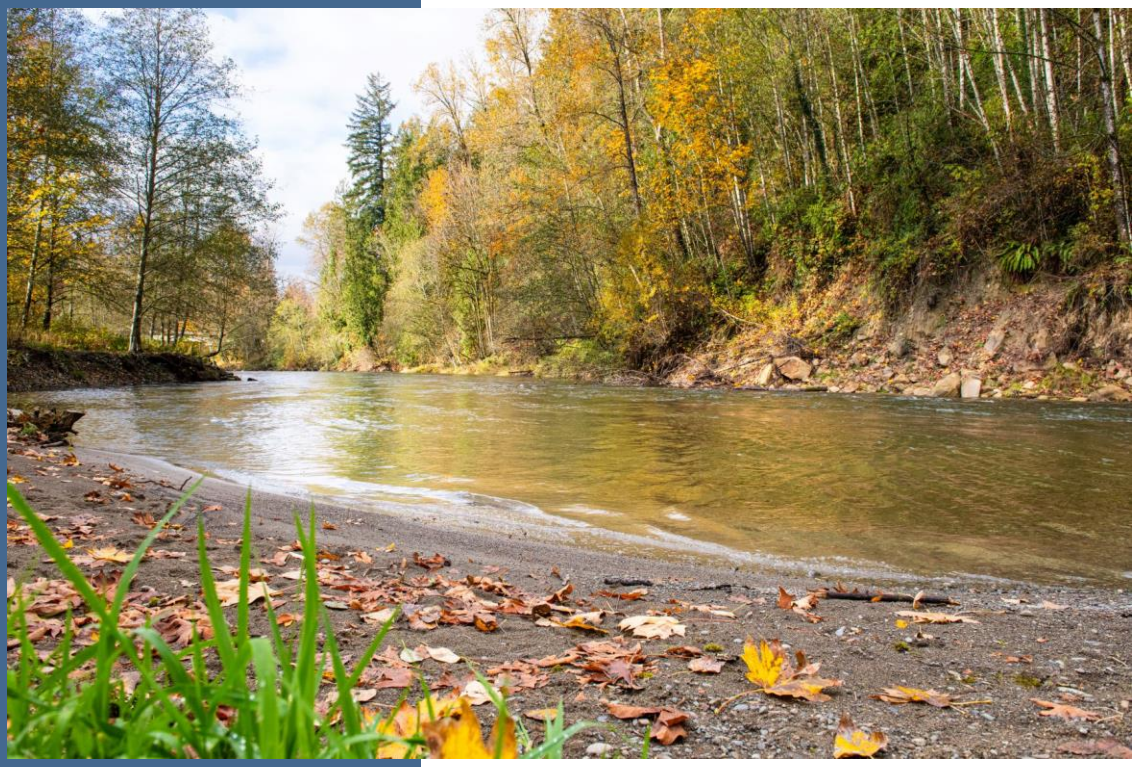

Watershed Restoration and Enhancement Plan
WRIA 8 – Cedar Sammamish Watershed

Final Draft Plan
November 2020

DEPARTMENT OF ECOLOGY
State of Washington

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Acronyms

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

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Executive Summary

In January 2018, the Washington State Legislature passed the Streamflow Restoration law (RCW 90.94). The law clarifies how local governments issue building permits for homes intending to use a permit-exempt well for their domestic water supply and requires local watershed planning in 15 water resource inventory areas (WRIAs), including the Cedar-Sammamish watershed (WRIA 8). The law directs the Department of Ecology to lead Watershed Restoration and Enhancement Committees to develop Watershed Restoration and Enhancement Plans (watershed plans). Watershed plans must estimate the potential consumptive impacts of new permit-exempt domestic groundwater withdrawals on instream flows over 20 years (2018-2038), identify projects and actions to offset those impacts, and provide a net ecological benefit to the WRIA. This Watershed Restoration and Enhancement Plan meets the requirements of the law.

The Department of Ecology (Ecology) established the Cedar-Sammamish (WRIA 8) Watershed Restoration and Enhancement Committee (Committee) in October 2018 and invited representatives from the following entities in the watershed to participate: tribal governments, county governments, city governments, Department of Fish and Wildlife, the largest non-municipal water purveyor, and interest groups. The WRIA 8 Committee met for over 2 years to develop a watershed plan.

Ecology issued the Final Guidance on Determining Net Ecological Benefit (Final NEB Guidance) (Ecology 2019) to ensure consistency, conformity with state law, and transparency in implementing RCW 90.94. The Final NEB Guidance describes the minimum planning requirements: include clear and systematic logic, delineate subbasins, estimate new consumptive water use, evaluate impacts of new consumptive water use, and describe and evaluate projects and actions for their offset potential.

The WRIA 8 Committee divided WRIA 8 into 12 subbasins for purposes of assessing consumptive use and project offsets, as shown in Figure ES.1.

The WRIA 8 Committee projects that a total of 967 new PE wells will be installed within WRIA 8 during the 20-year planning horizon. The WRIA 8 Committee used this 20-year PE well projection to estimate 425.4 acre-feet per year (AFY) (0.59 cfs) of new consumptive water use in WRIA 8 that this watershed plan must address and offset.

The WRIA 8 Committee sought projects to offset at least 698.9 acre-feet of water per year (offset target). The offset target accounts for uncertainties in the PE well projection and consumptive use estimate, including higher rates of water use that could result from climate change and changing development patterns, as well as uncertainty regarding magnitude, duration, and timing of project benefits. The WRIA 8 Committee used the consumptive use scenario that assumes all homes use the legal withdrawal limit of 950 gpd per PE well connection to develop the water offset target.

The watershed plan includes nine water rights acquisitions projects and two reclaimed water managed aquifer recharge projects to offset consumptive use. If implemented, these 11 water

offset projects will provide an estimated offset of 1,762.18 AFY and exceed the offset target. A total of 25 habitat projects are included in the watershed plan. Ecological benefits associated with these projects vary and include floodplain restoration, wetland reconnection, availability of off-channel habitat for juvenile salmonids, reduction in peak flow during storm events, increase in groundwater levels and baseflow, and increase in channel complexity. The ecological and streamflow benefits from habitat projects are supplemental to the quantified water offsets and contribute to achieving a net ecological benefit.

The WRIA 8 Committee also included what they have termed "policy and regulatory recommendations" in the plan to show support for programs, policies, and regulatory actions that would contribute to the goal of streamflow restoration.

The WRIA 8 Committee has recommended adaptive management measures in the plan for the purpose of addressing uncertainty in plan implementation. Adaptive management measures include PE well tracking, project implementation tracking, and periodic watershed plan implementation reporting, with recommended adjustments to the plan. These measures, in addition to the surplus water offset and supplemental habitat improvement projects, provide reasonable assurance that the plan will adequately offset new consumptive use from PE wells anticipated during the planning horizon.

Based on the information and analyses summarized in this plan, the WRIA 8 Committee finds that the suite of projects in this plan, if successfully implemented, would achieve a net ecological benefit, as required by RCW 90.94.030 and defined by the Final NEB Guidance (Ecology 2019).

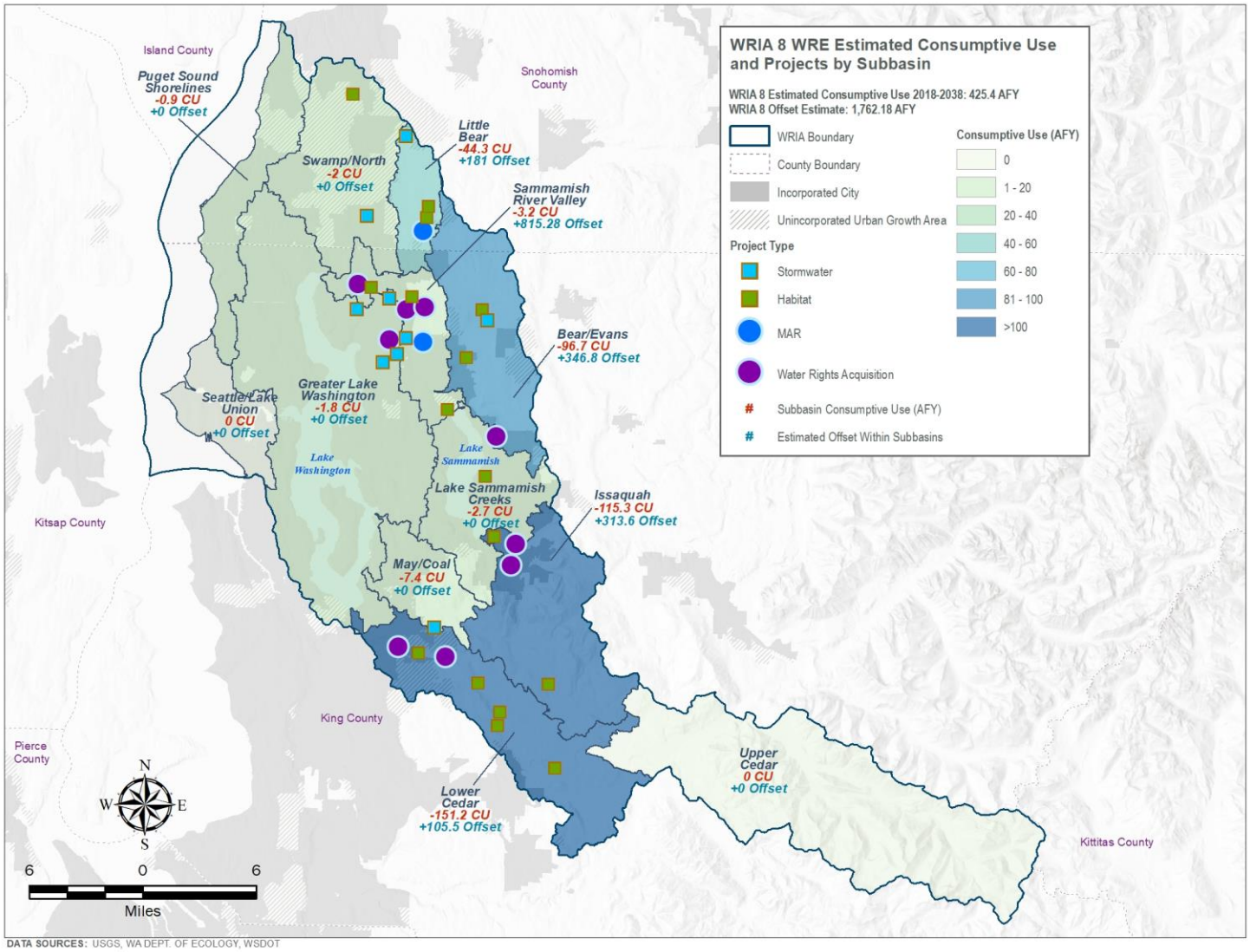


Figure ES.1: WRIA 8 Estimated Consumptive Use and Projects by Subbasin

Chapter One: Plan Overview

1.1 Plan Purpose and Structure

The purpose of the Water Resource Inventory Area (WRIA) 8 Watershed Restoration and Enhancement Plan is to offset the impacts of permit-exempt domestic wells to streamflows. The plan is one requirement of RCW 90.94.030. The law clarifies how local jurisdictions issue building permits for homes that use a permit-exempt well for a water source. Watershed Restoration and Enhancement Plans (watershed plans) must estimate the potential consumptive impacts of new permit-exempt domestic groundwater withdrawals on instream flows over 20 years (2018-2038), identify projects and actions to offset those impacts, and provide a net ecological benefit to the WRIA. The law requires that local watershed planning take place in 15 WRIAs across the state, including in the Cedar-Sammamish watershed (WRIA 8). The WRIA 8 Watershed Restoration and Enhancement Plan is coordinated with priorities for salmon recovery and watershed recovery, while ensuring it meets the intent of the law.

Pumping from wells can reduce groundwater discharge to springs and streams by capturing water that would otherwise have discharged naturally, reducing flows. 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). Projects and actions to offset new consumptive water use associated with permit-exempt domestic wells have become a focus to minimize future impacts to instream flows and restore streamflows.

[COMMENT: *the following paragraph is language to include if the Committee votes to approve the final plan*]. While this watershed plan is narrow in scope and is not intended to address all water uses or related issues within the watershed, successful completion of the plan by the WRIA 8 Watershed Restoration and Enhancement Committee (Committee) represents a noteworthy achievement regarding a technically and politically complex issue.

This watershed plan is divided into 7 Chapters:

1. Overview of the plan purpose and scope and plan development process;
2. Overview of the watershed, including land use and salmon presence, other planning efforts, hydrology and hydrogeology;
3. Summary of the subbasins;
4. Permit-exempt well projections and consumptive water use estimates;
5. Description of the recommended projects and actions identified to offset future permit-exempt domestic water use in WRIA 8;
6. Explanation of recommended policy, adaptive management and implementation measures; and

7. Evaluation and consideration of the net ecological benefits.

1.1.1 Legal and Regulatory Background for the WRIA 8 Watershed Restoration and Enhancement Plan

In January 2018, the Washington State Legislature passed Engrossed Substitute Senate Bill (ESSB) 6091 (session law 2018 c 1). This law was enacted in response to the State Supreme Court's 2016 decision in Whatcom County vs. Hirst, Futurewise, et al. (commonly referred to as the "Hirst decision"). As it relates to this Committee's work, the law, now primarily codified as RCW 90.94, clarifies how local governments can issue building permits for homes intending to use a permit-exempt well for their domestic water supply. The law also requires local watershed planning in 15 WRIAs, including WRIA 8.

1.1.2 Domestic Permit-Exempt Wells

This Watershed Restoration and Enhancement Plan, the law that calls for it, and the Hirst decision are all concerned with the effects of new domestic permit-exempt water use on streamflows. Several laws pertain to the management of groundwater permit-exempt wells in WRIA 8 and are summarized in brief here for the purpose of providing context for the WRIA 8 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. It is important to note that 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, these withdrawals of water are subject to the prior appropriations scheme, as are any other water uses. There is still regulatory oversight, including from local jurisdictions. Specifically, in order for an applicant to receive a building permit from their local government for a new home, the applicant must satisfy the provisions of RCW 19.27.097 for what constitutes evidence of an adequate water supply.

RCW 90.94.030 adds to the management regime for new homes using domestic permit-exempt well withdrawals in WRIA 8 and elsewhere. For example, local governments must, among other responsibilities relating to new permit-exempt domestic wells, collect a $500 fee for each building permit and record withdrawal restrictions on the title of the affected properties. Additionally, this law restricts new permit-exempt domestic withdrawals in WRIA 8 to a maximum annual average of 950 gallons per days per connection (which may be curtailed to 350 gallons per day per connection for indoor use only during drought), 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 has published its interpretation and implementation of RCW 19.27.097 and RCW 90.94 in Water Resources POL 2094 (Ecology 2019a). The WRIA 8

Committee directs readers to those laws and policy for comprehensive details and agency interpretations.

1.1.3 Planning Requirements Under RCW 90.94.030

While supplementing the local building permit requirements, RCW 90.94.030(3) goes on to establish the planning criteria for WRIA 8. In doing so, it sets the minimum standard for Ecology's collaboration with the WRIA 8 Committee in the preparation of this watershed plan. In practice, the process of plan development was one of integration, collectively shared work, and a striving for consensus described in the WRIA 8 Committee's adopted operating principles, which are further discussed below and in Appendix D.

In addition to these procedural requirements, the law and consequently this watershed plan, is concerned with the identification of projects and actions intended to offset the anticipated impacts from new permit-exempt domestic groundwater withdrawals over the 20-year planning horizon and provide a net ecological benefit. In establishing the primary purpose of this watershed plan, RCW 90.94.030(3) also details both the required and recommended plan elements. Regarding the WRIA 8 Committee's approach to selecting projects and actions, the law also speaks to "high and lower priority projects." The WRIA 8 Committee understands that, as provided in the Final Guidance on Determining Net Ecological Benefit, "use of these terms is not the sole critical factor in determining whether a plan achieves a NEB…and that plan development should be focused on developing projects that provide the most benefits…regardless of how they align with [these] labels" (Ecology 2019, p. 12). [COMMENT: The following is language to include if appropriate] It is the perspective of the WRIA 8 Committee that this locally approved plan satisfies the requirements of RCW 90.94.030.

1.2 Requirements of the Watershed Restoration and Enhancement Plan

RCW 90.94.030 of the Streamflow Restoration law directs Ecology to establish a Watershed Restoration and Enhancement Committee in the Cedar-Sammamish watershed for the sole purpose of developing a Watershed Restoration and Enhancement Plan (watershed plan) in collaboration with the WRIA 8 Committee. Ecology determined that the intent was best served through collective development of the watershed plan, using an open and transparent setting and process that builds on local needs.

At a minimum, the watershed plan must include projects and actions necessary to offset projected consumptive impacts of new permit-exempt domestic groundwater withdrawals on streamflows and provide a net ecological benefit (NEB) to the WRIA.

Ecology issued the Streamflow Restoration Policy and Interpretive Statement (POL-2094) and Final Guidance on Determining Net Ecological Benefit (GUID-2094) in July 2019 to ensure consistency, conformity with state law, and transparency in implementing RCW 90.94. The Final Guidance on Determining Net Ecological Benefit (hereafter referred to as Final NEB Guidance) establishes Ecology's interpretation of the term "net ecological benefit." It also informs

planning groups on the standards Ecology will apply when reviewing a watershed plan completed under RCW 90.94.020 or RCW 90.94.030. The minimum planning requirements identified in the Final NEB Guidance include the following (Ecology 2019, p. 7-8):

1. Clear and Systematic Logic: Watershed plans must be prepared with implementation in mind.
2. Delineate Subbasins: The committee must divide the WRIA into suitably sized subbasins to allow meaningful analysis of the relationship between new consumptive use and offsets.
3. Estimate New Consumptive Water Uses: Watershed plans must include a new consumptive water use estimate for each subbasins, and the technical basis for such estimate.
4. Evaluate Impacts from New Consumptive Water use: Watershed plans must consider both the estimated quantity of new consumptive water use from new domestic permit-exempt wells initiated within the planning horizon and how those impacts will be distributed.
5. Describe and Evaluate Projects and Actions for their Offset Potential: Watershed plans must, at a minimum, identify projects and actions intended to offset impacts associated with new consumptive water use.

The law requires that all members of the WRIA 8 Committee approve the plan prior to submission to Ecology for review. Ecology must then determine that the plan's recommended streamflow restoration projects and actions will result in a net ecological benefit to instream resources within the WRIA after accounting for projected use of new permit-exempt domestic wells over the 20-year period of 2018-2038.

1.3 Overview of the WRIA 8 Committee

1.3.1 Formation

The Streamflow Restoration law instructed Ecology to chair the WRIA 8 Committee, and invite representatives from the following entities in the watershed to participate:

- Each federally recognized tribal government with reservation land or usual and accustomed harvest area within the WRIA.
- Each county government within the WRIA.
- Each city government within the WRIA.
- Washington State Department of Fish and Wildlife.
- The largest publically-owned water purveyor providing water within the WRIA that is not a municipality.

- The largest irrigation district within the WRIA.[1]

Ecology sent invitation letters to each of the entities named in the law in September of 2018.

The law also required Ecology to invite local organizations representing agricultural interests, environmental interests, and the residential construction industry. Businesses, environmental groups, agricultural organizations, conservation districts, and local governments nominated interest group representatives. Local governments on the WRIA 8 Committee voted on the nominees in order to select local organizations to represent agricultural interests, the residential construction industry, and environmental interests. Ecology invited the selected entities to participate on the WRIA 8 Committee.

The WRIA 8 Committee members are included in Table 1.1. This list includes all of the members identified by the Legislature that agreed to participate on the WRIA 8 Committee.[2]

Table 1.1: WRIA 8 Entities and Membership

Entity Name	**Representing**
King County	County government
Snohomish County	County government
City of Bellevue	City government
City of Bothell	City government
City of Issaquah	City government
City of Kenmore	City government
City of Kent	City government
City of Sammamish	City government
City of Seattle	City government
Muckleshoot Indian Tribe	Tribal government
Snoqualmie Indian Tribe	Tribal government
Tulalip Tribes	Tribal government
Washington Department of Ecology	State agency
Washington Department of Fish and Wildlife	State agency
Alderwood Water and Wastewater District	Water utility
King County Agriculture Program	Agricultural interest
Master Builder Association of King and Snohomish Counties	Residential construction
Center for Environmental Law and Policy	Environmental interest group
WRIA 8 Salmon Recovery Council – ex officio	Salmon Recovery Lead Entity

The WRIA 8 Committee roster with names of representatives and alternates is available in Appendix C.

[1] There are no irrigation districts located in WRIA 8.

[2] The law did not require invited entities to participate, and some chose not to participate on the Committee. The City of Mukilteo withdrew from the Committee in August 2020. The City of Redmond withdrew from the Committee in November 2020.

The WRIA 8 Committee invited the WRIA 8 Salmon Recovery Council to participate as an "ex officio" member. Although not identified in the law, the ex officio members provide valuable information and perspective as subject matter experts. The ex officio members are active but non-voting participants of the WRIA 8 Committee.

1.3.2 Committee Structure and Decision Making

The WRIA 8 Committee held its first meeting in October 2018. Between October 2018 and February 2021 [UPDATE LAST MEETING DATE, IF NEEDED], the WRIA 8 Committee held [ADD NUMBER] committee meetings open to the public. The WRIA 8 Committee met monthly or every other month, and as needed to meet deadlines.

The two and a half years of planning consisted of planning group formation, data gathering, and developing plan components. WRIA 8 Committee members had varying degrees of understanding concerning hydrogeology, water law, salmon recovery, and rural development. Ecology technical staff, WRIA 8 Committee members, and partners presented on topics to provide context for components of the plan.

In addition to playing the role of WRIA 8 Committee chair, Ecology staff provided administrative support and technical assistance, and contracted with consultants to provide facilitation and technical support for the WRIA 8 Committee. The facilitator supported the WRIA 8 Committee's discussions and decision-making. The technical consultants developed products that informed WRIA 8 Committee decisions and development of the plan. The technical consultants developed all of the technical memorandums referenced throughout this plan.

Cities had the option of participating in the Committee through a caucus, with one person attending the Committee meetings as the caucus representative. Bellevue, Bothell, Issaquah, Kenmore, Mukilteo, Redmond, and Sammamish decided to form a cities caucus with the WRIA 8 Salmon Recovery Council representative serving as the caucus representative. The caucus representative's attendance and vote represented the participation and vote of all members of the caucus. The caucus had one collective vote on decisions that did not require approval by all Committee members. For decisions that required approval by all Committee members (adopting or amending the operating principles, final plan approval), each caucus member voted individually.

The WRIA 8 Committee established a technical workgroup to support planning efforts and to achieve specific tasks. The workgroup was open to all WRIA 8 Committee members as well as non-Committee members that brought capacity or expertise to the Committee. The workgroup made no binding decisions, but presented information to the Committee as either recommendations or findings. The WRIA 8 Committee acted on workgroup recommendations, as it deemed appropriate.

During the initial WRIA 8 Committee meetings, members developed and agreed to operating principles.[3] The operating principles set forward a process for meeting, participation

[3] Approved and signed operating principles can be found in Appendix D and on the WRIA 8 Committee webpage.

expectations, procedures for voting, structure of the WRIA 8 Committee, communication, and other needs in order to support the WRIA 8 Committee in reaching agreement on a final plan.

This planning process, by statutory design, brought diverse perspectives to the table. The authorizing legislation requires all members of the Committee to approve the final plan prior to Ecology's review.[4] It was important for the Committee to identify a clear process for how it made decisions. The Committee strived for consensus on interim decisions because consensus on decisions during plan development served as the best indicator of the Committee's progress toward an approved plan. [COMMENT: The following is language to include if appropriate: Consensus was reached on all interim decisions. The chair and facilitator documented agreement and dissenting opinions, as outlined in the Committee's operating principles. The Committee did not make any decisions by two-thirds majority.]

The WRIA 8 Committee reviewed components of the watershed plan and the draft plan on an iterative basis. [COMMENT: The following is language to include if the Committee votes to approve the final plan: Once the WRIA 8 Committee reached initial agreement on the final watershed plan, broader review and approval by the entities represented on the WRIA 8 Committee was sought, as needed. The WRIA 8 Committee reached final agreement on the Watershed Restoration and Enhancement Plan on [THIS DATE] 2021.]

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

Chapter Two: Watershed Overview

2.1 Brief Introduction to WRIA 8

The Cedar-Sammamish watershed is one of the 62 designated major watersheds in Washington State, formed as a result of the Water Resources Act of 1971. The Cedar River historically flowed into the Black River and the Cedar-Sammamish watershed was formed when the Cedar River was diverted into Lake Washington. The Cedar-Sammamish watershed is approximately 692 square miles in area and includes all the lands drained by the Cedar River, the Sammamish River, Lake Washington, and marine nearshore areas that drain directly to Puget Sound. Approximately 85 percent of the watershed is located within King County and the remaining 15 percent is located within Snohomish County. WRIA 8 is bounded on the north by WRIA 7 (Snohomish), on the west by Puget Sound, on the south by WRIA 9 (Duwamish-Green), and on the east by WRIA 39 (Upper Yakima).

The upper Cedar River watershed is the municipal drinking water supply for the City of Seattle and managed under a Habitat Conservation Plan (HCP) (City of Seattle 2000). The upper portion of the Cedar River watershed contains two dams, Masonry Dam and Landsburg Dam, that City of Seattle operates for municipal water supply and hydropower generation. The northwestern portion of the watershed contains the Sammamish River, Lake Washington, Lake Union, and Lake Sammamish. Numerous smaller lakes, ponds, and wetlands are present throughout the watershed. The construction of the Lake Washington Ship Canal, reservoirs, and various flood control projects in the 20th century altered the watershed from its pre-development state (WRIA 8 Steering Committee 2005).

The Cedar River originates in the Cascade Range near Yakima Pass and flows in a generally northwest direction for approximately 51 miles before discharging to the south end of Lake Washington. The mean annual flow in the Cedar River is 679 cubic feet per second (cfs), measured near Renton (U.S. Geological Survey 2020).

The Sammamish River originates at the north end of Lake Sammamish and flows northwest for approximately 14 miles before discharging to the north end of Lake Washington. The mean annual flow in the Sammamish River is 304 cfs, measured near Woodinville (U.S. Geological Survey 2020).

Lake Washington discharges to the Lake Washington Ship Canal, a highly channelized and urbanized waterway that traverses Portage Bay, Lake Union, and Salmon Bay before exiting the Chittenden Locks and entering Puget Sound at Shilshole Bay. Other tributaries within the system include Issaquah Creek, May Creek, Coal Creek, Bear Creek, Evans Creek, Little Bear Creek, Swamp Creek, and North Creek.

2.1.1 Land Use in WRIA 8

The City of Seattle's Cedar River Municipal Watershed covers over 90,000 acres in the eastern or upland portion of the watershed and generally consists of forestland (City of Seattle 2020a). Land uses shift to suburban developments and urban centers such as Maple Valley and Hobart

in the foothills of the Cascade Mountains. Extending from the city of Issaquah to the cities of Bellevue, Redmond, Seattle, and Everett the northwest portion of WRIA 8 is highly urbanized, characterized by a combination of residential, industrial, commercial, transportation, communication, and utility land covers. Over 50 percent of the watershed is within a city or designated urban growth area.

The Cedar-Sammamish watershed is the most heavily populated watershed in Washington. Industry, agriculture, commercial facilities, individual residences, and municipalities compete for a limited water supply, causing a strain on water availability. These out of stream uses compete with instream water needs, including providing water for salmon and other aquatic resources.

2.1.2 Tribal Reservations and Tribal Treaty Rights

WRIA 8 is located within the ancestral homelands of Indian tribes and bands that occupied this area since time immemorial. Tribes hold reserved treaty rights to fish, hunt and gather throughout the watershed (Treaty of Point Elliott). Tribal claims include the earliest (most senior) priority rights to water within the Cedar-Sammamish Watershed. While unquantified, these federally reserved water rights, intended to serve current and future uses, may be reserved by and protected in treaties, executive orders, and federal court decisions. Tribal water rights can extend to instream flows and minimum lake levels necessary to protect resources in all areas where Tribes have reserved rights. Treaty rights to fish can support claims for fish habitat, including instream flows. Nothing in this plan can alter tribal rights.

Indian people have always relied on the natural resources of this land. Their personal, cultural and spiritual survival depended on the ability to fish, hunt and gather the bountiful natural resources that once blessed this country (NWIFC 2014). Salmon are one of those resources that is critical to the cultural, spiritual and economic wellbeing of Tribes. Tribes depend upon salmon that originate from the waters found in the Cedar River and Lake Washington areas.

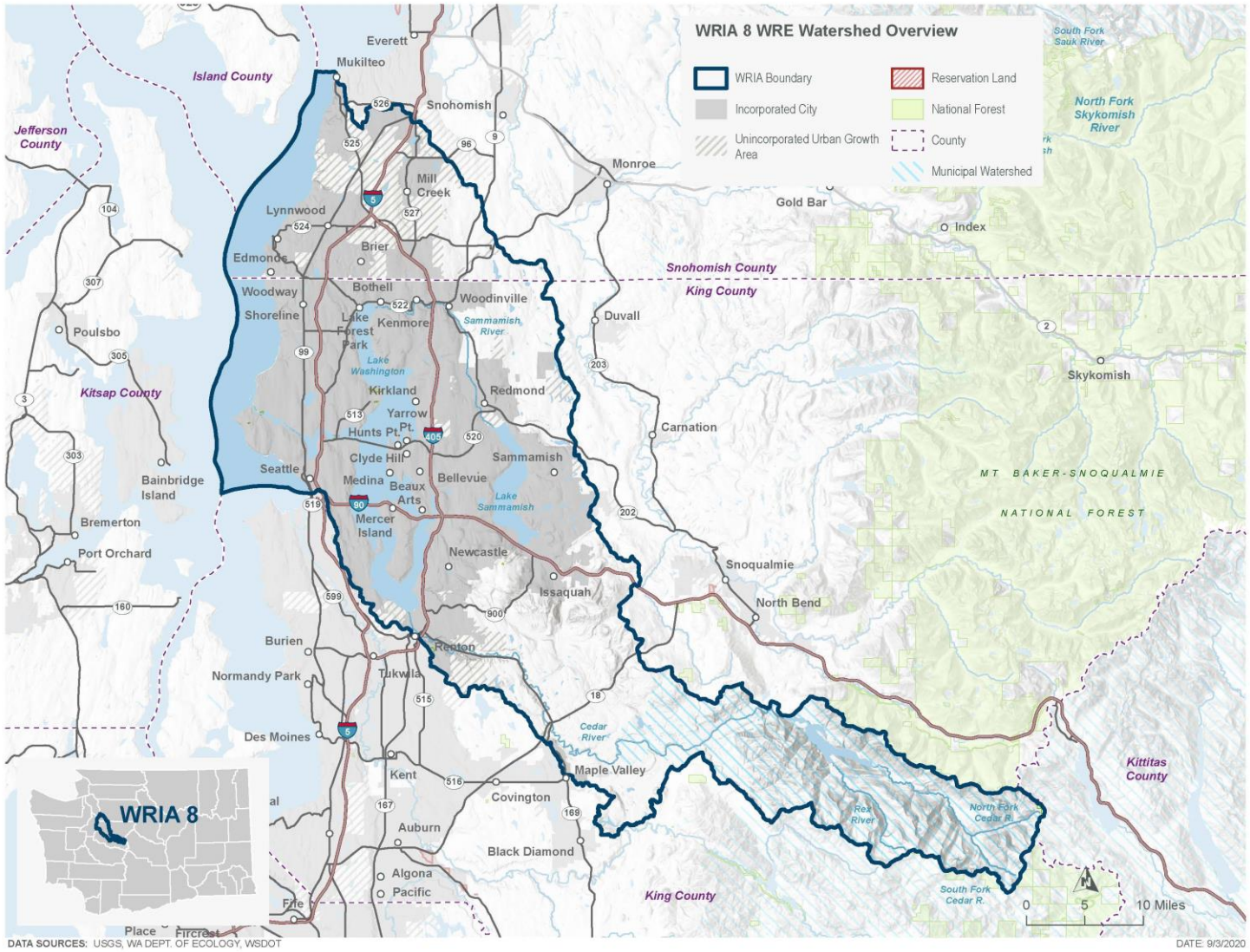


Figure 2.1: WRIA 8 Watershed Overview

2.1.3 Salmonids in WRIA 8

The Cedar-Sammamish watershed is an important and productive system for salmonids. Many tributaries provide spawning and rearing habitat for salmonids. These streams often experience low streamflows during critical rearing, migration, and spawning time. In addition, levees and other flood control and navigation measures have further limited habitat in lakes, rivers, and tributaries. The quality and quantity of spawning and rearing habitat, habitat access, water quality, including water temperature, and low streamflow, all affect local salmon populations (WRIA 8 Salmon Recovery Council 2017).

Salmon Presence (Fish Population and Life Histories)

The Cedar-Sammamish watershed has anadromous salmon runs that include three of the five North American Pacific salmon species (WDFW Salmonscape 2020a, SWIFD 2020). Chinook (*Oncorhynchus tshawytscha*), Coho (*Oncorhynchus kisutch*), and Sockeye salmon (*Oncorhynchus nerka*) migrate in and out of the Cedar-Sammamish watershed from Puget Sound. Cutthroat trout (*Oncorhynchus clarkii clarkii*), rainbow trout (*Oncorhynchus mykiss*), kokanee (*Oncorhynchus nerka*) and bull trout (*Salvelinus confluentus*) also inhabit the watershed. Steelhead trout (*Oncorhynchus mykiss*) may now be functionally extirpated from this basin.

The Puget Sound evolutionarily significant unit (ESU) of Chinook salmon was designated as threatened under the Endangered Species Act (ESA) on May 24, 1999. Designated critical habitat for Chinook salmon includes marine nearshore and freshwater habitats within WRIA 8 (70 FR 52630-52853). The Puget Sound distinct population segment (DPS) of steelhead trout was designated as threatened under ESA on May 7, 2007. Final designated critical habitat (DCH) for Puget Sound steelhead includes freshwater and estuarine habitat in Puget Sound, Washington (81 FR 9252-9325) including areas within WRIA 8. The Coastal-Puget Sound Distinct Population Segment (DPS) of Bull Trout was designated as threatened under ESA on December 1, 1999. Critical habitat has been designated for Bull Trout and includes both freshwater and saltwater aquatic habitat within WRIA 8 (75 FR 63897). Table 2.1 below lists the species present in the Cedar-Sammamish watershed and their regulatory status.

Table 2.1: Selected Salmonids Present within the Cedar-Sammamish Watershed

Common Name	Scientific Name	Evolutionary Significant Unit	Critical Habitat	Regulatory Agency Status
Chinook salmon	*Oncorhynchus tshawytscha*	Puget Sound Chinook	Yes/2005	NMFS/ Threatened/ 1999
Coho salmon	*Oncorhynchus kisutch*	Puget Sound/Strait of Georgia Coho	No	NMFS/Species of Concern/ 1997
Sockeye salmon	*Oncorhynchus nerka*	No listing	No listing	No listing

Common Name	Scientific Name	Evolutionary Significant Unit	Critical Habitat	Regulatory Agency Status
Kokanee	*Oncorhynchus nerka*	No listing	No listing	No listing
Steelhead Trout	*Oncorhynchus mykiss*	Puget Sound Steelhead	Yes/2016	NMFS/ Threatened/ 2007
Bull Trout	*Salvelinus confluentus*	Puget Sound Dolly Varden/Bull Trout	Yes	USFWS/ Threatened/ 1999
Coastal Cutthroat Trout	*Oncorhynchus clarkii clarkii.*	No listing	No listing	No listing
Rainbow trout	*Oncorhynchus mykiss*	No listing	No listing	No listing

Table 2.2 below lists the run timing and life stages of anadromous salmon and trout present throughout the watershed. Watershed specific data concerning salmonid life history and timing was largely summarized from the 2001 Salmon and Steelhead Habitat Limiting Factors Report for the Cedar-Sammamish Basin (Water Resource Inventory Area 8) (Kerwin 2001).

Table 2.2: Salmonid Life History Patterns within the Cedar-Sammamish Watershed

Species	Freshwater Life Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Subbasin Presence
Sockeye	Upstream migration					■	■	■	■	■	■	■		Bear Evans Greater Lake Washington Issaquah Lake Sammamish Creeks Little Bear Creek Lower Cedar May Coal Sammamish River Valley Seattle Lake Union Swamp North Upper Cedar
	Spawning	■	■							■	■	■	■	
	Incubation[1]	■	■	■	■	■	■	■	■	■	■	■	■	
	Fry emergence				■	■	■	■						
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	
	Juvenile outmigration				■	■	■	■	■	■	■	■	■	
Chinook (fall)	Upstream migration								■	■	■	■		All
	Spawning									■	■	■	■	
	Incubation	■	■	■	■	■				■	■	■	■	
	Juvenile rearing	■	■	■	■	■	■	■	■					
	Juvenile outmigration		■	■	■	■	■	■	■	■				
Coho	Upstream migration								■	■	■	■	■	All
	Spawning											■	■	
	Incubation	■	■										■	
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	

Species	Freshwater Life Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Subbasin Presence
	Smolt outmigration				■	■	■	■						
Bull Trout[2]	Upstream migration							■	■	■	■	■		Greater Lake Washington Lake Sammamish Creeks Lower Cedar Sammamish River Valley Seattle Lake Union Upper Cedar
	Spawning									■	■	■	■	■	■	■	■
	Incubation	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Coastal Cutthroat Trout	Upstream migration													All
	Spawning	■	■	■	■	■	■	■	■	■				■	■		
	Incubation	■	■	■	■	■	■	■	■	■	■						
	Fry emergence				■	■	■	■	■	■	■	■					
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Smolt outmigration					■	■	■	■	■	■						
Steelhead Trout (winter)	Upstream migration	■	■	■									■	■	Bear Evans Greater Lake Washington Issaquah Lake Sammamish Creeks Little Bear Creek Lower Cedar May Coal Sammamish River Valley Seattle Lake Union Swamp North Upper Cedar
	Spawning			■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Incubation[3]	■							■	■	■	■	■	■	■	■	■
	Juvenile rearing	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Smolt outmigration[3]				■	■	■	■	■	■	■	■	■	■	■	■	■
Kokanee[4]	Spawning	■						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	Bear Evans Greater Lake Washington Issaquah Lake Sammamish Creeks

Species	Freshwater Life Phase	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Subbasin Presence
	Incubation													Little Bear Creek Lower Cedar Sammamish River Valley Swamp North Upper Cedar
Rainbow Trout[5]	Spawning													-Greater Lake Washington -Sammamish River Valley -Upper Cedar
	Incubation													

Notes:

1. Information on sockeye salmon incubation timing from the South Puget Sound Salmon Enhancement Group.
2. Information on bull trout life history patterns specifically within the Cedar-Sammamish watershed is unavailable. Bull trout life history patterns for the Puget Sound Region were used within this report (King County 2000).
3. Information on steelhead incubation and migration timing specifically within the Cedar-Sammamish watershed is unavailable. Steelhead incubation and out-migration timing for the Puget Sound Region were used within this report (Blanton et al. 2011).
4. Information on kokanee taken from the Lake Sammamish Late Run Kokanee Synthesis Report (HDR Engineering 2009).
5. Information on rainbow trout life history specifically with the Cedar-Sammamish watershed is unavailable. Rainbow trout life history patterns for the Puget Sound Region were used within this report (Blanton et al. 2011).

Current Habitat Conditions

Habitat conditions within the Cedar-Sammamish subbasins were abstracted from the 2001 Salmon and Steelhead Habitat Limiting Factors Report (Kerwin 2001), the 2005 WRIA 8 Chinook Salmon Conservation Plan (WRIA 8 Salmon Recovery Council 2005), and the 2017 WRIA 8 Chinook Salmon Conservation Plan Update (WRIA 8 Salmon Recovery Council 2017). The Cedar-Sammamish watershed is one of the more significantly altered watersheds on the West Coast. It has been severely impacted by a variety of land uses ranging from commercial forestry in the Upper Cedar River subbasin to intense urban and suburban development throughout the western portion of the watershed. Fundamental historical changes to WRIA 8 include Seattle's use of the Cedar River as its main water supply (early 1900s), the construction of the Lake Washington Ship Canal and Hiram M. Chittenden locks (1911-1934), the redirection of the Cedar River from joining the Duwamish River via the Black River to entering the south end of Lake Washington, the channelization of the Sammamish River corridor (1920s), and the conversion of forests and farmlands to residential, commercial, and industrial uses (1945-present).

The 2001 Salmon and Steelhead Habitat Limiting Factors Report (Kerwin 2001) and the 2005 WRIA 8 Chinook Salmon Conservation Plan list the following primary limiting factors in the Cedar-Sammamish watershed:

- Fish habitat access and passage barriers
- Increased sedimentation and altered sediment transport processes
- Loss of channel and shoreline complexity and connectivity
- Degradation or lack of riparian conditions
- Altered hydrology, including increased peak and reduced low flows.
- Water quality issues
- Biological processes
- Loss of floodplain connectivity

Other emerging priority issues that limit salmon survival and recovery include parasites, nighttime lighting, warming waters especially in the ship canal and Sammamish River, and predation on juvenile salmon by invasive non-native fish. Although some issues are common across WRIA 8, habitat conditions vary within the watershed's subbasins and are described below.

Puget Sound Shoreline

The Puget Sound Shoreline subbasin includes marine nearshore areas and independent tributaries to the Puget Sound. WRIA 8 tributaries to the Puget Sound have been substantially impacted by residential, commercial, and industrial uses. Development has caused fish passage barriers, altered stream hydrology, reduced channel complexity, and degraded riparian habitat in these highly impacted streams that can no longer support naturally reproducing salmonid populations. The WRIA 8 marine nearshore habitat has been adversely impacted by residential

and commercial development; however, the construction of a railroad line along 87% of the shoreline represents the most significant impact within this area of the watershed. The railroad construction destroyed marine, riparian vegetation and severely impacted nearshore processes by cutting off pocket estuaries and backshore habitats and the supply of beach sediment from bluff erosion to nearby beaches.

Seattle/Lake Union

The Seattle/Lake Union subbasin was drastically altered by the construction of the Lake Washington Ship Canal and opening of the Hiram M. Chittenden Locks which created a connection between the Puget Sound, Lake Washington, and Lake Union. The subbasin is characterized by intensive commercial and recreational boat traffic and extensive residential, commercial, and industrial shoreline development. Bulkheads and shoreline armoring have greatly reduced natural overwater cover and riparian habitat quality. High water temperatures in the Ship Canal at lethal and sub-lethal levels during adult migration for both Chinook and Sockeye are key constraints to Chinook recovery (WRIA 8 Salmon Recovery Council 2017).

Greater Lake Washington

The Greater Lake Washington subbasin has a history of intense anthropogenic impacts beginning in 1916 when its original outlet to the Black River was blocked and flow from the Cedar River was redirected to Lake Washington and the Lake Washington Ship Canal and Ballard Locks. As a result, the water level in Lake Washington dropped by about 10 feet, leading to a dramatic reduction in overall lake surface area, shallow water habitat, and adjacent wetland area. Currently, the lake shoreline consists primarily of dense urban residential development. Approximately 71% of the Lake Washington shoreline is classified as hardened by either rip-rap or bulkheads. According to the Limiting Factors Report, “current and future land use practices all but eliminate the possibility of the shoreline to function as a natural shoreline to benefit salmonids (Kerwin 2001).” Limited natural vegetation, large wood, and natural shoreline conditions exist along the shoreline. Lake Washington tributaries have also suffered due to intense development. These streams are characterized by numerous fish passage barriers, limited pool habitat, fragmented or non-existent riparian habitat buffers, and changes to natural hydrologic regimes, including reduced low flows. Water temperature and dissolved oxygen are known to be significant limiting factors for both juvenile and adult salmon. The Lake Washington Ship Canal, the sole migration route for salmon to and from Lake Washington, routinely reaches temperatures of 21-23+ degrees Celsius by July each year. These high temperatures are believed to have contributed to disease leading to the pre-spawn mortality of approximately 40% of the Cedar River sockeye run in both 2014 and 2015 (NWIFC 2016).

Swamp/North

The Swamp/North subbasin combines the Swamp Creek and North Creek watersheds and drains to the Sammamish River Valley. The subbasin is characterized by a mix of urban and suburban residential and commercial development. Numerous fish passage barriers are scattered throughout the subbasin. Road crossings, streambank hydromodification, channel

incision, historical and on-going clearing, and development in riparian areas have greatly reduced channel complexity and floodplain connectivity. Water quality issues within the subbasin include excessive fecal coliform bacteria, water temperature, copper, lead, zinc, chromium, and low dissolved oxygen. The main issues within this subbasin include a lack of large wood, high levels of impervious surfaces, impaired riparian areas, and reduced floodplain connectivity.

Little Bear

The Little Bear Creek subbasin drains to the Sammamish River Valley and is characterized by a mix of rural and suburban residential and commercial development. The majority of the subbasin is accessible to anadromous salmon and trout. Approximately 40% of the subbasin is still forested and the Little Bear Creek subbasin has the least degraded salmonid habitat compared to other Sammamish River tributaries. However, numerous fish passage barriers are scattered throughout the subbasin, large wood recruitment is limited, and low flow problems exist (Lombard and Somers 2004). Riparian habitat condition varies widely throughout the subbasin with some riparian forests intact and others severely degraded or completely cleared.

Bear/Evans

The Bear/Evans subbasin combines the Bear Creek and Evans Creek watersheds and drains to the Sammamish River Valley. The subbasin is characterized by a mix of rural and suburban residential and commercial development. According to the Washington Department of Fish and Wildlife (WDFW) Washington State Fish Passage Map (WDFW 2020b), numerous fish passage barriers including culverts, dams, weirs, high velocity stream flows, and beaver dams are scattered throughout the subbasin. The loss of large wood and wetland habitat and the conversion of floodplain and riparian habitat areas to residential, commercial, and industrial development have dramatically reduced channel complexity and floodplain connectivity. Water quality issues within the subbasin include increased turbidity, high water temperature, reduced low flows, and excessive fecal coliform bacteria.

Sammamish River Valley

The Sammamish River Valley subbasin extends from the north end of Lake Sammamish to the northern tip of Lake Washington. Prior to Euro-American settlement, the area was a vast complex of wetlands connected by the slow-moving Sammamish River. The river corridor and adjacent areas were heavily logged throughout the 19th and 20th centuries. The 1916 opening of the Chittenden Locks lowered Lake Washington and drained large areas of sloughs and wetland habitat within the river valley. As agricultural land use expanded into the floodplain, farmers began to straighten the Sammamish River channel and construct extensive drainage ditches. In the 1960s, U.S. Army Corps of Engineers began to dredge the mainstem Sammamish River to prevent flooding of the adjacent farmlands. The combination of agricultural development and dredging of the river dramatically decreased floodplain habitat connectivity and complexity. Ultimately, the length of the river was reduced by nearly four miles and became disconnected from the floodplain and many of its tributary streams. The Sammamish River and its

contributing subbasins are impacted by numerous fish passage barriers, elevated water temperatures, bank hardening features, limited pool habitat, little floodplain hydrologic connectivity, reduced forest cover, increased impervious surfaces, reduced low flows, and reduced or fragmented riparian buffers. Lethal and sublethal temperatures in the Sammamish River during adult migration are a key constraint on recovery of Chinook (WRIA 8 Salmon Recovery Council 2017).

Lake Sammamish Creeks

A mix of residential, commercial, agricultural, and forestry land practices impact Lake Sammamish and its tributaries. The majority of the Lake Sammamish shoreline is privately owned and consists of residential development and associated hardened shoreline. Water quality issues, invasive plant and fish species, elevated water temperatures, low dissolved oxygen, and fragmented or inadequate riparian habitat buffers are the main habitat limiting factors within the lake. Of the 27 miles of streams that flow into Lake Sammamish, only 4 miles are accessible to anadromous fish. Erosion, dredging, and culvert blockages have rendered many of these streams inaccessible to migrating salmonids. Population density and the concomitant development of rural lands is expected to increase within the basin. Lake Sammamish tributaries are severely impacted by fish passage barriers, high levels of impervious surfaces, a lack of large woody debris, loss of channel complexity, reduced low flows, and fragmented riparian habitat buffers.

May/Coal

The May/Coal subbasin combines the May Creek and Coal Creek watersheds and drains to Lake Washington. This subbasin is characterized by a mix of residential and commercial development. Extensive coal mining in the early 1900's changed the course of streams and urban development continues to impede natural hydrology. Major habitat impacts within the subbasin include extensive sedimentation problems, loss of channel complexity, high water temperatures, reduced low flows, and increased impervious surfaces.

Issaquah

The Issaquah subbasin drains to Lake Sammamish and is characterized by a mixture of land uses including commercial forests; parks; quarry and mining; residential; commercial; and agricultural. The subbasin contains high quality habitat and productive populations of salmon (Kerwin 2001). However, habitat limiting factors include limited off-channel rearing and refuge habitat, a lack of large wood, several fish passage barriers, and high water temperatures (Ecology 2020). WDFW has a hatchery on Issaquah Creek that raises Chinook and Coho. Decreasing low flow trends are of concern (King County 2009).

Lower Cedar

The Lower Cedar River subbasin is characterized by agricultural and forestry in the east and residential, commercial, and industrial land uses in the west. The Lower Cedar River and its

tributaries are characterized by a lack of floodplain connectivity, numerous fish passage barriers (WDFW 2020b), limited pool habitat, increase in impervious surfaces, fragmented or inadequate riparian buffers, reduced low flows, and several flood control facilities and bank hardening features. WDFW and Seattle Public Utilities co-operate a hatchery on the Cedar River near the Landsburg diversion dam.

Upper Cedar

Land use within the Upper Cedar River subbasin is slowly transitioning from commercial forestry to forest preservation. The Upper Cedar River is protected as Seattle's municipal drinking water source and is being restored following impacts from historic commercial forestry practices.

Priority Actions

The Lake Washington/Cedar/Sammamish Watershed Chinook Salmon Conservation Plan Update (WRIA 8 2017) recommends a combination of projects and programs to protect, restore, and enhance salmonid habitat and watershed ecosystem processes. Projects include physical restoration such as removing or setting back flood control levees and revetments, installing large wood, planting native vegetation and removing invasive weeds in riparian areas throughout the watershed, replacing lakeshore armoring with natural shoreline or soft-shore alternatives, replacing fish passage barriers, as well as property acquisition to protect high functioning habitat. The plan identifies high priority habitat protection and restoration projects on the following water bodies: Cedar River, Bear/Cottage Lake Creek, Issaquah Creek, Sammamish River, Lake Washington shoreline, Lake Sammamish shoreline, Lake Union/Ship Canal, Puget Sound nearshore, North Creek, Little Bear Creek, Evans Creek, and Kelsey Creek. The WRIA 8 Salmon Conservation Plan also recommends land use actions that support habitat protection and restoration by addressing impacts from development, stormwater, increased impervious surface, etc.

2.2 Watershed Planning in WRIA 8

Citizens and local, state, federal, and tribal governments have collaborated on watershed and water resource management issues in WRIA 8 for decades. A brief summary of broad watershed planning efforts as they relate to the past, present, and future water availability in the Cedar-Sammamish watershed is provided below.

2.2.1 Other Planning Efforts in WRIA 8

This watershed plan builds on many of the past efforts to develop comprehensive plans for the entire watershed. For example, the South Central Action Area Caucus Group (South Central LIO) developed an ecosystem recovery plan, as part of the Action Agenda for Puget Sound Recovery. The planning process to develop an ecosystem recovery plan is community based with engagement by local, state, and federal agencies. The approach is holistic, addressing

everything from salmon to orca recovery, stormwater runoff, and farmland and forest conservation.

The WRIA 8 Salmon Recovery Council is the Salmon Recovery Lead Entity, a collaboration of local government partners and community groups, state and federal agencies, businesses, and citizens focused on protecting and enhancing wild salmon populations. The Salmon Recovery Council formed in 2000 and developed the Lake Washington/Cedar/Sammamish Watershed (WRIA 8) Chinook Salmon Conservation Plan in 2005. Since 2005, the WRIA 8 Salmon Recovery Council has worked to implement the Salmon Conservation Plan and updated the plan in 2017 (WRIA 8 Salmon Recovery Council 2017).

The South Central LIO and WRIA 8 Salmon Recovery Council include many of the same organizations and individuals that participate in the WRIA 8 Watershed Restoration and Enhancement Committee. This history of collaborative planning and shared priorities has supported the success of the Watershed Restoration and Enhancement Plan development in WRIA 8.

Coordinated Water System Plans (CWSPs) are mandated by the Public Water System Coordination Act of 1977. King County passed ordinances ratifying four CWSPs (East King County, Skyway, South King County, and Vashon). Snohomish County updated their CWSP in 2010. These plans ensure that water system service areas are consistent with local growth management plans and development policies. The location of new homes in relation to and within designated retail water system service areas and related policies determine if connection to a water system is available, or the new homes will need to rely on an alternative water source, most likely new permit-exempt domestic wells. Within their designated retail service area(s), water purveyors are given first right of refusal for new connections. The purveyor may decline to provide service if water cannot be made available in a 'reasonable and timely' manner. However, it can be the case that a new permit-exempt well is drilled without making any inquiries with the county or with the local water system.

2.2.2 Coordination with Existing Plans

Throughout the development of this watershed plan, Ecology streamflow restoration staff engaged with staff from the WRIA 8 Salmon Recovery Council, South Central LIO, and the Puget Sound Partnership, providing briefings on the streamflow restoration law, scope of the watershed plan, and plan development status updates. Throughout the planning process, the WRIA 8 Committee has coordinated closely with the WRIA 8 Salmon Recovery Council, including inviting lead entity staff to join the WRIA 8 Committee as an ex-officio member, and selecting habitat projects based on information from the Salmon Conservation Plan.

Snohomish County and King County planning staff contributed to the plan development to ensure consistency with the counties' Comprehensive Plans. The Comprehensive Plans set policy for development, housing, public services and facilities, and environmentally sensitive areas, among other topics. The Comprehensive Plans identify Snohomish and King Counties' urban growth areas, set forth standards for urban and rural development, and provide the basis for zoning districts.

2.3 WRIA 8 Geology, Hydrogeology, Hydrology, and Streamflow

2.3.1 Geologic Setting

Understanding the geologic setting of WRIA 8 helps to characterize surface and groundwater flow through the watershed. 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.

Within WRIA 8, bedrock forms mountain ranges and uplands and generally consists of igneous and sedimentary rocks. Within drainages and lowland areas, bedrock is overlain by glacial and alluvial sediments (Washington State Department of Natural Resources 2020). A minimum of four major glaciations covered the lower portion of the watershed during the Pleistocene Epoch (about 11,700 years to 2.6 million years ago), the most recent occurrence being the Vashon Stade of the Frasier Glaciation (Jones 1998; Vaccaro et al. 1998; Booth et al. 2003). The present topography and drainage network in WRIA 8 was shaped during the advance and retreat of the Vashon ice sheet (Evans 1996). These processes resulted in glacially-derived ridges and lakes linked by drainage channels (Booth and Goldstein 1994; Evans 1996). Pleistocene-age glacial and interglacial processes resulted in the deposition of a complex assemblage of sedimentary deposits in lowland areas. These glacial deposits consist of glacial till, recessional and advance outwash, and glaciolacustrine deposits. Glacial till deposits generally consist of dense, silty sand with gravel and silt lenses. Outwash deposits generally consist of sand and gravel with locally abundant wood debris and peat. Glaciolacustrine deposits generally consist of silt and clay. This sequence of glacial deposits exceeds 1,500 feet in thickness within the lower portions of the watershed (Jones 1996; Vaccaro et al. 1998).

Recent alluvial deposits are generally associated with channel and overbank deposits from the modern Cedar and Sammamish Rivers and their tributaries. These sediments generally consist of stratified silt, sand, gravel, with minor amounts of clay.

2.3.2 Hydrogeologic Setting

The U.S. Geological Survey identified six hydrogeologic units within the sequence of Puget Sound glacial and alluvial sediments within WRIA 8 (Vaccaro 1998). The hydrogeologic units typically alternate between aquifer units and semi-confining to confining layers (aquitards) which lack sufficient permeability to form aquifers.

Within the upper portion of the watershed, glacial and alluvial sediments occur within the Cedar River valley and drainages associated with area tributaries. Shallow glacial and alluvial sediments are widespread within the lower portion of the watershed. Glacial and alluvial aquifers are generally unconfined (under water-table conditions) except where overlain by low permeability confining layers (generally till or glaciolacustrine deposits). Transmissivity (a hydraulic property related to the rate of groundwater flow through an aquifer) and storativity (a hydraulic property related to the capacity of an aquifer to store/release water) of these aquifers vary significantly with depositional environment and are generally the highest in

outwash sands and gravels and lowest in fine-grained alluvial deposits. Glacial and alluvial aquifers are characterized by a shallow depth to the groundwater table and, where applicable, a direct hydraulic connection with adjacent surface water.

Bedrock aquifers underlay the entire watershed. However, within the lower portions of the watershed, glacial and alluvial sediments are hundreds to thousands of feet thick (Jones 1996; Vaccaro et al. 1998) and bedrock aquifers are seldom targeted by water supply wells. Thickness of the glacial and alluvial hydrogeologic units generally thin to the east within WRIA 8. Much of the watershed southeast of Bellevue is underlain by relatively shallow and frequently outcropping bedrock.

Bedrock aquifers are generally of relatively low transmissivity and storativity. Wells completed within bedrock aquifers typically do not have high enough capacity for municipal use. However, they can be valuable aquifers for residential water uses, and in specific areas are an important target aquifer for permit-exempt wells.

Recharge to glacial, alluvial, and bedrock aquifers within WRIA 8 is primarily associated with precipitation, applied irrigation, septic systems, leakage from surface water within losing reaches (where streamflow infiltrates to groundwater), and through leakage from adjacent aquifers. An important component of recharge, particularly to the deep aquifers, occurs through mountain front recharge. In WRIA 8 this includes recharge to shallower aquifers surrounding the Issaquah Alps and to aquifers adjacent to the Cascade Range in the southeastern part of the WRIA (Rock Creek/Ravensdale area). Watershed aquifers discharge to water supply wells, adjacent aquifers, gaining reaches of streams, and Puget Sound. Summer base flows in WRIA 8 rivers and tributaries are sustained by groundwater (baseflow) on most of the lower-elevation tributaries.

Regionally, groundwater flow direction within watershed aquifers generally is perpendicular to the westerly slope of the Cascade Range, although groundwater flow in shallow aquifers is more influenced by surface topography and streamflow within the watershed and is directed to the northwest. This groundwater flow paradigm is complicated throughout the watershed by aquifer boundaries, aquifer heterogeneities, topography, the influence of gaining and losing stream reaches, well pumping, and other factors.

2.3.3 Hydrology and Streamflow

The Cedar River and its headwaters are located in a snowmelt transition region where the rivers are fed by both snowmelt and rainfall. Within low elevation portions of the watershed, mean annual precipitation ranges from about 30 to 40 inches per year. Mean annual precipitation increases with topographic elevation and can exceed 120 inches within the Cascade Range (MGS Engineering Service and Oregon Climate Service 2006). Most precipitation occurs during the late fall and winter. Precipitation is lowest during the summer when water demands are highest. During these low precipitation periods, streamflow is highly dependent upon groundwater inflow (baseflow).

WAC 173-508 set minimum instream flows for the Cedar River and closed lakes and streams contributing to the Lake Washington drainage above the Hiram M. Chittenden Locks to further consumptive appropriations.

In the vicinity of Chester Morse Lake and the Masonry Pool, the stage of the Cedar River is controlled for municipal supply and hydroelectric power generation by Masonry Dam and associated secondary control structures. The Instream Flow Commission, which includes City of Seattle, Muckleshoot Indian Tribe, National Marine Fisheries Service, Washington Department of Ecology, Washington Department of Fish and Wildlife, King County, and the U.S. Army Corps of Engineers, meets regularly to review current hydrologic conditions and help guide real-time instream flow management for the Cedar River, pursuant to the Cedar River Watershed Habitat Conservation Plan (Seattle 2020b). The Muckleshoot Indian Tribe also has a 2006 Agreement with the City of Seattle. The Sammamish River has been extensively channelized during the 20th century and is controlled by an outlet weir installed in 1964. The Army Corps of Engineers controls the lake levels in Lake Washington through operation of the Chittenden Locks.

Cedar River and Sammamish River streamflow conditions are summarized by the following:

- USGS stream gage 12116500 (Cedar River at Cedar Falls): At this upper watershed location, mean daily discharge ranges from 100 cfs in September to 512 cfs in December (U.S. Geological Survey 2020) for the period of record from April 1914 to June 2020. This gage is the farthest upstream station on the Cedar River.
- USGS stream gage 12119000 (Cedar River at Renton): Near its discharge location in Renton, Washington, mean daily discharge ranges from 187 cfs in August to 1,140 cfs in January (U.S. Geological Survey 2020) for the consistent record from August 1945 to June 2020. This gage is also a compliance station for instream flows in WAC 173-508.
- USGS stream gage 12125200 (Sammamish River near Woodinville): Near Woodinville, Washington, mean daily discharge of the Sammamish River ranges from 72 cfs in August to 624 cfs in January (U.S. Geological Survey 2020) for February 1965 to June 2006. King County took over gaging from the USGS.
- USGS stream gage 12121600 (Issaquah Creek near mouth) mean daily discharge is 30 cfs in August and 270 cfs in January for the period of record from October 1963 through March 2020.
- King County also gages Bear Creek near the mouth (gage 02A), and other tributaries.

Anticipated future climate impacts will result in continued loss of snow in the Cascade Range, combined with rising temperatures and changes in precipitation. Earlier spring snowmelt, lower snowpack, increased evaporative losses, and warmer and drier summer conditions will intensify summer drought conditions and low flow issues in WRIA 8. These climate impacts are expected to drive changes in seasonal streamflows, increasing winter flooding, while intensifying summer low flow conditions. For the Cedar River, climate modeling predicts average minimum flows to be 25 percent lower (range: -32 to -13 percent) by the 2080s for a moderate warming scenario, relative to 1970 to 1999 (Mauger et al. 2015).

Several factors contribute to streamflow: snow pack and rate of melt, rainfall, surface water runoff and groundwater discharge. In addition to environmental factors, surface water withdrawals and groundwater pumping from wells in hydraulic continuity with surface water affect streamflow. This plan addresses impacts on groundwater discharge to streams due to withdrawals from permit-exempt wells for domestic use. Pumping from wells can reduce groundwater discharge to springs and streams by capturing water that would otherwise have discharged naturally. Groundwater pumping may diminish surface water flows. Consumptive water use (that portion not returned to the immediate water environment) potentially reduces streamflow, both seasonally and as average annual recharge. A well drawing from an aquifer connected to a surface water body either directly or through an overlying aquifer can either reduce baseflow or increase the quantity of water leaking out of the river (Ecology 1995). Water use from new permit-exempt domestic wells represents only a portion of all water use and factors affecting streamflow in the watershed.

Chapter Three: Subbasin Delineation

3.1 Introduction to Subbasins

Water Resource Inventory Areas are large watershed areas formalized under Washington Administrative Code for the purpose of administrative water management and planning. WRIAs encompass multiple landscapes, hydrogeologic regimes, levels of development, and variable natural resources. To allow for meaningful analysis of the relationship between new consumptive use and offsets per Ecology's Final NEB Guidance,[5] the WRIA 8 Committee divided WRIA 8 into subbasins. 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. In some instances, subbasins did not correspond with hydrologic or geologic basin delineations (e.g. watershed divides).[6]

3.2 Approach to Develop Subbasins

The WRIA 8 Committee divided WRIA 8 into 12 subbasins for purposes of assessing consumptive use and project offsets. The WRIA 8 Committee based their subbasin delineation on existing subwatershed units and interim growth projections developed by Snohomish County and King County. The Committee applied the following guiding principles to delineate subbasins:

- Use USGS hydrologic unit code subwatershed (HUC-12) boundaries in the Snohomish County portion of the watershed (USGS 2013; USGS 2016);
- Use King County drainage basin boundaries in the King County portion of the watershed (King County 2018);
- Combine HUC-12s (Snohomish County) and drainage basins (King County) in areas of the watershed that are urbanized and have existing water service and are therefore unlikely to have new homes using PE wells; and
- Keep distinct subbasins for HUC-12s and drainage basins with higher projected growth of new homes using PE wells.

[5] "Planning groups must divide the WRIA into suitably sized subbasins to allow meaningful analysis of the relationship between new consumptive use and offsets. Subbasins will help the planning groups understand and describe location and timing of projected new consumptive water use, location and timing of impacts to instream resources, and the necessary scope, scale, and anticipated benefits of projects. Planning at the subbasin scale will also allow planning groups to consider specific reaches in terms of documented presence (e.g., spawning and rearing) of salmonid species listed under the federal Endangered Species Act." Final NEB Guidance p. 7.

[6] 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 90.94.030(3)(b).

The WRIA 8 subbasin delineations are shown on Figure 3.1 and summarized below in Table 3.1. A more detailed description of the subbasin delineation is in the technical memo available in Appendix E.

Table 3.1: WRIA 8 Subbasins

Subbasin Name	**Primary Rivers and Tributaries**	**County**
Seattle/Lake Union	Elliott Bay and Lake Union	King County
Puget Sound Shorelines	Streams draining directly to Puget Sound between the City of Mukilteo and the City of Seattle, including Pipers Creek, Boeing Creek, and Shell Creek	Snohomish and King County
Swamp/North	Swamp Creek and North Creek	Snohomish and King County
Little Bear	Little Bear Creek	Snohomish County and King County
Sammamish River Valley	Sammamish River	King County and Snohomish County
Bear/Evans	Bear Creek and Evans Creek	Snohomish and King County
Greater Lake Washington	Streams draining to Lake Washington, including Lyon Creek, McAleer Creek, Thornton Creek, Juanita Creek, Forbes Creek, and Kelsey Creek	King County and Snohomish County
May/Coal	Coal Creek and May Creek	King County
Lake Sammamish Creeks	Streams draining to Lake Sammamish, including Tibbets Creek	King County
Issaquah	Issaquah Creek	King County
Lower Cedar	Cedar River below the Landsburg diversion dam	King County
Upper Cedar	Cedar River above the Landsburg diversion dam	King County

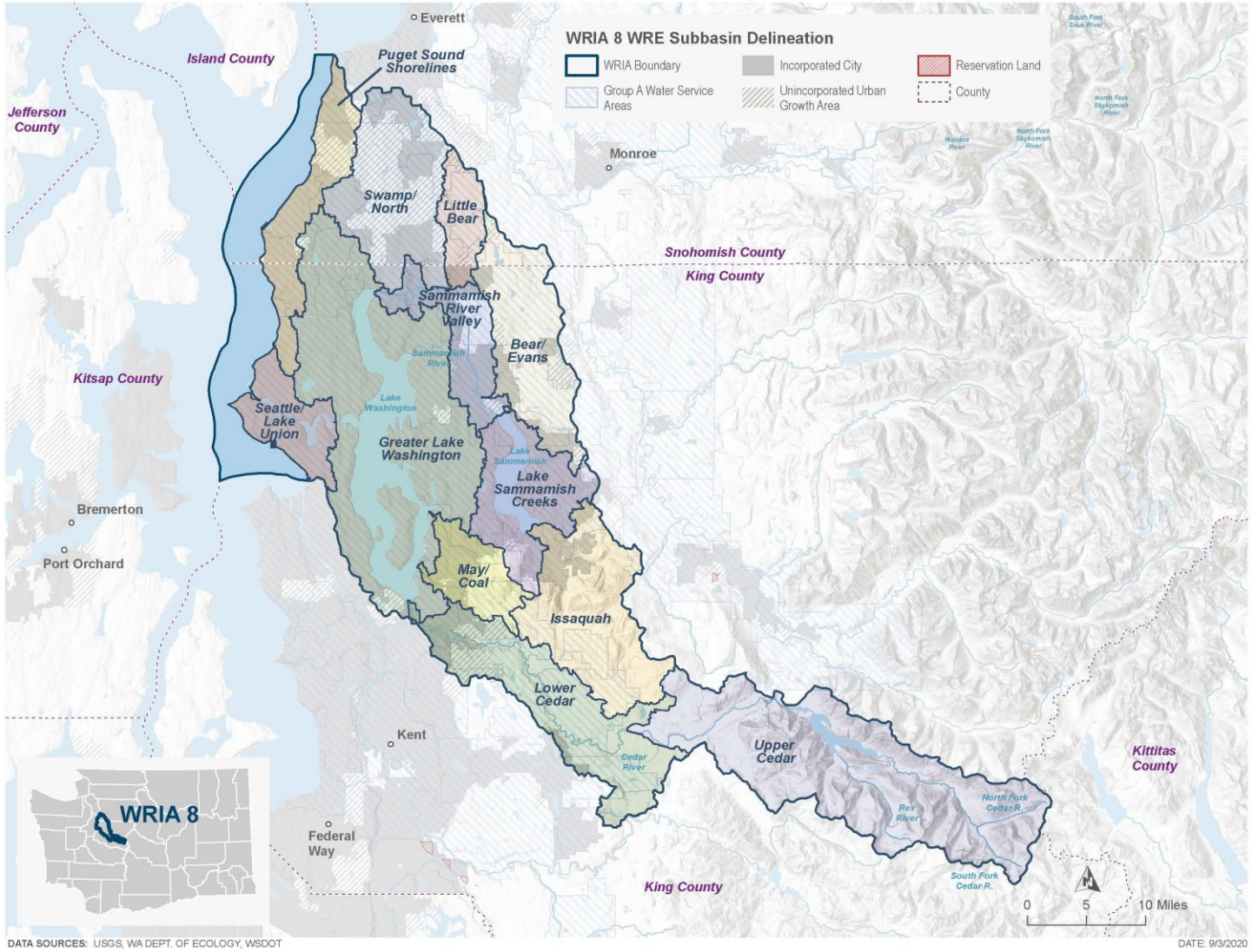


Figure 3.1: WRIA 8 Subbasin Delineation

Chapter Four: New Consumptive Water Use Impacts

4.1 Introduction to Consumptive Use

The Streamflow Restoration law requires watershed plans to include "estimates of the cumulative consumptive water use impacts over the subsequent twenty years" for "new domestic groundwater withdrawals exempt from permitting under RCW 90.44.050" (RCW 90.94.030(3)(e) and RCW 90.94.030(6)).The Final NEB Guidance states that, "Watershed plans must include a new consumptive water use estimate for each subbasin, and the technical basis for such estimate" (pg. 7). This chapter provides the WRIA 8 Committee's projections of new domestic permit-exempt well connections (hereafter referred to as PE wells) and their associated consumptive use for the 20-year planning horizon.[7] This chapter summarizes information from the technical memos (Appendices F and G) prepared for, and reviewed by, the WRIA 8 Committee.

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

The WRIA 8 Committee projects 967 PE wells over the planning horizon. Most of these wells are likely to be installed in the following subbasins outside of the Urban Growth Areas (UGAs): Lower Cedar, Issaquah, Bear/Evans, and Little Bear.

The WRIA 8 Committee developed a method that they agreed was appropriate to project the number of new PE wells over the planning horizon in WRIA 8, in order to estimate new consumptive water use. This method, referred to as the PE well projection method, is based on recommendations from Appendix A of Ecology's Final NEB Guidance (Ecology 2019). The following sections provide the 20-year projections of new PE wells for each subbasin within WRIA 8, the methods used to develop the projections (PE well projection method), and uncertainties associated with the projections.

4.2.1 Permit-Exempt Well Connections Projection by Subbasin

This WRIA 8 watershed plan compiles the Snohomish County and King County PE well projection data at both the WRIA scale and by subbasin. The projection for new PE wells in

[7] New consumptive water use in this document is from projected new homes connected to permit-exempt domestic wells associated with building permits issued during the planning horizon. Generally, new homes will be associated with wells drilled during the planning horizon. However, new uses could occur where new homes are added to existing wells serving group systems under RCW 90.44.050. In this document the well use discussed refers to both these types of new well use. PE wells may be used to supply houses, and in some cases other Equivalent Residential Units (ERUs) such as small apartments. For the purposes of this document, the terms "house" or "home" refer to any permit-exempt domestic groundwater use, including other ERUs.

WRIA 8 by subbasin is shown in Table 4.1 and Figure 4.1: WRIA 8 Distribution of Projected PE Wells for 2018-2038.

Table 4.1: Number of PE Wells Projected between 2018 and 2038 for the WRIA 8 Subbasins

Subbasins	King County	Snohomish County	Urban Growth Areas	Total PE Wells per Subbasin
Seattle/Lake Union	0	--	0	0
Puget Sound Shorelines	0	--	2	2
Swamp/North	0	0	5	5
Little Bear	0	118	0	118
Sammamish River Valley	8	--	0	8
Bear/Evans	138	92	4	234
Greater Lake Washington	0	--	4	4
May/Coal	15	--	0	15
Lake Sammamish Creeks	6	--	0	6
Issaquah	235	--	0	235
Lower Cedar	338	--	2	340
Upper Cedar	0	--	0	0
Totals	**740**	**210**	**17**	**967**

The total projection for WRIA 8 is 967 new PE wells. King County projects approximately 740 new PE wells over the planning horizon within WRIA 8 portions of unincorporated King County. Snohomish County projects approximately 210 new PE wells over the planning horizon within WRIA 8 portions of unincorporated Snohomish County. The King and Snohomish County methods do not account for potential PE wells in cities or UGAs so the WRIA 8 Committee completed an analysis of potential new PE wells within the UGAs and projected 17 new PE wells (UGA Well Log Spot Check).

4.2.2 Methodology

The WRIA 8 Committee conferred with each county to identify an appropriate method of projecting PE wells within their jurisdiction. King and Snohomish Counties used historical building data to project new potential PE wells, assuming the rate and general location of past

growth will continue over the 20-year planning horizon. Using past building permits to predict future growth is one of the recommended methods in the Final NEB Guidance (Ecology 2019). Due to data availability, which differed for the two counties, King and Snohomish County used different methods to estimate the number of homes that would be served by community water systems and municipalities, and remove those from the PE well projection. Snohomish County considered distance to existing water lines, whereas King County considered historical rates of connection to water service within water service area boundaries.[8] King and Snohomish Counties completed their analyses in-house and the methods are described in detail in Appendix F.

The WRIA 8 Committee also evaluated potential PE wells within the UGAs using data from Ecology's Well Report Viewer database.

King County completed a PE Well Potential Assessment which identified potential parcels where development could occur within rural King County. Snohomish County completed a similar assessment which they have referred to as a Rural Capacity Analysis. The PE Well Potential Assessment and Rural Capacity Analysis results were used to assess whether a subbasin (as identified by the Committee) has the capacity to accommodate the number of PE wells projected over the 20-year planning horizon.

All methods are summarized in the sections below. The WRIA 8 Growth Projections Technical Memorandum provides a more detailed description of the analysis and methods (Appendix F).

King County PE Well Projection Methodology

King County used historical residential building permit and parcel data from 2000 through 2017 to project the number of new PE wells for the planning horizon in unincorporated King County (referred to as the past trends analysis). This data set considers economic and building trends over an 18-year period and the method assumes that past trends will continue.

King County projected the number of new PE wells over the planning horizon using the following steps:

1. Gather historical building permit and parcel data (2000–2017) for new residential structures.[9]
2. Assess the total number of permits and average number of permits per year for WRIA 8.

[8] Water service area boundaries include areas currently served by existing water lines and may also include areas not yet served by water lines. King County used historic rates of connection to water service to predict future rates of connection because King County does not have County-wide information on the location of water lines.
[9] King County used the time period 2000 through 2017 because that data was available. The building permit data for 2000 through 2017 includes both periods of high growth and periods of low growth. King County compared these data with information from the Vision 2040 regional plan and population data and is confident in using the average of this time period to project into the future.

3. Link building permit and parcel data to determine water source for each building permit/parcel and separate into public, private, and other water source categories. Consider a building permit with water source listed as "private" as a PE well.
4. Calculate the number and percentage of building permits for each type of water source (public, private, or other) inside and outside water services areas by subbasin, and for the WRIA overall.

The WRIA 8 Committee used the King County past trends analysis to develop PE well projections by subbasin using the following steps:

5. Calculate the projected number of PE wells per year for each subbasin by multiplying the average number of building permits per year by the percentage of building permits per subbasin, and percentage of building permits using a private water source (well) per subbasin.
6. Multiply the projected number of PE wells per year per subbasin by 20 to calculate the total of PE wells projected over the 20-year planning horizon for each subbasin.
7. Add 6% to 20-year PE well projection per subbasin to account for gaps in the building permit and parcel data (6% error is based on the percentage of building permits with "other" as the water source).
8. Tabulate the total PE wells projected over the 20-year planning horizon, including the 6% error, for each subbasin and sum to get the total of PE wells projected over the 20-year planning horizon in rural unincorporated King County.

Snohomish County PE Well Projection Methodology

Snohomish County developed three PE well projection scenarios based on development trends and population projections, described in Appendix F. The WRIA 8 Committee chose to use the scenario that reviewed past development trends within WRIA 8 to estimate the number and location of potential new homes over the planning horizon (referred to as the past trends analysis).

Snohomish County used a different method than King County for their past trends analysis. They used a GIS model to identify areas where homes are likely to connect to water service, based on proximity to existing water distribution lines (referred to as public water service areas). Areas that were not proximal to existing water distribution lines were assumed to be served by a PE well (referred to as PE well areas).[10] Snohomish County used this spatial model, in combination with analysis of year-built data from 2008-2018 for recently built single-family residences, to develop PE well projections. The method assumes that past trends will continue, that water lines now are representative of water lines in the future, and that homes built

[10] PE well areas are more than 100' from a water main for homes that are not part of a subdivision and more than ¼ mile from a water main for homes that are part of a subdivision. See Snohomish County Growth Projections and Rural Capacity Analysis Methods in Appendix F for additional information.

proximal to water lines as they exist now will connect to public water service and not to PE wells.

Snohomish County projected the number of new PE wells over the planning horizon using the following steps:

1. Gather year-built data for single-family residences (i.e. housing units or HUs) built between 2008–2018.
2. Assign HUs to "public water service areas" or "PE well areas" based on the distance to existing water mains. Assume HUs in "PE well areas" will use a PE well for the water source.
3. Estimate the number of HUs per subbasin for each type of water source (public water service or PE well) and calculate the percentage of HUs per subbasin for each type of water source.
4. Calculate the average number of HUs per year (2008-2018) and multiply by 20 to calculate the estimated total of HUs projected over the 20-year planning horizon for rural unincorporated Snohomish County.
5. Apply HU projections to WRIA 8 subbasins based on the past percentage of growth per subbasin and past percentage of HU for each type of water source per subbasin.
6. Tabulate the total PE wells projected over the 20-year planning horizon for each subbasin and sum to get the total of PE wells projected over the 20-year planning horizon in rural unincorporated Snohomish County.

Urban Growth Area PE Well Projection Methodology

The King County and Snohomish County PE well projection methods do not account for potential PE wells within cities or UGAs. However, the WRIA 8 Committee recommended looking at the potential for PE well growth within UGAs. The WRIA 8 Committee completed an analysis of potential PE well growth within the incorporated and unincorporated UGAs using data from Ecology's Well Report Viewer database (referred to as the UGA well log spot check).

The general method included using Ecology's Well Report Viewer database (1998–2018) to query water wells with characteristics of a domestic well[11] within UGAs. The Committee randomly reviewed a subset of the water well reports and calculated the number and percentage of each type of well (domestic, irrigation, other and incorrect) located within the UGAs. They then multiplied the percentage of wells identified as domestic (assumed to be PE wells) by the total number of wells located within UGAs to estimate the number of PE wells installed over the past 20-year period. The Committee also cross-checked the physical address of the wells with the UGA boundaries to determine which subbasin the domestic wells were located in. The Committee used the total number of domestic wells per subbasin over the past

[11] Ecology's complete Well Report Viewer database was filtered for water wells 6 to 8 inches in diameter and greater than 30 feet deep, which are typical dimensions and depths for domestic wells. The Ecology Well Report Viewer database does not have the ability to filter for permit-exempt domestic wells.

20 years to project the number of PE wells located within the UGAs over the planning horizon for each WRIA 8 subbasin. A more detailed methodology is included in Appendix F.

King County PE Well Potential Assessment

King County completed an assessment of parcels available for future residential development in unincorporated King County (referred to as the PE well potential assessment). The Committee used the PE Well Potential Assessment to assess whether a subbasin has the capacity to accommodate the number of PE wells projected over the 20-year planning horizon.

King County used screening criteria to identify parcels with potential for future residential development by subbasin. The total number of parcels and dwelling units[12] (DUs) per subbasin were determined and labeled as inside or outside the water district service boundaries. King County then projected the water source for each parcel (public water or PE well) based on historic rates of connection to water service inside water district service boundaries. King County used historic rates of connection to water service because the County does not have County-wide information on the location of water lines. The WRIA 8 Committee compared the 20-year PE well projection to the PE well potential assessment. In areas where the number of projected PE wells exceeded the potential parcels available, the Committee reallocated those PE wells to the nearest subbasin with parcel capacity and similar growth patterns. The WRIA 8 Committee redistributed 1 well from the Upper Cedar subbasin to the Lower Cedar subbasin in the King County portion of WRIA 8. A more detailed methodology and list of assumptions is included in Appendix F.

Snohomish County Rural Capacity Analysis

Snohomish County completed a Rural Capacity Analysis in 2011 that resulted in an assigned future residential development capacity for each parcel in the rural area. Snohomish County updated their 2011 analysis to determine capacity to accommodate the 20-year PE well projection at the WRIA and subbasin level.

Snohomish County used screening criteria to identify parcels with potential for future residential development by subbasin. For each parcel, Snohomish County calculated residential development capacity based on development status, parcel size, density, and other attributes. The County assigned parcels to “public water service areas” or “PE well areas” per the past trends analysis method and aggregated the residential development capacity by subbasin and water source. Snohomish County compared the 20-year PE well projection with the rural capacity analysis and calculated the shortfall or surplus of available parcels to be sourced by PE wells. In areas where the number of projected PE wells exceeded the potential parcels available, the Committee reallocated those PE wells to the nearest subbasin with parcel capacity and similar growth patterns. The WRIA 8 Committee reallocated 59 wells from the

[12] A dwelling unit is a rough estimate of subdivision potential based on parcel size and zoning (e.g. a 22-acre parcel zoned RA-5 is assumed to have 4 dwelling units).

Little Bear subbasin to the Bear/Evans subbasin in the Snohomish County portion of WRIA 8. A more detailed methodology and list of assumptions is included in Appendix F.

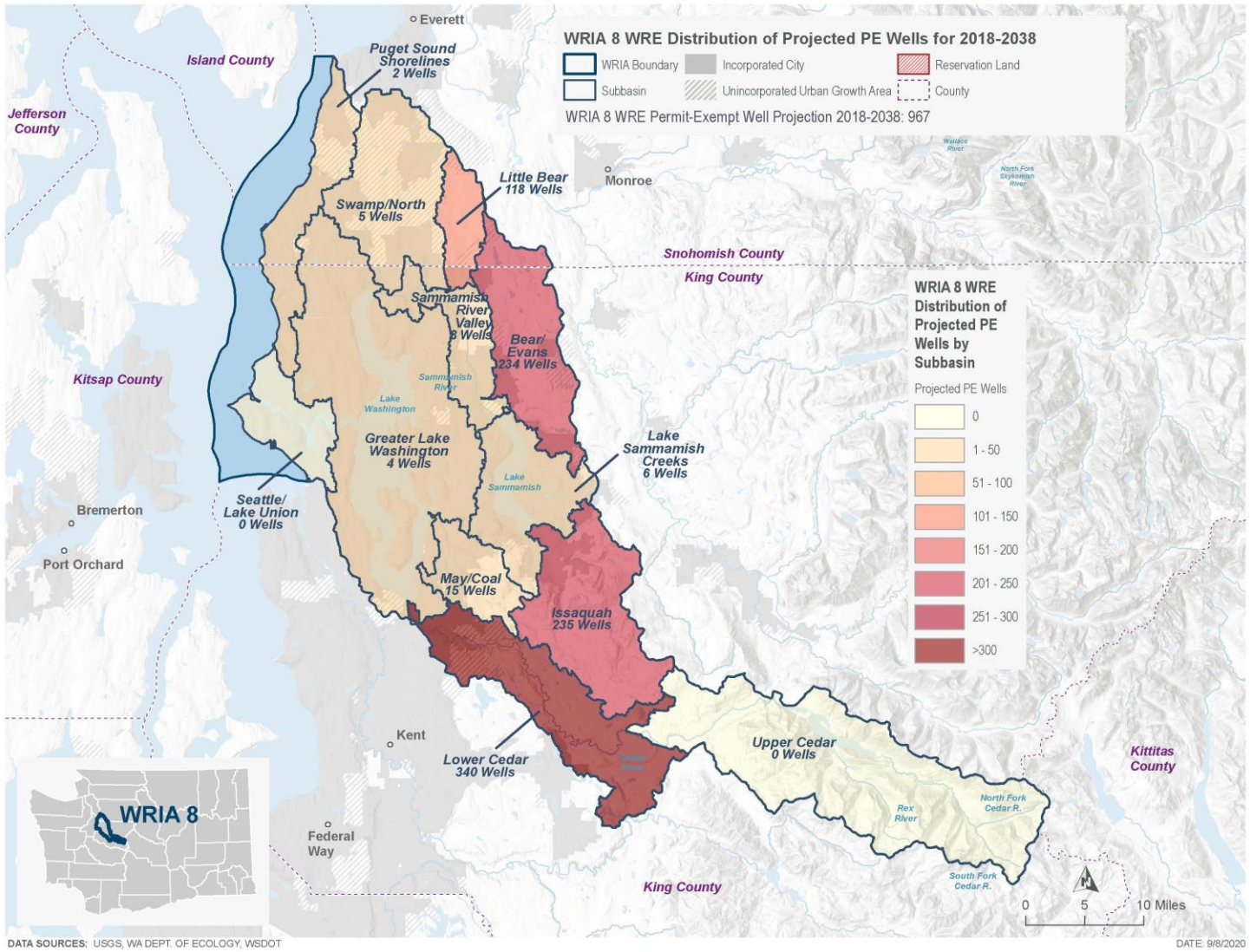


Figure 4.1: WRIA 8 Distribution of Projected PE Wells for 2018-2038

4.3 Impacts of New Consumptive Water Use

The WRIA 8 Committee used the 20-year projection of new wells for WRIA 8 (967) to estimate the new consumptive water use (consumptive use) that this watershed plan must address and offset. The WRIA 8 Committee estimates 425.4 acre-feet per year (AFY) (0.59 cfs) of new consumptive water use in WRIA 8. The WRIA 8 Committee added a margin of safety to the consumptive use estimate to account for uncertainties in the PE well projections and consumptive use estimate, including higher rates of water use that could result from climate change and changing development patterns. The WRIA 8 Committee sought projects to offset at least 698.9 AFY (hereafter referred to as the offset target). The offset target is based on the consumptive use scenario that assumes each home uses 950 gallons of water per day for indoor and outdoor household use (the legal withdrawal limit per PE well connection[13]), described below.

This section includes an overview of the methods used by the WRIA 8 Committee to estimate new consumptive water use and an overview of the anticipated impacts of new consumptive use in WRIA 8 over the planning horizon. The WRIA 8 Consumptive Use Estimates Technical Memorandum provides a more detailed description of the analysis and alternative scenarios considered (Appendix G).

4.3.1 Methods to Estimate Indoor and Outdoor Consumptive Water Use

Indoor water use patterns differ from outdoor water use. Indoor use is generally constant throughout the year, while outdoor use occurs primarily in the summer months. Also, the portion of water that is consumptive varies for indoor and outdoor water use. Appendix A of the Final NEB Guidance (Ecology 2019) describes a method (referred to as the Irrigated Area Method) which 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. The Irrigated Area Method accounts for indoor and outdoor consumptive use variances by using separate approaches to estimate indoor and outdoor consumptive use.

To develop the consumptive use estimate, the WRIA 8 Committee used the Irrigated Area Method and relied on assumptions for indoor use and outdoor use from Appendix A of the Final NEB Guidance. This chapter provides a summary of the technical memo which is available in Appendix G.

Consistent with the Final NEB guidance (Appendix B, pg. 25), for the purposes of calculating an estimate of consumptive use, the Committee assumed impacts from consumptive use on surface water are steady-state, meaning impacts to the stream from pumping do not change

[13] Legal withdrawal limits from PE wells in WRIA 8 are defined in RCW: “an applicant may obtain approval for a withdrawal exempt from permitting under RCW 90.44.050 for domestic use only, with a maximum annual average withdrawal of nine hundred fifty gallons per day per connection” RCW 90.94.030(4)(a)(vi)(B)

over time. This assumption is based on the wide distribution of future well locations and depths across varying hydrogeological conditions, and because empirical data to support the assumption is not locally available.

The WRIA 8 Committee looked at other scenarios for estimating consumptive use, including (1) assuming each home has 0.5-acre irrigated lawn area (legal maximum per PE well[14]) and (2) assuming each home uses 950 gallons of water per day (legal withdrawal limit per PE well connection[15]). The Committee chose a consumptive use estimate based on the irrigated area method. The technical memo in Appendix G includes the additional consumptive use scenarios and results.

New Indoor Consumptive Water Use

Indoor water use refers to the water that households use in kitchens, bathrooms, and laundry (Ely and Kahle 2012). The WRIA 8 Committee used the Irrigated Area Method and Ecology's recommended assumptions for indoor daily water use per person, local data to estimate the average number of people per household, and applied Ecology's recommended consumptive use factor to estimate new indoor consumptive water use (Ecology 2019). The assumptions the WRIA 8 Committee used to estimate household consumptive indoor water use are:

- 60 gallons per day (gpd) per person.
- 2.73 and 2.75 persons per household assumed for rural portions of King and Snohomish Counties, respectively. For areas spanning both counties, a weighted value was estimated based on the number of projected PE wells in each county.
- 10% of indoor use is consumptively used (or a consumptive use factor (CUF) of 0.10), based on the assumption that homes on PE wells are served by onsite sewage systems (septic). 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 gpd x 2.73 to 2.75 people per house x 365 days x .10 CUF

This results in an annual aggregated average of 0.0184 AF[16] (16.4 gpd or 0.000025 cfs[17]) indoor consumptive water use per day per well.

[14] Per RCW 90.44.050.
[15] Per RCW 90.94.030(4)(a)(vi)(B).
[16] Acre-foot is a unit of volume for water equal to a sheet of water one acre in area and one foot in depth. It is equal to 325,851 gallons of water. 1 acre-foot per year is equal to 893 gallons per day.
[17] Cubic feet per second (CFS) is a rate of the flow in streams and rivers. It is equal to a volume of water one foot high and one foot wide flowing a distance of one foot in one second. 1 cubic foot per second is equal to 646,317 gallons per day.

New Outdoor Consumptive Water Uses

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

The WRIA 8 Committee used aerial imagery to measure the irrigated areas of 153 randomly selected parcels in seven[18] WRIA 8 subbasins to develop an average outdoor irrigated area per subbasin. Parcels used for the irrigated footprint analysis were selected based on recent (2006-2017) building permits for new single-family residential homes not served by public water. There were more than 400 permits in WRIA 8 meeting these criteria. For subbasins with more than 20 applicable building permits, a statistically representative sample size was identified to ensure that the sample mean is representative over the WRIA. The average irrigated area for 131 randomly selected parcels, when aggregated across subbasins, was 0.32 acres per parcel.

The WRIA 8 Committee used the following assumptions, recommended in Appendix A of the Final NEB Guidance, to estimate household outdoor consumptive water use:

- The amount of water needed to maintain a lawn varies by subbasin due to varying temperature and precipitation across the watershed. The Committee used the Washington Irrigation Guide (WAIG) (NRCS-USDA 1997) Seattle-UW station and surrounding stations to develop a weighted average crop irrigation requirement (IR) for turf grass in each subbasin (the WRIA average IR is 15.66 inches). This value represents the amount of water needed to maintain a green lawn.
- The irrigation application efficiency (AE) used for WRIA 8 was the Ecology-recommended value of 75%. This increases the amount of water used to meet the crop's irrigation requirement.
- Consumptive use factor (CUF) of 0.8, reflecting 80% consumption for outdoor use. This means 20% of outdoor water is returned to the immediate water environment.

[18] The analysis covered seven of the ten subbasins in WRIA 8 with projected PE well connections. Due to small sample sizes, the subbasin-level results for Lake Sammamish Creeks, Sammamish River Valley, and May/Coal subbasins are not considered representative. Parcels in these subbasins were included in the overall average, but average irrigated areas from similar adjacent subbasins (Bear/Evans, Little Bear, and Lower Cedar, respectively) were used for the purpose of subbasin-scale consumptive use estimates. The Puget Sound Shorelines, Greater Lake Washington, and Swamp/North subbasins (with two, four, and five projected PE well connections, respectively) did not have any recent building permits for sites without purveyor-provided water service from which to estimate subbasin-specific irrigated area. The average irrigated area for the Little Bear subbasin was applied for purposes of subbasin-scale consumptive use estimates. Puget Sound Shorelines, Greater Lake Washington, and Swamp/North subbasins are almost entirely within the Urban Growth Area (UGA) and may have homes on smaller lots with smaller lawns than homes in Little Bear subbasin, which is mostly outside the UGA.

- Outdoor irrigated area per subbasin based on the irrigated footprint analysis (the WRIA average irrigated area size is 0.32 acres per PE well).

IR by subbasin (inches) ÷ 0.75 AE x average irrigated area by subbasin (acres) x 0.80 CUF

First, water loss is accounted for by dividing the crop irrigation requirement by the application efficiency. Next, the total water depth used to maintain turf is multiplied by the area which is irrigated. Finally, the volume of water is multiplied by 80 percent to produce the outdoor consumptive water use. To convert the equation from inches to acre-feet, divide the result by 12.

The result is total outdoor consumptive water use per PE well per subbasin ranging from 0.36 AFY in the Little Bear subbasin to 0.47 AFY in the May/Coal and Issaquah Creek subbasins. The outdoor consumptive use varies by subbasin due to differences in average outdoor irrigated area size and irrigation requirements across the watershed. This is total annual estimated consumptive use, however the Committee expects that more water use will occur in the summer than in the other months.

4.4 Consumptive Use Estimate for WRIA 8 and by Subbasin

The total consumptive use estimate for WRIA 8 is 425.4 AFY (0.59 cfs). The total consumptive use estimate for WRIA 8 is the number of PE wells projected by subbasin (see section 4.2) multiplied by the total indoor and outdoor consumptive use per PE well. Table 4.2 summarizes the estimated indoor and outdoor consumptive use by subbasin using the Irrigated Area Method. The highest consumptive use is expected to occur in the subbasin with the largest irrigated area per PE well and the most anticipated new PE wells, as presented in Figure 4.2.

Table 4.2: Consumptive Use Estimate Based on Irrigated Areas Method (1 Home + Subbasin Average Yard)

Subbasin	Projected PE wells	Average lawn size (acres)	Indoor CU per well (AFY)	Outdoor CU per well (AFY)	Total CU/year per well (AFY)	Total CU 2018-2038 (AFY)
Seattle/Lake Union	0	-	-	-	-	0
Puget Sound Shorelines	2	0.28	0.0185	0.42	0.44	0.9
Swamp/North	5	0.28	0.0185	0.38	0.40	2.0
Little Bear	118	0.28	0.0185	0.36	0.38	44.3
Sammamish River Valley	8	0.28	0.0183	0.39	0.41	3.2
Bear/Evans	234	0.31	0.0184	0.39	0.41	96.7

Subbasin	Projected PE wells	Average lawn size (acres)	Indoor CU per well (AFY)	Outdoor CU per well (AFY)	Total CU/year per well (AFY)	Total CU 2018-2038 (AFY)
Greater Lake Washington	4	0.28	0.0183	0.43	0.45	1.8
May/Coal	15	0.33	0.0183	0.47	0.49	7.4
Lake Sammamish Creeks	6	0.31	0.0183	0.43	0.44	2.7
Issaquah	235	0.37	0.0183	0.47	0.49	115.3
Lower Cedar	340	0.33	0.0183	0.43	0.44	151.2
Upper Cedar	0	-	-	-	-	0
WRIA 8	**967**	**0.33**	**0.0184**	**0.42**	**0.43**	**425.4**

Note: Values in table have been rounded

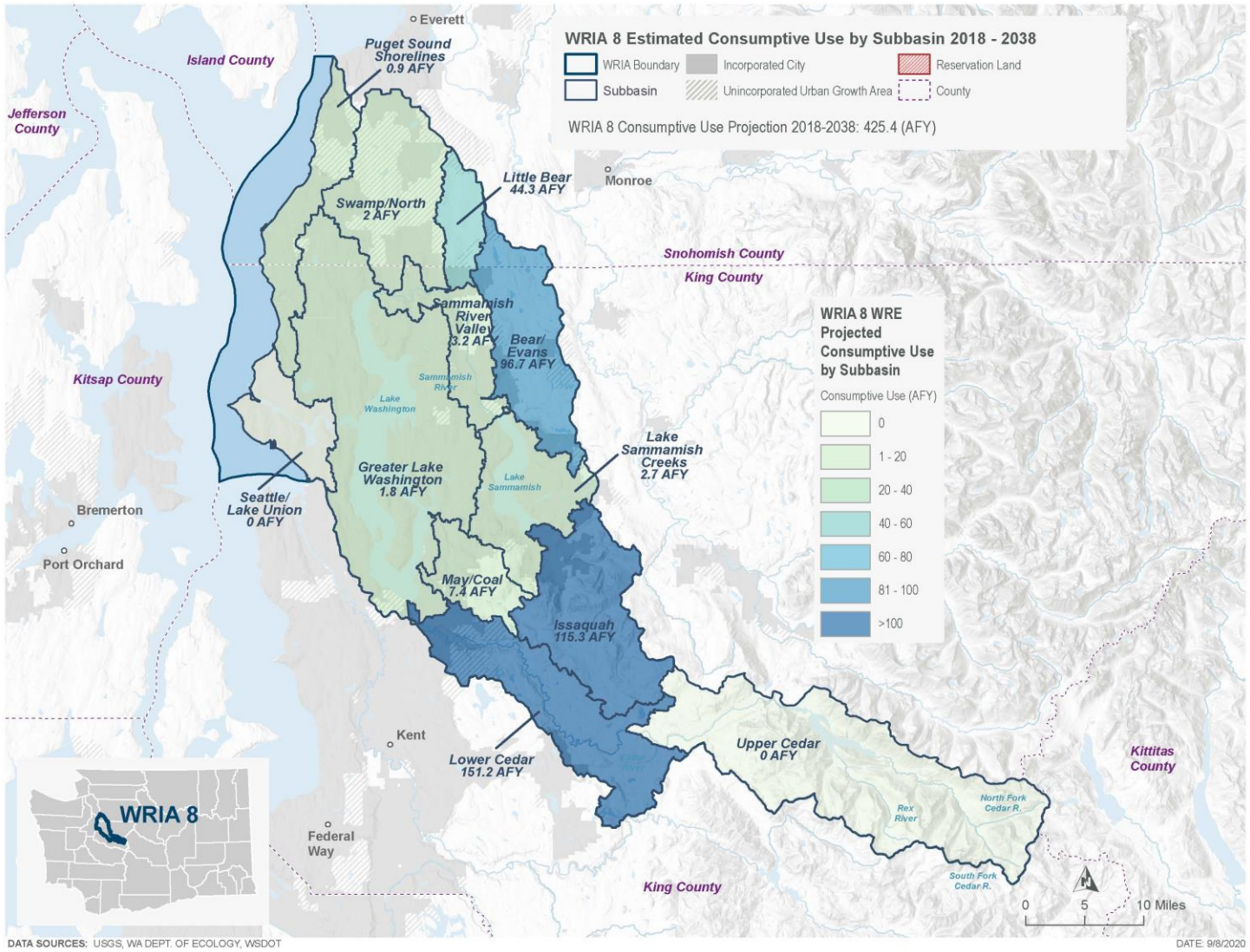


Figure 4.2: WRIA 8 Estimated Consumptive Use by Subbasin 2018-2038

4.5 Summary of Uncertainties and Scenarios

The methods described in Section 4.2 for projecting new PE wells include a number of uncertainties, which were discussed by the WRIA 8 Committee. The Committee recognized uncertainties as inherent to the planning process and addressed uncertainties where feasible. A selection of identified uncertainties are shared here to provide transparency in the planning process and deliberations of the Committee, and to provide context for monitoring and adaptive management.

Historical data on the number and location of PE wells within WRIA 8 was not available to inform PE well projections. Therefore, the WRIA 8 Committee relied on building permit data, and agreed on assumptions about the water source, in order to estimate the numbers of past and future PE wells. The assumptions were not ground-truthed and may have yielded imprecise and/or inaccurate results. Additionally, projections in Snohomish County assume that homes built within 100 feet of an existing water line will connect to public water service, but this is based on proposed draft code that has not been passed by the Snohomish County Council.

Another example of uncertainty is that the counties projected new PE wells within unincorporated areas and omitted PE wells installed within city limits, including PE wells installed for lawn watering purposes. Although most cities require new homes to connect to water systems, some allow exceptions if a connection is not available (for instance, if a home is more than 200 feet from a water line), or allow a home connected to a water system to install a PE well for lawn watering. The WRIA 8 Committee attempted to address this uncertainty by including a projection for new PE wells within the UGAs that was based on PE Well construction rates derived from available data for 1998 to 2018.

Both counties relied on historical data and assumed that these historical building trends will continue into the future. However, future building trends may not mirror historical building trends. Water service areas and water lines are expected to continue to grow and expand at an unknown rate and in unknown locations. Water line data was not readily available in King County, so the WRIA 8 Committee was not able to compare actual water lines with the historical data to see if and how the water service has expanded. Counties and cities generally enact policies intended to direct growth to urban areas (with access to public water service) to preserve rural and resource lands and protect critical areas. However, private property rights continue to allow landowners to build homes in rural areas. Additionally, uncertain economic and social factors, including the COVID-19 pandemic and increasing ability to telework, will affect the Committee's predictions in unknown ways and may result in greater rural growth than was predicted based on past trends.

RCW 90.94 requires counties to collect fees for new homes that rely on PE wells and provide a report and portion of those fees to Ecology. King and Snohomish Counties shared information on the fees collected since those requirements went into effect in January of 2018. King County reported 10 building permits with PE wells identified as the water source within the WRIA 8 portion of unincorporated King County between January 2018 and June 2020. Snohomish County reported 7 building permits with PE wells identified as the water source within the

WRIA 8 portion of unincorporated Snohomish County between January 2018 and June 2020. The King and Snohomish County total of 17 new wells averages to 7 new wells per year, in comparison to the WRIA 8 Committee's projection of 48 new wells per year.

The Irrigated Area Method used to estimate consumptive use (described in Section 4.3.1) contains a number of uncertainties and limitations. Measurement of consumptive water use in any setting is difficult, and it is virtually impossible for residential groundwater use, which must account for both indoor and outdoor use. PE wells are generally unmetered, so supply to each home is usually unknown, let alone the amount that is consumed versus infiltrated to the groundwater system. Therefore, the WRIA 8 Committee was limited to estimating consumptive use based on projections of future growth, local patterns and trends in water use, and generally accepted and reasonable assumptions.

The outdoor consumptive use calculation contains a high level of uncertainty. In aerial photos used to calculate average irrigated area, many parcels did not demonstrate a clear-cut distinction between irrigated and non-irrigated lawns and other landscaped areas. The WRIA 8 Committee attempted to address uncertainty and ensured consistency by applying conservative methods that err on the side of a higher irrigated area and having one GIS analyst evaluate all of the selected parcels in the WRIA. Assumptions for the aerial imagery analysis are described in detail in Appendix G.

Other factors of uncertainty in the outdoor consumptive use calculation are the assumptions about irrigation amounts and irrigation efficiencies. The calculation assumes that homeowners water their lawns and gardens at the rate needed for commercial turf grass (e.g., watering at rates that meet crop irrigation requirements per the WAIG). The irrigated area analysis demonstrated that many homeowners may 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 the lawns with an efficiency of 75%. In reality, households apply water to their lawns and gardens in many different ways, some more or less efficient than pop-up sprinklers. The WRIA 8 Committee discussed these uncertainties and scenarios and recognized that there is a range of water use across the watershed and individual PE well owners.

The consumptive use estimate assumes that current rural residential landscaping practices and outdoor water use will continue over the 20-year planning horizon. Because of uncertainty inherent in estimating growth patterns, domestic PE well pumping rates, and potential changes in outdoor watering practices, potentially related to climate change, the WRIA 8 Committee determined that the conservative assumptions used to estimate consumptive use based on the Irrigated Area Method, and assumptions for outdoor water use in particular, are justified.

To further address uncertainty and have a point of comparison, the Committee developed two additional consumptive use scenarios. One additional scenario assumed each home has the legal maximum 0.5-acre irrigated lawn area per PE well and resulted in a consumptive use estimate of 640 AFY for WRIA 8. The second additional scenario assumed each home withdraws the legal limit of 950 gallons per day for indoor and outdoor use and resulted in a consumptive

use estimate of 698.9 AFY for WRIA 8. The technical memo in Appendix G includes the additional consumptive use scenarios and results.

The Committee also compared the Irrigated Area method to local water purveyor data, taking into consideration several factors: customers connected to public water supply are incentivized to conserve water in order to reduce their water bill; purveyor data represents total water use (not consumptive use) and does not separate indoor and outdoor water use to account for different consumptive use factors; and water purveyors also serve areas that are more dense and urban with smaller lots and smaller irrigated footprints, on average, than rural areas where most new PE Wells are expected to be constructed. Especially in portions of the watershed with older homes, homes and lawns are smaller and less water is used for irrigation, so a lower water use on average over the service area is expected. The technical memo in Appendix G includes the water purveyor data.

The WRIA 8 Committee developed a water offset target of 698.9 AFY to account for uncertainties in the PE well projection and consumptive use estimate, including higher rates of water use that could result from climate change and changing development patterns, as well as uncertainty regarding magnitude, duration, and timing of project benefits. The offset target may also partly compensate for uncertainties related to project implementation, although such uncertainties will be more fully addressed through the adaptive management provisions described in Chapter 6. The WRIA 8 Committee used the consumptive use scenario that assumes all homes use the legal withdrawal limit of 950 gpd per PE well connection to develop the water offset target.

The WRIA 8 Committee also included plan implementation and adaptive management recommendations to address uncertainties related to the consumptive use estimate and project implementation (see Chapter 6).

Chapter Five: Projects and Actions

5.1 Approach to Identify and Select Projects

Watershed plans must identify projects that offset the potential impacts future PE wells will have on streamflows and provide a net ecological benefit to the WRIA. RCW 90.94.030(3)(b) requires the plan to offset consumptive use at the watershed scale, and states that "the highest priority recommendations must include replacing the quantity of consumptive water use during the same time as the impact and in the same basin or tributary. Lower priority projects include projects not in the same basin or tributary and projects that replace consumptive water supply impacts only during critical flow periods."

This chapter provides recommendations from the WRIA 8 Committee for projects and actions to offset consumptive use and meet NEB. The projects are described in this chapter as water offset projects and habitat projects. Water offset projects have a quantified streamflow benefit and contribute to offsetting consumptive use. Habitat projects contribute toward achieving NEB by focusing on actions that improve the ecosystem function and resilience of aquatic systems, support the recovery of threatened or endangered salmonids, and protect instream resources including important native aquatic species. Habitat projects may also result in an increase in streamflow, but the water offset benefits for these projects is difficult to quantify with a high degree of certainty. Therefore, the Committee did not rely on habitat projects to contribute toward offsetting consumptive use, however recognized they are still of value and therefore should be included in the plan.

The WRIA 8 Committee identified priorities for project types and locations to guide decisions on which projects to include in the plan. The Committee prioritized water rights acquisitions projects, followed by projects with streamflow benefits (including habitat projects with unquantified streamflow benefits), and projects that are expected to have near-term and reliable benefits. The Committee prioritized water offset projects in the following subbasins with higher projected PE wells and consumptive use: Little Bear, Bear/Evans, Issaquah, and Lower Cedar. The Committee also prioritized water offset projects in the Sammamish River Valley subbasin because of documented water temperature issues. The Committee prioritized habitat projects in subbasins with the greatest salmon habitat needs: Sammamish River Valley, Bear/Evans, Lake Sammamish Creeks, Issaquah, and Lower Cedar.

To identify the projects summarized in this chapter, the WRIA 8 Committee assembled a project inventory to capture and track all project ideas throughout the planning process. The project inventory consisted of hundreds of previously proposed projects as well as new project concepts and ideas.

Technical consultants supported the Committee's development of projects described in this chapter through researching project concepts, analyzing estimated water offset for projects, contacting project sponsors, and developing project descriptions. Initially, Ecology and the technical consultants identified projects with potential streamflow benefit from the WRIA 8 salmon recovery lead entity four-year workplans, habitat restoration plans, streamflow

restoration grant applications, and other ongoing planning efforts. These projects were assigned a project type consistent with the three project type examples listed in the Final NEB Guidance (Ecology 2019). These project types included: (a) water right acquisition offset projects; (b) non-acquisition water offset projects; and (c) habitat and other related projects. The WRIA 8 Committee also distributed a Call for Projects to request information on water offset and habitat projects at all stages of development from Committee members and partners in WRIA 8. Even with these efforts to identify projects, there were some subbasins where no water offset or habitat projects were identified.

Non-acquisition water offset projects were underrepresented within the WRIA 8 project inventory, which consisted largely of habitat and other related projects. Development of new non-acquisition water offset projects with quantifiable streamflow benefits became necessary in order for the plan to achieve the consumptive use offset. These projects are largely centered around changes in how and when water is diverted, withdrawn, conveyed, or used to benefit streamflow and instream resources. Examples include streamflow augmentation and managed aquifer recharge projects.

Non-acquisition water offset project development occurred through three main phases: (1) initial identification through brainstorming sessions during technical workgroup and Committee meetings; (2) prioritization and further analysis; (3) and development of project descriptions for projects included in the plan. Project progression from one phase to the next occurred after the Committee agreed to move the project to the next phase. The non-acquisition water offset projects that the Committee selected for the plan are described below in section 5.2.1.

In a separate effort, Ecology contracted with Washington Water Trust (WWT) to identify opportunities for water right acquisition water offset projects within WRIA 8, including source switches to municipal water and reclaimed water. In coordination with the WRIA 8 Committee, WWT developed a water right selection criterion based on the unique local nature of water rights and water use in WRIA 8. The water rights assessment consisted of four categories of potential projects: irrigation water rights in priority subbasins, irrigation water rights near existing reclaimed water infrastructure, water rights in the Trust Water Rights Program as a temporary donation, and specific water right acquisition opportunities identified by the Committee. WWT developed twelve water right acquisition project opportunity profiles for consideration by the Committee. The water rights acquisitions projects that the Committee selected for the plan are described below in section 5.2.1.

The Committee developed the list of habitat projects by reviewing projects recommended by Committee members, projects submitted in response to the Call for Projects, and projects identified by technical workgroup members based on priorities for project types and locations (projects in priority subbasins that are likely to have streamflow benefits). The habitat projects that the Committee selected for the plan are described below in section 5.2.2.

After selecting projects to include in the plan, the Committee used the following criteria to organize the list into tiers to reflect the likelihood that the project will be implemented, and the location of the project with respect to subbasin priorities. For water offset projects, this

evaluation considered the following: certainty of implementation; location of water offset benefit with respect to water offset priority subbasins; magnitude of water offset benefit; timing of water offset benefit; certainty of benefit and effectiveness; resiliency; and durability. For habitat projects, this evaluation considered the following: location of benefit with respect to water offset priority subbasins and habitat priority subbasins; projects which provide multiple benefits; certainty of implementation; certainty of benefit and effectiveness; resiliency; and durability. Since the projects were in different stages of development, with some still conceptual and some ready for implementation, the process to apply the tiering criteria and tier the project list was subjective.

Water offset projects and habitat projects were tiered separately. The Committee relied on the technical workgroup to develop a recommendation on tiering based on their knowledge of the proposed project as well as assumptions based on the design and performance of similar projects in the region. The tiering results are included in Table 5.1 and Table 5.2. The WRIA 8 Committee did not use tiering to indicate priorities for funding, water offset projects are the highest priority for funding. Water offset and habitat projects that the Committee selected to offset consumptive use and achieve NEB are summarized below in section 5.2.1 and 5.2.2. Detailed project descriptions and project profiles are included in Appendix H.

In addition to the water offset and habitat projects listed below, section 5.2.3 describes the types of projects that the Committee supports for further development and implementation in the future.

5.2 Projects and Actions

The projects presented below have water offset and/or ecological benefits and the WRIA 8 Committee identified these projects as contributing toward offsetting consumptive use and achieving NEB. The WRIA 8 Committee recommends implementation of all projects included in this chapter.

5.2.1 Water Offset Projects

Table 5.1 provides a summary of the 11 water offset projects identified by the Committee to offset consumptive use and contribute toward NEB. The total offset potential of these 11 projects for WRIA 8 is 1,762.18 acre-feet per year. Offset benefits are anticipated in the subbasins listed in Table 5.1 as well as downstream of the respective project locations. Figure 5.1 is a map of the watershed that shows the location of the projects listed in Table 5.1.

The WRIA 8 Committee supports the acquisition of the valid quantity of water for the water right acquisition projects included in the plan. However, to estimate the offset potential for each water right acquisition project, the WRIA 8 Committee used the estimate generated by WWT for the consumptively used portion of the water right. The estimated return flow portion of the water right is not counted as an offset as that portion of water returns to groundwater. Before water rights are acquired and put into Ecology's Trust Water Rights Program, Ecology will conduct a full extent and validity analysis to determine the actual quantity available for acquisition and the consumptive use component. Since this analysis generally happens after the

water right holder has agreed to sell, the Committee relied on the WWT evaluations to estimate the offset volumes listed in Table 5.1. The WRIA 8 Committee recommends that water rights acquisitions projects include removal of water conveyance infrastructure that is no longer needed (e.g. wells, surface water diversions).

The tier 1 water offset projects included in the plan all have project sponsors and are in priority subbasins. Initial conversations with water right holders have occurred for tier 1 water offset projects that include water right acquisitions. Tier 2 projects have more uncertainty related to project implementation.

A summary description for each project is provided below. More detailed water offset project descriptions are provided in Appendix H.

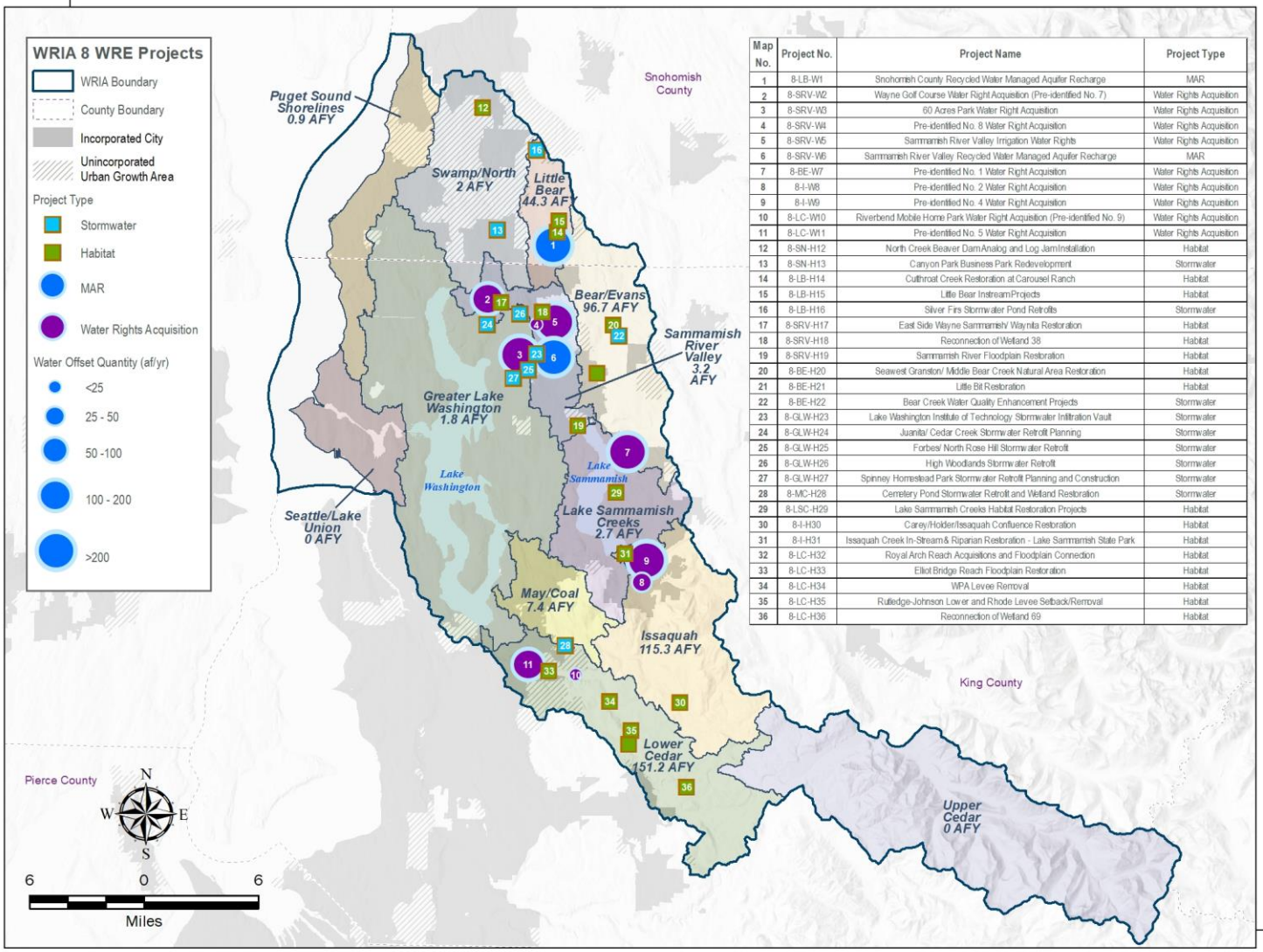
Table 5.1: WRIA 8 Water Offset Projects

Project Number	Project Name	Project type	Subbasin(s)	Water Offset (Annual AF)	Project Sponsor	Estimated project cost	Project tier
8-LB-W1	Snohomish County Recycled Water Managed Aquifer Recharge	Water storage and retiming - MAR	Little Bear	181	Washington Water Trust	$623,000	1
Little Bear Subbasin Subtotal				**181**			
8-SRV-W2	Wayne Golf Course Water Right Acquisition (Pre-Identified No. 7)	Water right acquisition	Sammamish River Valley	84.85	City of Bothell	$218,100	1
8-SRV-W3	Sixty Acres Park Water right Acquisition	Water right acquisition	Sammamish River Valley	126	King County	$323,900	1
8-SRV-W4	Pre-Identified No. 8 Water Right Acquisition	Water right acquisition	Sammamish River Valley	23.43	Washington Water Trust	$60,200	1
8-SRV-W5	Sammamish River Valley Irrigation Water Rights Acquisitions	Water right acquisition	Sammamish River Valley	400	Washington Water Trust	$1,028,400	1

Project Number	Project Name	Project type	Subbasin(s)	Water Offset (Annual AF)	Project Sponsor	Estimated project cost	Project tier
8-SRV-W6	Sammamish River Valley Recycled Water Managed Aquifer Recharge	Water storage and retiming - MAR	Sammamish River Valley	181	Washington Water Trust	$623,000	1
Sammamish River Valley Subbasin Subtotal				**815.28**			
8-BE-W7	Pre-Identified No. 1 Water Right Acquisition[1]	Water right acquisition	Bear/Evans	346.8	Washington Water Trust	$891,600	2
Bear/Evans Subbasin Subtotal				**346.8**			
8-I-W8	Pre-Identified No. 2 Water Right Acquisition	Water right acquisition	Issaquah	27.6	Overdale Water Association	$282,810	1
8-I-W9	Pre-Identified No. 4 Water Right Acquisition	Water right acquisition	Issaquah	286	Washington Water Trust	$735,300	1
Issaquah Subbasin Subtotal				**313.6**			
8-LC-W10	Riverbend Mobile Home Park Water Right Acquisition (Pre-Identified No. 9)	Water right acquisition	Lower Cedar	20.1	King County	$51,700	1

Project Number	Project Name	Project type	Subbasin(s)	Water Offset (Annual AF)	Project Sponsor	Estimated project cost	Project tier
8-LC-W11	Pre-Identified No. 5 Water Right Acquisition[1]	Water right acquisition	Lower Cedar	85.4	Washington Water Trust	$219,600	2
Lower Cedar Subbasin Subtotal				**105.5**			
WRIA 8 Total Water Offset (Cumulative from above)				**1,762.18**			
WRIA 8 Consumptive Use Estimate				**425.4**			
WRIA 8 Offset Target				**698.9**			

Notes:
[1] Tier 2 water rights acquisition projects do not have a detailed project descriptions in Appendix H.



Map No.	Project No.	Project Name	Project Type
1	8-LB-W1	Snohomish County Recycled Water Managed Aquifer Recharge	MAR
2	8-SRV-W2	Wayne Golf Course Water Right Acquisition (Pre-identified No. 7)	Water Rights Acquisition
3	8-SRV-W3	60 Acres Park Water Right Acquisition	Water Rights Acquisition
4	8-SRV-W4	Pre-identified No. 8 Water Right Acquisition	Water Rights Acquisition
5	8-SRV-W5	Sammamish River Valley Irrigation Water Rights	Water Rights Acquisition
6	8-SRV-W6	Sammamish River Valley Recycled Water Managed Aquifer Recharge	MAR
7	8-BE-W7	Pre-identified No. 1 Water Right Acquisition	Water Rights Acquisition
8	8-I-W8	Pre-identified No. 2 Water Right Acquisition	Water Rights Acquisition
9	8-I-W9	Pre-identified No. 4 Water Right Acquisition	Water Rights Acquisition
10	8-LC-W10	Riverbend Mobile Home Park Water Right Acquisition (Pre-identified No. 9)	Water Rights Acquisition
11	8-LC-W11	Pre-identified No. 5 Water Right Acquisition	Water Rights Acquisition
12	8-SN-H12	North Creek Beaver Dam Analog and Log Jam Installation	Habitat
13	8-SN-H13	Canyon Park Business Park Redevelopment	Stormwater
14	8-LB-H14	Cutthroat Creek Restoration at Carousel Ranch	Habitat
15	8-LB-H15	Little Bear InstreamProjects	Habitat
16	8-LB-H16	Silver Firs Stormwater Pond Retrofits	Stormwater
17	8-SRV-H17	East Side Wayne Sammamish/ Waynita Restoration	Habitat
18	8-SRV-H18	Reconnection of Wetland 38	Habitat
19	8-SRV-H19	Sammamish River Floodplain Restoration	Habitat
20	8-BE-H20	Seawest Granston/ Middle Bear Creek Natural Area Restoration	Habitat
21	8-BE-H21	Little Bit Restoration	Habitat
22	8-BE-H22	Bear Creek Water Quality Enhancement Projects	Stormwater
23	8-GLW-H23	Lake Washington Institute of Technology Stormwater Infiltration Vault	Stormwater
24	8-GLW-H24	Juanita/ Cedar Creek Stormwater Retrofit Planning	Stormwater
25	8-GLW-H25	Forbes/ North Rose Hill Stormwater Retrofit	Stormwater
26	8-GLW-H26	High Woodlands Stormwater Retrofit	Stormwater
27	8-GLW-H27	Spinney Homestead Park Stormwater Retrofit Planning and Construction	Stormwater
28	8-MC-H28	Cemetery Pond Stormwater Retrofit and Wetland Restoration	Stormwater
29	8-LSC-H29	Lake Sammamish Creeks Habitat Restoration Projects	Habitat
30	8-I-H30	Carey/Holder/Issaquah Confluence Restoration	Habitat
31	8-I-H31	Issaquah Creek In-Stream& Riparian Restoration - Lake Sammamish State Park	Habitat
32	8-LC-H32	Royal Arch Reach Acquisitions and Floodplain Connection	Habitat
33	8-LC-H33	Elliot Bridge Reach Floodplain Restoration	Habitat
34	8-LC-H34	WPA Levee Removal	Habitat
35	8-LC-H35	Rutledge-Johnson Lower and Rhode Levee Setback/Removal	Habitat
36	8-LC-H36	Reconnection of Wetland 69	Habitat

Figure 5.1: WRIA 8 WRE Projects

Little Bear Subbasin

Project Name: Snohomish County Recycled Water Managed Aquifer Recharge (8-LB-W1)
Project Description: The Snohomish County Recycled Water MAR project proposes to divert reclaimed water from the Brightwater treatment plant to a constructed MAR facility between May and October, when reclaimed water is expected to be available. This diverted water infiltrates into the shallow aquifer, is transported down-gradient, and ultimately discharges to one or more adjacent streams as re-timed groundwater baseflow. The goal of the project is to increase baseflow to the subject stream(s), especially during the critical flow period when surface flows are lowest, by recharging the aquifer adjacent to the stream(s) and providing additional groundwater discharge to the river through MAR. Currently, reclaimed water is only available via King County's recycled water pipeline within the Sammamish River Valley. However, King County is in the process of designing and constructing additional storage capacity at Brightwater, which would allow for distribution of reclaimed water to areas proximal to the plant and eventually to other portions of Snohomish County as reclaimed water infrastructure expands to meet future demand.

Initial calculations indicate the Snohomish County Recycled Water MAR project could infiltrate approximately 181 acre-feet annually. Additional information is included in the project description in Appendix H.

Sammamish River Valley Subbasin

Project Name: Wayne Golf Course Water Right Acquisition (Pre-Identified Water Right No. 7) (8-SRV-W2)
Project Description: The Wayne Golf Course Water Right Acquisition project proposes to acquire two groundwater rights in the Sammamish River Valley subbasin for an estimated 84.85 acre-feet annually of consumptively used water. The land, and a portion of the underlying water right, was previously used as a golf course. The other active irrigation within the water rights place of use occurs on a city park. The property is located within the City of Bothell. The City of Bothell purchased the property in 2017 with assistance from King County, which now holds a conservation easement over the property.

WWT utilized irrigation delineation analysis to estimate consumptive use of 84.85 AFY. This is an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

Initial conversations have occurred between Ecology and the City of Bothell regarding a transfer of this water right into the Trust Water Rights Program for permanent streamflow benefit. Additional information is included in the project profile in Appendix H.

Project Name: Sixty Acres Park Water Right Acquisition (8-SRV-W3)
Project Description: The Sixty Acres Park Water Right Acquisition project proposes to acquire an estimated 126 acre-feet annually of consumptively used water. There are two surface water rights associated with the property, one associated with the North Park property and one associated with the South Park property.

The total irrigated land attributed to the two surfaces water rights is 100 acres. While the sum of the irrigable acres authorized by these water rights documents is 100 acres, the irrigation delineation suggests as much as 59.5 irrigated acres in the most recent 5-year period. Ecology utilized irrigation delineation analysis to estimate consumptive use of 126 AFY. This is an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

Initial conversations have occurred between Ecology and King County regarding a transfer of this water right into the Trust Water Rights Program for permanent streamflow benefit. King County plans to continue to seasonally transfer some portion of this right downstream until recycled water or another feasible water source is available at the Sammamish Farm. Additional information is included in the project profile in Appendix H.

Project Name: Pre-Identified No. 8 Water Right Acquisition (8-SRV-W4)
Project Description: The Pre-Identified Water Right No. 8 Water Right Acquisition project proposes to acquire three groundwater rights in the Sammamish River Valley subbasin for an estimated 23.43 acre-feet annually of consumptively used water. The land under common management for this project opportunity is comprised of five parcels totaling 92.93 acres. Online sources indicate these parcels were purchased by the current owners and developed into a winery and vineyard in 1976.

WWT utilized irrigation delineation analysis to estimate consumptive use of 23.43 AFY. This is an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

Initial conversations have occurred between King County and the landowner regarding extending reclaimed water to the property, which could make the water rights available for transfer into the Trust Water Rights Program for permanent streamflow benefit. Additional information is included in the project profile in Appendix H.

Project Name: Sammamish River Valley Irrigation Water Rights Acquisitions (8-SRV-W5)
Project Description: The project proposes to acquire up to 400 AFY of irrigation water rights within or upstream of the Sammamish River Valley Agricultural Production District from willing sellers with access to an alternative water source, such as reclaimed water. Water rights would be permanently and legally held by Ecology in the Trust Water Rights Program to ensure that the benefits to instream resources are permanent. Additional information is included in the project profile for Sammamish River Valley water rights 3 in Appendix H.

Initial outreach to the water right holder for Sammamish River Valley water right No. 3 was completed by Washington Water Trust and the water right holder is open to further discussions. Washington Water Trust is continuing to conduct outreach to water right holders in the Sammamish River Valley as part of a separate outreach and education effort related to reclaimed water.

Project Name: Sammamish River Valley Recycled Water Managed Aquifer Recharge (8-SRV-W6)
Project Description: This Recycled Water MAR project proposes to divert reclaimed water from

the existing King County Brightwater Wastewater Treatment Plant (Brightwater) recycled water pipeline to a constructed Managed Aquifer Recharged (MAR) facility between May and October, when reclaimed water is available. This diverted water infiltrates into the shallow aquifer, is transported down-gradient, and ultimately discharges to the Sammamish River as re-timed groundwater baseflow. The goal of the project is to increase baseflow to the Sammamish River, especially during the critical flow period when surface flows are lowest, by recharging the aquifer adjacent to the river and providing additional groundwater discharge to the river through MAR. A specific project location has not yet been identified.

Initial calculations indicate the Sammamish River Valley Recycled Water MAR project could infiltrate approximately 181 acre-feet annually. Additional information is included in the project description in Appendix H.

Bear/Evans subbasin

Project Name: Pre-Identified No. 1 Water Right Acquisition (8-BE-W7)
Project Description: The Pre-identified Water Right No. 1 Water Right Acquisition project proposes to acquire two groundwater rights in the Bear/Evans subbasin for an estimated 346.8 acre-feet annually of consumptively used water. The land, and underlying water right, currently support single-family residences and a country club with three 9-hole golf courses. According to online sources, these facilities were constructed during 1967 and have been operated continuously since that time.

WWT utilized irrigation delineation analysis to estimate a consumptive use of 346.8 AFY. This is an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

WWT initiated outreach to this water right holder and, as of the time of this plan, did not receive a response.

Issaquah Creek Subbasin

Project Name: Pre-Identified No. 2 Water Right Acquisition (8-I-W8)
Project Description: The Pre-Identified No. 2 Water Right Acquisition project proposes to acquire two water rights in the Issaquah subbasin for an estimated 27.6 acre-feet annually of consumptively used water. These two water rights previously provided water supply to Overdale Water Association, a Group A water system, through 2004 until Overdale Water Association completed an intertie with the Sammamish Plateau Water and Sewer District. The water right holder has temporarily donated the water right to the Trust Water Rights Program until January 1, 2036. WWT identified that the water rights appear to have been put to continuous beneficial use.

Outreach to the water right holder was initiated by WWT and the water right holder expressed interest in the acquisition.

This project is low in the stream system compared to projected PE wells in the Issaquah subbasin, however it has important benefits to fish, especially Chinook.

Additional information is included in the project profile in Appendix H.

Project Name: Pre-Identified No. 4 Water Right Acquisition (8-I-W9)
Project Description: The Pre-identified Water Right No. 4 Water Right Acquisition project proposes to acquire one water right in the Issaquah subbasin approximately 286 acre-feet annually of consumptively used water. The land, and underlying water right, currently support commercial production of dairy products. According to online sources, the facility, located in the City of Issaquah's Cultural Business District, has been continuously operated since 1909. As of July 30, 2018, a portion of the annual quantity of the subject water right was temporarily donated to the Trust Water Rights Program. WWT identified that the water right appears to have been put to continuous beneficial use.

Initial outreach was completed by Washington Water Trust and the water right holder is open to further discussions.

This project is low in the stream system compared to projected PE wells in the Issaquah subbasin, however it has important benefits to fish, especially Chinook.

Additional information is included in the project profile in Appendix H.

Lower Cedar subbasin

Project Name: Riverbend Mobile Home Park Water Right Acquisition (Pre-Identified Water Right No. 9) (8-LC-W10)
Project Description: The Riverbend Mobile Home Park Water Right Acquisition project proposes to acquire one groundwater right in the Lower Cedar subbasin for an estimated 20.079 acre-feet annually of consumptively used water. The land, and underlying water right, previously were used to support a mobile home park. According to Ecology and online sources, the property and water right were purchased by King County in 2013 as acquisitions that formed part of a levee setback and floodplain restoration project.

WWT utilized irrigation delineation analysis to estimate a consumptive use of 20.079 AFY available for trust water transaction. This is an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

Initial conversations have occurred between Ecology and King County regarding a transfer of this water right into the Trust Water Rights Program for permanent streamflow benefit. Additional information is included in the project profile in Appendix H.

Project Name: Pre-identified No. 5 Water Right Acquisition (8-LC-W11)
Project Description: The Pre-identified Water Right No. 5 Water Right Acquisition project proposes to acquire one groundwater right in the Lower Cedar subbasin for an estimate 85.4 acre-feet annually of consumptively used water. The land, and underlying water right, is currently used as a golf course which, according to Ecology documents, has been in operation since the early 1930's.

WWT utilized irrigation delineation analysis to estimate consumptive use of 85.4 AFY available for trust water transaction. This is an estimate of consumptive use quantity. An extent and validity determination by Ecology would be required to determine the actual quantity available for acquisition.

As of the time of this plan, no outreach related to this project had been conducted.

5.2.2 Habitat Projects

Table 5.2 provides a summary of 25 habitat projects identified by the Committee to provide ecological benefits to WRIA 8. This list also includes projects that are expected to have ecological benefits from improvements to stormwater management and infiltration. More detailed habitat project descriptions are provided in Appendix H.

Although many of these projects have potential streamflow benefits, the WRIA 8 Committee elected not to quantify water offsets from habitat projects due to the uncertainty regarding magnitude, reliability, and timing of streamflow benefits. While habitat projects are not projected to provide water offsets, the project tiering considers the projects' contribution to ecological benefit in subbasins that need additional water offset in order to offset estimated consumptive use. Tier 1 habitat projects are multi-benefit (likely to provide benefits to streamflow based on the project type), and provide ecological benefit to subbasins that need additional water offset in order to offset estimated consumptive use. Tier 2 habitat projects have less certainty about streamflow benefit and/or are located in subbasins with water offset projects that exceed the estimated consumptive use. Stormwater projects are tier 3 because they contribute to hydrologic restoration, but are a not expected to contribute to habitat restoration at the same level as tier 1 and tier 2 projects. All habitat projects, if funded, are expected to be implemented within the planning horizon.

To ensure that all instream and floodplain management habitat projects meet hydrological performance standards, a Beaver Management Plan should be included, when appropriate. A Beaver Management Plan[19] should identify: key flood levels (long and short term allowable flooding elevations and onsite/offsite key protected infrastructure flood level elevations); and standards for when, where, and what methods of beaver deterrence should be used that comply with state and county requirements. In areas where multiple projects are proposed, the benefit of funding multiple projects to maximize biological benefit should be addressed.

[19] Contact the local WDFW Habitat Biologist for more information on Beaver Management Plans.

Table 5.2: WRIA 8 Habitat Projects

Project Number	Project Name	Project Description	Subbasin(s)	Anticipated Ecological Benefits	Project Sponsor	Estimated Cost	Project tier
8-SN-H12	North Creek Beaver Dam Analog and Log Jam Installation	Install 16 beaver analogs/logjams at three locations in the upper 2.5 miles of North Creek.	Swamp/North	Reduction of peak flow during storm events, increase in groundwater levels and recharge, increase channel complexity, increase species diversity, and increase salmonid habitat.	Adopt a Stream Foundation	$94,193	2
8-SN-H13	Canyon Park Business Park Redevelopment (stormwater)	Reduce overall impervious surface area, stormwater improvements and restoration and/or wetland enhancement along North Creek.	Swamp/North	Recharge to underlying aquifers, restore degraded channel and habitat structure.	City of Bothell	$150,000 for feasibility	3
8-LB-H14	Cutthroat Creek Restoration at Carousel Ranch	Stream, riparian, and upland restoration on Cutthroat Creek, including wood placement.	Little Bear	Increase hydraulic diversity, restore native vegetation, restore water temperature, provide erosion abatement.	Snohomish County	$499,500	2

Project Number	Project Name	Project Description	Subbasin(s)	Anticipated Ecological Benefits	Project Sponsor	Estimated Cost	Project tier
8-LB-H15	Little Bear Instream Projects	Instream restoration projects along Little Bear Creek, including wood placement.	Little Bear	Improve cover and hydraulic diversity in riparian buffer zone, floodplain reconnection.	Snohomish County	$741,000	2
8-LB-H16	Silver Firs Stormwater Pond Retrofits (stormwater)	Retrofit two existing stormwater ponds to increase infiltration capacity.	Little Bear	Improve stormwater management.	Snohomish County	$1,400,000	3
8-SRV-H17	East Side Wayne Sammamish/ Waynita Restoration	Restore the eastside of the former Wayne Golf Course property, including the south bank of the Sammamish River and the mouth and lower reach of Waynita Creek.	Sammamish River Valley	Floodplain restoration.	City of Bothell	$7,000,000	2
8-SRV-H18	Reconnection of Wetland 38	Reconnect Wetland 38 to the Sammamish River	Sammamish River Valley	Wetland reconnection.	Mid Sound Fisheries Enhancement Group	Unknown	2

Project Number	Project Name	Project Description	Subbasin(s)	Anticipated Ecological Benefits	Project Sponsor	Estimated Cost	Project tier
8-SRV-H19	Sammamish River Floodplain Restoration[1]	Restore Sammamish Transition Zone 1,500 feet above and below an existing weir. Enhance habitat through elements such as: excavation of a side channel in the left bank floodplain, creation of pools, removal of non-native vegetation, addition of gravel substrate, connection to restored segments of Tosh Creek, wetland and groundwater connections, and re-vegetation of riparian and wetland areas. Also explore alternatives for cold water supplementation.	Sammamish River Valley	Floodplain restoration, removal of non-native vegetation, addition of gravel substrate.	TBD	Unknown	2

Project Number	Project Name	Project Description	Subbasin(s)	Anticipated Ecological Benefits	Project Sponsor	Estimated Cost	Project tier
8-BE-H20	Seawest Granston/ Middle Bear Creek Natural Area Restoration	Restoration of up to 3,300 lineal feet of stream and approximately 32 acres of wetland and riparian areas.	Bear/Evans	Increase baseflow and groundwater levels, increase storage capacity. May augment streamflow and moderate stream temperature.	King County	$1,400,000	1
8-BE-H21	Little Bit Restoration	Addition of woody debris, excavation of off-channel habitats, and revegetation of the floodplain and riparian areas along 650 feet of Bear Creek.	Bear/Evans	Increase the volume and availability of off-channel habitat for juvenile salmonids and increase overall channel complexity and habitat quality.	King County	$1,000,000	1
8-BE-H22	Bear Creek Water Quality Enhancement Projects (stormwater)	Identification of stormwater retrofit projects in the Bear Creek basin.	Bear/Evans	Future projects will target water quality treatment, stream shading/temperature reduction, and/or enhanced flow control of storm runoff.	King County	Unknown	3

Project Number	Project Name	Project Description	Subbasin(s)	Anticipated Ecological Benefits	Project Sponsor	Estimated Cost	Project tier
8-GLW-H23	Lake Washington Institute of Technology (LWIT) Infiltration Vault (stormwater)	The LWIT Infiltration Vault would provide water quality treatment and subsequent infiltration of stormwater for 23.4 acres of contributing area.	Greater Lake Washington	Infiltrate stormwater before it reaches Totem Lake and subsequently Juanita Creek, a salmon bearing stream in Kirkland.	City of Kirkland	$2,700,000	3
8-GLW-H24	Juanita/ Cedar Creek Stormwater Retrofit Planning (stormwater)	Conduct stormwater retrofit planning for Cedar Creek, resulting in conceptual design and cost estimates for three facilities and an implementation plan.	Greater Lake Washington	Stormwater retrofit facilities will contribute to stream restoration efforts that include installation of a fish passable culvert.	City of Kirkland	$6,000,000	3
8-GLW-H25	Forbes/ North Rose Hill Stormwater Retrofit (stormwater)	Implementation of stormwater projects in the North Rose Hill and Forbes Creek stormwater retrofit plans.	Greater Lake Washington	Stormwater management will support summer streamflows and control winter peak flows.	City of Kirkland	$4,800,000	3
8-GLW-H26	High Woodlands Stormwater Retrofit (stormwater)	Site and size stormwater retrofit facilities within the High Woodlands subbasin of Juanita Creek.	Greater Lake Washington	Contribute to improved flows and water quality.	City of Kirkland	$6,000,000	3

Project Number	Project Name	Project Description	Subbasin(s)	Anticipated Ecological Benefits	Project Sponsor	Estimated Cost	Project tier
8-GLW-H27	Spinney Homestead Park Stormwater Retrofit Planning and Construction (stormwater)	Conduct stormwater retrofit planning, design development, and facility construction at Spinney Homestead Park.	Greater Lake Washington	Stormwater management will support summer streamflows and control winter peak flows.	City of Kirkland	$4,700,000	3
8-MC-H28	Cemetery Pond Stormwater Retrofit and Wetland Restoration (stormwater)	Improve the water quality in May Creek through the retrofit design of an existing stormwater detention pond.	May/Coal	Support summer streamflows and control winter peak flows to May Creek by providing stormwater detention.	King County	Unknown	3
8-LSC-H29	Lake Sammamish Creeks Habitat Restoration Projects[1]	Habitat restoration projects in Ebright, Zackuse, and Laughing Jacobs Creeks.	Lake Sammamish Creeks	Restoration of Kokanee habitat.	TBD	Unknown	2
8-I-H30	Carey/ Holder/ Issaquah Confluence Restoration	Restore riparian vegetation, add livestock fencing, and implement other best management practices for livestock on a 120-acre site, and potentially install large woody debris.	Issaquah	Increase the volume and availability of off-channel habitat for juvenile salmonids and increase overall channel complexity and habitat quality.	King County	Unknown	2

Project Number	Project Name	Project Description	Subbasin(s)	Anticipated Ecological Benefits	Project Sponsor	Estimated Cost	Project tier
8-I-H31	Issaquah Creek In-Stream & Riparian Restoration - Lake Sammamish State Park	Complete in-stream restoration and riparian buffer restoration along Issaquah Creek within Lake Sammamish State Park.	Issaquah	Enhance the quality and quantity of key, strategically located salmonid habitat, particularly for juvenile Chinook rearing and adult Chinook holding in Issaquah Creek.	Mountains to Sound Greenway Trust	$472,142	2
8-LC-H32	Royal Arch Reach Acquisitions and Floodplain Connection	Acquire floodplain properties for future floodplain reconnection and restoration.	Lower Cedar	Restore the floodplain connectivity, improving the aquatic habitats associated with the Cedar River.	Seattle Public Utilities	$4,200,000	1
8-LC-H33	Elliot Bridge Floodplain Restoration	Acquire parcels near the former Elliot Bridge site to enable floodplain restoration.	Lower Cedar	Floodplain restoration, enhance habitat conditions in Madsen creek.	King County	Unknown	1

Project Number	Project Name	Project Description	Subbasin(s)	Anticipated Ecological Benefits	Project Sponsor	Estimated Cost	Project tier
8-LC-H34	WPA Levee Removal	Acquire remaining parcel not in public ownership and setback or remove the WPA levee.	Lower Cedar	Restore the floodplain connectivity, improving the aquatic habitats along the Cedar River.	King County	Unknown	1
8-LC-H35	Rutledge-Johnson Lower and Rhode Levee Setback/ Removal	Acquire necessary property, remove/setback levees, and restore reconnected floodplain along the Rutledge-Johnson levee (a) and the Rhode and Rutledge-Johnson Levees.	Lower Cedar	Restore the floodplain connectivity, improving the aquatic habitats along the Cedar River.	King County	Unknown	1

Project Number	Project Name	Project Description	Subbasin(s)	Anticipated Ecological Benefits	Project Sponsor	Estimated Cost	Project tier
8-LC-H36	Reconnection of Wetland 69	Acquire necessary property to reconnect Wetland 69 to the Cedar River and remove a revetment.	Lower Cedar	Reconnect a wetland feature, known as Wetland 69, with the Cedar River, which will provide refugia for fish and vegetation and nutrients for insects and invertebrates which are a prey source for fish.	King County	Unknown	1

Notes:
[1] The Sammamish River floodplain restoration project and Lake Sammamish Creeks habitat restoration projects are conceptual and do not have detailed project descriptions in Appendix H.

5.2.3 Prospective Projects and Actions

In addition to the projects described in this chapter, the WRIA 8 Committee supports projects and actions that achieve the following goals:

- Acquisitions of water rights to increase streamflows and offset the impacts of PE wells. Water rights should be permanently and legally held by Ecology in the Trust Water Rights Program to ensure that the benefits to instream resources are permanent.

  The WRIA 8 Committee acknowledges that all water rights transactions rely on willing sellers and willing buyers. The WRIA 8 Committee recognizes the importance of water availability for farmers and the limited available water supply within the Agricultural Production Districts. The WRIA 8 Committee supports the current King County policy to encourage the maintenance and preservation of agriculture water rights for agriculture purposes, and supports the acquisition of irrigation water rights within designated Agricultural Production Districts if the properties underlying the water rights have access to an alternative water source, such as reclaimed water, that can be reliably supplied to the properties at a rate that is comparable to the cost of current irrigation management.

- Projects or programs that support connections to public water systems. Projects could provide financial incentives for homes using PE wells to connect to public water service and decommission the well; and/or provide financial support for water purveyors to extend water distribution systems further into their individual service areas, particularly where PE wells are concentrated or rapid rural growth is anticipated, without impacting critical areas or indirectly encouraging development outsides of UGAs.

- Projects or programs that provide outreach and incentives to rural landowners with wells in order to lower indoor and outdoor water use through water conservation best practices, and comply with drought and other water use restrictions. Programs would encourage the following types of water conservation strategies and best practices: natural lawn care; irrigation efficiency; rainwater catchment and storage; drought resistant and native landscaping; smaller lawn sizes; forest, meadow and wetland conservation; indoor water conservation; and voluntary metering. Conservation and water use efficiency projects that involve water rights should permanently convey the saved water to Ecology to be held in the Trust Water Rights Program for instream flow purposes.

- Projects that beneficially switch the source of withdrawal from surface to groundwater, or other beneficial source exchanges such as a source switch to reclaimed water. The benefits of a source exchange project may depend on the connection between the sources, benefits to instream resources (e.g., a surface to groundwater source switch may have negative impacts on fish if the groundwater baseflow provides refuge areas in

streams with high water temperature issues), and should take into consideration the possible consequences of unsustainable withdrawals from the affected aquifer.

- Projects that provide streamflow and habitat benefits by returning stream habitat to a more natural state, such as through levee setback or removal, river-floodplain restoration, and instream habitat restoration.
- Projects or programs that support adding additional water into the Cedar River from changes to dam and/or reservoir operations. These projects would add water above any legal requirements and agreements. This water would provide benefit for streamflow and habitat. Ideally these benefits arrive in the watershed when most needed.
- Projects such as managed aquifer recharge that re-time flood-level flows on the Cedar River to provide streamflow benefits during low-flow periods.
- Projects that contribute to offsetting consumptive use in the following subbasins with higher projected PE wells and consumptive use: Little Bear, Bear/Evans, Issaquah, and Lower Cedar.

5.3 Project Implementation Summary

5.3.1 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, the Committee estimated 425.4 AFY of consumptive use from new PE wells over the planning horizon. As discussed in section 4.5, the Committee developed an offset target of 698.9 AFY to address uncertainty in the consumptive use estimate and project implementation, including uncertainties related to climate change, and ensure that projects and actions in the plan would offset consumptive use.

The plan includes nine water rights acquisitions projects and two reclaimed water managed aquifer recharge projects to offset consumptive use. These water offset projects included in Table 5.1 provide an estimated offset of 1,762.18 AFY and exceed the offset target.

A total of 25 habitat projects have been identified by the Committee and are included in Table 5.2. Ecological benefits associated with these projects vary and include floodplain restoration, wetland reconnection, availability of off-channel habitat for juvenile salmonids, reduction of peak flow during storm events, increase in groundwater levels and baseflow, and increase in channel complexity. While many of these projects have potential streamflow benefits, water offset from habitat projects are not accounted for in this plan. The ecological and streamflow benefits from habitat projects are supplemental to the quantified water offsets and contribute to achieving a net ecological benefit.

5.3.2 Cost Estimate for Offsetting New Domestic Water Use Over 20 Year Planning Horizon

Per RCW 90.94.030(3)(d), this watershed plan must include an evaluation or estimation of the cost of offsetting new domestic water uses over the subsequent twenty years. To satisfy this requirement, the Committee relied on Ecology to develop planning-level cost estimates for each of the water offset projects listed in Table 5.1. The Committee also included costs estimates for habitat projects in Table 5.2, when that information was provided by the project sponsor.

Cost estimates for water offset projects included in the plan are planning level cost estimates only. Ecology developed the cost estimates by reviewing recent streamflow restoration program grant applications for similar project types and recently completed water right acquisitions. For all water right acquisitions, an extent and validity determination will need to be completed to establish the quantity of water that can be permanently protected through transfer to Ecology's Trust Water Rights program. The price for these water rights will be negotiated between the willing seller and the willing buyer. Project costs for other water offset project types will be further developed after the plan is submitted, when the project sponsors seek funding and prepare grant applications. The total estimated cost for implementing the water offset projects listed and described in this chapter is $5,057,610.

The estimated cost for implementing individual habitat projects range from $94,193 to $7 million, with several of the project costs unknown.

5.3.3 Certainty of Implementation

The WRIA 8 Committee used a tiering process to identify the projects that are more likely to be implemented in the short term. Tier 1 water offset projects are more likely to be implemented and provide benefits in the near-term because those projects have project sponsors and for water rights acquisitions included in tier 1, initial outreach to water right holders has occurred and those water right holders indicated interest in further discussions. The two tier 2 water right acquisition projects (Pre-Identified Water Right No. 1 and Pre-Identified Water Right No. 5), have greater uncertainty because at the time of this plan, the water right holder has not expressed interest in an acquisition.

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

The WRIA 8 Committee identified funding availability, especially for larger capital projects, as an implementation challenge. Projects that include land acquisition should be a high priority for implementation and funding in order to take advantage of opportunities to purchase property. The WRIA 8 Committee recommends projects that infiltrate water (e.g. managed aquifer recharge projects and stormwater projects) include estimated operations and maintenance costs in applications for streamflow restoration funding.

The WRIA 8 Committee also developed adaptive management recommendations, detailed in Chapter 6, to increase reasonable assurance that the projects and actions in the plan will be implemented.

Chapter Six: Adaptive Management and Implementation, and Policy Recommendations

6.1 Plan Implementation and Adaptive Management Recommendations

The WRIA 8 Committee recommends an adaptive management process for implementation of the WRIA 8 watershed plan. Adaptive management is defined in the Final NEB Guidance as "*an iterative and systematic decision-making process that aims to reduce uncertainty over time and help meet project, action, and plan performance goals by learning from the implementation and outcomes of projects and actions*."

Adaptive management is intended to help address uncertainty, provide more reasonable assurance for plan implementation, and to ensure that 1) water use from new permit exempt (PE) wells is adequately offset, as required by RCW 90.94.030, and 2) implementation of the watershed plan produces a net ecological benefit to the watershed, as required by RCW 90.94.030. The periodic review in this adaptive management process will provide a verifiable process for plan monitoring and ensure transparency in plan implementation.

Existing Challenges

The WRIA 8 Committee identified the following challenges in the planning process and seeks to address these challenges through monitoring and adaptive management:

- The watershed plan includes projected, not actual, PE well water use by subbasin. Many factors could influence the consumptive water use from new PE wells in the future, including water system infrastructure expansion, policies or programs to require or incentivize homes to connect to public water systems, and programs that provide education and incentives for homeowners to conserve water. Monitoring the number of new PE wells, actual PE well water use, and associated consumptive water use would provide data for comparison and adjustments, as needed, in planning for ongoing offsets to ensure the mandates of RCW 90.94 are being met.

- The watershed plan includes water offset and habitat projects, and estimated benefits associated with each, by subbasin. The WRIA 8 Committee used a tiering process to identify projects with greater implementation certainty, however that will likely change over time. Measuring and tracking project implementation and actual water offsets and habitat benefits by subbasin, to the extent possible, can be used to verify intended streamflow benefits.

- Our global climate is changing. While the effects of climate change over the 20-year life of this plan cannot be precisely known, shifts in climatic conditions will influence the hydrologic regime in the watershed and will impact instream flows. Rainfall, snowmelt,

and evapotranspiration have been and will continue to be identified as the primary mechanisms driving changes in groundwater storage. These mechanisms will be affected by a changing climate. Air and water temperatures will increase and summer streamflows will be reduced. Under these conditions, groundwater pumping and indirect effects of irrigation and land use changes, like increases in impervious surface and reduced recharge, will have an increasing impact to groundwater resources and the availability for future water supply and instream flows. The Committee recognizes that a successful plan must acknowledge that climate is changing and include a mechanism to ensure that the statutory requirements to offset water withdrawals by new PE wells and provide a net ecological benefit will be met under future climatic conditions. Monitoring actual water use and the amount of offset water actually generated will inform this determination.

- Projects identified in the plan are expected to provide water offset through methods including increasing groundwater storage and augmenting streamflows. Water offset projects should be monitored in order to ensure that they continue to function as designed, and generate instream water to offset new PE wells, under a changing climate. The WRIA 8 Committee chose to apply an overall margin of safety to help address these concerns. However, this margin of safety may not address the possibility that a water offset project might fail to meaningfully function under changed conditions.

- The adaptive management recommendations in this plan will help to monitor and assess the validity of the projections identified, to determine whether projects are functioning as designed even under climate change conditions, and to allow for course corrections where needed. Water offset projects should be analyzed to determine how much offset water they are actually producing. Habitat projects should also be analyzed for their resilience to changing conditions.

To address the above challenges, the WRIA 8 Committee added a margin of safety to the consumptive use estimate and recommends the following adaptive management strategies.

6.1.1 Tracking and Monitoring

The WRIA 8 Committee recommends that the Washington Department of Ecology (Ecology) monitor watershed plan implementation, in consultation with the Washington Department of Fish and Wildlife (WDFW), and King and Snohomish Counties. Specifically, the Committee recommends that Ecology, in consultation with WDFW and King and Snohomish Counties, review actions resulting from watershed plans to ensure the mandates of RCW 90.94 are being met, including;

- Track annual new permit-exempt wells by subbasin;

- Track project implementation and the actual amount of offset water generated, or reasonably certain to be generated, by subbasin; and
- Develop a process to adaptively manage implementation if net ecological benefit is not being met as envisioned by the watershed plan.

Track PE Wells and Project Implementation

The WRIA 8 Committee recommends WDFW, in collaboration with Ecology and the Recreation and Conservation Office (RCO), pilot the Salmon Recovery Portal (https://srp.rco.wa.gov/about), managed by RCO, for tracking streamflow restoration projects and new domestic permit-exempt wells.[20] To improve harmonization of streamflow restoration with ongoing salmon recovery efforts, local salmon recovery Lead Entity Coordinators shall be consulted prior to initial data uploads. While input and oversight is welcomed, no commitment of additional work is required from Lead Entity Coordinators. University of Washington data stewards will be employed to conduct data entry, quality assurance, and quality control.

Tracking streamflow restoration projects and new domestic permit-exempt wells will:

- Improve the capacity to conduct implementation and effectiveness monitoring of streamflow restoration projects and actions,
- Build grant funding opportunities and track streamflow restoration associated costs, and
- Provide a template for adaptively managing emergent restoration needs.

Continue monitoring of streamflow and groundwater levels

This Watershed Restoration and Enhancement Plan is one of many water resource management efforts underway in WRIA 8. Understanding the status and trends of streamflow in the basin will assist with adaptively managing this plan. The WRIA 8 Committee understands that neither the impact of individual projects nor new permit exempt wells would be tracked through monitoring streamflow or groundwater levels, but the Committee believes that monitoring assists with an overall understanding of the hydrology in the basin.

The WRIA 8 Committee recommends that agencies with current or planned gauging stations and groundwater monitoring programs continue funding and/or seek supplemental funding sources to ensure that monitoring continues and the data is publicly available. This includes counties, Ecology, USGS, and other relevant entities. The Committee would support the development of a clearinghouse so that external reports, data and links to hydrological and

[20] See Supplemental Document: Project Tracking for WRE Plans for further details on project tracking procedures using the Salmon Recovery Portal.

hydrogeological data is easier to find and use. The development of widespread groundwater elevation tracking across the WRIA would help monitor trends.

Continue studies that improve understanding of WRIA 8 hydrology

The Committee supports the continuation or initiation of research, models, and additional datasets that provide regional, basin-wide and site-specific information to better understand the hydrology of WRIA 8 and inform the adaptive management of the plan (examples may include subbasin level studies such as the Bear Creek Watershed Management Study, UW Climate Impacts Group Research, VELMA, DHSVM or other process-based modeling, hydrology-fish life cycle modeling, King County water quality monitoring, and others).

Table 6.1 summarizes the entities responsible for carrying out this recommendation and associated funding needs.

Table 6.1: Implementation of Tracking and Monitoring Recommendation

Action	**Entity or Entities Responsible**	**Funding Considerations**
Track building permits issued with permit-exempt wells.	Ecology (via reporting from counties and cities)	The number of building permits and associated fees are transmitted to Ecology annually. No additional funding is needed.
Maintain an ongoing list and map of new PE wells within each subbasin.	Ecology	Update the existing Ecology well report tracking database. No additional funding is needed.
Maintain a summary of the status of implementation for each project.	WDFW using the Salmon Recovery Portal	WDFW may need additional funding to support maintaining the Salmon Recovery Portal.
Monitor streamflow and groundwater levels.	Various (USGS, Ecology, Counties, etc)	External entities fund and implement these programs. Committee support may be helpful in communicating the importance and ensuring continuation of these efforts.
Continue studies that improve understanding of WRIA 8 hydrology.	Various (University of Washington, Counties, Tribes, NGOs, etc)	These studies will require additional and new funding outside the Streamflow Grant process. Committee support may be helpful in securing outside funds.

6.1.2 Oversight and Adaptation

The WRIA 8 Committee recommends Ecology issue four watershed plan implementation reports, one each in 2027, 2032, 2037, and 2042 detailing the successes, challenges, and gaps related to implementation of the watershed plan. Each report should cover the five-year period occurring immediately prior to the year of issuance, except the first reporting period, which should start when the plan is adopted by Ecology. The report should include information on whether the watershed plan is on track to achieve the expected net ecological benefit and water offsets as well as streamflow conditions, including identifying subbasins with known impacts that have not yet implemented water offset or habitat projects. In addition, the report should include information on any discretionary programs that were implemented, including for example, water conservation education and outreach, incentives for public water service connections, and voluntary PE well metering. The report should be sent to all members of the WRIA 8 Committee, King and Snohomish County Councils, all local jurisdictions within the watershed, and any additional stakeholders identified at the time of reporting.

Ecology's report should include recommendations to adjust the projects and actions if the adopted goals of the watershed plans are not on track to being met in the plan's 20-year timeframe. If Ecology or any other Committee member determines that the watershed plan is not on track to achieve NEB and water offsets, a notice of action to adjust the plan should be sent to Ecology and all members of the WRIA 8 Committee with 60 days to comment.

At that time, any member of the WRIA 8 Committee may request that Ecology reach out to members of WRIA 8 Committee to reconvene. However, members of the WRIA 8 Committee are not obligated to reconvene after approving the plan.

The WRIA 8 Committee as a whole will reconvene if at least one entity representing each of the following groups agrees to participate. A subgroup of Committee members may convene, but representation from all of the following groups is needed to represent the entire Committee.

- A federally recognized tribal government with reservation land or usual and accustomed harvest area within the WRIA.
- A county government within the WRIA.
- A city government within the WRIA.
- Washington State Department of Fish and Wildlife.
- A water purveyor.
- An organization representing agricultural interests.
- An organization representing environmental interests.
- An organization representing the residential construction industry.

If no representative is available from the same government or organization that participated in the WRIA 8 Committee at the time of plan approval, the Committee member may propose an alternate entity that can represent the same interest on the Committee.

Ecology should review, publish, and attempt to address comments received from the WRIA 8 Committee before amending the plan. Following a 45-day initial public comment period, Ecology should issue its responses and findings to the public. Following the issuance of Ecology's responses to comments, the public should have an additional 14-days to offer additional comments to Ecology. At the end of the full 60-day public comment period, any final adjustments and amendments to the plan shall be at the sole discretion of Ecology. Ecology should issue its final findings within 30-days from the close of the full 60-day public comment period.

Preference for funding of new projects should be given to watersheds projects in subbasins that have not offset permit-exempt water use.

Table 6.2 summarizes the entities responsible for carrying out this recommendation and associated funding needs.

Table 6.2: Implementation of Oversight and Adaptation Recommendation

Action	**Entity or Entities Responsible**	**Funding Considerations**
Develop and distribute Watershed plan implementation report, including any recommended adjustments to projects and actions.	Ecology	Ecology may need additional funding to support development of the report.
Support reconvening of the WRIA 8 Committee, if needed.	Ecology	Ecology may need additional funding to support reconvening.
Revise Streamflow Restoration Grant Guidance to prioritize projects in subbasins that have not offset permit-exempt water use.	Ecology	No additional funding is needed.

6.1.3 Funding

The WRIA 8 Committee recommends funding plan implementation and adaptive management from a variety of sources including the Washington State Legislature, cities, counties, and various grant programs administered by state and federal agencies. Funding and staffing at local, county and state levels is likely to see continued shortfalls due to COVID-19 related

impacts over the next several years. The Committee urges a collaborative approach to fund Ecology, RCO, and WDFW to ensure plan implementation and monitoring, streamflow health, water offsets, net ecological benefit, and full compliance with the mandates found in RCW 90.94.

6.2 Policy and Regulatory Recommendations

The Streamflow Restoration law lists optional elements committees may consider including in the plan to manage water resources for the WRIA or a portion of the WRIA (RCW 90.94.030(3)(f)). The WRIA 8 Committee included what they have termed "policy and regulatory recommendations" in the plan to show support for programs, policies, and regulatory actions that would contribute to the goal of streamflow restoration. When similar concepts arose from other Watershed Restoration and Enhancement Committees, the WRIA 8 Committee coordinated with those other Committees to put forward common language for inclusion in the watershed plans, when appropriate. Coordination also occurred for jurisdictions that cross multiple watersheds. All projects and actions the WRIA 8 Committee intended to count toward the required consumptive use offset or Net Ecological Benefit are included in Chapter 5: Projects and Actions.[21]

As required by the NEB Guidance, the WRIA 8 Committee prepared the plan with implementation in mind. However, as articulated in the Streamflow Restoration Policy and Interpretive Statement (POL-2094), "RCW 90.94.020 and 90.94.030 do not create an obligation on any party to ensure that plans, or projects and actions in those plans or associated with rulemaking, are implemented."

The WRIA 8 Committee initially identified a list of potential policy and regulatory recommendations. After iterative rounds of discussion, the Committee narrowed the recommendations in this section to those that both supported the goal of streamflow restoration and had the support of the full Committee. Committee members identified as the implementing entity for each recommendation are committed to investigating the feasibility of the recommendation. The identification and listing of these policy and regulatory recommendations is directly from the WRIA 8 Committee members and is not endorsed or opposed by Ecology.

The WRIA 8 Committee supports the following recommendations:

6.2.1 Well reporting upgrades

Proposed implementing entity:

Ecology

Recommendation:

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

Change the Ecology well tracking system in the following ways, in order to efficiently and transparently track the number and location of permit-exempt wells in use:

- Implement a web-based well report form that mimics the current well report forms, and that uploads directly to Ecology's database with Ecology verification;
- Require coordinates (latitude and longitude) of wells on well report forms, and implement an intuitive web tool for well drillers which automatically provides the Public Lands Survey (PLS) location and coordinates for a new well;
- Identify permit-exempt wells on well report forms; and
- Provide Well ID Tag numbers to older wells, and associate well decommissioning, replacement, or other well activities with the Well ID Tag.

Purpose:

Directly and efficiently address identified shortcomings in Ecology's existing well tracking database and reporting protocols. Accurate tracking of the locations and features of permit-exempt wells will support the WRIA 8 Committee's desire to engage in monitoring and adaptive management after adoption of the watershed plan.

Funding sources:

Leverage existing resources and efforts currently underway through the Ecology Well Construction Technical Advisory Group (TAG) and other departmental means. Additional funding from the Washington State Legislature or local permitting fees to increase capacity for Ecology to verify well reports may aid in implementing this recommendation in a timely manner.

Additional information or resources:

Ecology's Well Report Location Accuracy Study

Ecology's Mason County Well Location Accuracy Study

6.2.2 Encourage conservation and reduce impacts on tributaries and subbasins through connections to public water

Proposed implementing entities:

County and city planning departments; public utilities and other water purveyors; Ecology; Department of Health.

Recommendation:

- Adopt and implement consistent and coordinated policies that reduce dependence on water use from PE wells and promote connections to municipal and regional water supplies.
- Water purveyors and county/city land use planners explore opportunities to extend water distribution systems further into their individual service areas, particularly where rapid rural growth is anticipated.

- Develop cost-benefit analysis and fiscal implications to (1) fund programs to support connections to public water systems and (2) gain political support.

Purpose:

Reduce uncertainty about future streamflow and aquifer impacts from PE wells. Encourage state/local policies and funding to support streamflow objectives within the watershed plan. Demonstrate the WRIA 8 Committee's endorsement of encouraging conservation through promoting connections to public water systems, provided that all provisions of the Growth Management Act continue to be followed, and that rural growth is not accelerated through the extension of water lines into rural areas, thereby unintentionally counteracting potential benefits of conversation with impacts from increased rural development.

Funding sources:

Fees collected through local permitting processes; pass-through fees associated with well maintenance services collected by service providers; state or local rate increases or taxes.

6.2.3 Development and use of reclaimed water

Proposed implementing entities:

Washington State Legislature; Ecology; Washington State Department of Health

Recommendation:

Enact and promulgate state laws, rules, and regulations that enable the development and use of reclaimed water, for the purpose of:

- Offsetting the impact of or providing an alternative source to permit exempt wells or other water rights using reclaimed water.
- Facilitating enhanced reclaimed water treatment to enable its use for streamflow restoration projects, other than direct augmentation.
- Encouraging developers to integrate rainwater and/or reclaimed water into their projects for the purpose of avoiding or limiting use of a permit-exempt well.
- Encouraging partnership with the local water purveyors, where appropriate.

Purpose:

Offset water that would otherwise be diverted from the supply in rivers and streams due to permit exempt wells. Reduce the amount of treated wastewater discharged into receiving water bodies. Create water supply options as an alternative or to offset permit exempt wells while enhancing resiliency against drought and climate change.

Funding sources:

If Ecology does not have capacity to support the work to integrate this proposal into the RCW and WAC with existing staffing and resources, the WRIA 8 Committee recommends the Washington State Legislature provide funding for this purpose.

6.2.4 Voluntary permit exempt well metering program

Proposed implementing entity:

Ecology; King and/or Snohomish Counties; King and/or Snohomish Conservation Districts.

Recommendation:

Pilot a voluntary five-year program in one or more WRIA 8 subbasins to meter permit-exempt wells (indoor and outdoor residential use). Supplement the voluntary metering program with a robust education and community engagement program about water consumption and conservation.

Purpose:

Increase confidence in assumptions made regarding the average water use of individual PE well users to inform the adaptive management process and future water management and planning efforts. Data could inform (1) growth policies and patterns, (2) where to target incentives and education/outreach programs, and (3) where to place resources across subbasins to help improve streamflow, water levels, and temperature.

Funding sources:

Individual landowners are not expected to pay for costs associated with participation in the program. General operation or appropriated funds from (1) the state, (2) counties, and/or (3) conservation districts related to water, habitat restoration (salmon recovery), or housing. Environmental grants.

6.2.5 Water conservation education & incentives program

Proposed implementing entity:

Ecology; King and Snohomish Counties; water purveyors; with support from conservation districts and non-governmental organizations.

Recommendation:

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

Education and incentives could include:

- Educate current homeowners and offer rebates to install water-saving fixtures and appliances, as well as more efficient plumbing techniques.

- Invite new and current residents to participate in the well-metering pilot program.
- Educate new and existing homeowners about the overall positive impacts water conservation has on the environment and climate.

Empower homeowners to be good stewards of rural lands. Programs could also include education and outreach to homebuilders to adopt Built Green or other green building incentives, and adopt water saving design and landscaping strategies like green roofs, rain barrels, buried retention tanks, bio retention, drip irrigation systems, and drought tolerant plantings.

Purpose:

Raise awareness of the impacts PE well water usage has on (1) groundwater levels and (2) the connection to streams and rivers. Supplement water offset and restoration projects, especially in subbasins critical for fish and where water offset projects were difficult to find.

Funding sources:

Potential funding sources could include: new funding from Washington State Legislature; grants (e.g., Ecology's Streamflow Restoration Grant Program); allocation of Ecology resources; fees associated with new PE wells; contributions from local governments and tribes; part of county or conservation district ongoing education, outreach and incentive program.

6.2.6 Statewide mandatory water conservation measures in unincorporated areas of the state during drought

Proposed implementing entity:

Washington State Legislature; Ecology.

Recommendation:

- Implement mandatory water conservation measures for PE well users during drought events. Measures would focus on limiting outdoor water use, with exemptions for growing food. Washington State Legislature could require Ecology to implement water conservation policies.
- Ecology could write a rule to require water conservation measures.

Purpose:

Reduce water usage from PE well users during drought. Reduce impacts on streamflows from PE well users and support net ecological benefit goals. Increase climate change resilience.

Funding sources:

Potential funding sources could include: new funding from Washington State Legislature; allocation of existing Ecology resources; fees associated with new PE wells.

Chapter Seven: Net Ecological Benefit

7.1 Introduction to Net Ecological Benefit Evaluation

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 20 years (2018-2038), 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 2019).

The Final NEB Guidance states that "planning groups are expected to include a clearly and systematically articulated NEB evaluation in the watershed plan" and provides guidance for planning groups on what to include in the NEB evaluation (Ecology 2019). The Final NEB Guidance also states that "a watershed plan that includes a NEB evaluation based on this guidance significantly contributes to the reasonable assurances that the offsets and NEB within the plan will occur. Ecology will review any such plan with considerable deference in light of the knowledge, insights, and expertise of the partners and stakeholders who influenced the preparation of their plan. Ecology will make the NEB determination as part of this review" (Ecology 2019).

The WRIA 8 Committee chose to complete a NEB evaluation for the watershed plan and the results of that evaluation are included in this chapter.

7.2 Water Offsets

The WRIA 8 Committee projects that a total of 967 new PE wells will be installed within WRIA 8 during the planning horizon. The WRIA 8 Committee used this 20-year PE well projection to estimate 425.4 AFY of new consumptive water use in WRIA 8, as described in detail in Chapter 4. The WRIA 8 Committee sought projects to offset at least 698.9 AFY to account for uncertainties in the planning process related to the PE well projection, consumptive use assumptions, and project implementation. If the plan is implemented, the WRIA 8 Committee projects a total water offset of 1,762.18 AFY from 11 water offset projects (described in Chapter 5 and listed in Table 7.1), a surplus offset of 1,336.78 AFY above the consumptive use estimate and 1,063.28 AFY above the offset target. Through this comparison, the WRIA 8 Committee has determined that this plan, if implemented, likely provides in offsetting consumptive use impacts at the WRIA scale.

Table 7.1: Summary of WRIA 8 Water Offset Projects included in NEB analysis

Project Number	Project Name	Project Short Description	Subbasin	Estimated Water Offset Benefits (AFY)	Timing of Benefit[1, 2]	Project Tier
8-LB-W1	Snohomish County Recycled Water Managed Aquifer Recharge	Diversion of reclaimed water from the Brightwater treatment plant for infiltration at a constructed MAR facility	Little Bear	181	Year-round	1
8-SRV-W2	Wayne Golf Course Water Right Acquisition (Pre-Identified No. 7)	Acquisition of two water rights previously used for golf course irrigation	Sammamish River Valley	84.85	Irrigation season	1
8-SRV-W3	Sixty Acres Park Water Right Acquisition	Acquisition of two surface water rights used for irrigation of a park	Sammamish River Valley	126	Irrigation season	1
8-SRV-W4	Pre-Identified No. 8 Water Right Acquisition	Acquisition of three water rights used at a winery/vineyard	Sammamish River Valley	23.43	Year-round	1
8-SRV-W5	Sammamish River Valley Irrigation Water Rights Acquisitions	Acquisition of irrigation water rights within or upstream of the Sammamish River Valley Agricultural Production District from willing sellers with access to an alternative water source, such as reclaimed water	Sammamish River Valley	400	Year-round	1

Project Number	Project Name	Project Short Description	Subbasin	Estimated Water Offset Benefits (AFY)	Timing of Benefit[1, 2]	Project Tier
8-SRV-W6	Sammamish River Valley Recycled Water Managed Aquifer Recharge	Diversion of reclaimed water from the existing Brightwater Wastewater Treatment Plant recycled water pipeline to a constructed MAR facility	Sammamish River Valley	181	Year-round	1
8-BE-W7	Pre-Identified No. 1 Water Right Acquisition	Acquisition of two water rights used for golf course irrigation and residential water supply	Bear/Evans	346.8	Year-round	2
8-I-W8	Pre-Identified No. 2 Water Right Acquisition	Acquisition of two water rights previously used to provided municipal water to Overdale Water Association, a Group A water system	Issaquah	27.6	Year-round	1
8-I-W9	Pre-Identified No. 4 Water Right Acquisition	Acquisition of one water right previously used to support commercial production of dairy products	Issaquah	286	Year-round	1
8-LC-W10	Riverbend Mobile Home Park Water Right Acquisition (Pre-Identified No. 9)	Acquisition of one water right previously used for water supply at a mobile home park	Lower Cedar	20.1	Year-round	1
8-LC-W11	Pre-Identified No. 5 Water Right Acquisition	Acquisition of one water right used for golf course irrigation	Lower Cedar	85.4	Irrigation Season	2

Project Number	Project Name	Project Short Description	Subbasin	Estimated Water Offset Benefits (AFY)	Timing of Benefit[1, 2]	Project Tier
			Tier 1 subtotal	**1,329.98**		
			Total	**1,762.18**		

Notes:

[1] The water right project profiles in Appendix H indicate the period of use associated with the water right. For water rights that rely on surface water, the timing of benefit is assumed to be the same as the period of use. For water rights that rely on groundwater, the timing of benefit is assumed to be year-round, due to the lag time between well pumping and streamflow impact. Irrigation season is typically April through October, but the specific period of use is different for each water right.

[2] Managed Aquifer Recharge Projects are expected to provide benefits year-round. Streamflow augmentation benefits will continue to discharge to the river after each year's storage window closes because of the lag time of water moving through an aquifer and the distance of the flow path to the river. The temporal distribution and absolute value of those benefits will be estimated during the feasibility study that has to be conducted before a MAR project can proceed to construction and operation.

The WRIA 8 Committee used a tiering process to identify projects with greater implementation certainty (tier 1). Tier 1 projects all have project sponsors. For tier 1 water rights acquisitions projects, discussions were initiated with the water right holders. The tier 1 projects provide a water offset of 1,329.98 AFY.

Estimated consumptive use and potential water offset are compared at the subbasin scale in Table 7.2 for both tier 1 and tier 2 projects. If the tier 1 and tier 2 projects described in Table 7.1 are implemented, surplus water offset is achieved in a total of four subbasins (Little Bear, Sammamish River Valley, Bear/Evans, and Issaquah), ranging from 136.7 AFY in the Little Bear subbasin to 812.08 AFY in the Sammamish River Valley subbasin. Neutral water offset occurs in the Seattle/Lake Union and Upper Cedar River subbasins, both with 0 estimated consumptive use. A deficit in water offset remains in a total of six subbasins (Puget Sound Shorelines, Swamp/North, Greater Lake Washington, May/Coal, Lake Sammamish Creeks, and Lower Cedar), ranging from 0.9 AFY in the Puget Sound Shorelines subbasin to 45.7 AFY in the Lower Cedar River subbasin. See Figure 5.1 in Chapter 5 for a map of water offset projects by subbasin.

Table 7.2: Subbasin Water Offset Totals Compared to Permit-Exempt Well Consumptive Use Estimate

Subbasin	**Offset Project Totals (AFY)**	**Permit-Exempt Well Consumptive Use (AFY)[1]**	**Surplus/Deficit (AFY)[2]**
Seattle/Lake Union	0	0	0
Puget Sound Shorelines	0	0.9	-0.9
Swamp/North	0	2.0	-2.0
Little Bear	181	44.3	+136.7
Sammamish River Valley	815.28	3.2	+812.08
Bear/Evans	346.8	96.7	+250.1
Greater Lake Washington	0	1.8	-1.8
May/Coal	0	7.4	-7.4
Lake Sammamish Creeks	0	2.7	-2.7
Issaquah	313.6	115.3	+198.3

Subbasin	Offset Project Totals (AFY)	Permit-Exempt Well Consumptive Use (AFY)[1]	Surplus/Deficit (AFY)[2]
Lower Cedar	105.5	151.2	-45.7
Upper Cedar	0	0	0
WRIA 8 Total	**1,762.18**	**425.4**	**+1,336.78**

Notes:

[1] Values in table have been rounded, which is why totals may differ.

[2] Surplus water offset is associated with a positive value and a deficit in water offset is associated with a negative value.

The higher offset target and potential water offset from tier 1 and tier 2 projects are compared at the subbasin scale in Table 7.3.

Table 7.3: Subbasin Water Offset Totals Compared to Offset Target

Subbasin	Offset Project Totals (AFY)	Offset Target (AFY)[1]	Surplus/Deficit (AFY)[2]
Seattle/Lake Union	0	0	0
Puget Sound Shorelines	0	1.4	-1.4
Swamp/North	0	3.6	-3.6
Little Bear	181	85.2	+95.8
Sammamish River Valley	815.28	5.8	+809.48
Bear/Evans	346.8	169.1	+177.7
Greater Lake Washington	0	2.9	-2.9
May/Coal	0	10.8	-10.8
Lake Sammamish Creeks	0	4.3	-4.3
Issaquah	313.6	169.9	+143.7
Lower Cedar	105.5	245.8	-140.3
Upper Cedar	0	0	0

Subbasin	Offset Project Totals (AFY)	Offset Target (AFY)[1]	Surplus/Deficit (AFY)[2]
WRIA 8 Total	**1,762.18**	**698.9**	**+1063.28**

Notes:
[1] Values in table have been rounded, which is why totals may differ.
[2] Surplus water offset is associated with a positive value and a deficit in water offset is associated with a negative value.

The water offset projects listed in Table 7.1 provide additional benefits to instream resources beyond those necessary to offset the impacts from new consumptive water use within the WRIA. For the project types planned in WRIA 8, additional benefits could include the following:

- Water right acquisition projects: Aquatic habitat improvements during key seasonal periods; reduction in groundwater withdrawals and associated benefit to aquifer resources; and/or beneficial use of reclaimed water (if applicable).
- MAR projects: Aquatic habitat improvements during key seasonal periods; increased groundwater recharge; reduction in summer/fall stream temperature; increased groundwater availability to riparian and near-shore plants; and beneficial use of reclaimed water.

7.3 Habitat Benefits

A total of 25 habitat improvement projects are included within the plan, as summarized in Table 7.4 and shown in Figure 5.1 in Chapter 5.

Habitat project tiering relates to the projects' contribution to net ecological benefit. Tier 1 habitat projects are multi-benefit (likely to provide benefits to streamflow based on the project type) and are located in subbasins that need additional water offset in order to offset estimated consumptive use. Tier 2 habitat projects have less certainty about streamflow benefits and/or are located in subbasins with water offset projects that exceed the estimated consumptive use. Stormwater projects are tier 3 because they contribute to hydrologic restoration, but are a not expected to contribute to habitat restoration at the same level as tier 1 and tier 2 projects.

Habitat improvement strategies associated with these projects include a combination of aquatic habitat restoration, riparian vegetation plantings, land acquisition, levee removal, LWD installation, beaver colonization, and stormwater management. Many of the habitat improvement projects include more than one of these elements. Project distribution is summarized by the following:

Table 7.4: Summary of Habitat Projects by Subbasin

Subbasin	Habitat Projects	Benefiting Stream
Seattle/Lake Union		
Puget Sound Shorelines		
Swamp/North	2 projects: 8-SN-H12 and 8-SN-H13	North Creek
Little Bear	3 projects: 8-LB-H14, 8-LB-H15, and 8-LB-H16	Cutthroat Creek and Little Bear Creek
Sammamish River Valley	3 projects: 8-SRV-H17, 8-SRV-H18, and 8-SRV-H19	Sammamish River
Bear/Evans	3 projects: 8-BE-H20, 8-BE-H21, and 8-BE-H22	Bear Creek
Greater Lake Washington	5 projects: 8-GLW-H23, 8-GLW-H24, 8-GLW-H25, 8-GLW-H26, 8 and 8-GLW-H27	Various creeks
May/Coal	1 project: 8-MC-H28	May Creek
Lake Sammamish Creeks	1 project: 8-LSC-H29	Ebright, Zackuse, and Laughing Jacobs Creeks
Issaquah	2 projects: 8-I-H30 and 8-I-H31	Issaquah Creek and its tributaries
Lower Cedar	5 projects: 8-LC-H32, 8-LC-H33, 8-LC-H34, 8-LC-H35, 8-LC-H36	Cedar River
Upper Cedar		

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

Table 7.5: Summary of WRIA 8 Habitat Improvement Projects included in NEB Analysis

Project Number	**Project Name**	**Project Short Description**	**Subbasin**	**River Miles Benefitted**	**Other Benefits with Quantifiable Metric** (e.g. structures per mile)	**Habitat Limiting Factor(s) Addressed**[1, 2]
8-SN-H12	North Creek Beaver Dam Analog and Log Jam Installation	Installation of 16 beaver analogs/ logjams at three locations in North Creek.	Swamp/ North	Upper 2.5 miles of North Creek	-Installation of beaver dam analogs (16 structures) -Reduction of peak flow during storm events (monitoring) -Increase in recharge/ groundwater levels (monitoring) -Increase in channel complexity (mapping) -Increase in species diversity (monitoring) -Increase in salmonid habitat (acres)	-Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity -Altered hydrology -Water quality issues -Loss of floodplain connectivity
8-SN-H13	Canyon Park Business Park Redevelopment (stormwater)	Reduction in impervious surface area, stormwater improvements and restoration and/or wetland enhancement along North Creek.	Swamp/ North	North Creek at and downstream of Canyon Park	-Increase in recharge/ groundwater levels (monitoring) -Restoration of aquatic habitat and wetlands (acres) -Stormwater retrofit area treated (acres)	-Degradation or lack of riparian conditions -Altered hydrology -Loss of floodplain connectivity -Water quality issues

Project Number	**Project Name**	**Project Short Description**	**Subbasin**	**River Miles Benefitted**	**Other Benefits with Quantifiable Metric** (e.g. structures per mile)	**Habitat Limiting Factor(s) Addressed**[1, 2]
8-LB-H14	Cutthroat Creek Restoration at Carousel Ranch	Stream, riparian, and upland restoration on Cutthroat Creek, including wood placement.	Little Bear	870 feet of Cutthroat Creek at Carousel Ranch	-Stream length that is restored (870 feet) -Increase in hydraulic diversity (mapping) -Restoration of native vegetation (acres) -Moderation of water temperature (monitoring) -Erosion abatement (mapping)	-Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity -Altered hydrology -Water quality issues -Loss of floodplain connectivity
8-LB-H15	Little Bear Instream Projects	Instream restoration projects along Little Bear Creek, including wood placement.	Little Bear	Multiple sites along Little Bear Creek in Woodinville	-Number of sites improved (four) -Increase in hydraulic diversity (mapping) -Floodplain reconnection (mapping) -Riparian restoration (acres) -LWD installation (number of structures)	-Increased sedimentation and altered sediment transport processes -Loss of channel and shoreline complexity and connectivity -Altered hydrology -Water quality issues -Loss of floodplain connectivity

Project Number	**Project Name**	**Project Short Description**	**Subbasin**	**River Miles Benefitted**	**Other Benefits with Quantifiable Metric** (e.g. structures per mile)	**Habitat Limiting Factor(s) Addressed**[1, 2]
8-LB-H16	Silver Firs Stormwater Pond Retrofits (stormwater)	Retrofit of two existing stormwater ponds to increase infiltration capacity.	Little Bear	Northern portion of Little Bear Creek	-Increased stormwater pond volume (2.0 AF) -Increased infiltration (45 AFY) -Increase in recharge/ groundwater levels (monitoring) -Stormwater retrofit area treated (acres) -Streamflow maintenance (monitoring)	-Altered hydrology -Water quality issues
8-SRV-H17	East Side Wayne Sammamish/ Waynita Restoration	Restoration of the former Wayne Golf Course property, including the south bank of the Sammamish River and the mouth and lower reach of Waynita Creek.	Sammamish River Valley	1,000 feet along south bank of Sammamish River and lower reach of Waynita Creek	-Floodplain restoration (31.6 acres) -Stream length that is restored (1,000 feet) -LWD installation (number of structures)	-Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity -Altered hydrology -Water quality issues -Loss of floodplain connectivity
8-SRV-H18	Reconnection of Wetland 38	Reconnection of Wetland 38 to the Sammamish River.	Sammamish River Valley	Sammamish River at south end of Woodinville	-Wetland reconnection (acres)	-Altered hydrology -Water quality issues -Loss of floodplain connectivity

Project Number	Project Name	Project Short Description	Subbasin	River Miles Benefitted	Other Benefits with Quantifiable Metric (e.g. structures per mile)	Habitat Limiting Factor(s) Addressed[1, 2]
8-SRV-H19	Sammamish River Floodplain Restoration Project	Restoration of the Sammamish Transition Zone 1,500 feet above and below an existing weir and enhance habitat elements.	Sammamish River Valley	Sammamish River at Willowmoor	-Floodplain restoration (acres) -Removal of non-native vegetation (acres)- Addition of gravel substrate (mapping)	-Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity-Altered hydrology -Water quality issues -Loss of floodplain connectivity
8-BE-H20	Seawest Granston/ Middle Bear Creek Natural Area Restoration	Restoration of up to 3,300 lineal feet of stream and approximately 32 acres of wetland and riparian areas.	Bear/ Evans	Seawest Granston Reach of Bear Creek	-Riparian and wetland area restoration (32 acres) -Stream length that is restored (3,300 feet) -Increase baseflow and groundwater levels (monitoring) -Moderate stream temperature (monitoring) -LWD installation (number of structures)	-Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity -Altered hydrology -Water quality issues -Loss of floodplain connectivity

Project Number	Project Name	Project Short Description	Subbasin	River Miles Benefitted	Other Benefits with Quantifiable Metric (e.g. structures per mile)	Habitat Limiting Factor(s) Addressed[1, 2]
8-BE-H21	Little Bit Restoration	Addition of woody debris, excavation of off-channel habitats, and revegetation of the floodplain and riparian areas along 650 feet of Bear Creek.	Bear/ Evans	Little Bit Reach of Bear Creek	-Stream length that is restored (650 feet) -Increase the volume and availability of off-channel habitat for juvenile salmonids (acres) -Increase overall channel complexity and habitat quality (acres) -LWD installation (number of structures)	- Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity -Altered hydrology -Water quality issues -Loss of floodplain connectivity
8-BE-H22	Bear Creek Water Quality Enhancement Projects (stormwater)	Identification of stormwater retrofit projects in the Bear Creek basin.	Bear/ Evans	Bear Creek	-Water quality treatment (monitoring) -Moderation of water temperature (monitoring) -Enhanced flow control of storm runoff (monitoring)	-Altered hydrology -Water quality issues

Project Number	Project Name	Project Short Description	Subbasin	River Miles Benefitted	Other Benefits with Quantifiable Metric (e.g. structures per mile)	Habitat Limiting Factor(s) Addressed[1, 2]
8-GLW-H23	Lake Washington Institute of Technology (LWIT) Infiltration Vault (stormwater)	Water quality treatment and subsequent infiltration of stormwater for 23.4 acres of contributing area.	Greater Lake Washington	Totem Lake and Juanita Creek	-Infiltration vault dimensions (15,000 feet^2 by 10.5 feet in depth) -Increased infiltration (70 AFY) -Increase in recharge/ groundwater levels (monitoring) -Stormwater retrofit area treated (23.4 acres) -Streamflow maintenance (monitoring)	-Altered hydrology -Water quality issues
8-GLW-H24	Juanita/ Cedar Creek Stormwater Retrofit Planning (stormwater)	Stormwater retrofit planning for Cedar Creek, resulting in conceptual design and cost estimates for three facilities and an implementation plan.	Greater Lake Washington	Cedar Creek	-Stormwater retrofit area treated (50 acres) -Increased infiltration (70 AFY) -Increase in recharge/ groundwater levels (monitoring) -Stormwater retrofit area treated (acres) -Streamflow maintenance (monitoring)	-Altered hydrology -Water quality issues

Project Number	**Project Name**	**Project Short Description**	**Subbasin**	**River Miles Benefitted**	**Other Benefits with Quantifiable Metric** (e.g. structures per mile)	**Habitat Limiting Factor(s) Addressed**[1, 2]
8-GLW-H25	Forbes/ North Rose Hill Stormwater Retrofit (stormwater)	Implementation of stormwater projects in the North Rose Hill and Forbes Creek stormwater retrofit plans.	Greater Lake Washington	North Rose Hill basin of Forbes Creek Watershed	-Stormwater retrofit area treated (50 acres) -Increased infiltration (47 AFY) -Increase in recharge/ groundwater levels (monitoring) -Streamflow maintenance (monitoring)	-Altered hydrology -Water quality issues
8-GLW-H26	High Woodlands Stormwater Retrofit (stormwater)	Site and size stormwater retrofit facilities within the High Woodlands subbasin of Juanita Creek.	Greater Lake Washington	High Woodlands basin of Juanita Creek Watershed	-Stormwater retrofit area treated (approximately 48.5 acres) -Increased infiltration (70 AFY) -Increase in recharge/ groundwater levels (monitoring) -Streamflow maintenance (monitoring)	-Altered hydrology -Water quality issues

Project Number	**Project Name**	**Project Short Description**	**Subbasin**	**River Miles Benefitted**	**Other Benefits with Quantifiable Metric** (e.g. structures per mile)	**Habitat Limiting Factor(s) Addressed**[1, 2]
8-GLW-H27	Spinney Homestead Park Stormwater Retrofit Planning and Construction (stormwater)	Stormwater retrofit planning, design development, and facility construction at Spinney Homestead Park.	Greater Lake Washington	Forbes Creek near Spinney Homestead Park	-Stormwater retrofit area treated (approximately 48.5 acres) -Infiltration structure volume (2.1 to 7.8 AF) -Increased infiltration (76.5 AFY) -Increase in recharge/ groundwater levels (monitoring) -Streamflow maintenance (monitoring)	-Altered hydrology -Water quality issues
8-MC-H28	Cemetery Pond Stormwater Retrofit and Wetland Restoration (stormwater)	Water quality improvement in May Creek through the retrofit design of an existing stormwater detention pond.	May/Coal	May Creek near Renton	-Stormwater retrofit area treated (acres) -Increased infiltration (AFY) -Increase in recharge/ groundwater levels (monitoring) -Streamflow maintenance (monitoring) -Control winter peak flows to May Creek by providing stormwater detention (monitoring)	-Altered hydrology -Water quality issues

Project Number	**Project Name**	**Project Short Description**	**Subbasin**	**River Miles Benefitted**	**Other Benefits with Quantifiable Metric** (e.g. structures per mile)	**Habitat Limiting Factor(s) Addressed**[1, 2]
8-LSC-H29	Lake Sammamish Creeks Habitat Restoration Projects	Habitat restoration projects in Ebright, Zackuse, and Laughing Jacobs Creeks.	Lake Sammamish Creeks	Lake Sammamish Creeks	-Restoration of Kokanee habitat (acres)	-Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity-Altered hydrology -Water quality issues -Loss of floodplain connectivity
8-I-H30	Carey/Holder/ Issaquah Confluence Restoration	Riparian vegetation restoration, livestock fencing, and other best management practices for livestock on a 120-acre site, and potentially installation of large woody debris.	Issaquah	Confluence of Carey/ Holder/ Issaquah Creeks	-Increase in volume and availability of off-channel habitat for juvenile salmonids (acres) -Increase overall channel complexity and habitat quality (acres)	-Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity -Altered hydrology -Water quality issues -Loss of floodplain connectivity

Project Number	**Project Name**	**Project Short Description**	**Subbasin**	**River Miles Benefitted**	**Other Benefits with Quantifiable Metric** (e.g. structures per mile)	**Habitat Limiting Factor(s) Addressed**[1, 2]
8-I-H31	Issaquah Creek In-Stream & Riparian Restoration - Lake Sammamish State Park	In-stream restoration and riparian buffer restoration along Issaquah Creek within Lake Sammamish State Park.	Issaquah	6000 feet of Issaquah Creek within Lake Sammamish Park	-Enhance the quality and quantity of key, strategically located salmonid habitat (acres) -Riparian restoration (40 acres) -Native trees planted (9,000) -Stream length that is restored (6,000 feet) -LWD installation (number of structures) -Apex jam installation (3) -Large spur jam installation (17) -Log installation (32) -Log jack installation (16) -Small spur jam installation (1)	-Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity -Altered hydrology -Water quality issues -Loss of floodplain connectivity
8-LC-H32	Royal Arch Reach Acquisitions and Floodplain Connection	Acquisition of floodplain properties for future floodplain reconnection and restoration.	Lower Cedar	Royal Arch Reach of Cedar River	-Restore floodplain connectivity (mapping) -Property acquired (acres) -Restore aquatic habitats (acres)	-Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity -Altered hydrology -Water quality issues -Loss of floodplain connectivity

Project Number	**Project Name**	**Project Short Description**	**Subbasin**	**River Miles Benefitted**	**Other Benefits with Quantifiable Metric** (e.g. structures per mile)	**Habitat Limiting Factor(s) Addressed**[1, 2]
8-LC-H33	Elliot Bridge Floodplain Restoration	Acquisition of parcels near the former Elliot Bridge site to enable floodplain restoration	Lower Cedar	Elliot Bridge portion of Cedar River in Renton	-Property acquired (acres) -Floodplain restoration (acres) -Levee removal (feet) -Enhance habitat conditions in Madsen creek (mapping/number of structures)	-Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity -Altered hydrology -Water quality issues -Loss of floodplain connectivity
8-LC-H34	WPA Levee Removal	Acquisition of remaining parcel not in public ownership and setback or remove the WPA levee.	Lower Cedar	Cedar River adjacent to East Renton Highlands	-Levee removal (feet) -Floodplain restoration (acres) -Restore aquatic habitats (acres)	-Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity -Altered hydrology -Water quality issues -Loss of floodplain connectivity

Project Number	Project Name	Project Short Description	Subbasin	River Miles Benefitted	Other Benefits with Quantifiable Metric (e.g. structures per mile)	Habitat Limiting Factor(s) Addressed[1, 2]
8-LC-H35	Rutledge-Johnson Lower and Rhode Levee Setback/ Removal	Property acquisition, remove/setback levees, and restore reconnected floodplain along the Rutledge-Johnson levee (a) and the Rhode and Rutledge-Johnson Levees (b).	Lower Cedar	Cedar River in Maple Valley	-Floodplain restoration (16 acres) -Levee removal/ setback (600 feet) -Floodplain restoration (acres) -Restore aquatic habitats (acres)	-Altered sediment transport processes -Loss of channel and shoreline complexity and connectivity -Altered hydrology -Water quality issues -Loss of floodplain connectivity
8-LC-H36	Reconnection of Wetland 69	Property acquisition to reconnect Wetland 69 to the Cedar River and remove a revetment.	Lower Cedar	Cedar River in Hobart	-Wetland reconnection (acres)	-Altered hydrology -Water quality issues -Loss of floodplain connectivity

Notes:

[1] Habitat limiting factors are described in section 2.3.1 Salmonids in WRIA 8.

[2] Altered hydrology includes both high flows and low flows. Decreased water quality includes elevated water temperatures.

7.4 Adaptive Management

The WRIA 8 Committee identified a number of challenges related to plan implementation, described in Chapter 6. These challenges include uncertainty in consumptive use estimates, uncertainty in offsets associated with specific project types, project implementation, climate change, and other factors. The WRIA 8 Committee has recommended adaptive management measures in the plan for the purpose of addressing uncertainty in plan implementation. Adaptive management measures include PE well tracking, project implementation tracking, and periodic watershed plan implementation reporting, with recommended adjustments to the plan. These measures, in addition to the surplus water offset and supplemental habitat improvement projects described above, provide reasonable assurance that the plan will adequately offset new consumptive use from PE wells anticipated during the planning horizon.

7.5 NEB Evaluation Findings

The WRIA 8 watershed plan is intended to provide a path forward for offsetting an estimated 425.4 AFY of new consumptive water use in WRIA 8. The plan primarily achieves this offset through a total of 11 water offset projects with a cumulative offset projection of 1,762.18 AFY. Although the WRIA 8 Committee was not able to identify projects to completely offset consumptive use at the subbasin scale, the offset was achieved at the WRIA scale, as required by RCW 90.94.030. This projected total water offset yields a surplus offset of 1,336.78 AFY above the consumptive use estimate of 425.4 AFY in WRIA 8. The projected total water offset exceeds the offset target of 698.9 AFY that the Committee developed to account for uncertainties in the planning process.

This plan also includes 25 habitat improvement projects, which provide numerous additional benefits to aquatic and riparian habitat. While many of these habitat improvement projects have potential streamflow benefits, the WRIA 8 Committee chose to exclude any associated water offset from the plan's accounting due to uncertainties regarding magnitude, reliability, and timing of streamflow benefits.

The WRIA 8 Committee has additionally recommended an adaptive management process to provide reasonable assurance that the plan will adequately address new consumptive use impacts anticipated during the planning horizon, despite inevitable challenges that will arise during project implementation, operation, and maintenance.

Based on the information and analyses summarized in this plan, the WRIA 8 Committee finds that the suite of projects in this plan, if successfully implemented, would achieve a net ecological benefit as required by RCW 90.94.030 and defined by the Final NEB Guidance (Ecology 2019).

Appendix

WRIA 8 Cedar Sammamish

Final Draft Plan
November 2020

Appendix A – References

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Appendix B – Glossary

The glossary is available at:
https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA08/PLAN/WRIA8-FinalDraftWREPlan-AppendixB-Glossary.pdf

Appendix C – Committee Roster

Table C.1: WRIA 8 Committee Roster

Entity Representing	Primary Representative	Alternates
City of Bellevue (cities caucus)	Councilmember John Stokes	Brian Landau
City of Bothell (cities caucus)	Janet Geer	Chris Hall
City of Issaquah (cities caucus)	Allen Quynn	Bob York
City of Kenmore (cities caucus)	Richard Sawyer	
City of Kent	Evan Swanson	Mike Mactutis Shawn Gilbertson
City of Sammamish (cities caucus)	Danika Globokar	
City of Seattle	Michele Koehler	Elizabeth Garcia
King County	Denise Di Santo	Joan Lee
Snohomish County	Terri Strandberg	Elisa Dawson Ann Bylin
Muckleshoot Indian Tribe	Henry Martin	Carla Carlson
Snoqualmie Indian Tribe	Matt Baerwalde	Ann House
Tulalip Tribes	Kurt Nelson	Anne Savery
Alderwood Water & Wastewater District	John McClellan	Jenifer Galatas

Entity Representing	Primary Representative	Alternates
Washington Department of Fish and Wildlife	Stewart Reinbold	Ezekiel Rohloff
Master Builders Association of King and Snohomish Counties	Gina Clark	Jennifer Anderson
Center for Environmental Law and Policy	Dan Von Seggern	Trish Rolfe
King County Agriculture Program	Rick Reinlasoder	Melissa Borsting
Washington State Department of Ecology	Stephanie Potts	Ingria Jones
WRIA 8 Salmon Recovery Council, ex officio	Jason Wilkinson (cities caucus rep)	Jason Mulvihill-Kuntz

Appendix D – Operating Principles

The approved and signed operating principles are available at:
https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA08/WRIA8_approved_signed_operating_principles.pdf

Appendix E – Subbasin Delineation Memo

The Subbasin Delineation Technical Memo is available at:
https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA08/PLAN/WRIA%208-WREC-SubbasinDelineationMemo_Final.pdf

Appendix F – Permit-Exempt Well Projections Memo

The Permit-Exempt Well Projections Technical Memo is available at:
https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA08/202011/WRIA%208-WREC-PE%20Well%20Projection%20Memo_Final.pdf

Appendix G –Consumptive Use Memo

The Consumptive Use Technical Memo is available at:
https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA08/PLAN/WRIA%208-WREC-Consumptive%20Use%20Estimates%20Memo.pdf

Appendix H – Projects

Project descriptions are available at:
https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA08/PLAN/WRIA8-FinalDraftWREPlan-AppendixH-ProjectDescriptions.pdf