Water right acquisition	Patterson	71.6
Managed aquifer recharge in Snoqualmie	Water storage and retiming	Snoqualmie North, Snoqualmie South, Upper Snoqualmie	198
Snoqualmie River Watershed Surface Water Storage	Water storage and retiming	Cherry-Harris, Snoqualmie South, Upper Snoqualmie	77
		Total	1,444.4

The estimated cost for proposed water storage projects varies from $175,000 to $3.5 million. The water rights projects range from $5,000 to $324,000. The total cost for implementing all the water offset projects described in the plan is about $7 million. As of March 2022, three of the eleven planned water offset projects have secured initial feasibility funding. Project sponsors will further refine these cost estimates during their project scoping and development processes.

The certainty of implementation of projects depends on many factors, such as identification and support of project sponsors, readiness to implement the project, and identification of potential barriers. Each of the water offset projects identified in the plan has a project sponsor ready to proceed with project development. One of the largest barriers to implementation is funding. Additionally, willingness of landowners to sell existing water rights is one very uncertain component of this plan. Other potential barriers include the willingness of landowners to sell or allow development of projects. Many of the water offset projects included in the plan have not yet secured landowner approval.

If implemented, the planned water offset projects and actions identified in the WRIA 7 plan will offset the total projected impacts to in-stream flows from the total new consumptive water use.

Net Ecological Benefit

The plan identifies twenty-six proposed habitat projects that provide additional benefits to in-stream resources beyond those necessary to minimally offset the impacts from new consumption water use in the WRIA. Ecological benefits associated with these projects include floodplain restoration, wetland reconnection, availability of off-channel habitat, reduction of peak flow during storms, increased groundwater levels and baseflow, and increased channel complexity. These habitat projects will contribute to addressing limiting factors for salmonids in WRIA 7.

The estimated cost for implementing individual habitat projects ranges from $20,000 (per lined storage pond) for the Snohomish Conservation District Small Farm Storage Initiative project to $15.5 million for the Raging River Bridge to Bridge Acquisitions and Floodplain Restoration project. As of March 2022, five of the twenty-six planned habitat projects have secured funding. Project sponsors will further refine these cost estimates during their project scoping and development processes.

Recommendations

Overall, there is room for improvement in the plan for WRIA 7 but it meets the stated intent for a watershed restoration and enhancement plan. The watershed plan would be improved by a better distribution of projects to match the needs of individual subbasins, some improvements to reduce the uncertainty of the measurement of consumptive use, and implementation of projects to provide ecological benefit.

- The years used to calculate the King County consumptive use could be based on 2008 to 2018, the same as Snohomish County consumptive use.

- For projects focused on consumptive use or net ecological benefit, it would be helpful to identify feasibility and/or certainty of implementation. A matrix may be a helpful tool to use.

- The number of projects in Pilchuck and Patterson seem light, considering the needs. Additionally, we would have expected to see more projects in Cherry-Harris given consumptive use projections, even if estimates are low. We also suggest projects focused on irrigation and agriculture along the Skykomish and Snoqualmie Rivers, even if only modest offsets to projected consumption

WRIA 8

Introduction to the Watershed Plan

The Cedar-Sammamish watershed (WRIA 8) encompasses about 692 square miles and includes the lands that drain through the Ballard Locks as well as nearshore streams north of the Duwamish River to Mukilteo. The watershed has two major river basins, the Cedar and Sammamish, both of which empty into Lake Washington. The Cedar River has a mean annual flow of 679 cubic feet per second, over two times the discharge of the Sammamish River's 304 cubic feet per second. The upper Cedar River watershed provides water to Seattle. Other major tributaries include Bear Creek, Coal Creek, Evans Creek, Issaquah Creek, Little Bear Creek, May Creek, North Creek, and Swamp Creek. Fifty percent of the watershed is in a city or designated urban growth area. It is the most populated WRIA in Washington. About 85 percent of the watershed is in King County and the remaining 15 percent is in Snohomish County.

Technical Summary and Review Comments

Consumptive Use

A total of 967 new permit-exempt domestic wells are expected in WRIA 8 by 2038, with an estimated use of 425 acre-feet per year, with an estimated error of plus or minus six percent (Table 4). King County is projected to experience the most, with 740 wells, while

Snohomish County expects about 210. The remaining 17 are expected in cities and urban growth areas.

Table 4. Reported Estimated Consumptive Use for WRIA 8 and Assumptions used for Wells.

Wells and Consumptive Use	Quantity
o Projected number of permit-exempt wells in twenty-year planning horizon	o 967
o Indoor consumptive use, acre-feet per year/per well (average)	o 0.0184
o Outdoor consumptive use, acre-feet per year/per well (average)	o 0.42
o Total estimated consumptive use from 2018-2038, acre-feet per year	425

The method used to project the number of new permit-exempt wells and consumptive use estimates in WRIA 8 are based on recommendations from Appendix A of Ecology's *Final Guidance for Determining Net Ecological Benefit*. The method to calculate consumptive use assumes 90 percent of the indoor water use returns to groundwater via septic tanks and is not counted as a consumptive use. About 20 percent of the outdoor water use is assumed to return to groundwater or surface water and also is not counted as a consumptive use. A Geographic Information System analysis was used on 153 randomly selected parcels throughout the watershed to estimate outdoor irrigated area. The average irrigated area was estimated to be 0.32 acre.

Consumptive use is much higher in the summer than winter, but the calculations are based on an annual average. If the summer consumptive use was separated, it would help guide the implementation of future water offset projects during the most water-limited time of the year. As noted previously, King and Snohomish Counties' methods of calculating the number of permit-exempt wells differ slightly and may result in subtle differences in consumptive use in basins in different counties. However, the slightly different projections would have little overall effect because they both use the same methods prescribed by Ecology in a consistent manner.

Water Offsets

The WRIA 8 committee identified ten water offset projects, across five subbasins, which if implemented would provide a total water offset of 1,805 acre-feet per year (Table 5). The total offset yields a surplus offset of 1,380 acre-feet per year above the 425 acre-feet per year consumptive use estimate, making any subtle differences in projections negligible. There will be a water deficit in six of the twelve subbasins, but planned habitat restoration projects are identified in each subbasin intended to mitigate deficits.

Table 5. Estimated Water Offsets for WRIA 8 for Each Project Identified in the Plan by Project Type.

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Snohomish County Recycled Water Managed Aquifer Recharge	o Water storage and retiming	o Little Bear	o 181
o Wayne Golf Course Water Right Acquisition	o Water right acquisition	o Sammamish River Valley	o 3.54
o Sixty Acres Park Water Right Acquisition	o Water right acquisition	o Sammamish River Valley	o 126
o Water Right Acquisition Number 8	o Water right acquisition	o Sammamish River Valley	o 23.43
o Sammamish River Valley Irrigation Water Rights	o Water right acquisition	o Sammamish River Valley	o 551.83
o Sammamish River Valley Recycled Water Managed Aquifer Recharge	o Water storage and retiming	o Sammamish River Valley	o 181
o Number 1 Water Right Acquisition	o Water right acquisition	o Bear / Evans	o 346.8
o Number 4 Water Right Acquisition	o Water right acquisition	o Issaquah	o 286
o Riverbend Mobile Home Park Water Right Acquisition	o Water right acquisition	o Lower Cedar	o 20.1

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Number 5 Water Right Acquisition	o Water right acquisition	o Lower Cedar	o 85.4
o	o	o Total	o 1,805.1

Water offset projects include two water storage and retiming projects (or projects that change the timing of water withdrawal or addition from the river), and eight water right acquisitions. The total estimated cost for these projects is $4.4 million, with individual projects ranging from about $9,100 to $1.4 million. The certainty of implementation depends on support from landowners, funding, certainty of success, and feasibility. Each of these projects has project sponsors, but many do not have agreements in place with landowners or funding. It is difficult to imagine how budgets can be specific without concurrence on the project or the plan. If these impediments can be removed and the estimates provided by the committee are correct, the implementation of these projects would offset the total projected impacts to in-stream flows from the total new consumptive water use.

Net Ecological Benefit

Twenty-three habitat projects are proposed in the plan to provide ecological benefits, including improvements to stormwater management and infiltration. There is a great deal of uncertainty as to how these habitat projects may offset consumptive use because stormwater projects are in built-out basins, and in these instances are largely retrofits of out-of-date infrastructure. The projects that include floodplain restoration, wetland reconnection, increased off-channel habitat, increased groundwater levels and baseflow, and improved channel complexity in salmon-bearing streams, will provide ecological benefits; few of them offer any offset benefits. The projects that do, are in the Sammamish River and will not address the most limiting factor of warm water temperature. Estimates of project costs where available are between $94,000 for beaver dam analogs to $7 million for a floodplain reconnection project on the Cedar River. While not prioritized, each of these project concepts are consistent with creating potentially measurable and meaningful ecological benefits for salmonids within WRIA 8.

Recommendations

The Watershed Restoration and Enhancement Plan for WRIA 8 is well written and clear in its intent. There are some areas where it could be improved. Three specific improvements are as follows:

- For consistency across basins, King County and Snohomish County should use the same assumptions for new permit-exempt wells, possibly using numbers from the state Office of Financial Management.

- For projects focused on consumptive use or net ecological benefit, it would be helpful to identify feasibility and/or certainty of implementation. A matrix may be a helpful tool to use.

- Ecological projects should be prioritized and effort should be made to include design elements that would increase cold water refugia in the Sammamish River and specifically address water offset directly as design elements in planned restoration projects.

- The Sammamish Basin, North Lake Washington Tributaries (Little Bear, North, and Swamp), and the Bear/Evans basins seem to have the most mitigating effects on water withdrawals and have a lot of pressure for new consumptive use. There should be more emphasis on ecological projects in those streams that are cooler, rather than relying upon relatively small improvements in the much larger Sammamish River.

WRIA 13

Introduction to the Watershed Plan

WRIA13, the Deschutes watershed, in Thurston and Lewis Counties, covers 270 square miles. The Deschutes River is the major hydrologic basin in WRIA 13, with a number of smaller independent tributaries that drain into four saltwater inlets: Budd, Eld, Henderson, and Nisqually Reach. Other principal streams include Woodard and Woodland Creeks, which drain into Henderson. WRIA 13 is divided into nine subbasins for the purposes of the watershed plan.

The WRIA 13 Watershed Restoration and Enhancement Plan projects 2,616 new permit-exempt domestic wells in the next twenty years with an estimated consumptive use of 434 acre-feet per year. A total of four water offset projects would provide an expected offset of 1,801 acre-feet per year to benefit streamflow. This is estimated to provide a total net surplus offset of 1367 acre-feet per year. The WRIA 13 watershed plan identifies nineteen habitat projects designed to increase stream complexity, reconnect floodplains, promote fish passage, enhance natural processes, and ultimately benefit salmonids and other aquatic species.

Technical Summary and Review Comments

Consumptive Use

A total of 2,616 new permit-exempt wells are expected in WRIA 13 by 2038, with an estimated 434 acre-feet per year (Table 6). Although WRIA 13 includes both Thurston and Lewis County, no new permit-exempt wells are expected to occur in Lewis County in the twenty-year planning horizon. The largest number of wells are in the Middle and Lower Deschutes subbasins and the three peninsulas.

Table 6. Estimated Consumptive Use for WRIA 13

Wells and Consumptive Use	Quantity
o Projected number of permit-exempt wells in the twenty-year planning horizon	o 2,616
o Indoor consumptive use, acre-feet per year/per well (average)	o 0.017
o Outdoor consumptive use, acre-feet per year/per well (average)	o 0.15
o Total estimated consumptive use from 2018-2038, acre-feet per year	o 434

The method used to project the number of new permit-exempt wells in WRIA 13 is based on recommendations from Appendix A of Ecology's *Final Guidance for Determining Net Ecological Benefit*. Ecology used growth estimates and growth allocations that were prepared by individual counties to forecast the number of permit-exempt wells in the twenty-year planning horizon by subbasin.

The method assumed an average indoor use per person per day and used estimates of the average irrigated area (outdoor lawn and garden areas), amount of irrigation, and irrigation efficiency to derive the total water use per household with a permit-exempt well. A large portion (90 percent) of the indoor water use returns to groundwater via septic tanks and is not counted as a consumptive use. A small portion (20 percent) of the outdoor water use returns to groundwater or surface water and also is not counted as a consumptive use.

To estimate the average irrigated area for a new residence using a permit-exempt well, the lawn and garden areas of eighty parcels distributed throughout the WRIA and representative of a range of property values were analyzed. The average irrigated area was estimated to be 0.1 acre.

The methodology used to project the number of permit-exempt wells and consumptive use was consistent with WRIAs 14 and 15, the other watershed plans reviewed by our team. The indoor consumptive use per permit-exempt well estimated for WRIA 13 was the same as for WRIAs 14 and 15. The outdoor consumptive use estimated for WRIA 13 was the same as for WRIA 14 and slightly more than for WRIA 15. The difference is caused by a larger average irrigated area in WRIAs 13 and 14 (0.1 acre) compared to WRIA 15 (0.08 acre).

The estimated outdoor consumptive use is much greater than the indoor consumptive use and comprises 90 percent of the total consumptive use. Ecology expects the outdoor water use will occur mainly in summer, but the consumptive use calculations present an average annual use, not the summer use. Showing the summer consumptive use would help guide implementation of future water offset projects as the largest streamflow deficits occur in summer. However, the projections follow the guidance used and appear to be technically sound.

Water Offsets

The WRIA 13 committee identified four water offset projects, across six subbasins, which if implemented would provide a total water offset of 1,801 acre-feet per year (Table 7). The total offset yields a surplus offset of 1,367 acre-feet per year above the 434 acre-feet per year consumptive use estimate.

Subbasins were delineated by Ecology and the Watershed Restoration Committee to describe the location of projected new consumptive water use and as a guide to developing projects that offset that use in the same general locations and that addressed habitat needs to provide net ecological benefit.

Table 7. Estimated Water Offsets for WRIA 13

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Schneider's Prairie Off-Channel Connection	o Off-channel reconnection and infiltration	o Lower Deschutes	o 681
o Hicks Lake Stormwater Retrofit	o Stormwater infiltration in series with existing stormwater treatment	o Woodland	o 296
o Donnelly Drive Infiltration	o Improve neighborhood stormwater infiltration, avoiding surcharge and runoff to Chambers ditch	o Lower Deschutes	o 14
o Deschutes/ Chambers Managed Aquifer Recharge	o Several candidate locations for managed aquifer recharge of diverted Deschutes River water from high flow periods, exceeding in-stream minimum flows or ecological flows	o Boston Harbor o Cooper Point o Lower Deschutes o Middle Deschutes o Upper Deschutes o Woodland	o 810
o	o	o Total	o 1,801

Managed aquifer recharge projects account for 45 percent of the total water offsets for permit-exempt wells. The projected offsets rely heavily on managed aquifer recharge facilities with benefits that appear overestimated. While managed aquifer recharge facilities that accept stormwater or treated wastewater appear appropriate, managed aquifer recharge facilities that withdraw flow from streams rely on hydrologic manipulations of natural resources and natural processes that have questionable feasibility and benefits.

The plan segregates habitat projects from quantitative water offsets and fails to integrate natural stream processes into quantitative offset solutions. The plan provides the following quote, “Restoring floodplain connectivity and streamflow regimes, and re-aggrading incised channels are most likely to ameliorate streamflow and temperature changes and increase habitat diversity and population resilience” (Beechie et al. 2013) yet the plan fails to discuss degradation of streambed elevations as a root cause of reduced base flow volumes. Channel and streambed degradation is listed as a Habitat Limiting Factor Addressed for sixteen of the nineteen habitat projects listed in the plan. indicating root causes of reduced summer base flow. Channel degradation reduces water table elevations. Furthermore, the plan fails to sufficiently promote projects that specifically raise streambed and water table elevations.

Alteration of natural stream hydrology is a high-priority limiting factor in WRIA 13. Streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions. Yet the plan’s water offsets seem to rely on further alterations of natural stream hydrology instead of seeking solutions that reverse such alterations to offset permit-exempt well withdrawals.

The narrative description for managed aquifer recharge projects mentions stormwater as a source for these projects. Yet, it is the only occurrence of the word "stormwater" in the entire description for managed aquifer recharge projects in WRIA 13. The plan should contain more details about how stormwater could be considered a source of water for managed aquifer recharge projects.

There appears to be no consideration of turbidity associated with high flows and its effect on operations and maintenance of managed aquifer recharge facilities. Consideration of turbidity with high flows likely will reduce the number of delivery days to offset operations and maintenance costs of managed aquifer recharge facilities.

The plan assumes that the groundwater recharge rate will be maintained through a program of periodic rehabilitation of the infiltration structure(s). However, rehabilitation could mean a number of things including excavating managed aquifer recharge facilities and screening out fines, which are not compatible with some of the natural areas identified as managed aquifer recharge locations.

There seems to be quite a bit of uncertainty around many offset projects. The offsets for this plan and others with high uncertainty should be revisited and removed as potential offsets.

Net Ecological Benefit

The plan estimates a surplus and net ecological benefit of 1,367 acre-feet per year. This includes a number of projects that we feel are uncertain or don't have project sponsors and thus should not be included. In other cases, there are projects that we felt overestimated the potential benefit. Given the larger surplus, if the authors of the plan were to provide more conservative estimates or remove projects, it still is likely there would be a net ecological benefit. The location and quantity of net ecological benefit shows a deficit in five subbasins and a surplus in four subbasins. This also is a concern though we are not sure if it is possible to identify additional projects to create a more spatially balanced offset across subbasins.

The plan also includes nineteen habitat projects. The plan states that the ecological and streamflow benefits from these projects are supplemental to the quantified water offset projects but will contribute to achieving net ecological benefit. There are a few habitat projects that appear to benefit marine or estuarine habitat and, while beneficial for salmon and other species, should not be considered contributing to net ecological benefit. In addition, most of the habitat projects do not have a project sponsor, which suggests that they are unlikely to be implemented. These should be flagged as conceptual only and not likely to provide a benefit.

Recommendations

Many of the offset projects are highly conceptual and feasibility analyses may find that the potential estimated offset in acre-feet per year is too high. More conservative estimates are needed for most of the managed aquifer recharge and water right acquisition projects. The estuarine and nearshore projects are good habitat projects for salmon and other fish but would not provide an offset to projected consumptive use and should be removed from the list of projects.

Consider solutions that address and enhance natural processes. Wood additions have the potential to accrete sediments and increase water table elevations. We recommend including a discussion of projects that raise water table elevations through raising streambed elevations. Aggradation of gravels in streams acts as filter media and helps to improve water quality. Wood additions coupled with riparian plantings can raise streambed elevations while limiting lateral stream migration. Riparian plantings improve water quality by shading streamflows and promoting deposition of fine sediments on floodplains. Floodplain connectivity offsets can be evaluated with analyses similar to those identified in the WRIA 13 plan's Appendix I: Detailed Project Descriptions, pages I-26 and I-27.

We recommend developing strategies that recognize and reverse the root causes of reduced summer base flows. The plan should recognize impacts of increased stormwater flow and display a preference for intercepting stormwater to source managed aquifer recharge facilities. The plan should evaluate existing stormwater conveyance systems for managed aquifer recharge source water. The plan should make estimates of turbidity during high flows to consider turbid waters' plugging effect on recharge facilities and evaluate if turbid flows can be allowed or if they will increase operations and maintenance costs to such a level that the number of diversion days must be reduced.

The plan should use caution when replicating natural annual hydrographs through further manipulation of natural stream hydrography (i.e., stream withdrawals to source managed aquifer recharge projects). Instead, the plan should develop and evaluate projects that reduce alterations of natural stream hydrology and avoid further manipulation of natural stream processes.

We recommend the plan be revised to remove some of the less likely offset projects and consider other recommendations above.

WRIA 14

Introduction to the Watershed Plan

WRIA 14, the Kennedy Goldsborough watershed, is in Mason and Thurston Counties and covers 381 square miles and includes an extensive network of independent streams. Principal drainages include Alderbrook, Cranberry, Deer, Goldsborough, Johns, Kennedy, Mill, Perry, Sherwood, Shumocher, and Skookum Creeks. WRIA 14 is divided into eight subbasins.

The WRIA 14 Watershed Restoration and Enhancement Plan projects 4,294 new permit-exempt domestic wells in the next twenty years and an estimated consumptive use of 760 acre-feet per year. A total of eight water offset projects would provide an expected offset of 1,725 acre-feet per year to benefit streamflow. This is estimated to provide a total net surplus offset of 965 acre-feet per year. The WRIA 14 watershed plan identifies twenty-five habitat projects designed to increase stream complexity, reconnect floodplains, promote fish passage, enhance natural processes, and ultimately benefit salmonids and other aquatic species.

Technical Summary and Review Comments

Consumptive Use

A total of 4,294 permit-exempt wells are expected in WRIA 14 by 2038, with an estimated use of 760 acre-feet per year (Table 8). WRIA 14 includes both Mason and Thurston Counties, but the largest number of the wells are expected to be in Mason County in the Oakland Bay subbasin.

Table 8. Estimated Consumptive Use for WRIA 14

Wells and Consumptive Use	Quantity
o Projected number of permit exempt wells in twenty-year planning horizon	o 4,294
o Indoor consumptive use, acre-feet per year/per well (average)	o 0.017
o Outdoor consumptive use, acre-feet per year/per well (average)	o 0.16
o Total estimated consumptive use from 2018-2038, acre-feet per year	o 760

The method used to project the number of new permit-exempt wells in WRIA 14 is based on recommendations from Appendix A of Ecology's *Final Guidance for Determining Net Ecological Benefit*. Ecology used growth estimates and growth allocations that were prepared by individual counties to forecast the number of permit-exempt wells in the twenty-year planning horizon. Ecology also forecasts the number of permit-exempt wells in the planning horizon by subbasin.

The method assumed an average indoor use per person per day and used estimates of the average irrigated area (outdoor lawn and garden areas), the amount of irrigation, and irrigation efficiency to derive the total water use per household with a permit-exempt well. A large portion (90 percent) of the indoor water use returns to groundwater via septic tanks and is not counted as a consumptive use. A small portion (20 percent) of the outdoor water use returns to groundwater or surface water and also is not counted as a consumptive use.

To estimate the average irrigated area for a new residence using a permit-exempt well, the lawn and garden areas of eighty parcels distributed throughout the WRIA and representative of a range of property values were analyzed. The average irrigated area was estimated to be 0.1 acre.

The methodology used to project the number of permit-exempt wells and estimate consumptive use in WRIA 14 was consistent with WRIAs 13 and 15, the other watershed plans reviewed by our team. The indoor consumptive use per permit-exempt well estimated for WRIA 14 was the same as WRIAs 13 and 15. The outdoor use consumptive use estimated for WRIA 14 was the same as WRIA 13 and slightly more than WRIA 15. The difference is caused by a larger average irrigated area in WRIAs 13 and 14 (0.1 acre) compared to WRIA 15 (0.08 acre).

The estimated outdoor consumptive use is much greater than the indoor consumptive use and comprises 90 percent of the total consumptive use. Ecology expects outdoor water use will occur mainly in summer but the consumptive use calculations present an average annual use, not the summer use. Showing the summer consumptive use would help guide implementation of future water offset projects as the largest streamflow deficits occur in summer. However, the projections follow the guidance used and appear to be technically sound.

Water Offsets

The WRIA 14 committee identified six water offset projects across seven subbasins, which if implemented would provide a total water offset of 1,725 acre-feet per year (Table 9). The total offset yields a surplus offset of 965 acre-feet per year above the 760 acre-feet per year consumptive use estimate.

Subbasins were delineated by Ecology and the Watershed Restoration Committee to describe the location of projected new consumptive water use and as a guide to developing projects that offset that use in the same general location and that addressed habitat needs to provide net ecological benefit.

Table 9. Estimated Water Offsets for WRIA 14

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Mason County Rooftop Runoff	o New county requirement for new rural residential building to install low-impact development best management practices that infiltrate more than 95 percent of rooftop runoff	o WRIA-wide	o 224

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o City of Shelton Reclaimed Water / Washington Correction Center Source Switch	o Redirect north Shelton wastewater to the Water Reclamation Plan and infiltrate Class A reclaimed water at existing spray field near the Washington Corrections Center.	o Goldsborough	o 459
o Evergreen Mobile Estates	o Water system consolidation and water right acquisition	o Oakland	o 7
o Managed Aquifer Recharge	o Install managed aquifer recharge facilities	o Case, Goldsborough, Kennedy, Mill, Oakland, Skookum	o 910
o Water Right Opportunities	o A focused WRIA-wide analysis on potential water right efficiencies and acquisition for future studies and implementation	o Goldsborough, Hood, Mill, Oakland	o 111
o Steamboat Middle	o Surface water retention and infiltration	o Kennedy	o 14
o	o	o Total	o 1,725

Note that the Schneider's Prairie Off-Channel Connection was included in Table 10 of the plan, but Schneider's Prairie is in WRIA 13. Schneider's Prairie Off-Channel Connection was not included in water offsets for WRIA 14.

Managed aquifer recharge projects account for 53 percent of the total water offsets for permit-exempt wells. The projected offsets rely heavily on managed aquifer recharge facilities with benefits that appear overestimated. While managed aquifer recharge facilities that accept stormwater or treated wastewater appear appropriate, managed aquifer recharge facilities that withdraw flow from streams rely on hydrologic manipulations of natural resources and natural processes that have questionable feasibility and benefits.

The plan cites the National Oceanic and Atmospheric Administration's Puget Sound Watershed Characterization Project, which is a tool used in Puget Sound by planners and resource managers to identify priorities for habitat protection and restoration. The characterization project directs planners to identify the root causes of watershed issues and develop appropriate solutions. The plan fails to identify stream degradation as a root cause of reduced base flows even though it is well understood that reduced streambed elevations directly impact water table elevations and base flow volumes. Channel and streambed degradation is listed as a habitat limiting factor addressed for nineteen of the twenty-three habitat projects listed in the plan's Table 12, indicating them as root causes of reduced summer base flow. Channel degradation reduces water table elevations. Furthermore, the plan fails to sufficiently promote projects that specifically raise streambed and water table elevations.

Alteration of natural stream hydrology is a high-priority limiting factor in WRIA 14. Streamflow is important for supporting riparian vegetation and wetlands that provide shade, wildfire breaks, food web support, and flood and sediment attenuation functions. Yet the plan seems to rely on further alterations of natural stream hydrology such as diverting streamflow to managed aquifer recharge facilities instead of seeking solutions that reverse those alterations, such as reversing channel degradation.

The Narrative Description for managed aquifer recharge projects identifies stormwater as a water source. Yet, it is the only occurrence of the word "stormwater" in the entire description for managed aquifer recharge projects. The plan should contain more details about how stormwater could be considered a source of water for managed aquifer recharge projects.

There appears to be no consideration of turbidity associated with high flows and turbidity's effect on operations and maintenance of managed aquifer recharge facilities. Consideration of turbidity with high flows likely will reduce the number of delivery days to offset operations and maintenance costs of managed aquifer recharge facilities.

The plan assumes that the groundwater recharge rate will be maintained through a program of periodic rehabilitation of the infiltration structure(s). However, rehabilitation could mean a number of things including excavating managed aquifer recharge facilities and screening out fines, which are not compatible with some of the natural areas identified as managed aquifer recharge locations.

Net Ecological Benefit

The WRIA 14 watershed plan estimates a surplus and net ecological benefit of 965 acre-feet per year. This includes a number of projects that we feel either are uncertain or highly conceptual and thus should not be included. In addition, there are projects that we felt overestimated the potential benefit. Given the larger surplus, if the authors of the plan were to reduce or remove projects, it still is likely there would be a net ecological benefit. The location and quantity of net ecological benefit shows a deficit in three subbasins and a surplus in five subbasins. This is also a concern though we are not sure if it is possible to identify additional projects to create a more spatially balanced offset across subbasins.

The plan also identifies twenty-five habitat projects. The plan states that the ecological and streamflow benefits from these projects are supplemental to the quantified water offset projects but will contribute to achieving net ecological benefit. There are at least three habitat projects that appear to benefit marine or estuarine habitats and, while beneficial for salmon and other species, they should not be considered contributing to net ecological benefit. In addition, habitat projects without a project sponsor suggest a high likelihood that they will not be implemented. These should be flagged as conceptual only and not included.

Recommendations

The offset projects generally include many that are highly conceptual, and feasibility analyses may find that potential offsets in acre-feet per year are too high. We recommend providing more conservative estimates for most of the managed aquifer recharge, rooftop runoff/low-impact development, and water right acquisition projects while keeping the estimates for wastewater infiltration. Remove Schneider's Prairie Off-Channel Connection project from the plan as it is in WRIA 13.

The estuarine and nearshore projects are good habitat projects for salmon and other fish but would not provide an offset to projected consumptive use and should be removed from the list of projects. If habitat projects don’t have a sponsor or landowners have not indicated some interest, then the project really is only conceptual and should not be included.

Consider solutions that address root causes of reduced summer base flows and use natural stream processes to reverse root causes. Wood additions can be used to accrete sediments to raise streambed and water table elevations. Include a discussion that recognizes that raised streambed elevations also raise water table elevations to address root causes of reduced summer base flows. Accreted sediments in streams also act as filter media to improve water quality. Wood placements that effectively raise streambed elevations can be coupled with riparian plantings to minimize lateral stream migration. Riparian plantings also improve water quality by shading streams and promoting fine sediment deposition on floodplains.

We recommend using stormwater for managed aquifer recharge source water rather than surface water. Many managed aquifer recharge projects use surface water for their sources, which does not appear to consider that stormwater discharges to streams increases turbidity. Intercepting stormwater before it enters natural streams avoids increases in erosion and turbidity. The plan should evaluate existing stormwater conveyance systems for managed aquifer recharge source water and consider if turbidity during high flows can be allowed or if increased turbidity effects operations and maintenance costs to such a level that the number of diversion days must be reduced.

The plan should use caution when replicating natural annual hydrographs through further manipulation of natural stream hydrography (i.e., stream withdrawals to source managed aquifer recharge projects). Instead, the plan should develop and evaluate projects that reduce alterations of natural stream hydrology and avoid further manipulation of natural stream processes.

We recommend the plans be revised to remove some of the less likely offset projects and consider other recommendations above.

WRIA 15

Introduction to the Watershed Plan

WRIA 15, the Kitsap watershed, encompasses the entire Kitsap Peninsula and surrounding islands. It covers 676 square miles including Kitsap County and portions of King, Mason, and Pierce Counties. Major drainages include Dewatto, Tahuya, and Union Rivers and dozens of independent streams. WRIA 15 is divided into seven subbasins.

The WRIA 15 watershed plan projects 5,215 new permit-exempt domestic wells in the twenty-year planning horizon with an estimated consumptive use of 718 acre-feet per year. A total of fifteen water offset projects would provide an expected offset of 2,873 acre-feet per year to benefit streamflow. This is estimated to provide a total net surplus offset of 2,155 acre-feet per year. The plan identifies thirty-one habitat projects designed to provide a variety of ecological benefits.

Technical Summary and Review Comments

Consumptive Use

A total of 5,215 new permit-exempt wells are expected in WRIA 15 by 2038, with an estimated use of 718 acre-feet per year (Table 10). Kitsap County is projects to experience the most, with 2,568 new wells, followed by Mason County with 1,301 new wells, Pierce County with 978 new wells, and King County with 368 new wells.

Table 10. Estimated Consumptive Use for WRIA 15

Wells and Consumptive Use	Quantity
o Projected number of permit-exempt wells in the twenty-year planning horizon	o 5,215
o Indoor consumptive use, acre-feet per year/per well (average)	o 0.0168
o Outdoor consumptive use, acre-feet per year/per well (average)	o 0.121
o Total estimated consumptive use from 2018-2038, acre-feet per year	o 718

The method used to project the number of new permit-exempt wells in WRIA 15 is based on recommendations from Appendix A of Ecology's *Final Guidance for Determining Net Ecological Benefit*. Ecology used growth estimates and growth allocations that were prepared by individual counties to forecast the number of permit-exempt wells in the twenty-year planning horizon. Ecology also forecast the number of permit-exempt wells by subbasin.

The method assumed an average indoor use per person per day and used estimates of average irrigated area (outdoor lawn and garden areas), the amount of irrigation, and irrigation efficiency to derive the total water use per household with a permit-exempt well. A large portion (90 percent) of the indoor water use returns to groundwater via septic tanks and is not counted as a consumptive use. A small portion (20 percent) of the outdoor water use returns to groundwater or surface water and also is not counted as a consumptive use.

To estimate the average irrigated area for a new residence using a permit-exempt well, the lawn and garden areas of eighty parcels distributed throughout the WRIA and representative of a range of property values were analyzed. The average irrigated area was estimated to be 0.8 acre.

The methodology used to project the number of permit-exempt wells and estimate consumptive use in WRIA 15 was consistent with WRIAs 13 and 14, the other watershed plans reviewed by our team. The indoor consumptive use per permit-exempt well estimated for WRIA 15 was the same as for WRIAs 13 and 14. The outdoor consumptive use estimated for WRIA 15 was slightly lower than for WRIAs 13 and 14. The difference is caused by a larger average irrigated area used in WRIAs 13 and 14 (0.1 acre) compared to WRIA 15 (0.08 acre).

The estimated outdoor consumptive use is much greater than the indoor consumptive use and comprises 90 percent of the total consumptive use. Ecology expects the outdoor water use will occur mainly in summer, but the consumptive use calculations present an average annual use, not the summer use. Showing the summer consumptive use would help guide implementation of future water offset projects as the largest streamflow deficits occur in summer. However, the projections follow the guidance used and appear to be technically sound.

Water Offsets

The WRIA 15 committee identified fifteen water offset projects, across seven subbasins, which if implemented would provide a total water offset of 2,873 acre-feet per year (Table 11). The total offset yields a surplus offset of 2,155 acre-feet per year above the 718 acre-feet per year consumptive use estimate.

Subbasins were delineated by Ecology and the Watershed Restoration Committee to describe the location of projected new consumptive water use and as a guide to developing projects that offset that use in the same general location and that addressed habitat needs to provide net ecological benefits.

Table 11. Estimated Water Offsets for WRIA 15

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Kingston Wastewater Treatment Plan	o Reclaimed water to recharge groundwater	o North Hood Canal, West Sound	o 328
o Central Kitsap Water Treatment Plan	o Reclaimed water for stream augmentation	o North Hood Canal, West Sound	o 560
o Tahuya Managed Aquifer Recharge	o Managed aquifer recharge	o South Hood Canal	o 200
o South Hood Canal Lakes Managed Aquifer Recharge	o Surface water storage and aquifer recharge	o South Hood Canal	o 62

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Bainbridge Island Managed Aquifer Recharge Opportunities	o Managed aquifer recharge through diversion of flow and infiltration	o Bainbridge Island	o 64.2
o Belfair Wastewater Treatment Plant	o Reclaimed water for infiltration to recharge groundwater	o South Sound	o 70
o Rocky Creek Managed Aquifer Recharge	o Managed aquifer recharge through diversion of flow and infiltration	o South Sound	o 150
o M&E Farm Stormwater Infiltration	o Stormwater collection and infiltration to recharge groundwater	o Bainbridge Island	o 8
o Ridgetop Boulevard Stormwater	o Stormwater collection and infiltration to recharge groundwater	o West Sound	o 126.7
o Mason County Rooftop Runoff	o Recharge groundwater through infiltration at homes	o South Hood Canal, South Sound	o 71
o Beall Creek	o Flow improvements	o Vashon Maury	o 26

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
Stream Augmentation	Discharge water indirectly into streams to augment streamflow	Bainbridge Island (future), North Kitsap, South Sound, West Sound	632
Forests for Streamflow	Acquire forestland to preserve stands or emphasize longer harvest interval	Bainbridge Island, North Hood Canal, South Hood Canal, South Sound, South Sound Islands, Vashon Maury, West Sound	241.2
Raingardens and Low Impact Development	Improve infiltration on impervious surfaces that generate stormwater	Bainbridge Island, North Hood Canal, South Hood Canal, South Sound, Vashon Maury, West Sound	188
Water Right Acquisitions	Permanently protect water rights, habitat improvements	Bainbridge Island, Vashon Maury	146
		Total	2,873

The plan lists primary limiting factors of channel and streambed degradation, increased peak flows, low streamflow, loss of upland forest cover, loss of riparian forest, and loss of floodplain connectivity and habitats. The limiting factors listed all speak to past land-use practices of removing wood from streams and draining wetlands that resulted in reduced streambed and water table elevations. These practices coincided with increases in stormwater and associated water quality and quantity impacts. This does not appear to be appropriately identified and many solutions rely on further manipulation of natural systems instead of restoration of natural processes.

The plan cites the National Oceanic and Atmospheric Administration's Puget Sound Watershed Characterization Project, which is a tool used in Puget Sound by planners and resource managers to identify priorities for habitat protection and restoration. The characterization project directs planners to identify the root causes of watershed issues and develop appropriate solutions. The plan fails to identify stream degradation as a root cause of reduced base flows even though it is well understood that reduced streambed elevations directly impact water table elevations and base flow volumes. The plan's Table 14 lists channel and streambed degradation, degradation of wetland and shoreline habitats, or loss of floodplain connectivity and habitats, as a habitat limiting factor addressed for twenty-three of the thirty-one habitat projects. This is an indication of root causes of reduced summer base flow. Channel degradation reduces water table elevations. Furthermore, the plan fails to sufficiently promote projects that specifically raise streambed and water table elevations.

Stream augmentation from pumping groundwater twists a root cause problem into a solution. It will rely on electricity to pump water for streamflow augmentation. Electric supplies will become more at-risk during fire season as climate change worsens. Utilities may shut off power preemptively to avoid causing wildfires or electricity may be cut off due to wildfires. Providing generators as a solution to this concern does not address root causes of the problem.

Forest protection projects seem like a good idea, but there is uncertainty about the age of the stands. These also are largely protection projects and while protection is always cheaper than restoration or mitigation, the benefits seem theoretical and some revisit of the forestry offset should be considered.

It is unclear if forest protection projects–are considered an offset project by the Department of Ecology. It is clear from literature that mature forests provide better in-stream flows, but not clear if the parcels would become mature forest anyway.

Net Ecological Benefit

The watershed plan estimates a surplus and net ecological benefit of 2,155 acre-feet per year just by accounting for the offset projects. However, this includes a number of projects that we felt were uncertain and thus should not be included. In addition, there are projects that we felt overestimated the potential benefit. Given the larger surplus, if the authors of the plan were to reduce or remove unlikely projects, it still is likely there would be a net ecological benefit. The location and quantity of net ecological benefit shows that all subbasins have a surplus, though this may change when the offset is revisited to adjust for our suggestions.

The plan also identifies thirty-one habitat projects. The plan states that the ecological and streamflow benefits from these projects are supplemental to the quantified water offset projects but will contribute to achieving net ecological benefit. However, there are a few habitat projects that appear to benefit marine or estuarine habitats and, while beneficial for salmon and other species, should not be considered contributing to net ecological benefit. In contrast to other WRIAs, all the habitat projects have sponsors and thus may be more likely to be implemented.

Recommendations

The offset projects generally include many that are highly conceptual, which suggests that the potential offset in acre-feet per year is too high. We recommend providing more conservative estimates for most of the managed aquifer recharge, rooftop runoff/low-impact development, and water right acquisition projects while keeping the estimates for wastewater infiltration. Projects that pump groundwater to augment surface water should not be considered as off-set projects.

The estuarine and nearshore projects are good habitat projects for salmon and other fish but would not provide an offset to projected consumptive use and should be removed from the list of projects.

Consider solutions that address and enhance natural processes. Wood additions can accrete sediments and increase water table elevations. Include discussion of projects that raise streambed elevations to raise water table elevations. Accreted gravels in streams act as filter media and improve water quality. If wood additions are coupled with riparian plantings, lateral stream migration can be arrested. Water quality is improved by shading streamflows and fine sediments tend to deposit on floodplains with intact riparian corridors.

Recognize root causes of reduced summer base flows and develop strategies for reversing root causes. Display a preference for intercepting stormwater before it enters natural streams and increases in erosion and turbidity. Develop and evaluate projects that reduce alterations of natural stream hydrology and avoid further manipulation of natural stream processes.

Evaluate existing stormwater conveyance systems for managed aquifer recharge source water. Consider the turbid waters' plugging effect on managed aquifer recharge facilities. Make estimates of turbidity during high flows. Evaluate if turbid flows can be allowed or if they will increase operations and maintenance costs to such a level that the number of diversion days must be reduced.

We recommend the plan be revised to remove some of the less likely offset projects and consider other recommendations above.

Conclusions

We reviewed the watershed plans for WRIAs 7, 8, 13, 14, and 15 to answer specific questions about consumptive use, water offsets and net ecological benefits.

Consumptive Use: *Estimated water consumption from permit-exempt domestic groundwater withdrawals in the next twenty years*. Are the projections technically sound? Was the methodology applied consistently?

- Across all five plans, the consumptive use estimates were technically sound and the methodology was applied consistently.

Water Offsets: *Actions that put water back into aquifers and streams that offset new consumptive water use*. Will the planned projects and actions (if implemented), at a minimum, offset the total projected impacts to in-stream flows from new consumptive water use in all the subbasins in the WRIA?

- Yes, all plans identify projects that offset projected consumptive use impacts, though in particular for WRIAs 13, 14, and 15, we feel that those offsets are too optimistic, and some projects should be removed. However, we believe that even after removal of more uncertain projects, there still will be adequate offsets.

Net Ecological Benefit: *Actions in the plans provide additional benefits to aquifers and streams beyond the minimum to offset projected consumptive use*. Do the plans identify projects and actions that provide additional benefits to in-stream resources beyond those necessary to minimally offset the impacts from new consumptive water use in the WRIA?

- Yes, though, as noted above, there are a number of water offset projects in WRIAs 13, 14, and 15 and some habitat projects that should not be included.

While we recommend some minor revisions for WRIAs 7 and 8, we felt that they meet the stated intent for watershed restoration and enhancement plans. For WRIAs 13, 14, and 15, we recommend revising or removing some water offset and habitat projects and addressing other minor comments.

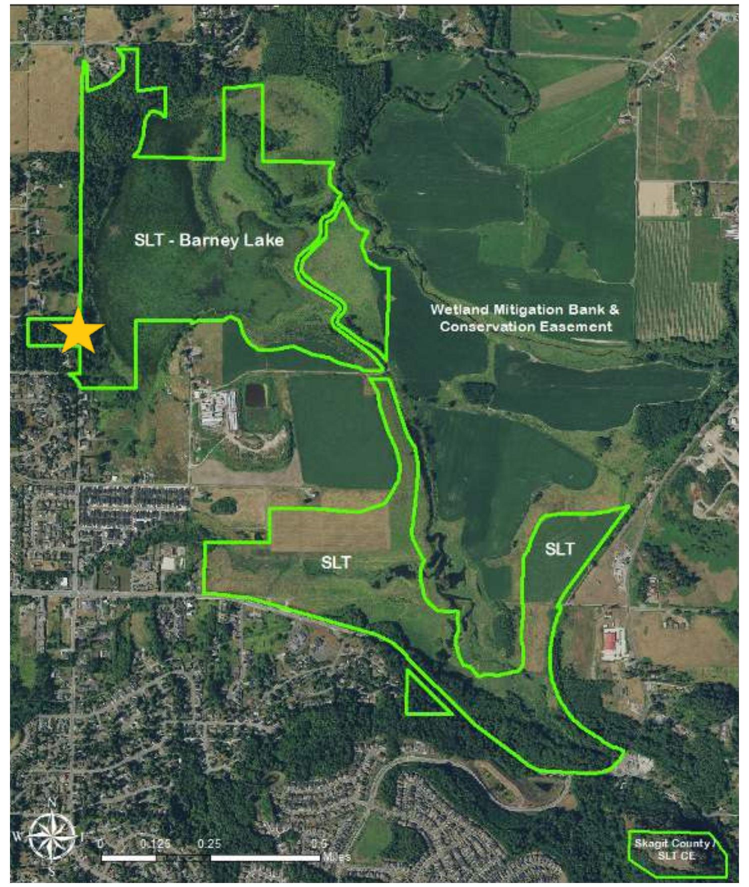
References

Washington Department of Ecology (Ecology). 2019. Final Guidance for Determining Net Ecological Benefit. GUID-2094 Water Resource Program Guidance. Publication 19-11-079. Olympia, Washington. Published on July 31, 2019.

sanctuary. SLT hosted member and community walks and events, gathered feedback through online surveys, and engaged youth in learning opportunities on the land. This past fall the Trust held a fundraising social on the land to kick off a campaign to support the next 30 years of conservation at Barney Lake. Several online presentations also shared the vision for future conservation efforts on the property which lies just beyond Mount Vernon.

Members heeded the call, donating over $160,000 to conserve land and explore wildlife compatible public access. In 2023 the Trust's Stewardship Department will review and incorporate feedback we received from Trust members and the community into Barney Lake's long term management plan.

"These plans are where we develop our vision and outline the actions we will take to get to that vision," says Stewardship Director Regina Wandler. "We are excited to incorporate thoughtful public access opportunities into this plan that keep the needs of wildlife as the priority into the future."



From top to bottom: Local youth learn about beavers on the property during a community walk; Guests tour along the Nookachamps during the fall fundraising social; Guests listen to a presentation on the last 30 years of conservation at Barney Lake and a vision for the next 30 years; participants on an early morning Trust tour to view swans; map with star showing expanded protection at Barney Lake.

SKAGIT LAND TRUST
Saving Land for Tomorrow

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Skagit Land Trust conserves wildlife habitat, agricultural and forest lands, scenic open space and shorelines for the benefit of our community and as a legacy for future generations.

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Join Us For An Upcoming Event!
Learn more & RSVP Online - www.skagitlandtrust.org

March 3 — Marblemount Planting Party — 10am-2pm

March 4 — Hurn Field Planting Party — 10am-2pm

March 4 — Samish Island Property Tour — 10am-11:30am

March 8 — Annual Meeting — 5:30-7pm
Online gathering with presentation on March Point & Great Blue Herons

March 10 — Skagit River Kahn Planting Party — 10am-2pm

March 11 — Samish Island Property Tour — 1pm-2:30pm

March 17 - Barney Lake Planting Party - 9am-1pm

March 17 - Suiattle River Planting Party - 10am-3pm

March 18 - Day Creek Planting Party - 10am-2pm

March 18 — Samish Island Property Tour — 10am-11:30am

April 20 — SLT Reads Saving Tarboo Creek — 5:30-7pm

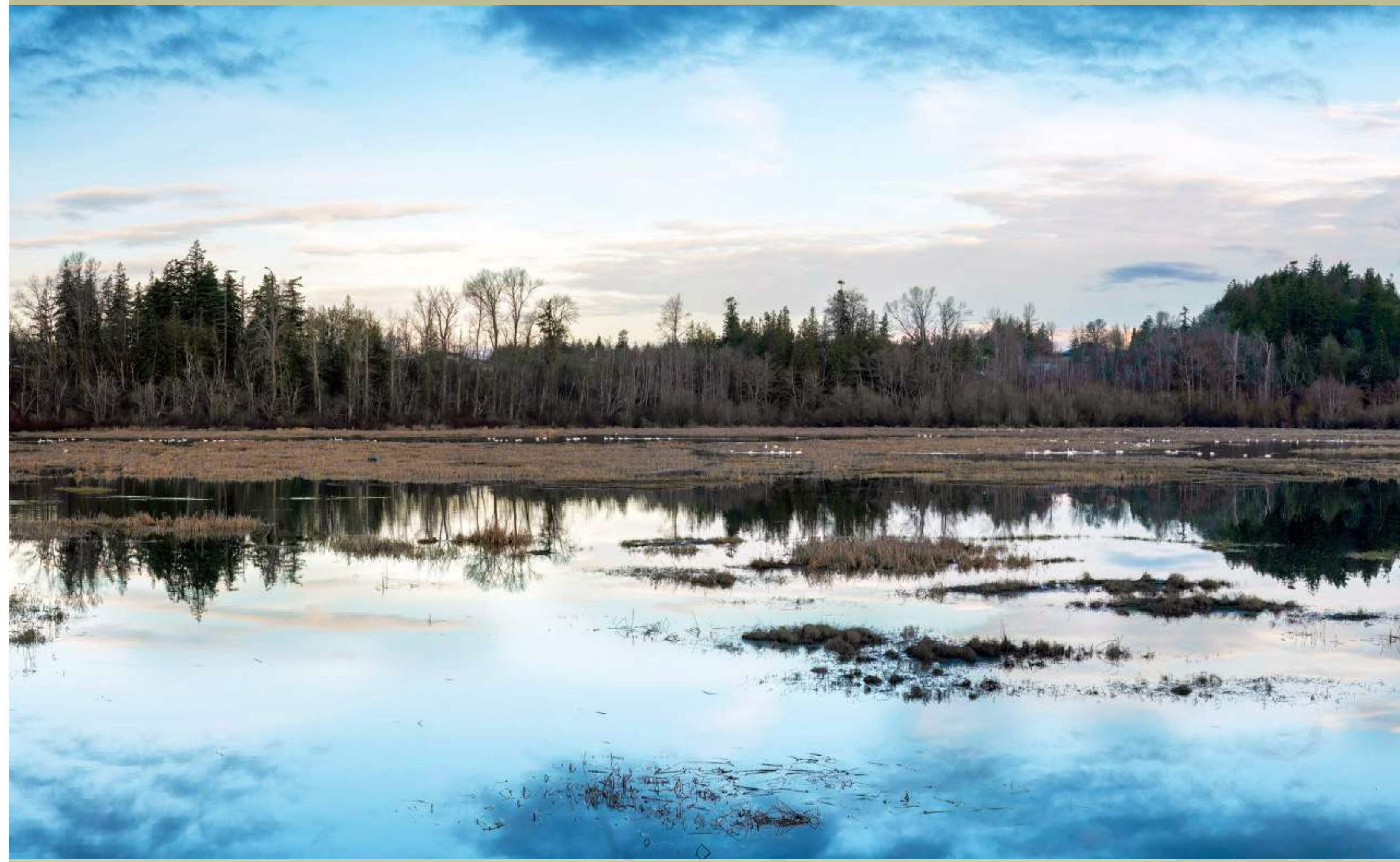
****Save the Date for our NEW Skagit Summer Social Fundraiser — June 15th*****
More information to come soon about this festive celebration on Lands We Love

The lands conserved and protected by Skagit Land Trust have been inhabited and stewarded by numerous tribes and Indigenous peoples since time immemorial. We recognize and respect the inherent, indigenous, and treaty rights of the Coast Salish People who have deep and abiding connections to these places. We seek to partner with local tribes as we conserve and care for these lands and waters.

SKAGIT LAND TRUST
Saving Land for Tomorrow
30th ANNIVERSARY

SKAGIT UPDATE

WINTER 2023



Barney Lake Conservation Area Grows Again

For the third time in the past year, our members and partners helped Skagit Land Trust add land to the Barney Lake Conservation Area. Five forested acres bordering the wetlands were bought in December, bringing the Trust's total ownership at Barney Lake to 376 acres of wetlands, farming fields, and forest.

"This property has been in the care of the same family since 1976," says Conservation Director Michael Kirshenbaum. "They were happy to know the cedar trees which form a natural buffer on the edge of the lake would be protected."

The mature forest found on the property

Barney Lake is one of the Trust's oldest and largest conservation areas. The Nookachamps River weaves through the property before reaching the Skagit River. This helps fill seasonal Barney Lake in the winter. A variety of wildlife find refuge here including Trumpeter swans, great blue herons, beaver, river otters, salmon, and a variety of other fish and migrating waterfowl. The Washington State Salmon Recovery Funding Board assisted with the purchase because the property also serves as Chinook salmon habitat.

Throughout 2022, the Trust shone a light on this wildlife

Continued on page 3...

Protecting A Place Loved Since Childhood

"I've been coming to Guemes Island since I was a small child," says Anne Casperson. "My husband Gary wanted to live in the San Juan Islands. I told him to check out Guemes. He toured around the Island and found this place."

That place was the southeastern point of Guemes Island, looking out over Saddlebag Island. Anne and Gary built their house in 1979 and began their life on the island. Over the years they purchased surrounding properties to keep the natural character of the point intact. After Gary passed away in 2006, Anne began thinking about a permanent way to protect her property and ensure it would remain mostly undeveloped for the wildlife and plants that lived there.

"The thing is, once these undeveloped places are gone – they are gone," says Anne.

Anne reached out to Skagit Land Trust in 2020 to explore ways to protect her land. She ultimately decided a conservation easement was the best fit for her. Conservation easements allow landowners to protect important parts of their property while still living on the land.

"Anne's conservation ethic shines through when you visit her property," says Kari Odden, Conservation Project Manager for the Trust. "The forest is well cared for. Anne has been a great steward and has kept her footprint on the land small."

The Casperson Conservation Easement protects a mature, mixed hardwood-conifer coastal forest with scattered rocky outcrops. The conservation easement includes 350+ feet of rocky shoreline, including a small, rocky pocket beach. It also protects open space on this prominent marine point, part of the viewshed from Guemes and Levant Channels, the Cascade Marine Water Trail, and Saddlebag Island State Park.

"I'm grateful that the conservation easement process is available for people who want to protect their land," says Anne. "Every little bit we can do to protect land helps. The more trees, wild spaces, and habitat we can preserve the better off we're all going to be."

If you would like to learn more about doing a conservation easement for your own property, please reach out to Conservation Director Michael Kirshenbaum, michaelk@skagitlandtrust.org, or call 360-428-7878.

From top to bottom: The view from Casperson Point; Stewardship Director Regina Wandler and Conservation Project Manager Kari Odden meet up with Anne onsite; Casperson Point is a well-known scenic view from the water.

Looking to the Next 100 Years on Samish Island

For thousands of years the Coast Salish people approached Samish Island through a wide slough that connected two bays and was surrounded by tidal marsh. The slough was named S7amésh Seqelích (Return to the Bay) by the Samish Indian Nation. In the 1930's Skagit County put fill across the last quarter mile of marsh to improve a dirt road on the Alice Bay (east) shoreline. A farmer diked his land to the west on Padilla Bay. And since then, Samish Island has been connected to the mainland by an isthmus.

For the past 25 years Skagit Land Trust (the Trust) has been working to conserve the land and waters at the entrance to Samish Island. We began with landowners donating conservation easements on forested uplands. We purchased the Samish Flower Farm in 2019 and the Samish Island Entrance Property in 2021, which together form the Samish Island Conservation Area. In December, the Trust bought 28 adjacent acres. This spring, the Trust hopes to buy another 45 acres which will bring the conserved lands at the entrance of Samish Island to 170 acres.

Thanks to a potential partner and future funding opportunities, the Trust only needs to raise another $105,000 for these recent acquisitions. Due to generous donors, $65,000 of that has already been donated. **We are only $40,000 away from reaching our goal that will support the purchase and stewardship of these expansive properties on the approach to Samish Island.** Our generous members are the reason we can stretch to purchases properties like these that will benefit all generations of people and wildlife, forever.

The two new property additions feature nearly a mile of shoreline on Padilla and Alice Bays. The tidelands outside the dikes include some salt marsh on Alice Bay. This gives us a glimpse of the habitat, now rare, that once made up most of the approach to the Island. The land that was created between the dikes has been farmed with various crops and grasses and is terrific bird habitat. It also serves as the only overland access to Samish Island.

Salt marsh on Alice Bay.

The dynamic nature of this isthmus environment was on full view during king tides coupled with low barometric pressure in December. The private dike on the Alice Bay side of the new property overtopped, flooding the county road to the island which lies below sea level, and severely eroding the dike. Emergency repairs on this dike had historically been done by the county to protect the road, however they said they could no longer take on a flood control role.

A multitude of wildlife use the property for feeding and shelter. Bald eagles, great blue herons, and migrating Brandt ducks are a few of the many species that use this land.

Skagit Land Trust stepped in to arrange and pay for the emergency repairs on the area at risk of breaching due to the extreme situation. In other areas of overtopping, volunteers sandbagged low spots. We are grateful for the help of local contractors-led by Arnie Svendsen Trucking Inc, Island residents, our members and volunteers including Steve Hopley who took a leadership role, and Dike District 5.

The event served as a reminder that the marine environment is powerful. Climate change will also increasingly impact infrastructure. Ongoing protection of a public road built below sea level is beyond the Trust's role. Those who live, work on, and visit Samish Island likely don't want to revert to the days when people timed their travel by the tide levels. Thus, the Alice Bay dike, meant to protect a buggy road almost 100 years ago, will need a good deal of further attention from all stakeholders working together to find solutions for the next 100 years. Recent, productive conversations with partners and the community make us hopeful this can happen.

King tides showed the age of the private dike. Trust staff met with community partners to begin talks on solutions to the aged dike.

Conservation ownership of these lands provides significant benefit to the community. Skagit Land Trust has extinguished development rights behind these dikes. Skagit Land Trust's growing conservation work on Samish Island has only been possible with the help of Trust members and volunteers, along with support from numerous partners including Coast Salish tribes such as the Samish Indian Nation, former landowners such as the Squires and Murphy families, conservation easement landowners, The Conservation Fund, other nonprofits, as well as local, state, and federal grant partners. Support from this extended community has played an important part in the conservation journey of the entrance to Samish Island. That journey is entering a new phase.

Working with the Padilla Bay National Estuarine Research Reserve(PBNERR), the Trust is excited to explore potential marine habitat restoration of the site's historic tidal inlet and salt marsh habitat. PBNERR is committed to being a long-term partner in this project and is pursuing funding to acquire these newly protected lands from the Trust. PBNERR will continue to collaborate with Skagit Land Trust in ongoing evaluation of habitat restoration. Together, we will work with the County and other stakeholders on opportunities for reducing the vulnerability of the road and dike systems. Through such partnerships, the Trust aims to achieve a sustainable vision for all who rely on, or treasure, this beautiful land. We hope to share more information about these efforts later this year.

Only $40,000 to go to protect more of the Samish Island Entrance!

Help protect and steward the beautiful approach to Samish Island. Please consider making a special gift today. You can send a check or make a gift online - note that your gift is for Samish Island.

Join us for a tour of the property during the dates listed below. Come see what you helping to conserve for all generations of people and wildlife. RSVP online today.

March 4th at 10am

March 11th at 1pm

March 18th at 10am

WASHINGTON
SALMON
COALITION
Community-Based Salmon Recovery

May 11, 2023

Chair Duffy & Salmon Recovery Board Members

RE: Washington Salmon Coalition "Partner Updates"

Coming off a very successful Salmon Recovery Conference, and a legislative session that found our Senators and Representatives supporting Lead Entity Coordinators through increased capacity funding we find ourselves pretty thankful. There was a lot of hard work that went into the planning for the Salmon Recovery Conference and the legislative session, and we are appreciative of the RCO and GSRO staff that made this happen.

Over the last few months Nick Norton has worked hard to thread the needle on the Targeted Investment Policy. The process he went through to coordinate with all of the parties was implemented very well. WSC is supportive of moving forward with the policy as written, with the caveat that we monitor its implementation and modify it as appropriate in the future.

WSC is also supportive of revising the Match Policy. Nick seems to be on the right track, and we encourage the Board to support his continued work on this important policy.

Thanks for your time today!

Sincerely,

Mike Lithgow, Chair of the Washington Salmon Coalition

Lead Entity Happenings May 2023

NOAA Fisheries awards WDFW and local partners $24 million in restoration funding through the Bipartisan Infrastructure Law funding

Submitted by Aundrea McBride, Skagit Watershed Council Lead Entity Coordinator and Gretchen Glaub, Snohomish County Lead Entity Coordinator

NOAA Fisheries announced late last month that WDFW and various Whidbey Basin salmon recovery project sponsors were selected to receive $24 million in federal salmon restoration funding known as the Transformational Habitat Restoration & Coastal Resilience Grants.

Here's a behind the scenes glimpse which illustrates the role lead entities play with their partners in facilitating such collaborative grant opportunities and project development. **This type of work is supported by SRFB Lead Entity and PSAR capacity funding.**

Lead Entity Coordinators and staff from Lead Entities whose geographic areas make up the Whidbey Basin- Snohomish, Skagit, Stillaguamish, and Island; have been meeting monthly since mid-2021 to share resources, support one another's lead entity functions and strategize around accelerating salmon restoration implementation. In anticipation of potential funding opportunities, they developed a shared, vetted project list. When the federal NOAA Transformational Habitat Grant Request for Proposals was released, lead entity staff partners drew from their shared project list to develop a suite of projects for inclusion in a Whidbey Basin application. Together they worked with their project sponsors, who drafted the content and budget for the grant applications, and WDFW's Jay Krienitz. WDFW took the lead in pulling the applications together and finalizing the narrative and budget.

These Lead Entity Coordinators, included:

- Snohomish Basin Lead Entity - Morgan Ruff, Capital Projects Coordinator, Tulalip Tribe; Gretchen Glaub, LE Coordinator, Snohomish County
- Skagit Lead Entity - Aundrea McBride, Watershed Coordinator, Skagit Watershed Council; Richard Brocksmith, Skagit Watershed Council Executive Director
- Stillaguamish Co-Lead Entity - Dani Driscoll, LE Coordinator, Snohomish County; Kit Crump former Snohomish County LE Coordinator;
- Island LE - Clea Barenburg, LE Coordinator; former Island LE Coordinator Dawn Pucci.

The entire partnership includes the Tulalip Tribes, Stillaguamish Tribe, Skagit River System Cooperative, Snohomish County, Snohomish Conservation District, The Nature Conservancy, Adopt-A-Stream Foundation, American Rivers, WDFW, and other local partners.

The Grant Award includes:

- Funding for North Whidbey Basin in the amount of $11.6 million is divided among 6 projects, 4 of which received design dollars from the SRFB, and 1 that received most of its construction dollars from the PSAR Large Cap program.
- North Whidbey projects will restore 627 acres of estuarine tidal marsh and pocket estuary habitat in one of the most important watersheds within Puget Sound for recovery of the ESU.

- Funding for South Whidbey Basin in the amount of $12.1 million is divided among 15 projects, 9 of which received SRFB and PSAR dollars for design and/or phases of construction.
- South Whidbey projects will restore over 1,200 acres of estuary and river floodplain function along over 17 miles of shoreline, and advance over 750 acres of future work.

The grant funding project timeline extends from spring of 2023 through December 31 of 2025.

For more information, please see NOAA Fisheries - Transformational Web Story: https://www.fisheries.noaa.gov/feature-story/more-265-million-funding-recommended-transformational-habitat-restoration-and-coastal

Map of Puget Sound and the Salish Sea showing the relative location of the Whidbey basin

Duncan Springs Cold Water Refugia Project
Kalispell Tribe Lead Entity
Submitted by Mike Lithgow, Information and Outreach/Policy Analyst
Kalispel Tribe Natural Resource Department

The Duncan Springs project was informed by results presented in Mejia et al (2020) and Garavelli et al (2021), which looked at water temperature differences within the Box Canyon reservoir portion of the Pend Oreille River and its tributaries, as well as Westslope Cutthroat and Bull trout usage of mouths of these same tributaries. Many of the tributaries remain cold during the warm summer months and act as a thermal refuge for trout, and other fish species, as they migrate through the warm reservoir during this time period.

Duncan Springs is an area with a series of small springs/seeps that come out of the bank and into the Pend Oreille River. This water averages around 11 or 12 degrees Celsius in the summer as opposed to the 23 degrees of the Pend Oreille River. Adult Bull Trout historically and recently have been observed in the area during the summer, attempting to take advantage of the cold water. The major issue they faced was the small amount of water and space available for them to utilize. The small inflow of cold water, coupled with the extremely shallow depths and complete lack of cover, made it difficult for adult fish to effectively use the cold water as a refuge without being prone to predation or other threats.

Duncan Springs Cold Water Refugia Project

The Duncan Springs project aimed to pool up the cold water from two of the seeps/springs by creating a spit to slow and back up the water. This in turn created a much larger overall area of cold water, but a Duncan Springslso provided depth and cover for protection from predators. This project is located on private property and cooperation with the landowner was necessary, so an old failing earthen dam was removed and replaced with one that was properly constructed. Most of the cold water in the project comes from an impoundment behind this dam. Water exits the impoundment through a fishway before flowing into the pool behind the spit. This fishway also allows fish to enter or exit the impoundment should they so desire, providing them with even more cold water to utilize during the warm summer months. The site was planted with native grasses and shrubs/trees to help stabilize it as well as provide cover as the trees mature.

References:

Mejia, Francine H., Christian E. Torgersen, Eric K. Berntsen, Joseph R. Maroney, Jason M. Connor, Aimee H. Fullerton, Joseph L. Ebersole, and Mark S. Lorang. 2020. Longitudinal, Lateral, Vertical, and Temporal Thermal Heterogeneity in a Large Impounded River: Implications for Cold-Water Refuges. *Remote Sens*. 12, 1386.

Garavelli, Lysel, Shannon E. Blackburn, Allan T. Scholz, Jason M. Connor, Mark C. Paluch, Jason A. Olson, and Brian J. Bellgraph. 2021. *Hydrobiologia*. https://doi.org/10.007/s10750-021-04625-7.

COUNCIL OF REGIONS UPDATE for the SRFB's March 8, 2023 Meeting

Prepared by Alex Conley, Chair

The Council of Regions (COR) brings together the state's seven Salmon Recovery Regions to 1) share information among the regions, GSRO & RCO, 2) provide input to the Salmon Recovery Funding Board & 3) coordinate activities that address shared needs of the regional organizations. Since the last SRFB meeting:

1. Regions and Lead Entities are **hard at work implementing the 2023 grant round**;
2. COR has **held monthly COR calls and organized COR participation** in groups such as SRNet and the Fish Barrier Removal Board. Huge thanks to RCO Director Duffy for her quarterly check-in calls and to Erik Neatherlin for organizing quarterly check-in calls with WDFW leadership.
3. The **four Columbia River Regions continue to meet monthly** to discuss and coordinate regional input on Columbia River policy and priorities with other state partners.

Specific Council of Regions Input for the May SRFB Meeting:

Item #4: Targeted Investment Policy

The Council of Regions would like to thank Nick Norton for his frequent and substantive engagement with the Council of Regions while the Targeted Investment policy before you today was being drafted. As proposed, the policy as creates a strong framework for future Targeted Investment grant rounds and effectively highlights the key role of regional organizations in identifying key recovery needs and soliciting projects that address them. We look forward to the opportunity to provide specific input as the SRFB develops the requests for proposals and associated criteria for future Targeted Investment grant rounds.

Item #5: Board Match Policy

Regional Organizations and many of our partner organizations are excited to see the SRFB evaluating ways to reduce the burden on project sponsors associated with documenting match funding. We strongly encourage the Board to continue to pursue Option 1, which removes match requirements while maintaining the ability to track and report on non-SRFB funds leveraged by projects.

Item #7: Board Funding Decisions

The Regions thank all who have worked to secure the diverse funding sources that are being allocated today. We are excited to see the SRFB considering both robust funding levels for the grant round and the first major increase in capacity funding for Regions and Lead Entities in over 15 years! We concur with the staff recommendation to not pursue Targeted Investments at this time and look forward to providing future input as staff develop proposals for riparian program guidelines and criteria. We would note that 1) riparian projects are unlikely to fit well in a Targeted Investment approach, and 2) that Regions and Lead Entities will likely have ranked and reviewed projects that will be submitted as part of the 2023 project lists that could be eligible for riparian funding prior to September 2024, if the SRFB would like to pursue that option.