Watershed Restoration and Enhancement Draft Plan

WRIA 15
Kitsap Watershed

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FINAL DRAFT PLAN FOR LOCAL REVIEW

DEPARTMENT OF ECOLOGY
State of Washington

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Acronyms

Acronym	Definition
AE	Application Efficiency
AF/yr	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

Acknowledgements

This watershed plan was written as a collaboration between the Department of Ecology, the WRIA 15 Committee, and the technical consultants. We express our sincere gratitude to those that supported the development of the plan and supplemental materials.

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[1]David Nash, formerly with Kitsap County, is now deceased.

[2]No longer at entity.

[3]Withdrew from Committee.

Executive Summary

In January 2018, the Washington State Legislature passed the Streamflow Restoration law (RCW 90.94) to help support robust, healthy, and sustainable salmon populations while ensuring rural communities have access to water. The law, as interpreted by the Department of Ecology (Ecology), directs Ecology to lead local planning Committees to develop Watershed Restoration and Enhancement Plans that identify projects to offset potential consumptive impacts of new permit-exempt domestic groundwater withdrawals on instream flows over the next 20 years (2018 – 2038) and provide a net ecological benefit to the watershed. While not all members of the WRIA 15 Watershed Restoration and Enhancement Committee agreed with Ecology's interpretations of the law, this Watershed Restoration and Enhancement Plan was written to meet the guidance and policy interpretations as provided by Ecology.[2]

Ecology established the Watershed Restoration and Enhancement Committee to collaborate with tribes, counties, cities, state agencies, and special interest groups in the Kitsap watershed, also known as Water Resource Inventory Area (WRIA) 15. The WRIA 15 Committee met for two and a half years to develop a watershed plan.

To allow for meaningful analysis of the relationship between new consumptive use and offsets, the WRIA 15 Committee divided the watershed into seven subbasins. Subbasins help describe the location and timing of projected new consumptive water use, the location and timing of impacts to instream resources, and the necessary scope, scale, and anticipated benefits of projects.

This watershed plan projects 5,568 permit exempt (PE) well connections over the 20-year planning horizon. If implemented as intended, the projects and policy recommendations in this watershed plan can offset the consumptive water use from those 5,568 PE well connections. The projected new consumptive water use associated with the new PE well connections is 766.4 acre-feet per year (1.06 cubic feet per second [cfs] or 684,150 gallons per day [gpd]) in WRIA 15, equal to 123 gpd per PE well connection. This watershed plan also sets an offset target of 1,218 acre-feet per year for project implementation in order to benefit streams. That target is based upon a consumptive use of 177 gpd per PE well connection which equals 1.68 cfs and 1.087 million gallons per day.

This watershed plan includes projects that, if implemented as intended, provide an anticipated offset of 1,076.7 acre-feet per year to benefit streamflows and enhance the watershed. The WRIA 15 Committee set a goal of offsetting consumptive use estimates within each subbasin and agreed that offsets should be as close to impacts as feasible. This plan falls short of the WRIA 15 Committee's goal of meeting the offset need by subbasin (consumptive use is offset in 5 of 7 subbasins and the higher offset target is reached in 2 of 7 subbasins).

[2] Some members of the WRIA 15 Committee have different interpretation of RCW 90.94.030. Signing statements and other documents provided in the Compendium provide more information on their interpretations.

Table ES-1 presents a summary of the anticipated impacts and benefits by subbasin. Additional projects in the plan include benefits to fish and wildlife habitat, such as several thousand feet of streambed improvements, dozens of acres of restoration and protection, and many miles of riparian restoration across WRIA 15.

Table ES-1: Consumptive Use and Project Benefits by Subbasin

Subbasin	Consumptive Use Estimate (acre feet per year)	Higher Offset Target (acre feet per year)	Offset Benefits from Projects (acre feet per year)	Additional Benefits from Projects
North Hood Canal	90.3	136.5	263.5	Projects would provide direct streamflow benefit, protection and restoration of habitat for fish critical streams. Over 1,600 feet of stream restoration are included along with over ten acres of habitat restoration.
West Sound	183.9	277.9	365	Projects would provide direct streamflow benefit, protection and restoration of habitat for fish critical streams. Projects include over 2800 feet of stream restoration, riparian restoration, over 100 acres of land protection, and over 140 acres of habitat restoration.
South Hood Canal	155.0	223.4	130.2	Projects would provide direct streamflow benefit, protection and restoration of habitat for fish critical streams. This subbasin includes projects that will repair up to three miles of riparian area.
Bainbridge Island	67.6	102.2	67.6	Projects would provide direct streamflow benefit, protection and restoration of habitat for fish critical streams.
Vashon-Maury Island	50.7	72.9	69.9	Projects would provide direct streamflow benefit, water rights and land acquisition.

Subbasin	Consumptive Use Estimate (acre feet per year)	Higher Offset Target (acre feet per year)	Offset Benefits from Projects (acre feet per year)	Additional Benefits from Projects
South Sound	213.8	394.6	173.5	Projects would provide direct streamflow benefit, protection and restoration of habitat for fish critical streams. Projects include up to nine miles of riparian restoration.
South Sound Islands	5.2	11.1	7	Projects would provide direct streamflow benefit, protection and restoration of habitat for fish critical streams.
Totals	766.4	1218.7	1076.7	

To increase reasonable assurance of plan implementation and track progress, this watershed plan includes policy and regulatory recommendations and an adaptive management process. The 11 policy and regulatory recommendations are included to contribute to the goals of this watershed plan, including streamflow restoration and meeting net ecological benefit. These recommendations enhance water conservation efforts; improve research, monitoring, and data collection; support beaver habitat conservation; plan for better drought response; and finance plan implementation. The watershed plan describes an adaptive management approach, which identifies (1) an ongoing implementation group and lead organization to support watershed plan implementation, (2) a tracking and reporting structure to assess progress and adjust as needed, and (3) a funding mechanism to adaptively manage implementation. Adaptive management will be necessary to achieve the goal of meeting offset needs within each subbasin and improving streamflow where this watershed plan currently falls short, through the identification, development and implementation of projects throughout WRIA 15.

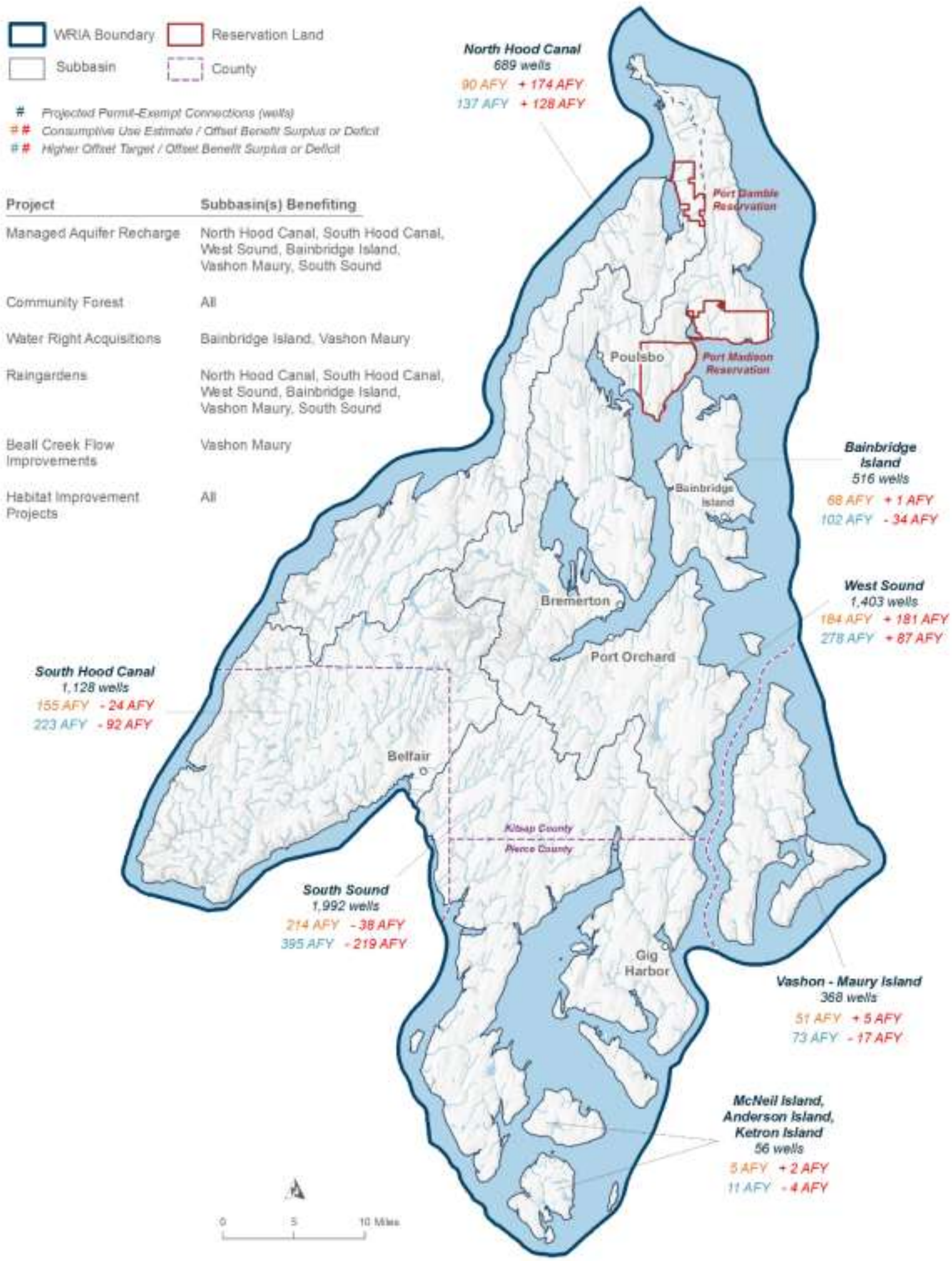

Figure ES 1: Summary of findings of the WRIA 15 Watershed Restoration and Enhancement Plan, including estimates for new domestic PE well growth, consumptive use estimates, and project offset benefits. Map prepared by HDR.

Chapter 1 – Plan Overview

1.1 WRIA 15 Watershed Plan Purpose and Structure

The purpose of the Water Resource Inventory Area (WRIA) 15 Watershed Restoration and Enhancement Plan is to identify projects and actions intended to offset the impacts of new domestic permit-exempt (PE) wells to streamflows. The Watershed Restoration and Enhancement Plan is one requirement of RCW 90.94.030. Watershed Restoration and Enhancement Plans must identify projects to offset the projected consumptive impacts of new PE domestic groundwater withdrawals on instream flows over 20 years (2018-2038) and provide a net ecological benefit (NEB) to the WRIA. The WRIA 15 Watershed Restoration and Enhancement Plan (watershed plan) considers priorities for salmon recovery and watershed recovery, while ensuring it meets the intent of the law, as interpreted by Ecology.[3]

While not all members of the WRIA 15 Watershed Restoration and Enhancement Committee (Committee) agree with the Department of Ecology's (Ecology) interpretations of the law, this watershed plan was written to meet the guidance and policy interpretations as provided by Ecology. References to meeting the requirements of the law throughout this plan refer to Ecology's interpretation of the law and may not encompass the interpretations held by all members of the WRIA 15 Committee.

Pumping from wells can reduce groundwater discharge to springs and streams by capturing water that would otherwise have discharged naturally, thereby reducing flows (Barlow and Leake 2012). Consumptive water use (the portion not returned to the aquifer) reduces streamflow, both seasonally and as average annual recharge. A well pumping from an aquifer connected to a surface water body can either reduce the quantity of water discharging to the river or increase the quantity of water leaking out of the river (Barlow and Leake 2012).

While this watershed plan is narrow in scope and not intended to address all water uses or related issues within the watershed, it may provide a path forward for future water resource planning.

[Language to be included when appropriate]: The Committee, by completing the watershed plan, has developed, and come to consensus[4] on, a technically and politically complex issue in water resource management. That success will set the stage for improved coordination of water resources and overall watershed health in our WRIA.

This watershed plan includes seven chapters:

1. Plan overview;

[3] Some members of the WRIA 15 Committee have different interpretation of RCW 90.94.030. Signing statements and other documents provided in the Compendium provide more information on their interpretations.

[4] The WRIA 15 Committee defines the level of consensus in their operating principles. Complete operating principles can be found on the WRIA 15 Committee EZ View webpage and in Appendix B: https://www.ezview.wa.gov/site/alias__1962/37327/watershed_restoration_and_enhancement_-_wria_15.aspx

2. Overview of the watershed's hydrology, hydrogeology, and streamflow;
3. Summary of the subbasins;
4. Growth projections and consumptive use estimates;
5. Description of the recommended projects to offset the future PE domestic water use in WRIA 15 and meet NEB;
6. Explanation of recommended policy, monitoring, adaptive management, and implementation measures; and
7. Evaluation and consideration of the NEB.

1.1.1 Legal and Regulatory Background for the WRIA 15 Watershed Restoration and Enhancement Plan

In January 2018, the Washington State Legislature passed Engrossed Substitute Senate Bill (ESSB) 6091 (session law 2018 c 1). This law was enacted in response to the State Supreme Court's 2016 decision in Whatcom County vs. Hirst, Futurewise, et al. (commonly referred to as the "Hirst decision"). As it relates to this Committee's work, the law, now primarily codified as RCW 90.94, clarifies how local governments can issue building permits or approve subdivisions for homes intending to use a PE well for their domestic water supply. The law also requires local watershed planning in fifteen WRIAs across the state, including WRIA 15.[5]

1.1.2 Domestic Permit-Exempt Wells

This watershed plan, the law that calls for it, and the Hirst decision are all concerned with the effects of new domestic PE water use on streamflows. Several laws pertain to the management of groundwater PE wells in WRIA 15 and are summarized in brief here for the purpose of providing context for the WRIA 15 watershed plan.

Washington State follows the doctrine of prior appropriation, which means that the first users have rights senior to those issued later. This doctrine is called "first in time, first in right." If a water shortage occurs, senior rights are satisfied first and junior rights are curtailed. Seniority is established by priority date — the original date a water right application was filed, or the date that water was first put to beneficial use in the case of claims and the groundwater permit exemption. Although groundwater PE uses do not require a water right permit, they are always subject to state water law. In some instances, Ecology has had to regulate PE water users when they interfere with older, "senior" water rights, including instream flow rules. More information is available on Ecology's website: https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-availability.

[5] ESSB 6091 includes the following: "*AN ACT Relating to ensuring that water is available to support development; amending RCW 19.27.097, 58.17.110, 90.03.247, and 90.03.290; adding a new section to chapter 36.70A RCW; adding a new section to chapter 36.70 RCW; adding a new chapter to Title 90 RCW; creating a new section; providing an expiration date; and declaring an emergency.*" (p. 1)

RCW 90.44.050, commonly referred to as "the Groundwater Permit Exemption," establishes that certain small withdrawals of groundwater are exempt from the state's water right permitting requirements, including small indoor and outdoor water use associated with homes. Although these withdrawals do not require a state water right permit, the water right is still legally established by the beneficial use. Even though a water right permit is not required for small domestic uses under RCW 90.44.050, there is still regulatory oversight, including from local jurisdictions. Specifically, in order for an applicant to receive a building permit from their local government for a new home, the applicant must satisfy the provisions of RCW 19.27.097 for what constitutes evidence of an adequate water supply.

RCW 90.94.030 adds to the management regime for new homes using domestic PE well withdrawals in WRIA 15 and elsewhere. For example, local governments must, among other responsibilities relating to new PE domestic wells, collect a $500 fee for each building permit and record withdrawal restrictions on the title of the affected properties. Additionally, this law restricts new PE domestic withdrawals in WRIA 15 to a maximum annual average of up to 950 gallons per days (gpd) per connection, subject to the 5,000 gpd and ½-acre outdoor irrigation of non-commercial lawn/garden limits established in RCW 90.44.050. Ecology has published its interpretation and implementation of RCW 19.27.097 and RCW 90.94 in Water Resources POL 2094 (Ecology 2019a). For additional information, readers can review those laws and policy for comprehensive details and agency interpretations.

1.1.3 Planning Requirements Under RCW 90.94.030

While supplementing the local building permit requirements, RCW 90.94.030(3) goes on to establish planning criteria for WRIA 15. In doing so, it sets the minimum standard of Ecology's collaboration with the WRIA 15 Committee in the preparation of this watershed plan. In practice, the process of plan development was one of broad integration, collectively shared work, and a striving for consensus described in the Committee's adopted operating principles, which are further discussed below.

In addition to these procedural requirements, the law (and consequently, this watershed plan) is concerned with the identification of projects and actions intended to offset the anticipated impacts from new PE domestic groundwater withdrawals over the next 20 years and provide a NEB.[6] In establishing the primary purpose of this watershed plan, RCW 90.94.030 (3) also details both the required and recommended plan elements. Regarding the WRIA 15 Committee's approach to selecting projects and actions, the law also speaks to "high and lower priority projects." The Committee understands that, as provided in the Final Guidance on

[6] The planning horizon for achieving a NEB is the 20 year period beginning with January 19, 2018 and ending on January 18, 2038. The planning horizon only applies to determining which new consumptive water uses the plan must address under the law. The projects and actions required to offset the new uses must continue beyond the 20-year period and for as long as new well pumping continues. (Ecology 2019b; page 7)

Determining Net Ecological Benefit (Ecology 2019b), "use of these terms is not the sole critical factor in determining whether a plan achieves a NEB… and that plan development should be focused on developing projects that provide the most benefits… regardless of how they align with [these] labels" (page 12). For WRIA 15, this watershed plan recognizes the goal of protecting water quantity as the primary component of habitat for fish populations and aquatic life. In order to provide a benefit to the greatest length of stream channel, the highest priority projects are those that provide protection or restoration of headwater streamflows.

1.2 Requirements of the WRIA 15 Watershed Restoration and Enhancement Plan

RCW 90.94.030 of the Streamflow Restoration law directs Ecology to establish a Watershed Restoration and Enhancement Committee in the Kitsap watershed and develop a watershed plan in collaboration with the WRIA 15 Committee. Ecology determined that the intent was best served through collective development of the watershed plan, using an open and transparent setting and process that builds on local needs.

At a minimum, the watershed plan must include projects and actions necessary to offset projected consumptive impacts of new PE domestic groundwater withdrawals on streamflows and provide a NEB to the WRIA.

Ecology issued the Streamflow Restoration Policy and Interpretive Statement (POL-2094) and Final Guidance on Determining Net Ecological Benefit (GUID-2094) in July 2019 to ensure consistency, conformity with state law, and transparency in implementing RCW 90.94. The Final Guidance on Determining Net Ecological Benefit (hereafter referred to as Final NEB Guidance) establishes Ecology's interpretation of the term "net ecological benefit." It also informs planning groups on the standards Ecology will apply when reviewing a watershed plan completed under RCW 90.94.020 or RCW 90.94.030. The minimum planning requirements described by Ecology in the Final NEB Guidance include the following (pages 7-8):

> Streamflow Restoration law RCW 90.94.030(3)
>
> (b) At a minimum, the plan must include those actions that the committee determines to be necessary to offset potential impacts to instream flows associated with permit-exempt domestic water use. 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. Lower priority projects include projects not in the same basin or tributary and projects that replace consumptive water supply impacts only during critical flow periods. The plan may include projects that protect or improve instream resources without replacing the consumptive quantity of water where such projects are in addition to those actions that the committee determines to be necessary to offset potential consumptive impacts to instream flows associated with permit-exempt domestic water use.
>
> (c) Prior to adoption of the watershed restoration and enhancement plan, the department must determine that actions identified in the plan, after accounting for new projected uses of water over the subsequent twenty years, will result in a net ecological benefit to instream resources within the water resource inventory area.
>
> (d) The watershed restoration and enhancement plan must include an evaluation or estimation of the cost of offsetting new domestic water uses over the subsequent twenty years, including withdrawals exempt from permitting under RCW 90.44.050.
>
> (e) The watershed restoration and enhancement plan must include estimates of the cumulative consumptive water use impacts over the subsequent twenty years, including withdrawals exempt from permitting under RCW 90.44.050.

1. Clear and Systemic Logic. Watershed plans must be prepared with implementation in mind.

2. Delineate Subbasins. [The Committee] must divide the WRIA into suitably sized subbasins to allow meaningful analysis of the relationship between new consumptive use and offsets.

3. Estimate New Consumptive Water Uses. Watershed plans must include a new consumptive water use estimate for each subbasin and the technical basis for such estimate.

4. Evaluate Impacts from New Consumptive Water Use. Watershed plans must consider both the estimated quantity of new consumptive water use from new domestic PE wells initiated within the planning horizon and how those impacts will be distributed.

5. Describe and Evaluate Projects and Actions for Their Offset Potential. At a minimum, watershed plans must identify projects and actions intended to offset impacts associated with new consumptive water use. Offset benefits must continue as long as the anticipated consumptive use impacts, which are assumed to be in perpetuity.

The WRIA 15 Committee prepared the WRIA 15 watershed plan with the intent that the plan, including all projects, is fully implemented. The law requires that all members of the Committee approve the plan prior to submission to Ecology for review. Ecology must then determine that the plan's recommended streamflow restoration projects and actions will result in a NEB to instream resources within the WRIA after accounting for projected use of new PE domestic wells over the 20-year period of 2018-2038.

RCW 90.94.030 (6). This section [90.94.030] only applies to new domestic groundwater withdrawals exempt from permitting under RCW 90.44.050 in the following water resource inventory areas with instream flow rules adopted under chapters 90.22 and 90.54 RCW that do not explicitly regulate PE groundwater withdrawals: 7 (Snohomish); 8 (Cedar-Sammamish); 9 (Duwamish-Green); 10 (Puyallup-White); 12 (Chambers-Clover); 13 (Deschutes); 14 (Kennedy Goldsborough); and 15 (Kitsap) and does not restrict the withdrawal of groundwater for other uses that are exempt from permitting under RCW 90.44.050.

1.3 Overview of the WRIA 15 Committee

1.3.1 Formation

The Streamflow Restoration law instructed Ecology to chair the WRIA 15 Committee, and invite representatives from the following entities in the watershed to participate in the development of the watershed plan:

- Each federally recognized tribal government with reservation land or usual and accustomed harvest area within the WRIA.
- Each county government within the WRIA.
- Each city government within the WRIA.

- Washington State Department of Fish and Wildlife.
- The largest publicly owned water purveyor providing water within the WRIA that is not a municipality.
- The largest irrigation district within the WRIA.

Ecology sent invitation letters to each of the entities named in the law in September of 2018. Note that WRIA 15 does not have an irrigation district.

The law also required Ecology to invite local organizations representing agricultural interests, environmental interests, and the residential construction industry. Businesses, environmental groups, agricultural organizations, conservation districts, and local governments nominated interest group representatives. Local governments on the WRIA 15 Committee voted on the nominees in order to select local organizations to represent agricultural interests, environmental interests, and the residential construction industry. Ecology invited the selected entities to participate on the Committee.

Committee members are listed in Table 1. This list includes all of the members identified by the Legislature that agreed to participate on the WRIA 15 Committee.[7]

Table 1: WRIA 15 Committee Participating Entities

Entity Name	**Representing**
Kitsap County	County government
King County	County government
Mason County	County government
Pierce County	County government
Puyallup Tribe	Tribal government
Skokomish Tribe	Tribal government
Squaxin Island Tribe	Tribal government
Suquamish Tribe	Tribal government
Port Gamble S'Klallam Tribe	Tribal government
City of Port Orchard	City government
City of Bremerton	City government
City of Gig Harbor	City government
City of Bainbridge Island	City government
Kitsap Public Utility District	Water utility
Department of Fish and Wildlife	State agency
Department of Ecology	State agency

[7] All participating entities committed to participate in the process and designated representatives and alternates to sit on the WRIA 15 Committee. A roster with the names of the representatives is available in Appendix A. The City of Poulsbo originally participated in the process but withdrew from the Committee in October 2020.

Entity Name	Representing
Kitsap Building Association	Residential construction industry
Kitsap Conservation District	Agricultural interest group
Great Peninsula Conservancy	Environmental interest group
Mason-Kitsap Farm Bureau - ex officio	Self
Washington Water Service - ex officio	Self

The WRIA 15 Committee invited the Mason-Kitsap Farm Bureau and the Washington Water Service to participate as "ex-officio" members. Although not identified in the law, the ex-officio members provide valuable information and perspective as subject matter experts. The ex-officio members are active but non-voting participants of the WRIA 15 Committee.

The law does not identify a role for the Committee following development of the watershed plan.

1.3.2 Committee Structure and Decision Making

The WRIA 15 Committee held its first meeting in October 2018. Between October 2018 and January 2021, the WRIA 15 Committee held 28 Committee meetings.[8] All Committee and workgroup meetings were open to the public. The WRIA 15 Committee met monthly and as needed to meet deadlines. From March 2020 through April 2021, the Committee met virtually due to the global pandemic.

The two and a half years of planning consisted of training, research, and developing watershed plan components. Ecology technical staff, WRIA 15 Committee members, and partners presented on topics to provide context for components of the plan, such as an overview of WRIA 15 hydrogeology, water law, tribal treaty rights, salmon recovery, and local planning processes.

Ecology staff chaired the WRIA 15 Committee and provided administrative support and technical assistance. Ecology contracted with consultants to provide facilitation and technical support for the Committee. The facilitator supported the Committee's discussions and decision-making and coordinated recommendations for policy change and adaptive management. The technical consultants developed products that informed Committee decisions and development of the plan. Examples include working with counties on growth projections, calculating consumptive use using multiple methods, preparing maps and other tools to support decisions, and researching project ideas. The technical consultants brought a range of expertise to the Committee including hydrogeology, geographic information system (GIS) analysis, fish biology, engineering, and planning. The technical consultants developed the technical memorandums referenced throughout this watershed plan.

[8] This includes regular Committee meetings and special Committee meetings where most representatives attended. This does not include project workgroup, technical workgroup, or one-time workgroup meetings.

The WRIA 15 Committee established two workgroups to support planning efforts and to achieve specific tasks:

- The **Technical Workgroup** focused on preparing recommendations for PE well projections and consumptive use estimates.
- The **Project Workgroup** focused on developing and reviewing projects within the Committee's project inventory (additional workgroups that met only one time covered topics such as beaver management, policies, and adaptive management).

The workgroups were open to all WRIA 15 Committee members as well as non-Committee members that brought capacity or expertise not available on the Committee. The workgroups made no binding decisions but presented information to the Committee as either recommendations or findings. The Committee acted on workgroup recommendations, as deemed appropriate.

During the initial WRIA 15 Committee meetings, members developed and agreed to operating principles.[9] The operating principles established a process for meetings, participation expectations, procedures for voting, structure of the Committee, communication, and other needs in order to support the Committee in reaching consensus on a final plan.

By statutory design, this planning process brought a diversity of perspectives to the table. Therefore, it was important for the Committee to identify a clear decision-making process. The WRIA 15 Committee strived for consensus, and when consensus could not be reached, the chair and facilitator documented the Committee members' positions. The Committee strived for consensus because the authorizing legislation requires that all members of the Committee approve the final watershed plan prior to Ecology's review (RCW 90.94.030[3] "...all members of a Watershed Restoration and Enhancement Committee must approve the plan prior to adoption"). Therefore, consensus on the foundational decisions during plan development served as the best indicators of the Committee's progress toward an approved plan.

All consensus and dissenting opinions were documented in meeting summaries that were reviewed and agreed upon by the Committee. The Committee recognized that flexibility was needed in terms of timeline, and if a compromise failed to reach consensus within the identified timeline, the Committee agreed to allow the process for developing the plan to move forward while the work towards consensus continued. The Committee agreed to revisit decisions where consensus was not reached.

The Committee reviewed components of the watershed plan iteratively throughout the process in addition to reviewing the draft plan as a whole. [**Language to be included when appropriate]:** The WRIA 15 Committee reached final approval on the Watershed Restoration and Enhancement Plan on THIS DATE 2021.

[9] Complete operating principles can be found on the WRIA 15 Committee EZ View webpage and in Appendix B: https://www.ezview.wa.gov/site/alias__1962/37327/watershed_restoration_and_enhancement_-_wria_15.aspx

Chapter Two: Watershed Overview

2.1 Brief Introduction to WRIA 15

Water Resource Inventory Areas (WRIAs) are large watershed areas formalized under Washington Administrative Code (Water Resources Code of 1971) for the purpose of administrative management and planning. WRIAs encompass multiple landscapes, hydrogeological regimes, levels of development, and variable natural resources. WRIA 15, also referred to as the Kitsap Watershed, is one of the 62 designated major watersheds in Washington State.

WRIA 15 encompasses the entire Kitsap peninsula and surrounding islands. It comprises 676 square miles, including Kitsap County and portions of Pierce, Mason, and King Counties (Figure 1). Major rivers include Union River, Tahuya River, and Dewatto River, all located in the western part of the watershed and draining to Hood Canal. These rivers are home to Chinook, Summer Chum, and Steelhead, which are listed under the Endangered Species Act (ESA). Most of the area is drained by short streams that discharge directly into the surrounding marine waters of Puget Sound and Hood Canal.

2.1.1 Land Use in WRIA 15

Approximately 10 percent of the watershed is within a designated urban growth area. Major cities in WRIA 15 include Bremerton, Port Orchard, Bainbridge Island, Gig Harbor, Poulsbo, Silverdale (unincorporated), Belfair, and Kingston (unincorporated). The area's port districts are important as centers for commerce and military installations, as well as critical hubs for marine transportation (West Central LIO 2019). The area connects to Seattle via several ferry routes and local jurisdictions anticipate increased growth with the designation of several high-capacity transit communities (Puget Sound Regional Council 2019). Many people move to the area for its rural feel and choose to live outside of the incorporated areas (West Central LIO 2017).

Federal ownership makes up approximately two percent of the watershed. A number of naval installations are located within WRIA 15, including the active Puget Sound Naval Shipyard (part of the Naval Base Kitsap) at Bremerton. Approximately 12 percent of the watershed is under state ownership, primarily by Washington Department of Natural Resources and Washington Department of Fish and Wildlife. The largest areas of forestland use are in the southern and western Tahuya Peninsula in Mason County.

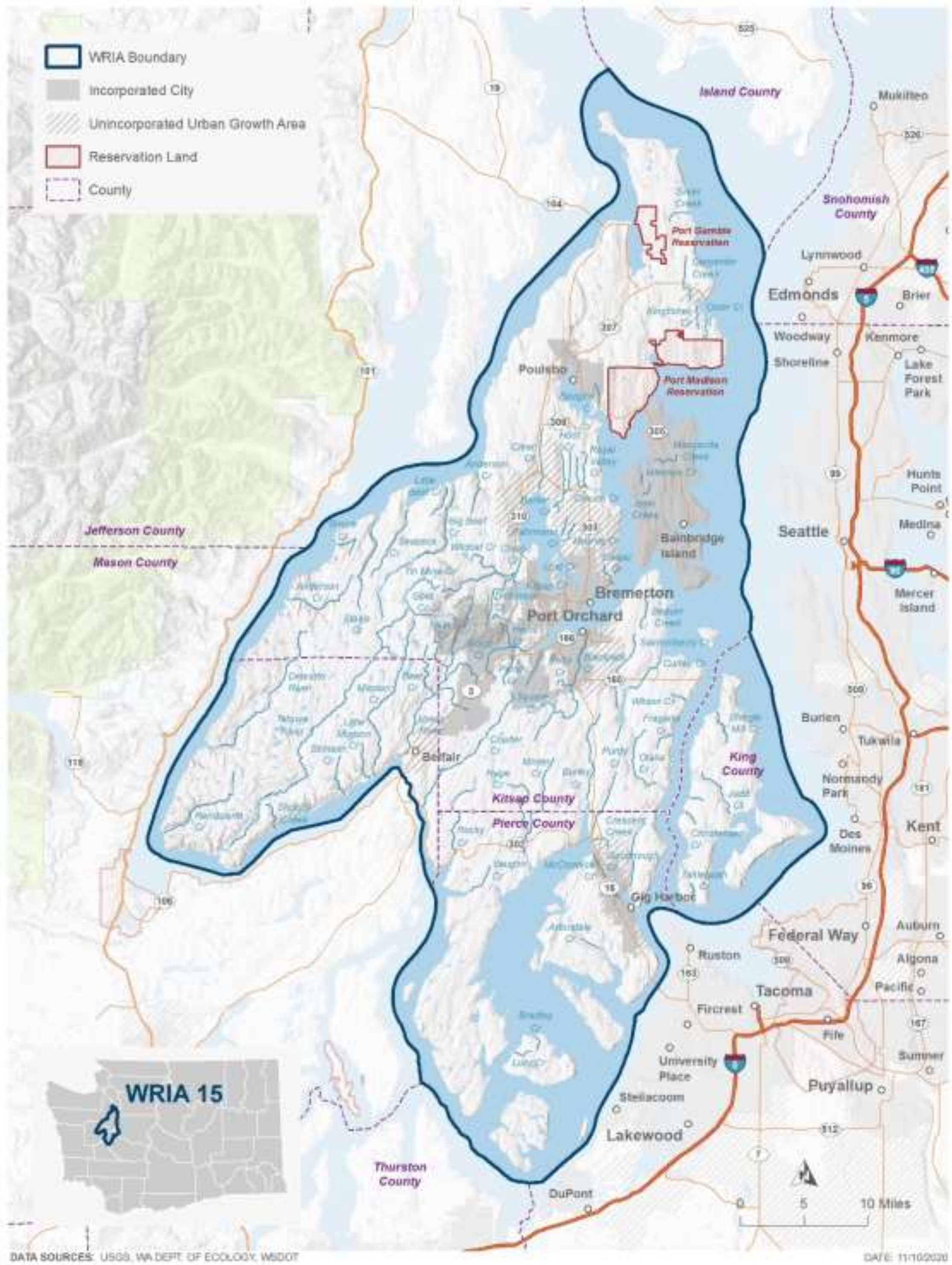

Figure 1: Water Resource Inventory Area 15 Overview. Map prepared by HDR.

2.1.2 Tribal Reservations and Usual and Accustomed Fishing Areas

The Port Gamble S'Klallam Tribe Reservation occupies approximately 1,700 acres. The Port Madison Indian Reservation (Suquamish Tribe) occupies approximately 7,458 acres within WRIA 15. Tribes with usual and accustomed fishing areas within WRIA 15 include the Suquamish, Port Gamble S'Klallam, Squaxin Island, Skokomish, Nisqually, and Puyallup Tribes (NWIFC 2019). Within WRIA 15, these Tribes hold Treaty-reserved senior water rights and fishing rights under the federal government (Treaty of Medicine Creek, Treaty of Point No Point, Treaty of Point Elliot).

The Tribes hold Treaty-reserved water rights in WRIA 15 under federal law that are necessary to support healthy salmon populations; to support and maintain hunting, fishing and cultural resource harvesting right; and to meet all homeland purposes reserved by the Treaties. These reserved water rights are necessary to fulfill the promises and purpose of the Treaties. Federal Indian water rights retain a senior priority date over all other federal and state water rights holders and state instream flow rules. Although federal Indian water rights in WRIA 15 have yet to be adjudicated, these rights are senior to all other rights and have not been accounted for by the State of Washington in the way in which the State determines water availability, over appropriation, and instream flow rules.

Language provided by WRIA 15 Tribes.

2.1.3 Salmon Distribution and Limiting Factors

WRIA 15 includes numerous small, lowland stream systems which drain to both Puget Sound and Hood Canal. The West Sound, South Sound, Bainbridge Island, Vashon-Maury Island, and McNeil-Anderson-Ketron Islands (also referred to as South Sound Islands) subbasins drain to Puget Sound (further described in Chapter 3). The North Hood Canal and South Hood Canal subbasins drain to Hood Canal. Primary streams in the West Sound subbasin include Olalla, Blackjack, Chico, and Grovers Creeks. Primary streams in the South Sound subbasin include Coulter, Rocky, Burley, Purdy, Minter, and Crescent Creeks. Primary streams in the North Hood Canal subbasin include Big Beef, Anderson, Gamble, and Stavis Creeks. Primary rivers in the South Hood Canal subbasin include Dewatto River, Union River, Tahuya River, and Mission Creek (a more complete list of rivers and streams by subbasin is available in Chapter 3). The island subbasins generally have very small streams with only minor salmonid presence or use. The Puget Sound and Hood Canal drainages are described separately as different salmonid populations occupy the two areas.

The Puget Sound subbasins within WRIA 15 have anadromous salmon runs that include three of the five Pacific salmon species (WDF 1975, WDFW 2020); Chinook (*Oncorhynchus tshawytscha*), Coho (*Oncorhynchus kisutch*), and Chum salmon (*Oncorhynchus keta*). Chinook Salmon have been documented in Coulter, Rocky, Burley, Purdy, Curley, Crescent, Minter, Olalla, Blackjack, Gorst, Clear, Chico, Royal Valley, Barker, and Dogfish creeks (WDFW 2020). However, spawning is only known to occur in Burley, Purdy, Olalla, Curley, Blackjack and Gorst Creeks. Both summer and fall-run Chum Salmon are present, with summer Chum Salmon present in Rocky, Coulter, Burley, Curley, and Blackjack Creeks (WDFW 2020). Steelhead Trout (*Oncorhynchus mykiss*) and Cutthroat Trout (*Oncorhynchus clarki clarki*) also inhabit Puget Sound subbasins.

The Hood Canal subbasins have anadromous salmon runs that include Chinook, Coho, Chum, and Pink (*Oncorhynchus gorbuscha*) salmon, as well as Steelhead and Cutthroat trout. Both summer and fall-run Chum Salmon are present. Pink Salmon are only present in the Dewatto River and Union River (WDFW 2020).

Of these populations, three are federally listed as threatened species: Puget Sound Chinook Salmon, Puget Sound Steelhead Trout, and Hood Canal Summer Chum Salmon. Table 2 lists the species present in WRIA 15 and their regulatory status.

Table 2: Salmonid Species and Status in WRIA 15

Common Name	Scientific Name	Population[1]	Critical Habitat	Regulatory Agency Status
Puget Sound				
Chinook Salmon	*Oncorhynchus tshawytscha*	Puget Sound Chinook	Designated in 2005; does not include Kitsap Basin	NMFS/ Threatened/1999
Chum Salmon	*Oncoryhnchus keta*	Puget Sound Chum	No	Not listed
Coho Salmon	*Oncorhynchus kisutch*	Puget Sound/Strait of Georgia Coho	No	NMFS/Species of Concern/1997
Steelhead Trout	*Oncorhynchus mykiss*	Puget Sound Steelhead	Yes/2016	NMFS/ Threatened/2007
Coastal Cutthroat Trout	*Oncorhynchus clarki*	No listing	No listing	No listing
Hood Canal				
Chinook Salmon	*Oncorhynchus tshawytscha*	Puget Sound Chinook	Designated in 2005; does not include Kitsap Basin	NMFS/ Threatened/1999
Chum Salmon	*Oncoryhnchus keta*	Hood Canal Chum	Yes/2005	NMFS/ Threatened/1999
Coho Salmon	*Oncorhynchus kisutch*	Puget Sound/Strait of Georgia Coho	No	NMFS/Species of Concern/1997
Steelhead Trout	*Oncorhynchus mykiss*	Puget Sound Steelhead	Yes/2016	NMFS/ Threatened/2007
Coastal Cutthroat Trout	*Oncorhynchus clarki*	No listing	No listing	No listing

Note: 1. Population indicates Evolutionary Significant Unit.

Table 3 lists the run timing and life stages of anadromous salmon and trout present throughout WRIA 15.

Table 3: Salmonid Presence and Life History Timing in Kitsap Basin

Species	Freshwater Life Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Presence
Chinook (fall)	Upstream migration													Puget Sound -- Coulter, Rocky, Burley, Purdy, McCormick, Curley, Crescent, Judd, Minter, Olalla, Blackjack, Gorst, Clear, Crouch, Chico, Royal Valley, Barker, and Dogfish creeks Hood Canal -- Dewatto, Tahuya, and Union rivers, Mission, Anderson, Boyce, Big Beef creeks
	Spawning													
	Incubation													
	Juvenile rearing													
	Juvenile outmigration													
Coho	Upstream migration													All
	Spawning													
	Incubation													
	Juvenile rearing													
	Smolt outmigration													
Chum (summer)	Upstream migration													Puget Sound -- Rocky, Coulter, Burley, Curley, and Blackjack creeks Hood Canal -- Dewatto, Tahuya and Union rivers; Anderson and
	Spawning													
	Incubation													
	Juvenile rearing													

Species	Freshwater Life Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Presence
	Juvenile outmigration													Big Beef creeks
Chum (fall)	Upstream migration													All
	Spawning													
	Incubation													
	Juvenile rearing													
	Juvenile outmigration													
Pink	Upstream migration													Hood Canal - Dewatto and Union rivers
	Spawning													
	Incubation													
	Juvenile rearing													
	Juvenile outmigration													
Coastal Cutthroat	Upstream migration													All
	Spawning													
	Incubation													
	Juvenile rearing													
	Smolt outmigration													
Steelhead (winter)	Upstream migration													All
	Spawning													
	Incubation													
	Juvenile rearing													
	Smolt outmigration													

Table Data Sources: Heard 1998; Johnson 1999; Wydoski & Whitney 2003; HCCC 2005; NSD & ICF 2014; WDFW 2020

Limiting Factors

Development and population growth in the Puget Sound lowlands region has substantially altered WRIA 15 from its historic conditions and natural stream habitat forming processes. Extensive wetland systems or lakes in the headwaters have historically sustained many of these rainfall-dominated, lowland stream systems throughout the year. Development has led to the removal of forest canopy cover, filling and draining of wetlands, channelization of streams, implementation of numerous road crossing and fish passage barriers, and creation of substantial areas of impervious surfaces, resulting in habitat loss and degradation.

In general, the primary limiting factors in freshwaters of WRIA 15 include (Kuttel 2003; May & Peterson 2003):

- Channel and streambed degradation
- Increased peak flows
- Low streamflow
- Loss of upland forest cover
- Loss of riparian forest
- Loss of floodplain connectivity and habitats
- Degradation of wetland and shoreline habitats
- Conversion of wetlands to open water habitats
- Fish passage barriers
- Lack of large wood
- Fine sediment

Past timber harvest and ongoing residential and commercial development have removed forest and riparian cover and increased impervious surfaces in most areas of the Kitsap Basin. These changes (1) reduce infiltration and storage of groundwater; (2) can contribute to reduced streamflow; and (3) increase runoff during storms that can scour streambeds and contribute to bank erosion and instability. Research shows timber harvest may also impact streamflow as young forests often use more water than mature forests.[10] Loss of functioning riparian corridors, combined with low flows in summer, results in high water temperatures that can reduce habitat suitability and cause sublethal physiological changes in adult and juvenile salmonids—or even mortality at high temperatures (Shared Strategy 2007).

Roads and various land uses have straightened and constrained many streams, resulting in a loss of floodplain connectivity and off-channel habitats and simplification of in-stream habitats. Road crossings also create fish passage barriers in many locations.

To address low streamflow, the Instream Resources Protection Program (IRPP) for WRIA 15 (Ecology 1981) through WAC173-515 set minimum instream flows for 21 streams and closed 54 streams and their tributaries (including lakes) to further appropriation of surface water. An

[10] More information provided in the Compendium in a memo from Paul Pickett, Squaxin Island Tribe.

additional 14 streams and their tributaries are closed to further appropriation of surface water for part of the year. Section 2.3.3 discusses instream flows.

The *East Kitsap Salmon Habitat Restoration Strategy* Summary (Kitsap County 2005) identifies protection and/or restoration of hydrologic and riparian functional integrity as the highest priority for freshwater areas. Tier 1 streams of focus include Chico, Minter, and Rocky Creeks.

The *East Kitsap Steelhead Recovery Plan* (ESA and Suquamish Tribe 2020) prioritizes Blackjack, Chico, Clear, Curley, Gorst, and Grovers Creeks for water quantity and quality protection and restoration.

The *Kitsap Salmonid Refugia Report* (May & Peterson 2003) identify Chico and Stavis Creeks and the Dewatto River and Tahuya River as the highest quality refugia for salmonids that should be protected, especially for hydrologic functions.

The *Hood Canal Summer Chum Salmon Recovery Plan* (HCCC 2005) identifies loss of channel complexity, lack of riparian forest, and high water temperatures as primary limiting factors in the Union River and Tahuya River. The Union River is home to ESA-listed Chinook, Summer Chum, and Steelhead. Coho spawn in this river and are a species of concern.

For the Dewatto River, Anderson Creek and Big Beef Creek, the significant change in hydrology (increased peak flows, reduced low flows), channel instability and erosion, loss of channel complexity, and loss of floodplain habitats are primary limiting factors. Salmon recovery lead entities provide additional information on limiting factors and priorities for WRIA 15.[11]

2.1.4 Water System Distribution and Impacts in WRIA 15

Groundwater is the primary source of drinking water for most of the population of the Kitsap Watershed and as such, demand for groundwater increases with population growth (Frans and Olsen 2016). According to the U.S. Geological Survey (USGS), the quantity of usable groundwater is likely limited, mostly due to (1) the geography and the potential for declines in water levels, (2) decreases in groundwater discharge to streams, and (3) seawater intrusion as groundwater usage increases (Frans and Olsen 2016).

The USGS estimates 14 percent of the population (43,400 people) on the Kitsap Peninsula are supplied by PE wells and the remainder (268,800 people) by water purveyors under Group A and Group B systems (Welch et al. 2014). No estimates are available for WRIA 15 areas outside of the Kitsap Peninsula. Casad Dam, located above McKenna Falls on the Union River, is the only major surface water diversion structure in Kitsap County. The Union River Reservoir (behind the dam) provides approximately 65 percent of Bremerton's drinking water (City of Bremerton 2020).

[11] More information on salmon recovery planning in Puget Sound, watershed plans, and limiting factors available here: https://www.psp.wa.gov/salmon-recovery-watersheds.php.

Pumping from wells can reduce groundwater discharge to springs and streams by capturing water that would otherwise have discharged naturally. Surface water may be influenced by groundwater pumping such that flows are diminished. Consumptive water use (the portion not returned to the aquifer) potentially reduces streamflow, both seasonally and as average annual recharge. A well pumping from an aquifer connected to a surface water body can either reduce the quantity of water discharging to the river or increase the quantity of water lost from the river to groundwater (Barlow and Leake 2012).

2.2 Watershed Planning in WRIA 15

Citizens and local, state, federal, and tribal governments have collaborated on watershed and water resource management issues in WRIA 15 for decades. A brief summary of broad watershed planning efforts as they relate to the past, present, and future water availability in the Kitsap Watershed is provided in Section 2.2.1.

2.2.1 Current watershed planning efforts in WRIA 15

The WRIA 15 watershed plan builds on many previous and current watershed planning efforts, including previous watershed planning efforts under RCW 90.82. Other efforts include ecosystem recovery planning by local integrating organizations (LIOs) and salmon recovery planning by salmon recovery lead entities. WRIA 15 crosses boundaries with the West Central LIO (now merged with the West Sound Lead Entity and referred to as the "West Sound Partners for Ecosystem Recovery"), the Alliance for a Healthy South Sound, South Central LIO, and the Hood Canal Coordinating Council. The LIOs have completed ecosystem recovery plans as part of the Action Agenda for Puget Sound Recovery and are actively working to implement holistic approaches to recovery, including projects on salmon and orca recovery, stormwater runoff, shellfish protection, and forest conservation.[12]

Several salmon recovery lead entities cross boundaries with WRIA 15, including the West Sound Partners for Ecosystem Recovery (previously known as West Sound Lead Entity), Hood Canal Lead Entity and Regional Organization, WRIA 9 Lead Entity (Green Duwamish), Puyallup Lead Entity, Nisqually Lead Entity, and South Sound Lead Entity.[13] Each of the salmon recovery lead entities facilitates implementation of their watershed recovery chapter as part of the Puget Sound Salmon Recovery Plan and the Puget Sound Steelhead Recovery Plan. The Hood Canal Lead Entity and Regional Organization is also responsible for facilitating implementation of the Hood Canal Summer Chum Recovery Plan. The salmon recovery lead entities are activity working with local governments, tribal governments, and other partners to implement salmon recovery actions across WRIA 15.

[12] More information on local integrating organizations and their efforts to recovery Puget Sound is available here: https://www.psp.wa.gov/LIO-overview.php.

[13] Salmon recovery lead entities in Puget Sound were established under RCW 77.85.050. More information on their roles as well as links to the recovery plan and watershed chapters is available here: https://www.psp.wa.gov/salmon-recovery-overview.php.

The LIOs and salmon recovery lead entities include many of the same organizations and individuals that participated in the WRIA 15 Committee. Because the Committee was newly established and brought in entities involved in many other planning efforts, the Committee invested time in developing relationships and understanding priorities of the various entities participating in the watershed planning process.

The Public Water System Coordination Act of 1977 created Critical Water Supply Service Areas (CWSSA).[14] This Act requires each water purveyor in a CWSSA to develop a water system plan for their service area, with boundaries in compliance with the provision of the Act. The Washington State Department of Health is primarily responsible for the water system plan approval; however, local governments ensure consistency with local growth management plans and development policies. Pierce County, Kitsap County, and King County have adopted coordinated water system plans that focus on the Group A water systems. This Act and the water system plans are important for the WRIA 15 watershed planning process as water system service areas and related laws and policies can set stipulations regarding timely and reasonable service as to whether new homes connect to water systems or rely on new PE domestic wells.[15]

2.2.2 Coordination with existing plans

Throughout the development of the watershed plan, Ecology streamflow restoration staff have engaged with staff from the salmon recovery lead entities and the Puget Sound Partnership, providing briefings on the streamflow restoration law, scope of the watershed plan, and plan development status updates. The Committee chair conducted outreach to the lead entities in WRIA 15 regarding coordination with the Committee to ensure alignment of salmon recovery priorities and the streamflow planning process. While none of the lead entities participated as ex-officio members of the Committee, they reviewed project lists and provided feedback to the Committee.

County and city comprehensive planning under the Growth Management Act (GMA) of 1990 identifies where and how future population, housing, and job growth is planned. The comprehensive plans set policy for development, housing, public services and facilities, and environmentally sensitive areas, among other topics. In WRIA 15 counties, comprehensive plans identify Kitsap, Pierce, Mason, and King counties' urban growth areas, set forth standards for urban and rural development, and provide the basis for zoning districts. Because of the overlap in planning for twenty years of growth, the WRIA 15 county representatives helped ensure

[14] RCW 70.116.070

[15] Water system planning information for each county is available.
Kitsap County: https://kitsappublichealth.org/environment/files/regulations/CWSP2005.pdf
Pierce County: https://www.co.pierce.wa.us/951/Coordinated-Water-System-Planning
Mason County: https://www.co.mason.wa.us/health/environmental/drinking-water/public-water-systems.php
King County: https://www.kingcounty.gov/depts/dnrp/utilities-technical-review-committee/coordinated-water-system-plans.aspx

content of the WRIA 15 watershed plan was coordinated with the Kitsap, Pierce, Mason, and King counties' comprehensive plans.[16]

There are numerous linkages between growth management and water resource management. The GMA addresses water resources through requirements related to water availability as well as ground and surface water protection. Public facilities, which include domestic water systems must be adequate to serve a proposed development at the time the development is available for occupancy. The requirements also call for the protection of the water quality and quantity of groundwater used for public water systems in addition to critical areas including critical aquifer recharge areas. In the rural area, GMA further requires a land use pattern that protects the natural water flows along with recharge and discharge areas for ground and surface waters. As discussed in Sections 1.1.1 and 1.1.2, ESSB 6091 was enacted in response to the State Supreme Court's "Hirst decision" (primarily codified as RCW 90.94, and other statutes) and amended the GMA. In addition to GMA, there are other connections between land use codes, water planning and water systems.

2.3 Description of the Watershed – Geology, Hydrogeology, Hydrology, and Streamflow

2.3.1 Geologic setting

Pleistocene glaciation (2.6 million to 11,700 years ago) played an important role in sculpting the landscape of the Puget Sound Lowlands. Reaching a maximum extent during the Vashon stage of the Fraser Glaciation approximately 16,000 years ago, an ice sheet advanced southward into present day Puget Sound (Futornick 2008). Multiple advances and retreats of the ice sheet formed the Puget Sound Lowlands, depositing a complex sequence of glacial and inter-glacial sediments on top of older sediments.

The landforms and subsurface area of WRIA 15 are dominated by a sequence of unconsolidated glacial and interglacial deposits. Depth to bedrock ranges from exposed at ground surface near the center of the WRIA to more than 2,000 feet below land surface (Welch et al. 2014).

Understanding the geologic setting allows characterization of surface and groundwater flow through the basin. Defining the relationships between surface water flow and deeper groundwater are important to understanding how to manage surface water resources and can be helpful in identifying strategies to offset the impacts of pumping from PE wells.

[16] Comprehensive planning under GMA is available from each county:
King County: https://www.kingcounty.gov/depts/executive/performance-strategy-budget/regional-planning/king-county-comprehensive-plan/2020-Executive-Recommended-Plan.aspx [see Chapter 5, p. 5-42; Chapter 9, p 9-19]
Kitsap County: http://compplan.kitsapgov.com/Pages/home.aspx
Pierce County: https://www.co.pierce.wa.us/950/Comprehensive-Plan
Mason County: https://www.co.mason.wa.us/community-services/planning/2036-comp-plan-update/index.php

2.3.2 Hydrogeologic setting

The USGS described the hydrogeology of WRIA 15 in a hydrogeologic framework report for the Kitsap Peninsula titled *Hydrogeologic Framework, Groundwater Movement, and Water Budget of the Kitsap Peninsula, West-Central Washington* (Welch et al. 2014). The study area covered all of WRIA 15, except for the southern Key Peninsula; Anderson, McNeil, and Ketron Islands; and Vashon-Maury Island. The hydrogeologic units of the area are described as being either water-bearing ("aquifer") or non-water-bearing ("aquitard" or "confining layer") sediments, without regard to geologic origin or age. Major groundwater aquifers are found in the unconsolidated glacial and interglacial sediments.

Building on the hydrogeologic framework, USGS developed a numerical groundwater flow model to further understand water resources on the Kitsap Peninsula (Frans and Olsen 2016). The City of Port Orchard's Foster Pilot uses this groundwater model and Kitsap Public Utility District (Kitsap PUD) is conducting an analysis of the model using a one-year pumping test, which may lead to further refinement of model for consideration in adaptive management of watershed plan implementation.

Groundwater in the aquifers generally flows radially outward from the peninsula to Puget Sound or Hood Canal. These generalized flow patterns are complicated by the presence of low permeability confining units and bedrock that separate discontinuous bodies of aquifer material and act as local groundwater-flow barriers (Welch et al. 2014). Summer base flows in the watershed are sustained by groundwater.

The USGS describes the hydrogeology of the watershed as 12 hydrogeologic units, typically alternating between aquifer and non-aquifer layers. All aquifer and confining units other than the Vashon Recessional Aquifer (Qvr) are present throughout the area, except in the center of the WRIA where bedrock is at or near ground surface. The five aquifer units defined by the USGS are summarized in Appendix C: Aquifer Units within WRIA 15. Of these units, the relatively shallow and laterally extensive Vashon Advance Aquifer (Qva) and Sea Level Aquifer (QA1) are the most heavily used and most likely water sources for new PE wells. The upper three aquifer units (Qvr, Qva, QC1) are also the main source of direct recharge or baseflow to the surface water system.

Given the proximity to Puget Sound or Hood Canal for much of the watershed, saltwater (or seawater) intrusion has been raised as a potential issue (Economic and Engineering Services Inc. 1997). Kitsap County has not identified specific areas impacted by saltwater, but manages coastal areas with this issue in mind. Likewise, Tacoma Pierce County Health Department manages a program focused on the Key Peninsula and the Gig Harbor areas where risks of saltwater intrusion may be higher. The largest risks are found on small, privately-owned housing lots found along many coastal areas. Individual wells in such areas may be closely spaced and are often shallow, tapping water table aquifers that could be subject to saltwater intrusion if over-used or impacted by drought conditions. A summary of water resources (Suquamish Tribe 2016) noted that thus far, no widespread or serious saltwater intrusion problems have been identified.

In 2011, USGS modeled the potential risks of saltwater intrusion due to municipal withdrawals on Bainbridge Island (Frans, L.M. et al. 2011). The study found no risk of saltwater intrusion to the aquifers of interest through the year 2035. A more recent study (Kitsap PUD et al. 2018) on the Seabold Water Association on Bainbridge Island concludes that elevated chloride levels measured at a well (an early warning indicator of saltwater intrusion) are localized and not a regional problem. The elevated chloride levels may have been caused by disposal of water treatment brine.

2.3.3 Hydrology and Streamflow

Due to its irregular configuration, relatively small size, and geologic and topographic characteristics, the Kitsap Peninsula is drained by hundreds of relatively small lowland stream and river systems. Most of the area is drained by short streams that discharge directly into surrounding marine waters. Over 580 streams and 180 lakes, reservoirs, ponds, and marshes have been inventoried in WRIA 15 (Garling et al. 1965). WRIA 15 is unique hydrologically, as only 12 streams in the area have surface drainage areas that exceed 10 square miles, and most are less than one square mile.

Addressing the complexity of groundwater and surface water systems in WRIA 15 requires analysis at many different hydrologic scales, depending on the needs of the studies. Examples of these scales include the subbasins (discussed in Chapter 3) and USGS Hydrologic Units, such as Hydrologic Unit Code 12 (HUC-12) boundaries. In addition, there is evidence that some aquifers are continuous beneath several drainage basins (Ecology 1981; Kitsap Public Utility District 1997).

Temperatures rarely drop below freezing in WRIA 15, and as a result, snowfall accumulation is minimal. There is no contribution from upstream watersheds because WRIA 15 is surrounded by marine waters. Because all streams are contained in the WRIA, upstream sources, snow, and snowpack are not influencing factors in the watershed. Precipitation as rainfall is the dominant natural input of fresh water to the basin and streamflows are extremely sensitive to areal and seasonal variations in precipitation (Golder Associates 2004).

Annual precipitation varies considerably, ranging from an average of less than 30 inches in the northern tip of the peninsula to more than 80 inches along Hood Canal in the southwest portion of the WRIA. Most of the WRIA receives an average of 40 to 60 inches of precipitation annually (Kitsap PUD 2020). In general, precipitation increases by one inch for every mile southward from the northern tip of the Peninsula. On average, July is the driest month and December is the wettest month (Golder Associates and EES 2002).

In addition to directly contributing to streamflow maintenance, precipitation also contributes to storage in lakes and groundwater aquifers that serve as natural reservoirs, helping to moderate extreme high and low flows. Groundwater provides the majority of late summer flow to area streams. Practically all streams in WRIA 15 are augmented by groundwater discharge and many would go dry if groundwater recharge during precipitation became insufficient to maintain streamflow during dry periods (Ecology 1981). Small streams draining the east shore of Hood

Canal typically originate in lakes and wetlands, have moderate gradients, and exhibit low flows in late summer and early fall (Kuttel 2003).

WAC173-515 set minimum instream flows for 21 streams and closed 54 streams and their tributaries (including lakes) to further appropriation of surface water. An additional 14 streams and their tributaries are closed to further appropriation of surface water for part of the year. Some of the streams with partial closures are in basins which also have minimum instream flows set (Ecology 1981). Streams subject to minimum instream flows are Union River, Tahuya River, Rendsland Creek, Dewatto River, Anderson Creek, Stavis Creek, Big Beef Creek, Anderson Creek (different creek than previously listed), Grover's Creek, Steel Creek, Strawberry/Kochs/Cooks Creek, Dickerson Creek, Chico Creek, Gorst Creek, Curley Creek, Ollala Creek, Crescent Creek, Purdy Creek, Lackey Creek, Rocky Creek, and Coulter Creek.

The Instream Resources Protection Program (IRPP) for WRIA 15 provides context on how instream flows and closures were set (Ecology 1981):

- **Instream flows** were set for streams where continuous flow records existed, or correlations of flow to other stream gages were possible, and where average annual flows exceeded five cfs.
- **Streams closed by the WAC** were previously closed pursuant to water right recommendations or had average annual flows less than five cfs and a known high value for fish production, aesthetics, and other environmental values.

The IRPP does not describe the instream flow setting technique; instream flows are believed to have been set using a combination of Physical Habitat Simulation (PHABSIM), which is a suite of hydraulic and habitat models that compute an index of habitat suitability and discharge, and the toe-width method to determine a habitat-based instream flow recommendation. The instream flow recommendations tended to use the 40-50 percent exceedance as a hydrologic limit to the habitat-based instream flow recommendation (Pacheco 2020).

In establishing instream flows by regulation, Ecology used regulatory flows that were higher than the flows commonly seen in the stream and as such, were not designed to be met 100 percent of the time, nor was there an intent to try to achieve the instream flow on any given day. Instead, the intent of the regulation was to protect streams from further depletion (e.g., through subsequent appropriations) when flows approach or fall below the recommended discharges (Ecology 1981)." When streamflows are below the instream flow, Ecology may manage water use by contacting junior water users and inform them of the need to curtail water use. Ecology protects instream flows when issuing new water rights, or denies a water right application if mitigation is not provided.

For example, in Chico Creek, minimum instream flows are often not met. Figure 2 shows the flow exceedance for Chico Creek plotted against the regulatory minimum instream flow. Minimum instream flows are greater than the median flow (50 percent exceedance) from March until September and exceed dry year (90 percent exceedance) flows for most of the year. Since Chico watershed has one of the largest salmon runs in Kitsap County, not meeting minimum flows during migration periods can negatively impact many fish species and result in massive pre-spawn mortalities of salmon.[17] The inability to meet minimum instream flows similarly impacts Grovers Creek (Suquamish Tribe 2016).

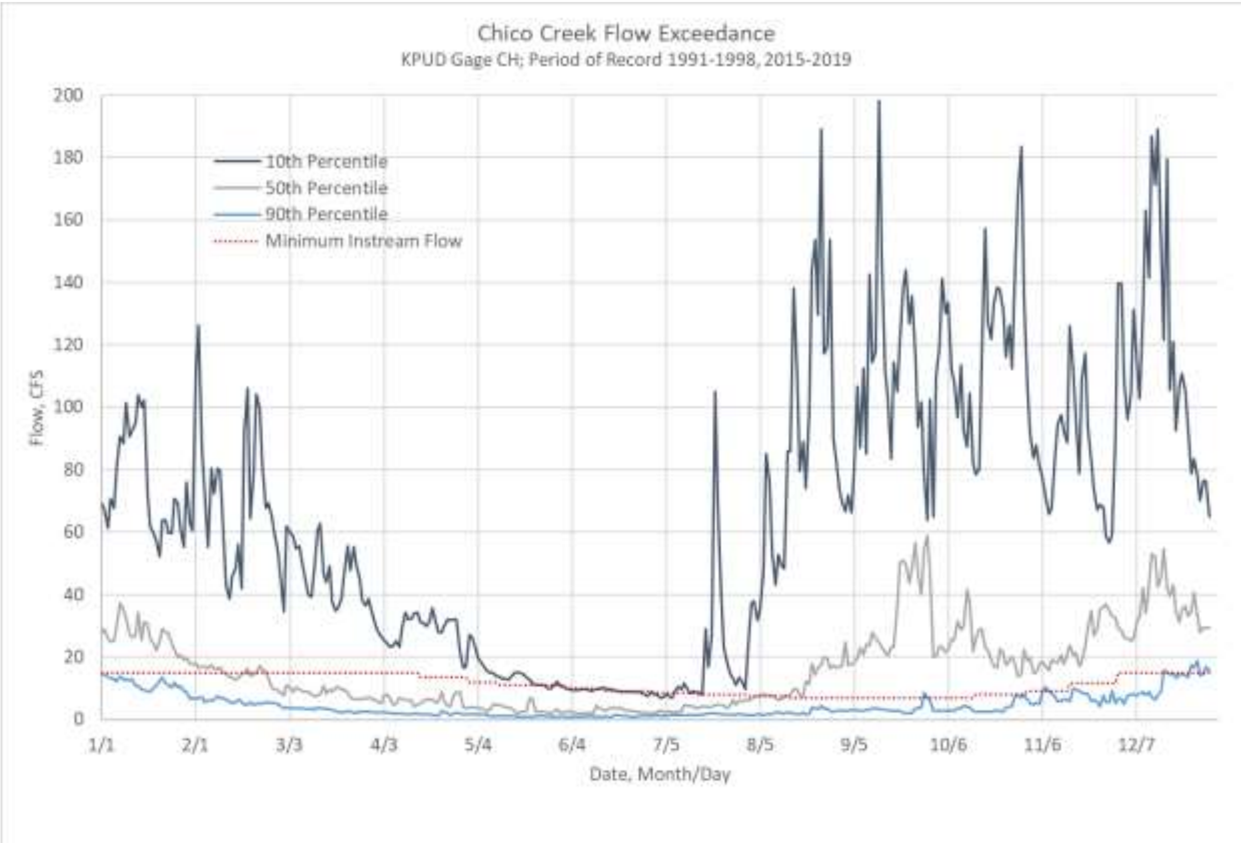

Figure 2. Chico Creek Flow Exceedance. Graph prepared by Ecology.

Due to the sensitivity of the watershed to precipitation, the salmonid habitat in the streams of WRIA 15 are highly susceptible to hydrologic changes resulting from stormwater runoff (West Sound Watershed Council 2005). The increase in impervious surfaces associated with residential and commercial development increases surface runoff and the frequency, duration, and magnitude of peak stream flows.[18] The result is that less water is available to sustain flows through the dry months, and the increased peak flows result in increased bank and streambed instability, channel scour, and loss of instream habitat diversity, which may adversely affect salmonid production (West Sound Watershed Council 2005).

Predictions of change in climate are available from The Climate Toolbox (climatetoolbox.org). The Climate Mapper on the website was used to obtain forecasts of changes in temperature

[17] Several species of fish migrate through the Chico Watershed, including chum and coho salmon, steelhead, and sea-run cutthroat trout.

[18] Note that RCW 90.94.030 does require developments associated with new building permits to have stormwater management and LID.

and precipitation over WRIA 15 under future conditions. The Climate Mapper allows a comparison of future conditions to present conditions under assumptions of which Representative Concentration Pathway (RCP) greenhouse gas concentration trajectory is assumed, and which future time frame is selected. Assuming the RCP 8.5 pathway ("Business as Usual") and a baseline of 1971-2000, mean annual precipitation is projected to increase by 2.2-2.6 percent for the 2010-2039 timeframe and 3.7-5.6 percent for the 2040-2069 timeframe. Precipitation is projected to increase in fall, winter, and spring and decrease in summer. Mean annual air temperatures will increase by 2-2.6° F in the 2010-2039 timeframe and 4.6-6° F in the 2040-2069 timeframe. Temperatures will increase in all seasons. In addition, heavy rainfall events are projected to become more severe and occur more frequently (Mauger et al. 2015).

The Climate Impacts Group prepared climate forecasts for streamflow in the Puget Sound basin (Krosby et al. 2018). No streams in WRIA 15 have forecasts; the closest stream with forecasts is the North Fork Skokomish River, located in WRIA 16. There may be limitations in using these results as a proxy for the smaller streams in WRIA 15 as larger river systems may behave differently than larger rain-dominant systems under a changing climate. Comparison of July through September streamflows between 1992 and 2011 with projections of streamflow for climate forecasts for 2070 – 2099 project a decline of 30 to 40 percent in streamflow during the low flow season (Krosby et al. 2018). It is likely with a reduction in summer precipitation and increases in temperature, streams in WRIA 15 will also experience declines in streamflow during summer—although the extent of decline has not been predicted. Water temperatures are also expected to rise which will impact salmonid survival, growth, and fitness.

2.3.4 Water Quality

Ecology evaluates surface waters in WRIA 15 every two years through a water quality assessment.[19] The assessment evaluates existing water quality data and classifies waterbodies into the following categories:

- Category 1: Meets tested standards for clean waters.
- Category 2: Waters of concern; waters in this category have some evidence of a water quality problem, but not enough to show persistent impairment.
- Category 3: Insufficient Data.
- Category 4: Impaired waters that do not require a total maximum daily load (TMDL):
    - Category 4a: already has an EPA-approved TMDL plan in place and implemented.

[19] Note limitations to the Ecology data, particularly with being outdated. Additional water quality assessments are conducted in WRIA 15, and may have more updated information, such as those available from Kitsap County, City of Bainbridge Island, and the South Sound monitoring program. The Ecology Water Quality monitoring program is provided as an example of the type of information collected in water quality assessments.

    - Category 4b: has a pollution control program, similar to a TMDL plan, that is expected to solve the pollution problems.
    - Category 4c: is impaired by causes that cannot be addressed through a TMDL plan. Impairments in these water bodies include low water flow, stream channelization, and dams.
- Category 5: Polluted waters that require a water improvement project.

The latest water quality assessment classified many waterbodies in WRIA 15 (Ecology 2020a). Category 4 and 5 assessment results are listed in Appendix D. Category 5 listings are based on exceedance of water temperature, dissolved oxygen, pH, bacteria, copper, lead, and total phosphorus water quality standards. Of the Category 4 and 5 results, 62 waterbodies are listed for either temperature, dissolved oxygen, total phosphorus, or pH. These parameters are sensitive to low flows and could be improved with streamflow restoration.

Three TMDL studies have been prepared in WRIA 15 to address water quality impairments (specifically, fecal coliform): Liberty Bay Tributaries; Sinclair and Dyes Inlets; and Union River Tributaries (Ecology 2002, 2012, 2014). These TMDLs are summarized in Appendix E.

Chapter Three: Subbasin Delineation

3.1 Introduction

To allow for meaningful analysis of the relationship between new consumptive use and offsets, and per Ecology's Final Net Ecological Benefit (NEB) Guidance (Ecology 2019b), the WRIA 15 Committee divided WRIA 15 into subbasins.[20] This division was helpful in describing (1) the location and timing of projected new consumptive water use, (2) the location and timing of impacts to instream resources, and (3) the necessary scope, scale, and anticipated benefits of projects. The WRIA 15 Committee set a goal of using the subbasins as boundaries for finding projects closest to anticipated impacts (i.e. finding enough offset benefit projects by subbasin to offset anticipated consumptive use). This approach is further discussed in Chapter 5 (Projects) and Chapter 6.2 (Adaptive Management). In some instances, subbasins may not correspond with hydrologic or geologic basin delineations (e.g., watershed divides). This chapter is based on the Subbasin Delineation Technical Memorandum (Appendix F), which was finalized by the WRIA 15 Committee at the June 4, 2020 meeting.

3.2 Approach to Develop Subbasins

The WRIA 15 Committee divided WRIA 15 into seven subbasins for purposes of assessing projections for new permit-exempt (PE) wells, consumptive use, and project offsets.[21] In delineating subbasin boundaries for this planning process, the Committee considered the following:

- WRIA 15 was initially divided into seven "regions" as an early delineation of subbasins. The Committee later agreed to accept the region delineations as subbasin boundaries.
- The subbasins are part of a nested approach—with further subdivision at the HUC12 and Puget Sound Watershed Assessment Unit scales—where projects will be placed as close to impacts as possible.
- Subbasin boundaries were used for generating growth projections and consumptive use estimates.
- Isolated areas like islands without connectivity should be included as their own subbasins.

[20] The term "subbasin" is used by the WRIA 15 Committee for planning purposes only and to meet the requirements of RCW 90.94.030 (3)(b).
[21] This approach is consistent with Final NEB Guidance that defines subbasins as a geographic subarea within a WRIA. A subbasin is equivalent to the words "same basin or tributary" as used in RCW 90.94.020(4)(b).

Other considerations included:

- Right-sizing subbasins such that offset projects have some geographic relevance to the location of withdrawal (e.g., an offset project in Seabeck bears little relevance to withdrawals in Longbranch).
- Surface water flows and rainfall patterns should be included.
- Rural growth pattern projections will likely drive project and impact locations.
- Priority areas for salmon recovery should be included.

For some Committee members, it was also important to consider alignment of subbasins with Tribal Usual and Accustomed fishing areas and county jurisdiction. The WRIA 15 Subbasin Delineation Technical Memorandum available in Appendix F provides a more detailed description of the subbasin delineation.

3.3 WRIA 15 Subbasins

Figure 3 presents the map of WRIA 15 subbasin delineations, which are also summarized in Table 4.

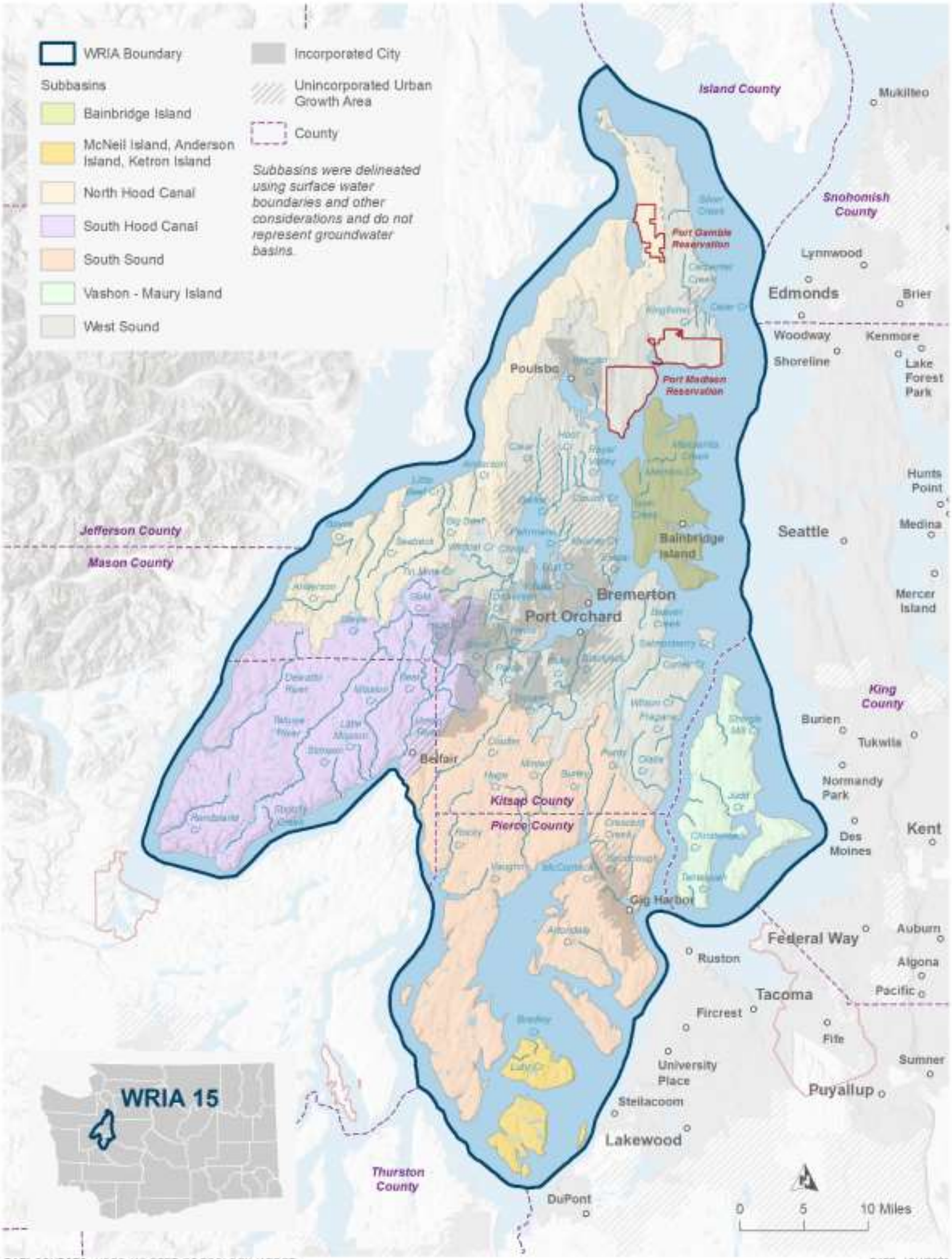

Figure 3: WRIA 15 Subbasin Delineation for the Watershed Restoration and Enhancement Plan. Map prepared by HDR.

Table 4: WRIA 15 Subbasins

Subbasin Name	Primary Rivers and Tributaries	County
Bainbridge Island	Manzanita Creek, Issei Creek, Miemois Creek, Springbrook Creek, Murden Creek (Doe-qud-sake-qub), Mac's Dam Creek, Cooper Creek, Schel Chelb Creek	Kitsap
McNeil Island, Anderson Island, Ketron Island	Luhr Creek, Bradley Creek, Schoolhouse Creek	Pierce
North Hood Canal	Boyce Creek, Anderson Creek, Stavis Creek, Seabeck Creek, Big Beef Creek, Little Beef Creek, Port Gamble Creek, Martha John Creek, Kinman Creek	Kitsap
South Hood Canal	Rendsland Creek, Dewatto River, Tahuya River, Stimson Creek, Mission Creek, Union River, Bear Creek, Hazel Creek, Tin Mine Creek	Kitsap and Mason
South Sound	Vaughn Creek, Rocky Creek, Coulter Creek, Huge Creek, Artondale Creek, Crescent Creek, Burley Creek, Purdy Creek	Pierce and Kitsap
Vashon - Maury Island	Judd Creek, Tahlequah Creek, Christensen Creek, Green Valley Creek, Shingle Mill Creek	King
West Sound	Olalla Creek, Fragaria Creek, Curley Creek, Wilson Creek, Salmonberry Creek, Beaver Creek, Black Jack Creek, Ruby Creek, Parish Creek, Lost Creek, Kitsap Creek, Wildcat Creek, Chico Creek, Mosher Creek, Enetai Creek, Pahrmann Creek, Silver Creek, Carpenter Creek, Osier Creek, Clear Creek, Crouch Creek, Barker Creek, Salmon Creek, Grovers Creek, Clear Creek, Crouch Creek, Illahee Creek, Steele Creek, Big Scandia Creek, Johnson Creek, Dogfish Creek, Bjorgen Creek, Klebeal Creek, Sam Snyder Creek, Gorst Creek	Kitsap

Chapter Four: New Consumptive Water Use Impacts

4.1 Introduction to Consumptive Use

Ecology's Final Net Ecological Benefit (NEB) Guidance states, "watershed plans must include a new consumptive water use estimate for each subbasin, and the technical basis for such estimate" (Ecology 2019b, page 7).[22] This chapter provides the WRIA 15 Committee's projections of new domestic permit-exempt (PE) well connections and their associated consumptive use for the 20-year planning horizon. This chapter summarizes information from the technical memorandums prepared for and approved by the WRIA 15 Committee on June 4, 2020 and included in Appendix G.

4.2 Projection of Permit-Exempt Well Connections (2018–2038)

This watershed plan addresses new consumptive water use from projected new homes connected to PE wells. Generally, new homes are associated with wells drilled during the planning horizon. However, new uses can occur where new homes are added to existing wells serving group systems under RCW 90.44.050. This plan addresses both types of new well use. PE wells are used to supply houses and, in some cases, other equivalent residential units (ERUs) such as small apartments. For the purposes of this document, the terms "house" or "home" refer to any PE domestic groundwater use, including other ERUs.

To estimate new consumptive water use, the counties or technical consultants (depending on the county) developed projections for the number of new PE wells over the planning horizon in WRIA 15. The methods for projections were based on recommendations from Appendix A of the Final NEB Guidance. The WRIA 15 Committee included projections for low, moderate, and high numbers of PE wells, for select counties. WRIA 15 is predominantly rural and projections demonstrate a wide distribution of PE wells throughout the watershed.

The following sections provide (1) the 20-year projections of new PE wells for each subbasin within WRIA 15, (2) the methods used to develop the projections, and (3) the uncertainties associated with the projections.

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[22] Though the statute requires the offset of "consumptive impacts to instream flows associated with PE 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 withdrawals. Ecology recommends consumptive use as a surrogate for consumptive impact to eliminate the need for detailed hydrogeologic modeling, which is costly and likely infeasible to complete within the limited planning timeframes provided in chapter 90.94 RCW. RCW 90.94.020 and 90.94.030 direct how watershed plans are to project, offset, or account for "water use." Ecology interprets these subsections of the law (RCW 90.94.020(4)(b), 90.94.020(4)(c), 90.94.030(3)(b), 90.94.030(3)(c), 90.94.030(3)(d), and 90.94.030(3)(e)) to relate to the consumptive water use of new PE domestic withdrawals that come online during the planning horizon. (Ecology, 2019a, page 7)

Addressing Uncertainties, Assumptions, and Limitations Associated with Projections for Growth and Consumptive Use. Uncertainties and limitations are inherent with any planning process. Understanding the limitations of the available data (and analyses that use that data) are important, as well as acknowledging the uncertainties associated with the analysis. The WRIA 15 Committee recognized and discussed uncertainties associated with projecting new PE well connections, models and methods used to calculate consumptive use associated with the PE well connections, as well with project implementation. Chapter 4 presents projections based on the best information available at the time and presents assumptions associated with the projections. Uncertainty is described in more detail in the technical memo found in Appendix G. The WRIA 15 Committee recommends that if new information, modeling, or data becomes available, adjustments are made through adaptive management to provide greater certainty that this plan continues to meet NEB.

4.2.1 Projections of Permit-Exempt Well Connections by Subbasin

The WRIA 15 watershed plan compiles the growth projection data both at the WRIA scale and by subbasin. This section presents WRIA 15 growth projection data for Kitsap, King, Mason, and Pierce counties. Table 5 and Figure 4 show the projected number of new PE wells per subbasin and their distribution across WRIA 15. To capture the various projections for PE wells, this watershed plan refers to lower estimates, moderate estimates, and higher estimates of growth.

The moderate estimates for the number of new PE wells in unincorporated areas of the four counties (within WRIA 15) over the planning horizon:

- Kitsap County: 2,921 new PE wells
- King County: 368 new PE wells
- Mason County: 1,301 new PE wells
- Pierce County: 978 new PE wells

The total moderate estimate is 5,568 PE wells over the planning horizon, the lower estimate is 4,861 PE wells, and the higher estimate is 6,152 PE wells.

4.2.2 Methodology

The WRIA 15 Committee gave deference to each county in identifying the most appropriate method of projecting PE wells. Different methods were used for calculating the projections for each county:

- Two methods were used for Kitsap County. The County's method is based upon a land capacity analysis, using the Kitsap Regional Coordinating Council growth targets. Kitsap PUD developed projections based on historical wells. The high and low projections are based on an estimated five percent margin of error.

- King County's method is based upon historical building permit data. King County developed the projections.
- Mason County's method is based upon Office of Financial Management 2040 moderate growth population forecasts.[23] The technical consultant team developed the projections.
- Pierce County projections are based on historical well permit data. The technical consultant team developed the projections. The high and low projections are based on different historical periods.

The WRIA 15 Permit-Exempt Growth and Consumptive Use Summary (HDR 2020) provides more detail on each of the growth projection methods.

[23] Note that some Committee members requested a high growth projection for Mason County, but that projection was not included as part of this watershed plan at the request of the County.

Table 5: Number of Permit-Exempt Connections Projected between 2018 and 2038

Subbasin	Moderate Estimate					Higher Estimate					Lower Estimate				
	Kitsap	Pierce	Mason	King	Total	Kitsap	Pierce	Mason	King	Total	Kitsap	Pierce	Mason	King	Total
West Sound	1,336				1,336	1,403				1,403	1,142				1,142
North Hood Canal	656				656	689				689	561				561
South Hood Canal	49		1,077		1126	52		1077		1,128	42		1077		1,119
Bainbridge Island	491				491	516				516	491				491
South Sound	389	940	224		1,553	406	1,360	224		1,992	332	602	224		1,158
Vashon-Maury Island				368	368				368	368				368	368
South Sound Islands		38			38		56			56		22			22
Total	**2,921**	**978**	**1,301**	**368**	**5,568**	**3,066**	**1,416**	**1,301**	**368**	**6,152**	**2,568**	**624**	**1,301**	**368**	**4,861**

4.2.3 Distribution of New PE Wells

The WRIA 15 Committee mapped potential locations of new PE wells in the watershed based on the parcels available for residential development that will depend on PE wells. The resulting heat map (Figure 4) shows the areas where this development is most likely to occur.

4.2.4 Summary of Assumptions

The methods described in Appendix A of the Final NEB Guidance for projecting new PE wells include several assumptions. The assumptions shared here provide transparency in the planning process and deliberations of the Committee to support any future adaptive management undertaken by the entities implementing the plan. The WRIA 15 Permit-Exempt Growth and Consumptive Use Summary in Appendix G (HDR 2020) provides a detailed listing of the assumptions used to project new PE wells. Kitsap, King, and Pierce counties relied on historical data, assuming these historical trends will continue into the future.

To provide greater certainty in this assumption, this watershed plan includes additional PE well scenarios using different periods in the historical Tacoma-Pierce County Health Department (TPCHD) well database. The high-growth scenario uses the 1999–2008 data, which was a time of relatively healthy economic growth resulting in more rapid rural development. The low-growth scenario uses the 2009–2018 data, which was a time of relatively slower rural development and corresponds with the recession and housing downturn.

The technical consultants applied a plus or minus five percent to calculate the high- and low-growth scenarios for Kitsap County. Five percent is the assumed margin of error in the County's land capacity analysis. Mason and King County requested no high- or low-growth scenarios calculations to be included in this watershed plan for their respective counties. The Committee used all three growth scenarios to determine the most likely consumptive use estimate for the planning horizon.

To estimate the distribution of PE wells in Kitsap County, the County based growth assumptions for each subbasin upon the proportion of the historical number of building permits for each subbasin for the period of 2002-2019. The County made assumptions regarding the number of developable parcels that would use PE wells by only counting parcels greater than 0.75 acres outside a 200-foot water or sewerline buffer.

King County based the percentage of houses with PE wells on historical trends from 2000-2017.

Mason County assumed the proportion of houses with PE wells is equal to the proportion of buildout capacity in rural areas compared to urban growth areas.

Pierce County assumed the same historic growth rate in PE wells by subbasin will occur in the future. Wells were projected within UGAs or existing water system boundaries if the parcels met the criteria discussed above. The Growth and Consumptive Use Summary (HDR 2020), available in Appendix G, further discusses these methods.

4.2.5 Projected Growth Map

Figure 4 represents the distribution of new PE wells under the moderate estimate.

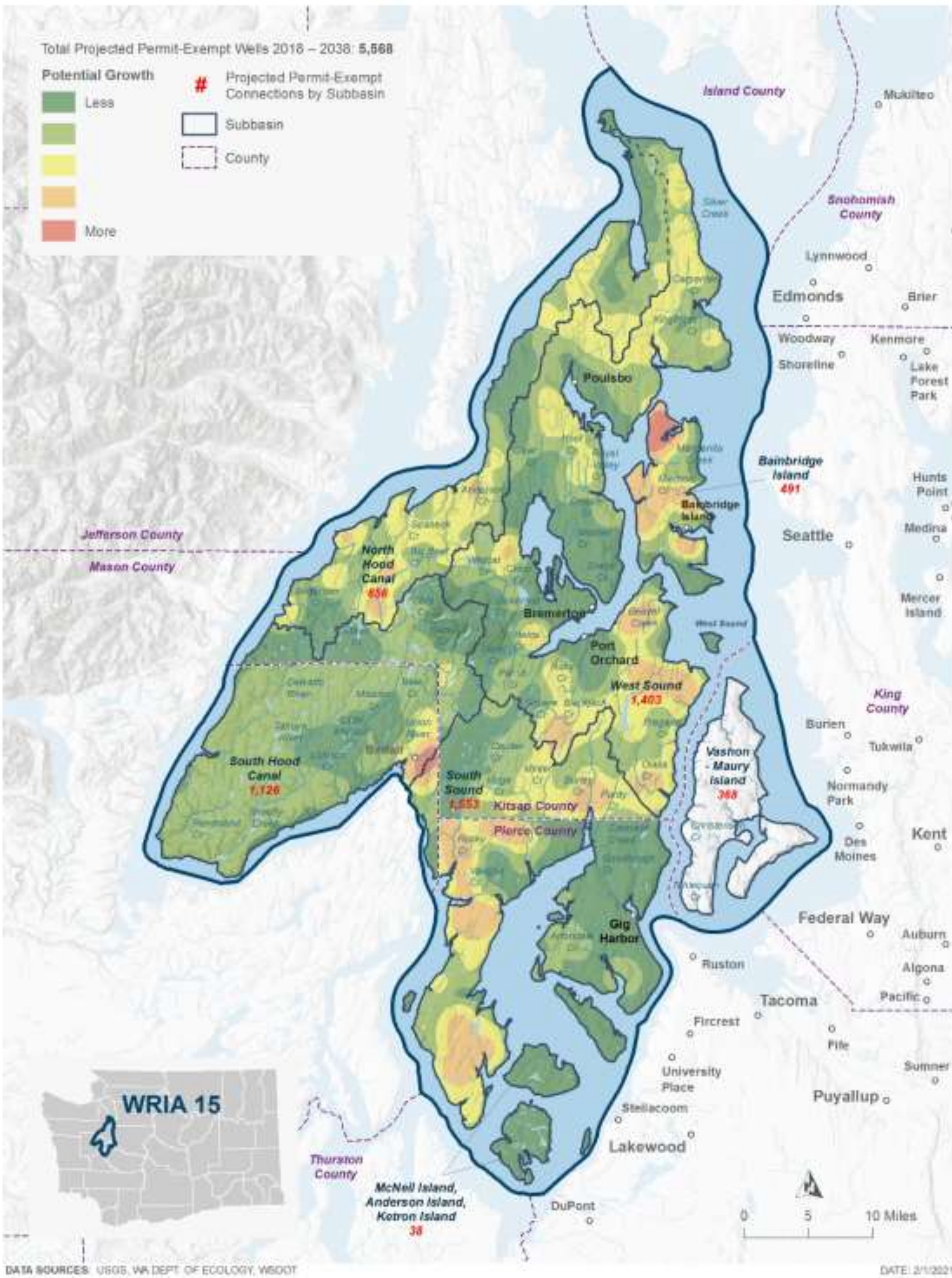

Figure 4. WRIA 15 Projected New Permit-Exempt Wells (number and likely area) Under the Moderate Estimate Growth Scenario 2018-2038. The “heat” map is generated based on

modeled growth projections that considers zoning, land use, and distance from existing water lines. The results are highly generalized but help illustrate the approximate location and relative growth of new domestic PE wells. Map prepared by HDR.

4.3 Impacts of New Consumptive Water Use

This watershed plan used the 20-year projections of new PE wells to estimate the consumptive water use that must be addressed and offset. As above, this section uses "new PE wells" as a shorthand for new domestic permit-exempt well connections unless otherwise described. This section includes an overview of (1) the methods used to estimate new consumptive water use (consumptive use), (2) the anticipated impacts of new consumptive use in WRIA 15 over the planning horizon, and (3) other considerations and assumptions. The WRIA 15 Permit-Exempt Growth and Consumptive Use Summary provides a more detailed description of the analysis and alternative scenarios considered (Appendix G).

The Committee considered all three growth scenarios (lower, moderate, and higher estimates) as well as three methods for estimating consumptive use. Based on the deliberations of the Committee, this watershed plan recommends a consumptive use estimate of 766.4 acre feet per year (684,150 gallons per day [gpd]). This estimate is based on the moderate growth projection for the Irrigated Area method and is viewed as the most likely consumptive use based on historical information and current understanding of water use in WRIA 15.

Some members of the WRIA 15 Committee believed that a higher consumptive use estimate of 1,218 AF/yr (177 gpd per PE well connection) is necessary to ensure that offsets are met and streams are benefited. The Committee reached consensus that achieving an offset target of 1,218 AF/yr through project implementation would be beneficial to streams. Based on data presented, some members of the Committee supported a lower consumptive use estimate and others supported a higher number, but the Committee ultimately reached consensus that 766.4 acre-feet per year (AF/yr) should be the consumptive use estimate.

This section provides an overview and results from the various methods used to estimate consumptive use. Section 4.3.4 provides additional information on the consumptive use estimate as well as considerations for a higher offset target with a breakdown by subbasin.

4.3.1 Methodology to Estimate Indoor and Outdoor Consumptive Water Use

To calculate indoor and outdoor consumptive use, the technical consultants presented three different methods to the Committee for consideration: Metered Data Method, U.S. Geological Survey (USGS) Groundwater Model Method, and the Irrigated Area Method. This section presents an overview and results on the three methods.

While the consumptive use estimate presented in this plan relies on the irrigated area method, some members of the Committee preferred the alternative methods. All three methods are presented in this Chapter due to the lack of consensus on which method to use, to account for uncertainty associated with each method, and the level of analysis used to provide a consumptive use estimate and higher offset target. Additional information is available in Appendix G.

Metered Data Method

HDR estimated consumptive use using metered connections from water systems. HDR requested data from Committee members for water systems that use (or have used) a flat rate billing structure and were similar in character to the rural environments in which households may connect to PE wells. In WRIA 15, Kitsap PUD provided consumption data for all Kitsap PUD water systems for years 2017 and 2018.

This method assumed that (1) average daily water use in December, January, and February is representative of year-round daily indoor use; and (2) 10 percent of indoor water use is consumptively used. Average daily system-wide use was divided by the number of connections (assuming all connections are residential), to estimate average daily indoor use per connection. The 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.

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 subtracted from total annual use by a water system to estimate total annual outdoor use. It was assumed 80 percent of the outdoor use is consumptively used. That factor was applied to estimate the consumptive portion of outdoor use.

Outdoor consumptive use was also estimated on a seasonal basis. The Washington Irrigation Guide (WAIG) reports irrigation requirements between the months of April and September for representative weather stations in WRIA 15; as such, seasonal outdoor water use was assumed to occur over a period of six months. 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 WAIG.

The annual average consumptive use values are 0.0138 acre-foot (AF) [24] (0.000019 cubic foot per second [cfs]) for indoor use per well and 0.0583 AF (0.000081 cfs) [25] for outdoor use per well. The corresponding values in gallons are 4,470 gallons for indoor consumptive use and 18,980 gallons for annual average outdoor consumptive use per well. The combined indoor and outdoor consumptive use equates to 64.25 gpd per PE well connection.

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[24] Acre-foot (AF) is a unit of volume for water equal to a sheet of water one acre in area and one foot in depth. It is equal to 325,851 gallons of water. One acre-foot per year (AF/yr) is equal to 893 gallons per day (gpd).

[25] Cubic feet per second (cfs) is 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. One cubic foot per second is equal to 646,317 gallons per day.

USGS Groundwater Model Method

The USGS Groundwater Model method refers to water use data collected for a groundwater-flow model of the Kitsap Peninsula.[26] A report prepared by the USGS (Welch, Frans, and Olsen 2014) provides a survey of consumption from select water utilities serving more than 221,700 people with more than 88,500 residential connections on the Kitsap Peninsula. The USGS study differentiated between the indoor and outdoor portions of use:

- Estimated **indoor use** (based on November–April pumping values) was 66 gallons per person per day. For the purposes of groundwater modeling, USGS assumed the consumptive use rate for indoor domestic use is 10 percent in non-sewered areas.
- **Outdoor use** was estimated for the outdoor growing season and varied by month from four gallons per person per day in May to 97 gallons per person per day in September. Estimates for average annual outdoor use are 26 gallons per person per day. For the purposes of groundwater modeling, USGS assumed the consumptive use rate for outdoor use is 90 percent.

The annual average consumptive use values are 0.0185 acre-foot (AF) (0.000026 cubic foot per second [cfs]) for indoor use per well and 0.0655 AF (0.000091 cfs) for outdoor use per well. The corresponding values in gallons are 6,023 gallons for indoor consumptive use and 21,350 gallons for outdoor consumptive use per well. The combined indoor and outdoor consumptive use equates to 75 gpd per PE well connection. While these estimates are annual averages, the Committee expects that outdoor use will occur mainly in summer.

Irrigated Area Method

Appendix A of the Final NEB Guidance describes the Irrigated Area method, which provides an average indoor use per person per day, and reviews aerial imagery to provide a basis to estimate irrigated area of outdoor lawn and garden areas.

Indoor and outdoor water use patterns differ; indoor use is generally constant throughout the year, while outdoor use occurs primarily in the summer months. Similarly, the portion of water use that is consumptive varies for indoor and outdoor water uses. The Irrigated Area method uses separate approaches to estimate indoor and outdoor consumptive use.

To develop the consumptive use estimate, the WRIA 15 Committee used the Irrigated Area method and relied on assumptions for indoor use and outdoor use from Appendix A of the Final NEB Guidance. This chapter provides a summary of the technical memo, which is available in Appendix G.

Consistent with Appendix B of the Final NEB Guidance, the Committee assumed that impacts from consumptive use on surface water are steady-state, meaning impacts to the stream from

[26] Note that water system data is metered with a fee structure based on water use. PE wells in WRIA 15 are not metered and have no associated fee structure.

pumping do not change over time. The wide distribution of future well locations and depths across varying hydrogeological conditions led to this assumption.

New Indoor Consumptive Water Use

Indoor water use refers to the water that households use (such as in kitchens, bathrooms, and laundry) and that leave the house as wastewater (Kenny and Juracek 2012). The Technical Consultants used Ecology's recommended assumptions for indoor daily water use per person and local data to estimate the average number of people per household, and applied Ecology's recommended consumptive use factor (CUF) to estimate new indoor consumptive water use (Ecology 2019b):

- 60 gpd per person, as recommended by Ecology.
- 2.5 persons per household assumed for rural portions of WRIA 15, based on the Office of Financial Management and County data.
- 10 percent of indoor use is consumptively used (or a CUF of 0.10), based on the assumption that homes on PE wells are served by onsite sewage systems. Onsite sewage systems percolate back to groundwater; a fraction of that water is lost to the atmosphere through evaporation in the drain field.

The equation used to estimate household consumptive indoor water use is:

$$60 \text{ gpd} \times 2.5 \text{ people per house} \times 365 \text{ days} \times 0.10 \text{ CUF}$$

This results in an average indoor consumptive use of 15 gpd (0.000023 cfs) and an annual average of 0.0168 AF (5,475 gallons) per year per well.

New Outdoor Consumptive Water Uses

Most outdoor water is used to irrigate lawns, gardens, and landscaping. To a lesser extent, households use outdoor water for car and pet washing, exterior home maintenance, pools, and other water-based activities. Water from outdoor use does not enter onsite sewage systems, but instead infiltrates into the ground or is lost to the atmosphere through evapotranspiration (Ecology 2019b, page 19).

The WRIA 15 Committee used aerial imagery to measure the irrigated areas of 80 randomly selected parcels served by PE wells to develop an average outdoor irrigated area. This analysis returned more than one-half of the parcels with no visible irrigation, resulting in irrigated area values of zero. The average irrigated area for the 80 randomly selected parcels was 0.08 acre. The Committee believes that 0.08 acre represents the irrigated areas for PE wells in WRIA 15 and adopted that value for consumptive use calculations. This estimate is based on the understanding that the consumptive use calculation likely overestimates water use and the independent analyses performed to confirm the measurements of irrigated acreage.

The WRIA 15 Committee used the following assumptions, recommended in Appendix A of the Final NEB Guidance, to estimate outdoor consumptive water use:

- Crop irrigation requirements (IR) for turf grass according to WAIG (NRCS-USDA 1997): 16.84 inches per year for the Bremerton WAIG station. This value was rounded up to 17 inches (1.42 feet) per year and used to estimate the amount of water needed for outdoor irrigation.
- An irrigation application efficiency (AE) to account for water that does not reach the turf: 75 percent. This AE increases the amount of water used to meet the crop's IR by 25 percent.
- CUF of 0.8, reflecting 80 percent consumption for outdoor use. This means a return of 20 percent of outdoor water to the immediate water environment.
- Outdoor irrigated area based on existing homes using PE wells: 0.08 acre.

The equation used to estimate household consumptive outdoor water use is:

$$Household\ Outdoor\ CU = \left(\frac{1.42\ feet}{0.75\ AE}\right) x\ 0.08\ acre\ x\ 0.8\ CUF$$

First, water loss is accounted for by dividing the IR by the AE. Next, the total water volume used to maintain turf is multiplied by the area that is irrigated. Finally, the volume of water is multiplied by 80 percent to produce the outdoor consumptive water use.

This calculation results in an annual average outdoor consumptive use of 0.121 AF (0.00017 cfs) per PE well. The corresponding values in gallons are 39,400 gallons annual average and 108 gpd per PE well. While this estimate is an average for the year, the Committee expects that outdoor water use will occur mainly in summer. The outdoor consumptive use will vary by subbasin because of differences in temperature and precipitation across the watershed. The same IR for turf grass is used to simplify the calculations. The outdoor consumptive use equals 43.2 gpd per person.[27]

4.3.2 Assumptions with Calculating Consumptive Use

The law calls for an estimate of "consumptive water use impacts" (RCW 90.94.030(3)(e). However, the process of estimating impacts is complex, and therefore the Committee agreed to use the estimated amount of new consumptive use for the offset amount and the impacts of

[27] The estimated outdoor consumptive use equals 43.2 gpd per person, or 108 gpd per household. The outdoor non-consumptive use is 27 gpd (using 80 percent consumptive use factor), giving a total outdoor water use of 135 gpd per household. Ecology compiled information on existing PE well metering programs across the state for the purpose of policy and project discussions at Committee meetings (Ecology, 2020c). Six different well metering programs are described. The average water use amongst the six programs varied from 114 to 241 gpd per household. That value includes outdoor and indoor water use. The highest values were for a small group of eight wells in King County. Data from Lummi Peninsula, Dungeness, and Kittitas represented over 90 percent of the metered data obtained. The range of water use in those areas was 114 – 124 gpd. The total outdoor water use estimate using the irrigated area method of 135 gpd per household exceeds the average water use in the metered areas. Adding indoor use of 150 gpd per household, the irrigated area method may predict twice the average water use of other areas in Washington State with PE wells with metering data.

that use. This approach is consistent with Appendix A of the Final NEB Guidance (Ecology 2019b).

Below is a discussion of assumptions for each method; all three methods assumed an average household size of 2.5 people. The household size may vary across the WRIA and may change over time. In addition, all three methods considered future indoor and outdoor water use per household to be the same as estimated for current conditions. While the Committee recognized that climate change may lead to more frequent hotter and drier summers, calculations of consumptive use were based on data available.[28] More information on uncertainties and limitations is presented in the technical memo available in Appendix G.

Metered Data Method

The Metered Data Method uses data collected by Kitsap PUD for all connections (about 15,700) within their service area in Kitsap County. Use of this method in calculating consumptive use for PE wells assumes that water use data for metered connections is comparable to PE wells with no meter. Although the Kitsap PUD data only covers Kitsap County, the Committee assumed the data are applicable to Pierce and Mason County areas in WRIA 15. This method calculated an indoor use of 49 gpd per person and outdoor use of 26 gpd per person. Metered data from other areas of the South Sound region ranged from 35 to 68 gpd per person for indoor use, and from 13 to 60 gpd per person for outdoor use. The Metered Data Method assumes that indoor water use is consistent throughout the year in order to estimate outdoor water use. Assumptions on the consumptive portion of water use (10 percent for indoor, 80 percent for outdoor) are also used.

USGS Groundwater Model Method

USGS collected data from select water utilities serving more than 221,700 people with more than 88,500 residential connections on the Kitsap Peninsula. This method assumes that water use data for metered connections is comparable to PE wells with no meter. While the USGS study did not include the Key Peninsula or the islands of Vashon Maury, Fox, Anderson, McNeil and Ketron, this method assumes the data from Kitsap Peninsula is relevant to those areas. The method also assumes 10 percent consumptive use for indoor and 90 percent for outdoor.

Irrigated Area Method

The irrigated area method relies on a measured factor and assumed values from literature or research to estimate consumptive water use, as described in Section 4.3.1. The measured factor is the average outdoor irrigated area per parcel. The average outdoor irrigated area estimate relies on a sample size of 80 parcels, distributed by location and property values. To account for the small sample size and to further test the assumption that the 80 parcels were fairly representative of outdoor irrigation in WRIA 15, Kitsap PUD and the Suquamish Tribe performed independent analyses on the list of parcels to confirm the findings of the irrigated

[28] The Squaxin Island Tribe's calculation of increased evapotranspiration (and therefore water use) due to temperature increases suggested eight percent more water demand in 20 years.

area analysis. HDR also compared the results of the analysis with similar analyses undertaken by other Watershed Restoration and Enhancement Committees (GeoEngineers and HDR 2020). While the results showed that on average, HDR's methods resulted in a lower outdoor irrigation estimate, the Committee concluded that the results were within a reasonable range for WRIA 15.

The outdoor consumptive use calculation for the Irrigated Area method assumes that homeowners water their lawns and gardens at the rate needed for commercial turf grass (i.e., watering at rates that meet crop IR per the WAIG). Although the WAIG provides estimates of crop IRs using meteorological data prior to 1985, this assumption likely results in an overestimate as the irrigated area analysis demonstrated that many people irrigate their lawns enough to keep the grass alive through the dry summers, but not at the levels that commercial turf grass requires. The method also assumes that residential pop-up sprinkler systems irrigate lawns with an efficiency of 75 percent. In reality, households apply water to their lawns and gardens in many different ways, at rates more or less efficient than a 25 percent water loss. The method assumes 10 percent indoor consumptive use and 80 percent outdoor consumptive use. Members of the WRIA 15 Committee conducted their own analyses to evaluate assumptions and uncertainties with the consumptive use methods.[29]

4.3.3 Summary of Consumptive Use Estimates

Below is a summary of consumptive use estimates by method.

Metered Data Method

The total consumptive use estimate for WRIA 15 is the number of PE wells projected (see Section 4.2) multiplied by the total indoor and outdoor consumptive use per PE well. The combined indoor and outdoor consumptive use per PE well for the baseline growth projection is 0.072 AF/yr (0.0001 cfs, 64 gpd). The total consumptive use estimate for WRIA 15 for the medium-growth projection using the Metered Data Method is 401 AF/yr (0.55 cfs, 357,700 gpd). The total consumptive use for the low-growth projection is 350 AF/yr (0.48 cfs, 312,300 gpd) and for the high-growth projection is 443 AF/yr (0.61 cfs, 395,300 gpd). Table 6 summarizes the estimated indoor and outdoor consumptive use by subbasin for the moderate

[29] In order to help reduce consumptive use uncertainty when considering both the USGS Groundwater Model and the Irrigated Area Methods, some Committee members developed their own analyses. The Skokomish Tribe and Aspect Consulting conducted an assessment to determine if/how precipitation variability across geography and time would affect outdoor irrigation consumptive use estimates in WRIA 15. The study used up to date climatological data from AgWeatherNet and PRISM to compare to values using the Irrigated Area Method. The Tribe conducted this analysis to (1) address concerns that methodologies may be too conservative or not conservative enough and (2) determine whether or not a "safety factor" should be used. This assessment is provided in the Compendium. The analysis provided similar results to the Irrigated Area method. The study also suggests that water use in dry years is substantially higher, pointing to the likelihood of increased water use as climate change makes the dry season longer, hotter, and drier. The Squaxin Island Tribe also evaluated future evapotranspiration rates under projected hotter and drier conditions using 20-year climate projections. The analysis found 1.6 inches of increased evapotranspiration (and likely an equivalent amount of irrigation water demand) for about an 8% increase in annual water use. A summary memo is provided in the Compendium.

estimate of growth projection. Table 7 summarizes the consumptive use by subbasin for the lower and higher estimates for growth projections. The Committee expects the highest consumptive use to occur in the South Sound subbasin, which has the most projected new PE wells, as presented in Table 7.

Table 6. Indoor and Outdoor Consumptive Use Estimates by Subbasin for 2038: Moderate Estimate for Growth Projection and Metered Data Method

Subbasin	**Projected PE wells**	**Indoor CU**		**Outdoor CU**		**Total CU in 2038**	
		(AF/yr	**GPD**	**AF/yr**	**GPD**	**AF/yr**	**GPD**
West Sound	1,336	18.3	16,366	77.8	69,472	96.2	85,838
North Hood Canal	656	9.0	8,036	38.2	34,112	47.2	42,148
South Hood Canal	1,126	15.5	13,794	65.6	58,552	81.0	72,346
Bainbridge Island	491	6.7	6,015	28.6	25,532	35.3	31,547
South Sound	1,553	21.3	19,024	90.5	80,756	111.8	99,780
Vashon-Maury Island	368	5.0	4,508	21.4	19,136	26.5	23,644
South Sound Islands	38	0.5	466	2.2	1,976	2.7	2,442
Total	**5,568**	76.4	68,208	324.3	289,536	400.8	357,744

Table 7. Indoor and Outdoor Consumptive Use Estimates by Subbasin for 2038: Lower- and Higher-Estimates for Growth Projections and Metered Data Method.

Subbasin	Lower Estimate					Higher Estimate				
	Projected PE wells	Indoor CU (AF/yr)	Outdoor CU (AF/yr)	Total CU in 2038		Projected PE wells	Indoor CU (AF/yr)	Outdoor CU (AF/yr)	Total CU in 2038	
				(AF/yr)	GPD				(AF/yr)	GPD
West Sound	1,142	15.7	66.5	82.2	73,374	1,403	19.3	81.7	101.0	90,143
North Hood Canal	561	7.7	32.7	40.4	36,044	689	9.5	40.1	49.6	44,268
South Hood Canal	1,119	15.4	65.2	80.5	71,896	1,128	15.5	65.7	81.2	72,474
Bainbridge Island	491	6.7	28.6	35.3	31,547	516	7.1	30.1	37.1	33,153
South Sound	1,158	15.9	67.5	83.3	74,402	1,992	27.3	116.0	143.4	127,986
Vashon-Maury Island	368	5.0	21.4	26.5	23,644	368	5.0	21.4	26.5	23,644
South Sound Islands	22	0.3	1.3	1.6	1,414	56	0.8	3.3	4.0	3,598
Total	4,861	66.7	283.2	349.9	312,319	6,152	84.4	358.4	442.8	395,266

USGS Groundwater Model Method

The total consumptive use estimate for WRIA 15 is the number of PE wells projected (see Section 4.2) multiplied by the total indoor and outdoor consumptive use per PE well. The combined indoor and outdoor consumptive use per PE well is 0.084 AF/yr (0.000116 cfs, 75 gpd). The total consumptive use estimate for WRIA 15 for the medium-growth projection using the USGS Groundwater Model Method is 468 AF/yr (0.65 cfs, 417,600 gpd). The total consumptive use for the lower estimate for growth projection is 408 AF/yr (0.57 cfs, 364,600 gpd) and for the higher estimate for growth projection is 517 AF/yr (0.72 cfs, 461,400 gpd).

Table 8 summarizes the estimated indoor and outdoor consumptive use by subbasin for the moderate estimated growth projection. Table 9 summarizes the consumptive use by subbasin for the lower and higher estimates. The Committee expects the highest consumptive use to occur in the South Sound subbasin, which has the most projected new PE wells, as presented in Table 9.

Table 8: Indoor and Outdoor Consumptive Use Estimates by Subbasin for 2038: Moderate Estimate for Growth Projection and USGS Groundwater Model Method

Subbasin	**Projected PE wells**	**Indoor CU**		**Outdoor CU**		**Total CU in 2038**	
		(AF/yr	**GPD**	**AF/yr**	**GPD**	**AF/yr**	**GPD**
West Sound	1,336	24.7	22,044	87.6	78,156	112.2	100,200
North Hood Canal	656	12.1	10,824	43.0	38,376	55.1	49,200
South Hood Canal	1,126	20.8	18,579	73.8	65,871	94.6	84,450
Bainbridge Island	491	9.1	8,102	32.2	28,724	41.3	36,825
South Sound	1,553	28.7	25,625	101.8	90,851	130.5	116,475
Vashon-Maury Island	368	6.8	6,072	24.1	21,528	30.9	27,600
South Sound Islands	38	0.7	627	2.5	2,223	3.2	2,850
Total	**5,568**	102.9	91,872	364.9	325,728	467.8	417,600

Table 9: Indoor and Outdoor Consumptive Use Estimates by Subbasin for 2038: Lower and Higher Estimates for Growth Projections and USGS Groundwater Model Method

Subbasin	Lower Estimates					Higher Estimates				
	Projected PE wells	Indoor CU (AF/yr)	Outdoor CU (AF/yr)	Total CU in 2038		Projected PE wells	Indoor CU (AF/yr)	Outdoor CU (AF/yr)	Total CU in 2038	
				(AF/yr)	GPD				(AF/yr)	GPD
West Sound	1,142	21.1	74.8	95.9	85,650	1,403	25.9	91.9	117.9	105,225
North Hood Canal	561	10.4	36.8	47.1	42,075	689	12.7	45.2	57.9	51,675
South Hood Canal	1,119	20.7	73.3	94.0	83,925	1,128	20.8	73.9	94.8	84,600
Bainbridge Island	491	9.1	32.2	41.3	36,825	516	9.5	33.8	43.4	38,700
South Sound	1,158	21.4	75.9	97.3	86,850	1,992	36.8	130.5	167.4	149,400
Vashon-Maury Island	368	6.8	24.1	30.9	27,600	368	6.8	24.1	30.9	27,600
South Sound Islands	22	0.4	1.4	1.8	1,650	56	1.0	3.7	4.7	4,200
Total	4,861	89.8	318.6	408.4	364,575	6,152	113.7	403.2	516.9	461,400

Irrigated Area Method

The total consumptive use estimate for WRIA 15 is the number of PE wells projected (see Section 4.2) multiplied by the total indoor and outdoor consumptive use per PE well. The combined total indoor and outdoor consumptive use is 0.138 AF/yr (.00019 cfs, 123 gpd). The total consumptive use estimate for WRIA 15 for the medium-growth projection is 766 AF/yr (1.06 cfs, 684,200 gpd). The total consumptive use for the lower estimates for growth projection is 669 AF/yr (0.93 cfs, 597,300 gpd) and for the higher estimates for growth projection is 847 AF/yr (1.17 cfs, 755,900 gpd).

Table 10 summarizes the estimated indoor and outdoor consumptive use by subbasin for the moderate estimates for growth projection. Table 11 summarizes the consumptive use by subbasin for the lower and higher estimates. The Committee expects the highest consumptive use to occur in the South Sound subbasin, which has the most projected new PE wells, as presented in Table 11.

Table 10: Indoor and Outdoor Consumptive Use Estimates by Subbasin for 2038: Moderate Estimate for Growth Projection and Irrigated Area Method

Subbasin	**Projected PE wells**	**Indoor CU**		**Outdoor CU**		**Total CU in 2038**	
		(AF/yr	**GPD**	**AF/yr**	**GPD**	**AF/yr**	**GPD**
West Sound	1,336	22.4	19,987	161.5	144,175	183.9	164,161
North Hood Canal	656	11.0	9,814	79.3	70,792	90.3	80,606
South Hood Canal	1,126	18.9	16,845	136.1	121,513	155.0	138,358
Bainbridge Island	491	8.2	7,345	59.4	52,986	67.6	60,332
South Sound	1,553	26.0	23,233	187.7	167,592	213.8	190,825
Vashon-Maury Island	368	6.2	5,505	44.5	39,713	50.7	45,218
South Sound Islands	38	0.6	568	4.6	4,101	5.2	4,669
Total	**5,568**	93.3	83,297	673.1	600,872	766.5	684,170

Table 11: Indoor and Outdoor Consumptive Use Estimates by Subbasin for 2038: Lower and Higher Estimates for Growth Projections and Irrigated Area Method

Subbasin	Lower Estimate					Higher Estimate				
	Projected PE wells	Indoor CU (AF/yr)	Outdoor CU (AF/yr)	Total CU in 2038		Projected PE wells	Indoor CU (AF/yr)	Outdoor CU (AF/yr)	Total CU in 2038	
				(AF/yr)	GPD				(AF/yr)	GPD
West Sound	1,142	19.1	138.1	157.2	140,324	1,403	23.5	169.6	193.1	172,394
North Hood Canal	561	9.4	67.8	77.2	68,933	689	11.5	83.3	94.8	84,661
South Hood Canal	1,119	18.8	135.3	154.0	137,497	1,128	18.9	136.4	155.3	138,603
Bainbridge Island	491	8.2	59.4	67.6	60,332	516	8.6	62.4	71.0	63,404
South Sound	1,158	19.4	140.0	159.4	142,290	1,992	33.4	240.8	274.2	244,768
Vashon-Maury Island	368	6.2	44.5	50.7	45,218	368	6.2	44.5	50.7	45,218
South Sound Islands	22	0.4	2.7	3.0	2,703	56	0.9	6.8	7.7	6,881
Total	4,861	81.5	587.6	669.1	597,297	6,152	103.1	743.7	846.8	755,929

4.3.4 Summary of Consumptive Use Estimate

This watershed plan uses a consumptive use estimate of 766.4 AF/yr, based on the moderate growth projection estimate and the irrigated area method and is viewed as the most likely consumptive use. Figure 5 shows the distribution of consumptive use across the WRIA. Based on data presented, some members of the Committee supported a lower consumptive use estimate and others supported a higher number, but the Committee ultimately reached consensus that 766.4 AF/yr (123 gpd per PE well connection) should be the consumptive use estimate.[30]

The Committee also reached consensus that achieving an offset target of 1,218 AF/yr (177 gpd per well connection) through project implementation would be beneficial to streams. To obtain the consumptive use estimate of 766.4 AF/yr, HDR used the measured average of 0.08 acres for the outdoor irrigated area along with the moderate growth estimate. The average acreage is small due to a high number of non-irrigated parcels. The higher number of 1,218 AF/yr is based on a higher estimate for growth projections and a substitution of 0.12 acres for the average irrigated area under the irrigated area method.

HDR performed statistical analyses of the irrigated acreage to characterize the potential range in the irrigated area measurements. The 0.12 acre number was obtained by substituting 0.05 acre for every parcel with no irrigated acreage measured and recalculating the mean and upper confidence limits (95 percent). The 0.12 acre number is the upper confidence limit. The substitution of 0.05 acre for parcels with no irrigated acreage measured was made to account for a minimum amount of outdoor irrigation that might occur but not be observable on aerial photos. Table 12 provides the higher offset target by subbasin.

As data on actual growth, climate change, water use, experience with project implementation, and other new information is collected over time, adaptive management of plan implementation will need to support adjustments of the proposed approach and water offsets in order to meet NEB.

[30] The legal withdrawal limit for PE wells in WRIA 15 is 950 gpd average annual use per connection per RCW 90.94.030. This watershed plan did not calculate consumptive use using the legal limit.

Table 12. Summary of higher offset target by subbasin when substituting 0.12 acres for outdoor irrigation using the irrigated area method. While the Committee did not reach consensus on using the higher estimate for consumptive use, this table provides the summary of how the higher target applies to well projects, indoor and outdoor consumptive use, and total consumptive use across subbasins. Reaching these offset targets for each subbasin through project implementation would be beneficial to streams.

Subbasin	Higher Estimate of PE Wells, Average Irrigated Area = 0.12 acre				
	Projected PE wells	Indoor CU (AF/yr)	Outdoor CU (AF/yr)	Total CU in 2038	
				(AF/yr)	GPD
West Sound	1,403	23.5	254.4	277.9	248,097
North Hood Canal	689	11.5	124.9	136.5	121,838
South Hood Canal	1,128	18.9	204.5	223.4	199,468
Bainbridge Island	516	8.6	93.6	102.2	91,246
South Sound	1,992	33.4	361.2	394.6	352,251
Vashon-Maury Island	368	6.2	66.7	72.9	65,075
South Sound Islands	56	0.9	10.2	11.1	9,903
Total	6,152	103.1	1115.6	1218.6	1,087,876

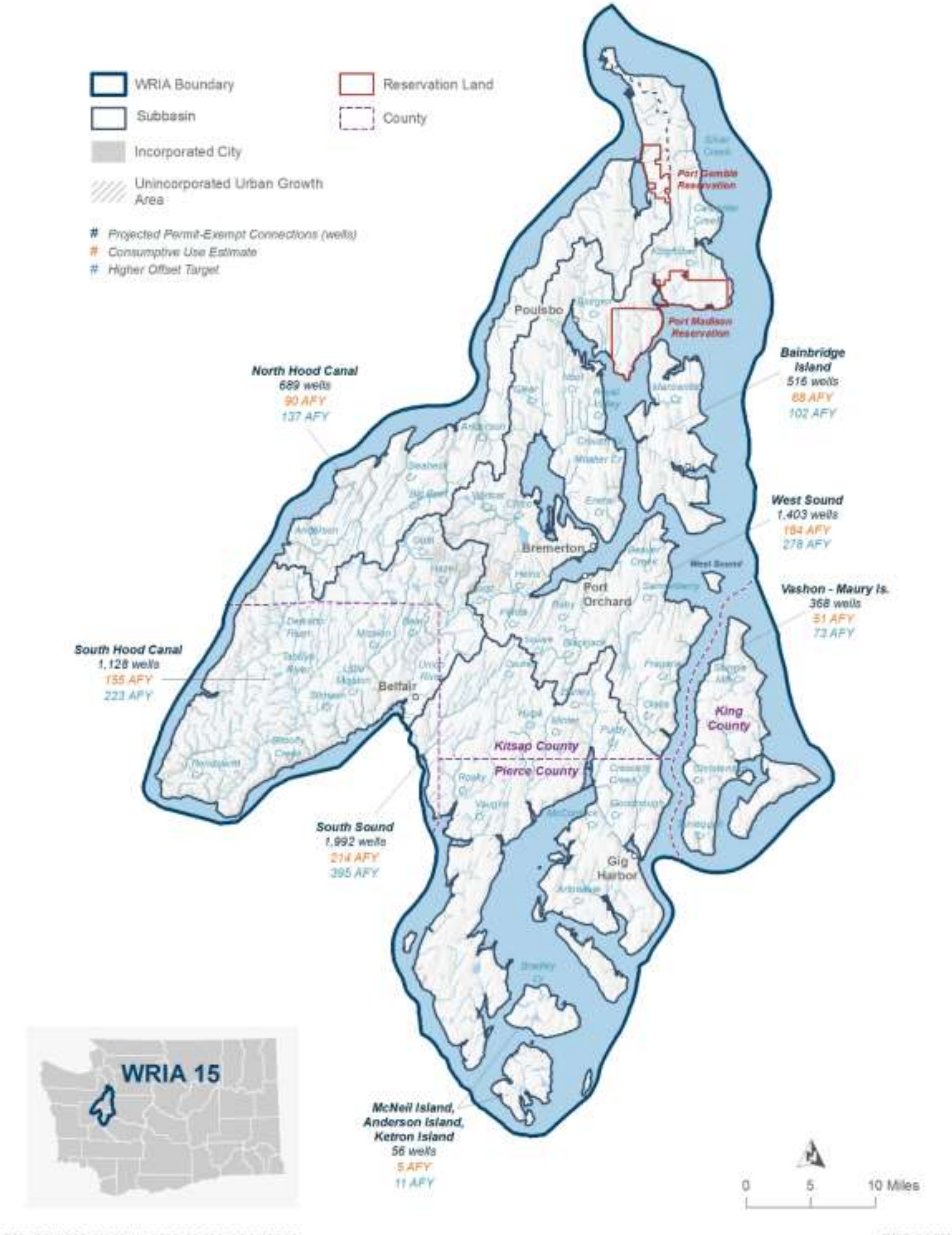

Figure 5. WRIA 15 Estimated Consumptive Use based on Moderate Estimate for Growth Projections and Irrigated Area Method, 2018-2038. Map prepared by HDR.

Chapter Five: WRIA 15 Projects

5.1 Description and assessment

Watershed plans must identify projects that offset the potential impacts that future PE wells will have on streamflows and provide a NEB to the WRIA.[31] This chapter recommends and describes projects to offset consumptive use and meet NEB:

- **Water offset projects** have a quantified streamflow benefit and contribute to offsetting consumptive use.[32]
- **Habitat projects** contribute toward achieving NEB by improving the ecosystem function and resilience of aquatic systems, supporting the recovery of threatened or endangered salmonids, and protecting instream resources, including important native aquatic species. The habitat projects included in this watershed plan will also result in an increase in streamflow, but the water offset benefits for these projects is difficult to quantify. Therefore, this watershed plan does not rely on habitat projects to contribute toward offsetting consumptive use.

To identify the projects summarized in this chapter, as well as the complete project inventory in Appendix H, Committee members and WRIA 15 partners brought project suggestions forward to the project workgroup and Committee for discussion. Ecology and the technical consultants also identified projects with potential streamflow benefit from the Puget Sound Action Agenda near term actions, salmon recovery lead entity four-year workplans, streamflow restoration grant applications, and public works programs. The Committee used a project inventory to capture and track all project ideas, no matter their phase of development, throughout the planning process.

Ecology distributed the project inventory to conservation districts, LIOs, and salmon recovery lead entities in WRIA 15 to solicit feedback on project alignment with other planning processes and identify any projects of concern for inclusion in the watershed plan. At any point in the process, Committee members or WRIA 15 partners could identify projects of concern for inclusion in the watershed plan and recommend removal of the project from the project

[31] The NEB Guidance defines "projects and actions" as "General terms describing any activities in watershed plans to offset impacts from new consumptive water use and/or contribute to NEB." (Ecology 2019b, page 5) This watershed plan uses the term "projects" for simplicity to encompass both projects and actions as defined by the NEB guidance.

[32] In 2015, the State Supreme Court issued a decision on Foster v. Ecology, City of Yelm, and Washington Pollution Control Hearings Board. The decision, frequently referred to as the "Foster decision," reaffirmed and reinforced that instream flows adopted in a rule must be protected from impairment. The Legislature established the Joint Legislative Task Force on Water Resource Mitigation (Task Force) in RCW 90.94.090 to understand impacts of the 2015 Foster decision. In that law, Ecology is authorized to issue permit decisions for up to five water mitigation pilot projects using a stepwise mitigation approach that can include out of kind mitigation. The City of Port Orchard is one of the entities undertaking a pilot project; as of January 2021, the pilot project work is still ongoing. More information about the Task Force, including their 2019 report to the legislature, can be accessed on their webpage: http://leg.wa.gov/JointCommittees/WRM/Pages/default.aspx. (Ecology 2020b)

inventory. Ecology and the technical consultants reached out to all identified project sponsors prior to including the project in the watershed plan.

Based on initial available project information, the Committee identified a subset of offset projects that showed promise for quantitative streamflow benefits. The technical consultants developed detailed analyses on the subset of projects and the Committee determined the offset value to attribute to each project. This chapter presents summaries of those projects with additional detail on each project in Appendix I.

In a separate effort, Ecology contracted with Pacific Groundwater Group (PGG) to support identification of water right acquisition opportunities for WRIA 15. With direction from the Committee, PGG narrowed down the list of opportunities. The Committee provided input on the revised list of projects and PGG developed detailed project descriptions for water right acquisition opportunities that appeared to be the most valid. For each water right acquisition project, the Committee used PGG's estimate of the consumptive use portion of the right. Before these rights are acquired and put into the Trust Water Rights Program,[33] they will go through a full extent and validity analysis to determine the consumptive use offset component. As this analysis cannot happen until the owner of the right has agreed to sell, the Committee is relying on the PGG evaluations to estimate the offset volumes described in Section 5.2. PGG developed a more detailed description of the water rights analysis, provided in Appendix J.

For projects that did not provide a measurable streamflow benefit, the WRIA 15 Committee chose not to invest technical consultant resources to further develop the projects during this planning period. Information presented on these projects is based on available information from WRIA 15 partners. The Committee instead focused the technical resources and expertise on finding projects that provide quantifiable offset benefits.

The projects identified in this plan are consistent with the project type examples listed in Ecology's Final NEB Guidance: (a) water right acquisition offset projects; (b) non-acquisition water offset projects; and (c) habitat and other related projects (Ecology 2019b). This watershed plan presents projects in the following four categories:

I. Water right acquisition offset projects and non-acquisition water offset projects that are ready to proceed. These projects provide a quantitative streamflow benefit.
II. Projects that provide habitat and streamflow benefits, but streamflow benefits are difficult to quantify.
III. Projects that primarily benefit habitat.
IV. Projects that are not currently implementable (e.g., due to legal restrictions) or are highly conceptual.

[33] More information on Ecology's Trust Water Rights Program available at: https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-rights/Trust-water-rights

Projects in Category I are presented in this chapter. All other projects are presented in the project inventory in Appendix H. The WRIA 15 Committee recommends implementation of projects in this chapter as well as in Appendix I in order to meet the offset need and NEB for WRIA 15.

Many of the projects in this plan are conceptual, as Committee members and partners brought the ideas forward during the planning process. The Committee recognizes that once these projects are further developed, some may no longer be feasible. Through the adaptive management process recommended in Chapter 6, an implementation group and project sponsors may need to find alternative projects that provide the same types of benefits in the same locations as the projects identified in this Chapter and the project inventory.

5.2 Category I Projects

The WRIA 15 Committee set a goal of offsetting consumptive use estimates within each subbasin and agreed that offsets should be as close to impacts (i.e., new wells) as feasible. This watershed plan also has an offset target of 1,218 AF/yr for project implementation in order to benefit to streams. The Committee's goal is to achieve the offset target by subbasin, with deficiencies in offset benefit and project implementation addressed through adaptive management (see Chapter 6.2).

The projects presented below have quantifiable streamflow benefit and the Committee identified these projects as having the greatest potential for implementation and achieving the required offset need. Some of these project benefits may span across subbasins, but detailed modeling of streamflow benefits was not completed during this planning process. Detailed descriptions of each project presented in Section 5.2. are available in Appendix I. A summary of projects and offset benefits by subbasin are presented at the end of this section in Tables 16-22.

5.2.1 Managed Aquifer Recharge Package

The WRIA 15 Committee considered Managed Aquifer Recharge (MAR) projects as a method for (1) increasing infiltration to aquifers to improve streamflow and (2) offsetting water use from future PE wells in the watershed. Appendix I provides a detailed description of the project.

"MAR" is used to describe many types of projects.[34] Aquifer Storage and Recovery (ASR) projects actively inject water into aquifers for storage and recovery through pumping. Passive MAR projects infiltrate water into shallow aquifers, with the intent that water discharges from the shallow aquifer into streams on a delayed basis and improves streamflow during low-flow periods (see Figure 6). For WRIA 15, only passive MAR projects, in which water infiltrates by

[34] More information on these project types is available from Ecology: https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-recovery-solutions/Aquifer-storage-recovery-recharge

gravity, are being considered. The source of water for the passive MAR projects in WRIA 15 may be recycled water (highly treated wastewater), stormwater, or diverted surface water.

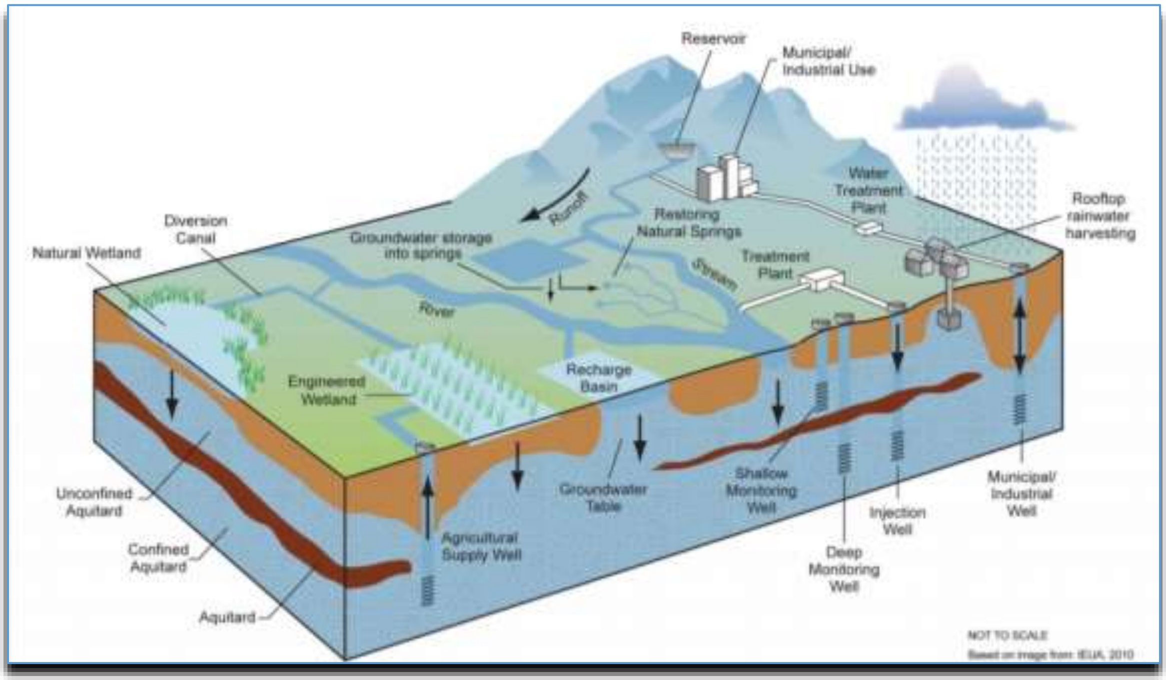

Figure 6. Diagram of different types of MAR projects from Golder and Associates. This watershed plan includes only some of the types of MAR projects shows in the diagram.

The planning, implementation, and operations and maintenance of MAR projects is complex, leading to uncertainty around their potential use as water offset projects and inclusion in the watershed plan. This watershed plan addresses uncertainty by including a portfolio of MAR projects that have different locations, project sponsors, water sources, and size. Uncertainty is also addressed by qualitatively assessing the potential for implementation on a high, medium, and low basis and then assigning a probability to the potential offset from each project.

The overall potential for MAR in WRIA 15 is the sum of the potential offsets multiplied by their probability. MAR projects in WRIA 15 have been identified through different sources and are estimated to have a total potential water offset of 1,736 AF/yr. The overall potential, accounting for likelihood of implementation, is estimated to be 456.9 AF/yr. Considering MAR projects that can be implemented within the next 10 years, the estimated potential offset is 361.8 acre-feet/year (with adjusted offset for implementation feasibility). The remaining MAR projects would likely take longer than 10 years to implement.

MAR projects implemented in WRIA 15 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.[35] The Committee opposes projects that reroute streams or include instream structures (e.g., diversions) because they may result in negative impacts to ecological function. The Committee supports MAR projects that address water quality (e.g., adequate treatment of stormwater or reclaimed water).

Table 13 summarizes the MAR projects identified in WRIA 15 and water offsets adjusted by probability of implementation. More detailed descriptions of the projects are available in Appendix I. A description of the work required to implement a MAR project is provided in the detailed project descriptions.

Table 13. Managed Aquifer Recharge Package with Potential Offset Benefit and Adjusted Offset Benefit Based on Certainty and Feasibility. Additional break down of certainty and feasibility is available in Appendix I.

Subbasin	**MAR Project Name** (sponsor, if identified)	**Potential Offset** (AF/yr)	**Adjusted Offset Benefit Based on Certainty and Time to Implementation** (AF/y)[3]	**Anticipated Timing of Streamflow Benefit** (if known)
West Sound	Kingston Treatment Plant Recycled Water (Kitsap County)*	328	91.8^	Summer low streamflows predicted to be increased
	Grovers Creek MAR	20[1]	2	To be determined (TBD)
	Central Kitsap Treatment Plant[2*] (Silverdale Water District)	167	83.5	Variable, can be designed to time benefits
North Hood Canal	Central Kitsap Treatment Plant, includes Asbury Parcel [2*] (Silverdale Water District)	333	166.5	Variable, can be designed to time benefits
South Hood Canal	Tahuya River MAR	200	20	TBD
	Oak Lake Storage and MAR	75	7	TBD
	Shoe Lake Storage and MAR	62	6.2	TBD

[35] "…Qualifying projects must be specifically designed to enhance streamflows and not result in negative impacts to ecological functions or critical habitat," (RCW 90.94.030 (3) (b)).

Subbasin	MAR Project Name (sponsor, if identified)	Potential Offset (AF/yr)	Adjusted Offset Benefit Based on Certainty and Time to Implementation (AF/y)[3]	Anticipated Timing of Streamflow Benefit (if known)
Bainbridge Island	M & E Farm Storage, MAR*	17	8.5	TBD
	Johnson Farm Storage, MAR*	90	9	TBD
	Winslow Treatment Plant Recycled Water*	45	22.5	Can be configured to benefit summer low streamflow
	Miller Rd MAR	19	1.9	TBD
South Sound	Port Orchard Airport MAR*	100	10	TBD
	Belfair WWTP MAR*	70	7	TBD
	Rocky Creek south of Trophy Lake Golf Course MAR	150	15	TBD
	Minter Creek MAR	20[1]	2	TBD
	Rocky Creek between Wye and Koeneman Lakes MAR	20[1]	2	TBD
Vashon – Maury Island	Judd Creek MAR	20[1]	2	TBD
South Sound Islands	-	-	-	
Totals		**1,736**	**456.9**	

[1]*Potential offset not yet estimated; 20 AF/yr assumed based upon 0.25-acre total size infiltration basin at each project site.*

[2] *Central Kitsap Treatment Plant could provide water offsets to both West Sound and North Hood Canal subbasins. An assumption of the split in benefits was made (2/3 North Hood Canal, 1/3 West Sound).*

[3] *Adjusted offset benefit is based on high relative certainty and less than 5 years to implement (80%), medium relative certainty and 5-10 years to implement (50%), and low relative certainty and greater than 10 years to implement (10%)*

**Detailed project description available at end of document.*

^ Offset value based on Aspect Consulting study. The Aspect estimates for benefits to Grovers Creek range from 35% to 50% of the total recharge volume.

5.2.2 Community Forest Package

Community Forest projects rely on the acquisition of forest lands (or change in forest management practices) to preserve stands or emphasize a longer harvest interval. Preserving or maintaining forests with stand ages more than 40 years can increase dry-season low flows.

Table 14 presents the acreage of potential community forest projects identified by sponsors by subbasin, as well as a target acreage in each subbasin that will provide water offsets to help meet the Watershed Plan goal of offsetting future consumptive use within each subbasin. The projects listed in the table are preliminary opportunities, but new projects may arise in the future that provide benefit for streamflow. Each project will need to be evaluated for its potential offset based on location as well as historical and planned forestry practices.

The total target acreage is 1,723 acres, which will provide an estimated 241 acre-feet of water offset. More detailed descriptions of the projects are available in Appendix I. The projects identified by sponsors need further confirmation to determine whether the projects would meet the criteria of having forest stands greater than 40 years old and subject to harvest.

Table 14. Package of Community Forest Type Projects in WRIA 15.

Subbasin	Project Name (Sponsor, if known): Preliminary Sites	Acreage: Preliminary and Target	Potential Streamflow Restoration Increase (Acre-feet/year)
Bainbridge Island	Springbrook Creek Protection and Restoration (Bainbridge Island Land Trust)	22.85	3.2
North Hood Canal	Community Forest Projects, including: • Crabapple Creek Habitat Acquisition and Restoration • Little Anderson Creek Habitat Protection • Divide Block Habitat Acquisition and Restoration • West Port Gamble Block Habitat Protection • Port Gamble Heritage Park Timber Rights Acquisition[1] • Gamble Creek Parcel • Boyce Anderson DNR Parcel • Seabeck DNR Parcel • Grovers Creek Mainstem protection and restoration (Sponsors may be Great Peninsula Conservancy and Port Gamble S'Klallam Tribe)	Approx. 2100 acres has been identified as potential projects by sponsors, target for Community Forest in this subbasin is 500 acres	70
South Hood Canal	Community Forest Projects, including: • Bear Creek Protection • Tahuya Headwaters (Sponsors may be Great Peninsula Conservancy and others)	Target is 500 acres in South Hood Canal Subbasin	70
South Sound	Community Forest Projects, including: • Rocky Creek Preserve • Coulter Creek Overton Lands	Target is 500 acres in South Sound Subbasin	70

Subbasin	Project Name (Sponsor, if known): Preliminary Sites	Acreage: Preliminary and Target	Potential Streamflow Restoration Increase (Acre-feet/year)
	• Key Peninsula Forest Lands (Sponsors may be Great Peninsula Conservancy and others)		
Vashon Maury	Community Forest Projects, including: • Judd Creek Headwaters • Shinglemill Creek Headwaters • Mileta Creek Headwaters • Christiansen Creek Headwaters • Fisher Creek Headwaters • Tahlequah Creek Headwaters (Sponsors may be Vashon-Maury Island Land Trust or King County)	Target is 100 acres in Vashon Maury Subbasin	14
West Sound	Community Forest Projects, including: • East Branch Ostrich Bay Creek along Skylark Drive W. • Strawberry and L. Anderson Creek Parcel (Sponsors may be Great Peninsula Conservancy and others)	Target is 50 acres in West Sound Subbasin	7
South Sound Islands	Anderson Island Community Forest Projects • Near Idie Ulsh Park (40 acres total) • Other areas (Sponsors may include Anderson Island Parks and Recreation District, Great Peninsula Conservancy, Nisqually Land Trust)	Target is 50 acres in South Sound Islands Subbasin	7
Totals		Overall Target is 1,723 acres	241

[1] Subject to existing agreements.

5.2.3 Rain Garden and Low Impact Development Package

This project entails installing Rain Garden and Low Impact Development (LID) projects at existing homes and driveways, roadways, parking lots, and other impervious areas that generate stormwater. Appendix I provides a detailed project description. These projects would focus on critical WRIA 15 stream basins in which PE well numbers are projected to be high, and with homes that have the greatest potential for new infiltration. Techniques include rain gardens, bio-infiltration swales, permeable pavement, and reductions in the footprint of roadways with permeable surface replacement.

Kitsap Conservation District (KCD) has a Rain Garden and LID Program that works cooperatively with county services, landowners, and local communities to expand knowledge and use of LID practices throughout Kitsap County, including some cities within the county. Since 2010, the KCD Rain Garden and LID cost-share program has helped landowners fund and install 320 rain gardens. Pierce Conservation District (PCD) and Mason Conservation District (MCD) have similar programs.

KCD can implement 50 projects a year with existing staff resources, assuming sufficient funding. The capacity of PCD and MCD is less than KCD, but with funding, is assumed to be 10 per year, per district. The average offset will vary with precipitation, soils, and other factors but is likely about 0.15 acre-foot per residential rain garden. Other LID practices can infiltrate more water, depending on the impervious surface treated.

Table 15 presents a recommended target and distribution of rain garden projects per year and potential range of water offsets over the life of the plan (18 years).

Table 15. Target Number of Raingarden and LID Projects.

Subbasin	Targeted Number of Projects per year	Target % of Projects	Total Amount of Potential Offset Benefit by 2038 (18 years of projects), acre-feet/year
North Hood Canal	10	14%	27
West Sound	20	29%	54
Bainbridge Island	5	7%	13.5
South Sound	25	36%	67.5
South Hood Canal	10	14%	27
Totals	**70**		**189**

5.2.4 Vashon-Maury Island Water Right Acquisition Package

This project would acquire (through fees and conservation easements) sensitive habitats and water rights in the Vashon-Maury Island subbasin with the intent of enhancing instream flows and mitigating out of stream uses (i.e., reductions in flows associated with PE wells). Assuming property acquisition is coupled with water right acquisition, associated habitat benefits could include removal of structures and impervious surfaces, wetland and riparian protection and restoration, and decommissioning PE wells. Appendix I provides a description of this project.

The range of potential offset benefit from the water right acquisition opportunities on Vashon Maury is approximately 56 to 279 AF/yr. The Committee accounts for 10 percent of the total potential available water rights as the offset benefit, or 27.9 AF/yr.

5.2.5 Beall Creek Flow Improvement

The Beall Creek project is located in the Vashon-Maury Island subbasin. The project intends to develop a more accurate measurement of the Water District 19 water requirements at their diversion on Beall Creek and improve bypass flow at the diversion, resulting in flow improvements to Beall Creek at an estimated rate of 26 AF/yr. Appendix I provides a more detailed project description.

5.2.6 Bainbridge Island Water Right Acquisitions

This project would acquire two water rights on Bainbridge Island, totaling 90 acre-feet. This watershed plan uses 10 percent of the total potentially available water rights as the offset benefit, or 9 AF/yr. This watershed plan does not present the details of the potential water rights in order to protect the privacy of the water right holders.

5.2.7 Pierce County Project Assessment

In partnership with groups like the Great Peninsula Conservancy, South Puget Sound Salmon Enhancement Group, the Squaxin Island Tribe, the Puyallup Tribe of Indians, and the Nisqually Indian Tribe, Pierce County proposes developing a streamflow restoration strategy and project prioritization for the Pierce County portion of the South Sound and South Sound Islands subbasins. This work would happen in conjunction with adaptive management to ensure the projects align with the WRIA 15 watershed plan.

The project will constitute the first phase of a multiphase approach to restoring streamflow. The main purpose of this first phase will be to assess habitat and hydrologic functions of several priority stream reaches and align them with potential opportunities for habitat improvement, water rights acquisition, and MAR. The focus will be on projects that can provide multiple benefits—such as increased streamflow and salmon habitat improvement—while at the same time leveraging existing plans, resources, and opportunities. The functional assessment will result in (1) a better understanding of groundwater/surface water interactions, (2) identification of restoration strategies that would be most effective, and (3) a prioritized list of specific restoration actions and opportunities across the South Sound and South Sound Island subbasin.

The project will identify high-priority stream reaches and develop conceptual designs for at least three high priority restoration opportunities. The information generated from the assessment will inform prioritization of future projects and programs that would improve streamflow and salmon habitat in WRIA 15. Future phases will include final design and construction, and design of additional restoration opportunities identified in this project. No offset benefit is currently attributed to this project.

5.2.8 Ridgetop Boulevard Stormwater

As a part of a regional effort to improve water quality and aquatic habitat in streams and the Puget Sound, Kitsap County has implemented a plan for LID stormwater retrofit improvements in the Silverdale urban growth area. One of these improvements proposes to retrofit Ridgetop Boulevard NW (from State Highway 303/Northwest Waaga Way to Silverdale Way Northwest) with water quality treatment and infiltration. Two of three project phases are complete; the third phase is seeking funding in the amount of $2 million. Kitsap County Public Works is the project sponsor and the only current barrier to the project is funding. The County has conducted extensive studies on the hydrography and infiltration rates. The infiltration rates for Phases 1 and 2 are 82.7 acre feet. The additional infiltration volume for Phase 3 is estimated at 44 acre-feet. The total volume for all three phases is estimated at 126.7 AF/yr. Clear Creek is the benefiting stream. This is an initial estimate and further analysis is needed. The subbasin benefitting from this project is West Sound.

More information on the project is available from the following resources:

1. Ridgetop Boulevard Project Page - KCPW Projects (arcgis.com)
2. Herrera Environmental Consultants, Inc. 2013. Silverdale Low Impact Development Retrofit Plan. Prepared for Kitsap County.
3. Kindred Hydro. 2014. Infiltration Testing and Assessment – Ridgetop Boulevard Green Stormwater Project, Silverdale, Washington. Prepared for Kitsap County.

Table 16. West Sound Subbasin Category I Projects.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Kingston Treatment Plant Recycled Water	Use recycled water for irrigation on a golf course and infiltrate groundwater to improve streamflow. Benefits Grovers Creek.	91.8	Summer low streamflows predicted to be increased	Kitsap County	$13.65M	Funding and agreement on O&M needed. Likely 5 year implementation schedule.
Central Kitsap Water Treatment Plant	Use recycled water to infiltrate near Newberry Road. Could benefit West Sound and North Hood Canal subbasins. Possible benefits to Johnson, Wildcat, and Chico creeks.	83.5	Variable, can be designed to time benefits	Silverdale Water District	$14.7-15.4M (project cost also included in North Hood Canal Subbasin)	Funding needed and Water Quality issues need resolution. Likely 5 year implementation schedule.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Raingarden and LID Projects	Install residential raingardens and LID projects to infiltrate water from existing impervious surfaces	54	Variable, because of wide distribution benefits likely to occur year-round	Kitsap Conservation District	$1.0-1.8M	Ready to proceed in some areas; some additional funding necessary to expand program.
Ridgetop Blvd Stormwater Improvements	Improve stormwater management and infiltration.	126.7	TBD	Kitsap County	$2,000,000	Design and partial funding completed. Ready to proceed.
Grovers Creek MAR	MAR, will benefit Grovers Creek	2	TBD	TBD	$100,000	Funding needed, Likely >10 year implementation schedule
Community Forest Package	Acquire forest lands or change forest management practices to preserve stands or emphasize a longer harvest interval. Target is 50 acres.	7	Would likely benefit summer low streamflow	Great Peninsula Conservancy and others	$500-750,000	Funding needed.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Total Offset Benefit from Projects		**365**				
Offset Need for Subbasin		183.9				
Higher Offset Target for Subbasin		**277.9**				

Table 17. Bainbridge Island Subbasin Category I Projects.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
M&E Farm Storage, MAR	MAR, will benefit Manzanita Creek	8.5	TBD	City of Bainbridge Island	$270,000	Funding needed, likely 5-10 year implementation schedule.
Miller Road MAR	MAR, will benefit Manzanita Creek	1.9	TBD	City of Bainbridge Island	$270,000	Funding needed, likely >10 year implementation schedule.
Johnson Farm Storage, MAR	MAR, will benefit	9	TBD	Not yet identified	$540,000	Funding Needed, likely >10 year implementation schedule.
Winslow Treatment Plant Recycled Water	MAR, location to be determined	22.5	Can be configured to benefit summer low streamflow	City of Bainbridge Island	$6,500,000	Likely >10 year implementation schedule
Raingarden and LID Projects	Install residential raingardens and LID projects to infiltrate water from existing impervious surfaces	13.5	Variable, because of wide distribution benefits likely to occur year-round	Kitsap Conservation District	$270-450,000	Ready to proceed in some areas; some additional funding necessary to expand program.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Water Rights	Acquire water rights	9	During permitted time of use, likely summer irrigation season	Washington Water Trust	$25,000	Further analysis and water right holder agreement needed.
Community Forest Package	Acquire forest lands to preserve stands. 22.85 acres identified.	3.2	Would likely benefit summer low streamflow	Bainbridge Island Land Trust	$230-350,000	Funding needed.
Total Offset Benefit from Projects		67.6				
Offset Need for Subbasin		67.6				
Higher Offset Target for Subbasin		102.2				

Table 18. North Hood Canal Subbasin Category I Projects.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Community Forest Package	Acquire forest lands or change forest management practices to preserve stands or emphasize a longer harvest interval. Target is 500 acres.	70	Would likely benefit summer low streamflow	Great Peninsula Conservancy, Jamestown S'Klallam Tribe and others	$5.0-7.5M	Funding needed.
Central Kitsap Water Treatment Plant	Use recycled water to infiltrate near Newberry Road. Could benefit West Sound and North Hood Canal subbasins. Possible benefits to Little Anderson, Anderson and Big Beef creeks.	166.5	Variable, can be designed to time benefits	Silverdale Water District	$14.7-15.4M (project cost also included in West Sound Subbasin)	Funding needed and Water Quality issues need resolution. Likely 5 year implementation schedule.
Raingarden and LID Projects	Install residential raingardens and LID projects to infiltrate water from existing impervious surfaces	27	Variable, because of wide distribution benefits likely to occur year-round	Kitsap Conservation District	$540,000-900,000	Ready to proceed in some areas; some additional funding necessary to expand program.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Total Offset Benefit from Projects		**263.5**				
Offset Need for Subbasin		**90.3**				
Higher Offset Target for Subbasin		**136.5**				

Table 19. South Hood Canal Subbasin Category I Projects.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Raingarden and LID Projects	Install residential raingardens and LID projects to infiltrate water from existing impervious surfaces	27	Variable, because of wide distribution benefits likely to occur year-round	Mason Conservation District	$540-900,000	Ready to proceed in some areas; some additional funding necessary to expand program.
Community Forest Package	Acquire forest lands or change forest management practices to preserve stands or emphasize a longer harvest interval. Target is 500 acres.	70	Would likely benefit summer low streamflow	Great Peninsula Conservancy and others	$5.0–7.5M	Funding Needed.
Tahuya River MAR	MAR, will benefit Tayuha River	20	TBD	Washington Water Trust (potential)	$700,000	Funding Needed, likely >10 year implementation schedule.
Oak Lake Storage and MAR	MAR, will benefit Dewatto River	7	TBD	Not yet identified	$300,000	Funding Needed, likely >10 year implementation schedule.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Shoe Lake Storage and MAR	MAR, will benefit Dewatto River	6.2	TBD	Not yet identified	$250,000	Funding Needed, likely >10 year implementation schedule.
Total Offset Benefit from Projects		**130.2**				
Offset Need for Subbasin		**155**				
Higher Offset Target for Subbasin		**223.4**				

Table 20. Vashon Maury Subbasin Category I Projects.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Beall Creek	Water management to improve streamflow in Beall Creek	26	Summer low flow period	Water District 19	$110,000	Funding needed, can proceed within a year.
Community Forest Package	Acquire forest lands or change forest management practices to preserve stands or emphasize a longer harvest interval. Target is 100 acres.	14	Would likely benefit summer low streamflow	Vashon Island Land Trust and others	$5.0–10M	Funding Needed.
Judd Creek MAR	MAR, could benefit Judd Creek and other streams	2	TBD	Washington Water Trust (potential)	$100,000	Funding Needed, likely >10 year implementation schedule.
Water Right Acquisition Package	Acquire property and water rights, could benefit multiple streams	27.9	During permitted time of use, likely summer irrigation season	Vashon Maury Island Land Trust, King County, others	$75,000	Funding needed.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Total Offset Benefit from Projects		**69.9**				
Offset Need for Subbasin		**50.7**				
Higher Offset Target for Subbasin		**72.9**				

Table 21. South Sound Subbasin Category I Projects.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
MAR Package including • Port Orchard Airport MAR • Belfair WWTP MAR • Rocky Creek south of Trophy Lake	MAR, could benefit multiple streams	36	TBD, if multiple projects are implemented there would likely be benefits year-round	Washington Water Trust and others	$1.3M	Funding Needed, likely >10 year implementation schedule.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Golf Course MAR • Minter Creek MAR • Rocky Creek between Wye and Koeneman Lakes MAR						
South Sound and South Sound Island Planning Project	Identify priority projects to benefit streamflow and habitat.	NA	TBD	SSSEG, GPC, Others		Ready, some funding needed.
Community Forest Package	Acquire forest lands or change forest management practices to preserve stands or emphasize a longer harvest interval. Target is 500 acres.	70	Would likely benefit summer low streamflow	Great Peninsula Conservancy and others	$5.0-7.5M	Funding needed.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Raingarden and LID Projects	Install residential raingardens and LID projects to infiltrate water from existing impervious surfaces	67.5	Variable, because of wide distribution benefits likely to occur year-round	Kitsap Conservation District, Pierce Conservation District	$1.4-2.3M	Ready to proceed in some areas; some additional funding necessary to expand program.
Total Offset Benefit from Projects		**173.5**				
Offset Need for Subbasin		**213.8**				
Higher Offset Target for Subbasin		**394.6**				

Table 22. South Sound Islands Subbasin Category I Projects.

Project Name	Project Type and Description	Estimated Water Offset AF/yr	Timing of Benefit (if known)	Project Sponsor	Estimated Project Cost	Readiness to Proceed
Community Forest Package	Acquire forest lands or change forest management practices to preserve stands or emphasize a longer harvest interval. Target is 50 acres.	7	Would likely benefit summer low streamflow	Nisqually Land Trust, Great Peninsula Conservancy, Anderson Island Parks and Recreation District, and others	$500-750,000	Funding needed.
Total Offset Benefit from Projects		**7**				
Offset Need for Subbasin		**5.2**				
Higher Offset Target for Subbasin		**11.1**				

5.3 Category II-IV Projects

This watershed plan includes an inventory of additional projects to meet offset needs and NEB for the watershed. The remaining categories include the following:

II. Projects that provide habitat and streamflow benefits, but streamflow benefits are difficult to quantify.

III. Projects that primarily benefit habitat.

IV. Projects that currently are not implementable (e.g., legal restriction) or are highly conceptual.

If implemented, 61 projects included in the project inventory will support meeting NEB. These projects include habitat restoration and protection, stream augmentation, riparian restoration, reclaimed water expansion, storage, and other project types. Appendix H presents projects in the inventory.

provides a summary of the number of projects per category by subbasin and estimated quantitative benefits provided by projects by subbasin.

Table 23. Summary of habitat benefits from Category II-IV projects. Does not include habitat benefits of Category I projects, which are provided in the detailed project descriptions.

Subbasin	No. Projects Categories II-IV	Description of projects in Categories II-IV
Bainbridge Island	3	This subbasin contains projects that, if implemented, would provide direct streamflow benefit, protection and restoration of habitat for fish critical streams.
North Hood Canal	5	This subbasin contains projects that, if implemented, would provide direct streamflow benefit, protection and restoration of habitat for fish critical streams. Over 1600 feet of stream restoration are included along with over ten acres of habitat restoration.
South Hood Canal	2	This subbasin contains projects that, if implemented, would provide direct streamflow benefit, protection and restoration of habitat for fish critical streams. This subbasin includes projects that will restore up to three miles of riparian area.
South Sound	26	This subbasin includes projects that, if implemented, would provide direct streamflow benefit, protection and restoration of habitat for fish critical streams. Projects include up to nine miles of riparian restoration.
South Sound Islands	2	This subbasin contains projects that, if implemented, would provide direct streamflow benefit, protection and restoration of habitat for fish critical streams.
Vashon Maury	4	This subbasin contains projects that, if implemented, would provide direct streamflow benefit, water rights and land acquisition.
West Sound	19	This subbasin contains over projects that, if implemented, would provide direct streamflow benefit, protection and restoration of habitat for fish critical streams. Projects include over 2800 feet of stream restoration, riparian restoration, over 100 acres of land protection, and over 140 acres of habitat restoration.

5.2.3 Prospective Projects and Actions

In addition to the projects described in this chapter and the project inventory in Appendix H, the WRIA 15 Committee supports future projects and actions in the following categories:

Climate Adaptation and Resiliency. The Committee recognizes the potential impacts of climate change on streamflow and recommends that projects and actions (1) are resilient to the impacts of climate change and (2) include components that help improve the resiliency of our stream systems.[36]

Water Right Acquisitions. The Committee supports the full and partial acquisition of water rights to increase streamflows and offset the impacts of PE wells. Water rights should be permanently and legally held by Ecology in the Trust Water Rights Program to ensure that the benefits to instream resources are permanent. The Committee acknowledges that all water right transactions rely on willing sellers and willing buyers and recognizes the importance of water availability for producers and the limited available water supply.

Land Acquisitions and Conservation Easements. The Committee supports acquisitions and conservation easements of land to increase streamflows and offset the impacts of PE wells. The Committee recommends focusing acquisitions and easements in areas with wetlands and headwaters to prevent new PE wells, decommission old PE wells, and extend time between harvest of timber.

Managed Aquifer Recharge and Other Storage Projects. The Committee supports MAR and other storage projects that re-time flood-level flows to provide streamflow benefits during low-flow periods. The Committee encourages storage projects in the headwaters or high in the system, as well as those that provide multiple benefits (e.g., flood reduction, habitat benefits). See section 5.2.1 above on more information regarding MAR projects.

Connections to Public Water Systems and Permit Exempt Well Decommissioning. The Committee supports projects or programs that encourage connections of existing homes on PE wells to public water systems without impacting critical areas or indirectly encouraging development outside of UGAs. Projects could provide financial incentives for homes using PE wells to connect to public water service and decommission the well and/or provide financial support for water purveyors to extend water distribution systems further into their individual service areas, particularly where PE wells are concentrated or rapid rural growth is anticipated. The purveyor will need to demonstrate how they plan to connect PE users to the extended line and agree to forgo the consolidation of the groundwater right(s) exempt from the permit

[36] For more information, see Beechie et al., 2012. Restoring Salmon Habitat for a Changing Climate. River Restoration and Application. 29: 939-960.
For more information, see Puget Sound Partnership, Adaptation International, and EcoAdapt, 2017. Planning for the Effects of Climate Change on Protection and Restoration Projects. Available at: https://www.psp.wa.gov/salmon-recovery-overview.php (Accessed December 2020).

requirement under RCW 90.44.050 (the groundwater right associated with the formerly exempt well) through the RCW 90.44.105 process.

5.3 Project Implementation Summary

5.3.1 Summary of Projects and Benefits

As specified in Chapter 4, this watershed plan estimates 766.4 AF/yr of new consumptive use from new PE wells over the planning horizon. This watershed plan also has an offset target of 1,218 AF/yr for project implementation in order to benefit streams.

The Category I projects included in Tables in Section 5.2, if implemented as intended, provide an estimated offset of 1076.7 AF/yr and exceed the consumptive use estimate offset need for the WRIA. The current project list falls short of the offset need for some subbasins. In addition, the watershed plan falls short of meeting the higher offset target for project implementation in some subbasins. To support the Committee's goal of meeting offset need by subbasin, as well as the higher offset target, the watershed plan lays out an adaptive management and implementation process in Section 6.2.

The Committee has identified an additional set of Category II-IV projects, with quantified streamflow benefit, unquantified streamflow benefit, and habitat improvement; these projects are included in Chapter 5.2. The ecological and streamflow benefits from these projects are supplemental to the quantified water offsets required by RCW.90.94.030.

5.3.2 Cost Estimate for offsetting new domestic water use over 20 Year Planning Horizon

Per RCW 90.94.030(3)(d), this watershed plan must include an evaluation or estimation of the cost of offsetting new domestic water uses over the subsequent twenty years. To satisfy this requirement, the technical consultants developed planning-level cost estimates for each of the water offset projects listed in Section 5.2 and included cost estimates for projects in the inventory (if readily available).

The estimated cost of implementing individual water offset projects range from $25,000 for acquiring a small set of water rights to over $15 million for the Central Kitsap Water Treatment Plant MAR project. The total estimated cost for implementing the water offset projects listed and described in this chapter is $53 million to $64 million. However, that cost includes many MAR projects that have a low likelihood of being implemented for reasons such as site feasibility. By assigning the same certainty of implementation of the MAR projects to the costs of those projects, the estimated cost becomes $49 million to $61 million. Assuming 1076.7 AF/yr of water offset is achieved through implementation of these projects, the average cost per AF/yr ranges from $41,000 to $51,000.

The estimated cost of implementing projects in Categories II-IV range from $10,000 (single site for stream augmentation) to several million dollars for large land acquisition and restoration projects. The total estimated cost for implementing projects in Categories II-IV is unknown due to the highly conceptual nature of many projects. A general project cost per acre of acquisition or restoration is challenging to provide given the difference in costs across the WRIA (e.g., land costs may differ by region/county). However, the West Sound Partners for Ecosystem Recovery provide an average cost of $1.4 million for projects submitted as Near-Term Actions in the 2018-2022 Puget Sound Action Agenda. Their projects address stormwater improvements, habitat restoration and protection, floodplain restoration, shoreline restoration, monitoring and modeling, and fish barrier removal. This average cost may be applicable for the range of projects included in the WRIA 15 watershed plan. Details on known costs for individual projects are provided in the project inventory.

5.3.3 Certainty of Implementation

The watershed plan provides adaptive management recommendations (see Chapter 6) to increase reasonable assurance that the projects and actions in the plan will be implemented to meet the offset needs and goals identified by the Committee.

Chapter 6. Additional Plan Recommendations

6.1 Policy and Regulatory Recommendations

The Streamflow Restoration law lists optional elements that 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 15 Committee included "policy and regulatory recommendations" in the watershed plan to show support for programs, policies, and regulatory actions that would contribute to the goals of this watershed plan, including streamflow restoration and meeting NEB.

All projects the WRIA 15 Committee intended to count toward the required consumptive use offset or NEB are included in Chapter 5 and Appendix H: Project Inventory.[37] When similar concepts arose from multiple Watershed Restoration and Enhancement Committees, the WRIA 15 Committee coordinated with those other Committees to put forward common language for inclusion in the watershed plans, as appropriate. Coordination also occurred for jurisdictions that cross multiple watersheds.

As recommended by Ecology's NEB Guidance, the WRIA 15 Committee prepared the plan with implementation in mind. However, as articulated in the Streamflow Restoration Policy and Interpretive Statement (POL-2094), "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). These policy and regulatory recommendations were developed by WRIA 15 Committee members and are not endorsed or opposed by Ecology.

The Committee initially identified a list of potential recommendations based on proposals brought forward by members. Through iterative rounds of discussion and feedback during Committee meetings, one-on-one conversations, and surveys, the Committee narrowed down recommendations to those presented below. Unless otherwise specified, the proposed implementing entity is not obligated by this plan to implement the recommendation; however, the Committee requests consideration of each recommendation by the identified implementing entity.

The WRIA 15 Committee provides the following recommendations (not listed in order of priority):

[37] "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

1. Track the number and location of permit-exempt wells

Proposed implementing entity: Department of Ecology

Recommendation: Change Ecology's well tracking system in the following ways to track the number and location of permit-exempt (PE) wells in use:

- Collect latitude and longitude of wells on well report forms;
- Identify PE wells on well log form; and
- Provide Well ID Tag numbers to older wells, and associate well decommissioning, replacement, or other well activities with the Well ID Tag.

Purpose: Accurate tracking of the locations and features of PE wells will support the Committee's desire to engage in monitoring and adaptive management after plan adoption.

Funding source: If Ecology does not have capacity do this work with existing staffing and resources, the Committee recommends that the Legislature provide additional funding.

Appendix K provides a detailed description of this recommendation.

2. Monitoring and Research

Proposed implementing entity: Multiple agencies would likely be involved in monitoring. Ecology would coordinate the development of the strategy.

Recommendation: Develop a research and monitoring strategy for WRIA 15 that addresses topics such as the following:

- Streamflow monitoring (status and trends)
- Groundwater monitoring
- Precipitation and drought conditions
- Water usage and water supply data
- Improvements in modeling of surface and groundwater hydrology

Given the cost and effort involved in developing a comprehensive strategy, this effort may need to be phased and prioritized to address most urgent needs first. The implementation group (discussed in Section 6.2) will further develop details for the monitoring and research plan to provide data that informs adaptive management and implementation of the watershed plan.

Purpose: The WRIA 15 Committee desires monitoring data on the health of the watershed, including status and trends.

Funding source: Funding is needed either through legislative appropriations, grants, pooling of resources by Committee members and other stakeholders, or other means.

3. Annual Report on Monitoring

Proposed implementing entity: Ecology, with support from Kitsap PUD, Squaxin Island Tribe, and any other jurisdictions collecting flow data under an approved Quality Assurance Project Plan.

Recommendation: Compile annual monitoring data on the status of water resources and water quality in the basin over the past year, collected by Ecology or provided by partner jurisdictions. Partner jurisdictions are encouraged to provide relevant data to Ecology for inclusion. Monitoring of streamflows, groundwater, precipitation and drought conditions, water usage, and water supply could be included. This information should be provided to the WRIA 15 Committee or a new implementation group, if established.

Purpose: This recommendation provides additional information on water resources that will provide context for addressing adaptive management.

Funding source: It is assumed this can be completed with existing resources.

4. Report on Additional Water Resource Information

Proposed implementing entity: Ecology

Recommendation: By September of 2026, Ecology reports the following information with the support from the Washington Department of Health and local jurisdictions:

- Estimates of:
  - The total number of connections to PE wells currently in use, as described in RCW 90.94.030(3)(b).
  - The number domestic and municipal water rights in use and their current quantity of use, including estimates of inchoate water remaining in municipal water rights, and categorized by whether they are mitigated or not and which subbasin they are in, as described in RCW 90.94.030(3)(c).
  - The cumulative consumptive water use impacts on instream flows from all pre-2018 PE wells and unmitigated municipal water rights, as described in RCW 90.94.030(3)(d)(e).
- An evaluation of the costs of offsetting all new domestic water uses over the next 20 years, as described in RCW 90.94.030(3)(d). The initiation of adjudication would be considered an acceptable substitute for this study.

Purpose: This recommendation collects additional information on water resources that will provide context for addressing adaptive management.

Funding source: Grant funding or a legislative appropriation will be necessary to hire consultant assistance to Ecology for this effort.

5. South Sound and South Hood Canal Planning Study

Proposed implementing entity: State, local, and tribal governments in WRIA 15

Recommendation: Conduct a study of how county and local government planning and permitting influences water management within WRIA 15 and potential opportunities to improve:

1) Water management outcomes that support aquatic habitat and human needs.
2) Efficiencies and potential cost savings.
3) Information sharing among the various governmental entities.

The study should focus on how management can protect and enhance streamflows, groundwater recharge, and other water resource management efforts that support aquatic habitat and water supply.

Purpose: This study could identify opportunities for improved outcomes at potentially lower costs.

Funding source: Grant funding or a legislative appropriation will be necessary to hire consultants to complete this study.

6. Drought Response Planning

Proposed implementing entity: Local governments

Recommendation: Local governments develop and implement a drought response plan if they do not already have one. Local governments review existing drought response plans for potential updates.

- Ecology and Department of Health provide technical assistance.
- The plans should include an education and outreach program to educate and notify the public about water conservation and drought water use limitations and practices.

Purpose: Drought response will be an important component of protecting streamflows. Clear plans and education by all local governments will better prepare the watershed for droughts.

Funding source: Grant funding or other funding may be needed by some local governments.

7. Recycled Water

Proposed implementing entity: Washington State Legislature and/or Ecology

Recommendation: Enact state policies that encourage the development and use of reclaimed water.

Purpose: Using reclaimed water will:

- Offset water that would otherwise be diverted from rivers and streams, thus preserving natural high-quality instream flow;
- Reduce the amount of treated wastewater discharged into receiving water bodies; and
- Create water supply options, which makes the water supply system more resilient against drought and climate change.

Funding source: Funding is needed through legislative appropriations, grants, pooling of resources by Committee members and other stakeholders, and/or other means. Individual projects and construction components will have to be funded with a market-based approach.

8. Water Conservation Education

Proposed implementing entity: Ecology and counties with support from conservation districts and non-governmental organizations.

Recommendation: Ecology should partner with counties and conservation districts to develop and implement outreach and incentives programs that encourage rural landowners with PE wells to (1) reduce their indoor and outdoor water use through water conservation best practices; and (2) comply with drought and other water use restrictions.

Purpose: Raise awareness of the impacts PE well water usage has on (1) groundwater levels and (2) the connection to streams and rivers. Supplement water offset and restoration projects.

Funding source: Funding is needed through legislative appropriations, grants, pooling of resources by Committee members and other stakeholders, and/or other means.

9. Water Conservation Statewide Policy

Proposed implementing entity: Ecology and/or local governments

Recommendation: Implement mandatory water conservation measures in unincorporated areas of the state during drought events. Measures would focus on limiting outdoor water use with exemptions for growing food.

Purpose: Reduce water usage in key subbasins (especially during drought), reduce impacts on stream flows, and increase climate change resilience.

Funding source: Funding is needed through legislative appropriations, grants, pooling of resources by Committee members and other stakeholders, and/or other means.

10. Beaver Habitat and Streamflow

Proposed implementing entity: Varies; see details below.

Recommendation:

1. **Map and protect likely beaver habitat:** The Committee recommends a pilot project with Kitsap County and Great Peninsula Conservancy to identify potential easements to purchase and protect as beaver habitat. The Committee recommends combining mapping and modeling to understand both the water holding potential and beaver habitat suitability of

selected areas. Easements would be purchased on a voluntary basis and certain areas of the WRIA need to be protected for drinking water.

2. **Education & outreach:** The Committee recommends a partnership between local organizations to develop and implement an education and outreach program to landowners regarding beavers and beaver management. The partners could also reach out to entities to address known concerns (e.g., tree loss, hazard trees, encroaching on farmland, change of vegetation, flooding) associated with beavers and discuss management options.
3. **Monitoring & research:** The Committee recommends developing a monitoring program for beaver habitats which may include collecting information on fish passage, groundwater levels, vegetation types, permits, and beaver dam analogues versus natural beaver habitat. Streamflow and habitat benefits should be quantified where possible to help define the benefit from a surface water / habitat perspective (e.g., temperature, streamflows, salmon, riparian vegetation, etc.). Implementing entities could include local jurisdictions, tribes, federal or state agencies.

Purpose: Beaver habitat can provide benefits to streamflows. A multi-faceted approach would provide additional tools for jurisdictions and landowners to help manage beavers.

Funding source: Funding is needed through legislative appropriations, grants, pooling of resources by Committee members and other stakeholders, and/or other means.

11. Financing

Proposed implementing entity: Legislature and/or Committee members or other stakeholders

Recommendation: The Committee recommends the Legislature provides funding for plan implementation, monitoring, and adaptive management of the plan, including:

- Annual tracking of new PE wells and project implementation by subbasin;
- Staffing for the ongoing Committee;
- Ongoing Committee member participation; and
- Developing a process to adaptively manage implementation if NEB is not being met as envisioned by the watershed plan (e.g., identification and development of alternative projects, etc.).

If necessary, the Committee may also recommend additional funding including grants, fees, shared contributions from members and other stakeholders, and other sources that may emerge.

Purpose: Plan implementation is key to success and it will take ongoing funding.

Funding source: Legislature or others.

6.2 Adaptive Management Recommendations

The Committee recommends an adaptive management process for implementation of the WRIA 15 watershed plan. Adaptive management is defined in Ecology's Final NEB Guidance as "*an interactive 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"* (Ecology 2019b). The WRIA 15 Committee set a goal of offsetting consumptive use estimates within each subbasin and agreed that offsets should be as close to impacts (i.e., new wells) to the extent feasible. This watershed plan also has an offset target of 1,218 AF/yr for project implementation in order to benefit to streams. Adaptive management will be necessary to achieve the goal of meeting offset needs within each subbasin and improving streamflow where this watershed plan currently falls short, through the identification, development and implementation of projects throughout WRIA 15.

Adaptive management will:

- Be informed through monitoring, research, tracking and reporting.
- Help address uncertainty.
- Ensure that the goals of this plan are being met.
- Provide more reasonable assurance for plan implementation.
- Provide information to improve implementation of streamflow restoration projects and actions.
- Track implementation costs and developing grant funding opportunities.
- Adaptively manage emerging plan implementation needs.

To support implementation of the watershed plan, RCW 90.94 includes a statement on the Legislature's intent. RCW 90.94 Intent—2018 c 1: "The Legislature intends to appropriate $300 million for projects to achieve the goals of this act until June 30, 2033. The Department of Ecology is directed to implement a program to restore and enhance streamflows by fulfilling obligations under this act to develop and implement plans to restore streamflows to levels necessary to support robust, healthy, and sustainable salmon populations." [2018 c 1 § 304.]"

1. Project, Policy, and Permit-Exempt Well Tracking

The Committee recommends tracking the growth of PE wells 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.

A. The WRIA 15 Committee recommends tracking the following information on an ongoing basis:
   - New building permits issued that include PE wells and total number of permits issued since January 2018.
   - Status of implementation for each project included in the plan.
   - Status of policy recommendations included in the plan.
   - An ongoing list of new PE wells in the WRIA since the enactment of RCW 90.94.
     - The lists of building permits and projects will be organized by subbasin, and (if feasible) represented on a map that includes subbasin delineations.

Counties are encouraged to provide parcel or other geographic information in their reports to Ecology to support mapping by subbasin.

- Data may be evaluated at a more refined scale to improve understanding of the impacts and benefits (e.g., Watershed Assessment Unit, subregions or HUC 12). Figure 7 provides a map of Watershed Assessment Units.

B. To assess the status of project implementation, the Committee recommends using the Salmon Recovery Portal (https://srp.rco.wa.gov/about), managed by the Washington State Recreation and Conservation Office (RCO), to support project tracking.

- The Washington Department of Fish & Wildlife (WDFW), in collaboration with RCO, would coordinate the implementation of project tracking through the Salmon Recovery Portal.
- Project sponsors are expected to support project tracking efforts and data sharing.
- To improve harmonization of streamflow restoration with ongoing salmon recovery efforts, local salmon recovery Lead Entity Coordinators will be consulted prior to initial data uploads; however, Coordinators will not be expected to provide ongoing support for project entry, maintenance, or reporting.
- University of Washington data stewards, contracted by WDFW, will conduct data entry, quality assurance, and quality control. If this approach changes, WDFW will propose an alternative method for completing this task.
- Entities with representation in the WRIA 15 Committee (or an implementation group, if created) are encouraged to assist as needed with coordination, data gathering and input, and tracking.

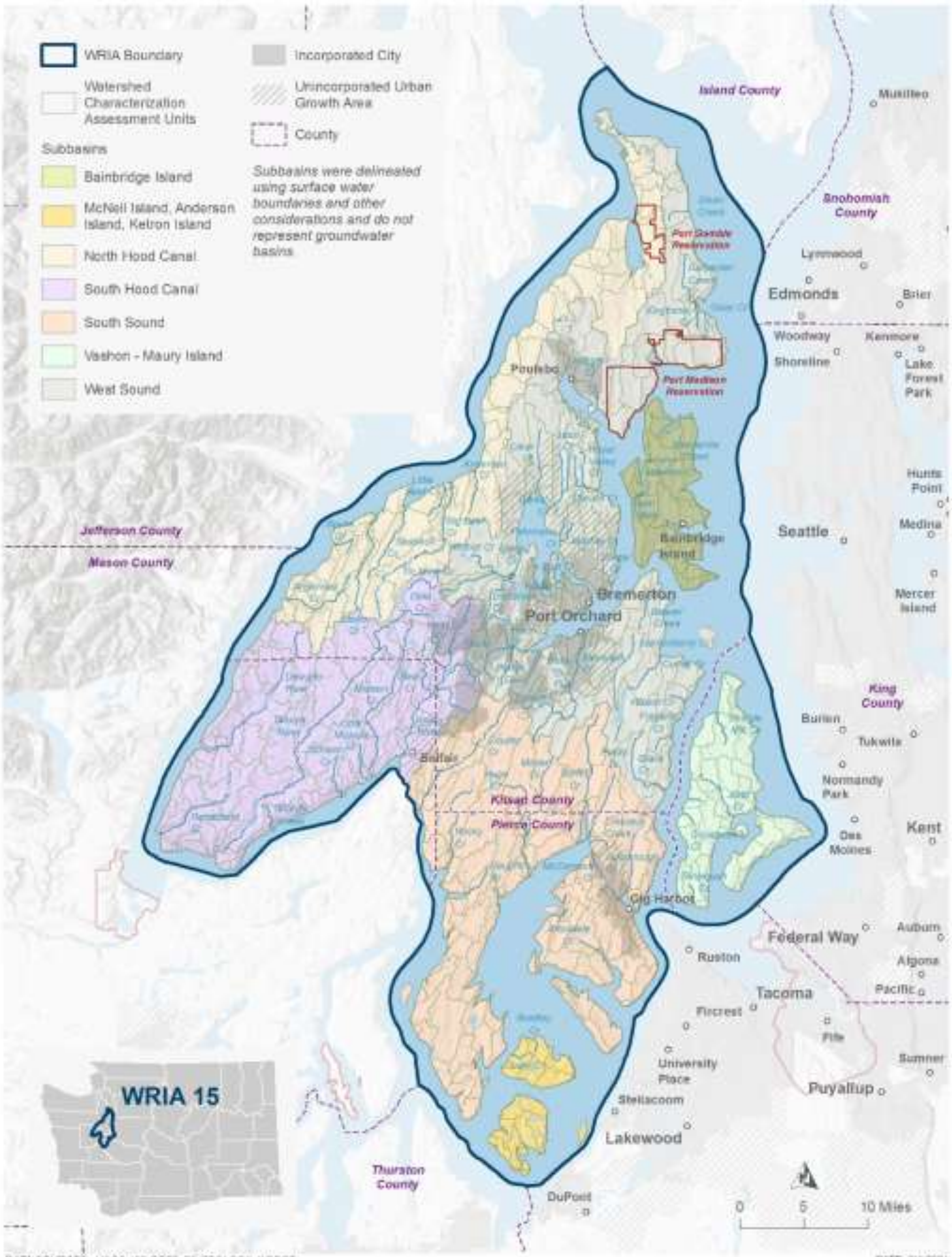

Figure 7. WRIA 15 Subbasin overlay with Watershed Assessment Units. This map represents an example of a more refined analysis for impacts and benefits. Map prepared by HDR.

Table 24 summarizes the entities responsible for implementing the tracking and monitoring recommendation and associated funding needs.

Table 24. Implementation of Tracking and Monitoring Recommendation.

Action	**Entity or Entities Responsible**	**Funding Considerations**
Track building permits issued with PE wells (including new connections).	Ecology (via reporting from counties and cities).	The number of building permits and associated fees are transmitted to Ecology annually. No additional funding is needed.
Maintain an ongoing list and map of new PE wells within each sub-basin.	Ecology	Information included with data on new PE wells, provided by local governments. No additional funding is needed.
Maintain a summary of the status of implementation for each project.	Ecology via the Salmon Recovery Portal, with support from WDFW, RCO, and project sponsors	WDFW may need additional funding to support maintaining the Salmon Recovery Portal.
Maintain a summary of the status of each policy recommendation.	Implementation Group	Additional funding may be needed to gather status updates.

2. Reporting and Adaptation

The Committee recommends that Ecology provides the data collected above to all entities represented on the Committee and other interested parties through annual reporting and a self-assessment as described below. These reports and assessments will help determine whether the plan's recommendations are being implemented and whether they are having the intended impacts.

A. The WRIA 15 Committee recommends annual reporting as follows:
   - By September of each year, Ecology will prepare an annual report that includes:
     - A list of total building permits issued in the prior calendar year along with the total number of associated new domestic PE wells, using the information provided to Ecology by the local jurisdictions.
     - A brief description of the status of WRIA 15 projects and actions included in this plan (descriptions may be drawn from the Salmon Recovery Portal, if available).
       - If the project as implemented differs significantly from the original description or assumptions included in the plan, the annual report will also include an estimate of changes to the offset benefit.

    - Other implementation actions to date, including any changes in approach since the last report and any challenges identified that may require adaptation in plan implementation.
    - The lists of building permits and projects, organized by subbasin, and (if feasible) represented on a map that includes subbasin delineations. Counties are encouraged to provide parcel or other geographic information in their reports to Ecology to support mapping by subbasin.
  - The first annual report should include an estimate of expenses necessary for plan implementation and associated funding options. Funding options could include:
    - Local or state fees, including PE well fees
    - Grants
    - State funding
  - Ecology will share the report with Committee members and other interested parties.

B. The WRIA 15 Committee recommends preparing a self-assessment every five years as follows:
  - By September of 2026, and every five years thereafter during the planning horizon period, Ecology will compile and report (based on available information from previous reports and partners):
    - All cumulative information required in the annual report.
    - Estimated water offset quantities, consumptive use, and instream flow benefits realized through implementation of projects and actions identified in this plan.
    - A comparison of each item above to the original assumptions included in the plan and a summation of overall ecological benefit (i.e., greater than expected, less than expected, or about the same as expected).

C. The WRIA 15 Committee believes a group of engaged stakeholders and tribal representatives are needed to continue collaboration on the implementation of this plan. The Committee recommends continuing to meet as needed, with participation from all interested WRIA 15 representatives.
  - Interested WRIA 15 Committee members, or a new implementation group if established, will convene annually via telephone to:
    - Review and discuss the annual report.
    - Share updates on project and policy implementation.
    - Discuss or develop recommendations for revisions, additions, or deletions to planned projects or actions.
  - Every five years, interested WRIA 15 Committee members, or a new implementation group if established, will hold a series of meetings to conduct the self-assessment, which includes:
    - Reviewing the five-year assessment report from Ecology.

    - Developing recommendations to adapt projects and actions to meet NEB, including reaching the higher offset targets by subbasin.
    - Updating data and assumptions.
    - Other items identified by Committee members.
- Additional meetings may be scheduled as needed.
- Kitsap PUD has offered to play the role of coordinating an implementation group for WRIA 15 using existing capacity and will seek funding opportunities to support their role. Kitsap PUD will convene interested member entities of the Committee to form the implementation group in the summer of 2021. This group will consider the following activities related to plan implementation:
    - Redefining the WRIA 15 Committee, which could include a new name, charter, and/or supporting interlocal agreement.
    - Identifying project development lead(s) and supporting project development;
    - Identifying triggers for adaptive management and developing responses to emerging challenges;
    - Coordinating monitoring and research;
    - Coordinating reporting;
    - Identifying funding mechanisms to provide capacity for the Committee members and facilitator; and
    - Other tasks as needed.

Table 25 summarizes the entities responsible for carrying out the reporting and adaptation recommendation and associated funding needs.

Table 25. Implementation of Reporting and Adaptation Recommendation.

Action	Entity or Entities Responsible	Funding Considerations
Annual Reports	• Local jurisdictions provide building permit information to Ecology. • Ecology compiles information on project status, drawn from the Salmon Recovery Portal. • Entities provide monitoring data to Ecology for inclusion in reports. • Ecology combines monitoring data from within the agency with data provided by other entities. • Ecology compiles information into a single report for distribution to the	• Local jurisdictions are already required to provide building permit information to Ecology (no additional funding needed). • Ecology staff would compile reports using existing resources. • WDFW may need additional funds to manage the Salmon Recovery Portal.

Action	Entity or Entities Responsible	Funding Considerations
	Committee and other interested parties.	
Five-Year Self-Assessment:	• Local jurisdictions provide building permit information to Ecology. • Ecology compiles information on project status, drawn from the Salmon Recovery Portal. • Entities provide monitoring data to Ecology for inclusion in reports. • Ecology combines monitoring data from within the agency with data provided by other entities. • Ecology prepares estimates of the quantity of water, instream flow, and habitat benefits realized through implementation of projects and actions identified in this plan. • Ecology compiles information into a single report for distribution to Committee and other interested parties. • WRIA 15 Committee convenes to prepare adaptation recommendations on changes to planned projects or actions.	• Local jurisdictions are already required to provide building permit information to Ecology (no additional funding needed). • Ecology may need funding to complete the estimate of realized benefits. • State funding or staff support will be needed to reconvene a group to prepare recommendations. • Committee members who cannot participate in meetings using existing resources will need additional funding. • Kitsap PUD may need additional funding to support their role in convening the implementation group.

3. Funding

The WRIA 15 Committee recommends ongoing implementation oversight and a process to adaptively manage the plan as new information emerges. The Committee recommends the Legislature provides funding for monitoring and adaptively managing the plan, including:

- Annual tracking of new PE wells and project implementation by subbasin.
- Staffing for the ongoing Committee.
- Ongoing Committee member participation; and
- Developing a process to adaptively manage implementation if NEB is not being met as envisioned by the watershed plan (e.g., identification and development of alternative projects, etc.).

Table 26 summarizes the entities responsible for carrying out this recommendation and associated funding needs.

Table 26. Summary of WRIA 15 Adaptive Management Funding Recommendation.

Action	**Entity or Entities Responsible**	**Funding Considerations**
Funding of Adaptive Management	Legislature	The Legislature should provide funding and authorize plan implementation to adaptively manage implementation if NEB is not being met as envisioned by the watershed plan.

6.3 Assurance of Plan implementation

The WRIA 15 Committee prepared this watershed plan with the intent that the plan is fully implemented. Members of the Committee provided the following statements to support implementation of the watershed plan:

- Washington Department of Ecology will:
    - Follow NEB Guidance in reviewing the watershed plan and considering plan adoption.
    - Administer the streamflow restoration competitive grant program as authorized under RCW 90.94.060 and Chapter 173-566 WAC.
    - Consider watershed plan recommendations where Ecology is identified as the lead.
    - Report to the Legislature as required under RCW 90.94.050 in 2020 and 2027.
- King County:
    - Supports and participate 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.
- Kitsap County:
    - Contingent on funding and resources, Kitsap County commits as follows in support of the Plan:
        - Participate in annual and 5-year Adaptive Management meetings.
        - Participate in intervening meetings or an implementation group and participate in adaptive management actions to support Plan implementation.
        - Support the Department of Ecology in its compilation of the Plan's 5-year self-assessments.
        - Continue to annually report permit data associated with permit-exempt wells to the Department of Ecology.
        - Continue to collect fees and transmit them to the Department of Ecology per RCW 90.94 for residences constructed with permit-exempt wells.
        - Continue to provide permit and parcel data to the Department of Ecology as needed to support the Plan's capital and non-capital projects, and the Plan's adaptive management activities.

        - Support acquisition of funding from the State Legislature and grant sources for plan implementation.
        - Continue design and implementation of the Kingston Treatment Plant Recycled Water project.
        - Partner with the Washington State Department of Fish and Wildlife (WDFW) and the Great Peninsula Conservancy (GPC) to implement the "Beaver Package" including:
            - Ongoing coordination with WDFW and GPC;
            - Mapping of potential beaver habitat to identify candidate sites for easement protection with the expectation that GPC will lead easement acquisition efforts;
            - Examination of the feasibility and possible adaptation of Kitsap County's transfer of development rights program to support the Beaver Package; and
            - Inclusion of beaver pond presence/absence in stream assets in the County's natural resources asset management system currently in development.
        - Propose and consider language regarding coordination with WRIA-15 WREC Plan in the County's 2024 Comprehensive Plan update
        - Provide infiltration design data for the Koch Creek Regional Stormwater Facility, previously completed, for the purpose of calculating offset value toward the Plan's objectives.
        - Complete the Ridgetop Boulevard Green Street LID Retrofit Phase III and provide infiltration design data for project phases 1, 2, and 3 for the purpose of calculating offset value toward the Plan's objectives.
        - Support and consent to the acquisition of Port Gamble Heritage Park timber rights for forest health, preservation, and restoration purposes, subject to existing agreements that may encumber the properties.

- Mason County will:
    - Support collaboration among WRIA 15 members to implement a comprehensive strategy for balancing competing demands for water, while at the same time preserving and enhancing the future integrity of the WRIA 15 watershed basin.
    - Adopt this watershed plan by resolution, formalizing our support of the plan contents.
    - Support and participate in implementation activities, as staff capacity and funding 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.

- Pierce County will:
    - Approve this watershed plan by resolution, formalizing our support of the plan contents.
    - Watershed plan becomes one of the guiding project implementation plans for the Surface Water Improvement Plan (SWIP).
    - Evaluate and prioritizes capital projects included in this plan for placement into the Capital Facilities Plan.
    - Support and participate in implementation activities as staff capacity allows, including:
        - Participating in annual 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 Bremerton will:
    - Support and participate in implementation activities, as staff capacity allows, including participating in annual implementation group meetings.
- Squaxin Island Tribe will:
    - Participate in implementation group meetings.
    - Support project development and seek project opportunities.
    - Seek and support funding opportunities that support implementation.
    - Monitor implementation and identify areas for improvement.

Chapter Seven: Net Ecological Benefit Evaluation

7.1 Water Offsets

This watershed plan projects a total of 5,568 new PE wells to be installed within WRIA 15 during the planning horizon, resulting in an estimated 766.4 AF/yr of new consumptive water use in WRIA 15. However, the Committee sought projects to offset 1,218 AF/yr, a higher target that reflects use of the 95% upper confidence limit of the average measured irrigated area (see Chapter 4). This higher offset target provides greater certainty that streams are benefited. Although there was not consensus around the higher offset target, the Committee to reach consensus that achieving an offset target of 1,218 AF/yr would be beneficial to streams.

The Committee's approach was to develop a list of potential offset projects that exceed the anticipated impacts by a margin large enough to give reasonable assurance that this plan will be successful over the planning timeline. The watershed plan demonstrates that the water offset project portfolio, if implemented, can succeed in offsetting consumptive use impacts at the WRIA scale.

If implemented as intended, the projects will provide offset benefits as presented in this watershed plan and would exceed the consumptive use estimate at the WRIA scale by 310.3 AF/yr. However, the Committee set a goal of offsetting consumptive use estimates by subbasin, and the watershed plan falls short in the South Hood Canal and South Sound subbasins, in part due to the approach to account for certainty that a project will be implemented. Estimated project offset potential was discounted by 90% for longer term and highly conceptual projects with greater uncertainty of implementation. Water offset potential for more certain MAR projects were discounted by 20% to 50%.

This watershed plan also does not achieve the higher WRIA wide target with a deficit of 141.3 AF/yr. The higher offset target is not achieved in five of seven subbasins. However, the adaptive management and implementation approaches laid out in Chapter 6.2, including a robust project tracking protocol, will help to ensure that projects are identified, developed and implemented throughout the watershed to address offset needs across the numerous small streams.

In summary, while this watershed plan demonstrates the water offset portfolio will offset consumptive use impacts at a WRIA scale, it is unlikely to meet the goal of some Committee members for offset benefit by subbasins. Adaptive management will be necessary to achieve the goal of meeting offset needs within each subbasin and improving streamflow where this watershed plan currently falls short, through the identification, development and implementation of projects throughout WRIA 15.

The projects identified in this watershed plan are consistent with the project type examples listed in the Final NEB Guidance: (a) water right acquisition offset projects; (b) non-acquisition water offset projects; and (c) habitat and other related projects (Ecology 2019b). Chapter 5 presents projects in the following four categories:

I. Water right acquisition offset projects and non-acquisition water offset projects that are ready to proceed. These projects provide a quantitative streamflow benefit.

II. Projects that provide habitat and streamflow benefits, but streamflow benefits are difficult to quantify.

III. Projects that primarily benefit habitat.

IV. Projects that currently are not implementable (e.g., legal restriction) or are highly conceptual.

Projects in Category I are described in Chapter 5, Tables 16-22 and used to estimate a total water offset for WRIA 15. Projects in Categories II-IV are presented in the project inventory in Appendix H and support this watershed plan in meeting NEB. The WRIA 15 Committee recommends implementation of projects in Chapter 5 as well as the project inventory in order to offset consumptive use and achieve NEB for WRIA 15. Figure 8 presents a map summarizing project location for all projects.

The WRIA 15 Committee projects a total water offset of 1,076.7 AF/yr from Category I water offset projects if implemented as intended (described in Chapter 5 and listed in Tables 16-22), a surplus offset of 310.3 AF/yr above the consumptive use estimate and 141.3 AF/yr below the higher offset target. Consumptive use and the higher offset target are compared to Category I project offsets at the subbasin scale in Table 27. Surplus water offset is achieved in all but 2 subbasins (South Hood Canal and South Sound). When looking at the higher offset target based on a high growth scenario, a deficit in water offset occurs in a total of 5 of 7 subbasins (Bainbridge Island, South Sound Islands, South Hood Canal, South Sound and Vashon-Maury Island).

Table 27. Subbasin Water Offset Totals from Category I Projects Compared to Permit-Exempt Well Consumptive Use Estimates and Offset Targets. The projected new consumptive water use associated with the new PE well connections is 123 gallons per day (gpd) which equals 766.4 acre-feet per year (1.06 cubic feet per second [cfs] or 684,150 gpd) in WRIA 15. This watershed plan also sets an offset target of 1,218 acre-feet per year (equivalent to 177 gpd per connection) for project implementation in order to benefit streams

Subbasin	Offset Project Totals (AF/YR)	Consumptive Use Estimate (AF/YR)	CU Estimate Surplus/ Deficit (AF/YR) [3]	Higher Offset Target – (AF/YR) [1,2]	Higher Target Surplus/ Deficit (AF/YR) [3]	County
Bainbridge Island	67.6	67.6	0	102	-34.4	Kitsap
South Sound Islands	7	5.2	+1.8	11	-4	Pierce
North Hood Canal	263.5	90.3	+173.2	136.5	+127	Kitsap
South Hood Canal	130.2	155.0	-24.8	223	-92.8	Kitsap and Mason
South Sound	173.5	213.8	-40.3	394.6	-221	Pierce and Kitsap
Vashon - Maury Island	69.9	50.7	+19.2	73	-3.1	King
West Sound	365	183.9	+181.1	278	+87	Kitsap
WRIA 15 Total	**1076.7**	**766.5**	**+310.2**	**1218**	**-141.3**	

Notes:
[1] Values in table have been rounded, which is why totals may differ. AF/Yr in 2038
[2] Offset Target is equivalent to PE consumptive use associated with high growth scenario and increased irrigated acreage to reflect uncertainty in estimates
[3] Surplus water offset is associated with a positive value and a deficit in water offset is associated with a negative value. Surplus and Deficit equal to Offset Project Totals less Offset Target.

The water offset projects listed in Tables 16-22 in Chapter 5 provide additional benefits to instream resources beyond those necessary to offset the impacts from new consumptive water use within the WRIA. For the project types planned in WRIA 15, additional benefits could include the following:

- Water right acquisition projects: Aquatic habitat improvements during key seasonal periods; reduction in groundwater withdrawals and associated benefit to aquifer resources; and/or beneficial use of reclaimed water. Many water right acquisition opportunities in WRIA 15 are associated with land acquisitions which provide additional conservation-related habitat benefits.
- MAR projects: Aquatic habitat improvements during key seasonal periods; increased hydration of wetlands and headwaters; increased groundwater recharge; reduction in summer/fall stream temperature; increased groundwater availability to riparian and near-shore plants; and/or contribution to flood control. Improvements to water quality may also occur as a result of infiltration.
- Community Forests Projects: Conservation, preservation and protection will increase habitat value of existing forestland. May include restoration of streams, riparian areas and wetlands.
- Raingarden and LID, projects: Provide habitat for wildlife and improvement of water quality.
- Stormwater projects: Water quality improvements and erosion control benefits.

7.2 Benefits from Category II-IV Projects

The WRIA 15 watershed plan includes an inventory of additional projects to meet the offset needs and NEB for the watershed. The remaining categories include the following:

II. Projects that provide habitat and streamflow benefits, but streamflow benefits are difficult to quantify.

III. Projects that primarily benefit habitat.

IV. Projects that currently are not implementable (e.g., legal restriction) or are highly conceptual.

There are 61 projects included in the project inventory that will support the watershed plan in meeting NEB. The projects are presented in the project inventory in Appendix H. Table 23 in Chapter 5 summarizes the number of Category II and IV projects and the respective benefits of those projects by subbasin. Habitat improvement attributes associated with these projects include a combination of aquatic habitat restoration and protection, stream augmentation, riparian restoration, reclaimed water expansion, managed aquifer recharge, stormwater management, and other types of projects.

These projects provide additional benefits to instream resources that, together with direct water offsets, are beyond those necessary to offset the impacts from new consumptive water use within the WRIA. These additional benefits include increased hydraulic/aquatic habitat diversity, restored native vegetation, restored water temperature, erosion abatement, improved spawning and rearing habitat, improved passage, and water quality benefits, among others.

Factors limiting salmonid distribution and survival in WRIA 15 are summarized in Chapter 2.1.3. Habitat and water offset projects in the plan address all limiting factors throughout the basin with the exception of fish passage barriers (as determined by Committee), and in some circumstances, the lack of large wood. Highest priority for freshwater areas such as Chico, Minter, and Rocky Creeks is to protect and/or restore hydrologic and riparian functional integrity. In Hood Canal subbasins, the loss of channel complexity, lack of riparian forest and high water temperatures in Union and Tahuya Creeks are of most concern. In creeks such as Dewatto, Anderson and Big Beef, loss of floodplain habitat and channel complexity, hydrologic regime, and channel instability and erosion are the most limiting for species recovery.

The watershed plan also includes a number of policy recommendations, described in Chapter 6. Some of these recommendations are expected to result in additional benefits to habitat, fish and wildlife. Benefits include reduced water consumptive, increased water conservation, improved water quality, habitat protection and restoration, and direct streamflow benefits.

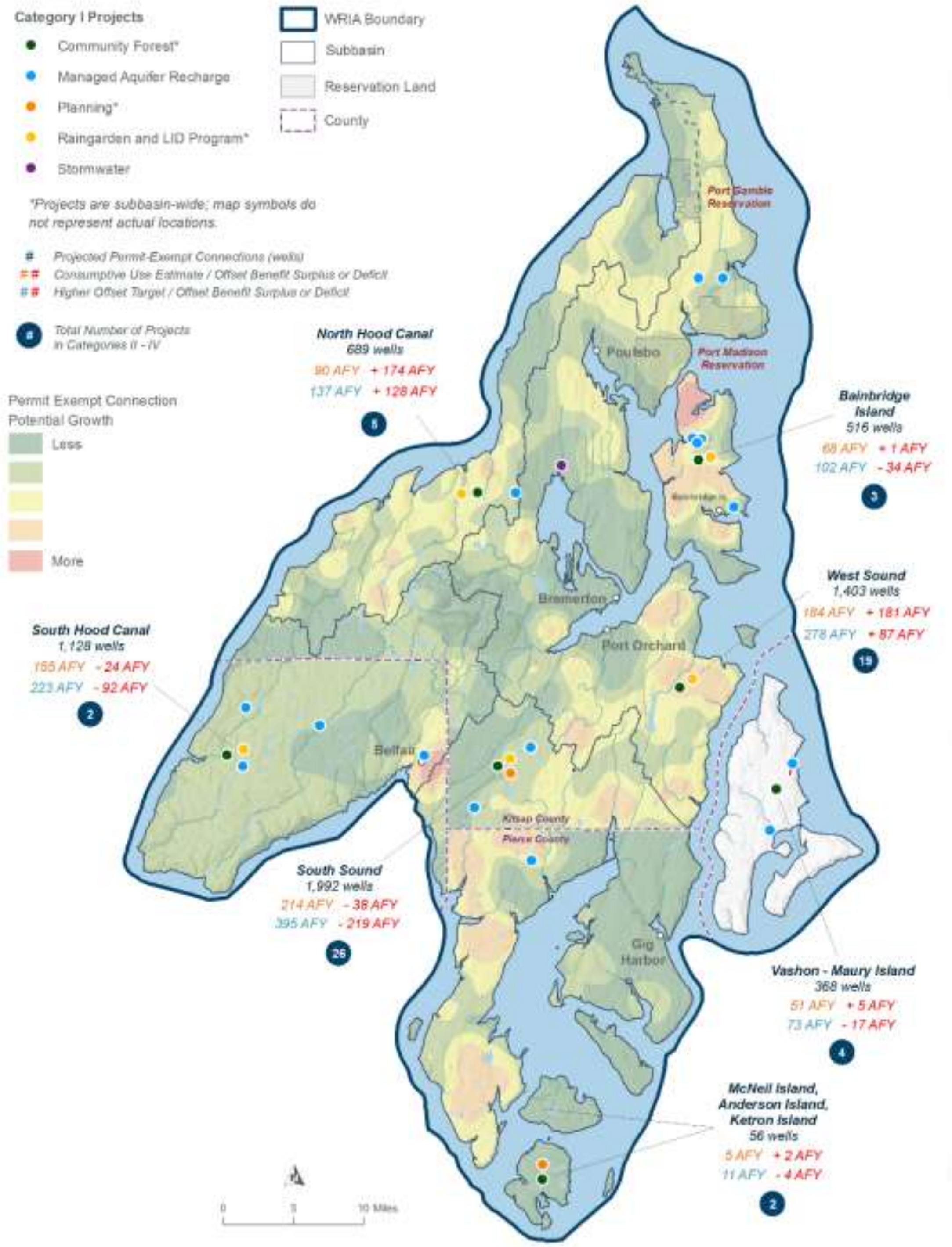

Figure 8. Proposed Category I-IV projects and anticipated offset benefits for WRIA 15. Map prepared by HDR.

7.3 Adaptive Management

The WRIA 15 Committee identified a number of challenges related to watershed plan implementation. These challenges include the impact of climate change, uncertainty in consumptive use estimates, uncertainty in offsets associated with specific project types, project implementation challenges, narrowness in the scope of the watershed plan, and other factors. This watershed plan recommends adaptive management measures for the purpose of addressing uncertainty in plan implementation (See Chapter 6.2). Implementation recommendations include increased legislative funding for plan implementation and funding for adaptive management, funding and project implementation tracking, PE well tracking and reporting, continued monitoring of streamflow and groundwater levels, and project effectiveness monitoring. These measures, in addition to the project portfolio and associated benefits described in Chapter 5, increase the resiliency of the plan and increase the certainty that sufficient additional water from projects is available to achieve NEB by protecting, restoring and enhancing streamflows in addition to offsetting new consumptive use from PE wells anticipated during the planning horizon. Through the WRIA 15 adaptive management and implementation approach described in Chapter 6, the implementation group will be able to help achieve the goals of the Committee, particularly the shortcomings of meeting the higher offset target by subbasin and restoring and enhancing streamflows. Through adaptive management, the implementation group can find, develop and implement projects closest to the anticipated impact from PE wells.

7.4 NEB Evaluation Findings

The WRIA 15 watershed plan provides projects that, if implemented as intended, can offset an estimated 766.4 AF/yr of new consumptive water use and come close to offsetting a higher target of 1,218 AF/yr. The watershed plan primarily achieves this offset through a total of 29 water offset projects with a cumulative offset projection of 1,076.7 AF/yr. The estimate of cumulative water offset is conservative in that the calculated water offset potential of a project was discounted by 20-90% based on the level of uncertainty associated with its implementation (see Chapter 5). The projected water offset from all projects, after accounting for the discount, yields a surplus offset of 310.3 AF/yr above the consumptive use estimate of 766 AF/yr and a deficit of 141.3 AF/yr below the higher offset target of 1,218 AF/yr in WRIA 15. On a subbasin basis, the watershed plan provides projects that will offset consumptive use in 5 of 7 subbasins and offset the higher target in 2 of 7 subbasins.

Within this watershed plan, water offset projects are complimented by a total of 61 habitat improvement projects, which provide numerous additional benefits to aquatic and nearshore habitat. While many of these habitat improvement projects have potential streamflow benefits, the WRIA 15 Committee chose to exclude any associated water offset from the watershed plan's accounting due to uncertainty in quantifying the benefit. Water offset projects are further complimented by the policy and regulatory recommendations addressed in Chapter 6.

The projects in this plan have not been prioritized for funding and implementation at this time. As project sponsors pursue project implementation, it is possible that some projects in this plan will not be constructed due to feasibility and design constraints, or other factors. The WRIA 15 Committee has recommended adaptive management measures to provide greater certainty that the watershed plan will adequately address new consumptive use impacts anticipated during the planning horizon. Adaptive management can also address unforeseen future developments, climate change, and provide additional water for streams, despite inevitable challenges that will arise during project implementation, operation, and maintenance.

This WRIA 15 watershed plan describes projects, which if implemented as intended, can offset the anticipated new consumptive use over the planning horizon and achieve NEB. The WRIA 15 Committee developed the WRIA 15 watershed plan to the best of the Committee's ability given the limitations of the timeline and resources. The Committee developed the watershed plan to meet NEB, and as this chapter describes, the watershed plan provides ecological benefits in many ways. The WRIA 15 Committee is leaving the final NEB determination to Ecology.

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Glossary

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 Flows and Instream Flow Rule (IFR): Instream flows are a specific flow level measured at a specific location in a given stream. Seasonal changes cause natural stream flows to vary throughout the year, so instream flows usually vary from month to month rather that one flow rate year-round. State law requires that enough water in streams to protect and preserve instream resources and uses. The Department of Ecology sets flow levels in administrative rules. Once instream flow levels are established in a rule, they serve as a water right for the stream and the resources that depend on it. Instream flow rules do not affect pre-existing, or senior, water rights; rather, they protect the river from future withdrawals. Once an instream flow rule is established, the Department of Ecology may not issue water rights that would impair the instream flow level. (ECY)

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 (Addresses 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 "surfboard", 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)

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

Appendices

Appendix A – Committee Roster

Entity Representing	Primary Representative Name	First Alternate Name
Kitsap County	Dave Ward	Kathy Peters
Mason County	Randy Neatherlin	Kevin Shutty, David Windom
Pierce County	Dan Cardwell	Austin Jennings
Puyallup Tribe	David Winfrey	
Skokomish Tribe	Alex Gouley	Seth Book, Dana Sarff
Squaxin Island Tribe	Jeff Dickison	Paul Pickett
Suquamish Tribe	Leonard Forsman	Alison O'Sullivan
Port Gamble S'Klallam Tribe	Sam Phillips	Paul McCollum
City of Port Orchard	Jacki Brown	Mark Dorsey, Zach Holt
City of Bremerton	Teresa Smith	Allison Satter
City of Gig Harbor	Trent Ward	Jeff Langhelm, Brienn Ellis
City of Bainbridge Island	Michael Michael	Christian Berg
Kitsap Public Utility District	Joel Purdy	Mark Morgan
Department of Fish and Wildlife	Brittany Gordon	Nam Siu
Department of Ecology	Stacy Vynne McKinstry	Stephanie Potts
King County	Greg Rabourn	
Kitsap Building Association	Russ Shiplet	Ellen Ross-Cardoso
Kitsap Conservation District	Joy Garitone	Brian Stahl
Great Peninsula Conservancy	Nathan Daniel	Erik Steffens
Mason-Kitsap Farm Bureau *ex officio*	Larry Boltz	
Washington Water Service *ex officio*	Shawn O'Dell	

Appendix B – Operating Principles

Watershed Restoration Enhancement Committee

Water Resource Inventory Area (WRIA) 15

Operating Principles

Approved Version Sent for Signature February 12, 2019

Revised and Approved August 6, 2020

SECTION 1: PURPOSE

The purpose of the operating principles is to establish the watershed restoration and enhancement committee, as authorized under RCW 90.94.030, for the purpose of developing the watershed restoration and enhancement plan. The document sets forward a process for meeting, participation expectations, procedures for voting, structure of the Committee, communication and other needs in order to support the Committee in reaching agreement on a final plan.

SECTION 2. AGREEMENT AND AMENDMENTS TO THE OPERATING PRINCIPLES

The formal establishment of an agreement to the operating principles will take place via a member decision, with all members of the watershed restoration and enhancement committee (Committee) approving the operating principles. Participants will work in good faith to participate productively in the development of the operating principles. By approving the operating principles, members of the Committee agree to uphold the principles as outlined in this document.

The Committee may review the operating principles periodically. Any member of the Committee may bring forward a recommendation for an amendment to the operating principles. Amendments will be brought for discussion when a quorum (2/3 of the membership) is present and take effect only if decided on unanimously by the full Committee for inclusion in the operating principles.

Nothing contained herein or in any amendment developed under the Agreement shall prejudice the legal claims of any party hereto, nor shall participation in this planning process abrogate any party's authority or the reserved or other rights of tribal governments, except where the obligation has been accepted in writing.

SECTION 3.PARTICIPATION EXPECTATIONS AND GROUND RULES

Participation expectations

Each entity invited by Ecology to participate on the Committee, and which has responded indicating their commitment to participate, shall identify a representative and up to two alternates to participate on the Committee. Committee members will, in good faith and using their best professional judgement:

- Actively participate in Committee meetings;
- Review materials in preparation for the meetings;
- Review materials following the meetings;
- Engage in workgroups (if applicable);
- Come prepared for discussions and decisions (when applicable); and
- Commit to implementing the Committee ground rules (see below).

The chair will consult with the Committee to ensure that adequate time is given for review of materials. The chair will provide meeting materials at least 7 days before meetings, with additional time given for longer documents. The chair recognizes that members may need to discuss decisions with their organizations prior to bringing forward a decision to the Committee and the chair and facilitator will work with Committee members to establish reasonable review time for materials prior to reaching a decision. Members of the Committee will actively work with their decision making authorities to receive feedback on decisions in a timely manner as to not delay decisions coming before the Committee. When possible, Committee members will provide the chair reasonable notice if additional review time is needed prior to making a decision.

Committee meetings will take place on a monthly basis for an initial period, with the interval of meetings being modified as needed to meet the deadlines (either more or less frequently). The chair will hold meetings at a convenient location in the watershed. Meetings are expected to last for approximately 4 hours, with the length modified as needed to meet deadlines.

The chair or facilitator will contact Committee members that miss meetings. A lack of participation does not mean the process to develop the plan will be stalled. However, it is recognized that if a quorum is not present, meetings may be cancelled or decisions postponed which may impact the overall timeline for plan approval. If an entity misses multiple meetings, the chair or facilitator will work with the entity to identify reasonable accommodations to support reengagement.

Remote Participation

It is the expectation that Committee representatives shall attend all meetings in person. In person participation is essential to efficiency, clarity, and honest communication. Although it should not be routine, remote participation can be accommodated when necessary to facilitate Committee member participation and when possible given technology availability. Remote participants may engage in decision-making; however the primary purpose of remote participation is listening to the Committee meeting, as it may be difficult to fully participate in discussion. If there are difficulties with technology, the chair's priority is to continue the meeting with the in-person participants and not delay the meeting to address technology challenges. Representatives are strongly encouraged to attend meetings in-person.

The Committee chair will allow for remote participation (e.g. via phone, web, video conference) if:

- Notice is provided to the chair or facilitator at least 1 week in advance of the meeting (except in the case of emergencies such as illness, weather event, etc.), AND

- Representative and alternates are not available to attend in person, AND
- Meeting room accommodates remote participation.

If extraordinary events, such as a pandemic or natural disaster, require the committee to meet remotely, all meetings will be held remotely and the operating procedures will remain in force, except portions that assume in-person versus remote participation.

Ground rules

Water management is inherently complicated and the Committee is striving for consensus on the watershed restoration and enhancement plan. Therefore, given the range of members' diverse perspectives, the Committee has established the following to ensure good faith and productive participation amongst its members:

1. **Be Respectful**
    - Listen when others are speaking. Do not interrupt and do not participate in side conversations. One person speaks at a time.
    - Recognize the legitimacy of the concerns and interests of others, whether or not you agree with them.
    - Cooperate with the facilitator to ensure that everyone is given equitable time to state their views. Present your views succinctly and try not to repeat or rephrase what others have already said.
    - Silence cell phones and limit use of cell phones and laptops during the meeting.
    - Respect other communication styles and needs.
    - Assume good intent of other Committee members.
2. **Be Constructive**
    - Participate in the spirit of giving the same priority to solving the problems of others as you do to solving your own problems.
    - Share comments that are solution focused. Avoid repeating past discussions.
    - Do not engage in personal attacks or make slanderous statements. Do not give ultimatums.
    - Ask for clarification if you are uncertain of what another person is saying. Ask questions rather than make assumptions.
    - Work towards consensus. Identify areas of common ground and be willing to compromise.
    - Minimize the use of jargon and acronyms. Attempt to use language observers and laypersons will understand.
    - It is okay to disagree, but strive to reach common ground.
3. **Be Productive**
    - Adhere to the agenda. Respect time constraints and focus on the topic being discussed.
4. **Bring a Sense of Humor and Have Fun.**

Interpersonal conflict resolution

In the event a conflict arises amongst members or established workgroups of the Committee, the following steps should be taken by individuals:

1. Communicate directly with the person or persons whose actions are the cause of the conflict.
2. If the circumstance is such that the person with a conflict is unable or unwilling to communicate directly with the person or persons whose actions are the cause of the conflict, the person shall speak with the Committee chair and facilitator.
3. The conflict should first be brought up verbally. If this does not lead to satisfactory resolution, the impacted parties should describe the conflict in writing to the chair.
4. If such matters are brought to the chair and facilitator, the chair in consultation with the facilitator, will address the conflict as appropriate and may seek outside or independent assistance as needed.

SECTION 4. ALTERNATES, EX OFFICIO MEMBERSHIP AND WORKGROUPS

Alternates

Committee members shall provide to the chair, in writing, up to two designated alternate committee members from their organization or government. Committee members shall inform the chair in writing of any changes to the main representative or alternates. If the primary representative cannot attend a meeting, they should, if possible, send the designated alternate and notify the Committee chair and the facilitator as early as possible. It is the responsibility of the primary representative to brief the alternate on previous meetings and key topics arising for discussion in order for the alternate to participate productively.

Representatives may call on alternates that attend the meeting at any time to speak. Only one representative from the government or entity shall sit at the table and participate in a decision. If the primary representative and alternates are no longer able to attend (staffing change, ongoing scheduling conflicts), the government or organization shall work with the chair to quickly identify alternative representation from the same government or organization. If no alternative representative is available from the government or organization, an alternate entity that can represent the same interest is allowed and shall be brought forward by the departing entity to the chair for approval. Replacement members are subject to latecomer provisions.

Latecomers

Ecology invited all entities identified in 90.94.030 to participate on the Committee and all entities in WRIA 15 have accepted the invitation to participate. A replacement entity is allowed to join the Committee at a later date under the following conditions:

1. The entity cannot request to revisit items previously decided on by the Committee;
2. The entity signs an intent to participate, provides primary and alternate Committee representatives;
3. The entity agrees to and abides by the operating principles; and

4. The entity joins the Committee and participates in meetings no later than six months prior to final plan approval.

Removal from the Committee

Entities must participate in the committee process after September 1, 2020 to retain membership on the committee. If an entity does not attend at least one committee or workgroup meeting over any three-month period it will be assumed they have withdrawn from the committee and will be removed as members, unless the member provides a written explanation and requests to remain on the committee. The Chair, via electronic communication, will inform any committee member who has not been participating for two months with this information to provide a minimum of one-month notice before removal.

Resignation from the Committee

If an entity no longer wishes to participate in the committee process or the final plan approval, they should send written notice (electronic or mailed notice) to the chair as early as possible prior to their resignation. Advance notice will support the chair and facilitator in managing consensus building and voting procedures.

Ex-Officio and Ad-Hoc Members

The Committee may decide by full consensus to invite an additional entity to join the Committee as an *ex officio* non-voting member. *Ex Officio* members are invited to sit at the Committee table and participate actively in discussions and review of documents, but shall not make decisions on any items.[38] Ex-officio members shall adhere to the operating procedures.

The Committee may decide by consensus to invite an individual or organization to participate in select meetings or agenda items where additional expertise or perspective is desired. Ad hoc members will be invited by the chair to sit at the Committee table, participate actively in discussions, and review of documents for the specified agenda items. They shall not make decisions on any items.

Workgroups and Advisory Groups

The Committee may establish workgroups or subcommittees as it sees fit. Workgroups may be temporary, established to achieve a specific purpose within a finite time frame, or a standing workgroup addressing the goals of the Committee. The decision to form a workgroup is not required by the legislation and may be developed at the discretion of the Committee or the chair in order to support Committee decision making. All Committee workgroups are workgroups of the whole, meaning their role is to support the efforts of the Committee and all Committee members are welcome to participate in any workgroup formed by the Committee. The chair or Committee may also engage established workgroups in the watershed or invite non-Committee members to participate on the workgroups if they bring capacity or expertise not available on the Committee. No binding decisions will be made by

[38] Ecology leadership has determined that additional voting members will not be invited to join the committees in order to stay true to the legislation and keep the Committee size manageable. However, the Committee may decide to include non-voting members if they choose.

the workgroups; all issues discussed by workgroups shall be communicated to the Committee as either recommendations or findings as appropriate. The Committee may, or may not, act on these workgroup outcomes as it deems appropriate.

SECTION 5. ROLE OF THE CHAIR AND COMMITTEE SUPPORT

RCW 90.94.030 (2b) states that "The department shall chair the watershed restoration and enhancement committee…" Ecology's streamflow restoration implementation lead chairs the Committee on behalf of the agency. In the event that the chair is unable to attend a scheduled meeting due to illness or other unanticipated absence, Ecology will designate an interim chair to avoid cancelling the meeting. The interim chair may make decisions coming before the Committee.

The chair shall make decisions on all items coming before the Committee.[39] The role of the chair is to help the Committee complete the plan with the goal to attain full agreement from the Committee members. If full agreement cannot be obtained, the chair shall ensure all opinions inform future decision making for the final plan.

The chair, with assistance from Ecology technical staff, contractors, members of the Committee, and/or workgroups, shall prepare the watershed restoration and enhancement plan for the Committee's review, comment, and approval.

Ecology may provide the Committee a facilitator. The role of the facilitator is to focus on process and support the Committee in productive discussions and decision-making. Ecology will provide administrative support for the Committee as well as technical assistance through Ecology staff and consultants.

Ecology may provide the Committee with technical support in the form of Ecology staff or hired consultants. Ecology will seek input from the Committee on consultant selection prior to entering into contract.

SECTION 6. DECISION MAKING

This planning process, by statutory design, brings a diversity of perspectives to the table. It is therefore important the Committee identifies a clear process for how it will make decisions. Committee members shall always strive for consensus, and when consensus cannot be reached, the chair and facilitator will document agreement and dissenting opinions. The reason why Committee members will strive for consensus is that the authorizing legislation requires that final plan itself must be approved by all members of the Committee prior to Ecology's review (RCW 90.94.030[3] "…all members of a watershed restoration and enhancement committee must approve the plan prior to adoption"). Therefore it

[39] RCW 90.94 (3) states that "the department shall prepare and adopt a watershed restoration and enhancement plan for each watershed listed under subsection (2)(a) of this section, in collaboration with the watershed restoration and enhancement committee. Except as described in (h) of this subsection, all members of a watershed restoration and enhancement committee must approve the plan prior to adoption." Based on input from the Attorney General's office, because Ecology is a member of the Committee and must ultimately vote on whether or not to approve the plan, Ecology shall vote on all items coming before the Committee.

follows that consensus during the foundational decisions upon which the plan is constructed will serve as the best indicators of the Committee's progress toward an approved plan.

Quorum

A quorum is constituted when two-thirds of the entities represented on the Committee are present (either in person or on the phone). A quorum must be present for decisions to occur. Each member of the Committee may record a single formal opinion.

Decisions leading up to the final plan approval

In recognition that consensus can be difficult to achieve and in some cases decisions need to be made within a limited period of time to stay on track to meet the plan deadline, the following process will be used to make decisions leading up to plan approval:

1. The Committee will strive toward consensus.[40] The levels of consensus include:
    - I can say an unqualified "yes"!
    - I can accept the decision.
    - I can live with the decision.
    - I do not fully agree with the decision; however, I will not block it.
2. The Committee will spend adequate time[41] for substantive discussion of issues prior to asking for a decision. After substantive discussion, the chair will ask consensus.
3. When consensus cannot be reached, the facilitator will identify the members in disagreement[42] at the meeting. The chair and/or facilitator will support coordination of the following actions, but the responsibility is on the disagreeing members. Disagreeing members agree to:
    a. meet within seven days of the meeting;
    b. develop a summary paper on the issue and needs; and
    c. develop a draft timeline for resolution or a recommendation back to the Committee.

    As appropriate, the chair and/or facilitator will work with the parties in disagreement to reach a resolution using whatever means are necessary and within reason (in person meetings, conference calls, identifying additional research needs, etc.). Members unable to reach consensus must agree to work cooperatively with the chair and facilitator in this process. The Committee recognizes that flexibility is needed in terms of timeline and presentation of

[40] Definition of Consensus: Consensus is a group process where the input of everyone is carefully considered and an outcome is crafted that best meets the needs of the group as a whole. The root of consensus is the word consent, which means to give permission to. When members consent to a decision, they are giving permission to the group to go ahead with the decision. Some members may disagree with all or part of the decision, but based on listening to everyone else's input, all members agree to let the decision go forward because the decision is the best one the entire group can achieve at the current time.

[41] The chair will identify definitive deadlines by which decisions need to be made in order to say on track to meet the plan deadline.

[42] If much of the group is in agreement and only one or two members are in disagreement, individuals may be selected to negotiate on behalf of the larger group.

resolution depending on the nature of the disagreement. If requested, Ecology may provide a facilitator to help develop the compromise language.

4. If the compromise fails to reach consensus within the identified timeline, the Committee will agree to allow the process for developing the plan to move forward while the work toward consensus continues. The Committee agrees to revisit decisions where consensus is not reached at a later date.
5. Throughout the process, the chair and facilitator will ensure that areas of concern and disagreement are documented within meeting summaries and other materials as necessary.

Decision process

- Thumbs up – approval
- Thumbs down – disapproval
- Thumbs sideways – (accept, can live with, will not object)
- Five fingers – abstain

The facilitator will record all decisions and, where there are dissenting or ambivalent opinions, the meeting summary will document the concerns.

Conflict of Interest

Committee members shall abstain from making a decision if they have a vested personal financial interest in a decision. The committee acknowledges that each entity represents stakeholders that have an interest in the outcomes of this process.

Electronic decision making

In the case a decision is needed prior to the next Committee meeting, the chair can request a opinion or decision via email or survey. This approach will only be used for time-critical items or when a quorum was not present to come to a decision. The chair will allow a minimum of 3 working days for responses. A non-response is considered an “abstention”.[43]

The result of an electronic decision will be reported at the next Committee meeting and the chair or facilitator may request a decision to reaffirm the electronic decision.

Straw poll

From time to time, the chair or the facilitator may ask for a straw poll to gather information on group needs. These polls do not need to follow the formal decision-making protocols of this section. Informal polls will be used solely for information-gathering and will not result in a decision.

[43] If an ‘out of office’ message is received for the primary representative, the alternate representative(s) will be contacted. The chair and facilitator will make at least 3 points of contact with each Committee member and alternates before marking them as an abstention (e.g. phone, email, text).

Letters of Support for Projects

The Committee may choose to submit a letter of support for streamflow restoration projects applying for funding through Ecology's Streamflow Restoration Funding program or other sources. The decision to submit a letter of support on behalf of the Committee shall be by consensus. If the Committee does not approve a letter of support for a project, individual Committee representatives may submit a letter of support from their entity or government.

Final approval of the plan

RCW 90.94 (3) states that "… all members of a watershed restoration and enhancement committee must approve the plan prior to adoption." This means that each and all committee members get to record their decision (quorum is not applicable for final approval) and that all committee members must support the plan in order for it to be approved and provided to Ecology for "net ecological benefit"[44] review and potential adoption by Ecology.[45]

The final plan approval will be shown by hands:

- Thumbs up – approval
- Thumbs down – disapproval

The final plan approval may also be given verbally or in writing when in-person participation is not possible:

- Approve
- Disapprove

The facilitator will record all decisions.

SECTION 7. PUBLIC COMMENTS AND PUBLIC MEETING NOTICE

The agenda will provide time for public comment at each meeting. Members of the public may only speak during public comment. The chair and facilitator will determine the time and extent of the public comment period based on the agenda for each meeting, with input from the Committee. While the Committee is not explicitly required to follow the requirements of the Open Public Meetings Act, reasonable efforts will be made to post information and materials on the pertinent website in a timely manner to keep the public informed.

SECTION 8. COMMITTEE AND MEDIA COMMUNICATION

To support clear communication with the Committee, Ecology will:

[44] Per RCW 90.94, Ecology shall review the watershed restoration and enhancement plan to ensure it meets net ecological benefit. Ecology shall provide the Committee with a definition and guidance of net ecological benefit.
[45] RCW 90.94.030 does not require local jurisdiction approval prior to plan adoption.

1. Operate a listserv for Committee members and interested parties;
2. Develop and manage a website for members of the Committee to access documents such as agendas, meeting summaries, technical reports, calendar, and other items as requested by the Committee;
3. Conduct briefing calls with the Committee ahead of each meeting; and
4. Conduct follow up calls with Committee members unable to attend meetings or with differing opinions.

The facilitator and Ecology shall prepare, distribute and post on the Committee webpage a written meeting summary for each Committee meeting within 10 business days of the last Committee meeting. The summary, at a minimum, will include a list of attendees, decisions, discussion points, assignments, and action items. If comments are cited in such summaries, each speaker will be identified as appropriate or requested. Meeting summaries will capture areas of agreement and disagreement within the group. The Committee will approve the meeting summary at the following meeting.

Communication with the media

When speaking to the media or other venues, the Committee members will clearly identify any opinions expressed as their personal opinions and not necessarily those of the other Committee members or the Committee as a whole. The Committee members will not attempt to speak for other members of the group or to characterize the positions of other members to the media or other venues. Comments to the media will be respectful of other Committee members.

Following significant accomplishments, the Committee may request Ecology to issue formal news releases or other media briefing materials. All releases and information given to the media will accurately represent the work of the Committee. Ecology will make every effort to provide the Committee with materials in advance for input, recognizing that media timelines may not allow for adequate review by the Committee.

Appendix C – Aquifer Units within WRIA 15

Aquifer	Description	Typical Thickness
Qvr – Vashon Recessional Aquifer	Found at land surface where present, this aquifer consists of sand, gravel, and silt, with lenses of silt and clay derived from recessional glacial outwash. Presence is limited to former outwash channels, primarily found along major surface water drainages in the WRIA.	Thickness, where present, ranges from a few feet up to about 120 feet with an average of about 22 feet.
Qva – Vashon Advance Aquifer	This aquifer is mainly composed of deposits from the Vashon advance outwash (Qva). The deposits are usually well-sorted sand or sand and gravel, sometimes with lenses of silt or clay. The unit is generally unconfined, but confining conditions exist where the aquifer is fully saturated and overlain by the Vashon Till confining unit (Qvt).	The thickness typically ranges from 20 to about 240 feet, with some areas exceeding 300 feet.
QA1 – Sea-Level Aquifer	This aquifer consists primarily of glacial (pre-Vashon) sand and gravel with silt interbeds. This unit is generally confined by the overlying Upper Confining Unit (QC1). The upper surface of this aquifer ranges from several hundred feet below sea level to 300 feet above sea level, with an average elevation of about 20 feet.	The thickness typically ranges from 50 to about 250 feet, with an average of about 84 feet.
QA2 – Glaciomarine Aquifer	Composition of this aquifer ranges from sand and gravel to silt. This unit is confined by the overlying Middle Confining Unit (QC2). Few wells tap this aquifer, given its greater depth and lower productivity than the overlying Qvr and QA1 aquifers. The upper surface of this aquifer ranges from 600 feet below sea level to less than 200 feet below sea level.	The thickness typically ranges from less than 20 to more than 300 feet, with an average of about 85 feet.
QA3 – Deep Aquifer	This aquifer consists mostly of sand and gravel with silt interbeds. This unit is confined by the overlying Lower Confining Unit (QC3). The upper surface of this aquifer ranges from more than 900 feet below sea level to slightly more than 200 feet below sea level.	The thickness typically ranges from 50 to 350 feet, with an average of about 128 feet.

Appendix D – Surface Water Quality Assessments Category 4 and 5 Listings in WRIA 15

WATERBODY	CURRENT CATEGORY	PARAMETER	TMDL_NAME	MEDIUM_NAME
ANDERSON CREEK	4C	Fish And Shellfish Habitat		Habitat
ANNAPOLIS CREEK	5	Dissolved Oxygen		Water
	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
BARKER CREEK	5	Dissolved Oxygen		Water
	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
ARRANTES CREEK	5	Temperature		Water
	4A	Bacteria	Liberty Bay Watershed Bacteria TMDL	Water
BEAR CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Bear, Burley, and Purdy Creeks 4b Project	Water
BEAVER CREEK	5	Dissolved Oxygen		Water
	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
BELFAIR CREEK	4A	Bacteria	Union River Bacteria TMDL	Water
BIG ANDERSON CREEK	5	pH		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
BIG BEEF CREEK	5	Temperature		Water
		Dissolved Oxygen		Water
		pH		Water
BIG MISSION CREEK	5	Temperature		Water
BIG SCANDIA CREEK	5	Temperature		Water
		Dissolved Oxygen		Water
BIG SCANDIA CREEK	4A	Bacteria	Liberty Bay Watershed Bacteria TMDL	Water
BJORGEN CREEK	5	Dissolved Oxygen		Water
		Temperature		Water
	4A	Bacteria	Liberty Bay Watershed Bacteria TMDL	Water
BLACKJACK CREEK	5	Dissolved Oxygen		Water
	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
BOYCE CREEK	5	Dissolved Oxygen		Water

WATERBODY	CURRENT CATEGORY	PARAMETER	TMDL_NAME	MEDIUM_NAME
	4B	Bacteria	Kitsap County Bacteria 4B	Water
BURLEY CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Bear, Burley, and Purdy Creeks 4b Project	Water
CARPENTER CREEK	5	Dissolved Oxygen		Water
	5	Temperature		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
CHICO CREEK	5	Dissolved Oxygen		Water
	5	Temperature		Water
	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
CLEAR CREEK	5	Dissolved Oxygen		Water
	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
CLEAR CREEK, W.F.	5	Dissolved Oxygen		Water
COULTER CREEK	5	Dissolved Oxygen		Water
	5	pH		Water
COWLING CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
CURLEY CREEK	5	Dissolved Oxygen		Water
		Temperature		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
DANIELS CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
DEWATTO RIVER	4B	Bacteria	Kitsap County Bacteria 4B	Water
DICKERSON CREEK	5	Temperature		Water
		Dissolved Oxygen		Water
DOGFISH CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Dogfish Creek 4b Project	Water
DOGFISH CREEK, E.F.	5	Dissolved Oxygen		Water
	4B	Bacteria	Dogfish Creek 4b Project	Water
DOGFISH CREEK, S.F.	4B	Bacteria	Kitsap County Bacteria 4B	Water

WATERBODY	CURRENT CATEGORY	PARAMETER	TMDL_NAME	MEDIUM_NAME
DUNCAN CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
ENETAI CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
FISHER CREEK	5	Temperature		Water
GAMBLE CREEK	5	Temperature		Water
		Dissolved Oxygen		Water
GORST CREEK	5	Dissolved Oxygen		Water
GROVERS CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
HUGE CREEK	5	Dissolved Oxygen		Water
ILLAHEE CREEK	5	Dissolved Oxygen		Water
INDIANOLA CREEK	4B	Bacteria	Kitsap County Bacteria 4B	Water
JOHNSON CREEK	5	Dissolved Oxygen		Water
	4A	Bacteria	Liberty Bay Watershed Bacteria TMDL	Water
JUDD CREEK	5	Temperature		Water
JUMPOFF JOE CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
KARCHER CREEK	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
KEYPORT CREEK	4A	Bacteria	Liberty Bay Watershed Bacteria TMDL	Water
KINMAN CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
KITSAP CREEK	5	Dissolved Oxygen		Water
		Temperature		Water
	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
KITSAP LAKE	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
LAGOON CREEK	5	pH		Water
LEMOLO CREEK	5	Dissolved Oxygen		Water

WATERBODY	CURRENT CATEGORY	PARAMETER	TMDL_NAME	MEDIUM_NAME
	4A	Bacteria	Liberty Bay Watershed Bacteria TMDL	Water
LITTLE MINTER CREEK	5	Bacteria		Water
LITTLE MISSION CREEK	5	Bacteria		Water
LITTLE SCANDIA CREEK	5	Dissolved Oxygen		Water
	4A	Bacteria	Liberty Bay Watershed Bacteria TMDL	Water
LOFALL CREEK	4B	Bacteria	Kitsap County Bacteria 4B	Water
LONG LAKE	5	Total Phosphorus		Water
	4C	Invasive Exotic Species		Habitat
MARTHA-JOHN CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Martha John and Gamble Creeks 4b Project	Water
MAYO CREEK	5	Bacteria		Water
		Temperature		Water
MINTER CREEK	5	Bacteria		Water
		Dissolved Oxygen		Water
MISSION LAKE	4C	Invasive Exotic Species		Habitat
MURDEN CREEK	4B	Bacteria	Kitsap County Bacteria 4B	Water
OSTRICH BAY CREEK	5	Dissolved Oxygen		Water
	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
OSTRICH BAY CREEK, W.B.	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
PAHRMANN CREEK	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
PERRY CREEK	4A	Bacteria	Liberty Bay Watershed Bacteria TMDL	Water
PHINNEY CREEK	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
PICNIC CREEK	5	Bacteria		Water
		pH		Water
PRIVATE CREEK	5	Bacteria		Water
		pH		Water
PURDY CREEK	5	Bacteria		Water

WATERBODY	CURRENT CATEGORY	PARAMETER	TMDL_NAME	MEDIUM_NAME
		Dissolved Oxygen	Bear, Burley, and Purdy Creeks 4b Project	Water
RAVINE CREEK	5	Bacteria		Water
	5	Bacteria		Water
RIDGETOP CREEK	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
ROSS CREEK	5	Dissolved Oxygen		Water
	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
ROYAL VALLEY CREEK	4B	Bacteria	Kitsap County Bacteria 4B	Water
SACCO CREEK	5	pH		Water
	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
SALMONBERRY CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
SEABECK CREEK	5	Dissolved Oxygen		Water
SHOOFLY CREEK	5	Bacteria		Water
SPRINGBROOK CREEK	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
SQUARE LAKE	4C	Invasive Exotic Species		Habitat
STATE PARK CREEK	5	Dissolved Oxygen		Water
	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
STAVIS CREEK	5	Dissolved Oxygen		Water
STEELE (CROUCH) CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
STEELE CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
STRAWBERRY CREEK	5	Dissolved Oxygen		Water
	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
TAHUYA LAKE	4C	Invasive Exotic Species		Habitat

WATERBODY	CURRENT CATEGORY	PARAMETER	TMDL_NAME	MEDIUM_NAME
TAHUYA RIVER	5	Dissolved Oxygen		Water
		Temperature		Water
		Dissolved Oxygen		Water
UNION RIVER	5	Dissolved Oxygen		Water
		Temperature		Water
	4A	Bacteria	Union River Bacteria TMDL	Water
UNNAMED CREEK (IN THE ANDERSON CREEK SYSTEM)	4C	Fish And Shellfish Habitat		Habitat
UNNAMED CREEK (IN THE BIG BEEF CREEK SYSTEM)	4C	Fish And Shellfish Habitat		Habitat
UNNAMED CREEK (IN THE BOYCE CREEK SYSTEM)	4C	Fish And Shellfish Habitat		Habitat
UNNAMED CREEK (IN THE HARDING CREEK SYSTEM)	4C	Fish And Shellfish Habitat		Habitat
UNNAMED CREEK (IN THE LITTLE ANDERSON CREEK SYSTEM)	4C	Fish And Shellfish Habitat		Habitat
UNNAMED CREEK (IN THE STAVIS CREEK SYSTEM)	4C	Fish And Shellfish Habitat		Habitat
UNNAMED CREEK (TRIB TO AMSTERDAM BAY)	5	Bacteria		Water
UNNAMED CREEK (TRIB TO BANGOR TRIDENT LAKE OUTLET CREEK)	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
UNNAMED CREEK (TRIB TO DOGFISH CREEK)	4B	Bacteria	Kitsap County Bacteria 4B	Water
UNNAMED CREEK (TRIB TO DUTCHER COVE)	5	Bacteria		Water

WATERBODY	CURRENT CATEGORY	PARAMETER	TMDL_NAME	MEDIUM_NAME
UNNAMED CREEK (TRIB TO FILUCY BAY)	5	Bacteria		Water
UNNAMED CREEK (TRIB TO GREAT BEND/LYNCH COVE)	5	Bacteria		Water
UNNAMED CREEK (TRIB TO HOOD CANAL)	5	Bacteria		Water
UNNAMED CREEK (TRIB TO KITSAP LAKE)	4A	Bacteria	Sinclair & Dyes Inlets Tributaries Bacteria TMDL	Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
UNNAMED CREEK (TRIB TO LIBERTY BAY)	5	Temperature		Water
UNNAMED CREEK (TRIB TO LIBERTY BAY)	4A	Bacteria	Liberty Bay Watershed Bacteria TMDL	Water
UNNAMED CREEK (TRIB TO NORTH CREEK)	5	Lead		Water
		Copper		Water
UNNAMED CREEK (TRIB TO ORO BAY)	5	Bacteria		Water
UNNAMED CREEK (TRIB TO UNION RIVER)	5	Dissolved Oxygen		Water
		Temperature		Water
UNNAMED CREEK (TRIB TO VAUGHN BAY)	5	Bacteria		Water
VAUGHN CREEK	5	Bacteria		Water
WILSON CREEK	5	Dissolved Oxygen		Water
	4B	Bacteria	Kitsap County Bacteria 4B	Water
WYE LAKE	4C	Invasive Exotic Species		Habitat

Appendix E – TMDL Table for WRIA 15

Category 5, 303(d) listed streams in WRIA 15

WATERBODY_NAME	Temp	DO	pH	Bacteria	Copper	Lead	TP
ANNAPOLIS CREEK		X					
BARKER CREEK		X					
BARRANTES CREEK	X						
BEAR CREEK		X					
BEAVER CREEK		X					
BIG ANDERSON CREEK			X				
BIG BEEF CREEK	X	X	X				
BIG MISSION CREEK	X						
BIG SCANDIA CREEK	X	X					
BJORGEN CREEK	X	X					
BLACKJACK CREEK		X					
BOYCE CREEK		X					
BURLEY CREEK		X					
CARPENTER CREEK	X	X					
CHICO CREEK	X	X					
CLEAR CREEK		X					
CLEAR CREEK, W.F.		X					
COULTER CREEK		X	X				
COWLING CREEK		X					
CURLEY CREEK	X	X					
DANIELS CREEK		X					
DICKERSON CREEK	X						
DOGFISH CREEK		X					
DOGFISH CREEK, E.F.		X					
DUNCAN CREEK		X					
ENETAI CREEK		X					
FISHER CREEK	X						
GAMBLE CREEK	X	X					
GORST CREEK		X					
GROVERS CREEK		X					
HUGE CREEK		X					
ILLAHEE CREEK		X					
JOHNSON CREEK		X					
JUDD CREEK	X						
JUMPOFF JOE CREEK		X					
KINMAN CREEK		X					
KITSAP CREEK	X	X					
LAGOON CREEK			X				
LEMOLO CREEK		X					
LITTLE MINTER CREEK				X			
LITTLE MISSION CREEK				X			

WATERBODY_NAME	Temp	DO	pH	Bacteria	Copper	Lead	TP
LITTLE SCANDIA CREEK		X					
LONG LAKE							X
MARTHA-JOHN CREEK		X					
MAYO CREEK	X			X			
MINTER CREEK		X		X			
OSTRICH BAY CREEK		X					
PICNIC CREEK			X	X			
PRIVATE CREEK			X	X			
PURDY CREEK		X		X			
RAVINE CREEK				X			
ROSS CREEK		X					
SACCO CREEK			X				
SALMONBERRY CREEK		X					
SEABECK CREEK		X					
SHOOFLY CREEK				X			
STATE PARK CREEK		X					
STAVIS CREEK		X					
STEELE (CROUCH) CREEK		X					
STEELE CREEK		X					
STRAWBERRY CREEK		X					
TAHUYA RIVER	X	X					
UNION RIVER	X	X					
TRIB TO AMSTERDAM BAY				X			
TRIB TO DUTCHER COVE				X			
TRIB TO FILUCY BAY				X			
TRIB TO GREAT BEND/LYNCH COVE				X			
TRIB TO HOOD CANAL				X			
TRIB TO LIBERTY BAY	X						
TRIB TO NORTH CREEK					X	X	
TRIB TO ORO BAY				X			
TRIB TO UNION RIVER	X	X					
TRIB TO VAUGHN BAY				X			
VAUGHN CREEK				X			
WILSON CREEK		X					

Appendix F – Subbasin Delineation Memo

Technical Memorandum
WRE Committees Technical Support

To:	Stacy Vynne McKinstry, Washington State Department of Ecology
From:	Bob Montgomery, Anchor QEA; Chad Wiseman, HDR
Date:	February 12, 2020 (original); May 27, 2020 (revised); June 4, 2020 (review completed by Committee)
Subject:	WRIA 15 Subbasin Delineation (Work Assignment WA-01, Task 2)

1.0 Introduction

HDR is providing technical support to the Washington State Department of Ecology (Ecology) and the Watershed Restoration and Enhancement (WRE) committee for Water Resource Inventory Area (WRIA) 15. The Streamflow Restoration law (Revised Code of Washington [RCW] Chapter 90.94) requires that 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, delineations must be developed for the subbasins in WRIA 15 that will be used as a spatial framework for growth projections, consumptive-use estimates, and priority offset projects. The Net Ecological Benefit (NEB) evaluation will also be based on this framework. This technical memorandum addresses the basis for subbasin delineation in WRIA 15 (Kitsap).

2.0 Subbasin Delineation

This section explains the initial and final delineations for WRIA 15. The term "subbasin" is used by the WRIA 15 WRE committee for planning purposes only and to meet the requirements of RCW 90.94.030 (3)(b).

2.1 Initial Delineation

The WRIA 15 workgroup (a subcommittee of the WRE committee) was tasked to delineate subbasin boundaries for discussion at WRE committee meetings. An initial discussion was held at the April 4, 2019, workgroup meeting and Pierce County, the Kitsap Public Utility District (PUD), and the Squaxin Tribe subsequently developed maps of proposed subbasin boundaries and provided those to Ecology and the WRE committee.

The initial, general considerations included the following:

- Subbasins should be neither too big nor too small.
- Surface water flows and rain flow patterns should be included.
- Anticipated rural growth and where there is little growth will likely drive projects and impacts.
- Priority areas for salmon recovery should be included.
- Isolated areas like islands without streamflow connectivity to the mainland should be included as their own subbasin (for example, the South Sound Islands are grouped based on relatively low projected growth and proximity to Pierce County mainland).
- There should be recognition that the WRE committee can revise subbasins throughout the process.

The maps were further discussed at the May 2, 2019, WRE committee meeting and the workgroup meeting that immediately followed that meeting.

The result of the discussion on May 2, 2019, was a proposal that divides WRIA 15 into "regions" that are an initial delineation of subbasins that will be revisited as the watershed planning process continues. The key points discussed are as follows:

- Considerations for subbasins include starting large, using a nesting approach, and ensuring that there is justification for offset projects outside of a subbasin.
- The workgroup is committed to finding projects closest to the impact and revisiting subbasin delineations throughout the process.
- The regions map will be used for generating growth projections and consumptive use. The counties shared that they can project growth at any level but recognize that the smaller the subbasins are, the less reliable the data are. It is helpful for the counties to have the proposed size of regions for providing their growth projections.
- Some workgroup members are interested in using smaller assessment areas as well, such as Hydrologic Unit Code 12 (HUC12) boundaries, to look at particular stream impacts.
    - Workgroup members also suggesting using Assessment Units[46] (from Ecology's Puget Sound Watershed Characterization Project) as a starting point for mitigation.
- The Squaxin Tribe would like to see a road map of how the subbasin delineations will be revisited throughout the process.

Further discussion of the regions approach occurred in the June 4, 2019, workgroup meeting and the June 6, 2019, WRE committee meeting. Agreement was reached on proceeding with use of the regions with the following caveats:

- The regions approach is a nested approach where regions are essentially a "do not cross" line for finding projects to offset impacts.
- Projects should be closest to the anticipated impact and provide benefit to streams. Using a nested approach, the potential for offsets will be evaluated first at the assessment unit scale, then at the HUC 14 scale, and finally at the subbasin scale. In other words, the committee will look for projects at the finest scale possible first. If the offsets are not achievable at the small or intermediate unit scale, justification will be provided (for example, there is greater relative benefit in a larger project in a stream of importance).
- The WRE committee will continue to revisit delineation of subbasins once growth projections and projects are developed.

The June proposal included three main regions: South Sound, West Sound, and Hood Canal. The boundary between the West Sound region and the Hood Canal region in the northern Kitsap Peninsula was left flexible with the recognition that projects in one region could benefit streams in the other

[46] Assessments Units are described in the Puget Sound Watershed Characterization Project (Department of Ecology, 2013). Each WRIA is made up of subwatersheds, called watershed management units, which are further divided into Assessment Units. A variety of watershed assessment results are presented for each assessment unit, including: water flow (for delivery, surface storage, recharge, and discharge processes); water quality processes (for five parameters: sediment, phosphorus, nutrients, pathogens, and metals); and fish and wildlife habitats (for terrestrial, freshwater and marine habitats).

region. The other regions are Bainbridge Island, Vashon-Maury Island, and the three south Puget Sound islands (McNeil, Anderson, and Ketron).

2.2 Revision to Hood Canal Region

The Skokomish Tribe proposed to revise the region delineation by dividing the Hood Canal region into North Hood Canal and South Hood Canal regions. The reason is differing precipitation amounts, development and status of fish species. The proposal was first presented to the WRIA 15 Committee in October who passed it to the workgroup for discussion. A subset of workgroup members reviewed the proposal and recommended the proposal be accepted. The proposal was further discussed at the November 7, 2019 WRIA 15 Committee meeting. There was agreement amongst all Committee members present to accept the revision to the Hood Canal region.

2.3 Final Delineation

Agreement was reached at the March 5, 2020 WRIA 15 committee meeting to accept the region delineations as the subbasin boundaries. Figure 1 presents the subbasins as agreed to at that meeting.

3.0 Conclusion

The WRIA 15 WRE committee delineation of subbasins will be used as an organizational framework for growth projection and consumptive-use scenarios.

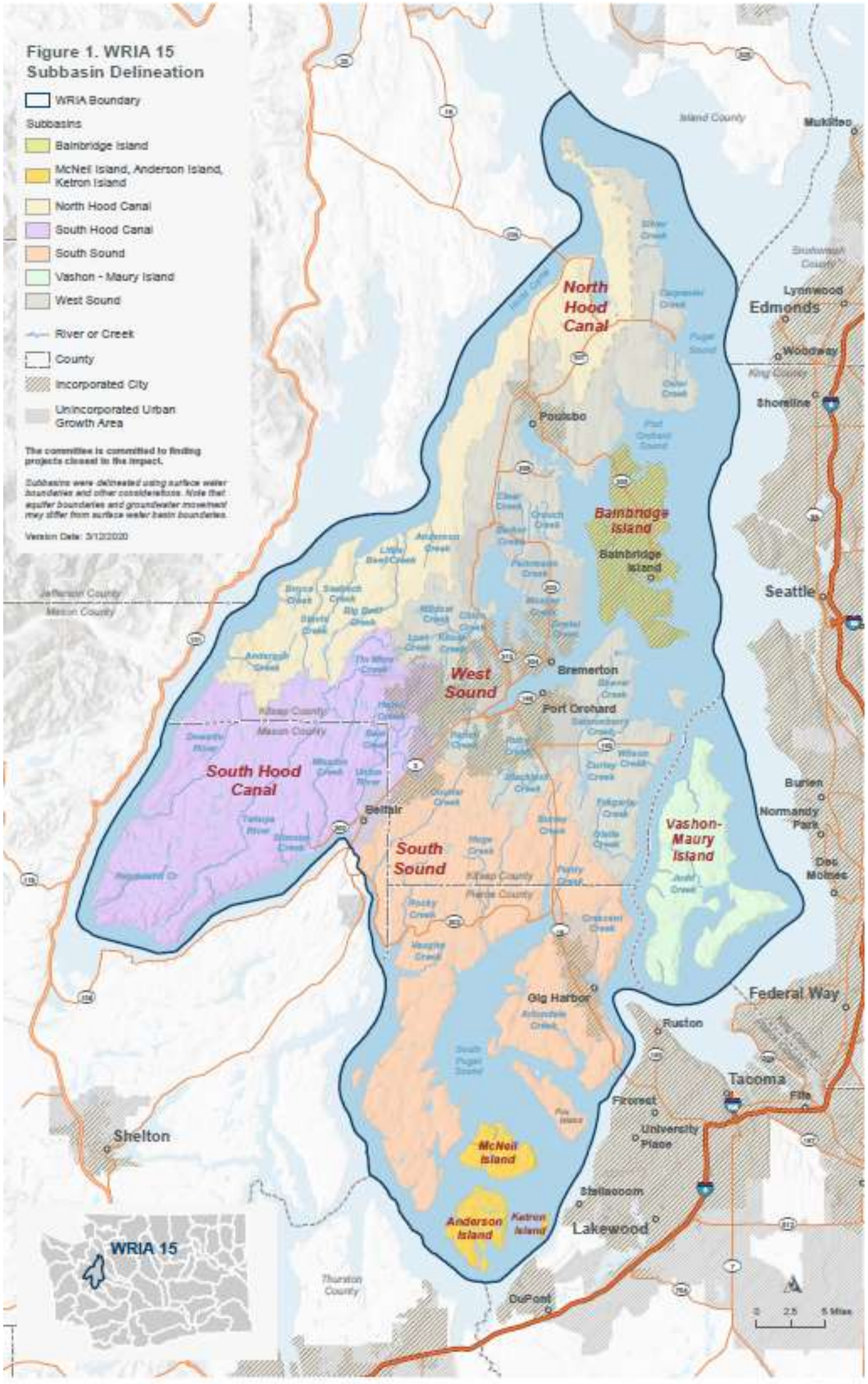
References

Revised Code of Washington (RCW). 2019. Watershed Planning, Chapter 90.82 RCW. Accessed on June 23, 2019, at https://app.leg.wa.gov/rcw/default.aspx?cite=90.82.

RCW. 2019. Streamflow Restoration, Chapter 90.94 RCW. Accessed on June 23, 2019, at https://app.leg.wa.gov/RCW/default.aspx?cite=90.94.

U.S. Geological Survey and U.S. Department of Agriculture, Natural Resources Conservation Service (USGS). 2013. Federal Standards and Procedures for the National Watershed Boundary Dataset (WBD) (4 ed.): Techniques and Methods 11–A3, 63 p., https://pubs.usgs.gov/tm/11/a3/.

Figure 1. WRIA 15 subbasin delineation



Appendix G – Growth Projections and Consumptive Use Memo

Technical Memorandum DRAFT

To:	Stacy Vynne McKinstry, Washington State Department of Ecology
From:	Chad Wiseman, HDR and Bob Montgomery, Anchor QEA
Date:	February 13, 2020 (original); May 27, 2020 (revised); June 4, 2020 (review completed by Committee)
Subject:	WRIA 15 PE Growth and Consumptive Use Summary (Work Assignment 2, Tasks 2 and 3)

Introduction

HDR is providing technical support to the Washington State Department of Ecology (Ecology) and the Watershed Restoration and Enhancement (WRE) committees for Water Resource Inventory Areas (WRIAs) 10, 12, 13, 14, and 15.

Under RCW 90.94, consumptive water use by permit-exempt domestic wells and connections (PE wells) occurring over the 20 year period of 2018-2038 (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 PE wells and related consumptive use of groundwater that is projected to impact WRIA 15 over the planning horizon.

This memorandum includes:

- A summary of WRIA 15 baseline, low, and high PE growth scenarios.
- A summary of WRIA 15 baseline, low, and high scenario consumptive use using three different methods.

WRIA 15 PE Growth Projection Methods

Portions of Mason, Pierce, and King Counties and all of Kitsap County are located within WRIA 15. The WRIA 15 WRE committee agreed to develop high and low growth projection scenarios based on varying the Kitsap and Pierce County projections. At this time, Mason County and King County growth projections remained the same for the baseline high and low scenario projections; however the Squaxin Island Tribe has expressed interest in possibly seeing a higher growth scenario or safety factor for Mason County. Mason County wants to ensure that the adaptive management component of the plan considers the results of the census for changes in population growth (available in 2022).

1.2 Kitsap County

Two methods were used to project growth over the planning horizon for Kitsap County. Both the Kitsap County Land Capacity Analysis, completed by County staff, and the Historical Wells Method, completed by Kitsap Public Utility District (Kitsap PUD), result in similar numbers:

Kitsap County Land Capacity Analysis

1) Identify 20-year growth projections from the Kitsap Regional Coordinating Council growth projections (conversion to single-family residences based on assumed people per household and rural growth target).
2) Allocate growth by subbasin based on proportion of historical building permits by subbasin from 2002 to 2019.
3) Conduct a land capacity analysis. Determine vacant parcels within each subbasin that is within and outside of the waterline or sewerline 200-foot buffer. Assume that all parcels greater than 0.15 acre are buildable if they are within the 200-foot buffer. Buildout capacity for parcels greater than 0.75 acre outside of a 200-foot waterline buffer is assumed to be served by PE wells. Assume that that growth occurs along the waterline areas first, and that the forecasted number of PE wells is less than the forecasted number of single family residences as some wells may have multiple connections.
4) Multiply the growth for each subbasin (step 2) by the proportion of growth expected to be served by PE wells (step 3).
5) The application of this method to City of Bainbridge Island results in no new PE wells. An alternative method for City of Bainbridge Island was performed which assumes one PE well connection per parcel, regardless of parcel size. It was also assumed that growth occurs along the waterline areas first with the remaining growth occurring on parcels needing PE wells.

Kitsap County developed three iterations of growth projections in rural areas based on varying the minimum parcel size to be suitable for a PE well in the land capacity analysis (Step 3). The versions included 0.25 acre, 0.75 acre, and 1.0 acre. The final version recommended by the county assumed a minimum acreage for PE wells of 0.15 acre in their land capacity analysis and also used additional data on water lines and sewer lines (as a proxy for water lines). This version was provided to HDR on November 22, 2019. Kitsap County provided a flow chart of the land capacity analysis and heat map (HDR 2019a).

Historical Wells Method (Kitsap PUD):

1) Calculate historical growth rates of PE wells using County records of wells drilled (2003-2018). Note this is all wells drilled, not just PE wells.
2) Forecast growth of future PE well connections for the 20-year planning horizon, based on the historical growth rate.
3) Allocate growth of PE wells within each subbasin spatially, based upon land capacity analysis (i.e., parcel must be outside of UGA, not in a water and wastewater system boundary, not already built upon, or must have zoning category that allows for domestic use).

1.3 King County

The following methods were used to project growth over the planning horizon:

1) Use historical building permit data (2000–2017) to project future growth.
2) Define if each historical building permit used for growth projections is public or private (aka PE well) water service.
3) Multiply the annual (projected) number of building permits per year by the percentage of permits using private water to determine a projected number of PE well connections per year to yield the annual rate of PE well connections.
4) Multiply the rate of annual PE well connections by 20 for the estimated total of PE well connections over a 20-year period.
5) Overlay subbasins to determine number of new PE well connections in each subbasin.
6) Remove the portion of the wells that are projected to be inside of the water district service boundaries.

The King County method is described in more detail in a technical memo provided by the county dated December 16, 2019 (HDR 2019a). King County growth projections did not change from the initial projections on July 31, 2019.

1.4 Mason County

The following methods were used to project growth during the planning horizon:

1) Develop 20-year growth projections based on the Mason County Comprehensive Plan (the Comprehensive Plan is based on Office of Financial Management medium population growth estimates, and conversion to dwelling units based on assumed people per dwelling unit).
2) Determine available land for single-family domestic units and determine proportion of buildout capacity by county urban growth areas (UGAs) and rural lands.
3) Apply growth projections to buildable lands.
4) Remove projected development unlikely to connect to a PE well (i.e., parcel is located within a water system service area; parcel is smaller than 1 acre).
5) Overlay subbasins to determine new PE connections in each subbasin.

Initial growth projections for Mason County were updated because of 1) updates to county parcel attributes and 2) a request from the WRIA 14 and WRIA 15 WRE committees to account for PE wells within water system service areas. Parcel data were updated to correct for circumstances where the zoning and land use attributes identified a parcel as buildable but were also associated with a feature that was incompatible with building (e.g., on top of a waterbody). The initial methods assumed zero PE well growth within water system service areas in both the urban growth areas (UGAs) and rural areas. HDR developed a method that allocates PE well growth in rural water systems proportional to the number of parcels in each water system not currently served by the water system.

The method is comprised of the following steps:

1) Assume future growth is proportional to buildable parcels with available water system hookup and parcels that would require a PE well or connection for development.

2) Define total buildable parcels per county buildable lands analysis that are contained within each respective water system service area. The water system service areas are defined by the Washington State Department of Health (DOH) as polygons in the Geographic Information Service (GIS) platform.
3) Define active and total approved (active + available) water system connections from the DOH Sentry database.
4) Calculate buildable parcels with an available water system hookup (total approved minus active water system connections)
5) Calculate buildable parcels that would require a PE well or connection for development (total buildable parcels minus total approved connections).
6) Calculate ratio of buildable parcels that would require a PE well or connection (step 5) to the parcels with an available water system hookup (step 4) and multiply by the number of dwellings predicted to occur in that water system service area.

1.5 Pierce County

The following methods were used to project growth over the planning horizon:

1) Calculate historical growth rates of PE wells for each subbasin using the Tacoma-Pierce County Health District (TPCHD) well database (1999–2018).
2) Forecast growth of future PE well connections for the planning horizon, based on the subbasin-specific historical growth rate.
3) Allocate growth of PE wells within each subbasin spatially, based upon a parcel assessment for PE well potential (i.e., parcel must be outside of UGA, not in a water and wastewater system boundary, not already built upon, or must have zoning category that allows for domestic use).

No changes were made to the growth projection methods or results occurred since the initial growth projection on July 31, 2019.

High and Low Growth Scenarios

Because of the uncertainty in the projections, the WRIA 15 Committee evaluated additional permit-exempt well scenarios using different periods in the historical TPCHD well database. The high growth scenario uses the 1999–2008 data, which was a time of relatively healthy economic growth resulting in more rapid rural development. The low growth scenario uses the 2009–2018 data, which was a time of a relatively slower rate of rural development and corresponds with the recession and housing downturn. For Kitsap County, a plus or minus five percent was used to calculate the high and low growth scenario. The five percent is based on the margin of error in the County's land capacity analysis. High and low growth scenarios were not calculated for Mason or King Counties at the Counties' request.

WRIA 15 Consumptive Use Methods

Consumptive use of water from projected PE well growth was estimated using three different methods; 1) the Irrigated Area Method; 2) the Water System Data Method and; 3) the USGS Groundwater Model Method

Irrigated Area Method

Consumptive use was calculated using Ecology's recommended assumptions for indoor and outdoor consumptive use (Ecology 2018; 2019).

Indoor Consumptive Use – Irrigated Area Method

Ecology (2018; 2019) recommends the following assumptions for estimating indoor consumptive water use:

- 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 PE well use septic systems for wastewater. 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.

The above assumptions were used to estimate indoor consumptive water use by occupants of a single dwelling unit. Assuming that there is one PE well connection per dwelling unit, a "per PE well 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:

$$HCIWU\ (gpd) = 60\frac{gal}{day * person} * \ 2.5\frac{people}{household} * CUF$$

Where:

HCIWU = Household Consumptive Indoor Water Use (gpd)

CUF= Consumptive use factor; assumed to be 10% (factor expressed as 0.10)

This estimate of indoor per household per day can be annualized and converted to acre-feet per year or cubic feet per second.

Outdoor Consumptive Use – Irrigated Area Method

Ecology (2018; 2019) recommends estimating future outdoor water use based on an estimate of the average outdoor irrigated area for existing homes served by PE wells. To calculate the consumptive portion of total outdoor water required per parcel/connection over a single growing season, Ecology recommends:

- Estimating the average irrigated lawn area (pasture/turf grass) per parcel in each WRIA,
- 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 (80 percent outdoor consumptive use recommended).

WRE Committees were given the opportunity to adjust variables used in the analysis when applicable to the specific WRIA. WRIA 15 opted not to adjust variables.

The average irrigated area in WRIA 15 was estimated by measuring areas of visible irrigation (i.e. green lawns relative the surrounding, gardens, managed landscaping) in using aerial imagery in 80 random parcels with existing dwellings that have a PE well or connection (Figure 1). The average irrigated area was 0.08 acres (Table 1). Most parcels evaluated did not have visible signs of irrigation in the aerial imagery (Figure 2). Detailed methods and results are defined in the consumptive use methods technical memorandum and report (HDR 2019b).

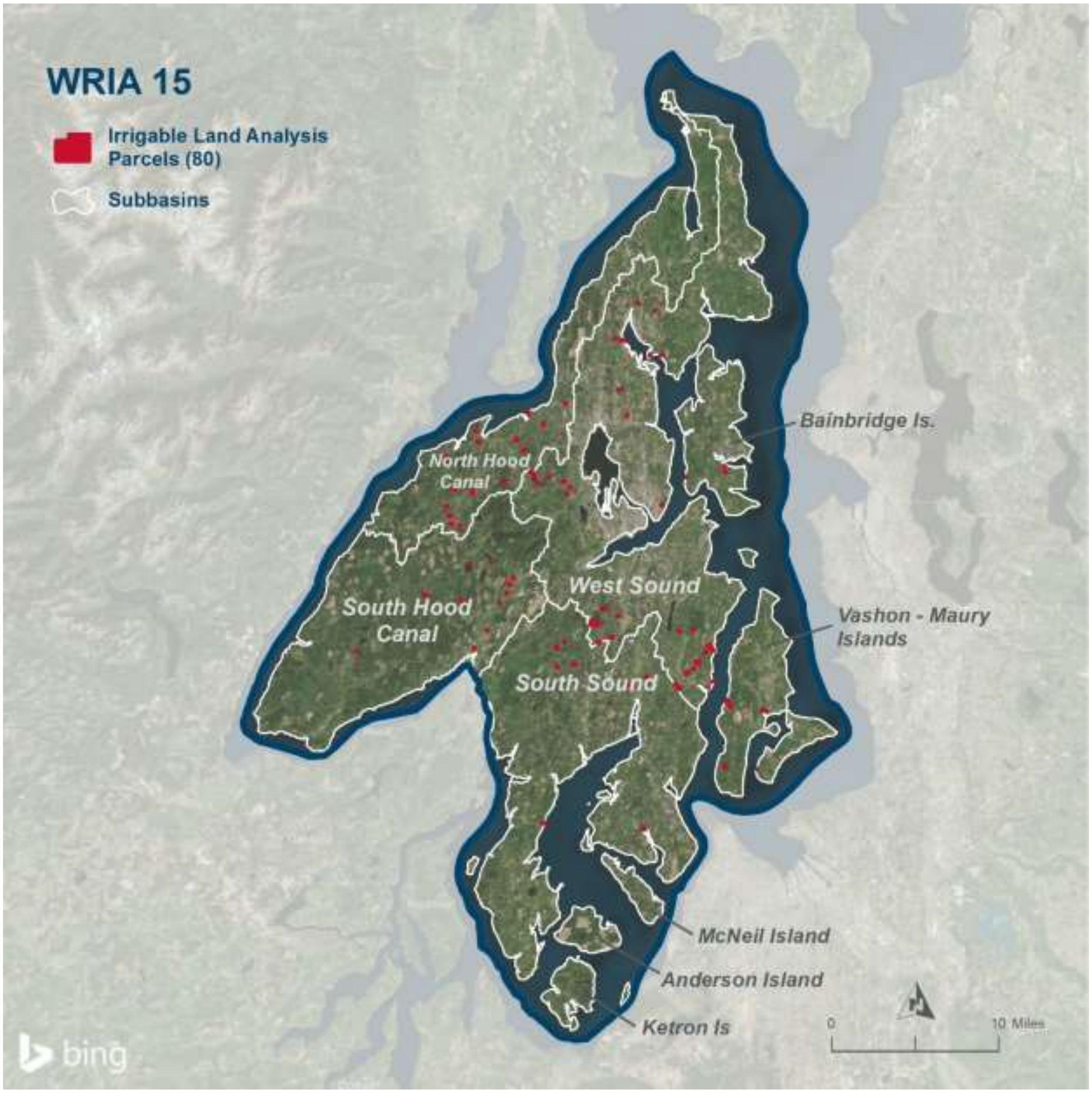


Figure 1. Parcels selected in WRIA 15 with existing PE well that were delineated for apparent irrigated areas.

Table 1. Irrigated acreage delineation results.

Statistic	WRIA 15
PE Parcel Sample Pool	8,987
Sample Size	80
Mean (acres)	0.08
Standard Deviation (acres)	0.13
95% UCL (acres)	0.14

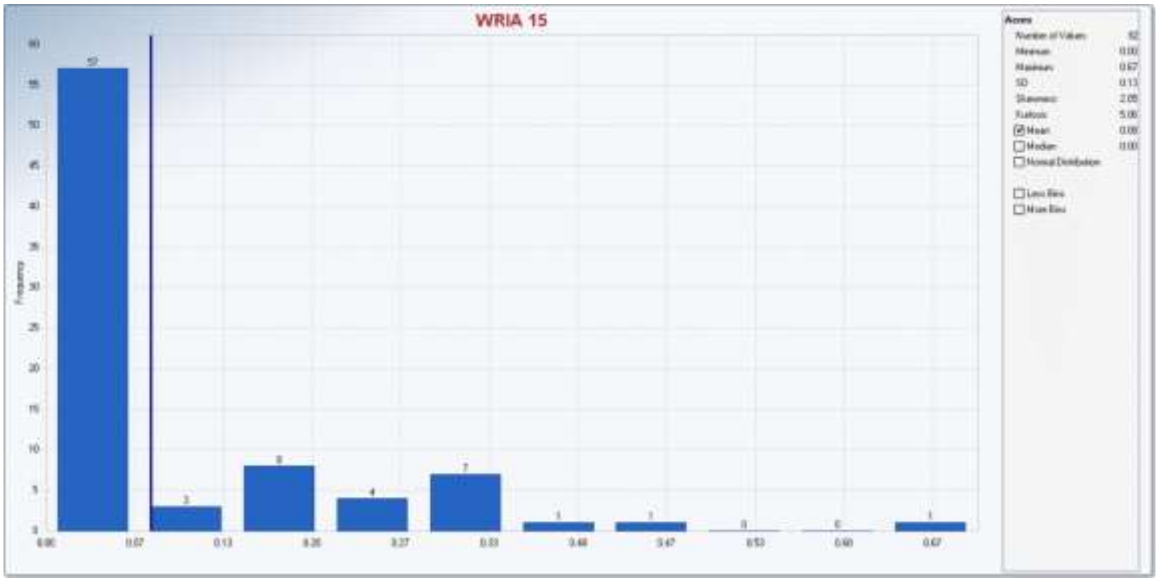


Figure 2. Histogram of WRIA 15 irrigated acreage delineation results.

Once average irrigable acreage per connection was determined for a WRIA, water use was calculated based on irrigation requirements and application efficiency. Crop irrigation requirements were estimated for pasture/turf grass from nearby stations as provided in the Washington Irrigation Guide (NRCS-USDA, 1997). An irrigation application efficiency was applied to account for water that does not reach the turf. Ecology (2018; 2019) recommends using a 75 percent application efficiency factor. The consumptive portion of total amount of water used for outdoor use was assumed to be 80 percent of the total. This method is summarized in the following equation:

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

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)

CF = Conversion Factor to convert afy to gpd; 1 afy = 892.742 gpd

Uncertainty in Irrigated Area Calculations

The irrigated area measurements were performed using a set of 80 parcels distributed throughout WRIA 15. The number of parcels selected was based on the budget for this task as agreed to by HDR and Ecology. Concern was expressed by some members of the Committee that a repeatable, spatially distributed, and statistically valid subset of parcels was not used. While this concern was recognized and acknowledged, ultimately the Committee determined that the results were representative of the WRIA.

The parcels analyzed were selected using the following procedure:

- Define the available pool of parcels with existing PE wells using Tacoma-Pierce County Health Department data for Pierce County and in Mason, Kitsap and King counties using assessor's data and water system boundary data to locate existing residences not served by water systems
- Classify parcels by value (less than $350,000, $350-600,000, greater than $600,000)
- From the available pool of parcels, randomly select a subset of parcels throughout WRIA 15, while ensuring the distribution of parcel values is like that of the entire WRIA 15

The parcel selection procedure provided a spatially distributed and representative sample of parcels with PE wells.

After measuring irrigated area for the subset of 80 parcels, the results were presented to a WRIA 15 workgroup. Kitsap PUD and the Suquamish Tribe performed analyses to independently verify the results. The two independent analyses confirmed the findings of the irrigated area analysis. This indicates the procedure was repeatable. The Committee, with their knowledge of the WRIA, stated that the results were in line with water use in the WRIA. In addition, the technique used to delineate irrigated area was subject to a quality assurance check by another consultant, GeoEngineers, at the request of Ecology (GeoEngineers and HDR, 2020).

The average irrigated area measured for the 80 parcels is 0.08 acres. The area is low due to a high number of non-irrigated parcels. HDR performed statistical analyses of the irrigated acreage to estimate the upper confidence limits and to determine the sample size of parcels required to estimate a mean value of irrigated acreage for error margins ranging from 0.01 acre to 0.06 acre. It was found the set of 80 parcels allows the mean to be calculated within a 0.03-acre error margin.

The Committee reviewed the irrigated area calculations and chose not to adjust the calculations by assuming a base amount of irrigation instead of zero for non-irrigated parcels. The Committee believes that 0.08 acres is representative of the irrigated areas for PE wells in WRIA 15 and adopted that value for consumptive use calculations. Factors in that decision are the conservative nature of the consumptive use calculation when applied to the irrigated area and the independent analyses performed to confirm the measurements of irrigated acreage.

At the request of Committee members, the consultant team considered other approaches to measuring and calculating average irrigated area. Measurement techniques using remote sensing data were considered but it was determined that it would be more costly and time-consuming than the method employed by HDR. Additional parcels for analysis were delineated and provided to Committee members for additional analysis for further verification of average irrigated area. No additional analysis was received from Committee members.

Water System Data Method

Consumptive use by PE wells and connections may also be estimated using metered connections from water systems. HDR requested data from WRE Committee members for water systems that use (or have used) a flat rate billing structure and were similar in character to the rural environments in which households may connect to PE wells. In WRIA 15, Kitsap PUD provided consumption data for all Kitsap PUD water systems for years 2017 and 2018.

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 connections (assuming all connections are residential), to determine average daily indoor use per connection. 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.

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 subtracted from total annual use by a water system to estimate total annual outdoor use. An 80 percent consumptive factor was applied to determine the consumptive portion of outdoor use.

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 15. Therefore, seasonal outdoor water use was assumed to occur over a period of six months. 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.

1.6 USGS Groundwater Model Method

A groundwater-flow model was developed by the USGS to improve understanding of water resources on the Kitsap Peninsula. The study area did not include WRIA 15 areas of Key Peninsula, and Vashon, Fox, Anderson, McNeil and Ketron Islands. The first step in the modeling process was to characterize the groundwater-flow system on the Kitsap Peninsula and to prepare a water budget for the study area, which are contained in the report titled *Hydrogeologic Framework, Groundwater Movement and Water Budget of the Kitsap Peninsula, West-Central Washington* (Welch, Frans, and Olsen, 2014). The report provides a survey of consumption from select water utilities serving more than 221,700 people with more than 88,500 residential connections on the Kitsap Peninsula. The USGS study differentiated between the indoor and outdoor portions of use. Estimated indoor use (based on November–April pumping values) was 66 gallons per person per day. Outdoor use was estimated for the outdoor growing season and varied by month from 4 gallons per person per day in May to 97 gallons per person per day in September; a value of 26 gallons per person per day was used in the calculation. For the purposes of groundwater modeling USGS set the consumptive use rate for indoor domestic use at 10 percent in nonsewered areas, and the consumptive use rate for outdoor use at 90 percent. The water use values and consumptive use rates for the USGS study area are used in this report to develop an additional estimate of consumptive use per permit-exempt connection for the entire WRIA 15. To differentiate this method from the water system data method that uses Kitsap PUD managed water system data, it is termed the USGS groundwater model method.

Results

PE Connection Growth

Baseline PE connection growth is projected to be 5,568 connections (Table 2). The high PE growth scenario is projected to have 584 additional connections, for a total of 6,152 PE connections. The low PE growth scenario is projected to have 707 fewer connections than the baseline scenario, for a total of 4,861 PE connections. PE connection growth is expected to be greatest in the "South Sound" subbasin.

Consumptive Use

The irrigated area method yielded a total consumptive use per PE connection of 122.9 gpd.

The water system data method yielded a total consumptive use per PE connection of 64.3 gpd. The USGS model method yielded a total consumptive use per PE connection of 75 gpd.
The estimates of consumptive use in WRIA 15 over the 20 year planning horizon using the irrigation area method was 1.06 (baseline), 0.93 (low growth), and 1.17 cfs (high growth).

The estimates of consumptive use in WRIA 15 over the planning horizon using the water system data method were 0.55 cfs (baseline), 0.48 cfs (low growth), and 0.61 cfs (high growth).

The estimates of consumptive use in WRIA 15 over the planning horizon using the USGS model method were 0.65 cfs (baseline), 0.57 (low growth), and 0.72 (high growth).
For WRIA 15 scenarios, the estimates of consumptive use using the irrigation area method estimates are approximately 1.9 times higher than the water system data method. Consumptive use is 1.1 times higher in the high growth scenario than the baseline scenario, and approximately 1.7 times higher than the USGS model method. Consumptive use is approximately 1.14 times higher in the baseline scenario than the low growth scenario.

Table 2. Annualized Average Consumptive Use Estimates for WRIA 15 – Baseline Growth

Annualized Consumptive Use Estimates for WRIA 15 (2020 2040) Baseline Growth Projection; 0.75 acre minimum threshold										
Subbasin	Projected PE Well Connections	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: USGS Estimates			Annual Consumptive Use: Irrigated Area Estimate (per Ecology Guidance)		
		AFY	GPM	CFS	AFY	GPM	CFS	AFY	GPM	CFS
West Sound	1,336	96.2	59.6	0.1331	112.2	69.6	0.1553	183.9	114.0	0.2545
Hood Canal	656	47.2	29.3	0.0653	55.1	34.2	0.0763	90.3	56.0	0.1249
South Hood Canal	1,126	81.0	50.2	0.1121	94.6	58.6	0.1309	155.0	96.1	0.2145
Bainbridge Island	491	35.3	21.9	0.0489	41.3	25.6	0.0571	67.6	41.9	0.0935
South Sound	1,553	111.8	69.3	0.1547	130.5	80.9	0.1805	213.8	132.5	0.2958
Vashon – Maury Island	368	26.5	16.4	0.0367	30.9	19.2	0.0428	50.7	31.4	0.0701
McNeil Island, Anderson Island, Ketron Island	38	2.7	1.7	0.0038	3.2	2.0	0.0044	5.2	3.2	0.0072
Totals	**5,568**	**400.8**	**248.4**	**0.5545**	**467.8**	**290.0**	**0.6473**	**766.4**	**475.1**	**1.0605**

Table 3. Annualized Average Consumptive Use Estimates for WRIA 15 – Low Growth

Annualized Consumptive Use Estimates for WRIA 15 (2020 2040) Low Growth Projection; 0.75 acre minimum threshold										
Subbasin	Projected PE Well Connections	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: USGS Estimates			Annual Consumptive Use: Irrigated Area Estimate (per Ecology Guidance)		
		AFY	GPM	CFS	AFY	GPM	CFS	AFY	GPM	CFS
West Sound	1,142	82.2	51.0	0.1137	95.9	59.5	0.1328	157.2	97.4	0.2175
Hood Canal	561	40.4	25.0	0.0559	47.1	29.2	0.0652	77.2	47.9	0.1068
South Hood Canal	1,119	80.5	49.9	0.1114	94.0	58.3	0.1301	154.0	95.5	0.2131
Bainbridge Island	491	35.3	21.9	0.0489	41.3	25.6	0.0571	67.6	41.9	0.0935
South Sound	1,158	83.3	51.7	0.1153	97.3	60.3	0.1346	159.4	98.8	0.2206
Vashon – Maury Island	368	26.5	16.4	0.0367	30.9	19.2	0.0428	50.7	31.4	0.0701
McNeil Island, Anderson Island, Ketron Island	22	1.6	1.0	0.0022	1.8	1.1	0.0026	3.0	1.9	0.0042
Totals	**4,861**	**349.9**	**216.9**	**0.4841**	**408.4**	**253.2**	**0.5651**	**669.1**	**414.8**	**0.9258**

Table 4. Annualized Average Consumptive Use Estimates for WRIA 15 – High Growth

Annualized Consumptive Use Estimates for WRIA 15 (2020 2040) High Growth Projection; 0.75 acre minimum threshold										
Subbasin	Projected PE Well Connections	Annual Consumptive Use: Water System Estimate			Annual Consumptive Use: USGS Estimates			Annual Consumptive Use: Irrigated Area Estimate (per Ecology Guidance)		
		AFY	GPM	CFS	AFY	GPM	CFS	AFY	GPM	CFS
West Sound	1,403	101.0	62.6	0.1397	117.9	73.1	0.1631	193.1	119.7	0.2672
Hood Canal	689	49.6	30.7	0.0686	57.9	35.9	0.0801	94.8	58.8	0.1312
South Hood Canal	1,128	81.2	50.3	0.1123	94.8	58.8	0.1311	155.3	96.2	0.2148
Bainbridge Island	516	37.1	23.0	0.0514	43.4	26.9	0.0600	71.0	44.0	0.0983
South Sound	1,992	143.4	88.9	0.1984	167.4	103.8	0.2316	274.2	170.0	0.3794
Vashon – Maury Island	368	26.5	16.4	0.0367	30.9	19.2	0.0428	50.7	31.4	0.0701
McNeil Island, Anderson Island, Ketron Island	56	4.0	2.5	0.0056	4.7	2.9	0.0065	7.7	4.8	0.0107
Totals	**6,152**	**442.8**	**274.5**	**0.6127**	**516.9**	**320.4**	**0.7152**	**846.8**	**524.9**	**1.1717**

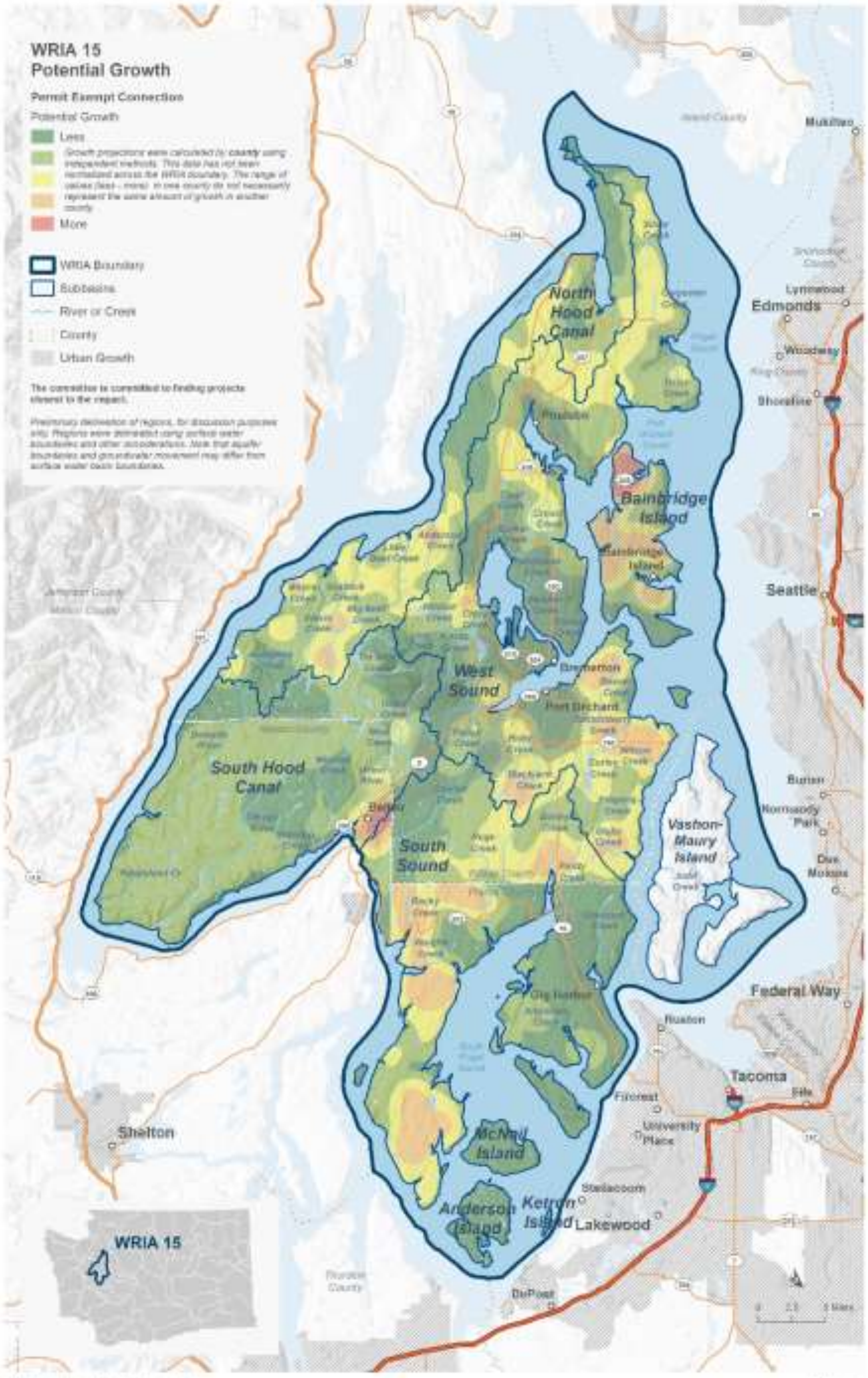


Figure 3. WRIA 15 projected PE connection growth.

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 scenario (Table 4). 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 4: WRIA 15 Monthly Consumptive Water Use

Subbasin	Projected No. PE Wells (Baseline)	Consumptive Use by Month (cfs)											
		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
West Sound	1,336	0.0311	0.0311	0.0311	0.0311	0.3316	0.7239	0.9879	0.7585	0.3726	0.0311	0.0311	0.0311
Hood Canal	656	0.0153	0.0153	0.0153	0.0153	0.1628	0.3555	0.4851	0.3724	0.1829	0.0153	0.0153	0.0153
South Hood Canal	1,126	0.0262	0.0262	0.0262	0.0262	0.2795	0.6101	0.8327	0.6393	0.3140	0.0262	0.0262	0.0262
Bainbridge Island	491	0.0114	0.0114	0.0114	0.0114	0.1219	0.2661	0.3631	0.2788	0.1369	0.0114	0.0114	0.0114
South Sound	1,553	0.0361	0.0361	0.0361	0.0361	0.3855	0.8415	1.1484	0.8817	0.4331	0.0361	0.0361	0.0361
Vashon – Maury Island	368	0.0086	0.0086	0.0086	0.0086	0.0914	0.1994	0.2721	0.2089	0.1026	0.0086	0.0086	0.0086
McNeil Anderson, Ketron	38	0.0009	0.0009	0.0009	0.0009	0.0094	0.0206	0.0281	0.0216	0.0106	0.0009	0.0009	0.0009
Totals	**5,568**	**0.1295**	**0.1295**	**0.1295**	**0.1295**	**1.3822**	**3.0171**	**4.1174**	**3.1612**	**1.5527**	**0.1295**	**0.1295**	**0.1295**
Subbasin	**Projected No. PE Wells (Low Growth)**	**Consumptive Use by Month (cfs)**											
		Jan	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
West Sound	1,142	0.0266	0.0266	0.0266	0.0266	0.2835	0.6188	0.8445	0.6484	0.3185	0.0266	0.0266	0.0266
Hood Canal	561	0.0130	0.0130	0.0130	0.0130	0.1393	0.3040	0.4148	0.3185	0.1564	0.0130	0.0130	0.0130
South Hood Canal	1,119	0.0260	0.0260	0.0260	0.0260	0.2778	0.6064	0.8275	0.6353	0.3120	0.0260	0.0260	0.0260
Bainbridge Island	491	0.0114	0.0114	0.0114	0.0114	0.1219	0.2661	0.3631	0.2788	0.1369	0.0114	0.0114	0.0114
South Sound	1,158	0.0269	0.0269	0.0269	0.0269	0.2875	0.6275	0.8563	0.6574	0.3229	0.0269	0.0269	0.0269
Vashon – Maury Island	368	0.0086	0.0086	0.0086	0.0086	0.0914	0.1994	0.2721	0.2089	0.1026	0.0086	0.0086	0.0086
McNeil Anderson, Ketron	22	0.0005	0.0005	0.0005	0.0005	0.0055	0.0119	0.0163	0.0125	0.0061	0.0005	0.0005	0.0005
Totals	**4,861**	**0.1130**	**0.1130**	**0.1130**	**0.1130**	**1.2067**	**2.6340**	**3.5946**	**2.7598**	**1.3555**	**0.1130**	**0.1130**	**0.1130**
Subbasin	**Projected No. PE Wells (High Growth)**	**Consumptive Use by Month (cfs)**											
		Jan	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
West Sound	1,403	0.0326	0.0326	0.0326	0.0326	0.3483	0.7602	1.0375	0.7965	0.3912	0.0326	0.0326	0.0326
Hood Canal	689	0.0160	0.0160	0.0160	0.0160	0.1710	0.3733	0.5095	0.3912	0.1921	0.0160	0.0160	0.0160
South Hood Canal	1,128	0.0262	0.0262	0.0262	0.0262	0.2800	0.6112	0.8341	0.6404	0.3145	0.0262	0.0262	0.0262
Bainbridge Island	516	0.0120	0.0120	0.0120	0.0120	0.1281	0.2796	0.3816	0.2930	0.1439	0.0120	0.0120	0.0120
South Sound	1,992	0.0463	0.0463	0.0463	0.0463	0.4945	1.0794	1.4730	1.1309	0.5555	0.0463	0.0463	0.0463
Vashon – Maury Island	368	0.0086	0.0086	0.0086	0.0086	0.0914	0.1994	0.2721	0.2089	0.1026	0.0086	0.0086	0.0086
McNeil Anderson, Ketron	56	0.0013	0.0013	0.0013	0.0013	0.0139	0.0303	0.0414	0.0318	0.0156	0.0013	0.0013	0.0013
Totals	**6,152**	**0.1430**	**0.1430**	**0.1430**	**0.1430**	**1.5272**	**3.3336**	**4.5493**	**3.4928**	**1.7155**	**0.1430**	**0.1430**	**0.1430**

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Appendix H – Project Inventory

WRIA 15 Project Inventory for Inclusion in the Watershed Restoration and Enhancement Plan
As discussed in Chapters 5 and 7, these projects support the watershed plan in meeting NEB. The categories for projects included in Chapter 5 and this inventory are included below. These categories do not reflect prioritization as all projects are needed to help achieve NEB in WRIA 15.

CATEGORIES
I. Ready to implement and provides quantitative offset value (see Chapter 5).
II. Ready to implement and provides habitat benefit and un-quantifiable streamflow benefit.
III. Provides habitat only benefit.
IV. Unable to implement at this time because the project is highly conceptual or not currently legal.

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
Bainbridge Island Subbasin												
III	Springbrook Creek Bridge	Habitat no Offset	47°38'35.0" N 122°34'02.5 "W	Reconnect side channel habitat and minor flood plain restoration. (Part of a larger barrier removal project.)					City of Bainbridge Island/ Bainbridge Island Land Trust	Final Design / Construct	$1,200,000 (includes barrier removal costs)	$200,000
IV	Transfer surface water right to groundwater for public farmland	Water Rights Acquisition	47°37'50.8" N 122°33'27.9 "W	Switch irrigation source from surface reservoir to existing or new well to re-time stream flows and improve stream temperature issues.	TBD				City of Bainbridge Island/ Friends of the Farms	Feasibility		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Kitsap PUD Stream Augmentation Project	Offset no Habitat	Multiple Streams	Kitsap Public Utility District (Kitsap PUD) currently owns and operates 54 public water systems throughout rural Kitsap County. Kitsap PUD is proposing to augment streams that are located near water mains of their systems. The water would be produced from either existing water-supply wells or new wells installed to be dedicated only for stream augmentation. The objective of the project is to provide “water-for-water” offset for future permit-exempt wells (PEWs) by discharging water indirectly into the stream to augment streamflow. Kitsap PUD has systems located in West Sound, North Hood Canal and Bainbridge Island subbasins of WRIA 15. Some members of the WRIA 15 Committee support further exploration of this project through feasibility studies. There are a number of concerns, including impact on deep aquifers and water quality. If Kitsap PUD decides to pursue this project, close coordination with the WRIA 15 Tribes and WRIA 15 partners is recommended.	67.6			Kitsap PUD		Conceptual	$10,000 per site plus $8000 annual O&M	

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
North Hood Canal Subbasin												
II	Big Beef Creek Restoration	Habitat with Offset	Multiple Parcels (hidden for privacy)	Restore wetlands, floodplain, and riparian along this ditched segment of upper Big Beef Creek. Acquisition likely needed.						Scoping		$667,092
II	Grovers Creek and Leyman Wetland Restoration	Habitat with Offset	Robinson and Duncans parcels	Stream channel and wetland restoration are proposed on 1,600 feet of Grovers Creek and 10 acres of wetlands. Two parcels owned by the Robinson and Duncans were historically farmed, reed canary grass established and stream channel ditched. The project will improve fish passage and establish wetland and riparian vegetation. The project will also enhance water infiltration and improve floodplain function. This project will benefit Coho, Chum, steelhead and cutthroat habitat. Funding for restoration design has been obtained and preliminary design is in progress. Funding for final design and construction are needed.		1600 ft of stream restoration ; 10 acres wetland		Kitsap Conservati on District (KCD)		Design	$300,000	
II	Hansville Wetland Enhancement	Habitat with Offset	Hansville	Degraded wetland could be restored.			Link			Conceptual		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Big Beef Refugia Acquisitions	Habitat no Offset	Big Beef Creek					Kitsap County		Conceptual		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Kitsap PUD Stream Augmentation Project	Offset no Habitat	Multiple Streams	Kitsap PUD currently owns and operates 54 public water systems throughout rural Kitsap County. Kitsap PUD is proposing to augment streams that are located near water mains of their systems. The water would be produced from either existing water-supply wells or new wells installed to be dedicated only for stream augmentation. The objective of the project is to provide "water-for-water" offset for future permit-exempt wells (PEWs) by discharging water indirectly into the stream to augment streamflow. Kitsap PUD has systems located in West Sound, North Hood Canal and Bainbridge Island subbasins of WRIA 15. Some members of the WRIA 15 Committee support further exploration of this project through feasibility studies. There are a number of concerns, including impact on deep aquifers and water quality. If Kitsap PUD decides to pursue this project, close coordination with the WRIA 15 Tribes and WRIA 15 partners is recommended.	90.3			Kitsap PUD		Conceptual	$10,000 per site plus $8000 annual O&M	

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
South Hood Canal Subbasin												
II	Tahuya Headwaters	Habitat with Offset	Tahuya River (South Kitsap)	Purchase of fee and/or easement of up to 3 miles of riparian corridor in the upper Tahuya River and tributaries. Floodplain restoration including potential for LWD placement and BDA. Currently under one timberland owner.		3 miles riparian corridor protected				Acquisition		
IV	Bremerton Reclaimed Water/Water Reuse Feasibility Study	Offset no Habitat		Pursue feasibility studies for reclaimed and reuse water opportunities.								
South Sound Subbasin												
II	Coulter Creek Protection	Habitat with Offset	Coulter Creek	Coulter Creek. Protection (acquisition of fee or easement) of riparian buffer and floodplain restoration of 3-5 mile riparian corridor owned by single landowner.		3-5 miles riparian protection and restoration		GPC		Acquisition		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
III	Gig Harbor Golf Club Artondale Creek Habitat Improvement	Habitat with Offset	Artondale Creek	A portion of Artondale Creek and approximately 2 acres of the floodplain would be restored by replacing two existing bridges to open up the floodplain and plantings to increase shade, improve instream habitat, reduce stream temperature, and improve riparian buffers and upland habitat conditions. The restoration project may also be extended downstream if needed to improve fish passage to the project site. The project is located in the South Sound subbasin of WRIA 15 on the Gig Harbor Peninsula.		Improve instream and floodplain habitat conditions; improve water temperatures.			Gig Harbor Golf Club, Pierce Co, Tribe	Conceptual	$500,000 (with offset improvements)	
III	Rocky Creek Protection and Riparian Buffer	Habitat no Offset	Rocky Cr	Rocky Creek. Protection (acquisition of fee or easement) of riparian buffer and floodplain restoration of ~4 mile riparian corridor owned by single landowner.		4 miles riparian corridor protection and restoration		GPC		Acquisition		
IV	Upper Little Minter Creek watershed acquisition and floodplain/wetland restoration project	Habitat with Offset	Little Minter Creek - 15311 and 12521 94TH AV NW	Reconnecting ditches, more sinuosity, beaver habitat; potential water right.						Conceptual		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Upper Burley Creek Floodplain/ Wetland Restoration	Habitat with Offset	East of Bethel Burley Road, south of Holman Road. Kitsap Co Parcels: 242301-3-016-2006, 242301-3-017-2005, 252301-2-009-2006, 252301-2-038-2001, 252301-2-039-2000, 252301-2-047-2000	Restore wetlands, floodplain, and riparian along this segment of Burley Creek that has been ditched and drained. Acquisition likely needed also.						Conceptual		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Mid Burley Creek Floodplain/ Wetland Restoration	Habitat with Offset	East of Bethel Burley Road, south of Swofford Lane. Kitsap Co Parcels: 362301-2-004-2008, 362301-2-003-2009, 9000-010-192-0008, 362301-2-021-2007, 362301-2-022-2006, 362301-2-012-2008, 362301-2-005-2007, 362301-2-014-2006, 362301-3-021-2005, 362301-3-020-2006	Restore wetlands, floodplain, and riparian along this segment of Burley Creek that has been ditched and drained. Acquisition likely needed also.						Conceptual		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	360 Trails/Gateway Park	Habitat with Offset	Minter Creek - E of Gateway Park, N of SR 302, W of 94th Ave NW	Education/outreach, land acquisition, conservation easement, beaver enhancement opportunity.					WDFW or Kitsap Conservation District	Conceptual		
IV	Burley Creek Drainage Floodplain and Ag Restoration	Habitat with Offset	North of Bethel Burley and Burley Olalla intersection.							Conceptual		
IV	Pierce County parcels near Belfair - 186th Ave	Habitat with Offset	Pierce County property - undeveloped woodland/riparian on Rocky Creek. 13711 186th Ave NW, Gig Harbor	Assess riparian area for floodplain or wetland enhancement						Conceptual		
IV	Filucy Bay Floodplain Enhancement	Habitat with Offset	Filucy Bay	Restore/improve floodplain and surrounding wetlands on a Pierce Co owned property.						Scoping		
IV	Coulter Tree Farm	Habitat with Offset	Coulter Creek							Conceptual		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Pierce County parcel near Belfair - Elgin Clifton Road	Habitat with Offset	Pierce County property - undeveloped woodland near south branch of Rocky Creek	Assess wetland area for enhancement or beavers						Conceptual		
IV	Floodplain enhancement on multiple sites	Habitat with Offset	Rocky, Curley, L. Anderson, Irene, Grovers	Floodplain restoration on existing properties owned by GPC. Large Woody Debris placement on Rocky Creek, Curley Creek, Little Anderson Creek, Irene Creek. Beaver Dam Analogs on Rocky Creek and Grovers creek preserves.				Great Peninsula Conservancy		Conceptual		
IV	Artondale Creek Preservation	Habitat no Offset	Parcel removed for privacy.	Identified in the Wild Fish Conservancy (WFC) watershed typing exercise for potential preservation. Land owner is interested.					Great Peninsula Conservancy; Wild Fish Conservancy	Conceptual		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Pierce County parcel near Belfair - Elgin Clifton Road	Offset no Habitat	Pierce County property - public works site. https://epip.co.pierce.wa.us/cfapps/atr/epip/summary.cfm?parcel=0022244000	Stormwater retrofit or MAR at sand/gravel pit.	TBD					Conceptual		
IV	Pierce County parcel near Belfair - Elgin Clifton Road	Offset no Habitat	Pierce County property - undeveloped woodland near south branch of Rocky Creek	Preserve forest for infiltration benefit (conservation easement in trust).						Conceptual		
IV	Pierce County parcel near Home - 18th St NW	Offset no Habitat	Pierce County property - undeveloped woodland. Corner of 18th St NW and 180th Ave NW	Preserve forest for infiltration benefit (conservation easement in trust).						Conceptual		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Burley Creek Watershed Mine Reclamation Options	Offset no Habitat	West of Bethel Burley Rd, north of High Ridge Ct. Kitsap Co Parcels: 4799-000-009-0008, 4799-000-001-0303, 4799-000-020-0102, 262301-1-039-2001, 262301-1-041-2007, 262301-1-013-2001	Review mine reclamation plan and determine whether infiltration or wetland restoration are options.						Conceptual		
IV	Horseshoe Lake Golf Course Water Use Options	Water Rights Acquisition	Parcel: 5349-000-007-0002	Review water use at Horseshoe Lake Golf Course and consider options for water use reductions, transfer of water rights, etc.						Scoping		
IV	Trophy Lake Golf Course Water Use Options	Water Rights Acquisition	Parcel: 202301-3-010-2006	Review water use at Trophy Lake Golf Course and consider options for water use reductions, transfer of water rights, etc.						Scoping		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Coulter Creek / Estuary	Habitat no Offset	Coulter / Estuary	Opportunities for land acquisition and habitat restoration.			Acquisition + Develop natural storage on GPC properties		Great Peninsula Conservancy	Acquisition	$350,000	$0
IV	Burley Creek	Habitat no Offset	Burley Ck	Opportunities for land acquisition and habitat restoration.			Acquisition + Develop natural storage on GPC properties		Great Peninsula Conservancy	Conceptual		
IV	Purdy Creek	Habitat no Offset	Purdy Ck	Opportunities for land acquisition and habitat restoration.			Acquisition + Develop natural storage on GPC properties		Great Peninsula Conservancy	Conceptual		
IV	Minter Creek	Habitat no Offset	Minter Ck	Opportunities for land acquisition and habitat restoration.			Acquisition + Easement to increase average stand age for higher baseflows		Great Peninsula Conservancy	Acquisition	$225,000	$105,000
IV	Rocky Creek	Habitat no Offset	Rocky Creek	Opportunities for land acquisition and habitat restoration.			Develop natural storage on GPC properties		Great Peninsula Conservancy	Conceptual		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Filucy Bay projects	Habitat no Offset	Filucy Bay tributaries (Schoolhouse Ck)	Opportunities for land acquisition and habitat restoration.			Develop natural storage on GPC properties		Great Peninsula Conservancy	Conceptual		
South Sound Islands Subbasin												
II	Schoolhouse Creek Restoration	Habitat with Offset	Anderson Island	The Anderson Island Parks District and Pierce County has been working on this Creek for many years. The County replaced two culverts in 2013. There are two remaining barriers on County road that the County is seeking funding from the fish barrier removal board for and one partial barrier on a private road. The Parks District has also been looking for funding to creek meandering and wetland restoration on a section of creek that was previously ditched and used for agriculture.						Construction		
II	East Oro Bay Barrier Removal	Habitat with Offset	Anderson Island, East Oro Bay near Jacobs Point Park	There is an earthen dam that impounds the top of the estuary in East Oro Bay.						Construction		
Vashon Maury Subbasin												

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Maury Island Initiative	Water Rights Acquisition	Maury	Property associated with the WR first acquired in 2008 and later in 2019. Portion of the WR may have already been forfeited and remaining portion may be small. Likely .05 CFS instantaneous flow certificate for group domestic supply; Parcel numbers 3222039011, 3222039027	TBD					Conceptual		
IV	Frog Holler Forest Water Right Acquisition	Water Rights Acquisition	South Vashon	Forest was acquired by VLT in 2016. There may be a water right associated with the property that is at risk of relinquishment in 2021. Likely 6 irrigated acres. Beneficial Use is for irrigation and domestic; Long Claim; Parcel Number 2522029016	6?				King County or Vashon Maury Island Land Trust	Conceptual		
IV	Piner Point	Water Rights Acquisition	South Vashon	Property was acquired by King County Parks in 2014. There is a small cabin on the property and the water right supports domestic water supplies across three properties. Small, but may be important since V-M is a single source aquifer. Est at 1.5 annual acre feet. Parcel 6175800300; Certificate: Domestic Use Multiple	1.5					Conceptual		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Forest Glen Natural Area	Water Rights Acquisition	Vashon	Property acquired in 2014 and converted into a park owned by King County. May be forfeited already or coming up in 2022; Long Claim for domestic supply and irrigation; 16 annual acre feet; 10 GPM instantaneous flow	16					Conceptual		
West Sound Subbasin												
II	Mid Olalla Creek Floodplain/Wetland restoration	Habitat with Offset	Parcels removed for privacy	Restore wetlands, floodplain, and riparian along this segment of Olalla Creek that has been ditched and drained. Acquisition likely needed also.						Conceptual		
II	Ruby Creek Restoration	Habitat with Offset	Ruby Creek	Approximately .44 miles of stream will be enhanced by excavating reed canary grass from the channel which is also inhibiting fish passage in this stream section. Installation of LWD, excavation of planting mounds and riparian planting are also proposed. The overall project involves restoration and enhancement of 11.7 acres of stream and wetland habitat. Chum, Coho, cutthroat trout and steelhead are documented in this reach of Ruby Creek. Design is complete and funding is needed for construction. Part of a larger fish barrier removal project.		Open access to 3.5 miles; improve 11.7 acres of stream and wetland habitat			Kitsap Conservation District	Construction		635000 (includes barrier removal)

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
II	Dogfish Creek Wetland Restoration	Habitat no Offset	Malone parcel	This project involves enhancement of 2,832 feet of Dogfish Creek and enhancement of 24 acres of mapped wetland. The 80 acres owned by Malone was historically farmed, reed canary grass established and stream channel ditched. The project will enhanced beaver activity and establish wetland and riparian vegetation. This project will also improve stream flow and floodplain function. This project will benefit Coho, Chum, steelhead and cutthroat habitat. Funding for restoration design has been obtained and preliminary design is in progress. Funding for final design and construction are needed. Part of a larger fish barrier removal project.		Enhance 2832 feet of creek and 24 acres of wetland		Kitsap Conservation District (KCD)		Design		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
II	Lower Blackjack Creek Subbasin Restoration and Remediation Actions	Habitat with Offset	Lower Blackjack Cr	This project proposes restoration and remediation of stream corridor habitat within the lower Blackjack Creek Subbasin as a subset of the Foster Pilot program within WRIA 15. Each restoration and remediation action has been identified and vetted by the Suquamish Tribe in their Blackjack Creek Watershed Protection and Restoration Plan composed in December, 2017.				Port Orchard Public Works		Design	$2,133,500	
II	Lower Blackjack Creek Infrastructure Removal and Habitat Remediation	Habitat with Offset	Lower Blackjack Cr	Assess the feasibility, perform due diligence, then construction/remediation of infrastructure in Blackjack Creek. This is part of the WRIA 15 Foster Pilot program. Projects include: 1. Rehabilitating an existing water main crossing over the creek by directionally drilling the water main to cross underneath the creek and removing the old infrastructure 2. Cleaning up debris from abandoned transient camps and replanting 3. Update old storm drainage to creek/tributary with LID principles				Port Orchard Public Works		Feasibility	$3,130,000	

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
II	Blackjack Watershed Protection & Restoration Feasibility Plan	Habitat with Offset	Blackjack Creek	This project will build on the 2017 "Blackjack Creek Watershed Assessment, Protection, and Restoration Plan", and identify the highest priority tax parcels for protection or restoration based on a systematic evaluation of their value to salmon recovery. This evaluation will include a literature review of existing studies and GIS desktop analysis to identify the riparian and wetland habitats with the most value to salmon, highest connectivity to other salmon habitat, and greatest threat of development. The project will use this evaluation to rank parcels, and conduct outreach to landowners of the highest ranked parcels.				Great Peninsula Conservancy		Planning/Design	$200,000	$0
III	Salmonberry Creek and Wetland Protection Project	Habitat no Offset	Salmonberry Creek	Great Peninsula Conservancy (GPC) will protect 90 acres of riparian, wetland, and fish habitat through purchasing a conservation easement on property on Salmonberry Creek in Kitsap County. Salmonberry Creek is located in an ESSB 6091 prioritized basin (WRIA 15), and contains Endangered Species Act-listed steelhead trout.		90 acres protection		Great Peninsula Conservancy		Acquisition	$420,000	

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
III	Floodplain Restoration Upstream of Navy RR Trestle	Habitat with Offset	Link	This action will aim to restore floodplain connectivity, riparian processes, and instream habitat conditions. Restoration actions should focus on removal of artificial fill along the abandoned road grade constricting the channel at RS 11100, restoring riparian forest conditions, and targeted wood placements to increase channel complexity and restore natural stream grade. Restoration of riparian processes will require negotiation of conservation easements or acquisition of the streamside parcel along the northern (left) bank. The parcel totals 6 acres and has an assessed value of $240,000 per 2012 tax records. This action is constrained, in part, by channel confinement at the Navy RR trestle. The channel reach upstream of this segment flows through parcels that are part of the Mountaineers Foundation Rhododendron Preserve, where riparian conditions are more intact, instream wood is more abundant, and a broader floodplain exists due to the lack of bank protection.		6 acres restoration				Construction		$255,000

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
III	Curley Creek Acquisition	Habitat no Offset	Link	This project will build upon work done through the SRFB Curley Creek Estuary Acquisition and Curley Creel Feasibility study. Project will acquire highest quality remaining Chinook and steelhead habitat available on lower Curley Creek.						Feasibility		$200,000
III	Instream Habitat Enhancement at the Confluence with Chico Creek	Habitat no Offset	Chico Creek	Large wood placements to create additional complexity near the tributary confluence will improve habitat conditions in the near term while concurrent efforts to set back constraints to floodplain processes can be implemented.						Conceptual		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
III	Grovers Creek Protection Phase II	Habitat no Offset	Lower Grovers Creek	Great Peninsula Conservancy's Lower Grovers Creek Habitat Protection Project aims to protect and restore 10.5 acres of riparian and wetland habitat along Grovers Creek and Miller bay in north Kitsap County for the benefit of people, salmon, and other wildlife. This project includes two properties in the Grovers Creek Watershed of north Kitsap County, including the 1.5-acre Tucker property and 9-acre Grovers Creek Durham Preserve Project owned by GPC. The Puget Sound Nearshore Ecosystem Restoration Project has prioritized the Grovers Creek Watershed as a "Protect High" watershed under its Coastal Inlet Strategy due to the fact that it remains relatively undeveloped.		10.5 acres protection	-	Great Peninsula Conservancy		Acquisition	$685,650	

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
III	Curley Creek prioritized restoration	Habitat no Offset	Curley Creek	In November 2017 the Suquamish Tribe released a completed watershed assessment and protection and restoration plan for Curley Creek, one of the three high priority freshwater streams in the East Kitsap shoreline. This Near Term Action proposes to use this plan to work with partners to identify which of the high priority protection and restoration actions are feasible to move forward to implementation and then to carry out that work.				Midsound Fisheries Enhancement Group		Planning/Design	$625,000	$0
IV	Floodplain Restoration Upstream of Kitsap Lake	Habitat no Offset	Kitsap Lake							Conceptual		
IV	Acquisition of Johnson Creek headwaters	Habitat no Offset	Johnson Creek headwaters	The headwater wetlands of Johnson Creek (a salmon stream) in Poulsbo is relatively intact and undeveloped, however it is at risk of being developed. There is opportunity to acquire for preservation (GPC) or recreation (Parks).						Conceptual		
IV	Lower Strawberry Creek Restoration Design	Habitat no Offset	Strawberry Creek - Dyes Inlet							Design		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Mid-Upper Blackjack Creek Floodplain/Wetland Restoration	Habitat with Offset	Parcels removed for privacy	Restore wetlands, floodplain, and riparian along this segment of Blackjack Creek that has been ditched and drained. Acquisition likely needed also.						Conceptual		
IV	Remove infrastructure from outlet of Kitsap Lake	Offset no Habitat	Link	Remove infrastructure from the channel at the lake outlet to prevent future manipulation of lake levels. Fish screens at the outlet of Kitsap Lake previously restricted anadromous fish passage. The screens were removed in 1999; however, the concrete pieces that supported the screens remain in the channel. At times, this infrastructure has been altered by local residents to control the lake level without authorization. Such action results in rapid drawdown of streamflow in downstream segments of Kitsap Creek.						Conceptual		
IV	Long Lake Augmentation	Offset no Habitat	Long Lake	Potential flow augmentation and BDAs.						Conceptual		

Category	Project Name	Type of Project	Project Location	Project Description	Estimated Water Offset Amount (acre feet)	Habitat Value (no set value)	Project Hyperlink (if applicable)	Existing Sponsor	Potential Sponsor (Where No Existing Sponsor Exists)	Project Stage	Estimated Cost	Existing Funding (as of Dec 2020)
IV	Kitsap PUD Stream Augmentation Project	Offset no Habitat	Multiple Streams	Kitsap PUD currently owns and operates 54 public water systems throughout rural Kitsap County. Kitsap PUD is proposing to augment streams that are located near water mains of their systems. The water would be produced from either existing water-supply wells or new wells installed to be dedicated only for stream augmentation. The objective of the project is to provide “water-for-water” offset for future permit-exempt wells (PEWs) by discharging water indirectly into the stream to augment streamflow. Kitsap PUD has systems located in West Sound, North Hood Canal and Bainbridge Island subbasins of WRIA 15. Some members of the WRIA 15 Committee support further exploration of this project through feasibility studies. There are a number of concerns, including impact on deep aquifers and water quality. If Kitsap PUD decides to pursue this project, close coordination with the WRIA 15 Tribes and WRIA 15 partners is recommended.	183.9			Kitsap PUD		Conceptual	$10,000 per site plus $8000 annual O&M	

Appendix I – Detailed Project Descriptions

Managed Aquifer Recharge Project Portfolio for WRIA 15

Summary

Managed Aquifer Recharge (MAR) projects are being considered in WRIA 15 as a method to increase infiltration to aquifers to improve streamflow and to offset the water use from future permit exempt (PE) wells in the watershed. The planning and implementation of MAR projects is complex, leading to uncertainty as to their potential use as water offset projects and inclusion in the Watershed Restoration and Enhancement Plan. A potential approach to addressing uncertainty is to include a portfolio of MAR projects that have different locations, project sponsors, water sources, and size. Uncertainty is addressed by qualitatively assessing the potential for implementation on a high, medium, and low basis and then assigning a probability to the potential offset from each project. The overall potential for MAR in WRIA 15 is the sum of the potential offsets multiplied by their probability. MAR projects in WRIA 15 have been identified through different sources and are estimated to have a total potential water offset of 1736 acre-feet/year. The overall potential, accounting for uncertainty, is estimated to be 456.9 acre-feet/year. Considering MAR projects that can be implemented within the next 10 years, the estimated potential offset is 361.8 acre-feet/year (with adjusted offset for implementation feasibility). The remaining MAR projects would likely take longer than 10 years to implement.

WRIA 15 MAR Projects

There are different types of MAR projects. Aquifer Storage and Recovery (ASR) projects are a type of MAR project that actively injects water into aquifers for storage and recovery by pumping later. Passive MAR projects infiltrate water into shallow aquifers, with the intent that water discharges from the shallow aquifer into streams on a delayed basis and improves streamflow during low-flow periods. For WRIA 15, only passive MAR projects are being considered. The source of water for the passive MAR projects in WRIA 15 may be recycled water (highly treated wastewater), stormwater or diverted surface water.

MAR projects have the potential to recharge a significant volume of water into shallow aquifers, greater than the estimated consumptive use of PE wells forecast for the next 20 years. However, the planning and implementation of individual MAR projects is complex, leading to uncertainty as to their potential use as water offset projects and inclusion in the Watershed Restoration and Enhancement Plan. Proposing a portfolio of potential MAR projects is an approach which will provide projects in most subbasins in WRIA 15, have different water sources, different scales and different implementing entities. Table 1 lists the current portfolio of MAR projects and includes the potential water offset, the estimated timeframe for implementation and the relative certainty of implementation. The estimated timeframe is included to address whether the project can provide water offsets on a timely basis consistent with growth in PE connections. The relative certainty of implementation is a qualitative assessment based upon the project sponsor's ability to perform the project, the relative cost, and potential issues in design, permitting and funding.

MAR projects implemented in WRIA 15 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.[47] The Committee opposes projects that reroute streams or include instream structures. The Committees supports MAR projects that address water quality (e.g., adequate treatment of stormwater or reclaimed water).

[47] "…Qualifying projects must be specifically designed to enhance streamflows and not result in negative impacts to ecological functions or critical habitat," (RCW 90.94.030 (3) (b)).

Table 1. Portfolio of Potential Managed Aquifer Recharge Projects

Subbasin	MAR Project	Potential Sponsor	Potential Offset (ac-ft/year)	Estimated Timeframe for Implementation	Relative Certainty of Implementation (High, Medium, Low)
West Sound	Kingston Treatment Plant Recycled Water*	Kitsap County Public Works	328^	5 years	High
	Grovers Creek MAR	Not yet identified	20[1]	>10 years	Low
	Central Kitsap Water Treatment Plant [2]*	Silverdale Water District	167	5 years	Medium
North Hood Canal	Central Kitsap Water Treatment Plant, includes Asbury Parcel[2] *	Silverdale Water District	333	5 years	Medium
South Hood Canal	Tahuya River MAR	Washington Water Trust	200	5-10 years	Low
	Oak Lake Storage and MAR	Not yet identified	75	>10 years	Low
	Shoe Lake Storage and MAR	Not yet identified	62	>10 years	Low
Bainbridge Island	M & E Farm Storage*	City of Bainbridge Island	17	5-10 years	Medium
	Johnson Farm Storage*	Not yet identified	90	>10 years	Low
	Winslow Treatment Plant Recycled Water	City of Bainbridge Island	45	>10 years	Medium

Subbasin	MAR Project	Potential Sponsor	Potential Offset (ac-ft/year)	Estimated Timeframe for Implementation	Relative Certainty of Implementation (High, Medium, Low)
	Miller Rd MAR*	Not yet identified	19	>10 years	Low
South Sound	Port Orchard Airport MAR*	Washington Water Trust	100	>10 years	Low
	Belfair WWTP MAR*	Not yet identified	70	>10 years	Low
	Rocky Creek south of Trophy Lake Golf Course MAR	Not yet identified	150	>10 years	Low
	Minter Creek MAR	Washington Water Trust	20[1]	>10 years	Low
	Rocky Creek between Wye and Koeneman Lakes MAR	Washington Water Trust	20[1]	>10 years	Low
Vashon – Maury Island	Judd Creek MAR	Washington Water Trust	20[1]	>10 years	Low
McNeil Island, Anderson Island, Ketron Island	None				

Subbasin	MAR Project	Potential Sponsor	Potential Offset (ac-ft/year)	Estimated Timeframe for Implementation	Relative Certainty of Implementation (High, Medium, Low)
Totals			**328**		High Relative Certainty
			567		Medium Relative Certainty
			846		Low Relative Certainty

*[1]Potential offset not estimated yet; 20 acre-feet/year assumed based upon ¼ acre total size infiltration basin at each project site. [2] Central Kitsap Water Treatment Plant Project could provide water offsets to both West Sound and North Hood Canal Subbasins. An assumption of the split in benefits was made (2/3 North Hood Canal, 1/3 West Sound). *Detailed project description available at end of document. ^Further reduced based on Aspect Consulting Study*

One MAR project, the Kingston Recycled Water Project, is thought to have a high relative certainty. The potential water offset from the project is 328 acre-feet per year. Four potential MAR projects are thought to have a medium relative certainty. Those projects have a potential water offset of 567 acre-feet per year. The remainder have a low relative certainty but should remain on the list until more is found out about those projects.

A method of predicting outcomes from the portfolio of projects is to assign a probability to each level of relative certainty and multiply that probability by the potential offset. That calculation is shown in Table 2. Probabilities of 80 percent, 50 percent, and 10 percent are used in the calculation to represent high through low relative certainty. Using this calculation, the likely offset that will occur from pursuing a portfolio of MAR projects is 456.9 acre-feet per year. The calculation can be adjusted by changing the relative certainty of a project or by using a different probability to represent the different levels of relative certainty.

Table 2. Water Offsets Adjusted by Probability of Implementation

Relative Certainty of Implementation (High, Medium, Low)	Total Estimated Offset (acre-feet/year)	Probability	Adjusted Offset (acre-feet/year)
High Relative Certainty	328	80%	262
Medium Relative Certainty	567	50%	284
Low Relative Certainty	846	10%	85
Totals			**631**

The high and medium relative certainty projects could be implemented in the next ten years, providing an estimated potential offset of 361.8 acre-feet/year (with adjusted offset for implementation feasibility). The remaining MAR projects would likely take longer than 10 years to implement.

Work Required to Implement a MAR Project

The successful implementation of a MAR project is complex and involves several critical steps prior to actual construction (Covert 2019):

- Identification of potential locations that:
    - Have available aquifer capacity such that water infiltration can occur without creating overflows to the surface,

- Have soils and underlying geology with suitable hydraulic properties,
    - Are located such that enough infiltrated water will discharge to surface water during low streamflow periods, and
    - Are available for permanent use through acquisition or easements.
- Identification of a physically and legally available water source.
- Characterization and evaluation of site-specific hydrogeologic properties.
- Assessment of source water and aquifer compatibility, potential water quality changes during infiltration, and other water quality considerations.
- Development of preliminary MAR project designs and implementation cost estimates.
- Identification of project permitting requirements and potential hurdles.
- Assessment of ongoing operation and maintenance (O&M) costs, and identification of potential funding sources to support O&M.

References

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

Detailed Descriptions for Larger MAR Projects

Kingston Treatment Plant Recycled Water And Managed Aquifer Recharge Project- West Sound Subbasin

Description

Kitsap County is proposing to produce Class A recycled water at the existing Kingston Treatment Plant, which would be used for summer irrigation at the White Horse Golf Course (WHGC) and winter indirect groundwater recharge to the area north of WHGC. The stated objective of the County for the project is to "treat water as a resource rather than a waste stream" to address water quality and quantity concerns specific to Kingston, and other related water resource issues throughout the county. This project is in the West Sound subbasin of WRIA 15.

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

Currently, irrigation water for WHGC is purchased from the Kitsap Public Utility District (Kitsap PUD) and is sourced from groundwater wells in the area that pump from a sea-level aquifer. Quantity of usable groundwater is limited and, eventually, as the local demand for groundwater supplies increases, this water source could decline because it is not being adequately replenished. Additionally, with increased withdrawals from the sea-level aquifer, there is a concern of saltwater intrusion and the associated impacts to groundwater quality over time. Delivery of recycled water to WHGC would preserve 29 million gallons per year (89 acre-feet) of potable water from Kitsap PUD's groundwater supply system and eliminate the stress to the supply system imposed by large swings in potable water system demands during the irrigation season. Recycled water use will also decrease the risk of saltwater intrusion within the regional sea-level aquifer and extend the useful life of existing potable water infrastructure. The proposed Project would infiltrate about 107 million gallons per year (328 acre-feet) of highly treated recycled water into the shallow aquifer that provides baseflow to Grovers Creek and its tributaries. Assuming an average infiltration volume of 0.3 million gallons per day, the Project could increase baseflow in Grovers Creek by roughly 0.5 cfs. The water use and infiltration numbers are obtained from the Kingston Recycled Water Plan (Brown & Caldwell 2019).

The water offset quantity for the WRIA 15 Watershed Plan would be 328 acre-feet per year.

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

Figure 1 shows the location of the facilities proposed for the project. Additional maps and drawings can be obtained in the Kingston Recycled Water Facility Plan.

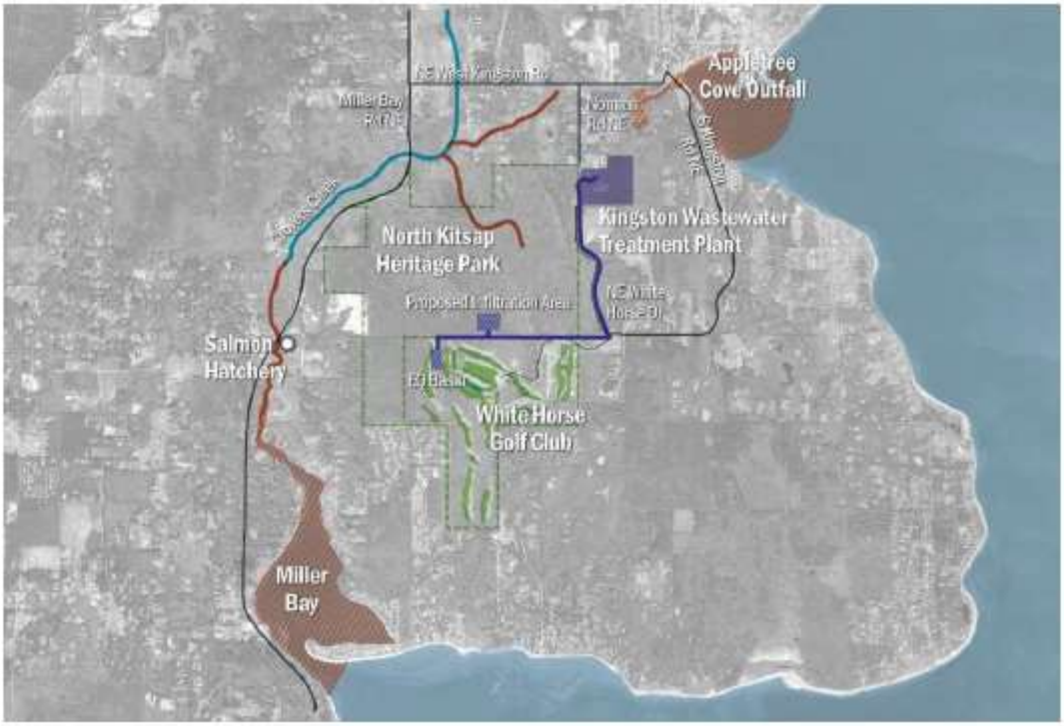


Figure 1. Location of pipeline to WHGC and to infiltration area (from Brown & Caldwell, 2019)

Description of the anticipated spatial distribution of likely benefits

Water infiltration at the White Horse Golf Course could increase groundwater levels over approximately 500 acres of the headwaters of the South Fork of Grovers Creek and provide increased groundwater inputs and flows into nearly three miles of perennial streams (Grovers Creek and SF Grovers Creek) and up to 1.5 miles of intermittent streams (tributaries to Grovers Creek and SF Grovers Creek). Water infiltration could also enhance or restore wetlands associated with the creeks or headwater areas.

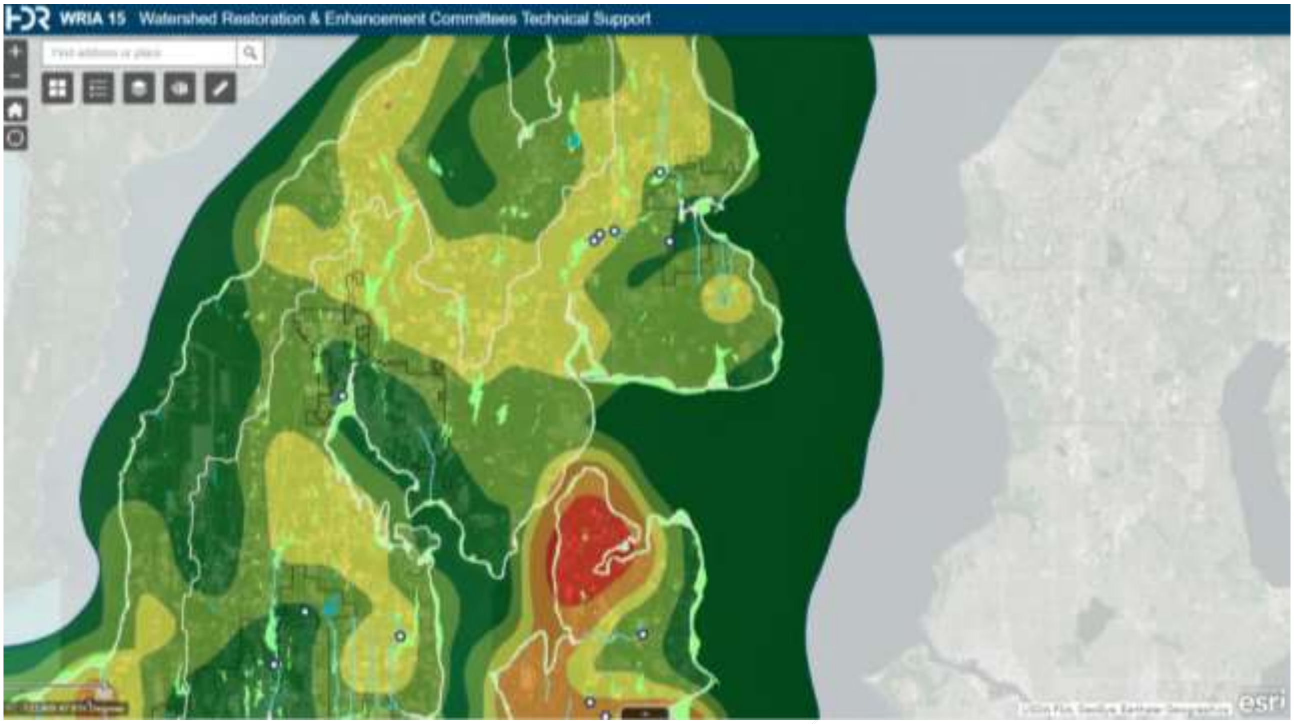
Location relative to future PE well demand

The forecast consumptive use for the West Sound subbasin using the irrigated area method and baseline growth assumptions is listed in Table 1.

Table 1. Forecast PE Consumptive Use Demand for West Sound Subbasin

Acre-feet per year	Gallons per minute	Cubic feet per second
183.9	114.0	0.2545

A copy of the PE growth heat map from the WRIA 15 webmap is shown in Figure 2.



Source:
https://hdr.maps.arcgis.com/apps/webappviewer/index.html?id=d7d02dedb57241aa81dd7eb376c8625a

Figure 2. WRIA 15 PE Growth Heat Map

Performance goals and measures.

The performance goals are to reduce groundwater use by 89 acre-feet per year during summer by switching the source of supply from Kitsap PUD to recycled water and to increase infiltration by 328 acre-feet per year to improve baseflow in Grovers Creek. The measures will be an increase in baseflow in summer in Grovers Creek and South Fork Grovers Creek by about 0.5 cfs. The increased baseflow should reduce water temperatures in those streams.

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

The Washington Department of Fish and Wildlife (WDFW 2020) has identified that coho salmon are present in both Grovers Creek and the SF Grovers Creek; the Endangered Species Act (ESA) listed Puget Sound winter steelhead are present in Grovers Creek (although Grovers Creek is not listed as critical habitat); and chum salmon are present at the mouth of Grovers Creek below the fish hatchery weir/dam operated by the Suquamish Tribe near Miller Bay Road (barrier ID: 930696), for Grovers Creek Hatchery. The Washington Stream Catalog (WDF 1975) indicates that both coho and chum salmon were historically present in Grovers Creek. These North Kitsap streams were noted in the

Stream Catalog (WDF 1975) as having good steady base flows at the time (likely due to the glacial outwash soils and infiltration of water).

Increased base 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 both productivity and survival of juveniles. The alteration of natural stream hydrology has been identified as a high priority limiting factor in WRIA 15 (NOAA 2007) and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions.

Identification of anticipated support and barriers to completion.

A stakeholder coordination and public involvement program was completed and is described in the Water Facility Plan. Support was expressed for the recycled water, WHGC irrigation and winter infiltration option. The project is also believed to be in alignment with the broader goals of Ecology, Governor Jay Inslee's Shellfish Initiative, West Central Local Integrating Organization, and the Puget Sound Partnership's Strategic Initiatives to prevent pollution, protect and restore habitat, and recover shellfish beds. The main barrier to completion is funding for construction as well as determination of how to fund and who will manage the operations and maintenance of the project. Consultation with the Suquamish Tribe is necessary prior to the project proceeding.

Potential budget and O&M costs.

The total construction costs of water treatment, conveyance, irrigation and infiltration are estimated to be $13.65 million (includes engineering and construction costs). The construction costs for conveyance and infiltration basins total $3.3 million and infrastructure needed for irrigation at WHGC is $1.6 million. An additional 35 percent would be added for design, construction services and administrative costs. The annual O&M cost for winter infiltration and summer irrigation is estimated to be $151,000.

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by Kitsap County Public Works, O&M would likely be funded through ratepayers, and the source of water (domestic wastewater) will increase with increasing population and will not vary substantially from year to year due to climate factors.

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

The project sponsor would be Kitsap County Public Works Department. A pre-design study was completed (Brown & Caldwell 2019). In addition, stakeholder coordination and public involvement was performed and there is general support for this project, but additional details (particularly around O&M) need to be addressed prior to proceeding.

References

Brown and Caldwell, November 14, 2019. Kingston Recycled Water Facility Plan. Prepared for Kitsap County Public Works.

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.

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/

Central Kitsap Treatment Plant (Silverdale Water District No. 16 Recycled Water Project) – North Hood Canal and West Sound Subbasins

Description

Silverdale Water District No. 16 (SWD) is building infrastructure to move recycled water throughout most of their service area. The source of the recycled water is wastewater that originates from surrounding communities of Poulsbo, Bangor, Silverdale, and Central Kitsap, and flows to the Central Kitsap Treatment Plant (CKTP). Currently, the treated effluent discharges into Puget Sound approximately 3,200 feet offshore at Port Orchard Bay. The average daily rate of discharge is about 3.4 million gallons per day (MGD). The goal for the project is for zero discharge into Puget Sound.

The CKTP will produce recycled water ("Class A" reclaimed water[48]) using a sand filtration system with a capacity of 4 MGD. SWD will distribute the recycled water for various uses, including irrigation, dual-plumbing (flushing toilets), construction, streamflow augmentation and aquifer recharge. SWD has installed 7.4 miles of the planned 13.7 miles of purple pipe, the universal color for recycled water pipes. When completed, SWD will have the ability to move 3.5 MGD through the system.

The stated objective of the project is to provide "water-for-water" offset for future permit-exempt (PE) wells. This can be accomplished by infiltrating water and indirectly augmenting streamflow or by direct augmentation to a surface water body such as a stream or wetland. The key element of SWD's recycled water infrastructure pertinent to an offset for PE wells is the pipeline that runs along Newberry Hill Road. By extending this portion of pipeline and connecting it to the recycled water source, the recycled water would reach three potential infiltration sites that could indirectly augment streams. These are the sand and gravel facilities at Dickey Road, the Asbury Soils site and a stormwater retention pond along Newberry Hill Road at the end of the pipeline. The benefitting streams are within the West Sound and North Hood Canal subbasins of WRIA 15. They are potentially Little Anderson, Anderson, Big Beef, Strawberry, Wildcat, and Chico creeks. Direct augmentation could also occur along the pipeline route. Strawberry Creek is along the path of a recycled water pipeline and is a candidate for direct augmentation. In other parts of SWD's service area with recycled water pipelines Clear and Barker creeks are candidates for direct augmentation. For this project description only the infiltration projects along Newberry Hill Road are described.

Quantitative or qualitative assessment of how the project will function, including anticipated offset benefits, if applicable. Show how offset volume(s) were estimated. SWD estimates the total amount available for stream augmentation through infiltration at the Newberry Hill Road sites is approximately 0.5 MGD, equivalent to 0.77 cubic feet per second (CFS), 560 acre-feet per year (AFY)

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[48] "Class A reclaimed water" means a water resource that meets the treatment requirements of chapter 173-219 WAC, including, at a minimum, oxidation, coagulation, filtration, and disinfection.

and 347 gallons per minute (GPM). The reclaimed water system will be equipped with a Supervisory Control and Data Acquisition (SCADA) system that includes weather monitoring and forecasting. The SCADA systems will allow SWD to regulate flow at all points of discharge/augmentation.

Map of the project and location.

Figure 1 shows the location of existing and proposed recycled water system pipe within the SWD service area, the three potential sites along the proposed Newberry Hill Road pipeline, and the costs for future elements of the planned recycled water system.

Description of the anticipated spatial distribution of likely benefits

The potential infiltration site at the Dickey gravel pit would likely benefit Strawberry Creek in the West Sound subbasin. The Asbury infiltration site would likely benefit Johnson, Wildcat and Chico Creek in the West Sound subbasin. The stormwater retention pond along Newberry Road would likely benefit Little Anderson Creek in the North Hood Canal subbasin and could enhance the nearby wetland at the headwaters of Anderson Creek and a tributary to Big Beef Creek.

Locations relative to future PEW demand

The estimated consumptive use for future PE wells for the West Sound and North Hood Canal subbasins are provided in Table 1. The quantities assume the median growth estimate and use of the irrigated area method.

Table 1. Estimated Future Consumptive Use Quantity Using Median Growth Estimate and Irrigated Area Method

Subbasin	Estimated Future Consumptive Use (AFY)
West Sound	183.9
North Hood Canal	90.3

The potential water offset quantity for this project is much greater (285 AFY greater) than the PE well consumptive use estimates for the West Sound and North Hood Canal subbasins combined. Additional recycled water could be available for Clear and Barker Creeks,

The Anderson Creek subbasin appears to have a relatively high concentration of PE wells just north of the project area. The stormwater retention pond augmentation site at the headwaters of Little Anderson Creek would address is located in an area with especially high potential for future PE wells.

A copy of the PE well growth heat map from the WRIA 15 webmap is shown in Figure 2.

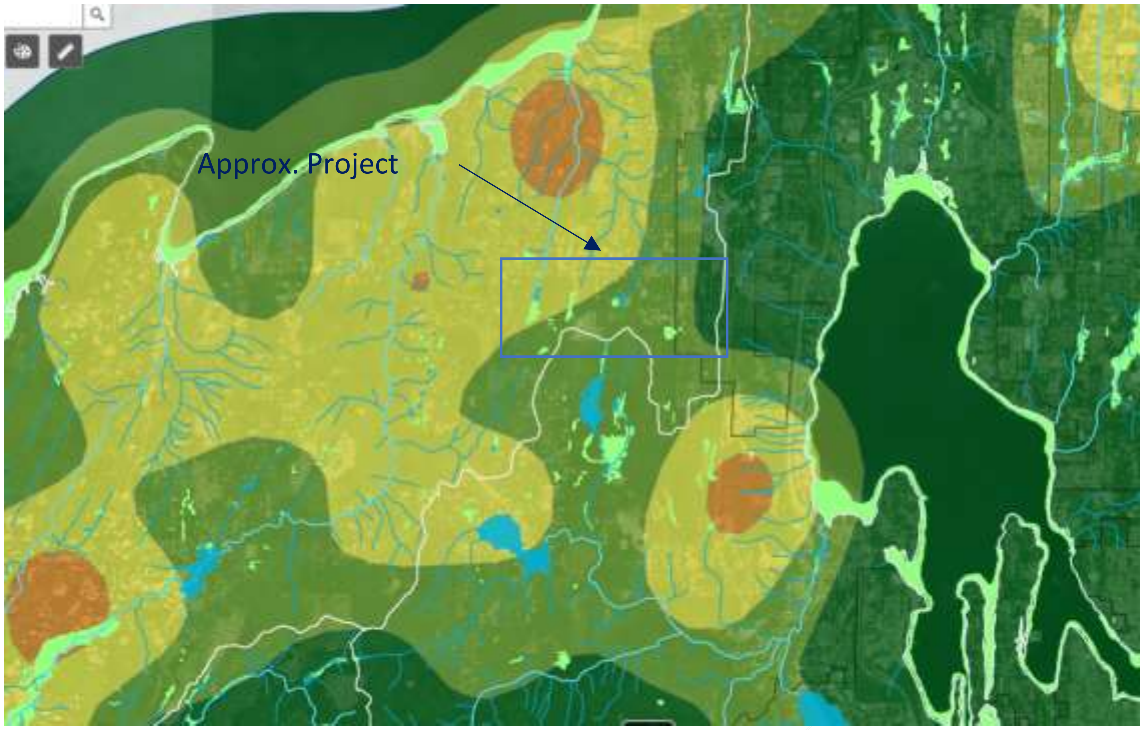


Figure 2. WRIA 15 PE Growth Heat Map

Performance goals and measures.

The stream augmentation amount will be measured and recorded using totalizing flow meters. The performance goals are to augment streams that are located near the infiltration sites. Kitsap PUD currently maintains 29 stream gaging stations in Kitsap County. Kitsap PUD's monitoring of Little Anderson Creek is on a monthly basis, not continuously, because of the stream channel conditions and access. Kitsap PUD does not currently monitor Strawberry Creek. However, the indirect augmentation may not be obviously detectible or measurable at a stream gage that is typically located near the mouth given the variability of stream flow in Kitsap County that is dependent on the timing and amount of precipitation (daily, monthly, seasonally, year-to-year) in these drainage basins. The increased baseflow should be most detectible in the upper reaches of the stream if the augmentation occurs near the headwaters of the stream. The increased baseflow, although small, should reduce water temperatures in those streams.

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

The Washington Department of Fish and Wildlife (WDFW 2020) has identified that coho and chum salmon and the Endangered Species Act (ESA) listed Puget Sound winter steelhead are present in both Anderson Creek and Strawberry Creek; Big Beef Creek and Wildcat Creek contain these species plus the ESA-listed Puget Sound Chinook salmon.; and chum salmon are present at the mouth of

Koch Creek below Highway 3. The Washington Stream Catalog (WDF 1975) indicates that both coho and chum salmon were historically present in all of these creeks, although due to their size, only Big Beef Creek produced large numbers of salmon. These streams (except Big Beef Creek) were noted in the Stream Catalog (WDF 1975) as having substantial low flow problems including intermittent flows.

Big Beef Creek is listed for high water temperatures on Ecology's 303(d) list of impaired waterbodies and Strawberry Creek is listed for dissolved oxygen and bacteria (Ecology 2020).

Increased base streamflow and reduced water temperatures would benefit both adult migrants to spawning grounds and juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve survival of adults and both productivity and survival of juveniles. The alteration of natural stream hydrology has been identified as a high priority limiting factor in WRIA 15 (NOAA 2007) and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions.

The headwaters of Big Beef Creek and Anderson Creek include wetland areas that could also benefit from increased groundwater levels, further supporting cold water volumes to the creek.

Identification of anticipated support and barriers to completion.

SWD is the stakeholder who will coordinate the operations and maintenance of the infiltration/augmentation sites. SWD will collect, compile, share and report the metering data.

The primary barrier is the availability of funding for the construction and operations and maintenance (O&M) costs. Other barriers include water quality issues (concerns regarding trace chemicals, such as pharmaceuticals and personal care products) and the feasibility of infiltration. Feasibility issues would need to be studied and addressed during a feasibility study phase.

Potential budget and O&M costs.

As of today, the construction costs for building the elements to get the reclaimed water to the end of the Newberry Hill section is $12.8 million. These costs include $5.1 million for the conveyance and metering along Newberry Hill Road. The annual O&M cost for the reclaimed water system is estimated to be $100,000. Additional costs for feasibility studies, design, permitting and construction management would be incurred, typically 15-20 percent of the construction cost, or $1.92 -$2.56 million. The total implementation costs would be approximately $14.7 million to $15.4 million.

Anticipated durability and resiliency.

The project would have lasting benefits. SWD will manage the augmentation. The SCADA system will allow for adaptive management of the augmentation rate. It is proposed to use only a portion of the recycled water available, ensuring a reliable supply. Assuming an O&M funding source is found, SWD will manage the infiltration and provide a reliable, long-term operator.

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

SWD would sponsor the project. The project is in agreement with their plans for recycled water and is a continuation of pipeline already constructed. A feasibility study is needed to analyze and plan for conditions at the sites, as well as work through easements or acquisitions of sites suitable for infiltration. The overall feasibility, planning, permitting and design stage would take up to 2 years. Funding for the project will also need to be secured. As this project will help remove a wastewater outfall into Puget Sound, we assume the Departments of Ecology and Health will support it and provide grant funding for implementation.

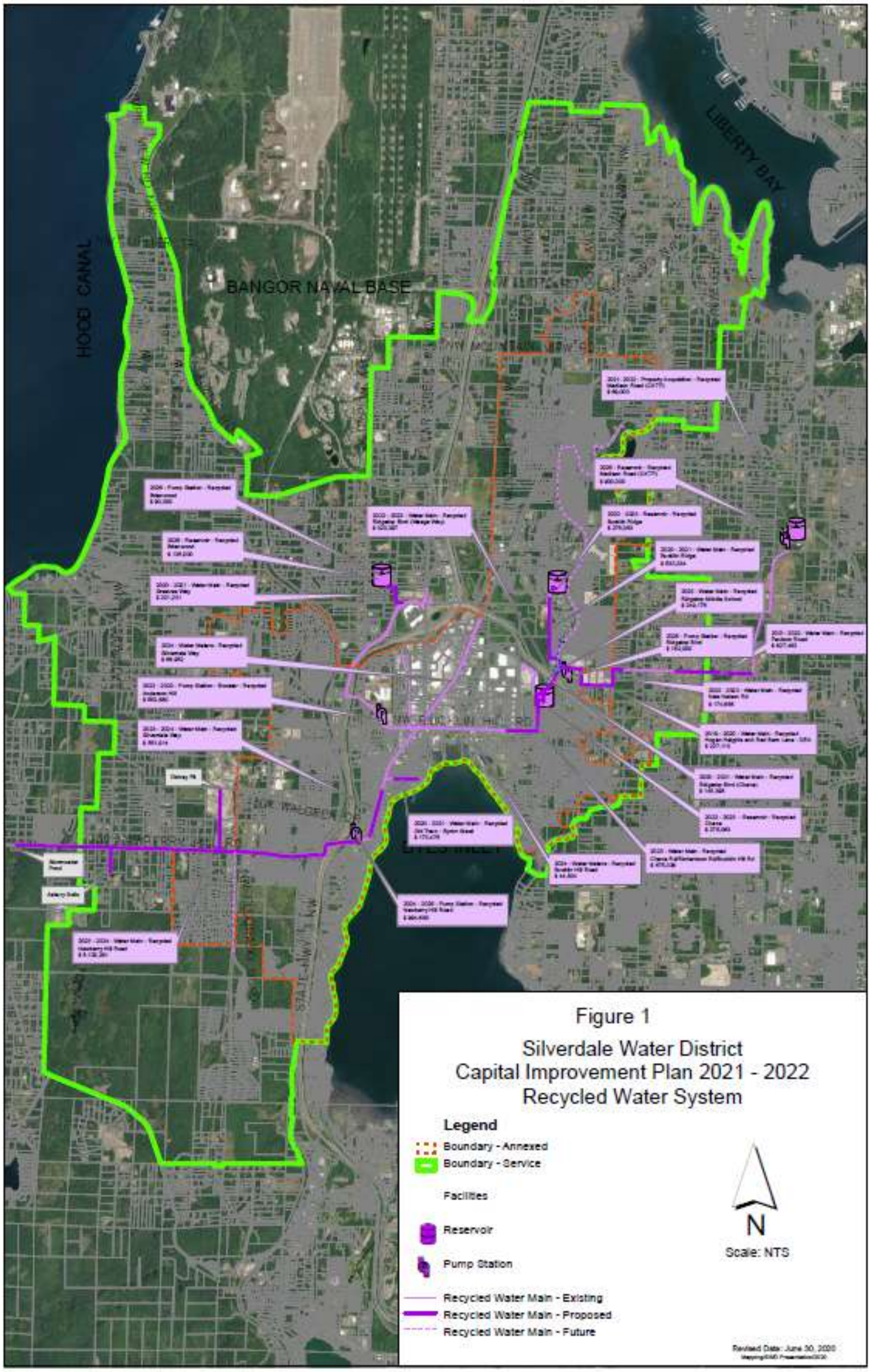
Sources of Information

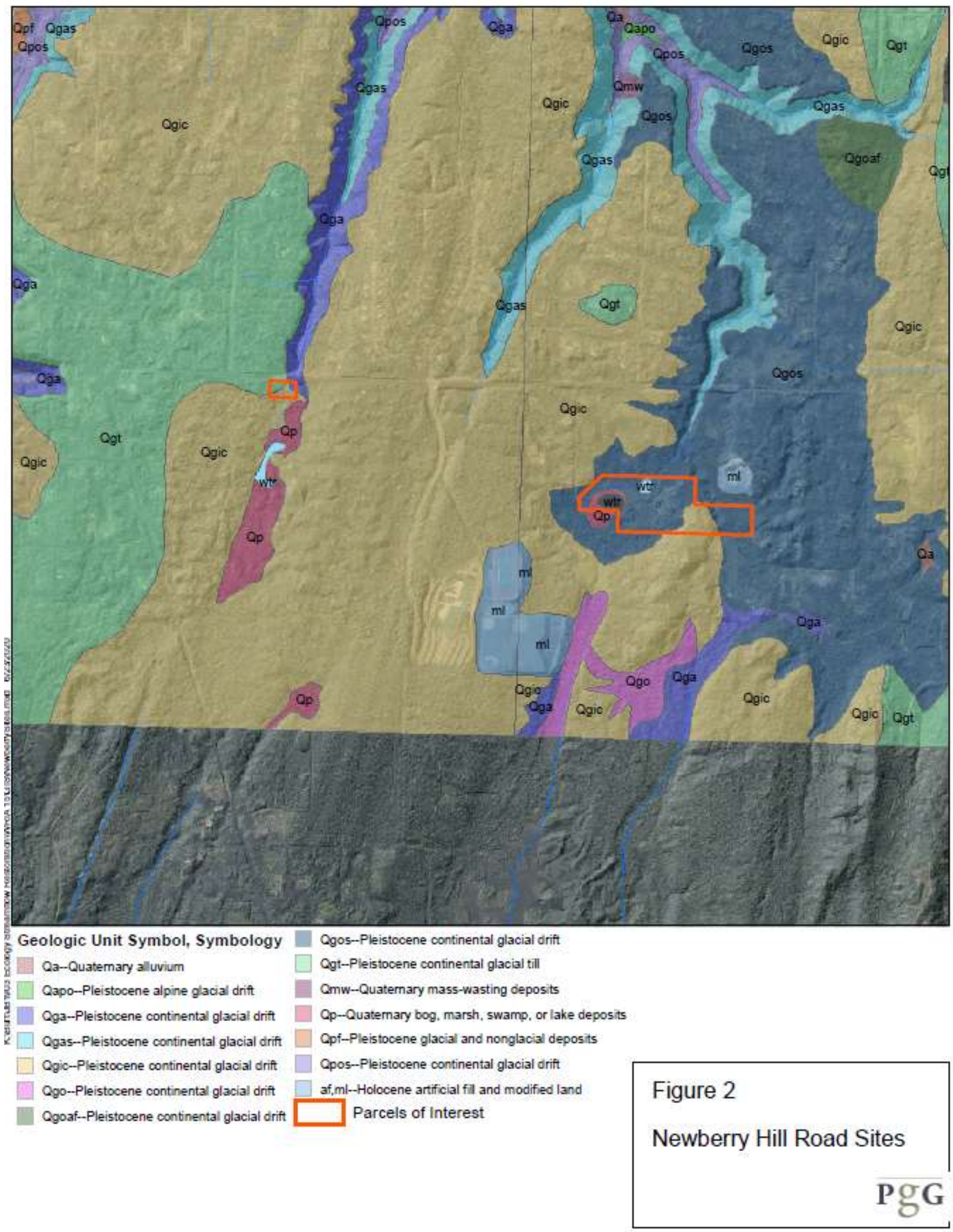
Ecology (Washington Department of Ecology), 2020. 303(d) Listed Waterbodies. Available at: https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-improvement/Assessment-of-state-waters-303d

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.

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/


HOOD CANAL
BANGOR NAVAL BASE
LIBERTY BAY
Figure 1
Silverdale Water District
Capital Improvement Plan 2021 - 2022
Recycled Water System
Legend
Boundary - Annexed
Boundary - Service
Facilities
Reservoir
Pump Station
Recycled Water Main - Existing
Recycled Water Main - Proposed
Recycled Water Main - Future
N
Scale: NTS
Revised Date: June 30, 2020


Qpf
Qgas
Qpos
Qgic
Qga
Qgt
Qp
wtr
Qapo
Qa
Qmw
Qgos
Qgoaf
Qgo
ml
Geologic Unit Symbol, Symbology
Qa--Quaternary alluvium
Qapo--Pleistocene alpine glacial drift
Qga--Pleistocene continental glacial drift
Qgas--Pleistocene continental glacial drift
Qgic--Pleistocene continental glacial drift
Qgo--Pleistocene continental glacial drift
Qgoaf--Pleistocene continental glacial drift
Qgos--Pleistocene continental glacial drift
Qgt--Pleistocene continental glacial till
Qmw--Quaternary mass-wasting deposits
Qp--Quaternary bog, marsh, swamp, or lake deposits
Qpf--Pleistocene glacial and nonglacial deposits
Qpos--Pleistocene continental glacial drift
af,ml--Holocene artificial fill and modified land
Parcels of Interest
Figure 2
Newberry Hill Road Sites
PGG

Port Orchard Airport Stormwater Infiltration Project – South Sound Subbasin

Description

The proposed project would divert stormwater from the 104-acre Port Orchard Airport to a nearby infiltration facility which could be at several locations, including the airport, off-site at a nearby Kitsap County-owned parcel or off-site at an area south of the airport.

Future development at the airport would increase stormwater runoff and can provide the opportunity to construct stormwater facilities that could infiltrate stormwater or convey stormwater to an off-site infiltration facility. An option would be to capture runoff from existing impervious areas. The airport site is located along Sidney Road SW in Port Orchard and was rezoned as REC – Rural Employment Center in 2016. This zone provides for isolated areas of industrial and commercial type uses in the rural areas of Kitsap County and are designated to promote the rural economy by providing and creating jobs close to where people live. This zoning allows future development at the airport including a wider range of commercial, industrial, and institutional uses such as offices, retail, and restaurants.

The project is in the South Sound subbasin of WRIA 15. The site is mostly within a Category II Critical Aquifer Recharge Area (CARA), with a small area of Category I CARA at the southerly end of the site. The streams that could potentially benefit are Minter and Burley creeks and their tributaries in the vicinity of the project site.

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 would function by collecting stormwater runoff from impervious surfaces and conveying it to an infiltration facility. Water quality treatment of the stormwater would also be required before infiltration to settle out fine particles which may plug an infiltration facility. Three potential areas for infiltration and groundwater recharge have been identified. They are on-site at the south end of the airport, east of the airport at a County-owned parcel that was used as a gravel pit and south of the airport. Although there are active gravel pits adjacent to the airport, use of those pits for infiltration is not proposed as an option as it is believed those pits will be in operation for years and will not likely to be suitable for infiltration.

Figure 1 provides a conceptual plan view for the project and Figure 2 provides a geologic map clipped from the WRIA 15 web map. An initial geologic review of an infiltration project was performed and indicated there is potential for groundwater recharge. A more detailed geotechnical evaluation would be required to confirm the site suitability and provide recommendations on the design of the infiltration facility.

To estimate the volume of stormwater runoff that may be available for recharge, streamflow data on Burley Creek from Kitsap PUD was used (Kitsap Public Utility District 2020). Average monthly flows in

Burley Creek were multiplied by the ratio of the drainage area at the point of diversion to the Burley Creek drainage area. Table 1 summarizes the anticipated average monthly yield at the project site based on the area-discharge relationship from Burley Creek. This is a conservative (low) estimate of stormwater runoff as impervious surfaces will generate much more runoff per acre than that of the Burley Creek basin.

Table 1
Estimated Average Monthly Yield at Port Orchard Airport (acre-feet)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
44	35	38	31	24	19	17	16	16	25	38	40

Two assumptions were made in estimating the potential groundwater recharge. The first is the infiltration facility would operate in the winter and early spring (November to March) and the second is 50 percent of the runoff could be infiltrated. The quantity that can be infiltrated will not be known until more detailed hydrological and geotechnical investigations are completed. With those assumptions, up to 98 acre-feet per year could be recharged. The average rate of recharge would be 0.33 cfs (148 gpm). Averaged throughout the entire year, the average rate of recharge would be 0.135 cfs (61 gpm).

The water offset quantity for the WRIA 15 Watershed Plan is preliminarily estimated to be up to 98 acre-feet per year. If suitable infiltration areas are identified, it is likely additional water would be available for recharge to groundwater.

Conceptual-level map and drawings of the project and location.
Figure 1 shows the locations of the potential infiltration facilities proposed for the project.

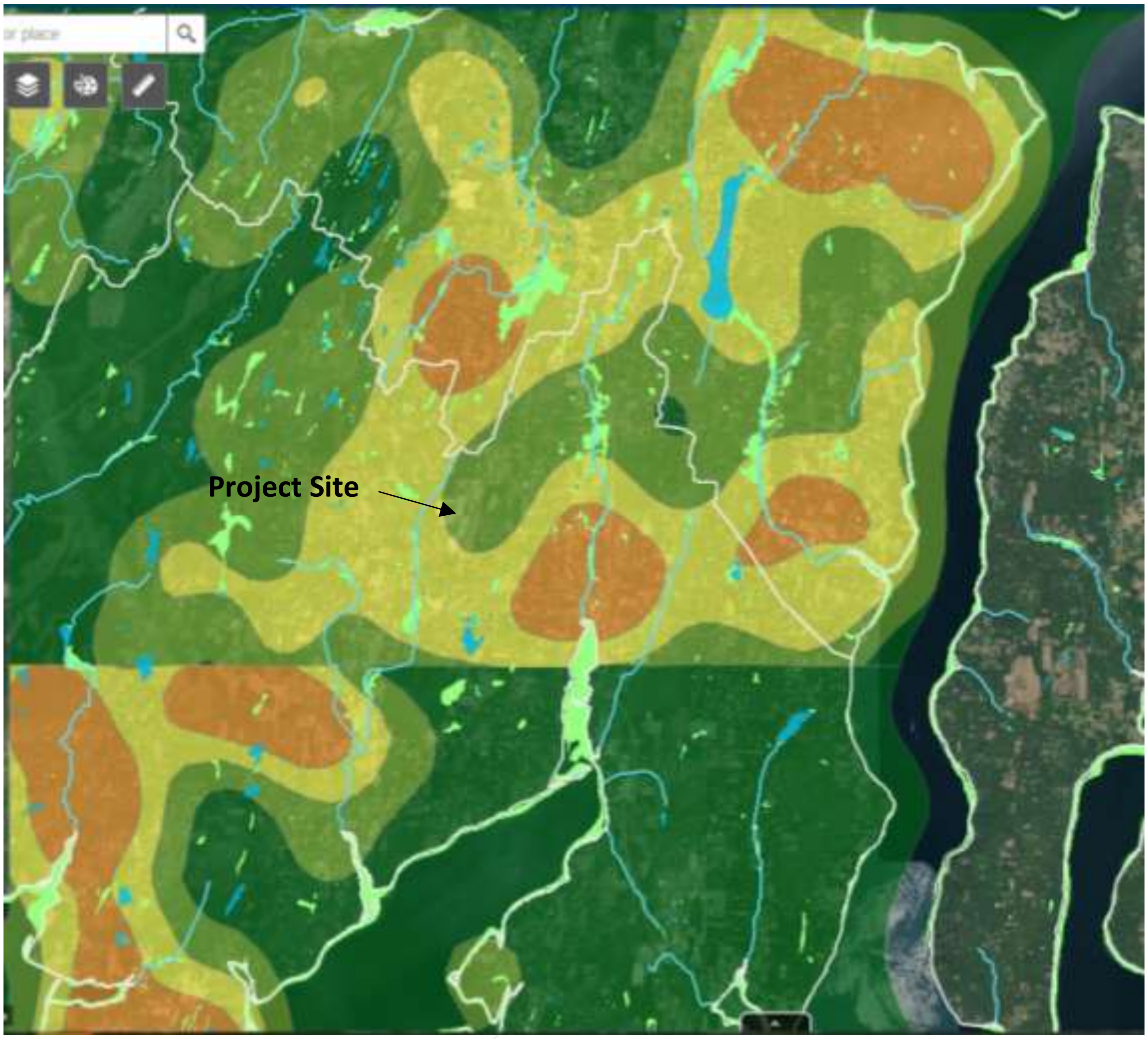
Description of the anticipated spatial distribution of likely benefits
Stormwater storage and infiltration could provide additional groundwater input and flows to the Minter and Burley Creek stream systems. Water infiltration could also enhance or restore wetlands associated with groundwater discharge areas. Depending on the location of the infiltration facility, there is approximately 5 miles of tributaries to Burley Creek and Burley Creek that could benefit from groundwater recharge, or approximately 4.5 miles of tributaries to Minter Creek and Minter Creek that could benefit.

Location relative to future PE well demand
The forecast consumptive use for the South Sound subbasin using the irrigated area method and baseline growth assumptions is listed in Table 2.

Table 2. Forecast PE Consumptive Use Demand for South Sound Subbasin

Acre-feet per year	Gallons per minute	Cubic feet per second
213.8	132.5	0.2958

A copy of the PE growth heat map from the WRIA 15 webmap is shown in Figure 3. The project site is in an area predicted to have a lesser level of growth in PE wells, however higher levels of growth is predicted in both the Minter Creek and Burley Creek basins. The estimated water offset benefit of 98 acre-feet per year is 46 percent of the offset estimated for the South Sound subbasin.



Source: https://hdr.maps.arcgis.com/apps/webappviewer/index.html?id=d7d02dedb57241aa81dd7eb376c8625a

Figure 3. WRIA 15 PE Growth Heat Map

Performance goals and measures.

The performance goals are to increase groundwater recharge by 98 acre-feet per year to improve baseflow in Minter and Burley Creeks. The measures will be an increase in baseflow in summer in the creeks by about 0.13 cfs, assuming the water infiltrated discharges to creeks at a steady-state rate equal to the annual average recharge. The average flow in Burley Creek from July to September is 17 cfs, with low flows about 9 cfs. There is less streamflow data available for Minter Creek, however data reviewed indicates streamflow levels about the same as Burley Creek. The increased streamflow from recharge will be a very small increase in either stream but may benefit tributaries receiving increased groundwater discharge relatively more.

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

Minter and Burley creeks support a variety of species and life stages including the Endangered Species Act-listed Puget Sound winter steelhead and its critical habitat (NOAA 2016). Tributaries of the East Kitsap Peninsula are part of the Central and South Puget Sound Demographically Independent Population (DIP; NOAA 2019). Other anadromous salmonid species found in the watershed that would benefit from this project include Coho, coastal cutthroat trout, fall and summer chum, and fall Chinook salmon (WDFW 2020).

The salmonids and other aquatic species in the Burly/Minter watershed are subject to degraded ecosystem function due to limiting factors present at the site. In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 15 (NOAA 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions. Increased base 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. Along with the habitat restoration actions and regional planning efforts already undertaken in the Minter/Burly watersheds, addressing increasing base streamflow could contribute to the VSP parameters of abundance, productivity, spatial structure, and diversity for the ESA-listed Distinct Population Segment of Puget Sound winter steelhead.

Identification of anticipated support and barriers to completion.

The project was proposed by members of the Watershed Restoration and Enhancement Committee as a potential project that would fit the goals of the committee. There is not currently a sponsor. The primary barrier would be the availability of funding for the construction and operations and maintenance (O&M) costs. Other barriers include the feasibility of infiltration and whether the timing of development and subsequent project matches the time frame for water offsets. Owners of the airport also have not been contacted to ascertain their interest in a project.

It is anticipated that the project would be supported by both the Minter Creek Watershed Strategies Group, the Puget Sound Partnership, and the West Sound Watersheds Council (the lead entity in this region of WRIA 15). The Minter Creek Watershed Strategies Group (MCWSG) conducted a regional planning effort for the Minter/Burley Creek basin. The goals of this project to increase base streamflows and reduce temperatures in the basin align with the priorities for land use identified in the MCWSG's 2014 report, Minter Creek Watershed Strategies: A Coordinated Approach to Land Use Planning in the Watershed (MCWSG 2014). Section 8 of the same plan identifies intersections with the Puget Sound Partnership's Action Agenda, with which this project also aligns. West Sound Watersheds Council aligns salmon strategies with Puget Sound Salmon Recovery Plans and implements the Puget Sound Partnership's Action Agenda in coordination with the West Central Local Integrating Organization. The West Central Local Integrating Organization's 2016 Ecosystem Recovery Plan identifies actions in the basin to implement salmon recovery actions. Two theories of change identified in this plan are directly addressed by the proposed project: "7.2 Decrease water withdrawal, diversion, per capital water use," and "10.3 Fix problems caused by development" (WCLIO 2016). Minter and Burley creeks are not directly identified in the plan, but the project fits into general strategies for improving streamflow and habitat conditions for salmonids in WRIA 15. The project also addresses strategies identified in NOAA's Recovery Plan for Puget Sound Steelhead (NOAA 2019). Recovery Strategy 3.3.2 specifically identifies improving hydrologic conditions and restoring groundwater recharge areas as important to improving survival for steelhead in South Puget Sound.

Potential budget and O&M costs.

The construction costs of an infiltration facility separate from stormwater facilities constructed for future development at the airport is estimated to be around $400,000. An additional 35 percent would be added for design, construction services and administrative costs, for a total of $540,000. The annual O&M cost is estimated to be $30,000. All costs are based upon a conceptual level of understanding of the project and will change once additional feasibility studies are completed. The size of the infiltration facility will have the largest effect on construction costs. No entity that will pay the annual O&M costs has been identified. It is assumed project costs would be covered through grants.

Anticipated durability and resiliency.

The project would have lasting benefits. The source of water (stormwater runoff) will vary from year to year due to climate factors, however the project benefits were described assuming a conservative amount of stormwater is captured and infiltrated.

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

Washington Water Trust is willing to explore sponsorship for a limited number of MAR sites. The project is also in a very conceptual level of detail and additional studies will be needed to determine its feasibility or arrangement.

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Belfair Wastewater Reclamation Facility – South Sound Subbasin

Description

A potential project was identified that would use recycled water from the Belfair Wastewater and Water Reclamation Facility and infiltrate the water to provide an offset. Research into the operations of the current treatment facility is summarized below.

The Belfair Wastewater and Water Reclamation Facility is authorized to distribute Class A reclaimed water to public and private entities for commercial and industrial uses, to apply reclaimed water to land for irrigation at agronomic rates, and/or for groundwater recharge by surface percolation at locations listed in the permit. Current authorized uses are shown in the following table.

Customer	Use	Location	Average Monthly Flow
Mason County – Forest Irrigation Field	Irrigation and groundwater recharge	39-acre irrigation site just east of reclamation plant	0.125 MGD
Mason County – Belfair Reclamation Plant	Supply to hose bibs, equipment wash, toilet flushing, plant processes, fire flow, and irrigation	25200 NE State Route 3	

The irrigation site is in the West Fork Coulter Creek basin. Currently, the plant is at about ½ capacity and treats/irrigates about 70 acre-feet per year.

Issues

Potential issues with this project are:

- The irrigation site is already in operation and has capacity to treat the remainder of the plant capacity.

Johnson Farm Springbrook Creek Managed Aquifer Recharge Project – Bainbridge Island Subbasin

Description

The Johnson Farm property has an existing storage pond that is used to supply irrigation water to the farm during the summer. The property has a surface water right to withdraw 0.2 cfs and 40 acre-feet to irrigate 20 acres. The period of use is June 1 to September 30.

The Johnson Farm site has the potential for additional surface water storage, for infiltration of stored water and for transfer of an existing surface water source to a groundwater source. For this project description, only the potential for infiltration and groundwater recharge, along with a source switch, is described as they have the potential for providing water offsets to fit the goals of the Watershed Restoration and Enhancement Committee**. This project is currently not feasible due to legal restrictions.**

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 would function by diverting water from an existing storage pond to an area on the farm for infiltration during the winter and early spring season (November to March). During the summer months, groundwater would be used in lieu of surface water for irrigation. There will be a benefit to groundwater from infiltration and benefit to surface water during summer by allowing surface water to flow through or around the pond instead of being used for irrigation. The project would require reconfiguration of the existing pond to allow water to be routed around the pond in summer and to provide a source of water by gravity or pumping to an infiltration basin. Figure 1 provides a conceptual plan view for the project and Figures 2-4 provide geologic maps prepared to review the initial feasibility of an infiltration project. The initial geologic review indicated there is potential for groundwater recharge. A more detailed geotechnical evaluation would be required to confirm the site suitability and provide recommendations on the design of the infiltration facility.

To estimate the volume of stormwater runoff that may be available for recharge, streamflow data on Springbrook Creek from the City of Bainbridge Island (Berg 2020) was used. Average monthly flows in Springbrook Creek were multiplied by the ratio of the pond drainage area to the Springbrook Creek drainage area. Table 1 summarizes the anticipated average monthly yield at the project site based on the area-discharge relationship from Springbrook Creek.

Table 1
Estimated Average Monthly Yield at Johnson Farm (acre-feet)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
28	51	42	25	15	7	4	4	4	17	38	23

Two assumptions were made in estimating the potential groundwater recharge. The first is the infiltration facility would operate in the winter and early spring (November to March) and the second is 50 percent of the runoff could be infiltrated. The quantity that can be infiltrated will not be known until more detailed hydrologic and geotechnical investigations are completed. With those assumptions, up to 91 acre-feet per year could be recharged. The average rate of recharge would be 0.31 cfs (138 gpm). Averaged throughout the entire year, the average rate of recharge would be 0.126 cfs (57 gpm). It is not known at this time whether it is feasible to infiltrate at that rate.

In addition to groundwater recharge, removing the surface water discharge would improve streamflow by up to 0.2 cfs during summer. High temperatures and low dissolved oxygen have been measured at the existing pond discharge during warmer months. If the existing pond were bypassed during summer, the project would also improve instream water quality by reducing stream temperatures and increasing dissolved oxygen.

The water offset quantity for the WRIA 15 Watershed Plan is preliminarily estimated to be up to 91 acre-feet per year.

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

Figure 1 shows a conceptual plan view of the project.

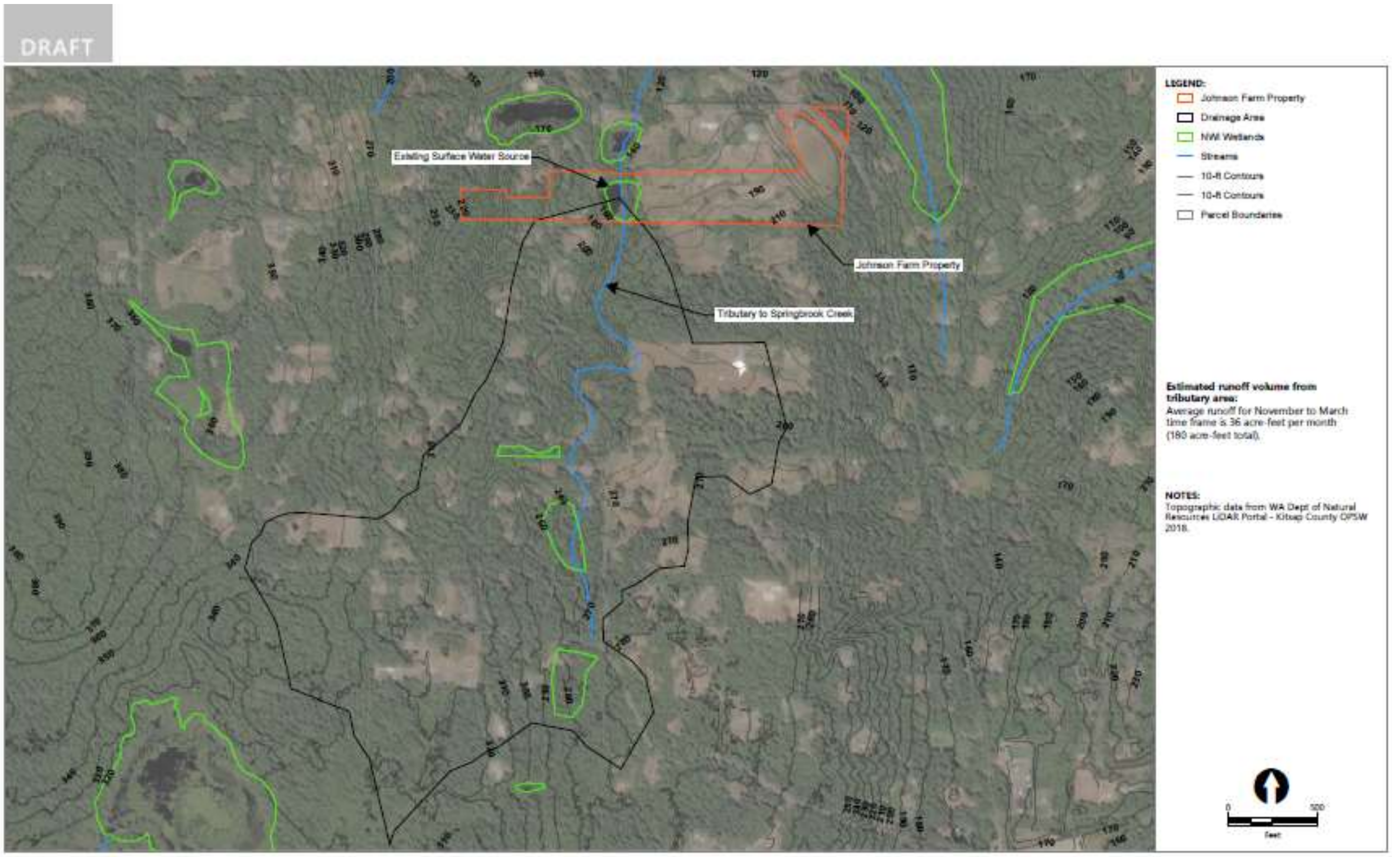
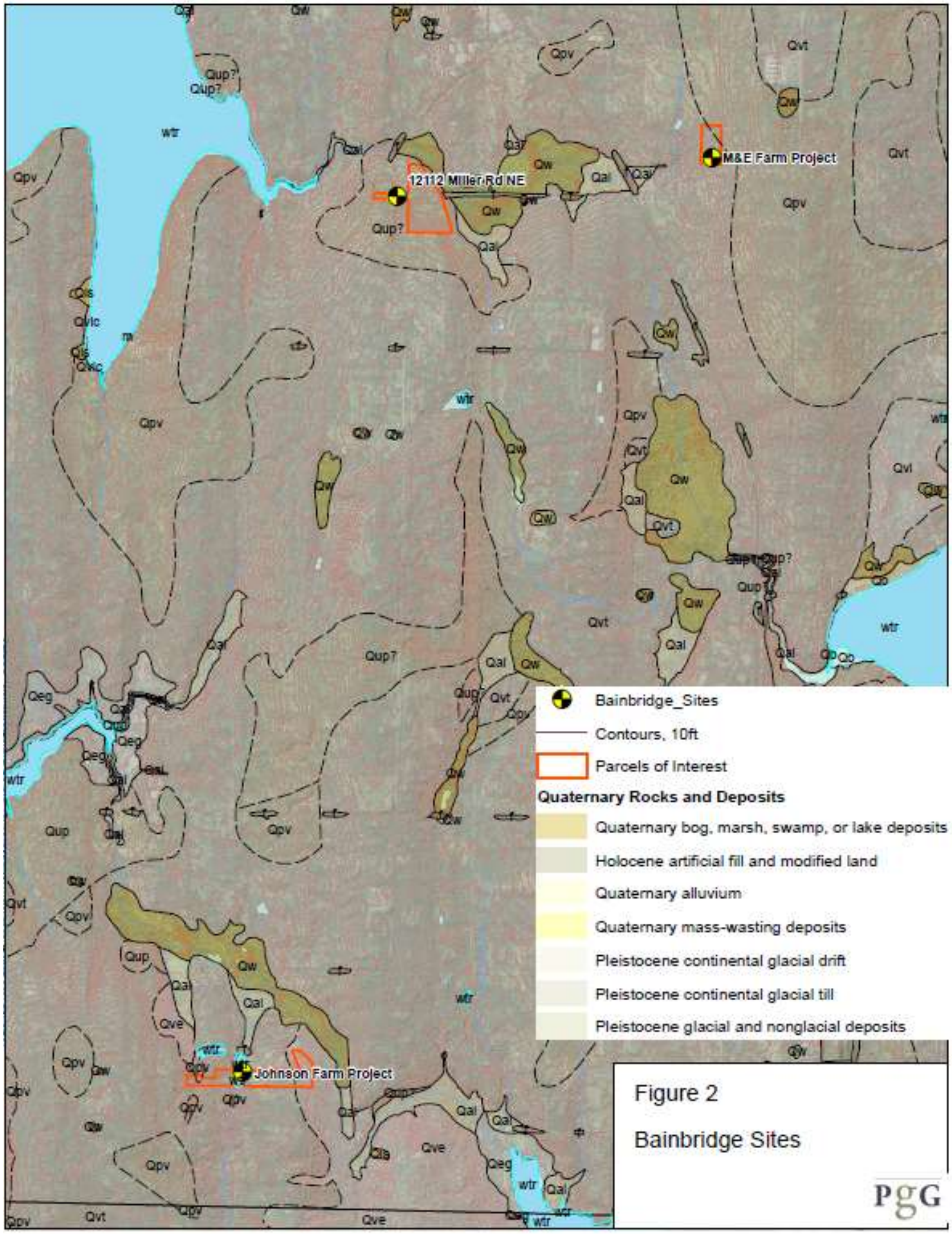
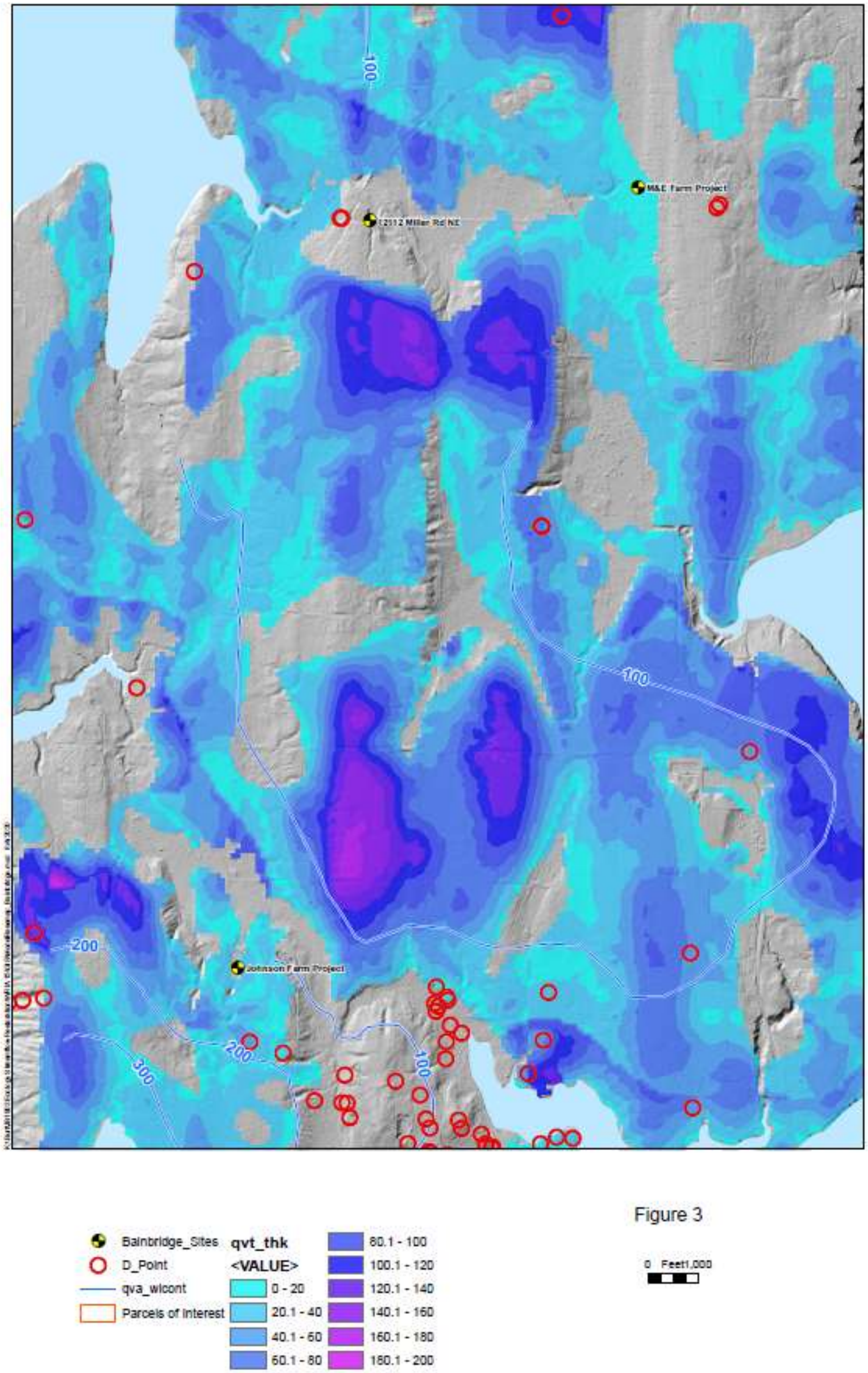


Figure 1
Johnson Farm, Springbrook Creek - Stormwater Infiltration
WRIA 15
Watershed Restoration and Enhancement


M&E Farm Project
12112 Miller Rd NE
Johnson Farm Project
Bainbridge_Sites
Contours, 10ft
Parcels of Interest
Quaternary Rocks and Deposits
Quaternary bog, marsh, swamp, or lake deposits
Holocene artificial fill and modified land
Quaternary alluvium
Quaternary mass-wasting deposits
Pleistocene continental glacial drift
Pleistocene continental glacial till
Pleistocene glacial and nonglacial deposits
Figure 2
Bainbridge Sites
PgG


M&E Farm Project
12112 Miller Rd NE
Johnson Farm Project
100
200
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Bainbridge_Sites
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Parcels of Interest
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80.1 - 100
100.1 - 120
120.1 - 140
140.1 - 160
160.1 - 180
180.1 - 200
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Figure 3

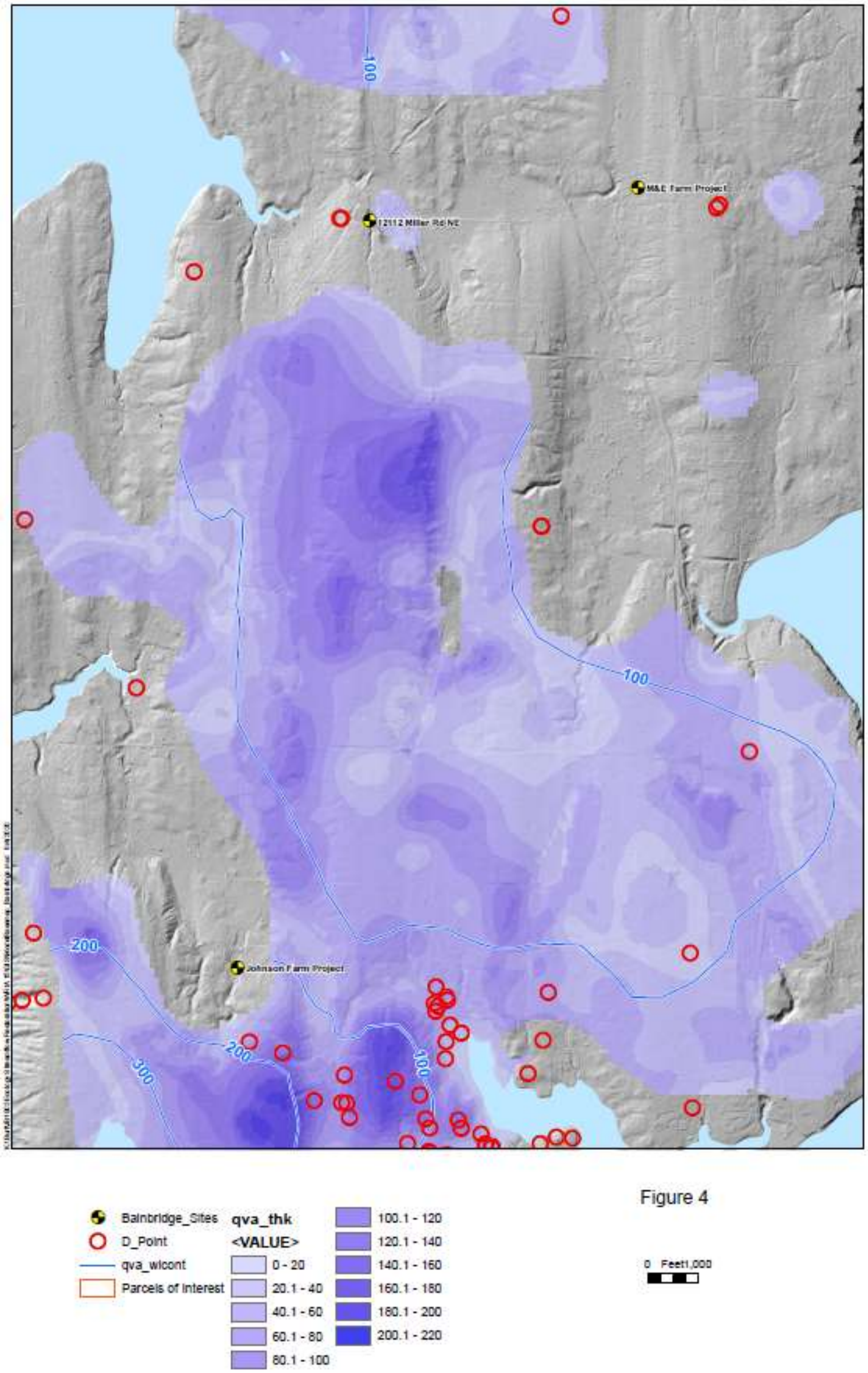


Figure 4

Description of the anticipated spatial distribution of likely benefits

Replacement of the surface water source with a new groundwater source at Johnson Farm could improve water quality in Springbrook Creek and its tributary that runs through the property. Water storage and infiltration at the Johnson Farm Property could increase groundwater levels in the headwaters of Johnson Creek and provide increased groundwater inputs and flows into Springbrook Creek. The length of stream potentially benefitting is 1.4 miles (from the site to the mouth of Springbrook Creek). Detailed groundwater evaluations would be required to estimate how much benefit to Springbrook Creek would occur. Water infiltration could also enhance wetlands associated with groundwater discharge areas.

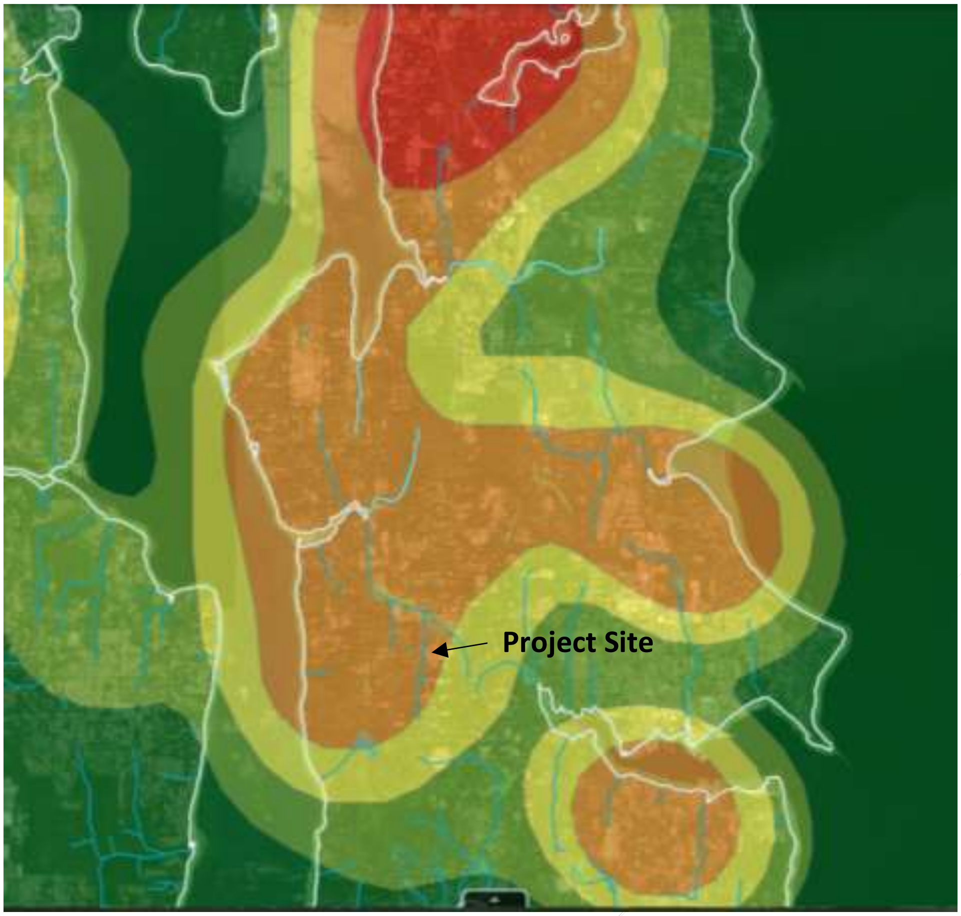
Location relative to future PE well demand

The forecast consumptive use for the Bainbridge Island subbasin using the irrigated area method and medium growth assumptions is listed in Table 1.

Table 1. Forecast PE Consumptive Use Demand for Bainbridge Island Subbasin

Acre-feet per year	Gallons per minute	Cubic feet per second
67.6	41.9	0.0935

A copy of the PE growth heat map from the WRIA 15 webmap is shown in Figure 5. The project site is located in an area predicted to have a moderate amount of PE well growth compared to other areas in Kitsap County. Much of the Springbrook Creek watershed is in an area predicted to have a moderate amount of PE well growth so this project would provide a water offset where additional consumptive use is predicted. The estimated water offset benefit of 91 acre-feet per year exceeds the total offset estimated for the Bainbridge Island subbasin using the irrigated area method and medium growth prediction.



Source:
https://hdr.maps.arcgis.com/apps/webappviewer/index.html?id=d7d02dedb57241aa81dd7eb376c8625a

Figure 5. WRIA 15 PE Growth Heat Map

Performance goals and measures.

The performance goals are to reduce surface water use by up to 40 acre-feet per year during summer by switching the source of supply to a new onsite groundwater source and to increase infiltration by up to 91 acre-feet per year to improve baseflow in Springbrook Creek. The measures will be an increase in baseflow in summer in Springbrook Creek by about 0.3 cfs, assuming the water infiltrated discharges to Springbrook Creek at a steady-state rate equal to the annual average recharge. The flow in Springbrook Creek in July-September averages about 0.5 cfs with annual low flows of less than 0.4 cfs (Berg 2020). The groundwater recharge could increase baseflows by 75 percent. Increased baseflow and bypass of the existing pond during summer could also slightly reduce water temperatures in the stream.

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

Springbrook Creek is one of the most productive fish-bearing streams on Bainbridge Island. It supports cutthroat trout, coho salmon, chum salmon, sculpin, lamprey, and historically supported ESA-listed Puget Sound winter steelhead (BILT 2018). Springbrook Creek also contains one of two reaches on Bainbridge Island that are designated as critical habitat for Puget Sound steelhead (BILT 2018).

The salmonids and other aquatic species in Springbrook Creek are subject to degraded ecosystem function due to limiting factors present at the site. In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 15 (NOAA 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions. Increased base 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.

The project was proposed by the City of Bainbridge Island as a potential project that would fit the goals of the Watershed Restoration and Enhancement Committee. Friends of the Farms is the land manager and could be the project sponsor. Either the City or Friends of the Farm could construct, operate and maintain the pond and infiltration facilities as they own the property. Even though the City does not operate the farm, they are the water resources manager for Bainbridge Island and would have the resources to manage the project. The primary barrier would be the availability of funding for the construction and operations and maintenance (O&M) costs. Other barriers include the feasibility of infiltration. Feasibility issues would need to be studied and addressed during a feasibility study phase.

Potential budget and O&M costs.

The total construction costs of the pond reconfiguration, piping and infiltration facility is estimated to be around $400,000. An additional 35 percent would be added for design, construction services and administrative costs, for a total of $540,000. The annual O&M cost is estimated to be $30,000. All costs are based upon a conceptual level of understanding of the project and may change once additional feasibility studies are completed. The costs would also change if the project is scaled back.

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by the City of Bainbridge Island with O&M funded by the City using existing staff. The source of water could vary substantially from year to year due to climate factors, however the project benefits were described assuming a conservative amount of stormwater is captured and infiltrated.

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

The City of Bainbridge Island is the most suitable project sponsor but has not committed to assuming the project sponsor role yet. The project is also in a very conceptual level of detail and additional hydrologic and geotechnical studies will be needed to determine its feasibility or arrangement.

References

Bainbridge Island Land Trust, 2018. Springbrook Creek Watershed Assessment, Final Report December 26, 2018. SRFB Project #14-1517. Available from: https://www.bi-landtrust.org/wp-content/uploads/2019/02/Springbrook-Creek-Assessment-Report-Narrative-1.pdf

Berg, Christian, 2020. Personal Communication, June 24, 2020

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.

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/

Winslow WasteWater Treatment Plant Reclaimed Water

Description

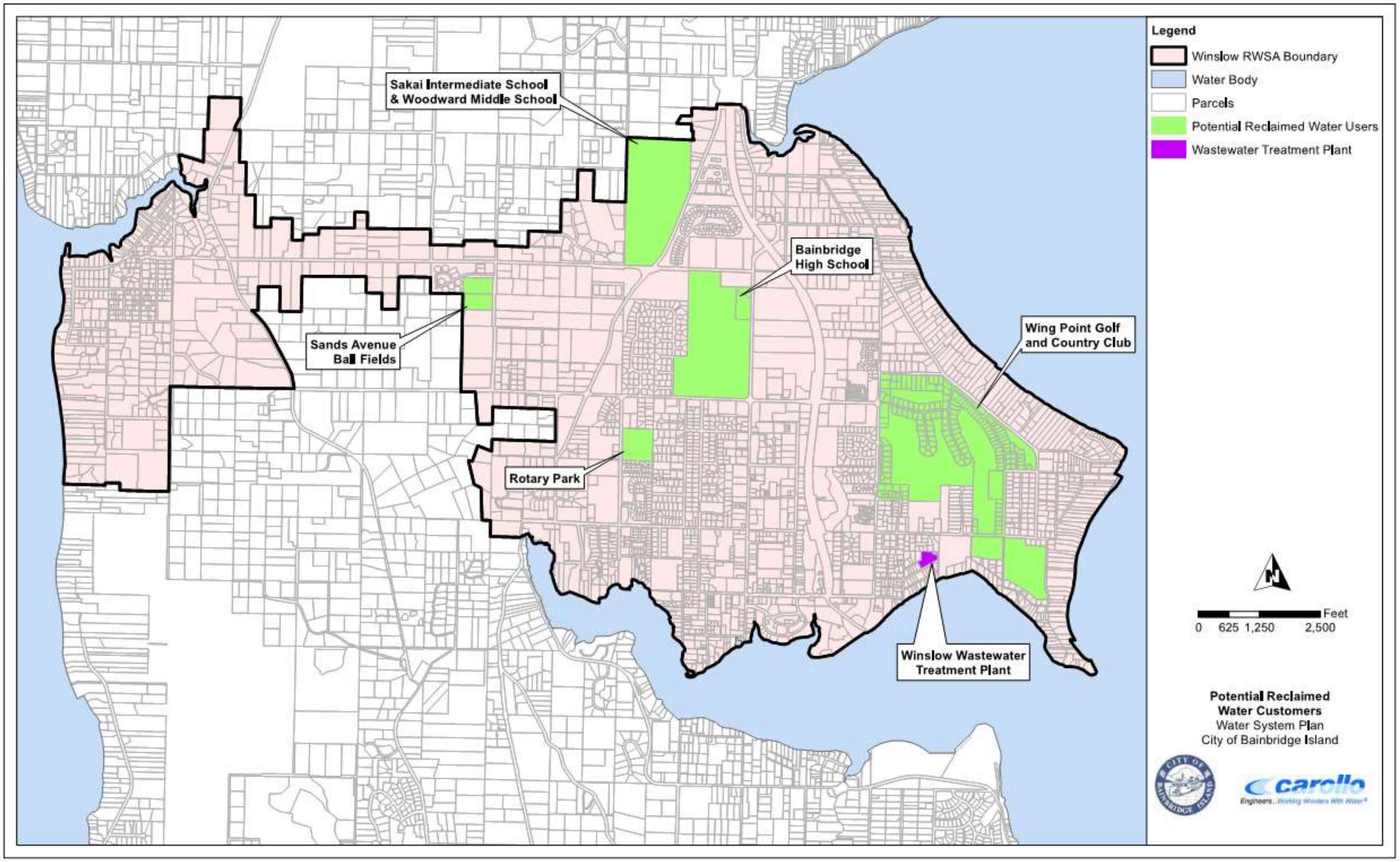
Currently the Winslow wastewater treatment plant (WWTP) produces an average of 0.5 MGD of effluent that goes unused and ends up in the Puget Sound. With a tertiary treatment system this effluent could be reclaimed and brought up to a quality that will make the water useable as irrigation in nearby sports areas. By replacing water from the City of Bainbridge Island Water utility with reclaimed water from the WWTP less water will be taken out of the shallow aquifer and more water will be available for streamflow.

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 would function by diverting water from the outfall of the WWTP in the irrigation season (May-October). During the summer months, reclaimed water would be used in-lieu of municipal water for irrigation. There will be a benefit to surface water during summer by replacing some of the shallow groundwater extraction from the well field near Cooper Creek. Figure 1 provides a conceptual plan view of some of the likely areas where reclaimed water could be used for irrigation. Figures 2 provide a map of Cooper creek (salmon bearing) and associated shallow well field, known as Head of the Bay.

To estimate the volume of water that could be offset a rough, conservative calculation was made of the irrigated sports turf (schools and golf course) within the Winslow service area at 45 acres. If irrigation was applied at a rate of 1 inch per week for 12 weeks, an offset of 45 acre-feet/year could be achieved.

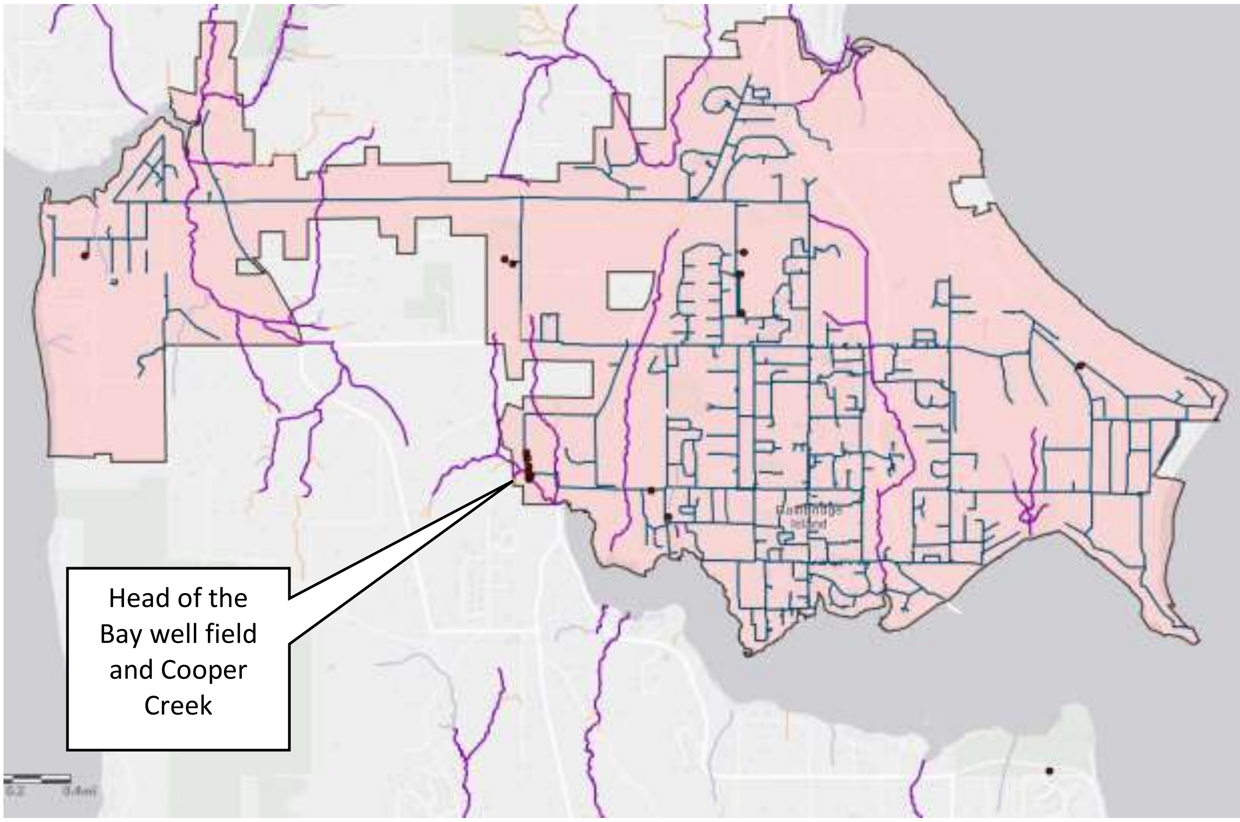
Figure 1 Map of potential application sites



Description of the anticipated spatial distribution of likely benefits

Replacement of the groundwater extraction from the Head of the Bay well field will allow more interflow from the shallow aquifers (Vashon and Sea Level) to supply baseflow to Cooper creek that runs through the well field.

Figure 2 Map of well field and associated stream.



Location relative to future PE well demand

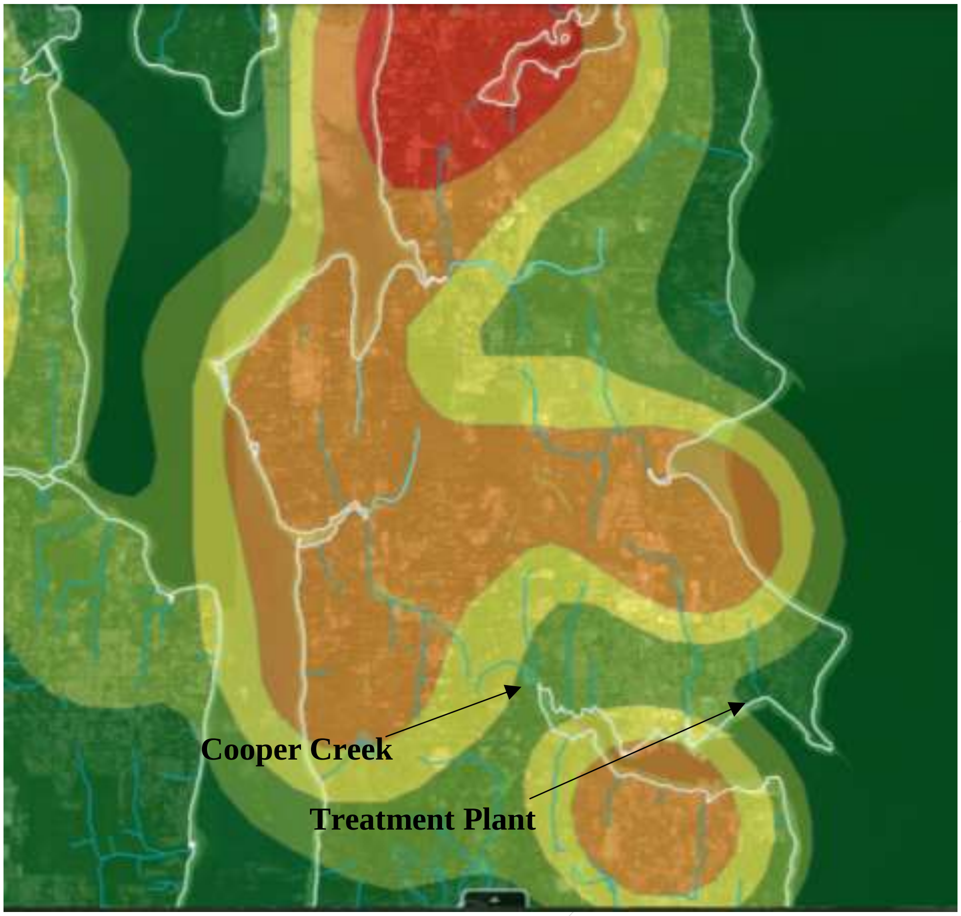
The forecast consumptive use for the Bainbridge Island subbasin using the irrigated area method and medium growth assumptions is listed in Table 1.

Table 1. Forecast PE Consumptive Use Demand for Bainbridge Island Subbasin

Acre-feet per year	Gallons per minute	Cubic feet per second
67.6	41.9	0.0935

A copy of the PE growth heat map from the WRIA 15 webmap is shown in Figure 3. While the site of the treatment plant is not located in an area expected to receive many new PE wells the area of groundwater extraction and expected streamflow benefit is located in an area predicted to have low to moderate amount of PE well growth compared to other areas in Kitsap County.

Figure 3. WRIA 15 PE Growth Heat Map



Source: https://hdr.maps.arcgis.com/apps/webappviewer/index.html?id=d7d02dedb57241aa81dd7eb376c8625a

Performance goals and measures.

The performance goals are to reduce surface water use by up to 45 acre-feet per year during summer by switching the source of supply from existing groundwater withdrawal to reclaimed water from the Winslow WWTP to improve baseflow in Cooper Creek. The measures will be an increase in baseflow in summer in Cooper Creek by about 0.06 cfs.

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

Cooper Creek is one of the purest fish-bearing streams on Bainbridge Island consistently providing cool, clear, oxygen-rich water. It supports cutthroat trout and coho salmon, (WDFW, 2021). Also, Cooper Creek is slated to receive its second major fish-passage barrier correction project in 2023.

The salmonids and other aquatic species in Cooper Creek are subject to degraded ecosystem function due to limiting factors present at the site. In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 15 (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 base 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.

The project was proposed by the City of Bainbridge Island as a potential project that would fit the goals of the Watershed Restoration and Enhancement Committee. The primary barrier would be the availability of funding for the construction and operations and maintenance (O&M) costs. Other barriers include the feasibility of adding distribution facilities to transfer the reclaimed water from the treatment plant to the application sites. Feasibility issues would need to be studied and addressed during a feasibility study phase. Currently there is a study underway to characterize the effluent of the WWTP and propose applicable treatment options.

Potential budget and O&M costs.

The total construction costs of the plant reconfiguration, piping and new treatment facility is estimated to be around $5,000,000.00 An additional 30% would be added for design, construction services and administrative costs, for a total of $6,500,000.00. The annual O&M cost is estimated to be $100,000.00. All costs are based upon a conceptual level of understanding of the project and may change once additional feasibility studies are completed. The costs would also change if the project is scaled back.

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by the City of Bainbridge with O&M funded by the City using existing and new staff.

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

The City of Bainbridge Island is the most suitable project sponsor but has not committed to assuming the project sponsor role yet. The project is also in a very conceptual level of detail and additional hydrologic and geotechnical studies will be needed to determine its feasibility or arrangement.

References

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.

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), 2021. Salmonscape mapping of fish distribution. Available at: http://apps.wdfw.wa.gov/salmonscape/

Rocky Creek Tributary Managed Aquifer Recharge

Description

This project is a potential MAR project on a tributary to Rocky Creek, south of Trophy Lake Golf Course. The tributary has a watershed area of approximately 1,200 acres upstream of its confluence with Rocky Creek. Preliminary geologic maps from the WRIA 15 indicate a zone of recessional outwash in the project area. Properties that are candidate for MAR sites are owned by Alpine Evergreen, a forestry management company and Selig Real Estate, a development company.

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 would function by diverting flows from the tributary during winter and conveying it to an infiltration facility. Water quality treatment of the stormwater would also be required before infiltration to settle out fine particles which may plug an infiltration facility. Rocky Creek has minimum flows per WAC 173-515 and is closed to further consumptive use from mid-June through October. Salmonscape does not show presence of salmonids in the tributary. Approximately 1200 acres is the tributary area that would contribute runoff to the potential recharge area

To estimate the volume of runoff that may be available for recharge, streamflow data on Burley Creek from Kitsap PUD was used (Kitsap Public Utility District 2020). Average monthly flows in Burley Creek were multiplied by the ratio of the drainage area at the point of diversion to the Burley Creek drainage area. Table 1 summarizes the anticipated average monthly yield at the project site based on the area-discharge relationship from Burley Creek.

Table 1
Estimated Average Monthly Yield at Rocky Creek Tributary (acre-feet)

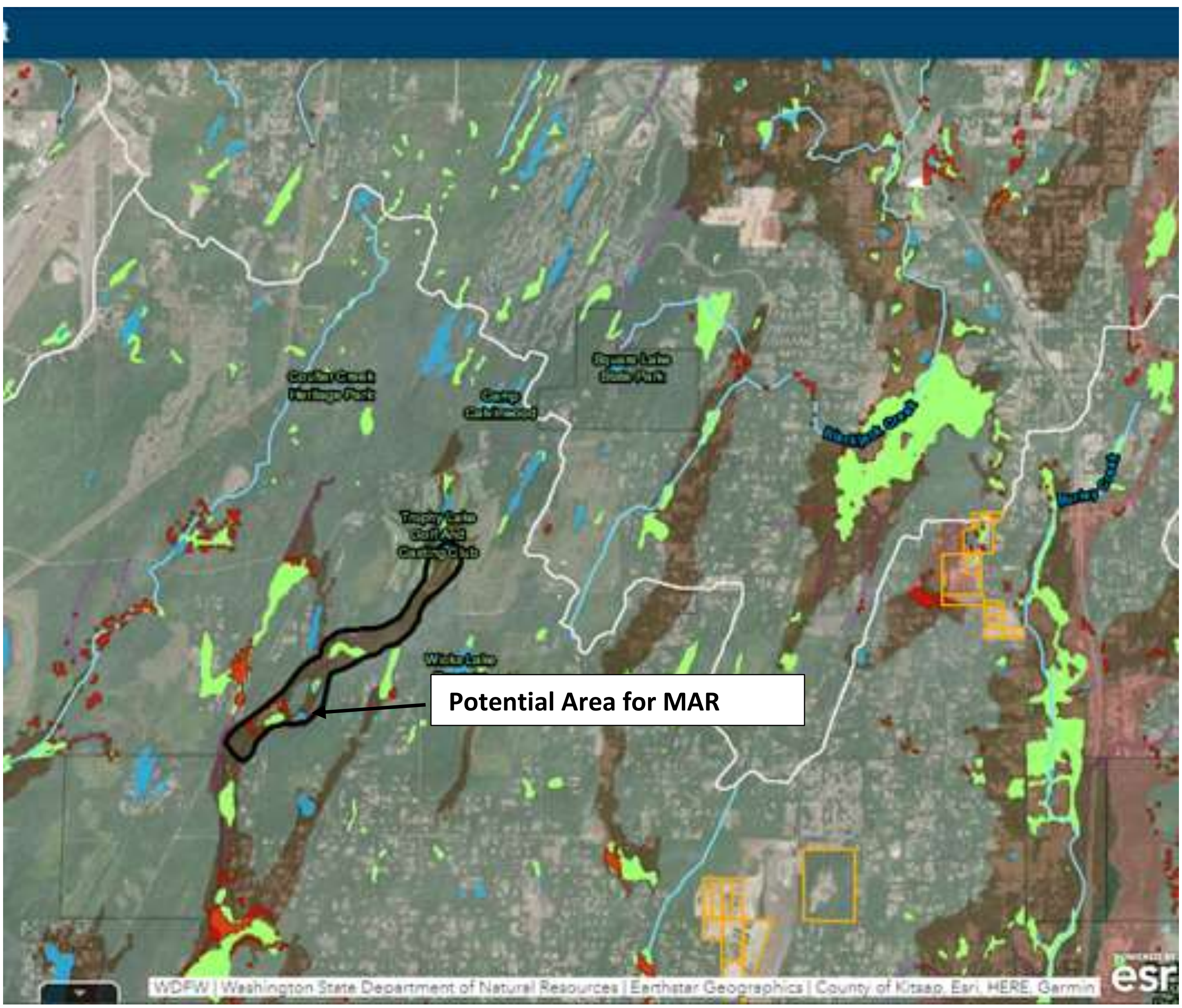
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
510	406	439	356	273	219	196	188	189	287	443	465

The assumptions made in estimating the potential volume of groundwater recharge were the infiltration facility would operate in the winter and early spring (November to March) and the infiltration rate would be 1 cfs (approximately 60 acre-feet/month). That infiltration volume is assumed based upon a soil infiltration rate of 2 feet/day (1 inch/hour) and an infiltration basin size of one acre. It is also assumed that the facility would operate 50% of the time to account for periods that minimum flows are not met in Rocky Creek. With those assumptions, up to 150 acre-feet per year could be recharged. Averaged throughout the entire year, the rate of recharge would be 0.21 cfs (92 gpm). The quantity that can be infiltrated will not be known until more detailed hydrological and geotechnical investigations are completed as well as determining which property would be available for a project. With redundancy and the need for a settling basin, the overall size of the infiltration facility would be 2-3 acres.

The water offset quantity for the WRIA 15 Watershed Plan is preliminarily estimated to be up to 150 acre-feet per year. If suitable infiltration areas are identified and are available, it is likely additional water would be available for recharge to groundwater.

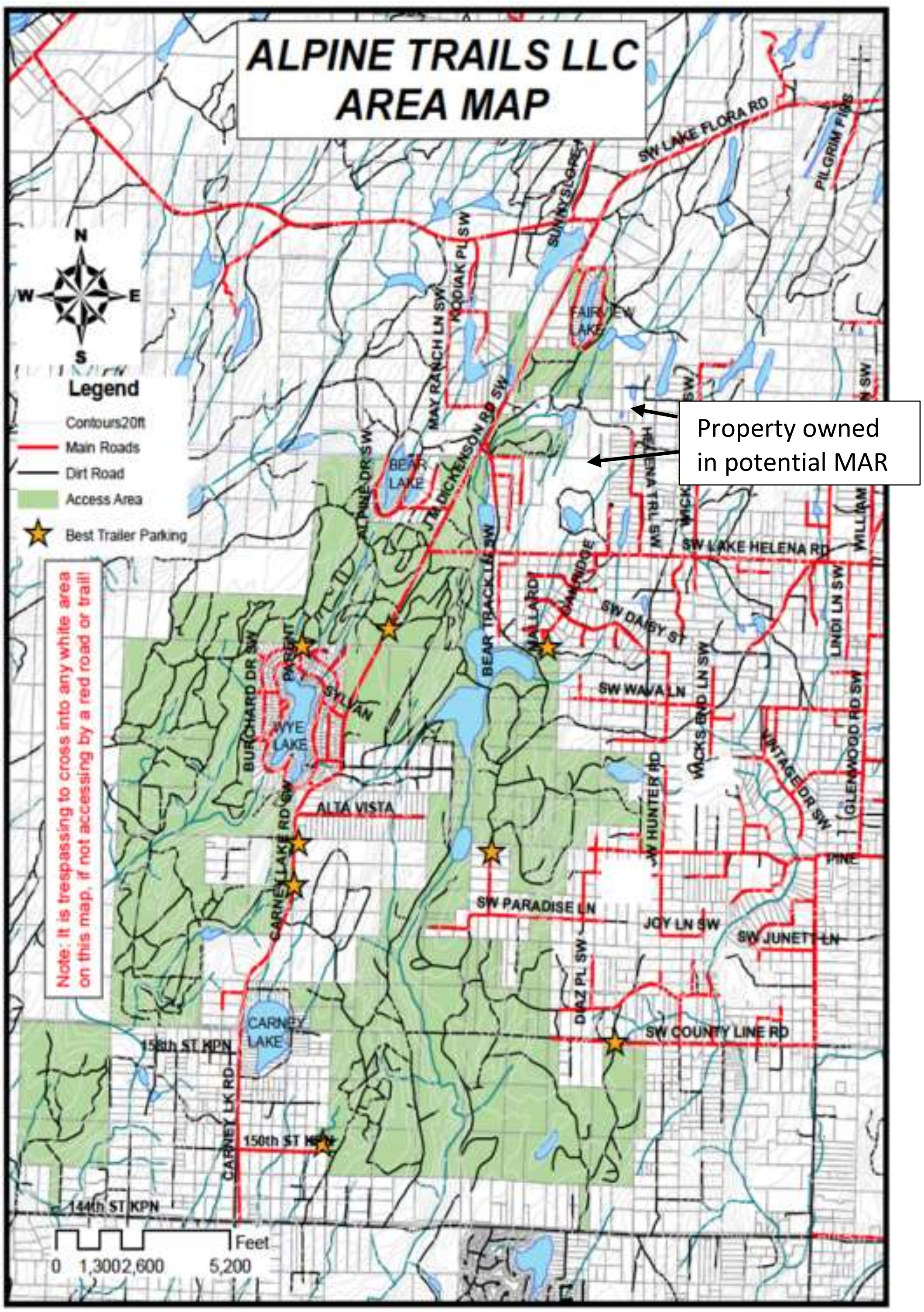
Conceptual-level map and drawings of the project and location.
Figure 1 shows the area that could be used for MAR.

Figure 1. Rocky Creek Tributary MAR Area



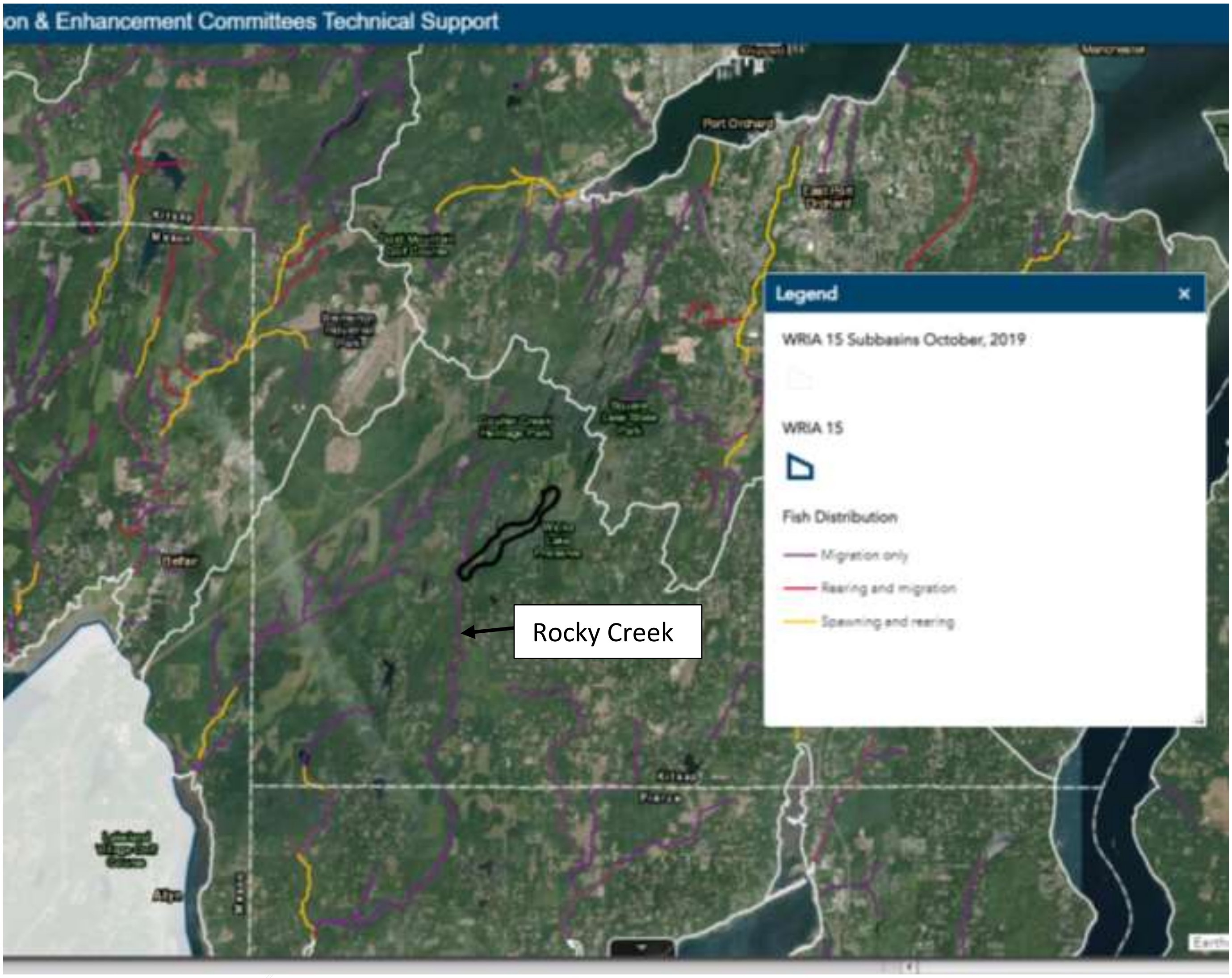
Alpine Evergreen is one of the owners, they own a large area zoned for forestry. Figure 2 shows their ownership in green.

Figure 2. Ownership by forestry company in MAR area



Fish Distribution from Salmonscape is provided in figure 3.

Figure 3. Fish distribution near MAR area



Oak Lake Storage and Potential Managed Aquifer Recharge

Description

This project is a potential surface water storage and MAR project at a small lake that feeds a tributary to the Dewatto River in the South Hood Canal subbasin. The site is reported to be an old gravel pit and geologic maps indicate the presence of recessional outwash, which could be a suitable material for MAR. The lake has only one owner (Manke Timber Company).

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 could capture and infiltrate water from a tributary area of 230 acres. The Dewatto River has minimum flows per WAC 173-515 and is closed to further consumptive use from mid-June through October. No streamflow or lake level data is available. The lake varies in surface area during the year; an aerial photo from July 2018 showed three visible ponds with a combined surface area of 4.2 acres. An aerial photo from February 2015 showed a single lake with a surface area of about 25 acres. It's not known if the water in the lake discharges to a stream or infiltrates into the ground.

The project would entail placing a control structure at the lake outlet which would either maintain lake levels at a higher elevation later in the year or raise the level of the lake to store more water. Maintaining lake levels 2 feet higher or raising the lake by 2 feet and infiltrating that water to time streamflow benefit could provide 50 acre-feet of streamflow benefit in summer. Maintaining or raising by 3 feet would provide 75 acre-feet. Typically lakes can be raised or held a few feet without extensive costs. An infiltration basin could be constructed in the footprint of the lake or adjacent to the lake.

An estimate of runoff was prepared using stream gage records from the Dewatto River (USGS 12068500 Dewatto River Near Dewatto, WA) and adjusting the basin yield by area. The tributary area to the lake has much more runoff than the potential storage increase of 50-75 acre-feet. The Dewatto River has minimum flows per WAC 173-515 and is closed to further consumptive use from mid-June through October. Although the Dewatto River stream gage records are old (period of record 1947-1974) flows in the November to March time period appear to exceed the minimum flows for greater than 50% of the time, indicating additional flow could be stored in the lake.

Salmonscape data does not show salmonid use in the stream draining the lake.

The water offset quantity for the WRIA 15 Watershed Plan is preliminarily estimated to be up to 75 acre-feet per year. Hydrologic and geologic studies are required to prepare a better estimate of the potential offset.

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

Figure 1 shows the site location, figure 2 show the geology and tributary area, Figure 3 shows the Salmonscape layer and Figure 4 a parcel map.

Figure 1. Location map

Figure 2. Geology Map and Tributary Area

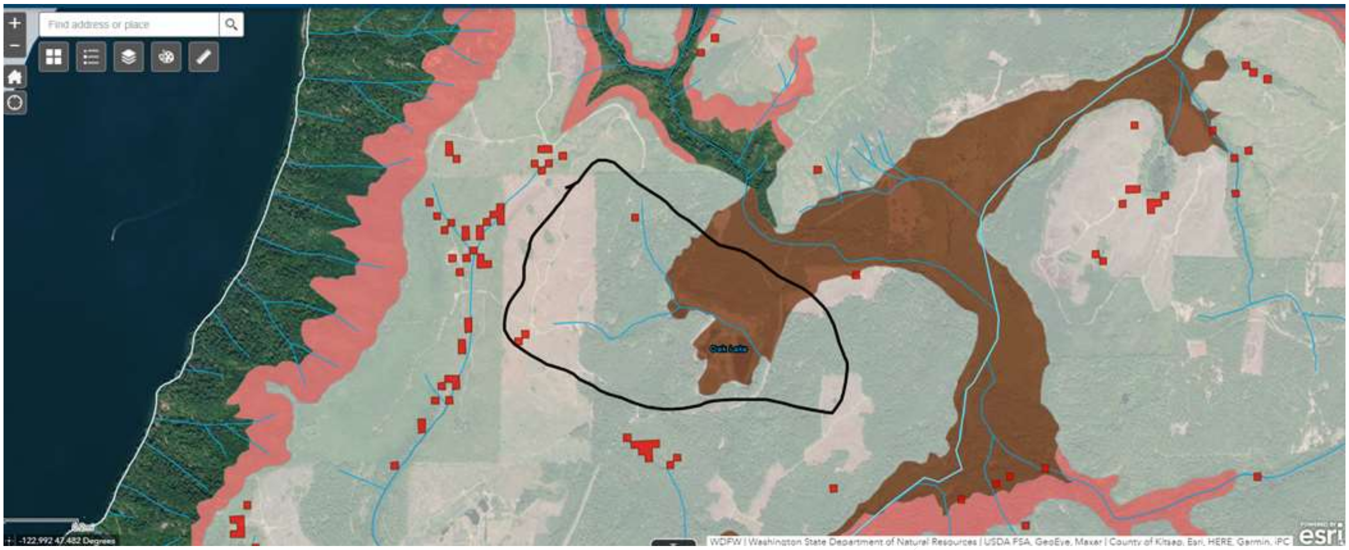


Figure 3. Salmonscape Layers

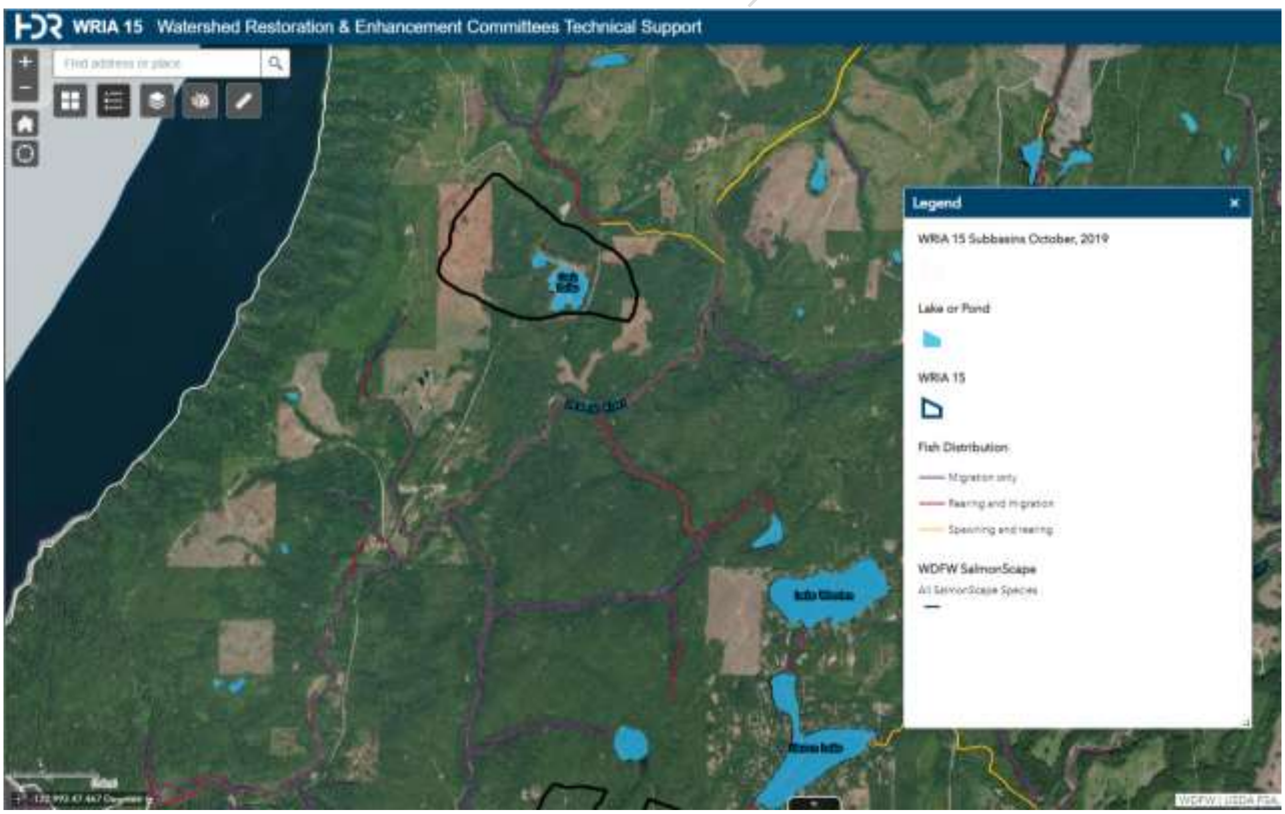
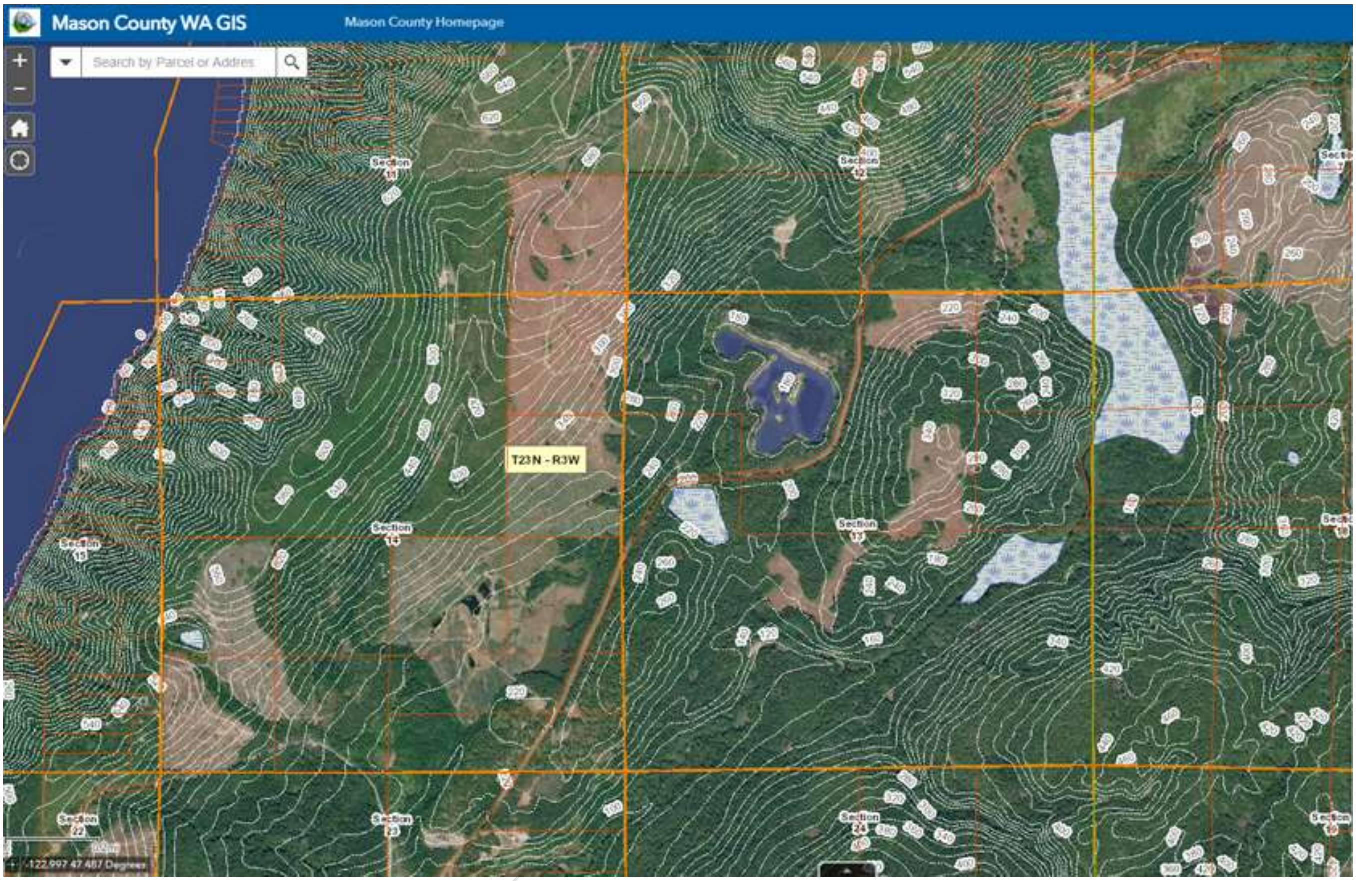


Figure 4. Parcel Map at Oak Lake



Shoe Lake Storage and Potential Managed Aquifer Recharge

Description

This project is a potential surface water storage project at a small lake that feeds a tributary to the Dewatto River in the South Hood Canal subbasin. A MAR component would be preferred but preliminary geologic maps don't indicate a suitable formation is close by. Additional research into the potential for MAR is needed if that component of the project is desired. The lake is a candidate as there are only 2 owners – the south 1/2 is owned by DNR and the north ½ by a private group. There is only one house near the lake on the north side, and it appears to be higher in elevation than the lake so additional storage may not impact that house. The project would increase storage in winter and release it throughout summer at a controlled rate that is higher than natural streamflow, especially in summer. If a suitable MAR site is nearby, the releases could be timed to maximize streamflow benefit by using the time lag from infiltration to streamflow benefit. It would also reduce the potential for water quality impacts from surface water releases in summer, which would likely be warm.

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 would function by placing a control structure at the lake outlet which would either maintain lake levels at a higher elevation later in the year or raise the level of the lake to store more water. The tributary area to the lake is estimated to be 224 acres and the lake surface area is 21 acres. Maintaining lake levels 2 feet higher or raising the lake by 2 feet would provide 42 acre-feet of streamflow benefit in summer. Maintaining or raising by 3 feet would provide 62 acre-feet. Typically, lakes can be raised or held a few feet higher without extensive costs.

No streamflow or lake level data is available. An estimate of runoff was prepared using stream gage records from the Dewatto River (USGS 12068500 Dewatto River Near Dewatto, WA) and adjusting the basin yield by area. The tributary area to the lake has much more runoff than the potential storage increase of 42-62 acre-feet. The Dewatto River has minimum flows per WAC 173-515 and is closed to further consumptive use from mid-June through October. Although the Dewatto River stream gage records are old (period of record 1947-1974) flows in the November to March time period appear to exceed the minimum flows for greater than 50% of the time, indicating additional flow could be stored in the lake.

Salmonscape data does not show salmonid use in the stream draining the lake.

The water offset quantity for the WRIA 15 Watershed Plan is preliminarily estimated to be up to 62 acre-feet per year. Hydrologic and geologic studies are required to prepare a better estimate of the potential offset.

Figure 1 shows the site location. Figure 2 shows the geology and tributary area. Figure 3 shows Salmonscape layers in the project vicinity and Figure 4 shows parcels at the site.

Figure 1. Location map

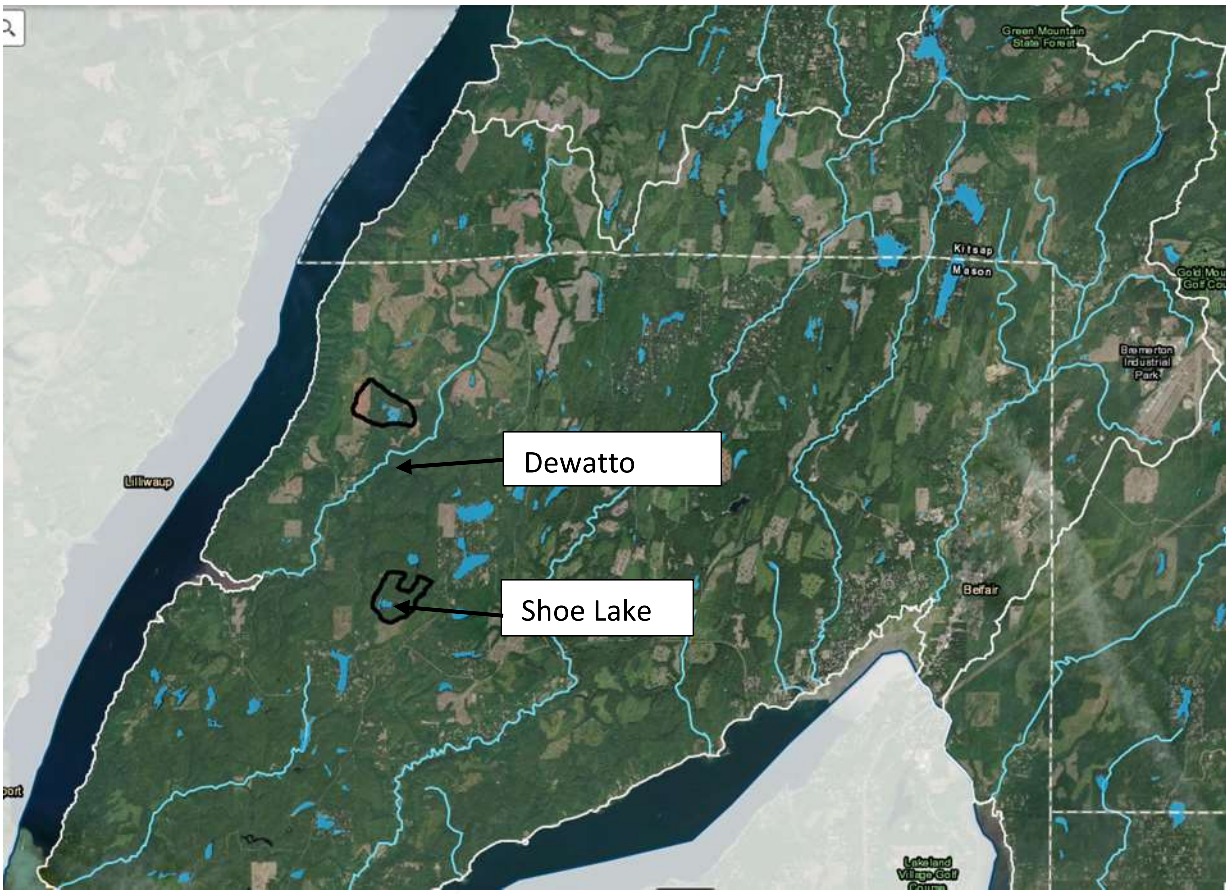


Figure 2. Geology and Tributary area

Figure 3. Salmonscape layers

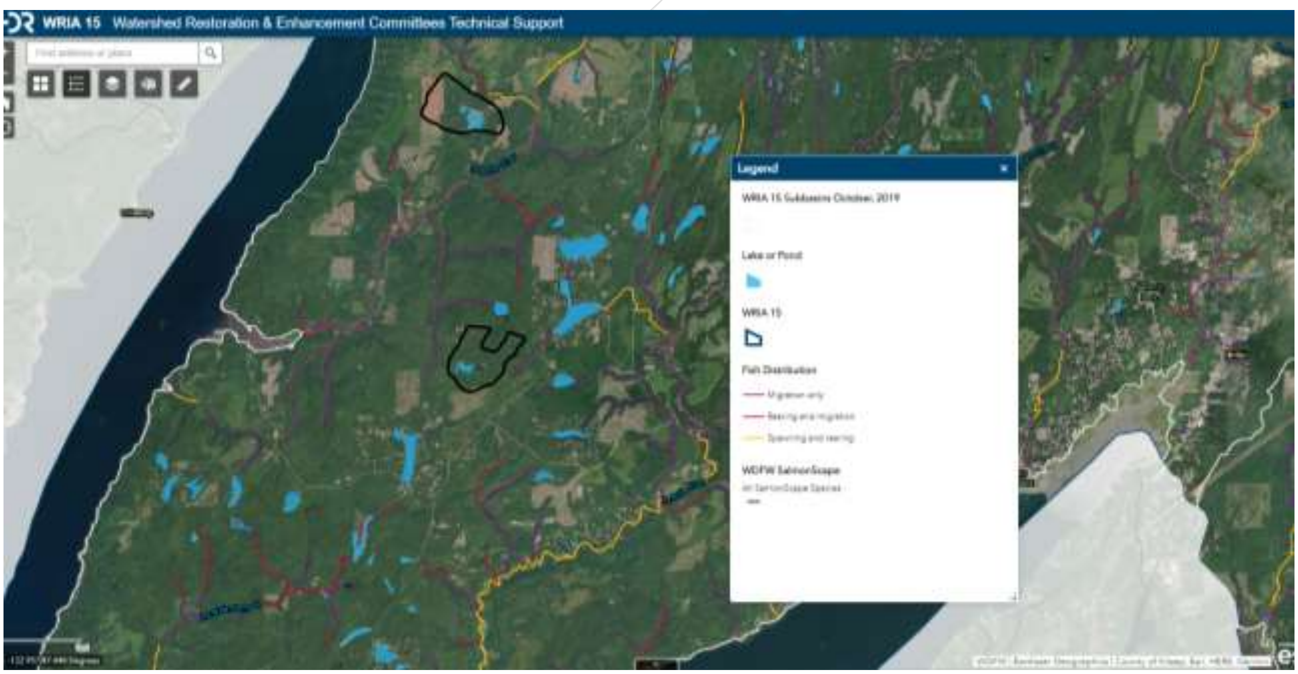


Figure 4. Parcel map

M&E Farm Manzanita Creek Infiltration Project-Bainbridge Island

Description

The proposed project at the historic M&E Tree Farm site would collect stormwater runoff from an adjacent residential area for infiltration and groundwater recharge in a constructed infiltration facility. The project is located in the Manzanita Creek watershed on Bainbridge Island in the Bainbridge Island subbasin.

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 would function by collecting stormwater from an adjacent area and directing it to a city-owned parcel (historic M&E Tree Farm) near the upper reaches of Manzanita Creek. An infiltration facility would be constructed on that site to recharge groundwater. A stormwater pond may be required for flow equalization and settling out fine particles which may plug an infiltration facility. Figure 1 provides a conceptual plan view for the project and Figures 2-4 provide geologic maps prepared to review the initial feasibility of an infiltration project. The initial geologic review indicated there is potential for groundwater recharge. A more detailed geotechnical evaluation would be required to confirm the site suitability and provide recommendations on the design of the infiltration facility.

To estimate the volume of stormwater runoff that may be available for recharge, streamflow data on Manzanita Creek from Kitsap PUD was used. Average monthly flows in Manzanita Creek were multiplied by the ratio of the stormwater collection area to the Manzanita Creek drainage area. Table 1 summarizes the anticipated average monthly yield at the project site based on the area-discharge relationship from Manzanita Creek.

Table 1
Estimated Average Monthly Yield at M&E Tree Farm Site (acre-feet)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
13	6.4	3.3	3.9	1.4	0.9	0.6	0.5	0.6	1.4	4.3	8.3

Two assumptions were made in estimating the potential groundwater recharge. The first is the infiltration facility would operate in the winter and early spring (November to March) and the second is 50 percent of the runoff could be infiltrated. The quantity that can be infiltrated will not be known until more detailed geotechnical investigations are completed. With those assumptions, up to 17.6 acre-feet per year could be recharged. The average rate of recharge would be 0.06 cfs (27 gpm). Averaged throughout the entire year, the average rate of recharge would be 0.024 cfs (11 gpm).

The water offset quantity for the WRIA 15 Watershed Plan is preliminarily estimated to be up to 17.6 acre-feet per year.

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

Figure 1 shows a conceptual plan view of the project.

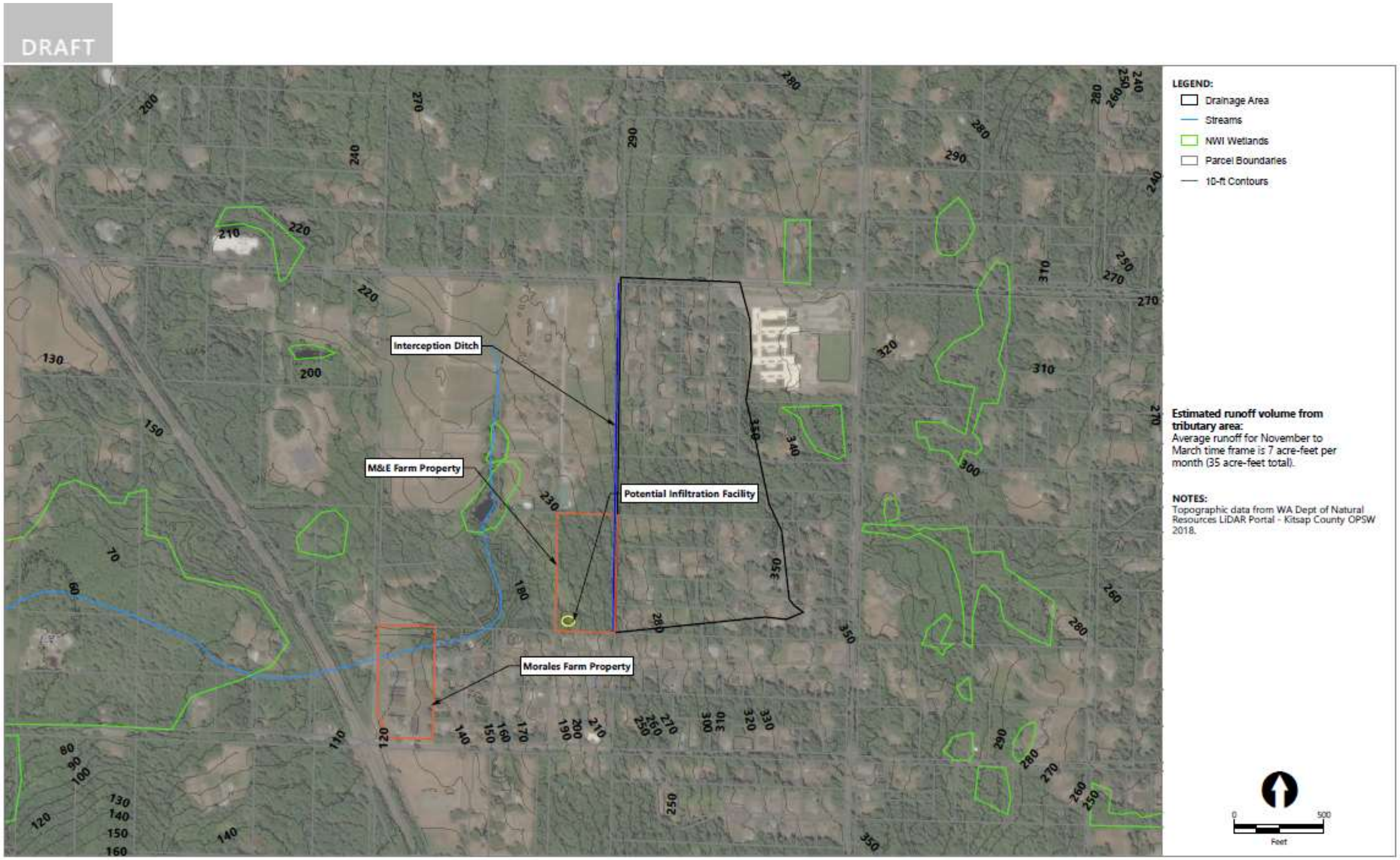
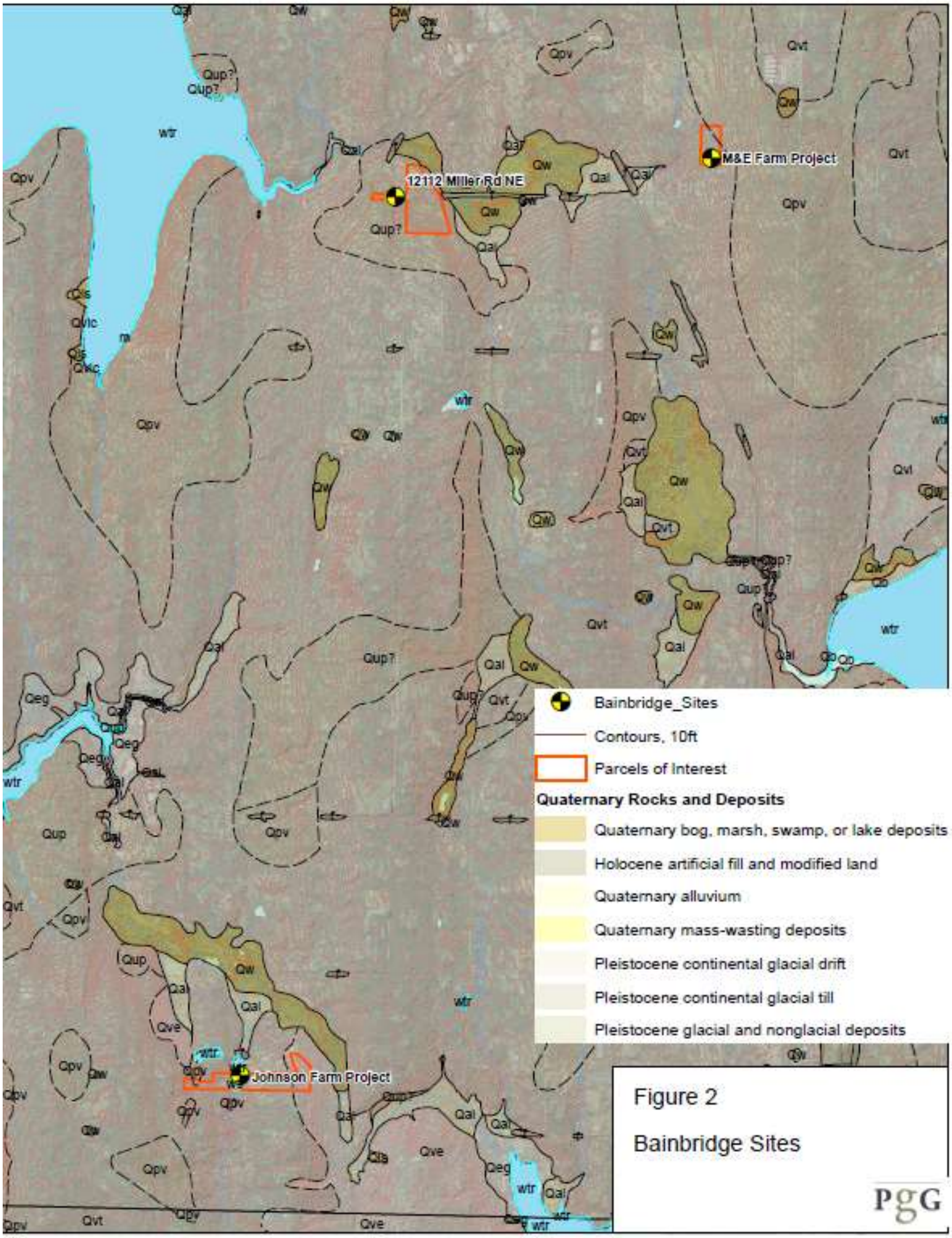


Figure 1
M&E Farm, Manzanita Creek - Stormwater Infiltration
WRIA 15
Watershed Restoration and Enhancement


12112 Miller Rd NE
M&E Farm Project
Johnson Farm Project
Bainbridge_Sites
Contours, 10ft
Parcels of Interest
Quaternary Rocks and Deposits
Quaternary bog, marsh, swamp, or lake deposits
Holocene artificial fill and modified land
Quaternary alluvium
Quaternary mass-wasting deposits
Pleistocene continental glacial drift
Pleistocene continental glacial till
Pleistocene glacial and nonglacial deposits
Figure 2
Bainbridge Sites
PgG

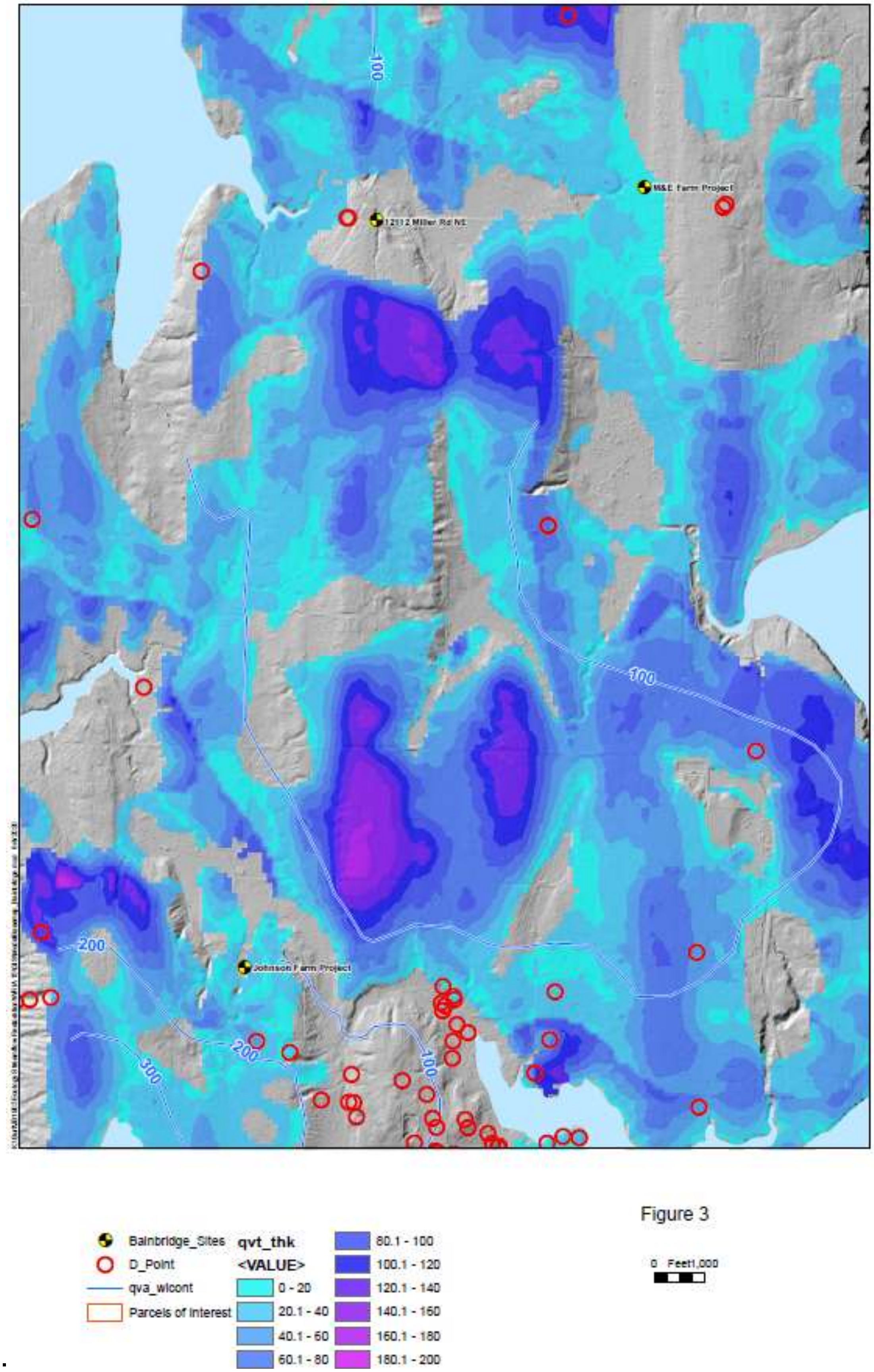
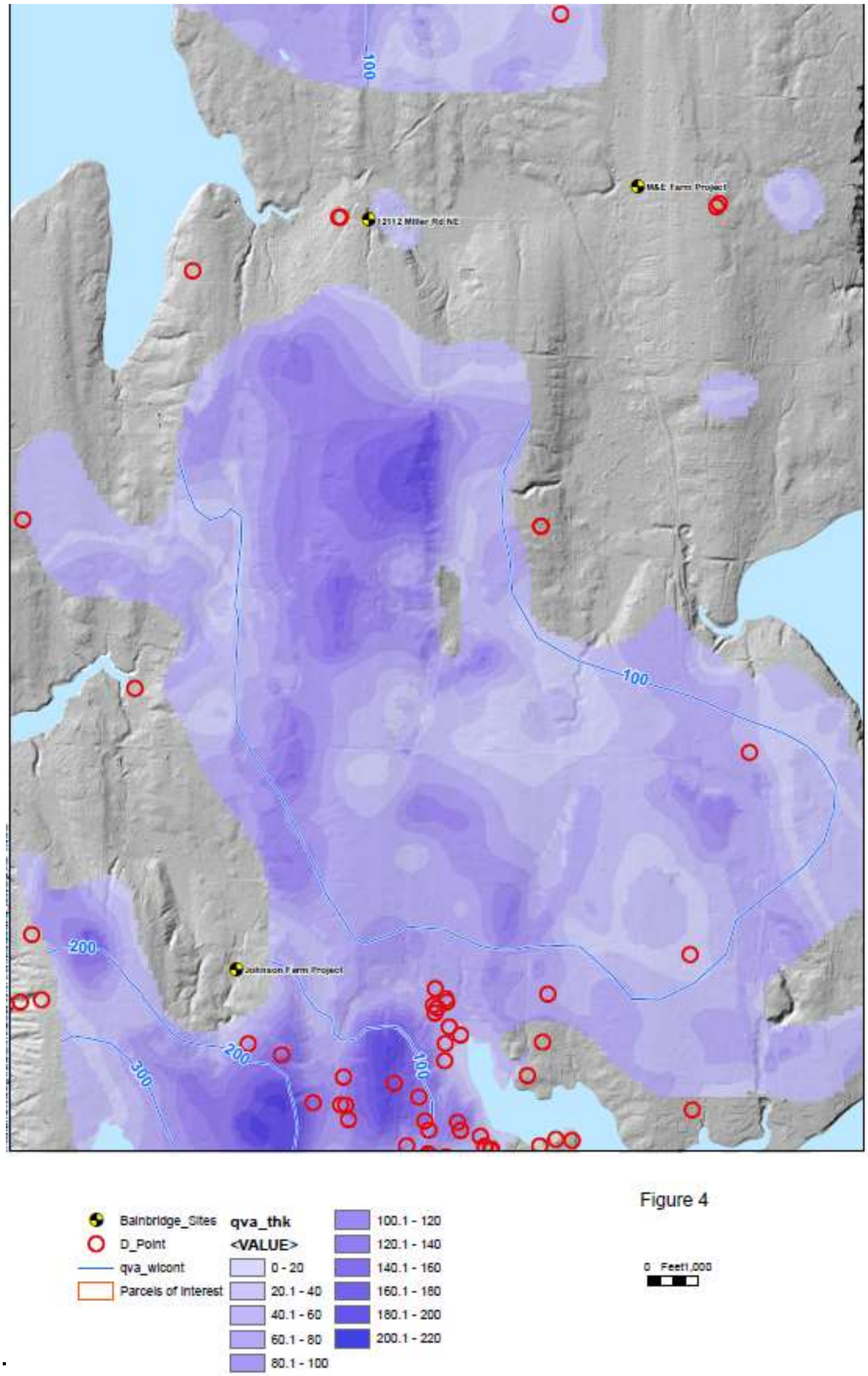

100
M&E Farm Project
12112 Miller Rd NE
100
Johnson Farm Project
200
200
300
100
Bainbridge_Sites
D_Point
qva_wlcont
Parcels of Interest
qvt_thk
<VALUE>
0 - 20
20.1 - 40
40.1 - 60
60.1 - 80
80.1 - 100
100.1 - 120
120.1 - 140
140.1 - 160
160.1 - 180
180.1 - 200
0 Feet1,000

Figure 3



100
M&E Farm Project
12112 Miller Rd NE
100
200
Johnson Farm Project
200
300
100
Bainbridge_Sites
D_Point
qva_wlcont
Parcels of Interest
qva_thk
<VALUE>
0 - 20
20.1 - 40
40.1 - 60
60.1 - 80
80.1 - 100
100.1 - 120
120.1 - 140
140.1 - 160
160.1 - 180
180.1 - 200
200.1 - 220
0 Feet 1,000

Figure 4

Description of the anticipated spatial distribution of likely benefits

Water storage and infiltration at the historic M&E Tree Farm Property could increase groundwater levels in the headwaters of Manzanita Creek and provide increased groundwater inputs and flows into Manzanita Creek. Detailed groundwater evaluations would be required to estimate how much benefit to Manzanita Creek would occur. Water infiltration could also enhance wetlands associated with groundwater discharge areas.

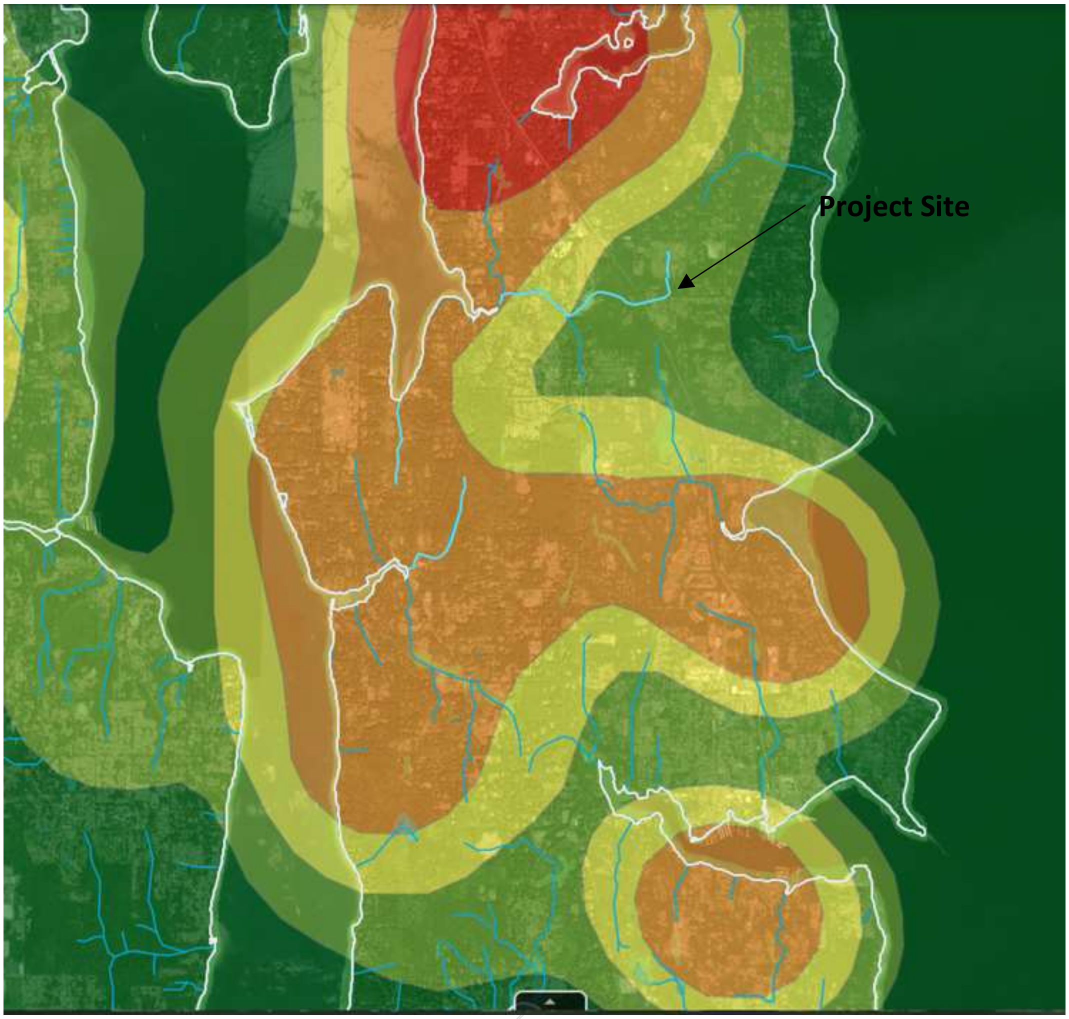
Location relative to future PE well demand

The forecast consumptive use for the Bainbridge Island subbasin using the irrigated area method and baseline growth assumptions is listed in Table 1.

Table 1. Forecast PE Consumptive Use Demand for Bainbridge Island Subbasin

Acre-feet per year	Gallons per minute	Cubic feet per second
67.6	41.9	0.0935

A copy of the PE growth heat map from the WRIA 15 webmap is shown in Figure 5. The project site is located in an area predicted to have less growth in PE wells, however more growth is predicted northwest of the site in the Manzanita Creek watershed along the North Fork Manzanita Creek. The estimated water offset benefit of 17.6 acre-feet per year is 26 percent of the offset estimated for the Bainbridge Island subbasin.



Source: https://hdr.maps.arcgis.com/apps/webappviewer/index.html?id=d7d02dedb57241aa81dd7eb376c8625a

Figure 5. WRIA 15 PE Growth Heat Map

Performance goals and measures.

The performance goals are to increase groundwater recharge by 17.6 acre-feet per year to improve baseflow in Manzanita Creek. The measures will be an increase in baseflow in summer in Manzanita Creek by about 0.02 cfs, assuming the water infiltrated discharges to Manzanita Creek at a steady-state rate equal to the annual average recharge. The flow in Manzanita Creek in July-September averages about 0.3 cfs with annual low flows of 0.11 to 0.18 cfs (Kitsap Public Utility District 2020). The groundwater recharge could increase baseflows by 8-20 percent. Increased baseflow could also slightly reduce water temperatures in the stream.

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

The Washington Department of Fish and Wildlife (WDFW 2020) has identified that coho salmon are present in both Manzanita Creek and the SF Manzanita Creek; the Endangered Species Act (ESA) listed Puget Sound winter steelhead are present in Manzanita Creek (although Manzanita Creek is not listed as critical habitat); and chum salmon are present at the mouth of Manzanita Creek below the fish hatchery weir/dam operated by the Suquamish Tribe near Miller Bay Road (barrier ID: 930696), for Manzanita Creek Hatchery. The Washington Stream Catalog (WDF 1975) indicates that both coho and chum salmon were historically present in Manzanita Creek. These North Kitsap streams were noted in the Stream Catalog (WDF 1975) as having good steady base flows at the time (likely due to the glacial outwash soils and infiltration of water).

The salmonids and other aquatic species in Manzanita Creek are subject to degraded ecosystem function due to limiting factors present at the site. In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 15 (NOAA 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions. Increased base 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 both productivity and survival of juveniles. The alteration of natural stream hydrology has been identified as a high priority limiting factor in WRIA 15 (NOAA 2007) and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions. Increased base 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. Addressing increased base streamflow could contribute to the VSP parameters of abundance, productivity, spatial structure, and diversity for the ESA-listed Distinct Population Segment of Puget Sound winter steelhead.

Identification of anticipated support and barriers to completion.

The project was proposed by the City of Bainbridge Island as a potential project that would fit the goals of the Watershed Restoration and Enhancement Committee. Friends of the Farms is the land manager and could be the project sponsor. The City would likely construct, operate and maintain the stormwater collection and infiltration facilities. The primary barrier would be the availability of funding for the construction and operations and maintenance (O&M) costs. Other barriers include the feasibility of infiltration. Feasibility issues would need to be studied and addressed during a feasibility study phase.

It is anticipated that the project would be supported by the Puget Sound Partnership, the West Sound Watersheds Council (the lead entity in this region of WRIA 15), and other local partners. The West Sound Watersheds Council aligns salmon strategies with Puget Sound Salmon Recovery Plans and implements the Puget Sound Partnership's Action Agenda in coordination with the West Central Local Integrating Organization. One of the Near-Term Actions in the Action Agenda is a planning and design project to conduct the following:

> "Watershed-scale planning in two highest priority salmon-habitat basins on Bainbridge Island, working in collaboration with stakeholders through the Bainbridge Island Natural Resources Management Team (City departments of planning and public works, Kitsap County planning, WDFW, local Land Trust, local Watershed Council, Puget Sound Restoration Fund, Mid Sound Fisheries Enhancement Group, Metro Parks and Recreation, Suquamish Tribe, Kitsap Conservation District, and Kitsap Public Health District)" (PSP 2020).

The proposed project could fit into this watershed-scale planning effort which would include Manzanita Creek. The West Central Local Integrating Organization's 2016 Ecosystem Recovery Plan also identifies actions in the basin to implement salmon recovery actions. Two theories of change identified in this plan are directly addressed by the proposed project: "7.2 Decrease water withdrawal, diversion, per capital water use," and "10.3 Fix problems caused by development" (WCLIO 2016). Manzanita Creek is not directly identified in the plan, but the project fits into general strategies for improving streamflow and habitat conditions for salmonids in WRIA 15. The project also addresses strategies identified in NOAA's Recovery Plan for Puget Sound Steelhead (NOAA 2019). Recovery Strategy 3.3.2 specifically identifies improving hydrologic conditions and restoring groundwater recharge areas as important to improving survival for steelhead in South Puget Sound.

Potential budget and O&M costs.

The total construction costs of an interceptor ditch, stormwater pond and infiltration facility is estimated to be around $200,000. An additional 35 percent would be added for design, construction services and administrative costs, for a total of $270,000. The annual O&M cost is estimated to be $20,000. All costs are based upon a conceptual level of understanding of the project and may change once additional feasibility studies are completed.

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by the City of Bainbridge Island with O&M funded by the City using existing staff. The source of water could vary substantially from year to year due to climate factors, however the project benefits were described assuming a conservative amount of stormwater is captured and infiltrated.

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

The City of Bainbridge Island is the most suitable project sponsor but has not committed to assuming the project sponsor role yet. The project is also in a very conceptual level of detail and additional geotechnical studies will be needed to determine its feasibility or arrangement.

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Gig Harbor Golf Club Project-South Sound Subbasin

Description

The proposed project would replace a surface water diversion on Artondale Creek with a new groundwater well to provide irrigation water for Gig Harbor Golf Club and restore habitat over a 600-foot reach of Artondale Creek. A portion of Artondale Creek and approximately 2 acres of the floodplain would be restored by replacing two existing bridges to open up the floodplain and plantings to increase shade, improve instream habitat, reduce stream temperature, and improve riparian buffers and upland habitat conditions. The restoration project may also be extended downstream if needed to improve fish passage to the project site. The project is located in the South Sound subbasin of WRIA 15 on the Gig Harbor Peninsula. **This project is not currently feasible due to legal restrictions.**

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 would function by removing a surface water diversion and constructing a new well to replace the water supply for the golf course. The golf club has a Certificate of Surface Water Right of 0.27 cfs and 70 acre-feet per year to irrigate 35 acres. The priority date is May 7, 1958. The period of use is April 15 to October 1. By switching to a groundwater source, there would be an immediate surface water increase in Artondale Creek of up to 0.27 cfs during the April 15 – October 1 time frame. The average increase (70 acre-feet/165 days) would be 0.21 cfs. There would be a corresponding increase in groundwater use and a new well would need to withdraw from a deep aquifer to minimize the potential effect on surface water. However, since the golf club is on a peninsula and close to Wollochet Bay, the impact to surface water is likely minimal. Groundwater analyses are required to design a new well to minimize surface water impacts.

Stream restoration elements and the removal of two bridges would increase floodplain connection and improve riparian habitat conditions, providing beneficial habitat impacts to fish and other aquatic species.

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

Figure 1 shows the location of the stream restoration elements and new groundwater well source for irrigation water.

Figure 1. Conceptual Project Description.

Description of the anticipated spatial distribution of likely benefits

The project could result in an increased streamflow of up to 0.27 cfs and up to 70 acre-feet during the late Spring to early fall period in Artondale Creek. The increased streamflow would benefit 0.6 miles of Artondale Creek between the golf course and the head of Wollochet Bay.

Location relative to future PEW demand

The estimated consumptive use for future PE wells for the South Sound subbasin is 213.8 acre-feet, assuming the median growth estimate and use of the irrigated area method.

The project site is located in an area of relative moderate amount of predicted PE well growth. A copy of the PE well growth heat map from the WRIA 15 webmap is shown in Figure 2.

Figure 2. WRIA 15 PE Growth Heat Map

Performance goals and measures.

The performance goals are to decrease surface water use by up to 0.27 cfs and 70 acre-feet per year to improve streamflow in Artondale Creek and improve instream and floodplain habitat conditions. The increased streamflow and increased shade from riparian plantings should also reduce water temperatures in the stream.

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

Artondale Creek supports a variety of species and life stages, similar to the other small streams within the Gig Harbor Peninsula area. The primary anadromous species found in Artondale Creek are coho and chum salmon, and cutthroat trout have also been observed. Specifically, Artondale Creek and its east branch support runs of coho salmon and cutthroat trout and Artondale Creek supports a run of chum salmon (Pierce County 2015). The salmonids and other aquatic species in Artondale Creek are subject to degraded ecosystem function due to limiting factors present at the site. In the Puget Sound Salmon Recovery Plan, NOAA identifies the alteration of natural stream hydrology as a high priority limiting factor in WRIA 15 (NOAA 2007), and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions. Increased base 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.

A preliminary meeting was held with Board members of the Gig Harbor Golf Club and they were receptive of the project. Input from WDFW, tribes, Pierce County and other stakeholders is needed before developing the project any further. If support is obtained from those stakeholders, the main barrier to completion would be obtaining funding.

The West Sound Watersheds Council, which is the Lead Entity in this region of WRIA 15, aligns salmon strategies with Puget Sound Salmon Recovery Plans and implements the Puget Sound Partnership's Action Agenda in coordination with the West Central Local Integrating Organization. The West Central Local Integrating Organization's 2016 Ecosystem Recovery Plan identifies actions in the Gig Harbor basin to implement salmon recovery actions. Two theories of change identified in this plan are directly addressed by the proposed project: "7.2 Decrease water withdrawal, diversion, per capital water use," and "10.3 Fix problems caused by development" (WCLIO 2016). Artondale Creek is not directly identified in the plan, but the project fits into general strategies for improving streamflow and habitat conditions for salmonids in WRIA 15.

The Gig Harbor Basin Plan, which was written by Pierce County Public Works and Utilities and adopted in 2005, is a comprehensive guide to surface water management in the Gig Harbor Basin (Pierce County 2005). It identifies surface water management issues in the basin and recommends actions to reduce flood hazards, improve water quality, improve fish passage, and improve riparian habitat in the Gig Harbor Basin. Artondale Creek is described in this plan as having more than 50 percent fair or poor fish habitat in addition to problem areas such as fish passage barriers. The reach of Artondale Creek which extends through the project area has the least valuable habitat for fish and wildlife than any other reach in Artondale Creek due to channelization and removal of riparian vegetation. The proposed project directly addresses this degraded habitat and aligns with the Gig Harbor Basin Plan.

Potential budget and O&M costs.

No detailed estimate of implementation costs has been prepared but a conceptual level cost of about $500,000 is estimated. That includes costs of drilling, testing and permitting a new well, restoration of 2 acres of floodplain and stream, construction of a traffic bridge at the entrance to the golf club and a lighter duty bridge to cross the stream near a tee box, engineering and permitting. A contingency of 25 percent was added because of the conceptual level of detail available at this stage. The O&M costs of the well and bridges would likely be paid for by the golf course as part of their maintenance activities.

Anticipated durability and resiliency.

The project would have lasting benefits as it would be actively managed by Gig Harbor Golf Club with O&M likely performed by existing golf course maintenance and grounds staff. The new groundwater well source for irrigation should provide more reliability and less variability from year to year due to climate factors.

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

A project sponsor has not yet been identified but could be the Gig Harbor Golf Club, Pierce County, a tribe, the lead entity or another restoration organization in Pierce County and WRIA 15.

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Community Forest Projects Portfolio in WRIA 15

Summary

This streamflow restoration action is the acquisition of forest lands or change in forest management practices to preserve stands or emphasize a longer harvest interval. Preserving or maintaining forests with stand ages more than 40 years can increase dry-season low flows. A portfolio of projects is presented along with an estimate of the potential increase in streamflow. To date, 20 projects have been identified and streamflow increases of over 1,000 acre-feet/ year are estimated assuming the forest stands are more than 40 years old and subject to harvest. Potential streamflow benefits were estimated using average values of streamflow increase per acre estimated from the VELMA hydrologic model for similar projects in the Nisqually Watershed (WRIA 11). As projects move forward for funding considerations, further hydrologic modeling would need to be performed for WRIA 15 Community Forest projects to estimate potential increases in streamflow.

Description of Community Forest Projects

Hydrologic modeling performed for Community Forest Projects in the Nisqually Watershed show that forest management practices that emphasize longer harvest intervals (>80 years), forest thinning and robust riparian buffers can significantly increase dry-season low flows. The hydrologic modeling was performed using the VELMA model and the results are consistent with available observed long-term monitoring data in the Pacific Northwest region (Perry and Jones 2016, Segura et al. 2020). Recent empirical studies in western Oregon have established that young, rapidly growing forests can transpire over three times more water than mature forests. These studies were conducted at relatively small scales, ranging from individual trees and stands of trees (Moore et al. 2004) to small headwater catchments (Perry and Jones 2016).

An estimate of the potential streamflow increase with implementation of Community Forest projects was prepared using information contained in the Nisqually Watershed Response to the 2018 Streamflow Restoration Act (Nisqually Watershed Planning Unit 2019). In that plan, the average streamflow benefit is 0.14 acre-feet per year per acre of Community Forest acquired. That assumes the forest stands acquired have an average age of 40 years. The value for WRIA 15 may differ because of differing hydrologic conditions and would need to be modeled to select an appropriate value. In some cases for WRIA 15, the value may be higher because of permanent protection.

Maintaining mature forest cover also provides significant habitat benefits that grow with stand complexity and age. Older trees provide a wider range of niche habitats and create long-term habitat benefits of snags and large woody debris.

The estimated consumptive use for future PE wells in WRIA 15 is 766.4 acre-feet per year, with a higher goal of 1218 acre feet per year. Table 1 presents the acreage of potential community forest projects identified by sponsors by subbasin, as well as a target acreage in each subbasin that will provide water offsets to help meet the Watershed Plan goal of offsetting future PE well demand within each subbasin. The total target acreage is 1,723 acres, which will provide an estimated 241 acre-feet of water offset. The projects identified by sponsors need further confirmation to determine whether the projects would meet the criteria of having forest stands greater than 40 years old and subject to harvest. In some cases, thinning is expected to occur on the properties.

The cost of acquiring community forest is likely in the range of $10,000 - $15,000 per acre.[49] The total acquisition cost for 1,723 acres would likely be in the range of $17.2 – $25.8 million. This does not include restoration costs.

Additional information about Community Forest type projects was prepared by Paul Pickett of the Squaxin Tribe and is located on Box at https://app.box.com/file/690715571320?s=98rgsj14yxzhakbmkl7y1j4euminkp0b

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[49] Current costs in North Hood Canal per acre are approximately $9000. The larger range takes into account variations across the WRIA and future pricing. This estimate is only for the acquisition and does not include any potential restoration work that may occur on some properties.

Table 1. Portfolio of Community Forest Type Projects in WRIA 15

Subbasin	Project Name (Sponsor, if known)	Description	Acreage	Potential Streamflow Restoration Increase (Acre-feet/year)
Bainbridge Island	Springbrook Creek Protection and Restoration (Bainbridge Island Land Trust)	Purchase of 22.85 acres of intact stream, wetland, riparian and forest habitat and removal of fish passage barrier culvert in high priority protection site as identified in Springbrook Creek Watershed Assessment (2018) and Department of Ecology Watershed Characterization.	22.85	3.2
North Hood Canal	Community Forest Projects, including: • Crabapple Creek Habitat Acquisition and Restoration • Little Anderson Creek Habitat Protection • Divide Block Habitat Acquisition and Restoration • West Port Gamble Block Habitat Protection • Port Gamble Heritage Park Timber Rights Acquisition[1] • Gamble Creek Parcel • Boyce Anderson DNR Parcel • Seabeck DNR Parcel • Grovers Creek Mainstem protection and restoration (Sponsors may be Great Peninsula Conservancy, Kitsap County and Port Gamble S'Klallam Tribe)	Community forest projects will protect forested land from development or change timber harvest practices and restore streams, riparian areas, wetlands	Approx. 2,100 acres has been identified as potential projects by sponsors, target for Community Forest in this subbasin is 500 acres	70

Subbasin	Project Name (Sponsor, if known)	Description	Acreage	Potential Streamflow Restoration Increase (Acre-feet/year)
South Hood Canal	Community Forest Projects, including: • Bear Creek Protection • Tahuya Headwaters (Sponsors may be Great Peninsula Conservancy and others)	Community forest projects will protect forested land from development or change timber harvest practices and restore streams, riparian areas, wetlands	Target is 500 acres in South Hood Canal Subbasin	70
South Sound	Community Forest Projects, including: • Rocky Creek Preserve • Coulter Creek Overton Lands • Key Peninsula Forest Lands (Sponsors may be Great Peninsula Conservancy and others)	Community forest projects will protect forested land from development or change timber harvest practices and restore streams, riparian areas, wetlands	Target is 500 acres in South Sound Subbasin	70
Vashon Maury	Community Forest Projects, including: • Judd Creek Headwaters • Shinglemill Creek Headwaters • Mileta Creek Headwaters • Christiansen Creek Headwaters • Fisher Creek Headwaters • Tahlequah Creek Headwaters (Sponsors may be Vashon-Maury Island Land Trust or King County)	Community forest projects will protect forested land from development or change timber harvest practices and restore streams, riparian areas, wetlands	Target is 100 acres in Vashon Maury Subbasin	14
West Sound	Community Forest Projects, including: • East Branch Ostrich Bay Creek along Skylark Drive W. • Strawberry and L. Anderson Creek Parcel (Sponsors may be Great Peninsula Conservancy and others)	Community forest projects will protect forested land from development or change timber harvest practices and restore streams, riparian areas, wetlands	Target is 50 acres in West Sound Subbasin	7

Subbasin	Project Name (Sponsor, if known)	Description	Acreage	Potential Streamflow Restoration Increase (Acre-feet/year)
South Sound Islands	Anderson Island Community Forest Projects • Near Idie Ulsh Park (40 acres total) (Sponsors may include Anderson Island Parks and Recreation District, Great Peninsula Conservancy, Nisqually Land Trust, Forterra)	Community forest projects will protect forested land from development or change timber harvest practices and restore streams, riparian areas, wetlands	Target is 50 acres in South Sound Islands Subbasin	7
Totals			Overall Target is 1,723 acres	241

[1] Subject to existing agreements.

Conservation District Rain Garden and Low Impact Development Programs

Description

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

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

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

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

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

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

Low impact development encompasses the practices listed above and focuses on ways that human-constructed landscapes can be adapted to reduce harmful impacts on natural resources and the environment.

The Rain Garden and Low Impact Development (LID) Program at the Kitsap Conservation District (KCD) works cooperatively with county services, landowners, and local communities to expand knowledge and use of LID practices throughout Kitsap County. With funding from Clean Water Kitsap, the KCD helps landowners to protect local water resources by providing information, technical assistance, and financial incentives toward the installation and maintenance of rain gardens and other LID solutions. Within this program, the KCD offers free site visits to any landowner in unincorporated Kitsap County to assess and discuss what LID projects are feasible for their property.

Since 2010, the KCD Rain Garden and LID cost-share program has helped landowners fund and install 320 rain gardens (KCD 2020; KCD, Pers. Comm., September 29, 2020).[50] In 2014, the program expanded to include a number of new LID options in addition to rain gardens, such as rain barrels, lawn modification, soakage trenches, and native plants. 163 of these practices have been installed (KCD 2020, Appendix A).

Based on 10 years of data, the KCD Rain Garden and Low Impact Development Program has cumulatively put 257 acre-feet of water back into the ground. The KCD estimates that they will continue to implement 50 practices (40 RG plus 10 other practices) per year (KCD, Pers. Comm., September 29, 2020). Appendix A provides figures showing the location of rain garden and LID projects that have been implemented by KCD.

Pierce Conservation District and Mason Conservation District also partner with landowners in the design and construction of low impact development projects, although not at the same scale as KCD, which has more funding for that purpose.

The goal of this project would be to support the implementation of rain garden and LID projects across WRIA 15, with an emphasis on subbasins that will experience the most growth and/or contain priority streams, as defined by the WRIA 15 Committee. In Kitsap County, the area that is currently served is the unincorporated area within the county (see Figure A-1) as they are funded by a grant from Kitsap County. With additional funding from sources other than Kitsap County (such as Streamflow Restoration Grants through Washington Department of Ecology) projects could be implemented in all areas within the county. With funding, Pierce Conservation District and Mason Conservation Districts can implement projects within their respective counties.

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

The average rain garden or LID project is estimated to put 0.15 acre-feet of water into the ground on an annual basis (see Appendix B). KCD intends to implement 50 practices (40 rain gardens plus 10 other practices) per year, while we are assuming Pierce and Mason Conservation Districts will implement 10 projects per year in their respective counties. The average annual offset in 2038 is

[50] Installations include projects within the cities of Poulsbo, Bremerton and Bainbridge Island.

estimated to be 189 acre-feet. The targeted percentage and number of projects per subbasin is presented in Table 1. The total offset in 2038 per subbasin is also listed in Table 1. Note that there will be 18 years of projects assuming the program begins in 2021.

Table1. Target Percent of Projects per Subbasin per Year

Subbasin	Targeted Number of Projects per year	Target % of Projects	Total Amount of Potential Offset Benefit by 2038 (18 years of projects), acre-feet/year
North Hood Canal	10	14%	27
West Sound	20	29%	54
Bainbridge Island	5	7%	13.5
South Sound	25	36%	67.5
South Hood Canal	10	14%	27
Totals	**70**		**189**

Description of the anticipated spatial distribution of likely benefits

The spatial distribution of likely benefits from this project would occur throughout WRIA 15 with priority towards critical streams in which permit exempt wells are projected to be high which are identified by orange and red in Figure 1.

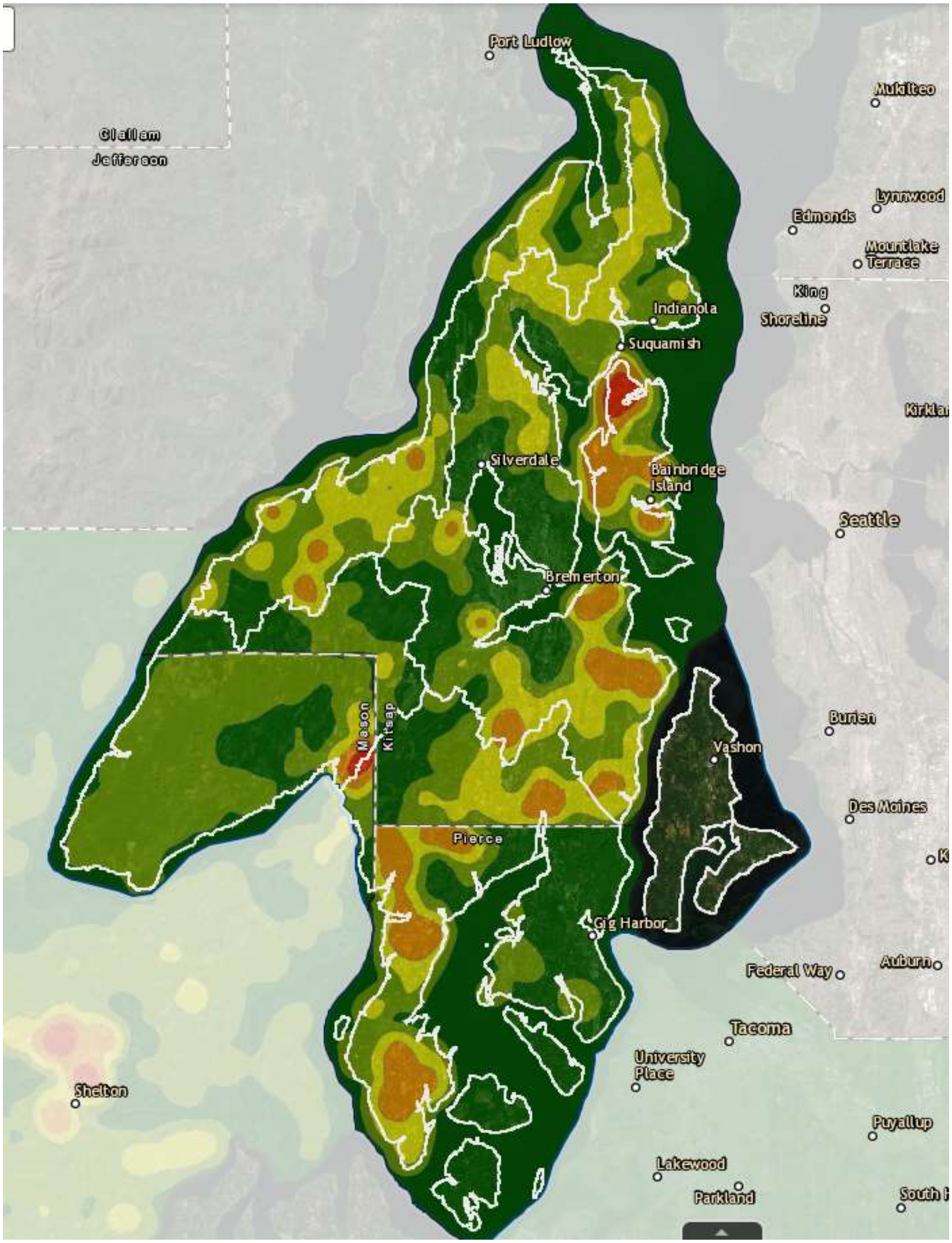


Figure 1. WRIA 15 permit exempt connections potential growth. Red shading indicates high future projected growth and green shading indicates low future projected growth.

Performance goals and measures.

This project would be measured by the number of functional rain gardens and LIDs installed within WRIA 15.

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

The Washington Department of Fish and Wildlife has identified that Fall Chinook, Coho Salmon, Summer Chum, Fall Chum, Winter steelhead, and Pink Salmon are present in WRIA 15 (WDFW 2020). Increased base streamflow and reduced water temperatures would benefit both adult migrants to spawning grounds and juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve survival of adults and both productivity and survival of juveniles. The alteration of natural stream hydrology has been identified as a high priority limiting factor in WRIA 15 (NOAA 2007) and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions.

Identification of anticipated support and barriers to completion.

The three conservation districts would be the project sponsors who will coordinate the design and construction of the rain gardens and LIDs infiltration/augmentation sites. The districts will collect, compile, share and report data.

The primary barrier is the availability of funding for the construction of rain gardens and LIDs. Other barriers include private landowner willingness and partnerships with the county and cities to focus in particular areas.

Potential budget and O&M costs.

A review of KCD data indicates an average rain garden infiltration area of about 200 square feet. The average construction cost for a rain garden or LID is ~$10-15 per square foot if using a landscape contractor for installation. (Costs can be much higher if the whole project is done by a contractor as opposed to conservation district employees.) It is assumed that the landowner would be responsible for the O&M costs. For larger commercial site applications, using a general contractor, the estimated cost per square foot would be $20-35. Additional costs would be incurred by the conservation districts for administrative, design and construction inspection.

Anticipated durability and resiliency.

The project would have lasting benefits. The KCD will manage the implementation of RGs and LIDs in partnership with the landowner.

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

The conservation districts are willing project sponsors and are ready to proceed immediately. KCD will construct the most projects (50 per year) and has been successfully installing rain garden and LIDs since 2010 with increased complexity beginning in 2014 (KCD 2020). If funding is increased, the primary barrier would be private landowner willingness as well as partnerships with the county and cities to focus in particular areas.

Sources of Information

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.

Kitsap Conservation District (KCD). 2020. 2010-18 KCD RG Program Practices – South, North, and Central Districts. https://kitsapcd.org/programs/raingarden-lid. Accessed September 28, 2020.

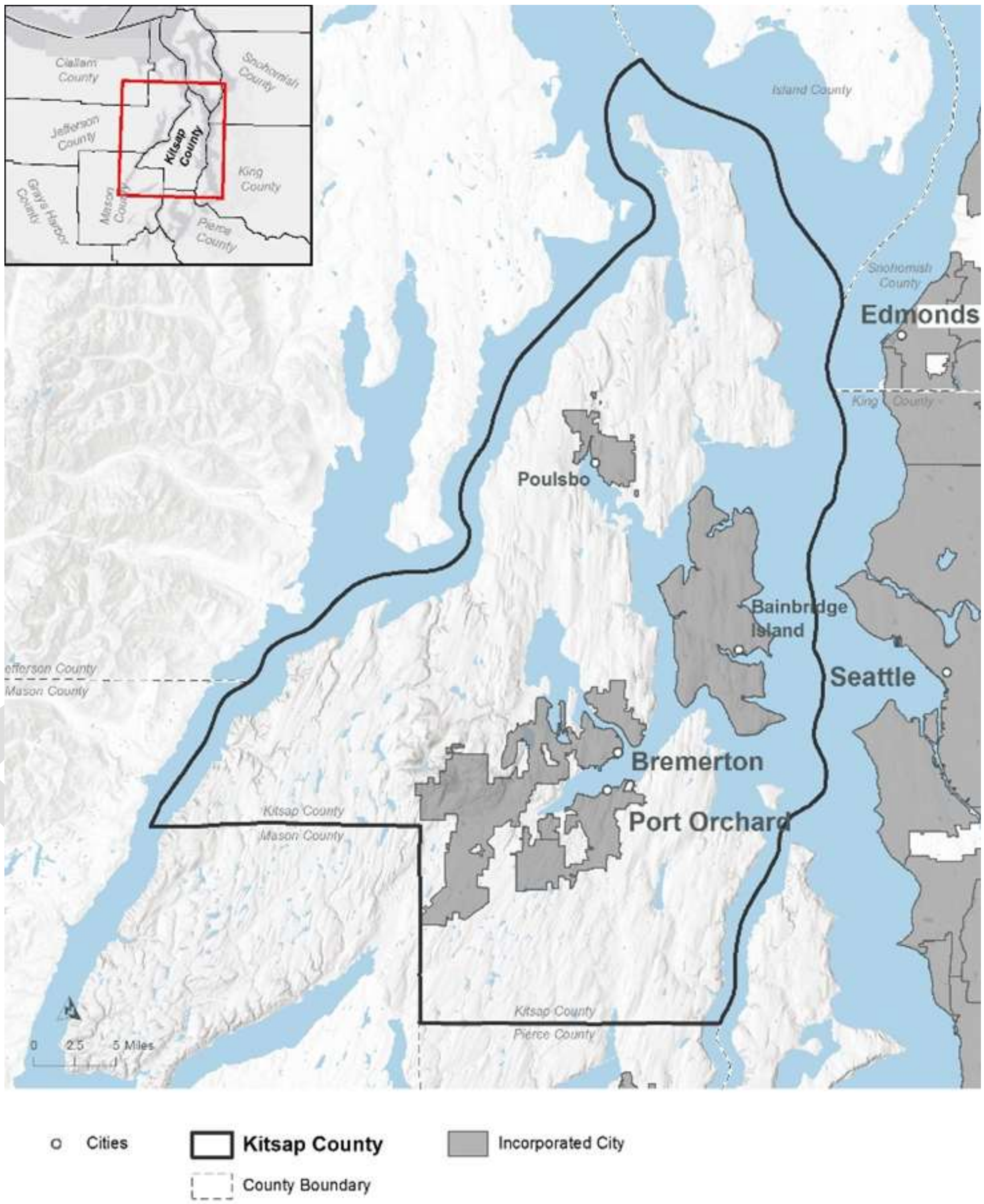
WDF (Washington Department of Fisheries), 1975. "A Catalog of Washington Streams and Salmon Utilization, WRIA 15." Accessed at: https://www.streamnetlibrary.org/?page_id=95.

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

Raingarden and LID Project Appendix A

Kitsap Conservation District Rain Garden and LID Project Locations

Figure A-1. Current KCD service area for rain garden and LID projects



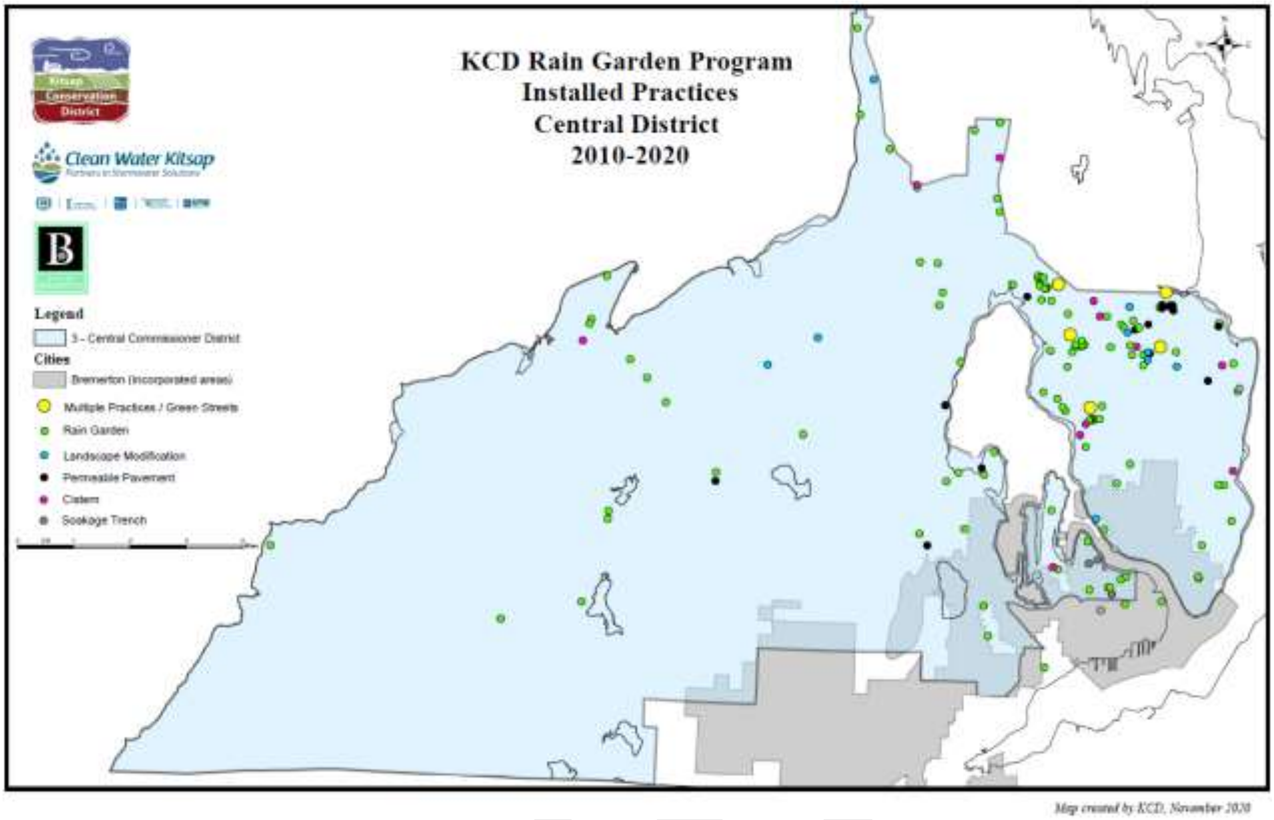


Figure A-2. KCD Rain Garden program installed practices in Central District (2010-2020).

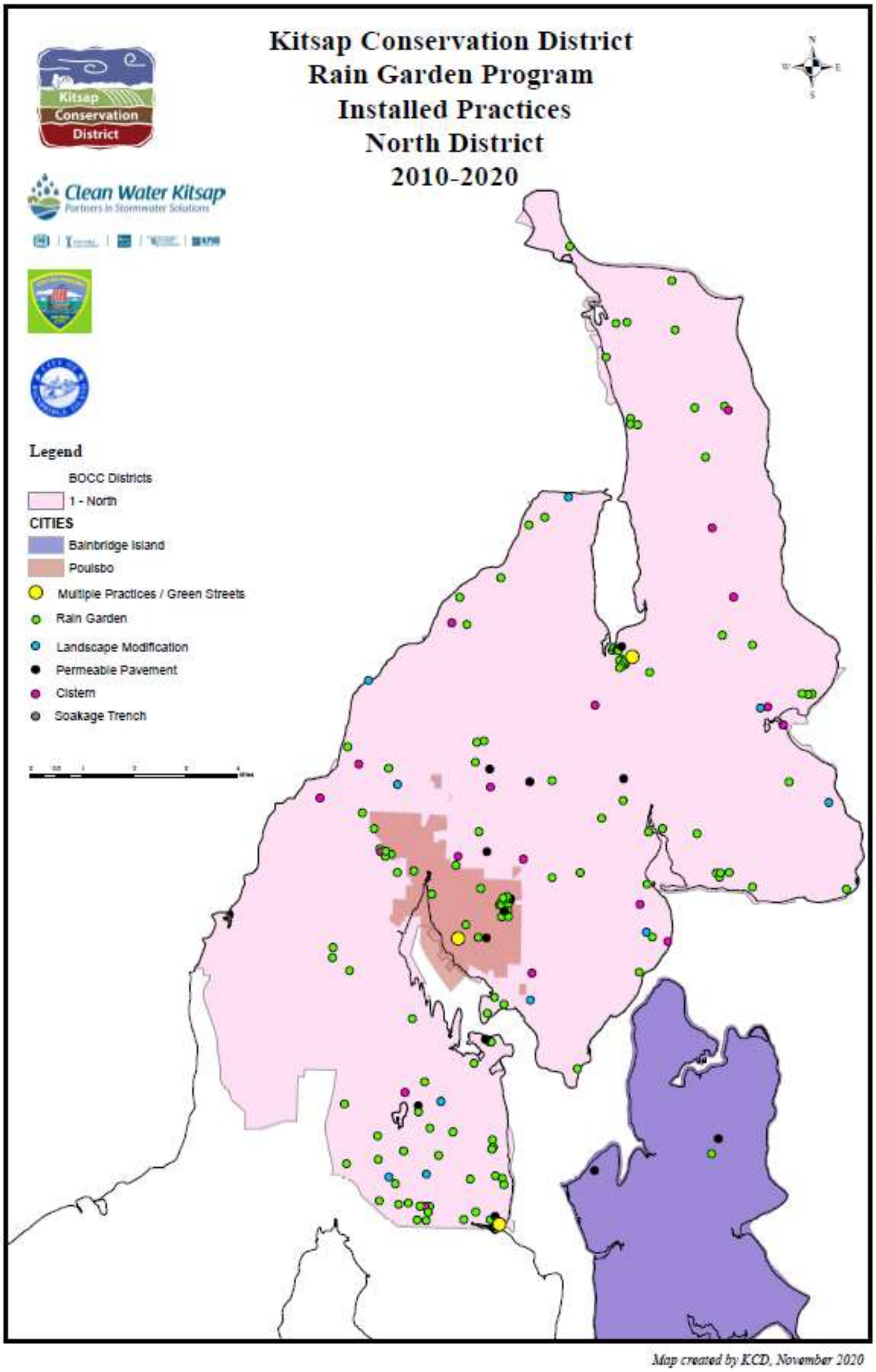


Figure A-3. KCD Rain Garden program installed practices in North District (2010-2020).

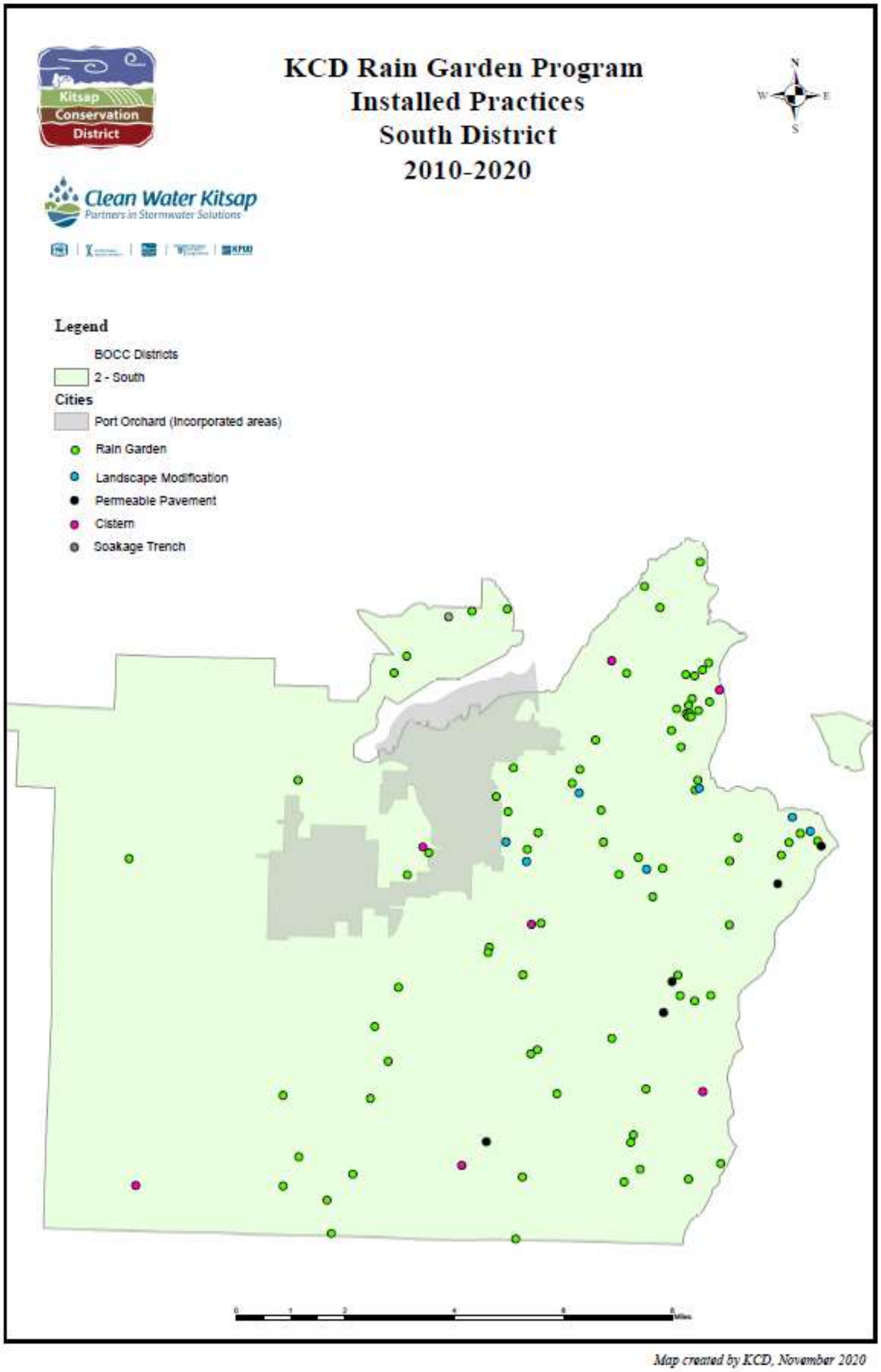


Figure A-4. KCD Rain Garden program installed practices in South District (2010-2020).

Raingarden and LID Appendix B

Rain Garden Water Offset Calculations

Proposed Water Offset for Typical Kitsap Conservation District Raingarden

Introduction

The purpose of this document is to estimate the average annual recharge for future rain garden projects in WRIA 15 using Kitsap Conservation District data on average size of rain garden and LID projects they have installed since 2010. Annual recharge calculations are based upon hydrologic modeling performed by HDR for the Mason County Rooftop Infiltration Project (HDR, 2020). For these calculations it was assumed rain gardens will be installed on houses that are currently connected to a storm drainage system, so that the entire infiltration volume will be counted as a water offset. A lesser infiltration volume and water offset would be realized for houses that are not currently connected to a storm drainage system as roof downspouts may splash onto the ground and partially or totally infiltrate.

Calculations

Calculations are provided using a range of potential rain garden sizes. KCD data shows the average rain garden they have constructed since 2010 has an infiltration trench area of 200 square feet (sf) and captures 1,900 sf of impervious surface. Infiltration volumes are calculated using rain garden sizes of 100, 150, and 200 sf, as well as impervious surfaces of 1,600, 2,000 and 2,800 sf. The Mason County Rooftop Infiltration Project assumed 2,800 sf as the impervious surface that would be captured, based upon an average roof and driveway size. The infiltration rate used in the calculations corresponds to Group B soils as rain gardens use amended soils which are similar to Group B. The infiltration rate used for Group B soils is 2 inches/hour.

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

A larger infiltration trench will infiltrate more water; there is a proportional relationship between infiltration area and infiltration capacity. There is also a proportional relationship to the amount of runoff to the impervious area, assuming all the runoff is captured. A limit to the amount of infiltration is the volume of annual precipitation minus potential losses due to evaporation. To estimate the amount of water that will be infiltrated in a KCD rain garden the HDR results were proportionally scaled up by the amount of infiltration area (100 – 200 sf) and scaled down by the amount of impervious area (1,600 – 2,800 sf). Those calculations are summarized in Table 1.

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

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

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

Table 2. Volume of Rainfall Potentially Infiltrated

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

The calculations indicate that the rain gardens KCD is installing have, on average, the capacity to infiltrate 65.3 inches of precipitation, or 0.25 acre-ft per installation per year. The infiltration capacity is not limited by the amount of precipitation that occurs in most areas of Kitsap County. Table 3 provides infiltration volumes for varying precipitation volumes and the average impervious area captured in a KCD project. To be conservative, 10% loss due to evaporation or other losses are assumed.

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

Average Annual Precipitation, inches	Annual Volume Infiltrated, Inches	Annual Volume Infiltrated, acre-feet
40	36	0.138
50	45	0.172
60	54	0.207
70	63	0.241

These volumes can be used as estimates of the water offset quantity for WRIA 15 rain garden projects. The actual values will need to be tracked during implementation, but the quantities shown in Table 3 provide a planning-level estimate of water offsets from rain garden projects that capture 2,000 sf of impervious area and are constructed using a 200 sf infiltration trench in Group B soils. It is recommended that the average of the volume infiltrated between 40- and 50-inches annual precipitation be used for estimating water offsets in WRIA 15. That equals 0.15 acre-feet per rain garden.

References

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

Vashon-Maury Island Land Conservation And Water Rights Acquisition Project

Description

One set of potential projects being evaluated by the Watershed Restoration & Enhancement Committee (Committee) for Water Resources Inventory Area (WRIA) 15 is the acquisition (fee and conservation easements) of sensitive habitats and water rights in the Vashon-Maury Island sub-basin with the intent of enhancing instream flows and mitigating out of stream uses (i.e., reductions in flows associated with permit-exempt wells). Assuming property acquisition is coupled with water right acquisition, associated habitat benefits could include removal of structures and impervious surfaces, wetland and riparian protection and restoration, and decommissioning permit exempt wells (PEWs).

To support identification of potential water right acquisition projects, the Department of Ecology (Ecology) queried their Water Rights Tracking System (WRTS) database and provided tables and associated GIS data of all active water rights within WRIA 15 to the Committee. Inactive water rights (e.g., previously approved changes, cancelled or withdrawn applications) were excluded from the data provided by Ecology. The tables of active water rights included over 8,500 water right files within WRIA 15. As an initial screening, water rights under consideration were limited to certificates and permits that included commercial and Industrial (CI), stockwater (ST), or irrigation (IR) uses. The list of active water right permits and certificates was further reduced by removing any with a priority date later than the July 24, 1981 adoption date of Chapter 173-515 WAC, the instream flow rule for WRIA 15. Over 1,000 water rights in WRIA 15 met these screening criteria, including 86 water rights (70 surface water and 16 groundwater) in the Vashon-Maury Island sub-basin.

The Committee identified priority streams in the Vashon-Maury Island sub-basin for land conservation and restoration activities, including water right acquisition. Going generally north to south, priority streams include Shinglemill, Beall, Judd, Fisher, Christiansen, and Tahlequah creeks on Vashon Island and Mileta Creek on Maury Island (Figure 1). These stream basins are priority due to their flows and salmon use, but additional water rights and may occur on smaller tributaries. The water right list was then reviewed to identify water rights with points of diversion or withdrawal within the drainages of the priority streams, with a focus on water rights located near the headwaters of the streams. Based on the Committee's review, and specifically review by the King County representative, selected water rights excluded from the initial screening (e.g., claims and rights with purposes of use other than CI, ST, and IR) were added back to the list of water rights for further evaluation. Twenty-seven water rights were identified in the priority stream drainages. Twenty-six of the water rights authorize surface water diversions and one authorizes a groundwater withdrawal. This list of rights represents the set of potential water right acquisition projects in the Vashon-Maury Island sub-basin. Table 1 provides a summary of the number of selected water rights per priority stream sub-basin and the dominant purpose of use[51].

Table 1. Summary of Selected Water Rights in Priority Stream Sub-Basins

Stream Sub-Basin	Number of Rights by Dominant Purpose of Use		
	IR	DG/DM/DS	ST
Beall	1	0	0
Christiansen	2	1	0
Fisher	3	1	0
Judd	3	3	0
Mileta	2	0	0
Shinglemill	3	3	1
Tahlequah	2	2	0
Total	16	10	1

Notes:

IR – Irrigation

DG/DM/Ds – Domestic General, Domestic Multiple, Domestic Single
ST - Stockwater

These rights authorize a combined instantaneous diversion rate (Qi) of 1.569 cubic feet per second (cfs). Only 13 of the 27 selected water rights list the annual authorized quantity (Qa). The stockwater right does not list an annual quantity. Three of the ten domestic water rights list the Qa, with quantities of 1 to 2 acre-feet per year (afy). Ten of the 16 irrigation water rights list the Qa, with a combined quantity of 184 afy for irrigation of 89.5 acres, or approximately 2 afy per acre. The remining 6 irrigation water rights list a combined acreage of 50 acres. Assuming a water use of 2 afy per acre, similar to the other irrigation water rights in the sub-basin, 50 acres would equate to an additional annual irrigation use of 100 afy. .

Benefits to instream flow would be realized by acquiring all or a portion of a given water right and placing it into the state Trust Water Right Program (TWRP) for instream flow purposes. Quantitative benefits to instream flow would depend on the purpose of use and the manner in which the right is currently used. For example, a domestic water right that diverts from a stream for indoor uses only may have a consumptive use of about 10 percent of total use. If the septic return flows from this use return to the same stream from which the water was diverted, placing this water right into the

[51] Water rights may include more than one purpose of use. For this summary, water rights with an irrigation component among the authorized uses are included in the IR column; rights with a stockwater component and no irrigation use are included in the ST column; and rights with domestic uses and no stock or irrigation uses are included in the DG/DM/DS column.

TWRP would have only limited benefit to instream flows. Conversely, an IR water right may have a consumptive use 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. The period of use, or seasonality, will also affect when instream flow benefits would 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 would be realized through nonuse of the acquired water rights. Depending on the specific opportunity, nonuse would be achieved through fallowing of irrigated fields, reduced hay harvest, changing to an alternate crop that does not require irrigation, removal of livestock, or provision of an alternate source of supply. The acquired water right would be placed into the state 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 or use.

The potential instream flow 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 potential consumptive use associated with irrigation, stockwater, and domestic uses is provided in the following paragraphs. More detailed evaluation would be required once a specific project or projects are selected to accurately quantify consumptive uses and assess the timing and location of instream flow offsets associated with placing a right into the TWRP.

The timing and location of instream flow offsets will depend on several factors, including:

- The period of use of the water right (seasonal or continuous). A seasonal diversion may only affect stream flows for part of the year, while a continuous diversion (e.g., for domestic uses) would likely affect stream flows year-round.
- Whether the right is for surface water or groundwater. The effect of groundwater withdrawals on surface water flows tend to lag behind the pumping period, such that the effects of seasonal pumping persist for weeks or months after pumping ceases. The location of effects on surface water flows may also be more dispersed and the peak impact lower with groundwater pumping. Conversely a surface water diversion will affect stream flow instantaneously and directly.
- Hydrogeologic conditions and the location of the place of use. Only a portion of water diverted for use is consumed, the remaining quantity that recharges groundwater and/or discharges back to surface water is termed the return flow. The timing and location of where return flows would return to an affected stream depend on the location where water is used, how water is managed (e.g., domestic septic systems versus sewer systems), and hydrogeologic conditions between the place of use and the surface water.

For an irrigation water right, annual consumptive use can be estimated based on the State of Washington Irrigation Guide (WIG) and Ecology Water Resources Program Guidance 1210 – Determining Irrigation Efficiency and Consumptive Use (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. Using the Bremerton station, CIRs in WRIA 15 range from about 4.51 inches (0.375 feet) for strawberries to 22.3 inches (1.86 feet) for raspberries. The CIR for grass/pasture, the most likely crop grown, is 16.8 inches (1.4 feet).

Guidance 1210 provides typical irrigation application efficiencies (Ea) and percent consumptive use (%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 %CU provides the consumptive use. Assuming sprinkler irrigation with an average Ea of 75 percent, TIRs per acre in WRIA 15 could range from about 0.5 feet to 2.5 feet, with a likely amount of 1.9 feet. Assuming a %CU of 80 percent if the TIR, consumptive use per acre could range from 0.4 to 2 feet per acre of irrigated land, with a likely value of 1.5 feet. The total consumptive use for a water right can then be estimated as the irrigated acreage times the consumptive use per acre.

Table 2 provides a summary of irrigated acreage and the potential range of associated consumptive use, based on the consumptive use per acre described above and the authorized irrigated acreage listed in the water rights. Site-specific evaluations of crop type, irrigation methods, and irrigated acreage would be needed to determine the potential consumptive use that could be available to support instream flows by placing a given water right into the TWRP.

Table 2. Summary of Authorized Irrigated Acreage and Consumptive Use by Priority Stream Sub-Basins

Stream Sub-Basin	Authorized Acreage	Low-End CU in AFY	High-End CU in AFY	Likely CU in AFY
Beall	8	3.2	16	12
Christiansen	19	7.6	38	28.5
Fisher	42	16.8	84	63
Judd	30	12	60	45
Mileta	7	2.8	14	10.5
Shinglemill	11.5	4.6	23	17.3
Tahlequah	22	8.8	44	33
Total	139.5	55.8	279	209.3

The period over which consumptive use impacts occur would generally be the irrigation season, or about May through September, although as discussed above accounting for the lag associated with groundwater pumping impacts and the timing of return flows would affect this period. As an example, retiring about 3 acre-feet of consumptive use would equate to an average instream flow benefit of about 0.01 cfs during the irrigation season.

Typical indoor domestic uses are expected to be about ten percent consumptive. The domestic water rights in the property drainages authorize use of less than 2 afy each, such that annual benefits to instream flow would be less than 0.2 afy per domestic water right. Acquiring domestic water rights would likely require providing an alternate source of supply (e.g., hookup to a public water system) or acquisition of the residential properties served by the water right. For ST rights the benefits would depend on the specific stock operation, including water uses and management and discharge of effluent. Although more limited in the potential amount of water that could be realized by retiring these water rights, domestic and ST water rights are expected to provide opportunities for year-round instream flow benefits not presented by the IR water rights.

Map of the project and location.

Figure 1 (attached) shows the location of priority streams within the Vashon-Maury Island sub-basin.

Description of the anticipated spatial distribution of likely benefits

Water right acquisition would be focused on stream headwaters or above known areas of fish habitat. By acquiring a water right, discontinuing uses, and placing the right into the TWRP historical consumptive use associated with the right would be allowed to remain instream. The instream flow represented by the water right in the TWRP would be protected from future appropriation or use by others allowed to remain instream from the historic point of diversion to the point of discharge to marine waters, benefiting aquatic habitat through the entire downstream reach.

Performance goals and measures.

The range of potential offset benefit from the water right acquisition opportunities on Vashon Maury is approximately 56 to 279 acre feet per year. We recommend counting 10 percent of the total potentially available water rights as the offset benefit presented in the WRIA 15 plan, or 27.9 acre-feet per year (10 percent was applied for the water right acquisition opportunities in the Nisqually plan).

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

The Washington Department of Fish and Wildlife (WDFW 2020a; WDFW 2020b) has identified that coho and chum salmon are present in Judd and Shinglemill creeks, and the Endangered Species Act (ESA) listed Puget Sound fall Chinook are present in Judd Creek, the ESA-listed Puget Sound winter steelhead are present in Judd, Christensen, and Shinglemill creeks, and cutthroat trout are likely present in all Vashon and Maury Island creeks that have perennial flow (noted as present in Fisher, Tahlequah, Shinglemill, Christensen, and Mileta creeks). The Washington Stream Catalog (WDF 1975) indicates that both coho and chum salmon were historically present in Judd Creek and other creeks on Vashon Island, although there had been limited surveys of fish populations at that time. East Kitsap creeks were generally noted in the Stream Catalog (WDF 1975) as having substantial low flow problems, lack of riparian cover, and fine sediment inputs from forestry and agricultural land uses. An impassable fish barrier culvert is present at about rivermile 1 on Judd Creek and an impassable dam is present on Beall Creek (WDFW 2020a).

Judd and Fisher creeks are listed as Category 5 for high water temperatures on Ecology's 303(d) list of impaired waterbodies; Judd and Shinglemill creeks are listed as Category 5 and Christensen Creek is listed as a Category 2 for bioassessment (poor quality based on macroinvertebrate sampling); and Shinglemill and Tahlequah creeks are listed as Category 1 for water temperature (Ecology 2020).

Increased base streamflow and riparian and wetland restoration would contribute to reducing water temperatures that would benefit both adult migrants to spawning grounds and juvenile salmonid rearing habitats by providing increased area and quality of summer stream rearing habitat. This would improve survival of adults and both productivity and survival of juveniles. The alteration of natural stream hydrology has been identified as a high priority limiting factor in WRIA 15 (NOAA 2007) and streamflow is important for supporting riparian vegetation and wetlands that provide shading, food web support, and flood and sediment attenuation functions.

The headwaters of Judd, Fisher, and Shinglemill creeks include numerous wetland areas that could also benefit from increased groundwater levels, further supporting cold water volumes to the creeks.

Land conservation and restoration activities may provide habitat benefits in addition to streamflow restoration. Those habitat benefits would derive from removal of structures and impervious surfaces, decommission of PE wells, wetland and riparian protection and restoration.

Identification of anticipated support and barriers to completion.

The primary barrier is the willingness of water right holders to sell their water rights and land. A secondary barrier is the availability of funding for water right acquisition and permitting.

Potential budget and O&M costs.

Water right acquisition costs are location and market specific. As a planning-level assumption, costs per consumptive acre-foot of irrigation water or stockwater could be in the $1,000 to $5,000 range. As discussed above, consumptive use per acre could range from about 0.4 to 2.0 acre-feet. Costs for acquisition of domestic water rights are likely to be strongly affected by the costs of providing an alternate water supply. These costs could be highly variable, depending on the availability and location of an alternate supply. Following water right acquisition and permitting there are expected to be no ongoing O&M costs associated with water right acquisition.

Budgets and O&M costs for property acquisition and associated habitat benefits through removal of structures and impervious surfaces, wetland and riparian protection and restoration, and decommissioning of PEWs will depend on the specific project opportunities and are not included in here.

Anticipated durability and resiliency.

Water right acquisition projects would have long-lasting benefits and would require minimal future management once permitting is complete. The durability and resiliency of other habitat improvement projects associated with property acquisition will depend on the specific projects and are not included in here.

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

King County and Vashon-Maury Island Land Trust are potential sponsors of the projects. Both entities have extensive experience with implementing similar projects and would be ready to proceed once funding is secured.

Sources of Information

Ecology (Washington Department of Ecology), 2020. 303(d) Assessed Waterbodies. Available at: https://apps.ecology.wa.gov/waterqualityatlas/StartPage.aspx

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

WDFW, 2020b. Priority Habitats and Species on the Web. Available at: https://geodataservices.wdfw.wa.gov/hp/phs/

Beall Creek Bypass Flow Improvement

Description

Beall Creek is a first order stream along the eastern shore of Vashon Island in King County with a drainage basin of 211 acres (Figure 1). Historically, Beall Creek likely had a fish community that included Cutthroat Trout, Coho Salmon, and steelhead trout. Juvenile coastal cutthroat have been observed utilizing Beall Creek (Salmonscape 2020). The focus of this project for the WRIA 15 watershed plan is to more accurately measure the Water District 19 water requirements at the Water District 19 (District) diversion. To accomplish that the existing diversion, which is a fish passage barrier, will be replaced. This project will improve bypass flow at the diversion, resulting in flow improvements to Beall Creek at a rate of an estimated 26 acre feet per year.

Fish Barriers on Beall Creek

A plastic sheet pile dam across Beall Creek impounds water for the District's irrigation diversion at river mile (RM) 0.30 (Figure 2). The District withdraws as much as 350 gallons per minute from the spring-fed creek (a type-two water supply) for community water supply. There are no fish passage facilities at the District's irrigation diversion which results in a complete barrier to upstream fish passage at this location (Kerwin and Nelson 2000, Salmonscape 2020). The Washington Department of Fish and Wildlife (WDFW) identified the District's irrigation diversion as a complete fish passage barrier in June 2017 (Salmonscape 2020). A partial fish passage at Beall Creek RM 0.02 was also identified in June 2017. There are currently no plans to address the partial barrier at RM 0.02.

Previous Project Development

In May 2018, a Preliminary Design Report for the Beall Creek Fish Passage project was completed for the District's upstream irrigation diversion at RM 0.30 (Fisheries Engineers 2018). The report included a number of proposed modifications to the District's Beall Creek diversion including:

- A new concrete dam to be built flush with the existing stream channel;
- A proposed roughened channel for upstream fish passage;
- A means to measure and control the water supply diversion and release of bypass flow;
- A new vertical plate fish screen installed within the existing water intake basin to physically exclude fish from the pumped water intake;
- A sand and silt sluicing system to facilitate the District's maintenance of the water supply intake; and
- A new water delivery system to Water Treatment Plant 1 (Fisheries Engineers 2018).

Some members of the WRIA 15 Committee do not support including offset benefits from fish barrier removal projects. Therefore, the streamflow benefit considered for this project are modifications to the diversion to improve flow in Beall Creek.

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

If this Beall Creek Bypass Flow Improvement project were completed, the improved measuring capabilities would ensure a minimum flow in the stream of 48 gallons per minute and a more accurate diversion of water supply requirements thereby bypassing more flow than they currently do. The estimated offset benefit would be the minimum flow during the dry season when water demands and diversions by the District is highest. Assuming a 4-month dry season (June-September), the offset quantity would be 26 acre-feet.

Map of the project and location.

Figure 1. Location of Vashon Island and Beall Creek (red circle).

Figure 2. Beall Creek with a partial fish passage barrier at river mile 0.02 (yellow) and a complete fish passage barrier at river mile 0.30 (red). Both locations are associated with Water District 19. This project is focused on flow improvements at river mile 0.30.

Description of the anticipated spatial distribution of likely benefits

This project would put more water in the last 0.3 miles of Beall Creek to support aquatic life downstream. The fish barrier removal component of the project would open up ~0.6 miles of stream habitat for migratory fishes in Beall Creek, upstream of the District's irrigation diversion (Figure 2). However, a partial fish passage at Beall Creek RM 0.02 remains unaddressed so fish distribution throughout Beall Creek may remain limited even if the project is completed.

Performance goals and measures.

The project will be measured by the presence of a minimum 48 gallons per minute bypass flow to allow fish passage through the roughened channel and preserve aquatic life downstream of the diversion.

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

WDFW has identified that resident Coastal Cutthroat trout are present in Beall Creek (Salmonscape 2020). The proposed roughened channel would allow for upstream fish passage and the new vertical plate fish screen installed within the existing water intake basin would physically exclude fish from the pumped water intake, reducing or eliminating fish mortality. As a whole, this project supports all life stages of the resident Coastal Cutthroat trout.

Identification of anticipated support and barriers to completion.

Water District 19 is the primary stakeholder for the bypass flow improvement project. The District will collect, compile, share and report project data. The project is supported by the Washington Department of Fish and Wildlife, the Washington Department of Ecology, and the Puyallup Tribes of Indians.

The primary barrier is the availability of funding for project construction and operations. The preliminary design and cost estimate was developed in 2018 (Fisheries Engineers 2018) however the District has been unable to obtain funds for the project.

Potential budget.

As of October 2019, the estimated costs for both the barrier removal and the flow improvements was $110,000 (Fisheries Engineers 2018, Water District 19 2019). This cost estimate includes $82,000 for construction, $8,000 for Final Project Design, $6,000 for Project Permits, and $14,000 for Construction Management (Fisheries Engineers 2018).

Anticipated durability and resiliency.

The project would have lasting benefits. The project would likely improve the District's maintenance capabilities for the water diversion system integrated with the fish passage facilitates (Fisheries Engineers 2018) providing a more reliable bypass flow.

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

The District would sponsor the project. Funding for the project will also need to be secured.

Sources of Information

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Appendix J – Water Rights Assessment Technical Memo

Technical Memorandum

To: Department of Ecology WRIA 15 Watershed Restoration and Enhancement Committee

From: Burt Clothier, LHG

Joe Morrice, LHG

Re: Water Right Screening Methodology

Date: December 21, 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 Water Resources Inventory Area (WRIA) 15, Kitsap. This work was completed by Pacific Groundwater Group (PGG) on behalf of the WRIA 15 Watershed Restoration and Enhancement (WRE) Committee (the 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 and offset 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 15, PGG assisted the Committee in selecting a focused set of water rights for further review to assess potential benefits and 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 15. 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 excluded.

The GIS data included the mapped place of use and point(s) of diversion or withdrawal locations, where available. Where Ecology does not have detailed location information for points of diversion or withdrawal, or such has not yet been added to their dataset, the default location is typically the nearest quarter or quarter-quarter section, based on the water right file information.

The Committee's desire was to identify classes or groups of water rights that could potentially be converted, purchased, or retired as mitigation water. The hope being that rights in key sub-basins could be found that, if applicable and available, could be use to off-set the projected impacts of future permit exempt wells and/or provide an environmental benefit to local surface water bodies. Such mitigation projects require the combination of available water (legally and physically), willing seller and buyers, and methods to apply the water to the proposed mitigation purpose. This ranges from simply retiring the right back to the State where no further action is assumed and the water simply ceases to be used for its prior purpose up to more complex efforts where a right is changed to a new use or a new location (or both) and directly applied to the mitigation project (e.g. streamflow augmentation or groundwater recharge).

The tables of active water rights included over 8,500 water right files within WRIA 15. Following consultation with the Committee, PGG limited the water rights under consideration to certificates and permits[52] that included commercial and Industrial (CI), stockwater (S), or irrigation (IR) uses. Municipal and domestic (or multiple domestic) categories were excluded based on the expectation that these rights would not be available for conversion into sources of mitigation water. Irrigation rights were also classified based on the reported irrigated acreage.

The list of active water right permits and certificates was further reduced by removing any with a priority date later than the July 24, 1981 adoption date of Chapter 173-515 WAC, the instream flow rule for WRIA 15.

The list of active permits and certificates with CI, IR, and/or ST uses was reduced again based on authorized instantaneous (Qi) and annual (Qa) quantities. Water rights with both a Qi of less than 0.1 cfs (45 gpm) and a Qa of less than 10 acre-feet per year were excluded from further consideration. This was an arbitrary cut-off intended to focus on high-value possibilities over smaller ones and provide for more manageably sized lists.

The resulting data was subdivided by the priority subbasins identified by the Committee. The result was a suggested list for each subbasin of between six and 31 water rights. From these, a set of 13 rights were selected as example potential projects. Each of the rights were further researched and described in one- to two-page summaries for Committee review.

The Committee was tasked with review of both the subbasin lists and the 13 suggested water rights. Several committee members and Ecology staff provided comments during review and nine of the selected summaries were eliminated from further consideration. The remaining four were refined for use in the draft report planning. Follow-on conversations with Kitsap Conservation District (KCD) were also held to discuss the possibility that KCD may take on the future project of further organizing and utilizing the water rights lists to find and negotiate purchase or transfer of water rights as mitigation off-sets.

[52] This includes certificates, certificates of change, permits, and superseding permits.

Appendix K – Proposed Improvements to the Department of Ecology's Well Reporting Processes

The "Upgrade Well Reporting" Proposal

Developed by the Squaxin Island Tribe in consultation with Ecology's Well Construction and Licensing Office

Contributors: Ecology - Joe Witczak, Scott Malone, and Tara Roberts
Squaxin Island Tribe - Erica Marbet

Final Draft May 28, 2020

Purpose:
Accurate well data is critical for all parties to make water management decisions that are protective of the environment and beneficial to communities. The quality of well data in Washington State can be improved with changes to how the State collects information from drillers. These improvements are essential for monitoring and management of shared water resources in the State of Washington.

Background:
In 2018, at the request of the Squaxin Island Tribe, Ecology assigned staff to assess the accuracy of water well location reporting in Mason County. The project checked 187 water well reports (2.1% of the 8,910 water well reports from the county). Ecology uses the Public Land Survey system (PLS) to record well locations by township, range, section, quarter and quarter-quarter. Currently wells are mapped by 40-acre quarter-quarter centroids on the State Well Report Viewer. The results showed that 79% of well locations could be verified with the information on the report. Of those that could be verified, 33% had incorrectly reported PLS locations. Ecology performed a similar, statewide assessment of well location data and found a 24% error rate for all types of regulated wells.

As Tribes utilize Ecology's well report database frequently, tribal staff would benefit by improving well location data management and processes. In discussions between Ecology, Squaxin, and Mason County, all agreed that improvements to Ecology's well reporting processes could help reduce the error in water well location reporting.

Ecology is eager to expand their web-based well reporting options. In 2019, Ecology surveyed well drillers to determine their preferences regarding format and features. Of 133 respondents, 63% placed a high importance on a new well location mapping tool that would use recent aerial imagery to determine a well's PLS location and coordinates. Only 6% responded that this effort would be of low importance. These results showed drillers preferred to submit well reports from a web form in the current well report format.

We propose the following changes to Ecology's well data processes:

1. **New well location mapping tool for drillers**
   An interactive web-based mapping tool that provides an intuitive means of determining PLS location has been implemented in Oregon recently. Ecology is interested in developing their own web tool which provides the PLS and coordinates location (latitude/longitude) for a new well automatically. The Notice of Intent web form would shell into a new GIS application utilizing recent aerial imagery, a parcel overlay, and a tool that updates the quarter-quarter and coordinates on the NOI. The well driller need only click on the interactive map to generate a well location. When a driller finishes a well report, they can utilize the same tool to refine their coordinates and PLS location.

2. **Require coordinates on well reports**
   Coordinates can perfectly describe a well location within a parcel. Adding latitude and longitude on well reports will serve to verify a well's location on the ground accurately and easily. Ecology intends to require well coordinates on reports, though a WAC change may eventually be needed.

3. **New web-based well reporting application**

- Ecology is determining the best approach for implementing a new web-based well reporting application. According to a recent survey of drillers and their support staff, a web-form mimicking the current well report forms that uploads directly to Ecology's database is desired. The benefits of using a web-based well reporting process are numerous:
-
    - Less backlog of scanning and data entry - more time for Ecology staff to vet well reports
    - Legible text, fewer written responses
    - Digitizing all well report data, not just the fields that were captured by Ecology staff during the scanning process
    - A smart form format can eliminate out-of-range entries
    -
- By capturing digitized well location data, it would be feasible in the future to automate the process of verifying well locations and water right information. Tracking well location and permit-exempt wells is a need of users who download geospatial datasets from Ecology's GIS data page (https://ecology.wa.gov/Research-Data/Data-resources/Geographic-Information-Systems-GIS/Data)

The Well Construction and Licensing Office at Ecology needs more capacity to vet well reports. Automation from web-based reporting would free up staff to do more vetting, because the office's staff would not have to do as much scanning of paper documents and manual entry of data fields for each report. They need more automation, not FTEs.

Please share this proposal with your RCW 90.94 watershed planning committees ask members to support it. This would include adding it as a proposed action in a watershed plan.

Please contact Mary Verner, Manager of Ecology's Water Resources Program and Tyson Oreiro, Ecology's Tribal Liaison to express your support for the "Upgrade Well Reporting" proposal.

See next two pages for figures.

https://appswr.ecology.wa.gov/wellconstruction/Wells/NoticeOfIntentForm.aspx?form=noiwaterwellform

DEPARTMENT OF ECOLOGY State of Washington

About us

Laws, Regs and Rules | Notice of Intent Forms | Contact Us

Well Construction and Licensing Search Tools

Step 1 of 3: Enter Information

An asterisk (*) designates the field as required.

Notice of Intent Form to Construct a Water Well

Property Owner Contact Information

*An organization name or the first and last property owner name is required.

Organization Name* [ ] (e.g. Daisy Farms LLC)

OR

Last Name* [ ]

First Name* [ ]

Email Address* [ ]

Confirm Email Address* [ ]

Mailing Address* [ ]

City* [ ]

State* [▼]

Zip* [ ]

Phone ([ ]) [ ]

International customers cannot submit online. Contact us for assistance.

Consulting Firm Contact Information

Firm Name [ ]

Well Location

Township* [▼] Latitude [ ]

Range* [▼] Longitude [ ]

Section* [▼]

* Quarter-Quarter Section:

NW	NE	NW	NE
SW	SE	SW	SE
NW	NE	NW	NE
SW	SE	SW	SE

Well Street Address [ ]

Well City [ ]

Well Zip Code [ ]

Tax Parcel Number [ ]

County* [▼]

Add interactive map to automatically identify township, range, section, latitude, and

Make Optional

Make Mandatory

https://fortress.wa.gov/ecy/publications/documents/ecy050120.pdf

WATER WELL REPORT — DEPARTMENT OF ECOLOGY, State of Washington

Type of Work:
☐ Construction
☐ Decommission ⟹ Original installation NOI No. ______

Proposed Use: ☐ Domestic ☐ Industrial ☐ Municipal ☐ Dewatering ☐ Irrigation ☐ Test Well ☐ Other ______

Construction Type: ☐ New well ☐ Alteration ☐ Deepening ☐ Other ______
Method: ☐ Driven ☐ Jetted ☐ Cable Tool ☐ Dug ☐ Air- ☐ Mud-Rotary

Dimensions: Diameter of boring ______ in., to ______ ft.
Depth of completed well ______ ft.

Construction Details:

Casing	Liner	Diameter	From	To	Wall Thickness	Steel	PVC	Welded	Thread
☐	☐	____ in.	____	____	____ in.	☐	☐	☐	☐
☐	☐	____ in.	____	____	____ in.	☐	☐	☐	☐
☐	☐	____ in.	____	____	____ in.	☐	☐	☐	☐
☐	☐	____ in.	____	____	____ in.	☐	☐	☐	☐

Perforations: ☐ Yes ☐ No Type of perforator used ______
No. of perforations ______ Size of perforations ______ in. by ______ in.
Perforated from ______ ft. to ______ ft. below ground surface

Screens: ☐ Yes ☐ No ☐ K-Packer ⟹ Depth ______ ft.
Manufacturer's Name ______
Type ______ Model No. ______
Diameter ______ in. Slot size ______ in. from ______ ft. to ______ ft.
Diameter ______ in. Slot size ______ in. from ______ ft. to ______ ft.

Sand/Filter pack: ☐ Yes ☐ No Size of pack material ______ in.

Notice of Intent No. ______
Unique Ecology Well ID Tag No. ______
Site Well Name (if more than one well) ______
Water Right Permit/Certificate No. ______
Property Owner Name ______
Well Street Address ______
City ______ County ______
Tax Parcel No. ______
Was a variance approved for this well? ☐ Yes ☐ No
If yes, what was the variance for? ______

Location (see instructions on page 2): ☐ WWM or ☐ EWM
______ ¼-¼ of the ______ ¼; Section ______ Township ______ Range ______
Latitude (Example: 47.12345) ______
Longitude (Example: -120.12345) ______

Make Mandatory

Driller's Log/Construction or Decommission Procedure
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information. Use additional sheets if necessary.

Material	From	To

Add interactive map to automatically identify township, range, section, latitude, and

Change this water well report into a web form.