Appendices

WRIA 13 Deschutes Watershed

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Appendix B – Glossary

Acronym	Definition
AE	Application Efficiency
AFY	Acre-Feet per Year
CFS	Cubic Feet per Second
CU	Consumptive Use
CUF	Consumptive Use Factor
GPD	Gallons per Day
GIS	Geographic Information System
IR	Irrigation Requirements
LID	Low Impact Development
LIO	Local Integrating Organization
MAR	Managed Aquifer Recharge
NEB	Net Ecological Benefit
PE	Permit-Exempt
RCW	Revised Code of Washington
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Areas

Acre-feet (AF): A unit of volume equal to the volume of a sheet of water one acre in area and one foot in depth. (USGS)

Adaptive Management: An iterative and systematic decision-making process that aims to reduce uncertainty over time and help meet project, action, and plan performance goals by learning from the implementation and outcomes of projects and actions. (NEB)

Annual Average Withdrawal: RCW 90.94.030 (4)(a)(vi)(B) refers to the amount of water allowed for withdrawal per connection as the annual average withdrawal. As an example, a homeowner could withdraw 4,000 gallons on a summer day, so long as they did not do so often enough that their annual average exceeds the 950 gpd.

Beaver Dam Analogue (BDA): BDAs are man-made structures designed to mimic the form and function of a natural beaver dam. They can be used to increase the probability of successful beaver translocation and function as a simple, cost-effective, non-intrusive approach to stream restoration. (From Anabranch Solutions)

Critical Flow Period: The time period of low streamflow (generally described in bi-monthly or monthly time steps) that has the greatest likelihood to negatively impact the survival and recovery of threatened or endangered salmonids or other fish species targeted by the planning group. The planning group should discuss with Ecology, local tribal and WDFW biologists to determine the critical flow period in those reaches under the planning group's evaluation. (NEB)

Cubic feet per second (CFS): A rate of the flow in streams and rivers. It is equal to a volume of water one foot high and one foot wide flowing a distance of one foot in one second (about the size of one archive file box or a basketball). (USGS)

Domestic Use: In the context of Chapter 90.94 RCW, "domestic use" and the withdrawal limits from permit-exempt domestic wells include both indoor and outdoor household uses, and watering of a lawn and noncommercial garden. (NEB)

ESSB 6091: In January 2018, the Legislature passed Engrossed Substitute Senate Bill (ESSB) 6091 in response to the Hirst decision. In the Whatcom County vs. Hirst, Futurewise, et al. decision (often referred to as the "Hirst decision"), the court ruled that the county failed to comply with the Growth Management Act requirements to protect water resources. The ruling required the county to make an independent decision about legal water availability. ESSB 6091 addresses the court's decision by allowing landowners to obtain a building permit for a new home relying on a permit-exempt well. ESSB 6091 is codified as Chapter 90.94 RCW. (ECY)

Evolutionarily Significant Unit (ESU): A population of organisms that is considered distinct for purposes of conservation. For Puget Sound Chinook, the ESU includes naturally spawned Chinook Salmon originating from rivers flowing into Puget Sound from the Elwha River (inclusive) eastward, including rivers in Hood Canal, South Sound, North Sound and the Strait of Georgia. Also, Chinook Salmon from 26 artificial propagation programs. (NOAA)

Foster Pilots and Foster Task Force: To address the impacts of the 2015 Foster decision, Chapter 90.94 RCW established a Task Force on Water Resource Mitigation and authorized the Department of Ecology to issue permit decisions for up to five water mitigation pilot projects. These pilot projects will address issues such as the treatment of surface water and groundwater appropriations and include management strategies to monitor how these appropriations affect instream flows and fish habitats. The joint legislative Task Force will (1) review the treatment of surface water and groundwater appropriations as they relate to instream flows and fish habitat, (2) develop and recommend a mitigation sequencing process and scoring system to address such appropriations, and (3) review the Washington Supreme Court decision in Foster v. Department of Ecology. The Task Force is responsible for overseeing the five pilot projects. (ECY)

Four Year Work Plans: Four year plans are developed by salmon recovery lead entities in Puget Sound to describe each lead entity's accomplishments during the previous year, to identify the current status of recovery actions, any changes in recovery strategies, and to propose future actions anticipated over the next four years. Regional experts conduct technical and policy reviews of each watershed's four year work plan update to evaluate the consistency and appropriate sequencing of actions with the Puget Sound Salmon Recovery Plan. (Partnership)

Gallons per day (GPD): An expression of the average rate of domestic and commercial water use. 1 million gallons per day is equivalent to 1.547 cubic feet per second.

Group A public water systems: Group A water systems have 15 or more service connections or serve 25 or more people per day. Chapter 246-290 WAC (Group A Public Water Supplies), outlines the purpose, applicability, enforcement, and other policies related to Group A water systems. (WAC)

Group B public water systems: Group B public water systems serve fewer than 15 connections **and** fewer than 25 people per day. Chapter 246-291 WAC (Group B Public Water Systems), outlines the purpose, applicability, enforcement, and other policies related to Group B water systems.(WAC)

Growth Management Act (GMA): Passed by the Washington Legislature and enacted in 1990, this act guides planning for growth and development in Washington State. The act requires local governments in fast growing and densely populated counties to develop, adopt, and periodically update comprehensive plans.

Home: A general term referring to any house, household, or other Equivalent Residential Unit. (Policy and Interpretive Statement)

Hydrologic Unit Code (HUC): Hydrologic unit codes refer to the USGS's division and sub-division of the watersheds into successively smaller hydrologic units. The units are classified into four levels: regions, sub-regions, accounting units, and cataloging units, and are arranged within each other from the largest geographic area to the smallest. Each unit is classified by a unit code (HUC) composed of two to eight digits based on the four levels of the classification in the hydrologic unit system (two digit units are largest and eight digits are smallest). (USGS)

Impact: For the purpose of streamflow restoration planning, impact is the same as new consumptive water use (see definition below). As provided in Ecology WR POL 2094 "Though the statute requires the offset of 'consumptive impacts to instream flows associated with permit-exempt domestic water use' (RCW 90.94.020(4)(b)) and 90.94.030(3)(b)), watershed plans should address the consumptive use of new permit-exempt domestic well withdrawals. Ecology recommends consumptive use as a surrogate for consumptive impact to eliminate the need for detailed hydrogeologic modeling, which is costly and unlikely feasible to complete within the limited planning timeframes provided in chapter 90.94 RCW. " (NEB)

Instream Flow: A designated flow (also in cfs) that is set by rule as the amount of water needed to protect beneficial uses and used for determining whether there is water available for appropriation. Flow levels set as Instream Flows do not reflect the actual amount of water flowing at a given time. They are designated, or administrative numbers (flow levels) that are set for periods of time (bi-weekly to several months) throughout the year. The instream flows vary by season and account for different instream resource needs (such as fish spawning, rearing and migration). When (actual) stream flow is lower than the Instream Flow, there is not water available for appropriation (Instream Flows are not being met) and water users whose water rights are junior to the Instream Flows must discontinue water use under that right.

Instream Flow Rule (IFR): An administrative rule that establishes Instream Flows.

Instream Resources Protection Program (IRPP): The IRPP was initiated by the Department of Ecology in September 1978 with the purpose of developing and adopting instream resource protection measures for Water Resource Inventory Areas (WRIAs) (see definition below) in Western Washington as authorized in the Water Resources Act of 1971 (RCW 90.54), and in accordance with the Water Resources Management Program (WAC 175-500).

Instream Resources: Fish and related aquatic resources. (NEB)

Large woody debris (LWD): LWD refers to the fallen trees, logs and stumps, root wads, and piles of branches along the edges of streams, rivers, lakes and Puget Sound. Wood helps stabilize shorelines and provides vital habitat for salmon and other aquatic life. Preserving the debris along shorelines is important for keeping aquatic ecosystems healthy and improving the survival of native salmon. (King County)

Lead Entities (LE): Lead Entities are local, citizen-based organizations in Puget Sound that coordinate salmon recovery strategies in their local watershed. Lead entities work with local and state agencies, tribes, citizens, and other community groups to adaptively manage their local salmon recovery chapters and ensure recovery actions are implemented. (Partnership)

Listed Species: Before a species can receive the protection provided by the Endangered Species Act (ESA), it must first be added to the federal lists of endangered and threatened wildlife and plants. The List of Endangered and Threatened Wildlife (50 CFR 17.11) and the List of Endangered and Threatened Plants (50 CFR 17.12) contain the names of all species that have been determined by the U.S. Fish and Wildlife Service (Service) or the National Marine Fisheries Service (for most marine life) to be in the greatest need of federal protection. A species is added to the list when it is determined to be endangered or threatened because of any of the following factors: the present or threatened destruction, modification, or curtailment of its habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; disease or predation; the inadequacy of existing regulatory mechanisms; or other natural or manmade factors affecting its survival. (USFWS)

Local Integrating Organizations (LIO): Local Integrating Organizations are local forums in Puget Sound that collaboratively work to develop, coordinate, and implement strategies and actions that contribute to the protection and recovery of the local ecosystem. Funded and supported by the Puget Sound Partnership, the LIOs are recognized as the local expert bodies for ecosystem recovery in nine unique ecosystems across Puget Sound. (Partnership)

Low Impact Development (LID): Low Impact Development (LID) is a stormwater and land-use management strategy that tries to mimic natural hydrologic conditions by emphasizing techniques including conservation, use of on-site natural features, site planning, and distributed stormwater best management practices (BMPs) integrated into a project design. (ECY)

Managed Aquifer Recharge (MAR): Managed aquifer recharge projects involve the addition of water to an aquifer through infiltration basins, injection wells, or other methods. The stored water can then be used to benefit stream flows, especially during critical flow periods. (NEB)

National Pollutant Discharge Elimination System (NPDES): The NPDES permit program addresses water pollution by regulating point sources that discharge pollutants to waters of the United States. Created by the Clean Water Act in 1972, the EPA authorizes state governments to perform many permitting, administrative, and enforcement aspects of the program. (EPA)

Net Ecological Benefit (NEB): Net Ecological Benefit is a term used in ESSB 6091 as a standard that watershed plans (see below for definition) must meet. The outcome that is anticipated to occur through implementation of projects and actions in a plan to yield offsets that exceed impacts within: a) the planning horizon; and, b) the relevant WRIA boundary. See *Final Guidance for Determining Net Ecological Benefit - Guid-2094 Water Resources Program Guidance.* (NEB)

Net Ecological Benefit Determination: Occurs solely upon Ecology's conclusion after its review of a watershed plan submitted to Ecology by appropriate procedures, that the plan does or does not achieves a NEB as defined in the Net Ecological Benefit guidance. The Director of Ecology will issue the results of that review and the NEB determination in the form of an order. (NEB)

Net Ecological Benefit Evaluation: A planning group's demonstration, using NEB Guidance and as reflected in their watershed plan, that their plan has or has not achieved a NEB. (NEB)

New Consumptive Water Use: The consumptive water use from the permit-exempt domestic groundwater withdrawals estimated to be initiated within the planning horizon. For the purpose of RCW 90.94, consumptive water use is considered water that is evaporated, transpired, consumed by humans, or otherwise removed from an immediate water environment due to the use of new permit-exempt domestic wells. (NEB)

Office of Financial Management (OFM): OFM is a Washington state agency that develops official state and local population estimates and projections for use in local growth management planning. (OFM)

Offset: The anticipated ability of a project or action to counterbalance some amount of the new consumptive water use over the planning horizon. Offsets need to continue beyond the planning horizon for as long as new well pumping continues. (NEB)

Permit exempt wells: The Groundwater Code (RCW 90.44), identified four "small withdrawals" of groundwater as exempt from the permitting process. Permit-exempt groundwater wells often provide water where a community supply is not available, serving single homes, small developments, irrigation of small lawns and gardens, industry, and stock watering.

Permit-exempt uses: Groundwater permit exemptions allow four small uses of groundwater without a water right permit: domestic uses of less than 5,000 gallons per day, industrial uses of less than 5,000 gallons per day, irrigation of a lawn or non-commercial garden, a half-acre or less in size, or stock water. Although exempt groundwater withdrawals don't require a water right permit, they are always subject to state water law. (ECY)

Planning groups: A general term that refers to either initiating governments, in consultation with the planning unit, preparing a watershed plan update required by Chapter 90.94.020 RCW, or a watershed restoration and enhancement committee preparing a plan required by Chapter 90.94.030 RCW. (NEB)

Planning Horizon: The 20-year period beginning on January 19, 2018 and ending on January 18, 2038, over which new consumptive water use by permit-exempt domestic withdrawals within a WRIA must be addressed, based on the requirements set forth in Chapter 90.94 RCW. (NEB)

Projects and Actions: General terms describing any activities in watershed plans to offset impacts from new consumptive water use and/or contribute to NEB. (NEB)

Puget Sound Acquisition and Restoration (PSAR) fund: This fund supports projects that recover salmon and protect and recover salmon habitat in Puget Sound. The state legislature appropriates money for PSAR every 2 years in the Capital Budget. PSAR is co-managed by the Puget Sound Partnership and the Recreation and Conservation Office, and local entities identify and propose PSAR projects. (Partnership)

Puget Sound Partnership (Partnership): The Puget Sound Partnership is the state agency leading the region's collective effort to restore and protect Puget Sound and its watersheds. The organization brings together hundreds of partners to mobilize partner action around a common agenda, advance Sound investments, and advance priority actions by supporting partners. (Partnership)

Puget Sound Regional Council (PSRC): PSRC develops policies and coordinates decisions about regional growth, transportation and economic development planning within King, Pierce, Snohomish and Kitsap counties. (PSRC)

RCW 90.03 **(Water Code)**: This chapter outlines the role of the Department of Ecology in regulating and controlling the waters within the state. The code describes policies surrounding surface water and groundwater uses, the process of determining water rights, compliance measures and civil penalties, and various legal procedures.

RCW 90.44 **(Groundwater Regulations)**: RCW 90.44 details regulations and policies concerning groundwater use in Washington state, and declares that public groundwaters belong to the public and are subject to appropriation for beneficial use under the terms of the chapter. The rights to appropriate surface waters of the state are not affected by the provisions of this chapter.

RCW 90.44.050 **(Groundwater permit exemption)**: This code states that any withdrawal of public groundwaters after June 6, 1945, must have an associated water right from the Department of Ecology. However, any withdrawal of public groundwaters for stock-watering purposes, or for the watering of a lawn or of a noncommercial garden not exceeding one-half acre in area, or for single or group domestic uses in an amount not exceeding five thousand gallons a day, or for an industrial purpose in an amount not exceeding five thousand gallons a day, is exempt from the provisions of this section and does not need a water right.

RCW 90.54 (**Water Resources Act of 1971**): This act set the stage for the series of rules that set instream flow levels as water rights, as well as a compliance effort to protect those flows.

RCW 90.82 **(Watershed Planning)**: Watershed Planning was passed in 1997 with the purpose of developing a more thorough and cooperative method of determining what the current water resource situation is in each water resource inventory area of the state and to provide local citizens with the maximum possible input concerning their goals and objectives for water resource management and development.

RCW 90.94 **(Streamflow Restoration)**: This chapter of the Revised Code of Washington codifies ESSB 6091, including watershed planning efforts, streamflow restoration funding program and the joint legislative task force on water resource mitigation and mitigation pilot projects (Foster task force and pilot projects).

Reasonable Assurance: Explicit statement(s) in a watershed plan that the plan's content is realistic regarding the outcomes anticipated by the plan, and that the plan content is supported with scientifically rigorous documentation of the methods, assumptions, data, and implementation considerations used by the planning group. (NEB)

Revised Code of Washington (RCW): The revised code is a compilation of all permanent laws now in force for the state of Washington. The RCWs are organized by subject area into Titles, Chapters, and Sections.

Salmon Recovery Funding Board (SRFB): Pronounced "surf board", this state and federal board provides grants to protect and restore salmon habitat. Administered by a 10-member State Board that includes five governor-appointed citizens and five natural resource agency directors, the board brings together the experiences and viewpoints of citizens and the major state natural resource agencies. For watersheds planning under Section 203, the Department of Ecology will submit final draft WRE Plans not adopted by the prescribed deadline to SRFB for a technical review (RCO and Policy and Interpretive Statement).

Section 202 or Section 020: Refers to Section 202 of ESSB 6091 or Section 020 of RCW 90.94 respectively. The code provides policies and requirements for new domestic groundwater withdrawals exempt from permitting with a potential impact on a closed water body and potential impairment to an instream flow. This section includes WRIAs 1, 11, 22, 23, 49, 59 and 55, are required to update watershed plans completed under RCW 90.82 and to limit new permit-exempt withdrawals to 3000 gpd annual average.

Section 203 or Section 030: Refers to Section 203 of ESSB 6091 or Section 030 of RCW 90.94 respectively. The section details the role of WRE committees and WRE plans (see definitions below) in ensuring the protection and enhancement of instream resources and watershed functions. This section includes WRIAs 7, 8, 9, 10, 12, 13, 14 and 15. New permit-exempt withdrawals are limited to 950 gpd annual average.

SEPA and SEPA Review: SEPA is the State Environmental Policy Act. SEPA identifies and analyzes environmental impacts associated with governmental decisions. These decisions may be related to issuing permits for private projects, constructing public facilitates, or adopting regulations, policies, and plans. SEPA review is a process which helps agency decision-makers, applications, and the public understand how the entire proposal will affect the environment. These reviews are necessary prior to Ecology adopting a plan or plan update and may be completed by Ecology or by a local government. (Ecology)

Stream Flow: A specific flow level measured at a specific location in a given stream, usually described as a rate, such as cfs. Stream flow is the actual amount of real water at a specific place and at a given moment. Stream flows can change from moment to moment.

Subbasins: A geographic subarea within a WRIA, equivalent to the words "same basin or tributary" as used in RCW 90.94.020(4)(b) and RCW 90.94.030 (3)(b). In some instances, subbasins may not correspond with hydrologic or geologic basin delineations (e.g. watershed divides). (NEB)

Trust Water Right Program: The program allows the Department of Ecology to hold water rights for future uses without the risk of relinquishment. Water rights held in trust contribute to streamflows and groundwater recharge, while retaining their original priority date. Ecology uses the Trust Water Right Program to manage acquisitions and accept temporary donations. The program provides flexibility to enhance flows, bank or temporarily donate water rights. (ECY)

Urban Growth Area (UGA): UGAs are unincorporated areas outside of city limits where urban growth is encouraged. Each city that is located in a GMA fully-planning county includes an urban growth area where the city can grow into through annexation. An urban growth area may include more than a single city. An urban growth area may include territory that is located outside of a city in some cases. Urban growth areas are under county jurisdiction until they are annexed or incorporated as a city. Zoning in UGAs generally reflect the city zoning, and public utilities and roads are generally built to city standards with the expectation that when annexed, the UGA will transition seamlessly into the urban fabric. Areas outside of the UGA are generally considered rural. UGA boundaries are reviewed and sometimes adjusted during periodic comprehensive plan updates. UGAs are further defined in RCW 36.70.

WAC 173-566 **(Streamflow Restoration Funding Rule)**: On June 25, 2019 the Department of Ecology adopted this rule for funding projects under RCW 90.94. This rule establishes processes and criteria for prioritizing and approving grants consistent with legislative intent, thus making Ecology's funding decision and contracting more transparent, consistent, and defensible.

Washington Administrative Code (WAC): The WAC contains the current and permanent rules and regulations of state agencies. It is arranged by agency and new editions are published every two years. (Washington State Legislature)

Washington Department of Ecology (DOE/ECY): The Washington State Department of Ecology is an environmental regulatory agency for the State of Washington. The department administers laws and regulations pertaining to the areas of water quality, water rights and water resources, shoreline management, toxics clean-up, nuclear and hazardous waste, and air quality.

Washington Department of Fish and Wildlife (WDFW): An agency dedicated to preserving, protecting, and perpetuating the state's fish, wildlife, and ecosystems while providing sustainable fish and wildlife recreational and commercial opportunities. Headquartered in Olympia, the department maintains six regional offices and manages dozens of wildlife areas around the state, offering fishing, hunting, wildlife viewing, and other recreational opportunities for the residents of Washington. With the tribes, WDFW is a co-manager of the state salmon fishery. (WDFW)

Washington Department of Natural Resources (WADNR or DNR): The department manages over 3,000,000 acres of forest, range, agricultural, and commercial lands in the U.S. state of Washington. The DNR also manages 2,600,000 acres of aquatic areas which include shorelines, tidelands, lands under Puget Sound and the coast, and navigable lakes and rivers. Part of the DNR's management responsibility includes monitoring of mining cleanup, environmental restoration, providing scientific information about earthquakes, landslides, and ecologically sensitive areas. (WADNR)

Water Resources (WR): The Water Resources program at Department of Ecology supports sustainable water resources management to meet the present and future water needs of people and the natural environment, in partnership with Washington communities. (ECY)

Water Resources Advisory Committee (WRAC): Established in 1996, the Water Resources Advisory Committee is a forum for issues related to water resource management in Washington State. This stakeholder group is comprised of 40 people representing state agencies, local governments, water utilities, tribes, environmental groups, consultants, law firms, and other water stakeholders. (ECY)

Watershed Plan: A general term that refers to either: a watershed plan update prepared by a WRIA's initiating governments, in collaboration with the WRIA's planning unit, per RCW 90.94.020; or a watershed restoration and enhancement plan prepared by a watershed restoration and enhancement committee, per RCW 90.94.030. This term does not refer to RCW 90.82.020(6). (NEB)

Watershed Restoration and Enhancement Plan (WRE Plan): The Watershed Restoration and Enhancement Plan is directed by Section 203 of ESSB 6091 and requires that by June 30, 2021, the Department of Ecology will prepare and adopt a watershed restoration and enhancement plan for WRIAs 7, 8, 9, 10, 12, 13, 14 and 15, in collaboration with the watershed restoration and enhancement committee. The plan should, at a minimum, offset the consumptive impact of new permit-exempt domestic water use, but may also include recommendations for projects and actions that will measure, protect, and enhance instream resources that support the recovery of threatened and endangered salmonids. Prior to adoption of an updated plan, Department of Ecology must determine that the actions in the plan will result in a "net ecological benefit" to instream resources in the WRIA. The planning group may recommend out-of-kind projects to help achieve this standard.

WRIA: Water Resource Inventory Area. WRIAs are also called basins or watersheds. There are 62 across the state and each are assigned a number and name. They were defined in 1979 for the purpose of monitoring water availability. A complete map is available here: https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-availability/Watershed-look-up

Appendix C – Committee Roster

WRIA 13 Committee Members – Primary Representatives and Alternates

John Kliem, Lewis County

Kaitlynn Nelson, Thurston County

Brad Murphy, Thurston County

Joshua Cummings, Thurston County

Donna Buxton, City of Olympia

Jesse Barham, City of Olympia

Deputy Mayor Cynthia Pratt, City of Lacey

Julie Rector, City of Lacey

Councilmember Charlie Schneider, City of Tumwater

Dan Smith, City of Tumwater

Jeff Dickison, Squaxin Island Tribe

Paul Pickett, Squaxin Island Tribe

Commissioner Linda Oosterman, Thurston PUD 1

John Weidenfeller, Thurston PUD 1

Julie Parker, Thurston PUD 1

Ruth Clemens, Thurston PUD 1

Sue Patnude, Deschutes Estuary Restoration Team

Dave Monthie, Deschutes Estuary Restoration Team

Dave Peeler, Deschutes Estuary Restoration Team

Erin Hall[1], Olympia Master Builders[3]

Josie Cummings, Building Industry Association of Washington

Sarah Moorehead, Thurston Conservation District

Adam Peterson, Thurston Conservation District

Karin Strelioff, Thurston Conservation District

Theresa Nation[2], Department of Fish and Wildlife

Megan Kernan, Department of Fish and Wildlife

Tristan Weiss, Department of Fish and Wildlife

Noll Steinweg, Department of Fish and Wildlife

Amy Hatch-Winecka, WRIA 13 Salmon Habitat Recovery Lead Entity Coordinator (ex officio)

Wendy Steffensen, LOTT Clean Water Alliance (ex officio)

John Millard, City of Tenino (ex officio)

George Walter, Nisqually Indian Tribe (ex officio)

Technical and Project Workgroup

John Kliem, Lewis County

Kaitlynn Nelson, Thurston County

Kevin Hansen, Thurston County

Brad Murphy, Thurston County

Donna Buxton, City of Olympia

Jesse Barham, City of Olympia

Deputy Mayor Cynthia Pratt, City of Lacey

Julie Rector, City of Lacey

Dan Smith, City of Tumwater

Meredith Greer, City of Tumwater

Marina Magaña[1], City of Tumwater

Paul Pickett, Squaxin Island Tribe

Erica Marbet, Squaxin Island Tribe

Julie Parker, Thurston PUD 1

Ruth Clemens, Thurston PUD 1

Sue Patnude, Deschutes Estuary Restoration Team

Dave Monthie, Deschutes Estuary Restoration Team

Dave Peeler, Deschutes Estuary Restoration Team

Erin Hall[1], Olympia Master Builders[3]

Sarah Moorehead, Thurston Conservation District

Adam Peterson, Thurston Conservation District

Karin Strelioff, Thurston Conservation District

Theresa Nation, Department of Fish and Wildlife

Megan Kernan, Department of Fish and Wildlife

Tristan Weiss, Department of Fish and Wildlife

Noll Steinweg, Department of Fish and Wildlife

Amy Hatch-Winecka, WRIA 13 Salmon Habitat Recovery Lead Entity Coordinator (ex officio)

Wendy Steffensen, LOTT Clean Water Alliance (ex officio)

Mark Mazeski, Department of Health

Angela Johnson, Department of Ecology

Tom Culhane, Department of Ecology

Jim Pacheco, Department of Ecology

Chad Wiseman, HDR

[1] No longer at entity

[2] Did not participate on Committee through the final vote

[3] Entity withdrew from Committee before final vote

Appendix D – Final Meeting Summary of the WRIA 13 Watershed Restoration and Enhancement Committee

MEETING SUMMARY

WRIA 13 Watershed Restoration and Enhancement Committee

April 20, 2021 | 12:30 p.m. - 3:00 p.m. | committee website

Location	Committee Chair	Handouts
WebEx	Angela Johnson angela.johnson@ecy.wa.gov	1. Plan Adoption Pathways 2. Final Plan 3. Plan Compendium

Attendance

Committee Representatives and Alternates *

Angela Johnson (*Ecology – Committee Chair)*
Jeff Dickison (*Squaxin Island Tribe*)
Paul Pickett (*Squaxin Island Tribe*)
Kaitlynn Nelson (*Thurston County*)
John Kliem (*Lewis County*)
Donna Buxton (*City of Olympia*)
Cynthia Pratt (*City of Lacey*)
Charlie Schneider (*City of Tumwater*)
Dan Smith (*City of Tumwater*)
Ruth Clemens (*Thurston PUD*)
Noll Steinweg (*WDFW*)
Josie Cummings (*BIAW*)
Dave Monthie (*DERT*)
Sarah Moorehead (*Thurston Conservation District*)
Amy Hatch Winecka (*WRIA 13 Salmon Habitat Recovery Lead Entity*, *ex officio*)
Wendy Steffenson (*LOTT*, *ex officio*)

Committee Representatives Not in Attendance*

Other Attendees*

Gretchen Muller *(Cascadia Consulting)*
Jimmy Kralj (*ESA*)
Mike Noone (*Ecology*)
Tom Culhane (*Ecology*)
Stacy Vynne-McKinstry (*Ecology*)
Rebecca Brown (*Ecology*)
Chad Wiseman (*HDR*)

*Attendees list is based on WebEx participation.

Welcome

Angela and Gretchen kicked off the meeting with WebEx logistics, roll call, and a review of the meeting agenda.

Updates and Announcements

- The December 2020 and January 2021 meeting summaries were approved over email, no action is needed today.
    - We will have the same approval process for the meeting summary for this meeting.
- Angela provided updates regarding plan approvals in the 90.94.020 and 90.94.030 processes.
- Ecology will determine the timing of the next round of the Streamflow Restoration Grant program once funding is confirmed by the legislature.
- Angela provided a short summary of corrections and additions made to the plan since it was distributed for local review.
    - Angela explained that minor revisions such as fixing typos and formatting were made to the plan. Additionally, Angela asked the Committee if there were any concerns including the newly proposed "Appendix L: Streamflow Statistics" that had been distributed to the Committee ahead of the meeting.
        - The Building Industry Association of Washington (BIAW) expressed frustrations that some information was added to the plan after it was distributed for local review, such as the revision to the instream flow rule policy proposed by the Squaxin Island Tribe and Thurston County, the additional "Appendix L: Streamflow Statistics" proposed by the Squaxin Island Tribe, and some documents entities submitted to include in the Plan Compendium.
            - The Squaxin Island Tribe responded with some additional details about the streamflow statistics that were added after the plan went out for local review: the origins of the data (Ecology), and why it was added when it was.
            - Angela confirmed that the information in the newly proposed Appendix L was developed by Jim Pacheco from Ecology, using stream gage data from Thurston County and the USGS.
    - No entities indicated they opposed the corrections and additions to the plan at this time, and Angela confirmed that those proposed changes would be considered part of the plan that the Committee would vote on later in the meeting.

Steps to Plan Adoption

- Angela provided an overview of the two pathways to plan adoption, as stated in the handout distributed with meeting materials (Plan Adoption Pathways): plans approved by the Committee, and plans not approved by the Committee or not adopted by Ecology by June 30, 2021.
    - Angela stated that if the plan were not approved by the Committee, under the alternative path in the legislation Ecology would prepare a final plan. Ecology would start from the

baseline minimum requirements in the law, and would consider information developed to this point by the Committee.

- In response to Committee questions, Angela clarified that if the Director of Ecology were to not adopt a Committee approved plan, the plan would then be adopted through the non-Committee approved plan approval pathway.
    - Angela provided additional clarification that the process for RCW 90.94.020 (which included WRIA 1) did not direct Ecology to prepare a plan, but went straight to rulemaking; however, the process for RCW 90.94.030 (which includes our Committee) directs ecology to prepare and adopt a plan if the Committee cannot locally approve a plan, and initiate rulemaking within 6 months of plan adoption.
    - DERT expressed frustrations that Ecology has been involved in this process throughout its entire duration, but there is still a chance Ecology could not approve a unanimously adopted plan.
- Ecology responded that they will be voting on the plan today, however this vote is considered preliminary and distinct from the plan review Ecology will undertake if a plan is locally approved and submitted to Ecology for review and agency action in accordance with RCW 90.94.030(3)(c). The Squaxin Island Tribe asked about the SEPA process for non-Committee approved plans.
    - Ecology said this would likely occur but did not have further information at this time.

Public Comment

- No public comments were received.

Committee Member Vote and Statements

- Gretchen outlined voting procedures as per the Committee's operating principles.
    - She also noted that some entities have submitted written signing statements ahead of the meeting which have been uploaded on Box, and Committee members are welcome to provide a verbal statement along with their vote.
- Committee members were called upon in the order they are listed in the Streamflow Restoration law to verbally state "approve" or "disapprove" of the plan, and were given the opportunity to make a verbal statement.

- **Washington Department of Ecology**
    - Approve
    - Angela thanked the Committee for their work throughout the planning process.
- **Squaxin Island Tribe**
    - Approve
    - The Tribe noted there are weaknesses in the plan that need to be address moving forward, but they feel the plan has outlined procedures to address those weaknesses. Despite the fact that more work is needed for projects and their locations to offset impacts, the Tribe sees potential for reaching the intent of the planning process. The Tribe thanked Thurston County for their discussions about rulemaking. They noted their disagreement with Ecology over interpretation of the

    law, and stated that the Tribe would continue to have those issues and would continue to discuss them.
  - The draft Plan offers the potential for success, so the Tribe will approve and continue to work towards the goals outlined in the plan.
- **WDFW**
  - Approve
  - WDFW has outlined specific concerns in their signing statement.
- **Lewis County**
  - Approve
  - The Board of Commissioners has approved the plan and passed a resolution.
- **Thurston County**
  - Approve
  - The Board of Commissioners has approved the plan.
- **City of Lacey**
  - Approve
  - City Council has approved the plan.
- **City of Olympia**
  - Approve
  - The City sees the plan as capturing promise for collaboration and believes the plan will guide the watershed to opportunities to balance growth and water resources into the future.
- **City of Tumwater**
  - Approve
  - The City looks forward to continue working with the Committee to implement the plan.
- **Thurston PUD 1**
  - Approve
  - Thanked everyone for their work throughout the plan development process.
- **Building Industry Association of Washington**
  - Disapprove
  - Thanked everyone for their time. BIAW stated that their members feel that the plan goes outside the scope of the law. They were concerned about items being added to the plan after it was sent for final approval. They believe the plan should focus on new exempt wells and they have concerns about the instream flow rule and policy recommendation. They were hoping the plan would focus on shovel-ready projects and not policies.
- **DERT**
  - Approve
  - DERT has submitted a signing statement explaining their stance. They don't believe the plan follows all elements of the law, but they are impressed with the final plan. DERT is disappointed in Ecology's interpretation of the law and unwillingness to implement the plan. DERT looks forward to the implementation of the Deschutes Watershed Council and other elements of the plan.

- **Thurston Conservation District**
    - Approve
    - In particular, the district appreciates the group's interest in landowner education and creating non-regulatory and voluntary processes that didn't exist before. The District looks forward to implementation and engagement.

- **The plan was not approved, with one entity voting to disapprove, and 11 entities voting to approve. The tally of the votes by the Committee is presented below.**

Entity	Committee Member	Vote
Ecology	Angela Johnson	Approve
Squaxin Island Tribe	Jeff Dickison	Approve
Department of Fish and Wildlife	Noll Steinweg	Approve
Lewis County	John Kliem	Approve
Thurston County	Kaitlynn Nelson	Approve
City of Lacey	Cynthia Pratt	Approve
City of Olympia	Donna Buxton	Approve
City of Tumwater	Dan Smith	Approve
Thurston PUD 1	Ruth Clemens	Approve
BIAW	Josie Cummings	Disapprove
DERT	Dave Monthie	Approve
Thurston CD	Sarah Moorehead	Approve

Post-Vote Discussion

Angela and Gretchen confirmed with the Committee that the plan was not approved, and asked the Committee if there was any discussion on the outcome of the vote or how the Committee would like to proceed.

- **Squaxin Island Tribe**: The Tribe was surprised the plan was not approved and shared their opinion that the entity that stands to benefit the most was the one that voted against the plan.
- **BIAW**: BIAW stated that the policy recommendations will limit homeowners and builders, and that they might hinder development and make home construction more expensive. BIAW hopes that Ecology takes the plan and projects it includes and moves them forward.
- **Thurston Conservation District**: Asked whether or not the Committee could vote again and asked what that process looks like and how it could work with current development timelines.
    - Angela and Gretchen clarified that the Committee can vote again, working with in the timeline of the June 30, 2021 deadline to have an approved and adopted plan.
    - The District shared their hope that groups can work together to achieve consensus.

    - BIAW is open to further conversations regarding the plan, but the policy recommendation on opening up the instream flow rule raises the most concerns for BIAW.
- **City of Tumwater**: Expressed their willingness to entertain conversations about getting to approval and wished the issues raised by the BIAW would have been addressed sooner.
- **DERT**: Stated this was a "blindsided vote" by BIAW. Stated that BIAW did not express these concerns when these issues were initially discussed. They are also concerned about making revisions in the plan and how that would require another approval process which would likely lead to the Committee missing the June 30th deadline. Ecology has been very clear that the provisions in the plan are not required to be implemented. DERT "struggled to understand" why BIAW will reject the plan knowing that this will now move the process to Ecology's jurisdiction, removing the Committee from their processes.
- **Ecology**: Angela stated that the best chance of getting a plan approved by Ecology is to submit it as soon as possible. Ecology will do everything they can to review a Committee approved plan by June 30th, but the required approval steps mean there is a tight deadline and members should keep that in mind.
- **City of Lacey:** Expressed disappointment that the concerns by BIAW were not expressed during plan development. Additionally, the City of Lacey is unsure as to why the Appendix L addition was an issue considering it only contains technical streamflow data. The City asked the group how they can move forward.
- **Thurston Conservation District**: Appreciates people coming to the table in good faith. Time has been a major constraint throughout the process. They recognized that there have been concerns raised by BIAW but there hasn't been sufficient time to address all of them during plan development. They expressed interest in whether or not the Committee could pursue consensus after the June 30th deadline, and if the Committee could send guidance to Ecology.
    - Gretchen noted that it would be helpful to find out what the 1-3 issues are that are "sticky wickets" for BIAW, and if Josie could share those now. If BIAW can't share them now, Gretchen asked of Josie could follow-up with communication to the Committee to understand what the issues are and if there is room to find consensus.
    - Angela stated that if the June 30th deadline lapses, Ecology will begin its process to prepare the plan. However, Ecology will consider information provided by the Committee. Committee members can submit information to Ecology management for their review/consideration at any time.
- **Thurston County**: The County Board decided that this plan was better than the alternative to benefit homeowners and builders and believed it was necessary to efficiently allow building to happen in the County. The Commissioners believed that the rulemaking process would include public comment, including allowing the jurisdictions and organizations like BIAW to voice their concerns. Thurston County invited BIAW to talk to the County Commissioners, and offered to discuss with BIAW what they considered in their decision to approve the plan, if that would be helpful to resolve the issue and achieve consensus.
- **BIAW:** BIAW will follow up with written comments to the Committee for clarity.

    - Instream flow rule: The BIAW did express concerns related to the instream flow policy after the group dispersed for local approval.
    - BIAW would be more comfortable handing off things to Ecology than approving the plan at this point with elements with which they fundamentally disagree.
    - Josie will follow up with a written response to the Committee to provide more information regarding the BIAW position on their disapproval of the plan.
    - Josie offered to speak directly with Committee members and can be reached at 360-352-7800 ext 163.
- **Squaxin Island Tribe**:
    - From the Tribe's perspective, BIAW came late to the process, and prior to their active involvement the Tribe had talked to the representative of the Olympia Master Builders, (previous residential construction representative on the Committee) who did not object to instream flow provisions.
    - There were discussions between the Tribe and the County and they developed a revised proposal based on these conversations in order to find a policy write-up that worked for all parties. The Tribe reached out to BIAW offering to discuss the policy write-up, but did not receive a call back. BIAW had opportunities to object, and opportunities to call another meeting, but the BIAW did neither of those things.
    - Additionally, Appendix L contains only technical information and there was never any notice of objection from the BIAW prior to today's meeting.
    - The Law now requires Ecology to initiate rulemaking, so even though the BIAW chose to reject the plan because of a recommendation about opening up the instream flow rule, it will happen anyway.
    - The Tribe is not optimistic, given the problems with process, that anything will come from further discussion, but will participate if it happens.
- **DERT**: Asked what the baseline minimum requirements will be that Ecology will use as the starting point for a plan to be adopted under their alternative process?"
    - Angela stated that if the plan is not approved by the Committee, Ecology must prepare and adopt a final plan, and initiate rule making within six months of plan adoption through the alternate pathway of an Ecology prepared plan.
    - Angela referred to the information provided in the "Plan Adoption Pathways" handout and stated that there is no timeline identified in the legislation for Ecology to finalize the plan.
    - Ecology does not have specific information on this process yet, but they will start with the minimum requirements of the law and review Committee produced information.
- Josie provided her contact information and will distribute written comments to the Committee by Friday April 23.
- The Squaxin Island Tribe noted their perspective on the irony of BIAW's position about rulemaking, and added further clarification. When faced with the closing of the process that did not include rulemaking, the Tribe went out of their way to engage with Thurston County Commission to address that issue. The Tribe wants to make it clear that without the rulemaking recommendation, they would not vote to approve. If BIAW wants that provision removed, the Tribe doubts that there is any further cause for discussion.

- Angela and Gretchen thanked the Committee for this discussion and indicated they would be moving on to the next steps to wrap-up the meeting. They confirmed that the plan was not approved, and that based on the Committee's discussion there would be no further action to make changes to the plan unless Committee members reached out to them with a path forward for consensus. Gretchen stated that the facilitation team is available to support Committee members in any way helpful and are available to connect 1-1 with Committee members or convene a meeting for the Committee or subset of the Committee if requested by one or more Committee members.
    - Committee members made the following additional statements:
        - DERT expressed concerns about the timelines and deadlines related to plan approval if additional changes are proposed.
        - Lewis County expressed interest in pursuing a path towards yes. Stated it would be important to talk with Josie and the BIAW to better understand why they are voting this way. There may be an issue of misunderstanding.
        - The Squaxin Island Tribe expressed concern that the problem is bigger than just "happy talk". They shared their recollection of the process: that although BIAW mentioned some concerns, and responded to the Tribe's initial contacts to discuss their concerns, they never returned a call to the Tribe to have that discussion. BIAW also didn't ask for a Committee meeting to discuss the concerns that brought them to disapprove the plan when they had a chance earlier in the process. The Tribe feels that this has soured relationships, and although Committee members want to save the Plan, the process is already damaged.
        - Thurston CD noted that they heard the frustration, but still thought the issues should be discussed.

Next Steps

- Angela will notify Ecology management that the WRIA 13 Watershed Restoration and Enhancement Plan is not approved at this time, and will send the final draft plan along with any signing statements submitted by entities to confirm their vote.
- Angela will follow-up with the Committee over email to confirm that the plan is not approved and to clarify next steps.
- The BIAW will provide written information to Committee members detailing their reasons for not approving the plan. Angela will distribute this to the Committee as soon as it is received.
- After the Committee reviews information provided by the BIAW, Angela and Gretchen will have check-in calls about the potential to reach consensus.
- Ecology is prioritizing their review for approved plans. The timing of Ecology preparing plans that are not approved by Committees will be dependent upon work and demands from other plans and Committees – Ecology will be evaluating this over the next couple of months.
- The meeting summary will be approved over email.

- Angela and Gretchen thanked the Committee members and their entities, consultants, Ecology technical team, and all workgroup members for their time, hard work, and participation over the last 2.5 years.

Appendix E – Regional Aquifer Units within WRIA 13

Aquifer (DNR Nomenclature in Parentheses)	Description	Typical Thickness
Qvr (Qgo/Qgos)	Often present at land surface, this aquifer primarily consists of stratified silt, sand, and gravel deposits of Vashon recessional outwash of the Frasier glaciation.	10 feet to about 40 feet thick; locally exceeds 150 feet. Where saturated, the unit represents a water-table aquifer and is often in direct continuity with surface-water bodies.
Qva (Qga)	This aquifer is mainly composed of deposits from the Vashon advance outwash. The deposits are poorly- to moderately-well sorted gravel in a sand matrix. This unit is generally confined by the overlying glacial till (Qvt or Qgt).	10 to 45 feet; locally exceeds 100 feet. Thin on northern peninsulas, greater thicknesses in Lacey area.
Qc (Qpg)	Sometimes called the “sea-level aquifer” due its coincident elevation, this unit is usually coarse sand and gravel deposits of pre-Vashon age glacial drift. Confined by the overlying Kitsap formation (Qf or Qpf).	15 to 70 feet thick in most places in the area. Generally absent south of Rainier, though present near Lake Lawrence.
TQu	Composed of unconsolidated and undifferentiated sedimentary deposits from the early Quaternary and late Tertiary period. Mainly consists of deposits of silt, sand, and gravel. Water bearing units are irregularly distributed and local aquitard units are present.	Thickness can exceed 1,000 feet and is poorly constrained. Greater thicknesses in the northern portion of watershed, where it is an important water bearing unit.

Appendix F - Policy, Regulatory, and Adaptive Management Recommendations Proposed by the WRIA 13 Committee

The WRIA 13 Committee spent several months preparing recommendations for policy and regulatory change, as well as plan implementation tracking and adaptive management. While Ecology is not putting forward these recommendations as part of our plan, we want to preserve the work of the committee and present the recommendations for WRIA 13 partners that may choose to move these recommendations forward.

This language is taken directly from the Committee's WRIA 13 draft plan (version March 18, 2021) with only minor revisions for clarity.

Policy Recommendations, Adaptive Management, and Implementation

6.1 Policy and Regulatory Recommendations

RCW 90.94 lists optional elements committees may consider including in the plan to manage water resources for the WRIA or a portion of the WRIA (RCW 90.94.030(3)(f)). The WRIA 13 Committee included what they have termed "policy and regulatory recommendations" in the plan to show support for projects, programs, policies, and regulatory actions that would contribute to the goal of streamflow restoration. When similar concepts arose from multiple Watershed Restoration and Enhancement Committees, the WRIA 13 Committee coordinated with those other Committees to put forward common language for inclusion in the watershed plans, when appropriate. Coordination also occurred for jurisdictions that cross multiple watersheds. All projects and actions the WRIA 13 Committee intended to count toward the required consumptive use offset or Net Ecological Benefit are included in Chapter 5: Projects and Actions. [1] As recommended by the NEB Guidance, the WRIA 13 Committee prepared this watershed plan with the intention that it be implemented. [2]

The WRIA 13 Committee initially identified a list of potential policy and regulatory recommendations. After iterative rounds of discussion, the Committee narrowed the recommendations in this section to those that both supported the goal of streamflow restoration and had the support of the full Committee. Unless otherwise specified, the proposed implementing entity is not obligated by this plan to implement the recommendation; however, the WRIA 13 Committee supports the recommendations and their implementation by the appropriate entity. Committee members identified as the implementing entity for each recommendation have indicated that they are committed to investigating the feasibility of the recommendation. [3] Additional information on assurance of implementation has been provided by many entities in section 6.3.2.

The Committee recommends that Lewis County be exempt from policy recommendations at this time because of the lack of PE well growth in the Lewis County portion of WRIA 13.

The WRIA 13 Committee supports the following recommendations, which are not listed in order of priority:

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[1] "New regulations or amendments to existing regulations adopted after January 19, 2018, enacted to contribute to the restoration or enhancement of streamflows may count towards the required consumptive use offset and/or providing NEB." Streamflow Restoration Policy and Interpretive Statement, POL-2094

[2] Ecology's interpretation, as articulated in the Streamflow Restoration Policy and Interpretive Statement (POL-2094), is that "RCW 90.94.020 and 90.94.030 do not create an obligation on any party to ensure that plans, or projects and actions in those plans or associated with rulemaking, are implemented." (Ecology 2019a)

[3] The identification and listing of these policy and regulatory recommendations is directly from the WRIA 13 Committee members and is not endorsed or opposed by the Washington State Department of Ecology.

1. Water Conservation and Drought Adaptation Education and Outreach

Proposed implementing entity:

Thurston Conservation District, potentially with support from WSU Extension and Thurston County.

Recommendations:

- Develop educational materials and workshops for new or existing homeowners.
- Work with local nurseries to stock and label low water use native species for xeriscaping.
- Develop Irrigation Water Management Plans for agricultural producers and gardeners.
- Support development of a program to compensate agriculture producers for not using their full water rights, with conserved water to be temporarily placed into Trust Water Rights program.
- Support development of incentive program to upgrade outdated or inefficient irrigation systems.
- Include drought tolerance/water use efficiency as a factor in recommended tree lists.

Purpose:

Promote water conservation in residential and agricultural sectors. Reduced leaching of nutrients into streams and water bodies due to over watering.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2

2. Drought Response Limits

Proposed implementing entity:

Ecology, Thurston County, and other organizations.

Recommendations:

Research the use of water from permit exempt wells during drought periods, and whether upon the issuance of a drought emergency order under RCW 43.83B.405, consider a language change to state that the withdrawal of groundwater exempt from permitting under RCW 90.44.050 “will” be limited to no more than 350 gallons per day per connection for indoor use only, instead of “may”. Consider including new exemptions for growing food, maintaining a fire control buffer, or supporting an environmental restoration project. Engage local stakeholders in considering this change. Consider developing or enhancing a County-wide drought response plan.

Purpose:

Build resilience against climate change impacts (e.g., extreme heat, low precipitation, low flows). Protect Tribal Treaty rights and senior water rights. Support NEB goals for streamflow restoration.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2 Other possible sources of funding include funding allotted to Ecology under RCW 90.94 and potential reassignment of existing or future staff.

3. County Policies to Promote Connections to Group A Systems

Proposed implementing entity:

Thurston County

Recommendations:

Research and review existing plans, policies, and ordinances to determine if there are opportunities to limit PE wells when Group A service is available.

Purpose:

Reduce the number of projected new PE wells, thereby reducing groundwater consumptive use and providing an offset safety factor.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2

4. Revolving Loan & Grant Fund for Small Public Water Systems

Proposed implementing entity:

Ecology and Thurston County

Recommendations:

Investigate the feasibility of establishing and operating a revolving loan/grant fund to offset the costs of connecting to Group A public water systems. Funding would be available when the increased cost of connecting to a Group A system (instead of constructing a PE well) creates an economic barrier for applicants. Feasibility would be determined by criteria set for the provider and applicant (such as the availability of a sufficient water right; consistency with the relevant Water System Plan).

Purpose:

Reduce barriers to connecting to Group A systems, thereby reducing the number of projected new PE wells, reducing groundwater consumptive use, and providing an offset safety factor.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

5. South Sound Water Steward

Proposed implementing entity:

Ecology, local governments, and other entities as appropriate.

Recommendations:

Ecology creates a new position of "South Sound Water Steward," whose duties include:

- Monitoring instream flows, wells, and other relevant water bodies to support implementation of the watershed plans and compliance with state rules.
- Conducting ongoing education, outreach, and technical support for permit-exempt wells owners and water rights holders (especially as part of drought response).
- Providing technical advisement to Ecology during water rights decisions in the South Sound.
- Investigating and enforcing illegal water use issues, in accordance with current regulations for enforcement, in accordance with current regulations for enforcement.

As appropriate, the position would include legal authorities consistent with both a Water Master and a Ground Water Supervisor (RCW 90.03.060; 90.03.070; RCW 90.44.200; WAC Chapter 508-12). Duties would not conflict with existing Water Master staff at Department of Ecology Southwest Regional Office, but may build upon them for specific duties at the discretion of the Water Resources Southwest Regional Manager.

Purpose:

Supports compliance with water resources laws/regulations and Tribal Treaty rights. Consistent and effective implementation of watershed plans. Gives Ecology a visible and clear role for supporting plan implementation and compliance with state laws and regulations.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, reassignment of existing or future staff or other means. More funding information is available in Section 6.2.

6. Upgrade Well Reporting

Proposed implementing entity:

Ecology

Recommendations:

- Develop interactive web-based well mapping and reporting tool for drillers.
- Require well coordinates on reports.
- Increase capacity for the Well Construction and Licensing Office at Ecology to vet well reports.

Purpose:

Improve well location data and access to it. Accurate well data is critical for monitoring and management of shared water resources throughout Washington. Streamline data collection process.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

Additional information or resources:

The full policy proposal is included in Appendix K.

7. Instream Flow Rules

Proposed implementing entities:

Ecology; Washington State Legislature; local governments.

Recommendations:

- Investigate the WRIA 13 salmon streams and determine needed revisions to the WRIA 13 Instream Flow (ISF) Rule (WAC 173-513). Streams under review for instream flow revisions will be clearly represented to the public through maps in an accessible manner. Consider need to close streams in WRIA 13 with summer salmonid habitat (which could include: Upper Deschutes River, Middle Deschutes River, Lower Deschutes River, McLane Creek, Green Cove, Woodland Creek, Woodard Creek, Percival Creek, Adams Creek, and other associated tributaries and small coastal streams with salmonid habitat) annually in the low flow season (typically from June through October) and what effect it would have on growth in the watershed. This would apply to water rights that have a priority date after any changes made to the instream flow rule.

- Review other salmon streams without existing ISF between November and May and consider setting ISF levels using current methodology.
- Use the latest ISF assessment methodology to reassess ISF values for the Deschutes River below Deschutes Falls.
- Revise and add any other conditions consistent with the final watershed plan to the ISF rule
- Ecology to initiate rulemaking to update the 40-year old WRIA 13 rule to reflect changed conditions and new information, and make the rule effective, legally consistent, and enforceable.[4]

Purpose:

Greater protection of aquatic resources, streamflows, Tribal Treaty water rights, and senior water rights from future water demands.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

8. Permit Exempt Well Withdrawal Limits

Proposed implementing entity:

Ecology

Recommendations:

Research water use in WRIA 13 and PE well limits.

- Investigate actual indoor and outdoor domestic water use and compare to current legal limits and determine if a lower limit is appropriate. Consider allowing exceedance of limits if the outdoor water use is for food production, fire protection, or an environmental restoration project.

Purpose:

Benefits: reduces potential impact of new permit-exempt domestic wells. Limitations provide a "safety factor" by setting limits on PE well use based on good water conservation practices. This

[4] Ecology believes this rulemaking recommendation seeks amendments to the WRIA 13 instream flow rule that go above and beyond changes that are feasible within the two year rule adoption requirement of RCW 90.94.030(3)(h). Therefore, Ecology will coordinate with partner governments and stakeholders in the WRIA to explore options, if any, with regard to this recommendation.

improves the net benefits of offset projects as they are completed to restore streamflows and protect senior water rights.

Funding source:
Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

9. Salmon Recovery Portal Project Tracking

Proposed implementing entity:

WDFW in collaboration with Ecology, RCO, University of Washington data stewards, and WRIA 13 Committee.

Recommendations:

Pilot the Salmon Recovery Portal, currently managed by Washington State Recreation and Conservation Office (RCO), for tracking streamflow restoration projects and new PE wells. WDFW would coordinate this effort—in collaboration with Ecology and the WRIA 13 Committee—and consult Lead Entity Coordinators prior to initial data uploads. University of Washington data stewards would perform data entry, quality assurance, and quality control.

Purpose:

- Coordinate streamflow restoration with ongoing salmon recovery efforts.
- Improve capacity to monitor implementation of streamflow restoration projects and actions.
- Build grant funding opportunities and track costs associated with streamflow restoration.
- Provide a template for adaptively managing emergent restoration needs.

Funding source:

WDFW, additional funding may be required.

Additional information or resources:
https://srp.rco.wa.gov/

10. Deschutes Watershed Council (DWC)

Proposed implementing entities:

Deschutes Estuary Restoration Team (DERT); Tribes; local governments; other stakeholders (i.e. agricultural, residential construction, environmental interest representatives).

Interested members of the WRIA 13 Watershed Restoration and Enhancement Committee would reconvene to initiate the DWC, such as DERT, City of Tumwater, City of Olympia, City of

Lacey, Thurston County, Thurston Conservation District, the WRIA 13 Salmon Habitat Recovery Lead Entity Coordinator, and others.

Recommendations:

Convene a collaborative partnership that builds on successful models in other watersheds, uses science-based tools with demonstrated effectiveness, and stresses collaborative solutions that reduce conflict and avoid litigation Responsibilities could include:

- Formally implementing Plan recommendations.
- Identifying and implementing water quantity and quality management solutions on a regional scale that increase regional self-reliance, reduce conflict, and manage water to concurrently achieve social, environmental, and economic objectives.
- Incorporating adaptive management techniques to address climate change and other impacts.

Purpose:

The WRIA 13 Committee recommends creating a Deschutes Watershed Council (DWC) to (1) implement the plan; (2) provide a structure for collaboration on projects; (3) identify, recommend, and implement actions to offset impacts from new water right applications, transfers, and changes, and other water use that impact streamflows; and (4) address water quality issues.

Funding sources:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

Additional information or resources:

Ecology – Deschutes River, Percival Creek, & Budd Inlet Tributaries TMDL Improvement Projects

11. County Planning Study – Streamflow Restoration Effectiveness

Proposed implementing entity:

Ecology or other department would contract a consultant to perform work.

Recommendations:

Conduct a study to compare planning and permitting policies/programs among Kitsap County, Pierce County, Thurston County, Mason County, and King County. Determine how effectively these policies/programs support protection and enhancement of streamflow restoration (e.g., through protection and enhancement of groundwater recharge). Evaluate (1) how and why county programs have been effective, and (2) gaps or areas where planning has been less effective. Propose strategies for improving rules to promote recharge enhancement and streamflow restoration.

Purpose:

Inform decision-making and improve planning/permitting to promote streamflow restoration.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

12. Water Supply Data for Comprehensive Water Planning

Proposed implementing entity:

Ecology with support from counties, Department of Health, and potentially consultants.

Recommendations:

Collect, estimate, and/or project the following data and include in a future update of WRIA 13's Watershed Plan:

- Number of existing permit exempt domestic water wells and their water use
- All projected water usage for the next 20 years (i.e., PE wells, inchoate rights, new water rights).
- Number of municipal water supply connections expected in the next 20 years, by subbasin.
- Total number of existing PE wells by county.

Within the first five years of WRIA 13's Watershed Plan implementation, collect, estimate, and/or project the following for each subbasin:

- Total existing (2018 and earlier) connections in service using (1) unmitigated inchoate water rights; (2) mitigated inchoate water rights; or (3) PE wells.
- Total connections expected to be put into service in the next 20 years using (1) unmitigated inchoate water rights; (2) mitigated inchoate water rights; or (3) PE wells.

Purpose:

Provide robust information base for comprehensive water planning. Provide context for the Watershed Plan and its goals.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

13. Rainwater Collection - Education & Incentives

Proposed implementing entity:

Thurston Conservation District

Recommendations:

- Assurance from regulatory entities at all levels that rainwater collection is allowed under current DOE policy (Policy #1017).
- Rainwater collection design support at multiple scales of capacity, but only at scales allowed under current DOE policy. Design support through this policy is intended for PE well users only.*
- Financial assistance for rainwater harvesting infrastructure, intended for PE well users only.*

** The proposed limitations regarding eligible assisted community members would only apply to work performed as part of this policy and would not restrict the work of individual partners to provide support for rainwater collection across WRIA 13.*

Purpose:

Education and support around allowed uses of rainwater collection. Could help minimize flashy flows in some locations. Could reduce PE well usage, although reduction volumes are likely minimal. Encourages a shift towards viewing water as a finite resource. Provides community members with a tangible—and practical—action to support water conservation efforts in their communities.

Funding source:

Funding is needed either through legislative appropriations, grants, pooling of resources by committee members and other stakeholders, or other means. More funding information is available in Section 6.2.

Additional information or resources:

Ecology's clarification of rainwater collection with basic planning resources:

https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-recovery-solutions/Rainwater-collection

14. Water Conservation Statewide Policy

Proposed implementing entities:

Ecology, Conservation Commission, Conservation Districts, and counties, with direction from legislature.

Recommendations:

The legislature consider authorizing and funding a statewide program of WRIA-based water conservation measures for domestic PE wells in unincorporated areas of the state during drought events. Measures would focus on Voluntary methods for efficient outdoor water use.

Purpose:

Reduce domestic PE well water usage across the state, and especially during drought declarations in affected WRIAs. Reduce impacts on stream flows. Increase climate change resilience. Provide offset safety factor. Support NEB goals.

Funding source:

Potential funding sources could include: legislative budget line item providing additional allocations to Ecology and the Conservation Commission, to pass through to Conservation Districts and Counties.

15. Revise Thurston County Critical Areas Code Regarding Reclaimed Water Use

Proposed implementing entity:

Thurston County

Recommendations:

- Consider changes to the Thurston County Critical Areas Ordinance, specifically the Critical Aquifer Recharge Areas regulations under TCC 24.10.190, 24.30.085, and 24.25.080, to allow for additional uses of reclaimed water. Thurston County's Critical Areas Ordinance currently does not permit large-scale infiltration of reclaimed water (defined as "application to the land's surface above agronomic rates").
- Review additional information from the Regional Groundwater Recharge Scientific Study (now known as LOTT's Reclaimed Water Infiltration Study) and other sources. Thurston County could reconsider this limitation in light of new state-level guidance and information from LOTT's pending study, which will be completed in 2021.

Purpose:

Allowing additional uses of reclaimed water would increase options for mitigating streamflows in unincorporated Thurston County, along with other potential benefits, by replenishing groundwater, augmenting streamflows, enhancing wetlands and other habitat, and offsetting the quantity of water that is withdrawn for other purposes.

Funding:

Funding is undetermined and needed through either grants, committee resources, Thurston County general funds, or other potential funding methods.

6.2 Plan Implementation and Adaptive Management

The WRIA 13 Committee supports an adaptive management process for implementation of the WRIA 13 Watershed Plan. Adaptive management will help address uncertainty and provide more reasonable assurance for plan implementation.

The WRIA 13 Committee recommends tracking the growth of new PE wells and the total number of new building permits requiring a water connection in the watershed, as well as the projects and policies that were planned to offset the impacts of these PE wells. This data will allow the Committee to determine whether planning assumptions were accurate and whether adjustments to plan implementation are needed.

The WRIA 13 Committee makes the following recommendations:

6.2.1 Oversight

The WRIA 13 Committee recommends creating a **Deschutes Watershed Council (DWC)** to (1) implement the watershed plan; (2) provide a structure for collaboration on projects; and (3) identify, recommend, and implement actions to offset impacts from new water right applications, transfers, and changes, and other water use that impact streamflows. The DWC would comprise of representatives interested in protecting, conserving, and restoring the Deschutes Watershed. For example, this would include the Squaxin Island Tribe; local governments; special purpose districts (taxing authority); businesses; non-profit conservation, land trust organizations, agricultural representatives, environmental interests, residential construction industry; and other entities that participated in the WRIA 13 Committee; and key involvement from a diverse range of community members from across WRIA 13.".

The DWC could address water quality and quantity issues by:

- Providing a **structure for collaboration** on projects to offset impacts to streamflow and changes in water quality.
- **Inventorying** existing (1) water quantity and quality regulations and (2) incentive-based and/or voluntary water protection and conservation programs.
- Identifying and implementing **regional water management solutions** that increase self-reliance, reduce conflict, and manage water to concurrently achieve social, environmental, and economic objectives.
- Evaluating and pursuing legislation for the development of **mitigation banks** to be used to offset impacts of future development of either permit-exempt wells or permit-required wells.
- Partner with Stream Team, or engage **community-based volunteer and education programs** to initiate a sense of place, ownership, and responsibility for the future of the Deschutes watershed.

- Specific tasks for DWC could include:
    - Support for review, revision, and prioritization for grant applications, to ensure consistency with the overall approach of the Plan
    - Tracking of offsets and the number of exempt well developments authorized by the counties, both by WRIA and by subbasin.
    - Reporting of Plan progress to Ecology, Committee members and the public.
    - Identification and development of long-term stable funding. The Plan proposes funding to provide capacity to the Lead Organization or Committee. The funding strategy is described in a separate proposal.
    - Development of a multi-party agreement that establishes membership, operating principles, and administration of the DWC.
    - Developing and maintaining the institutional knowledge needed to provide a continuing approach to implement over the long-term.
    - The long-term responsibility for Plan implementation.

6.2.2 Project Tracking

Counties should continue to track permit-exempt well construction. The WRIA 13 Committee also recommends tracking streamflow restoration projects to: (1) track status of implementation, including projects and other recommendations; (2) build grant funding opportunities; (3) track project costs; and () provide a template for adaptively managing emergent restoration needs.

The WRIA 13 Committee recommends piloting the Washington State Recreation and Conservation Office's (RCO) **Salmon Recovery Portal** **(SRP)** to track Watershed Plan projects through planning and implementation phases. As a statewide tool administered by RCO in partnership with salmon recovery Lead Entities, the SRP provides a dynamic platform to track project offsets. SRP can set goals, create project hierarchy tiers, include supplemental information, and generate automated reports.

To support the implementation of the above pilot program for tracking projects under 90.94.030 RCW, the Washington Department of Fish & Wildlife (WDFW) has initiated pilot projects in two 90.94.020 RCW basins: the Nisqually River Basin (WRIA 11) and the Chehalis River Basin (WRIAs 22/23). These pilots are coordinated by WDFW in conjunction with RCO, Ecology, local Lead Entity Coordinators, and the Planning Units for WRIA 11 and WRIA 22/23. Intended as a proof of concept, these pilots are planned to explore the capacity and effectiveness of the SRP to track streamflow restoration projects.

Tracking of projects will begin with **two primary data entry phases**, shown in the table below.

Table F-1: Phases of Project Tracking Data Entry

Tasks:	**Phase 1**: Upload required project information for each project in Watershed Plan.	**Phase 2**: Upload/update all funded projects, project reports, and completed projects annually.
Coordinator	WDFW	WDFW
Funding	WDFW, and other entities TBD.	WDFW, and other entities TBD.
Data entry	University of Washington data stewards in collaboration with RCO and Ecology	University of Washington data stewards in consultation with RCO, Ecology Grant Management staff, and WDFW.
Quality control	University of Washington data stewards	University of Washington data stewards

Local salmon recovery Lead Entity Coordinators will be consulted prior to initial data uploads. At a minimum, the Committee recommends tracking the following **data points for each project**:

- WRIA
- Sub-basin
- Estimated cost
- Funding source
- Project description
- Target implementation date
- Project status (e.g., not started; in progress; completed)
- Project proponent (if applicable)
- Project spatial boundaries or coordinates
- Estimated water offset and/or habitat benefits

6.2.3 Monitoring and Research

In addition to monitoring project implementation as described above, the WRIA 13 Committee proposes the DWC plans and coordinates additional monitoring and research to improve water planning data, reduce uncertainty, and inform decision-making as the Plan is implemented. This additional information will support adjustments to the Watershed Plan to focus limited resources on the most significant problems and best solutions. Additional monitoring and research initiatives could include:

- Developing an overarching **Monitoring and Research Plan** as part of implementation.
- Monitoring all streams with Instream Flow Rule provisions.
- Improving regional groundwater data, maps, and models.
- Developing a program to monitor habitat and net ecological benefit (NEB).
- Monitoring of project implementation and effectiveness.

Existing Monitoring Data

Multiple jurisdictions have operated, and continue to operate, monitoring and data collection programs throughout WRIA 13. The USGS operates gages on the Deschutes River at Rainier (since 1949) and at Tumwater (since 1938). Thurston County operates a weather network (11 stations), groundwater network (10 wells) and stream gaging network (7 gages) in the WRIA, some with continuous data extending back to the 1980s. The County also managed a volunteer lake level monitoring program that was active from 1990 through 2012 on Ward, Hewitt, Chambers, Hicks, Pattison, Long, Offut, Lawrence, and Summit lakes. The Stream Team (a cross-jurisdictional effort between Lacey, Olympia, Tumwater, and Thurston County) has collected volunteer Benthic Index of Biotic Integrity data on streams throughout the region since 1990.

A monitoring and research plan can include these sources of data, as well as any other credible sources of data. Surface water monitoring data in WRIA 13 is available from Thurston County, Ecology, and other entities.

Annual Reporting & Adaptive Management

Using annual reports to identify trends and indicators, the Committee recommends that DWC take an adaptive management approach to implementing the WRIA 13 Watershed Plan. The adaptive management provisions outlined below will also help determine whether projects are functioning as designed under climate change conditions and allow for course corrections as needed.

The Committee recommends requiring the following annual reports:

- Counties provide reports to Ecology and DWC on PE well construction and connections, as well as the total number of new water connections.
- Project sponsors provide report to DWC on project status and estimated project offset amounts of completed projects.

The WRIA 13 Committee also recommends that Ecology's Streamflow Restoration grant guidance be revised to include a requirement that funded projects provide annual reports to Ecology.

Beginning the fifth year of implementation, DWC will compare the following by subbasin and summarize in a report to Ecology:

- Estimated consumptive use for permit exempt wells constructed during year (using the methodology designated in the WRIA 13 Watershed Plan).
- Estimated annual project offset amounts by subbasin.
- If sufficient project information is not available within the fifth year of implementation, reporting will be adjusted to accommodate project needs.

If the comparison report indicates that total project offset amounts are less than the cumulative total of new permit exempt well consumptive use amounts described in Chapter 4, the Committee recommends:

- DWC identifies opportunities to accelerate completion of offset projects in progress and includes an associated timeline for completion in report to Ecology.
- DWC works with local jurisdictions to consider additional strategies and actions.
- Ecology considers appropriate actions to protect senior water rights and support implementation of the plan

If the comparison report indicates that project offset amounts are exceeding the consumptive use offset targets identified in Chapter 4 as a higher estimate (513 AFY) to achieve through adaptive management (on an annual prorated basis), or if PE well growth is lower than predicted, Ecology could relax restrictions and make reporting cycles less frequent (e.g., every other year).

6.2.4 Funding

Funding is critical to implementing the WRIA 13 Watershed Plan and achieving its goals. Based on funding estimates from other watershed groups, the Committee recommends that an amount not exceeding $200,000 annually could be needed to establish and maintain the Deschutes Watershed Council (which will implement tasks described in sections 1-4 above). Funding described in this section is for oversight, monitoring, and tracking of implementation and does not reflect funding needs for implementation of projects discussed in Chapter 5. Recommended investigation of funding strategies include:

- **Increase permit exempt well fees**. Consider an equitable approach to increasing the existing well fee based on impact to groundwater and needs of plan.
- **Request sustainable funding from the Washington State Legislature**. Funding would be available statewide to WRIAs with a plan or Rule under RCW 90.94. Activities prioritized for funding could include oversight; monitoring and research; education, outreach, and technical assistance; and reporting. The Committee recommends a dedicated fee (e.g., an annual fee on permit exempt wells as part of annual property tax assessments) rather than reliance on the general fund.
- **Other funding methods**. Research additional options for funding to implement the WRIA 13 plan that could include programs, optional mitigation, or other funding methods.

Additional sources of funding could include grants, DWC member cost-sharing or fees, and/or DWC service revenues.

6.3 Other Issues

6.3.1 Summary of Legislative Requests

Legislative funding is requested for all recommendations except 6.1.9.

6.3.2 Assurance of Plan Implementation

WRIA 13 Committee members and participating entities strongly advocate for implementation of the watershed plan. Members of the Committee provided the following statements of assurance of their commitment to plan implementation.

- **Department of Ecology**
  - Ecology follows NEB Guidance and RCW 90.94.030 provisions in reviewing the watershed plan and considering plan adoption.
  - Ecology administers the 90.94 Grant Program, giving priority evaluation points to projects included in WRIA plans, and updating grant guidance as needed to better support plan implementation.
  - Ecology considers watershed plan recommendations and investigates the feasibility of actions and recommendations where Ecology is identified as the lead.
  - Ecology reports to the legislature on the status of the watershed plan implementation in 2020 and 2027.
- **Squaxin Island Tribe**
  - The Squaxin Island Tribe supports and participates in implementation activities as staff capacity allows, including:
    - Participating in implementation group meetings.
    - Coordination between meetings, including:
      - Supporting project development and seeking project opportunities
      - Seeking and supporting funding opportunities to achieve implementation
      - Tracking implementation and identifying areas for improvement
- **Lewis County**
  - Lewis County adopts this watershed plan by resolution, formalizing our support of the plan contents.
  - This watershed plan becomes one of the guiding project implementation plans.
  - Lewis County supports and participates in implementation activities as staff capacity allows, including:
    - Participating in implementation group meetings.
    - Coordination between meetings, including:

        - Supporting project development and seeking project opportunities
        - Seeking and supporting funding opportunities to achieve implementation

- **Thurston County**

    - Thurston County will adopt this watershed plan by resolution, formalizing our support of the plan contents once the plan has been approved by Ecology.
    - This watershed plan will become one of the guiding documents for Thurston County community planning work, including implementation of the Comprehensive Plan and related plans.
    - Thurston County will evaluate the relationship of identified projects within the watershed plan with the Thurston County Capital Improvement Program, seeking potential for overlap in funding opportunities.
    - Thurston County supports and participates in implementation activities as staff capacity allows, including:
        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seeking project opportunities
            - Seeking and supporting funding opportunities to achieve implementation
            - Tracking implementation and identifying areas for improvement

- **Thurston PUD**
    - Thurston PUD supports and participates in implementation activities as staff capacity allows, including:
        - Participating in Implementation meetings
        - Communications with internal and external stakeholders
        - Support project development and management

- **Thurston Conservation District**

    - The Thurston Conservation District supports and participates in implementation activities as staff capacity allows, including:

        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seeking project opportunities
            - Seeking and supporting funding opportunities to achieve implementation

- **Building Industry Association of Washington (BIAW)**

    - BIAW supports and participates in implementation activities as staff capacity allows, including:
        - Participating in implementation group meetings.

    - Coordination between meetings, including:
        - Supporting project development and seeking project opportunities
        - Seeking and supporting funding opportunities to achieve implementation
        - Tracking implementation and identifying areas for improvement

- **City of Lacey**
    - The City of Lacey supports and participates in implementation activities as staff capacity allows, including:
        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seeking project opportunities
            - Seeking and supporting funding opportunities to achieve implementation
            - Tracking implementation and identifying areas for improvement
    - The City of Lacey adopts this watershed plan by resolution, formalizing our support of the plan contents.

- **City of Olympia**
    - The City of Olympia supports and participates in implementation activities as staff capacity allows, including:
        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seeking project opportunities
            - Seeking and supporting funding opportunities to achieve implementation
            - Tracking implementation and identifying areas for improvement
    - The City of Olympia participates on the Nisqually Watershed Council and intends to participate on the Deschutes Watershed Council when formally established.
    - The City of Olympia engages in regional water resource management activities when consistent with the City's authority and regulations, and jurisdictional interests, thereby providing support to other entities' efforts when appropriate.

- **City of Tumwater**
    - The City of Tumwater supports and participates in implementation activities as staff capacity allows, including:
        - Participating in implementation group meetings.
        - Coordination between meetings, including:
            - Supporting project development and seeking project opportunities
            - Seeking and supporting funding opportunities to achieve implementation
            - Tracking implementation and identifying areas for improvement
    - The City of Tumwater intends to participate on the Deschutes Watershed Council when formally established.

- The City of Tumwater engages in regional water resource management activities when consistent with the City's authority and regulations, and jurisdictional interests, thereby providing support to other entities' efforts when appropriate.

- **Deschutes Estuary Restoration Team (DERT)**
    - DERT supports and participates in implementation activities as staff capacity allows, including:
        - Inform other interested and affected environmental organizations in WRIA 13 of its provisions, and the extent to which the plan conforms to the letter and spirit of the legislation;
        - Advocate at the Legislature for authorization and funding for the Deschutes Watershed Council;
        - Participate in the activities of the Deschutes Watershed Council, including implementation of projects and policies contained in the Plan;
        - Advocate with Ecology for adoption of rule revisions for WRIA 13 if recommended in the Plan;
        - Advocate with Ecology and the Legislature for greater prioritization in Ecology's grant program for priority projects identified in the Plan;
        - Work with the Squaxin Tribe and other representatives to the WREC, to ensure better information and collaborative efforts for restoration of the watershed; and
        - Consistent with DERT's mission for the past ten years, and as a Puget Soundkeeper Affiliate, work for restoration of the Deschutes Estuary, and for improvement of both water quantity and water quality conditions in the Deschutes Watershed.

Appendix G – Subbasin Delineation Memo

The following technical memo was developed for the WRIA 13 Committee process. Therefore, final conclusions as presented in this plan may not align with the technical memo.

Technical Memorandum

To:	Angela Johnson (Ecology) Washington State Department of Ecology
From:	Chad Wiseman (HDR)
Copy:	
Date:	June 05, 2019
Subject:	WRIA 13 Subbasin Delineation Alternatives

1.0 Purpose and Background

RCW 90.94.030(3)(b) requires that Watershed Restoration and Enhancement plans (WRE plans)include actions to offset new consumptive use impacts associated with permit-exempt domestic water use. RCW 90.94.030(3)(b) states "The highest priority recommendations must include replacing the quantity of consumptive water use during the same time as the impact and in the same basin or tributary." Therefore, the WRIA 13 committee will work to identify projects to offset impacts from new permit-exempt domestic wells within the same subbasin. This memo is intended to summarize the rationale for the two subbasin delineations alternatives currently proposed and to inform the selection of a preferred alternative.

2.0 Initial Delineation

The WRIA 13 WRE committee defined a draft subbasin delineation. The initial data was provided by Thurston County based on Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) data. Members of the workgroup refined the delineations based on fish bearing streams of importance and other factors. The initial delineation had the following characteristics:

- The Deschutes River watershed was trisected into upper, middle, and lower subbasins. The lower subbasin generally corresponds to the cities of Lacey, Olympia, and Tumwater, and their urban growth areas (UGA). The middle subbasin is primarily rural residential areas and the City of Rainier. The upper subbasin is a mix of rural residential and forestland.
- Spurgeon Creek was defined as its own subbasin, because of its unique value to fish and its relatively cold water from groundwater contribution.
- McLane Creek was defined as its own subbasin, because of its unique value to fish. McLane Creek supports multiple salmonid species.
- The land surrounding Puget Sound in the northern portion of WRIA 13 was delineated into subbasins based on 1) direction of surface drainage to different inlets and 2) on the current level of development that is assumed to be correlated with the quality of localized stream health.
    - The Cooper Point peninsula was delineated into the "Eld Inlet" and "Budd Inlet West" subbasins.
    - The Boston Harbor peninsula was delineated into the "Budd Inlet East" and "Henderson West" subbasins.

- The Johnson Point peninsula was delineated into the “Henderson East” and “Nisqually Reach” subbasins. The “Henderson East” subbasin includes the Woodland Creek watershed.

3.0 Proposed Alternatives

During the May 21, 2019 WRIA 13 workgroup meeting, the Squaxin Island Tribe proposed two changes to the initial delineation. The proposed changes were to 1) modify the border between the lower and middle Deschutes subbasins, and to 2) delineate the Woodland Creek watershed as a separate subbasin. The workgroup decided not to modify the border between the lower and middle Deschutes subbasins. However, the workgroup agreed to delineate the Woodland Creek watershed as a separate subbasin. The rationale was that Woodland Creek is a relatively large watershed in WRIA 13, and the northern portion has development pressure that includes permit-exempt wells or connections. The workgroup also agreed to combine the remainder of “Henderson East” with “Nisqually Reach” subbasin, and re-name it “Johnson Point” because the development character of the remainder of “Henderson East” was similar to the “Nisqually Reach”. These changes to the initial delineation are reflected in the Alternative #1 delineation (Figure 1).

The workgroup also discussed combining the remaining inlet subbasins for the Boston Harbor and Cooper Point peninsulas, respectively. This potential change is reflected in the Alternative #2 delineation (Figure 1). Alternatives #1 and #2 may be compared in terms of the benefits of splitting (Alternative #1) or combining (Alternative #2) the Cooper Point and Boston Harbor peninsulas.

The benefits can be considered in terms of targeting stream management units with existing low flow limitations and closures for protection, protection of unique aquatic habitat or fish, hydrogeology, residential development potential, and overall WRE planning efficiency. These factors are briefly discussed and summarized in Table G-1.

Stream management units under Chapter 173-513 WAC include an unnamed stream draining to Eld Inlet, an unnamed stream draining to Gull Harbor, and Woodward Creek, draining to Woodward Bay. Protection of these stream management units may be more targeted under Alternative #1, because the subbasins that contain them are smaller. On the other hand, offset opportunities may still be targeted to be protective of these streams with larger subbasins under both Alternatives #1 and #2.

Stream and wetland habitat is likely to be similar on each respective peninsula, regardless of whether the waterbodies drain to Eld, Budd, or Henderson Inlets. Streams entering the inlets will have limited fish use and function as pocket estuaries. The stream habitat in the southern portions of each peninsula are more developed and therefore, the stream habitat is generally more degraded.

The hydrogeology of the Cooper Point and Boston Harbor peninsulas is complex and the impact of new permit-exempt domestic well consumptive use will be partly a function of well depth. The delineation of the peninsulas into separate subbasins (as in Alternative #1) does not necessarily reflect the groundwater flow direction divides that would be affected by new permit-exempt domestic well consumptive use.

Residential development potential, as defined by the Thurston Regional Planning Council (TRPC), is similar in the northern portions of the Cooper Point and Boston Harbor peninsulas, but varies in potential in the southern portions. The Cooper Point peninsula has a greater parcel density on the east side. Similarly, the Boston Harbor peninsula has a greater parcel density on the west side. This was part of the rationale for dividing the peninsulas into "east-west" subbasins, as represented by Alternative #1. There may be a benefit to this delineation, in terms of accounting for consumptive use and offsets separately in the more high-developed areas. However, if the subbasins were to be combined, as reflected in Alternative #2, the same distribution of offsets could be defined.

WRE planning would be slightly more efficient for Alternative #2, because there would be two fewer subbasins requiring accounting and evaluation, in terms of NEB.

Table G-1. Comparison of Alternatives.

Attribute	Alternative #1	Alternative #2
Stream Management Units	More spatially targeted	Less spatially targeted
Habitat/Fish	Similar habitat	Similar habitat
Hydrogeology	No clear benefit	No clear benefit
Development Potential	Some benefit	No clear benefit
WRE Efficiency (i.e. # of subbasins)	11 Subbasins	9 Subbasins

4.0 Final Delineation

Ultimately the WRIA 13 Committee agreed that the approach for Alternative #2 reflected the needs of the Committee, and chose to move forward with that delineation.

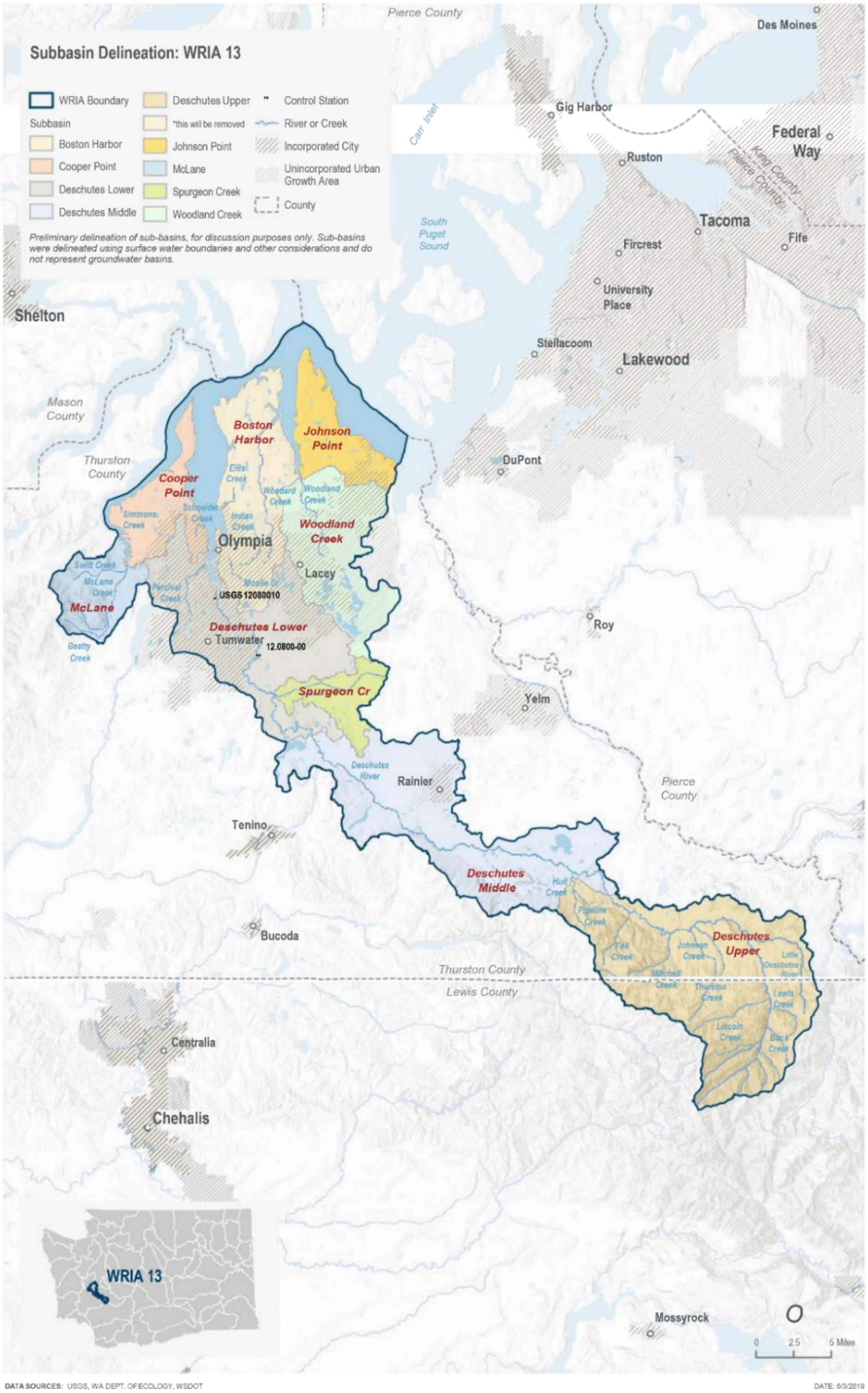

Figure 8. WRIA 13 Committee Subbasin Delineation

Appendix H –Permit-Exempt Growth and Consumptive Use Summary Technical Memo

The following technical memo was developed for the WRIA 13 Committee process. Therefore, final conclusions as presented in this plan may not align with the technical memo.

HDR

Technical Memorandum DRAFT

To:	Angela Johnson, Washington State Department of Ecology
From:	Chad Wiseman, HDR
Copy:	
Date:	July 14, 2020
Subject:	WRIA 13 Permit-Exempt Growth and Consumptive Use Summary (Work Assignment 2, Tasks 2 and 3)

1.0 Introduction

HDR is providing technical support to the Washington State Department of Ecology (Ecology) and the Watershed Restoration and Enhancement (WRE) committees for WRIA 13. This memorandum provides a summary of the analytical methods used for Work Assignment 2 Task 2: Consumptive Use (CU) Estimates, and the final estimates of CU per WRIA.

Under RCW 90.94, consumptive water use by permit-exempt connections occurring over the planning horizon must be estimated to establish the water use that watershed restoration plans and plan updates are required to address and offset. This memorandum summarizes permit-exempt connections and related CU of groundwater that is projected to impact WRIA 13 over the planning horizon.

This memorandum includes:

- A summary of WRIA 13 initial permit-exempt growth and an alternative scenario of permit-exempt growth.
- A summary of WRIA 13 initial and alternative scenario consumptive use using two different methods.

2.0 WRIA 13 Permit-Exempt Growth Projection Methods

Permit-exempt growth over the planning horizon was projected using methods at the county scale and then combined at the WRIA scale. Thurston County (working with the Thurston Regional Planning Council) provided methods and results for Thurston County. Note that Thurston County and Lewis County are both within WRIA 13; however, the Lewis County portion is entirely comprised of timberland and so was not included in the projection for new PE wells.

HDR worked with the WRIA 13 workgroup and WRIA 13 committee (the Committee) to define one alternative growth scenario that allowed for some permit-exempt growth in rural water system boundaries based on the proportion of parcels not currently served by their respective water system.

2.1 Thurston County Methods

The Thurston County initial permit-exempt growth projections were developed by the Thurston Regional Planning Council (TRPC) (Appendix A). The following is a summary of the TRPC methods:

1) Develop 20-year growth projections based on OFM medium population growth estimates, and conversion to dwelling units based on assumed people per dwelling unit (TRPC).
2) Develop residential capacity estimates (TRPC).
3) Allocate growth to parcels based on recent residential development and permit trends, where capacity is available (TRPC).
4) Once allocated, define permit-exempt connections based on the following criteria:
    a) Growth in rural areas, outside of water systems, is assumed to be permit-exempt growth.
    b) Growth in incorporated cities is assumed to connect to a municipal water system
    c) Water systems within UGAs; permit-exempt growth is assumed to occur on parcels with no sewer service.
    d) Rural water systems; assumed no new permit-exempt growth

An alternative permit-exempt growth projection scenario was developed by assuming that some permit-exempt growth will occur in the rural water system areas (i.e. water systems outside of the urban growth areas). It was assumed growth in each respective rural water system will be proportional to buildable parcels without water system hookups relative to parcels with water system hookups, which changes the assumption in 4b above.

The following methods were applied on top of the initial methods:

1. Define total buildable parcels in GIS, using Department of Health (DOH) service area polygons and county parcel data.
2. Define total approved water system connections (active + available) and active water system connections using the DOH Sentry database (DOH 2019).
3. Buildable parcels with water system hookup = total approved minus active water system connections.
4. Buildable parcels without water system hookup = total buildable parcels minus total approved water system connections.
5. Define proportion of projected permit-exempt growth within each water system by dividing the number of buildable parcels without water system hookups by the total number of buildable parcels.
6. Multiply the proportion of permit-exempt growth within each respective water system by total growth projected to occur in that water system.
7. Sum the additional permit-exempt growth by subbasin and add to the initial permit-exempt growth projection.

This alternative permit-exempt growth projection scenario was accepted by the Committee for consumptive use estimation.

The original permit-exempt growth projections were provided to Ecology and the Committee in 2019 (HDR 2019). In 2020, an error in the TRPC results was identified: 116 permit-exempt wells or connections were projected to occur in the Silver Hawk water system service area, when the water system had adequate connections to accommodate all predicted growth. Therefore, these connections were removed from the original projection (Appendix A). These results were organized by subbasin. The WRIA 13 Committee cited this as an example of uncertainty in the assumptions made in the analysis of where new PE wells are expected to occur.

3.0 WRIA 13 Consumptive Use Methods

Under RCW 90.94, consumptive water use (consumptive use) by permit-exempt connections that are forecast to be installed over the planning horizon must be estimated to establish the water offsets required under the Streamflow Restoration law. The following definitions from the *Final Guidance for Determining Net Ecological Benefit - ESSB 6091 - Recommendations for Water Use Estimates* (Ecology's Final NEB Guidance) are used in this memorandum as a guide to estimate consumptive water use by permit-exempt connections (Ecology 2019).

- Consumptive use: water that evaporates, transpires, is consumed by humans, or otherwise removed from an immediate water environment.
- Domestic Use: includes both indoor and outdoor household uses, and watering of a lawn and noncommercial garden.
- New Consumptive Water Use: The consumptive water use from the permit-exempt domestic groundwater withdrawals estimated to be initiated within the 20 year planning horizon (2018 – 2038) (planning horizon).
- Net Ecological Benefit: The outcome that is anticipated to occur through implementation of projects and actions in a plan to yield offsets that exceed impacts within: a) the planning horizon; and, b) the relevant WRIA boundary.
- Water Offsets: Projects that put water back into aquifers or streams that offset new consumptive water use. Ecology's Final NEB Guidance defines offset as the anticipated ability of a project or action to counterbalance some amount of the new consumptive water use over the next 20 years (2018-2038). Offsets need to continue beyond the 20-year period for as long as new well pumping continues (Ecology 2019).

Ecology has provided guidance for estimating indoor and outdoor consumptive water use in Ecology's Final NEB Guidance (Ecology 2019).

Consumptive use estimates are divided into two components: the indoor and outdoor portions of use. The use patterns and consumptive portions of indoor versus outdoor use associated with permit-exempt connections are different; therefore, separate approaches within each method that account for these differences are used to estimate consumptive use.

Ecology's indoor consumptive water use guidance includes literature-based assumptions on per-capita indoor water use and the consumptive proportion. Outdoor consumptive water use guidance includes methods for the estimation of irrigated area, assumed irrigation requirements, irrigation efficiency, and the consumptive proportion. Ecology's guidance also recommends local corroboration using water system meter data for both indoor and outdoor estimates (Ecology 2018; Ecology 2019). For purposes of this technical memorandum, Ecology's method for estimating consumptive use is called the Irrigated Area method, and estimation of consumptive use using local water system meter data is called the Water System Data method.

Consistent with the Final NEB guidance, the Committee assumed impacts from consumptive use on surface water are steady-state, meaning impacts to the stream from pumping groundwater do not change over time. This assumption is based on the wide distribution of future well locations and depths across varying hydrogeological conditions.

Consumptive use of water from projected permit-exempt connection growth was estimated using two different methods; 1) the Irrigated Area Method and 2) the Water System data Method.

3.1 Methods for Indoor and Outdoor Consumptive Use Estimates

Based on Ecology's Final NEB Guidance (Ecology 2019), estimating indoor and outdoor consumptive water use included literature-based assumptions for both the per capita indoor water use and indoor and outdoor use proportions.

3.1.1 Per Capita Indoor Consumptive Use

The following assumptions were used to estimate indoor consumptive water use by occupants of a dwelling unit (Ecology 2018; 2019):

- 60 gallons per day per person within a household
- 2.5 persons per household (or as otherwise defined by the Counties)
- 10 percent of indoor use is consumptively used

Most homes served by a permit-exempt connection use septic systems for wastewater (Ecology 2019). This method assumes 10 percent of water entering the septic system will evaporate out of the septic drain field and the rest will be returned to the groundwater system.

Assuming that there is one permit-exempt connection per dwelling unit, a "per permit-exempt connection" consumptive use factor was applied to the growth projections forecast in each subbasin to determine total indoor consumptive use per subbasin. This method is summarized by the following equation:

HCIWU (AFY) = 60 gpd x 2.5 people per household x 365 days x 10% CUF

or

$$HCIWU\ (afy) = 60gpd * 2.5\ people\ per\ house * 365\ days * 0.00000307\ AF/gallon * 10\%\ CUF$$

Where:
HCIWU = Household Consumptive Indoor Water Use (gpd)
CUF= Consumptive use factor

This estimate of indoor consumptive water use per household is 15 gpd and can be annualized and converted to acre-feet per year (AFY) or cubic feet per second (cfs).

3.1.2 Outdoor Consumptive Use – Irrigated Area Method

Ecology (2018; 2019) recommends estimating future outdoor water use based on an evaluation of the average outdoor irrigated area for existing dwelling units served by permit-exempt connections. To calculate the consumptive portion of total outdoor water required per connection, Ecology recommends:

- Estimating the average irrigated lawn area (pasture/turf grass) per parcel,
- Applying crop irrigation requirements,
- Correcting for application efficiency (75 percent efficiency recommended by Ecology guidance) to determine the total outdoor water required over a single growing season, and
- Applying a percentage of outdoor water that is assumed to be consumptive. This method assumes 80 percent of outdoor domestic water use is consumed by evaporation and transpiration.

Future outdoor water use may be based, in part, on an estimate of the average outdoor irrigated area for existing homes served by PE domestic wells (Ecology 2018; 2019). HDR estimated the average irrigated lawn area for WRIA 13 by delineating the apparent irrigated area in 80 parcels identified as containing a dwelling unit served by a permit-exempt well in WRIA 13, and averaging them (Appendix B). The irrigated areas were delineated using one technician and a standard method. The average irrigated area per PE connection in WRIA 13 was estimated to be 0.06 acres. The majority of the parcels evaluated did not have an apparent irrigated area (i.e. most parcels had zero irrigated area).

Bias in the irrigated area delineation methods was evaluated by doing a side-by-side comparison study with another consulting form, who was providing similar technical support for the WRIAs 7, 8, and 9 WRE plans (Appendix C). This comparability study concluded that there was no inherent bias in the methods. Overall method bias was also evaluated by comparing the CU calculated with this irrigated area method to specific parcels with meter records (Appendix D). The irrigated area method overestimated overall water use, relative to the actual metered use.

Because of the high proportion of zero irrigated acreage measurements contributing to the 0.06 irrigated acreage average, and because of the large variability in the results (e.g. large standard deviation), HDR proposed a range of alternatives to mitigate that uncertainty:

- To account for uncertainty of detecting small areas of irrigation, the Committee could impute the zero values with a “minimum detection” irrigated area of 0.05 aces – which would result in a 0.10 acre average irrigated area size.
- HDR completed an irrigated area comparability study (Attachment C) for the irrigated area parcel analysis, and determined that an additional way to account for uncertainty in “human error” could be done using a “correction factor” – which would result in a 0.09 acre average irrigated area size.
- HDR has completed a statistical analysis of their data, and has determined that using the 95% Upper Confidence Limit of the data (based on initial analysis with 0 values) could be an additional way to account for uncertainty – which would result in a 0.12 acre average irrigated area size.

The Committee decided to move forward with all three of these alternatives as “working numbers”. Consumptive use based on all three acreages were evaluated and compared to the consumptive use calculated from the Water System Data Method. Later, the Committee agreed to include the consumptive use estimate based on the 0.10 acre average irrigated area as the “most likely” estimate, and the consumptive use estimate based on the 0.12 acre average irrigated area as a higher goal to achieve through adaptive management.

Crop irrigation requirements, irrigation efficiency and outdoor use assumptions were also made to estimate outdoor CU. An average crop irrigation requirement of 16.8 inches per year was estimated for pasture/turf grass from nearby stations as provided in the Washington Irrigation Guide, Appendix B (NRCS-USDA, 1997). Irrigation application efficiency (i.e. the percent of water used that actually reaches the turf) was assumed to be 75%, consistent with Ecology (2018; 2019) recommendations. Finally, the consumptive portion of total amount of water used for outdoor use was assumed to be 80 percent. The Committee chose not to modify the irrigation efficiency or indoor and outdoor consumptive factors used in the Irrigation Area Method.

This method is summarized in the following equation:

$$HCOWU\ (afy) = A\ (acres) * \ IR(feet) * \ AE * \ CUF$$

Where:

HCOWU = Household Consumptive Outdoor Water Use (gpd)
A = Irrigated Area (acres)
IR = Irrigation Requirement over one irrigation season (feet)
AE = Application efficiency; assumed to be 75% (factor expressed as 1/0.75)
CUF= Consumptive use factor; assumed to be 80% (factor expressed as 0.80)

This estimate of outdoor consumptive water use per household per day can be annualized and converted to gallons per minute (gpm) or cubic feet per second (cfs).

Conversion Factors:

gpm = AFY * 0.61996

cfs = AFY * 0.00138128

This estimate of outdoor consumptive use per household per day is 0.15 AFY (assuming average irrigated area of 0.09 acres), 0.17 AFY (assuming average irrigated area of 0.10 acres) and 0.20 AFY (assuming average irrigated area of 0.12 acres) and can be annualized and converted to acre-feet per year or cubic feet per second.

Seasonal consumptive use was estimated on a monthly basis by allocating total outdoor consumptive use proportional to the monthly irrigation requirement. The monthly irrigation requirement was defined by the Washington Irrigation Guidance.

4.0 Water System Data Method

Consumptive use by permit-exempt connections may also be estimated using metered connections from water systems. Water systems required to plan per WAC 246-290 must install meters on all customer connections. Smaller water systems that do not have state planning requirements may choose to meter their customer connections if the system bills based on a tiered rate structure (i.e., increasing costs per unit of water consumed coincident with higher total use in the billing period).

Some systems bill customers a flat rate (i.e., same bill every month regardless of consumption). The lack of a tiered rate structure reduces the financial incentive to conserve water, which may result in consumption patterns more similar to those observed on a permit-exempt connection. These systems may or may not choose to meter their customers if meters are not required by law. In WRIA 13, the Thurston PUD provided data for the Prairie Ridge water system from 2007 – 2010, which billed at a flat rate during that time period.

4.1 Indoor Use

Average daily use in December, January, and February is representative of year-round daily indoor use. Average daily system-wide use is divided by the number of permit-exempt connections (assuming all connections are residential), to determine average daily indoor use per permit-exempt connection. Similar to that used in the Ecology Irrigated Area method, a 10 percent consumptive use factor was applied to the average daily use in the winter months to determine the consumptive portion of indoor water use per connection.

4.2 Annual Outdoor Water Use

Average daily indoor use was multiplied by the number of days in a year to estimate total annual indoor use. Total annual indoor use was then subtracted from total annual use by a water system to estimate total annual outdoor use. Similar to that used in the Ecology Irrigated Area Method, an 80 percent consumptive factor was applied to determine the consumptive portion of outdoor use.

4.3 Seasonal Outdoor Water Use

Outdoor consumptive use was also estimated on a seasonal basis. The Washington Irrigation Guide reports irrigation requirements between the months of April and September for representative weather stations in WRIA 13, therefore seasonal outdoor water use was assumed to occur over a period of six months (April through September). Average daily indoor use was multiplied by the number of days in the irrigation season to calculate total indoor use for the irrigation season. Total irrigation season indoor use was then subtracted from total season use to determine total outdoor use for the irrigation season. The value was proportionally allocated to each month in the irrigation season using the requirements from the Washington Irrigation Guide. An 80 percent consumptive factor was applied to determine the consumptive portion of outdoor use.

5.0 Results

5.1 Permit-Exempt Connection Growth

Initial permit-exempt connection growth is projected to be 2,309 connections (Table H-1). The alternative Revised Permit-Exempt Connection Growth scenario is projected to have 307 additional connections, for a total of 2,616 permit-exempt connections. Permit-exempt connection growth is expected to be greatest in the "Deschutes Middle" subbasin. The Revised Permit-Exempt Connection Growth scenario was selected by the Committee for use in consumptive use estimates.

Table H-1. WRIA 13 Alternative Growth Projection Scenarios.

Subbasin	Initial Growth Estimate	Revised Growth Estimate Including Water System Service Areas
Boston Harbor	236	296
Cooper Point	171	232
Deschutes Lower	341	379
Deschutes Middle	715	734
Deschutes Upper	29	30
Johnson Point	412	520
McLane	163	165
Spurgeon Creek	88	92
Woodland Creek	154	168
Totals	2309	2616

5.2 Consumptive Use

The WRIA-wide consumptive use estimates using the Irrigated area method were 0.55 cfs (average irrigated area of 0.09 acres), 0.60 cfs (average irrigated area of 0.10 acres), and 0.71 cfs (average irrigated area of 0.12 acres) (Tables H-2 – H-4).

The water system data analysis for WRIA 13 was conducted using consumption data averaged between years 2007 – 2010 from the Prairie Ridge Water System, managed by the Thurston PUD. Consumptive use was projected to be 0.64 cfs (Tables H-2 – H-4). The Prairie Ridge Water System charges a flat rate for water service and services homes with large lawns that customers heavily irrigate. While some households on permit-exempt connections may exhibit this type of behavior, several members of the Committee have expressed concern that this may not be representative of the "average" household on a permit-exempt connection.

Estimates of consumptive use using the Irrigated Area method are greater than or less than the water system data estimates, depending on the assumed average irrigated area. The Committee selected the irrigated area method for a consumptive use estimate.

Table H-2. Annualized Average Outdoor Consumptive Use Estimates for WRIA 13 (20-year planning horizon) – 0.09 acres average irrigated area (correction factor).[5]

Subbasin	Projected No. Permit-exempt Connection	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: Irrigated Area Estimate (per Ecology Guidance)		
		AFY	GPM	CFS	AFY	GPM	CFS
Boston Harbor	296	52	32	0.07	45	28	0.06
Cooper Point	232	41	25	0.06	35	22	0.05
Deschutes Lower	379	67	41	0.09	57	36	0.08
Deschutes Middle	734	129	80	0.18	111	69	0.15
Deschutes Upper	30	5	3	0.01	5	3	0.01
Johnson Point	520	92	57	0.13	79	49	0.11
McLane	165	29	18	0.04	25	15	0.03
Spurgeon Creek	92	16	10	0.02	14	9	0.02
Woodland Creek	168	30	18	0.04	25	16	0.04
Totals	2616	461	286	0.64	396	245	0.55

[5] Outdoor consumptive water use estimates were rounded to the nearest whole number.

Table H-3. Annualized Average Outdoor Consumptive Use Estimates for WRIA 13 (20 year planning horizon) – 0.10 acres average irrigated area (minimum detection value of 0.05 irrigated acres).[6]

Subbasin	Projected No. Permit-exempt Connection	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: Irrigated Area Estimate (per Ecology Guidance)		
		AFY	GPM	CFS	AFY	GPM	CFS
Boston Harbor	296	52	32	0.07	49	30	0.07
Cooper Point	232	41	25	0.06	39	24	0.05
Deschutes Lower	379	67	41	0.09	63	39	0.09
Deschutes Middle	734	129	80	0.18	122	76	0.17
Deschutes Upper	30	5	3	0.01	5	3	0.01
Johnson Point	520	92	57	0.13	86	54	0.12
McLane	165	29	18	0.04	27	17	0.04
Spurgeon Creek	92	16	10	0.02	15	9	0.02
Woodland Creek	168	30	18	0.04	28	17	0.04
Totals	2616	461	286	0.64	435	269	0.60

[6] Outdoor consumptive water use estimates were rounded to the nearest whole number.

Table H-4. Annualized Average Outdoor Consumptive Use Estimates for WRIA 13 (20 year planning horizon) – 0.12 acres average irrigated area 95% Upper Confidence Limit).[7]

Subbasin	Projected No. Permit-exempt Connection	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: Irrigated Area Estimate (per Ecology Guidance)		
		AFY	GPM	CFS	AFY	GPM	CFS
Boston Harbor	296	52	32	0.07	58	36	0.08
Cooper Point	232	41	25	0.06	45	28	0.06
Deschutes Lower	379	67	41	0.09	74	46	0.10
Deschutes Middle	734	129	80	0.18	144	89	0.20
Deschutes Upper	30	5	3	0.01	6	4	0.01
Johnson Point	520	92	57	0.13	102	63	0.14
McLane	165	29	18	0.04	32	20	0.04
Spurgeon Creek	92	16	10	0.02	18	11	0.02
Woodland Creek	168	30	18	0.04	33	20	0.05
Totals	2616	461	286	0.64	513	318	0.71

[7] Outdoor consumptive water use estimates were rounded to the nearest whole number.

6.0 Seasonal Use

Monthly outdoor water use was calculated as part of the consumptive use analysis for the Irrigated Area method. Seasonal water use by month is reported by subbasin and consumptive use scenario (Tables H-5 – H-7). The month of July has the highest irrigation requirement, resulting in the highest monthly consumptive use impact. This information may be used when evaluating projects designed to offset subbasin- and season-specific impacts.

Table H-5: WRIA 13, Monthly Outdoor Consumptive Water Use (CFS) - 0.09 acres average irrigated area (correction factor)

Subbasin	Projected No. Permit-exempt Connections	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Boston Harbor	296	0.0028	0.0028	0.0028	0.0243	0.0956	0.1390	0.1983	0.1385	0.0764	0.0028	0.0028	0.0028
Cooper Point	232	0.0022	0.0022	0.0022	0.0190	0.0749	0.1089	0.1555	0.1086	0.0598	0.0022	0.0022	0.0022
Deschutes Lower	379	0.0035	0.0035	0.0035	0.0311	0.1224	0.1779	0.2539	0.1774	0.0978	0.0035	0.0035	0.0035
Deschutes Middle	734	0.0068	0.0068	0.0068	0.0603	0.2371	0.3446	0.4918	0.3435	0.1893	0.0068	0.0068	0.0068
Deschutes Upper	30	0.0003	0.0003	0.0003	0.0025	0.0097	0.0141	0.0201	0.0140	0.0077	0.0003	0.0003	0.0003
Johnson Point	520	0.0048	0.0048	0.0048	0.0427	0.1680	0.2441	0.3484	0.2433	0.1341	0.0048	0.0048	0.0048
McLane	165	0.0015	0.0015	0.0015	0.0135	0.0533	0.0775	0.1106	0.0772	0.0426	0.0015	0.0015	0.0015
Spurgeon Creek	92	0.0009	0.0009	0.0009	0.0076	0.0297	0.0432	0.0616	0.0431	0.0237	0.0009	0.0009	0.0009
Woodland Creek	168	0.0016	0.0016	0.0016	0.0138	0.0543	0.0789	0.1126	0.0786	0.0433	0.0016	0.0016	0.0016
Totals	**2,616**	**0.02**	**0.02**	**0.02**	**0.21**	**0.85**	**1.23**	**1.75**	**1.22**	**0.67**	**0.02**	**0.02**	**0.02**

Table H-6: WRIA 13 Monthly Outdoor Consumptive Water Use (CFS) – 0.10 acres average irrigated area (minimum detection value of 0.05 irrigated acres)

Subbasin	Projected No. Permit-exempt Connections	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Boston Harbor	296	0.0028	0.0028	0.0028	0.0267	0.1059	0.1541	0.2201	0.1536	0.0845	0.0028	0.0028	0.0028
Cooper Point	232	0.0022	0.0022	0.0022	0.0209	0.0830	0.1208	0.1725	0.1204	0.0663	0.0022	0.0022	0.0022
Deschutes Lower	379	0.0035	0.0035	0.0035	0.0342	0.1357	0.1973	0.2818	0.1967	0.1082	0.0035	0.0035	0.0035
Deschutes Middle	734	0.0068	0.0068	0.0068	0.0662	0.2627	0.3822	0.5457	0.3809	0.2096	0.0068	0.0068	0.0068
Deschutes Upper	30	0.0003	0.0003	0.0003	0.0027	0.0107	0.0156	0.0223	0.0156	0.0086	0.0003	0.0003	0.0003
Johnson Point	520	0.0048	0.0048	0.0048	0.0469	0.1861	0.2707	0.3866	0.2698	0.1485	0.0048	0.0048	0.0048
McLane	165	0.0015	0.0015	0.0015	0.0149	0.0591	0.0859	0.1227	0.0856	0.0471	0.0015	0.0015	0.0015
Spurgeon Creek	92	0.0009	0.0009	0.0009	0.0083	0.0329	0.0479	0.0684	0.0477	0.0263	0.0009	0.0009	0.0009
Woodland Creek	168	0.0016	0.0016	0.0016	0.0152	0.0601	0.0875	0.1249	0.0872	0.0480	0.0016	0.0016	0.0016
Totals	**2,616**	**0.02**	**0.02**	**0.02**	**0.24**	**0.94**	**1.36**	**1.94**	**1.36**	**0.75**	**0.02**	**0.02**	**0.02**

Table H-7: WRIA 13 Monthly Outdoor Consumptive Water Use (CFS) - 0.12 acres average irrigated area 95% Upper Confidence Limit)

Subbasin	Projected No. Permit-exempt Connections	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Boston Harbor	296	0.0028	0.0028	0.0028	0.0315	0.1266	0.1844	0.2635	0.1838	0.1009	0.0028	0.0028	0.0028
Cooper Point	232	0.0022	0.0022	0.0022	0.0247	0.0992	0.1445	0.2065	0.1440	0.0791	0.0022	0.0022	0.0022
Deschutes Lower	379	0.0035	0.0035	0.0035	0.0403	0.1621	0.2361	0.3374	0.2353	0.1292	0.0035	0.0035	0.0035
Deschutes Middle	734	0.0068	0.0068	0.0068	0.0781	0.3139	0.4572	0.6535	0.4557	0.2502	0.0068	0.0068	0.0068
Deschutes Upper	30	0.0003	0.0003	0.0003	0.0032	0.0128	0.0187	0.0267	0.0186	0.0102	0.0003	0.0003	0.0003
Johnson Point	520	0.0048	0.0048	0.0048	0.0553	0.2224	0.3239	0.4630	0.3228	0.1772	0.0048	0.0048	0.0048
McLane	165	0.0015	0.0015	0.0015	0.0176	0.0706	0.1028	0.1469	0.1024	0.0562	0.0015	0.0015	0.0015
Spurgeon Creek	92	0.0009	0.0009	0.0009	0.0098	0.0393	0.0573	0.0819	0.0571	0.0314	0.0009	0.0009	0.0009
Woodland Creek	168	0.0016	0.0016	0.0016	0.0179	0.0718	0.1047	0.1496	0.1043	0.0573	0.0016	0.0016	0.0016
Totals	**2,616**	**0.02**	**0.02**	**0.02**	**0.28**	**1.12**	**1.63**	**2.33**	**1.62**	**0.89**	**0.02**	**0.02**	**0.02**

7.0 References

Ecology. 2018. *Recommendations for Water Use Estimates*. Washington State Department of Ecology, Publication 18-11-007.

Ecology. 2019. Final Guidance for Determining Net Ecological Benefit. Washington State Department of Ecology, Publication 19-11-079.

Natural Resource Conservation Service, 1997. Washington Irrigation Guide (WAIG). U.S. Department of Agriculture.

Attachment A

Estimation of Average Irrigated Area

Methods

1. 80 parcels representing an existing dwelling served by a permit-exempt well or connection was defined.
    a. A pool of parcels with an existing dwelling served by a permit-exempt well or connection was defined.
    b. The selection pool was classified by property value. The classes were 1) Under $350,000, 2) $350,000 – $600,000, and 3) over $600,000.
    c. 80 parcels were randomly drawn from the selection pool, weighted by the proportion of property value class membership.
    d. Additional parcels were randomly selected as alternates, in case any of the primary (80) samples were able to be interpreted to irrigated area.
    e. All parcels were provided in a Google Earth .kmz file.
2. The irrigated area in each parcel was delineated according to the following procedure:
    a. Used a single technician to minimize operator variability.
    b. Irrigated area delineations were made using Google Earth aerial imagery taken during drier summer months (i.e., July and August). Unirrigated lawns (pasture/turf) go dormant in the dry summer months and turn brown. As such, areas that remain green in the summer imagery were considered irrigated.
    c. Aerial imagery from winter months was reviewed alongside summer imagery to reveal which lawn areas change from green to brown. Those areas that do not change color, or moderately change color but remain green, were considered irrigated.
    d. If available, multiple years of aerial imagery were used to corroborate the irrigated area delineation.
    e. Landscaped shrub/flower bed areas within a larger irrigated footprint were included. Shrub and flower bed areas outside of the irrigated footprint were excluded.
    f. If the irrigated area extended beyond the parcel boundary, those areas were included.
    g. Parcels with no visible signs of irrigation were assumed to have zero irrigated acres.
    h. Areas that appeared to be native forest or unmaintained grass were not included in the irrigated footprint.

i. Parcels with homes or ADUs under construction in the most recent Google Earth imagery were excluded from the analysis, and an alternate parcel was evaluated.

Figures H-1 through H-4 illustrate some example delineations.

Figure H-1. No irrigated areas visible in most recent google earth aerial imagery.

Figure H-2. Area in white includes maintained grass. Residence constructed between June 2017 and July 2018. Therefore, historical irrigation of property is unavailable in GoogleEarth imagery

Figure H-3. Irrigated area includes landscaped area in driveway, maintained yard around residence, garden area, and maintained grass near garden area.

Figure H-4. No irrigated area. Assumption that green vegetation on southern portion of parcel is due to proximity to Spurgeon Creek since clear delineation of irrigated area is not present on aerial. Green area near residence appears to be tree and shrubs, not maintained landscaping and is excluded.

Results

Eighty parcels were evaluated for irrigated acreage (Figure H-5). Average irrigated acreage was 0.15 acres (Table H-8). In all WRIAs evaluated, most of the parcels had zero irrigated acres (Figure H-6). The distribution of irrigated acreages for all WRIAs were skewed, because of the large percentage of parcels that had zero irrigated acres. Some parcels had an irrigated area nearly an order of magnitude larger than the mean, resulting in a large standard deviation. The 95% upper confidence limit of the mean could only be fit with a non-parametric distribution and was about two times the quantity of the calculated arithmetic mean.

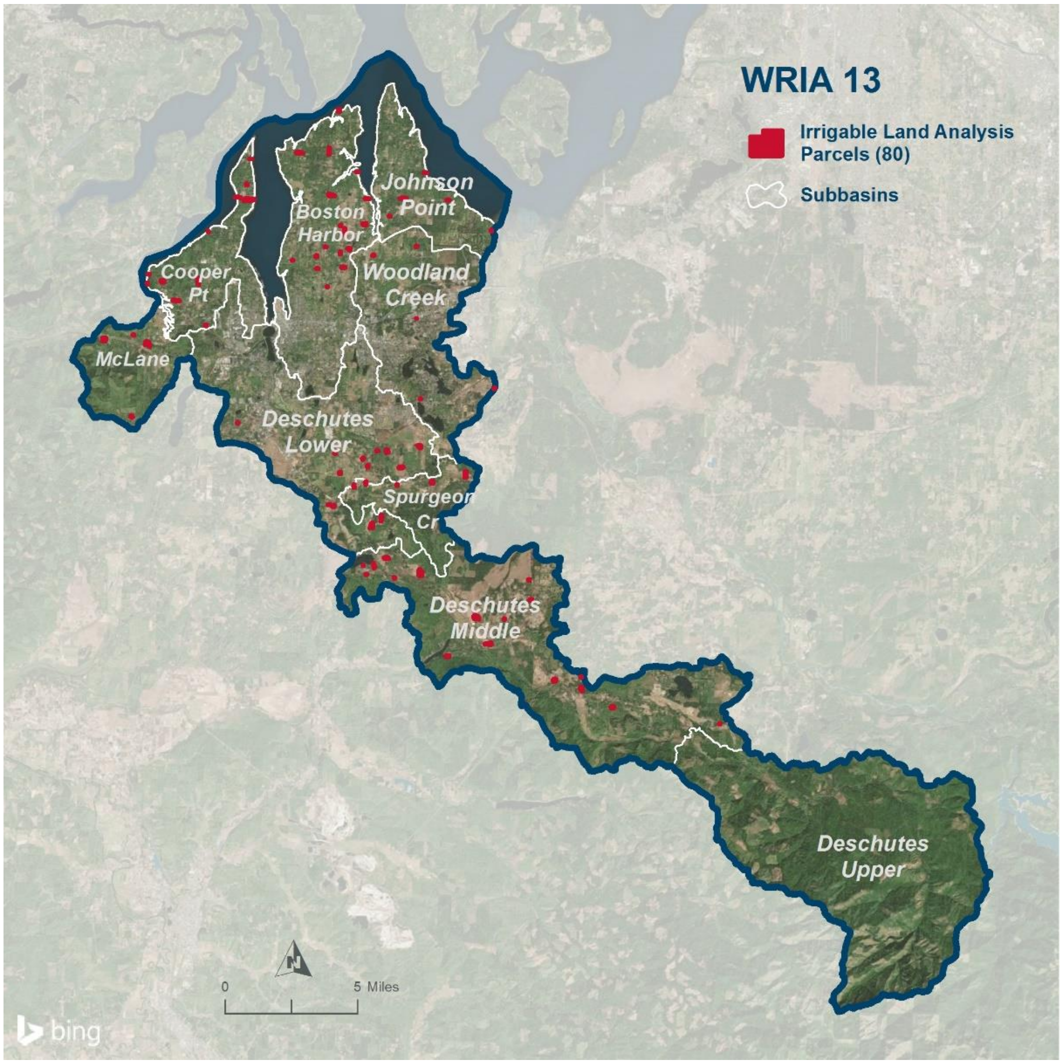

Figure H-5. Parcels selected in WRIA 13 with existing PE connections that were delineated for apparent irrigated areas.

Table H-8. Irrigated acreage delineation results.

Statistic	WRIA 13
PE Parcel Sample Pool	7,271
Sample Size	80
Mean (acres)	0.06
Mean with 0.05 minimum acreage (acres)	0.10
Standard Deviation (acres)	0.12
95% UCL (acres)	0.12

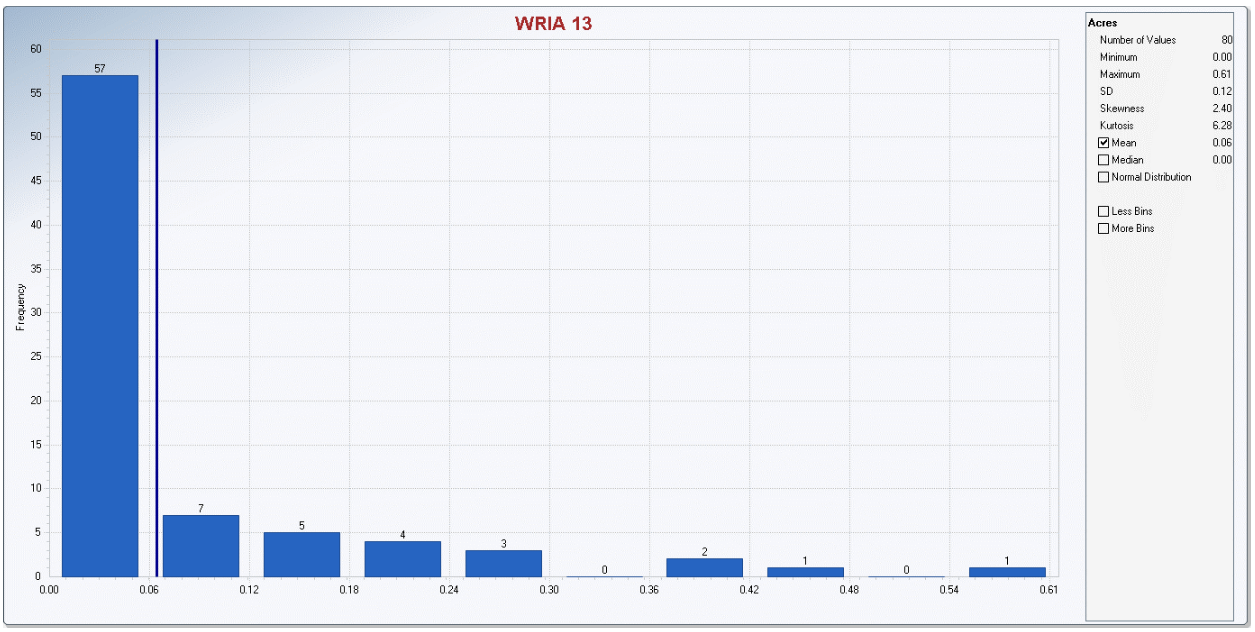

Figure H-6. Histogram of WRIA 13 irrigated acreage delineation results

Attachment C

Consumptive Use Corroboration Analysis

Thurston, Mason, and Kitsap PUDs provided water consumption data for several systems with a small number of connections. These systems were analyzed using both consumptive use estimation methods. All parcels in each system were analyzed for irrigated area, providing a direct comparison between the water estimated using the Irrigated Area method and the actual measured consumption by the water system. Tables H-6a-d contain the results of the corroboration analysis.

Tables H-9a-d: Annual and Seasonal Consumptive Use Corroboration Analysis

WRIA 12 Whiskey Hollow	Water System Data	Irrigated Area Method	% Difference
Annual Consumptive Use	53.6	181.1	238
Summer Consumptive Use	85.8	346.3	304
Winter Consumptive Use	11.2	15.0	34

WRIA 14 Canyonwood Beach	Water System Data	Irrigated Area Method	% Difference
Annual Consumptive Use	29.3	86.4	195
Summer Consumptive Use	51.2	157.4	207
Winter Consumptive Use	7.2	15.0	107

WRIA 13 Rich Road	Water System Data	Irrigated Area Method	% Difference
Annual Consumptive Use	52.6	113.2	115
Summer Consumptive Use	86.8	210.8	143
Winter Consumptive Use	7.3	15.0	107

WRIA 13 Echo Valley	Water System Data	Irrigated Area Method	% Difference
Annual Consumptive Use	76.7	75.5	-2
Summer Consumptive Use	137.9	135.7	-2
Winter Consumptive Use	15.2	15.0	-1

[1]Change in consumptive use from the Water System Data method to the Irrigated Area method.

The Irrigated Area method estimated consumptive use values at least double those estimated from the Water System Data method in WRIAs 12, 13, and 14. This is true for both indoor and outdoor use. The exception is winter consumptive use in the Whiskey Hollow system, which suggests that customers purchasing water from Whiskey Hollow use indoor water at a rate similar to that assumed in the Irrigated Area method (i.e., 60 gpd per person). The Echo Valley system in WRIA 15 has a slight decrease in estimated consumptive use in the Irrigated Area method compared to the Water System Data method. Customers in this system may heavily irrigate their lawns, or the estimate of total irrigated area in the system may be biased low. No small water system data were provided in WRIA 10.

Appendix I – Detailed Project Descriptions

The following project descriptions were developed based on information provided to Ecology prior to December 2021.

Donnelly Drive Infiltration Galleries Project

Project Name

Donnelly Drive Infiltration Galleries Project

WRIA 13 WRE Subbasin

Deschutes Lower subbasin

Water Offset

13.82 acre-feet (AF) per year

Project Status

Portions of Donnelly Drive SE, and Normandy Drive SE in Thurston County, Washington flood during major rainfalls, which impacts public property and reduces public safety. Thurston County Roads Maintenance has routinely responded to calls from residents for assistance. The Donnelly Drive Infiltration Gallery Project is in the preliminary design phase and proposes to install treatment devices and infiltration systems in the Donnelly Drive vicinity to reduce flooding of public streets and promote infiltration to groundwater.

This project is described in detail in a Technical Memorandum by HDR (2020), which is available in Appendix J and has been excerpted to form portions of this project description.

Narrative Description

There are five locations in the within the Donnelly Drive project area that historically have experienced flooding during precipitation events. These locations are shown in Figure 1. Each of these locations is a topographic low where an existing drywell is located to infiltrate stormwater.

As part of their project analysis, HDR (2020) conducted the following:

- A site visit to observe drywell performance during a precipitation event.
- A basin delineation to determine the contributing drainage area to each flooding location.
- Modeling, using Western Washington Hydrology Model (WWHM), for the purpose of: (1) sizing infiltration galleries that will address flooding issues and increase shallow groundwater recharge; and (2) estimating the post-construction increase in annual infiltration relative to existing conditions.

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

HDR (2020) used WWHM to estimate the increase in infiltration/groundwater recharge to the shallow aquifer system that will result from project implementation. Results are summarized in Table I-1. HDR (2020) estimates that, under existing conditions, existing project stormwater management facilities infiltrate an average of 5.53 AF per year. With galleries sized to infiltrate all but the largest storms, the increase in infiltration volume is 13.78 AF per year. With galleries sized for 100 percent infiltration, the increase in infiltration volume is 13.82 AF per year.

Table I-1. Stormwater infiltration volume (HDR, 2020)

Scenario	Annual Average Infiltrated Volume (AFY)	Increase in Annual Average Infiltrated Volume Relative to Existing Conditions (AFY)
Existing conditions	5.53	0
Galleries sized to infiltrate all but the two largest storms	19.31	13.78
Galleries sized for 100% infiltration	19.35	13.82

Conceptual-level map and drawings of the project and location.

Five locations within the Donnelly Drive Infiltration Galleries Project historically have flooded and will be retrofit with stormwater infiltration facilities as components of this project. These locations are presented in Figure 9.

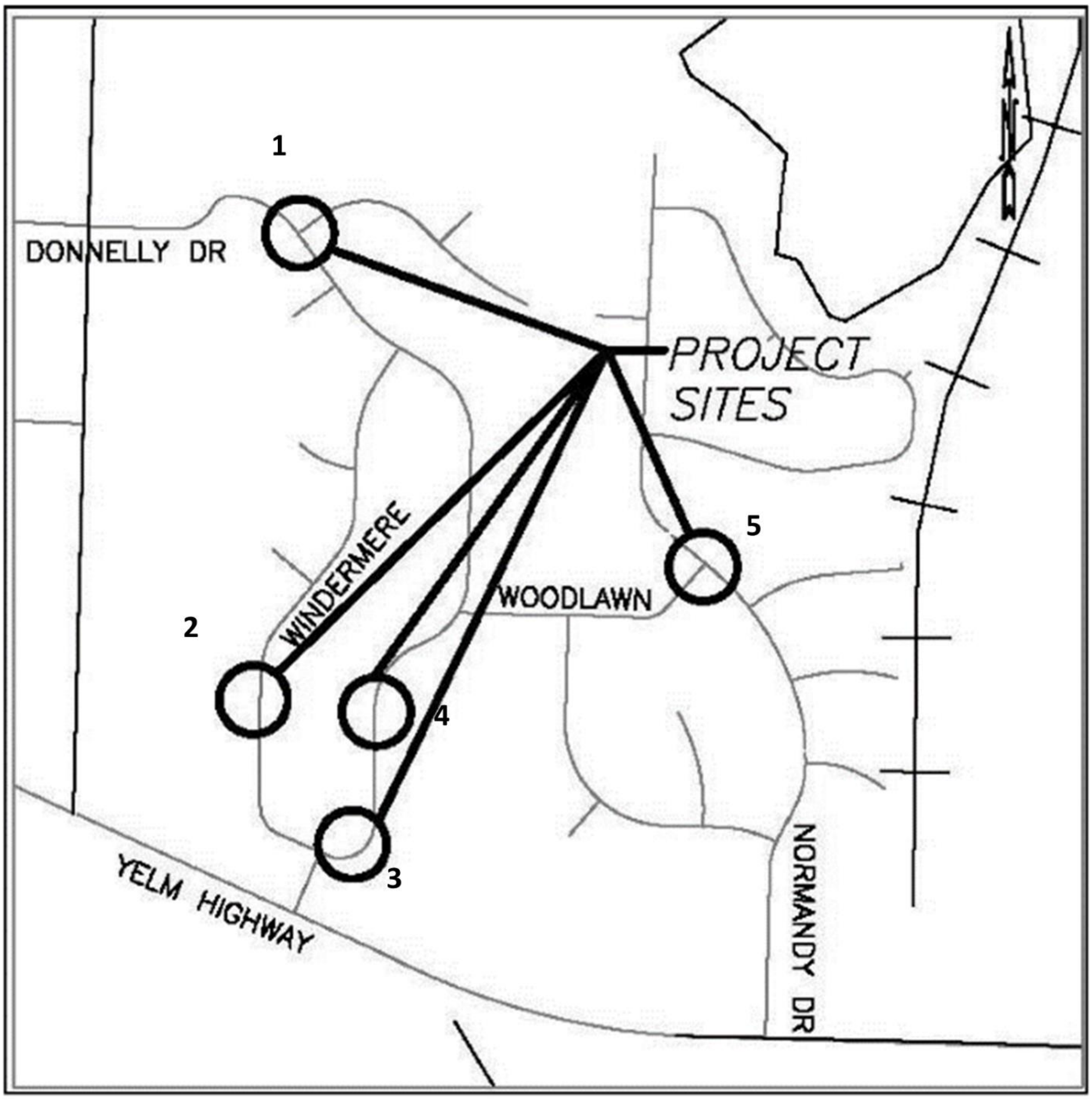

Figure I-1. Historic flooding locations (HDR, 2020).

Description of the anticipated spatial distribution of likely benefits.

Groundwater recharge associated with enhanced infiltration of stormwater within the Donnelly Drive Infiltration Galleries Project area will increase groundwater storage in the shallow aquifer system under planned project sites and, potentially, associated groundwater discharge to streams in hydraulic connection with the shallow aquifer system.

Performance goals and measures.

The project's performance goal is to increase infiltration to the shallow aquifer system underlying Donnelly Drive Infiltration Galleries Project locations. A project performance measure will be the length of installed infiltration gallery. A second performance measure will be an increase in streamflow in adjacent streams, such as the Deschutes River, which could be estimated by the analytical code STRMDEPL08 or equivalent.

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

The Deschutes River is inhabited by numerous fish species tracked by the Washington State Department of Fish and Wildlife (WDFW 2021), which include winter Chum Salmon, fall Chum Salmon, fall Chinook Salmon, Coho Salmon, winter steelhead, and resident Coastal Cutthroat.

In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 13 (NOAA 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions.

Increased streamflow and associated reduced water temperatures will primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This will improve the survival of juveniles. Addressing the streamflow limiting factor and improving habitat conditions 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 is in alignment with the goals of the Streamflow Restoration Act. Infiltration projects are a project type that potentially could address new consumptive water use and achievement of net ecological benefit (NEB).

Barriers to implementation could include applicability of enhanced infiltration to areas with poor infiltration characteristics and procurement of funding for the stormwater retrofits.

Potential budget and O&M costs.

HDR (2020) provided estimates for implementation of the Donnelly Drive Infiltration Galleries Project. HDR assumed a construction cost of $684 per foot installed infiltration gallery, with additional costs related to geotechnical design, engineering, administrative costs, permitting, and contingency. Costs are provided for the following three scenarios related to the assumed infiltration rate of site soils.

- 0.25 inches per hour (iph)
- 0.25 iph with 100 percent infiltration
- 0.50 iph.

HDR’s opinion of probable construction costs for these three scenarios is provided in Table I-2. Costs range from $5.6 million for the 0.50 iph scenario to $8.73 million for the 0.25 iph with 100 percent infiltration scenario.

Table I-2. Opinion of probable construction cost (HDR 2020).

Cost Item	0.25 iph	0.25 iph for 100% Infiltration	0.50 iph
Construction Cost	$3,608,043	$6,019,105	$2,889,855
Contingency (30%)	$1,082,413	$1,082,413	$1,082,413
Geotechnical (30%)	$541,206	$541,206	$541,206
Engineering (15%)	$541,206	$541,206	$541,206
Admin (10%)	$360,804	$360,804	$360,804
Permitting (5%)	$180,402	$180,402	$180,402
Total Cost	**$6,310,000**	**$8,730,000**	**$5,600,000**

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the Donnelly Drive Infiltration Galleries Project to maintain the estimated water offset over time despite changing external conditions (which could include seasonal variation in hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- Stormwater would be conveyed from the source location to the infiltration structure within engineering conveyance.
- Groundwater recharge rate can be maintained through a program of periodic rehabilitation of the infiltration structure(s). However, long-term infiltration capacity will depend on the owner’s commitment to O&M operations.

- Land use changes external to the project sites could alter the water budget of the drainage basin and impact project function.
- The quantity of infiltrated water will fluctuate as a function of short-and long-term trends in precipitation.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, and/or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Sea level increase, on the order of several feet or less, likely would not impact project function.
- Project function could be impacted by a decrease in seasonal and/or annual precipitation.
- Wildfire damage to the surrounding drainage area could impact the water budget of the drainage basin and impact project function.

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

A project sponsor has not currently been identified. Thurston County is a potential sponsor.

Documentation of sources, methods, and assumptions.

HDR. 2020. Technical Memorandum, Donnelly Drive Infiltration Gallery Analysis. Technical Memorandum prepared by HDR for the Washington State Department of Ecology. May 20. 8 p.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

WDFW (Washington Department of Fish and Wildlife). 2021. Salmonscape mapping of fish distribution. Accessed at: http://apps.wdfw.wa.gov/salmonscape/

Hicks Lake Stormwater Retrofit Project

Project Name
Hicks Lake Stormwater Retrofit Project

WRIA 13 WRE Subbasin
Woodland Creek subbasin

Water Offset
296 acre-feet (AF) per year

Project Status
The Ruddell Road Stormwater Facility was constructed by the City of Lacey (the City) in 1999, consisting of a pretreatment settling basin that flows to constructed wetlands; ultimately flowing into Hicks Lake. Although the facility is an improvement to the previous, untreated condition, the limited wet pool volume, relatively high inflows, and flow-through design limit water quality treatment and provides minimal, if any, infiltration benefit. Therefore, the City is investigating the feasibility of constructing an offset infiltration facility, herein described as the Hicks Lake Stormwater Retrofit Project, as an upgrade to the current system.

This project is described in detail in a Project Summary by HDR (2020), which is available in Appendix J and has been excerpted to form portions of this project description.

Narrative Description
The Hicks Lake Stormwater Retrofit Project is based upon the construction of improvements to the Ruddell Road Stormwater Facility to enhance stormwater infiltration. These improvements will provide water offset and ecological benefits consistent with RCW 90.94.030 to the Woodland Creek subbasin. This stormwater retrofit project is expected to increase groundwater recharge to the shallow aquifer system underlying the project area and augment baseflow to Hicks Lake, Pattison Lake, and Long Lake. Baseflow augmentation in these lakes ultimately will benefit Woodland Creek, which is currently impaired by low instream flows (303d listing 6169). Proposed upgrades to the facility include a flow splitting manhole, filtration treatment, infiltration gallery, and an overflow structure to the existing wetland.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated.
The drainage basin contributing stormwater to the existing Ruddell Road Stormwater Facility has a total area of 346.46 acres. Stormwater runoff was modeled for the catchment by characterizing precipitation, soils, impervious surfaces, and land use composition. The proposed infiltration facility was sized according to potential stormwater flows, an assumed soil infiltration rate, and soil characteristics. Three stormwater runoff flow scenarios were simulated; these scenarios were based upon maximum runoff rates of 1 cubic feet per second (cfs), 2 cfs, and 3 cfs. These simulations yielded average annual infiltration rates of 167 AF per year, 244 AF per year, and 296 AF per year, respectively. Modeling results suggest that stormwater flows up to approximately 3.5 cfs are expected to fully infiltrate within the proposed facility. However, stormwater flows in excess of 3 cfs are not expected to be sustainable long-term because of reductions in facility infiltration rate associated with siltation and other factors. Therefore, a maximum stormwater inflow rate of 3 cfs and a projected water offset of 296 AF per year is proposed for this project.

Conceptual-level map and drawings of the project and location.
Figure 10 shows the general layout of the proposed infiltration facility, which will be constructed in series with the existing stormwater (water quality) treatment facility. Excess stormwater that is not infiltrated at the constructed infiltration structure will be routed to the existing facility and ultimately flow into Hicks Lake.

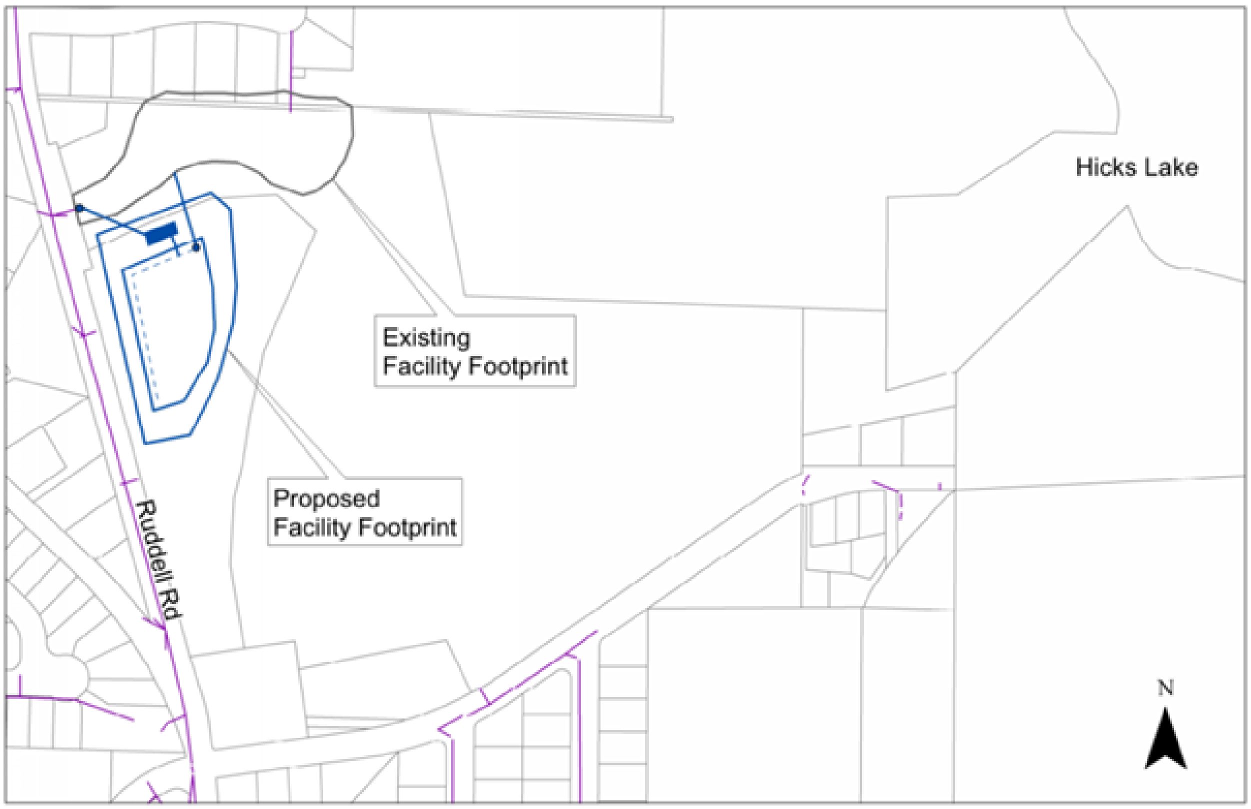

Figure I-2. Layout of proposed infiltration facility.

Description of the anticipated spatial distribution of likely benefits.

Groundwater recharge associated with enhanced infiltration of stormwater within the Hicks Lake Stormwater Retrofit Project will increase groundwater storage in the shallow aquifer system underlying the project site and associated groundwater discharge to Hicks Lake. Hicks Lake serves as the headwaters of the Woodland Creek watershed. Water in Hicks Lake flows through Pattison Lake, Long Lake, and then into Woodland Creek. Infiltrated stormwater will reduce flood flows. Retiming of stormwater discharge to the Woodland Creek system will increase surface water flows during low flow periods.

Performance goals and measures.

The project's performance goal is to increase infiltration to the shallow aquifer system underlying the Hicks Lake Stormwater Retrofit Project. A project performance measure will be the length of installed infiltration gallery. A second performance measure will be an increase in streamflow in adjacent streams, such as the Deschutes River, which could be estimated by the analytical code STRMDEPL08 or equivalent.

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

Woodland Creek is inhabited by numerous fish species tracked by the Washington State Department of Fish and Wildlife (WDFW 2021), which include fall Chum Salmon, fall Chinook Salmon, Coho Salmon, winter steelhead, and resident Coastal Cutthroat. These salmonids are present from Henderson Inlet to Long Lake. Within this reach, the creek is seasonally dry from Lake Lois to Beatty Springs, north of Martin Way. The watershed is heavily urbanized in the headwaters, contributing to reduced summer flows. This project will contribute to moderating the effects of urban stormwater impacts.

In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 13 (NOAA 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions.

Increased streamflow and associated reduced water temperatures will primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This will improve the survival of juveniles. Addressing the streamflow limiting factor and improving habitat conditions 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 is in alignment with the goals of the Streamflow Restoration Act. Infiltration projects are a project type that potentially could address new consumptive water use and achievement of net ecological benefit (NEB).

The City supports the project, and the project will occur within property the City is planning to purchase. The City does not anticipate any barriers to completion.

Potential budget and O&M costs.

The preliminary opinion of probable cost of construction (OPCC) totals approximately $3.3 million. A detailed breakdown of this estimate is provided in Attachment A

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the Hicks Lake Stormwater Retrofit Project to maintain the estimated water offset over time despite changing external conditions (which could include seasonal variation in hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned project will be moderately durable, based on the following:

- Stormwater would be conveyed from the source location to the infiltration structure within engineering conveyance.
- Groundwater recharge rate can be maintained through a program of periodic rehabilitation of the infiltration structure(s). However, long-term infiltration capacity will depend on the City's O&M operations.
- Land use changes external to the project sites could alter the water budget of the drainage basin and impact project function.
- The quantity of infiltrated water will fluctuate as a function of short-and long-term trends in precipitation.

Herein, resiliency refers to the capacity of the project to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, and/or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Sea level increase, on the order of several feet or less, likely would not impact project function.
- Project function could be impacted by a decrease in seasonal and/or annual precipitation.
- Wildfire damage to the surrounding drainage area could impact the water budget of the drainage basin and impact project function.

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

The project sponsor is the City. The City is ready to implement this stormwater retrofit project, contingent upon funding acquisition.

Documentation of sources, methods, and assumptions.

HDR. 2020. Hicks Lake Stormwater Retrofit. Project Summary prepared by HDR for the Washington State Department of Ecology. 5 p.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

WDFW (Washington Department of Fish and Wildlife). 2021. Salmonscape mapping of fish distribution. Accessed at: http://apps.wdfw.wa.gov/salmonscape/

Attachment A:

Opinion of Probable Cost of Construction (OPCC) - Concept Plan Level

Total OPCC:	**$3,295,000**

General Requirements - Stormwater Facilities

Item	Description	Unit	Unit Cost	Qty	Cost	Comments
1	Mob/Demob, Survey, Temp Facilities, Utilities Protection, Traffic Control, etc.	ls	331,000	1	$331,000	15% of Items below

Flow Splitter at Connection to Existing SD

Item	**Description**	**Unit**	**Unit Cost**	**Qty**	**Cost**	**Comments**
2	Flow Splitter Vault with Adjustable High Flow Bypass Weir	ls	$60,000	1	$60,000	Precast vault with interior lateral weir wall with aluminum adjustable weir plate - assume 8'X16' vault size

Water Quality Pre-Treatment

Item	**Description**	**Unit**	**Unit Cost**	**Qty**	**Cost**	**Comments**
3	Pre-treatment Facilities Prior to Groundwater Discharge	cfs	$80,000	3	$240,000	Pre-settling vault and/or hydrodynamic separator(s) - allowance for 3 cfs capacity

Drainage Conveyance System

Item	**Description**	**Unit**	**Unit Cost**	**Qty**	**Cost**	**Comments**
4	12" Dia. Storm Drain (Polypropylene)	lf	$60	700	$42,000	Collective 12" conveyance SD; 4' - 6' Depth
5	Catch Basin Type 1	ea	$4,000	4	$16,000	Collective Type 1 CBs, 5' Std Depth
6	Catch Basin Type 2	ea	$7,000	2	$14,000	Collective Type 2 CBs, 6' - 10' Depth
7	Catch Basin Type 2 Emergency Overflow w/Debris Rack	ea	$10,000	1	$10,000	Overflow spillway from infiltration gallery to existing constructed wetland; debris cage
8	Trench Excavation Safety Systems	ls	$7,000	1	$7,000	All conveyance facilities

Earthwork

Item	Description	Unit	Unit Cost	Qty	Cost	Comments
9	Construction TESC Control and Compliance	ls	$70,000	1	$70,000	CSWPPP, TESC, SPCC, Temp Treatment, Discharge, CSGP Monitoring/Compliance
10	Clearing, Grubbing, Disposal	ac	$14,000	3.0	$42,000	Forested parcel; on-site processing with grinder assumed
11	Infiltration Facility Pad Excavation Incl Haul, Disposal	cy	$20	32,000	$640,000	Assumes excess material disposal within 5 mi
12	Infiltration Gallery Footprint Excavation, Haul, Disposal	cy	$24	6,500	$156,000	Assumes excess material disposal within 5 mi
13	Shoring or Extra Excavation	ls	$15,000	1	$15,000	Temporary shoring for gallery excavation

Infiltration Gallery

Item	Description	Unit	Unit Cost	Qty	Cost	Comments
14	Storm HDPE Arch Infiltration Chambers	lf	$40	12,000	$480,000	16" high HDPE arch infiltration chambers
15	Crushed Stone - 1.5" Fractured/Washed	cy	$55	4,500	$247,500	Infiltration chambers zone backfill
16	Geotextile	sy	$4	5,500	$22,000	Separation geotextile from overlying soils
17	Topsoil	cy	$40	1,100	$44,000	Topsoil above gallery and in disturbed fringe areas
18	Access Road Restoration - AC Pavement	sy	$36	1,200	$43,200	Perimeter 1,100' X 10'W access road and connection to Ruddell Rd
19	Gallery Footprint Restoration Seeding	ls	$5,000	1	$5,000	Grass surface restoration above infiltration gallery
20	Perimeter landscape Plantings and Irrigation	ls	$50,000	1	$50,000	Landscaping allowance

Subtotal	**$2,534,700**
Construction Contingency (Planning Level, 30%)	**$760,410**

Note: This preliminary OPCC does not include budget associated with sales tax, design, construction management, property acquisition, legal costs, and other administrative costs.

Managed Aquifer Recharge Projects in WRIA 13

Project Name

Managed Aquifer Recharge (MAR) Projects in WRIA 13

WRIA 13 WRE Subbasin

Deschutes Upper, Deschutes Middle, Deschutes Lower, Cooper Point, Boston Harbor, and Woodland Creek subbasins

Water Offset

810 acre-feet (AF) per year

Project Status

MAR projects in WRIA 13 would take peak seasonal streamflow from the Deschutes River and select streams, and infiltrate this at engineered facilities that are hydraulically connected with shallow aquifer systems and source streams. Seventeen potential MAR sites in 6 subbasins in WRIA 13 have been identified and are included herein. These locations were developed based on a site suitability analysis conducted by Pacific Groundwater Group, and source water availability and MAR facility sizing analyses conducted by HDR, with site selection criteria based on direction from the WRIA 13 Watershed Restoration and Enhancement (WRE) committee (the committee).

This project is described in detail in a Technical Memorandum by PGG (2020) and a Project Summary by HDR (2020), which are available in Appendix J and have been excerpted to form portions of this project description.

Narrative Description

General

MAR projects can derive water from a variety of sources, including stormwater, Class A reclaimed water, and peak flows in rivers and streams. This project is specific to MAR projects that divert, convey, and infiltrate peak seasonal streamflow in engineered MAR facilities that are in hydraulic connection with the shallow aquifer system and the source stream. Flows will be diverted from the source stream in quantities that will not reduce habitat suitability for salmonids and that do not reduce habitat forming processes. Water infiltrated at the MAR facilities will be transported downgradient through the shallow aquifer system and emerge as baseflow in one or more area stream(s). Enhanced conditions will occur across a broad time period, including the late summer and early fall, when flows are typically the lowest, and water demand for consumptive use is the highest.

This project description describes candidate MAR locations, potential methods for diversion and conveyance, potential diversion and infiltration quantities, and the associated potential water offset benefits. Detailed feasibility analyses are not included in this project description and will occur during plan implementation for each specific location.

Diversion

Capture and recovery methods will vary by source stream but will likely include a combination of screened gravity diversion/bypass systems, screened water lift and/or pump systems, and/or a series of below ground infiltration galleries/collector pipes (e.g., Raney wells) adjacent to source streams. Prior to selection, these capture and recovery methods will need to be evaluated within the context of operation and maintenance (O&M), fish passage performance, permitting, reliability, public safety, construction and lifecycle cost, and available funding mechanisms in order to determine the best fit for the specific water sources.

Conveyance

After capture and recovery, water will be transported to the respective MAR sites through conveyance systems that could consist of canals, ditches, trenches, closed surface piping, and/or closed subsurface piping/tunnels. Conveyance can be accomplished using gravity fed structures or pumping, depending on elevations along the conveyance route. Ideally, source streams and MAR sites would be in close proximity to minimize the complexity and associated expense of the conveyance systems.

Storage and Infiltration

Diverted water will be infiltrated to the shallow aquifer system at MAR facilities. Depending on diversion and infiltration rates, MAR facility design could include a storage component consisting of one or more small storage reservoirs. After water is captured during periods of excessive river flow, water will be conveyed to the MAR facility and allowed to infiltrate into the subsurface. MAR sites will be chosen carefully and evaluated for potential infiltration rates and volumes as well as anticipated hydrologic and water quality effects resulting from the project. Suitable sites will have permeable material at or near ground surface and a water table deep enough to support infiltration and associated groundwater mounding.

Feasibility Study

It is assumed that for each project component that is implemented, an MAR feasibility study will be conducted. This will be consistent with Appendix B of Ecology's Net Ecological Benefit (NEB) guidance (Ecology 2019) and Appendix D of the Streamflow Restoration Grant application requirements assuming funding from Ecology is provided subsequent to a future grant round (Ecology 2021). All values presented in this project description are for planning purposes and may not represent actual site conditions.

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

Potential MAR Locations

Potential MAR locations were determined based on a screening process conducted by Pacific Groundwater Group (PGG 2020), which is provided in an . Areas in WRIA 13 with the following features were considered for inclusion:

- Favorable soils and surficial geology
  - Soils mapped in hydrologic groups A and B with all soil layers having a permeability greater than 2 inches per hour.
  - Surficial geology primarily composed of sand and/or gravel.
  - Areas with low permeability surficial geology (i.e., silt, clay, bedrock) were excluded.
  - Wetlands, lakes, and high groundwater areas were excluded.
- Depth and thickness of aquifer
  - Depth to water of 8 feet or greater.
  - Surficial aquifer saturated thickness of 10 feet or greater.
- Distance to potential water source

  Favorable MAR locations were defined as those within 0.25 and 0.5 miles from a potential source stream or river.

This screening identified both general areas and specific locations that appear favorable for MAR project implementation; these locations are listed in Table I-3 and shown in Figure I-3. PGG (2020) separated the identified potential MAR sites into Tier 1 and Tier 2 locations. Tier 1 locations are favorable in terms of land ownership, property size, and relative net ecological benefit (NEB) (i.e., significant use by anadromous salmonids). Tier 2 locations meet most of the eligibility criteria but are either located farther than 0.5 miles from a stream or are near a source water closed to further appropriation. Additional candidate locations might be identified and proposed during plan implementation.

Table I-3. Potential MAR locations (PGG 2020)

Tier	Site No.	Subbasin	Location	Source Stream
1	1	Deschutes Upper	South of Clear Lake	Deschutes River
1	2	Deschutes Middle	Rainier View Park	Deschutes River
1	3	Deschutes Middle	North of Rainier View Park	Deschutes River
1	4	Deschutes Middle	Route 507, SW of Raymond	Deschutes River
1	5	Deschutes Middle	East of Offut Lake	Deschutes River
1	6	Deschutes Lower	Thurston County Roads Gravel Pit, Waldrick Rd SE	Deschutes River
1	7	Deschutes Lower	Nelson Ranch	Deschutes River
1	8	Deschutes Lower	Alpine Sand and Gravel, Rixie Road	Deschutes River
1	9	Cooper Point	Cooper Point	Green Cove Creek
2	12	Deschutes Lower	Lower Percival Creek, SPSCC	Percival Creek
2	14	Boston Harbor	Former borrow pit	Woodard Creek
2	15	Boston Harbor	Private	Woodard Creek
2	16	Boston Harbor	Mission creek	Mission creek
2	17	Boston Harbor	Near 4th Avenue E and Interstate 5	Indian Creek
2	18	Woodland Creek	Property with kettle pond on 15th Avenue NE	Woodland Creek
2	19	Woodland Creek	Near Pleasant Glade Road	Woodland Creek
2	20	Woodland Creek	Near Dept. of Ecology Headquarters	Woodland Creek

Source Water Availability and MAR Facility Sizing

Methodology

Streams that can viably support MAR projects are those that have a flow record adequate for an assessment of flow diversion quantities and infiltration facility design. The amount of water that can be diverted from a target stream (diversion flows) and the number of days when flows can be diverted were determined by HDR using the following methodology:

- Diversion flows were proposed based on maintaining minimum instream flows and habitat forming processes (i.e., ecological flows). Diversion flows in streams and rivers with minimum instream flows (i.e., the Deschutes River) were assumed to be equal to 2 percent of the wet season (November through April) minimum flow. For the case of the Deschutes River, 2 percent of the wet season minimum flow of 400 cubic feet per second (cfs) yields a diversion flow of 8 cfs.
- Diversion of flow to an MAR facility can occur during days when flows exceed minimum instream flows. These days were tallied for each day in the flow record and summed by month. These "diversion days" were summed across the wet season (November through April) for each water year in the flow record. The average and minimum number of diversion days were calculated across all water years in the flow record.

- For the case where a stream or river does not have minimum instream flows, the 75th percentile flows for each month across the entire flow period of record were calculated. For this case, diversion flows were proposed based on 2 percent of the average 75th percentile flows during the period from November through April. Under this paradigm, diversion of flow to an MAR facility can occur during days when flows exceed the 75th percentile. Therefore, flows can be diverted to an MAR facility 25 percent of the time (i.e., 45 days during the November through April wet season).
- The minimum and average volume of water that can be diverted to one or more MAR facilities in each stream was calculated by multiplying the diversion flow by the number of diversion days, and transforming the volume to AF per year.

Deschutes Upper, Deschutes Middle, and Deschutes Lower Subbasins

The Deschutes River is closed to consumptive appropriations between April 15 and October 15, per Chapter 173-513 WAC. From October 16 through April 14, the wet season minimum flow in the Deschutes River is 400 cfs, as measured at the downstream control point, the USGS 12080010 gage at Tumwater, WA.

Potential diversion flows for the Deschutes River are assumed to be 2 percent of maximum wet season minimum flows (400 cfs), or approximately 8 cfs. The minimum number of diversion days between the years 2000 and 2020 is 50 days (Table I-4). The average number of diversion days during the same period is 108 days (Table I-4). For the potential MAR sites located within Deschutes River subbasins that are associated with streams with minimum instream flows, water offset estimates were 198 AF per year for minimum diversion days and 428 AF per year for average diversion days (Table I-7). Due to greater environmental benefits associated with MAR projects higher in the river system, for analysis purposes it was assumed that the 4 Deschutes River MAR projects will be located in the middle and upper Deschutes subbasins.

In the Deschutes Lower subbasin, a potential MAR location was also identified near Percival Creek (Figure I-3; Table I-4). Percival Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration could be feasible with a rule change to accommodate this flow restoration project. Measured flows near the potential MAR location are near zero in the summer and range from 11 to 15 cfs in the wet season (Table I-5). If an MAR project is implemented at this location, it likely will be a small-scale (on the order of 0.2 cfs) diversion when flows exceed 10 cfs (Table I-6). The diversion period is likely about 45 days per year. This will result in an offset of approximately 18 AF per year (Table I-7). However, Percival Creek was one of several potential MAR sites where no potential benefits were claimed in the plan, due to uncertainty associated with the need to address a stream closure before the project can proceed.

Cooper Point Subbasin

In the Cooper Point subbasin, a potential MAR location was identified near Green Cove Creek (Figure I-3; Table I-4). Green Cove Creek does not have an instream flow closures or minimum flows (Chapter 173-513 WAC). Measured flows near the potential MAR location are near zero in the summer and range from 7 to 11 cfs in the wet season (Table I-5). If an MAR project is implemented at this location, it likely will be a small-scale (on the order of 0.2 cfs) diversion when flows exceed 10 cfs (Table I-6). The diversion period is likely about 45 days per year. This yields an offset of approximately 18 AF per year (Table I-7).

Boston Harbor Subbasin

In the Boston Harbor subbasin, potential MAR locations were identified near Woodard Creek (Figure I-3; Table I-4). Woodard Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration could be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location are near zero in the summer and range from 10 to 17 cfs in the wet season (Table I-5). If an MAR project is implemented at this location, it likely will be a small-scale (on the order of 0.2 cfs) diversion when flows exceed 10 cfs (Table I-6). The diversion period is likely about 45 days per year. This yields an offset of approximately 18 AF per year (Table I-7). However, Woodard Creek was one of several potential MAR sites where no potential benefits were claimed in the plan, due to uncertainty associated with the need to address a stream closure before the project can proceed.

Potential MAR locations were also identified near Mission Creek and Indian Creek (Figure I-3; Table I-5). However, flow in these streams is very low year-round (Table I-6) and these streams have very little value for anadromous salmonids. Therefore, projects associated with these streams were excluded from the water offset compilation in Table I-7.

Woodland Creek Subbasin

In the Woodland Creek subbasin, potential MAR locations were identified near Woodland Creek (Figure I-3; Table I-4). Woodland Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration could be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location are near zero in the summer and range from 10 – 17 cfs in the wet season (Table I-5). If an MAR project is implemented at this location, it likely will be a small-scale (on the order of 0.7 cfs) diversion when flows exceed 48 cfs (Table I-6). The diversion period is likely about 45 days per year. This will result in an offset of approximately 62 AF per year (Table 1-7). However, Woodland Creek was one of several potential MAR sites where no potential benefits were claimed in the plan, due to uncertainty associated with the need to address a stream closure before the project can proceed.

Estimated Water Offset

The total quantity of water potentially diverted and infiltrated at MAR sites in WRIA 13 ranges from 908 to 1,828 AF per year, depending on whether the minimum or average diversion days are assumed (Table I-7). For the purpose of assigning a projected water offset for MAR Projects in WRIA 13, Ecology conservatively selected the water offset associated with the minimum number of diversion days (908 AF per year), then reduced this amount to exclude potential project benefits associated with streams that currently have year-round closures (i.e. Percival Creek, Woodard Creek and Woodland Creek (Chapter 173-513 WAC). The subsequent total potential water offset for this project claimed in the plan is 810 AFY.

Table I-4. Number of days when flows are at least five percent greater than minimum flows during the wet season (November through April). Deschutes River at E St Bridge at Tumwater, WA (USGS 12080010). Cells outside of the wet season are shaded.

Month	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
January	25	0	31	17	21	8	31	29	25	25	26	29	22	20	11	22	31	12	31	16	30
February	27	2	28	16	20	0	21	13	22	1	10	11	29	15	19	12	27	24	26	13	21
March	30	0	29	24	6	5	0	31	25	16	9	31	31	24	31	17	31	31	20	3	2
April	6	3	9	15	0	15	0	15	15	15	15	15	15	12	14	15	15	15	10	9	6
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
November	6	22	1	15	17	26	27	19	22	30	30	26	30	29	30	30	30	26	19	0	7
December	2	31	10	26	10	13	31	30	4	13	31	8	29	7	24	30	29	21	22	9	0
Sum	**96**	**58**	**108**	**113**	**74**	**67**	**110**	**137**	**113**	**100**	**121**	**120**	**156**	**107**	**129**	**126**	**163**	**129**	**128**	**50**	**66**

Table I-5. Average measured monthly flow (CFS) at Green Cove Creek, Indian Creek, Mission Creek, Percival Creek, Woodard Creek, and Woodland Creeks. Cells outside of the wet season are shaded.

Month	Green Cove Creek at 36th Avenue NW	Indian Creek Mouth at Quince Street SE	Mission Creek at Boston Harbor Road	Percival Creek at Pedestrian Footbridge	Woodard Creek at 36th Ave NE	Woodland Creek at Pleasant Glade Road	Woodland Creek at Desmond Drive Ecology HQ
January	10.9	6.0	2.2	11.8	13.9	44.8	12.8
February	7.2	5.2	1.2	15.1	12.9	45.7	9.4
March	10.1	7.1	1.6	11.9	16.6	51.2	8.0
April	4.7	3.3	0.8	9.0	12.7	44.3	17.9
May	2.5	2.9	0.6	8.7	10.0	34.1	8.6
June	1.0	2.0	0.4	6.7	7.3	24.4	4.1
July	0.3	1.4	0.5	3.3	5.4	17.8	2.0
August	0.2	1.2	0.3	2.7	4.4	14.6	1.4
September	0.6	1.1	0.3	3.3	4.7	14.3	0.5
October	2.1	2.4	0.9	6.4	6.2	16.0	0.1
November	7.6	4.5	0.4	14.1	10.2	24.5	1.0
December	11.2	5.8	1.9	11.6	12.4	35.3	5.5

Table I-6. Seventy-Fifth percentile of monthly flows during the period of record at Green Cove Creek, Woodland Creek, and Woodard Creek and monthly average flows for Percival Creek. Cells outside of the wet season are shaded.

Month	Green Cove Creek at Bulter Cove FS	Woodland Creek at Pleasant Glade Rd.	Woodard Creek at 36th Ave NE	Percival Creek at SPSCC
Period of Record	2009 - 2020	2008 - 2020	2008 - 2020	2009 - 2015
January	15.9	51.9	14.9	11.8
February	9.0	52.3	14.9	15.1
March	12.4	56.7	18.7	11.9
April	5.5	53.8	14.7	9.0
May	3.1	40.8	11.1	8.7
June	1.8	28.6	8.2	6.7
July	0.6	21.1	6.0	3.3
August	0.2	16.2	4.4	2.7
September	0.3	16.3	4.7	3.3
October	1.5	19.1	5.8	6.4
November	8.1	30.8	10.8	14.1
December	11.6	44.3	13.8	11.6
Average	**10.4**	**48.3**	**14.6**	**12.3**
Diversion	**0.2**	**0.7**	**0.2**	**0.2**
Diversion Days	**45**	**45**	**45**	**45**

Table I-7. Potential MAR site locations, facility sizes, and water offsets with minimum yearly diversion days[8] and average yearly diversion days[9].

Subbasin	Stream	Location	Facility Size (square feet)	Diversion Flow (cfs)	Minimum Days of Diversion	Minimum Water Offset Per Year (CFY)	Minimum Water Offset Per Year (AFY)	Average Days of Diversion	Average Water Offset Per Year (CFY)	Average Water Offset Per Year (AFY)
Deschutes Upper	Deschutes River	South of Clear Lake	12,400	2	50	8,640,000	198	108	18,662,400	428
Deschutes Middle	Deschutes River	Rainier View Park	12,400	2	50	8,640,000	198	108	18,662,400	428
Deschutes Middle	Deschutes River	North of Rainier View Park	12,400	2	50	8,640,000	198	108	18,662,400	428
Deschutes Middle	Deschutes River	Route 507, SW of Raymond	12,400	2	50	8,640,000	198	108	18,662,400	428
Cooper Point	Green Cove Creek	Cooper Point	1,240	0.2	45	777,600	18	45	777,600	18
Deschutes Lower	Percival Creek	Lower Percival Creek, SPSCC	1,240	0.2	45	777,600	18	45	777,600	18
Boston Harbor	Woodard Creek	Former borrow pit	1,240	0.2	45	777,600	18	45	777,600	18
Woodland Creek	Woodland Creek	Property with kettle pond on 15th Ave NE		0.7	45	2,721,600	62	45	2,721,600	62
					Minimum Total Offset		**908 AFY**	**Average Total Offset**		**1,828 AFY**

[8] Based on the minimum days exceeding minimum flows (November through April)
[9] Based on the average number of days exceeding minimum flows (November through April)

Conceptual-level map and drawings of the project and location.

Results of the screening process conducted by PGG (2020), including identification of general areas and specific sites that could be favorable for MAR, are presented in Figure 11.

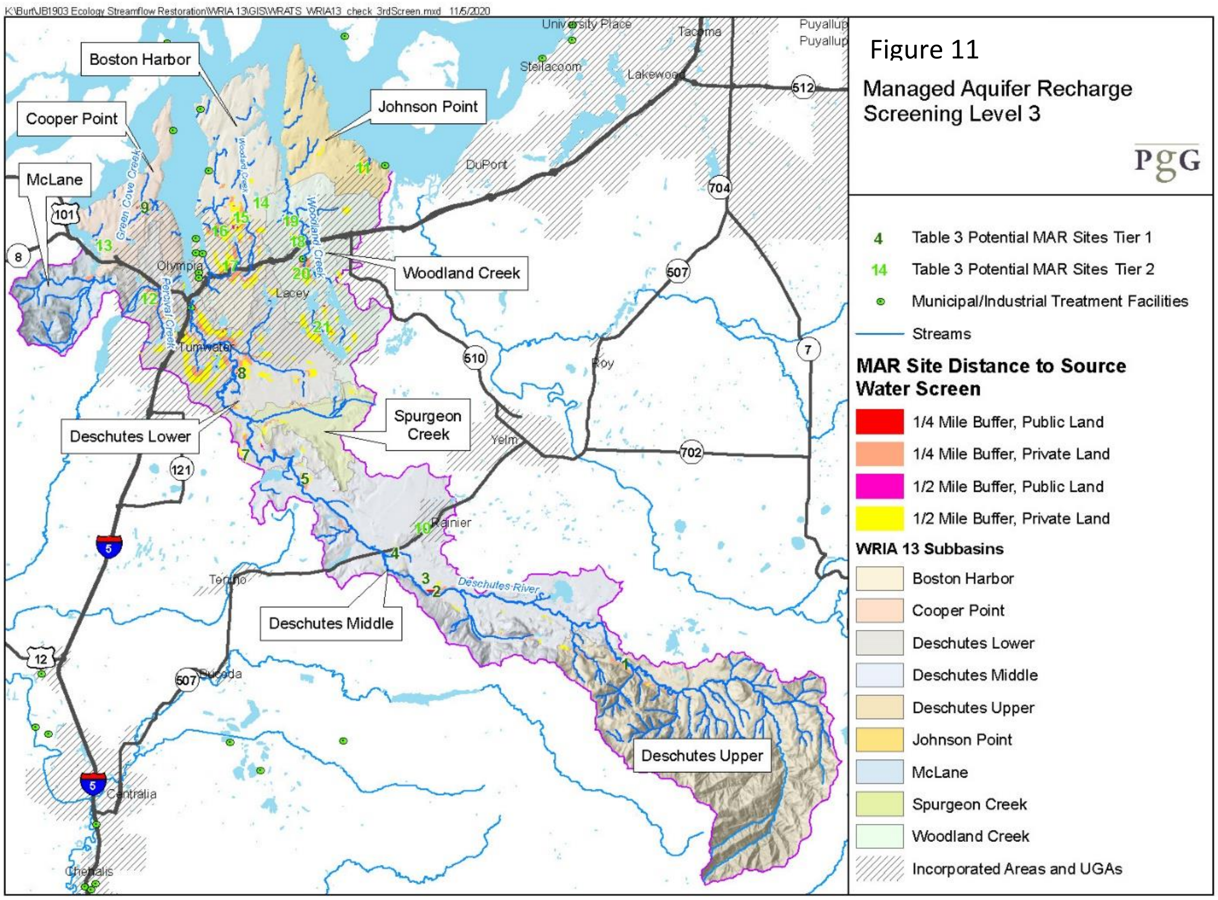

Figure I-3. Areas favorable for MAR locations and potential MAR sites.

Description of the anticipated spatial distribution of likely benefits.

The proposed MAR projects will increase streamflow in target streams during the summer and early fall, and also will increase usable aquatic habitat. Project implementation will benefit rearing for yearling salmonids such as Coho Salmon, steelhead, and Coastal Cutthroat Trout.

Performance goals and measures.

The performance goals are to increase water storage in the shallow aquifer system adjacent to WRIA 13 streams by infiltrating water through MAR facilities to augment baseflow. The performance measures will be the volume of water infiltrated at MAR facilities and, by extension, the increase in streamflow in targeted streams. Specific quantities and timing for surface water diversion will be determined during a feasibility study.

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

Streams within the WRIA 13 subbasins listed in Table I-3 are inhabited by numerous fish species tracked by the Washington State Department of Fish and Wildlife (WDFW 2021), which could include Chum Salmon, Chinook Salmon, Coho Salmon, Pink Salmon, steelhead, Bull Trout, kokanee, Rainbow Trout, and resident Coastal Cutthroat Trout.

In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 13 (NOAA 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions.

Increased streamflow and reduced water temperatures will primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This will improve the survival of juveniles. Addressing the streamflow limiting factor and improving habitat conditions 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 aligns with the goals of the Streamflow Restoration Act. MAR is an identified project type that could address the new consumptive water use and achievement of NEB. Thurston County will likely support and implement these projects, with potential support from other partners and an implementation group.

The barriers to completion include evaluation of MAR feasibility, obtaining funding for construction and O&M costs, and obtaining necessary permitting from the Washington State Department of Ecology, which could include water right permitting depending on project design. Streamflow mitigation could be required, consistent with the Foster Decision, if the projects cause transient impairment of minimum instream flows.

Potential budget and O&M costs.

The potential budget for WRIA 13 MAR projects is based on estimates compiled by Ecology from similar projects, resulting in an estimate of about $3,400 per AF. For the total water offset estimate of 810 AF per year, this equates to a total cost of approximately $2.8 million.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the potential MAR projects to maintain the estimated water offset over time despite changing external conditions (which could include seasonal variation in streamflow, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned projects will be moderately durable, based on the following:

- The reliability of the water sources decrease during low water years.
- The feasibility of MAR has not been evaluated.
- The rates of diversion will be precisely maintained through engineering controls and conveyed with minimal losses to the recharge location.
- Groundwater recharge rates will be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- Land use changes external to the project sites likely will have negligible impact on project functions.

Herein, resiliency refers to the capacity of the projects to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, and/or other impacts. We anticipate that the planned project will be resilient to the potential impacts of climate change based on the following:

- Diversions typically will occur during late fall through spring, which generally does not coincide with anticipated (post-climate change) low-streamflow conditions.
- Project functions will not be impacted by summer drought conditions.
- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project site and surrounding area will not impact project functions and the anticipated water offsets.

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

Thurston County has indicated that they will take a lead role in implementing these projects. However, other project partners and sponsors could emerge during project planning and implementation.

Documentation of sources, methods, and assumptions.

Ecology (Washington State Department of Ecology). 2019. Final Guidance for Determining Net Ecological Benefit. GUID-2094 Water Resources Program Guidance. Publication 19-11-079. July 2019.

Ecology (Washington State Department of Ecology). 2021. Streamflow Restoration Competitive Grants, 2022: Guidance for project applicants. Publication 21-11-019. September 2021. https://apps.ecology.wa.gov/publications/documents/2111019.pdf

HDR. 2020. Managed Aquifer Recharge Projects in WRIA 13. Project Summary prepared by HDR for the Washington State Department of Ecology. 12 p.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

PGG (Pacific Groundwater Group). 2020. Technical Memorandum, Managed Aquifer Recharge Assessment Methodology. Technical Memorandum prepared by PGG for the Department of Ecology WRIA 13 Watershed Restoration and Enhancement Committee. December 18, 5p.

WDFW (Washington State Department of Fish and Wildlife). 2021. Salmonscape Mapping of Fish Distribution. http://apps.wdfw.wa.gov/salmonscape/

Schneider's Prairie Off-Channel Storage and Release Project

Project Name
Schneider's Prairie Off-Channel Storage and Release Project

WRIA 13 WRE Subbasin
Deschutes Lower subbasin

Water Offset
285 to 1,310 acre-feet (AF) per year

Project Status
The Schneider's Prairie Off-Channel Storage and Release Project conceptually would restore the hydrologic connection between the Deschutes River and Schneider's Prairie, allowing water to flow from the river to the floodplain and seep into the ground. Capitol Land Trust owns part of the project area. The WRIA 13 Salmon Lead Entity is organizing potential partners for a larger Deschutes River project encompassing the project area. Because of these efforts, this water offset project might best be implemented as one component of the larger conservation effort to protect this part of the lower Deschutes River, an area of substantial ecological and hydrologic value.

This project is described in detail in a Project Summary by HDR (2020), which is available in Appendix J and has been excerpted to form portions of this project description.

Narrative Description
The Schneider's Prairie Off-Channel Storage and Release Project is located on the east (right) bank of the Deschutes River, west of the Keanland Park Lane SE, in north-central Thurston County, as shown in Figure 1. The project includes Ayer Spring/Pond and Ayer Creek within Schneider's Prairie, as shown in Figure 2.

This project will restore hydrologic connectivity between the Deschutes River and Schneider's Prairie. Schneider's Prairie is a depressional feature that contains the Ayer Creek drainage. Aerial photos and LiDAR images show that multiple Paleochannels historically connected the Deschutes River with Schneider's Prairie. Reconnecting these two features and Ayer Creek would provide rearing habitat and flood refugia for juvenile salmonids, stormflow attenuation, and water infiltration for later-season release to augment flow in the lower Deschutes River.

The project concept is to deepen an existing floodplain paleochannel that would hydrologically connect the Deschutes River with Schneider's Prairie (Figure 2). The deepened paleochannel will be connected to the existing Ayer Creek that runs north to return flow to the Deschutes River. The paleochannel and Ayer Creek will be roughened with large woody debris (LWD) and beaver dams (analogs and beaver introduction) to flood adjacent floodplain habitat and pond creek flow. Ayer Creek will be realigned with a meander pattern (correcting historical ditching). Ayer Creek will also be modified near the mouth using biotechnical techniques (e.g., buried logs and log jams) to maintain grade control at an elevation that would inundate a portion of the off-channel area during high flow events. The seasonal inundation will result in infiltration and subsequent seepage back to the river on the time scale of days to months.

The existing paleochannel will be deepened to convey water from the Deschutes River to Ayer Creek, within the off-channel feature. The connection point of the paleochannel to the Deschutes River will be through an abandoned oxbow that fills with river water from the downstream end during moderate and high flows. Connecting the paleochannel to the Deschutes River through the oxbow is expected to provide a stable, low-energy connection to the river. The deepened paleochannel will have an assumed invert elevation of 155 feet relative to the North American Vertical Datum of 1988 (NAVD88) that would convey water from the river to the off-channel feature when Deschutes River flows are above 400 cubic feet per second (cfs). In this design scenario, when the river is flowing above 400 cfs, the channel will convey water to the off-channel feature.

Schneider's Prairie is a broad depressional off-channel feature that contains an extensive wetland, including Ayer Springs and Ayer Creek. Diverted floodwaters will inundate about 52 acres of this feature, below an elevation of 152 feet NAVD 88, frequently during the months of November through April, and infrequently during the shoulder months of May, June, September, and October. Ponded water will infiltrate into the shallow aquifer system underlying the site and be transported downgradient where it will emerge as Deschutes River baseflow.

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

Water offset benefits were estimated by HDR based on estimates of:

- Inlet flows into the Schneider's Prairie off-channel feature.
- Inundation extent and depth.
- Emergence of infiltrated water into the Deschutes River as baseflow.

Inflows from the Deschutes River to the Schneider's Prairie off-channel area were estimated on a cumulative monthly basis during period the from November through April (Table I-8). Monthly inflows were developed based on assumed inlet channel geometry, daily streamflow values at the USGS E Street Gage in Tumwater, WA (USGS Gage 12080010), and corresponding river elevations derived from the HEC-RAS hydrologic model developed by the Federal Emergency Management Authority (FEMA) for the Deschutes River. This methodology assumes that only streamflow values greater than 400 cfs caused inflows into the Schneider's Prairie off-channel area, and inflows were restricted to the November through April timeframe.

The inlet channel was added to the existing HEC-RAS model using a standard channel geometry. The surface of the banks and floodplain were built from LiDAR data. Using the 2011 LiDAR terrain contours, a storage area of about 52 acres was considered practical for seasonal inundation, as shown by the pink shaded area in Figure 2. Water depths of 1 to 3 feet were considered potentially obtainable using either surface roughness (natural) or a low dike to retain water, at an elevation of 152 feet NAVD 88. Modifications to the mouth of Ayer Creek with grade control at 152 feet may be required but would require fish passage for both adult and juvenile salmonids.

Inflows from the Deschutes River were compared to the maximum infiltration capacity of the off-channel area (i.e. 52 acres). Maximum infiltration capacity was estimated using a Darcy's Law-based calculation. The smaller of the two values were used as an assumed infiltration quantity (Table I-8). River inflows that exceeded the infiltration capacity were assumed to be retained as ponded water in the Schneider's Prairie feature. This retained inflow volume was assumed to infiltrate during the late spring, when river inflows were no longer occurring.

The resulting monthly infiltration quantities were used to model streamflow benefits (i.e., baseflow contribution to the Deschutes River) over time. Augmented baseflow was modeled using the analytical code STRMDPEL08 and increases over time because of the cumulative effect of infiltrating water over multiple seasonal cycles. This cumulative increase reaches an asymptote (i.e., additional benefits are minimal) after about 50 years of infiltration (Table I-9). Augmented baseflow does not change substantially with season but is slightly higher during the period from May through October relative to the period from November through April. Streamflow benefits during the period from May through October period are predicted to be 285, 681, 958, and 1,310 AF per year during the first, fifth, tenth, and fiftieth year of infiltration, respectively.

There are a number of uncertainties associated with the modeling analysis that could limit analytical precision. These include:

1. Evapotranspiration was not accounted for.
2. The site infiltration capacity is approximate.
3. Climate change was not accounted for.
4. The declining streamflow trend of the Deschutes was not accounted for.
5. Sediment issues in the Deschutes were not accounted for.
6. Modeling assumptions including transmissivity of aquifer, and streambed conductance were not based on site-specific data.
7. Modeling represents average, rather than dry year, conditions.

To account for project uncertainties, Ecology chose to recognize 681 AFY of seepage back to the river during the May through October dry season from this project, which represents less than half of the total estimated based on preliminary hydrologic and hydrogeologic modeling.

Table I-8. Projected infiltration and diversion quantities.

Month	Monthly Deschutes River Diversion (AF)	Maximum Monthly Infiltration Capacity (AF)	Excess Water (AF)	Water Infiltrated from Storage (AF)	Monthly Volume Infiltrated (AF)
January	717	435	282	--	435
February	568	393	175	--	393
March	505	435	70	--	435
April	229	421	0	192	421
May	0	435	0	435	435
June	0	421	0	175	175
July	0	435	0	--	0
August	0	435	0	--	0
September	0	421	0	--	0
October	0	435	0	--	0
November	415	421	0	--	415
December	709	435	274	--	435
Total Annual	**3,143**	**4,683**	**802**	**802**	**3,143**

Table I-9. Modeled streamflow benefits over time.

Modeled Benefit by Year After Project Start	Total Water Year Benefit (AF)	Percent of Infiltrated Volume	May - October Benefit (AF)	Percent of Infiltrated Volume
Year 1	316	10%	285	9%
Year 5	1,235	39%	681	22%
Year 10	1,824	58%	958	30%
Year 50	2,537	81%	1,310	42%

Notes:
The STRMDEPL08 analysis utilized the following inputs:
Transmissivity = 1,400 square feet per day (ft^2/d)
Streambed Conductance = 1 feet per day (ft/d)
Wetlands Hydraulic Conductivity = 0.20 ft/day
Total Annual Diversion Applied to Groundwater Recharge = 3,143 AF.

Conceptual-level map and drawings of the project and location.

The approximate location of the Schneider's Prairie Off-Channel Storage and Release Project is shown in Figure I-4.

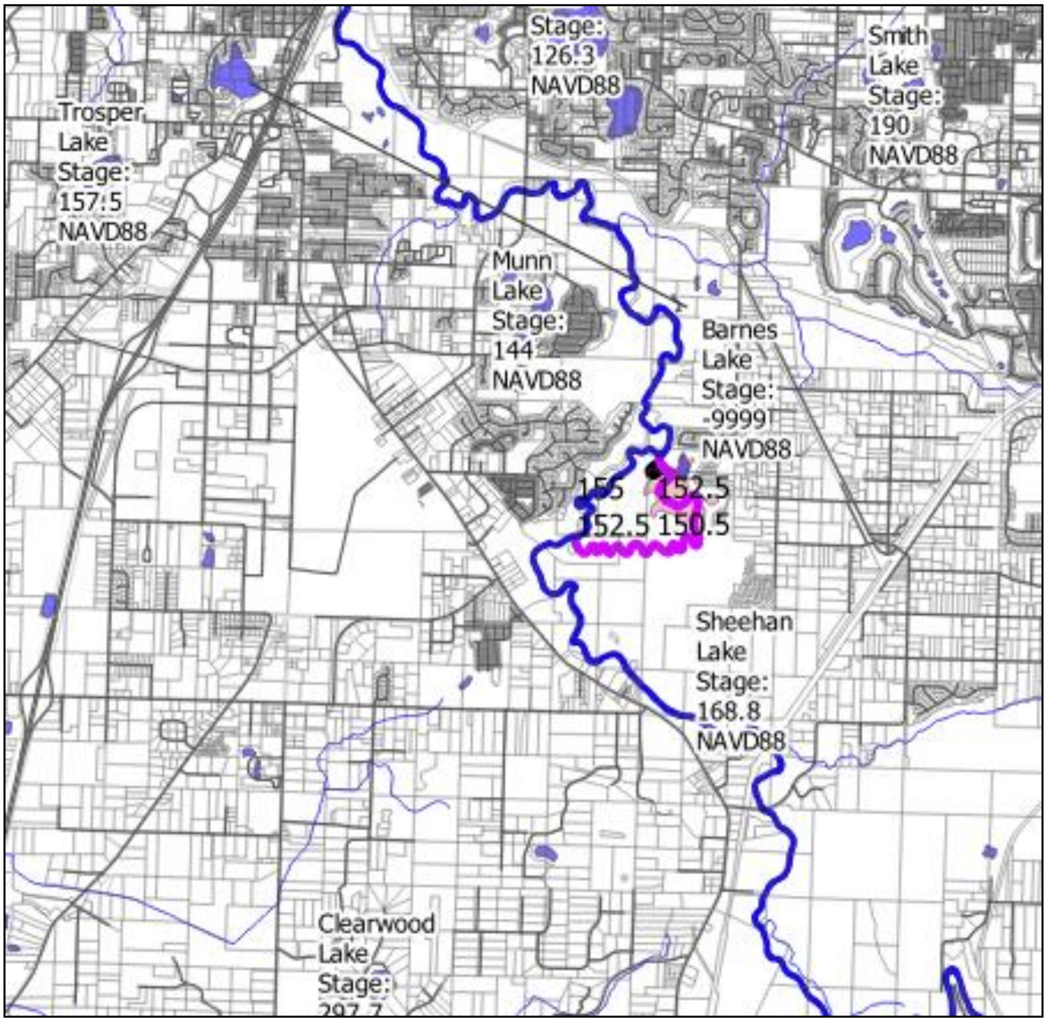

Figure I-4. Site location

The conceptual design for the project, including the off-channel storage area (pink shading) and location of the new stream channel (purple), is shown in Figure I-5.

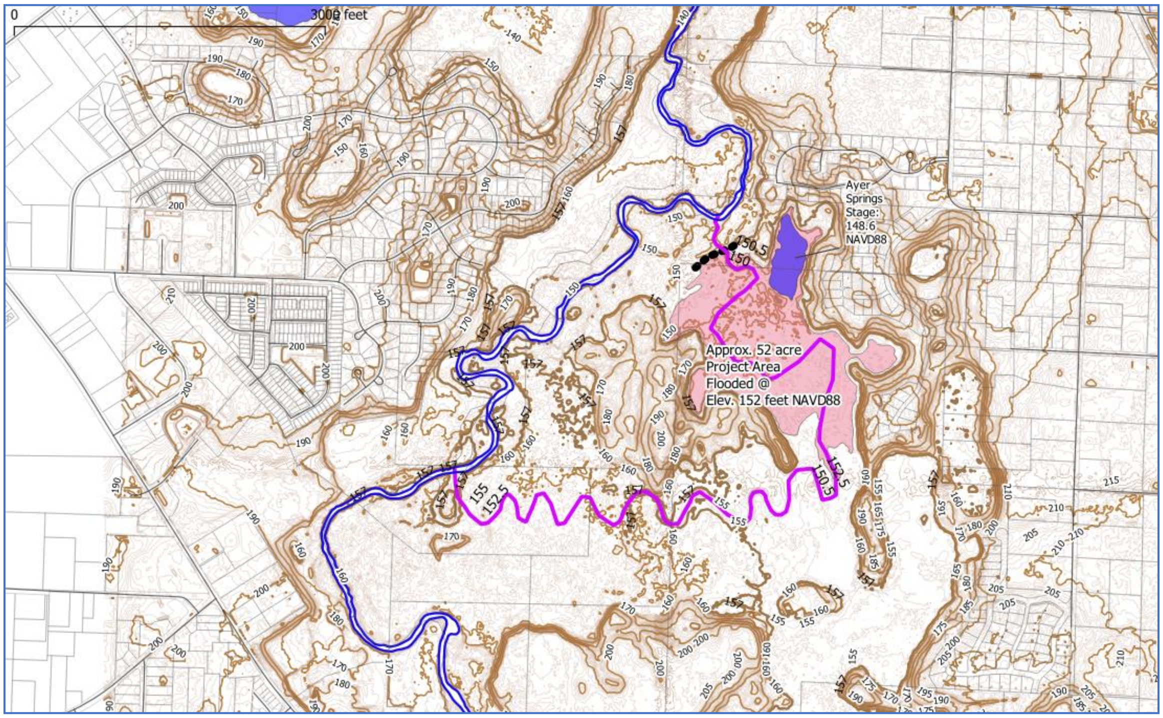

Figure I-5. Project Area showing conceptual off-channel storage area and new stream channel.

Description of the anticipated spatial distribution of likely benefits.

Streamflow benefits will occur in the Deschutes River downstream of the project area. Off-channel rearing benefits will occur within the inlet channel, within the off-channel area, Ayer Creek, and in the Deschutes River downstream of the confluence with Ayer Creek.

In addition, Ayer Creek currently has Total Maximum Daily Loads (TMDLs) proposed by the U.S. Environmental Protection Agency (USEPA) for water temperature, dissolved oxygen, and pH. Surface water connectivity to the river and increased seepage during the critical period could improve water quality. Increased base flow during the summer will increase usable aquatic habitat for fish and will also reduce temperatures and effects of eutrophication on dissolved oxygen and pH.

Finally, off-channel fish habitat will be created in the paleochannel and in the inundated floodplain area in Schneider's Prairie. The inlet and outlet will be designed to be low energy with fish cover and habitat complexity. The inlet and outlet channels will allow for fish ingress and egress. It is expected that this would likely improve habitat for Coho Salmon and numerous other species, as well as capturing silt and nutrients. Habitat and water offsets may be improved by increasing channel roughness. For example, beaver habitat/ponding, woody structures in the channels/floodplain, or mature forest land cover would slow down and diffuse flow entering and flowing through the off-channel feature. These elements will also increase habitat value for juvenile salmonid rearing.

Performance goals and measures.

The performance goals are to increase water storage in the shallow aquifer system beneath Schneider's Prairie by infiltrating diverted water to augment baseflow. The performance measures will be the quantity of increased water storage in Schneider's Prairie, which will determine the streamflow benefits.

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

The Deschutes River is inhabited by numerous fish species tracked by the Washington State Department of Fish and Wildlife (WDFW, 2021), which include winter Chum Salmon, fall Chum Salmon, fall Chinook Salmon, Coho Salmon, winter steelhead, and resident Coastal Cutthroat.

This project would provide off-channel rearing habitat during the winter period, when the inlet channel and wetland area is inundated. This habitat would primarily benefit Coho Salmon. Seepage back to the Deschutes River during the summer and early fall would benefit all fish species by providing cool water and increasing flows.

In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 13 (NOAA 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions.

Increased streamflow and reduced water temperatures will primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This will improve the survival of juveniles. Addressing the streamflow limiting factor and improving habitat conditions 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 is in alignment with the goals of the Streamflow Restoration Act. This project has elements of surface storage and managed aquifer recharge (MAR), both of which are identified project types that could address the new consumptive water use and achievement of NEB.

Capitol Land Trust owns part of the project area. Other water offset and habitat protection projects have been envisioned nearby, including Allen Creek Restoration Project (Habitat Work Schedule project ID 12-1109) by Wild Fish Conservancy but encountered land development pressures. This project would be an element of a larger "Floodplains by Design" grant proposal and concept design.

The barriers to completion include evaluation of infiltration feasibility, obtaining funding for construction and O&M costs, and obtaining necessary permitting from the Washington State Department of Ecology.

Potential budget and O&M costs.

Potential (Class V, order of magnitude) capital costs, including design, permitting, property acquisition, and construction, are approximately $5,000,000 (HDR 2020). O&M costs have not been evaluated at this time.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the Schneider's Prairie Off-Channel Storage and Release Project to maintain the estimated water offset over time and despite changing external conditions (which could include seasonal variation in streamflow, seasonal and/or long-term fluctuation in regional groundwater elevation, adjacent land use changes, and/or other factors). We anticipate that the planned projects will be <u>moderately durable</u>, based on the following:

- The reliability of the water source decreases during low water years.
- The feasibility of infiltration and baseflow augmentation has not been evaluated.
- The rate of diversion will be precisely maintained through engineering controls and conveyed with minimal loss to the recharge location.
- Groundwater recharge rate will be maintained through a program of periodic rehabilitation of the infiltration structure(s).
- Land use changes external to the project sites likely will have negligible impact on project function.

Herein, resiliency refers to the capacity of the projects to maintain the estimated water offset despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, and/or other impacts. We anticipate that the planned project will be moderately resilient to the potential impacts of climate change based on the following:

- Diversion typically will occur during late fall through spring, which generally does not coincide with anticipated (post-climate change) low-streamflow conditions.
- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project site could impact project function and the anticipated water offset.

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

Thurston County is a potential project sponsor. Thurston County's readiness to proceed is uncertain.

Documentation of sources, methods, and assumptions.

HDR. 2020. Off-Channel Storage-and-Release at Schneider's Prairie on the Mainstem of the Deschutes River (Thurston County ID 122). Project Summary prepared by HDR for the Washington State Department of Ecology. 6 p and 3 appendices.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

WDFW (Washington State Department of Fish and Wildlife). 2021. Salmonscape Mapping of Fish Distribution. http://apps.wdfw.wa.gov/salmonscape/

Small-Scale LID Project Development/Implementation for WRIA 13

Project Name
Small-Scale LID Project Development/Implementation for WRIA 13

WRIA 13 WRE Subbasin
Boston Harbor, Cooper Point, McLane, Johnson Point, Woodland Creek, Spurgeon Creek, Deschutes Lower, Deschutes Middle, and Deschutes Upper subbasins

Water Offset
To be determined

Project Status
The Small-Scale LID Project Development/Implementation for WRIA 13 is currently in the conceptual stage.

This project is also described in a Project Summary by HDR (2020), which is available in Appendix J and has been excerpted to form portions of this project description.

Narrative Description
In water budgets associated with undeveloped landscapes, a significant percentage of precipitation typically infiltrates into the subsurface, recharging shallow groundwater. As development occurs, stormwater runoff is generated in areas where compacted soils, impervious roofs, driveways, and parking lots concentrate stormwater runoff into conveyance systems, including roadside ditches and buried pipes, that transport stormwater from the site area and reduce site infiltration. Recent adoption of Low Impact Development (LID) practices for new development helps to address this issue. However, in all urbanized areas of WRIA 13 a significant legacy of conventional development continues to generate large volumes of runoff flowing untreated into stormwater systems, and this water ends up in treatment facilities or is discharged - untreated - into local streams and into Puget Sound.

By strategically concentrating small-scale LID retrofit work in urbanized settings and by partnering with residential and commercial community members to redirect runoff away from stormwater conveyance systems and into green stormwater infiltration facilities, Small-Scale LID Project Development/Implementation for WRIA 13 will help to conserve in-stream flow. In rural settings, efforts can explore additional opportunities to slow and infiltrate stormwater runoff that would otherwise rapidly discharge into nearby waterways.

Small-scale LID projects could incorporate one or more of the following components:

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

- Planter boxes are 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.

- Bioinfiltration swales are vegetated, mulched, or xeriscaped channels that provide stormwater treatment and retention as they move stormwater from one place to another. Vegetated swales slow, infiltrate, and filter stormwater. Bioswales can be designed in a linear orientation, making them well suited for placement along streets and parking lots.

- Permeable pavement infiltrates, treats, and/or stores rainwater where it falls (without conveyance). 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 used in conjunction with rain gardens and bioswales installed in medians and along the parking lot perimeter.

- Green streets are created by integrating green infrastructure elements into roadway design to store, infiltrate, and/or evapotranspire stormwater. Green streets can incorporate permeable pavement, bioswales, and/or planter boxes into roadway design.

Thurston Conservation District will work with partners to identify and implement retrofit projects to benefit groundwater recharge. Creative partnerships with local jurisdictions could result in incentive programs and a focus on areas of interest that will benefit stormwater programs as well as in-stream flow.

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

Given short-term uncertainties about project development and measurable benefits, small-scale LID retrofit projects won't be counted towards water offsets in the plan. However, long-term benefits will be quantified and tracked as projects are developed and implemented in regions with appropriate soils, willing partners, and waterways that can benefit from this work. The use of small-scale LID retrofit projects is an important tool to integrate into long-term planning for in-stream flow preservation. Construction of numerous, clustered infiltration facilities will result in a measurable impact and benefit.

Conceptual-level map and drawings of the project and location.

A map of potential project locations for Small-Scale LID Project Development/Implementation for WRIA 13 has not yet been developed.

Description of the anticipated spatial distribution of likely benefits.

Small-Scale LID Project Development/Implementation for WRIA 13 has to potential to increase groundwater recharge and, potentially, streamflow in streams adjacent to and downstream of future project locations throughout the watershed.

Performance goals and measures.

The project's performance goal is to increase groundwater recharge within the shallow aquifer system within WRIA 13 through the implementation of small-scale LID projects. Project performance will be measured by the number of small-scale LID projects implemented within WRIA 13 and, by extension, the estimated water offset.

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

The Washington Department of Fish and Wildlife (WDFW, 2020a) has identified that fall Chinook Salmon, Coho Salmon, Chum Salmon, and winter Steelhead trout are present in the Deschutes River and the independent drainages in WRIA 13. Chinook Salmon are of hatchery origin, but the other species are of wild or mixed origin (WDFW, 2020b). Chinook and Steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 13 (NOAA, 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions.

Increased streamflow and reduced water temperatures would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve the survival of juveniles. Addressing the streamflow limiting factor and improving habitat conditions would 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 is believed to be in alignment with the goals of the Streamflow Restoration Act. Water conservation and efficiency projects are an identified non-water offset project type that could achieve net ecological benefit (NEB).

Thurston Conservation District is the project sponsor, and it is anticipated that other conservation organizations and/or municipalities also will support the project.

Barriers to project implementation could include the availability of funding for new project construction and the willingness of private landowners to participate in the program.

Potential budget and O&M costs.

Capital and O&M costs for specific projects have not yet been evaluated. However, the U.S. Environmental Protection Agency (2007) concluded that stormwater LID practices can result in cost savings of 15 to 80 percent relative to conventional stormwater management practices.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of Small-Scale LID Project Development/Implementation in WRIA 13 maintain benefit to watershed streams over time and despite changing external conditions (which could include seasonal variation in hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned project will be durable, based on the following:

- LID project implementation is anticipated to provide water offset over a range of hydrologic conditions, though the magnitude of the water offset will vary with precipitation amount.
- LID components will be controlled by the property owners and preserved long-term.
- Land use changes external to the project sites likely would have negligible impact on project function.

Herein, resiliency refers to the capacity of the project to maintain the benefit to watershed streams despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, and/or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- Project engineering elements can be engineered and constructed in a manner that is resilient to flood events.
- Wildfire damage to the project sites could impact project function.
- Project function could be impacted by a decrease in seasonal and/or annual precipitation.

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

The project sponsor is Thurston Conservation District. Readiness to proceed with this project is contingent upon project funding.

Documentation of sources, methods, and assumptions.

EPA (U.S. Environmental Protection Agency). 2007. Reducing stormwater costs through low impact development (LID) strategies and practices. EPA Publication 841-F-07-006. December. 37 p.

HDR. 2020. Small-scale LID Project Development/Implementation for WRIA 13. Project Summary prepared by HDR for the Washington State Department of Ecology. 1 p.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007

WDFW (Washington Department of Fish and Wildlife). 2020a. Salmonscape. Available at: http://apps.wdfw.wa.gov/salmonscape/map.html

WDFW (Washington Department of Fish and Wildlife). 2020b. Salmon Conservation and Reporting Engine. Available at: https://fortress.wa.gov/dfw/score/score/maps/map_details.jsp?geocode=wria&geoarea=WRIA13_Deschutes

Water Right Opportunities in WRIA 13

Project Name

Water Right Opportunities in WRIA 13

WRIA 13 WRE Subbasin

Various

Water Offset

To be determined

Project Status

Pacific Groundwater Group (PGG) conducted an investigation to identify potential water right acquisition opportunities in WRIA 13. PGG's methodology and results were summarized in their Technical Memorandum dated December 18, 2020, which is available in Appendix J and has been excerpted to form portions of this project description.

Although the above-described previous investigation researched and identified a list of water rights for consideration, this project description is intended to be general in nature and no specific water rights are identified for acquisition herein.

Narrative Description

Potential opportunities exist within WRIA 13 for the acquisition of water rights to offset future PE water use. The Water Right Opportunities in WRIA 13 project will benefit instream flows in priority streams by acquiring all or a portion of a selected water right and, if applicable, placing it into Ecology's Trust Water Right Program (TWRP). Quantitative benefits to instream flow will depend on the current use of the specific water right. For example, a domestic water right that diverts from a stream for indoor uses only might have a consumptive use (CU) of about 10 percent of total use. If the return flows from this use return to the same stream from which the water was diverted, placing this water right into the TWRP would have only limited benefit to instream flows. Conversely, an irrigation water right may have a CU of about 80 percent of total use (assuming reasonably efficient irrigation practices) and placing this water right into the TWRP would result in greater benefits. Additionally, the period of use, or seasonality, will affect the portion of the year that instream flow benefits occur.

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

Direct benefits to instream flow in a priority stream will be realized through an interruption or retirement of the use of the acquired water rights. Depending on the specific opportunity, the eliminated water use could be supported by fallowing of irrigated fields, reducing hay harvest, changing to an alternate crop that does not require irrigation, removing livestock, or providing an alternate source of supply. The acquired water right could be placed into the TWRP and dedicated to instream flow purposes. By placing it into the TWRP, increases in instream flows realized by a project would be protected from future appropriation.

The potential water offset realized by a project would be limited to the consumptive impact on instream flows under the existing water right uses. A general discussion of the CU associated with irrigation and domestic uses is provided in the following paragraphs. Once a specific project or acquisition is selected, more detailed evaluation will be required to accurately quantify CU and assess the timing and location of instream flow offsets associated with placing a right into the TWRP.

The timing and location of water offset will depend on a number of factors, including:

- The period of use of the water right (for example, seasonal or continuous). A seasonal diversion might affect stream flows for part of the year, while a continuous diversion would likely affect stream flows year-round.
- Whether the right is for surface water or groundwater. Surface water diversions affects streamflow instantaneously. However, the effect of groundwater withdrawal on streamflow flows lags behind the pumping period, such that the effect of seasonal pumping begins a period of time after pumping begins and can persist for weeks to months after pumping ceases. Also, the location where groundwater withdrawal impacts streamflow tends to be more dispersed than a surface water diversion.
- Distance from a groundwater withdrawal to surface water.
For a groundwater withdrawal, the hydrogeologic characteristics of the aquifer system and degree of hydraulic connection with surface water.

For irrigation water rights, CU can be estimated based on the State of Washington Irrigation Guide (WIG) (NRCS 1997) and Ecology Water Resources Program Guidance 1210 (Ecology 2005). The WIG lists the crop irrigation requirement (CIR) for a variety of crops at stations throughout the state. The CIR is the amount of water needed from irrigation to support crop growth that is not provided by precipitation or stored soil moisture. Guidance 1210 provides typical irrigation application efficiencies (Ea) and percent CU associated with different irrigation methods. The CIR divided by the application efficiency provides the total irrigation water requirement (TIR). Multiplying the TIR by the percent CU yields CU.

No specific water offsets for this project have been developed.

Conceptual-level map and drawings of the project and location.

No specific project locations are included herein.

Description of the anticipated spatial distribution of likely benefits.

The Water Right Opportunities in WRIA 13 project will increase streamflow in target streams during periods tied to the permitted water rights, which typically include greatest water use during the summer and early fall, and therefore provide the greatest aquatic habitat benefits.

Performance goals and measures.

The performance goal is to increase streamflow in targeted streams by terminating water use associated with specific water rights. Project performance will be measured by the CU retired by the water rights acquired by the project.

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

Streams within WRIA 13 are inhabited by numerous fish species tracked by the Washington State Department of Fish and Wildlife (WDFW, 2021), which could include Chum Salmon, Chinook Salmon, Coho Salmon, Pink Salmon, steelhead, Bull Trout, kokanee, Rainbow Trout, and resident Coastal Cutthroat Trout.

In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 13 (NOAA 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions.

Increased streamflow and reduced water temperatures will primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This will improve the survival of juveniles. Addressing the streamflow limiting factor and improving habitat conditions 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 aligns with the goals of the Streamflow Restoration Act. Water right acquisition is an identified project type that could achieve net ecological benefit (NEB).

This project is anticipated to have broad support among Ecology and WRIA 13 stakeholders. Barriers to project implementation could be the availability of project funding and the willingness of existing water right holders/property owners to sell their water rights.

Potential budget and O&M costs.

Water right acquisition costs are location and market specific. For a planning-level estimate, costs per consumptive acre-foot can be assumed to be in the range of $1,500 to $6,500 (WestWater Research, 2019). Assuming a CU of 100 AF, this equates to a total project cost of $150,000 to $650,000.

Anticipated durability and resiliency.

In this context, durability refers to the capacity of the Water Right Opportunities in WRIA 13 Project to maintain benefit to watershed streams over time despite changing external conditions (which could include seasonal variation in hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned project will be durable, based on the following:

- Water right acquisition is anticipated to provide water offset over a range of hydrologic conditions.
- Acquired water rights will be controlled by the TWRP or purchasing entity.

- Land use changes external to the project site likely would have negligible impact on project function.

Herein, resiliency refers to the capacity of the project to maintain the benefit to watershed streams despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, and/or other impacts. We anticipate that the planned project would be resilient to the potential impacts of climate change based on the following:

- Water right acquisition is anticipated to provide water offset over a range of climatic conditions.
- Wildfire damage to the project site and surrounding area would not impact project function.

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

Project sponsor(s) have not been identified for this project.

Documentation of sources, methods, and assumptions.

Ecology (Washington State Department of Ecology). 2005. Water Resources Program Guidance 1210, Determining Irrigation Efficiency and Consumptive Use. October 11. 11 p.

NRCS (United States Department of Agriculture Natural Resources Conservation Service). 1997. National Engineering Handbook, Irrigation Guide. September. 820 p.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

PGG (Pacific Groundwater Group). 2020. Technical Memorandum, Water Right Screening Methodology. Technical Memorandum prepared by PGG for the Department of Ecology WRIA 13 Watershed Restoration and Enhancement Committee. December 18, 3p.

WDFW (Washington State Department of Fish and Wildlife). 2021. Salmonscape Mapping of Fish Distribution. http://apps.wdfw.wa.gov/salmonscape/

WestWater Research, LLC. 2019. Valuation of a Proposed Water Release Agreement, Final Report. Report prepared by WestWater Research of Boise, Idaho for the Washington State Department of Ecology and Seattle City Light. January 26. 29 p.

Chambers Creek Habitat Project (13-DL-H1)

Project Name

Chambers Creek Habitat Project

WRIA 13 WRE Subbasin

Deschutes Lower subbasin

Project Status

The Chambers Creek Habitat Project is sponsored by Thurston County and proposes to remeander a series of ditched channels through an existing complex of fields southeast of the intersection of Yelm Highway and Rich Road SE in Thurston County, Washington. A conceptual design for the project has been developed and is summarized in Figure 1.

This project is described in a Technical Memorandum by HDR (2020), which is available in Appendix J and has been excerpted to form portions of this project description.

Narrative Description

Chambers Creek is a tributary of the Deschutes River in Thurston County and is listed as high priority for restoration (SIT, 2015). Thurston County is proposing to remeander a series of ditched channels through an existing field complex south of Yelm Highway and east of Rich Road, as shown in Figure 1.

The Chambers Creek Habitat Project is intended to improve aquatic and salmonid habitat and has the potential to provide a connection to existing Coho Salmon spawning habitat within the Deschutes Lower subbasin. A goal of the project is to improve fish productivity and survival within Chambers Creek by enhancing the quality and quantity of instream habitat within the project reach. Habitat within Chambers Creek is currently impaired by lack of riparian vegetation and large woody debris (LWD), simplification of instream habitats, poor floodplain connectivity, channel incision, and poor water quality.

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

The Chambers Creek Habitat Project is located at the confluence of Chambers Creek with Chambers Ditch and an unnamed tributary (herein designated the South Tributary). The three converging streams are ditched through an existing field, as shown in Figure 1. The proposed project area is designated as both wetland and floodplain. Thurston County will work with the landowners to recreate the natural stream sinuosity and the surrounding wetland. Additionally, LWD will be added to offer refuge from predators and opportunities for salmon to feed, while the wetland area provides slower water during high flow events. Native plants will be planted throughout the ¾-acre project area to provide shade.

Chambers Creek is a lowland tributary of and a critical contributor of cold water to the Deschutes River. Overall, the Chambers Creek basin is composed of 8,323 acres that drain to Chambers Lake, Little Chambers Lake, Smith Lake, Chambers Ditch, and Chambers Creek. The

Chambers/Little Chambers Lake complex is the largest waterbody in the basin. It does not have a feeder system, but Little Chambers Lake does form the headwaters for Chambers Ditch. Smith Lake is a 12-acre, groundwater-fed lake (Thurston County 1995). Chambers Ditch is a seasonal stream that was ditched for most of its length early in the century. Chambers Ditch flows from Chambers Lake south to its juncture with Chambers Creek and the South Tributary upstream of Rich Road. Chambers Creek is a natural stream with year-round flow through most of its length. Chambers Creek flows into the Deschutes River. The South Tributary is a network of natural channels, artificial ditches, and poorly defined wetlands, which flows intermittently and remains dry most of the year (Thurston County, 1995).

The proposed project is intended to improve water quality and increase salmon rearing habitat for juvenile Coho Salmon. The system is modeled as habitat for Fall Chinook, Coho and Chum Salmon. Specifically, the project will be designed to accomplish the following:

- Increase stream length by at least 1/8-mile.
- Restore at least 1/3-mile of creek.
- Increase instream shading.
- Increase instream complexity by adding LWD.
- Increase community involvement.

This habitat project could potentially produce a water offset benefit, however, the size of that benefit would be quite small and no estimate of size was developed.

A map and drawings of the project location.

Figure I-6 presents the project location.

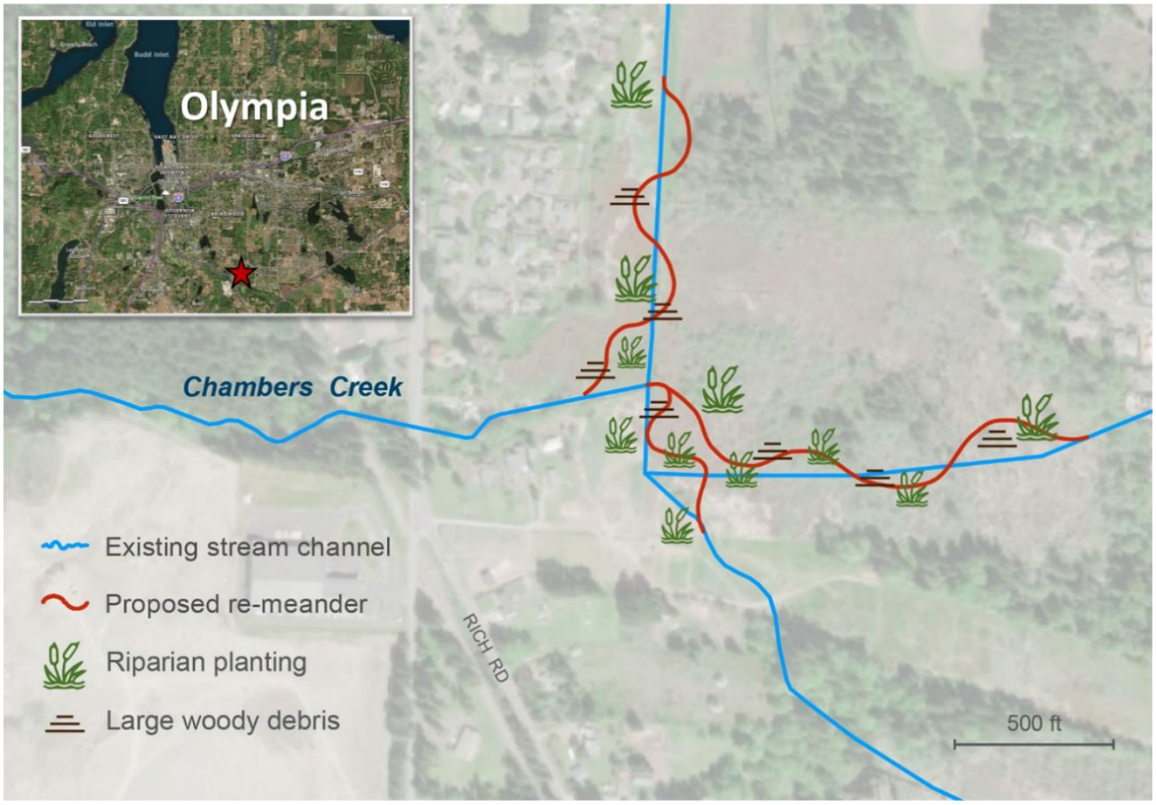

Figure I-6. Location of proposed Chambers Creek Habitat Project in Thurston County, Washington.

Description of the anticipated spatial distribution of likely benefits.

The Chambers Creek Habitat Project encompasses approximately 3 acres. Within that project footprint, the length of Chambers Creek will increase through the restoration of meanders. The new channel alignment will improve instream habitat, improve floodplain connectivity, and increase groundwater storage in shallow soil underlying the project area.

Performance goals and measures.

The project's performance goal is to improve/restore habitat conditions within Chambers Creek. The performance measures are the associated increase in channel sinuosity and length, the increase in instream habitat complexity, and the increase in channel roughness. Specific metrics will be defined during project feasibility investigation and design.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

The Washington Department of Fish and Wildlife has identified that Coho Salmon and Fall Chinook are present in Chambers Creek and that Coho Salmon and Fall Chinook have access to Chambers Creek (WDFW, 2020). WDFW (2020) documents spawning in Chambers Creek and small areas in the lowermost reaches. The Washington Stream Catalog indicates that both Coho, Chum, and Chinook Salmon were historically present in Chambers Creek which is identified as an important tributary to the Deschutes River (WDF 1975). Chinook are priority species, protected under the U.S. Endangered Species Act (ESA). Chambers Creek also provides habitat for reticulate sculpin, Olympic mudminnow, wood duck, and wintering waterfowl.

Chambers Creek has inadequate spawning gravel and low summer flows (Haring and Konovsky, 1999). Chambers Creek offers three types of Coho Salmon habitat. The segment near the mouth contains a few spawning sites. The lower section provides year-round rearing habitat from the springs below Rich Road to the mouth. The portion from the springs below Rich Road up to a point below Yelm Highway provides winter habitat when the creek is flowing. The area near the mouth of Chambers Creek is considered the best remaining habitat for anadromous fish in the Chambers Creek basin with relatively clean gravel, large trees, and a well-developed understory near the creek that provides shading. Upstream from the mouth, the habitat quality declines. The riparian cover gives way to open fields south of the creek below Rich Road (Thurston County, 1995).

The lower quarter mile of the South Tributary upstream of Rich Road contains viable seasonal habitat for migrating fish, with fair overhanging cover and in-stream woody debris. However, upstream areas have been channelized through agricultural development, the channel disappears frequently within wetlands and there is poor substrate and very little, large organic debris within the channel (Thurston County, 1995).

Identification of anticipated support and barriers to completion.

This project is in alignment with the goals of the Streamflow Restoration Act. Channel habitat improvement projects are an identified project type that could achieve net ecological benefit (NEB).

Thurston County has indicated support for this project. Because the proposed project area includes privately owned parcels, the primary barrier to completion is likely to be land acquisition and/or obtaining conservation easements.

Estimate of capital costs and reoccurring O&M costs.

The total costs of construction, engineering, permitting, and cultural assessments are estimated to be less than $1 million, based on an order of magnitude estimate. No estimate of O&M costs is currently available.

Project durability and resiliency.

In this context, durability refers to the capacity of the Chambers Creek Habitat Project to maintain benefit to watershed streams over time and despite changing external conditions (which could include seasonal variation in hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned project will be durable, based on the following:

- The project will be actively managed by Thurston County or their future project partner(s).
- The restored stream section will be designed to mimic natural fluvial and ecological processes and be self-sustaining.
- Land use changes external to the project site likely would have negligible impact on project function.

Herein, resiliency refers to the capacity of the project to maintain the benefit to watershed streams despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, and/or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project will be designed to be resilient to perturbations in climate.
- A climate-related decrease in summer streamflow would impact the ability of the project site to support fish populations.
- Wildfire damage to the project site and surrounding area would impact project function.

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

The project sponsor is Thurston County and is ready to implement the project. An initial step in implementation will be an evaluation of project feasibility.

Documentation of sources.

Haring, D. and J. Konovsky. 1999. Salmon Habitat Limiting Factors Final Report. Water Resource Inventory Area 13. Washington State Conservation Commission.

Thurston County (Thurston County Storm and Surface Water Program). 1995. Chambers/Ward/Hewitt Comprehensive Drainage Basin Plan. Prepared for the City of Olympia and Thurston County.

SIT (Squaxin Island Tribe). 2015. Deschutes River Coho Salmon Biological Recovery Plan. Prepared by Confluence Environmental Company and Shane Cherry Consulting. http://blogs.nwifc.org/psp/files/2017/12/Deschutes-Coho-Recovery-Plan.pdf. September 2015.

WDF (Washington Department of Fisheries). 1975. "A Catalog of Washington Streams and Salmon Utilization, WRIA 13." Accessed at: https://www.streamnetlibrary.org/?page_id=95.

WDFW (Washington Department of Fish and Wildlife). 2020. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/

Spurgeon Creek Remeander Habitat Project (13-S-H1)

Project Name
Spurgeon Creek Remeander Habitat Project

WRIA 13 WRE Subbasin
Spurgeon Creek subbasin

Project Status
The Spurgeon Creek Remeander Habitat Project is sponsored by the South Puget Sound Salmon Enhancement Group. A 30 percent plan set was completed by the South Puget Sound Salmon Enhancement Group and the Wild Fish Conservancy. In addition, stakeholder coordination and public involvement were conducted and concluded that there is a general consensus of support for this project.

This project is described in a Technical Memorandum by HDR (2020), which is available in Appendix J and has been excerpted to form portions of this project description.

Narrative Description
Spurgeon Creek is the largest lowland tributary of the Deschutes River in Thurston County and is listed as high priority for restoration (SIT, 2015). The South Puget Sound Salmon Enhancement Group is currently proposing to remeander a ditched channel through the adjacent wet fields just south of a private driveway and north of and below the Fox Hill development (Figure 1). The proposed project is intended to improve water quality as well as salmonid, aquatic, and riparian habitat by increasing habitat area and floodplain activity. The project also has the potential to provide salmon viewing and educational opportunities to local residents and the public at large.

The goal of the project is to improve fish productivity and survival within Spurgeon Creek by enhancing the quality and quantity of instream habitat within the project reach. Habitat within Spurgeon Creek is currently impaired, particularly within the lower portion of the project reach, by lack of riparian vegetation and large woody debris (LWD), simplification of instream habitats, poor floodplain connectivity, channel incision and poor water quality.

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.
The Spurgeon Creek restoration project is located near the head waters of Spurgeon Creek in Thurston County. At the project location, the creek is currently ditched through a field, as shown in Figure 1. Through this project, the South Puget Sound Salmon Enhancement Group will work with area landowners to recreate the natural stream sinuosity through a wetland area. Additionally, LWD will be added to the restored stream channel to offer refuge from predators and opportunities for salmon to feed, while the wetland will provide slower water during high flow events. Native plants will be planted throughout the ¾-acre project area.

Spurgeon Creek is the largest lowland tributary to the Deschutes River and a critical contributor of cold water. The proposed project is specifically intended to improve water quality and increase salmon rearing habitat for juvenile Coho Salmon. The project will be designed to accomplish the following:

- Increase stream length by 1/8-mile.
- Restore 1/3-mile of creek.
- Increase instream shading by 20 percent.
- Increase instream complexity by adding LWD.
- Increase community involvement.

This habitat project could potentially produce a water offset benefit, however, the size of that benefit would be quite small and no estimate of size was developed.

A map and drawings of the project location.

Figure I-7 presents the project location.

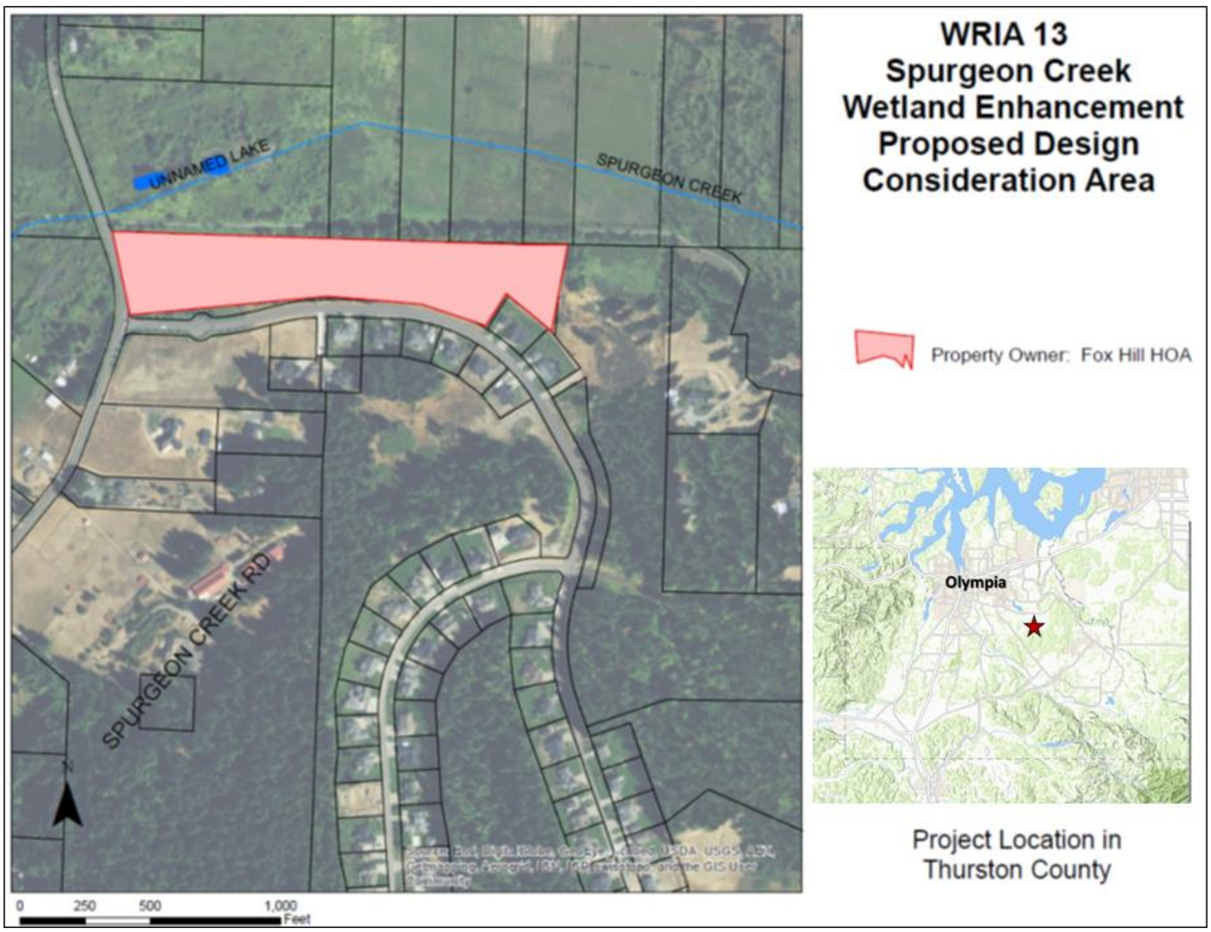

Figure I-7. Location of proposed Spurgeon Creek Remeander Habitat Project in Thurston County, Washington.

Figure I-8 presents a conceptual design drawing of the project from the 30 percent design plans completed by the South Puget Sound Salmon Enhancement Group and the Wild Fish Conservancy.

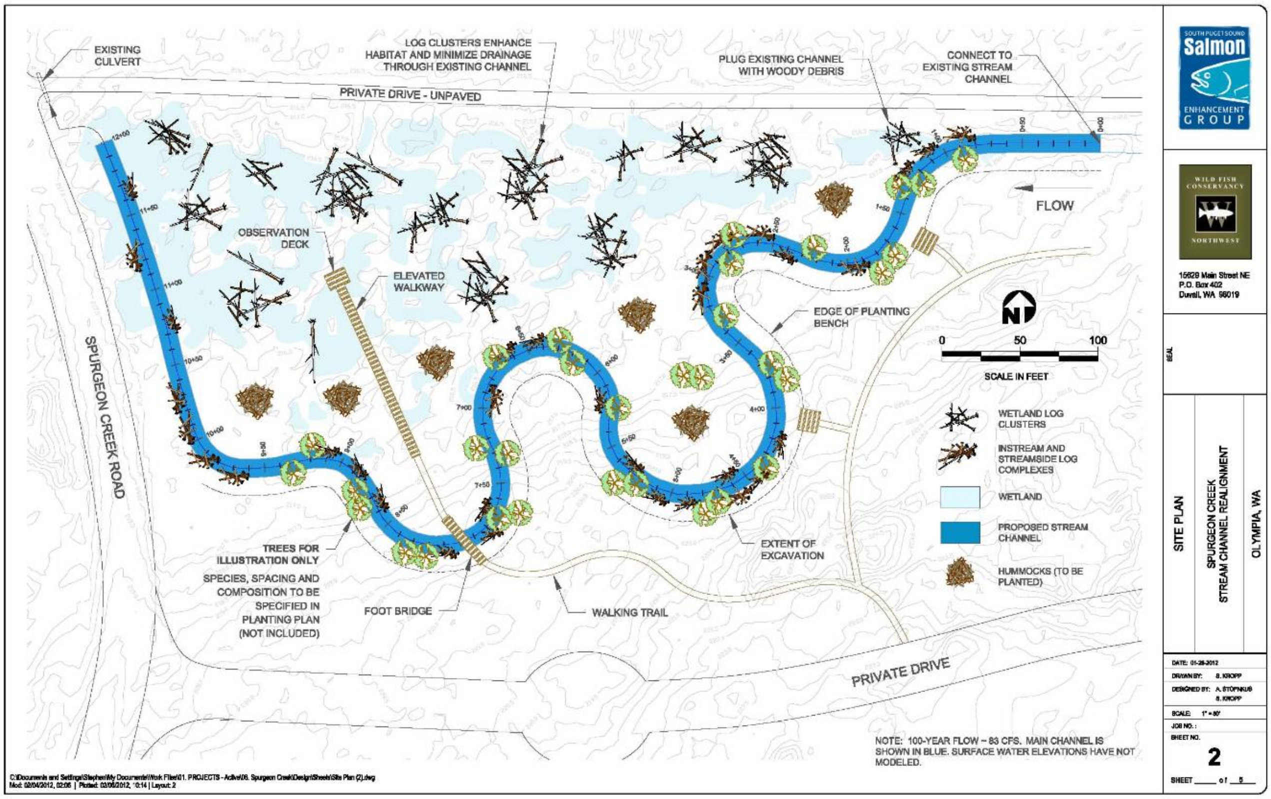

Figure I-8. Conceptual drawing of Spurgeon Creek Remeander Habitat Project.

Description of the anticipated spatial distribution of likely benefits.

The Spurgeon Creek Remeander Habitat Project site encompasses approximately three quarters of an acre. Within that project footprint, the length of Spurgeon Creek will increase by approximately 1/8-mile relative to existing conditions through the restoration of stream meanders. This will effectively restore one third of the total length of the creek. Water quality benefits will extend approximately two miles downstream of the project site.

Performance goals and measures.

The project's performance goal is to improve/restore habitat conditions within Spurgeon Creek. The performance measures are to restore 1/3-mile of Spurgeon Creek, increase stream length by 1/8-mile, increase instream complexity by adding LWD, increase instream shading by 20 percent, and increase community involvement.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

The Washington Department of Fish and Wildlife has identified that Coho Salmon and Fall Chinook are present in Spurgeon Creek and that Chum Salmon and winter steelhead have access to Spurgeon Creek (WDFW, 2020). WDFW (2002) documents spawning in Spurgeon Creek and small areas in the lowermost reaches of a limited number of other middle and lower tributaries are shown as supporting spawning (WDFW, 2002; Anchor, 2008). The Washington Stream Catalog indicates that both Coho, Chum, and Chinook Salmon were historically present in Spurgeon Creek which has historically been identified as an important tributary to the Deschutes River (WDF, 1975). Chinook are priority species, protected under the U.S. Endangered Species Act (ESA). Spurgeon Creek also provides habitat for reticulate sculpin, Olympic mudminnow, wood duck, and wintering waterfowl.

The portion of Spurgeon Creek proposed for restoration has the potential to provide rearing and foraging habitat for the aforementioned salmon and trout populations year-round. Increased base streamflow, improved water quality, and reduced water temperatures would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve both productivity and survival of juveniles. The alteration of natural stream hydrology has been identified as a high priority limiting factor and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions (NOAA, 2007).

Identification of anticipated support and barriers to completion.

This project is in alignment with the goals of the Streamflow Restoration Act. Channel habitat improvement projects are an identified project type that could achieve net ecological benefit (NEB).

The actions included in this project are recommended by the WRIA 13 Four-Year Work Plan and the Squaxin Island Tribe Natural Resources Deschutes Coho study (SIT, 2015). This project has support from the Fox Hill Homeowners Association, the Washington Department of Fish and Wildlife, and the Squaxin Island Tribe. Spurgeon Creek is a high priority for restoration based on the Deschutes River Coho Salmon Biological Recovery Plan.

The project design envisions moving the creek out of its confined channel on the eastern extent of the adjacent homeowner's association (HOA) property to re-engage wetlands and expand Coho rearing opportunities. However, property boundary issues, existing property disputes, and less than full support from neighboring, non-HOA parcels may limit the ability to move Spurgeon Creek out of its confined channel to recreate natural stream sinuosity (Walley, 2019).

Another barrier to project completion could be related to the permeability of site soil. The proposed project area is at least partially underlain by glacial till, which could limit the ability to create and effectively sustain wetland habitat because of drainage issues. The soils present onsite are adequate for growing coniferous trees but appear to not be adequate for supporting wetland creation and enhancement (Hatch-Winecka, 2019).

Estimate of capital costs and reoccurring O&M costs.

The total costs of construction, engineering, permitting, and cultural assessments are estimated to be $1,000,000. No estimate of O&M costs is currently available.

Project durability and resiliency.

In this context, durability refers to the capacity of the Spurgeon Creek Remeander Habitat Project to maintain benefit to watershed streams over time and despite changing external conditions (which could include seasonal variation in hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned project will be durable, based on the following:

- The project will be actively managed by the South Puget Sound Salmon Enhancement Group.
- The restored stream section will be designed to mimic natural fluvial and ecological processes and be self-sustaining.
- Land use changes external to the project site likely would have negligible impact on project function.

Herein, resiliency refers to the capacity of the project to maintain the benefit to watershed streams despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, and/or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project will be designed to be resilient to perturbations in climate.
- A climate-related decrease in summer streamflow would impact the ability of the project site to support fish populations.
- Wildfire damage to the project site and surrounding area would impact project function.

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

The project sponsor is the South Puget Sound Salmon Enhancement Group. The project sponsor will engage with watershed partners based on their level of interest and ability to be involved with the study. Potential project partners who have indicated their interest include: The Fox Hill Homeowners Association; the Washington Department of Fish and Wildlife; and the Squaxin Island Tribe.

Documentation of sources.

Anchor (Anchor Environmental, LLC). 2008. Final Deschutes River Watershed Recovery Plan: Effects of Watershed Habitat Conditions on Coho Salmon Production. Prepared for Squaxin Island Tribe Natural Resources Department, Shelton, WA.

Hatch-Winecka. 2019. Scope change request for the Spurgeon Creek Wetland Restoration project (16-1408). Email from Amy Hatch-Winecka to Amee Bahr, Grant Manager. October 11, 2019.

NOAA (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2007. Puget Sound Salmon Recovery Plan. Volume I. Adopted by the National Marine Fisheries Service, January 19, 2007.

SIT (Squaxin Island Tribe). 2015. Deschutes River Coho Salmon Biological Recovery Plan. Prepared by Confluence Environmental Company and Shane Cherry Consulting. http://blogs.nwifc.org/psp/files/2017/12/Deschutes-Coho-Recovery-Plan.pdf. September 2015.

Walley, Jerilyn. 2019. Email sent to Amy Hatch-Winecka, WRIA 13 Lead Entity Coordinator. RE: Scope change request for the Spurgeon Creek Wetland Restoration project (16-1408). October 11, 2019.

WDFW (Washington Department of Fish and Wildlife). 2002. Washington State Salmon and Steelhead Stock Inventory. Prepared by Washington Department of Fish and Wildlife, Olympia, Washington. Available at SalmonScape at: https://fortress.wa.gov/dfw/salmonscape/.

WDFW (Washington Department of Fish and Wildlife). 2020. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/.

WDF (Washington Department of Fisheries). 1975. “A Catalog of Washington Streams and Salmon Utilization, WRIA 13.” Accessed at: https://www.streamnetlibrary.org/?page_id=95.

Woodard Creek Project (13-BH-H1)

Project Name
Woodard Creek Project

WRIA 13 WRE Subbasin
Boston Harbor subbasin

Project Status
In 2014, a study of the Woodard Creek basin identified and ranked potential stormwater retrofit sites that would have a positive impact on the Woodard Creek water quality (AHBL, 2014a; 2014b). Since 2014, two sites have been completed, one site has been removed from consideration, and two remaining sites are in the process of being completed. All of the proposed sites identified in AHBL (2014a; 2014b) address water quality and do not address any flow control issues. The Woodard Creek Project builds on this previous work by addressing the water quantity impacts of stormwater discharge to Woodard Creek by attenuating flood flows, increasing stream bed roughness, and restoring channel sinuosity.

This project is described in a Technical Memorandum by HDR (2020), which is available in Appendix J and has been excerpted to form portions of this project description.

Narrative Description
Woodard Creek basin is located in northern Thurston County; it includes a mix of urban and rural areas and is bisected by Interstate-5, a major transportation corridor in the region, as shown in Figure 1. Woodard Creek flows into Henderson Inlet. The hydrology of the area has been extensively modified by development in the upstream (southern) portion of the basin, resulting in stormwater impacts. Habitat within Woodard Creek is currently impaired, particularly within the northern portion of the project reach, by lack of riparian vegetation and large woody debris (LWD), simplification of instream habitats, poor floodplain connectivity, channel incision, and poor water quality.

The focus of the Woodard Creek Project is to increase stream length, increase water transit time, and increase habitat complexity by modifying portions of stream in the northern end of the basin. The project will increase floodplain connectivity and overall floodplain storage capacity. Increasing streambed roughness with biotechnical techniques (for example, LWD) will also enhance the quality and quantity of instream habitat within the project reach.

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.
The Chambers Creek Project is composed of a number of candidate locations and/or stream reaches. The project sponsor will work with landowners to identify reaches available for restoration. Restoration reaches will have LWD added to suitable or reference densities. The LWD will provide fish cover, hydraulic complexity, and will increase pool density and depth. Coho Salmon will benefit from increased pool density, both for juvenile rearing and adult

holding. Riparian vegetation will be planted, as necessary, throughout the restoration reaches which will recruit wood and provide shade.

This habitat project could potentially produce a water offset benefit, however, the size of that benefit would be quite small and no estimate of size was developed.

A map and drawings of the project location.

Figure I-9 presents the potential project locations.

Figure I-9. Location of Woodard Creek basin in Thurston County. Potential project locations are outlined by red boxes (A-C).

Description of the anticipated spatial distribution of likely benefits.

The proposed stream restoration will benefit Woodard Creek. The length of the benefitted reach will depend on the specific project site(s) that is selected.

Performance goals and measures.

The project's performance goal is to improve/restore habitat conditions within Woodard Creek through increasing channel sinuosity and length, instream habitat complexity, and channel roughness. Specific metrics and measures will be defined during project feasibility and design.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

Although portions of the area have been highly urbanized, Woodard Creek basin supports a variety of wildlife. Many species of fish utilize the creek, including Coho Salmon, Chum Salmon, Steelhead trout, and Cutthroat Trout. Olympic mudminnow have been noted in the creek near the I-5 interchange, though high winter flows and low summer flows in the river have reduced the usability of this habitat (Thurston County, 2015). There are a number of bald eagle nesting sites within the basin, as well as a purple martin breeding area. There are several large wetland areas in the basin, including along Ensign and South Bay Roads.

Limiting factors identified for the creek include alteration of the natural flow regime from increased impervious surfaces, lack of LWD, and barriers to fish passage. The riparian corridor has been impaired by the removal of vegetation in some areas, a lack of conifers in the remaining vegetation, direct animal access to the stream, and excessive amounts of fine sediment in potential spawning areas.

The Washington Department of Fish and Wildlife has identified that Coho Salmon, Chum Salmon, and winter Steelhead are present in Woodard Creek and that Fall Chinook Salmon have access to Woodard Creek (Thurston County, 2015; WDFW, 2020). WDFW (2020) documents spawning in Woodard Creek. The Washington Stream Catalog indicates that Coho Salmon, Chum Salmon, and Chinook Salmon were historically present in Woodard Creek (WDF, 1975). Chinook and Steelhead are priority species, protected under the U.S. Endangered Species Act (ESA). Woodard Creek also provides habitat for reticulate sculpin, Olympic mudminnow, wood duck, and wintering waterfowl.

Identification of anticipated support and barriers to completion.

This project is in alignment with the goals of the Streamflow Restoration Act. Channel habitat improvement projects are an identified project type that could achieve net ecological benefit (NEB).

Thurston County has indicated support for this project. Because the proposed project area includes privately owner parcels, the primary barrier to completion is likely to be land acquisition or obtaining conservation easements.

Estimate of capital costs and reoccurring O&M costs.

The total costs of construction, engineering, permitting, and cultural assessments are estimated to be less than $1 million, based on an order of magnitude estimate. No estimate of O&M costs is currently available.

Project durability and resiliency.

In this context, durability refers to the capacity of the Woodard Creek Project to maintain benefit to watershed streams over time and despite changing external conditions (which could include seasonal variation in hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned project will be durable, based on the following:

- The project will be actively managed by Thurston County or their future project partner(s).
- The restored stream section will be designed to mimic natural fluvial and ecological processes and be self-sustaining.
- Land use changes external to the project site likely would have negligible impact on project function.

Herein, resiliency refers to the capacity of the project to maintain the benefit to watershed streams despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, and/or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The project will be designed to be resilient to perturbations in climate.
- A climate-related decrease in summer streamflow would impact the ability of the project site to support fish populations.
- Wildfire damage to the project site and surrounding area would impact project function.

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

The project sponsor is Thurston County and is ready to implement the project. An initial step in implementation will be an evaluation of project feasibility.

Documentation of sources.

AHBL. 2014a. Stormwater Retrofit Site Rankings – Woodard Creek Stormwater Retrofit. April 14, 2014, Revised June 4, 2014. https://www.thurstoncountywa.gov/sw/swdocuments/projects-woodard-creek-final-feasibility-screening.pdf

AHBL. 2014b. Draft Summary Memo, Task 4 - Evaluate Stormwater Retrofit Sites. August 26, 2014. https://www.thurstoncountywa.gov/sw/swdocuments/projects-woodard-creek-top-5-site-selection.pdf.

Thurston County. 2015. Guiding Growth – Healthy Watersheds: Woodard Creek Basin Water Resource Protection Study June 2015 https://www.thurstoncountywa.gov/planning/planningdocuments/woodard-creek-basin-water-resource-protection-study-final-report-june-2015.pdf

TMDL Report. https://www.thurstoncountywa.gov/sw/swdocuments/projects-woodland-cr-henderson-inlet-tmdl-report.pdf

Washington Department of Fish and Wildlife (WDFW). 2002. Washington State Salmon and Steelhead Stock Inventory. Prepared by Washington Department of Fish and Wildlife, Olympia, Washington. Available at SalmonScape at: https://fortress.wa.gov/dfw/salmonscape/.

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WDFW (Washington Department of Fish and Wildlife). 2020. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/

WRIA 13 General Floodplain Restoration Project (13-WRIA-H1)

Project Name

WRIA 13 General Floodplain Restoration Project

WRIA 13 WRE Subbasin

Boston Harbor, Cooper Point, McLane, Johnson Point, Woodland Creek, Spurgeon Creek, Deschutes Lower, Deschutes Middle, and Deschutes Upper subbasins

Project Status

The WRIA 13 General Floodplain Restoration Project is currently in the conceptual stage. A mapping exercise was conducted as part of the WRIA 13 planning process that identified the potential floodplain restoration project locations shown in Figure 1.

This project is described in a Technical Memorandum by HDR (2020), which is available in Appendix J and has been excerpted to form portions of this project description.

Narrative Description

The Deschutes River originates on Cougar Mountain in Lewis County and flows 57 miles, mostly within Thurston County, with several smaller independent tributaries that drain into three saltwater inlets: Henderson, Budd, and Eld. Other principal streams include Woodard Creek and Woodland Creek, which are the largest of the major tributaries to Henderson Inlet. Key limiting factors for salmonid habitat and productivity in WRIA 13 were identified by Haring & Konovsky (1999), Thurston Conservation District (2004), and Confluence Environmental (2015). These limiting factors include:

- Natural stream processes have been significantly altered due to adjacent land uses including timber harvest, agricultural uses, and residential and commercial development.
- Fine sediment levels are high, reducing spawning habitat quality.
- Lack of large woody debris (LWD) in streams, particularly larger key pieces that are stable and most capable of forming pools and other instream habitats and retaining sediment and smaller wood.
- Lack of adequate pool frequency and particularly a lack of large, deep pools that are key habitats for rearing juvenile salmonids and adult salmonids on their upstream migration.
- Naturally high rates of channel migration occur in this geologically young basin with easily erodible glacial outwash soils, but exacerbated rates of streambank erosion and substrate instability due to intermittent bank armoring and removal of forested riparian vegetation and subsequent loss of bank strength and stability.
- Loss of riparian function due to removal/alteration of natural riparian vegetation, which affects water quality, cover, shading, instream habitat conditions, sediment deposition, and wildlife habitat.

- The presence of a significant number of fish passage barriers that inhibit upstream or downstream access to juvenile and adult salmonids.
- Significant alterations to the natural hydrology in streams where the uplands have been heavily developed, which has led to increased peak flows and decreased low flows that cause bed scour, bank erosion, and reduced water quality; and the threat of similar impacts to streams that are experiencing current and future development growth.
- Estuarine habitat quantity and quality is significantly impacted by physical alteration of the natural estuary (such as the damming of Capitol Lake that dramatically reduced the area of estuarine habitat), dredging, fill, poor water quality in the estuary, and by significant alteration of nearshore ecological function due to shoreline armoring.

WRIA 13 floodplain restoration projects will address functional loss of water storage, low flows, and water quality within the Deschutes River and tributaries within WRIA 13. The specific actions proposed for a given project will be specific to the restoration opportunity and habitat capacity of that location. The primary goal of this project portfolio will be to rehabilitate lost processes and functions that are provided by floodplain connectivity. More detailed objectives pursuant to this goal will be specific to each respective project.

Quantitative or qualitative assessment of how the project will function, including water offset benefits, if applicable.

Individual WRIA 13 General Floodplain Restoration projects will vary in form and function depending on the stream setting, habitat capacity, the impact that is being remediated, and the corresponding opportunities for restoration. Potential floodplain restoration actions include the following:

- Channel re-alignment (for example, remeander projects).
- Removing bank protection.
- Installation of LWD to promote hyporheic and floodplain water storage.
- Removal of fill or creation of inset floodplain (for example, excavation of terraces).
- Side channel and off-channel feature reconnection, creation, or enhancement.

This habitat project could potentially produce a water offset benefit, however, the size of that benefit would be quite small and no estimate of size was developed.

A map and drawings of the project location.

As part of the planning process, recommendations for specific locations for the WRIA 13 General Floodplain Restoration Project were received from the WRIA 13 Watershed Restoration and Enhancement Committee (the committee). The following process was used to identify the candidate sites:

- Identified reaches that are unconfined using a hillshade surface built from LiDAR coverages. Unconfined reaches were defined as those with relatively wide valleys and floodplains.

- Identified reaches within floodplains.
- Identified land that is vacant, and therefore potentially available for acquisition and restoration.
- Identified land that is public and potentially easier to acquire for restoration.
- Identified areas of tributary inflow, because these areas are often areas of biological importance, habitat complexity, and in many cases intermittent flooding.

Figure 18 presents the project locations identified during the planning process, which include the following general locations:

- Tributary to Woodard Bay, east of Libby Road.
- Tributary to Gull Harbor, north of Inlet Drive.
- Tributary to Henderson Inlet, between Johnson Point Road and 67th Avenue NE.
- Tributary to Henderson Inlet, east of Puget Road and north of Pleasant Forest Road.
- Deschutes River, downstream of Pioneer Park.
- Deschutes River, east of Munn Lake.
- Deschutes River, Schneider's Prairie.
- Upper Spurgeon Creek.
- Deschutes River, north of Offut Lake.
- Deschutes River, North of Military Road SE.

All project locations will be subject to feasibility evaluation during plan implementation. Also, other locations not shown on Figure I-10 might be identified by project sponsors during plan implementation.

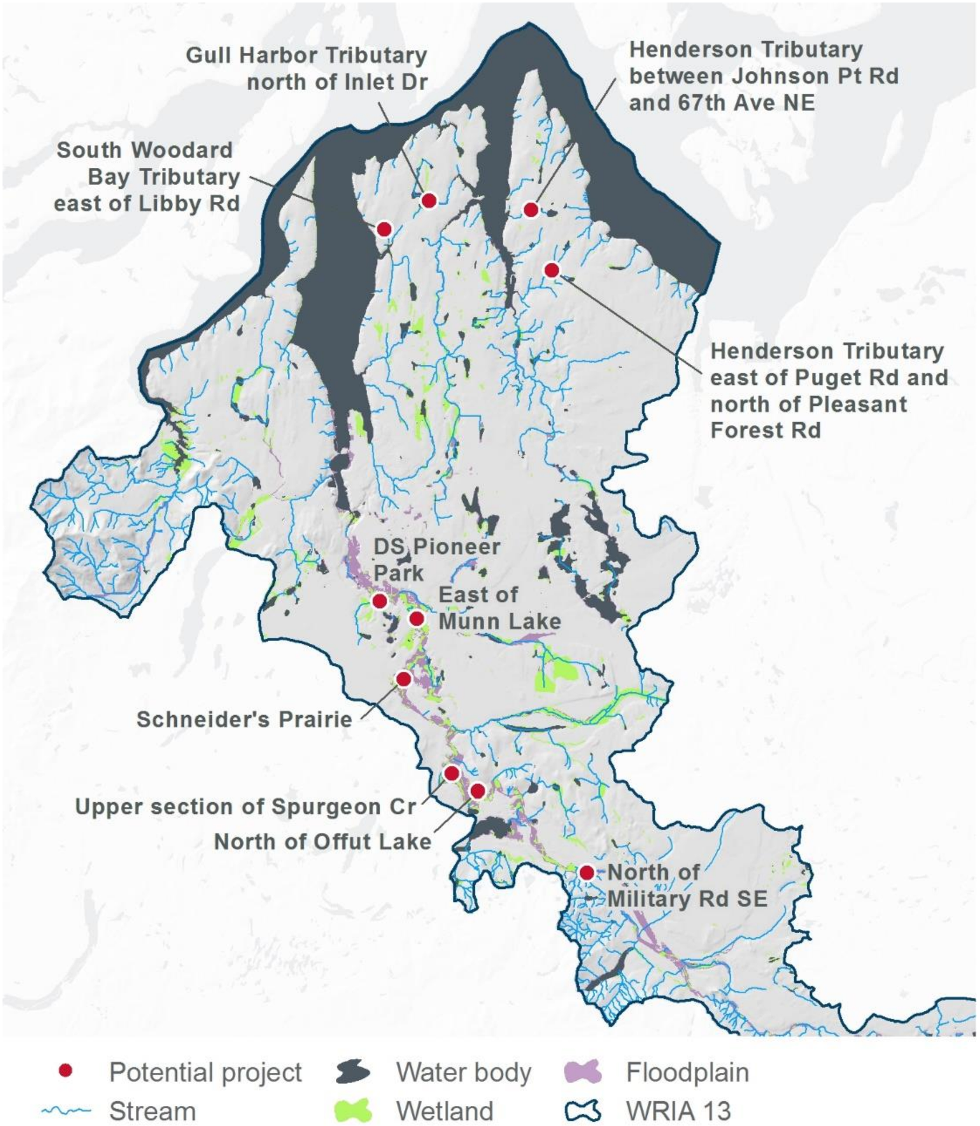


Figure I-10. Potential floodplain restoration project locations.

Description of the anticipated spatial distribution of likely benefits.

The Deschutes River watershed (WRIA 13) contains the Deschutes River and its tributaries, along with 22 independent drainages that enter Henderson, Budd, and Eld inlets. The primary independent drainages are associated with McLane Creek, Woodward Creek, and Woodland Creek.

Potential floodplain restoration projects have been identified in the upper reaches of several small tributaries to Budd and Henderson inlets that historically had more extensive wetlands in their headwaters. Restoring floodplain connectivity, along with riparian and wetland habitats, could benefit up to 5 miles of these tributaries and their associated tributaries by storing direct precipitation as well as stormwater runoff in the headwaters and floodplain areas, contributing additional flows during low flow periods.

The Deschutes River has been noted for low summer/fall flows for decades (WDF, 1975). Potential floodplain restoration projects have been identified in multiple floodplain reaches of the Deschutes River and one potential project in the upper reaches of Spurgeon Creek (a primary tributary to the Deschutes River). Restoring floodplain connectivity, along with instream, riparian, and wetland habitats, could benefit up to 16 miles of the Deschutes River, plus up to 5 miles in Spurgeon Creek by storing direct precipitation as well as stormwater and flood storage in floodplain areas that could contribute additional flows during low flow periods.

Performance goals and measures.

Performance goals and measures will vary depending on the project. In general, the goals will be to implement specific restoration actions with their intended quantity and purpose. Depending on the project, directly measurable restoration elements could include acres of floodplain; acres of wetland and/or riparian habitats restored; stream-miles enhanced; predicted quantity of baseflow volume restored; predicted reduction in stream temperature; and potentially other metrics.

Descriptions of the species, life stages and specific ecosystem structure, composition, or function addressed. Note if threatened and endangered fish species would benefit.

The Washington Department of Fish and Wildlife (WDFW, 2020a) has identified that fall Chinook Salmon, Coho Salmon, Chum Salmon, and winter Steelhead trout are present in the Deschutes River and the independent drainages in WRIA 13. Chinook Salmon are of hatchery origin, but the other species are of wild or mixed origin (WDFW, 2020b). Chinook and Steelhead are priority species, protected under the U.S. Endangered Species Act (ESA).

Increased floodplain habitats and improved riparian and instream habitat conditions will primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer rearing habitats. This will improve both productivity and survival of juveniles, particularly Coho Salmon and steelhead. The restoration of floodplain processes and functions could also improve summer/fall base flows and reduce water temperatures. This will improve both juvenile and adult migration conditions. The alteration of natural stream hydrology has been identified as a high priority limiting factor in WRIA 13 (Haring & Konovsky, 1999;

Confluence Environmental, 2015) and the restoration and reconnection of floodplain habitats and riparian enhancements provide shading, food web support, and flood and sediment attenuation functions.

Identification of anticipated support and barriers to completion.

This project is in alignment with the goals of the Streamflow Restoration Act. Riparian and fish habitat improvement projects are identified project types that could achieve net ecological benefit (NEB). We anticipate that individual projects could receive support from area conservation groups, municipalities, and regulators.

Barriers to completion could include funding acquisition, property acquisition, and/or opposition from neighboring landowners.

Estimate of capital costs and reoccurring O&M costs.

Capital and O&M costs for specific projects have not yet been evaluated.

Project durability and resiliency.

In this context, durability refers to the capacity of the WRIA 13 General Floodplain Restoration Project to maintain benefit to watershed streams over time and despite changing external conditions (which could include seasonal variation in hydrologic conditions, seasonal and/or long-term fluctuation in regional groundwater elevation, population change, adjacent land use changes, and/or other factors). We anticipate that the planned projects will be durable, based on the following:

- The projects will be actively managed by the project sponsors.
- The restored stream sections will be designed to mimic natural fluvial and ecological processes and be self-sustaining.
- Land use changes external to the project sites likely would have negligible impact on project function.

Herein, resiliency refers to the capacity of the projects to maintain the benefit to watershed streams despite the impacts of climate change. Within the watershed, climate change could result in an increase in seasonal temperature, a decrease in summer precipitation, an increase in winter rainfall, a decrease in winter snowfall and/or spring snowpack, an increase in the frequency and/or intensity of storm events, an increase in wildfires, an increase in sea level, and/or other impacts. We anticipate that the planned project would be moderately resilient to the potential impacts of climate change based on the following:

- The projects will be designed to be resilient to perturbations in climate.
- A climate-related decrease in summer streamflow could impact the ability of the project sites to support fish populations.
- Wildfire damage to the project site and surrounding area would impact project function.

Project sponsor(s) (if identified) and readiness to proceed/implement.
No specific project sponsors have been identified.

Documentation of sources.

Confluence Environmental Company. 2015. Deschutes River Coho Salmon Biological Recovery Plan. Prepared for the Squaxin Island Tribe Natural Resources Department, September 2015.

Haring, D. and J. Konovsky, 1999, Salmon Habitat Limiting Factors Final Report, Water Resource Inventory Area 13. Prepared by the Washington State Conservation Commission.

Thurston CD, 2004. Salmon Habitat Protection and Restoration Plan for Water Resource Inventory Area 13, Deschutes. Prepared by the Thurston Conservation District Lead Entity.

WDFW (Washington Department of Fish and Wildlife). 2020a. Salmonscape. Available at: http://apps.wdfw.wa.gov/salmonscape/map.html

WDFW (Washington Department of Fish and Wildlife). 2020b. Salmon Conservation and Reporting Engine. Available at: https://fortress.wa.gov/dfw/score/score/maps/map_details.jsp?geocode=wria&geoarea=WRIA13_Deschutes

Appendix J – HDR Project Technical Memos

The following technical memos were developed for the WRIA 13 Committee process. Therefore, final conclusions as presented in this plan may not align with these technical memos, but are provided as a supplement for project descriptions in Appendix I.

Chambers Creek Habitat Project

Project Description

Description

Chambers Creek is a tributary of the Deschutes River in Thurston County and is listed as high priority for restoration (SIT 2015). Thurston County is proposing to re-meander a series of ditched channels through the adjacent wet fields south of Yelm Highway and east of Rich Road (Figure 1). The proposed project is intended to improve aquatic and salmonid habitat. The project has the potential to provide a connection to existing Coho Salmon spawning habitat in the lower basin.

The goal of the project is to improve fish productivity and survival within Chambers Creek by enhancing the quality and quantity of instream habitat within the project reach. Habitat within Chambers Creek is currently impaired, by lack of riparian vegetation and large woody debris, simplification of instream habitats, poor floodplain connectivity, channel incision and poor water quality.

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

The Chambers Creek restoration project is located at the confluence with Chambers Ditch, in Thurston County. At the project location, Chambers Creek, Chambers Ditch, and an unnamed tributary converge, and are ditched through a wet field (Figure 1). The proposed project area is both in designated wetland and floodplain. Thurston County will work with the landowners to recreate the natural stream sinuosity and the surrounding wetland. Additionally, wood structures will be added that offer refuge from predators and opportunities for salmon to feed, while the wetland offers slower water during high flow events. Native plants will be planted throughout the ¾-acre project area that will recruit wood and provide shade into the future.

Chambers Creek is a lowland tributary to the Deschutes River and a critical contributor of cold water. Overall, the Chambers Creek basin is composed of 8,323 acres that drain to Chambers, Little Chambers, Smith Lake, Chambers Ditch, and Chambers Creek. Chambers/Little Chambers Lake complex is the largest waterbody in the basin. It does not have a feeder system, but Little Chambers Lake does form the headwaters for Chambers Ditch. Smith Lake is a 12-acre, groundwater-fed lake (Thurston County, 1995). Chambers Ditch is a seasonal stream that was ditched for most of its length early in the century. Chambers Ditch flows from Chambers Lake south to its juncture with Chambers Creek and the South Tributary upstream of Rich Road. Chambers Creek is a natural stream with year-round flow through most of its length. Chambers Creek flows into the Deschutes River. The South Tributary is a network of natural channels, artificial ditches, and poorly defined wetlands, which flows intermittently and remains dry most of the year (Thurston County, 1995).

The proposed project is intended to improve water quality and increase salmon rearing habitat for juvenile Coho Salmon. The system is modeled as habitat for Fall Chinook, Coho and Chum Salmon. Specifically, the project will designed to accomplish the following:

- Increase stream length by at least 1/8 miles.
- Restore at least 1/3 mile of creek.
- Increase instream shading.
- Increase instream complexity by adding Large Woody Debris (LWD).
- Increase community involvement.

Conceptual-level map and drawings of the project and location.

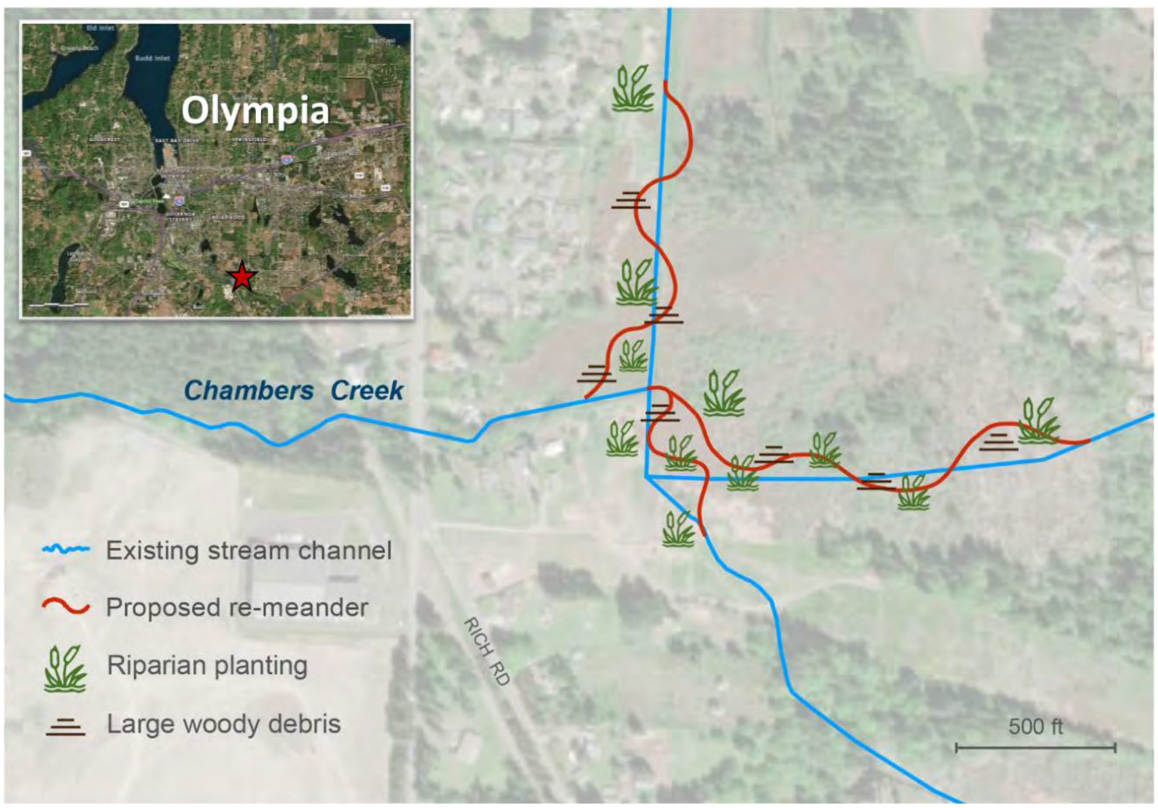


Figure 1. Location of proposed Chambers Creek remeander project in Thurston County.

Description of the anticipated spatial distribution of likely benefits

The proposed project site is approximately 3 acres. Within that footprint, the length of Chambers Creek is expected to be increased by increasing the sinuosity. The new channel alignment will have improved instream habitat, floodplain connectivity (i.e. local flooding from increased sinuosity channel roughness elements), and increased groundwater storage (i.e. in terms of saturated soils from increased local flooding.

Performance goals and measures.

The performance goals are to increase channel sinuosity and length, increase instream habitat complexity, and channel roughness. Specific metrics and measures will be defined when during feasibility and design.

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

The Washington Department of Fish and Wildlife has identified that Coho Salmon and Fall Chinook are present in Chambers Creek and that Coho Salmon and Fall Chinook have access to Chambers Creek (WDFW Salmonscape 2020). WDFW (2020) documents spawning in Chambers Creek and small areas in the lowermost reaches (WDFW 2020). The Washington Stream Catalog indicates that both Coho, Chum, and Chinook salmon were historically present in Chambers Creek which is identified as an important tributary to the Deschutes River (WDF 1975). Chambers Creek also provides habitat for reticulate sculpin, Olympic mudminnow, wood duck, and waterfowl overwintering.

Chambers Creek has inadequate spawning gravel and low summer flows (Haring and Konovsky, 1999). Chambers Creek offers three types of coho habitat. The segment near the mouth contains a few spawning sites. The lower section provides year-round rearing habitat from the springs below Rich Road to the mouth. The portion from the springs below Rich Road up to a point below Yelm Highway provides winter habitat as long as the creek is flowing. The area near the mouth of Chambers Creek is the best remaining habitat for anadromous fish in the basin with relatively clean gravel, large trees, and a well-developed understory near the creek that provides shading. Upstream from the mouth, the habitat quality declines. The riparian cover gives way to open fields south of the creek below Rich Road (Thurston County, 1995). The lower quarter mile of the South Tributary upstream of Rich Road contains viable seasonal habitat for migrating fish, with fair overhanging cover and in-stream woody debris. However, upstream, it has been channelized through agricultural lands, and disappears frequently in the wetlands. There is poor substrate and very little large organic debris in the channel (Thurston County, 1995).

Identification of anticipated support and barriers to completion.

Thurston County has indicated support for this project. The primary barrier to completion is likely to be land acquisition or obtaining conservation easements. The proposed project area includes privately owned parcels.

Potential budget and O&M costs.

The total costs of construction, engineering, permitting, and cultural assessments are estimated to be <$1 million, based on an order of magnitude estimate (includes engineering and construction costs).

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by Thurston County or their future project partner. The restored stream section would be designed to be compatible with natural ecological processes to be self-sustaining and resilient to perturbations to minimize long-term maintenance costs.

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

The project sponsor is Thurston County and is ready to implement the project. Implementation would require an evaluation of feasibility.

References

Haring,D. and J. Konovsky. 1999. Salmon Habitat Limiting Factors Final Report. Water Resource Inventory Area 13. Washington State Conservation Commission.

Thurston County Storm and Surface Water Program. (1995a). Chambers/Ward/Hewitt Comprehensive Drainage Basin Plan. Prepared for the City of Olympia and Thurston County.

Squaxin Island Tribe (SIT). 2015. Deschutes River Coho Salmon Biological Recovery Plan. Prepared by Confluence Environmental Company and Shane Cherry Consulting. http://blogs.nwifc.org/psp/files/2017/12/Deschutes-Coho-Recovery-Plan.pdf. September 2015.

WDF (Washington Department of Fisheries), 1975. "A Catalog of Washington Streams and Salmon Utilization, WRIA 15." Accessed at: https://www.streamnetlibrary.org/?page_id=95.

WDFW (Washington Department of Fish and Wildlife), 2020. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/

Donnelly Drive Infiltration Galleries

To: Angela Johnson (Ecology and Kaitlynn Nelson (Thurston County)
From: HDR
Date: May 20, 2020
Subject: Donnelly Drive Infiltration Gallery Analysis

Background

Portions of Donnelly Drive SE, and Normandy Drive SE flood during major rainfalls and impacts public property and reduces public safety. Thurston County Roads Maintenance has routinely responded to calls from residents for assistance. It is proposed to install treatment devices and infiltration systems in the Donnelly Drive vicinity to reduce flooding of public streets and promote infiltration to groundwater. There are five locations in the area which see flood issues as shown on Figure 1. Each of these locations are a low point where an existing drywell is located to infiltrate stormwater.

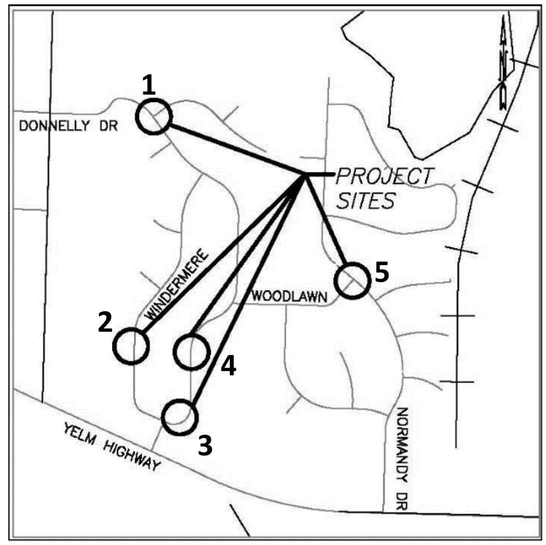


Figure 6. Flooding areas

At Location 1 (at the intersection of Donnelly Drive SE and Glendale Drive SE) is a single drywell installed at some point after the original neighborhood was built.

At location 2 (along Windermere Drive SE) are two drywells installed on either side of the roadway. The drywells are original to the initial construction of the neighborhood.

At location 3 (at the intersection of Donnelly Drive SE and Windemere Drive SE near Yelm Highway), are three drywells installed on all sides of the intersection, all of which were installed at some point after the original neighborhood was built.

At location 4 (along Donnelly Drive SE) are two drywells installed on either side of the roadway. The drywells are original to the initial construction of the neighborhood.

At location 5 (intersection of Woodlawn Drive SE and Normandy Drive SE), are three inlet inlets. Two of these are located on the west side of the intersection and one is located on the south side of the intersection. It is unclear how many of these are drywells.

Analysis and Results

Site Visit

During the rainfall event, it was observed that the drywells at Locations 2 and 4 were fully surcharged and bypassing all flow reaching them with negligible infiltration.

At Location 5, the northern most inlet was surcharged while the inlet on the west side of the intersection had a water surface elevation approximately 2-inches below the rim. The southern inlet was surcharges with flow slightly greater in the curb downstream of the inlet than upstream. A slow rise of particles was seen out of the inlet indicating flow was coming out of the inlet. If this inlet/drywell is connected to the inlet on the other side of the street, this may indicate that the flow to the combined structures exceeded the infiltration capacity and is surcharging. If not connected, this may indicate groundwater coming up out of the inlet.

Locations 1 and 3 were not surcharging during the May 2, 2020 rainfall event and fully infiltrating.

Basin Delineation

The contributing stormwater basins to each flooding area was delineating by using topography data from the 2011 Thurston County LiDAR survey and verified with a site visit during a rainfall event occurring on May 2, 2020. Five basins were delineated and shown on Figure 2 with each basin flowing towards one of the flooding areas.

For determining basin areas for sizing infiltration galleries, only the directed connected impervious area of the roadway and driveways was considered.

Assumed Infiltration Rate

According to the NRCS Web Soil Survey, the soils in the area consist primarily of sandy loams. Table A.1 of the Thurston County Drainage Manual lists the estimated design (long-term) infiltration rate for sandy loam as 0.25 inches per hour. Past project experience in this area also has found infiltration rates similar to 0.25 inches per hour. The analysis looks into sizing assuming a 0.25 inch per hour infiltration rate as well as 0.5 inches per hour.

Infiltration Gallery Sizing

The required infiltration gallery size was determined using the Western Washington Hydrology Model (WWHM). The model assumed an infiltration gallery cross-section similar to what was installed at Husky Way which had a width of 8 feet, height of 4 feet, and a 24-inch diameter perforated pipe.

The required length of infiltration gallery for each basin is given in Table 1 for three different scenarios these include:

- Infiltration rate of 0.25 inches per hour and sized to infiltrate for all but the two largest storms
- Infiltration rate of 0.25 inches per hour and sized for 100 percent infiltration
- Infiltration rate of 0.50 inches per hour and sized to infiltrate for all but the two largest storms

The reason for sizing for all but the two largest storms is that getting to 100 percent infiltration causes the galleries to be unfeasibly large (approximately 67 percent larger). An example of the stage height seen in each infiltration gallery when not sized for 100 percent infiltration is shown on Figure 2.

Figure 2. Drainage basins

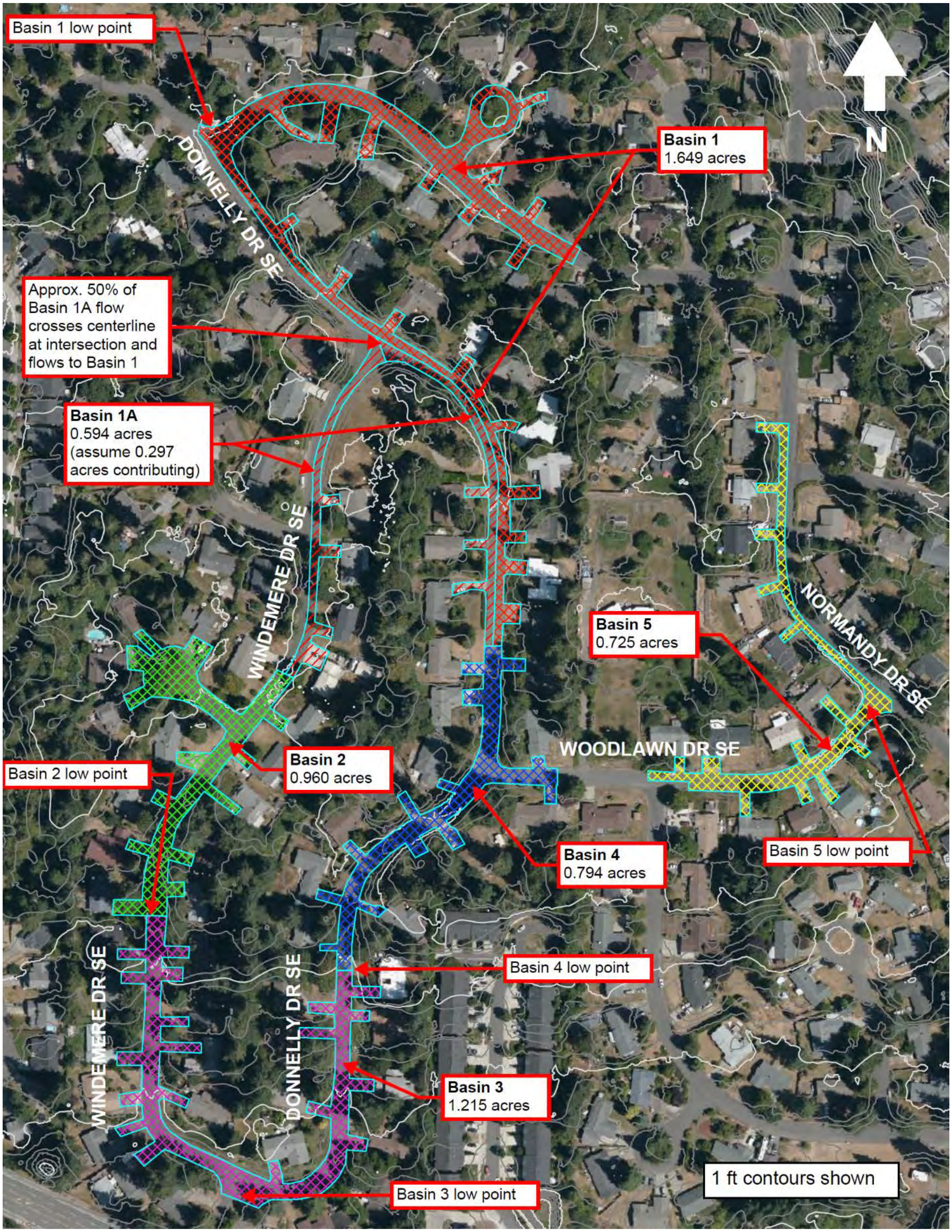


Figure 3.

Table 14. Infiltration gallery length

Basin	Calculated infiltration gallery length (feet)		
	0.25 inch/hour	0.25 inch/hour – 100% infiltration	0.5 inch/hour
1	1,800	3,000	1,450
2	900	1,500	725
3	1,150	1,900	900
4	750	1,250	600
5	675	1,150	550
TOTAL	5,275	8,800	4,225

Figure 7. Drainage basins

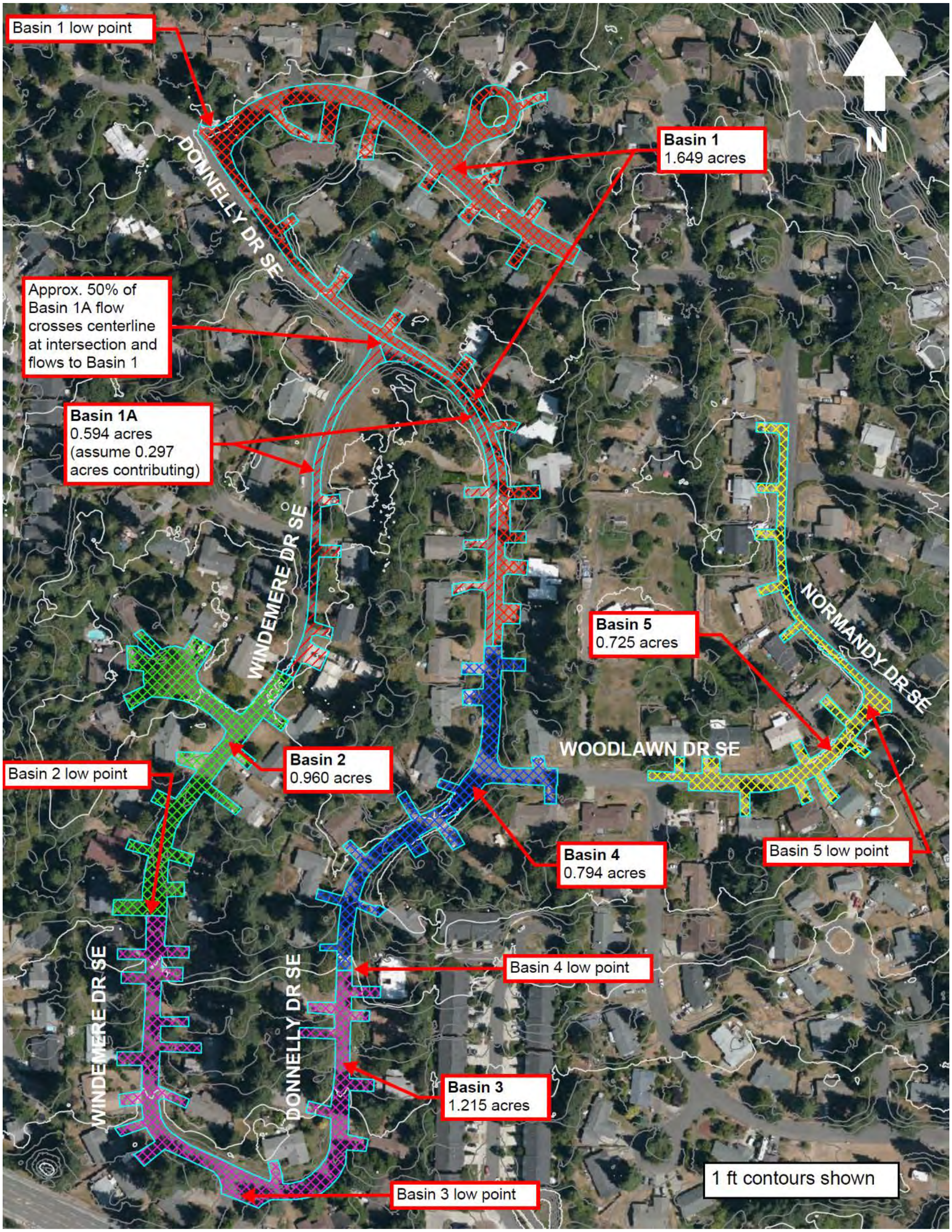
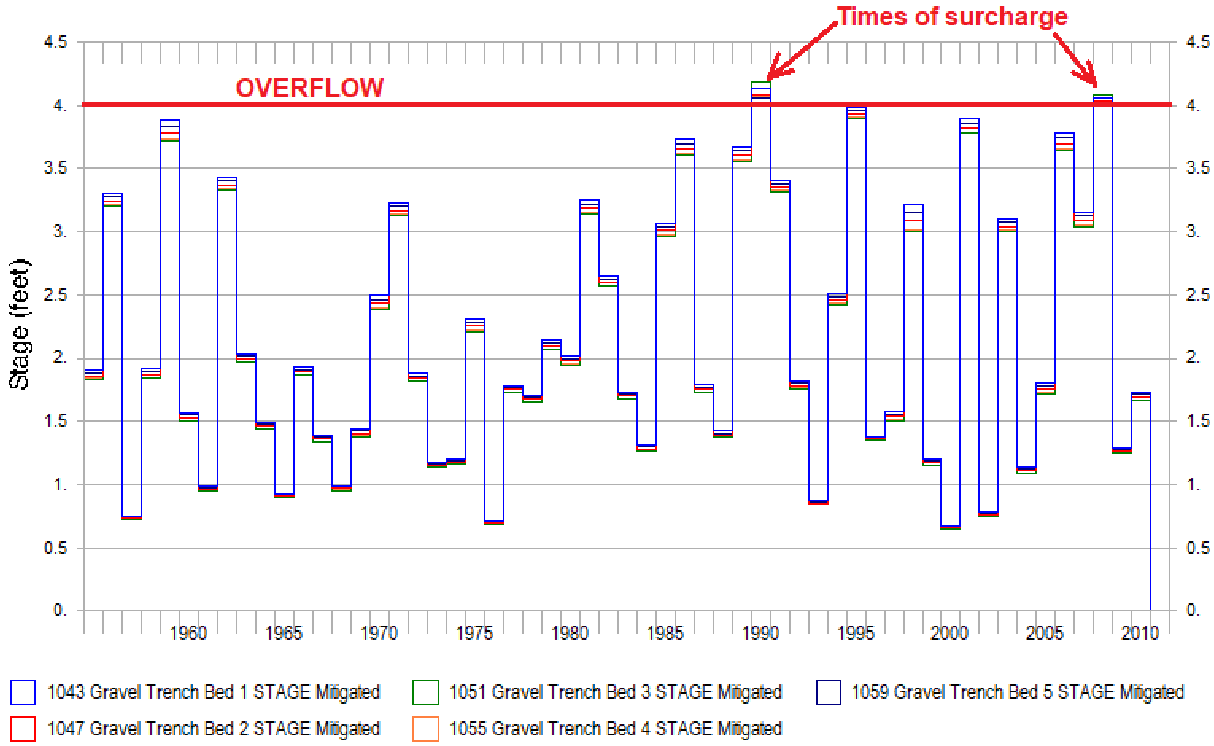


Figure 8. Times of surcharge across WWHM model run



If the infiltration rate were to increase to 0.5 inches per hour from 0.25 inches per hour, the length of infiltration gallery needed would decrease by approximately 20 percent.

Stormwater Infiltration Volume

The Donnelly Drive project is being considered to not only reduce the flood nuisance but to also provide additional groundwater recharge for mitigation purposes. WWHM was used to estimate the increase in volume infiltrated.

Table 15. Stormwater infiltration volume

Scenario	Annual average infiltrated volume (acre-feet)	Increase in annual average infiltrated volume over existing (acre-feet)
Existing	5.53	0
Galleries sized to infiltrate for all but the two largest storms	19.31	13.78
Galleries sized for 100% infiltration	19.35	13.82

Opinion of Probable Construction Cost

The Husky Way infiltration gallery project was used as a basis to estimate the linear foot construction cost of an infiltration gallery. The engineers estimate, done in 2012, for Husky Way had a construction cost of $166,757 to build 335 feet of infiltration gallery, excluding tax. Inflated to today’s dollars and including tax, this corresponds to a cost of approximately $684 per foot of infiltration gallery.

On top of the construction cost the cost estimate also includes the following costs based on a percentage of the construction cost: (1) 30 percent contingency; (2) 15 percent for geotechnical investigation; (3) 15 percent for engineering; (4) 10 percent for administrative costs; (5) 5 percent for permitting.

Due to the low infiltration rates expected in the area, a substantial area is needed for infiltration with infiltration galleries running along the length of most of the streets within the basins. To further design, additional geotechnical investigation should be completed to verify infiltration rates as infiltration rates higher than what is assumed could substantially lower the cost of the project by reducing the length of infiltration gallery needed.

Table 3 provides a summary of opinion of probable construction costs by project scenario.

Table 16. Opinion of probable construction cost

Cost item	Costs by scenario		
	0.25 inch/hour	0.25 inch/hour for 100% infiltration	0.50 inch/hour
Construction Cost	$3,608,043	$6,019,105	$2,889,855
Contingency (30%)	$1,082,413	$1,082,413	$1,082,413
Geotechnical (30%)	$541,206	$541,206	$541,206
Engineering (15%)	$541,206	$541,206	$541,206
Admin (10%)	$360,804	$360,804	$360,804
Permitting (5%)	$180,402	$180,402	$180,402
Total Cost	$6,310,000	$8,730,000	$5,600,000

Floodplain Restoration

General Project Description for Opportunities in WRIA 13

Narrative description, including goals and objectives.

The Deschutes River originates on Cougar Mountain in Lewis County and flows 57 miles, mostly within Thurston County, with several smaller independent tributaries that drain into three saltwater inlets: Henderson, Budd, and Eld. Other principal streams include Woodard and Woodland Creeks which are the largest of the major tributaries to Henderson Inlet. Key limiting factors for salmonid habitat and productivity in Water Resource Inventory Area (WRIA) 13 were identified in Haring & Konovsky (1999), Thurston Conservation District (2004), and Confluence Environmental (2015).

- Natural stream processes have been significantly altered due to adjacent land uses including timber harvest, agricultural uses, and residential and commercial development,
- Fine sediment (<.85 mm) levels are high, reducing spawning habitat quality,
- Lack of large wood in streams, particularly larger key pieces that are stable and most capable in forming pools and other instream habitats and retaining sediment and smaller wood,
- Lack of adequate pool frequency and particularly a lack of large, deep pools that are key habitats for rearing juvenile salmonids and adult salmonids on their upstream migration,
- Naturally high rates of channel migration occur in this geologically young basin with easily erodible glacial outwash soils, but exacerbated rates of streambank erosion and substrate instability due to intermittent bank armoring and removal of forested riparian vegetation and subsequent loss of bank strength and stability,
- Loss of riparian function due to removal/alteration of natural riparian vegetation, which affects water quality, cover, shading, instream habitat conditions, sediment deposition, and wildlife habitat,
- The presence of a significant number of fish passage barriers that inhibit upstream or downstream access to juvenile and adult salmonids,
- Significant alterations to the natural hydrology in streams where the uplands have been heavily developed, which has led to increased peak flows and decreased low flows that cause bed scour, bank erosion, and reduced water quality; and the threat of similar impacts to streams that are experiencing current and future development growth, and
- Estuarine habitat quantity and quality is significantly impacted by physical alteration of the natural estuary, such as by the dam and creation of Capitol Lake that dramatically reduced the area of estuarine habitat, dredging, fill, poor water quality in the estuary, and by significant alteration of nearshore ecological function due to shoreline armoring.

WRIA 13 restoration projects would address functional loss of water storage, low flows and water quality within the Deschutes River and other streams and rivers throughout WRIA 13. The specific actions proposed for any given project would be specific to the restoration opportunity and habitat capacity of that location. The goal of any given project would be to rehabilitate lost processes and functions that are provided by floodplain connectivity. More detailed objectives pursuant to this goal would be specific to each respective project.

Qualitative assessment of how the project will function.

Projects will vary depending on the stream setting, habitat capacity, the impact that has occurred, and the corresponding opportunities for restoration. Potential floodplain restoration actions include the following:

- Channel re-alignment (i.e. re-meander),
- Removing bank protection,
- Installation of large wood to promote hyporheic and floodplain water storage
- Removal of fill or creation of inset floodplain (i.e. excavation of terraces),
- Side channel and off-channel feature reconnections, creation or enhancement.

Conceptual-level map of the project and location.

- A mapping utility was used to solicit WRIA 13 floodplain project recommendations from the WRIA 13 committee. The following data and reasoning was used to select candidate sites in WRIA 13:
- Identify reaches that are unconfined with Lidar hillshade. Unconfined reaches have wider valleys and floodplains.
- Identify reaches in flood zones
- Identify land that is vacant, and therefore potentially available for acquisition and restoration.
- Identify land that is public and potentially easier to acquire for restoration.
- Identify areas of tributary inflow, because they are often areas of biological importance and habitat complexity. They may also be areas more prone to intermittent flooding.

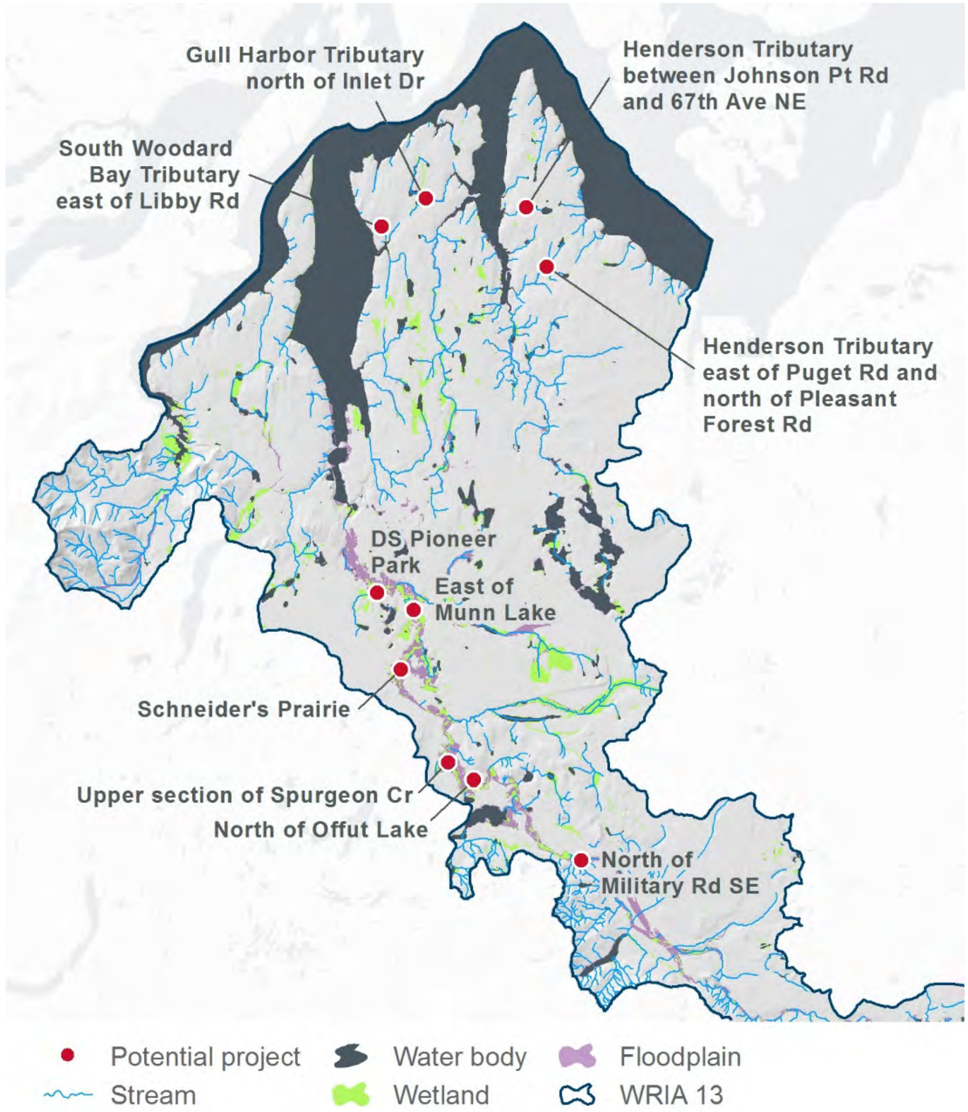


Figure 1. Potential floodplain restoration project locations.

Project locations identified by the committee include the following:

- Tributary to Woodard Bay, east of Libby Road
- Tributary to Gull Harbor, north of Inlet Drive
- Tributary to Henderson Inlet, between Johnson Point Road and 67th Avenue NE
- Tributary to Henderson Inlet, east of Puget Road and north of Pleasant Forest Road

- Deschutes River, downstream of Pioneer Park
- Deschutes River, east of Munn Lake
- Deschutes River, Schneider’s Prairie
- Upper Spurgeon Creek
- Deschutes River, north of Offut Lake
- Deschutes River, North of Military Rd SE

All project locations would be subject to evaluation of feasibility during plan implementation. Other locations may be identified by committee members or other project sponsors during plan implementation.

Performance goals and measures.

Performance goals and measures will vary depending on the project. In general, the goals will be to implement the restoration actions with their intended quantity and purpose. The measures will be directly measurable elements such as acres of floodplain, wetland, or riparian habitats restored, stream-miles enhanced, predicted quantity of baseflow volume restored, predicted reduction of temperature, etc..

Description of the anticipated spatial distribution of likely benefits.

The Deschutes River watershed (WRIA 13) contains the Deschutes River and its tributaries, along with 22 independent drainages that enter Henderson, Budd, and Eld inlets. The primary independent drainages are McLane, Woodward, and Woodland creeks.

Potential floodplain restoration projects have been identified in the upper reaches of several small tributaries to Budd and Henderson inlets that historically had more extensive wetlands in their headwaters. Restoring floodplain connectivity, along with riparian and wetland habitats could benefit up to 5 miles of these tributaries and their associated tributaries by storing direct precipitation as well as stormwater runoff in the headwaters and floodplain areas, contributing additional flows during low flow periods.

Potential floodplain restoration projects have been identified in multiple floodplain reaches of the Deschutes River and one potential project in the upper reaches of Spurgeon Creek (primary tributary to the Deschutes River). Restoring floodplain connectivity, along with instream, riparian, and wetland habitats could benefit up to 16 miles of the Deschutes River, plus up to 5 miles in Spurgeon Creek by storing direct precipitation as well as stormwater and flood storage in floodplain areas that could contribute additional flows during low flow periods. The Deschutes River has been noted for low summer/fall flows for decades (WDF 1975) and

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

The Washington Department of Fish and Wildlife (WDFW 2020a) has identified that fall Chinook, coho, and chum salmon, and winter steelhead trout are present in the Deschutes River and the independent drainages in WRIA 13. Chinook salmon are hatchery origin, but the other species are wild or of mixed origin (WDFW 2020b).

Increased floodplain habitats and improved riparian and instream habitat conditions would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer rearing habitats. This would improve both productivity and survival of juveniles, particularly coho and steelhead. The restoration of floodplain processes and functions could also improve summer/fall base flows and reduce water temperatures. This would improve both juvenile and adult migration conditions. The alteration of natural stream hydrology has been identified as a high priority limiting factor in WRIA 13 (Haring & Konovsky 1999; Confluence Environmental 2015) and the restoration and reconnection of floodplain habitats and riparian enhancements provide shading, food web support, and flood and sediment attenuation functions.

Identification of anticipated support and barriers to completion.

No specific projects have been identified.

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

No specific projects have been identified.

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, contributing to flood storage, groundwater recharge, recruitment of large wood, and creation of habitats. Floodplain reconnection projects that provide the river with more room to meander and more ways to hold water in the hyporheic zone and porous floodplain soils are important solutions to restore watershed processes and to provide resiliency from a changing climate.

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

No specific projects have been identified.

References

Confluence Environmental Company. 2015. *Deschutes River Coho Salmon Biological Recovery Plan*. Prepared for the Squaxin Island Tribe Natural Resources Department, September 2015.

Haring, D. and J. Konovsky, 1999. *Salmon Habitat Limiting Factors Final Report, Water Resource Inventory Area 13*. Prepared by the Washington State Conservation Commission.

Thurston CD, 2004. *Salmon Habitat Protection and Restoration Plan for Water Resource Inventory Area 13, Deschutes*. Prepared by the Thurston Conservation District Lead Entity.

WDFW, 2020a. Salmonscape. Available at: http://apps.wdfw.wa.gov/salmonscape/map.html

WDFW, 2020b. Salmon Conservation and Reporting Engine. Available at: https://fortress.wa.gov/dfw/score/score/maps/map_details.jsp?geocode=wria&geoarea=WRIA13_Deschutes

Hicks Lake stormwater retrofit

Description

The Ruddell Road Stormwater Facility was constructed by the City of Lacey in 1999, consisting of a pretreatment settling basin that flows to constructed wetlands; ultimately flowing into Hicks Lake. Although the facility is an improvement to the previous, untreated condition, the limited water quality wet pool volume, relatively high inflows, and flow-through design conditions, limit water quality treatment and provides minimal, if any, infiltration benefit. Therefore, the City is investigating the feasibility of an offset infiltration facility as an upgrade to the current system.

The proposed project would provide water offsets and ecological benefit (per RCW 90.94.030) to the Woodland Creek sub-basin. The improvements are expected to provide a significant shallow groundwater recharge component, and augment base flow to Hicks, Pattison, and Long Lakes, ultimately benefitting Woodland Creek, which is currently impaired by low instream flow (303d listing 6169). Proposed upgrades to the facility include a flow splitting manhole, filtration treatment BMP, infiltration gallery and an overflow structure to the existing wetland.

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

The delineated basin contributing to the existing stormwater system has an approximate total area of 346.46 acres. Stormwater runoff was modeled for the catchment by characterizing precipitation, soils, impervious surfaces, and land use composition. The proposed infiltration facility was sized according to potential stormwater flows, an assumed soil infiltration rate, and soil characteristics. A range of diversion flows were modeled (1cfs, 2cfs, and 3 cfs) were modeled and resulted in a corresponding range of average annual infiltration of 167, 244, and 296 afy, respectively. All flows, up to 3.5 cfs are expected to be 100% infiltrated, but infiltrating up to 3cfs accounts for reduction in infiltration capacity over time. Therefore, infiltrating up to 3 cfs for an offset benefit of 296 cfs is reasonable.

Conceptual-level map and drawings of the project and location.

Figure 1 shows the general layout of the proposed infiltration facility, in series with the existing stormwater (water quality) treatment facility. Up to 3 cfs in stormwater flow would be directed to and infiltrated in the proposed facility. Any stormwater not infiltrated would still over into the existing facility, and flow into Hicks Lake.

Figure 1. Layout of Proposed Infiltration Facility

Description of the anticipated spatial distribution of likely benefits

The infiltrated stormwater would seep into Hicks Lake. Hicks Lake is the headwaters of the Woodland Creek watershed. Water in Hicks Lake flows through Pattison Lake, Long Lake, and then into Woodland Creek. Infiltrated stormwater would reduce flood flows and presumably increase base flows in the entire system during non-storm periods.

Performance goals and measures.

Performance will be measured in terms of infiltration. Stormwater flows and infiltration capacity (or bypass to the water quality BMP) will be measured or observed, for effectiveness.

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

Woodland Creek supports spawning populations of coho, chum, and Chinook salmon (WDF 1975; WDFW 2020). Steelhead trout has documented presence. These salmonids are present from Henderson Inlet to Long Lake. Within this reach, the creek is seasonally dry from Lake Lois to Beatty Springs, north of Martin Way. The watershed is heavily urbanized in the headwaters, contributing to reduced summer flows. This project will contribute to moderating the effects of urban stormwater impacts.

Identification of anticipated support and barriers to completion.

The City supports this project. The project will be on property the City is planning to purchase, and the City does not anticipate any barriers to completion.

Potential budget and O&M costs.

The preliminary OPCC totals approximately $3.3 million for the proposed facilities as currently envisioned (Attachment A).

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by City.

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

The project sponsor is the City of Lacey. The City is ready to implement this stormwater retrofit project, commensurate with funding.

References

WDF (Washington Department of Fisheries), 1975. “A Catalog of Washington Streams and Salmon Utilization, WRIA 13.”

WDFW (Washington Department of Fish and Wildlife), 2020. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/

Attachment A - Opinion of Probable Costs of Construction (OPCC) - Concept Plan Level

Note: Preliminary OPCC does not include sales tax, design, CM, property acquisition, legal, and other administrative/legal costs

Total OPCC:	**$3,295,000**

Item	Description	Unit	Unit Cost	Qty	Cost	Comments
	General Requirements - Stormwater Facilities					
1	Mob/Demob, Survey, Temp Facilities, Utilities Protection, Traffic Control, etc.	ls	331,000	1	$331,000	15% of Items below
	Flow Splitter at Connection to Existing SD					
2	Flow Splitter Vault with Adjustable High Flow Bypass Weir	ls	$60,000	1	$60,000	Precast vault with interior lateral weir wall with alluminum adjustable weir plate - assume 8'X16' vault size
	Water Quality Pre-Treatment					
3	Pre-treatment Facilities Prior to Groundwater Discharge	cfs	$80,000	3	$240,000	Pre-settling vault and/or hydrodynamic separator(s) - allowance for 3 cfs capacity
	Drainage Conveyance System					
4	12" Dia. Storm Drain (Polypropylene)	lf	$60	700	$42,000	Collective 12" conveyance SD; 4' - 6' Depth
5	Catch Basin Type 1	ea	$4,000	4	$16,000	Collective Type 1 CBs, 5' Std Depth
6	Catch Basin Type 2	ea	$7,000	2	$14,000	Collective Type 2 CBs, 6' - 10' Depth

7	Catch Basin Type 2 Emergency Overflow w/Debris Rack	ea	$10,000	1	$10,000	Overflow spillway from infiltration gallery to existing constructed wetland; debris cage
8	Trench Excavation Safety Systems	ls	$7,000	1	$7,000	All conveyance facilities
	Earthwork					
9	Construction TESC Control and Compliance	ls	$70,000	1	$70,000	CSWPPP, TESC, SPCC, Temp Treatment, Discharge, CSGP Monitoring/Compliance
10	Clearing, Grubbing, Disposal	ac	$14,000	3.0	$42,000	Forrested parcel; on-site processing with grinder assumed
11	Infiltration Facility Pad Excavation Incl Haul, Disposal	cy	$20	32,000	$640,000	Assumes excess material disposal within 5 mi
12	Infiltration Gallery Footprint Excavation, Haul, Disposal	cy	$24	6,500	$156,000	Assumes excess material disposal within 5 mi
13	Shoring or Extra Excavation	ls	$15,000	1	$15,000	Temporary shoring for gallery excavation
	Infiltration Gallery					
14	Storm HDPE Arch Infiltration Chambers	lf	$40	12,000	$480,000	16" high HDPE arch infiltration chambers
15	Crushed Stone - 1.5" Fractured/Washed	cy	$55	4,500	$247,500	Infiltration chambers zone backfill
16	Geotextile	sy	$4	5,500	$22,000	Separation geotextile from overlying soils
17	Topsoil	cy	$40	1,100	$44,000	Topsoil above gallery and in disturbed fringe areas
18	Access Road Restoration - AC Pavement	sy	$36	1,200	$43,200	Perimeter 1,100' X 10'W access road and connection to Ruddell Rd
19	Gallery Footprint Restoration Seeding	ls	$5,000	1	$5,000	Grass surface restoration above infiltration gallery
20	Perimeter landscape Plantings and Irrigation	ls	$50,000	1	$50,000	Landscaping allowance

Subtotal	**$2,534,700**
Construction Contingency (Planning Level, 30%)	**$760,410**

Managed Aquifer Recharge Projects in WRIA 13

Description

The WRIA 13 WRE committee has identified managed aquifer recharge (MAR) projects as a viable approach to offsetting the consumptive use associated with permit exempt well growth. MAR projects may include many water sources, such as stormwater, Class A reclaimed water, and peak flows in rivers and streams. This general project is limited to MAR projects that divert, convey, and infiltrate peak seasonal river flows in engineered facilities that are in connection with the local alluvial aquifer that the donor stream or river is also in connection. Flows would be diverted in quantities that would not reduce habitat suitability for salmonids and that do not reduce habitat forming processes. Seepage back into the river would result in attenuation of these flows, increasing base flows across a broader time period, including the late summer and early fall, when flows are typically the lowest, and water demand for consumptive use is the highest.

This project description describes candidate MAR locations, potential methods for diversion and conveyance, potential diversion quantities, typical infiltration basins that would infiltrate those diversion quantities, and the associated offset benefits. Detailed feasibility analysis is not included in this project description and would occur during plan implementation for each specific location.

The total potential offset from all project locations is 909 acre-feet/year (AFY); however ,the Committee acknowledged that potential projects located in streams with year-round closures (Chapter 173-513 WAC) should be removed from the overall total, resulting in a potential offset of 811 AFY.

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

Potential MAR Locations

Potential MAR locations were determined based on a screening process (Attachment A). Areas in WRIA 13 with the following features were considered for candidate locations:

- Favorable soils and surficial geology-
    - Soils mapped in hydrologic groups A and B with all soil layers having a permeability greater than 2 inches per hour.
    - Surficial geology primarily composed of sand and/or gravel.
    - Exclude areas with low permeability surficial geology (i.e. silt, clay, bedrock).
    - Exclude wetlands, lakes, and high groundwater areas.

- Depth and thickness of aquifer
  - o Depth to water of 8 feet or greater.
  - o Surficial aquifer saturated thickness of 10 feet or greater.
- Distance to potential water source
  - o Favorable MAR locations were defined as those within 0.25 and 0.5 miles from a potential donor stream or river.

This screening resulted in favorable areas and specific locations for consideration during WRE Plan implementation (Figure 1; Table 1). Tier 1 locations are favorable in terms of land ownership, property size, and relative net ecological benefit (i.e. significant use by anadromous salmonids). Tier 2 locations are either located farther than 0.5 miles from a stream or are near a source water closed to further appropriation. At the WRIA 13 committee's request, potential locations were identified on the Cooper Point, Boston Harbor, and Johnson Point, and Woodland Creek subbasins with less restrictive criteria (Appendix A). Many tier 2 locations were identified that do not have nearby source waters. These sites may be considered for future stormwater infiltration projects.

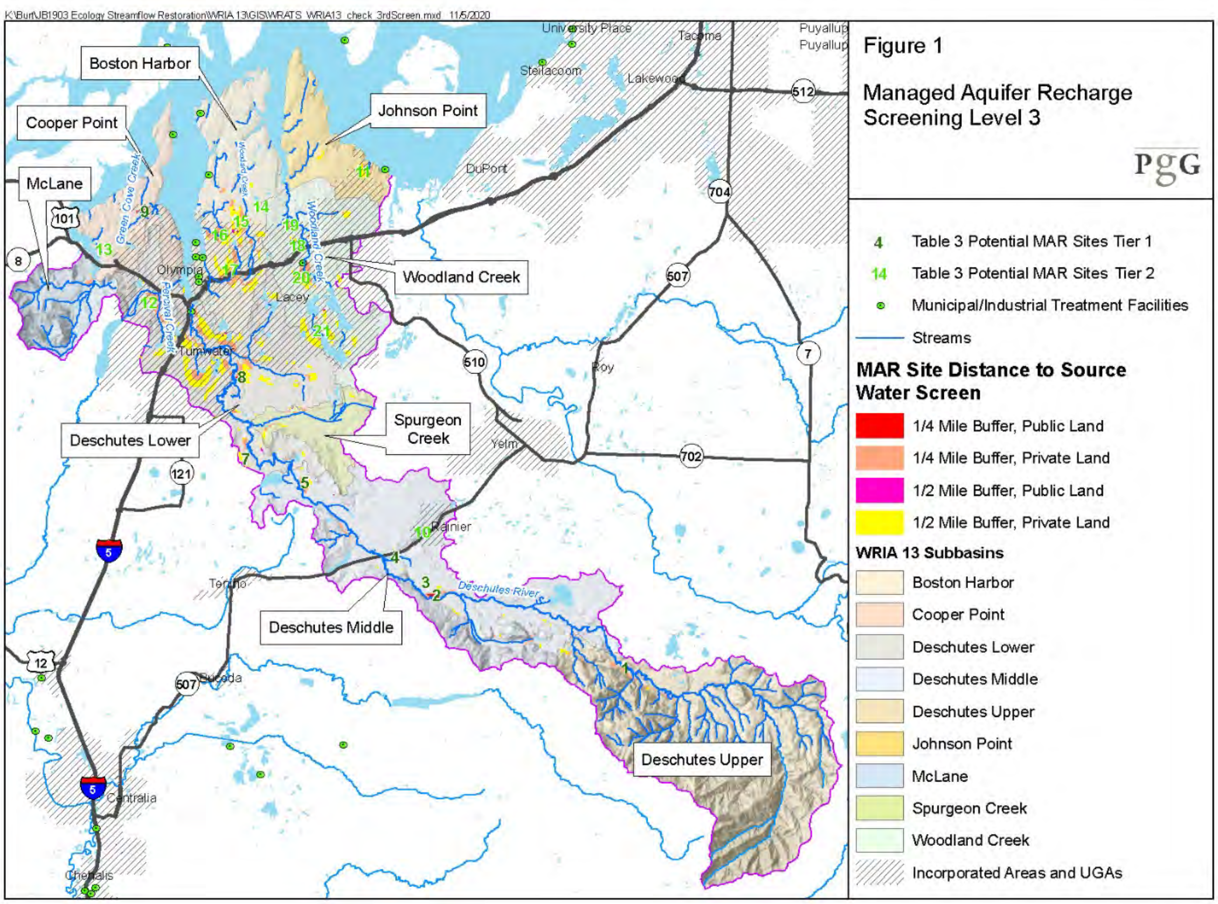


Figure 1. Areas favorable for MAR locations and potential MAR sites.

Table 1. Potential managed aquifer recharge locations.

Tier	Site #	Subbasin	Location	Source Stream
1	1	Deschutes Upper	South of Clear Lake	Deschutes River
1	2	Deschutes Middle	Rainier View Park	Deschutes River
1	3	Deschutes Middle	North of Rainier View Park	Deschutes River
1	4	Deschutes Middle	Route 507, SW of Raymond	Deschutes River
1	5	Deschutes Middle	East of Offut Lake	Deschutes River
1	6	Deschutes Lower	Thurston County Roads Gravel Pit, Waldrick Rd SE	Deschutes River
1	7	Deschutes Lower	Middle Deschutes Property	Deschutes River
1	8	Deschutes Lower	Alpine Sand and Gravel, Rixie Road	Deschutes River
1	9	Cooper Point	Cooper Point	Green Cove Creek
2	12	Deschutes Lower	Lower Percival Creek, SPSCC	Percival Creek
2	14	Boston Harbor	Former borrow pit	Woodard Creek
2	15	Boston Harbor	Private	Woodard Creek
2	16	Boston Harbor	Mission creek	Mission creek
2	17	Boston Harbor	Near 4th Avenue E and Interstate 5	Indian Creek
2	18	Woodland Creek	Property with kettle pond on 15th Avenue NE	Woodland Creek
2	19	Woodland Creek	Near Pleasant Glade Road	Woodland Creek
2	20	Woodland Creek	Near Dept. of Ecology Headquarters	Woodland Creek

Additional candidate locations may be proposed during plan implementation. Additional candidate locations are likely to be within these favorable areas but may also be demonstrated as suitable for MAR based on an independent site-specific analysis.

Source Water Availability and MAR Facility Sizing

Potential streams that could be part of MAR projects are those that have a flow record adequate for an assessment of flow diversion quantities and infiltration facility design. Diversion flows and the number of days when flows may be diverted were determine in two different ways, depending on whether the stream has minimum instream flows or not.

Diversion flows were proposed based on maintaining minimum instream flows and habitat forming processes (i.e. ecological flows). Diversion flows in streams and rivers with minimum instream flows (i.e. the Deschutes River) were set at 2 percent of wet season (November – April) minimum flows (e.g. 2% of 400 cfs equals 8 cfs for the Deschutes River). Diversion of flow to an MAR facility could occur during days when flows exceed minimum instream flows. These days were tallied for each day in the flow record and summed by month. These "diversion days" were summed across the wet season (November – April) for each water year in the flow record. The average and minimum number of diversion days were calculated across all water years in the flow record.

When a stream or river does not have minimum instream flows, the 75th percentile flows for each month across the entire flow period of record was calculated. Diversion flows were proposed based on 2% of the average 75% percentile flows during November – April. Diversion of flow to an MAR facility could occur during days when flows exceed 75th percentile flows. Flows would exceed 75% percentile flows 25% of the time (i.e. 45 days during the November – April wet season).

The minimum and average volume of water that could be diverted to one or more MAR facilities in each stream was calculated by multiplying the diversion flow by the number of diversion days, and transforming the volume to acre-feet/ year.

Deschutes Upper and Middle

Water availability in the upper to middle Deschutes may be approximated by flows the USGS 12079000 gage near Rainier, WA (Figure 2). The Deschutes River is closed to consumptive appropriations between April 15 – October 15 (Chapter 173-513 WAC). From October 16 – April 14, there are variable minimum flows, with the greatest minimum flow of 400 cfs, as measured at the downstream control point, the USGS 12080010 gage at Tumwater, WA.

The capacity and appropriateness of potential MAR projects in the Upper and Middle Deschutes should be guided by local flows, but the maximum quantity of potential MAR diversion flows is based on meeting minimum instream flows at the downstream control point, the USGS 12080010 gage at Tumwater, WA (see Deschutes Lower Section).

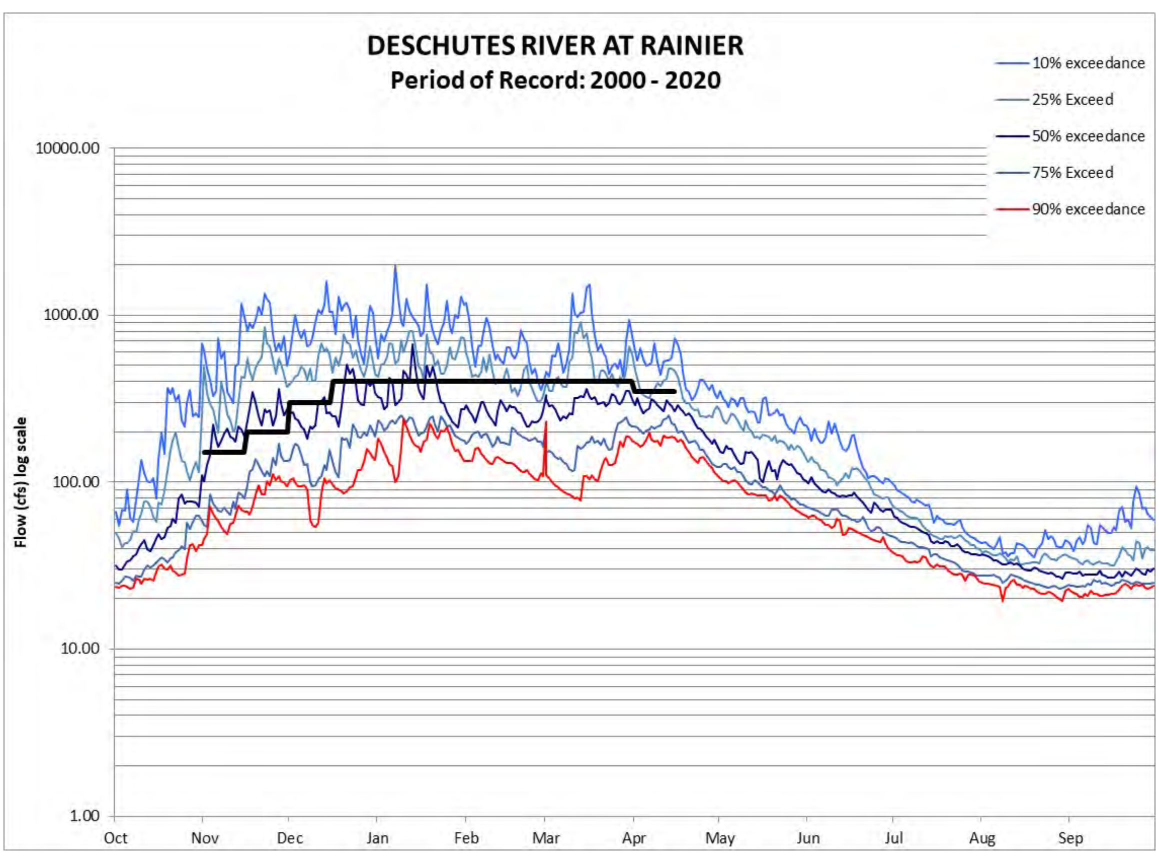


Figure 2. Deschutes River at Rainier (USGS Station 12079000) daily flow exceedances, from 2000 – 2020.

Deschutes Lower

Water availability in the Lower Deschutes may be approximated by flows the USGS 12080010 gage at Tumwater, WA (Figure 3). The Deschutes River is closed to consumptive appropriations between April 15 – October 15 (Chapter 173-513 WAC). From October 16 – April 14, there are variable minimum flows, with the greatest minimum flow of 400 cfs.

Potential diversion flows for the Deschutes River is two percent of maximum wet season minimum flows (400 cfs), or approximately 8 cfs. Potential diversion days range from 50 – 108 days per year (Table 2). Diverting 8 cfs for 50 – 108 days, would equal 792 – 1,712 afy of water diverted and infiltrated for subsequent seepage into the river throughout the year. These flows could be diverted and conveyed to one or more MAR facilities. A scenario of splitting the 8 cfs among four MAR sites is depicted in Table 5.

In the Lower Deschutes subbasin, a potential MAR location was also identified near Percival Creek (Figure 1; Table 1). Percival Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration may be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location are near zero in the summer and range from 11 - 15 cfs in the wet season (Table 3). If an MAR project were to occur at this location, it could be small-scale, approximately 0.2 cfs diversion when flows exceed 10 cfs (Table 5). The diversion period is likely around 45 days per year. This would result in an offset of around 18 afy (Table 5).

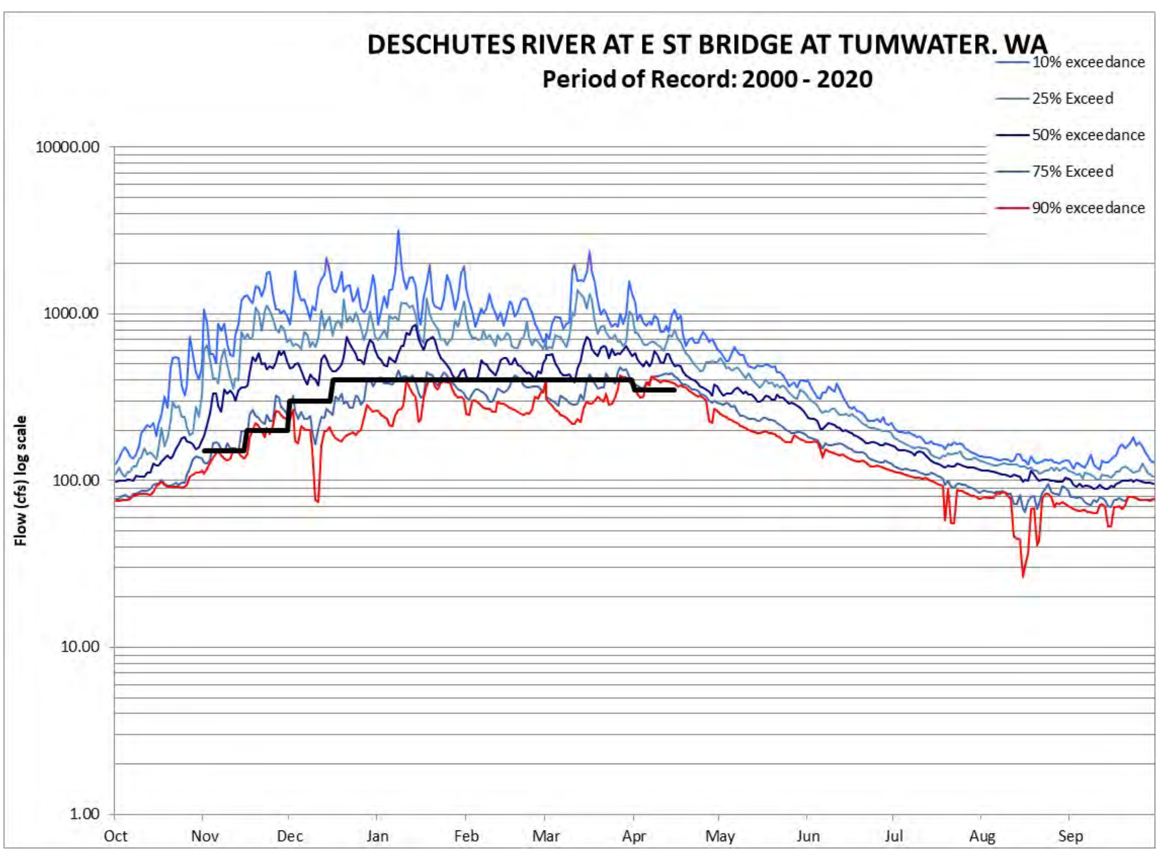


Figure 3. Deschutes River at Tumwater (USGS Station XXX) daily flow exceedances, from 2000 – 2020.

Table 2. Number of days when flows are at least five percent greater than minimum flows during the wet season (November – April). Deschutes River At E St Bridge at Tumwater, WA (USGS 12080010).

Month	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
January	25	0	31	17	21	8	31	29	25	25	26	29	22	20	11	22	31	12	31	16	30
February	27	2	28	16	20	0	21	13	22	1	10	11	29	15	19	12	27	24	26	13	21
March	30	0	29	24	6	5	0	31	25	16	9	31	31	24	31	17	31	31	20	3	2
April	6	3	9	15	0	15	0	15	15	15	15	15	15	12	14	15	15	15	10	9	6
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
November	6	22	1	15	17	26	27	19	22	30	30	26	30	29	30	30	30	26	19	0	7
December	2	31	10	26	10	13	31	30	4	13	31	8	29	7	24	30	29	21	22	9	0
Sum	**96**	**58**	**108**	**113**	**74**	**67**	**110**	**137**	**113**	**100**	**121**	**120**	**156**	**107**	**129**	**126**	**163**	**129**	**128**	**50**	**66**
Min	**50**																				
Avg	**108**																				

Cooper Point

In the Cooper Point subbasin, a potential MAR location was identified near Green Cove Creek (Figure 1; Table 1). Green Cove Creek does not have any instream flow closures or minimum flows (Chapter 173-513 WAC). Measured flows near the potential MAR location are near zero in the summer and range from 7 – 11 cfs in the wet season (Table 3). If an MAR project were to occur at this location, it could be small-scale, approximately 0.2 cfs diversion when flows exceed 10 cfs (Table 5). The diversion period is likely around 45 days per year. This would result in an offset of around 18 afy (Table 5).

Boston Harbor

In the Boston Harbor subbasin, potential MAR locations were identified near Woodard Creek (Figure 1; Table 1). Woodard Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration may be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location are near zero in the summer and range from 10 – 17 cfs in the wet season (Table 3). If an MAR project were to occur at this location, it could be small-scale, approximately 0.2 cfs diversion when flows exceed 10 cfs (Table 4). The diversion period is likely around 45 days per year. This would result in an offset of around 18 afy (Table 5).

Potential MAR locations were also identified near Mission Creek and Indian Creek (Figure 1; Table 1). However, flow in these streams are very small during all seasons (Table 3) and also have very little value for anadromous salmonids. Therefore, diverting water from these streams for MAR infiltration may not be feasible.

Woodland Creek

In the Woodland Creek subbasin, potential MAR locations were identified near Woodland Creek (Figure 1; Table 1). Woodland Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration may be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location are near zero in the summer and range from 10 – 17 cfs in the wet season (Table 3). If an MAR project were to occur at this location, it could be small-scale, approximately 0.7 cfs diversion when flows exceed 48 cfs (Table 4). The diversion period is likely around 45 days per year. This would result in an offset of around 62 afy (Table 5).

If fully implemented, the total quantity of water potentially diverted and infiltrated at MAR sites in WRIA 13 range from 909 – 1,830 afy (Table 5).

Table 3. Average measured monthly flow at Green Cove, Indian, Mission, Percival, Woodard, and Woodland Creeks.

Month	Green Cove Creek @ 36th Avenue NW	Indian Creek Mouth @ Quince Street SE	Mission Creek @ Boston Harbor Road	Percival Creek @ Pedestrian Footbridge	Woodard Creek @ 36th Ave NE	Woodland Creek @ Pleasant Glade Road	Woodland Creek @ Desmond Drive Ecology HQ
January	10.9	6.0	2.2	11.8	13.9	44.8	12.8
February	7.2	5.2	1.2	15.1	12.9	45.7	9.4
March	10.1	7.1	1.6	11.9	16.6	51.2	8.0
April	4.7	3.3	0.8	9.0	12.7	44.3	17.9
May	2.5	2.9	0.6	8.7	10.0	34.1	8.6
June	1.0	2.0	0.4	6.7	7.3	24.4	4.1
July	0.3	1.4	0.5	3.3	5.4	17.8	2.0
August	0.2	1.2	0.3	2.7	4.4	14.6	1.4
September	0.6	1.1	0.3	3.3	4.7	14.3	0.5
October	2.1	2.4	0.9	6.4	6.2	16.0	0.1
November	7.6	4.5	0.4	14.1	10.2	24.5	1.0
December	11.2	5.8	1.9	11.6	12.4	35.3	5.5

Table 4. Seventy-Fifth percentile of monthly flows during the period of record at Green Cove, Woodland, and Woodard Creek and monthly average flows for Percival Creek.

Month	**Green Cove Creek at Bulter Cove FS**	**Woodland Creek at Pleasant Glade Rd.**	**Woodard Creek at 36th Ave NE**	**Percival Creek at SPSCC**
Period of Record	2009 - 2020	2008 - 2020	2008 - 2020	2009 - 2015
January	15.9	51.9	14.9	11.8
February	9.0	52.3	14.9	15.1
March	12.4	56.7	18.7	11.9
April	5.5	53.8	14.7	9.0
May	3.1	40.8	11.1	8.7
June	1.8	28.6	8.2	6.7
July	0.6	21.1	6.0	3.3
August	0.2	16.2	4.4	2.7
September	0.3	16.3	4.7	3.3
October	1.5	19.1	5.8	6.4

November	8.1	30.8	10.8	14.1
December	11.6	44.3	13.8	11.6
Average	**10.4**	**48.3**	**14.6**	**12.3**
Diversion	**0.2**	**0.7**	**0.2**	**0.2**
Diversion Days	**45**	**45**	**45**	**45**

Table 5. Potential MAR site locations, facility sizes, and water offsets.

Subbasin	Stream	Location	Facility Size (sq ft)	Diverstion Flow (cfs)	Minimum Days Exceeding Minimum Flows (Nov - Apr)			Average Days Exceeding Minimum Flows (Nov - Apr)		
					Total Days of Diversion	Total Water Per Year (cfy)	Total Water Per Year (afy)	Total Days of Diversion	Total Water Per Year (cfy)	Total Water Per Year (afy)
Deschutes Upper	Deschutes River	South of Clear Lake	12,400	2	50	8,640,000	198	108	18,662,400	428
Deschutes Middle	Deschutes River	Rainier View Park	12,400	2	50	8,640,000	198	108	18,662,400	428
Deschutes Middle	Deschutes River	North of Rainier View Park	12,400	2	50	8,640,000	198	108	18,662,400	428
Deschutes Middle	Deschutes River	Route 507, SW of Raymond	12,400	2	50	8,640,000	198	108	18,662,400	428
Deschutes Middle	Deschutes River	East of Offut Lake	Reserve		Reserve			Reserve		
Deschutes Lower	Deschutes River	TC Roads Gravel Pit, Waldrick Rd SE	Reserve		Reserve			Reserve		
Deschutes Lower	Deschutes River	Middle Deschutes Property	Reserve		Reserve			Reserve		
Deschutes Lower	Deschutes River	Alpine Sand and Gravel, Rixie Road	Reserve		Reserve			Reserve		
Cooper Point	Green Cove Creek	Cooper Point	1,240	0.2	45	777,600	18	45	777,600	18
Deschutes Lower	Percival Creek	Lower Percival Creek, SPSCC	1,240	0.2	45	777,600	18	45	777,600	18

Boston Harbor	Woodard Creek	Former borrow pit	1,240	0.2	45	777,600	18	45	777,600	18
Boston Harbor	Woodard Creek	Private	Reserve		Reserve			Reserve		
Boston Harbor	Mission creek	Mission creek	Inadequate Flow		Inadequate Flow			Inadequate Flow		
Boston Harbor	Indian Creek	Near 4th Avenue E and Interstate 5	Inadequate Flow		Inadequate Flow			Inadequate Flow		
Woodland Creek	Woodland Creek	Property with kettle pond on 15th Avenue NE		0.7	45	2,721,600	62	45	2,721,600	62
Woodland Creek	Woodland Creek	Near Pleasant Glade Road	Reserve		Reserve			Reserve		
Woodland Creek	Woodland Creek	Near Dept. of Ecology Headquarters	Reserve		Reserve			Reserve		
						Total	909		Total	1,830

Diversion

Capture and recovery methods would vary by water source but would likely include some combination of a screened gravity diversion/bypass, a screened water lift and/or pump system, or a series of below ground infiltration galleries/collector pipes (e.g. Raney wells) adjacent to source streams. All of these methods would need to be evaluated based on a number of factors including operation and maintenance, fish passage performance, permitting, reliability, public safety, construction and lifecycle cost, and available funding mechanisms (HDR 2017) in order to determine the best fit for the water source. Screened water gravity diversions require the most extensive infrastructure but would need the least amount of effort to get water into conveyance structures. Screened water lift and/or pump systems would require less infrastructure than a screened water gravity diversion however the risk of damage would be greater.

The WRIA 13 Committee acknowledges that some diversion methods including in-channel structures may pose an impact to fish habitat, and strongly advocates the use of diversion methods that do not include in-channel structures. For example, diverted water could be conveyed through a collector well adjacent to the river (e.g. Ranney Collector well). The WRIA 13 Committee suggests that projects should be specifically designed to enhance streamflows and to avoid a negative impact to ecological functions and/or critical habitat needed to sustain threatened or endangered salmonids.

Conveyance

After capture and recovery, water would be transported to the MAR site through a conveyance system which would be some combination of open canals/ditches, surface and subsurface closed piping, tunnels, and trenches (e.g. lined and unlined). Conveyance can be facilitated through gravity fed structures or strategic pumping throughout the system. Once constructed or modified, maintenance –including repair, leakage control, preventing recontamination, and the operation of pumping stations where gravity pressure is not enough– has to be ensured. Ideally, source streams and MAR sites would be in close proximity to minimize the complexity of the conveyance system.

Storage and Infiltration

MAR sites (e.g. shallow aquifer recharge sites) are expected to consist of one or more small storage reservoirs (ideally less than 10 AF in volume or less than 6 feet in height). After water is captured during periods of excessive river flow, water will be conveyed into storage reservoirs and allowed to infiltrate into the local water table over time. Infiltration sites must be chosen carefully and evaluated for potential infiltration rates and volumes as well as anticipated hydrologic and water quality effects resulting from the project. Suitable sites would have permeable material at the surface and a water-table deep enough to allow levels to rise without causing problems, such as flooding.

Description of the anticipated spatial distribution of likely benefits

The benefits will vary depending on the Creek, fish use. MAR seepage back to any of the proposed creeks would target benefits to the low-flow summer and early fall period. This would benefit rearing for yearling salmonids such as coho, steelhead, and coastal cutthroat trout.

Performance goals and measures.

Performance goals would be the quantity of water diverted and infiltrated. This goal could be measured by metering the conveyance pipe flow and the water depth of the MAR infiltration basin. Secondarily, water table elevations between the MAR and receiving waters, flow in the receiving waters, and seepage observations could be done, as an indication of flow benefits.

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

These MAR projects would increase flow during the summer and early fall periods, increasing usable aquatic habitat, overall.

Identification of anticipated support and barriers to completion.

Thurston County will likely support and implement these projects, with potential support from other partners and an implementation group.

Potential budget and O&M costs.

The estimated costs for MAR projects are based on an assumption of ~$3,443/acre-foot of estimated offset. For the total 811 AFY estimated as potential offset for WRIA 13 (does not include streams closed year-round this would equate to ~$2.8 million.

Anticipated durability and resiliency.

The project would require regular operation and maintenance.

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

Thurston County has indicated that they will take a lead role in implementing these projects. However, other project partners and sponsors may occur and would benefit implementation.

Sources of Information

WDFW (Washington Department of Fish and Wildlife), 2020. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/

Attachment A

Favorable MAR Areas and Potential Locations

Technical Memorandum

To: Department of Ecology WRIA 13 Watershed Restoration and Enhancement Committee

From: Glenn Mutti-Driscoll, LHG Pacific Groundwater Group

Re: Managed Aquifer Recharge Assessment Methodology

Date: December 18, 2020

This technical memorandum documents the methodology used to identify properties that appear to have characteristics favorable for Managed Aquifer Recharge (MAR) in Water Resources Inventory Area (WRIA) 13, Deschutes. MAR project sites potentially can support watershed restoration and enhancement projects within the WRIA. This work was completed by Pacific Groundwater Group (PGG) on behalf of the WRIA 13 Watershed Restoration and Enhancement (WRE) Committee (Committee) and the Department of Ecology (Ecology). This work was performed under Ecology Contract Number C1700029, Work Assignment PGG104.

Under RCW 90.94.030, Ecology has the responsibility to convene WRE committees and prepare WRE plans for eight WRIAs in the Puget Sound and Hood Canal areas. The general purpose of the plans is to document potential offsets to projected depletion of instream flows resulting from new, permit-exempt domestic well uses in the WRIAs over the next 20 years.

To support development of the WRE plan for WRIA 13, PGG used regional data to assist the Committee in selecting properties within WRIA 13 that appear to have favorable infiltration characteristics and a close enough proximity to water so that MAR may occur. MAR projects could potentially offset the impacts of permit exempt wells on WRIA 13 streams. This memorandum outlines the methodology used to identify potentially favorable MAR project sites.

PROCEDURE

Regional soils, geologic, and hydrologic data coverages were compiled for WRIA 13 using Geographic Information System (GIS) software. A series of screening criteria were then applied to identify sites that appear most favorable.

Screening Level 1- Soils and Surficial Geology

The initial screen focused on areas where regionally mapped soil and geologic units appear favorable for infiltration. The following criteria were applied:

- Soils types mapped on the County level by NRCS (Pringle, 1990) were reviewed and only soils in hydrologic groups A and B where all layers within the mapped soil type had a permeability greater than or equal to 2 inches per hour were retained as favorable for infiltration. **Table 1** lists these soils.

- Surficial geologic maps were reviewed and geologic units primarily composed of sand and/or gravel were identified as favorable for infiltration, while low permeability units (with higher silt and/or clay contents or bedrock) were excluded. 1:24,000 geologic maps by the Washington State Department of Natural Resources (DNR) exist for most of WRIA 13 (including Logan and others (2003); Logan and others (2009); Walsh and others (2003); and Walsh and others (2005)), in areas of the upper watershed where 1:24,000 geologic mapping does not exist a regional 1:100,000 map by DNR was used (Schasse, 1987). **Table 2** lists geologic units identified as favorable for MAR.
- Wetlands, lakes, and high groundwater areas as mapped by Thurston County were excluded from favorable infiltration areas.

Areas that meet the Level 1 screening criteria are shown in **Figure 1**.

Screening Level 2 – Depth and Thickness of Aquifer

The second screen focused on removing areas with potentially shallow groundwater or a thin aquifer that may prevent it from transmitting infiltrated water away from a MAR facility. Thurston County provided output from its county-wide groundwater flow model[78] for use in assessing the water-table depth and the surficial aquifer saturated thickness. No regional-scale piezometric surface map exists for the surficial aquifer, and therefore output from Thurston County's groundwater model is considered the best available data source[79]. The following screening criteria were applied to areas identified as having favorable infiltration characteristics from the first level screen:

- A depth-to-water in the surficial aquifer of eight feet or greater was assumed necessary for MAR to be feasible. This depth was selected to allow a groundwater mound of at least five to develop under an infiltration trench or basin, with the uppermost three feet assumed necessary for basin/trench construction and to provide a vadose zone between the base of the infiltration facility and the top of the groundwater mound. This assumed eight foot depth-to-water screening value is somewhat arbitrary (in actuality groundwater mounding beneath a MAR site will be dependent on local soil and aquifer permeabilities), but was applied to screen out areas having marginal vadose zone thickness that most likely could not support long-term concentrated infiltration.
- A surficial aquifer saturated thickness of 10 feet or greater was assumed necessary for MAR to be feasible. The surficial aquifer saturated thickness was calculated using layer thicknesses and

[78] Head data from groundwater flow model version 186 and layer thicknesses from model version 169 were used for this analysis. It should be noted that Thurston County's groundwater flow model continues to be locally improved and calibrated, therefore water level and aquifer thickness values applied for this analysis may differ from values obtained from a later version of the model.
[79]Though the Thurston County groundwater model is the best available data source for county-wide water level data, considerable uncertainty is present in modeled shallow aquifer water levels due to limited calibration data (most water supply wells are installed in deeper aquifers than the water table aquifer).

simulated water table elevations from the Thurston County groundwater flow model. Generally the surficial aquifer saturated thickness equaled the saturated thickness of model Layer 1 (representing Vashon recessional outwash or alluvium), but in areas where the Layer 2 aquitard (Vashon till) was absent, the saturated thickness was calculated using the combined saturated thickness of model Layers 1, 2, and 3 (including representation of Vashon advance outwash). The 10-foot saturated thickness screening criteria applied is also somewhat arbitrary (local hydraulic conductivity values will have a significant impact on aquifer transmissivity), but is intended to remove areas where the aquifer transmissivity may be too low efficiently transmit infiltrated water away from the MAR facility.

Areas that meet the Level 2 screening criteria are shown in **Figure 2**.

Screening Level 3- Distance to Potential Source Water

The third screen focused on identifying areas in close proximity to potential MAR source waters. The following screening criteria were applied to areas identified as having favorable infiltration characteristics from the second level screen:

- Favorable MAR areas were defined as those within ¼ and ½ mile from a potential source water.
- Locations within ¼ and ½ mile from a potential source waters were subdivided into publicly or land-trust owned lands and privately owned lands. Public and land-trust lands potentially are more likely to be developed into MAR sites based on the conservation goals of those entities, and therefore were specifically identified where applicable.
- Potential source water locations included streams and municipal or industrial wastewater treatment plants (WWTPs). In addition to envisioned MAR approaches for stream and water treatment plant source waters, other potential source waters and guiding concepts were considered but not analyzed, as listed below.
    - For stream sources MAR would occur in the wet season (roughly November to mid-April) when instream flow requirements are met on the Deschutes River and its tributaries. Optimally, stream water recharged in the wet season would return to the stream during periods of water scarcity (e.g. summer and fall). Both distance-to-stream and aquifer properties control the timing for seasonal recharge to reach targeted streams.
    - For WWTP sources, treated effluent would be used for infiltration. In practice no potentially favorable sites reliant on treated water were identified, but if a site is identified in the future, a site-specific review of effluent and aquifer water quality criteria would be necessary.
    - Existing and planned reclaimed water pipelines were not included in this analysis as LOTT is not currently producing excess reclaimed water. However, changes in reclaimed water production, demand, and the construction of future conveyance pipelines could make reclaimed water be a more viable MAR source water in the future.

- Stormwater was not included in this analysis as no potential future projects were identified in the areas of interest by the Committee. However, this does not preclude runoff generated from future stormwater projects being used as a source water in areas with favorable soils and geology.
- Source water from wells pumping deeper aquifers was not considered as part of this analysis because water right acquisition would likely be required.
- A MAR approach that was not investigated but could be pursued in the future for glacial till areas is the injection of water through wells into the underlying Vashon advance outwash, which has significantly higher permeability than glacial till. Underground Injection Control regulations and source water quality criteria would need close review as part of this analysis.

Areas meeting the Level 3 screening criteria are shown in **Figure 3**. PGG also identified potential Tier 1 MAR sites based on the above screening criteria along with consideration of land ownership, property size, and relative net ecological benefit (NEB). Potential Tier 1 MAR sites are numbered on **Figure 3** and listed in **Table 3. Table 3** notes whether target receiving streams are salmon-bearing, if gopher soils are present on the site, associated flow restriction periods for the source water, and other relevant observations.

Figure 3 and **Table 3** also identify potential Tier 2 MAR sites. Tier 2 sites are either located farther than ½ mile from a stream or WWTP or are near a source water closed to further appropriation. The relative NEB for these sites will vary from relatively low (for sites located far from streams) to very high (for sites located by streams closed to further appropriation). At the Committee's request PGG reviewed the Deschutes Middle, Johnson Point, Cooper Point, Boston Harbor, and Woodland Creek subbasins to identify potential Tier 2 MAR sites. MAR at Tier 2 sites likely could occur with the identification of other non-stream/WWTP source waters. Tier 2 MAR sites are good potential candidates for future stormwater infiltration projects.

FUTURE STEPS

Site specific feasibility analyses for Tier 1 properties listed on **Table 3** should be pursued, and possibly for Tier 2 sites as well. Initial feasibility considerations will include ownership (and if the owners would consider selling, leasing, or permitting easements on their property to allow MAR) and the relative cost and complexity of providing source water to the site. Different sites will likely have different conveyance requirements that could include pumps, pipelines with significant elevation gain, long-distance subsurface pipelines, and pipeline easements for each property crossed by the conveyance line. For sites that remain favorable following initial owner outreach and conveyance considerations, a site specific hydrogeologic evaluation should be performed to identify local soil and aquifer hydrologic properties, depth to groundwater, and groundwater flow direction and gradient. Groundwater mound height and return flow travel time estimates would be included in this evaluation, as well as potential water quality or treatment concerns (such as the removal of particulate matter) prior to infiltration.

Sites listed on **Table 3** are specific properties that have been identified as likely having favorable MAR characteristics. It is likely that favorable MAR sites exist elsewhere in WRIA 13 but were not identified in this analysis based on the regional nature of the available data and the focus of surficial infiltration (and not subsurface injection). Though **Figure 3** is the best approximation of favorable surficial infiltration MAR sites in WRIA 13 using available data, the lack of local water level and geologic data most likely has caused areas with favorable MAR characteristics to not be identified. The set of regional screening maps (**Figures 1 – 3**) can and should be used for the future evaluation of properties, but results from any local or site specific hydrogeologic studies should generally be deferred to over the findings of this regional inventory. Local soil or geologic heterogeneities are generally not reflected in regional data sets, and observed depth to groundwater data will be more accurate than the regionally modeled depths used for this analysis. PGG (2019) presents a more localized infiltration analysis based on observed water levels in portions of the Deschutes Lower and Deschutes Middle subbasins that should also be referred to if future identified sites are within the report study area.

REFERENCES

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wria13_mar_methodology_dec2020
JB1903

Schneider's Prairie Off-Channel Storage-and-Release

(Thurston County ID 122)

PROJECT DESCRIPTION

Description

The Schneider's Prairie Off-Channel Storage-and-Release Project (Project) is located on the east (right) bank of the Deschutes River, west of the Keanland Park Lane SE, in north-central Thurston County (Figure 1), Deschutes River (Mainstem Lower) draft management unit. The Project includes Ayers Spring/Pond and Ayer Creek within Schneider's Prairie (Figure 2).

This project will restore hydrologic connectivity between the Deschutes River and Schneider's Prairie. Schneider's Prairie is a depressional feature that contains the Ayer Creek drainage. Paleochannels apparent from aerial photos and LiDAR images show that multiple channels historically connected the Deschutes River with Schneider's Prairie. Reconnecting the Deschutes River with Schneider's Prairie and Ayer Creek would provide rearing habitat and flood refugia for juvenile salmonids, stormflow attenuation, and water infiltration for later-season release to augment flow in the lower Deschutes River.

The project concept is to deepen an existing floodplain paleochannel that would hydrologically connect the Deschutes River to Schneider's Prairie (Figure 2). Schneider's Prairie contains Ayers Pond and Ayers Creek. The deepened paleochannel would be connected to the existing Ayers Creek that runs north and back to the Deschutes River. The paleochannel and Ayers Creek would be roughened with large woody debris (LWD) and beaver dams (analogs and beaver introduction) to flood adjacent floodplain habitat and pond creek flow. Ayers Creek would be realigned with a meander pattern (correcting historical ditching). Ayers Creek would be modified near the mouth using biotechnical techniques (e.g. buried logs and log jams) to maintain grade control at an elevation that would inundate a portion of the off-channel area during high flow events (152 ft NAVD88). The seasonal inundation would result in infiltration and subsequent seepage back to the river on the time scale of days to months.

The existing paleochannel will be deepened to convey water from the Deschutes River to Ayers Creek, within the off-channel feature. The connection point of the paleochannel to the Deschutes River will be through an abandoned oxbow that fills with river water from the downstream end during moderate and high flows. Connecting the paleochannel to the Deschutes River through the oxbow is expected to provide a stable, low-energy connection to the river, and it appears that the paleochannel naturally connects there. The deepened paleochannel could have an invert elevation of 155 ft (NAVD88) that would convey water from the river to the off-channel feature when Deschutes River flows are above 400 cfs. In this design scenario, when the river is flowing above 400 cfs, the channel would begin conveying water to the off-channel feature.

Schneider's Prairie is a broad depressional off-channel feature that contains an extensive wetland, including Ayers Springs and Ayers Creek. Diverted floodwaters would inundate about 52 acres of this feature, below an elevation of 152 ft (NAVD 88 datum), frequently during the months of November – April, and infrequently during the shoulder months of May, June, September, and October. Ponded water will infiltrate and seep back into the Deschutes River over time.

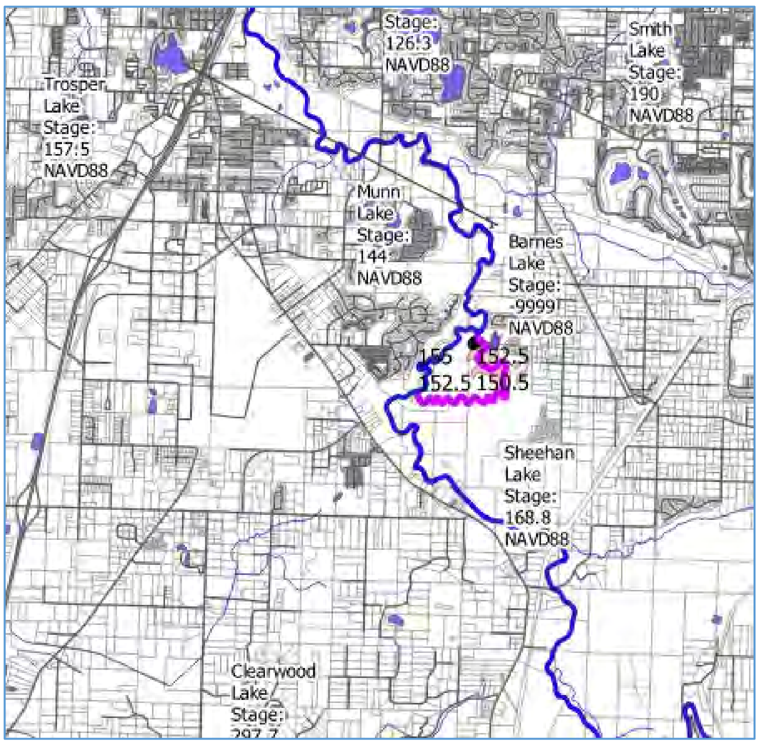

Figure 1. Site Location

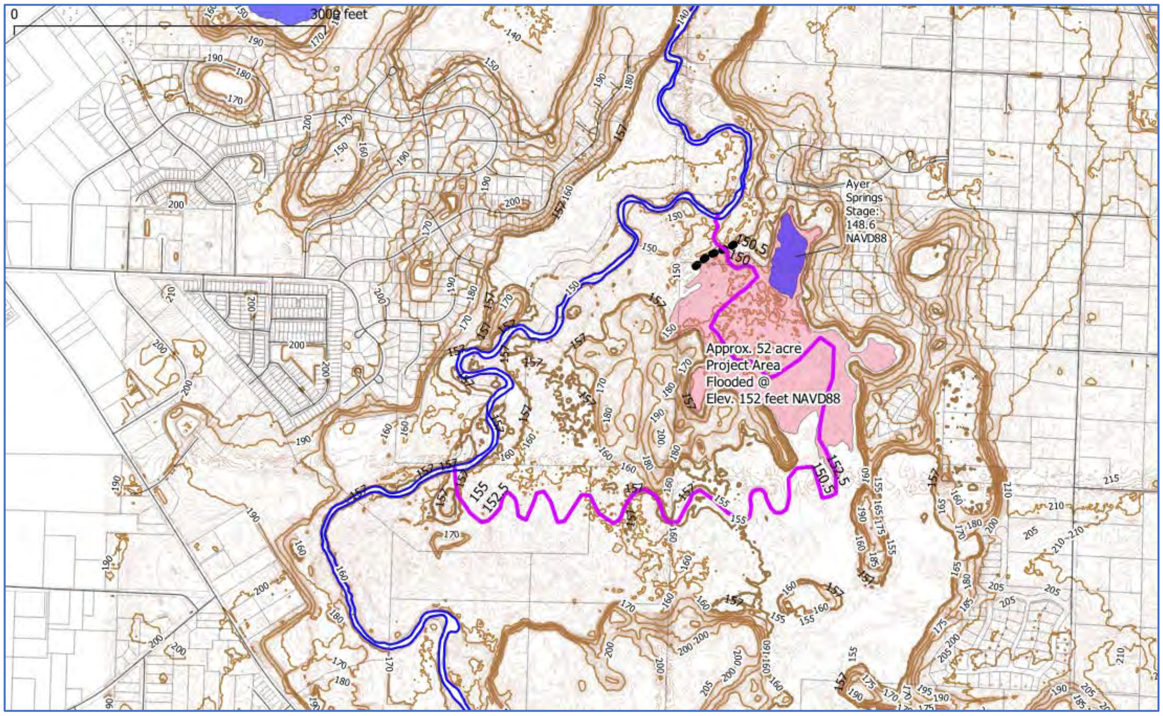

Figure 2. Project Area showing conceptual off-channel storage area and new stream channel.

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

Water offset benefits were calculated by estimating inlet flows into the Schneider's Prairie off-channel feature, inundation extent and depth, and seepage back to the Deschutes River.

Inflows from the Deschutes River to the Schneider's Prairie off-channel area were estimated on a cumulative monthly basis during November – April season (Table 1). Monthly inflows were developed based on assumed inlet channel geometry, daily river flow values river at the USGS E Street Gage in Tumwater, WA (USGS Gage 12080010) and corresponding river elevations derived from the HEC-RAS hydrologic model developed by FEMA for the Deschutes River. Only River flow values greater than 400 cfs caused inflows into the Schneider's Prairie off-channel area, and inflows were restricted to the November – April season.

The inlet channel was added to the existing HEC-RAS model using a standard channel geometry. The surface of the banks and floodplain were built from LiDAR data. Using the 2011 LiDAR terrain contours, a storage area of about 52 acres was considered practical for seasonal inundation – see flooded area polygon (Figure 2). Water depths of 1 to 3 feet were considered potentially obtainable using either surface roughness (natural) or a low dike to retain water, at an elevation of 152 (NAVD88 datum). Modifications to the mouth of Ayers Creek with grade control at 152 feet may be required but would require fish passage for both adult and juvenile salmonids.

Inflows from the Deschutes River were compared to the maximum infiltration capacity of the off-channel area (i.e. 52 acres). Maximum infiltration capacity was estimated using Darcy's Law calculations. The smaller of the two values were used as an assumed infiltration quantity (Table 1). River inflows that exceeded the infiltration capacity were assumed to be retained as ponded water in the Schneider's Prairie feature. This retained inflow volume was assumed to infiltrate during the late spring, when river inflows were no longer occurring.

These monthly infiltration quantities were used to model streamflow benefits (i.e. seepage back to the Deschutes River) over time. Seepage was modeled using STRMDPLT08. Seepage back to the Deschutes River increases over time, because of the cumulative effect of infiltrating additional water. This cumulative increase reaches an asymptote (i.e. additional benefits are minimal) after about 50 years of infiltration (Table 2). Seepage back to river does not change substantially with season, but slightly more seepage occurs during the May – October period, relative to the November – April period. Streamflow benefits during the May – October period are predicted to be 285, 681, 958, and 1,310 acre-feet per year during the first, fifth, tenth, and fiftieth year of infiltration, respectively.

Table 1. Maximum Infiltration and Diversion quantities.

Month	Monthly Deschutes River Inflow (acre-ft)	Maximum Monthly Volume Capacity (acre-ft)	Uninfiltrated Water Remaining (acre-ft)	Remaining Water Infiltrated (Acre-ft)	Monthly Volume Infiltrated (acre-ft)
January	717	435	282		435
February	568	393	175		393
March	505	435	70		435
April	229	421	0	192	421
May	0	435	0	435	435
June	0	421	0	175	175
July	0	435	0		0
August	0	435	0		0
September	0	421	0		0
October	0	435	0		0
November	415	421	0		415
December	709	435	274		435
Total Annual	**3,143**	**4,683**	**802**	**802**	**3,143**

Table 2. Modeled streamflow benefits over time.

Modeled Benefit by Year After Project Start	Total Water Year Benefit acre-feet	Percent of Diversion	May - October Benefit (acre-ft)	Percent of Diversion
Year 1	316	10%	285	9%
Year 5	1,235	39%	681	22%
Year 10	1,824	58%	958	30%
Year 50	2,537	81%	1,310	42%

Notes:

Transmissivity = 1,400 ft^2/d

Streambed Conductance = 1 ft/d

Wetlands Hydraulic Conductivity = 0.20 ft/day

Total Annual Diversion Applied to Groundwater Recharge = 3,143 acre-feet

The attenuation of these high river flows to increased and steady seepage back to the river will increase flow between flooding events, benefitting fish and overall ecological function. Increased base flow during the summer will increase usable aquatic habitat for fish and would also reduce temperatures and effects of euthrophication on dissolved oxygen and pH.

Finally, off-channel fish habitat will be created in the paleochannel and in the inundated floodplain area in Schneider's Prairie. The inlet and outlet will be designed to be low energy with fish cover and habitat complexity. The inlet and outlet channels will allow for fish ingress and egress. It is expected that this would likely improve habitat for Coho salmon and numerous other species, as well as capturing silt and nutrients. Habitat and water offsets may be improved by increasing channel roughness. For example, beaver habitat/ponding, woody structures in the channels/floodplain, or mature forest land cover would slow down and spread out flow entering and flowing through the off-channel feature. These elements would also increase habitat value for juvenile salmonid rearing.

Description of the anticipated spatial distribution of likely benefits

Streamflow benefits would occur in the Deschutes River adjacent to the Project area, to the confluence with Capital Lake. Off-channel rearing benefits would occur within the inlet channel, within the off-channel area, Ayers Creek, and in the Deschutes River, downstream of the confluence with Ayer Creek. The length of additional wetted channel and volume of water offset would require calculation during the Feasibility Study process.

In addition, Ayers Creek currently has TMDLs proposed by the USEPA for water temperature, dissolved oxygen, and pH. Surface water connectivity to the river and increased seepage during the critical period may improve water quality.

Uncertainties and Assumptions

The WRIA 13 Committee identified project uncertainties from the modeling analysis was not able to account for or where assumptions were made, including:

1. Evapotranspiration
2. Amount of infiltration
3. Climate change
4. Dropping flow trend of the Deschutes
5. Sediment issues in the Deschutes
6. Modeling assumptions including transmissivity of aquifer, and streambed conductance
7. Modeling represents average conditions, not dry year conditions

Performance goals and measures.

Streamflow and groundwater level monitoring may be required, subject to the refined concept, feasibility study, and design.

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

This Project would provide off-channel rearing habitat during the winter period, when the inlet channel and wetland area is inundated. This habitat would primarily benefit coho salmon. Seepage back to the Deschutes River during the summer and early fall would benefit all fish species by providing cool water and increasing flows.

Identification of anticipated support and barriers to completion.

Capitol Land Trust owns part of the project area. Other water offset and habitat protection projects have been envisioned nearby, including Allen Creek Restoration Project (Habitat Work Schedule project ID 12-1109) by Wild Fish Conservancy but encountered land development pressures. This project would be an element of a larger "Floodplains by Design" grant proposal and concept design.

This area is already under consideration by other entities water, protection and habitat improvement projects. Capitol Land Trust owns part of the project area. The WRIA 13 Salmon Lead Entity is organizing potential partners for a larger Deschutes River project encompassing this area. Because of these efforts, this water offset project is best conceived as one component of the larger effort to protect this part of the lower Deschutes River, an area of substantial ecological and hydrologic value.

Potential budget and O&M costs.

Potential (Class V, order of magnitude) capital costs, including design, permitting, property acquisition, and construction, are approximately $5,000,000.

Anticipated durability and resiliency.

The project would require regular operation and maintenance.

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

Thurston County and WRIA 13 implementation partners

Sources of Information

WDFW (Washington Department of Fish and Wildlife), 2020. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/

Small-scale LID Project Development/Implementation for WRIA 13

Sponsor: Thurston Conservation District

Problem:

In undeveloped landscapes, most rainfall typically soaks into the ground, recharging shallow groundwater. As development occurs, stormwater runoff is generated in areas where compacted soils, impervious roofs, driveways and parking lots concentrate surface flow that can no longer infiltrate into the ground. These impervious surfaces concentrate rainfall and it often flows as stormwater runoff into conveyance systems, whether roadside ditches or buried pipes. Recent adoption of Low Impact Development (LID) practices for new development begins to address this issue. However, in all urbanized areas of WRIA 13 a significant legacy of conventional development continues to generate large volumes of runoff flowing untreated into stormwater systems, and this water ends up in treatment facilities or is discharged – untreated - into local streams and into Puget Sound.

Project Description/Solution: By strategically concentrating small-scale LID retrofit work in urbanized settings and by partnering with residential and commercial community members to redirect runoff away from stormwater conveyance systems and into green stormwater infiltration facilities, this work will help to conserve in-stream flow. In rural settings, efforts can explore additional opportunities to slow and infiltrate stormwater runoff that would otherwise rapidly discharge into nearby waterways.

Thurston Conservation District will work with partners to identify and implement retrofit projects to benefit groundwater recharge. Creative partnerships with local jurisdictions could result in incentive programs and a focus on areas of interest that will benefit stormwater programs as well as in-stream flow. Given short-term uncertainties about project development and measurable benefits, small-scale LID retrofit projects won't be counted towards initial offsets in the plan. However, long-term benefits will be quantified and tracked as projects are developed and implemented in regions with appropriate soils, willing partners, and waterways that can benefit from this work. The use of small-scale LID retrofit projects is an important tool to integrate into long-term planning for in-stream flow preservation. Construction of numerous, clustered infiltration facilities including rain gardens and biofiltration swales will eventually result in a measurable impact and benefit.

Project Benefits: Infiltrating stormwater runoff into strategic, well-planned and concentrated clusters of LID retrofit projects offers an important opportunity to recharge shallow groundwater in areas where MARs or other large-scale projects are unlikely or infeasible. Small-scale LID retrofits can also (importantly) directly engage residential and commercial partners to contribute to in-stream flow preservation. This work will also immediately benefit water quality in nearby streams, which would otherwise receive untreated runoff and continue to experience flashy flow events along with the input of concentrated pollution.

Spurgeon Creek Remeander Habitat Project

PROJECT DESCRIPTION

Description

Spurgeon Creek is the largest lowland tributary of the Deschutes River in Thurston County and is listed as high priority for restoration (SIT 2015). The South Puget Sound Salmon Enhancement Group (SPSSEG) is currently proposing to re-meander a ditched channel through the adjacent wet fields just south of a private driveway and north of and below the Fox Hill development (Figure 1). The proposed project is intended to improve water quality as well as salmonid, aquatic, and riparian habitat by increasing habitat area and floodplain activity. The project also has the potential to provide salmon viewing and educational opportunities to local residents and the public at large.

The goal of the project is to improve fish productivity and survival within Spurgeon Creek by enhancing the quality and quantity of instream habitat within the project reach. Habitat within Spurgeon Creek is currently impaired, particularly within the lower portion of the project reach, by lack of riparian vegetation and large woody debris, simplification of instream habitats, poor floodplain connectivity, channel incision and poor water quality.

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

The Spurgeon Creek restoration project is located near the head waters of Spurgeon Creek in Thurston County. At the project location, the creek is currently ditched through a field (Figure 1). The South Puget Sound Salmon Enhancement Group has been working with the landowners to recreate the natural stream sinuosity through a wetland. Additionally, wood structures would be added that offer refuge from predators and opportunities for salmon to feed, while the wetland offers slower water during high flow events. Native plants would be planted throughout the ¾-acre project area that will recruit wood and provide shade into the future.

Spurgeon Creek is the largest lowland tributary to the Deschutes River and a critical contributor of cold water. The proposed project is intended to improve water quality and increase salmon rearing habitat for juvenile Coho Salmon. Specifically, the project will designed to accomplish the following:

- Increase stream length by 1/8 miles.
- Restore 1/3 mile of creek.
- Increase instream shading by 20%.
- Increase instream complexity by adding Large Woody Debris (LWD).

- Increase community involvement.

Conceptual-level map and drawings of the project and location.

Figures 1-2 show the location of the proposed project.

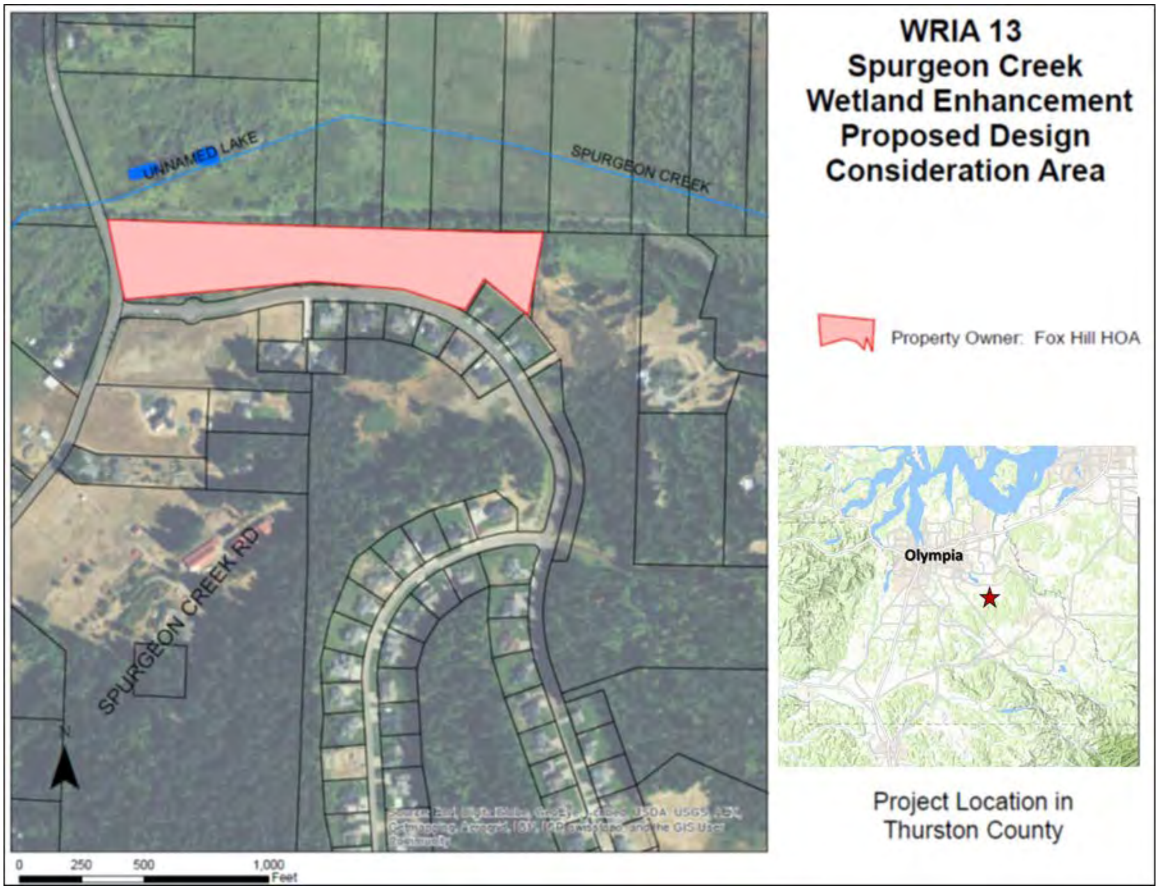

Figure 1. Location of proposed Spurgeon Creek remeander project in Thurston County.

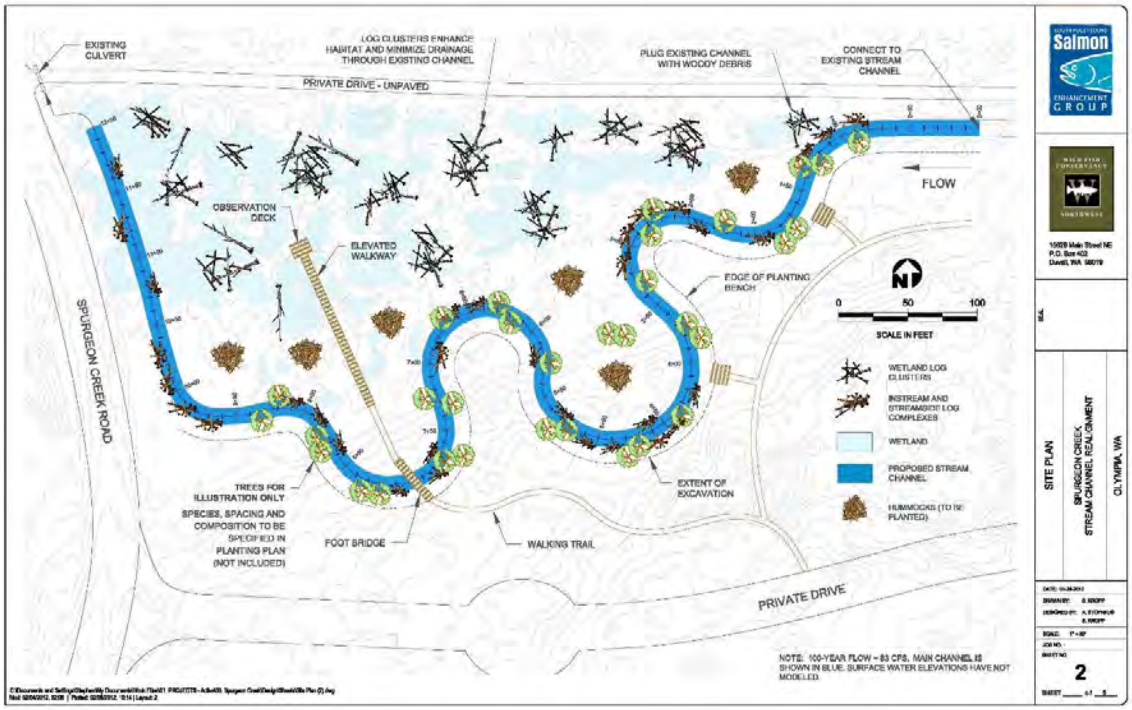

Figure 2. Conceptual drawing of Spurgeon Creek remeander project from 30% site plan (January 2012).

Description of the anticipated spatial distribution of likely benefits

The proposed project site is approximately ¾ of an acre. Within that footprint, Spurgeon Creek is expected to be increased by 1/8 miles, effectively restoring 1/3 of the creek. Water quality benefits will extend 2 miles downstream of the restoration site.

Performance goals and measures.

The performance goals are to increase stream length by 1/8 miles, restore 1/3 mile of creek, increase instream complexity by adding LWD, increase instream shading by 20%, and increase community involvement. Water quality benefits will extend 2 miles downstream of the restoration site.

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

The Washington Department of Fish and Wildlife has identified that Coho Salmon and Fall Chinook are present in Spurgeon Creek and that Chum Salmon and winter steelhead have access to Spurgeon Creek (WDFW Salmonscape 2020). WDFW (2015) documents spawning in Spurgeon Creek and small areas in the lowermost reaches of a limited number of other middle and lower tributaries are shown as supporting spawning (WDFW 2002, cited in Anchor 2008). The Washington Stream Catalog indicates that both Coho, Chum, and Chinook Salmon were historically present in Spurgeon Creek which is identified as an important tributary to the

Deschutes River (WDF 1975). Spurgeon Creek also provides habitat for reticulate sculpin, Olympic mudminnow, wood duck, and waterfowl overwintering.

The portion of Spurgeon Creek proposed for restoration has the potential to provide rearing and foraging habitat for the aforementioned salmon and trout populations year round. Increased base streamflow, improved water quality, and reduced water temperatures would primarily benefit juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve both productivity and survival of juveniles. The alteration of natural stream hydrology has been identified as a high priority limiting factor and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions (NOAA 2007).

Identification of anticipated support and barriers to completion.

The actions included in this project are recommended by the WRIA 13 Four-Year Work Plan and the Squaxin Island Tribe Natural Resources Deschutes Coho study (SIT 2015). This project has support from the Fox Hill Homeowners Association, the Washington Department of Fish and Wildlife, and the Squaxin Island Tribe. Spurgeon Creek is a high a priority for restoration based on the Deschutes River Coho Salmon Biological Recover Plan and would help address water temperature issues for protecting salmonid spawning and rearing.

The proposed project area lies in the transition between wetland soils and glacial till which may limit the ability to create and effectively sustain wetland habitat due to drainage issues. The soils present onsite are adequate for growing coniferous trees, but not for supporting wetland creation and enhancement (Winecka 2019). The project design envisions moving the creek out of its confined channel on the eastern extent of the HOA property, and re-engaging wetlands and expanding Coho rearing opportunities. However, property boundary issues, existing property disputes, and less than full support from neighboring, non-HOA parcels may limit the ability to move Spurgeon Creek out of its confined channel to recreate natural stream sinuosity (Walley 2019).

The main barrier to completion is adjacent landowner concerns at the project site.

Potential budget and O&M costs.

The total costs of construction, engineering, permitting, and cultural assessments are estimated to be $1,000,000 (includes engineering and construction costs).

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by the South Puget Sound Salmon Enhancement Group. The restored stream section would be designed to mimic natural fluvial and ecological processes to be self-sustaining and resilient to perturbations to minimize long-term maintenance costs.

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

The project sponsor is currently the South Puget Sound Salmon Enhancement Group. A 30% plan set was completed by the South Puget Sound Salmon Enhancement Group and the Wild Fish Conservancy. In addition, stakeholder coordination and public involvement was performed and there is general support for this project. The project team will also engage with watershed partners based on their level of interest and ability to be involved with the study. Potential Project partners who have indicated their interest include: The Fox Hill Homeowners Association, the Washington Department of Fish and Wildlife, and the Squaxin Island Tribe.

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Water Right Opportunities in WRIA 13

Technical Memorandum

To: Department of Ecology WRIA 13 Watershed Restoration and Enhancement Committee

From: Glenn Mutti-Driscoll, LHG Pacific Groundwater Group

Burt Clothier, LHG Pacific Groundwater Group

Re: Water Right Screening Methodology

Date: December 18, 2020

This technical memorandum documents the methodology used to screen and select water rights for potential use to support watershed restoration and enhancement projects in the Deschutes River Watershed, Water Resources Inventory Area (WRIA) 13. This work was completed by Pacific Groundwater Group (PGG) on behalf of the WRIA 13 Watershed Restoration and Enhancement (WRE) Committee (Committee) and the Department of Ecology (Ecology). This work was performed under Ecology Contract Number C1700029, Work Assignment PGG104.

Under RCW 90.94.030, Ecology has the responsibility to convene WRE committees and prepare WRE plans for eight WRIAs in the Puget Sound and Hood Canal areas. The general purpose of the plans is to document potential offsets to projected depletion of instream flows resulting from new, permit-exempt domestic well uses in the WRIAs over the next 20 years.

To support development of the WRE plan for WRIA 13, PGG assisted the Committee in selecting a focused set of water rights for further review to assess potential benefits and their suitability in offsetting impacts from permit-exempt wells on instream flows. This memorandum outlines the methodology used to develop the focused list of water rights.

PROCEDURE

Ecology staff queried their Water Rights Tracking System (WRTS) database and provided tables and associated GIS data of all active water rights within WRIA 13. Inactive water rights (e.g., previously approved changes, cancelled or withdrawn applications) were excluded from the data provided by Ecology. Water right claims and pending applications for new water rights or water right changes were also removed during the screening process.

The provided GIS data included the mapped place of use and point(s) of diversion or withdrawal locations, where available. Where Ecology did not have detailed location information for points of diversion or withdrawal (or such information has not yet been added to their GIS dataset), the default location is generally the nearest quarter or quarter-quarter section, based on the water right file information.

WRIA 13 permit exempt (PE) well growth projections were then compared by subbasin in addition to potential mitigation and habitat restoration projects, managed aquifer recharge projects, and the presence of priority salmon streams. From this evaluation, subbasins with the greatest projected PE well growth and consumptive use (Deschutes Middle with 122 acft/yr from 734 wells and Johnson Point with 86 acft/yr from 520 wells) were identified as having relatively few mitigation and restoration projects relative to expected PE well impacts. Therefore, water rights primarily within these subbasins were prioritized to identify potential rights that could be acquired, relinquished to trust, or whose owners could be engaged regarding implementation of water saving or conservation practices.

Over 850 active water right files were identified in the Deschutes Middle and Johnson Point subbasins. Following consultation with the Committee, PGG limited the water rights under consideration to certificates and permits[80] that included commercial and industrial (CI), irrigation (IR), and domestic multiple (DM) uses. DM water rights were included within the query since nearby municipal water systems (Lacey for the Johnson Point subbasin and Raymond for Deschutes Middle subbasin) potentially could have capacity to supply smaller Group A or B water systems. All other domestic categories (domestic single and domestic general) and municipal rights were excluded from the query based on the expectation that these rights would be unavailable for mitigation or small.

The list of active permits and certificates with CI, IR, and/or DM uses was reduced again based on authorized annual (Qa) quantities. For the Deschutes Middle and Johnson Point subbasin, rights with a Qa of less than 10 acft/yr were removed. This arbitrary cut-off rate was intended to focus on higher-value possibilities and provide a more manageably sized list. In general, larger water rights are considered higher value since they will provide greater flow benefits to a stream. Although not used for filtering, it's worth noting that surface water rights are considered higher value mitigation rights than groundwater rights since they will have an immediate, direct, and easily quantifiable benefit to a stream.

This list was further refined with Committee input regarding the inclusion/exclusion of specific rights, and rights from the neighboring Woodland Creek and Deschutes Lower subbasins were added based on input that they may be acquirable. Rights specifically identified by the Committee did not have the 10 acft/yr general screening criteria applied.

Table 1 lists the identified WRIA 13 water rights that could potentially be converted, purchased, or retired as mitigation water, while **Table 2** is a general summary of the focused water right list. These rights have been identified as having the greatest potential benefit to instream flows in the Johnson Point and Deschutes Middle subbasin vicinities by applying the criteria outlined above. However, this list should not preclude the Committee from pursuing specific water rights in other subbasins that could be identified in the future by other means. Therefore, moving forward, the Committee should investigate the availability of rights in the focused study area as well as in the broader WRIA if specific rights are identified.

[80] This includes certificates, certificates of change, permits, and superseding permits.

POTENTIAL FUTURE PROJECTS

Multiple conservation and water-right related offshoot projects were identified through the water right screening process and discussion with the Committee. Potential future opportunities for further study are listed below, all of which could potentially provide Net Ecological Benefit (NEB). Most projects listed provide hydrologic benefit through water offsets (as is noted below) since increases in streamflow generally provide greater NEB than habitat restoration projects.

- Outreach and potential quantification of water saved by implementing Best Management Practices (BMPs) for improving irrigation efficiencies at golf courses and on irrigated lands. Opportunities to improve irrigation efficiencies could be analyzed on a water right or project area scale to assess if hydrologic benefit and/or NEB is likely to occur[81]. Projects that result in NEB would be incentivized as feasible.
- Outreach and potential quantification of water saved through the repair of leaky water system pipes. A review of water system plans for public water systems within the WRIA could be pursued to identify systems with the greatest leakage losses, and if infrastructure repair appears to provide hydrologic benefit and/or NEB[2], incentives could be provided to systems that chose to upgrade.
- Incentivize off channel storage projects during the wet season for agricultural water right holders. Hydrologic benefit potentially can occur if impacts of summer pumping are offset by increases in summer streamflow.
- Create a water bank or other structure to track water quantities voluntarily conserved by agricultural water right holders. Some of the conserved quantities could be leased for other agricultural uses, while some would remain unused or put into temporary trust to provide hydrologic benefit and increase instream flows.
- Connect small water systems to nearby municipal water systems. The transfer of small-system water users to larger municipal water systems would be accommodated by the municipal system as part of its growth projections, while the smaller water system right would be relinquished or permanently donated to trust (providing hydrologic benefit).
- Partial or full relinquishment of water rights into permanent trust for hydrologic benefit.
- Outreach to golf courses, particularly those on salmon bearing streams or in close proximity to Puget Sound, regarding the Salmon Safe Certification program and BMPs. This project would primarily result in habitat benefits.

[81]Projects improving water management efficiencies will need to show how consumptive use is reduced through the upgrade. Upgrades that result in decreased recharge to the shallow aquifer (which would be a decrease in non-consumptive use) are unlikely to result in significant hydrologic benefit.

Woodard Creek Project

PROJECT DESCRIPTION

Description

Woodard Creek basin is located in central Thurston County; it includes a mix of urban and rural areas and is crossed by Interstate-5, a major transportation corridor in the region (Figure 1). Woodard Creek flows into Henderson Inlet. The hydrology of the area has been extensively modified by development in the upstream (southern) portion of the basin, resulting in stormwater impacts.

In 2014, a study done on Woodard Creek basin identified and ranked two potential stormwater retrofit sites that would have a positive impact on the Woodard Creek water quality (AHBL 2014a; 2014b). Since 2014, two sites have been completed, 1 site has been dropped because of issues, and the two remaining sites are in the process of being completed. All of the proposed sites identified in AHBL (2014a; 2014b) address water quality and do not address any flow control issues.

The goal of the Woodard Creek Project (Project) is to address the water quantity impacts of stormwater by attenuating flood flows by increasing stream bed roughness and restoring the channel sinuosity. This would increase floodplain connectivity and overall floodplain storage capacity. Increasing streambed roughness with biotechnical techniques (e.g. large woody debris) would also enhance the quality and quantity of instream habitat within the project reach. Habitat within Woodard Creek is currently impaired, particularly within the northern portion of the project reach, by lack of riparian vegetation and large woody debris, simplification of instream habitats, poor floodplain connectivity, channel incision and poor water quality. Therefore, the focus of this project is increase stream length, increase water transit time, and increase habitat complexity by modifying portions of stream in the northern end of the basin.

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

The Project is composed of a number of candidate locations or stream reaches. The Project sponsor will work with the landowners to identify reaches available for restoration. Restoration reaches will have large woody debris added to suitable or reference densities. The LWD will provide fish cover, hydraulic complexity, and will increase pool density and depth. Coho will benefit from increased pool density, in terms of juvenile rearing and adult holding. Riparian vegetation will be planted, as necessary throughout the restoration reaches that will recruit wood and provide shade into the future.

Conceptual-level map and drawings of the project and location.

Figures 1-2 show the location of the proposed project.

Figure 1. Location of Woodard Creek basin in Thurston County. Potential project locations are outlined by red boxes (A-C).

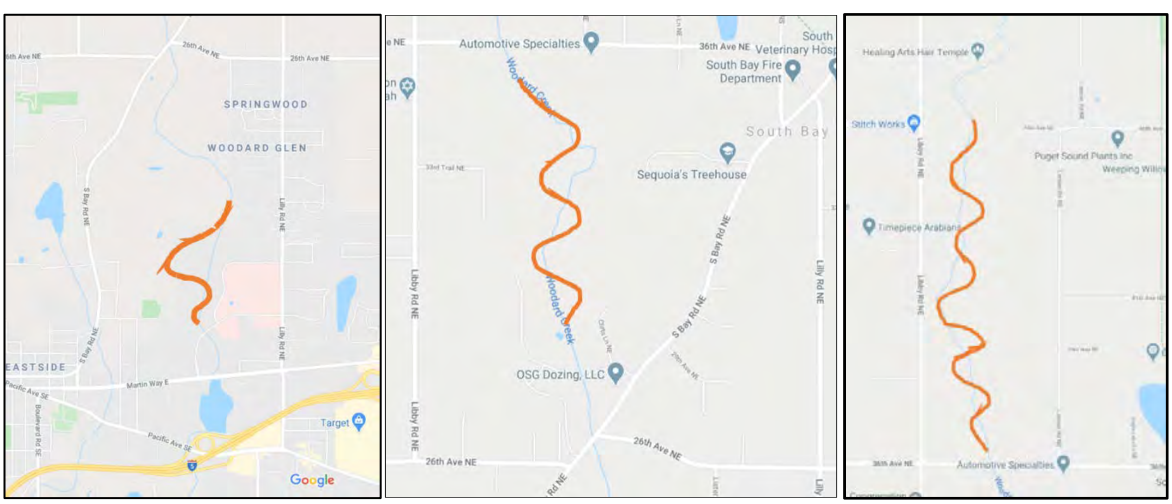

Figure 2. Conceptual drawing of Woodard Creek project locations at sites A, B, and C.

Description of the anticipated spatial distribution of likely benefits

The proposed stream restoration will benefit Woodard Creek. The benefits will be reach-specific..

Performance goals and measures.

The performance goals are to increase channel sinuosity and length, increase instream habitat complexity, and channel roughness. Specific metrics and measures will be defined when during feasibility and design.

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

Although portions of the area have been highly urbanized, Woodard Creek basin supports a variety of wildlife. Many species of fish utilize the creek, including coho, chum, steelhead, and cutthroat trout, and Olympic mudminnow have been noted in the creek near the I-5 interchange, though high winter flows and low summer flows in the river have reduced the usability of this habitat (Thurston County 2015). There are a number of bald eagle nesting sites within the basin, as well as a purple martin breeding area. There are several large wetland areas in the basin, including along Ensign and South Bay Roads.

Woodard Creek has historically supported native runs of coho, chum, cutthroat, and winter steelhead (Thurston County 2015). Limiting factors identified for the creek include alteration of the natural flow regime from increased impervious surfaces, lack of large woody debris (LWD), and barriers to fish passage. The riparian corridor has been impaired by the removal of vegetation in some areas, a lack of conifers in the remaining vegetation, and direct animal access to the stream. Fine sediment may also be a naturally occurring barrier.

The Washington Department of Fish and Wildlife has identified that Coho Salmon, Chum Salmon, Winter steelhead are present in Woodard Creek and that Fall Chinook Salmon have access to Woodard Creek (WDFW Salmonscape 2020). WDFW (2020) documents spawning in Woodard Creek (WDFW 2020). The Washington Stream Catalog indicates that both Coho, Chum, and Chinook Salmon were historically present in Woodard Creek (WDF 1975). Woodard Creek also provides habitat for reticulate sculpin, Olympic mudminnow, wood duck, and waterfowl overwintering.

The reaches of Woodard Creek proposed for restoration has the potential to provide rearing and foraging habitat for the aforementioned salmon and trout populations year round.

Identification of anticipated support and barriers to completion.

Thurston County has indicated support for this project. The primary barrier to completion is likely to be land acquisition or obtaining conservation easements. The proposed project area includes privately owned parcels.

Potential budget and O&M costs.

The total costs of construction, engineering, permitting, and cultural assessments are estimated to be <$1 million, based on an order of magnitude estimate (includes engineering and construction costs).

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by Thurston County or their future project partner. The restored stream section would be designed to be compatible with natural ecological processes to be self-sustaining and resilient to perturbations to minimize long-term maintenance costs.

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

The project sponsor is Thurston County and is ready to implement the project. Implementation would require an evaluation of feasibility.

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