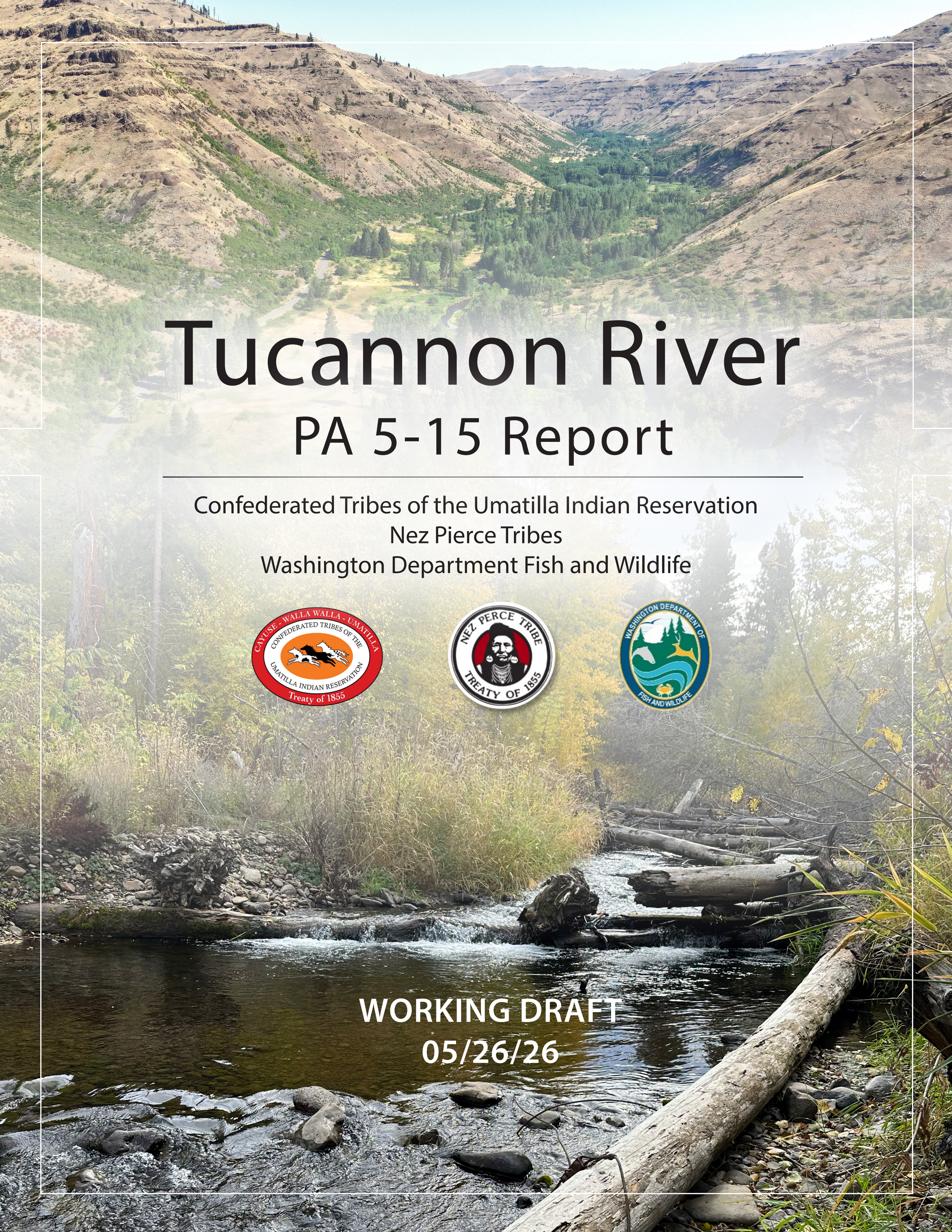

Tucannon River

PA 5-15 Report

Confederated Tribes of the Umatilla Indian Reservation
Nez Pierce Tribes
Washington Department Fish and Wildlife

WORKING DRAFT
05/26/26

Confederated Tribes of the
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Tucannon River PA 5-15 Report

Acknowledgements

Co-Manager Collaborators

The Confederated Tribes of the Umatilla Indian Reservation, the Washington Department of Fish and Wildlife, and the Nez Perce Tribe jointly sponsor the Tucannon River PA 5–15 Assessment and Conceptual Design. This collaborative effort brings together tribal, state, and scientific frameworks to inform restoration and management strategies. It reflects a shared commitment to integrating traditional ecological knowledge with contemporary science. The process emphasizes open coordination and transparent communication among all partners. Shared data and technical resources support consistent analysis and understanding across the project area. Joint decision-making ensures that outcomes are aligned with ecological goals, treaty obligations, and long-term watershed resilience.

Contributors

A collaborative approach was taken to incorporate ecological and fisheries recovery goals with local land management and use. The common goal was to create an action plan for improving salmonid habitat conditions and natural riverine processes while maintaining recreational oppportunities in the Tucannon River PA 5-15. Contributions to the assessment and planning process were provided through a technical and scientific team; including...to be completed - Itatur? Igenemp orerfero magnis ipicia sequo torro illecusdae pa nem et vento cum cone consequ iditio eaquatur?

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Tucannon - Caption Caption

Table of Contents

List of Figures

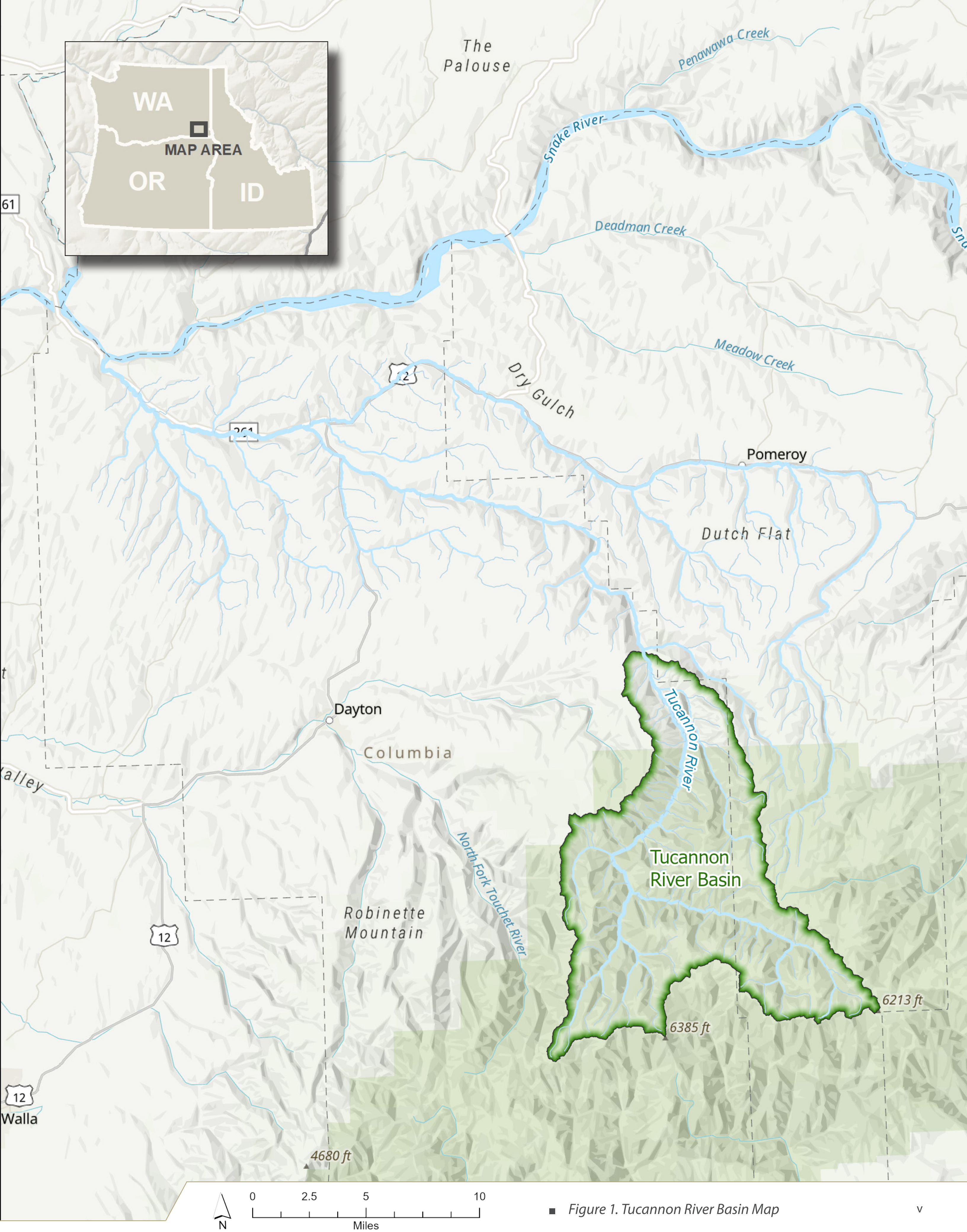
List of Tables

Tucannon River

The Tucannon River watershed is located in southeastern Washington, draining the west slope of the Blue Mountains before flowing into the Snake River. The watershed spans forested headwaters, mid-elevation canyons, and broader alluvial valleys, creating a diverse landscape of upland, floodplain, and aquatic habitats. This range of conditions supports a dynamic river system shaped by snowmelt, seasonal flows, and sediment processes that influence channel form and floodplain function.

For Native peoples, particularly the Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation, the Tucannon River is part of a larger cultural landscape tied to treaty-reserved rights and the First Foods tradition. The river and its watershed provide critical habitat for salmon, steelhead, and lamprey—species that are central to cultural identity, subsistence, and spiritual practices. Stewardship of these resources reflects a long-standing responsibility to maintain the health of the land and water for future generations.

Today, the Tucannon River watershed is also an important recreational destination. Areas such as the W.T. Wooten Wildlife Area attract anglers, hunters, campers, hikers, and wildlife viewers. The river supports popular fisheries, while the surrounding forests and open lands provide year-round outdoor opportunities. Balancing these uses with ecological restoration and cultural values is central to ongoing management efforts, making the watershed both a vital natural resource and a shared landscape for conservation and recreation.



■ *Figure 1. Tucannon River Basin Map*

Tucannon River
LINVILLE GULCH
Covello
2889 ft
3230 ft
3466 ft
CALLOWAY HILL
Sweeney Gulch Rd
DARLAN
LEWIS HOLLOW
Tumalum Creek
KIDWELL GULCH
Snake River
North Patit Creek
STEVENS RIDGE
STARVOUT RIDGE
Spring Lake
Rainbow Lake
ABELS RIDGE
SEOGGIN RIDGE
Peola
Pow Wah Kee Gu
Dry G
North Patit Creek
West Patit Creek
Watson Lake
Rose Springs
4732 ft
GULCH
Charle
JUMPOFF JOE
MARTIN RIDGE
MALONEY MOUNTAIN
BIG FOUR CANYON
4858 ft
5252 ft
GATES GULCH
4667 ft
MILL CANYON
HUCKLEBERRY BUTTE
MUD SPRING RID
ECKLER MOUNTAIN
Mountain Top
WHEATFIELD
Lick
BILLUPS GULCH
HIXON CANYON
Stentz Spring
LOST POINT RIDGE
Jim Creek
ELK POINT
TALLOW FLAT
SUNFLOWER FLAT
North Fork Asotin Creek
COURGAR RIDGE
Tucannon River
PAIGE RIDGE
MIDDLE POINT RIDGE
North Touchet River
Tucannon River
HORSE RIDGE
DEVILS
Meadow Creek
BIG TURKEY TAIL
AL WILLIAMS RIDGE
5852 ft
6174 ft
BUCKLEY RIDGE
WEST BUTTE RIDGE
ASE NTAIN
MIDDLE POINT RIDGE
6184 ft
MOUNT MISERY
6213 ft
DIAMOND PEAK
GRIZZLY BEAR RIDGE
Fork Touchet River
FRENCH
DANGER POINT
BALD BUTTE
RAY RIDGE
Tucannon PA 5-15
WT Wooten Wildlife Area
Tucannon basin
N
0 1 2 4
Miles
MONUMENT RIDGE
SADL

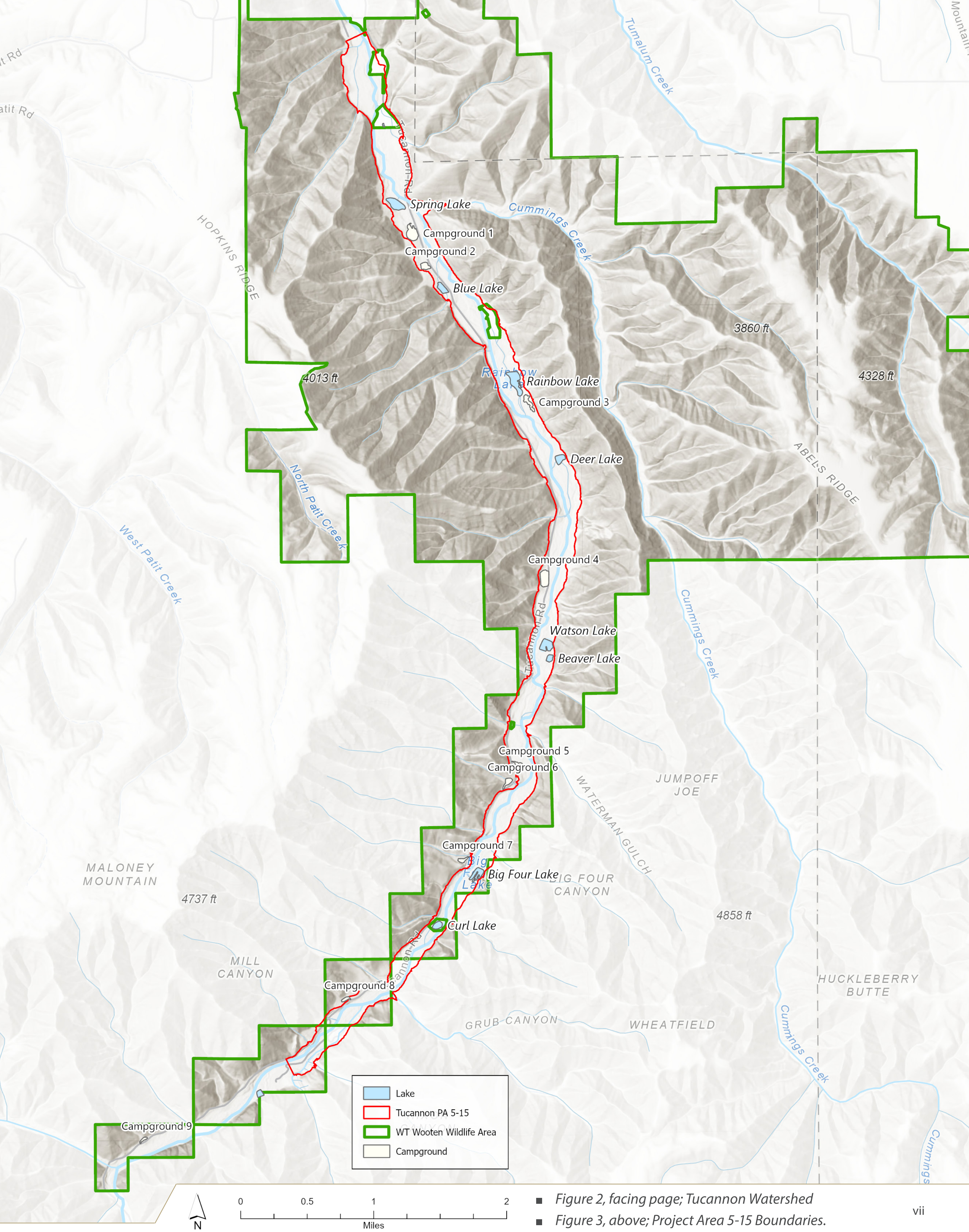
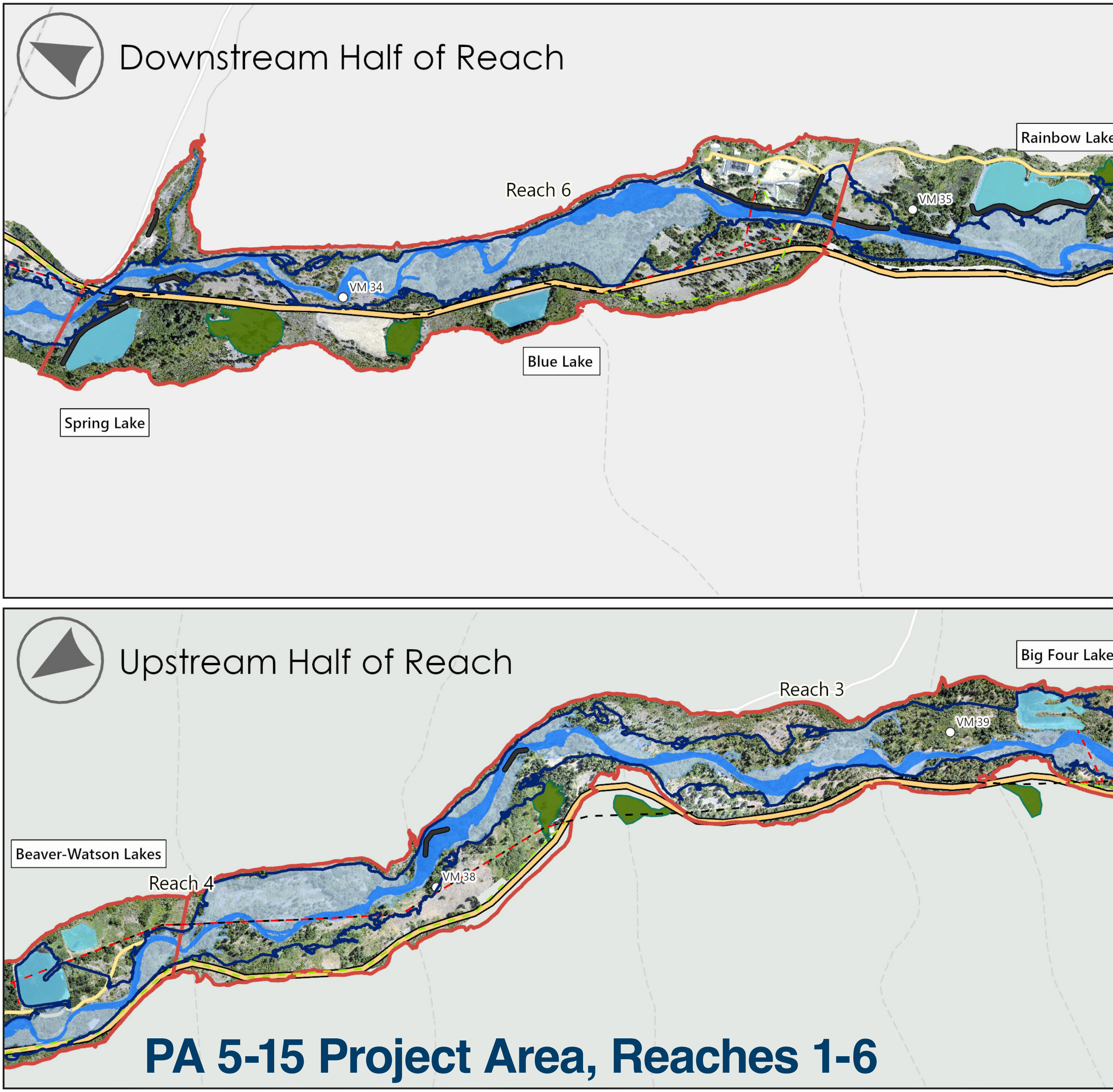


Figure 2, facing page; Tucannon Watershed

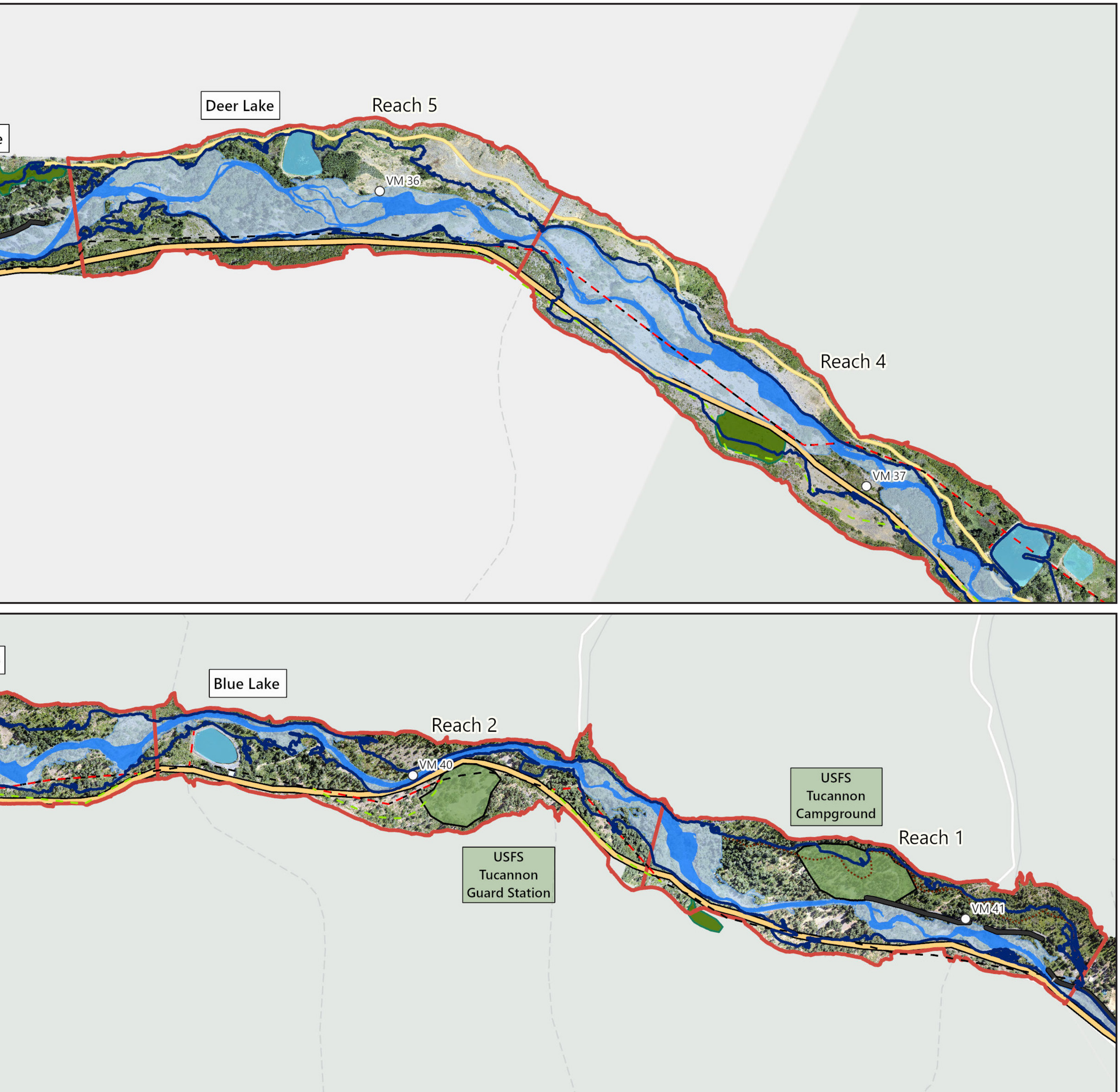
Figure 3, above; Project Area 5-15 Boundaries.



PA 5-15 Project Area, Reaches 1-6

The project reach is located within the W.T. Wooten Wildlife Area in southeast Washington, Columbia County, along the Tucannon River from below Camp Wooten (PA-5) downstream to Russell Springs (PA-15; RM 46.25–36.25). The assessment quantifies the impacts of floodplain infrastructure—including roads, lakes, powerlines, and campgrounds—on channel and floodplain function within this 10-mile reach.

Infrastructure encroachment has reduced floodplain connectivity through large wood removal, riparian vegetation loss, channel straightening, and levee construction. These alterations have increased stream power, promoted channel incision, reduced pool formation, and diminished channel complexity and riparian habitat. The reach exhibits characteristics of degraded physical and ecological processes.



Ecological impacts include reduced velocity refuge, limited food web productivity, and redd scour during relatively frequent flow events. This assessment and conceptual design prioritize restoration actions that improve floodplain connectivity and restore physical and ecological function and improve recreation access and resources.

■ *Figure 4 Project Area 5-15 Exisiting Conditions Map.*

Plan Co-Managers

The Confederated Tribes of the Umatilla Indian Reservation, the Washington Department of Fish and Wildlife, and the Nez Perce Tribe jointly sponsor the Tucannon River PA 5–15 Assessment and Conceptual Design. This process integrates tribal, state, and scientific frameworks and is guided by open coordination, shared data, and joint decision-making.

Washington Department of Fish and Wildlife

The Washington Department of Fish and Wildlife (WDFW) is responsible for conserving, protecting, and enhancing fish, wildlife, and their habitats across Washington for current and future generations. This includes restoring and maintaining healthy ecosystems, managing species populations, and ensuring the long-term sustainability of natural resources.

WDFW balances conservation with public access and use, working collaboratively with Tribal co-managers, agencies, and stakeholders to implement science-based management, support ESA recovery, and address changing environmental conditions. A core part of WDFW's mission is providing sustainable recreational opportunities—including fishing, hunting, camping, and wildlife viewing—while ensuring these uses remain compatible with long-term ecosystem health and species conservation goals. Within the W.T. Wooten Wildlife Area, this mission is carried out through integrated management of lands, waters, habitats, and public recreation.

Nez Perce Tribe

The Nez Perce Tribe manages natural resources through a framework grounded in cultural heritage, treaty-reserved rights, and a long-standing relationship with the land and waters of its ancestral territory. The Treaty of 1855 secured the Tribe's rights to fish, hunt, and gather across its usual and accustomed areas, forming the foundation for continued stewardship.

Management is guided by a holistic, ridge-top-to-ridge-top perspective that recognizes the interconnectedness of upland, floodplain, and aquatic systems. The Tribe emphasizes protection and restoration of native species—particularly salmon, steelhead, lamprey, and other First Foods—through restoration of watershed processes and ecosystem resilience. The Watershed Division works to protect and restore watersheds and fisheries resources throughout Nez Perce Territory, integrating traditional ecological knowledge with modern science to support healthy, harvestable fish populations for future generations.

Confederated Tribes of the Umatilla Indian Reservation

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) manage natural resources through a framework grounded in cultural traditions, First Foods responsibilities, and Treaty of 1855 rights, which ensure access to traditional foods across ceded lands and define the Tribe's long-standing stewardship role.

Management is guided by the First Foods concept—water, salmon, deer, cous, and huckleberry—and emphasizes protection and restoration of the watershed, floodplain, and aquatic processes that sustain these resources across connected upland and riverine systems. This approach recognizes the interdependence of healthy rivers, floodplains, riparian areas, fish populations, wildlife habitat, and water quality in supporting both ecological and cultural resilience.

The CTUIR Department of Natural Resources integrates traditional ecological knowledge with modern science to protect, restore, and enhance healthy ecosystems, resilient habitats, and sustainable fish populations for future generations and continued cultural use. In support of this mission, the Fisheries Habitat Program works to restore functional floodplain, channel, and watershed processes; develop science-based restoration strategies and priorities; maintain current understanding of watershed function and aquatic habitat conditions; and build cooperative relationships with agencies, Tribes, landowners, and stakeholders to improve restoration effectiveness, ecosystem resilience, and long-term stewardship outcomes.

Introduction to the Plan

Background, Call to Action, Vision

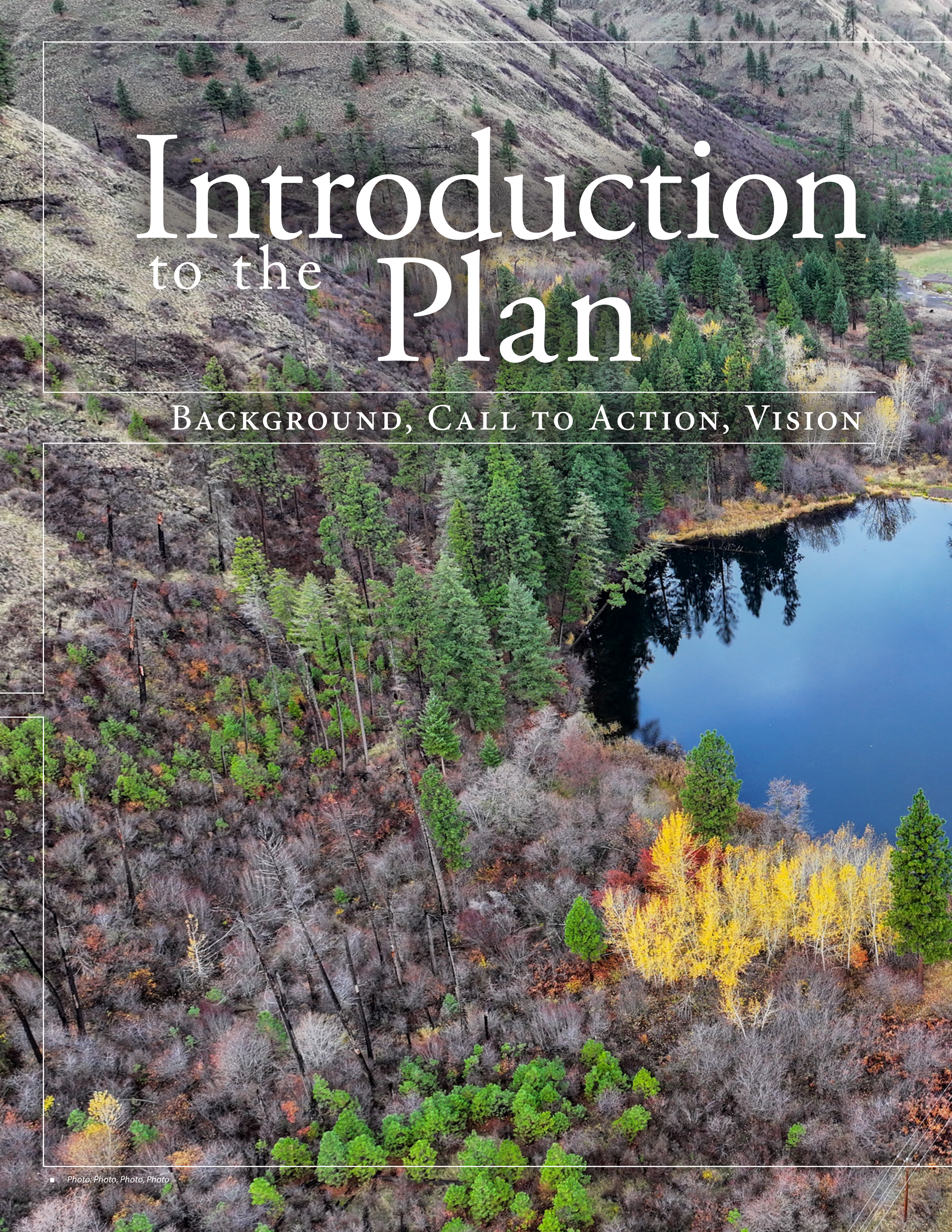


Photo: Photo, Photo, Photo

The overall project vision is to restore physical and ecological floodplain function to benefit key fish and aquatic species, while broadening and enhancing recreational opportunities, through coordinated planning and conceptual restoration designs for the floodplain and adjacent lands of Wooten Wildlife Area.

Restoration actions will maximize recovery potential for ESA-listed spring Chinook, summer steelhead, and bull trout on the Tucannon River.

Restoration actions will account for the multi-use nature of the project area.

The shared vision is a healthy and functional ecosystem, which also is a reliable water resource and an enjoyable place for recreation, so that the Tucannon sustainably supports native fish populations in balance with recreation and the regional community.

CTUIR, WDFW, and NPT jointly lead a collaborative, multi-use assessment of the Tucannon River PA 5–15 reach to evaluate floodplain constraints, watershed processes, and their effects on key limiting factors. The effort develops and advances conceptual design alternatives that improve habitat for ESA-listed species while reducing flood risk and guiding long-term, multi-use management.

The multi-use assessment identifies floodplain constraints and quantifies their effects on key limiting factors, including channel complexity, floodplain connectivity, stream power, and pool development. It develops, analyzes, and advances a range of alternatives into conceptual designs aimed at improving conditions for ESA-listed Snake River spring Chinook, summer steelhead, and bull trout. The resulting designs outline a pathway for multi-use management that reduces flood risk and long-term maintenance needs.

The project delivers a spatially explicit, process-based physical and biological assessment, informed by established restoration frameworks and supported through collaboration among CTUIR, WDFW, NPT, and other federal, state, and local partners. It evaluates historical and current geomorphic and hydrologic processes, assesses land-use impacts, identifies restoration actions, and incorporates cost-benefit considerations for preferred alternatives.

The assessment informs restoration priorities to support multiple species, including Snake River spring Chinook, summer steelhead, bull trout, Pacific lamprey, and freshwater mussels. The final product establishes a defensible, watershed-specific strategy for process-based floodplain restoration, grounded in analysis of land use, vegetation, aquatic communities, and physical processes, and shaped through ongoing stakeholder engagement.

W.T. Wooten Wildlife Area

The Wildlife Area is established in the early 1940s following its recommendation in 1940 as the "Tucannon Deer and Elk Range." Most acquisitions occur between 1941 and 1943, creating an initial 12,000-acre area to reduce conflicts between wildlife and livestock and provide lands for wildlife and public recreation. The area has since expanded to more than 16,000 acres.

The Tucannon River originates on U.S. Forest Service lands south of the Wildlife Area and flows about 17 miles through it, joined by tributaries including Cummings Creek and the Little Tucannon River. It supports diverse aquatic life, including ESA-listed fall and spring Chinook, summer steelhead, and bull trout. Surrounding lands provide important winter range for big game and year-round habitat for wildlife.

Public access improves in the 1970s with roadway upgrades, increasing visitation to approximately 120,000–140,000 visitor days annually, with peak holidays drawing 3,000–5,000 visitors, primarily from the Tri-Cities and nearby communities.

Recreation is supported by eight artificial lakes built in the 1950s. The lakes were installed as part of the Lower Snake Compensation agreement for mitigation of reduced recreational fishing opportunity resulting from the four Lower Snake River dams. Recreation is also supported by the Tucannon Fish Hatchery, which stocks about 88,000 catchable and 2,000 jumbo rainbow trout annually. The hatchery also supports ESA recovery and mitigation by producing steelhead and spring Chinook for the Tucannon River and regional programs.

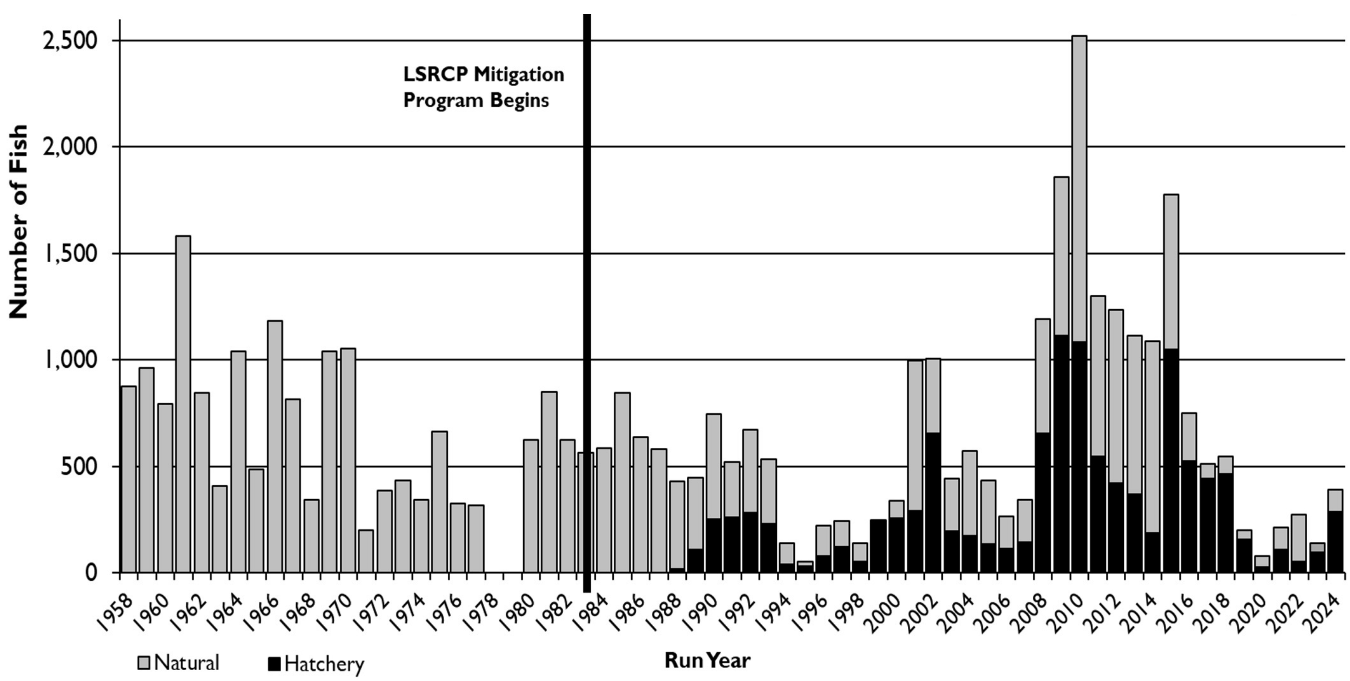
Need for Action on the Tucannon River

The Tucannon River within the W.T. Wooten Wildlife Area represents a critical yet impaired reach for ESA-listed salmonids and other aquatic species. Despite its ecological importance as a spawning and rearing corridor, restoration progress in this 10-mile reach has been limited due to extensive floodplain infrastructure, including roads, levees, lakes, powerlines, and campgrounds, which confine the channel and restrict natural processes.

Decades of floodplain encroachment have reduced channel complexity, disconnected the river from its floodplain, and increased stream power, leading to channel incision, reduced pool formation, and diminished habitat quality. These conditions reflect a system constrained in a degraded and self-reinforcing state, limiting natural recovery and reducing productivity for key species. At the same time, removal of large wood, degradation of riparian vegetation, and historical channel modifications have further simplified habitat and reduced ecological resilience. Current infrastructure also presents ongoing management challenges. Flood damage, maintenance demands, regulatory compliance issues, and ecological impacts—such as sedimentation, altered thermal regimes, and disrupted hydrology—highlight the unsustainability of existing conditions. In particular, the Tucannon Lakes and associated facilities both constrain floodplain function and require continued investment to maintain.

Biologically, the need for action is urgent. Populations of Snake River spring Chinook and steelhead have declined to levels near quasi-extinction thresholds, with recent returns among the lowest observed since ESA listing. Without intervention, current habitat conditions are insufficient to support recovery or long-term persistence of these species.

Salmon and steelhead populations in the Tucannon River have declined significantly due to factors such as commercial overharvesting, hydropower facilities, and climate change. In the basin, floodplain simplification, including channel straightening, floodplain smoothing, and agricultural development, along with the loss of floodplain vegetation, roughness, and large wood sources due to wildfires and infrastructure changes (such as roads, levees, and lakes), has reduced the active and available floodplain by approximately 70%. This has resulted in impacted habitats that affect juvenile rearing and spawning conditions.



■ *Figure 5. Tucannon River Spring Chinook Returns. Chinook Reaching Quasi-Extinction Status. NPT Ecological Goal: 22,000; Recovery Plan Goal: 750 to 3,000; Hatchery Goal: 1,152.*

Setting the Stage for Restoration

Previous planning efforts have largely avoided this reach due to infrastructure constraints and associated risks. However, new geomorphic data and improved understanding of floodplain processes show these areas play a far greater role in instream habitat than previously recognized, creating both an opportunity and a need to rethink management approaches.

A process-based assessment and conceptual design is needed to quantify floodplain confinement impacts, evaluate infrastructure modification or removal, and identify restoration actions that reconnect floodplains, reduce stream power, and restore channel complexity. These actions would support ESA-listed species recovery while reducing flood risk, improving resilience, and maintaining compatible recreational uses.

In short, the Tucannon River PA 5–15 reach requires coordinated action to transition from a constrained, degrading system to a resilient floodplain capable of supporting both ecological recovery and sustainable multi-use management.

Floodplain Management Plan

The 2012 Wooten Wildlife Area Floodplain Management Plan (FMP), developed by WDFW, provides an integrated strategy to address degraded floodplain conditions along the Tucannon River. Historic channel modification, infrastructure encroachment, loss of large wood, and riparian degradation have reduced ecological function and habitat quality.

The FMP establishes a balanced framework to restore river and floodplain processes, improve habitat for ESA-listed species and wildlife, sustain recreation, and maintain critical infrastructure. A key challenge is the location of Tucannon Lakes and associated infrastructure within the floodplain, which constrains natural processes and creates ongoing maintenance, regulatory, and ecological issues.

PA 5-15 Assessment

Building on the foundation of the Wooten Wildlife Area Floodplain Management Plan, the PA 5–15 Assessment and Conceptual Design advances this work by focusing on a critical 10-mile reach where floodplain constraints, infrastructure conflicts, and habitat limitations converge.

While the FMP establishes broad goals for balancing restoration, recreation, and infrastructure, the PA 5–15 effort provides the detailed, process-based evaluation and integrated vision needed to resolve these tradeoffs, prioritize actions, and define a clear pathway toward a more functional, resilient, and multi-use Tucannon River corridor.

Vision, Goals and Objectives

The vision, goals, and objectives for the Tucannon River PA 5–15 Assessment and Conceptual Design were developed collaboratively by CTUIR, WDFW, and NPT with input from partners, stakeholders, and the public. Guided by shared data, open coordination, and joint decision-making, the process integrates tribal, state, and scientific perspectives.

The shared vision focuses on restoring floodplain connectivity, channel complexity, and riparian function to support recovery of ESA-listed species while sustaining recreation and other public uses, including fishing, hunting, and camping within the Wildlife Area. The plan also recognizes the Treaties of 1855 and the importance of maintaining healthy watersheds, floodplains, and fish populations to support Tribal treaty rights, ecological resilience, and long-term multi-use management of the Tucannon River corridor.

Vision

Restore physical and ecological floodplain function to benefit key fish and aquatic species, while broadening and enhancing recreational opportunities, through coordinated planning and conceptual restoration designs for the floodplain and adjacent lands of WT Wooten Wildlife Area.

Goals

1. Assess the impacts of floodplain confining infrastructure on listed salmonids habitat, as well as other aquatic species.

2. Identify management needs and potential alternatives for each of the Tucannon Lakes.

3. Develop an assessment and accompanying conceptual designs to prioritize the restoration of physical and ecological functions of the river, floodplain, and riparian habitats.

4. Restoration actions will maximize recovery potential for ESA-listed spring Chinook, summer steelhead, and bull trout on the Tucannon River.

5. Restoration actions will account for the multi-use nature of the project area.

6. Prioritized conceptual designs will provide direction to the co-managers for implementation of restoration construction projects.

Objectives

- Consider alternatives and plans for the lake areas including lake modification, relocation, or removal.
- Conduct analyses of geomorphology, riparian vegetation, and connectivity.
- Conduct analyses of fishery and productivity modeling.
- Conduct analyses of climate change effects on hydrology and water quality.
- Conduct a Lakes Management Assessment (dam safety, maintenance, spoils management, and intake/outlets).
- Use new analyses and assessments to fill remaining data gaps and inform prioritization and conceptual designs.
- Identify metrics and criteria that address the critical path items in implementing restoration.
- Identify limiting factors and processes for ecosystem recovery and restoration that are tied to River Vision touchstones.
- Identify connections to Upland Vision touchstones.
- Identify estimates of potential ecosystem and fish productivity uplift (relative to cost) for restoration actions.
- Identify potential scale of actions and their respective benefits.
- Identify potential actions that would increase safety/reduce maintenance costs.
- Identify recreational use benefits.
- Develop lists of recommended actions by Project Area.
- Restoration actions will work to improve floodplain habitat conditions by decreasing floodplain confinement and increasing overbank inundation frequency.
- Restoration actions will enhance existing fishing, hunting, camping, wildlife viewing and other recreational activities.
- Conceptual designs will identify multi-use floodplain improvements to increase floodplain availability.
- Restoration actions will benefit all salmonid life stages but will specifically focus on egg-to-fry, juvenile rearing, and adult spawning life stages of ESA-listed salmon species.

CTUIR River Vision and Touchstones

The Tribes have a traditional and cultural connection to the foods provided by the earth. This is supported through ceremonial meals in the Tribal Longhouse and is further ingrained through the First Foods mission. The Umatilla River Vision was developed as an application of the Umatilla Tribes First Foods mission focusing on water and water quality management (Jones et. al., 2008). The vision provides management context to maintain the minimum ecological requirements for the First Foods of water and salmon and requires a river that is dynamic and shaped by physical and biological processes and interaction between those processes. The vision describes the desired ecological characteristics based on fundamental touchstones that include hydrology, geomorphology, connectivity, native riparian vegetation, and native aquatic biota. As a foundational approach to organizing this Action Plan, ecological processes by touchstone provides a way to categorize and identify functional metrics and relates well to limiting factors for important species. Although this vision is developed by the CTUIR to support the First Foods mission and is directed at the Umatilla River, it is consistent with other natural resource management agency goals and is applicable to other riverine systems.

Partners and Stakeholders

The Partners and Stakeholders are a key source of data and the ultimate recipient of the communications messaging. Identifying the project stakeholders ...Stakeholder groups and their respective roles are defined below. Key personnel per group and a summarization of their roles .

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Technical Team

General project oversight was accomplished through the formation of a group of cooperating entities and agencies that was defined as the Technical Team. TRatecessim suntibusda dipsum fugiam erios magnisto eatum dis solorendant quos simperi adipidem voloribus que exceatibus et illa pereprae. Riasper ehendam, sit inusamus et voluptia accae in nes exerum dunt acipis estinct atemolu ptinctur?

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Decision Making Process and Co-Manager Collaboration

The Tucannon PA 5-15 Assessment report is the product of nearly three years (2023-2026) of collaboration between CTUIR, NP, and WDFW personnel. This collaboration involved over 40 formal meetings with the co-managing organizations—six of which were in person, either on site along the banks of the Tucannon River, or in Walla Walla, WA, where Science and Leadership meetings were hosted. The five Science and Leadership meetings brought the project's organizational leadership and co-managers together to review and discuss potential alternatives and find agreement within a final combined preferred alternative. The list below shows the dates and key outcomes/ agreements associated with each of the five Science and Leadership meetings. Informal communication between personnel within the co-managing organizations was continuous throughout the three-year process. X meetings were held in Dayton and X to present the assessment to the public and solicit feedback from the public.

Science and Leadership meetings:

March 28, 2024- The co-managers discussed initial areas of agreement and consensus and areas that would require additional work to achieve alignment. Each of the co-managers provided their preliminary preferences for future conditions within the project area.

March 11, 2025- The co-managers reviewed the draft proposed potential alternatives and agreed to provide their respective preferred alternatives. Specific areas where the draft preferred alternatives required additional discussion/feedback to reach agreement were—Beaver/Watson Lake, Deer Lake, Curl Lake, and the Tucannon Campground.

June 13, 2025- The co-managers presented their respective preferred alternatives and discussed areas of agreement and areas of difference. WDFW conditionally agreed to the removal of Beaver/Watson Lake if suitable replacement fishing opportunities were identified. The co-managers agreed to review an updated design for the relocation and/or reconfiguration of Deer Lake. The co-managers agreed to engage the USFS about potential restoration opportunities within the USFS-owned Tucannon Campground.

August 22, 2025- The co-managers reviewed the updated draft combined preferred alternative and continued discussions/ negotiations, focusing on areas of agreement and differences. The co-managers provided feedback on the updated designs for the Deer Lake and the Tucannon Campground portions of the combined preferred alternative.

November 21, 2025- The co-managers reviewed a draft of the final combined preferred alternative, with a particular focus on negotiating agreement regarding alternatives for re-locating Deer Lake and removing Curl Lake. The co-managers conditionally agreed to re-locate Deer Lake if a suitable location was identified. The co-managers conditionally agreed to remove Curl Lake if a suitable location for a weir downstream was identified.

Rainbow Lake, Tucannon PA 5-15

Technical Assessments

This section provides a summary of techincal assessments for the PA 5-15 Assessment and Conceptual Design Project within the WT Wooten Wildlife Area.

Each technical summary delves into crucial questions that will play a significant role in shaping and prioritizing the restoration strategies for the Project Area.

The reach-scale assessments uncover distinct patterns that not only link this project area to broader ecological trends but also highlight its unique characteristics.

These summary assessments provide insight into the extent and root causes of ecological degradation while outlining key processes for recovery and recommended actions. Together, they inform conceptual restoration planning by focusing on underlying causes, resulting conditions, and the actions needed for effective restoration.

This summarized techincal briefs are based on the detailed techincal reports that are in the Appendices of this document.

1. Geomorphic Assessment and State of the Floodplain
2. Floodplain Space and Connectivity
3. Vegetation Assessment
4. Climate Change Impacts
5. Focal Species Production & HSI
6. Lakes and Infrastructure
7. Recreation
8. Wetlands

SUMMARY OF ASSESSMENT OUTCOMES

The assessment identified several key technical outcomes and long-term challenges within the reach.

- Approximately 70 percent of the floodplain has become disconnected due to lateral confinement from infrastructure and vertical channel incision caused by excess stream power.
- A minimum functional floodplain width of 450 feet was identified as necessary to reduce confinement pressures and improve system resilience.
- Existing conditions are further complicated by reduced riparian and floodplain vegetation, increasingly complex infrastructure constraints, and the effects of climate warming, including higher temperatures.
- These changes have contributed to a decline in overall wetland function and area.
- Aging lakes and infrastructure continue to drive increasing operation, maintenance, and replacement costs over time.
- Recreation is central to the Tucannon Valley, where artificial lakes, stocked fisheries, camping, hunting, hiking, and wildlife viewing support long-standing public use. Recreation assessments and user surveys help guide restoration and infrastructure improvements that enhance both ecological function and visitor experience.

1. GEOMORPHIC ASSESSMENT STATE OF THE FLOODPLAIN

Overview

Historical impacts to the Tucannon River floodplain include channel straightening, floodplain constriction by infrastructure, and removal of large wood. Together, these impacts have concentrated stream power and driven channel incision. The net result of lateral confinement and vertical disconnection is an active floodplain that occupies approximately 30% of its former width.

Using a new floodplain mapping approach, this study quantifies the relative factors disconnecting the floodplain from its historical extent. Confining infrastructure, which laterally disconnects the floodplain, accounts for approximately 35% of the historical floodplain extent. Lakes (18%), roads (10%), and levees (7%) make up these laterally disconnected areas. Channel incision has vertically disconnected an additional 37% of the historical floodplain extent.

As a result of this disconnection, the river has substantially increased energy and stream power. This concentration of energy creates highly erosive conditions within the river and floodplain, increasing the volume and size of sediment transported through the system. These conditions exacerbate the potential for redd scour, continued incision, and excessive wood transport.

Floodplain reconnection is the primary approach to address these erosive conditions. Reconnection efforts must address both lateral constraints and incision in concert. This can be achieved through large-scale river and floodplain reconnection actions, such as channel filling and floodplain shaping. Additional actions include removing or reducing encroaching infrastructure, reconnecting and developing side channels, increasing in-stream complexity (e.g., wood placement), enhancing riparian zones, increasing surface diversity across the floodplain, modifying or removing obstructions, and strategically relocating roads to further reduce lateral disconnection.

Techincal Discussion

This assessment evaluates geomorphic floodplain connectivity along the Tucannon River (PA 5–15) to support restoration planning by quantifying how channel incision and confining infrastructure limit floodplain function. A cross-section–based geospatial analysis was used to measure connected and disconnected

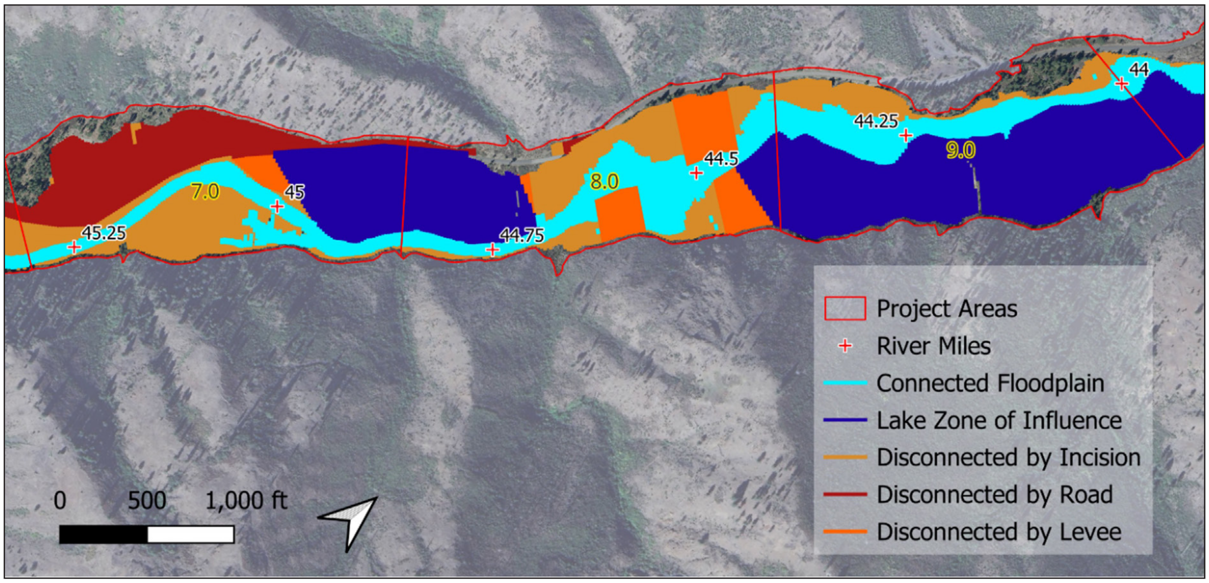
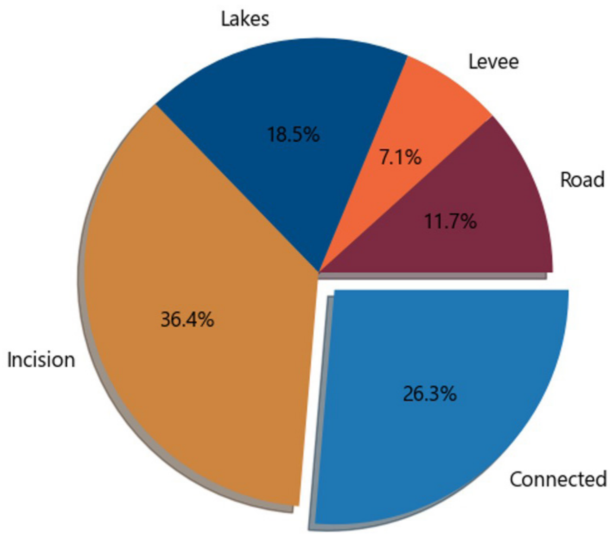


Figure 6. Example of cross-section-based connectivity analysis showing the reach from Curl Lake to Big Four Lake.



■ *Figure 7. Area-based summary of floodplain connectivity and disconnectivity by causal mechanism.*

■ *Figure 8. Historical photograph, taken 1906, of a log mill in the Tucannon River floodplain. Source: USFS*

floodplain width, identifying four primary drivers of disconnection: incision, roads, levees, and artificial lakes. Floodplain width serves as a key indicator of system function, as it reflects the space available for water and sediment to disperse, reducing erosive energy and enabling natural channel processes. Results show that approximately 74% of the floodplain is disconnected to some degree, with incision representing the largest contributor, followed by infrastructure that restricts lateral connectivity and channel migration.

These constraints concentrate flow within a narrowed channel, increasing stream power and sediment transport capacity while limiting the system's ability to dissipate energy across the floodplain. Under current conditions, spawning-sized gravels are frequently mobilized during relatively common flow events, indicating an over-energetic and transport-dominated system. This imbalance reduces channel stability and inhibits the formation and persistence of geomorphic features that depend on depositional processes. Analysis demonstrates that increasing effective floodplain width directly reduces stream power, shifting conditions toward greater sediment stability and improved geomorphic function.

A floodplain width of approximately 300 feet represents a minimum functional threshold for achieving more balanced conditions, although benefits continue to increase with greater levels of reconnection.

Findings also show that incision and infrastructure act in combination, and addressing only one source of disconnection is generally insufficient to restore functional connectivity. Incision limits vertical engagement of the floodplain, while roads, levees, and lakes restrict lateral expansion, together constraining the river's ability to adjust and recover. Effective restoration therefore requires coordinated, process-based actions that expand floodplain width, reduce confinement, and reestablish connection between the channel and valley bottom. Approaches such as infrastructure modification or removal, floodplain grading, and channel adjustments to reduce incision can collectively lower stream power, promote sediment deposition, and restore more stable and dynamic geomorphic conditions.

Overall, the analysis reinforces that geomorphic connectivity is fundamentally a function of space—specifically, the ability of the river to access and interact with its floodplain. Restoring this connectivity is essential to reducing excess energy, rebalancing sediment transport, and reestablishing the processes that sustain long-term channel stability and floodplain function across the Tucannon River system.

2. FLOODPLAIN SPACE AND CONNECTIVITY

Overview

The reduction in the width of connected floodplains is influenced by both lateral constraints—such as lakes, levees, and roads—and vertical disconnection caused by channel incision. This study evaluates the resulting changes in stream power, scour potential, habitat function, wood stability, and flood inundation that have occurred due to the historical constriction of the floodplain.

This study quantifies the benefits of increasing connected floodplain width along the Tucannon River, recognizing that floodplain space can be expanded through both lateral and vertical reconnection. A series of benefit curves were developed to estimate gains in habitat quality, river function, reduced stream power, and infrastructure resilience resulting from the reestablishment of floodplain space.

A minimum “low bookend” floodplain width of approximately 450 feet was identified as a planning target for connected floodplains in the Tucannon River. This width reduces the potential for continued incision and should be applied at artificial valley pinch points. Preserving this space at critical locations enhances the long-term function and resilience of wider, well-connected floodplain segments throughout the project area. A recommended planning range of 400–500 feet is suggested to guide future infrastructure and restoration investments.

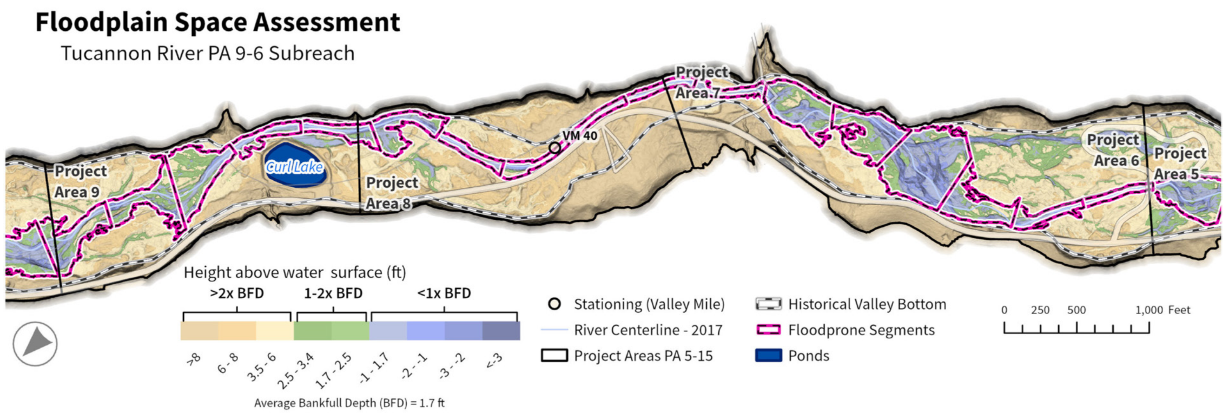
By establishing this minimum space at critical pinch points, restored segments that exceed the low bookend threshold are more resilient to incision. The developed benefit curves provide a framework for quantifying the potential benefits associated with broader floodplain reconnection strategies.

Techincal Discussion

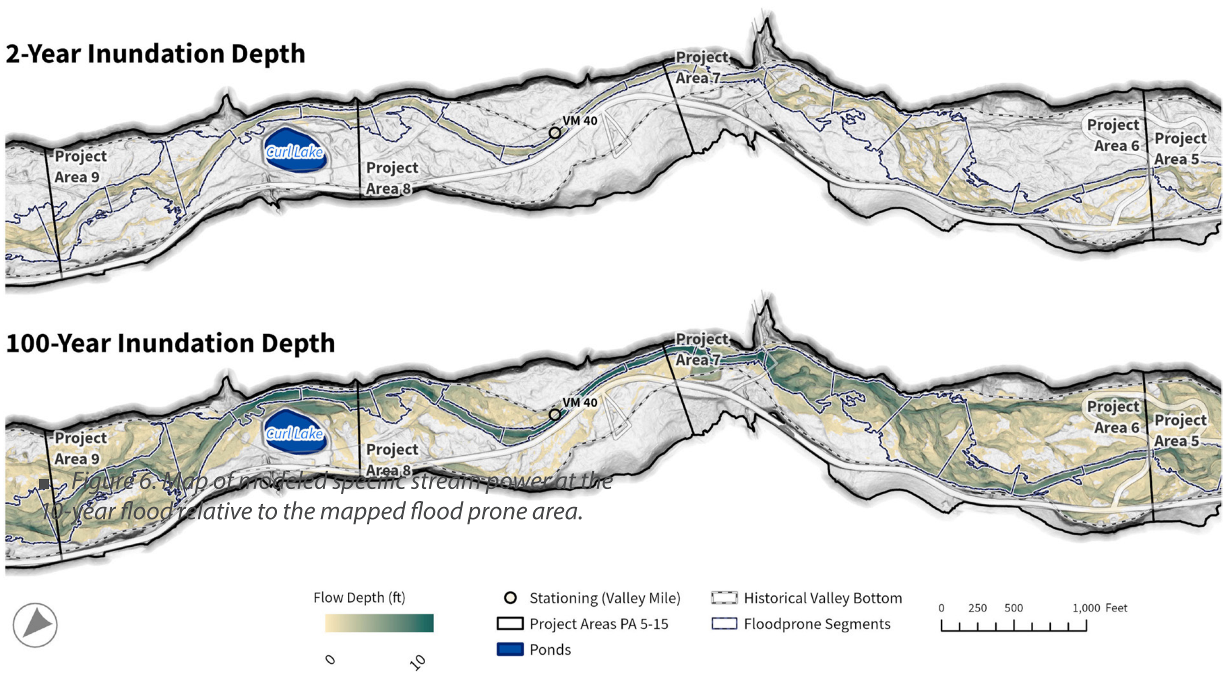
This assessment evaluates floodplain space along the Tucannon River (PA 5–15) to support integrated restoration and multi-use planning by quantifying current floodplain conditions, the functional benefits of increased space, and the minimum space needed to sustain long-term river and floodplain processes. The study is grounded in a process-based framework that recognizes floodplain space as a primary control on hydraulic, geomorphic, and ecological function. Mapping results show that the active, connected floodplain has been substantially reduced—averaging roughly 30% of its historical extent—due primarily to channel incision, with additional reductions caused by artificial lakes, roads, and levees that constrain lateral connectivity. In many locations, these constraints have narrowed the floodplain to a fraction of its former width, limiting the river’s ability to access its valley bottom and perform essential processes.

To understand the implications of this loss of space, the analysis developed reach-specific relationships—referred to as “benefit curves”—that link floodplain width to key hydraulic, geomorphic, and habitat metrics derived from modeling and field-informed data. These relationships demonstrate that floodplain width strongly influences inundation patterns, flow velocity, stream power, sediment transport, and habitat complexity. Wider floodplains consistently support greater inundation area and volume, particularly during larger flood events, while also reducing flow velocities and distributing hydraulic energy across a broader area.

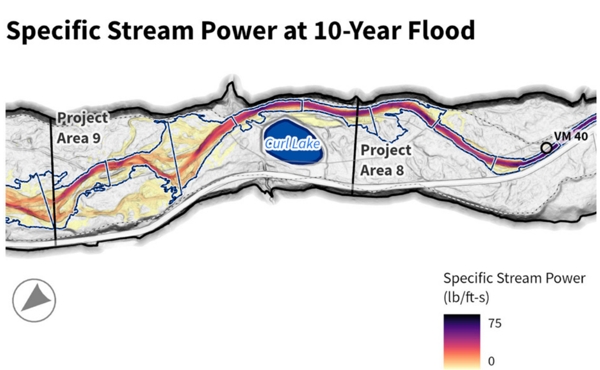
This reduction in energy lowers stream power and erosion potential, promoting more stable channel conditions and reducing the likelihood of incision and infrastructure damage. In contrast, narrow and confined floodplains concentrate flow and energy, resulting in elevated erosion risk, increased sediment transport, and reduced system stability.



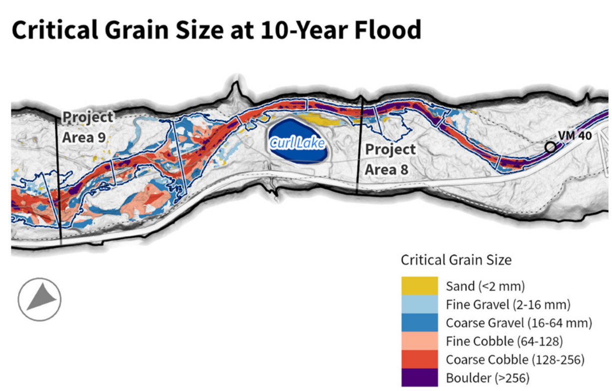
■ *Figure 9. Mapping of contemporary and historical floodplain extents on a relative elevation model basemap. Attachment A displays this mapping for the whole project reach. The flow direction is right to left.*



■ *Figure 10 (above) and Figure 11 (below). Example maps of modeled inundation relative to the flood prone area.*



■ *Figure 12. Map of modeled specific stream power at the 10-year flood relative to the mapped flood prone area.*



■ *Figure 13. Map of critical diameter (mm) produced from modeled shear stresses at the 10-year flood*

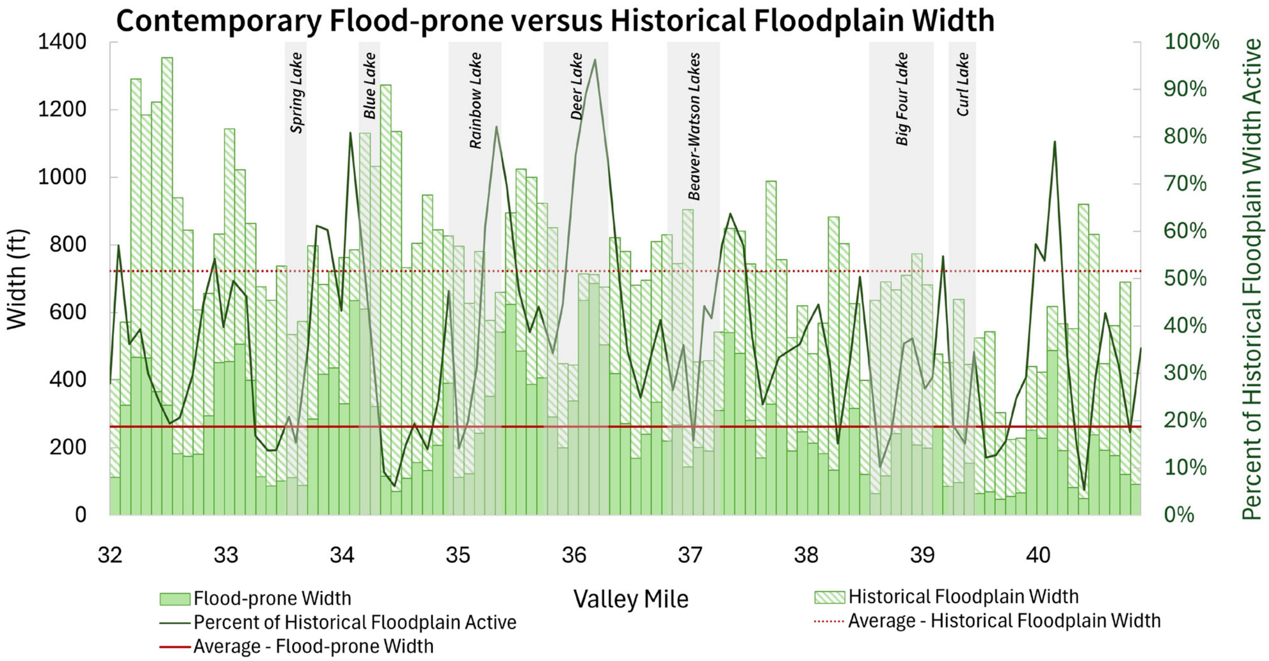


Figure 14. Historical versus contemporary (flood prone) floodplain width along the PA 5-15 Reach.

The study further demonstrates that floodplain space is closely tied to habitat function and resilience. Wider floodplains increase the availability and complexity of aquatic habitat by supporting multiple flow paths, off-channel areas, and increased edge habitat—features that are critical for juvenile fish rearing and refuge during high flows. At the same time, reduced velocities and shear stresses in wider floodplains decrease the likelihood of redd scour, improving survival conditions for incubating salmon eggs. The analysis shows that scour risk is highest in the most confined segments and decreases as floodplain width increases, highlighting a direct linkage between geomorphic condition and a key life-history bottleneck for spring Chinook. In addition, observations from restoration sites indicate that wider floodplains enhance the retention and stability of large wood, which in turn promotes channel complexity, habitat development, and long-term restoration effectiveness.

Beyond ecological benefits, the assessment identifies important implications for infrastructure and flood risk management. Constrained floodplains are more likely to overflow during large flood events, often directing floodwaters toward roads, campgrounds, and other developed areas. In contrast, wider floodplains provide greater capacity to store and convey floodwaters, reducing localized flood risk and potentially attenuating downstream flood peaks. These findings highlight that restoring floodplain space can simultaneously improve ecological function and reduce long-term infrastructure vulnerability and maintenance costs. The benefit curves developed in this study provide practical tools for evaluating these trade-offs, allowing planners to assess how changes in floodplain width translate into measurable improvements in system performance.

To inform planning decisions, the study also evaluates how much space the river needs to maintain long-term resilience. Using a multiple-lines-of-evidence approach, the analysis identifies three key conditions necessary to minimize incision and sustain floodplain function: bed stability, sediment deposition potential, and retention of large wood. By evaluating these factors in relation to floodplain width, the study identifies a minimum “low bookend” floodplain width of approximately 450 feet—roughly 10 times the bankfull channel width—as the threshold at which these processes

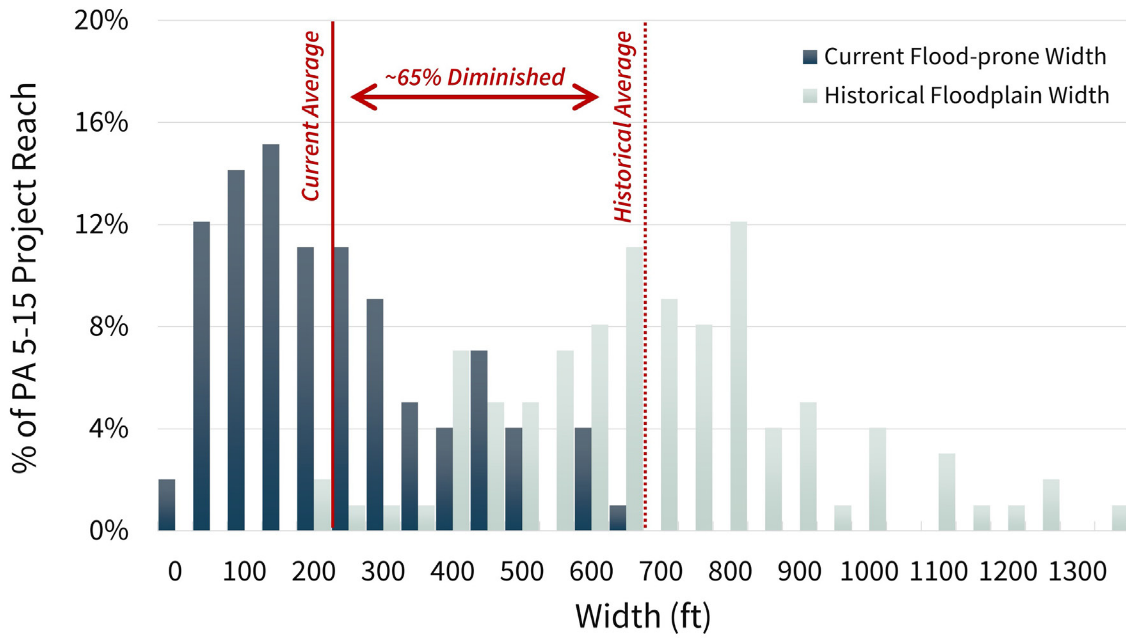


Figure 15. Histograms of existing floodplain (flood prone) widths and historical valley bottom widths.

are supported. At this width, stream power and shear stress are sufficiently reduced to stabilize the channel bed, sediment transport capacity is moderated to allow deposition, and conditions favor the retention of large wood and development of channel complexity.

This minimum width serves as a planning-level target to guide restoration design, infrastructure setbacks, and land-use decisions within the project area. However, the analysis also makes clear that this value represents a lower bound rather than an optimal condition. Benefits to floodplain function, habitat, and system resilience continue to increase with additional space, particularly as the river approaches full reconnection with its historical valley bottom. As such, restoration strategies that maximize floodplain width and connectivity—within the constraints of existing land use and infrastructure—are expected to produce the greatest long-term ecological and geomorphic gains.

Overall, the assessment demonstrates that floodplain space is the fundamental driver of river function in the Tucannon system. Loss of space has led to increased erosion, reduced habitat quality, and heightened infrastructure risk, while restoring space offers a pathway to reestablish natural processes, improve ecological outcomes, and enhance resilience to future disturbances. The findings provide a clear, quantitative framework for balancing restoration, recreation, and infrastructure needs, and for advancing a coordinated, process-based strategy for floodplain management in the Tucannon River valley.

How Much Space Does the Tucannon River Need?

Based on modeling and sediment transport analyses, we developed a low bookend space target according to the estimated minimum floodplain width needed to sufficiently reduce incision potential. We analyzed space needs to support a stable streambed, promote gravel deposition, and retain large wood. Floodplains of at least 450 feet wide addressed all three criteria. The 450-foot target is approximately 10 times the average bankfull channel width (44 feet) in the project reach. This low bookend target is intended for planning to support long-term resilience of the Tucannon River floodplain.

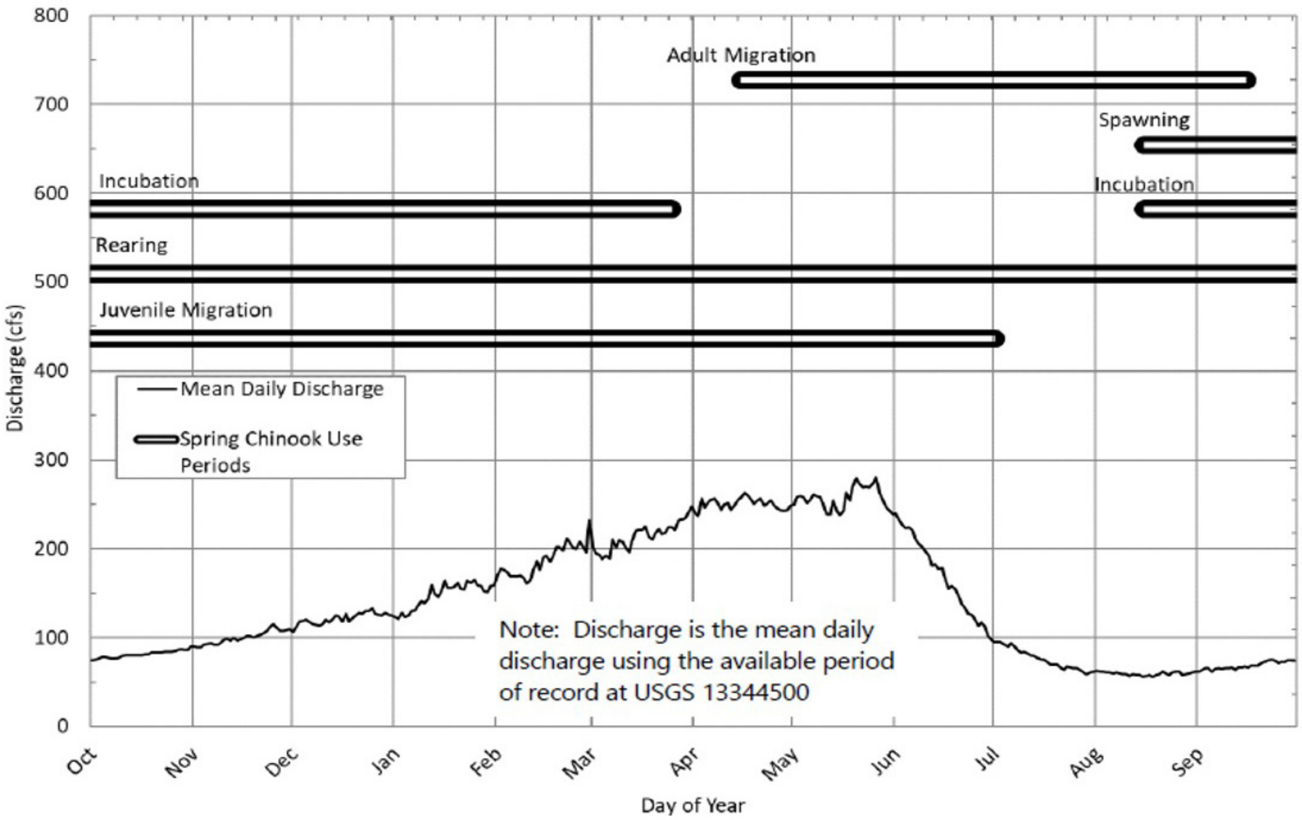


Figure 16. Mean annual hydrograph relative to use periodicity for spring Chinook (source: Anchor 2021)

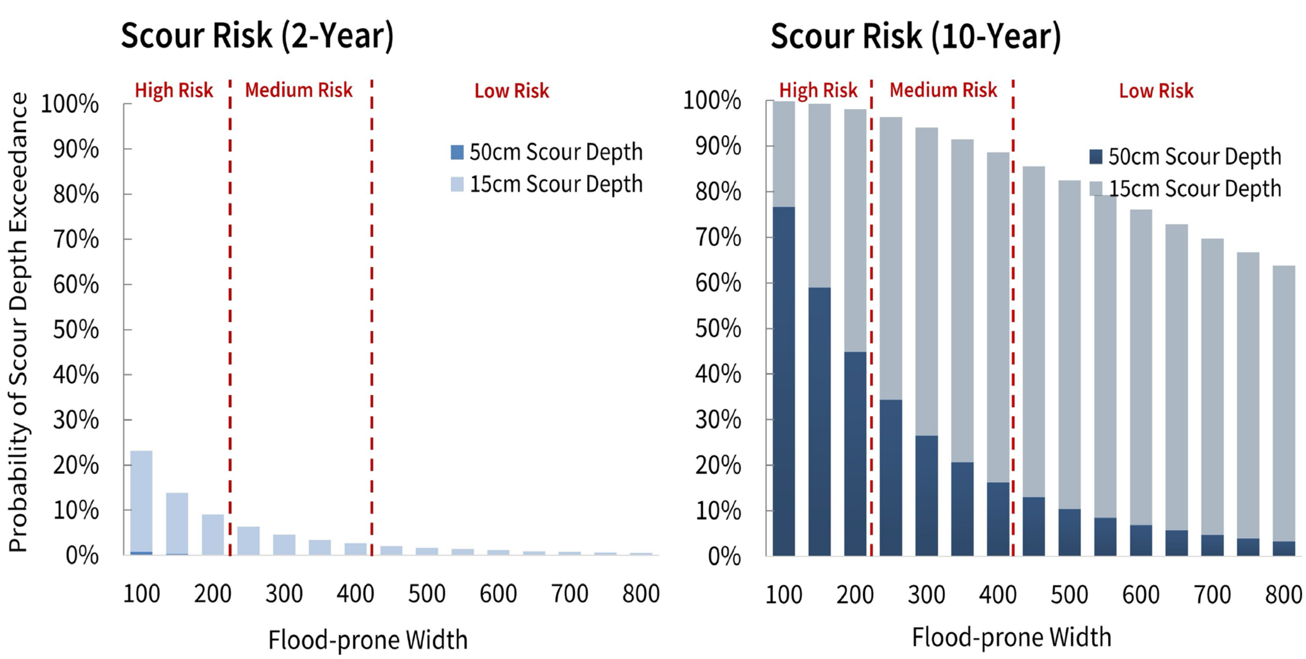


Figure 17. Probability of exceeding scour depths of 15 cm and 50 cm at the 2-year and 10-year floods. High-risk (<200 ft), medium-risk (200-400 ft), and low-risk (>400 ft) regions delineated by red bars.

3. VEGETATION ASSESSMENT

Overview

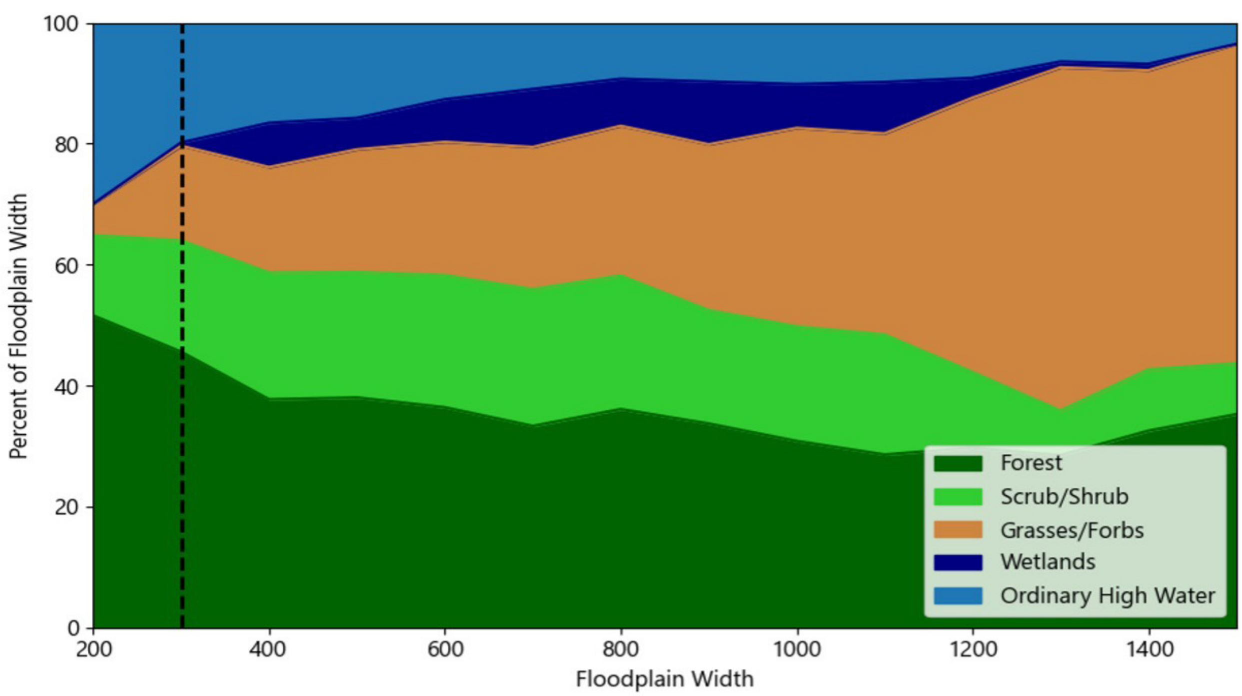
The construction of man-made lakes within the floodplain has significantly impacted vegetation communities by altering hydrology, sediment dynamics, and habitat availability. Wildfires have further contributed to the simplification of vegetation structure while increasing vulnerability to invasive species. Conversion of native floodplain forests and wetlands to agricultural lands has also reduced overall habitat complexity.

Riparian and floodplain conditions have been significantly degraded by the loss of forested systems and a broader simplification of vegetation structure. Forested and scrub-shrub communities, along with naturally occurring wetland types, have declined, reducing native plant diversity and allowing invasive species to establish and spread as monocultures. These changes have diminished habitat complexity and weakened key ecological functions across the floodplain.

Restoration should focus on reconnecting the floodplain to support the processes that sustain diverse native plant communities. Reestablishing hydrologic connectivity will help promote a wider range of vegetation types and improve overall ecosystem function. At the same time, targeted control of invasive species is necessary to prevent further displacement of native vegetation and to restore structural and biological diversity. Integrating fire management with restoration efforts will also be critical to maintaining these gains, supporting long-term resilience, and sustaining dynamic, self-maintaining riparian and floodplain systems.

Techincal Discussion

This assessment characterizes floodplain vegetation to support restoration planning by linking plant communities to hydrologic and geomorphic conditions. Vegetation patterns were mapped using LiDAR-derived canopy height, aerial imagery, and field observations, and categorized into general structural groups based on height and position within the floodplain. These patterns reflect gradients in inundation frequency and groundwater



■ *Figure 18. Summary of distribution of ecological communities by floodplain width. Results show the mean value per 100-foot floodplain width bin. Dashed black line denotes the minimum desired width of 300 feet.*

influence, with vegetation structure serving as an indicator of underlying floodplain processes and site conditions.

Results show that vegetation distribution is closely tied to floodplain position, with distinct community types associated with areas of varying elevation and hydrologic connectivity. Lower, more frequently inundated areas support vegetation adapted to wetter conditions, while higher and more disconnected areas support communities indicative of reduced floodplain interaction. The analysis highlights that vegetation structure provides a useful proxy for identifying areas of functional versus impaired floodplain conditions, particularly where hydrologic connectivity has been altered.

Overall, the findings demonstrate that vegetation patterns are a direct expression of floodplain processes and can be used to assess current conditions and guide restoration. Reestablishing hydrologic and geomorphic connectivity is expected to shift vegetation communities toward conditions that reflect more frequent inundation and dynamic floodplain interaction, supporting broader ecosystem function and resilience.

4. CLIMATE CHANGE IMPACTS

Overview

Climate projections indicate warming trends, potentially resulting in higher temperatures, earlier runoff, reduced base flows, and increased stream temperatures. NorWeST recent historic (2002–2011) and projected (2040 and 2080) August mean stream temperature predictions were used in combination with life stage–specific temperature thresholds from the literature for focal species to evaluate potential habitat limitations.

The project area is expected to function as a transitional zone for suitable summer stream temperatures for key species under projected climate scenarios.

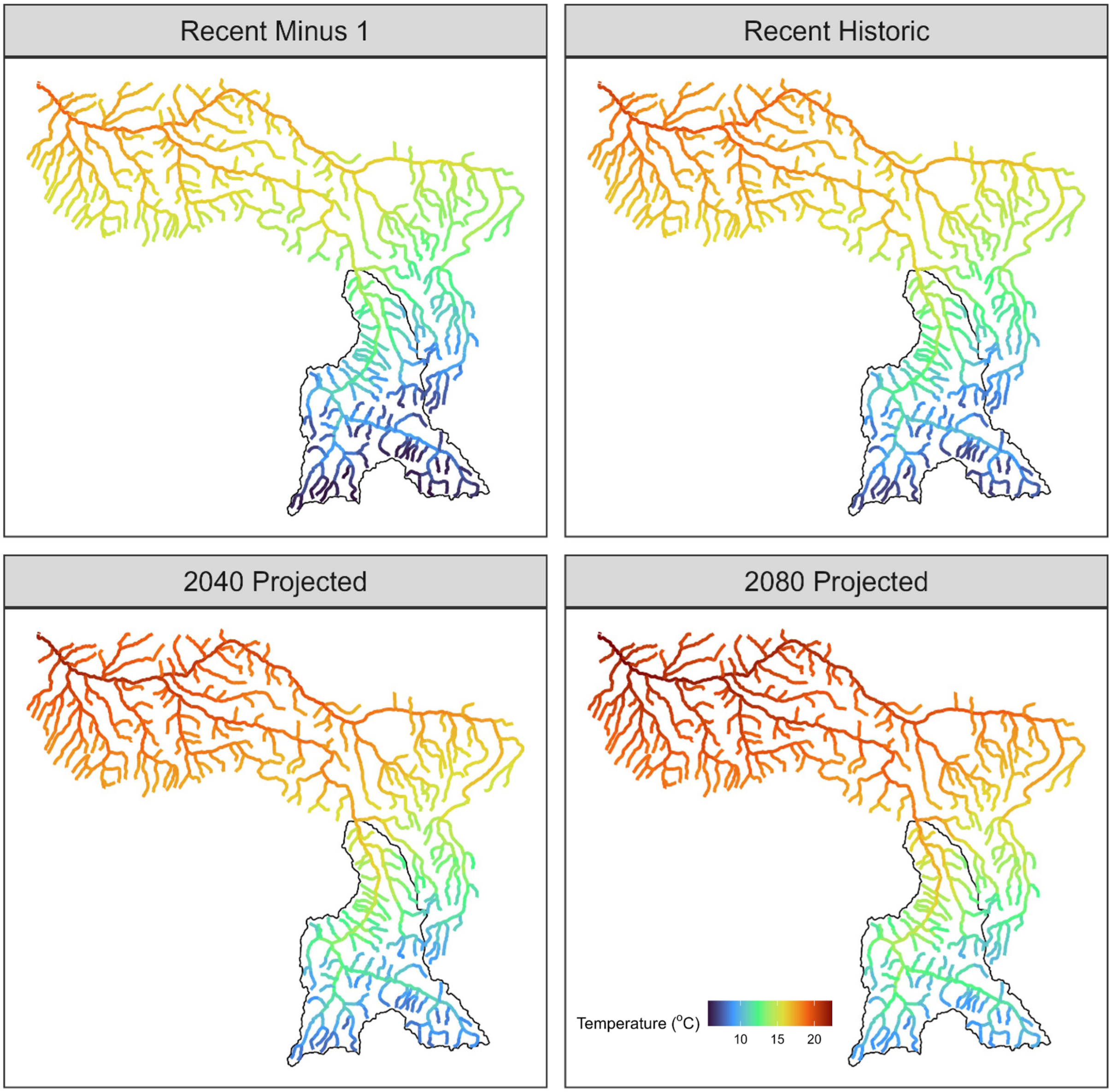
Lower and middle project areas are predicted to exceed “optimum” temperature thresholds for Chinook spawning, Chinook juvenile rearing, bull trout, and Pacific lamprey. By late century, some portions of Project Areas 15.1 and 15.2 are anticipated to exceed maximum thermal thresholds for Chinook spawning.

Restoration and rehabilitation efforts should be prioritized in areas projected to become less thermally suitable for focal species. These actions include reducing solar exposure by enhancing riparian shading, decreasing channel width where appropriate, improving hyporheic exchange through enhanced floodplain and lateral connectivity, and increasing summer streamflows by reducing water withdrawals. Collectively, these measures are intended to mitigate the effects of a warming climate on stream temperature conditions throughout PA 5–15.2 and the broader Tucannon River watershed.

Techincal Discussion

This assessment evaluates summer stream temperature conditions across the Tucannon River watershed, with a focus on Project Areas 1.1–15.2, to determine whether temperature is a limiting factor for fish productivity and how conditions may change under future climate scenarios. Results indicate that thermal conditions are already marginal in portions of the watershed, particularly in lower elevation reaches, and are projected to worsen substantially under 2040 and 2080 climate scenarios. As temperatures increase, thermally suitable habitat shifts upstream and declines across all focal species and life stages. Among these, Chinook salmon spawning is the most thermally sensitive, with the greatest extent of habitat exceeding optimal thresholds, while steelhead and Pacific lamprey exhibit higher tolerance but still experience notable reductions in suitable habitat.

Within PA 1.1–15.2, stream temperatures reflect a transitional zone between cooler headwaters and warmer downstream reaches. Under current conditions, many segments



■ *Figure 19. Modeled average August stream temperatures (oC) within the Tucannon River watershed for the Recent Historic, 2040 Projected, 2080 Projected, and Recent Minus 1 (oC) temperature scenarios. The portion of the Tucannon River watershed that is the focal area for the assessment, and includes Project Areas 1.1-15.2, is outlined in black.*

remain within or near optimal thresholds for several species and life stages, but this balance degrades under projected warming. The number of reaches exceeding optimal temperature thresholds increases under both the 2040 and 2080 scenarios, with impacts expanding in both magnitude and spatial extent. By mid- to late-century, a substantial portion of the project area is projected to experience thermal conditions that limit key life stages, particularly for Chinook salmon and bull trout. These patterns highlight priority areas where thermal stress is expected to become most acute and where restoration actions may provide the greatest benefit.

A hypothetical cooling scenario involving a 1°C reduction in stream temperature demonstrates that localized improvements are possible, particularly for Chinook salmon spawning. However, the overall effect is limited, indicating that small temperature reductions alone are insufficient to offset broader climate-driven warming trends. This underscores the need for comprehensive, watershed-scale strategies that address multiple drivers of stream temperature rather than relying on isolated actions.

Overall, the findings indicate that stream temperature is an increasingly important constraint on habitat availability and fish productivity in the Tucannon River system. Project Area 1.1–15.2 is likely to play a critical role as a transitional and potentially refugial zone, where maintaining and improving thermal conditions will be essential for sustaining cold-water species under future climate conditions. Effective restoration will require process-based approaches that reduce solar loading through increased shading, enhance hyporheic exchange and groundwater interaction through floodplain reconnection, and improve summer flow conditions. Implemented at both reach and watershed scales, these actions can help mitigate warming effects, maintain thermal refugia, and support long-term ecological resilience.

5. FOCAL SPECIES PRODUCTION & HABITAT SUITABILITY INDEX

Overview

Salmon and steelhead populations in the Tucannon River have declined significantly due to multiple factors, including commercial overharvesting, hydropower development, and climate change. Within the basin, floodplain simplification—through channel straightening, floodplain smoothing, and agricultural development—combined with the loss of floodplain vegetation, surface roughness, and large wood recruitment (due to wildfire and infrastructure such as roads, levees, and lakes), has reduced the active and available floodplain by approximately 70%. These changes have resulted in degraded habitat conditions that affect both juvenile rearing and spawning.

Juvenile winter rearing suitability for Chinook salmon, steelhead, and bull trout within PA 5–15.2 is generally low due to channel incision and reduced floodplain connectivity, which result in higher water velocities. Modeling indicates that increasing floodplain connectivity can improve hydraulic suitability for juvenile rearing.

Increasing the presence of side channels, multi-thread channel networks, off-channel habitats, and overall floodplain connectivity can improve hydraulic conditions by reducing velocities, benefiting juvenile winter rearing and other early life stages such as fry and parr. However, restoration efforts must be carefully designed to avoid excessive redistribution of flow from the main channel, as this could create barriers to upstream migration for adult Chinook salmon and bull trout during critical summer periods.

Techincal Discussion

The technical analysis evaluated hydraulic habitat suitability (HHS) for juvenile winter rearing Chinook salmon, steelhead, and bull trout, as well as juvenile summer rearing and adult spawning Chinook salmon, within PA 1.1–15.2 of the Tucannon River. Across species and life stages, modeled hydraulic conditions were generally poor throughout the study area. Velocity was consistently identified as the primary limiting factor for juvenile winter rearing, with conditions typically exceeding preferred ranges, while depth suitability was also limited for most species. Depth suitability for bull trout was somewhat higher than for Chinook salmon and steelhead, reflecting their preference for slightly shallower conditions. Summer rearing suitability for juvenile Chinook salmon was also constrained, largely due to shallow depths, and spawning suitability for Chinook salmon, although higher than juvenile rearing suitability, remained relatively low overall.

Regression analyses indicated that the proportion of connected floodplain area within each project area was only weakly correlated with hydraulic suitability. Positive relationships were observed between floodplain connectivity and winter velocity and composite suitability;

however, model fit was relatively poor, and no clear relationships were identified for Chinook salmon summer rearing or spawning suitability.

These results indicate that increasing floodplain connectivity alone is not sufficient to predict improvements in hydraulic habitat conditions. Rather, floodplain connectivity provides the spatial and geomorphic context necessary for processes to occur that generate suitable hydraulic conditions over time.

Despite the relatively weak statistical relationships, reaches with limited floodplain connectivity—particularly PA 4, 7, and 13—also exhibited some of the lowest composite suitability scores across species. These reaches are largely characterized by single-thread, channelized morphology with limited side-channel or off-channel habitat.

Conversely, PA 14.3 contains relatively large areas of connected floodplain but still exhibits low suitability, highlighting that connectivity alone does not ensure the development of hydraulically suitable habitat where channel complexity remains limited. Collectively, these patterns reinforce that floodplain connectivity should be understood as a process-enabling condition rather than a direct predictor of habitat suitability.

Decades of channel simplification, floodplain disconnection, water diversion, and altered geomorphic processes have produced hydraulic conditions that are generally too fast and shallow for juvenile rearing and only marginally suitable for Chinook salmon spawning. Increasing floodplain connectivity expands the area available for lateral flow

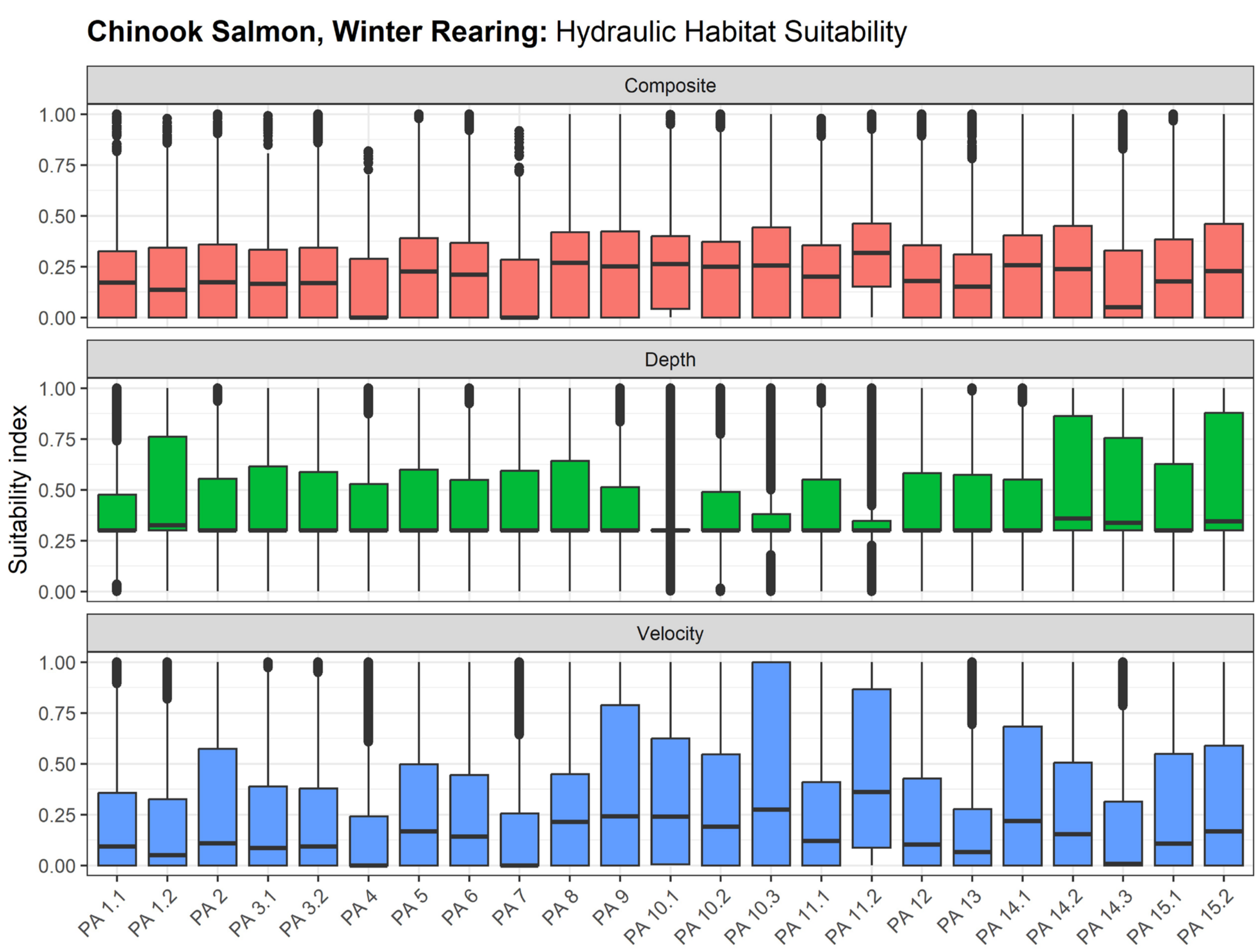


Figure 20. Box plots of composite, depth, and velocity suitability values for juvenile Chinook salmon winter rearing, summarized by project area, in PA 5-15.2 of the Tucannon River. The full Technical Report in the appendices includes box plots for Chinook Summer Rearing, and Spawning; Steelhead Winter Rearing; and, Bull Trout Winter Rearing

■ *Figure 21. Single and multi-thread channel complexes with relatively high habitat suitability. Exchange, channel migration, and the development of multi-thread channels, side channels, alcoves, pools, and other complex channel features create slower, deeper hydraulic environments that are more suitable for multiple juvenile life stages.*

exchange, channel migration, and the development of multi-thread channels, side channels, alcoves, pools, and other complex channel features. These features create slower, deeper hydraulic environments that are more suitable for multiple juvenile life stages. Although these habitat types are limited within PA 1.1–15.2, they exhibit some of the highest suitability scores where they occur.

Restoration strategies that increase connected floodplain area should be implemented within a broader process-based framework that promotes channel complexity, increases channel length, reduces channel gradient, and enhances lateral habitat development, rather than relying on floodplain connectivity alone as a direct mechanism for improving hydraulic conditions.

Restoration actions that increase lateral connectivity should also prioritize the creation and maintenance of deeper, low-velocity mainstem habitats such as pools, alcoves, and backwaters, which may provide important overwintering habitat not fully replicated by side-channel environments alone. Seasonal floodplain inundation can also provide velocity refugia and favorable growth conditions for fry and early parr (Jeffres et al. 2008), life stages not explicitly evaluated in this assessment due to limited suitability data.

At the same time, restoration strategies that redistribute flow laterally must consider potential tradeoffs with adult migration conditions. Excessive reductions in mainstem depth during summer migration periods, particularly in reaches influenced by water diversion, could increase the likelihood of passage constraints for adult Chinook salmon and bull trout. Process-based restoration approaches should therefore balance increased connectivity with the need to maintain adequate migration corridors in the primary channel.

Beyond hydraulic conditions, increased floodplain connectivity supports a range of ecological processes that benefit salmonids across life stages.

Regular floodplain inundation promotes riparian vegetation development, increases large wood recruitment, enhances channel complexity, and supports groundwater recharge and hyporheic exchange (Singh et al. 2018). These processes can moderate stream temperature extremes and create localized thermal heterogeneity that provides seasonal refugia (Poole and Berman 2001; Weber et al. 2017).

Hydraulic habitat suitability analyses provide important insight into species- and life stage–specific constraints but represent only one component of overall habitat quality. Results from this assessment should be interpreted alongside the biological and geomorphic appendices to support integrated, watershed-scale restoration planning and prioritization.

7. Lakes and Infrastructure

Overview

The existing lakes that have not been repaired or replaced present increasing concerns related to safety, structural stability, and operational functionality. Many of these features occupy more than 50% of the valley cross-section, significantly constraining flow and increasing vulnerability during high-flow events. Common deficiencies include insufficient dam crest width, elevated seepage rates, encroaching large woody vegetation on embankments, and the absence of functional outlets or drainpipes. Together, these conditions elevate the risk of structural failure and reduce the ability to safely manage water levels.

Lakes with high valley occupancy are particularly susceptible to overtopping and failure during flood events, as limited conveyance capacity concentrates flow and increases hydraulic pressure on aging structures. Addressing these risks will require targeted action at each site, including repairing critical deficiencies where feasible. However, for lakes with substantial structural issues and high cross-sectional occupancy, decommissioning or relocation should be strongly considered.

These actions would reduce safety risks, improve flood conveyance, and better align infrastructure with long-term watershed function and resilience.

Techincal Discussion

This assessment evaluates the operational condition, structural integrity, and floodplain impacts of multiple impoundments within the PA 5-15 area to inform decisions regarding repair, replacement, or decommissioning. The review integrates field observations, existing safety evaluations, and hydraulic modeling to characterize how each structure functions under both normal and high-flow conditions.

Across the system, many of the lakes are aging earthen dams with a range of deficiencies that affect both safety and performance. Common issues include deteriorated or leaking outlet pipes, inadequate dam crest widths, over-steepened slopes, high seepage rates, and encroachment of large woody vegetation into dam embankments. In several cases, outlet structures are no longer functional, limiting the ability to safely manage water levels and increasing the likelihood of uncontrolled filling during flood events.

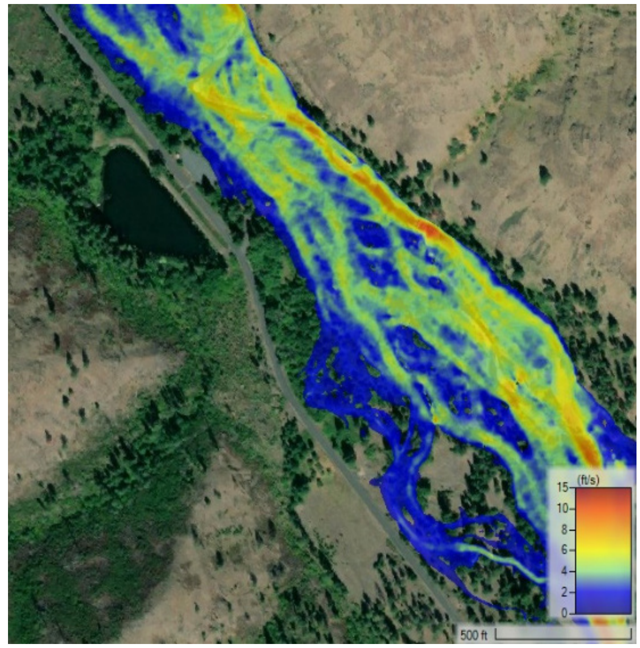
These structural deficiencies are compounded by the spatial footprint of the impoundments within the valley. Many lakes occupy a substantial portion of the floodplain cross-section—often exceeding 50%—which significantly constrains natural flow paths and limits the river's ability to distribute energy across the floodplain. This confinement increases hydraulic pressure on dam structures during high flows and reduces overall system resilience. Hydraulic modeling indicates that several impoundments become engaged during relatively common flood events, with elevated velocities at the toe of dams creating high erosion potential. Under these conditions, even moderate floods can initiate slope failure, piping, or overtopping, particularly where seepage or structural weaknesses are already present.

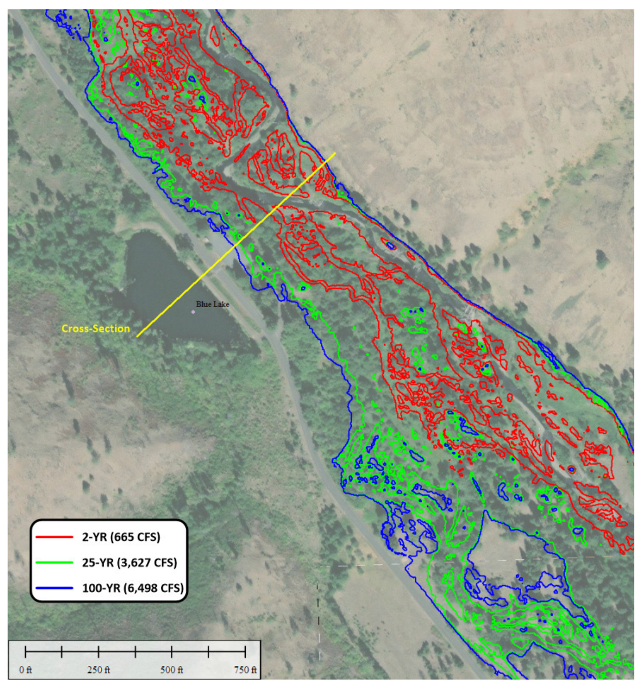
The analysis also highlights variability among lakes in terms of risk and functionality. Some impoundments remain relatively stable, with limited safety concerns and lower interaction with flood flows, while others exhibit significant operational challenges and high exposure to flood-related impacts. In higher-risk systems, past flood events have demonstrated vulnerabilities, including overtopping, erosion, and uncontrolled inflows. In these cases, continued operation without intervention increases the likelihood of future failure and associated downstream risks.

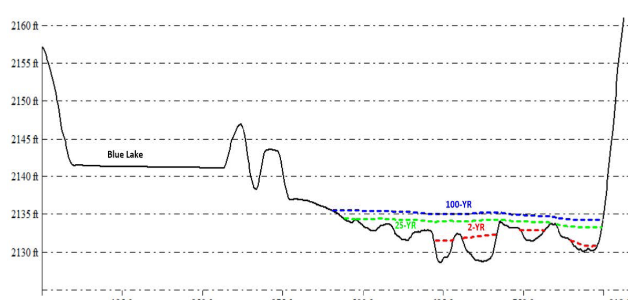
Repairing these structures is feasible but often complex and costly. Typical corrective actions include replacing aging pipe infrastructure, regrading dam slopes to meet safety standards, widening dam crests, removing vegetation from embankments, and addressing seepage through excavation and recompaction. However, these repairs carry inherent uncertainty, as modifying earthen dams often reveals additional deficiencies that increase cost and complexity.

Given these constraints, the assessment concludes that decommissioning or relocation should be strongly considered for impoundments with significant structural deficiencies and high floodplain occupancy. These actions would reduce safety risks, restore natural floodplain connectivity, and improve hydraulic performance during high-flow events.

Overall, the findings emphasize that many of the existing lakes represent a trade-off between recreational use and long-term system performance. Where structural risks and floodplain constraints are high, maintaining these impoundments in their current condition is increasingly difficult and costly. Transitioning toward a system that prioritizes safety, floodplain function, and resilience will require a combination of targeted repairs for lower-risk structures and strategic decommissioning.







■ *Figure 22, 23, 24. Top to bottom: HEC-RAS flow simulation showing velocity at 4,200 cfs; Flood inundation extents from hydraulic modeling ; Cross-section showing terrain and water surface elevations*

7. WETLANDS

Overview

Construction of road grades and other infrastructure, combined with channel incision and the loss of side channels, has reduced both surface and subsurface hydrologic connectivity between floodplain wetlands and the river.

Wetland functionality has declined, including reduced water quality benefits, diminished flood attenuation capacity, and decreased trophic support for salmonid prey species. Habitat availability for juvenile salmonids has also declined, resulting in fewer off-channel refuges and reduced winter-rearing environments. At the same time, the prevalence of non-native plant species has increased, while overall wetland acreage has decreased.

Water temperatures in both the mainstem and associated wetlands have also increased due to the loss of forested wetlands and riparian shading.

Restoring floodplain connectivity can be achieved through channel filling and removal of artificial structures to improve surface and subsurface hydrology. These actions aim to maintain higher water tables and support wetland function. Restoration may also include developing side channels and placing large wood to improve hydrologic connectivity, as well as removing invasive species and replanting native vegetation.

Techincal Discussion

This memorandum documents wetland mapping and ordinary high water mark (OHWM) delineation for the Tucannon River PA 5–15 Assessment and Conceptual Design Project. The study covers an approximately nine-mile reach within the W.T. Wooten Wildlife Area and supports a multi-partner effort to evaluate floodplain conditions and develop integrated restoration strategies.

■ *Table 1: Cowardin classified wetland types found in the Project area.*

Cowardin classification	Acres
Palustrine emergent	29.7
Palustrine emergent/Unconsolidated bottom	17.3
Palustrine forested	14.3
Palustrine scrub-shrub	3.3
Palustrine unconsolidated bottom	4.5

■ *Figure 25. Beaver Lake is a PEM/PUB classified wetland.*

■ *Figure 26. A wetland complex adjacent to Curl Lake. Each pond has adjacent wetlands due to berm seepage.*

Wetland identification combined desktop analysis—including LiDAR, aerial imagery, soils data, and National Wetland Inventory mapping—with field verification of vegetation, hydrology, and geomorphic indicators. This approach identified approximately 69 acres of wetlands across multiple types, including riverine, depressional, pond-associated, and hillslope seep systems.

The study area is heavily influenced by artificial lakes, levees, and flow diversions that have altered natural floodplain processes. These features contribute to channel confinement, sedimentation, and infrastructure challenges, reducing habitat quality while also diminishing long-term recreational value.

Findings indicate that current conditions reflect a legacy of floodplain disconnection and simplified channel form, limiting ecological performance and system resilience. At the same time, the project area presents opportunities to restore connectivity, improve habitat complexity, and reduce long-term maintenance demands.

Wetland and OHWM delineations provide a foundation for evaluating impacts, supporting Clean Water Act permitting, and informing restoration design.

8. RECREATION

Overview

The W.T. Wooten Wildlife Area is both a landscape and a legacy—a long, narrow river valley shaped by water, forest, recreation, and generations of human use. The project area contains a remarkably concentrated mix of recreational and ecological resources: eight lakes, eight campgrounds, a fish hatchery, extensive road access, and a valley floor nearly a thousand feet wide.

But the significance of the area extends far beyond recreation infrastructure. The Tucannon River forms the ancestral boundary between the Umatilla and Nez Perce Tribes, embedding the landscape within a much deeper cultural history. Over time, the valley evolved through successive eras of homesteading, logging, state land acquisition, dam mitigation projects, road expansion, and, more recently, ecological restoration. Each phase left its imprint on how people access and experience the area today.

In the 1950s, eight artificial lakes were constructed within the Tucannon River floodplain as mitigation for the recreational impacts of the Lower Snake River dams. These lakes have operated as popular "put and take" fisheries, stocked with trout from the Tucannon Fish Hatchery. The valley also serves as a major outdoor destination for campers, hunters, hikers, and bird watchers (among other uses). All users have experienced changes to the valley over time. Understanding these changes informs potential improvements for the community and user groups.

Efforts to assess recreational resources have included geospatial mapping to quantify lake size and fishable shoreline. Online user surveys have also been conducted to assess the user profile and experience. These efforts provide a foundational understanding that inform potential impacts and improvements for users from land management and infrastructure changes.

Considering recreational user experiences is a recommended integral part of restoration and infrastructure upgrade strategies identified in this project.

Discussion

The 2024 recreation survey reveals a user community with unusually deep ties to the landscape. Most respondents have been visiting for decades, with the largest group reporting more than 31 years of use. These are not transient visitors; they are repeat users with long-term familiarity and emotional investment in the Wildlife Area. Recreational use is also relatively immersive. While day trips remain common, many visitors stay overnight, often for multiple days, reinforcing the role of the valley as a destination rather than simply a stop along the way.

Fishing clearly defines the recreational identity of the area. Lake fishing was the single most common primary activity identified by respondents, followed by camping and more generalized outdoor enjoyment.

Certain lakes—particularly Rainbow Lake and Big Four Lake—emerge as focal points of use, likely reflecting a combination of accessibility, fishing quality, and established visitor patterns.

Overall satisfaction with the recreational experience remains high. Visitors consistently value the area's ease of access, strong fishing opportunities, and the broader experience of being immersed in nature. Yet the survey also points toward growing pressures and unmet expectations. Overcrowding was the most frequently cited negative issue, suggesting that the area's popularity may now be straining the qualities visitors value most. Maintenance concerns and the perceived lack of dedicated fly-fishing opportunities also surfaced repeatedly, hinting at both infrastructure and user-conflict challenges. The shoreline accessibility data further illustrates how recreation is unevenly distributed across the lakes.

Some lakes offer extensive accessible shoreline for anglers, while others remain constrained by terrain, vegetation, or infrastructure limitations. This imbalance likely concentrates users into a smaller subset of highly accessible lakes, contributing to crowding and diminished visitor experience in peak periods.

Taken together, the story emerging from the survey is not one of decline, but of transition. The W.T. Wooten Wildlife Area remains highly valued and deeply loved by its users, yet increasing demand is beginning to test the balance between accessibility, solitude, recreation quality, and ecological stewardship. The central management question moving forward is no longer simply how to provide recreation, but how to guide and distribute use in ways that preserve the qualities that have drawn people back to the valley for generations.

- *Figure 27 - Recreation Photos / Graphics TBD*

Preferred Alternative

Scale, Descriptions and Rationale

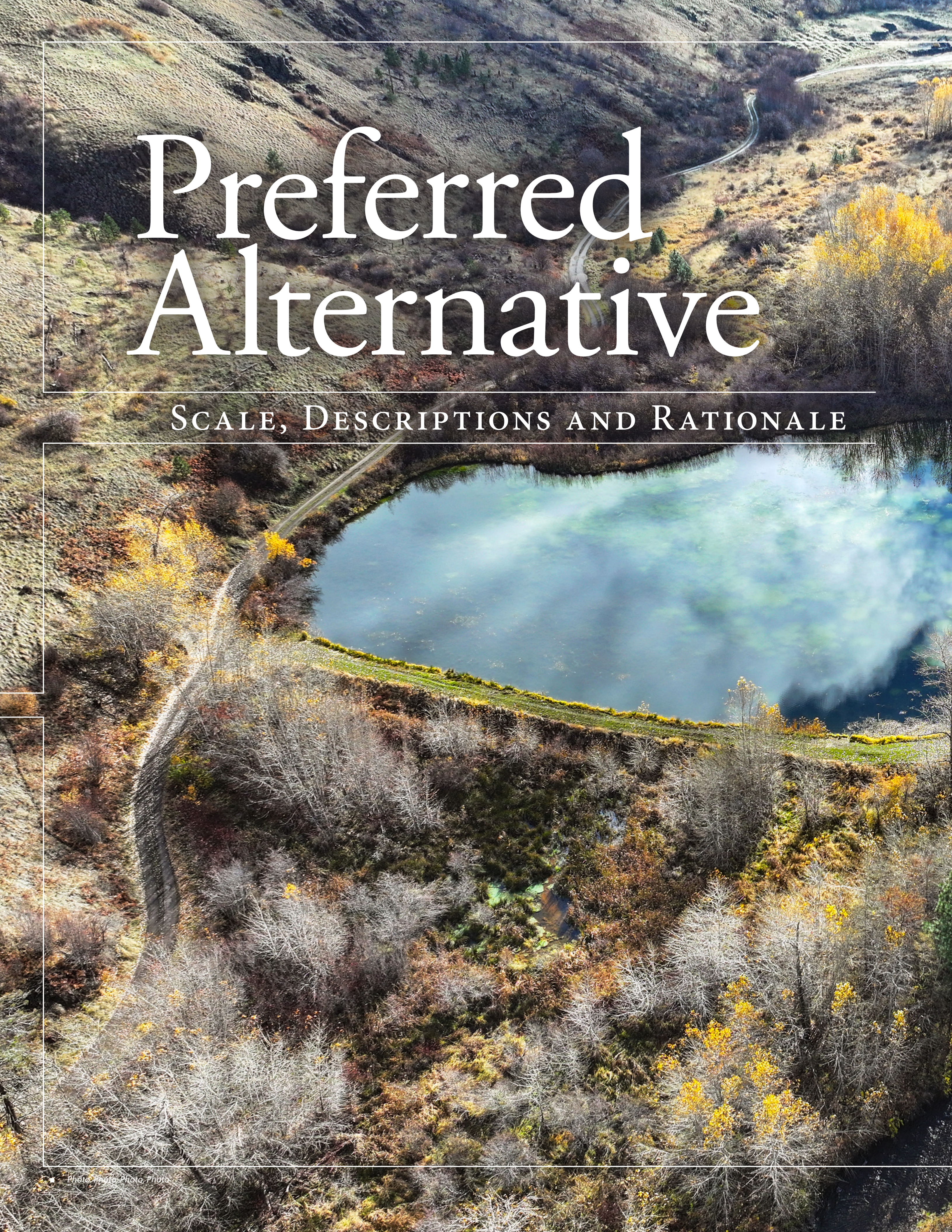


Photo: Photo, Photo, Photo

The Vision for the Tucannon PA 5-15 Reach is to restore physical and ecological floodplain function to benefit key fish and aquatic species, while broadening and enhancing recreational opportunities, through coordinated planning and conceptual restoration designs for the floodplain and adjacent lands of WT Wooten Wildlife Area.

Development and evaluation of the Reach-Scale Preferred Alternative included identifying those actions that provide continued recreational use of the reach while allowing as much functional restoration of the floodplain and ecosystem as possible within existing land-uses.

The Preferred Alternative is a coordinated set of actions that when implemented, will provide significant increase in floodplain and river process and function through the entire PA 5-15 reach.

The planned actions will expand the total area of connected and functional floodplain within the project reach from 231 acres to 379 acres, restoring floodplain processes and connectivity across the full extent of those 379 acres. These actions will also restore the minimum target floodplain width along approximately 40 percent of the 10.2-mile reach. Key actions include removal of the dilapidated Beaver and Watson Lakes from the active floodplain, reconnection and restoration of approximately 84 acres of floodplain through lake removal, road relocation, and channel restoration, and construction of a new fishing lake outside of the floodplain to maintain recreational opportunities while improving floodplain function.

Rationale

The proposed project is part of a long-term, multi-phase effort to restore floodplain function, improve salmon habitat, reduce flood risk, and sustain recreation within the W.T. Wooten Wildlife Area along the Tucannon River. The project emerged from recognition that past approaches focused too narrowly on individual infrastructure needs rather than the broader ecological and recreational function of the valley. Through a 10-mile assessment process involving technical analysis, public outreach, tribal guidance, and interagency coordination, the Co-Managers identified floodplain reconnection and infrastructure relocation as essential actions to restore natural river processes while maintaining the area's recreational and economic importance.

Decades of channelization, floodplain confinement, road construction, and lake infrastructure have narrowed and disconnected the Tucannon River floodplain, increasing stream power, accelerating erosion, degrading salmon habitat, and creating recurring flood damage to roads, campgrounds, and recreation facilities. The project directly addresses these issues by relocating vulnerable infrastructure out of the floodplain, reconnecting floodplain habitat, and restoring channel complexity and lateral connectivity. These actions are expected to reduce flood hazards, improve wood and gravel retention, support riparian forest recovery, and create substantially more productive habitat for ESA-listed spring Chinook, steelhead, and bull trout. At the same time, the project preserves and enhances public recreation through development of a new fishing lake with improved shoreline access and more resilient long-term operations.

The project also advances broader community and cultural objectives. A functioning floodplain will better store and slowly release water, helping sustain summer baseflows, reduce downstream flood impacts, and improve ecosystem resilience to wildfire and climate variability. Restoring productive salmon habitat is central to rebuilding fisheries that support tribal treaty rights and cultural continuity, while protecting recreation access that contributes significantly to the local economy. The project represents a coordinated investment in ecological recovery, public safety, recreational opportunity, and long-term watershed resilience.

Reach Scale Strategy

At the reach scale, the project envisions a comprehensive restoration of the Tucannon River corridor by reconnecting floodplains, removing outdated infrastructure, and reimagining recreational access in ways that better align with long-term ecological function. Central to this effort is the removal of the remnants of Big Four Lake and its associated infrastructure, followed by restoration of the river channel and adjacent floodplain. Similar restoration actions would occur at Beaver-Watson Lakes, where the lakes and related infrastructure would be removed to allow the floodplain and channel to function more naturally once again. Deer Lake would also be relocated upstream, with its existing in-stream diversion removed and replaced by a groundwater well, enabling restoration of the river channel and surrounding floodplain in that reach.

Several infrastructure modifications are proposed to support these restoration goals while maintaining access and utility services. The overhead powerline would be rerouted into the Tucannon Road right-of-way, and Tucannon Road itself would be rerouted at three locations to reconnect and restore adjacent floodplain areas currently constrained by the roadway. Access to Camp Wooten and the USFS Tucannon Campground would be improved through construction of a new bridge across the Tucannon River and reconfiguration of the campground access road. As part of this work, the portion of the existing USFS campground located on the west side of the river would be decommissioned, allowing the channel and floodplain between Tucannon Road and the campground access road to be reconnected and restored.

To maintain and enhance recreational opportunities within the corridor, a new lake would be constructed outside the active floodplain downstream of Blue Lake, replacing the recreational functions currently associated with Beaver-Watson Lakes and the now non-functioning Big Four Lake. Additional recreational improvements are planned at Spring Lake, Blue Lake, Rainbow Lakes, and the relocated Deer Lake, including installation of fishing platforms designed to improve access and increase recreational use.

■ *Table 1: Preferred Alternative Recreation and Floodplain metrics*

SUBREACH/ACTION	EXISTING FISHABLE SHORELINE (ft)	PROPOSED FISHABLE SHORELINE (ft)	EXISTING LAKE AREA (ac)	PROPOSED LAKE AREA (ac)	FLOODPLAIN AREA RESTORED (ac)
1 - Tucannon Campground	NA	NA	NA	NA	30.7
2- Curl Lake	1112.0	0.0	2.0	0.0	32.0
3 - Big Four	0.0	0.0	0.0	0.0	118.7
4 - Beaver-Watson	1642.0	0.0	4.2	0.0	83.9
5 - Deer Lake	605.0	2080.0	2.3	4.3	58.2
6 - New Lake	0.0	1793.0	0.0	4.2	55.8
Total	**3359.0**	**3873.0**	**8.5**	**8.5**	**379.3**

The Washington Department of Fish and Wildlife is implementing improvements at Rainbow Lake independently of the broader restoration effort.

The project also includes major updates to fish management infrastructure. A new downstream adult collection weir would be located, acquired through purchase or lease, designed, and constructed to replace the existing upstream collection facility near Rainbow Lake. This new facility would also eliminate the need for acclimation functions currently associated with Curl Lake. Following completion of the new collection system, Curl Lake and its infrastructure would be removed, and the channel and floodplain restored to a more natural condition.

Conceptual Designs by SubReach

The PA 5–15 Reach is divided into six subreaches based on distinct physical characteristics and the suite of restoration and infrastructure actions identified within the Preferred Alternative (Figure XX1). Organizing the reach into subreaches allows for a more detailed evaluation of existing conditions, restoration opportunities, and planned actions within each portion of the corridor.

Across all six subreaches, the primary focus is the reconnection and restoration of the river channel and floodplain to improve geomorphic function, floodplain engagement, and aquatic habitat conditions. Restoration actions generally include channel filling and shaping to address the effects of historic incision and channelization, as well as floodplain grading to remove or recontour artificially elevated surfaces. These grading efforts are intended to improve floodplain connectivity by creating swales, low-lying areas, and side channels that increase inundation frequency and support more dynamic floodplain processes.

The restoration approach also includes extensive installation of large wood habitat structures and distributed floodplain wood throughout the corridor. Wood would be placed both within the active channel and across the floodplain to promote channel complexity, improve habitat diversity, encourage sediment retention, and support natural floodplain processes. Invasive species control and revegetation with native, multi-layer, multi-species riparian plant communities would further enhance ecological function, long-term channel stability, and habitat quality throughout the reach.

The forthcoming 90 percent conceptual design report will further refine these actions at the subreach scale. Deliverables will include a high-level summary of anticipated restoration costs, proposed General Grade Line (GGL) targets intended to guide future restoration actions and establish the degree of riverbed elevation adjustment needed over time, and conceptual cut-and-fill polygons illustrating anticipated grading extents and material balance across the corridor.

Subreach 1 - Tucannon Campground

Within this subreach, access to Camp Wooten and the USFS Tucannon Campground would be improved through the design and construction of a new bridge crossing the Tucannon River. Associated roadway improvements would include raising the elevation of the access road between the two camp areas to improve resilience during high-flow events, with consideration given to installing one or more relief culverts to maintain floodplain connectivity and conveyance across the roadway corridor.

As part of the broader floodplain restoration effort, the portion of the existing USFS Tucannon Campground located on the west side of the river would be decommissioned. This would allow approximately 31 acres of channel and floodplain between Tucannon Road and the campground access road to be reconnected and restored, improving floodplain function, habitat complexity, and river processes within the reach.

Additional infrastructure modifications include relocation of the existing overhead powerline into the Tucannon Road right-of-way near the downstream end of the subreach, reducing conflicts with restoration activities and floodplain function. Implementation of these actions will require close coordination with both Washington State Parks, which manages Camp Wooten, and the U.S. Forest Service.

Subreach 2 - Curl Lake

The actions proposed within this subreach are dependent upon the construction and operation of a new adult collection weir in the lower Tucannon River, which would replace existing fish collection and acclimation functions currently associated with Curl Lake. Following implementation of the new downstream facility, Curl Lake and its associated infrastructure would be removed, allowing for restoration of more natural channel and floodplain processes within the reach.

Supporting infrastructure modifications would include relocation of the existing overhead powerline and rerouting of Tucannon Road near the USFS Tucannon Guard Station (VM 40) to reduce constraints on floodplain connectivity and accommodate restoration activities. These actions would enable the design, reconnection, and restoration of approximately 32 acres of channel and floodplain habitat, improving floodplain engagement, habitat complexity, and overall river function within the subreach.

Subreach 3 - Big Four

Within this subreach, restoration efforts would focus on removing the remnants of Big Four Lake and its associated infrastructure to eliminate existing constraints on channel and floodplain function. The existing overhead powerline would also be relocated into the Tucannon Road right-of-way, reducing infrastructure conflicts within the active floodplain corridor and supporting long-term restoration objectives.

These actions would facilitate the design, reconnection, and restoration of approximately 119 acres of channel and floodplain habitat. Restoration activities would aim to improve floodplain engagement, enhance channel complexity, and restore more natural geomorphic and ecological processes throughout the reach.

Subreach 4 - Beaver-Watson Lakes

Restoration actions within this subreach would include removal of Beaver and Watson Lakes and their associated infrastructure, including the existing in-channel diversion and water supply channel. Eliminating these features would allow the river and floodplain to function more naturally and reduce ongoing constraints on channel processes and habitat connectivity.

Additional infrastructure modifications would include relocation of the existing overhead powerline into the Tucannon Road right-of-way and realignment of Tucannon Road upstream of WDFW Campground 4 (VM 37) to the edge of the floodplain. Shifting the roadway away from the active floodplain corridor would create additional space for river movement and floodplain engagement while improving long-term roadway resilience.

Together, these actions would support the design, reconnection, and restoration of approximately 84 acres of channel and floodplain habitat, enhancing geomorphic function, aquatic habitat complexity, and overall ecological condition within the subreach.

Subreach 5 - Deer Lake

Actions proposed within this subreach begin with completion of a detailed feasibility analysis to evaluate opportunities for relocating Deer Lake upstream and assessing the viability of supplying the lake with groundwater from a new well source. Development of the new water supply system may require modification or transfer of the existing water right associated with the lake.

Based on the results of that analysis, a new Deer Lake would be designed and constructed upstream of its current location, supported by a groundwater well that would replace the existing in-stream diversion. Removal of the diversion would reduce direct impacts to river flows and improve channel continuity and floodplain function within the reach.

These actions would support the design, reconnection, and restoration of approximately 58 acres of channel and floodplain habitat, improving geomorphic processes, floodplain engagement, and aquatic habitat conditions. Recreational enhancements would also be incorporated into the project, including installation of a fishing platform to improve public access and increase recreational use of the new lake.

Subreach 6 - New Lake

Actions within this subreach would begin with completion of a feasibility analysis to evaluate potential locations and design considerations for construction of a new lake outside the existing active floodplain downstream of Blue Lake. The new lake is intended to provide long-term recreational opportunities while reducing conflicts with floodplain restoration objectives elsewhere in the corridor.

Following completion of the feasibility analysis, the New Lake would be designed and constructed outside of the active floodplain area. Water for the lake would be supplied using flow from Blue Lake, with the existing outflow ditch rerouted to serve as the primary water source. To improve water quality and enhance ecological function, a polishing wetland would also be constructed to treat and moderate outflow from the new lake before it reenters the broader system.

Supporting recreational infrastructure would include development of an expanded parking area adjacent to the New Lake to improve public access and accommodate anticipated recreational use.

Project Benefits

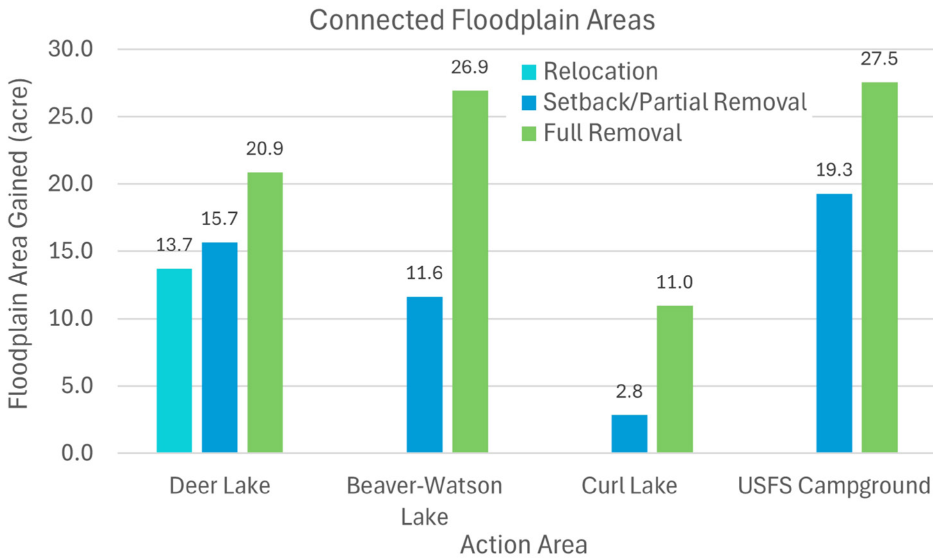
The project provides interconnected community, habitat, agricultural, recreation, and flood-risk reduction benefits through large-scale floodplain reconnection and restoration actions in the Tucannon River corridor. The project will reconnect and restore at least 84 acres of functional floodplain by removing aging in-channel lakes, relocating infrastructure out of the floodplain, and restoring natural floodplain processes. These actions will increase floodplain storage, reduce stream power during high flows, improve groundwater recharge, and reduce scour potential that threatens salmon redds and critical infrastructure.

The project also addresses urgent public safety and infrastructure concerns highlighted during the March 2026 flooding events, including erosion, debris accumulation, campground vulnerability, and dam safety risks associated with the Beaver-Watson Lakes. Construction of a new recreational lake outside the active floodplain will maintain and expand fishing and recreation opportunities while eliminating long-term flood and dam safety risks tied to the existing lakes.

Ecologically, the project supports recovery of Tucannon River spring Chinook salmon, which are currently at critically low population levels, by improving floodplain connectivity, stabilizing spawning gravels, retaining large woody debris, and increasing overall ecosystem resilience. These habitat improvements also benefit Tribal communities by supporting salmon and other First Foods central to cultural values and Treaty Rights. At the same time, downstream agricultural producers benefit from increased flood attenuation, improved water storage, and reduced infrastructure vulnerability during high-flow events.

Project Reach Maps

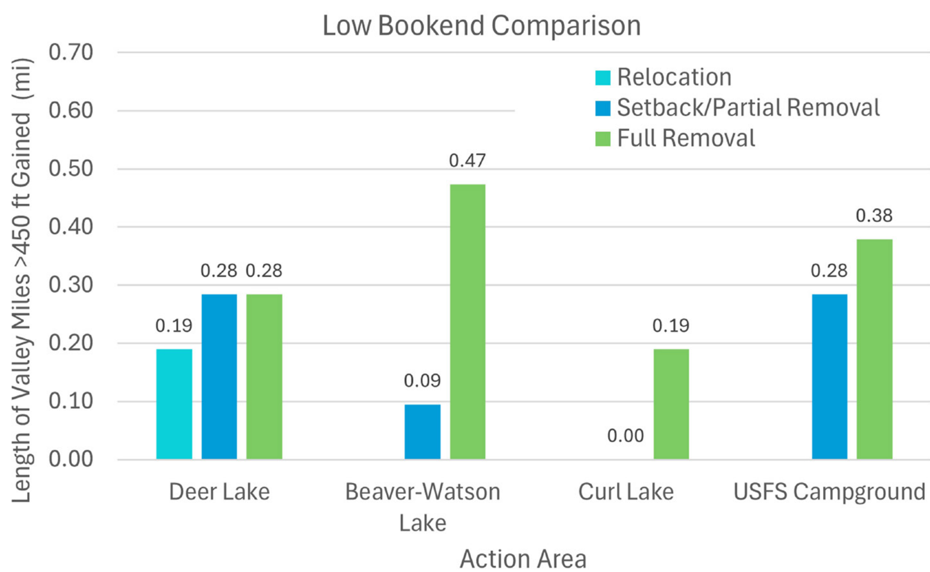
The following pages illustrate the preferred conceptual restoration plans for the PA 5–15 project area, organized by reaches 1 through 6. Each reach reflects site-specific restoration, floodplain reconnection, infrastructure, and recreational improvements identified through the multi-benefit assessment process.



■ *Figure 28.*

Connected Floodplain Areas.

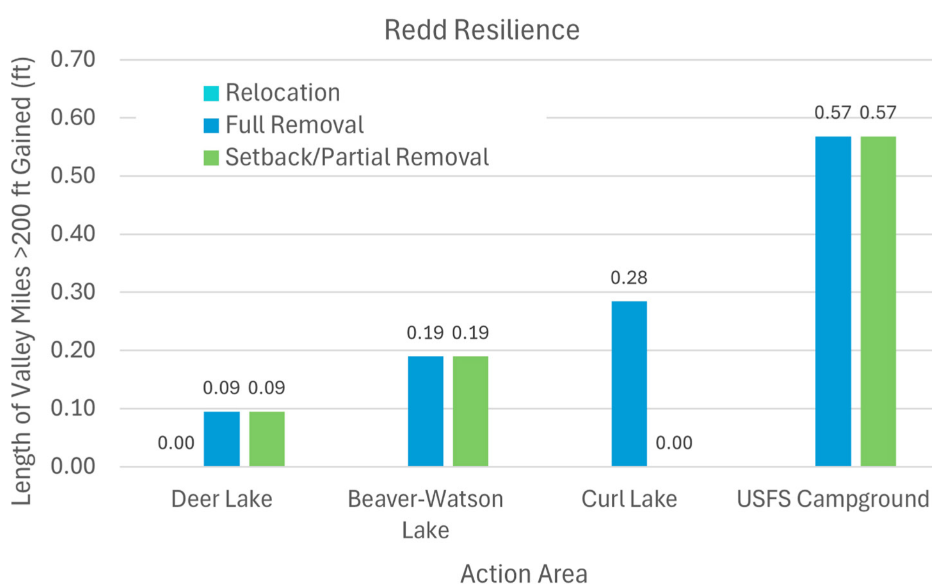
Connected floodplain area gains vary substantially by action type and location, with full infrastructure removal consistently providing the greatest increase in floodplain connectivity. Beaver-Watson Lake and the USFS Campground areas show the largest potential gains, exceeding 26 acres of reconnected floodplain under full removal scenarios.



■ *Figure 29.*

Low Bookend Comparison.

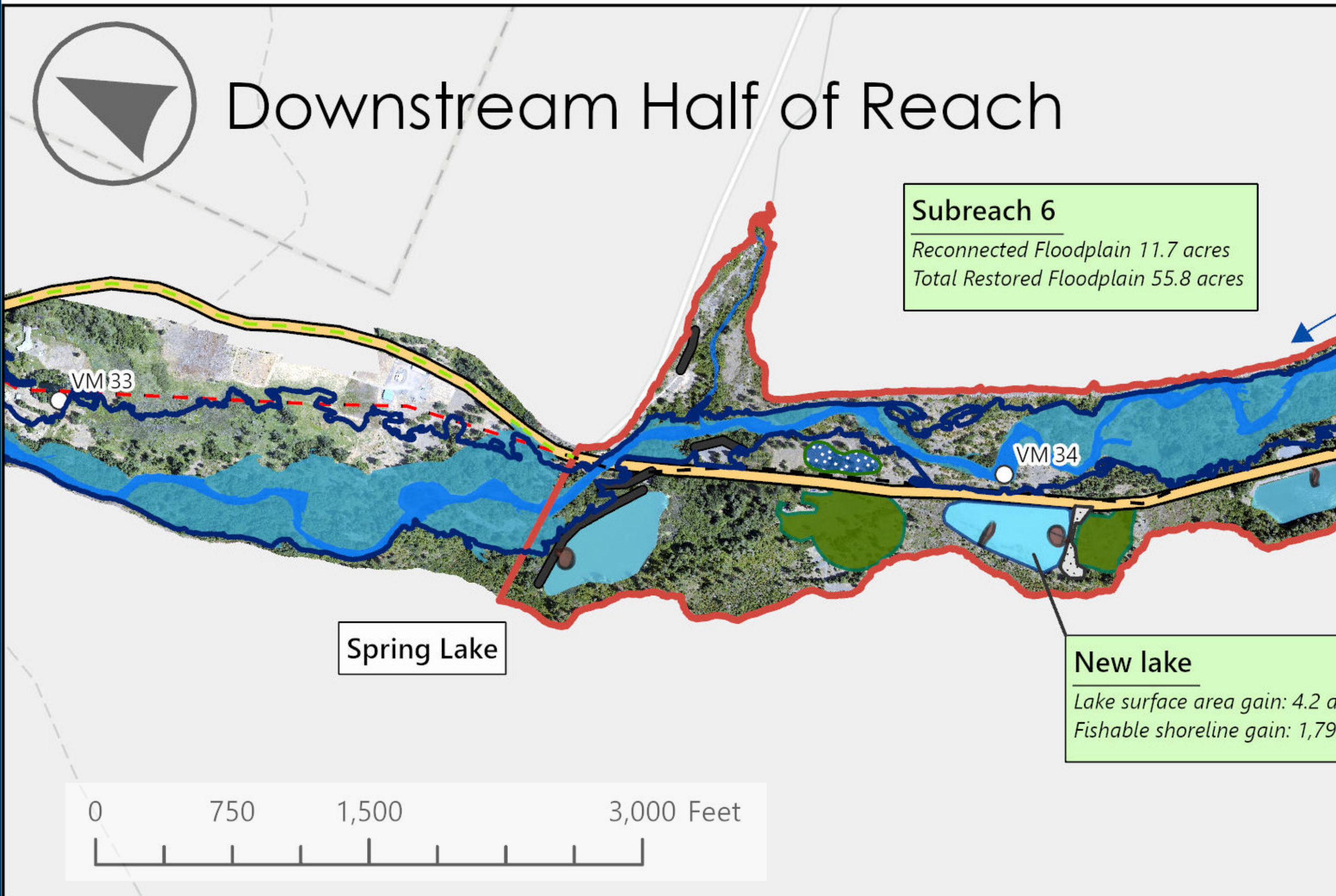
Full removal scenarios provide the greatest increase in valley segments meeting the 450-foot floodplain width target, particularly within the Beaver-Watson and USFS Campground reaches. These gains reflect substantially improved floodplain connectivity and capacity for lateral flow dissipation.

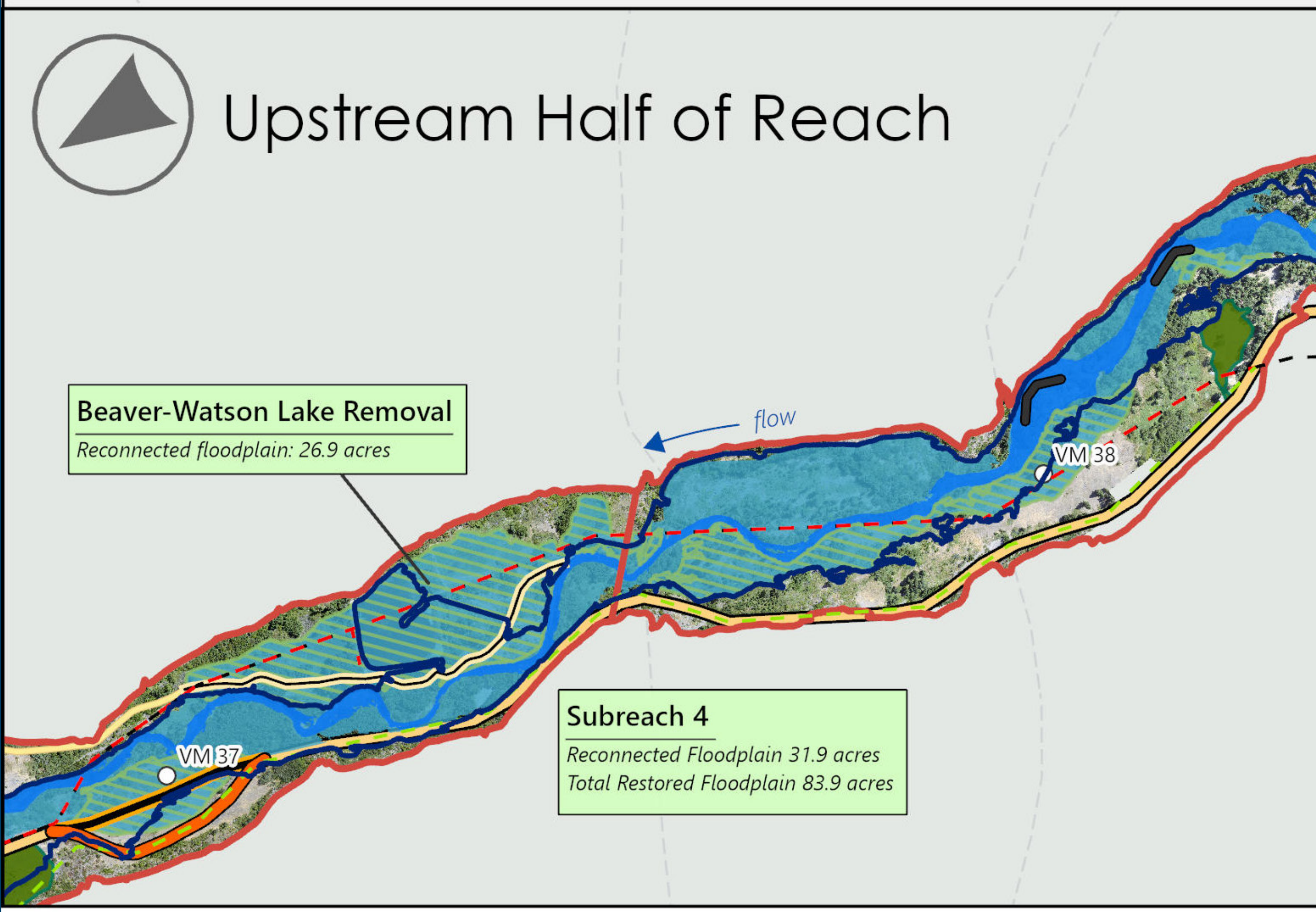


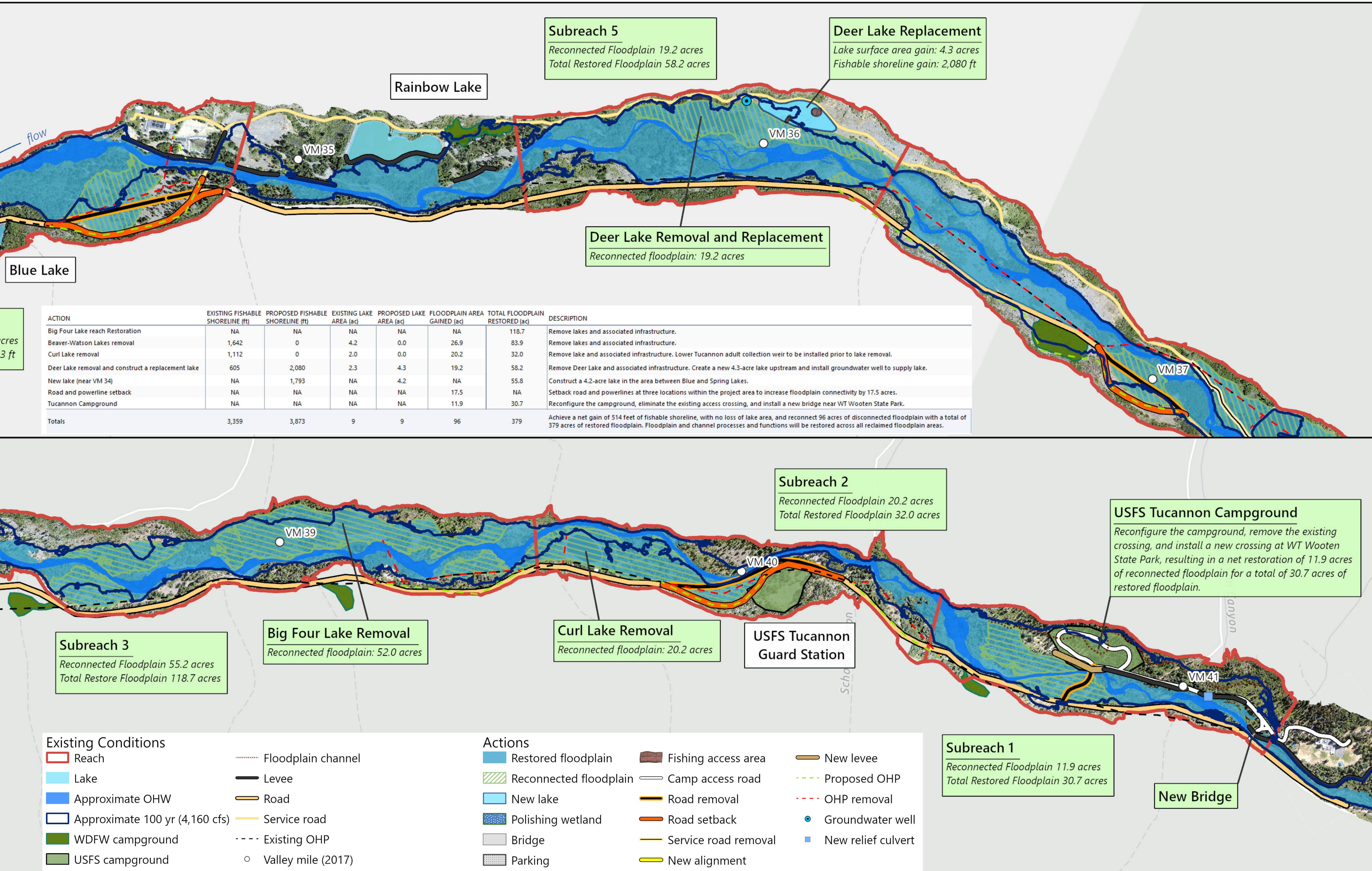
■ *Figure 30.*

Redd Resilience.

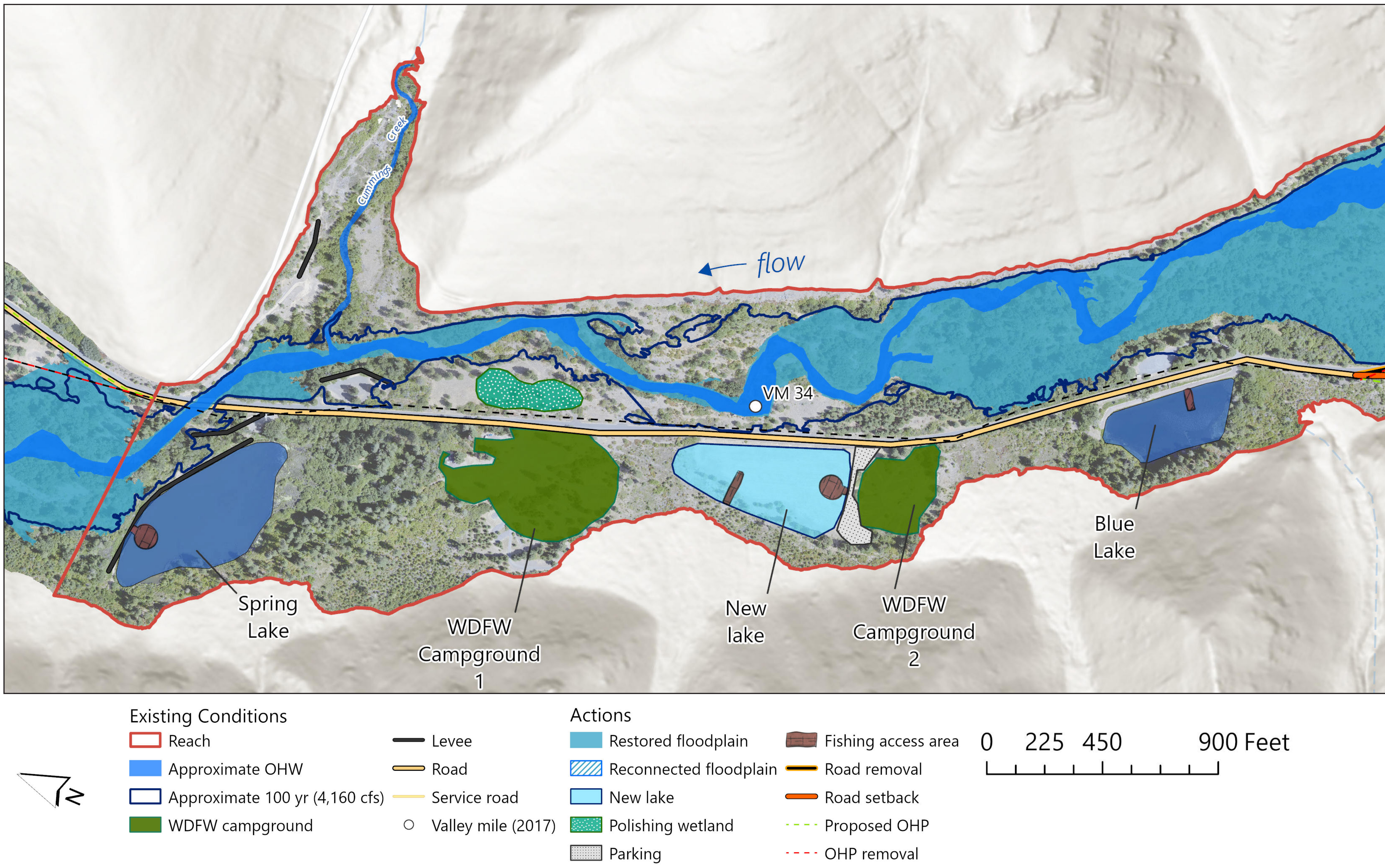
Improvements in redd resilience increase substantially under full removal and setback scenarios, particularly within the USFS Campground and Beaver-Watson reaches. These actions expand valley segments with reduced scour risk and improved spawning stability during high-flow events.


Downstream Half of Reach
Subreach 6
Reconnected Floodplain 11.7 acres
Total Restored Floodplain 55.8 acres
VM 33
VM 34
Spring Lake
New lake
Lake surface area gain: 4.2 a
Fishable shoreline gain: 1,79
0
750
1,500
3,000 Feet


Upstream Half of Reach
Beaver-Watson Lake Removal
Reconnected floodplain: 26.9 acres
flow
VM 38
VM 37
Subreach 4
Reconnected Floodplain 31.9 acres
Total Restored Floodplain 83.9 acres



ACTION	EXISTING FISHABLE SHORELINE (ft)	PROPOSED FISHABLE SHORELINE (ft)	EXISTING LAKE AREA (ac)	PROPOSED LAKE AREA (ac)	FLOODPLAIN AREA GAINED (ac)	TOTAL FLOODPLAIN RESTORED (ac)	DESCRIPTION
Big Four Lake reach Restoration	NA	NA	NA	NA	NA	118.7	Remove lakes and associated infrastructure.
Beaver-Watson Lakes removal	1,642	0	4.2	0.0	26.9	83.9	Remove lakes and associated infrastructure.
Curl Lake removal	1,112	0	2.0	0.0	20.2	32.0	Remove lake and associated infrastructure. Lower Tucannon adult collection weir to be installed prior to lake removal.
Deer Lake removal and construct a replacement lake	605	2,080	2.3	4.3	19.2	58.2	Remove Deer Lake and associated infrastructure. Create a new 4.3-acre lake upstream and install groundwater well to supply lake.
New lake (near VM 34)	NA	1,793	NA	4.2	NA	55.8	Construct a 4.2-acre lake in the area between Blue and Spring Lakes.
Road and powerline setback	NA	NA	NA	NA	17.5	NA	Setback road and powerlines at three locations within the project area to increase floodplain connectivity by 17.5 acres.
Tucannon Campground	NA	NA	NA	NA	11.9	30.7	Reconfigure the campground, eliminate the existing access crossing, and install a new bridge near WT Wooten State Park.
Totals	3,359	3,873	9	9	96	379	Achieve a net gain of 514 feet of fishable shoreline, with no loss of lake area, and reconnect 96 acres of disconnected floodplain with a total of 379 acres of restored floodplain. Floodplain and channel processes and functions will be restored across all reclaimed floodplain areas.



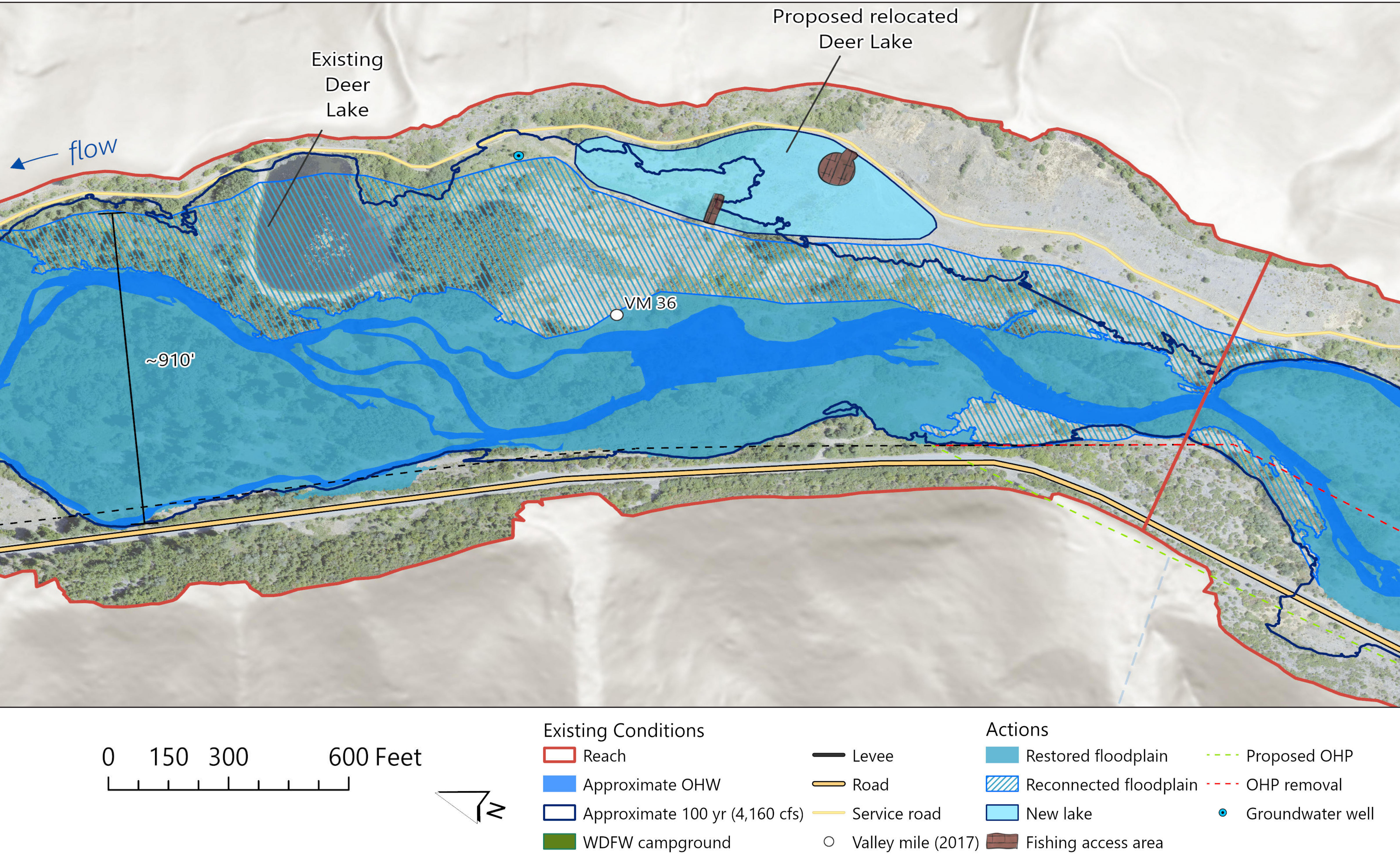
Cummings Creek
flow
VM 34
Spring Lake
WDFW Campground 1
New lake
WDFW Campground 2
Blue Lake
Existing Conditions
Reach
Approximate OHW
Approximate 100 yr (4,160 cfs)
WDFW campground
Levee
Road
Service road
Valley mile (2017)
Actions
Restored floodplain
Reconnected floodplain
New lake
Polishing wetland
Parking
Fishing access area
Road removal
Road setback
Proposed OHP
OHP removal
0 225 450 900 Feet
N

Tucannon PA 5-15

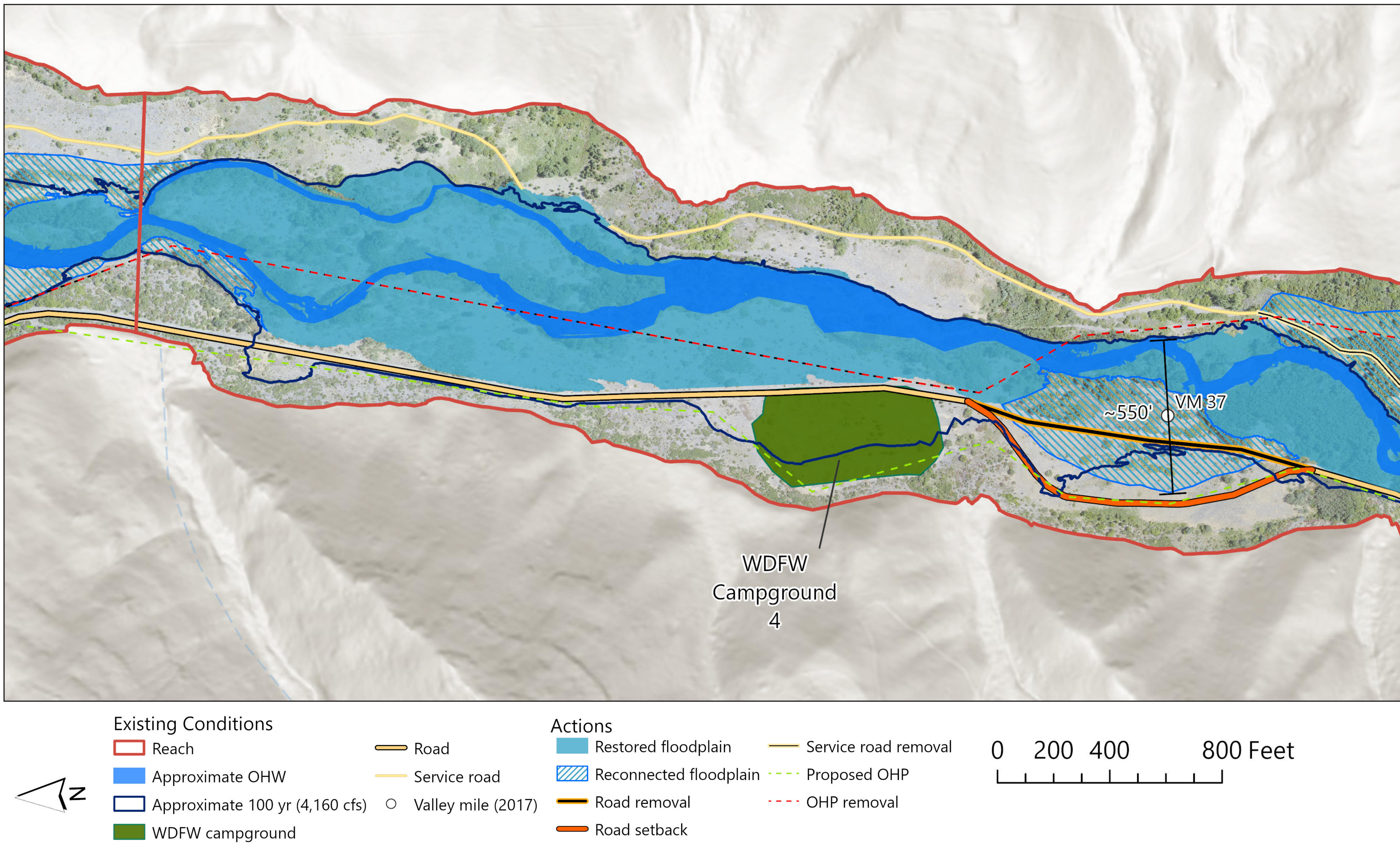
Sub-reach 6: VM 33.5 - VM 34.7

Tucannon PA 5-15

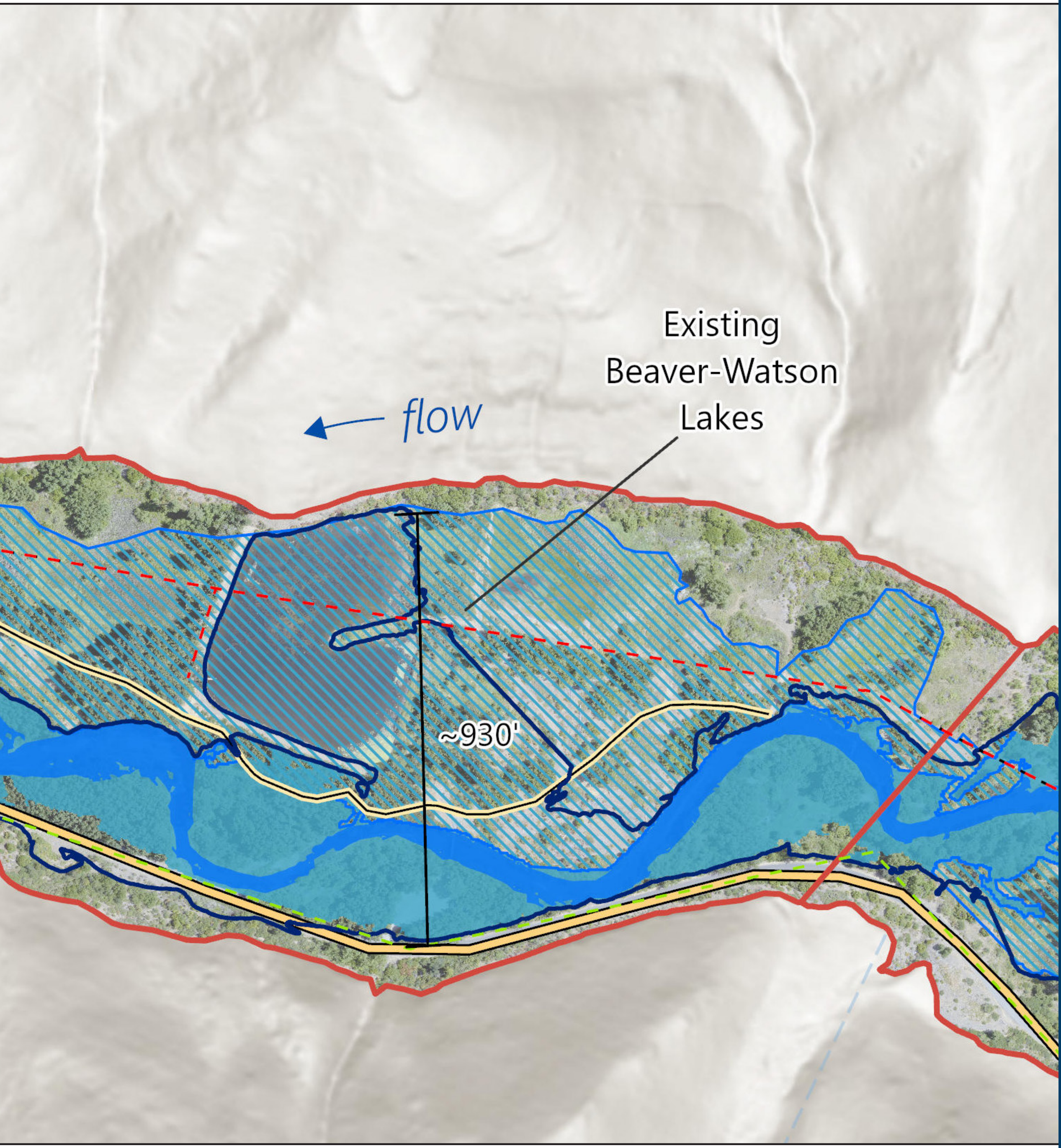
Sub-reach 5: VM 35.5 - VM 36.6



Proposed relocated Deer Lake
Existing Deer Lake
flow
VM 36
~910'
0 150 300 600 Feet
N
Existing Conditions
Reach
Approximate OHW
Approximate 100 yr (4,160 cfs)
WDFW campground
Levee
Road
Service road
Valley mile (2017)
Actions
Restored floodplain
Reconnected floodplain
New lake
Fishing access area
Proposed OHP
OHP removal
Groundwater well

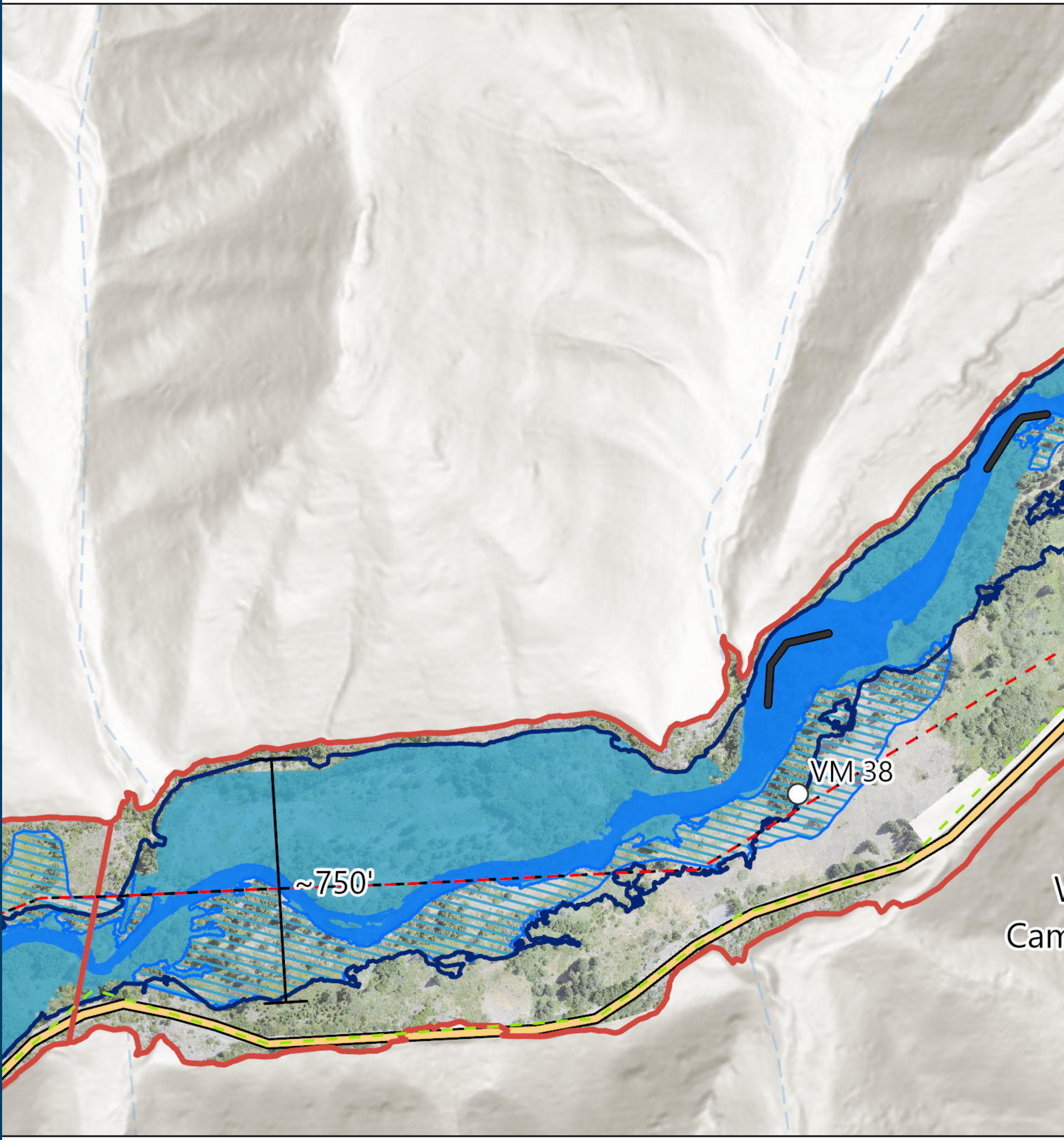


~550'
VM 37
WDFW Campground 4
Existing Conditions
Reach
Approximate OHW
Approximate 100 yr (4,160 cfs)
WDFW campground
Road
Service road
Valley mile (2017)
Actions
Restored floodplain
Reconnected floodplain
Road removal
Road setback
Service road removal
Proposed OHP
OHP removal
0 200 400 800 Feet
N



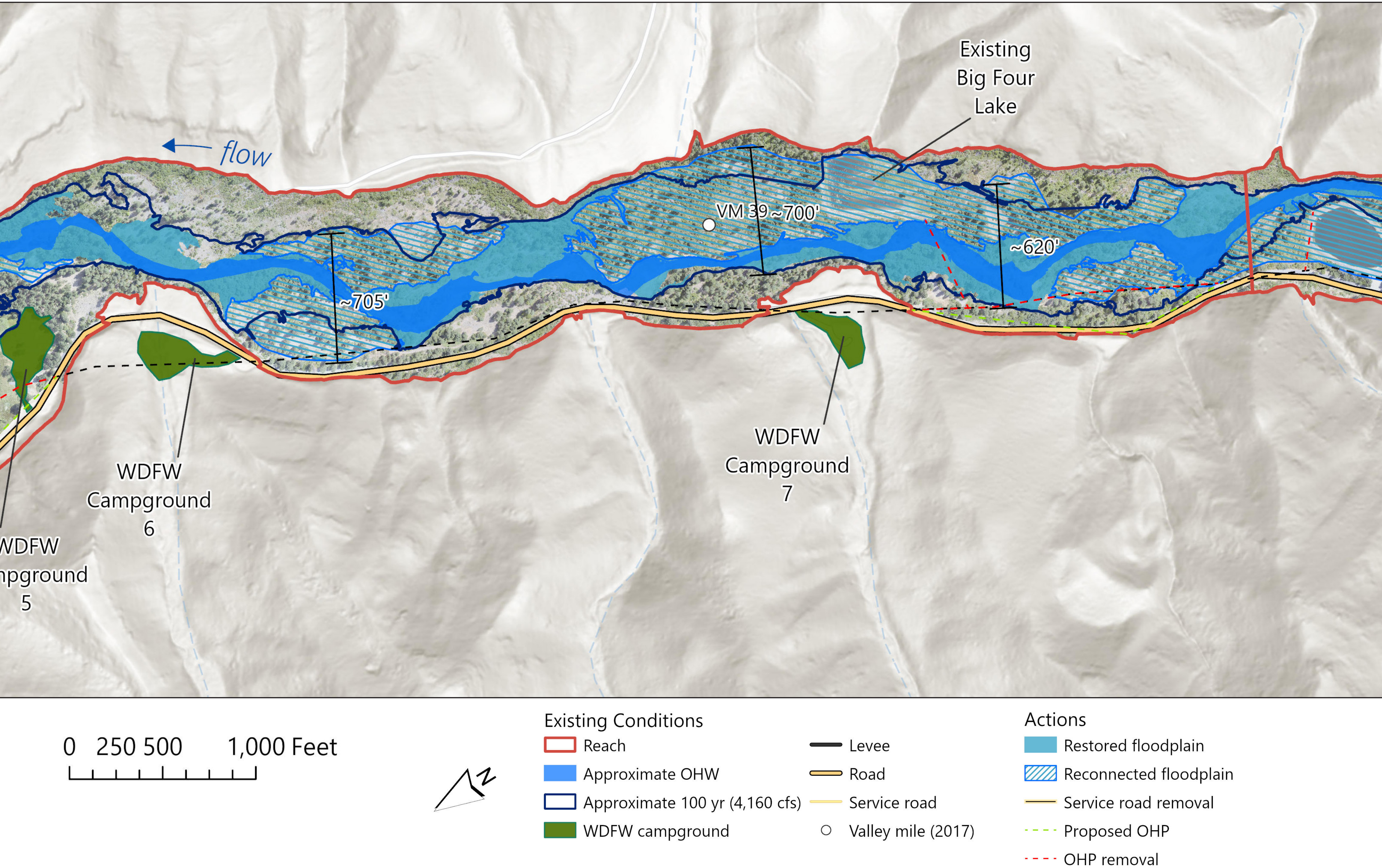
Tucannon PA 5-15

Sub-reach 4: VM 36.6 - VM 37.6

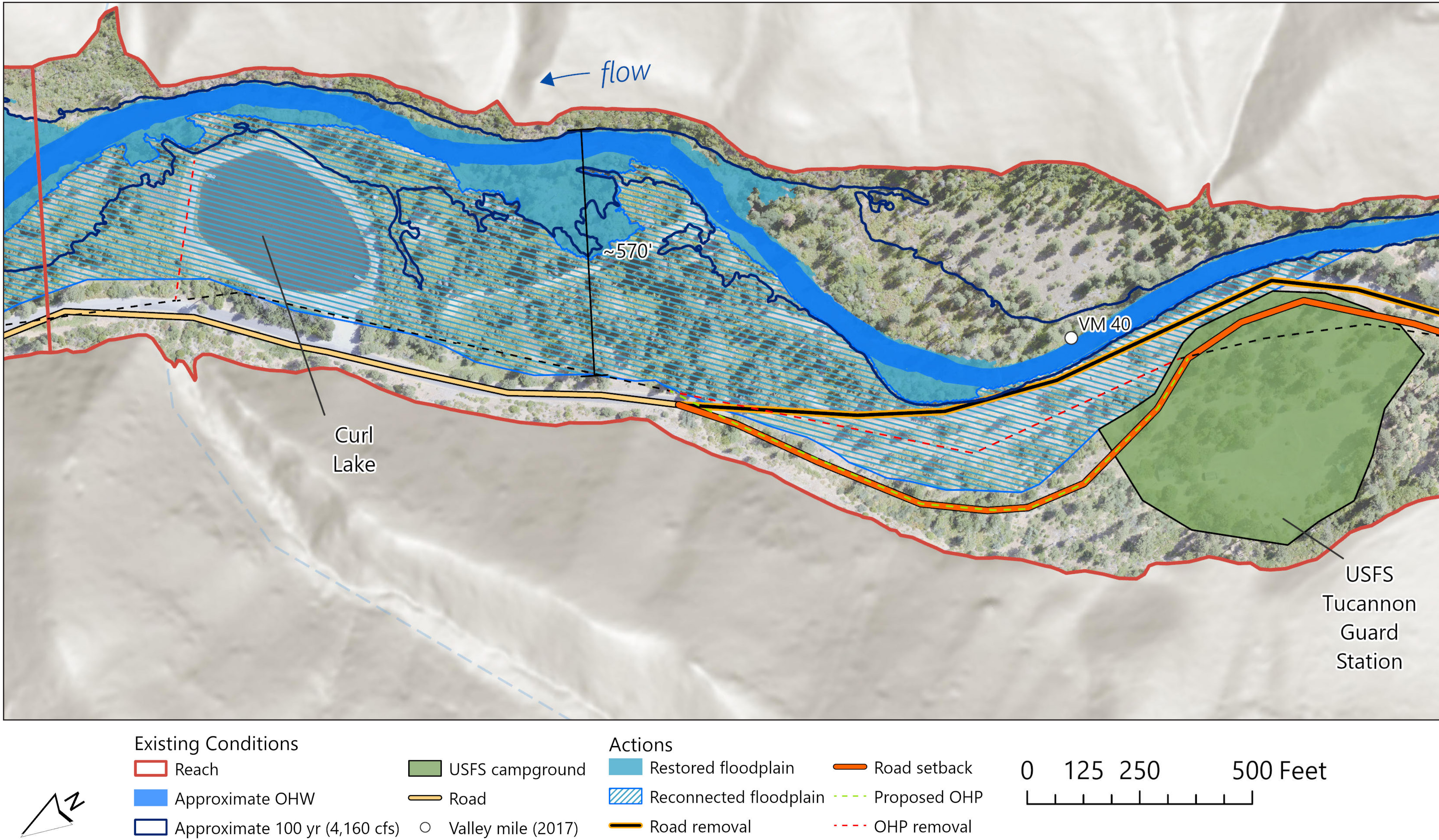


Tucannon PA 5-15

Sub-reach 3: VM 37.6 - VM 39.6

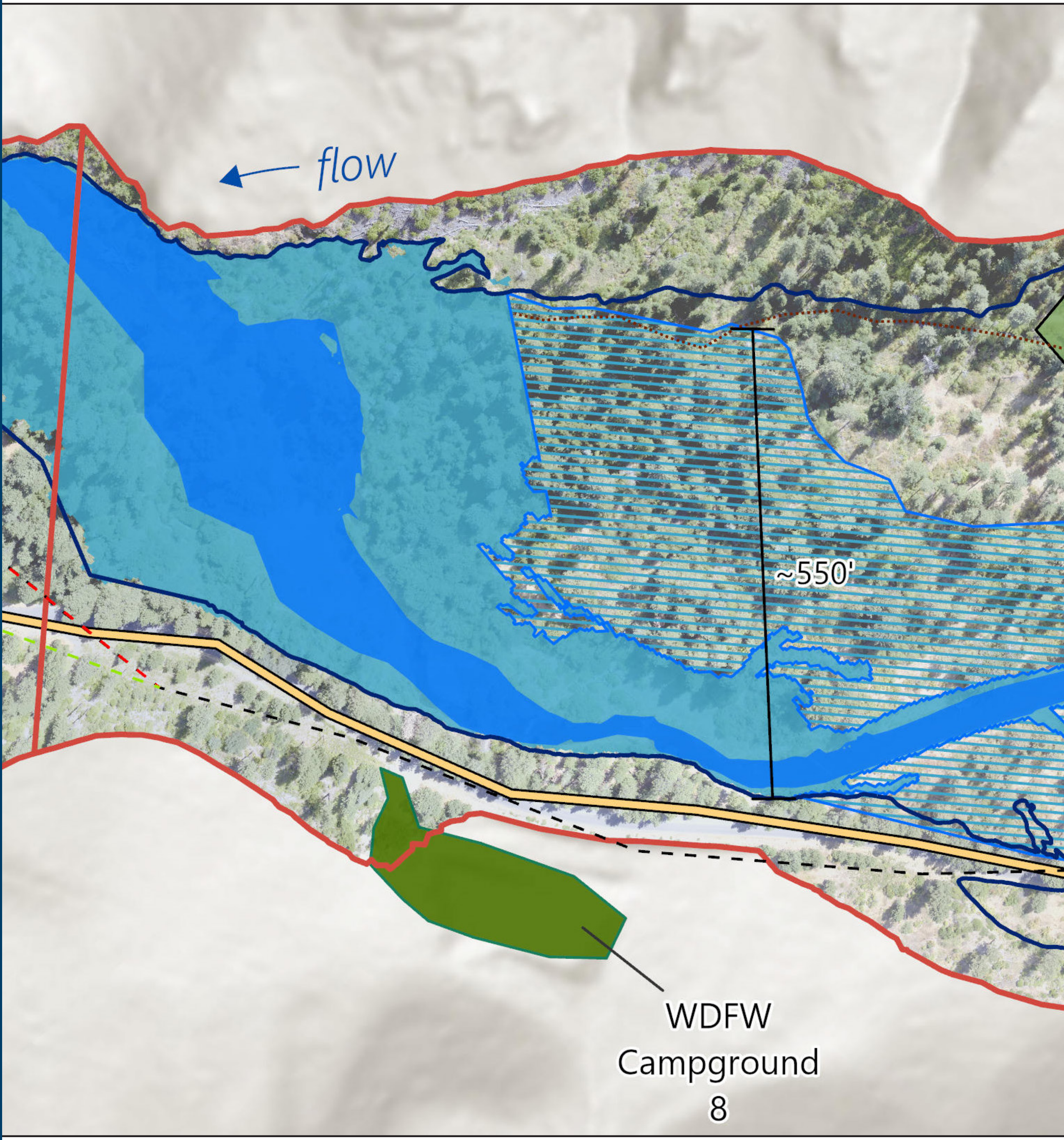


flow
Existing Big Four Lake
VM 39
~700'
~705'
~620'
WDFW Campground 5
WDFW Campground 6
WDFW Campground 7
0 250 500 1,000 Feet
N
Existing Conditions
Reach
Approximate OHW
Approximate 100 yr (4,160 cfs)
WDFW campground
Levee
Road
Service road
Valley mile (2017)
Actions
Restored floodplain
Reconnected floodplain
Service road removal
Proposed OHP
OHP removal


flow
~570'
VM 40
Curl Lake
USFS Tucannon Guard Station
Existing Conditions
Reach
Approximate OHW
Approximate 100 yr (4,160 cfs)
USFS campground
Road
Valley mile (2017)
Actions
Restored floodplain
Reconnected floodplain
Road removal
Road setback
Proposed OHP
OHP removal
0 125 250 500 Feet
N

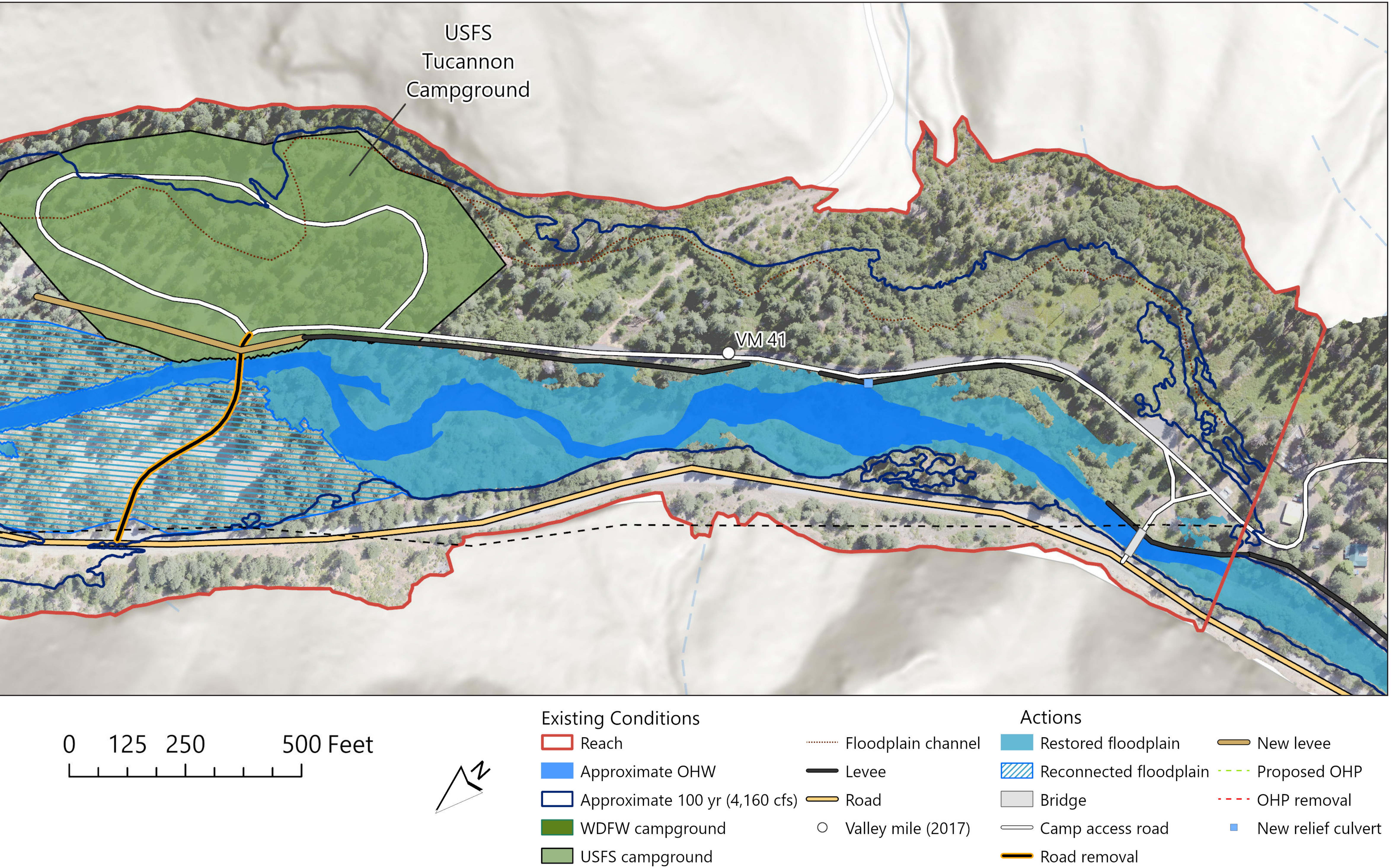
Tucannon PA 5-15

Sub-reach 2: VM 39.6 - VM 40.4



Tucannon PA 5-15

Sub-reach 1: VM 40.4 - VM 41.2


USFS
Tucannon
Campground
VM 41
0 125 250 500 Feet
N
Existing Conditions
Reach
Approximate OHW
Approximate 100 yr (4,160 cfs)
WDFW campground
USFS campground
Floodplain channel
Levee
Road
Valley mile (2017)
Actions
Restored floodplain
Reconnected floodplain
Bridge
Camp access road
Road removal
New levee
Proposed OHP
OHP removal
New relief culvert

■ *Figure XX - Renderings / Photos TBD*

■ *Figure XX - Renderings / Photos TBD*

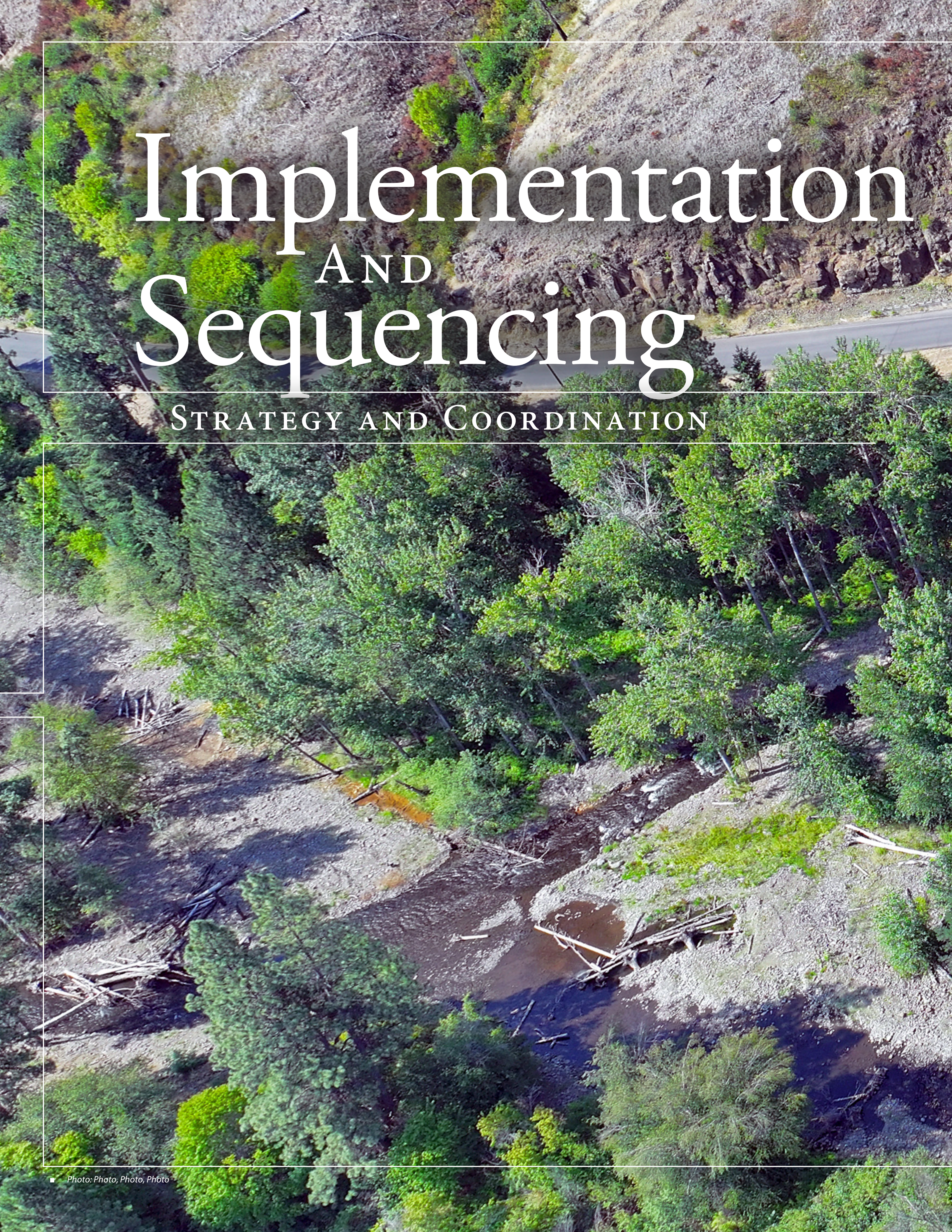
■ *Figure XX - Renderings / Photos TBD*

■ *Figure XX - Renderings / Photos TBD*

■ *Figure XX - Rendering of Deer Lake relocation and reconfiguration.*

Implementation And Sequencing

Strategy and Coordination



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Implementation of the Preferred Alternative will occur in phases, with actions sequenced to coordinate restoration, infrastructure relocation, fisheries improvements, and recreational access. Key early actions include Big Four Lake removal, construction of a replacement New Lake, powerline and road relocations, and development of a new downstream adult collection weir prior to Curl Lake removal. Other projects will advance as funding and opportunities allow.

Implementation of the Preferred Alternative will require coordination between several different actions. Some of the proposed actions are dependent upon a separate action being implemented first, and these actions will be accomplished in an order of sequence to meet the project partner's needs.

Implementation of the Preferred Alternative will occur through a phased and coordinated sequence of restoration, infrastructure, and recreational projects across the PA 5–15 Reach. Because several actions are dependent on completion of others, projects will be implemented in a prioritized order that reflects both logistical constraints and ecological objectives. Sequencing priorities will also consider funding availability, site access, anticipated benefits to recreation and habitat, and the protection of Tribal Treaty Rights and endangered species.

The implementation strategy begins with decommissioning Big Four Lake and restoring the associated channel and floodplain areas. Construction of the proposed New Lake downstream of Blue Lake is prioritized early in the sequence to ensure replacement recreational opportunities are available before Beaver-Watson Lakes are removed and restored. Subsequent phases include relocation of overhead powerlines and rerouting portions of Tucannon Road to remove infrastructure from the floodplain and create additional space for channel and floodplain restoration.

Construction of a new adult collection weir in the lower Tucannon River is another key prerequisite action. Once operational, the existing collection and acclimation facilities associated with Curl Lake can be decommissioned, allowing restoration of the surrounding floodplain and channel areas.

Several additional projects can proceed independently as funding and opportunities become available. These include relocation and reconstruction of Deer Lake with a new groundwater supply system, bridge and campground access improvements at the USFS Tucannon Campground and Camp Wooten area, and recreational enhancements such as fishing platforms at Spring, Blue, and Rainbow Lakes. Together, the phased implementation plan provides a flexible framework for advancing restoration while maintaining recreational access, supporting fisheries objectives, and coordinating infrastructure improvements across the Tucannon River corridor.

Discussion

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- ***Table 3. Dependent Actions*** *- Proposed prioritized sequencing for implementation for dependent actions is as follows:*

Priority	Step	Action	Subreach	PA
1	A	**Big Four Lake** and Infrastructure decommissioning, and channel and floodplain restoration **(VM37.6-39.6)**	3	8-10.3
2	A	**New Lake (VM 33.5-34.7)** a. Landowner agreements b. Scope and Fee c. feasibility analysis d. design e. construction/implementation before/concurrent with Beaver-Watson removal	6	14.1-14.3
	B	**Beaver-Watson Lakes (VM 36.6-27.6)** a. Landowner agreements b. Scope and Fee c. Decommission both Lakes d. Floodplain restoration design and implementation, including water supply diversion and inlet/outlet channels e. Channel restoration to address incision f. Includes floodplain restoration at VM 37/WDFW Campground 4 (after road relocation)	4	10.3-11.2
3	A	**Power Line – Reroute out of floodplain area to Tucannon Road Right-of-Way** a. Subreach 3 (Big Four Project) (VM 37.6-29.6) b. Road Relocation segments (VM 40, 37, & 34.3) c. Remaining PA 1-15 reach where applicable	2, 4, 6	
	B	**Reroute Tucannon Road at these locations:** a. Near USFS Guard Station (VM 40) b. Upstream from Blue Lake (VM34.3) c. at/near VM 37/Campground 4 (PA 11.1/11.2) d. Design and construct added floodplain restoration of area between rerouted road sections and Tucannon River if not already within other Project Areas	All	
4	A	**Adult Collection Weir** Lower River (Mile 0 to 10) adult collection weir prior to Curl Lake removal a. Locate, procure weir site b. Design, construct weir c. Decommission and restore floodplain at existing collection Weir	NA	
	B	**Curl Lake & USFS Guard Station (VM 39.6-40.4)** a. Decommission Curl Lake b. Floodplain restoration design and implementation, including area near USFS Guard Station/road relocation	2	6-8

- ***Table 4. Independent Actions*** *- The following proposed actions are not dependent on any other actions within the PA 5-15 Reach and will be implemented based on opportunity and funding*

Action	Subreach	PA
Deer Lake – move upstream and decommission existing Lake (VM 35.5-36.6) a. Feasibility/Geotech for rebuild/relocate b. Water Supply well i. Water right ii. location iii. feasibility d. New Deer Lake i. Design ii. Construction (includes new well) iii. Decommission old lake and infrastructure iv. Channel and floodplain restoration entire reach (diversion included)	5	11.2-12
USFS Tucannon Campground (VM 40.4-41.2) a. Design changes/new road and bridge(s) b. Construct new road, bridge(s), campground alterations c. Channel and floodplain restoration	1	5-6
Recreational Improvements at Spring, Blue, Rainbow Lakes (not dependent on any other actions, may be accomplished as funds are available) a. Plan/design fishing platforms b. Install/Construct	6	

Appendices

Tucannon River PA 5-15

Technical Reprts

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Glossary

Term	Definition
Action	Proposed activities to improve selected physical and ecological processes that may be limiting the productivity, abundance, spatial structure or diversity of the focal species. Examples include removing or modifying passage barriers to reconnect isolated habitat, planting appropriate vegetation to reestablish or improve the riparian corridor along a stream that reconnects channel-floodplain processes, placement of large wood to improve habitat complexity, cover and increase biomass.
Active channel	The portion of an alluvial stream considered a short-term geomorphic feature subject to change by prevailing discharges; its upper limit is defined by a break in the relatively steep bank slope of the active channel to a more gently sloping surface beyond the channel edge. The break in slope normally coincides with lower limit of perennial vegetation so that the two features, individually or in combination, define the active-channel reference level.
Aggradation	The raising or elevating of a bottomland surface through the process of alluvial deposition; conceptually it is the vertical component of accretion and is most frequently applied to sediment deposition on a channel bed, bar or other near-channel surfaces, flood plain, or, less often, low-lying alluvial terrace.
Alluvial deposit	alluvium
Alluvium	A general term for detrital deposits made by streams on river beds, floodplains, and alluvial fans; esp. a deposit of silt or silty clay laid down during time of flood. The term applies to stream deposits of recent time.
Anthropogenic	Caused by human activities.
Armoring	The winnowing of fine particles from the uppermost bed sediment of a stream channel, resulting in a bed-surface layer of generally gravel to boulder sizes that are resistant to scour; because armoring occurs at specific flow rates, the armor layer may be susceptible to removal by higher flow and sedimentation during lower flow.
Avulsion	A rapid change in the course or position of a stream channel, especially by incision (erosion) of lowland alluvium, to bypass a meander and thereby shorten channel length and increase channel gradient; avulsion commonly occurs during floods but also can occur by normal processes of lateral migration of a stream channel during non-flood discharges.
Bank	A sloping margin of a natural, stream-formed, alluvial channel that confines discharge during non-flood flow; within the earth sciences, designation of a right or left bank is done when looking in the downstream direction.
Bankfull discharge	The flow rate (m3 s-1) when the stage (height) of a stream is coincident with the uppermost level of the banks -- the water level at channel capacity, or bankfull stage. Thus, the concept of bankfull discharge, which often approximates the mean annual flood for perennial streams, includes the flood plain as a unique, identifiable geomorphic surface, all higher surfaces of alluvial bottomlands being terraces, and acknowledgement that bankfull discharge occurs only when stream stage is at flood-plain level.
Bank material	The sediment of which the mostly sloping sides, or banks, of a stream channel are formed; like bed material, it is generally reflective of the size range of the total sediment load of the stream, may be partly residual, but for regime channels is mostly indicative of the suspended-load transported by streams during non-flood periods.
Bar	In-channel sediment of relatively coarse bed material, typically coarse sand through cobbles in size, that is generally deposited during the recession of a high flow and is mostly exposed during periods of low flow.

Term	Definition
Bed	The bottom surface of a water course, generally of a stream channel, upon which water and sediment move during periods of discharge.
Bed load	The sediment that is moved by saltation, rolling, or sliding on or near the stream bed, essentially in continuous contact with it. Also considered as the sediment discharged as bed load.
Bed material	The sediment of which the mostly horizontal bed of a stream channel is formed; it is generally reflective of the size range of the total sediment load of the stream, in many cases may be partly residual, but is mostly indicative of the bed-load sizes transported by the stream.
Bedrock	The solid rock that underlies gravel, soil or other superficial material and is generally resistant to fluvial erosion over a span of several decades, but may erode over longer time periods.
Benthos diversity	A measure of the diversity and production of the benthic macroinvertebrate community; also used to describe the diversity of the physical structure along a streambed (i.e., benthos habitat diversity).
Cfs	Cubic feet per second; a measure of water flows
Channel forming flow	Sometimes referred to as the effective flow or ordinary high water flow and often as the bankfull flow or discharge. For most streams, the channel forming flow is the flow that has a recurrence interval of approximately 1.5 years in the annual flood series. Most channel forming discharges range between 1.0 and 1.8 years. In some areas it could be lower or higher than this range. It is the flow that transports the most sediment for the least amount of energy, mobilizes and redistributes the annually transient bedload, and maintains long-term channel form.
Channel morphology	The physical dimension, shape, form, pattern, profile and structure of a stream channel.
Channel planform	The two-dimensional longitudinal pattern of a river channel as viewed on the ground surface, aerial photograph or map.
Channel units	Morphologically distinct areas within a channel segment that are on the order of at least one to many channel widths in length and are defined by distinct hydraulic and geomorphic conditions within the channel (i.e. pools, riffles, and runs). Channel unit locations and overall geometry are somewhat stage dependent as well as transient over time, and observers may yield inconsistent classifications. To minimize the inconsistencies, channel units are interpreted in the field based on the fluvial processes that created them during channel forming flows, then mapped in a geographic information system (GIS) to provide geospatial reference.
Control	A natural or human feature that restrains a streams ability to move laterally and/or vertically.
Critical shear stress	The lowest required value of shear stress applied by flowing water to initiate motion of individual particles of specified size (diameter) along the bed of a stream.
Degradation	The lowering of a bottomland surface through the process of erosion; conceptually it is the opposite of the vertical component of aggradation and is most frequently applied to sediment removed from a channel bed or other low-lying parts of a stream channel.
Discharge	The movement downstream per unit length of channel of a volume of water; water discharge is given in volume per unit time, typically cubic meters per second (m3 s-1). As a sedimentology term, discharge is the movement of a mass of sediment per unit length of channel in a specified time interval; technically it is expressed in watts per meter (W m-1), but informally it is viewed as mass per unit time. Owing to theoretical considerations, the term sediment-transport rate is preferred to that of sediment discharge.
Diversity	Genetic and phenotypic (life history traits, behavior, and morphology) variation within a population. Also refers to the relative abundance and connectivity of different types of physical conditions or habitat.
Ecosystem	An ecologic system, composed of organisms and their environment. It is the result of interaction between biological, geochemical and geophysical systems.
Extirpation	The loss of a local or regional population, with the species continuing to survive elsewhere.
Fine sediment	Sand, silt and organic material that have a grain size of 2.0 mm or less.
Flood	Any climatically controlled, relatively high streamflow that overtops the natural or artificial banks in any reach of a stream, thereby being of geomorphic significance; where a flood plain exists, a flood is any flow that spreads over or inundates the floodplain.

Term	Definition
Floodplain	The portion of relatively smooth land bordering a stream, built of sediment carried by the stream and deposited in slackwater beyond the influence of the swift current of the channel; the level of the floodplain is generally about the stage of the mean annual flood, and therefore one and only one floodplain level can occur in a limited reach of valley bottom land.
Fluvial	Pertains to the action of a river or stream; included are stream processes (fluvial processes), fluvial landforms, such as fluvial islands and bars, and biota living in and near stream channels. Common usage is often extended by geomorphologists to hydrologic processes on hillslopes.
Fluvial process	A process related to the movement of flowing water that shape the surface of the earth through the erosion, transport, and deposition of sediment, soil particles, and organic debris.
Geomorphic reach	An area containing the active channel and its floodplain bounded by vertical and/or lateral geologic controls, such as alluvial fans or bedrock outcrops, and frequently separated from other reaches by abrupt changes in channel slope and valley confinement. Within a geomorphic reach, similar fluvial processes govern channel planform and geometry resulting from streamflow and sediment transport.
Geomorphology	A composite science in the study of landforms, including investigations into the processes that cause and alter the landforms.
GIS	Geographical information system. An organized collection of computer hardware, software, and geographic data designed to capture, store, update, manipulate, analyze, and display all forms of geographically referenced information.
Gradient	The rate of elevation change between two specified sites of horizontal distance measured along the thalweg of the channel; it is generally expressed as a non-dimensional number (m m-1)
Hydrology	The cycle of water movement from the atmosphere to land, surface-water, and ground-water bodies, including movement among land and water bodies, before returning to the atmosphere.
Indicator	A variable used to forecast the value or change in the value of another variable; for example, using temperature, turbidity, and chemical contaminants or nutrients to measure water quality.
Instability	As a descriptor of geomorphic processes and landforms, refers to a condition of imbalance between inflows and outflows of matter through or over a landscape feature. As a geomorphic concept, instability is often expressed as some state of dynamic- or quasi-equilibrium, signifying that geomorphic processes and landforms are almost always in a condition of dis-equilibrium and are almost always adjusting to regain relative stability; an objective if applying the term is to determine the degree to which a process or landform deviates from stability or equilibrium.
Large woody material (LWM)	Large downed trees or parts of trees that are transported and deposited by the river during high flows and are often deposited on gravel bars or at the heads of side channels as flow velocity decreases. The trees can be downed through river erosion, wind, fire, landslides, debris flows, or human-induced activities. Synonymous with large woody debris (LWD).
Limiting factor	Any factor in the environment that limits a population from achieving complete viability with respect to any Viable Salmonid Population (VSP) parameter.
Meander	One of a series of regular, sharp, freely developing, and sinuous curves, bends, loops, turns, or windings in the course of a stream; the process of stream meandering is a means of channel-gradient adjustment through sorting of stored sediment by erosion at the outside of a bend and deposition, as a point bar, at the inside of the bend.
Pool	A relatively deep, low velocity reach of quiescent flow between upstream and downstream riffles, or rapids, at which the flows are ordinarily more rapid and turbulent.
Pool-riffle sequence	A succession of one or more combinations of pools and riffles along the channel in the downstream direction; during flood the normally low water velocities in pools and higher water velocities at riffles are reversed, causing scour and removal of accumulated sediment from pooled reaches and deposition of bed sediment on riffles.
Reach	An uninterrupted part of a stream channel between two points; generally the two points are where readily recognizable tributary inflows occur, but can also include features such as meander bends, gorges, or a significant change in geology.
Restoration	The attempt to recreate the adjusted physical and biological conditions that were present prior to alteration by human activity; a goal of restoration, therefore, is to minimize and eliminate the effects of human-induced alterations, thus promoting stable landforms, bioproductivity, and species diversity.
Riffle	A short, relatively shallow and coarse-bedded length over which the stream flows at ordinarily higher velocity and greater turbulence than it does through upstream and downstream pooled reaches where cross-sectional areas of the channel are greater, bed material is smaller, and velocities and turbulence are less.

Term	Definition
Riparian area	An ecological term referring to that part of the fluvial landscape inundated or saturated by flood flows; it consists of all surfaces of active fluvial landforms up through the flood plain including channel, bars, shelves, and related riverine features such as oxbow lakes, oxbow depressions, and natural levees. Particularly in arid and semiarid (water-deficient) environments, the riparian zone may support plants and other biota not present on adjacent, drier uplands.
Riverine	That characteristic by which a feature or process pertains to or is formed by a river.
River mile (RM)	Miles measured in the upstream direction beginning from the mouth of a river or its confluence with the next downstream river.
Salmonid	Fish belonging to the family Salmonidae, including steelhead trout and salmon.
Saltation	The process by which sediment, generally of sand size and coarser, bounces along the stream bed by the impact of the flow of water or of other moving particles.
Sediment	Detached fragmental material that originates from either chemical or physical weathering of rocks and minerals and is transported by, suspended in, or deposited by water or air or is accumulated in beds by other natural agencies.
Sediment yield	Sediment-transport rate per unit area, generally from watersheds or drainage basins larger than the field scale; erosion studies, however, may consider sediment yield from smaller areas of the hillslope or plot scale.
Shear	A strain, or change in shape or volume of a body resulting from stress; as applied to fluvial processes and sediment transport, it typically refers to the stress that is exerted on sediment particles by a moving fluid – air, water, and ice.
Shear stress	That portion of stress acting tangentially as a tearing action (as opposed to that portion that acts as a normal stress) to a plane or surface; thus, a sediment particle resting on a channel bed is affected by the shear stress created by water moving on the bed.
Side channel	A distinct channel with its own defined banks that is not part of the main channel, but appears to convey water perennially or seasonally/ephemerally. May also be referred to as a secondary channel.
Sinuosity	A non-dimensional ratio, generally expressed in meters per meter or kilometers per kilometer, of the length of the channel thalweg to the length of the stream valley, measured between the same points.
Slope	Any inclined surface of the earth. As a geomorphic measurement, slope is the inclination, generally measured in degrees departure from horizontal or expressed as a non-dimensional number (meters per meter), of any surface of the earth's landscape (including sub-aqueous surfaces); for application to models of hillslope soil loss, steepness is often used synonymously with slope.
Stability	A condition of approximate balance between inflows and outflows of matter through or over a landscape feature. As a geomorphic concept, stability generally is regarded as being an integration of processes affecting a system and thus has time-independence; the term often is used synonymously with (dynamic or quasi) equilibrium.
Subwatershed	A subwatershed (or sub-watershed) represents the drainage area within a larger defined watershed; synonymous with sub-basin.
Terrace	A relatively stable, planar surface formed when the river abandons its floodplain. It often parallels the river channel, but is high enough above the channel that it rarely, if ever, is covered by over-bank river water and sediment. The deposits underlying the terrace surface are primarily alluvial, either channel or overbank deposits, or both. Because a terrace represents a former floodplain, it may be used to interpret the history of the river.
Thalweg	The line within a stream channel connecting the lowest points at all locations along the channel.
Tributary	A stream feeding, joining, or flowing into a larger stream or lake.
Valley segment	An area of river within a watershed sometimes referred to as a subwatershed that is comprised of smaller geomorphic reaches. Within a valley segment, multiple floodplain types exist and may range between wide, highly complex floodplains with frequently accessed side channels to narrow and minimally complex floodplains with no side channels. Typical scales of a valley segment are on the order of a few to tens of miles in longitudinal length.
Viable salmonid population	An independent population of Pacific salmon or steelhead trout that has a negligible risk of extinction over a 100-year time frame. Viability at the independent population scale is evaluated based on the parameters of abundance, productivity, spatial structure, and diversity.
Watershed	A drainage divide or a "water parting", but common usage of the term has been altered to signify a drainage-basin area contributing water to a network of stream channels, a lake, or other topographic lows where water can collect.

Tucannon River

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Confederated Tribes of the Umatilla Indian Reservation
Nez Perce Tribe
Washington Department of Fish and Wildlife