Watershed Restoration and Enhancement Plan

WRIA 13
Deschutes Watershed

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Acknowledgements

Ecology based much of this plan on work conducted through numerous committee and workgroup meetings of the WRIA 13 Watershed Restoration and Enhancement Committee. While the committee was unable to approve their version of the plan, the committee's contributions were instrumental to the development of the plan. Much of the underlying technical work was completed by a team of technical consultants, include HDR (Chad Wiseman and team), Anchor QEA (Bob Montgomery and team) and GeoEngineers (Bridget August and team). Our facilitation team was also instrumental to advancing the input and decisions by the committee, primarily Gretchen Muller (Environmental Science Associates [ESA]) and Jimmy Kralj (ESA). Thank you to the Washington State Conservation Office and the Salmon Recovery Funding Board for providing a technical review of the final draft watershed plan prior to adoption.

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 directs the Department of Ecology to develop a Watershed Restoration and Enhancement Plan in Water Resource Inventory Area (WRIA) 13 that identifies projects to offset potential consumptive impacts of new permit-exempt domestic groundwater withdrawals on instream flows over 20 years (2018 – 2038), and provides a net ecological benefit to the watershed.

Following the provisions of the law, the Department of Ecology (Ecology) collaborated with a committee composed of tribes, counties, cities, state agencies, and special interest groups in WRIA 13 (the Deschutes watershed) to prepare a committee draft plan. The law requires all members of the committee to approve the watershed plan prior to Ecology considering plan adoption. However, the WRIA 13 committee draft plan was not approved by all members of the committee ahead of the legislative deadline. The Streamflow Restoration law recognizes that some committees may not complete their plan preparation process. It establishes an alternative pathway for plan preparation, adoption, and rulemaking.

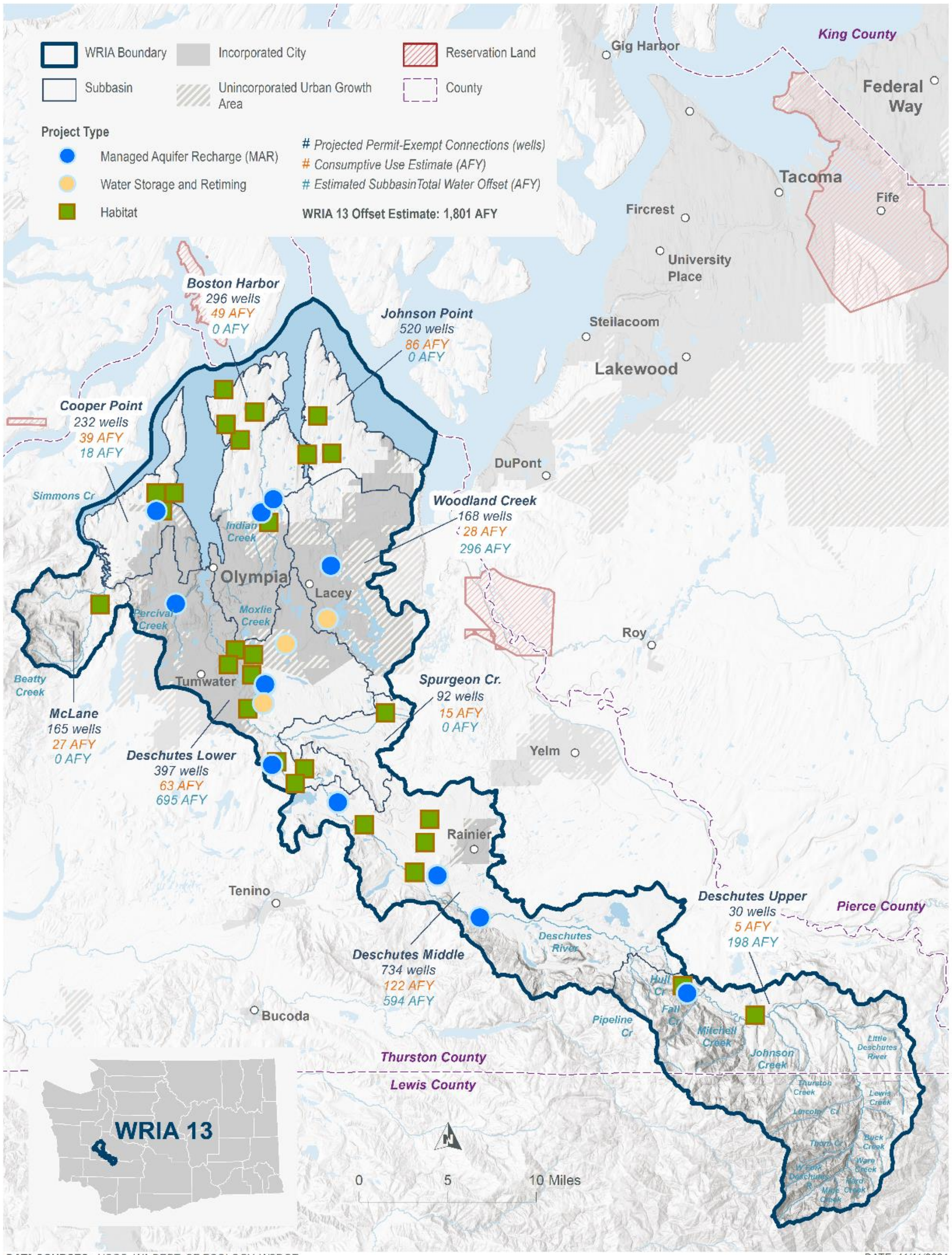
Therefore, as directed by the law, Ecology completed this watershed plan without additional committee input. As Ecology developed the final watershed plan, Ecology followed the law, the Streamflow Restoration Policy and Interpretive Statement (POL-2094)(Ecology 2019a) and Ecology's Final Guidance on Determining Net Ecological Benefit (GUID-2094) (Ecology 2019). Ecology also considered all available information, including draft materials developed by the committee. The Salmon Recovery Funding Board reviewed this plan and submitted recommendations, which Ecology considered, and incorporated as appropriate, prior to finalizing the watershed plan.

This watershed plan estimates 2,616 new permit-exempt domestic well connections (PE wells) over the planning horizon (2018-2038). The estimated consumptive water use associated with the new PE well connections is 434 acre-feet per year (AFY) (0.6 cubic feet per second [cfs] or 414,232 gallons per day [gpd]) in WRIA 13. The projects and actions in this watershed plan will address and offset the consumptive water use from those 2,616 PE wells.

This watershed plan includes projects and project types that provide an anticipated offset of 1,801 AFY to benefit streamflows and enhance the watershed. Additional projects in the plan provide benefits to fish and wildlife habitat, such several thousand feet of streambed improvements, dozens of acres of restoration and protection, and many miles of riparian restoration across WRIA 13.

As required by the law and to allow for meaningful analysis of the relationship between new consumptive water use and offsets, this watershed plan divides the watershed into nine subbasins. Subbasins help describe the location and timing of estimated new consumptive water use, the location and timing of impacts to instream resources, and the necessary scope, scale, and anticipated benefits of projects. Figure ES-1 provides consumptive use estimates by subbasin and project locations for WRIA 13.

Based on the information and analyses summarized in this watershed plan, Ecology finds that this watershed plan, if implemented, would achieve a net ecological benefit, as required by RCW 90.94.030 and defined by the Final NEB Guidance (Ecology 2019). Ecology and the state of Washington are invested in the implementation of this watershed plan, including periodically assessing plan and project implementation and issuing competitive grants to local projects that demonstrably implement this watershed plan while benefiting streamflows and aquatic habitat.



DATA SOURCES: USGS, WA DEPT. OF ECOLOGY, WSDOT

DATE: 11/11/2021

Figure ES 1: Summary of findings of the WRIA 13 Watershed Restoration and Enhancement Plan, including estimates for new domestic permit exempt well growth, consumptive use estimates, and project offset benefits. Map prepared by GeoEngineers.

Chapter One: Plan Overview

1.1 Plan Purpose and Background

The purpose of this Water Resource Inventory Area (WRIA) 13 Watershed Restoration and Enhancement Plan (watershed plan) is to identify the projects and actions necessary to "offset potential impacts to instream flows associated with permit-exempt domestic water use"[2] and "result in a net ecological benefit (NEB) to instream resources within the [WRIA]."[3] This plan achieves these purposes consistent with the requirements of RCW 90.94.030, the Streamflow Restoration Policy and Interpretive Statement (POL 2094)(Ecology 2019 a) and Ecology's Final Guidance on Determining Net Ecological Benefit (referred to as the Final NEB Guidance throughout this plan) (Ecology 2019). This plan considered all available information including priorities for salmon recovery and watershed recovery and the draft materials prepared by the WRIA 13 Watershed Restoration and Enhancement Committee (Committee). In order to accomplish its purpose, all eight of the watershed plans required by RCW 90.94.030, including this one, estimated the potential consumptive impacts of new domestic permit-exempt wells (referred to as PE wells throughout this plan) on instream flows over the planning horizon (January 2018 to January 2038) and identified the projects and actions necessary to offset those impacts and result in a NEB within the WRIA.

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"). The law, now primarily codified as RCW 90.94, clarifies how local governments can issue building permits for homes intending to use a PE well for their domestic water supply. Additionally, the law required the preparation of new local watershed plans for eight specified WRIAs, including this one.

To support local planning, the law required Ecology to establish a committee. The law tasked the committee with preparing a watershed plan approved by every member of the committee. Once the committee approved the draft watershed plan, the law required Ecology to review it and, presuming it met the requirements, adopt it no later than June 30, 2021. Despite working diligently over two and a half years, the WRIA 13 Committee did not submit an approved plan to Ecology for review before the mandated deadline.[4] Consequently, and as required by RCW 90.94.030 (3)(h), Ecology finalized this watershed plan and considered technical review and recommendations under an Inter-Agency Agreement with the Salmon Recovery Funding Board. Within six months of adopting this plan, Ecology will initiate the rulemaking required by this law. Ecology's rulemaking activities are a public process guided by the Washington Administrative Procedure Act (APA), ch. 34.05 RCW. Rulemaking will occur consistent with the

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[2] RCW 90.94.030 (3)(b)

[3] RCW 90.940.030 (3)(c)

[4] Please see Section 1.1.3 of this watershed plan for more background on the WRIA 13 Committee and their planning process.

requirements of the streamflow restoration law (RCW 90.94.030) and will be completed within two years of initiation of this rule making. [5]

1.1.1 Permit-Exempt Domestic Wells

As noted above, this watershed plan, the law that calls for it, and the Hirst decision are all concerned with the impacts of new PE well use on streamflows. Pumping water from PE wells can reduce groundwater discharge to springs and streams, reducing streamflows (Barlow and Leake 2021). Several laws pertain to the management of PE wells in WRIA 13. This plan summarizes those laws below to provide context for this WRIA 13 watershed plan.

First and foremost, 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 PE wells in WRIA 13 and elsewhere. For example, local governments must, among other responsibilities relating to new PE 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 wells in WRIA 13 to a maximum annual average of up to 950 gallons per days per connection, subject to the five thousand gallons per day and ½-acre outdoor irrigation of non-commercial lawn/garden limits established in RCW 90.44.050. Ecology, through working with the planning committee and finalizing this plan, has determined that these statutorily established fee amounts and water use restrictions are appropriate and will be considered in the rulemaking required in RCW 90.94.030(3h).

Ecology published its interpretation and implementation of RCW 19.27.097 and RCW 90.94 in Water Resources POL 2094 (Ecology 2019a), which provide comprehensive details and agency interpretations.

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[5] RCW 90.94.030 (3) (h)

1.2 Watershed Restoration and Enhancement Committee Planning under RCW 90.94.030

As discussed above, RCW 90.94.030 directed Ecology to establish the WRIA 13 Committee, invite the Committee participants, and chair the Committee.[6] As directed in RCW 90.94.030(3)(b) Ecology collaborated with the WRIA 13 Committee to prepare the watershed plan. In practice, the process of this collaboration and plan development was one of broad integration, collectively shared work, and a striving for consensus.

Ecology convened the WRIA 13 Committee in October 2018, and Ecology served as the Chair. The roster of Committee members is available in Table 1 and additional members of workgroups are available in Appendix C. Over the course of the following two and a half years and with the support of the Committee's consulting team, [7] the WRIA 13 Committee held formal monthly Committee meetings as well as periodic workgroup meetings. Ecology distributed the WRIA 13 Committee's draft watershed plan in January, 2021 for Committee member review and official approval from the entities they represented. The WRIA 13 Committee voted on the draft watershed plan in April, 2021. This vote yielded 11 entities voting to approve, and 1 entity voting to disapprove. The final WRIA 13 Committee meeting summary, along with the voting record, is available in Appendix C. Because the law required that all Committee members approve the watershed plan, the Committee did not approve their draft watershed plan.[8] Therefore, the watershed plan was not available for Ecology's review, and the June 30, 2021 statutory deadline for adoption was not met. Consequently, Ecology then implemented its mandate under RCW 90.94.030(3)(h) by finalizing this watershed plan. Ecology prepared the final plan based on all available information including priorities for salmon recovery and watershed recovery, draft materials developed by the WRIA 13 Watershed Committee, and recommendations from the Salmon Recovery Funding Board.

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[6] RCW 90.94.030 (2)(b) and (3)

[7] Facilitation support was provided by ESA (Gretchen Muller and Jimmy Kralj). Technical consulting support was provided by HDR (Chad Wiseman). Funding for these consulting services was provided by Ecology through Legislative appropriations that accompanied the passage of RCW 90.94.

[8] "…all members of a Watershed Restoration and Enhancement Committee must approve the plan prior to adoption" – RCW 90.94.030(3)

Table 1. WRIA 13 Committee Roster. See Appendix C for workgroup membership.

Primary Representative	Alternate(s)	Entity Name
Jeff Dickison	Paul Pickett	Squaxin Island Tribe*
Lee Napier	John Kliem	Lewis County*
Joshua Cummings	Kaitlynn Nelson, Brad Murphy	Thurston County*
Deputy Mayor Cynthia Pratt	Julie Rector	City of Lacey*
Donna Buxton	Jesse Barham	City of Olympia*
Councilmember Charlie	Dan Smith	City of Tumwater*
John Weidenfeller	Ruth Clemens, Julie Parker	Public Utility District No. 1 of Thurston County*
Noll Steinweg	Tristan Weiss, Megan Kernan	Washington Department of Fish and Wildlife*
Angela Johnson	Mike Noone, Rebecca Brown	Washington Department of Ecology*
Sarah Moorehead	Adam Peterson, Karin Strelioff	Thurston Conservation District*
Josie Cummings		Building Industry Association of Washington (previous participation from Olympia Master Builders)*
Sue Patnude	Dave Monthie, Dave Peeler	Deschutes Estuary Restoration Team*
Amy Hatch-Winecka		WRIA 13 Salmon Habitat Recovery Lead Entity (ex officio)
Wendy Steffensen		LOTT Clean Water Alliance (ex officio)
George Walter		Nisqually Indian Tribe (ex officio)
Grant Beck	Michael Grayum, Chad Bedlington	City of Yelm (ex officio)
John Millard		City of Tenino (ex officio)

*Ecology was required to invite entity to participate in committee under RCW 90.94.030(2)(a).

1.3 Plan Requirements and Overview

The law, Ecology's interpretation of the law, and the NEB Guidance set the structure of the watershed plan by describing the required elements. At a minimum, the watershed plan must include projects and actions necessary to offset potential impacts of new PE wells on streamflows and provide a NEB to the WRIA. The legislation requires the watershed plan to include the following elements:

- Recommendations for projects and actions that will measure and enhance instream resources and improve watershed functions that support the recovery of threatened and endangered salmonids (RCW 90.94.030(3)(a)).
- Actions determined necessary to offset potential impacts to instream flows associated with permit-exempt domestic water use (RCW 90.94.030(3)(b)).
- A cost evaluation or estimation of those actions (RCW 90.94.030(3)(d)).
- An estimate of the cumulative consumptive use impacts over the twenty-year period (2018-2038) (RCW 90.94.030(3)(e)).

This watershed plan includes six chapters:

- Plan overview.
- Overview of the watershed.
- Summary of the subbasins.
- Growth projections and consumptive use estimates.
- Description of the recommended projects and actions identified to offset the future permit-exempt domestic water use in WRIA 13.
- Evaluation and consideration of NEB.

Chapter Two: Watershed Overview

2.1 Brief Introduction to WRIA 13

Water Resource Inventory Areas (WRIAs) are large watershed areas established in chapter 173-500 WAC for the purpose of administrative management and planning. WRIAs encompass multiple landscapes, hydrogeological regimes, levels of development, and variable natural resources. WRIA 13, also referred to as the Deschutes Watershed, is one of the 62 designated major watersheds in Washington State.

The 270 square mile Deschutes Watershed is almost entirely within Thurston County, with only some of the headwaters of the Deschutes River in Lewis County (see Figure 1). The Deschutes River is the major hydrologic basin in WRIA 13, with a number of smaller independent tributaries that drain into four saltwater inlets: Nisqually Reach, Henderson, Budd, and Eld. Other principal streams include Woodard and Woodland Creeks, which are the largest of the major tributaries to Henderson Inlet (Haring et al. 1999). The Black Lake catchment drains to both the Black River (WRIA 23) and Percival Creek (WRIA 13);however, for planning purposes, the Black Lake catchment was included in the Chehalis (WRIAs 22 and 23) Watershed Plan Update and not the WRIA 13 watershed plan.

2.1.1 Land Use in WRIA 13

Approximately 26 percent of the watershed is within a city or designated urban growth area. Much of the designated Urban Growth Areas for Olympia, Lacey, Tumwater and Rainier, along with agriculture, rural residential areas and commercial timberlands are within WRIA 13.

Rural residential development has primarily occurred in the unincorporated areas of Thurston County. The portion of the Deschutes Watershed that is in Lewis County is entirely comprised of forest land and is assumed to have no rural growth (Figure 1).

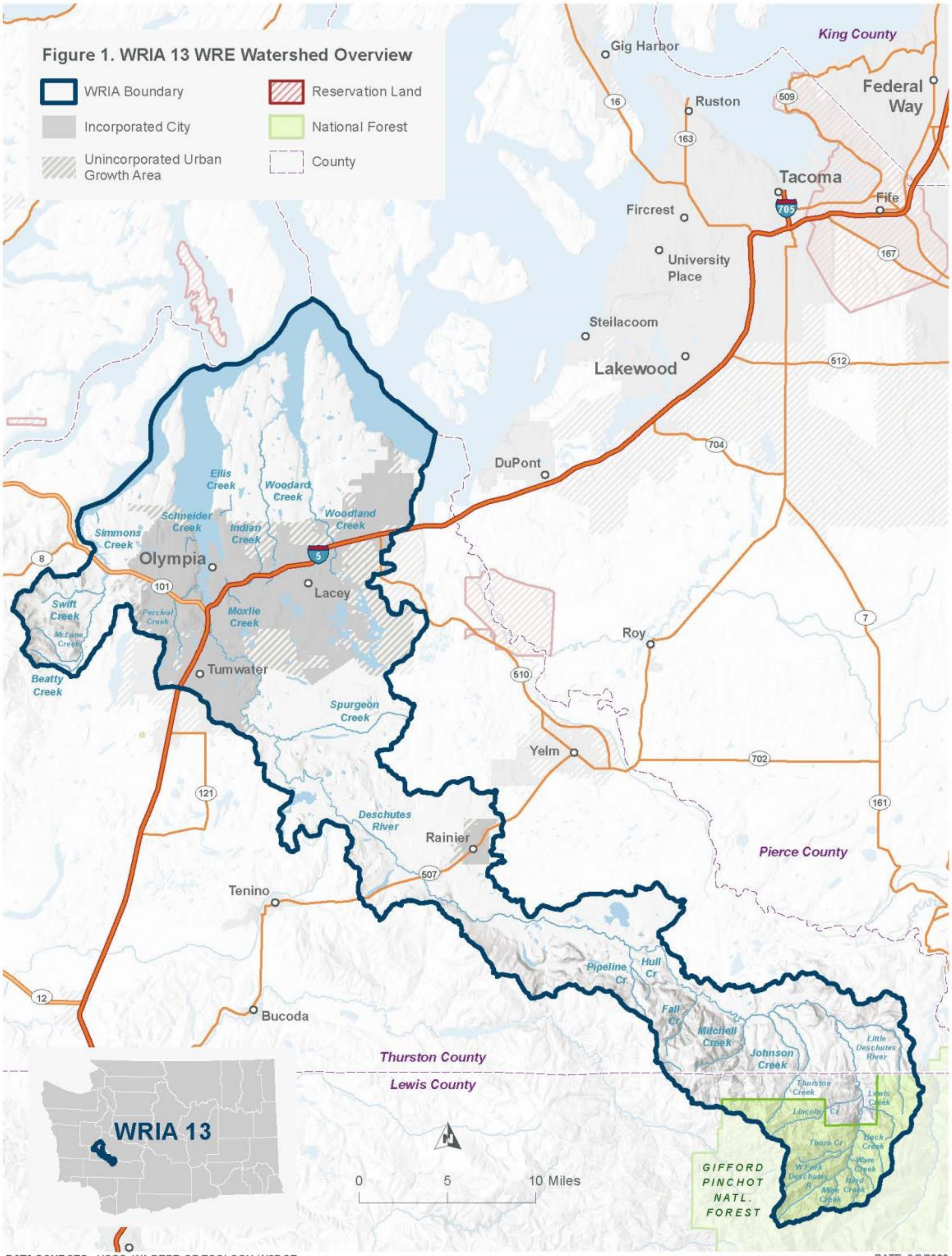

Figure 1: WRIA 13 WRE Watershed Overview. Map prepared by HDR.

The upper third portion of the Deschutes Watershed is predominantly commercial timber production with some commercial and non-commercial agricultural ventures overlapping in the lower extent. The middle third of the watershed is comprised of commercial and non-commercial agriculture production with rural residences found throughout the mid-watershed and the outer peninsulas. Land use in the lower watershed, near the mouth of the Deschutes River and inner Budd Inlet is mostly urban, with residences along the shoreline of the three inlets (Haring et al. 1999).

2.1.2 Tribal Reservations and Usual and Accustomed Fishing Areas

The Squaxin Island Tribe holds reserved fishing rights in the Deschutes watershed under the 1854 Treaty of Medicine Creek. Under this Treaty, the Tribe claims Treaty-reserved water rights in WRIA 13 under federal law that are necessary to support healthy salmon populations; to support and maintain hunting, fishing and cultural resource harvesting rights; and to meet all homeland purposes reserved by the Treaties. These rights have not been confirmed and quantified through an adjudication in federal or state court. 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 13 have yet to be adjudicated, any Treaty-reserved water rights are senior to all other rights and have not been fully accounted for by the State of Washington in the way in which the State determines water availability and over appropriation, and adopts instream flow rules.

2.1.3 Salmon Distribution and Limiting Factors

The Deschutes Watershed is an important and productive system for endangered and threatened salmonids. Anadromous salmonid spawning occurs from Tumwater Falls to Deschutes Falls. The Deschutes River and its tributaries often experience low streamflows during critical migration and spawning time. In addition, culverts, dams, and other flood control measures have limited habitat along the streams in WRIA 13 (Haring et al. 1999). With changing weather patterns, summer flows are expected to change, causing an additional disruption to the salmon as they migrate, spawn and rear (NWIFC, 2016).

The Deschutes Watershed is one of diverse land uses. Industry, agriculture (including salmon fisheries), commercial facilities, and municipalities compete for a limited water supply, causing a strain on water availability, especially during low seasonal flows in productive salmonid streams. Many people depend on the salmon fishery for commercial, sport, and subsistence harvest. This includes tribes with usual and accustomed fishing areas that overlap with the Deschutes watershed, such as the Squaxin Island Tribe.

The Deschutes WRIA watersheds primarily support Chinook Salmon, Coho Salmon, Chum Salmon, and winter steelhead (Tables 2 and 3). Chinook Salmon, Coho Salmon, and winter steelhead are all listed as threatened.

Table 2. Anadromous Salmonid Species and Status in WRIA 13

Common Name	Scientific Name	Population	Critical Habitat	Regulatory Agency Status
Chinook Salmon	Oncorhynchus tshawytscha	Puget Sound Chinook	Yes/2005	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
Winter Steelhead	*Oncoryhnchus mykiss*	Puget Sound Steelhead	Yes/2016	NMFS/Threatened/ 2007

Chinook Salmon enter WRIA 13 streams in the late summer and fall and spawn through the fall (Table 3). Incubation occurs through the following winter. Juvenile rearing occurs throughout the spring and early summer, with smolt outmigration occurring shortly thereafter.

Coho Salmon enter WRIA 13 streams in the fall and spawn through the winter and fall (Table 3). Incubation occurs through the following April. Juvenile rearing occurs for over a year before smolt outmigration the following spring.

Chum Salmon enter WRIA 13 streams in the late fall to early spring (Table 3). Incubation occurs through the late winter. Juvenile rearing and smolt outmigration occurs from that spring to early summer.

Winter steelhead enter WRIA 13 streams in the late fall through the following spring and spawn in the spring (Table 3). Incubation occurs through the following summer. Juvenile rearing occurs for over a year before smolt outmigration the following spring.

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

Table 3. Salmonid Presence and Life History Timing in the WRIA 13 Streams and Rivers

Salmonid Life History Timing in WRIA 13																										Subbasin Presence
Species	Freshwater Life Phase	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		
Chinook (fall)	Upstream migration												■	■	■	■	■	■	■	■	■					Woodland Deschutes Lower Deschutes Middle Deschutes Upper McLane Creek
	Spawning																	■	■	■	■	■				
	Incubation	■	■	■															■	■	■	■	■	■	■	
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	■	■											
	Juvenile outmigration				■	■	■	■	■	■	■	■	■	■	■	■	■									
Coho	Upstream migration															■	■	■	■	■	■	■				All
	Spawning	■	■																■	■	■	■	■	■	■	
	Incubation	■	■	■	■	■	■	■	■												■	■	■	■	■	
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
	Smolt outmigration					■	■	■	■	■	■	■	■	■	■											
Chum	Upstream migration																						■	■	■	Woodland Deschutes Lower McLane Creek Johnson Point Boston Harbor Cooper Point
	Spawning	■	■																				■	■	■	
	Incubation	■	■	■	■	■	■	■	■														■	■	■	
	Juvenile rearing				■	■	■	■	■	■	■	■	■	■												
	Juvenile outmigration				■	■	■	■	■	■	■	■	■	■												
Steelhead Trout (winter)	Upstream migration	■	■	■	■	■	■	■	■	■	■											■	■	■	■	Woodland Deschutes Lower Deschutes Middle Deschutes Upper McLane Creek Boston Harbor Cooper Point
	Spawning					■	■	■	■	■	■	■														
	Incubation					■	■	■	■	■	■	■	■	■	■	■										
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
	Smolt outmigration							■	■	■	■	■	■	■	■											

Salmonid habitat limiting factors have been defined by the Washington State Conservation Commission Limiting Factors Analysis (Haring and Konovsky 1999) and the Deschutes River Coho Salmon Biological Recovery Plan (Confluence 2015). Haring and Konovsky (1999) identified specific limiting factors for specific waterbodies, but also provide the following general themes throughout WRIA 13 streams and rivers on a multi-species basis:

- natural stream ecological processes have been significantly altered due to adjacent land management practices and direct actions within the stream corridor,
- fine sediment (<.85 mm) levels in the stream gravels regularly exceed the <12% level identified as representing suitable spawning habitat,

- lack of adequate large woody debris in streams, particularly larger key pieces that are critical to developing pools, log jams, and other habitat components important to salmonids,
- lack of adequate pool frequency and large, deep pools that are important to rearing juvenile salmonids and adult salmonids on their upstream migration,
- naturally high rates of channel movement in this geologically young basin, and high rates of streambank erosion and substrate instability due to loss of streambank and riparian integrity, and alteration of natural hydrology,
- loss of riparian function due to removal/alteration of natural riparian vegetation, which affects water quality, lateral erosion, streambank stability, instream habitat conditions, etc.,
- the presence of a significant number of culverts/screens/dams/etc. that preclude unrestricted upstream or downstream access to juvenile and adult salmonids,
- significant alterations to the natural stream hydrology in streams where the uplands have been heavily developed, and the threat of similar impacts to streams that are experiencing current and future development growth, and
- estuarine/marine function is significantly impacted by physical alteration of the natural estuary, by poor water quality in the estuary, and by significant alteration of nearshore ecological function due to shoreline armoring.

2.1.4 Water System Distribution and Impacts in WRIA 13

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. Group A and Group B water systems withdraw greater amounts of water and have more impact than PE wells. Group A systems require water rights and are regulated by the Department of Health. Group B systems often have permit-exempt wells and are regulated by counties. Within WRIA 13, there are approximately 151 Group A water systems, approximately 205 Group B water systems, and approximately 16,560 PE wells.[9] Consumptive water use (that 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 (Ecology 1995).

2.2 Watershed Planning in WRIA 13

Citizens and local, state, federal, and tribal governments have collaborated on watershed and water resource management issues in WRIA 13 for decades. An earlier Deschutes Planning Unit

[9] Estimates at the time of development of the watershed plan based on Ecology’s well log database.

completed a draft watershed plan in October 2004, but were unable to reach consensus on the document. A brief summary of broad watershed planning efforts as they relate to the past, present, and future water availability in the Deschutes Watershed is provided in this section.

This WRIA 13 watershed plan is building on many of the past and current efforts, including previous watershed planning efforts under RCW 90.82. Other efforts include the Local Integrating Organization (LIO) Alliance for a Healthy South Sound (AHSS)[10] ecological recovery plan,[11] and salmon recovery planning by the WRIA 13 Salmon Habitat Recovery Lead Entity. 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] The planning process to develop an ecosystem recovery plan is community-based with engagement by local, state and federal agencies. The AHSS has engaged the community in a collaborative planning process to help understand priorities and support the health and sustainability of the watershed.

The WRIA 13 Salmon Habitat Recovery Lead Entity is a collaboration of local governments, state, federal, and tribal partners, and nonprofit organizations focused on protecting and enhancing wild salmon populations. The Salmon Habitat Protection and Restoration Plan for WRIA 13 identifies and prioritizes projects that protect and restore habitat for salmonids that occur in the marine and freshwater environments of WRIA 13.

The Squaxin Island Tribe has been leading restoration planning for Coho Salmon in the Deschutes River (NWIFC, 2016). Restoration planning included modeling Coho Salmon habitat requirements, evaluation of existing habitat conditions, defining salmon habitat limiting factors, and recommendations for habitat restoration.

The Public Water System Coordination Act of 1977[13] requires each water purveyor in a Critical Water Supply Service Areas (CWSSA) to update a water system plan for their service area, with the boundaries being in compliance with the provision of the Act. The Washington State Department of Health is primarily responsible for water system plan approval; however, local governments ensure consistency with local growth management plans and development policies. This Act and the water system plans are important for the WRIA 13 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 permit-exempt domestic wells.[14]

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[10] More information on the AHSS can be found here: https://www.healthysouthsound.org/

[11] The AHSS boundaries include WRIA 13, except a small area in Lewis County which is not within a Local Integrating Organization.

[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] RCW 70.116.070

[14] Thurston County water system planning information is available at: https://www.thurstoncountywa.gov/planning/Pages/comp-plan.aspx

Thurston County last updated their Coordinated Water System Plan (CWSP) in 1996, as mandated by the Public Water System Coordination Act of 1977. WAC 246-290-100 requires public water systems with more than 1,000 connections submit a water system plan for review and approval by the Department of Health (DOH) every ten years. Within Thurston County, this includes the water systems of Lacey, Tumwater, Olympia, Tanglewilde-Thompson Place, and Pattison.[15] This ensures that water system service areas are consistent with local growth management plans and development policies. Water system service areas and related policies determine whether new homes connect to water systems or rely on new permit-exempt domestic wells. While the CWSP boundary covers the cities in North Thurston County and some surrounding areas, it does not cover most rural areas.

2.2.1 Watershed Characterization and Planning

The Puget Sound Watershed Characterization Project is a tool used in Puget Sound by planners and resource managers to identify areas to prioritize for habitat protection and restoration, and areas more suitable for development. The project covers the entire Puget Sound drainage area — from the Olympic Mountains to the Cascades.[16]

The characterization results can help:

- Achieve a more functional and resilient natural watershed ecosystem.
- Identify and resolve areas of conflict between proposed land use actions and protection of watershed resources.
- Identify the root cause of watershed issues and develop appropriate solutions.

For the purpose of this watershed plan, the characterization tool can help Ecology understand if identified projects are likely to achieve an ecological benefit. A component of the characterization project is a study by WDFW of the relative conservation value of freshwater habitat conducted at the small drainage area Assessment Unit (AU)[17] scale (Wilhere et al. 2013).[18] This freshwater habitat index has three components: the density of hydro-geomorphic features, local salmonid habitats, and the accumulative downstream habitats. Quantity and quality of habitats were assessed for eight salmonid species. The index is the relative value of the freshwater habitat in an Assessment Unit based on an average of:

- The density of wetlands and undeveloped floodplains inside the AU.
- The quantity and quality of salmonid habitats inside the AU.

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[15] North Thurston County Coordinated Water System Plan, 1996, WA State DOH Sentry Database

[16] For more information on the watershed characterization project, visit: [Watershed characterization project - Washington State Department of Ecology]

[17] Assessment units are sub-watershed units from the Salmon and Steelhead Habitat Inventory and Assessment Program. They are based primarily on gradient and confinement and reflect the processes that form and maintain stream segments.

[18] This index is called the "Freshwater Lotic Habitats Assessment" (GIS layer A3ns_avg) in the WDFW study and the "Sum of Freshwater Index Components" on the Puget Sound Watershed Characterization Project web map.

- The quantity and quality of salmonid habitats outside and downstream of the AU.

An analysis of projects in this plan in relation to the freshwater habitat index is presented in Chapter 6.2.4

Thurston County has adopted coordinated water system plans that focus on the Group A water systems. The water system plans determine water system service area boundaries and related laws and policies. These policies stipulate whether new homes connect to water systems or rely on new PE domestic wells.[19]

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 13 counties, comprehensive plans identify Thurston County's 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, county staff helped ensure content of the WRIA 13 watershed plan was coordinated with Thurston County's comprehensive plan.[20]

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 Habitat Recovery Lead Entity and the Puget Sound Partnership, providing briefings on the streamflow restoration law, scope of the watershed plan, and plan development status updates. Ecology conducted outreach to the WRIA 13 Salmon Habitat Recovery Lead Entity to ensure alignment of salmon recovery priorities in this watershed plan.

Development of this watershed plan also involved consideration of the Thurston County Comprehensive Plan, which is guided by the Growth Management Act and the Thurston County County-wide Planning Policies, a framework created in collaboration with the seven cities and towns within Thurston County. The Comprehensive Plan contains goals and policies to govern the unincorporated areas of Thurston County, and in turn, the Plan guides other specialized plans like the Joint plans for Urban Growth Areas, subarea plans, and other functional plans. The Comprehensive Plan also guides Development Regulations, Capital Facilities planning, land use permits, inter-local agreements, and other County programs, all with the main goal of effectively managing the county's physical growth.

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[19] Water system planning information for Thurston County is available: https://www.co.thurston.wa.us/health/ehdw/pdf/SouthCountyCoordinatedWaterSystemPlan.pdf

[20] Comprehensive planning under GMA is available from Thurston County: https://www.thurstoncountywa.gov/planning/Pages/comp-plan.aspx

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 both the Puget Sound Lowlands and the Cascade Mountain Range. Reaching a maximum extent during the Vashon stage of the Fraser Glaciation approximately 13,500 years ago, an ice sheet advanced southward into present day Puget Sound (Drost et al. 1999). Multiple advances and retreats of the ice sheet formed the Puget Sound Lowlands, depositing a complex sequence of glacial and interglacial sediments.

The general geology of WRIA 13 is dominated by a broad drift plain formed from a sequence of unconsolidated glacial and interglacial deposits. These deposits are locally incised by current and former river valleys. The southern terminus of the Pleistocene glacial advance occurs in Thurston County, resulting in thick sediment deposits in the north part of WRIA 13 (over 1,800 feet thick on the Johnson Point peninsula) and progressively thinner sediment deposits to the south and southwest (Drost et al. 1999). WRIA 13 is bounded by the bedrock outcrops of the Bald Hills to the south and the Black Hills west of McLane Creek. Local bedrock knobs (some at land surface and some in the subsurface) also exist, especially in the Tumwater Falls area.

Understanding the geologic setting allows characterization of surface and groundwater flow throughout 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 permit-exempt wells.

2.3.2 Hydrogeologic setting

The USGS described the hydrology of WRIA 13 in a hydrogeologic framework report based on previous studies and published reports for Thurston County (Drost et al. 1999). The hydrogeologic units of the area are described as being either water-bearing ("aquifer") and non-water-bearing ("aquitard" or "confining layer") sediments. Major groundwater aquifers are found in the unconsolidated glacial and interglacial sediments throughout the central and lower regions of the watershed. More recent studies have identified glacial outwash channels that eroded through regional aquitard units, and were then backfilled mostly with sands to form locally distinct aquifer units in the lower Deschutes Valley and along Woodland Creek.[21]

Groundwater in WRIA 13 aquifers generally flow north towards Puget Sound or locally toward the Deschutes River, Woodland Creek, or McLane Creek. Groundwater flow on the northern peninsulas is generally radially outward toward Puget Sound (Drost et al. 1999). Summer base flows in the watershed are sustained by groundwater. Groundwater in the eastern portion of the Deschutes and Woodland Creek watersheds generally move towards the Nisqually flats, in WRIA 11 (See Figure 19 in Drost et al. 1999). Similarly, groundwater in the southestern portion

[21] Walsh and others, 2003; Walsh and Logan, 2005; Golder, 2008; PGG, 2010

of the Deschutes River watershed flows to the Black River, in the Chehalis Basin (See Figure 19 in Drost et al. 1999).

The USGS described the hydrogeology of the watershed as six sedimentary units, typically alternating between aquifer and non-aquifer layers. Four of the six sedimentary units identified are aquifers and are present throughout much of the watershed. This information is summarized in Appendix E: Regional Aquifer Units in WRIA 13, and in Table 1 of Drost et al. (1999). These aquifers are the most likely sources for new permit-exempt wells. The upper two units will also be the main source of direct recharge or baseflow to the surface water system. Aquifer Qc generally does not have surficial expressions except for immediately adjacent to and below sea level in Puget Sound; surficial expressions of TQu only occur below sea level in Puget Sound.

2.3.3 Hydrology and Streamflow

WRIA 13 can be characterized by its three primary drainages, each draining into a separate saltwater inlet: Henderson Inlet to the east, Budd Inlet, and Eld Inlet to the West (Figure 1). The Deschutes River which drains into Budd Inlet is the major freshwater basin in WRIA 13. A portion of WRIA 13 drains to the Nisqually Reach.

Henderson Inlet, located in the northeast section of WRIA 13 drains approximately 30,000 acres from the Boston Harbor Peninsula, Johnson Point Peninsula and the Woodland Creek Basin. Woodland and Woodard Creeks are the largest of the main tributaries to Henderson Inlet, draining 80% of the Henderson Inlet watershed. The other streams in the watershed, Dobbs Creek (East Henderson), Meyer Creek (Inlet), and Sleepy Creek (West Henderson), drain small areas of the Dickerson Point and Johnson Point peninsulas.[22,23] Because most of the basin lies at an elevation of less than 200 feet above sea level, groundwater is the primary source of streamflow during low flow months. Groundwater-fed springs maintain year-round base flow in Woodard Creek and Woodland Creek.[24]

The approximately 120,000 acre Budd Inlet/Deschutes River Basin is comprised of 143 identified streams providing over 256 miles of drainage, approximately 84% of WRIA 13. The Budd Inlet/Deschutes River Basin includes the 52 mile-long Deschutes River along with other notable streams (Percival/Black Lake Ditch, Ellis, Moxlie, Indian, Adams, Mission and Schneider Creeks) within the Budd Inlet drainage system. The Deschutes River drops from its highest point within the watershed of 3,870 feet near Cougar Mountain to the lowest point near sea level at the mouth of Capitol Lake. The Deschutes River has a mean annual flow of 254 cubic feet per second (cfs).[25,26] Late summer flows average around 50 cfs near Rainier (USGS Station 12079000) and 100 cfs at the E-Street Bridge in Tumwater (USGS Station 12080010).

[22] Thurston County Department of Water and Waste Management, 1995
[23] WRIA 13 Planning Committee, 2004
[24] WRIA 13 Draft Bill Watershed Plan, 2004
[25] Measured at USGS stream gage 1207900 near Rainier, WA from 1949 through 2019. The 2019 mean annual flow was 149.3 cfs.
[26] USGS. National Water Information System. Water-Year Summary for Site USGS 1207900.

Deschutes River streamflows are typically lowest during the late summer and early fall, when precipitation is low and infrequent. Flows are sustained by groundwater during this period. Extreme low flows in these streams can occur during years with relatively low precipitation, because of lower water tables and reduced shallow subsurface flows from a paucity of summer precipitation. Extreme low flows can be characterized in terms of the lowest 7-day running average discharge in a river that occurs on average once every 10 years (7Q10 flows). Deschutes River 7Q10 flows are estimated from 1991 - 2001 to be 21 cfs near Rainier (USGS Station 12079000) and 56 cfs at the E-Street Bridge in Tumwater (USGS Station 12080010) (Ecology, 2012). These extreme low flows have decreased over time at both stations, indicating hydrologic impacts. Continuous monitoring streamflow data is available from two active USGS gages on Deschutes River, five active gages on other creeks monitored by Thurston County, and from other historical USGS gages.

The upper extent of the Deschutes River (river mile (RM) 41 to 52) has a moderately steep gradient and the river drops rapidly over Deschutes Falls at RM 41, forming a complete barrier to fish passage.[27] Much of the upper watershed lies in the transient snow zone of 1100 -3600 feet elevation. This is an area where rain-on-snow precipitation events are relatively common, making estimation of runoff and infiltration more difficult.

The lower 41 miles of drainage is lower gradient along a broad prairie-type valley floor.[28] The mainstem Deschutes River is composed of alternating gaining and losing reaches, ranging from a loss of 1.14 to a gain of 3.61 cfs per river mile, with an overall gain of groundwater of 41.4 cfs, between river miles 42.3 and 0.50, respectively (Ecology 2007a). Groundwater losses occur between RM 42.3 - 28.6, gain between RM 28.6 – 20.5, loss between RM 20.5 – 19.1, gain between RM 19.1 – 9.2, loss between RM 9.2 – 6.8, and gain between RM 6.8 – 0.5.

The Eld Inlet drainage area encompasses approximately 23,220 acres. The primary streams in this drainage area are McLane Creek, its tributaries (including Cedar Flat, Swift and Perkins Creeks) and Green Cove Creek, as well as various unnamed tributaries.[29,30] This drainage area also lies at relatively low elevation. Streamflow is fed primarily from groundwater recharge.

The climate of the region is typical Northwest maritime. Summers are relatively dry and cool while winters are mild, wet and cloudy. Annual precipitation averages about 45 inches[31] in Olympia to over 90 inches in the upper watershed (Miller et al. 1973).

Many of the lower elevation drainages to the inlets are characterized by extremely high peak flows that develop quickly during heavy rains and decline rapidly as rain subsides, and prolonged low flow or dry periods in the summer. The basic water quantity habitat issue of concern is the alteration of the natural hydrologic regime, including:

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[27] River mile delineation is digitized and available from Department of Ecology: https://geo.wa.gov/datasets/fff25ee77f9e43ff9539688ba8ab3af3_0

[28] Methodology to a Watershed Based Approach to Clean Water and Natural Resource Management, 2013

[29] WRIA 13 Draft Bill Watershed Plan, 2004

[30] Methodology to a Watershed Based Approach to Clean Water and Natural Resource Management, 2013

[31] Precipitation data is from the weather station at the Olympia Regional Airport

- alteration of the frequency and magnitude of high flow events (usually associated with increased stormwater runoff from impervious surfaces), and;
- reduction of summer base flows that affect the salmonid rearing capacity of streams (usually associated with reduced infiltration of groundwater, water withdrawals, or excess coarse sediment that can cause the flow to go subsurface).[32]

The Climate Impacts Group has developed numerous downscaled global climate models to forecast streamflow and precipitation changes in the Puget Sound, including WRIA 13. General trends such as increased stream temperatures, earlier streamflow timing, increased winter flooding, and lower summer minimum flows are expected (Mauger et al. 2015). Comparison of August average stream temperatures between 1992 and 2011 with projections of stream temperature from moderate climate forecasts for 2070 – 2099 suggest a rise of approximately 7.2 degrees F. Water temperatures impact salmonid survival, growth and fitness. Higher temperatures are made worse by low stream flow (Anchor Environmental 2008).

Flows typically are lowest in late summer and impact juvenile salmon (Coho Salmon) and steelhead rearing in the watershed, adult salmon (most likely Chinook Salmon) migrating and spawning in the river, and resident trout present in the river. Low flows limit the amount of wetted area available to rearing salmonids, and also limit productivity due to increased water temperatures and decreased dissolved oxygen (Haring et al. 1999).

Summer low flows in Woodland Creek are a habitat limiting factor. The reach of Woodland Creek from Lake Lois to below Martin Way typically goes dry during the summer months and summer flows elsewhere in the system are low. For Woodland and Woodard creeks, the largest threat to salmonids is the change in the natural flow regime resulting from the rapid urbanization of the watershed. Increased impervious surface from urban development typically results in increased peak flow storm runoff in the winter and reduced base flows in the summer. Other stream basins in WRIA 13 are also under intense development pressure. Unless the natural flow regime can be restored and maintained in developing basins, salmonid habitat will also be adversely impacted (Haring et al. 1999).

WAC173-513 set minimum instream flows for the Deschutes River, from the river's confluence with Capitol Lake upstream to the Deschutes Falls at river mile 41. This river is closed to new consumptive appropriates between April 15th – November 1st. Several other streams and their tributaries are closed to further consumptive appropriations, including McLane Creek, Woodland Creek, Woodard Creek, Percival Creek, and unnamed tributaries to Puget Sound. The background of how instream flows and closures were set is described in the Instream Resources Protection Program (IRPP) for WRIA 13 (Ecology 1980).

[32] WRIA 13 Draft Bill Watershed Plan, 2004

Chapter Three: Subbasin Delineation

3.1 Introduction

To allow for meaningful analysis of the relationship between new consumptive use and offsets, per Ecology's Final NEB Guidance, Ecology divided WRIA 13 into nine subbasins for the purposes of this watershed plan. This was helpful in describing 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. Ecology used the subbasin delineations to set priorities for developing water offset projects locations relative to anticipated impacts. In some instances, subbasins may not correspond with hydrologic or geologic basin delineations (e.g. watershed divides).[33] A more detailed description of the subbasin delineation is in the technical memo available in Appendix G.[34]

3.2 Approach to Develop Subbasins

This watershed plan divides WRIA 13 into nine subbasins for purposes of assessing projections for new PE wells, consumptive use, and project offsets.[35] The Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) data was used as the initial basis for subbasin delineations, with additional considerations including:

- Distinguishing areas of anticipated rural growth that would include permit-exempt wells or connections;
- Existing planning efforts that have already delineated subbasins;
- Presence of fish-bearing streams of importance within the watershed;
- Direction of surface drainage to different receiving bodies;
- Current level of residential development; and

Other considerations were:

- Size of the subbasins;
- Development character within the subbasin;
- Distinguishing areas where little rural growth is expected; and
- The location of streams included in the watershed rule (WAC-173-513) with closures or instream flow rule limits.

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[33] Washington State Department of Ecology (Ecology), 2019. Final Guidance for Determining Net Ecological Benefit, GUID-2094 Water Resources Program Guidance. Washington State, Department of Ecology, Publication 19-11-079.
[34] The WRIA 13 Committee reached agreement on the subbasin delineations presented in this watershed plan. Ecology concurs with the subbasin delineation.
[35] This 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).

3.3 Subbasin Map

The WRIA 13 subbasin delineations are shown on Figure 2 and summarized below in Table 4:

Table 4. WRIA 13 Subbasins

Subbasin Name	Primary Rivers and Tributaries	County
Boston Harbor	Ellis Creek, Indian Creek, Moxlie Creek, Woodard Creek	Thurston
Cooper Point	Simmons Creek, Schneider Creek	Thurston
Deschutes Lower	Deschutes River, Percival Creek	Thurston
Deschutes Middle	Deschutes River	Thurston
Deschutes Upper	Buck Creek, Lincoln Creek, Lewis Creek, Little Deschutes River, Thurston Creek, Johnson Creek, Mitchell Creek, Fall Creek, Pipeline Creek	Thurston and Lewis
Johnson Point	Unnamed tributaries to Henderson inlet and Nisqually Reach	Thurston
McLane	McLane Creek, Swift Creek, Beatty Creek	Thurston
Spurgeon Creek	Spurgeon Creek	Thurston
Woodland Creek	Woodland Creek	Thurston

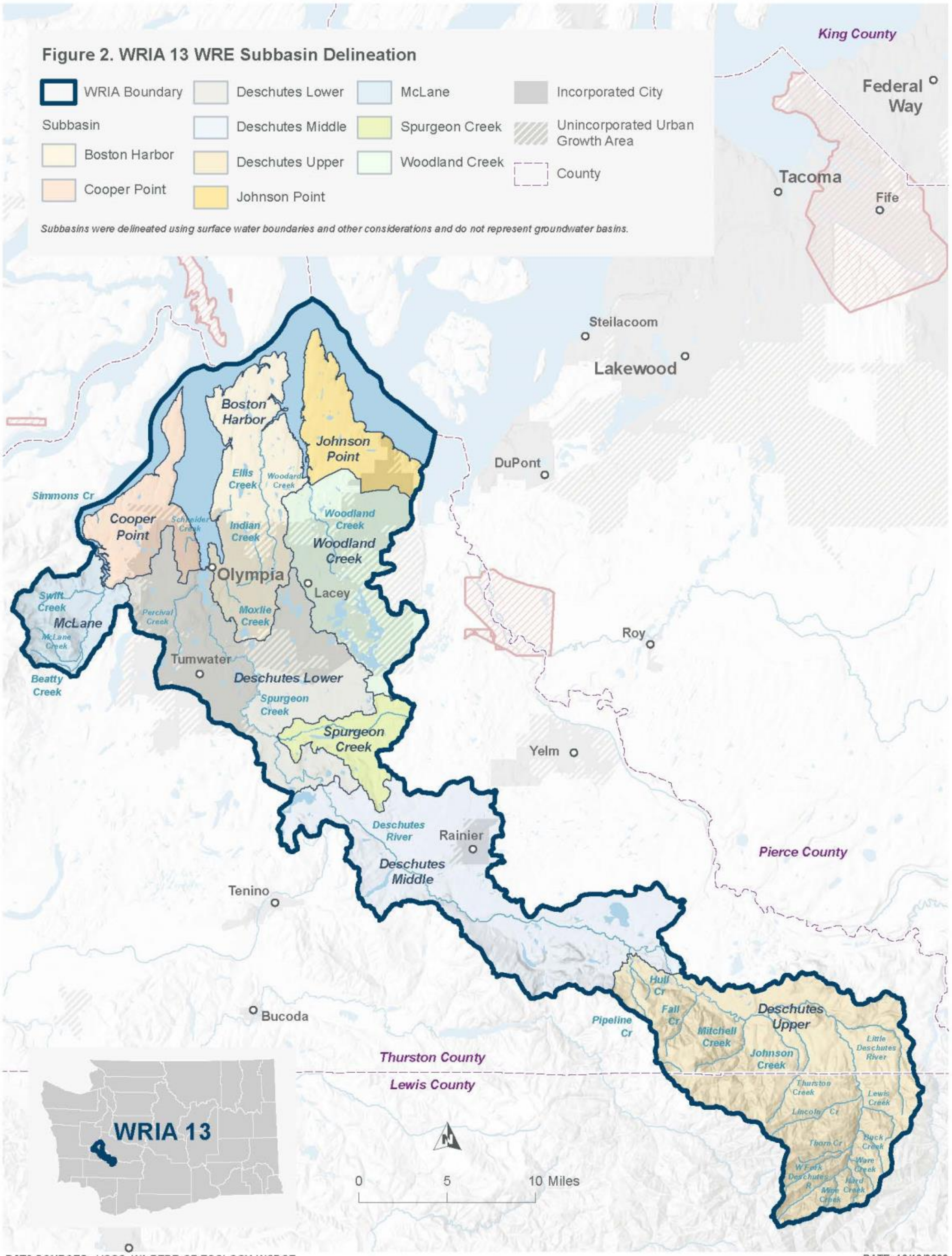

Figure 2: WRIA 13 WRE Subbasin Delineation for the Watershed Restoration and Enhancement Plan. Map prepared by HDR.

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).[36] This chapter provides Ecology's projections of new domestic permit-exempt (PE) well connections and their associated consumptive use for the 20-year planning horizon. A more detailed description of the methods and results for PE well and consumptive use projections is provided in a technical memorandum available in Appendix H.

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

This watershed plan projects 2,616 new PE wells over the planning horizon.[37] Note that Thurston County and Lewis County are both within WRIA 13; however, the Lewis County portion of WRIA 13 is entirely comprised of timberland and thus was not included in the projection for new PE wells. No new PE wells are expected to occur in Lewis County over the 20-year planning horizon. New PE well projections are distributed across the WRIA, with the largest numbers in the Middle and Lower Deschutes subbasins, and the three peninsulas. The fewest new PE wells are projected in the Upper Deschutes and Spurgeon Creek subbasins.

The method used to project the number of new PE wells in WRIA 13 is based on recommendations from Appendix A of Ecology's Final NEB Guidance. The following sections provide the 20-year projections of new PE wells for each subbasin within WRIA 13, and the methods used to develop the projections.

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[36] 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)

[37] Ecology concurs with the PE well projection methods and results developed by the WRIA 13 committee.

Addressing Uncertainties, Assumptions, and Limitations Associated with Projections for Growth and Consumptive Use. Uncertainties and limitation are inherent with any planning process. Appropriate data are not always available, so analyses rely on the best available information and often require assumptions to fill the gaps. Ecology based the PE well projections and consumptive use estimates in this chapter on the best information available at the time and presents assumptions associated with the projections. The technical memo in Appendix H provide more detail on the assumptions that Ecology used in this plan.

4.2.1 Methodology

The methodology was developed in collaboration with Thurston County and the Thurston Regional Planning Council (TRPC) for identifying the most appropriate method of projecting new PE wells within their jurisdiction. Population growth projections for Thurston County are produced by the TRPC every 3 to 5 years. Growth projections represent the expected growth based on currently adopted plans and policies. A detailed description of the TRPC methods is provided in Appendix H.[38] Permit-exempt growth was projected using the following steps to project growth of over the planning horizon:

1. Develop 20-year growth projections based on Office of Financial Management (OFM) medium population growth estimates, and conversion to dwelling units based on assumed people per dwelling unit

2. Develop residential capacity estimates

3. Allocate growth to parcels based on recent residential development and permit trends, where capacity is available

4. Once allocated, estimate the amount of development on permit-exempt connections based on the following criteria provided by Thurston County:

    a) Incorporated cities: no permit-exempt growth

    b) Urban growth areas (UGAs): permit-exempt growth is assumed to occur on parcels with no sewer service

    c) Rural areas outside of water systems: all permit-exempt growth

Ecology built upon the TRPC methodology by adding a small amount of permit-exempt growth in rural water systems, assuming that rural water systems may not be able to serve all growth within their service areas. Permit-exempt growth was assumed to be proportional to buildable parcels without water system hookups relative to parcels with water system hookups. Using past building permits to predict future growth is one of the recommended methods in the Final

[38] Documentation for TRPC's housing projections is available at https://www.trpc.org/236

NEB Guidance (Ecology 2019a). In this final plan, Ecology deferred to and incorporated the information provided by Thurston County and TRPC to determine PE well growth estimates.

4.2.2 Distribution of New PE Wells

This WRIA 13 watershed plan compiles Thurston County's growth projection data at both the WRIA scale and by subbasin. As mentioned above, no new PE wells are expected to occur in Lewis County over the 20-year planning horizon.

The TRPC allocated growth throughout Thurston County and WRIA 13. Ecology summed PE well growth by subbasin, and mapped potential locations of new PE wells in the watershed. The resulting map (Figure 3) shows the most likely area where new residential development dependent on PE wells will occur.

Based on the TRPC data, approximately 2,616 new PE wells are projected within WRIA 13 over the planning horizon.

PE well growth is distributed through all subbasins, with the largest numbers in the Middle and Lower Deschutes subbasins, and the three peninsulas (Table 5 and Figure 3).

Table 5. Number of new PE Wells Projected between 2018 and 2038 per WRIA 13 Subbasins

Subbasin	Projected New PE Wells
Boston Harbor	296
Cooper Point	232
Deschutes Lower	379
Deschutes Middle	734
Deschutes Upper	30
Johnson Point	520
McLane	165
Spurgeon Creek	92
Woodland Creek	168
Total	**2,616**

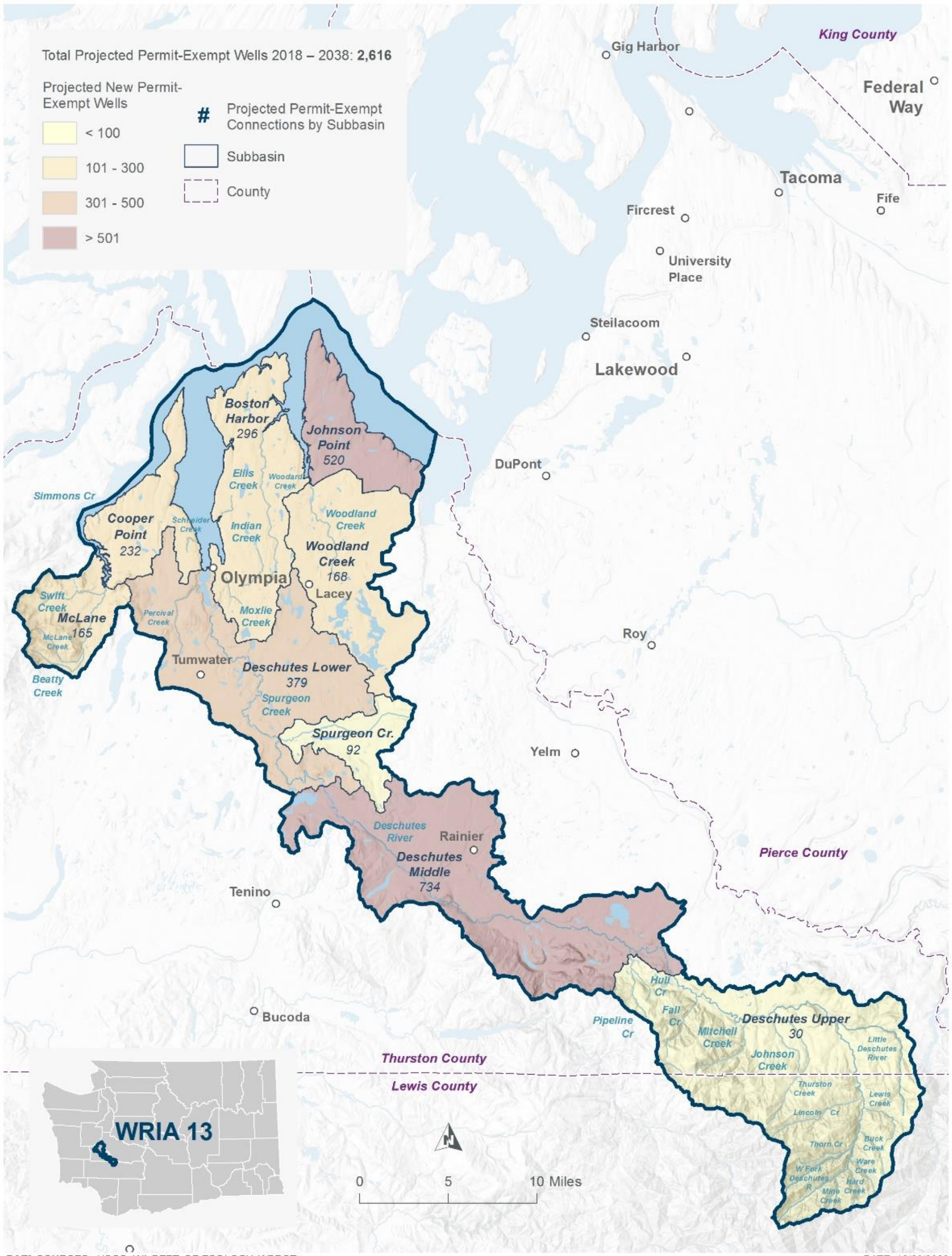

Figure 3: WRIA 13 WRE Distribution of Projected New PE Wells for 2018-2038. Map prepared by HDR.

4.3 Impacts of New Consumptive Water Use

Ecology used a 20-year projection for WRIA 13 of 2,616 new PE wells to estimate the consumptive water use that this watershed plan must address and offset. This watershed plan estimates 434 AFY of new consumptive water use in WRIA 13, and this section provides an overview of the methodology used to produce that estimate. In addition, the WRIA 13 Permit-Exempt Growth and Consumptive Use Summary provides a more detailed description of the analysis and alternative scenarios considered during the Committee process (Appendix H).[39]

Consistent with the Final NEB guidance [page 8, Appendix B], Ecology assumed that annual impacts from consumptive use on surface water are steady-state, meaning that impacts on the stream from pumping do not change over time. This assumption is based on the wide distribution of future well locations and depths across varying hydrogeological conditions.

4.3.1 Methodology to estimate indoor and outdoor consumptive water use

Appendix A of the Final NEB Guidance describes a method (referred to as the Irrigated Area method) that assumes 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. Use patterns for indoor uses versus outdoor uses are different. Indoor use is generally constant throughout the year, while outdoor use occurs primarily in the summer months. Also, the portion of water use that is consumptive varies for indoor and outdoor water uses. The Irrigated Area method accounts for indoor and outdoor consumptive use variances by using separate approaches to estimate these uses.

To develop the consumptive use estimate, the Ecology used the Irrigated Area method and relied on assumptions for indoor use and outdoor use from Appendix A of the Final NEB Guidance (Ecology 2019).

New indoor consumptive water use

Indoor water use refers to the water that households use (such as in kitchens, bathrooms, and laundry), and that leaves the house as wastewater, typically into a septic system (Kenny et al., 2012). The method uses the NEB Guidance recommendation for indoor daily water use per person and consumptive use factor (CUF), and relies on local data for the average number of people per household to estimate new indoor consumptive water use (Ecology 2019b):

- 60 gallons per day (gpd) per person, as recommended by Ecology.
- 2.5 persons per household assumed for rural portions of WRIA 13[40]

[39] The WRIA 13 Committee considered a "most likely" and a "higher adaptive management" consumptive use estimate. The higher estimate is not presented here because Ecology considers 434 AFY a reasonable estimate of consumptive water use. Additional information is presented in the technical memorandum in Appendix H.

[40] Thurston County OFM information can be found here: https://www.ofm.wa.gov/washington-data-research/county-and-city-data/thurston-county

- 10 percent of indoor use is consumptively used (or a CUF of 0.10), based on the assumption that homes on new PE wells are served by onsite sewage systems. Onsite sewage systems return most wastewater back to the immediate water environment; a fraction of that water is lost to the atmosphere through evaporation in the drainfield.

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

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

This results in an indoor consumptive water use of 15 gallons per day per PE well and an annual average of 0.017 AFY per PE well.

New outdoor consumptive water uses

Most outdoor water is used to irrigate lawns, gardens, orchards and landscaping, and may include water for livestock. 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 mainly through evapotranspiration (Ecology 2019).

Average outdoor irrigated area in WRIA 13 was estimated using aerial imagery to measure the irrigated areas of 80 randomly selected parcels of a stratified sample served by new PE wells. The average irrigated area for the 80 parcels was 0.06 acres. This analysis returned a large portion of parcels with no visible irrigation, which were given irrigated area values of zero. To account for undetected irrigation or potential outdoor water use other than irrigation, Ecology directed the technical consultants to replace the zero values with 0.05 acres. This value of 0.05 acres was used, because that was the lower end (i.e. <10th percentile) of measurable irrigated areas in WRIA 13. When using 0.05 acres for parcels with no visible irrigation, the average irrigated area was 0.10 acres (4,356 ft^2). The 0.10 acre value is used in the consumptive use calculations for WRIA 13.[41]

Ecology 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 the Washington Irrigation Guide (WAIG, Appendix B) (NRCS-USDA 1997): 16.8 inches for the Olympia, Packwood, and Centralia WAIG stations, which is a weighted average used to estimate the amount of water needed to maintain a lawn.
- An irrigation application efficiency (AE) to account for water that does not reach the turf: 75 percent. This increases the amount of water used to meet the crop's IR by 25 percent.
- Consumptive use factor (CUF) of 0.8, reflecting 80 percent consumption for outdoor use. This means that 20 percent of outdoor water is returned to the immediate water environment.

[41] The WRIA 13 Committee agreed to 0.10 acres as representative of the irrigated area.

- Outdoor irrigated area based on existing homes using PE wells: 0.10 acre

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

$$\frac{1.4\ feet\ per\ year * 0.10\ acres * 0.80\ CUF}{0.75\ AE}$$

This results in 0.15 AFY of outdoor consumptive water use per PE well for the WRIA. While this estimate is an average for the year, Ecology expects that outdoor water use will occur mainly in summer.

4.3.2 Consumptive Use Estimates

The combined total indoor and outdoor consumptive use per PE well is 0.166 AFY. Multiplying this by the projected 2,616 new PE wells, the total consumptive use estimate for WRIA 13 for is 434 AFY.

Table 6 summarizes the estimated indoor and outdoor consumptive use by subbasin, and Figures 3 and 4 presents the PE well projections and consumptive use estimate by subbasin. Ecology expects the highest consumptive use to occur in the Deschutes Middle subbasin, which has the most projected new PE wells.

4.3.3 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, so Ecology used the estimates of new consumptive water use to represent the impacts of that water use, and ultimately to determine the necessary offset amounts to cover that use. This approach is consistent with the Final NEB Guidance, Appendix A (Ecology 2019).

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 13, HDR compared the results of the analysis with similar analyses undertaken in other WRIAs (GeoEngineers and HDR 2020). The findings of the comparability study were that while the method is subject to error and results varied between the two analyses, variations were inconclusive in terms of accuracy and the differences detected were not large enough to warrant any revisions to the estimates. Some uncertainty associated with detection of irrigated areas in aerial photos was addressed by assigning a minimum value of 0.05 acre to the 80 parcels used to calculate the average irrigated area. When this minimum value was applied, the average irrigated area increased to 0.10 acres.

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, and there is 10 percent indoor consumptive use and 80 percent outdoor consumptive use.

Table 6. WRIA 13 Estimated PE Well Projections and Indoor and Outdoor Consumptive Use Estimates[42] by Subbasin, 2018-2038

Subbasin	Projected new PE Wells	Indoor CU (AFY)	Outdoor CU* (AFY)	Total CU/year* (AFY)
Boston Harbor	296	5	44	49
Cooper Point	232	4	35	39
Deschutes Lower	379	6	57	63
Deschutes Middle	734	12	110	122
Deschutes Upper	30	1	4	5
Johnson Point	520	9	78	86
McLane	165	3	25	27
Spurgeon Creek	92	2	14	15
Woodland Creek	168	3	25	28
Total	**2,616**	**44**	**391**	**434**

*Assumed irrigated acreage of 0.10 acre.

[42] Results are shown in acre feet per year (AFY). 1 acre foot per year is equivalent to 0.0014 cfs, or 892.74 gallons per day

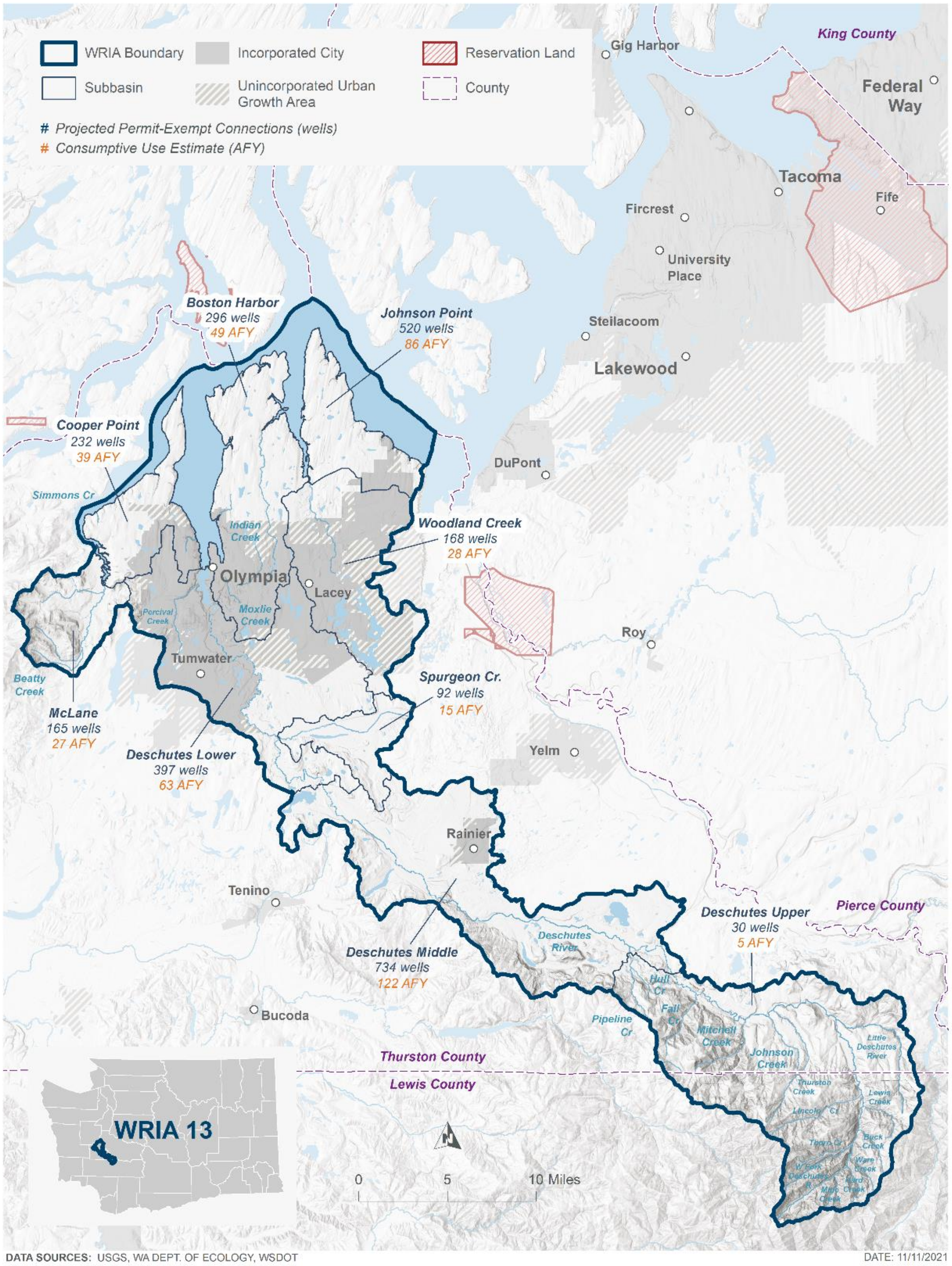

Figure 4: WRIA 13 Estimated Consumptive Use by Subbasin 2018-2038. Map developed by GeoEngineers.

Chapter Five: Projects and Actions

5.1 Description and Assessment

Watershed plans must identify projects and actions that offset the potential impacts future PE wells will have on streamflows and provide a net ecological benefit to the WRIA.[43] This chapter provides two types of projects to offset consumptive use and meet NEB:

- **Water offset projects** have a quantified streamflow benefit and contribute to offsetting consumptive use.
- **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. Some habitat projects included in this watershed plan will also result in an increase in streamflow, but the water offset benefits for these projects are difficult to quantify. Therefore, this watershed plan does not rely on habitat projects to contribute toward offsetting consumptive use.

To identify the projects, Ecology relied on information generated through the WRIA 13 Committee process. Ecology and the technical consultants[44] also identified projects with potential streamflow benefit from the Puget Sound Action Agenda near term actions, salmon recovery lead entity four-year workplans, and public works programs. Following the conclusion of the Committee process, Ecology worked with technical consultants to develop additional information for some projects to build reasonable assurance for meeting offset need and NEB. Projects that did not provide a reasonable benefit for the anticipated cost or that were highly conceptual without a detailed description or project sponsor, were removed. Ecology and the technical consultants reached out to all identified project sponsors to confirm interest prior to including the projects in the watershed plan.

The technical consultants developed detailed analyses on a subset of projects determined to provide an offset benefit and contribute to streamflows. This chapter presents summaries of those projects.

In a separate effort, Ecology contracted with Pacific Groundwater Group (PGG) to support identification of water right acquisition opportunities for WRIA 13. PGG developed a focused list of water rights for future project opportunities; however, no specific water rights were identified for acquisition, and no offset is being claimed in this watershed plan. Before these rights could be acquired and placed into the Trust Water Rights Program,[45] they would need to

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[43] 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.

[44] Technical support for projects provided by HDR, Anchor QEA, Pacific Groundwater Group and GeoEngineers.

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

go through a full extent and validity analysis to determine the consumptive use offset component.

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).

All project proponents voluntarily agreed to have their projects listed in the watershed plan. Although project proponents noted a willingness to proceed, the listing of a project herein does not obligate Ecology to fund a project or the project proponent to carry out the project (see Ecology's POL-2094). Therefore, neither the completion of projects nor the attainment of their anticipated results are guaranteed. However, the inclusion of multiple projects vetted for pertinence and feasibility provides reasonable assurance that projected consumptive use from new domestic permit-exempt withdrawals will be offset and that NEB will be achieved. Ecology encourages project proponents and advocates to work towards completing the projects, and uses incentives through the grant funding provided under the law.

Ecology recognizes the importance of developing projects with climate resiliency in mind, and the need to assess how climate change may affect project effectiveness. Restoring floodplain connectivity and streamflow regimes, and re-aggrading incised channels are most likely to ameliorate streamflow and temperature changes and increase habitat diversity and population resilience (Beechie et al. 2013).

In finalizing this plan, Ecology evaluated projects based on their feasibility and likelihood of implementation. This plan contains projects that Ecology has identified as having a high likelihood of implementation based on their technical merit and project sponsor support.

5.2 Water Offset Projects

The projects presented below have quantifiable streamflow benefit, and Ecology identified these projects as having the greatest potential for implementation and meeting achieving the required offset need. Water offset amounts for each project identified in this plan are based on calculations developed by project sponsors and technical consultants. In finalizing this plan, Ecology deferred to projects developed by the WRIA 13 committee, and provided further evaluation to include projects that have a high certainty of providing the estimated water offset. More information on the certainty of project implementation is described in Section 5.5.3 below. Detailed descriptions, including water offset calculations and assumptions, of each of the projects presented in this section are available in Appendix I. A summary of projects and offset benefits by subbasin are presented at the end of this section in Tables 7 - 9.

5.2.1 WRIA-wide Projects

5.2.1.1 Managed Aquifer Recharge Projects in WRIA 13

Managed aquifer recharge (MAR) projects divert, convey, and infiltrate peak seasonal river flows in engineered facilities that are in connection with the local alluvial aquifer that the donor stream or river is also in connection. MAR potential was estimated in terms of 1) potential locations suitable for MAR projects, 2) flow available for diversion during high flows, and 3) the number of days when diversion is feasible. To ensure that flows would be diverted in quantities that would not reduce habitat suitability for salmonids or reduce habitat forming processes, one of two methods were used to estimates flow rates. If minimum flows have been designated, then the flow rate was estimated as less than two percent of minimum flows. If minimum flows have not been designated, 2% of the average 75th percentile flows during November –April were used. Seepage back into the river would result in attenuation of these flows, increasing base flows across a broader time period, including the late summer and early fall, when flows are typically the lowest, and water demand for consumptive use is the highest. MAR projects are proposed for the Deschutes River and Green Cove Creek. MAR projects may be considered for Percival Creek, Woodard Creek, and Woodland Creek, but are not being proposed for offset credits in this plan.

MAR projects in WRIA 13 have been identified through analysis by the technical consultants to identify potential suitable locations, and are estimated to have a total water offset of 810 AFY. Due to uncertainties in the likelihood of projects being built, project performance over time, and the benefits being realized (including the timing of streamflow benefits), the Ecology chose to exclude estimates for projects located in basins with instream flow rule closures. Ecology recognizes that feasibility studies will be needed to make MAR projects a reality in WRIA 13, but is confident sufficient opportunities exist to produce the projected water offset benefit.

The MAR projects presented in this watershed plan are opportunities identified at the time of publication, and calculations are based on the best available site information. These projects represent well-formed project concepts, but they do not provide design or feasibility study elements. WRIA 13 partners may identify other future projects that are consistent with those presented in this watershed plan which will support offset benefits. Ecology encourages project partners to undergo a feasibility study for all MAR projects to identify any water quality, permitting, and design requirements. MAR projects funded through Streamflow Restoration grant funding are required to complete a feasibility study prior to any other phases of the MAR project being eligible for funding.

Thurston County has indicated that they will be the project sponsor of MAR projects, in coordination with project partners and implementation groups, pending feasibility studies.

5.2.1.2 Water Right Opportunities

Ecology supports the full and partial acquisition of water rights to increase streamflows and offset the impacts of PE wells. Acquired 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 effort conducted by PGG to identify potential WRIA 13 water right acquisition opportunities was guided by criteria established by the WRIA 13 Committee. This included considerations for priority subbasins, preferred sources, and purposes of use, as well as information provided by some committee members on known water rights. Subsequently Ecology has identified a description of potential future projects, however no specific water rights are identified for acquisition. A detailed project description can be found in Appendix I.

5.2.1.3 Small-scale LID Project Development

This project presents a programmatic project to strategically concentrate small-scale LID retrofit work in urbanized settings, partnering with residential and commercial community members to redirect runoff away from stormwater conveyance systems and into green stormwater infiltration facilities. In rural settings, efforts can explore additional opportunities to slow and infiltrate stormwater runoff that would otherwise rapidly discharge into nearby streams.

Thurston Conservation District has indicated a willingness to take a leadership role on this project, and is committed to working with partners to identify and implement retrofit projects to benefit groundwater recharge. Project locations will be determined during implementation.

Potential benefits include recharge of shallow groundwater areas where other large-scale projects are not feasible, and water quality benefits to nearby streams which would otherwise receive untreated runoff. Additionally, these projects would directly engage residential and commercial partners to contribute to streamflow preservation. Due to uncertainties regarding these types of projects, Ecology is not counting the potential offset benefits from this project during the quantification of offset quantities in this watershed plan.

Projects by Subbasin

5.2.2 Boston Harbor Subbasin

5.2.2.1 Managed Aquifer Recharge Project in Woodard Creek

An MAR project (as described in the WRIA-wide Projects section) is proposed for Woodard Creek (Appendix I). Woodard Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration may be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location are near zero in the summer and range from 10 –17 cfs in the wet season. If an MAR project were to occur at this location, it could be small-scale, approximately 0.2 cfs diversion when flows exceed 10 cfs. The diversion period is likely around 45 days per year, during the wet season. This would result in an offset of around 18 AFY. However, because of the uncertainty associated with being located on a closed stream, Ecology is not claiming offset credits for this project.

5.2.3 Cooper Point Subbasin

5.2.3.1 Managed Aquifer Recharge Project in Green Cove Creek

An MAR project (as described in the WRIA-wide Projects section) is proposed for Green Cove Creek (Appendix I), which has a 1.5 cfs low flow closure. Measured flows near the potential MAR location are near zero in the summer and range from 7 –11 cfs in the wet season. Therefore, water would be available, seasonally, above the low flow for an MAR project diversion. Assuming that an MAR project diverted approximately 0.2 cfs when flows exceeded 10 cfs, and a 45 day per year diversion period, this project would result in an offset of around 18 AFY.

5.2.4 Deschutes Lower Subbasin

5.2.4.1 Schneider's Prairie (Elwanger) Off-Channel Storage-and-Release

The Schneider's Prairie Off-Channel Storage-and-Release Project is located on the east bank of the Deschutes River, west of the Keanland Park Lane SE, in north-central Thurston County. This project will restore hydrologic connectivity between the Deschutes River and Schneider's Prairie. Schneider's Prairie is a depressional feature that contains the Ayer Creek drainage (Appendix H). Paleochannels apparent from aerial photos and LiDAR images show that multiple channels historically connected the Deschutes River with Schneider's Prairie. Reconnecting the Deschutes River with Schneider's Prairie and Ayer Creek would provide rearing habitat and flood refugia for juvenile salmonids, stormflow attenuation, and water infiltration for later-season release to augment flow in the lower Deschutes River.

The project concept is to deepen an existing floodplain paleochannel that would hydrologically connect the Deschutes River to Schneider's Prairie (Appendix I). Schneider's Prairie contains Ayers Pond and Ayers Creek. The deepened paleochannel would be connected to the existing Ayers Creek that runs north and back to the Deschutes River. Ayers Creek would be modified near the confluence with the Deschutes River using biotechnical techniques (e.g. buried logs and log jams) to maintain grade control at an elevation that would inundate a portion of the off-channel area during high flow events (152 ft. NAVD88).

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

The seasonal inundation would result in infiltration and subsequent seepage back to the river on the time scale of days to months. Seepage back to the Deschutes River would increase over time, because of the cumulative effect of infiltrating additional water. This cumulative increase would reach an asymptote (i.e. additional benefits are minimal) after about 50 years of infiltration. Seepage back to river would not change substantially with season, but slightly more seepage would occur during the May –October period, relative to the November –April period.

Streamflow benefits during the May –October period are predicted to be 285, 681, 958, and 1,310 acre-feet per year during the first, fifth, tenth, and fiftieth year of infiltration, respectively.

Ecology recognizes that a feasibility study would be beneficial to identify any water quality, permitting, or design requirements. Ecology identified project uncertainties that the modeling analysis was not able to account for or where assumptions were made, including:

1. Evapotranspiration
2. Amount of infiltration
3. Climate change
4. Dropping flow trends of the Deschutes
5. Sediment issues in the Deschutes
6. Modeling assumptions including transmissivity of aquifer, and streambed conductance
7. Modeling represents average conditions, not dry year conditions

To account for project uncertainties Ecology chose to recognize 681 AFY of seepage back to the river during the May – October dry season, which represents less than half of the total estimated based on preliminary hydrologic and hydrogeologic modeling (Tables 7 and 8).

5.2.4.2 Donnelly Drive Infiltration Galleries

Portions of Donnelly Drive SE, and Normandy Drive SE flood during major rainfalls and impacts public property and reduces public safety. Thurston County Roads Maintenance has routinely responded to calls from residents for assistance. It is proposed to install treatment devices and infiltration systems in the Donnelly Drive vicinity to reduce flooding of public streets and promote infiltration to groundwater (Appendix I). There are five locations in the area which see flood issues, and each of these locations are a low point where an existing drywell is located to infiltrate stormwater. These improved infiltration systems has been modeled to increase stormwater infiltration by approximately 14 AFY (Tables 7 and 8).

5.2.4.3 Managed Aquifer Recharge Project in Percival Creek

An MAR project (as described in the WRIA-wide Projects section) is proposed for Percival Creek (Appendix I). Percival Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration may be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location are near 3 cfs in the summer and range from 12 –15 cfs in the wet season. If an MAR project were to occur at this location, it could be small-scale, approximately 0.2 cfs diversion when flows exceed 10 cfs. The diversion period is likely around 45 days per year, during the wet season. This would result in an offset of around 18 AFY. However, because of the uncertainty associated with being located on a closed stream, Ecology is not claiming offset credits for this project.

5.2.5 Deschutes Middle Subbasin

5.2.5.1 Managed Aquifer Recharge Project in the Deschutes River

MAR projects (as described in the WRIA-wide Projects section) are proposed for the Middle Deschutes River (Appendix I). Projects would divert water from the Deschutes River, which then would be infiltrated into the ground for subsequent return flow to the river. To estimate the potential benefits from this project, flow data from measured flows are approximated by the Deschutes River at Rainier gage (USGS Station 12079000) and the Deschutes River at E St Bridge at Tumwater, WA (USGS 12080010). The amount of water available for diversion downstream to the control point (in Tumwater) is approximately 8 cfs during at least 50 days of the year, during the November – April wet season. Potential MAR locations have been identified in both the upper and middle Deschutes River subbasins (Appendix I). If all 8 cfs were diverted for several projects for these days and infiltrated for subsequent return flow to the river, which would equate to approximately 792 AFY of offset benefit. Currently, 6 of the 8 cfs is proposed to be applied to MAR projects in the Deschutes Middle subbasin, equaling 594 AFY.

Ecology recognizes that 8 cfs diversion is equal to just 2% of the of the 400 cfs minimum flow listed in Chapter 173-513-030 WAC for December 15 through March 31st. Much higher flows are frequently experienced during this time period, and higher diversion rates would be allowed under the WAC. Consequently, the assumptions used in this analysis produce very conservative estimates of the overall MAR potential.

5.2.6 Deschutes Upper Subbasin

5.2.6.1 Managed Aquifer Recharge Project in the Deschutes River

MAR projects (as described in the WRIA-wide Projects section) are proposed for the Upper Deschutes River (Appendix I). As described above for the Deschutes Middle subbasin, 2 of the 8 cfs is currently proposed to be applied to MAR projects in the Deschutes Upper subbasin, equaling 198 AFY.

5.2.7 Woodland Creek Subbasin

5.2.7.1 Hicks Lake Stormwater Retrofit

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

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

Hicks Lake is the headwaters of the Woodland Creek watershed. Water seeping into Hicks Lake from this project must travel through a wetland into Pattison Lake, and into another wetland into Long Lake, before that water reaches the beginning of Woodland Creek.

A range of diversion flows (1cfs, 2cfs, and 3 cfs) were modeled and resulted in a corresponding range of average annual infiltration of 167, 244, and 296 AFY, respectively. All flows, up to 3.5 cfs are expected to be 100% infiltrated, but infiltrating up to 3 cfs accounts for a reduction in infiltration capacity over time (i.e. from clogging of the infiltration basin from fine materials). Therefore, infiltrating up to 3 cfs for an offset benefit of 296 AFY is the estimate of stormwater infiltration (Tables 7 and 8).

5.2.7.2 Managed Aquifer Recharge Project in Woodland Creek

An MAR project (as described in the WRIA-wide Projects section) is proposed for Woodland Creek (Appendix H). Woodland Creek is a closed stream (Chapter 173-513 WAC). However, diverting water from the stream for MAR infiltration may be feasible with a rule change to accommodate these flow restoration projects. Measured flows near the potential MAR location average 14 cfs in the late summer and range from 24 – 51 cfs in the wet season. If an MAR project were to occur at this location, it could be small-scale, approximately 0.7 cfs diversion when flows exceed 36 cfs. The diversion period is likely around 45 days per year, during the wet season. This would result in an offset of around 62 AFY. However, because of the uncertainty associated with being a closed stream, Ecology is not claiming offset credits for this project.

Table 7. Water Offset Projects

Project Name	Project Type and Description	Subbasin	Estimated Water Offset (AFY)[46]	Project Sponsor	Estimated Project Cost[47]	Readiness to Proceed
Schneider's Prairie Off-Channel Connection	Off-channel reconnection and infiltration	Lower Deschutes	681	Thurston county	$4.93 M	High
Hicks Lake Stormwater Retrofit	Stormwater infiltration in series with existing stormwater treatment	Woodland	296	City of Lacey	$3.3 M	High
Donnelly Drive Infiltration	Improve neighborhood stormwater infiltration, avoiding surcharge and runoff to Chambers ditch.	Lower Deschutes	14	Thurston County	$6.31 M	High
Deschutes/ Chambers MAR	Several candidate locations for MAR of diverted Deschutes River water from high flow periods, exceeding instream minimum flows or ecological flows.	Upper Deschutes Middle Deschutes Lower Deschutes Woodland Boston Harbor Cooper Point	810	Thurston County	$2.8 M	High
Small-scale LID Project Development	Programmatic project to implement green stormwater infiltration facilities in urban and rural areas.	WRIA-wide	0	Thurston Conservation District	TBD	Low

[46] 1 acre foot per year is equivalent to 0.0014 cfs, or 892.74 gallons per day
[47] Costs are based on order of magnitude estimates.

Project Name	Project Type and Description	Subbasin	Estimated Water Offset (AFY)[46]	Project Sponsor	Estimated Project Cost[47]	Readiness to Proceed
Water Rights Opportunities	A focused WRIA-wide analysis on potential WR efficiencies and acquisition for future studies and implementation	Johnson Point Deschutes Middle Deschutes Lower Woodland Creek	0	TBD	$395,405	Low

WRIA 13 Total Water Offset	**1,801 AFY**
WRIA 13 Consumptive Use Estimate	**434 AFY**

Table 8. Water Offsets from Projects, summed by subbasin. All values are in acre-feet/year.[48]

Subbasin	MAR	Schneider's Prairie	Hicks Lake SW Retrofit	Donnelly Drive Infiltration	Total Water Offsets from Projects (AFY)	WRIA 13 Consumptive Use Estimate
Boston Harbor	0	0	0	0	0	49
Cooper Point	18	0	0	0	18	39
Deschutes Lower	0	681	0	14	695	63
Deschutes Middle	594	0	0	0	594	122
Deschutes Upper	198	0	0	0	198	5
Johnson Point	0	0	0	0	0	86
McLane	0	0	0	0	0	27
Spurgeon Creek	0	0	0	0	0	15
Woodland Creek	0	0	296	0	296	28
Total	**810**	**681**	**296**	**14**	**1,801**	**434**

[48] 1 acre foot per year is equivalent to 0.0014 cfs, or 892.74 gallons per day

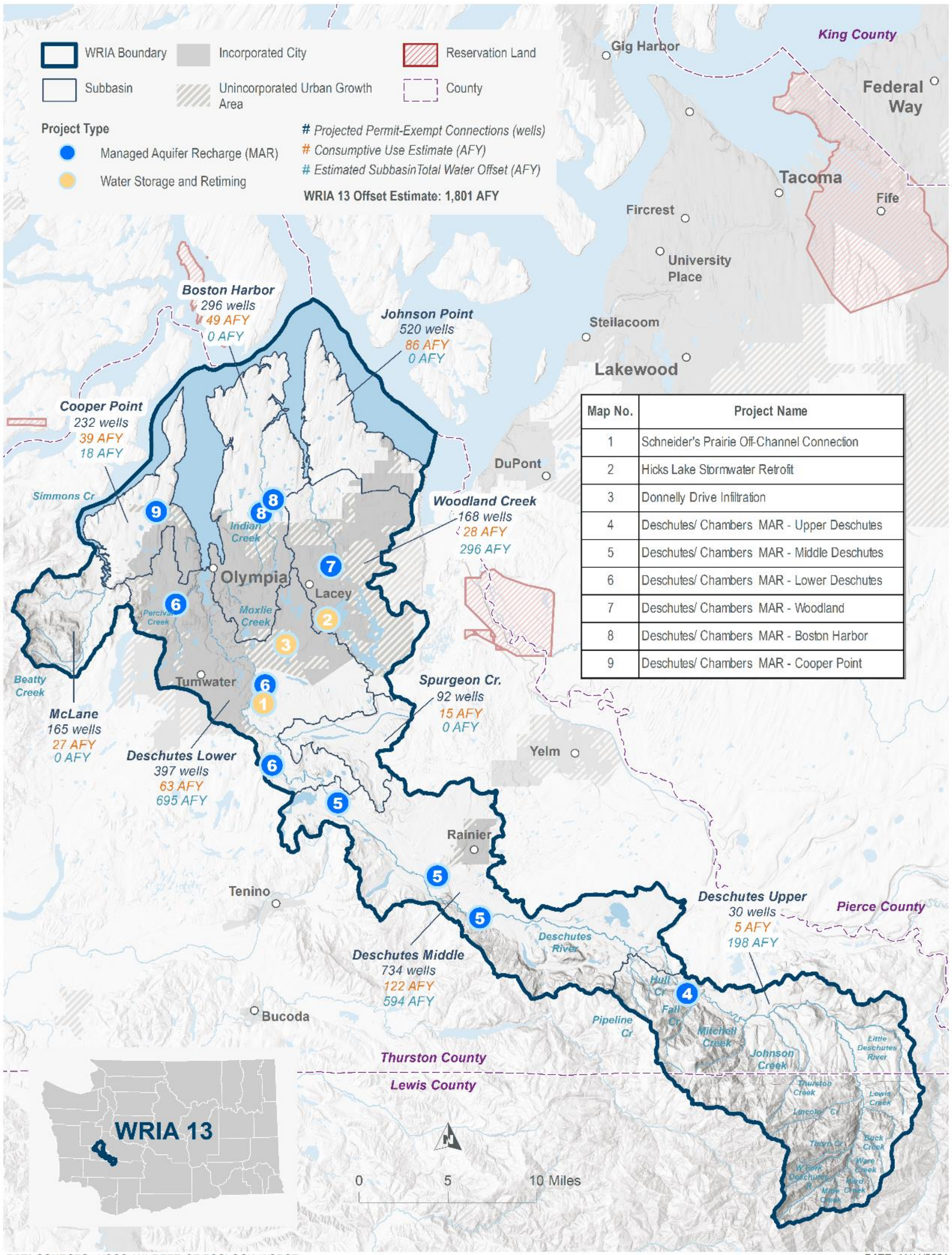


Figure 5: WRIA 13 Water Offset Projects by Subbasin. Map prepared by GeoEngineers.

5.3 Habitat Projects

A number of habitat restoration projects, and projects with unquantifiable streamflow benefit were identified in WRIA 13. While several of these projects may produce a marginal offset benefit by increasing seasonal storage, the benefits were too small or too complex to estimate. In general, these projects increase stream complexity, reconnect floodplains, promote fish passage, and enhance natural processes that had been lost to the benefit of salmonids and other aquatic species. Projects described below have project sponsors and are expected to be implemented within the planning horizon. Nineteen habitat projects are described in Table 9, and some detailed project descriptions are included in Appendix I. The project numbers listed in the table were developed for the purposes of this watershed plan and correspond to the map shown in Figure 6. In finalizing this plan, Ecology deferred to projects proposed by the WRIA 13 committee (including the Salmon Recovery Lead Entity Coordinator) and provided further evaluation to include projects that have a high certainty of providing stated habitat benefits.

5.3.1 WRIA-wide Projects

5.3.1.1 Floodplain Restoration

WRIA 13 floodplain restoration projects would address loss of groundwater storage, low flows and water quality conditions. The specific actions proposed for any given project would be specific to the restoration opportunity and habitat capacity of that location. The goal of any given project would be to rehabilitate natural hydrologic and geomorphic processes that are provided by floodplain connectivity. More detailed objectives pursuant to this goal would be specific to each respective project.

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

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

Potential floodplain restoration locations were identified based on being unconfined, within a flood zone, and being vacant. Secondary considerations were given to locations that were on public land, and near tributary inflow (and therefore potentially prone to flooding).

A detailed project description is included in Appendix I.

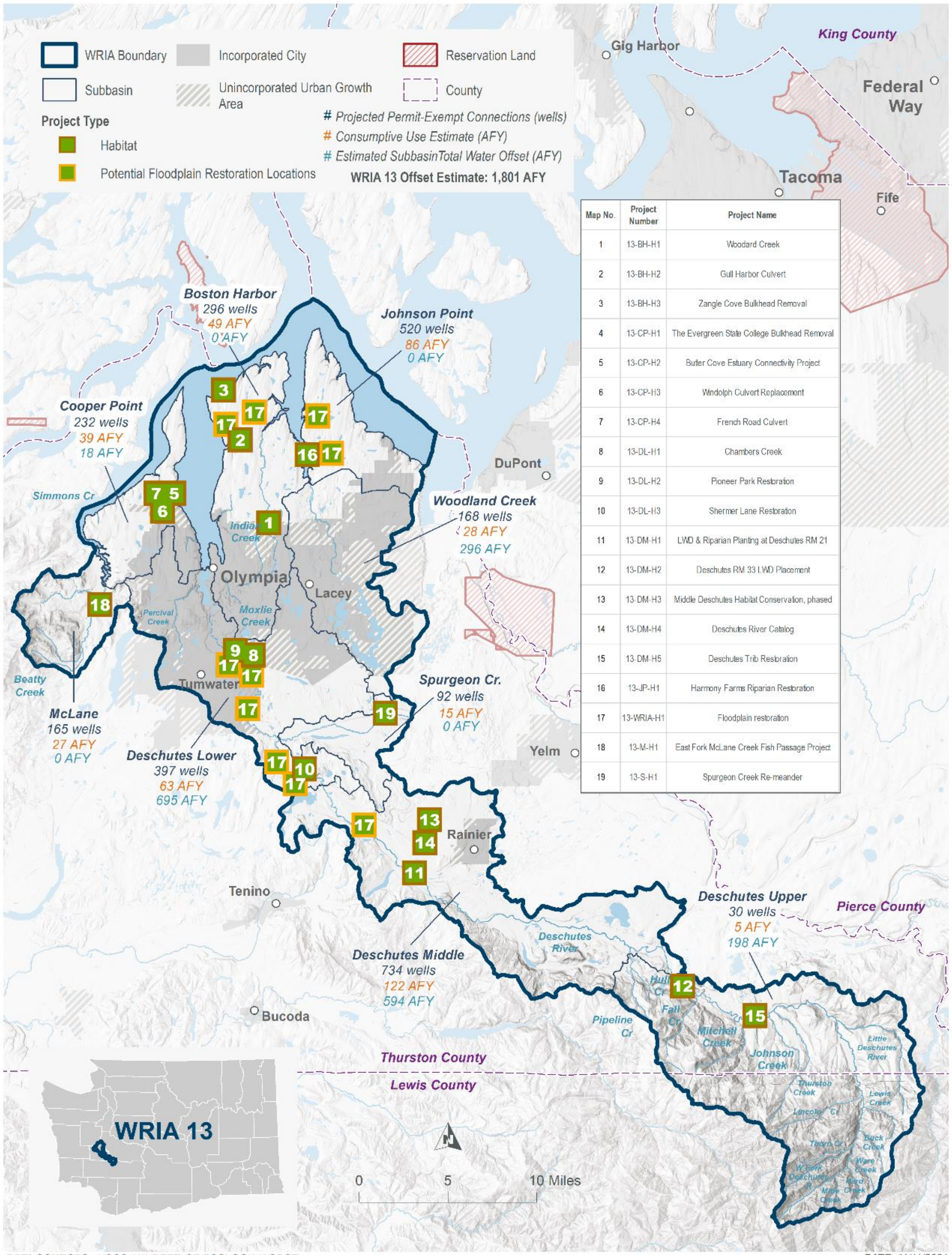
Table 9. Habitat Projects in WRIA 13

Project Number	Project Name	Description	Subbasin	Sponsor	Estimated Cost[49]
13-BH-H1	Woodard Creek	Increase channel sinuosity and length, increase instream habitat complexity and channel roughness.	Spurgeon	Thurston County	$1,000,000.00
13-BH-H2	Gull Harbor Culvert	Removal of total barrier culvert on the east side of Budd Inlet	Lower Deschutes	Thurston County	$950,000.00
13-BH-H3	Zangle Cove Bulkhead Removal	Nearshore restoration to remove 195 linear feet of shoreline armor, restoration, and invasive plant removal.	Boston Harbor	Thurston County	$113,000.00
13-CP-H1	The Evergreen State College Bulkhead Removal	Removal of 210 linear feet of bulkhead at The Evergreen State College. Shoreline restoration at the mouth of Snyder Creek - remove existing bulkhead, inclusive of revegetation. Project formerly known as Squaw Point.	Boston Harbor	Thurston County	$190,000.00
13-CP-H2	Butler Cove Estuary Connectivity Project	Remove series of derelict fish rearing ponds, replace fish passage, restore salmon refuge habitat.	Boston Harbor	SPSSEG	$192,000.00
13-CP-H3	Windolph Culvert Replacement	Removal of total barrier culvert on the west side of Budd Inlet	Boston Harbor	Thurston Conservation District	$600,000.00
13-CP-H4	French Road Culvert	Removal of total barrier culvert on the west side of Budd Inlet	Cooper Point	SPSSEG	$1,000,000.00

[49] Costs are based on order of magnitude estimates

Project Number	Project Name	Description	Subbasin	Sponsor	Estimated Cost[49]
13-DL-H1	Chambers Creek	Channel re-alignment to increase channel length and sinuosity at the confluence with Chambers Ditch.	Cooper Point	SPSSEG	$1,000,000.00
13-DL-H2	Pioneer Park Restoration	Restore riparian vegetation for complexity and to slow fine sediment erosion into the system.	Cooper Point	SPSSEG	$400,000.00
13-DL-H3	Shermer Lane Restoration	LWD placement, sediment reduction, 1,900 feet of shoreline restoration, 100 riparian buffer.	Cooper Point	SPSSEG	$360,000.00
13-DM-H1	LWD & Riparian Planting at Deschutes RM 21	LWD placement, sediment reduction, salmon refuge restoration, riparian buffer restoration, increase off-channel connectivity on 250 acres.	Deschutes Lower	Thurston County	$500,000.00
13-DM-H2	Deschutes RM 33 LWD Placement	Restore the aquatic habitats on approximately 1,500 linear feet of river channel in the reach by increasing the amount of large woody debris, re-establishing native riparian forest and creating in-stream complexity.	Deschutes Lower	City of Tumwater	$400,000.00
13-DM-H3	Middle Deschutes Habitat Conservation (phased(	Restoration of 144 acres, 4,300 feet of the Deschutes River, and 1,600 feet of Silver Creek to protect habitat for Chinook Salmon, Coho Salmon, Chum Salmon, steelhead, and cutthroat trout.	Deschutes Lower	CLT	$700,000.00
13-DM-H4	Deschutes River Catalog	Project development in the middle Deschutes, in coordination with other projects.	Deschutes Middle	SPSSEG	$120,000.00

Project Number	Project Name	Description	Subbasin	Sponsor	Estimated Cost[49]
13-DM-H5	Deschutes Trib Restoration	Identify, prioritize and provide designs for actions that project and restore wetland and stream complex.	Deschutes Middle	SPSSEG	$145,000.00
13-JP-H1	Harmony Farms Riparian Restoration	Restore ecosystem function and process to 55 aces and 4,800 feet of shoreline by removing numerous derelict structures and associated infrastructure, addressing invasive plant infestations and replanting with native vegetation to create a forested nearshore riparian buffer.	Deschutes Middle	CLT	$1,400,000.00
13-WRIA-H1	Floodplain restoration	Floodplain restoration opportunities in several subbasins o rehabilitate natural hydrologic and geomorphic processes that are provided by floodplain connectivity.	Deschutes Middle	SPSSEG	$1,000,000.00
13-M-H1	East Fork McLane Creek Fish Passage Project	Restore 1 mile of habitat through replacement of fish blockage.	Deschutes Middle	Wild Fish Conservancy	$130,000.00
13-S-H1	Spurgeon Creek Re-meander	Channel re-alignment to increase channel length and sinuosity on 2,244 feet of Chambers Creek. Native plantings on 0.75 acres.	Johnson Point	CLT	$1,000,000.00



Map No.	Project Number	Project Name
1	13-BH-H1	Woodard Creek
2	13-BH-H2	Gull Harbor Culvert
3	13-BH-H3	Zangle Cove Bulkhead Removal
4	13-CP-H1	The Evergreen State College Bulkhead Removal
5	13-CP-H2	Butler Cove Estuary Connectivity Project
6	13-CP-H3	Windolph Culvert Replacement
7	13-CP-H4	French Road Culvert
8	13-DL-H1	Chambers Creek
9	13-DL-H2	Pioneer Park Restoration
10	13-DL-H3	Shermer Lane Restoration
11	13-DM-H1	LWD & Riparian Planting at Deschutes RM 21
12	13-DM-H2	Deschutes RM 33 LWD Placement
13	13-DM-H3	Middle Deschutes Habitat Conservation, phased
14	13-DM-H4	Deschutes River Catalog
15	13-DM-H5	Deschutes Trib Restoration
16	13-JP-H1	Harmony Farms Riparian Restoration
17	13-WRIA-H1	Floodplain restoration
18	13-M-H1	East Fork McLane Creek Fish Passage Project
19	13-S-H1	Spurgeon Creek Re-meander

Figure 6: WRIA 13 Habitat Projects by Subbasin. Map prepared by GeoEngineers.

5.5 Project Implementation Summary

5.5.1 Summary of Projects and Benefits

Per RCW 90.94.030(3), this watershed plan must include actions necessary to offset potential impacts to instream flows associated with new PE well water use and result in a net ecological benefit to instream resources within the WRIA.

As specified in Chapter 4, this watershed plan estimates 434 AFY of new consumptive use from new PE wells over the planning horizon. The plan includes 6 water offset projects and project types to offset consumptive use (Table 7). These projects provide a total potential estimated water offset of 1,801 AFY, which exceeds the consumptive use offset need for the WRIA.

This watershed plan also identifies habitat benefiting projects. The ecological and streamflow benefits from habitat projects are supplemental to the quantified water offsets required by RCW 90.94.030.

5.5.2 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 consumptive use from new domestic PE wells over the subsequent twenty years. To satisfy this requirement, this watershed plan includes planning-level cost estimates for each of the water offset projects listed in Table 7. The watershed plan also includes costs estimates for habitat projects in Table 8. Details on known costs for individual projects are provided in the project summaries above.

The total estimated cost for implementing the water offset projects listed and described in this chapter range is $17.34 million, with projects ranging from $2.8 million to $6.31 million.

The total estimated cost for implementing the habitat projects listed and described in this chapter is $11.2 million.

5.5.3 Certainty of Implementation

Certainty of implementation depends on many factors, including identification and support of project sponsors, readiness to proceed and implement the project, and identification of potential barriers to completion.

Several types of water offset projects are included in this plan, such as water storage and, stream augmentation. These types of projects have been successfully implemented within Washington and the technology to implement these types of projects is proven. Each of the water offset projects listed in Table 7 have likely project sponsors who have experience implementing these types of projects and are ready to proceed with project development. If the water offset projects included in the plan are implemented, they will provide benefits during the planning horizon (2018-2038).

The habitat projects included in the plan, if funded, are expected to be implemented within the planning horizon. All habitat projects have project sponsors with experience implementing habitat restoration and acquisition projects.

Chapter Six: Determination of Net Ecological Benefit

6.1 Overview

Watershed Restoration and Enhancement Plans must identify projects and actions to offset the potential consumptive impacts of new permit-exempt domestic groundwater withdrawals on instream flows over the planning horizon and provide a net ecological benefit to the WRIA. The Final NEB Guidance establishes Ecology's interpretation of the term "net ecological benefit" as "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" (Ecology 2019b). This chapter provides Ecology's analysis of the WRIA 13 watershed plan's reasonable assurance in meeting NEB.

6.2 Net Ecological Benefit Analysis

The WRIA 13 watershed plan provides a path forward for offsetting an estimated 434 AFY of new consumptive water use in WRIA 13. The watershed plan primarily achieves this offset through 6 water offset projects and project types with a total estimated offset potential of 1,801 AFY. This total offset yields a potential surplus offset of 1,366 AFY above the 434 AFY consumptive use estimate. This plan also includes 19 habitat projects, which provide numerous additional benefits to aquatic and riparian habitat. The ecological and streamflow benefits from these habitat projects are supplemental to the quantified water offset projects and will contribute to achieving a NEB.

6.2.1 Review of PE Well Projection and Consumptive Water Use Estimate

This plan divides WRIA 13 into 9 subbasins (see Figure 2), then distributes the number of projected PE wells across the subbasins based on historic building trends.

This plan projects 2,616 new PE wells installed in WRIA 13 over the planning horizon. Based on this projection, the plan estimates 434 AFY of new consumptive water use from new PE wells in WRIA 13.

The method for estimating outdoor water use (outlined in Ecology's NEB Guidance) was designed to be protective of instream resources. The outdoor water use component was based on the assumption that every new PE well homeowner will water their lawn at rates equal to those of commercial turf grass in the Washington Irrigation Guide (NRCS-USDA 1997). Commercial turf grass irrigation rates are much higher than typical domestic applications. Therefore, Ecology considers 434 AFY a conservative estimate of consumptive water use.

6.2.2 Quantity and Spatial Distribution of Water Offset Project Benefits

Table 10 provides a summary of the 6 water offset projects and project types listed in the plan to offset consumptive use and contribute toward achieving NEB in WRIA 13. The potential water offset total of these projects is 1,801 AFY, a potential surplus of 1,366 AFY above the consumptive use estimate. Therefore, at the WRIA scale the plan will lead to offset amounts that exceed the consumptive use impacts.

At a subbasin scale when comparing estimated consumptive water use to projected water offset amounts, surpluses are projected in 4 subbasins (Deschutes Lower, Deschutes Middle, Deschutes Upper, and Woodland Creek), and deficits are projected in 5 subbasins (Boston Harbor, Cooper Point, Johnson Point, McLane, and Spurgeon Creek) (Table 11). However, the projected benefit amounts are large in subbasins where projected benefits exceed projected consumptive use, (193 to 632 AFY), and the deficits are much smaller in subbasins where the projected benefits are less than projected consumptive use (-86 to -15 AFY).

It is also worth noting that placement of flow benefits from the water-offset projects is strategic in terms of benefitting salmonids in the watershed. Seepage back to the Deschutes River during the summer and early fall from the Schneider's Prairie project and the Deschutes River MAR projects could provide cool water and increase flows in the Deschutes Lower and Deschutes Middle subbasins, which would improve valuable Coho and Steelhead juvenile habitat. A subbasin such as Johnson Point, on the other hand, has limited salmonid habitat, so the predicted 86 AFY water offset deficit there is not as critical. And McLane Creek is yet a third case, where the subbasin does have high habitat value and has no water or habitat projects, but the predicted water deficit is much smaller (-27 AFY).

If funded, Ecology expects projects will be implemented within the planning horizon and provide benefits beyond the planning horizon and as long as new PE well use continues. Ecology finds that the offset amounts are reasonable, and that these projects, once implemented, will meet the requirements of RCW 90.94.030.

Table 10. Summary of WRIA 13 Water Offset Projects included in NEB analysis

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (AFY)
Schneider's Prairie Off-Channel Connection	Off-channel reconnection and infiltration	Lower Deschutes	681
Hicks Lake Stormwater Retrofit	Stormwater infiltration in series with existing stormwater treatment	Woodland	296
Donnelly Drive Infiltration	Improve neighborhood stormwater infiltration, avoiding surcharge and runoff to Chambers ditch.	Lower Deschutes	14
Deschutes/ Chambers MAR	Several candidate locations for MAR of diverted Deschutes River water from high flow periods, exceeding instream minimum flows or ecological flows.	Upper Deschutes Middle Deschutes Lower Deschutes Woodland Boston Harbor Cooper Point	810
Small-scale LID Project Development	Programmatic project to implement green stormwater infiltration facilities in urban and rural areas.	WRIA-wide	n/a
Water Rights Opportunities	A focused WRIA-wide analysis on potential WR efficiencies and acquisition for future studies and implementation	Johnson Point Deschutes Middle Deschutes Lower Woodland Creek	n/a
		Total	**1,801**

Table 11 provides a summary of estimated water offset and consumptive use by subbasin, including surplus and deficit amounts.

Table 11. Subbasin Water Offset Totals compared to Subbasin Consumptive Use Estimate

Subbasin	Offset Project Totals (AFY)	Consumptive Use (AFY)	Surplus/Deficit (AFY)
Boston Harbor	0	49	-49
Cooper Point	18	39	-21
Deschutes Lower	695	63	+632
Deschutes Middle	594	122	+472
Deschutes Upper	198	5	+193
Johnson Point	0	86	-86
McLane	0	27	-27
Spurgeon Creek	0	15	-15
Woodland Creek	296	28	268
WRIA 13 Total	**1,801**	**434**	**+1,367**

The water offset projects provide additional benefits to instream resources beyond those necessary to offset the impacts from new consumptive water use within the WRIA. These additional benefits for the project types planned in WRIA 13 include the following:

- Schneider's Prairie Off-Channel Connection project: capture high flows in the Deschutes River November – April; augmenting low-flow season groundwater baseflow discharge, cooling river water during summer months, and increasing summer low flows. This project would also provide valuable off-channel habitat for juvenile salmonids and other aquatic life, with fish ingress and egress.
- Hicks Lake, Donnelly Drive and small-scale LID stormwater storage projects: capture high flows occurring during rain events, reducing flooding and erosion; augment groundwater baseflow discharge to streams, cooling surface waters during summer months and increasing summer low flows. Also, the Hicks Lake stormwater retrofit project would provide water offsets not just to Hicks Lake, but also Pattison and Long Lakes, and downstream Woodland Creek.

- MAR projects: Aquatic habitat improvements during key seasonal periods; increased groundwater recharge; reduction in summer/fall stream temperature; increased groundwater availability to riparian and nearshore plants; and beneficial use of reclaimed water.
- 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 (if applicable).

6.2.3 Quantity and Spatial Distribution of Habitat Project Benefits

The watershed plan presents a suite of 19 habitat projects that will provide ecological benefits to the watershed beyond those necessary to offset the impacts from new consumptive water use. Habitat improvement tactics associated with these projects include a combination of aquatic habitat restoration, riparian vegetation plantings, land acquisition, large woody debris installation, fish access, nearshore restoration and beaver habitat mapping and protection. Many of the habitat improvement projects include more than one of these elements. Project descriptions are summarized in Table 12.

These projects target the salmonid habitat limiting factors identified for this watershed. Benefits include increase channel length and sinuosity, protection of upland forest cover and riparian forest, restoration of floodplain and wetland habitats, removal of fish passage barriers, wood placement, and improved spawning and rearing habitat, among other benefits (see Table 12). Some of these habitat projects have potential streamflow benefits, but those quantities were not estimated due to uncertainties regarding magnitude, reliability, and timing of streamflow benefits.

All 19 of the habitat projects have identified project sponsors, and if funded, are expected to be implemented within the planning horizon.

Table 12. Summary of WRIA 13 Habitat Improvement Projects included in NEB Analysis

Project Number	Project Name	Project Short Description	Subbasin	Benefits with Quantifiable Metric	Habitat Limiting Factor(s) Addressed
13-BH-H1	Woodard Creek	Increase channel sinuosity and length, increase instream habitat complexity and channel roughness.	Boston Harbor	• TBD	• Channel and streambed degradation
13-BH-H2	Gull Harbor Culvert	Removal of total barrier culvert on the east side of Budd Inlet	Boston Harbor	• TBD	• Fish passage barriers • Channel and streambed degradation
13-BH-H3	Zangle Cove Bulkhead Removal	Nearshore restoration to remove 195 linear feet of shoreline armor, restoration, and invasive plant removal.	Boston Harbor	• 195 feet of shoreline	• Degradation of shoreline habitats

Project Number	Project Name	Project Short Description	Subbasin	Benefits with Quantifiable Metric	Habitat Limiting Factor(s) Addressed
13-CP-H1	The Evergreen State College Bulkhead Removal	Removal of 210 linear feet of bulkhead at The Evergreen State College. Shoreline restoration at the mouth of Snyder Creek - remove existing bulkhead, inclusive of revegetation. Project formerly known as Squaw Point.	Cooper Point	• 210 feet of shoreline	• Degradation of shoreline habitats
13-CP-H2	Butler Cove Estuary Connectivity Project	Remove series of derelict fish rearing ponds, replace fish passage, restore salmon refuge habitat.	Cooper Point	• TBD	• Fish passage barriers • Channel and streambed degradation
13-CP-H3	Windolph Culvert Replacement	Removal of total barrier culvert on the west side of Budd Inlet	Cooper Point	• TBD	• Fish passage barriers • Channel and streambed degradation

Project Number	Project Name	Project Short Description	Subbasin	Benefits with Quantifiable Metric	Habitat Limiting Factor(s) Addressed
13-CP-H4	French Road Culvert	Removal of total barrier culvert on the west side of Budd Inlet	Cooper Point	• TBD	• Fish passage barriers • Channel and streambed degradation
13-DL-H1	Chambers Creek	2,224 feet of channel re-alignment to increase channel length and sinuosity at the confluence with Chambers Ditch.	Deschutes Lower	• 2,224 feet of stream	• Channel and streambed degradation
13-DL-H2	Pioneer Park Restoration	Restore riparian vegetation for complexity and to slow fine sediment erosion into the system.	Deschutes Lower	• TBD	• Channel and streambed degradation • Loss of riparian forest
13-DL-H3	Shermer Lane Restoration	LWD placement, sediment reduction, 100 ft. riparian planting, shoreline restoration on 250 acres.	Deschutes Lower	• 1,900 feet of shoreline • 100 feet of riparian planning • 22 acres conservation	• Channel and streambed degradation • Loss of riparian forest • Loss of wetland and shoreline habitats

Project Number	Project Name	Project Short Description	Subbasin	Benefits with Quantifiable Metric	Habitat Limiting Factor(s) Addressed
13-DM-H1	LWD & Riparian Planting at Deschutes RM 21	LWD placement, sediment reduction, salmon refuge restoration, riparian buffer restoration, increase off-channel connectivity on 250 acres.	Deschutes Middle	• 250 acres conservation	• Channel and streambed degradation • Loss of riparian forest • Loss of wetland and shoreline habitats
13-DM-H2	Deschutes RM 33 LWD Placement	Restore the aquatic habitats on approximately 1,500 linear feet of river channel in the reach by increasing the amount of large woody debris, re-establishing native riparian forest and creating in-stream complexity.	Deschutes Middle	• 1,500 feet of stream	• Channel and streambed degradation • Loss of riparian forest • Loss of wetland and shoreline habitats

Project Number	Project Name	Project Short Description	Subbasin	Benefits with Quantifiable Metric	Habitat Limiting Factor(s) Addressed
13-DM-H3	Middle Deschutes Habitat Conservation, phased	Restoration of 144 acres, 4,300 feet of the Deschutes River, and 1,600 feet of Silver Creek to protect habitat for Chinook Salmon, Coho Salmon, Chum Salmon, steelhead, and cutthroat trout.	Deschutes Middle	• 5,900 feet of stream • 144 acres restoration	• Channel and streambed degradation • Loss of riparian forest • Loss of wetland and shoreline habitats
13-DM-H4	Deschutes River Catalog	Project development in the middle Deschutes, in coordination with other projects.	Deschutes Middle	• TBD	• Channel and streambed degradation • Loss of riparian forest • Loss of wetland and shoreline habitats • Loss of upland forest cover • Fish passage barriers • Loss of floodplain connectivity and habitats

Project Number	Project Name	Project Short Description	Subbasin	Benefits with Quantifiable Metric	Habitat Limiting Factor(s) Addressed
13-DM-H5	Deschutes Trib Restoration	Identify, prioritize and provide designs for actions that protect and restore wetland and stream complexity	Deschutes Middle	• TBD	• Channel and streambed degradation • Loss of riparian forest • Loss of wetland and shoreline habitats • Loss of upland forest cover • Fish passage barriers • Loss of floodplain connectivity and habitats

Project Number	Project Name	Project Short Description	Subbasin	Benefits with Quantifiable Metric	Habitat Limiting Factor(s) Addressed
13-JP-H1	Harmony Farms Riparian Restoration	Restore ecosystem function and process to 55 aces and 4,800 feet of shoreline by removing numerous derelict structures and associated infrastructure, addressing invasive plant infestations and replanting with native vegetation to create a forested nearshore riparian buffer.	Johnson Point	• 4,800 feet of shoreline	• Loss of riparian forest • Loss of wetland and shoreline habitats • Loss of upland forest cover

Project Number	Project Name	Project Short Description	Subbasin	Benefits with Quantifiable Metric	Habitat Limiting Factor(s) Addressed
13-WRIA-H1	Floodplain restoration	Floodplain restoration opportunities in several subbasins o rehabilitate natural hydrologic and geomorphic processes that are provided by floodplain connectivity.	Johnson Point, Boston Harbor, Deschutes Lower, Deschutes Middle	• TBD	• Channel and streambed degradation • Loss of floodplain connectivity and habitats • Loss of riparian forest
13-M-H1	East Fork McLane Creek Fish Passage Project	Restore 1 mile of habitat through replacement of fish blockage.	McLane	• 5,280 feet of stream	• Channel and streambed degradation • Fish passage barriers
13-S-H1	Spurgeon Creek Re-meander	Channel re-alignment to increase channel length and sinuosity on 2,244 feet of Chambers Creek. Native plantings on 0.75 acres.	Spurgeon	• 2,224 feet of stream • 0.75 acres restoration	• Channel and streambed degradation • Loss of floodplain connectivity and habitats • Loss of riparian forest

Projects will protect over 472 acres of wetland, floodplain area, and other habitats for fish and wildlife. Also, over 24,000 feet along the streams will potentially be protected or restored. Protects will restore riparian areas and other habitats, and improve water quality. These benefits will contribute to improving habitat for multiple salmonid species. Projects are spread throughout the WRIA and the stream systems, providing benefits for different life stages of salmonid.

The habitat projects and benefits are well distributed throughout the watershed and will contribute to improving conditions for multiple salmonid species. Habitat projects are proposed in 7 of the 9 subbasins, with the Deschutes Upper and Woodland Creek subbasins not having any sponsored projects at the time of this watershed plan development (see Table 13). Five of the subbasins with proposed habitat projects (Boston Harbor, Cooper Point, Johnson Point, McLane and Spurgeon) are projected to experience water-offset deficits. Contributions toward ecological health during key seasonal periods from habitat projects at these locations will partially compensate for the predicted PE well-pumping effects in those subbasins.

Table 13. Summary of Habitat Projects by Subbasin

Subbasin	Habitat Projects	Benefiting Streams
Boston Harbor	13-BH-H1, 13-BH-H2, 13-BH-H3, 13-WRIA-H1	Woodard Creek
Cooper Point	13-CP-H1, 13-CP-H2, 13-CP-H3, 13-CP-H4	Snyder Creek
Deschutes Lower	13-DL-H1, 13-DL-H2, 13-DL-H3, 13-WRIA-H1	Chambers Creek, Shermer Creek, Deschutes River
Deschutes Middle	13-DM-H1, 13-DM-H2, 13-DM-H3, 13-DM-H4, 13-DM-H5, 13-WRIA-H1	Deschutes River
Deschutes Upper	n/a	n/a
Johnson Point	13-JP-H1, 13-WRIA-H1	Henderson Inlet
McLane	13-M-H1	McLane Creek
Spurgeon Creek	13-S-H1	Spurgeon Creek
Woodland Creek	n/a	n/a

6.2.4 Watershed Characterization Analysis

Ecology compared the spatial distribution of the watershed plan's water offset and habitat projects against the freshwater habitat index from the Puget Sound Watershed Characterization Project (Wilhere et. al. 2013), which is discussed in Chapter 2.2.

This comparison shows the relationship between projects in the watershed plan and the general state of salmon habitat in the watershed. Figure 7 shows the project locations with respect to the freshwater habitat index in WRIA 13. Red on the map indicates lower-valued habitat, yellow for moderate-valued habitat, and green for higher-valued habitat. The project map symbols correspond with those in Figures 5 and 6, with circles indicating water offset projects listed in Table 10 and squares indicating habitat projects listed in Table 12.

As is evident on Figure 7, this watershed plan's water offset and habitat projects are located in areas with relatively higher-valued habitat (green and yellow), which means that projects are more likely to benefit fish and other instream resources. This provides added assurance that the watershed plan will result in a NEB.

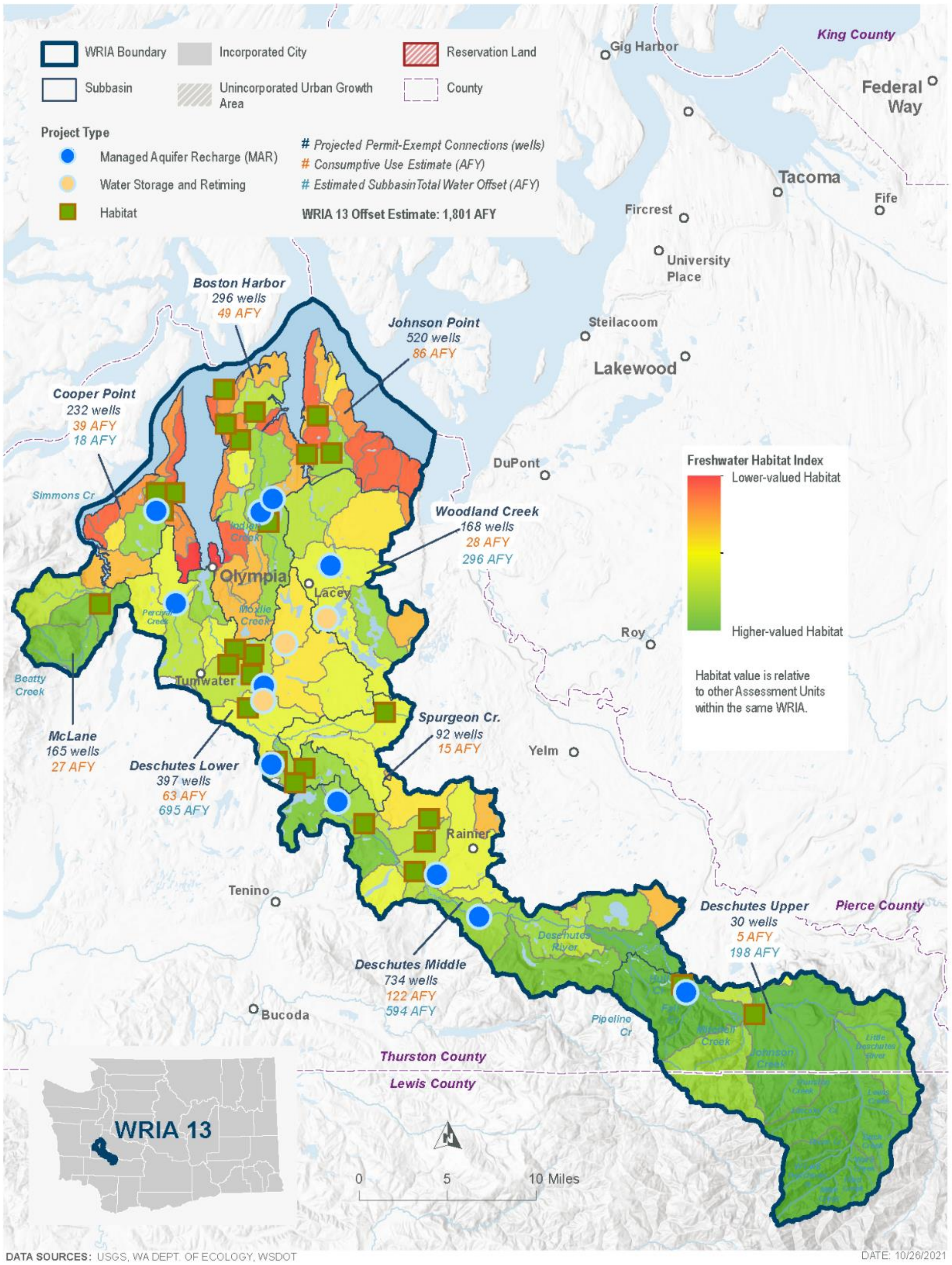


Figure 7. Map of Plan Project locations overlain on WDFW Assessment Unit Habitat Indices. Map prepared by GeoEngineers.

6.3 Uncertainty and Adaptive Management

There is uncertainty associated with all of the analyses presented in the plan – including the projected number of new PE wells, the consumptive use estimates, the water offset benefits from the proposed projects, and the likelihood that all projects will be implemented and maintained. In addition, external factors like climate change and human migration patterns could influence the projections and estimates in this plan. Ecology relied on data available at the time of writing this plan and is transparent in the assumptions used in the analyses. Because of the large surplus in the projected water offset, if some offset projects are not developed or benefits are less than expected, a subset of projects can still provide sufficient water to offset the estimated new consumptive use.

Ecology and the state of Washington are invested in the implementation of this watershed plan, including periodically assessing plan and project implementation and issuing competitive grants to local projects that demonstrably implement this plan while benefiting streamflows and aquatic habitat. As required by RCW 90.94.050, Ecology will also prepare and deliver a report to the legislature in 2027 that includes:

- watershed planning progress under this law;
- a description of current and potential program projects, costs, and expenditures;
- an assessment of the benefits from projects;
- a listing of other directly related efforts; and
- the total number of, and estimates of consumptive water use impacts associated with new withdrawals exempt from permitting under each WRIA by this law.

Ecology also acknowledges and supports the importance of adaptively managing the implementation of any-plan that covers a 20-year planning horizon. Ecology's periodic plan and project implementation assessments coupled with the availability of hundreds of millions of state appropriated dollars in competitive grant funding provide important catalysts for the necessary local action needed to coordinate project implementation and any associated adaptive management necessary as new information or changed circumstances arise. During the WRIA 13 Committee process, the Committee proposed a number of recommendations for adaptive management, which are provided for reference purposes in Appendix F.

6.4 NEB Determination

This watershed plan identifies 6 projects and project types to offset 434 AFY of potential consumptive impacts from new permit-exempt domestic groundwater withdrawals on instream flows over 20 years (2018 – 2038), and provide a net ecological benefit to the watershed. The watershed plan provides a surplus of 1,366 AFY in water offset benefits from 6 water offset projects and project types. Although flow improvements are concentrated in just 4 of the 9 subbasins, flow improvements there are quite large in comparison to the projected deficits for the remaining 5 subbasins. Additionally, Ecology finds that when comparing those subbasins affected by either water surpluses or water deficits, higher value fish habitat would experience surplus amounts and that additional water will benefit a much larger population of fish.

Nineteen habitat projects provide additional ecological and streamflow benefits that contribute to achieving a net ecological benefit at the WRIA scale. The surplus water offset and habitat improvement projects provide reasonable assurance that the plan will adequately offset new consumptive use from PE wells anticipated during the planning horizon and achieve a net ecological benefit.

There is uncertainty associated with all of the analyses presented in the plan; however, due to the large surplus in projected water offsets, if some projects are not developed or benefits are less than expected, a subset of these will still provide sufficient water to offset the estimated new consumptive use.

Based on the information and analyses summarized in this plan, Ecology finds that this WRIA 13 watershed plan, if implemented, would achieve a net ecological benefit, as required by RCW 90.94.030 and defined by the Final NEB Guidance (Ecology 2019b).

Appendices

WRIA 13 Deschutes Watershed

The following appendices are linked to this report as an Appendices file at:

https://apps.ecology.wa.gov/publications/SummaryPages/2211015.html

Appendix A – References

Appendix B – Glossary

Appendix C – Committee Roster

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

Appendix E – Regional Aquifer Units within WRIA 13

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

Appendix G – Subbasin Delineation Memo

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

Appendix I – Detailed Project Descriptions

Appendix J – HDR Project Technical Memos