Appendix H – Projects

WRIA 10 Project Inventory

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier (Offset Projects Only)	Project Stage	Estimated Water Offset Cost	Estimated Total Project Cost
Carbon River (CR)										
10-CR-W4	Alward Road	Levee Setback. Property acquisition and restoration of 150 acres of floodplain. Includes decommission of 20 PE wells	8	Year-round	Restoration of 150 acres of floodplain, flood hazard reduction	Pierce County	1	Feasibility Study	$ 21,000	$ 14,000,000
10-CR-W3	Carbon River Levee Setback and Acquisition	Water Right and Levee Setback. Purchase a property as part of a larger levee setback project and acquire associated water right.	14.3	Irrigation Season	Habitat restoration.	Pierce County	2	Assessment	$ 37,000	$ 19,000,000
Lower Puyallup (LP)										
10-LP-W6	Potential MAR	MAR. Construct an MAR in a gravel pit supplied with Tacoma Water. Three potential locations are identified in the Lower Puyallup.	300	Year-round		None	2	Conceptual	$ 1,100,000	$ 1,100,000
10-LP-W10	Bond	Water Right. Acquire water right as part of a larger property transfer and protection with the City of Puyallup	30	Irrigation Season		City of Puyallup	2	Outreach	$ 80,000	$ 80,000
10-LP-H5	Deer Creek Stream Bed Relocation	Relocate the creek bed to allow for a better connection to the floodplain, restore habitat in the adjacent areas.	N/A	N/A	Improve habitat and provide flood storage.	City of Puyallup	H	Design	N/A	TBD
10-LP-H6	Swan Creek Channel and Bank Stabilization	In-channel stabilization and restoration measures including installation of woody material and streambed gravel.	N/A	N/A	Restore 2.5 miles of Swan Creek.	Pierce County and Puyallup Tribe	H	Design	N/A	$ 3,700,000
10-LP-H7	Silver Creek bank Stabilization	Restoration. Stabilize slopes of Silver Creek to stop channel incision.	N/A	N/A	Habitat restoration.	City of Puyallup	H	Conceptual	N/A	TBD
10-LP-H8	Puyallup River (Union Pacific) Setback Levee (RM 2.6-3.0) - Acquisition	Levee setback. Acquire up to 30 acres of floodplain and former intertidal habitat.	N/A	N/A	Habitat restoration.	Pierce County	H	Conceptual		$ 8,500,000
10-LP-H9	Clear Creek RM 2.9 Acquisition and Levee	Levee setback and floodplain reconnection. Construct a new 13,600' levee along Clear Creek and remove flood gate. Reconnect up to 500 acres of floodplain.	N/A	N/A	Habitat restoration.	Pierce County	H	Conceptual		$ 5,473,802
10-LP-W18	Troutlodge Source Switch	Switch hatchery water right from surface diversion to groundwater.	N/A	N/A	Barrier removal	Pierce County, Puyallup Tribe	2	Conceptual	TBD	TBD
10-LP-H10	Fennel Creek Phase 3	Floodplain restoration This project will restore the Fennel Creek right bank floodplain to a more natural state. Project	N/A	N/A	Restore 14 acres of floodplain.	Pierce County	H	Design		$ 1,662,329

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier (Offset Projects Only)	Project Stage	Estimated Water Offset Cost	Estimated Total Project Cost
		may include a small offset by removing existing PE wells.								
10-LP-W9	Puyallup R. # 1	Water right acquisition would result in an additional 0.75 cfs in 10 miles of the Puyallup River.	82.82	Irrigation Season		TBD	2	Conceptual	$ 212,930	$ 212,930
10-LP-W10	Puyallup R. # 3	Water right acquisition would result in an additional 0.3 cfs in 6.5 miles of the Puyallup River.	36.23	Irrigation Season		TBD	2	Conceptual	$ 93,147	$ 93,147
10-LP-W11	Puyallup R. # 4	Water right acquisition would result in an additional 0.38 cfs in 1.5 miles of Clarks Creek and 6.7 miles of Puyallup River.	19.92	Irrigation Season		TBD	2	Conceptual	$ 51,214	$ 51,214
10-LP-W12	Fennel Cr - Puyallup R. #5	Water right acquisition would result in an additional 0.22 cfs in 16 miles of the Puyallup River.	23.55	Irrigation Season		TBD	2	Conceptual	$ 60,547	$ 60,547
10-LP-W13	Hylebos Cr - Fr Comm Bay #1	Water right acquisition would result in an additional 0.67 cfs in 6 miles of Wapato Creek.	34.35	Irrigation Season		TBD	2	Conceptual	$ 88,314	$ 88,314
Lower White (LW)										
10-LW-H14	Jovita Creek Habitat Project	Restoration actions to address channel confinement, and that restore habitat and habitat forming processes.	N/A	N/A	Habitat restoration.	City of Edgewood	H	Feasibility	N/A	$ 250,000
10-LW-H15	Pacific Right Bank	Levee setback The proposed project will remove a levee and other artificial floodplain fill, allowing for off-channel habitat and floodplain restoration. The total project area available for restoration is estimated at 32 acres.	N/A	N/A	Habitat restoration, floodplain reconnection.	King County Flood Control District	H	Design	N/A	$ 79,000,000
10-LW-H16	White River LB RM 2.9-4.2 Restoration	Habitat restoration. White River Restoration will restore sustainable instream, floodplain, and wetland habitats within a 170 acre area along the Lower White River between river miles 2.9 and 4.2. The tailrace between RM 3 and RM 3.5 is part of the Foster Pilot Project and not included as part of the offset and NEB accounting.	N/A	N/A	Restore sustainable instream, floodplain, and wetland habitats within a 170 acre area along the Lower White River between river miles 2.9 and 4.2.	City of Sumner	H	Design	N/A	$ 25,000,000

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier (Offset Projects Only)	Project Stage	Estimated Water Offset Cost	Estimated Total Project Cost
10-LW-H17	White River Bridge (Stewart Road) replacement RM 4.9	The project will consist of replacing the existing Stewart Road Bridge with a new bridge. The existing bridge is a restriction along the river, and a new bridge will allow the river more room to move naturally, allowing better utilization of instream habitat beneath the bridge. The current bridge also limits the flow of large woody debris, while a new bridge will let them large woody debris flow downstream and accumulate naturally through the rest of the lower White River.	N/A	N/A	Habitat restoration.	City of Sumner	H	Design	N/A	$ 30,000,000
10-LW-H18	White River Setback LB RM4.4-4.8 Stewart	The project consists of a levee setback on the left bank between RM 4.4 - RM 4.8. This project Improve Rearing Opportunity by creating slow water habitat, increased number/depth of pools, engaged floodplain food webs. Better High Flow Refuge with floodplain wetlands, and greater main channel roughness. Restore riparian forests. The project will reconnect about 20 acres of floodplain.	N/A	N/A	Habitat restoration. Reconnect 20 acres of floodplain.	City of Sumner	H	Design	N/A	$ 7,000,000
10-LW-H19	Pacific Pointbar	The project consists of a levee setback on the left bank between RM 4.4 - RM 4.8. This project will improve rearing opportunity by creating slow water habitat, increased number/depth of pools, and engaged floodplain food webs. Better High Flow Refuge with floodplain wetlands, and greater main channel roughness. Restore riparian forests. The project will reconnect about 25 acres of floodplain.	N/A	N/A	Habitat restoration. Reconnect 25 acres of floodplain.	City of Sumner	H	Design	N/A	$ 18,000,000
Middle White (MW)										
10-MW-W7	CWA purchase	Water Right. Acquire a portion of the Cascade Water Alliance water right to place in trust.	277	Year-round		Ecology	1	Outreach/Negotiation	$ 750,000	$ 750,000
10-MW-H13	Enumclaw Golf Course Restoration	Stream restoration to move Boise Creek back to its historic channel adjacent to the Enumclaw Golf Course.	N/A	N/A	Increased habitat complexity and channel roughness.	City of Enumclaw and Puyallup Tribe	H	Design	N/A	$ 2,300,000
10-MW-W14	Boise Cr - White R # 2	Water right acquisition would result in an additional 0.22 cfs in 24.7 miles of White River and 10.5 miles of Puyallup River.	53.86	Irrigation Season		TBD	2	Conceptual	$ 138,474	$ 138,474

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier (Offset Projects Only)	Project Stage	Estimated Water Offset Cost	Estimated Total Project Cost
10-MW-W15	Boise Cr - White R # 3	Water right acquisition would result in an additional 0.3 cfs in 0.2 miles of Cyclone Creek, 24.3 miles of White River, and 10.5 miles of Puyallup River.	47.06	Irrigation Season		TBD	2	Conceptual	$ 120,991	$ 120,991
10-MW-W16	Boise Cr - White R # 4	Water right acquisition would result in an additional 0.3 cfs in 3 miles of Boise Creek, 23.4 miles of White River, and 10.5 miles of Puyallup River.	4.706	Irrigation Season		TBD	2	Conceptual	$ 12,099	$ 12,099
South Prairie Creek (SPC)										
10-SPC-W2	Old Inglin Dairy	Water Right. Floodplain restoration of former dairy, and place water rights into trust after plants are established.	89.09	Irrigation Season	Floodplain restoration/reconnection, habitat enhancement.	Pierce Conservation District	1	In progress	$ 230,000	$ 230,000
10-SPC-H2	Implement habitat projects based on SPC study.	Habitat improvement projects. Identify and design protection and restoration actions for the lower 15.5 miles of South Prairie Creek and the lower 6 miles of Wilkeson Creek.	N/A	N/A	Habitat restoration, water quality improvements, fish passage improvements.	Pierce Conservation District, Puyallup Tribe, South Puget Sound Salmon Enhancement Group	H	Planning study funded	N/A	$ 469,000
10-SPC-H3	Stubbs Project	In-channel stabilization and restoration measures including installation of woody material and streambed gravel. Slight chance of a water right acquisition included in this project.	N/A	N/A	Habitat restoration.	Pierce Conservation District	H	Conceptual	TBD	TBD
10-SPC-H4	South Prairie Creek RM 4.0-4.5 Floodplain Planting	Habitat improvement. Continue planting efforts on the South Prairie Creek Preserve property between river mile 4.0 and 4.5 to maintain and in-fill existing plantings on the property.	N/A	N/A	Habitat restoration and establishment of 50-55 acres of forested floodplain.	Pierce Conservation District, South Puget Sound Salmon Enhancement Group (SPSSEG)	H	In progress	N/A	$ 369,000
10-SPC-H22	South Prairie Creek Floodplain Reconnection, RM 2.7-2.8 Phase 1	Floodplain restoration. Acquire 73 acres and implement a multi-benefit floodplain reconnection project that would reduce flood risk and maintenance costs, restore vital salmon habitat, and keep the property in agricultural production.	N/A	N/A	Habitat restoration. Water quality improvements.	Pierce Conservation District	H	Conceptual	N/A	$ 1,239,000
Upper Puyallup (UP)										

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier (Offset Projects Only)	Project Stage	Estimated Water Offset Cost	Estimated Total Project Cost
10-UP-W1	Orville Road Revetment Phase 2C Year 1	Floodplain Reconnection/Levee Setback. Purchased and decommission a PE well that served 3 homes as part of this project.	1.2	Year-round	Habitat restoration. 1,500 Linear Feet of setback revetment, 19 engineered log jams.	Pierce County	1	In progress/complete	$ 3,100	$ 2,200,000
10-UP-H1	Orville Road Revetment at Kapowsin Creek	This project will construct a setback revetment along the left bank Puyallup River near RM 26.3 from Kapowsin Creek confluence upstream. May allow for re-connection of approximately 25-acres of forested floodplain between Puyallup River and Orville Road.	N/A	N/A	Habitat restoration. Reconnect 25 acres of floodplain.	Pierce County	H	Preliminary Design	N/A	$ 3,880,306
10-UP-W17	Fiske Cr - Puyallup R. #3	Water right acquisition would result in an additional 0.45 cfs in 23 miles of the Puyallup River.	72.15	Irrigation Season		TBD	2	Conceptual	$ 185,498	$ 185,498
Upper White (UW)										
10-UW-H11	Greenwater Phase 4 Implementation	Reach scale restoration to restore instream complexity and floodplain connectivity.	N/A	N/A	Restore 1.2 miles of Greenwater River.	SPSSEG	H	Design	N/A	$ 1,500,000
10-UW-H12	West Fork White Floodplain Project	Floodplain restoration project to restore habitat and habitat-forming processes.	N/A	N/A		SPSSEG	H	Conceptual	N/A	$ 3,000,000
WRIA-Wide (WW)										
10-WW-W8	Green Stormwater Infrastructure	Stormwater infiltration. Support Green Stormwater Infrastructure retrofits for both individual property owners and jurisdictions. Goal of 10 projects per year.	27	Year-round	Water quality improvements	Pierce Conservation District	2	Planning	$ 900,000	$ 900,000
10-W9-W17	WWT assessment	Water Right. Acquire 10% of the water rights identified through Washington Water Trust assessment. These rights are listed individually in this table.	41.71	Irrigation Season		Unknown	2	Conceptual	$ 110,000	$ 110,000
10-WW-H20	Land acquisition, water right acquisition, and restoration	Seek out opportunities for land and water right acquisitions and large scale habitat restoration and floodplain reconnection/levee setbacks.	N/A	N/A	Habitat restoration, habitat protection.	Multiple	2	Conceptual	TBD	TBD
10-WW-W19	General source switches for ag producers	Ag producers switch from surface to groundwater rights. More water in the stream during the low flow periods. Individual projects would need to be evaluated for Foster impacts, and might not be legal until the Foster is addressed.	N/A	N/A	Improved water quality for agriculture producers.	PCC Farmland Trust	2	Conceptual	TBD	TBD

Project Number	Project Name	Project Type and Brief Description	Water Offset (AFY)	Timing of Water Offset	Additional Benefits	Project Sponsor	Tier (Offset Projects Only)	Project Stage	Estimated Water Offset Cost	Estimated Total Project Cost
10-WW-H21	Levee setbacks	Implement projects included on the Pierce County Levee Setback Feasibility Study as opportunities arise. The study lists levees in Pierce County that may be set back to improve floodplain function and habitat. Any of these levee setback projects would contribute to NEB as well as small but difficult to calculate water offsets by allowing for additional infiltration during high flow events.	N/A	N/A	Floodplain reconnection, habitat restoration.	Pierce County	H	Conceptual	N/A	TBD

ALWARD ROAD ACQUISITION AND RESTORATION

Narrative description, including goals and objectives.

Pierce County has been acquiring property along Alward Road near Orting since 1989, in the Carbon River sub-basin (WRIA 10). This proposal would complete the acquisition and construct a setback levee and make other restoration improvements which will reconnect 150 acres of floodplain adjacent to the Carbon River. Proposed actions at the Site include removing approximately 8,925 linear feet of existing levee located along the left (south) bank of the Carbon River. An armored levee of approximately 9,850 linear feet would be constructed and set back from the Carbon River to the south, encompassing an area of approximately 6,190,596 square feet (142 acres). Engineered log jams (ELJs) would be constructed alongside Alward Road to protect it from erosion. Riparian restoration would also occur in floodplain areas. A total of 30 properties will need to be acquired. An ongoing phase of the project (Phase 3) will purchase 10 of those properties.

The goals of the project include the following:

- Remove the existing river levee and reconnect the Carbon River left bank floodplain which will allow salmon and trout species to access an additional 150 acres of off-channel habitat.
- Allow for more natural floodplain inundation and function respective to frequency, depth and duration without obstruction.
- Facilitate the restoration of natural watershed and conserve the properties for habitat in perpetuity.

The objectives of the project are:

- Acquire thirty Carbon River Alward Road reach floodplain properties
- Remove structures on purchased property
- Remove existing levee and install setback levee
- Install ELJs alongside Alward Road
- Restore floodplain areas with riparian plantings

An estimated 20 residential structures will be acquired and removed, potentially providing a water offset benefit equal to 20 new permit-exempt wells. The water offset benefit will occur when the structures are acquired, likely within the next five years.

Qualitative assessment of how the project will function.

The project will function by allowing natural processes to develop in a large floodplain area currently isolated by a levee.

Conceptual-level map of the project and location.

The acquisition area of the proposed project is located along the north side of Alward Road between river miles 6.8 and 8.0 of the left bank side of the Carbon River. This segment of river lies between 226th AVE CT E and the end of Alward Road. Figure 1, prepared by Pierce County, shows the vicinity of the project. Figure

2 shows the parcels needing to be acquired and includes the ten parcels being acquired as part of Phase 3. Figure 3, prepared by GeoEngineers, shows an overview of the 30% design of the levee setback portion of the project. (The full set of 30% design drawings are available on Box.)

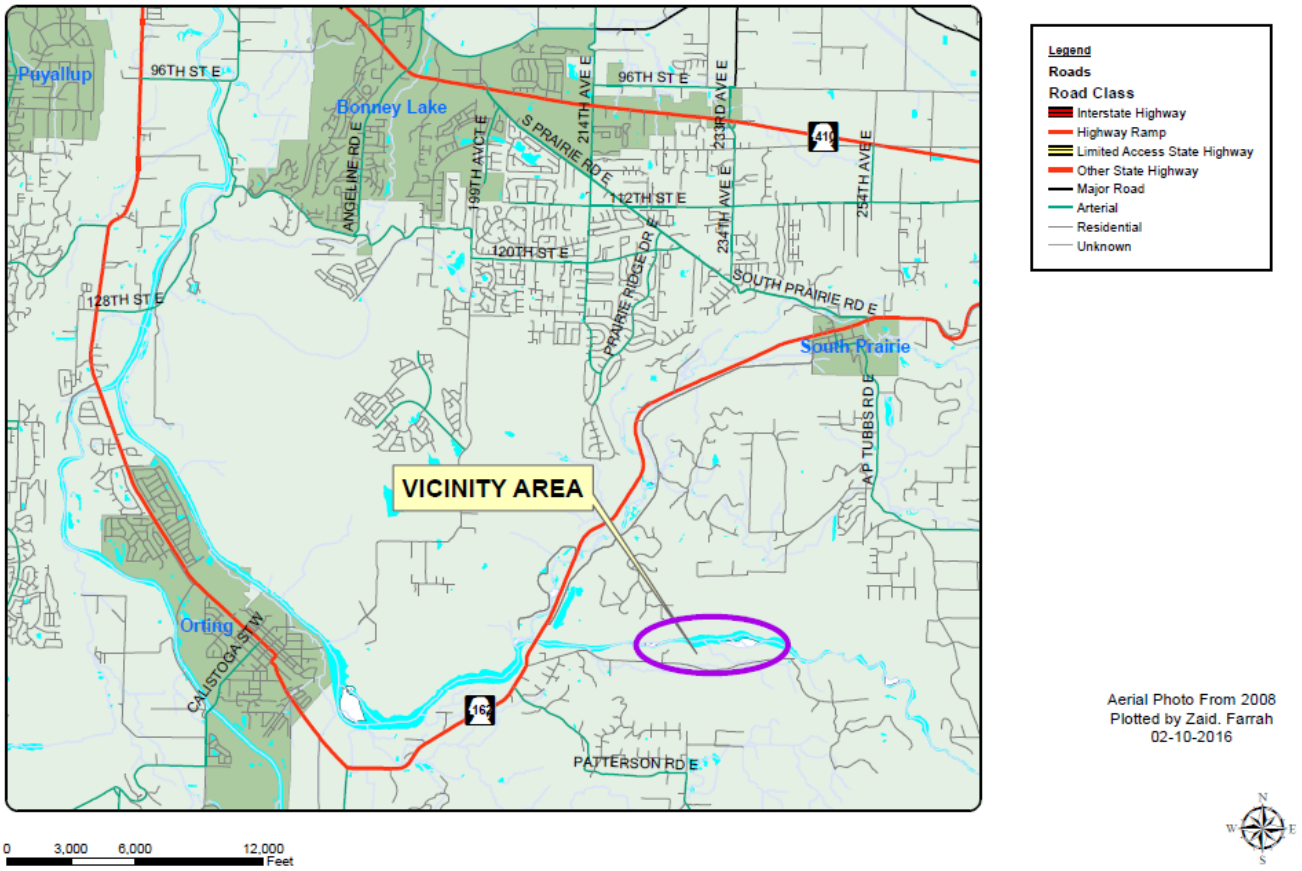


Figure 1. Alward Road Acquisition Project (from Pierce County, 2016)

Performance goals and measures.

The performance goal is to acquire 30 parcels between river miles 6.4 and 8.4 of the Carbon River. All existing structures will be removed, and all properties will be retained as open space in perpetuity. An existing levee will be removed and a setback levee constructed. Floodplain areas will be restored. This project builds upon SRFB project 13-1422 and other County efforts to acquire all floodplain parcels within the project reach.

Description of the anticipated spatial distribution of likely benefits.

Benefits to river processes will occur in the project area between river mile 6.4 and 8.4; side channel and other habitat features formed as a result of this project will benefit a variety of salmonid species as described in the next paragraph. Salmonids in the lower Carbon River and in the Puyallup River will benefit from increased habitat and reduced peak flow and sediment input.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

The Carbon River supports a variety of salmonid species including ESA threatened Chinook, Steelhead, and Bull Trout. Other salmonid species on the Carbon River that would receive benefit from this project include Coho, fall chum, and pink salmon, and Cutthroat Trout. The Carbon River fall Chinook salmon run is also listed as one of 22 unique species, or Evolutionarily Significant Units (ESUs), in Puget Sound. The salmonids and other aquatic species in the Greenwater River are subject to the current limiting factors present.

According to the Limiting Factors Report for the Puyallup Watershed by Kerwin (1999), limiting factors that may be addressed by the project include the following:

- Loss of floodplain habitat, wetlands, and connectivity to hyporheic zone
- Loss of bank stability
- Loss of off channel and side-channel habitat
- Loss of instream habitat complexity and connectivity due to large wood
- Loss of riparian habitat

Removal of the existing levee will promote the creation of a variety of habitat types including side channels, backwater channels, deep complex pools, spawning habitat and summer and winter rearing habitat by promoting the creation of a variety of habitat types and hydrologic features. ELJs would be placed strategically to promote lateral migration of the river. These complex habitats provide protection from flood events and act as riparian cover and rearing habitat, which supports juvenile salmonids and provides areas for fry to colonize. Coho salmon may also spawn in low velocity side channels. Deep complex pools would also be created. These provide cover and prey availability during migratory periods for adult salmonids and cover for juveniles when log jams are present. Deep pools are also generally colder than other in-water environments, providing appropriate temperatures and acting as a refuge. As new, sinuous channels develop, there will be a significant increase in the development of shallow edge habitat along the expanding channel system, providing shade and cover for fry and juvenile salmon during rearing. Invertebrates colonizing the edge habitat are also a prey source for juveniles. A more sinuous river will result in a slower velocity system where a greater range of sediment and substrate types are available due to the complexity of habitats present. Spawning salmonids would benefit from a range of substrate sizes. It should also be noted that habitat restoration is extremely important for Steelhead stocks due to the extended period of time they spend in freshwater. The functions and benefits of the habitat and hydrologic features that would be created by the project address many of the limiting factors currently present in the Carbon River.

Identification of anticipated support and barriers to completion.

This project builds upon other County efforts to acquire all floodplain parcels within the project reach. Prospective property owners have been contacted and Landowner Acknowledgment Forms have been signed for the Phase 3 portion of the project (acquisition of 10 parcels). All property owners in the Phase 3 project have indicated their willingness to sell their properties. The project is sponsored by Pierce County and supported by the Lead Entity.

Priority actions within the WRIA 10/12 Lead Entity Strategy include levee setbacks with highest priority to reestablish floodplain connectivity and to restore stream processes. Setbacks are identified as a Near Term Action and a High priority because they can result in re-connecting large areas of floodplain to the main river. They allow natural processes to create side-channel and off-channel habitat areas. The WRIA 10/12 Lead Entity Strategy additionally states that this type of action will provide the greatest restoration benefit to Puyallup/White River Chinook abundance. The Puget Sound Chinook Recovery Plan identified levee and dike setbacks as both a near-term and a long-term strategy to reduce further degradation of the mainstem rivers. Chapter 3 of the WRIA 10/12 Lead Entity Strategy and/or the PS Chinook Recovery Plan states, "Based on the tremendous benefits that floodplain reconnection projects will have for Chinook in WRIA 10/12, we think that our focus on freshwater habitat restoration in the lower Puyallup, lower Carbon and lower White River floodplains is an appropriate strategy."

Potential budget and O&M costs (order of magnitude costs).

The funding requested to complete acquisitions, removal of structures, levee setback, levee construction, and restoration of floodplain habitat is approximately $14 million. This cost estimate is based on acquisition and construction estimates that were completed in 2014. Some parcels have been acquired (RCO, 2020) which may reduce the cost; however, costs are likely higher due to inflation. A revised cost estimate will be needed.

No O&M costs have been identified for structure removal and levee removal. Levee installation and floodplain restoration may require some O&M to maintain riparian plantings and the new setback levee. These costs have not been estimated.

The costs of just decommissioning the existing wells to provide a water offset is not known; a unit cost of $2571 per acre-foot is recommended by Washington Department of Ecology for water right acquisitions (Melcher, 2020) and was used for this project. For 20 wells with an average water offset of 0.4 acre-feet per year, the total cost would be approximately $20,600. That cost is preliminary and is used just for purposes of estimating costs of water offset projects for the watershed plan.

Anticipated durability and resiliency.

Levee setback and floodplain restoration projects are durable as they restore natural processes to a reach of the river, allowing flooding and channel migration to occur unimpeded. Instream wood placement projects are also durable; they support natural processes and encourage accumulation of smaller debris. Given the changing climate conditions, that anticipates receding glaciers, and increases in precipitation, rain-on-snow events, and channel aggradation, setback projects that provide the river with more room to meander are important solutions to implement to restore watershed processes and to provide resiliency from a changing climate.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Pierce County is the project sponsor and is ready to implement the project as property owners have indicated their willingness to sell their properties. The overall project can likely be implemented within the next five years.

Documentation of sources, methods, and assumptions.

The following references were used:

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June. https://www.piercecountywa.org/ArchiveCenter/ViewFile/Item/6075

Kerwin, J. 1999. Salmonid Habitat Limiting Factors Report for the Puyallup River Basin. Washington Conservation Commission.

GeoEngineers, 2008. Levee Setback Project Carbon River - Alward Road Site River Mile Post 8.30 To 6.40 Left Bank 30% Design Plans.

GeoEngineers, 2008. Levee Setback Feasibility Analysis Puyallup River Watershed Pierce County, Washington. Prepared for Pierce County Public Works & Utilities, June 19, 2008

Mary Ann Reinhart & Tim Abbe, December 29, 2014. Flood Plain Reconnection Feasibility Study Puyallup, Carbon, White Rivers Pierce County, Washington. Prepared for: Puyallup River and Chambers Creek Lead Entity Technical Advisory by Natural Systems Design, Inc.

Melcher, Austin (Washington Department of Ecology). Memo regarding: Water Offset Project Potential Cost Estimate Methodology. Sent to Ingria Jones, John Covert. September 17, 2020

Pierce County, Alward Road Setback Levee Fact Sheet. Undated

Washington State Recreation and Conservation Office (RCO), 2020. Alward Rd. Acquisition Phase 3. PRISM Project #17-1355. Available from: https://secure.rco.wa.gov/prism/search/projectsnapshot.aspx?ProjectNumber=17-1355

Figure 2 [Attached]. Alward Road Parcels Map

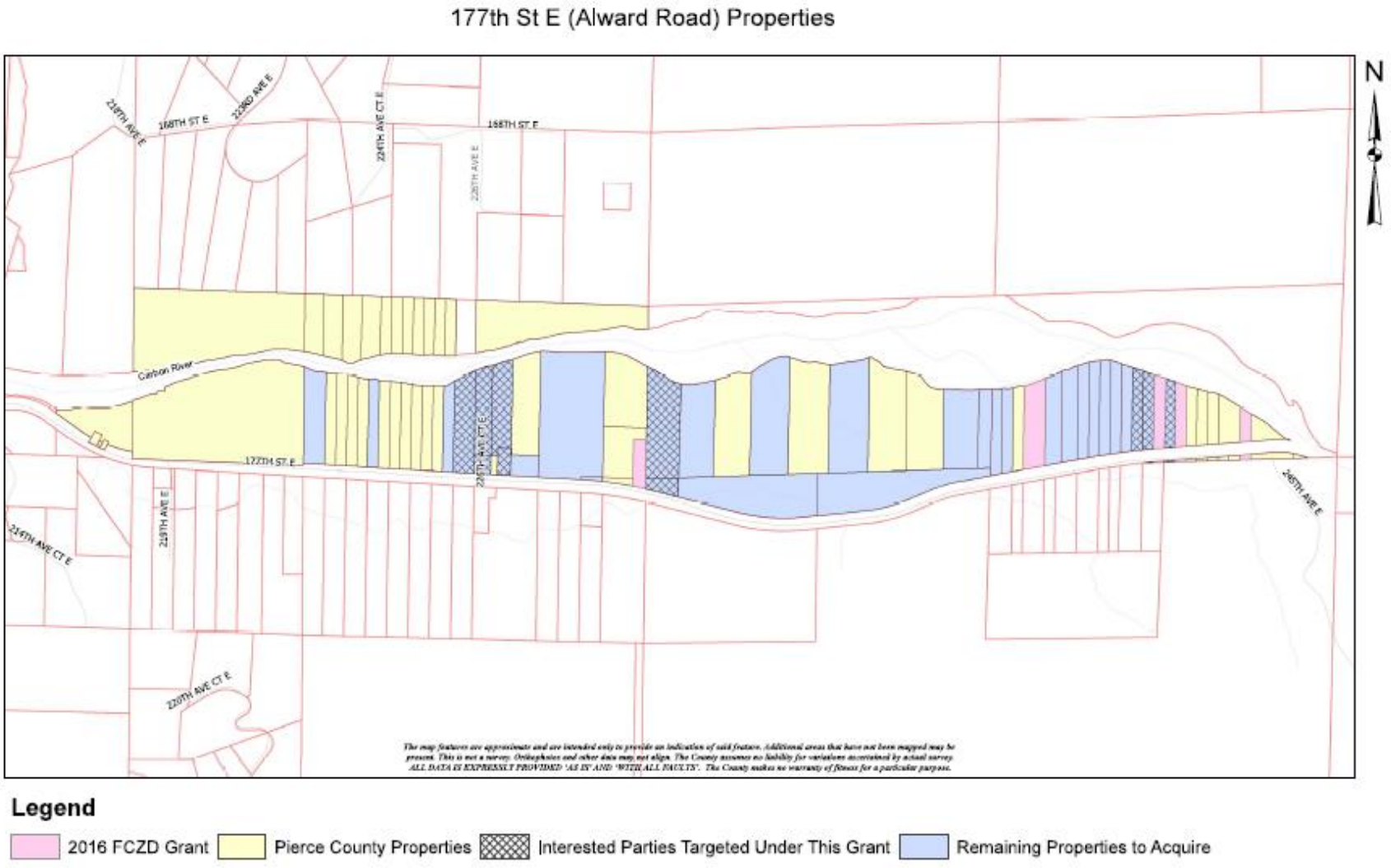
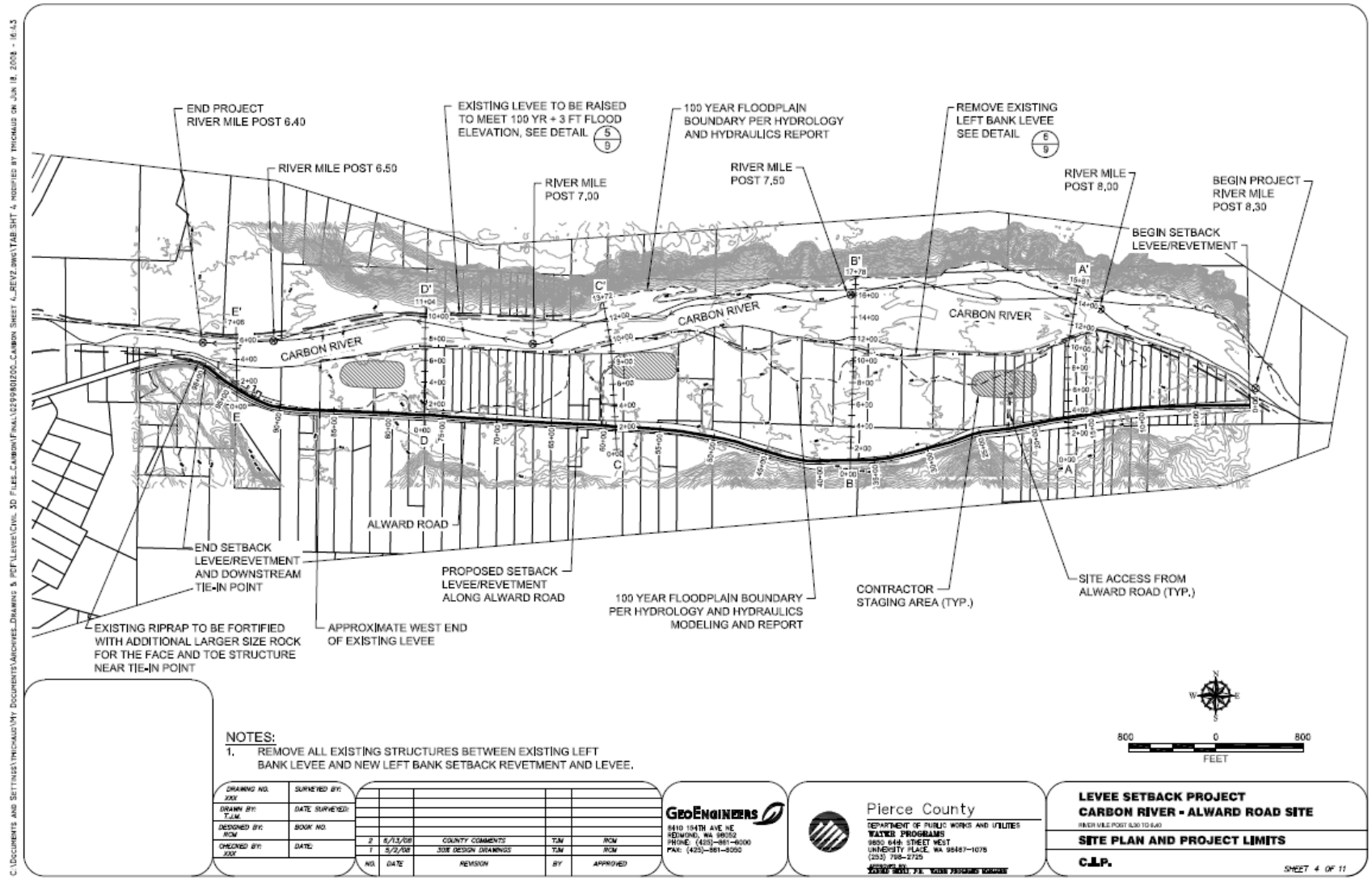


Figure 3 [Attached]. Alward Road 30% Design Drawings Overview (Page 4 from GeoEngineers, 2008)



WRIA 10 CASCADE WATER ALLIANCE WATER RIGHTS ACQUISITION
PROJECT DESCRIPTION – DECEMBER 28, 2020

Description

Cascade Water Alliance (CWA) currently serves communities north of WRIA 10 in the Green River and Lake Washington Watersheds. They acquired the Lake Tapps project from Puget Sound Energy and obtained water rights for future municipal use. This project would acquire a portion of the water rights from CWA and place it in the State's Trust Water Rights Program to contribute to streamflow while protecting the water right from relinquishment.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

CWA were granted water rights (Permit S2-29920(A)) with a priority date of June 20, 2000 for withdrawal of up to 1,000 cfs and 54,300 acre-feet from the White River. The purpose of use is municipal. The place of use for this water right is shown in Figure 1. This project would acquire 277 acre-feet from the municipal permit held by CWA and place that quantity in the State's Trust Water Right Program. The streamflow benefit will likely occur year-round.

Description of the anticipated spatial distribution of likely benefits

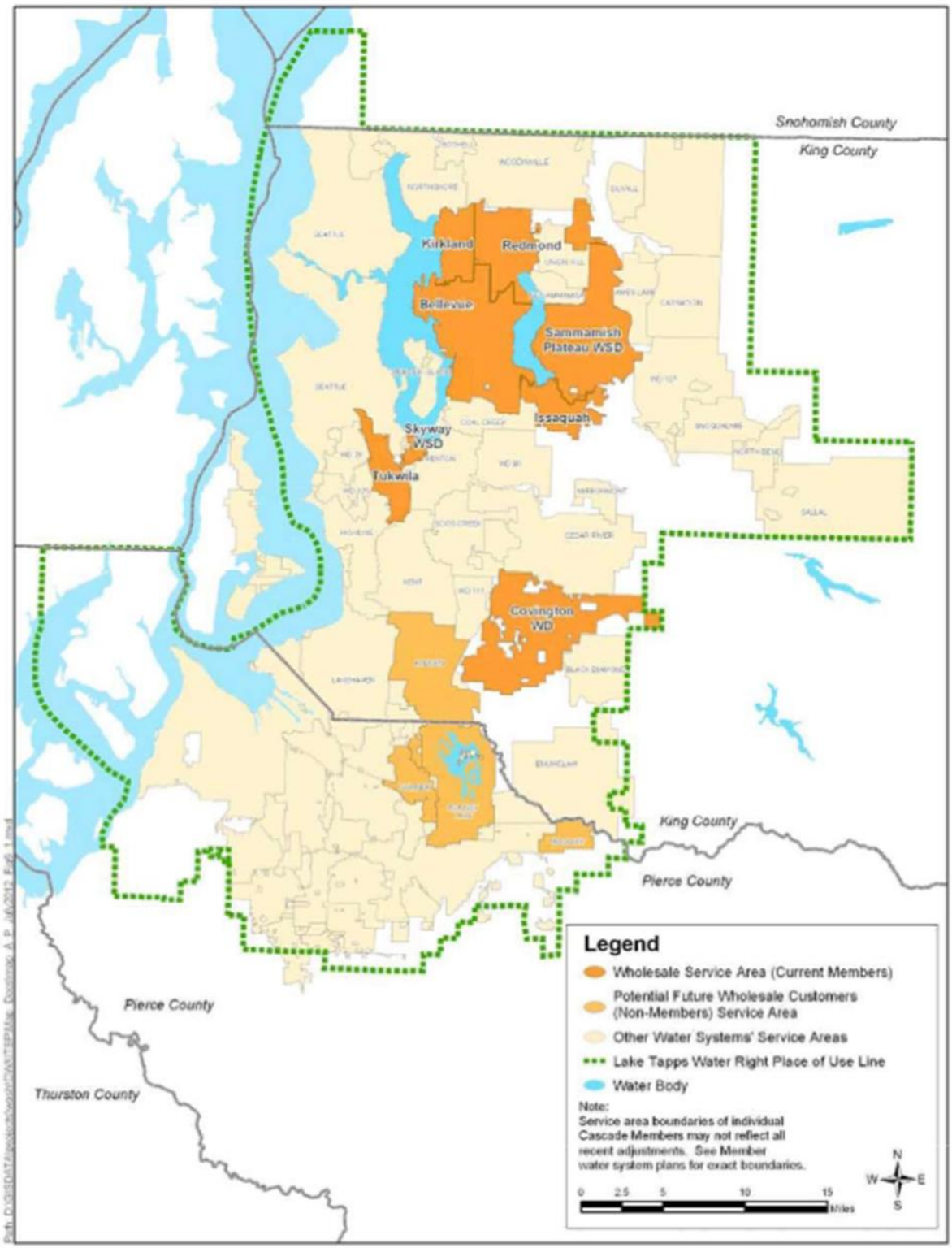
The water is currently diverted from the White River at river mile 24.3, held in Lake Tapps and released at river mile 3.6. The benefits on the White River could extend from the diversion dam at river mile 24.3 to its confluence with the Puyallup River at river mile 0.0 and on the Puyallup River from its river mile 10.4 to river mile 0.0. Those reaches of the White and Puyallup rivers are within WRIA 10. Figure 2 provides a schematic of the White and Puyallup river stream reaches.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

This project will slightly increase instream flow. The primary limiting factors in the Puyallup Watershed (Kerwin, 1999; Lead Entity, 2018) which would be addressed through this project include:

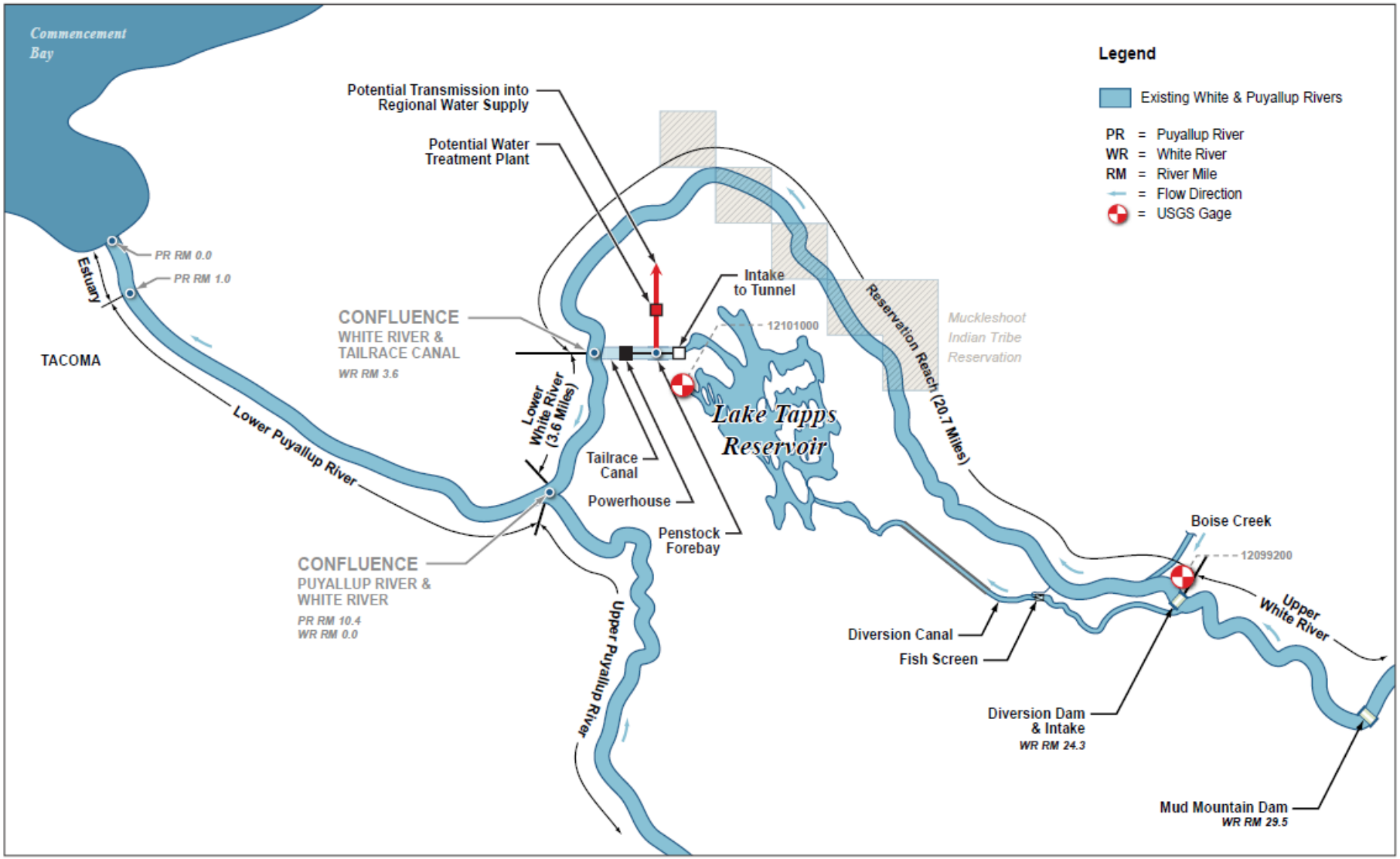
- Loss of upstream, downstream, and lateral fish passage
- Loss of spawning and rearing habitat
- Loss of good water quality, including appropriate temperature

Figure 1. Cascade Water Alliance Water Right Place of Use



Source: Cascade Water Alliance Transmission and Supply Plan, July 2012, Figure 6-1

Figure 2. Stream Reaches of the White and Puyallup Rivers



Source: Lake Tapps Reservoir Water Rights and Supply Project Draft Environmental Impact Statement January 29, 2010

Identification of anticipated support and barriers to completion.

The project is supported by the Watershed Restoration and Enhancement Committee and the barriers to completion would be negotiation of the water right acquisition from CWA and obtaining funding to purchase the water right. CWA has indicated a willingness to discuss the acquisition.

Potential budget and O&M costs.

No agreement or purchase price has been discussed with CWA. For planning purposes, a cost of $2,571 per acre-foot was used, resulting in an estimated cost of $750,000. The unit cost was obtained from an Ecology memo titled Water Offset Project Potential Cost Estimate Methodology (Melcher, 2020). No O&M costs would likely be incurred with this project.

Anticipated durability and resiliency.

The project would have lasting benefits as the Trust Water Right would be in perpetuity.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Washington Department of Ecology would be the project sponsor and would be ready to proceed immediately if acquiring a trust water right is feasible.

Sources of Information

Kerwin. 1999. Salmon Habitat Limiting Factors Report for the Puyallup River Basin (Water Resources Inventory Area 10). Washington State Conservation Commission. Olympia, WA.

Melcher, Austin. Memo regarding: Water Offset Project Potential Cost Estimate Methodology. Sent to Ingria Jones, John Covert. September 17, 2020

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June.

Managed Aquifer Recharge Project Portfolio for WRIA 10
December 28, 2020

Summary

Managed Aquifer Recharge (MAR) projects are being considered in WRIA 10 as a method to increase infiltration to aquifers to improve streamflow and to offset the water use from future permit exempt (PE) wells in the watershed. The planning and implementation of MAR projects is complex, leading to uncertainty as to their potential use as water offset projects and inclusion in the Watershed Restoration and Enhancement Plan. A potential approach to addressing uncertainty is to include a portfolio of MAR projects that have different locations, project sponsors, water sources, and size.

Potential WRIA 10 MAR Projects

There are different types of MAR projects. Aquifer Storage and Recovery (ASR) projects are a type of MAR project that actively injects water into aquifers for storage and recovery by pumping later. Passive MAR projects infiltrate water into shallow aquifers, with the intent that water discharges from the shallow aquifer into streams on a delayed basis and improves streamflow during low-flow periods. For WRIA 10, only passive MAR projects are being considered.

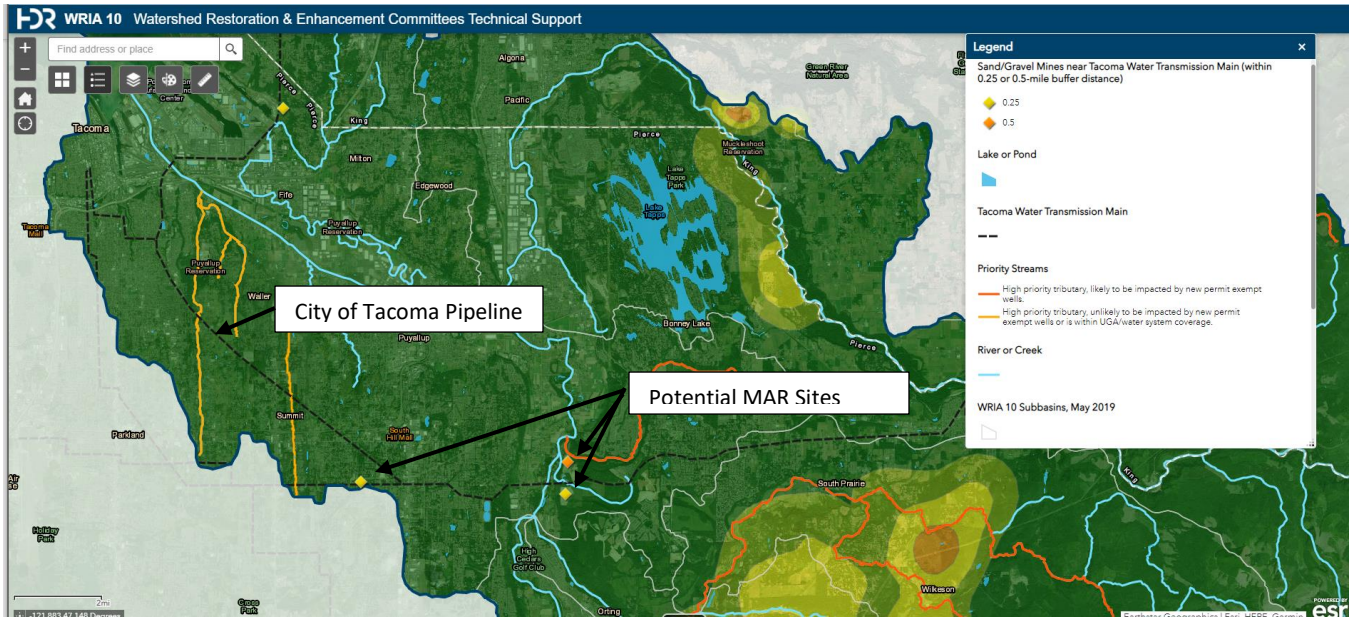
Passive MAR projects have the potential to recharge a significant volume of water into shallow aquifers, greater than the estimated consumptive use of PE wells forecast for the next 20 years in WRIA 10. The estimated consumptive use for future PE wells in WRIA 10 is 277 acre-feet per year.

The source of water for passive MAR projects in WRIA 10 may be stormwater, diverted surface water or water obtained from a City of Tacoma pipeline that delivers drinking water from the Green River watershed. Recycled water (highly treated wastewater) could be a source but at this time no source for recycled water was identified in WRIA 10 that is located outside of the Tacoma urban area.

The Watershed Restoration and Enhancement Committee expressed an interest in using City of Tacoma water supplied by their pipeline as it would be a clean and reliable source of water and may be easier to implement a project with that water source. A high-level screening of potential MAR sites was performed by PGG and HDR by searching for permitted sand and gravel mining operations located within a ½ mile distance of the pipeline. Three were found within ¼ mile and one within ½ mile. All the sites are located in the Lower Puyallup River subbasin. Three sites are included in this project description. The other site was located close to Commencement Bay and infiltration at that location would not provide a streamflow benefit. These sites have potential for MAR, however other sites not yet identified may also be suitable. A more intensive screening of sites should be performed if a MAR project is needed to provide water offsets for the Watershed Plan.

The location of the 3 sites and the City of Tacoma pipeline are shown in Figure 1.

Figure 1. Location of Potential MAR Sites



Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

Preliminary calculations of the potential size and infiltration capacity if a suitable gravel pit site is located were performed. A MAR facility may only need a footprint of 2 acres to infiltrate 300 acre-feet per year, using a conservative assumption of 2 feet/day for the infiltration rate. It was assumed that infiltration would occur during winter months as the City of Tacoma pipeline has excess capacity during winter. A flow rate of 1 cfs (450 gallons per minute) would be required from the City of Tacoma pipeline to infiltrate 300 acre-feet during the winter season. If several sites are feasible, the selection of how many are used and how much water is infiltrated at each would be a decision of the Watershed Restoration and Enhancement Committee. A MAR project can be scaled to the desired water offset or streamflow benefit.

A preliminary review of geology was performed for the sites. Geologic maps are shown in Figures 2 and 3. All three sites are in formations that would be suitable for infiltration. However additional geologic and geotechnical analyses are required before determining whether MAR projects would be feasible at those sites. The additional analyses are also required to determine the timing of the offset benefit. Water infiltrated at the two sites located just east of the Puyallup River would likely reach the adjacent streams (Fennel Creek, Canyonfalls Creek or the Puyallup River) more quickly than the third site which is located in the headwaters of Clarks Creek and Swan Creek. At this time, assuming the MAR facilities operate all but summer time, some streamflow benefit will likely occur

year-round.

Figure 2. Geology Map for MAR Sites East of Puyallup River near Bonney Lake

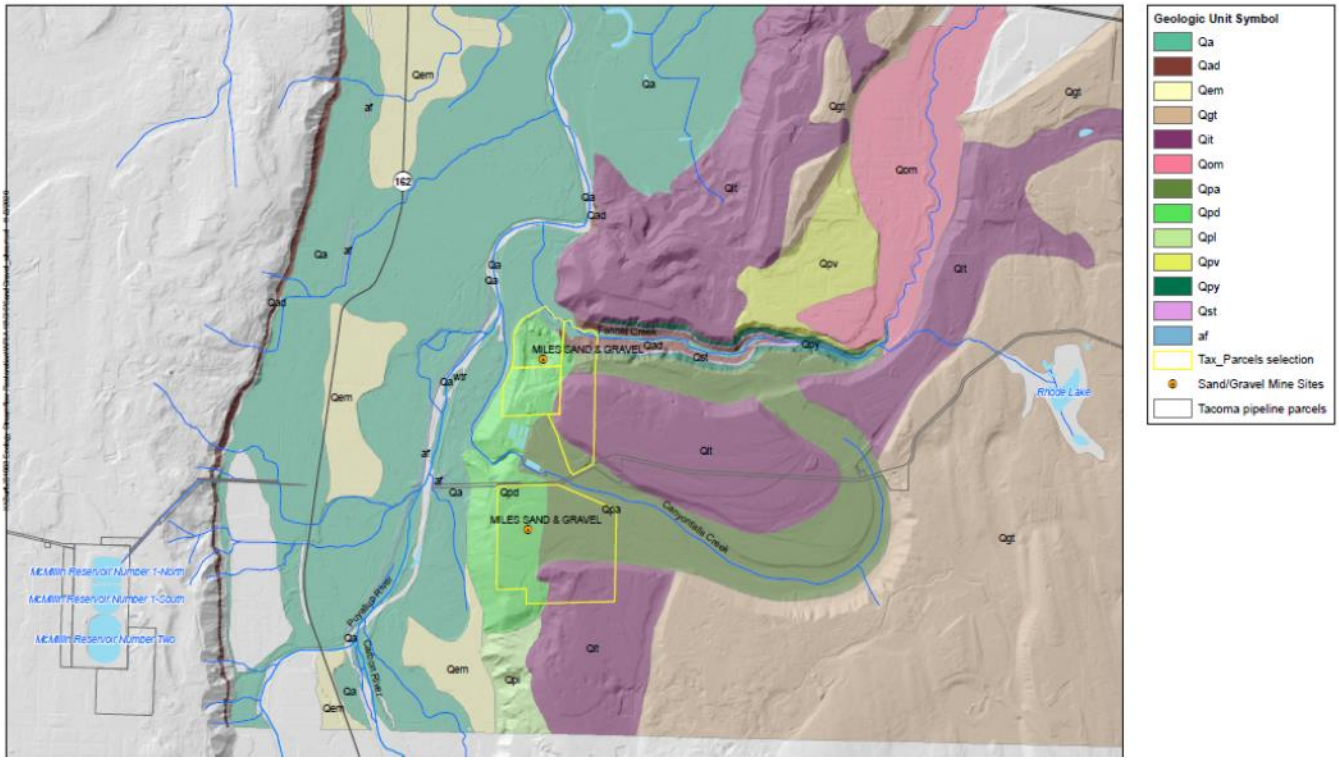
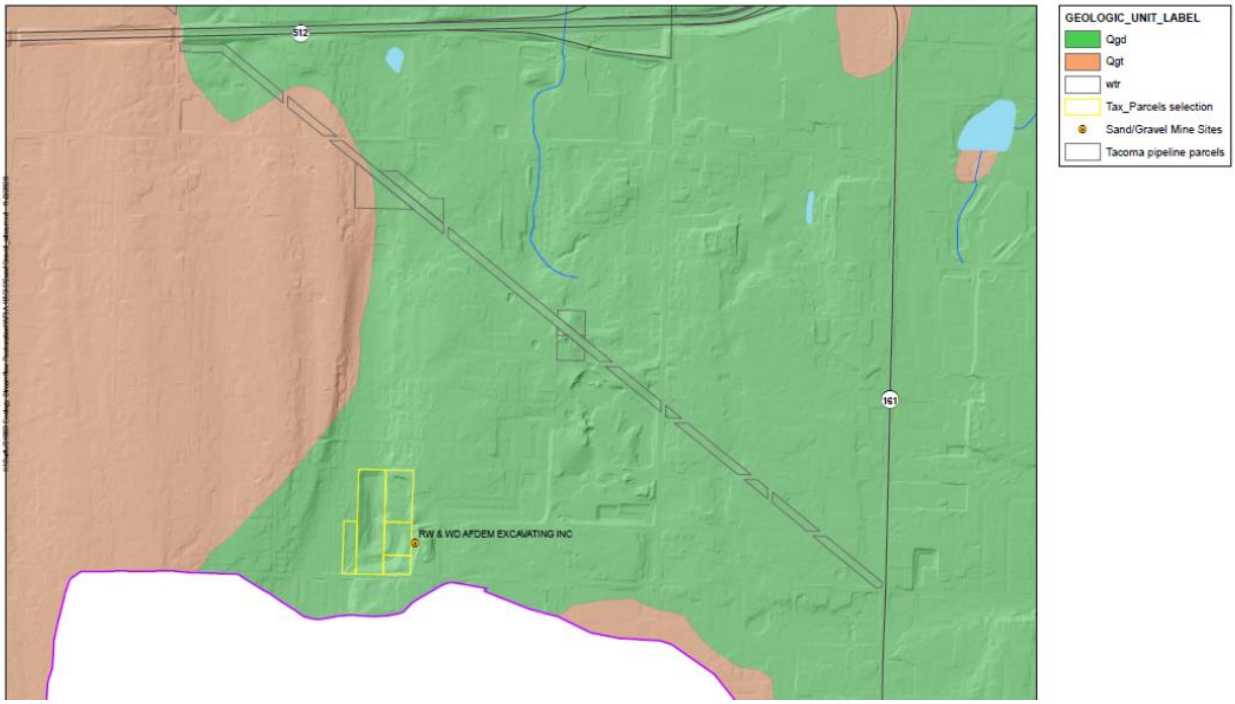


Figure 3. Geology Map for MAR Site in South Hill Area of Unincorporated Pierce County



Description of the anticipated spatial distribution of likely benefits

Two of the sites are active gravel pits located about ½ mile east of the Puyallup River near the City of Bonney Lake. Water infiltrated at those sites may improve stream flow conditions in the lower reach of Fennel Creek and Canyonfalls Creek or the Puyallup River. The length of the Puyallup River downstream of the sites is about 17 miles.

The third site is in unincorporated Pierce County in the South Hill area. Water infiltrated at that site may benefit Clarks Creek or possibly Swan Creek. Since the project is in the headwaters of those two creeks, a longer reach of the creeks may be benefitted. Clarks and Swan Creek merge together and flow into the Puyallup River approximately 5.8 miles from its mouth.

To assess the streamflow benefits of each project more detailed geologic mapping and hydrogeologic studies is needed. That work could be performed in a feasibility study of a site.

Locations relative to future PEW demand

Figure 1 also shows the heat map, with yellow to red colors indicating the geographic areas that are predicted to have the highest concentration of new permit-exempt wells. All the potential MAR sites are in locations with lower potential for growth in permit-exempt wells.

Performance goals and measures.

The volume of water purchased from the City of Tacoma will be measured and recorded using totalizing flow meters. The infiltration volume can be tracked through the amount of water purchased. A goal for infiltration can be established at the outset of the project and tracked at any time scale required. The amount and timing of water infiltrated can also be adjusted to time streamflow benefits to maximize benefits for fish.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

Projects that infiltrate water will increase groundwater recharge, provide more baseflow in summer and fall by increasing groundwater discharge, reduce summer and fall stream temperatures because of increased groundwater discharge and increase groundwater availability to riparian and near-shore plants.

The primary limiting factors in the Puyallup Watershed (Kerwin, 1999; Lead Entity, 2018) which would be addressed through this program include:

- Loss of riparian corridors, including marine riparian, and floodplain forests
- Loss of spawning and rearing habitat
- Loss of good water quality, including appropriate temperature

Two of the streams that may benefit from MAR are Fennel Creek and Swan Creek. Both were

identified by the committee as being high priority streams.

Identification of anticipated support and barriers to completion.

There is no sponsor currently. The barriers to implementing the project are finding a sponsor, landowner willingness and the availability of funding for the analysis, design and construction of a MAR project.

Potential budget and O&M costs.

The construction cost for a MAR project was preliminarily estimated using guidance from Ecology (Melcher, 2020). The cost per acre-foot for a MAR project is estimated to be $3442, resulting in a total estimated cost of $1.03 million. Much more analysis and design are needed to provide more certainty on the costs.

Anticipated durability and resiliency.

The projects could have lasting benefits, assuming a project sponsor is found. The City of Tacoma water supply would be a reliable source of water.

Project sponsor(s) (if identified) and readiness to proceed/implement.

No project sponsor has been identified and the projects will need additional analysis and design before being ready to proceed. The successful implementation of a MAR project is complex and involves several critical steps prior to actual construction (Covert, 2019):

- Identification of potential locations that:
- Have available aquifer capacity such that water infiltration can occur without creating overflows to the surface,
- Have soils and underlying geology with suitable hydraulic properties,
- Are located such that enough infiltrated water will discharge to surface water during low streamflow periods, and
- Are available for permanent use through acquisition or easements.
- Identification of a physically and legally available water source.
- Characterization and evaluation of site-specific hydrogeologic properties.
- Assessment of source water and aquifer compatibility, potential water quality changes during infiltration, and other water quality considerations.
- Development of preliminary MAR project designs and implementation cost estimates.
- Identification of project permitting requirements and potential hurdles.
- Assessment of ongoing operation and maintenance (O&M) costs, and identification of potential funding sources to support O&M.

Sources of Information

Covert, John. Presentation to Watershed Restoration and Enhancement Committee WRIA 15. Managed Aquifer Recharge Opportunities, January 14, 2019

Kerwin. 1999. Salmon Habitat Limiting Factors Report for the Puyallup River Basin (Water Resources Inventory Area 10). Washington State Conservation Commission. Olympia, WA.

Melcher, Austin. Memo regarding: Water Offset Project Potential Cost Estimate Methodology. Sent to Ingria Jones, John Covert. September 17, 2020

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June.

WRIA 10 RAIN GARDEN AND GREEN STORMWATER INFRASTRUCTURE PROGRAM PROJECT DESCRIPTION DECEMBER 28, 2020

Description

Rain gardens and Green Stormwater Infrastructure (GSI) retrofit projects could be applied to existing homes and driveways, roadways, parking lots and other impervious areas that generate stormwater. The techniques include rain gardens, planter boxes, bio-infiltration swales, permeable pavement and reducing the footprint of roadways and replacing with GSI (green streets).

Rain gardens are small stormwater facilities that collect, store, and filter rainwater and stormwater runoff from lawns, rooftops, sidewalks, driveways and other impervious surfaces. Designed as shallow, sunken planting beds with rain garden soil, runoff flows into them from nearby hard surfaces and connected downspouts. The rain gardens can also be designed to infiltrate water.

Planter boxes are urban rain gardens with vertical walls and either open or closed bottoms. They collect and absorb runoff from sidewalks, parking lots, and streets and are ideal for space-limited sites in dense urban areas and as a streetscaping element.

Bioswales are vegetated, mulched, or xeriscaped channels that provide treatment and retention as they move stormwater from one place to another. Vegetated swales slow, infiltrate, and filter stormwater flows. As linear features, they are particularly well suited to being placed along streets and parking lots. Bio-infiltration swales are specifically designed to infiltrate stormwater.

Permeable pavements infiltrate, treat, and/or store rainwater where it falls. They can be made of pervious concrete, porous asphalt, or permeable interlocking pavers. Permeable pavements can be installed in sections of a parking lot and rain gardens and bioswales can be included in medians and along the parking lot perimeter.

Green streets are created by integrating green infrastructure elements into their design to store, infiltrate, and evapotranspire stormwater. Permeable pavement, bioswales, planter boxes, and trees are among the elements that can be woven into street or alley design.

In WRIA 10, Pierce Conservation District and City of Puyallup have assisted residences in rain garden design and construction and the Conservation District has indicated they would be willing to help implement a program of additional rain garden and GSI construction. Links to information on these techniques:

- https://piercecd.org/244/Rain-Gardens

- https://www.cityofpuyallup.org/192/Puyallup-Rain-Gardens
- https://www.co.pierce.wa.us/2812/Rain-Gardens
- https://kitsapcd.org/programs/raingarden-lid/rgbasics
- https://fortress.wa.gov/ecy/publications/publications/1310027.pdf
- http://www.seattle.gov/utilities/your-services/sewer-and-drainage/green-stormwater-infrastructure
- https://www.epa.gov/green-infrastructure

The goal of this project would be to support the implementation of rain gardens and GSI across WRIA 10, with an emphasis on subbasins that will experience the most growth and/or contain priority streams, as defined by the WRIA 10 Committee.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.

The draft Watershed Restoration and Enhancement Committee identified rain gardens and GSI projects as having potential for implementation to help meet water offsets. The Committee set the goal for implementation at 10 projects per year.

The water offset from rain gardens and GSI projects was estimated using analyses performed for a Mason County rooftop runoff infiltration analysis. To estimate the potential water offset, the soil type, impervious area rain is collected from, the rain garden size and annual precipitation is required. For planning purposes, it is assumed Type B soils are present, a rooftop or driveway area of 2,000 square feet is directed to a rain garden, the rain garden has a 200 square feet infiltration area and the annual precipitation is between 40 and 50 inches. The estimated infiltration volume is 0.14 acre-feet per year for annual precipitation of 40 inches and 0.17 acre-feet per year for annual precipitation of 50 inches. Calculations are shown in the Appendix. The timing of the streamflow will depend on the location of the project and geologic conditions. With a number of rain garden and GSI projects implemented, it is expected their would be a range of timing of benefits and benefits would occur year-round.

The water offset benefit of adding 10 rain garden type projects per year is about 1.5 acre-feet per year, using an average of the 40- and 50-inch precipitation values. Over 18 years of plan implementation, the water offset benefit would add up to 27 acre-feet per year. If GSI projects were implemented that have greater impervious area, the water offset would be higher.

Description of the anticipated spatial distribution of likely benefits

The projects can occur in any subbasin and this program is described in the Watershed Restoration and Enhancement Plan as a WRIA-wide project. A committee goal is to focus the program on subbasins that will experience the most growth and/or contain priority streams. Figure 1 shows

WRIA 10 with the areas of highest growth in permit-exempt wells in yellow to red and priority stream in orange and yellow.

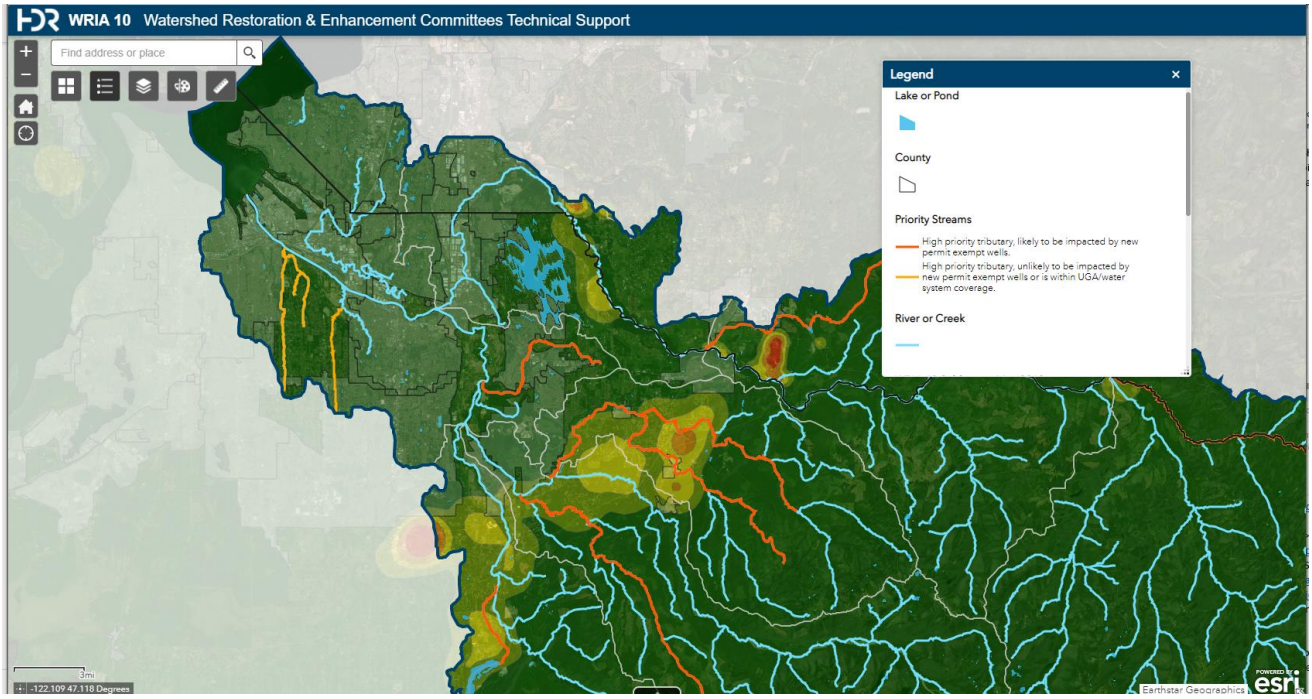


Figure 1. WRIA 10 permit exempt well potential growth and priority streams

Performance goals and measures.

This project would be measured by the number of functional raingardens or GSI projects installed within WRIA 10, which is planned to be 10 per year. The number may vary depending on factors such as finding suitable areas to retrofit, funding and capacity of project sponsors.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

Projects that infiltrate water will increase groundwater recharge, provide more baseflow in summer and fall by increasing groundwater discharge, reduce summer and fall stream temperatures because of increased groundwater discharge and increase groundwater availability to riparian and near-shore plants.

The primary limiting factors in the Puyallup Watershed (Kerwin, 1999; Lead Entity, 2018) which would be addressed through this program include:

- Loss of riparian corridors, including marine riparian, and floodplain forests
- Loss of spawning and rearing habitat
- Loss of good water quality, including appropriate temperature

Identification of anticipated support and barriers to completion.

Pierce Conservation District is primary sponsor and supports this program. The primary barrier is the availability of funding for the construction of rain gardens and GSI projects. Other barriers include private landowner willingness and potentially a limited number of projects in basins with higher estimated growth in permit-exempt wells and priority streams.

Potential budget and O&M costs.

The construction cost for a rain garden or GSI project is $15-$30 per square foot of infiltration trench constructed. Assuming a 200 square foot infiltration trench, the construction cost would be $3,000 - $4,500 each. Additional costs for program management would be incurred. For planning purposes, a cost of $5,000 each is likely conservative. For construction of 10 per year, the annual cost would be about $50,000.

Anticipated durability and resiliency.

The projects would have lasting benefits. Pierce Conservation District and other entities will manage the implementation of rain gardens and GSI projects.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Pierce Conservation District would be the main project sponsor and would be ready to proceed immediately if the program were supported. Pierce Conservation District has been successfully installing rain gardens and GSI projects. If funding is increased, the primary barrier would be private landowner willingness to install projects

Sources of Information

Kerwin. 1999. Salmon Habitat Limiting Factors Report for the Puyallup River Basin (Water Resources Inventory Area 10). Washington State Conservation Commission. Olympia, WA.

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June.

Appendix

Infiltration Volume Calculations

Estimated Water Offset for Typical Pierce Conservation District Raingarden Projects
December 28, 2020

Introduction

The purpose of this document is to estimate the water offset for future Pierce Conservation District (Pierce CD) rain garden projects. Calculations of the annual recharge are presented that are based upon hydrologic modeling performed by HDR for the Mason County Rooftop Infiltration Project (HDR, 2020). For these calculations it is assumed rain gardens will be installed on houses that are currently connected to a storm drainage system, so that the entire infiltration volume will be counted as a water offset. A lesser infiltration volume and water offset would be realized for houses that are not currently connected to a storm drainage system as roof downspouts may splash onto the ground and partially or totally infiltrate.

Calculations

Calculations are provided using a range of potential rain garden sizes. To allow an estimate of the potential water offset, an estimate of the average infiltration trench area and impervious area captured is required. Data from the Kitsap Conservation District (KCD) shows the average rain garden they have constructed since 2010 has an infiltration trench area of 200 square feet (sf) and captures 1,900 sf of impervious surface which are roofs, driveways and other impervious surfaces. They have constructed 320 rain garden projects since 2010. That is the best information we have on rain garden installations in the Puget Sound region.

To provide a range of potential Infiltration volumes are calculated using rain garden sizes of 100, 150, and 200 sf, as well as impervious surfaces of 1,600, 2,000 and 2,800 sf. The Mason County Rooftop Infiltration Project assumed 2,800 sf as the impervious surface that would be captured, based upon an average roof and driveway size. The infiltration rate used in the calculations corresponds to Group B soils as rain gardens use amended soils which are similar to Group B. The infiltration rate used for Group B soils is 2 inches/hour.

HDR's hydrologic modeling estimated the average annual recharge for an infiltration trench that is 80 sf to be 0.14 acre-feet/year. That was part of their calculation of baseline conditions assuming a minimum trench size of 80 sf under current regulations. The modeling was performed using an annual average of 70 inches precipitation, which occurs in Mason County. The average annual recharge equates to 26 inches per year over the 2,800-sf impervious surface.

A larger infiltration trench will infiltrate more water; there is a proportional relationship between infiltration area and infiltration capacity. There is also a proportional relationship to the amount of runoff to the impervious area, assuming all the runoff is captured. A limit to the amount of infiltration is the volume of annual precipitation minus potential losses due to evaporation. To estimate the amount of water that will be infiltrated in a Pierce CD rain garden the HDR results were proportionally scaled up by the amount of infiltration area (100 – 200 sf)

and scaled down by the amount of impervious area (1,600 – 2,800 sf). Those calculations are summarized in Table 1.

Table 1. Percentage Change in Infiltration Capacity and Corresponding Infiltration Volume

Impervious Surface Captured, sf	Infiltration Trench Size, sf/Infiltration Volume, acre-feet							
	80 (Mason County Study)		100		150		200	
	%	Volume	%	Volume	%	Volume	%	Volume
1,600	64%	0.090	80%	0.113	121%	0.169	161%	0.225
2,000	71%	0.100	89%	0.125	134%	0.188	179%	0.250
2,800	100%	0.140	125%	0.175	188%	0.263	250%	0.350

The equivalent values in terms of rainfall infiltrated is provided in Table 2.

Table 2. Volume of Rainfall Potentially Infiltrated

Infiltration Trench Size, sf			
80 (Mason County Study)	100	150	200
26 inches	32.7 inches	49.0 inches	65.3 inches

The calculations indicate that the rain gardens KCD is installing have, on average, the capacity to infiltrate 65.3 inches of precipitation, or 0.25 acre-ft per installation per year, based upon an infiltration trench size of 200 sf. The amount infiltrated is less than the capacity when precipitation is less than 65 inches.

The same calculation applies to Pierce County and demonstrates that the infiltration capacity of a 200 sf infiltration trench is not limited by the amount of precipitation that occurs in most areas of Pierce County, which is 40-50 inches per year. Table 3 provides infiltration volumes for varying precipitation volumes and an average impervious area of 2,000 sf. To be conservative, 10% loss due to evaporation or other losses are assumed.

Table 3. Estimate of Annual Volume Infiltrated for Pierce CD Rain Garden Projects

Average Annual Precipitation, inches	Annual Volume Infiltrated, Inches	Annual Volume Infiltrated, acre-feet
40	36	0.138
50	45	0.172
60	54	0.207

These volumes can be used as estimates of the water offset quantity for Pierce CD rain garden projects. The actual values will need to be tracked during implementation, but the quantities shown in Table 3 provide a planning-level estimate of water offsets from rain garden projects that capture 2,000 sf of impervious area and are constructed using a 200 sf infiltration trench is Group B soils. It is recommended that the average of the volume infiltrated between 40- and 50-inches annual precipitation be used for estimating water offsets in WRIA 10. That equals 0.15 acre-feet per rain garden.

References

HDR, 2020. Spreadsheet: WRIA14-Projects-Supplemental Data-RooftopRunoff_MGSFlood Results.xlsx. Accessed through Box at https://app.box.com/s/c2858d6mjdtoo41i4ahxqj55hz66mbzf

SWAN CREEK CHANNEL AND BANK STABILIZATION

Narrative description, including goals and objectives.

Pierce County Surface Water Management and the Puyallup Tribe propose to implement in-channel stabilization and restoration measures along Swan Creek, within the Lower Puyallup River sub-basin (WRIA 10). In the lower reaches of Swan Creek, the channel is incised and eroding the streambanks due to increased stormwater runoff, undersized culverts, and insufficient stormwater detention and loss of flood storage. This project proposes to use a combination of woody material, streambed gravel, and plantings to stabilize streambeds and banks and provide sediment recruitment capacity within the channel. The intention is to slow erosion and allow the channel to return to a more natural state. The proposed project reach begins immediately downstream of the 64th Street East culvert crossing and extends to Pioneer Way.

The goals of the project are as follows:

- Stabilize streambed and banks
- Provide sediment recruitment capacity

The objectives of the project are:

- Install woody material and riparian plantings
- Install streambed gravel

No estimate of the potential water offset was provided at this time as monitoring is proposed that would determine the offset.

Qualitative assessment of how the project will function.

The project will function by reducing stream power and streambed and streambank erosion.

Conceptual-level map of the project and location.

The proposed project is located along Swan Creek just downstream of the 64th St East culvert crossing at Pioneer Way. Figured 1 (Attached) shows the project location within the Swan Creek Watershed and Figure 2 shows an overview of the 90% design drawings. (The full set of design drawings are available on Box.)

Performance goals and measures.

Performance measures would be determined once a final design is selected.

Description of the anticipated spatial distribution of likely benefits.

Benefits to stream processes will occur in the project area downstream of the 64th street east culvert. The channel and habitat features improved as a result of this project will benefit a variety of salmonid species as described in the next paragraph. In the areas of Swan Creek downstream of this project, such as the floodplain, reduced sediment input from erosion will also improve habitat conditions and benefit salmonids.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

Salmonids in Swan Creek will benefit from decreased stream power downstream of the culvert, reduced rates of erosion, increased riparian habitats, and cool temperatures associated with groundwater recharge. The most abundant salmonids in Swan Creek are chum and coastal cutthroat trout but the stream also supports Coho and Chinook in limited quantities; and steelhead are very rarely observed (Pierce County, 2015). Lamprey and sculpin are also present in the creek. The salmonids and other aquatic species in Swan Creek are subject to the current limiting factors present.

According to the Limiting Factors Report for the Puyallup Watershed by Kerwin (1999), limiting factors that may be addressed by the project include the following:

- Loss of instream habitat complexity and connectivity
- Loss of large wood
- Increase in river channelization
- Increase in sediment load
- Loss of channel (substrate) stability
- Loss of spawning and rearing habitat
- Loss of good water quality, including appropriate temperature

Streambank stabilization, woody material addition, and replacement of streambed gravel would address these limiting factors and slow down Swan Creek, decreasing sediment load to the downstream portion of the creek and improving channel stability. Increased riparian vegetation and instream wood would improve rearing habitat for fishes by providing protection from flood events and acting as riparian cover and rearing habitat. Invertebrates colonizing the edge habitat are also a prey source for juvenile salmonids. Creating a slower velocity system would make a greater range of sediment and substrate types available as spawning habitat and as habitat for non-salmonids. While the ESA-listed Chinook and steelhead species are not as commonly observed in Swan Creek as Chum, cutthroat trout, and coho, the exceptionally cold water in Swan Creek (Pierce County, 2015) may become increasingly important for these species when temperatures in other tributaries are warmer. The functions and benefits of the habitat and hydrologic features that would be created by the project address many of the limiting factors currently present in Swan Creek. Addressing these limiting factors will help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project.

Identification of anticipated support and barriers to completion.

This project builds upon previous restoration actions in and around Swan Creek and is sponsored by the Puyallup Tribe and Pierce County and supported by the Lead Entity, Puyallup and Chambers Watersheds Salmon Recovery Lead Entity, and Metro Parks Tacoma. Swan Creek Park is one of Metro Parks Tacoma's capital improvement projects. The 2019 Master Plan for the park includes

habitat restoration work, stormwater management, and public interest in salmon ecology and restoration. Community meetings emphasize the public interest in restoration work in Swan Creek, with one park user stating, “salmon are a user group!” (Metro Parks Tacoma, 2020). This proposed project furthers restoration actions undertaken and planned by Metro Parks Tacoma in the same area.

The WRIA 10/12 Lead Entity Strategy identifies priority tributaries and actions within the Lower Puyallup and Nearshore Estuary watersheds. Clear Creek (of which Swan Creek is a tributary) is identified as a high priority system. Three of the high priority actions within this area are directly addressed by this project: “Restore normal flow regimes,” “restore riparian function,” and “restore and protect rearing, foraging, osmoregulatory habitats for juvenile salmonids, particularly Chinook salmon” (Lead Entity 2018). There are no anticipated barriers to completing this project due to its alignment with regional and basin-wide goals.

Potential budget and O&M costs (order of magnitude costs).

The funding requested to complete restoration treatments is approximately $3.7 million. No O&M costs have been identified.

Anticipated durability and resiliency

Streambank stabilization and instream wood placement projects are durable because they help restore natural processes to a reach of the stream. Given the changing climate conditions, that anticipates increases in precipitation, rain-on-snow events, and channel aggradation, stabilization and restoration projects that provide increased cover and habitat and more ways to hold water for longer are important solutions to implement to restore watershed processes and to provide resiliency from a changing climate.

Project sponsor(s) (if identified) and readiness to proceed/implement.

Pierce County and the Puyallup Tribe are the project sponsors and are ready to implement the project as soon as funding is made available. The project could be implemented within 5 years, which accounts for design and construction.

Attachments

Figure 1. Swan Creek Bank Stabilization at 64th St Outfall Repair project location (annotated from Swan Creek Watershed Characterization and Action Plan)

Figure 2. Sheet 5 of 90% Design Drawings for Swan Creek Channel Restoration (Prepared by Natural Systems Design)

Documentation of sources, methods, and assumptions.

The following references were used:

Metro Parks Tacoma. 2020. Swan Creek Improvements. Accessed June 30, 2020. https://www.metroparkstacoma.org/project/swan-creek-improvements/

Pierce County. 2015. Swan Creek Watershed Characterization and Action Plan. Prepared by: Pierce County Surface Water Management. September 2015. Available from: https://www.piercecountywa.gov/ArchiveCenter/ViewFile/Item/4798

National Marine Fisheries Service (NMFS). 2007. Puget Sound Salmon Recovery Plan. Plan adopted by NMFS on January 19, 2007. Submitted by the Shared Strategy Development Committee. Available from: https://repository.library.noaa.gov/view/noaa/16005

Natural Systems Design. 2018. Basis of Design Report Swan Creek. Prepared for Puyallup Tribe of Indians.

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June. https://www.piercecountywa.org/ArchiveCenter/ViewFile/Item/6075

Kerwin, J. 1999. Salmonid Habitat Limiting Factors Report for the Puyallup River Basin. Washington Conservation Commission.

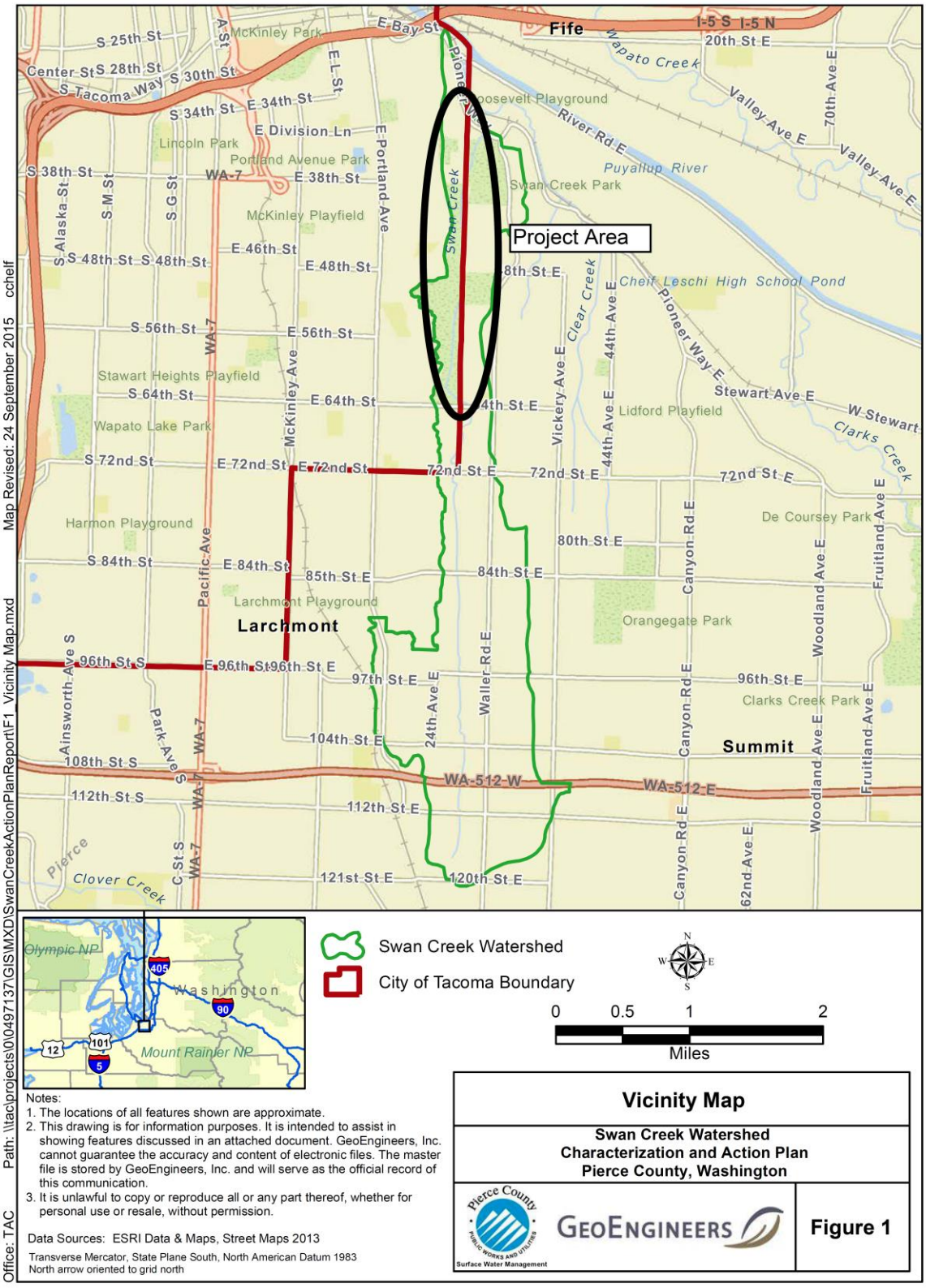


Figure 1. Swan Creek Project Vicinity Map. Source: Pierce County 2015.

JOVITA CREEK HABITAT PROJECT

Narrative description, including goals and objectives.

The City of Edgewood proposes to prepare a feasibility study to identify potential restoration actions in Jovita Creek, within the Lower White River sub-basin (WRIA 10). Recommended actions contained in the study would be implemented. This project area is Jovita Creek upstream of the culvert at Highway 167, up to 114th Ave E. Assessment efforts would focus on evaluating geomorphic impacts from Jovita Boulevard (which is adjacent to the stream), channel bed and bank restoration in the mainstem of Jovita Creek, and replacement of a fish passage barrier (culvert at 114th street) on a tributary to Jovita Creek. The feasibility study would result in identification of priority multi-benefit restoration project(s) that restore habitat and habitat forming processes while improving the flow of pedestrians and vehicles through the area by potentially changing the alignment of Jovita Blvd and completing a connection to the Interurban Trail that currently terminates at 114th Ave E.

The goal of the project is as follows:

- Evaluate stream processes in Jovita Creek and identify potential restoration actions.
- Implement restoration actions.
- Complete the Interurban Trail from 114th Ave E to West Valley Highway

The objectives of the project are:

- Complete a reach-scale feasibility study including an evaluation of the constriction caused by Jovita Boulevard and the fish passage barrier at 114th street.
- Identify and implement multi-benefit actions that would restore habitat and habitat-forming processes.

Qualitative assessment of how the project will function.

The feasibility study has no identified functions. The functions of restoration actions would depend on the type of restoration project implemented. One primary issue in Jovita Creek is channel confinement due to Jovita Boulevard, causing channel erosion from high velocities. Restoration actions that address this channel confinement would function by providing space for the creek to meander, wood to stabilize the creek bed and connection to the limited amount of off-channel habitat in the floodplain. There are no anticipated offset benefits related to the project because there are no identified permit exempt wells in the project area.

Conceptual-level map of the project and location.

The proposed project is located along Jovita Creek and its tributaries upstream of Highway 167, along approximately 1.0 stream miles of habitat. Figure 1 shows the approximate project location.

Figure 1. Jovita Creek Feasibility Study

Performance goals and measures.

The performance goals are to complete a reach-scale feasibility study of Jovita Creek and identify potential multi-benefit restoration projects. Performance measures for restoration projects would be determined once projects are identified.

Description of the anticipated spatial distribution of likely benefits.

Depending on the results of the feasibility study, benefits to stream processes may occur in the project area upstream of the culvert at highway 167. Salmonids in Jovita Creek and its tributaries have the potential to benefit from restoration actions.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

Jovita Creek supports a variety of salmonid species including chum and coho salmon, steelhead, sea run cutthroat and resident trout as identified by WSDOT (2017). SalmonScape additionally identifies fall Chinook and pink salmon as potentially present in Jovita Creek (WDFW, 2020). The salmonids and other aquatic species in the Jovita Creek are subject to degraded ecosystems due to limiting factors present at the site.

According to the Limiting Factors Report for the Puyallup Watershed by Kerwin (1999), Jovita Creek has the following limiting factors:

- Loss of floodplain connectivity
- Loss of bank stability
- Loss of instream habitat complexity and connectivity due to loss of large wood
- Loss of side-channel habitat
- Loss of riparian habitat
- Loss of pool habitat

- Loss of sediment fines
- Loss of good water quality and quantity

Restoration projects would address these limiting factors by promoting the creation of a variety of habitat types and hydrologic features. Reducing or removing constraints, streambank stabilization, woody material addition, and replacement of streambed gravel would address these limiting factors. and slow down Jovita Creek, decreasing sediment load to the downstream portion of the creek and improving channel stability. Increased riparian vegetation and instream wood would improve rearing habitat for fishes by providing protection from flood events and acting as riparian cover and rearing habitat. Invertebrates colonizing the edge habitat are also a prey source for juvenile salmonids. Creating a slower velocity system would make a greater range of sediment and substrate types available as spawning habitat and as habitat for non-salmonids.

Replacing the culvert at 114th Street E. would additionally provide more access to habitat upstream of the culvert. The functions and benefits of the habitat and hydrologic features that would be created by the project address many of the limiting factors currently present in Jovita Creek.

Along with the habitat restoration actions already undertaken in the Lower White River sub-basin, addressing these limiting factors will help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project.

Identification of anticipated support and barriers to completion.

This project builds upon previous restoration actions in the Lower White River sub-basin. The project is sponsored by the City of Edgewood and supported by the Lead Entity, Puyallup and Chambers Watersheds Salmon Recovery Lead Entity.

The WRIA 10/12 Lead Entity Strategy identifies priority tributaries and actions within the Lower Puyallup Watershed (which includes the lower White River sub-basin). Jovita Creek is a tributary to the Milwaukee Canal, which drains to the Lower White River. The White River is identified as a high priority tributary in the Lead Entity Strategy. One of the high priority actions within this area are directly addressed by this project: “restore natural geomorphic processes and riparian functions where they are compromised, degraded, or severed” (Lead Entity 2018). This habitat restoration project would build upon previous work completed by Washington State Department of Transportation—the culvert where Jovita Creek passes under Highway 167 was replaced in 2016 to allow for improved fish passage into the upper portions of Jovita Creek (WSDOT, 2017). The previous culvert presented hydraulic barriers to fish passage, and the new culvert allows unimpeded access to 2.53 miles of habitat in Jovita Creek including the proposed project area. There are no anticipated barriers to completing this project due to its alignment with regional and basin-wide goals.

Potential budget and O&M costs (order of magnitude costs).

No cost estimates for the feasibility study and projects that would be implemented are available. No O&M costs have been identified. A formal project description has not yet been written.

Anticipated durability and resiliency.

Habitat restoration projects are durable as they restore natural processes to a stream. Given changing climate conditions that are forecast to increase peak precipitation rates and erosion,

channel bed restoration projects will retain sediment and reduce aggradation near the mouth of the creek where slopes are flatter.

Project sponsor(s) (if identified) and readiness to proceed/implement.

The City of Edgewood is the project sponsor and is ready to implement the study as soon as funding is made available. The assessment would also include outreach to determine landowner willingness and potential for easements in the area of the potential projects. The study could be completed within 2 years of obtaining funding; the projects recommended for implementation will take longer, likely 10 years depending on availability of funding.

Documentation of sources, methods, and assumptions.

The following references were used:

Ecology, 2003. Mt. Baker-Snoqualmie National Forest, Upper White Watershed Sediment and Temperature TMDL for Aquatic Habitat. Submittal Report, Publication No. 03-10-032. Available from: https://fortress.wa.gov/ecy/publications/documents/0310032.pdf

National Marine Fisheries Service (NMFS). 2007. Puget Sound Salmon Recovery Plan. Plan adopted by NMFS on January 19, 2007. Submitted by the Shared Strategy Development Committee. Available from: https://repository.library.noaa.gov/view/noaa/16005

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June. https://www.piercecountywa.org/ArchiveCenter/ViewFile/Item/6075

WDFW, 2020. SalmonScape. Washington Geospatial Open Portal. Available from: http://geo.wa.gov/datasets/1e56a648718543ab952e75ff9971f086?fullScreen=true

WSDOT, 2017. Fish Passage Performance Report, 2016. June 30, 2017. Available from: https://www.wsdot.wa.gov/publications/fulltext/projects/FishPassage/2017FishPassageAnnualReport.pdf

Kerwin, J. 1999. Salmonid Habitat Limiting Factors Report for the Puyallup River Basin. Washington Conservation Commission.

City of Edgewood, 2020. Parks and Recreation: Interurban Trail. Available from: http://www.cityofedgewood.org/government/parks_and_recreation/interurban_trail_and_jovita_crossroads_trailhead_park.php

ENUMCLAW GOLF COURSE PROJECT

Narrative description, including goals and objectives.

The City of Enumclaw and the Puyallup Tribe propose to implement reach-scale stream restoration actions in Boise Creek, within the Middle White River sub-basin (WRIA 10). This project would move Boise Creek back to its historic channel adjacent to the Enumclaw Golf Course. Additionally, large woody material would be added to increase habitat complexity and channel roughness, diversifying habitats available to fish. The project is proposed to occur from river miles 3.7 to 4.2. A 30% design was completed for this project in 2010, and the proposed project would include finalizing the design and moving forward with construction.

The goals of the project are as follows:

- Improve habitat conditions in Boise Creek
- Address flooding on the golf course and nearby properties.

The objectives of the project are:

- Realign the creek with its historic channel.
- Restore habitat and increase channel roughness, diversifying instream fish habitat

Qualitative assessment of how the project will function.

The project will function by restoring the natural channel and improving habitat conditions, which will allow natural processes to develop in Boise Creek. A related project with water offset benefits would be the placement of water rights for a portion of the golf course in trust. Washington Water Trust estimated the offset benefits as 47 acre-feet and 0.2 cfs (90 gallons per minute).

Conceptual-level map of the project and location.

The proposed project is located along Boise Creek between river miles 3.7 and 4.2 and borders the Enumclaw Golf Course. The 30% designs (Attachment A) shows the project location and restoration plan. Figure 1 shows the vicinity of the project.

Figure 1. Enumclaw Golf Course Project Vicinity (circled in red, annotated from Watershed Restoration and Enhancement Committees Technical Support Web Map)

Performance goals and measures.

The performance goals are to complete final design of the project and implement reach-scale habitat restoration and channel realignment. Performance measures would be determined once a final design is selected.

Description of the anticipated spatial distribution of likely benefits.

Benefits to river processes will occur in the project area between river miles 3.7 to 4.2; habitat features formed as a result of this project will benefit a variety of salmonid species as described in the next paragraph.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

Boise Creek supports a variety of salmonid species and is one of the most productive salmon stream systems in the Puyallup/White River basin. No other stream in the basin, except for South Prairie Creek on the Puyallup River, is as productive in terms of both spawning density (number of spawners per mile) and total escapement size (Marks et al. 2013). Boise Creek continues to support steelhead as well as spring and fall Chinook (all ESA-listed), coho, pink, chum, sockeye and cutthroat trout. Bull trout have also been observed in the mouth of Boise Creek up to river mile (RM) 0.1 (RCO, 2020). The salmonids and other aquatic species in Boise Creek are subject to degraded ecosystems due to limiting factors present at the site.

According to the Limiting Factors Report for the Puyallup Watershed by Kerwin (1999), Boise Creek has the following limiting factors:

- Loss of floodplain connectivity

- Loss of bank stability
- Loss of instream habitat complexity and connectivity due to loss of large wood
- Loss of side-channel habitat
- Loss of riparian habitat
- Loss of pool habitat
- Loss of substrate fines
- Loss of good water quality and quantity

This project will benefit all life stages of salmonids present. Adults will have greater cover, depth and cooler fall water temperatures. Eggs and alevins will benefit through improved survival rates associated with improved channel stability and greater channel length, which reduces average velocity and therefore lessens scour losses and retains more variety in substrate size. Juveniles will benefit from the additional habitat length, cover, channel complexity and reduced summer rearing temperatures that will provide a new norm and greater overall habitat suitability. Coho and steelhead which reside for over 1 year in freshwater will be the two species most likely to benefit from these improvements. The functions and benefits of the habitat and hydrologic features that would be created by the project address many of the limiting factors currently present in Boise Creek.

Along with the habitat restoration actions already undertaken in the Middle White River sub-basin, addressing these limiting factors will help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project.

Identification of anticipated support and barriers to completion.

The project is supported by King County and the Puyallup and Chambers Watersheds Salmon Recovery Lead Entity.

The WRIA 10/12 Lead Entity Strategy identifies priority tributaries and actions within the Middle Puyallup Watershed (which includes the middle White River sub-basin). Boise Creek is identified as a high priority tributary in the Lead Entity Strategy. Two of the high priority actions within this area are directly addressed by this project: “restore natural geomorphic processes and riparian functions where they are compromised, degraded, or severed,” and “increase large wood inputs” (Lead Entity 2018). This habitat restoration project would build upon previous design work completed in 2010 (RCO, 2020; Attachment A).

There are no anticipated barriers to completing this project due to its alignment with regional and basin-wide goals.

Potential budget and O&M costs (order of magnitude costs).

The funding requested to complete final design and implement restoration treatments is approximately $2.3 million. The project can likely be implemented within the next five years provided funding is available.

No O&M costs have been identified as the project should not pose any maintenance obligations.

Anticipated durability and resiliency.

This project is anticipated to be durable because it would restore the stream to its historic channel. Habitat improvements would increase floodplain connection. Given the changing climate conditions, that anticipates increases in peak precipitation, rain-on-snow events, and channel aggradation, floodplain reconnection projects that provide the river with more ways to hold water for longer are important solutions to implement to restore watershed processes and to provide resiliency from a changing climate.

Project sponsor(s) (if identified) and readiness to proceed/implement.

The Puyallup Tribe is the project sponsor and is ready to implement the project as soon as funding is secured, and property owner permissions are obtained. The construction season would need to be coordinated with the Enumclaw Golf Course, which is owned by the City of Enumclaw.

Attachments

Attachment A: 30% Design of Boise Creek Golf Course Restoration Plan is in the Box folder with this project description.

Documentation of sources, methods, and assumptions.

The following references were used:

Washington Water Trust. 2020. WRIA 10 Water Rights Final Report Update. Presentation to WRIA 10 Workgroup on July 1, 2020.

Washington Water Trust, McCormick Water Strategies, and BlueWater GIS. 2020. WRIA 10 Puyallup-White Priority Water Rights Projects Report. Prepared for: WRIA 10 Workgroup. June 29, 2020.

National Marine Fisheries Service (NMFS). 2007. Puget Sound Salmon Recovery Plan. Plan adopted by NMFS on January 19, 2007. Submitted by the Shared Strategy Development Committee. Available from: https://repository.library.noaa.gov/view/noaa/16005

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June. https://www.piercecountywa.org/ArchiveCenter/ViewFile/Item/6075

Kerwin, J. 1999. Salmonid Habitat Limiting Factors Report for the Puyallup River Basin. Washington Conservation Commission.

Marks, E. L., R.C. Ladley, B.E. Smith, A.G. Berger, J.A. Paul, T.G. Sebastian and K. Williamson. 2013. 2012-2013 Annual Salmon, Steelhead, and Bull Trout Report: Puyallup/White River Watershed--Water Resource Inventory Area 10. Puyallup Tribal Fisheries, Puyallup, WA

RCO, 2020. Project Search. Middle Boise Creek Restoration. Available from: https://secure.rco.wa.gov/prism/search/ProjectSnapshot.aspx?ProjectNumber=16-1552

GREENWATER PHASE 4 IMPLEMENTATION

Narrative description, including goals and objectives.

South Puget Sound Salmon Enhancement Group proposes to implement reach-scale restoration actions in the Greenwater River, within the Upper White River sub-basin (WRIA 10), between river mile 2 and 4 to restore instream complexity and floodplain connectivity. This proposed phase 4 project builds upon work completed in 2010, 2011, and 2014 (phases 1-3) on upper sections of the Greenwater River between river mile 6 and 8. During these projects, 17 log jams were installed and 1 mile of road was removed from the floodplain. As part of the proposed phase 4 project, more road and fill would be removed and additional structures would be installed in the 2-mile project reach, increasing the functional habitat on the Greenwater River. These structures will provide relatively stable, instream structure currently lacking in the Greenwater system due to a legacy of aggressive timber harvest practices between the late 1950s to early 1970s.

The goal of the project is as follows:

- Rehabilitate lost processes that are provided by large instream wood accumulations, which benefits adult spawning and juvenile rearing salmon populations on the Greenwater River.

The objectives of the project are:

- Remove relic logging roads, fill, and armor restricting floodplain processes.
- Install mid-channel and floodplain structures.

Qualitative assessment of how the project will function.

The project will function by creating large stable structures that will trap mobile debris and sediment, increase floodplain connectivity and off channel habitat, increase number of pools with overhead cover, decrease median substrate size, and overall improve spawning and rearing conditions for salmonids in the Greenwater River. The proposed structures will accelerate and maintain system-wide natural processes while providing habitat for fish. Removing roads, fill, and armor will additionally allow natural processes to develop in a large floodplain. There are no anticipated offset benefits related to the project because there are no identified permit exempt wells in the project area. Additionally, the potential for the project to increase groundwater recharge has not been estimated.

Conceptual-level map of the project and location.

The proposed project is located along the Greenwater River between river miles 2 and 4. Figure 1 shows the approximate project location and the previous phases of the project.

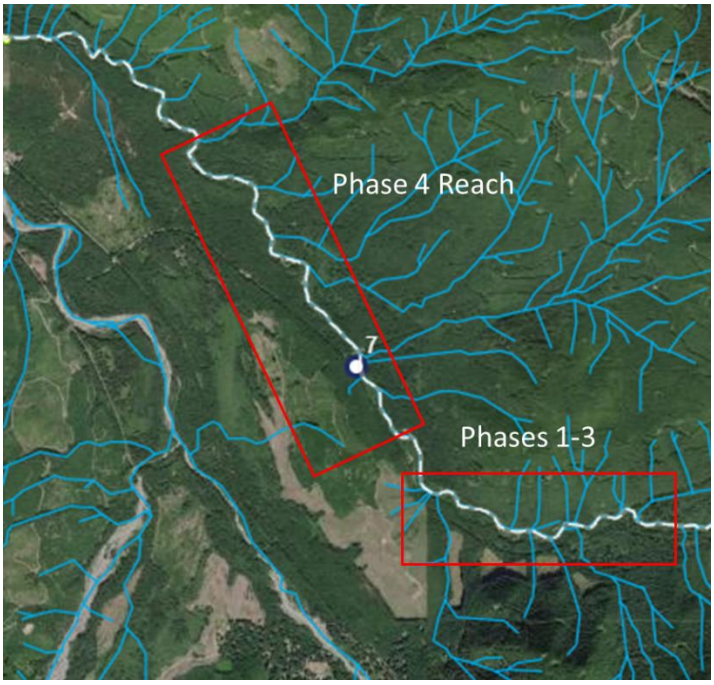


Figure 1. Greenwater Phase 4 Implementation Project (annotated from Watershed Restoration and Enhancement Committees Technical Support Web Map)

Performance goals and measures.

The performance goals are to complete a reach-scale assessment of river miles 2 to 4 of the Greenwater River and implement restoration treatments including road and fill removal and log jam installation . Performance measures would be determined once a final design is selected.

Description of the anticipated spatial distribution of likely benefits.

Benefits to river processes will occur in the project area between river mile 2 and 4; side channel and other habitat features formed as a result of this project will benefit a variety of salmonid species as described in the next paragraph. Salmonids in the Greenwater River and in the White River will benefit from increased habitat and reduced peak flow and sediment input.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

The Greenwater River supports a variety of salmonid species including Endangered Species Act-listed Chinook, Steelhead, and Bull Trout. Other anadromous salmonid species on the Greenwater River that would benefit from this project include Coho, Pink salmon, and coastal cutthroat trout. The White River supports an early returning population of White River spring Chinook which spawn in the upper and lower White River and is the most distinctive Chinook stock in central and south Puget Sound (NMFS, 2007). The USFWS has also identified five local bull trout populations within the Puyallup basin, one of which occurs in the Greenwater River. The salmonids and other aquatic species in the Greenwater River are subject to the current limiting factors present.

According to the Limiting Factors Report for the Puyallup Watershed by Kerwin (1999), limiting factors that may be addressed by the project include the following:

- Loss of floodplain habitat, wetlands, and connectivity to hyporheic zone
- Loss of off-channel and side-channel habitat
- Loss of instream habitat complexity and connectivity
- Loss of large wood
- Increase in river channelization
- Increase in sediment load
- Loss of channel (substrate) stability
- Loss of spawning and rearing habitat
- Loss of good water quality, including appropriate temperature

Removal of the existing road, fill, and armor, and installation of logjams would address these limiting factors by promoting the creation of a variety of habitat types and hydrologic features. Side channels, backwater channels, and off-channel habitat would develop because the jams would be placed strategically to promote lateral migration of the river. These habitats provide protection from flood events and act as riparian cover and rearing habitat, which supports juvenile salmonids and provides areas for fry to colonize. Coho salmon may also spawn in low velocity side channels. Deep complex pools would also be created. These provide cover and prey availability during migratory periods for adult salmonids and cover for juveniles when log jams are present. Deep pools are also generally colder than other in-water environments, providing appropriate temperatures and acting as a refuge. Shallow edge habitat would also be created when areas of fill and road are removed. These provide shade and function as cover and rearing habitat for fry and juvenile salmonids. Invertebrates colonizing the edge habitat are also a prey source for juveniles. Removal of the road and fill will also increase the sinuosity of the river, creating a slower velocity system where a greater range of sediment and substrate types are available due to the complexity of habitats present. Spawning salmonids (Chinook, steelhead, and Coho) would benefit from a range of substrate sizes. The functions and benefits of the habitat and hydrologic features that would be created by the project address many of the limiting factors currently present in the Greenwater River.

Along with the habitat restoration actions already undertaken in the Greenwater River and Upper White River sub-basin, addressing these limiting factors will help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project. And, for ESA-listed ESUs, restoring these areas would contribute to the VSP parameters of abundance, productivity, spatial structure, and diversity.

Identification of anticipated support and barriers to completion.

This project builds upon previous restoration actions in the Greenwater River and Upper White River sub-basin. The project is sponsored by South Puget Sound Salmon Enhancement Group and supported by the Lead Entity, Puyallup and Chambers Watersheds Salmon Recovery Lead Entity.

The WRIA 10/12 Lead Entity Strategy identifies priority tributaries and actions within the Upper Puyallup Watershed (which includes the upper White River sub-basin). The Greenwater River is

identified as a high priority tributary. Three of the high priority actions within this area are addressed by this project: “restore natural geomorphic processes and riparian functions where they are compromised, degraded, or severed,” “address failing roads to reduce sediment load,” and “increase large wood inputs (Lead Entity 2018). The WRIA 10/12 Lead Entity Strategy additionally states that this type of action will provide the greatest restoration benefit to Puyallup/White River Chinook abundance. In addition, The Puget Sound Salmon Recovery Plan specifically calls out the Greenwater River as a key area to increase protection and restoration. As a priority action for White River spring Chinook it identifies, “large woody debris [and] riparian restoration projects in the Upper White… including the Greenwater River and Huckleberry Creek restoration projects” (NMFS 2007). Pierce County (2012, 2018) also identifies the reach of the project as a priority area within their Flood Hazard Management Plan and completed a channel migration zone study within the reach of the project in 2017.

There are few anticipated barriers to completing this project given that three phases of the project have already been implemented.

Potential budget and O&M costs (order of magnitude costs).

The funding requested to complete reach-scale assessment efforts, inventory existing wood loading rates, assess habitat quantity and quality, map geomorphic features, assess hydraulic conditions, and implement restoration treatments based on these analyses is approximately $1,500,000.

No O&M costs have been identified as the project should not pose any maintenance obligations. The project reach is on Muckleshoot Indian Tribe property and the entire Greenwater Valley through the project reach is protected under a riparian reserve designation.

Anticipated durability and resiliency.

Floodplain reconnection projects are durable as they restore natural processes to a reach of the river, allowing flooding and channel migration to occur unimpeded. Instream wood placement projects are also durable; they support natural processes and encourage accumulation of smaller debris. Given the changing climate conditions, that anticipates receding glaciers, and increases in precipitation, rain-on-snow events, and channel aggradation, floodplain reconnection and instream placement projects that provide the river with more room to meander and more ways to hold water for longer are important solutions to implement to restore watershed processes and to provide resiliency from a changing climate.

Project sponsor(s) (if identified) and readiness to proceed/implement.

South Puget Sound Salmon Enhancement Group is the project sponsor and is ready to implement the project as soon as funding is made available. The project can likely be implemented within the next five years provided funding is available.

Documentation of sources, methods, and assumptions.

The following references were used:

National Marine Fisheries Service (NMFS). 2007. Puget Sound Salmon Recovery Plan. Plan adopted by NMFS on January 19, 2007. Submitted by the Shared Strategy Development Committee. Available from: https://repository.library.noaa.gov/view/noaa/16005

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June. https://www.piercecountywa.org/ArchiveCenter/ViewFile/Item/6075

Pierce County. 2018. Rivers Flood Hazard Management Plan 2017-2018 Update. Prepared by: Pierce County Public Works and Utilities Surface Water Management Division. Available: https://www.piercecountywa.org/1837/Rivers-Flood-Hazard-Management-Plan

Pierce County. 2012. Final Environmental Impact Statement for: Rivers Flood Hazard Management Plan. Prepared by: Pierce County Public Works and Utilities Surface Water Management Division. Available: https://www.piercecountywa.org/1837/Rivers-Flood-Hazard-Management-Plan

Kerwin, J. 1999. Salmonid Habitat Limiting Factors Report for the Puyallup River Basin. Washington Conservation Commission.

Recreation and Conservation Office. 2020. PRISM Project Search: Greewanter River Restoration Phase 3. Accessed June 24, 2020. https://secure.rco.wa.gov/prism/search/ProjectSnapshot.aspx?ProjectNumber=12-1288

WEST FORK WHITE FLOODPLAIN PROJECT

Narrative description, including goals and objectives.

South Puget Sound Salmon Enhancement Group proposes to implement reach-scale floodplain restoration actions in the West Fork White River, within the Upper White River sub-basin (WRIA 10). This project would complete assessment, feasibility, design, and construction of a floodplain restoration project on the lower 6 miles of the West Fork White River. Initial efforts would focus on a reach-scale assessment of the lower White River from river miles 2.4 to 5.7. Assessment efforts would evaluate geomorphic threats from a road (which is adjacent to the stream) to floodplain processes, instream flow velocities, and habitat structure and the assessment efforts would prescribe and implement restoration treatments to remove fill and armor and restore habitat and habitat forming processes.

The goal of the project is as follows:

- Rehabilitate lost processes that are provided by floodplain reconnection.

The objectives of the project are:

- Complete a reach-scale assessment including an evaluation of threats from an adjacent road.
- Remove fill and armor from the floodplain.
- Restore habitat and habitat-forming processes.

Qualitative assessment of how the project will function.

The project will function by removing fill and armor, which will allow natural processes to develop in a large floodplain. There are no anticipated offset benefits related to the project because there are no identified permit exempt wells in the project area. Additionally, the potential for the project to increase groundwater recharge has not been estimated.

Conceptual-level map of the project and location.

The proposed project is located along the West Fork White River between river miles 0 and 6, with an initial focus on river miles 2.4 to 5.7. Figure 1 shows the approximate initial project location.

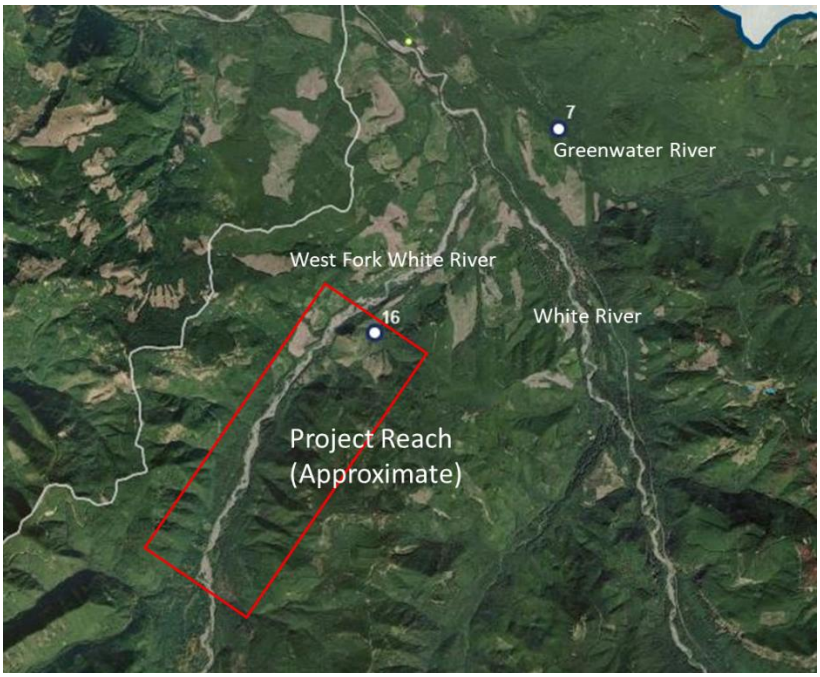


Figure 1. West Fork White Floodplain Project (annotated from Watershed Restoration and Enhancement Committees Technical Support Web Map)

Performance goals and measures.

The performance goals are to complete a reach-scale assessment of river miles 2.4 to 5.7 of the West Fork White River and implement restoration treatments including fill and armor removal. Performance measures would be determined once a final design is selected.

Description of the anticipated spatial distribution of likely benefits.

Benefits to river processes will occur in the project area between river miles 2.4 to 5.7; side channel and other habitat features formed as a result of this project will benefit a variety of salmonid species as described in the next paragraph. Salmonids in the West Fork White River and in the White River will benefit from increased habitat and reduced peak flow and sediment input.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed.

The West Fork White River supports a variety of salmonid species including Endangered Species Act-listed Chinook, Steelhead, and Bull Trout. Other anadromous salmonid species on the West Fork White River that would benefit from this project include Coho, Pink salmon, and coastal cutthroat trout. The White River supports an early returning population of White River spring Chinook which spawn in the upper and lower White River and is the most distinctive Chinook stock in central and south Puget Sound, and this population may spawn in the West Fork White River (NMFS, 2007). The USFWS has also identified five local bull trout populations within the Puyallup basin, one of which occurs in the West Fork White River and Upper White River (NMFS, 2007). The salmonids and other aquatic species in the West Fork White River are subject to the current limiting factors present.

According to the Limiting Factors Report for the Puyallup Watershed by Kerwin (1999), limiting factors that may be addressed by the project include the following:

- Loss of floodplain habitat, wetlands, and connectivity to hyporheic zone
- Loss of off-channel and side-channel habitat
- Loss of instream habitat complexity and connectivity
- Loss of large wood
- Increase in river channelization
- Increase in sediment load
- Loss of channel (substrate) stability
- Loss of spawning and rearing habitat
- Loss of good water quality, including appropriate temperature

Removal of the existing fill and armor would address these limiting factors by promoting the creation of a variety of habitat types and hydrologic features. Side channels, backwater channels, and off-channel habitat would develop because the river would be allowed to move laterally within the floodplain. These habitats provide protection from flood events and act as riparian cover and rearing habitat, which supports juvenile salmonids and provides areas for fry to colonize. Coho salmon may also spawn in low velocity side channels. Shallow edge habitat would also be created where areas of fill are removed. These provide shade and function as cover and rearing habitat for fry and juvenile salmonids. Invertebrates colonizing the edge habitat are also a prey source for juveniles. Removal of the armor and fill will also increase the sinuosity of the river, creating a slower velocity system where a greater range of sediment and substrate types are available due to the complexity of habitats present. Spawning salmonids (Chinook, steelhead, and Coho) would benefit from a range of substrate sizes. The functions and benefits of the habitat and hydrologic features that would be created by the project address many of the limiting factors currently present in the West Fork White River.

Along with the habitat restoration actions already undertaken in the Upper White River sub-basin, addressing these limiting factors will help support salmonids at various life stages and increase presence, recruitment, and survival in the area of the project. And, for ESA-listed ESUs, restoring these areas would contribute to the VSP parameters of abundance, productivity, spatial structure, and diversity.

Identification of anticipated support and barriers to completion.

This project builds upon previous restoration actions in the Upper White River sub-basin. The project is sponsored by South Puget Sound Salmon Enhancement Group and supported by the Lead Entity, Puyallup and Chambers Watersheds Salmon Recovery Lead Entity.

The WRIA 10/12 Lead Entity Strategy identifies priority tributaries and actions within the Upper Puyallup Watershed (which includes the upper White River sub-basin). The West Fork White River is

identified as a high priority tributary. Two of the high priority actions within this area are directly addressed by this project: “restore natural geomorphic processes and riparian functions where they are compromised, degraded, or severed,” and “address failing roads to reduce sediment load.” Additionally, lateral channel migration has the potential to recruit nearby trees and address a third high priority action: “increase large wood inputs” (Lead Entity 2018). The WRIA 10/12 Lead Entity Strategy additionally states that this type of action will provide the greatest restoration benefit to Puyallup/White River Chinook abundance. The Puget Sound Salmon Recovery Plan also calls out the Upper White River sub-basin as a priority area for White River spring Chinook and suggests actions such as “large woody debris [and] riparian restoration projects in the Upper White River” (NMFS 2007). There are no anticipated barriers to completing this project due to its alignment with regional and basin-wide goals.

Potential budget and O&M costs (order of magnitude costs).

The funding requested to complete reach-scale assessment efforts, evaluate geomorphic threats natural processes, and prescribe and implement restoration treatments based on these analyses is approximately $3,000,000.

No O&M costs have been identified as the project should not pose any maintenance obligations. The initial project reach is on National Forest property. The entire West Fork White River through the national forest is protected under a riparian reserve designation (Ecology 2003).

Anticipated durability and resiliency.

Floodplain reconnection projects are durable as they restore natural processes to a reach of the river, allowing flooding and channel migration to occur unimpeded. Given the changing climate conditions that anticipates receding glaciers, increases in precipitation and rain-on-snow events, and channel aggradation, floodplain reconnection projects that provide the river with more room to meander and more ways to hold water for longer are important solutions to implement to restore watershed processes and to provide resiliency from a changing climate.

Project sponsor(s) (if identified) and readiness to proceed/implement.

South Puget Sound Salmon Enhancement Group is the project sponsor and is ready to implement the project as soon as funding is made available. The overall project can likely be implemented within the next five years provided funding is available.

Documentation of sources, methods, and assumptions.

The following references were used:

Ecology, 2003. Mt. Baker-Snoqualmie National Forest, Upper White Watershed Sediment and Temperature TMDL for Aquatic Habitat. Submittal Report, Publication No. 03-10-032. Available from: https://fortress.wa.gov/ecy/publications/documents/0310032.pdf

National Marine Fisheries Service (NMFS). 2007. Puget Sound Salmon Recovery Plan. Plan adopted by NMFS on January 19, 2007. Submitted by the Shared Strategy Development Committee. Available from: https://repository.library.noaa.gov/view/noaa/16005

Puyallup and Chambers Watersheds Salmon Recovery Lead Entity (Lead Entity). 2018. Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds. June. https://www.piercecountywa.org/ArchiveCenter/ViewFile/Item/6075

Kerwin, J. 1999. Salmonid Habitat Limiting Factors Report for the Puyallup River Basin. Washington Conservation Commission.