Watershed Restoration and Enhancement Plan WRIA 12 – Chambers-Clover Watershed

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Executive Summary

In January 2018, the Washington State Legislature passed the Streamflow Restoration law (chapter 90.94 RCW) to help support robust, healthy, and sustainable salmon populations while ensuring rural communities have access to water. The law directs the Department of Ecology to lead local planning Committees to develop Watershed Restoration and Enhancement Plans that identify projects to offset potential consumptive impacts of new permit-exempt domestic groundwater withdrawals on instream flows over the next 20 years (2018 – 2038), and provide a net ecological benefit to the watershed. This Watershed Restoration and Enhancement Plan meets the requirements of the law.[2]

The Department of Ecology (Ecology) established the Watershed Restoration and Enhancement Committee to collaborate with tribes, counties, cities, state agencies, and special interest groups in the Chambers-Clover watershed, also known as Water Resource Inventory Area (WRIA) 12. The WRIA 12 Committee met for over 2 years to develop a watershed plan.

This watershed plan contains two projections for new PE well connections over the 20-year planning horizon; a moderate projection of 145 new PE wells and a high projection of 227 new PE wells. The projects and actions in this watershed plan will address and offset the consumptive water use from 227 PE well connections. The estimated consumptive water use associated with the new PE well connections is 89.9 acre-feet per year (0.08 cfs). This amount of water is equivalent to 353 gallons per day per new well.

This watershed plan includes two projects that capture and redirect stormwater and streamflow back into streams. These projects provide an estimated offset of 1,425 acre-feet per year to benefit streamflows and enhance the watershed. Additional projects in the plan provide benefits to fish and wildlife habitat, such as floodplain reconnections and stream improvements.

This watershed plan includes several policy recommendations and an adaptive management process. The policy recommendations contain actions to track PE wells and increase water conservation. The adaptive management process includes a mechanism for tracking new PE wells and project implementation, periodic reporting on project status, and recommendations for response if project implementation lags new PE well connections. 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 and the intention that projects in the plan will be implemented, the WRIA 12 Committee finds that this plan, when

[2] Some committee members have a different interpretation of 90.94 RCW. See the compendium for additional information: https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA12/Final%20Plan/WRIA%2012%20WRE%20Plan%20Compendium.pdf

implemented, will enhance streamflows in several important salmon streams and, for the WRIA as a whole, offset new consumptive use from PE wells anticipated during the planning horizon.

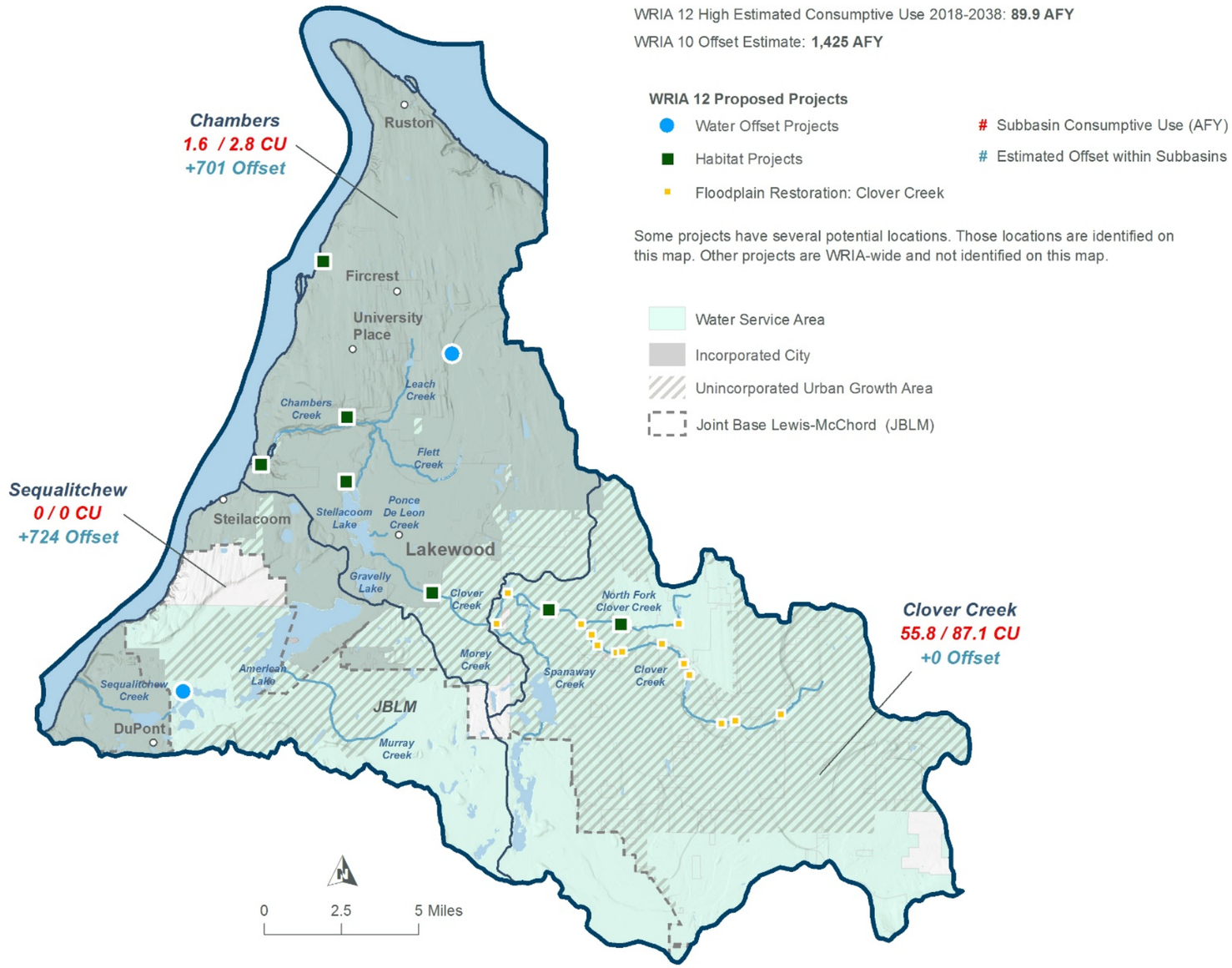

Figure 1 Summary Map

Chapter One: Plan Overview

1.1 WRIA 12 Plan Purpose and Structure

The purpose of the Water Resource Inventory Area (WRIA) 12 Watershed Restoration and Enhancement Plan (watershed plan) is to identify projects and actions necessary to offset the impacts of new domestic permit-exempt wells (referred to as PE wells throughout this plan) to streamflows. The watershed restoration and enhancement plan is one requirement of RCW 90.94.030.[3] Watershed plans must identify projects and actions to offset the potential consumptive impacts of new PE wells on instream flows over 20 years (2018-2038), and provide a net ecological benefit (NEB) to the WRIA. The WRIA 12 watershed plan considers 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 (Barlow and Leake 2012). 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 (Barlow and Leake 2012). Projects and actions to offset consumptive use associated with permit-exempt domestic water use have become a focus to minimize future impacts to instream flows and restore streamflow.

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

This watershed plan includes seven chapters:

- Plan overview.
- Overview of the watershed.
- Summary of the subbasins.
- Growth projections and consumptive use estimates.
- Description of the recommended projects and actions identified to offset the future permit-exempt domestic water use in WRIA 12.
- Explanation of recommended implementation and adaptive management measures.
- Evaluation and consideration of NEB.

1.1.1 Legal and Regulatory Background for the WRIA 12 Watershed Restoration and Enhancement Plan

[3] Some committee members have a different interpretation of 90.94 RCW. See the compendium for additional information: https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA12/Final%20Plan/WRIA%2012%20WRE%20Plan%20Compendium.pdf

In January 2018, the Washington State Legislature passed Engrossed Substitute Senate Bill (ESSB) 6091 (session law 2018 c 1)[4] 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 chapter 90.94 RCW, clarifies how local governments can issue building permits for homes intending to use a PE well for their domestic water supply. The law also requires local watershed planning in 15 different WRIAs, including WRIA 12.

1.1.2 The Local Building Permit Process and Permit-Exempt Wells

This watershed plan, the Streamflow Restoration law, and the Hirst decision are all concerned with the effects of new PE wells on streamflows. Several laws pertain to the management of groundwater PE wells in WRIA 12 and are summarized in brief here to provide context for the WRIA 12 watershed plan.

First and foremost, RCW 90.44.050, commonly referred to as "the Groundwater Permit Exemption," establishes that certain small withdrawals of groundwater are exempt from the state's water right permitting requirements, including small indoor and outdoor water use associated with homes. Although these withdrawals do not require a state water right permit, the water right is still legally established by the beneficial use. Even though a water right permit is not required for small domestic uses under RCW 90.44.050, there is still regulatory oversight, including from local jurisdictions. Specifically, 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 12 and elsewhere. For example, local governments must, among other responsibilities relating to new PE wells, collect a $500 fee for each building permit and record withdrawal restrictions on the title of the affected properties. Additionally, this law restricts new permit-exempt domestic withdrawals in WRIA 12 to a maximum annual average of 950 gallons per days per connection, subject to the 5,000 gallons per day and ½-acre outdoor irrigation of non-commercial lawn/garden limits established in RCW 90.44.050. The Washington Department of Ecology (Ecology) has published its interpretation and implementation of RCW 19.27.097 and chapter 90.94 RCW in Water Resources POL-2094 (Ecology 2019a). The WRIA 12 Committee directs readers to those laws and policy for comprehensive details and agency interpretations.

1.1.3 RCW 90.94.030's Planning Requirements

While supplementing the local building permit requirements, RCW 90.94.030(3) goes on to establish the planning criteria for WRIA 12. In doing so, it sets the minimum standard of Ecology's collaboration with the WRIA 12 Committee in the preparation of this watershed plan.

[4] An ACT Relating to ensuring that water is available to support development; amending RCW 19.27.097, 58.17.110, 90.03.247, and 90.03.290; adding a new section to chapter 36.70A RCW; adding a new section to chapter 36.70 RCW; adding a new chapter to Title 90 RCW; creating a new section; providing an expiration date; and declaring an emergency.

In practice, the process of plan development was one of broad integration, collectively shared work, and a striving for consensus described in Section 1.4.

Additionally, the Streamflow Restoration law requires this watershed plan to identify projects and actions intended to offset the anticipated impacts from new permit-exempt domestic groundwater withdrawals over the next 20 years while providing a NEB.[5] 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 approach to selecting projects and actions, the law also speaks to "high and lower priority projects." As provided in the Final Guidance on Determining Net Ecological Benefit (Ecology 2019b), "use of these terms is not the sole critical factor in determining whether a plan achieves a NEB… and that plan development should be focused on developing projects that provide the most benefits… regardless of how they align with [these] labels".

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

1.2 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 Chambers - Clover watershed and to collaborate with the Committee to develop a watershed plan. Ecology determined that collective development of the watershed plan, using an open and transparent setting and process that builds on local needs would best serve the intent of the law.

At a minimum, the watershed plan must include projects and actions necessary to offset projected consumptive impacts of new PE wells on streamflows and provide a NEB to the WRIA.[6]

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 chapter 90.94 RCW. 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

[5] Some committee members have a different interpretation of 90.94 RCW. See the compendium for additional information: https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA12/Final%20Plan/WRIA%2012%20WRE%20Plan%20Compendium.pdf

[6] Some committee members have a different interpretation of 90.94 RCW. See the compendium for additional information.

informs planning groups on the standards Ecology will apply when reviewing a watershed plan completed under RCW 90.94.020 or RCW 90.94.030. The minimum planning requirements described by Ecology in the Final NEB Guidance include the following:

1. Clear and Systemic Logic. Watershed plans must be prepared with implementation in mind.
2. Delineate Subbasins. [The Committee] must divide the WRIA into suitably-sized subbasins to allow meaningful analysis of the relationship between new consumptive use and offsets.
3. Estimate New Consumptive Water Uses. Watershed plans much 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 PE wells initiated within the planning horizon and how those impacts will be distributed.
5. Describe and Evaluate Projects and Actions for their Offset Potential. Watershed plans must, at a minimum, identify projects and actions intended to offset impacts associated with new consumptive water use.

The Streamflow Restoration law requires that all members of the WRIA 12 Committee approve the plan prior to submission to Ecology for review. Ecology must then determine that the watershed plan's recommended streamflow restoration projects and actions will result in a NEB to instream resources within the WRIA after accounting for projected use of new PE wells over the planning horizon.

RCW 90.94.030(3)

(b) At a minimum, the plan must include those actions that the committee determines to be necessary to offset potential impacts to instream flows associated with permit-exempt domestic water use. The highest priority recommendations must include replacing the quantity of consumptive water use during the same time as the impact and in the same basin or tributary. Lower priority projects include projects not in the same basin or tributary and projects that replace consumptive water supply impacts only during critical flow periods. The plan may include projects that protect or improve instream resources without replacing the consumptive quantity of water where such projects are in addition to those actions that the committee determines to be necessary to offset potential consumptive impacts to instream flows associated with permit-exempt domestic water use.

(c) Prior to adoption of the watershed restoration and enhancement plan, the department must determine that actions identified in the plan, after accounting for new projected uses of water over the subsequent twenty years, will result in a net ecological benefit to instream resources within the water resource inventory area.

(d) The watershed restoration and enhancement plan must include an evaluation or estimation of the cost of offsetting new domestic water uses over the subsequent twenty years, including withdrawals exempt from permitting under RCW 90.44.050.

(e) The watershed restoration and enhancement plan must include estimates of the cumulative consumptive water use impacts over the subsequent twenty years, including withdrawals exempt from permitting under RCW 90.44.050.

1.3 Overview of the WRIA 12 Committee

1.3.1 Formation

The Streamflow Restoration law instructed Ecology to chair the WRIA 12 Committee (referred to as "the 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.

RCW 90.94.030(2)(b) "The department shall chair the watershed restoration and enhancement committee and invite the following entities to participate."

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

The Streamflow Restoration 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 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 Committee.

The entities represented on the WRIA 12 Committee are included in Table 1. This list includes all of the entities identified by the Legislature that agreed to participate on the Committee.[7]

Table 1: WRIA 12 Membership

Entity Name	Representing
Puyallup Tribe	Tribal government
Squaxin Island Tribe	Tribal government
Pierce County	County government
Town of Steilacoom	City government
City of Lakewood	City government
City of Tacoma	City government
Washington Department of Fish and Wildlife	State agency
Washington Department of Ecology	State agency
Lakewood Water District	Water utility
Pierce County Conservation District	Agricultural interest
Master Builders Association of Pierce County	Residential building industry
Chambers-Clover Watershed Council	Environmental interest

[7] The law did not require invited entities to participate, and some chose not to participate on the Committee. Listed entities committed to participate in the process and designated representatives and alternates.

The Committee invited representatives from the WRIA 10/12 Salmon Recovery Entity and Joint Base Lewis-McChord to participate as "ex-officio" members. Although not identified in the law, the ex-officio members provide valuable information and perspective as subject matter experts. The ex-officio members were active but non-voting participants of the Committee. The roster with names and alternates is available in Appendix C.

1.4 Committee Structure and Decision Making

The Committee held its first meeting in November 2018. Between November 2018 and April 2021, the Committee held 25 meetings. Some meetings were held jointly with the WRIA 10 Committee. All Committee meetings were open to the public. The Committee met at least once a month, and as needed to meet deadlines.

The two and a half years of planning consisted of training, research, and developing plan components. Committee members had a range of knowledge about hydrogeology, water law, salmon recovery, and residential development. Ecology technical staff, Committee members, and partners presented on topics to provide context for components of the plan.

In addition to playing the role of Committee chair, Ecology staff provided administrative support and technical assistance, and contracted with consultants to provide facilitation and technical support for the Committee. The facilitator supported the Committee's discussions and plan content.[8] The technical consultants developed products that informed the development of the plan. The technical consultants developed all of the technical memorandums referenced throughout this plan.[9] The Committee established a technical workgroup to support planning activities and to achieve specific tasks. The workgroup was open to all Committee members as well as non-Committee members that brought capacity or expertise not available on the Committee. The workgroup presented information to the Committee as recommendations. The Committee acted on workgroup recommendations, as it deemed appropriate.

This planning process, by statutory design, brought a diversity of perspectives to the table. The Committee relied on the workgroup to bring forth recommendations. The Committee discussed the recommendations and identified areas of agreement and concerns. The chair and facilitator documented agreement and dissenting opinions in meeting summaries that the Committee reviewed and approved. The authorizing legislation requires that final plan itself must be approved by all members of the Committee prior to Ecology's review.[10] As such, the Committee focused on developing a plan that the whole Committee could accept. Identifying areas of agreement and concerns on the foundational elements of plan served as the best indicators of the Committee's progress toward an approved plan.

The Committee did not find a process for making interim conclusions that was acceptable to all Committee members, so Ecology took on the role of making interim conclusions as needed. The

[8] Facilitation was provided by ESA.
[9] Technical consultant team consisted of HDR, Pacific Groundwater Group, and Dally Environmental.
[10] RCW 90.94.030[3] "…all members of a watershed restoration and enhancement Committee must approve the plan prior to adoption".

Committee continued to meet to develop and reach agreement on a final plan without operating principles.

The WRIA 12 Committee reviewed draft plan and draft plan chapters on an iterative basis. Committee members reviewed the compiled plan and, in some cases, received direction on whether to approve the plan from the appropriate decision-makers at each entity. The full Committee voted to approve the plan unanimously on April 23, 2021.

Chapter Two: Watershed Overview

2.1 Brief Introduction to WRIA 12

WRIAs are large watershed areas formalized under Washington Administrative Code (Water Resources Code of 1971) for the purpose of administrative management and planning. WRIAs encompass multiple landscapes, hydrogeological regimes, levels of development, and variable natural resources. WRIA 12, the Chambers-Clover Watershed, is the smallest watershed of the 62 designated WRIAs in Washington State. The 180 square mile Chambers-Clover Watershed is entirely within Pierce County, Washington (see Figure 1) (Runge, Marcantonio, and Mahan 2003). The watershed includes Chambers Creek and Clover Creek as well as approximately 2,020 acres of lakes and extensive wetlands (Ecology 1995). These creek systems originate from springs and groundwater drainage to streams in the northeast corner of the watershed.

Chambers-Clover Creek flows 18.1 miles and discharges into the Puget Sound one mile north of downtown Steilacoom. Leach Creek and Flett Creek are two important tributaries to Chambers Creek. Numerous small drainages flow directly to Puget Sound, including Puget Creek and Sequalitchew Creek (Chambers-Clover Watershed Management Plan 2004).

2.1.1 Land Use in WRIA 12

The Chambers-Clover Watershed is predominantly urban, characterized by a combination of residential, industrial, commercial, manufacturing, transportation, communication, and military land uses (see Figure 1). The Chambers-Clover Watershed includes the western half of the City of Tacoma, all of the Cities of Lakewood, Ruston, DuPont, Fircrest and University Place, and the Town of Steilacoom. It also includes the unincorporated communities of Parkland, Spanaway, Elk Plain, Frederickson, and Midland. Approximately 67 percent of WRIA 12 is within a city or designated urban growth area. Joint Base Lewis-McChord (JBLM)[11] occupies 18.2 percent of the watershed (32.7 square miles).

The Chambers-Clover Watershed has experienced a steady pace of urbanization. Land use conversion from natural forested condition to residential, commercial, and agricultural uses has resulted in filling of floodplain wetlands, compaction of soils, and increased impervious surface, contributing to an increased magnitude and frequency of peak stream flows and reduced groundwater and wetland storage, reducing baseflows (Runge, Marcantonio, and Mahan 2003). In addition, sanitary sewers collect wastewater from most of the watershed. The wastewater is treated and discharged into the Puget Sound, further reducing groundwater recharge and baseflows in the WRIA.

2.1.2 Tribal Reservations and Usual and Accustomed Fishing Areas

Three federally recognized tribes, the Squaxin Island Tribe, the Puyallup Tribe of Indians, and the Nisqually Tribe, have usual and accustomed fishing areas in the watershed. The Tribes hold Treaty-reserved water rights in WRIA 12 under federal law that are necessary to support healthy salmon populations; to support and maintain hunting, fishing and cultural resource

[11] The former McChord Air Force Base and Fort Lewis.

harvesting right; and to meet all homeland purposes reserved by the Treaties. These reserved water rights are necessary to fulfill the promises and purpose of the Treaties. Federal Indian water rights retain a senior priority date over all other federal and state water rights holders and state instream flow rules. Although Federal Indian water rights in WRIA 12 have yet to be adjudicated, these rights are senior to all other rights and have not been accounted for by the State of Washington in the way in which the State determines water availability, over appropriation, and instream flow rules[12].

[12] Language provided by WRIA 12 Tribes.

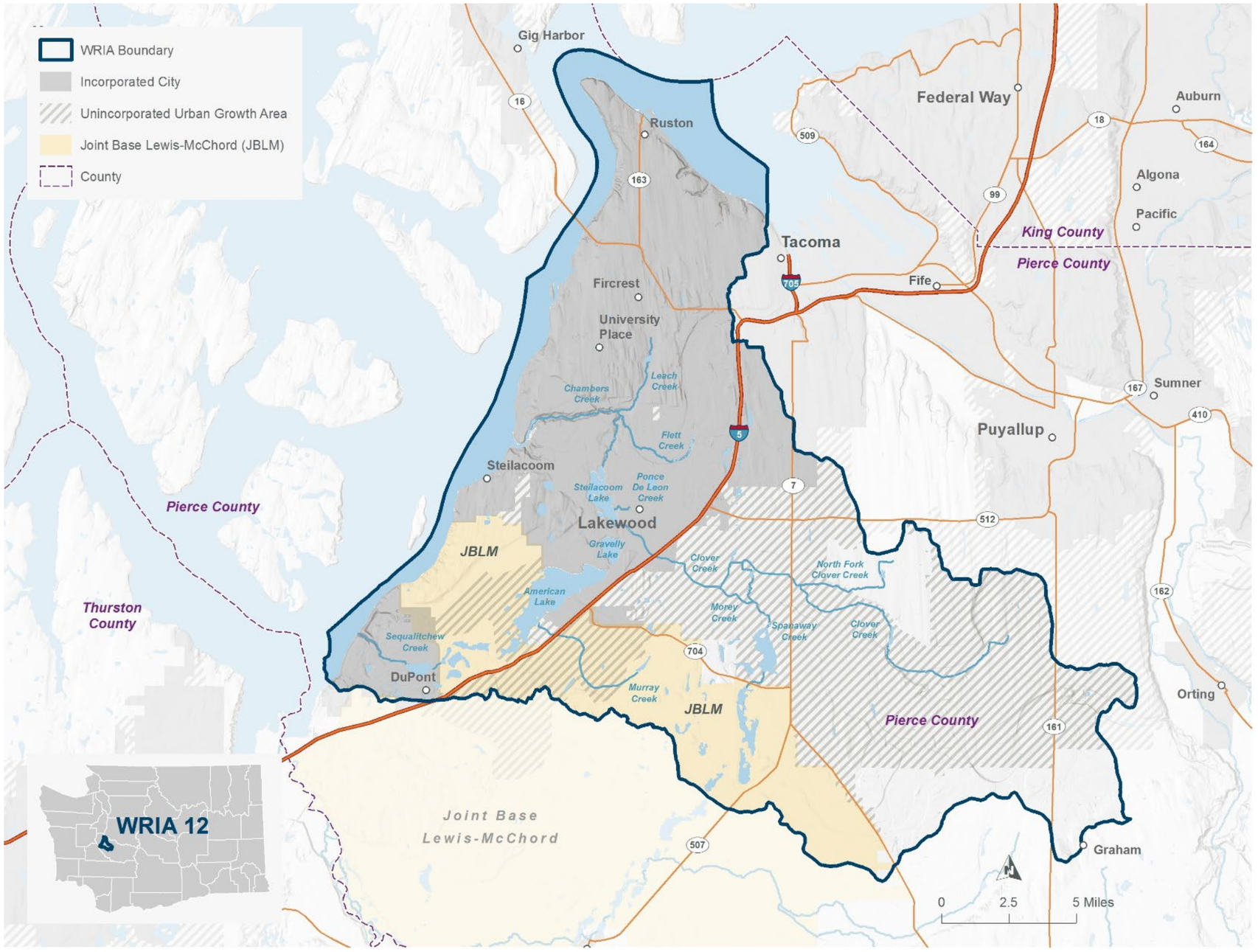

Figure 2 WRIA 12 Watershed Overview

2.1.3 Salmon in WRIA 12

The Chambers-Clover Watershed supports anadromous salmonids. The watershed includes approximately 27 miles of marine shoreline that supports local anadromous salmonid stocks, as well as salmonid stocks from other Puget Sound WRIAs. Several tributaries provide spawning and rearing habitat for juvenile salmonids including Chinook, Coho, Chum, Pink, Steelhead and Cutthroat trout. Many people depend on the salmon fishery, including those tribes with usual and accustomed fishing areas that overlap with the Chambers-Clover Watershed (Ecology 1995).

Urbanization has caused streams within the watershed to experience extremely low streamflows during migration and spawning time, and many stream reaches, including Clover Creek and Sequalitchew Creek, dry up completely in the dry season (Runge, Marcantonio, and Mahan 2003). In addition, levees, dams, and other flood control measures have further limited habitat along Clover Creek, Sequalitchew Creek, and unnamed creeks (Runge, Marcantonio, and Mahan 2003).

2.1.4 Water System Distribution and Impacts in WRIA 12

Water systems distribute most water in the watershed. In Pierce County, two or more connections are Group B systems;[13] most Group B systems are PE wells. Individual PE wells serve one connection. Most PE wells are located in unincorporated rural areas, where water systems are unavailable. Approximately 88.4 percent of the watershed is within a Group A water service area.[14]

The Public Water System Coordination Act of 1977[15] enabled the Pierce County Coordinated Water System Plan (CWSP). The Washington State Department of Health is primarily responsible for the water system plan approval; however, local governments ensure consistency with local growth management plans and development policies. Created in 1988 the CWSP allows water utilities to coordinate planning and construction programs with water utilities and other local jurisdiction programs. The plan provides the foundation for how public drinking water needs are met with consideration for future growth. A limited update was completed in 2001, but it did not address changes associated with water resources, water supply, and land use planning. A more significant update was completed in 2020.[16]

This planning ensures 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 they connect to water system or rely on new PE wells. Within their designated retail service area(s),

[13] Group B water systems serve fewer than 15 connections and 25 people per day. Group B systems serving fewer than six connections are often exempt from permitting because they can meet the requirements of RCW 90.44.050.
[14] Group A water systems serve 15 or more connections and 25 or more people per day and require a water right from the Department of Ecology.
[15] RCW 70.116.070.
[16] Additional water system planning information for Pierce County is available: https://www.co.pierce.wa.us/951/Coordinated-Water-System-Planning.

Group A water purveyors are given first right of refusal for new connections. The purveyor may allow an individual well if they are unable to provide service in a 'reasonable and timely' manner.

2.2 Watershed Planning in WRIA 12

Community members and local, state, federal, and tribal governments have collaborated on watershed and water resource management issues in WRIA 12 for decades. The Chambers-Clover Planning Unit completed a draft watershed plan in September 2004, but were unable to reach consensus on the document. This section contains a brief summary of broad watershed planning activities as they relate to the past, present, and future water availability in the Chambers-Clover Watershed.

2.2.1 Current Watershed Planning in WRIA 12

This watershed plan builds on many of the past watershed planning activities. For example, the Alliance for a Healthy South Sound[17] (AHSS) implements Puget Sound Partnership's Action Agenda for Puget Sound[18] Recovery in the South Puget Sound.[19] AHSS is a collaboration of local, state, and federal agencies, tribes, nonprofit organizations, and businesses. The Action Agenda addresses everything from salmon to orca recovery, stormwater runoff, shoreline restoration, and forest conservation. The AHSS has engaged the community in a collaborative planning process to help understand priorities and support the health and sustainability of the watershed. The Chamber-Clover Watershed Council, a volunteer-based organization focused on enhancing water quality, water quantity, habitat, and other environmental issues in the watershed, also implements the Action Agenda.

The Salmon Recovery Lead Entity, a collaboration of local governments, state, federal, and tribal partners, and nonprofit organizations, focuses on protecting and enhancing wild salmon populations. In 2018, the Lead Entity updated the Salmon Habitat Protection and Restoration Strategy for Puyallup and Chambers Watersheds.[20]

The AHSS and Salmon Recovery Lead Entity include many of the same organizations and individuals that participate in the Committee. This history of collaborative planning and shared priorities has supported the success of the watershed plan development in WRIA 12.

2.2.2 Coordination with Existing Plans

Throughout the development of the watershed plan, Ecology streamflow restoration staff have engaged with staff from the Salmon Recovery Lead Entity and the Puget Sound Partnership,

[17] https://www.healthysouthsound.org/.
[18] https://psp.wa.gov/action_agenda_center.php.
[19] The AHSS boundaries include WRIA 12, except a small area in Tacoma, which is in the Puyallup-White River Local Integrating Organization. More information on local integrating organizations and their activities to recovery Puget Sound is available here: https://www.psp.wa.gov/LIO-overview.php.
[20] Salmon recovery lead entities in Puget Sound were established under RCW 77.85.050. More information on their roles as well as links to the recovery plan and watershed chapters is available here: https://www.psp.wa.gov/salmon-recovery-overview.php.

providing briefings on the streamflow restoration law, scope of the watershed plan, and plan development status updates. The Committee chair conducted outreach to the WRIA 10/12 Salmon Recovery Lead Entity regarding coordination with the Committee to ensure alignment of salmon recovery priorities and the streamflow planning process. Throughout the planning process, Ecology has coordinated closely with the lead entity, including inviting lead entity to take part as an ex-officio member on the Committee and incorporating priority salmon recovery projects in the watershed plan.

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

This watershed plan incorporates assumptions that reflect the Pierce County comprehensive plan goals and policies. The comprehensive plan sets policy for development, housing, public services and facilities, and environmentally sensitive areas, among other topics. The comprehensive plan identifies where and how Pierce County plans for future population, housing, and job growth. This plan used the Pierce County zoning districts and Group A water system service areas as the basis for estimating the likely areas of future PE wells.

As a component of a comprehensive plan, a Capital Facilities Plan (CFP) identifies public facilities that will be needed to ensure service levels keep pace with expected development. It includes projects from a range of County functions, including: airport/ferries, emergency management, general administration, parks, roads, sewer, sheriff/court/correctional facilities, and surface water management. The CFP must identify the location and cost of capital facilities, as well as the sources of revenue that will be used to fund them. The plan is updated annually and appropriates funding for the following year. If the costs exceed the revenue, the County must reduce its level of service, reduce costs by implementing noncapital alternatives or other methods, or modify the land use element to bring development into balance with available or affordable facilities.

Projects may also fall under the noncapital category. Noncapital alternatives include programs, strategies, and methods other than 'brick and mortar'-type capital improvement to achieve the County's required level of service. This category includes programs like education and outreach, improvements to existing facilities, and projects to improve natural drainage as an alternative to engineered solutions (e.g., levees and dikes).

Capital projects (structures or engineered improvements to land) identified through the watershed plan may be evaluated and prioritized for placement into the CFP. Most proposed

projects will fall under the category of Surface Water Management. Pierce County's Surface Water Management Division (SWM) uses the Surface Water Improvement Plan (SWIP) as its primary basis for project implementation planning. Not all projects listed in the SWIP make it into the CFP, but the SWIP does inform which projects are incorporated. The SWIP is also a six-year plan that is updated bi-annually. Projects come from existing, County-approved plans and are ranked for their ability to address flooding, water quality, habitat, and other factors. Limited available funding and new mandatory obligations also factor into capital project prioritization. If approved, the watershed plan will become one of the guiding project implementation plans for the SWIP.

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

2.3.1 Geologic Setting

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

The general geology of WRIA 12 is dominated by a broad drift plain formed from a sequence of unconsolidated glacial and interglacial deposits. Depths to bedrock in the lowlands can exceed 2,000 feet (Welch et al. 2015).

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

2.3.2 Hydrogeologic Setting

The U.S. Geological Survey (USGS) described the hydrology of WRIA 12 in a hydrogeologic framework report for the Chambers-Clover Watershed based on previous studies and published reports for central Pierce County (Savoca et al. 2010). The hydrogeologic units of the area are described as being either water-bearing ("aquifer") or non-water-bearing ("aquitard" or "confining layer") sediments, without regard to geologic origin or age. Major groundwater aquifers are found in the unconsolidated glacial and interglacial sediments throughout the central and lower regions of the watershed.

Groundwater in the aquifers generally flows to the northwest towards Puget Sound or northwards towards the Puyallup River valley. Groundwater is not limited by WRIA boundaries and activities in WRIAs 10 and 11 may influence or be influenced by activities WRIA 12. The generalized flow patterns are complicated by the presence of low permeability confining units and bedrock that separate discontinuous bodies of aquifer material and act as local

groundwater-flow barriers (Welch et al. 2015). Summer baseflows in the watershed are sustained by groundwater.

The USGS describes the hydrogeology of the watershed as 12 units, typically alternating between aquifer and non-aquifer layers. Five of the eight aquifer layers included in the USGS definitions are present throughout watershed (see Appendix E). These aquifers are the most likely sources for new PE wells. The upper three units will also be the main source of direct recharge or baseflow to the surface water system. Two aquifers do not have surface expressions except below sea level into Puget Sound.

Two additional layers are included in the USGS reports, but do not occur in WRIA 12. One final aquifer occurs only at very deep depths in the watershed (typically over 800 feet). Future PE wells are unlikely to access water from this layer due to prohibitively expensive drilling costs.

2.3.3 Hydrology and Streamflow

The Chambers-Clover Watershed is a spring- and groundwater- fed system (Lead Entity 2018). Drainage originates from springs and groundwater discharge to springs and seeps in the northeastern corner of the WRIA 12. The watershed includes a number of named lakes in addition to the streams. Unlike many watersheds in Puget Sound, the upper watershed lies at a relatively low elevation of 600 feet and snowpack is not a significant source of late summer baseflow.

Groundwater forms the headwaters of Clover Creek and flows from east to northwest through McChord Air Force Base in the center of the watershed. The North Fork Clover Creek begins as a seasonal surface runoff on a plateau three miles east of Parkland and flows 3.2 miles southwest and west through the heavily developed residential and business districts of Parkland before joining Clover Creek on the east side of McChord airfield. Morey Creek is also a tributary of Clover Creek, separating from Spanaway Creek with a poorly defined channel and a number of associated wetlands. Two 12-foot diameter pipes convey Clover Creek underneath McChord airfield for 1800 feet (Clothier et al. 2003).[21] Clover Creek enters Steilacoom Lake at river mile (RM) 5.8.

Chambers Creek forms from the outlet of Steilacoom Lake and flows north and west into Puget Sound through Chambers Bay. Flett and Leach Creeks, two primary tributaries, contribute to the flow of Chambers Creek between Steilacoom Lake and Chambers Bay (Ecology 1995). Spanaway Creek is a tributary of Clover Lake, formed by springs and marshes on Ft. Lewis and flows north. Sequalitchew Creek originates at Sequalitchew Lake and drains westerly until it enters salt water south of the old DuPont Warf location (Runge, Marcantonio, and Mahan 2003).

Precipitation in the form of rain is the principle source of recharge in the Chambers-Clover Watershed. Annual precipitation near the city of Tacoma, at the northern boundary of the watershed averages approximately 40 inches per year, while annual precipitation at the

[21] JBLM began emergency repair and replacement of the culvert in the summer of 2020. The culvert will be replaced with a bridge designed to improve fish passage.

Olympia Station located approximately 15 miles south of the watershed averages approximately 51 inches per year. Precipitation increases with elevation and distance from Puget Sound. The numerous springs in the watershed contribute late-summer baseflow to streams and year-round discharge to the Puget Sound along shoreline bluffs (USGS 2013). Groundwater flooding is a frequent occurrence in the winter months.

The WRIA 12 Instream Resources Protection Program (chapter 173-512 WAC) preserves the uses and values of individual rivers, streams, and lakes. The rule protects existing flows from new permitted water rights by creating year-round closures for all streams in the WRIA and requires that the relationship between groundwater and surface water is fully considered in groundwater permitting. The Supreme Court Decisions in the Postema and Foster cases have generally extended the rule's closures to groundwater withdrawals where they might impact surface water bodies. Five USGS gages[22] track streamflow in WRIA 12. These gages provide a historical record of streamflows from at least 1950. The data from these gages form the basis for high, low, and medium average streamflows over the course of a water year. These graphs are available in Appendix E. Runoff contribution for most of the basin can be measured at a downstream gaging station on Chambers Creek below Leach Creek near Steilacoom, and indicate a mean annual flow of 111.5 cubic feet per second (cfs) for a period of record from 1938 to 2019 (USGS 2020).

Anticipated future climate impacts include rising temperatures and changes in precipitation. Increased evaporative losses and warmer and drier summer conditions will intensify summer drought conditions, low flow issues and high stream temperatures. This may result in more severe water quality and quantity impacts on fisheries (Lead Entity 2018). Seasonal temperature variations significantly affect the hydrologic cycle in this lowland watershed. Water quantity is an issue, especially during summer months when instream flows are so low that full reaches of Clover and Sequalitchew creeks go completely dry (Lead Entity 2018).

Historic records indicate that Clover Creek had higher flows during the summer months in the past and may have flowed year-round in the Parkland area (Tobiason 2003). A number of changes contributed to lower flows. Modifications to the drainage system starting in the 1940s lowered American Lake levels as well as groundwater levels. The regional sewer system installed in 1986 diverted treated wastewater directly to Puget Sound, thereby reducing groundwater recharge and increasing water use in the watershed. One other potential cause of diminished flows is the change within the basin from prairie to forested habitat. The water balance and amount of water available for baseflow is impacted by the presence (or absence) of trees as the evapotranspiration rate is much higher for forested areas, thereby reducing water available for baseflow (Chambers-Clover Watershed Management Plan 2004).

Development in WRIA 12 has straightened, diverted, armored, and contained in pavement-lined channels and culverts portions of streams. A dam at the outlet of Steilacoom Lake controls flow to Chambers Creek. A dam and fish weir[23] blocks upstream fish passage from Chambers

[22] USGS Gage 12090400 (North Fork Clover Creek); USGS Gage 12090500 (Clover Creek); USGS Gage 12091100 (Flett Creek); USGS Gage 12091200 (Leach Creek); and USGS Gage 12091500 (Chambers Creek)
[23] Part of a WDFW fish collection facility.

Bay estuary to the freshwater portions of Chambers Creek (Lead Entity 2018). Sequalitchew Creek streamflow is greatly reduced because all flow from Sequalitchew Lake is currently directed through a diversion canal and discharged directly to Puget Sound.

2.3.4 Salmon Presence

The Chambers Watershed primarily supports cutthroat trout, coho, and chum salmon, in Chambers and Sequalitchew Creek (see Tables 2 and 3). Chinook salmon are currently captured at the Chambers Creek Dam to use for hatchery production. Sockeye salmon are observed on occasion at the Chambers Creek Dam. A large population of kokanee (landlocked sockeye salmon) are present in American Lake. WDFW has documented Cutthroat trout and chum salmon in Clover Creek and associated tributaries. Historically, chum may have been present throughout Spanaway Creek. Both of these species are tribally significant (Still, K. and Spurrier, L. 2019).

Table 2 Salmonid Species and Status in WRIA 12

Common Name	Scientific Name	Evolutionary Significant Unit	Critical Habitat	Regulatory Agency Status
Coastal Cutthroat Trout	*Oncorhynchus clarkii ssp.*	No listing	No listing	No listing
Chum Salmon	*Oncorhynchus keta*	Puget Sound Chum	No	No listing
Coho Salmon	*Oncorhynchus kisutch*	Puget Sound/Strait of Georgia Coho	No	NMFS/Species of Concern/1997

Table source: Lead Entity 2018.

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

Table 3 Salmonid Presence and Life History Timing WRIA 12

Salmonid Life History and Timing in WRIA 12																								Subbasin Presence
Species	Freshwater Life Phase	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		
Coho	Upstream migration																									Chambers and Sequalitchew
	Spawning																									
	Incubation																									
	Juvenile rearing																									
	Smolt outmigration																									
Chum	Upstream migration																									Chambers and Sequalitchew
	Spawning																									
	Incubation																									
	Juvenile rearing																									
	Juvenile outmigration																									
Coastal Cutthroat Trout	Upstream migration																									Chambers and Sequalitchew
	Spawning																									
	Incubation																									
	Juvenile rearing																									
	Smolt Outmigration																									

Table source: Lead Entity 2018.

Limiting Factors

Salmonid habitat limiting factors have been defined by the WRIA 12 Lead Entity (2018) and Runge, Marcantonio, and Mahan (2003).[24]

Limiting factors in Chambers Creek include the following:

- Fish passage barrier at the mouth of Chambers Creek (dam).
- Floodplain and shoreline hydromodifications (e.g. streambank armoring).
- Channel complexity and riparian function.
- Modified hydrology (I.e. extreme high and low flows) from drainage modifications, high percentages of impervious surfaces in the watershed, and water use that lowers the regional water table in the summer.
- Viable habitat that provides connective corridors between riverine and estuarine habitats and between estuarine and open water.

Limiting factors in Clover Creek include the following:

- Fish passage at multiple locations.
- Floodplain and riparian function.
- Invasive plants reducing habitat function (e.g. reed canary grass).
- Channel straightening and hydromodifications, including paving sections of the stream channel bed.
- Lack of instream habitat (e.g. large woody debris).
- Low summer flows and areas of no summer flows.
- Water quality impairment from stormwater runoff, reduced riparian function, low instream flows, wetland losses, and livestock waste.

Limiting factors in Sequalitchew Creek include the following:

- Partial fish passage barrier and modified tidal hydrology at the confluence with Puget Sound.
- Partial fish passage barriers from beaver dams in the Edmond and Hamer Marsh reaches (RM 0.6 - 2.6).
- Fish passage barrier at the outlet of Sequalitchew Lake.
- Diversion of flow from Sequalitchew Lake and Edmond marsh to a diversion canal.
- Water withdrawals leading to reduced summer low flows.
- Fish entrainment into the diversion canal.
- Floodplain modifications from on-going sand and gravel mining.
- Channelizing of the upper reaches limits the lateral movement of the creek within its natural floodplain.
- Water temperature during low summer flows.

[24] Evaluation of Salmon Habitat Protect Protection and Restoration in Puyallup/White and Chambers/Clover Watersheds using Ecosystem Diagnosis and Treatment (EDT) was prepared for Pierce County in February 2021 and includes additional information about salmon presence, extent, and limiting factors in the Chambers-Clover Watershed.

- Viable habitat that provides connective corridors between riverine and estuarine habitats and between estuarine and open water.

2.3.5 Water Quality

Ecology evaluates surface waters in WRIA 12 periodically with a water quality assessment. The assessment evaluates existing water quality data and classifies waterbodies into the following categories:

- Category 1: Meets tested standards for clean waters.
- Category 2: Waters of concern; Waters in this category have some evidence of a water quality problem, but not enough to show persistent impairment.
- Category 3: Insufficient data.
- Category 4: Impaired waters that do not require a TMDL.
- Category 5: Polluted waters that require a water improvement project.

The latest water quality assessment classified many waterbodies in WRIA 12 (Ecology 2020). Appendix F lists the Category 5 assessment. The Category 5 listings most closely related to streamflows are water temperature on Clover and Spanaway Creeks, and dissolved oxygen on Chambers Creek. Other Category 5 listings are based on water quality standards exceedance of bacteria, copper, lead, mercury, total phosphorus, and various toxins.

Ecology prepared one Total Maximum Daily Load study (TMDLs) in WRIA 12 to addresses total phosphorus in Wapato Lake. Ecology paused the development of a second TMDL focused on dissolved oxygen, fecal coliform, and water temperature in Clover Creek in order to address directly the sources of pollution and implement solutions with watershed partners.

Chapter Three: Subbasin Delineation

3.1 Introduction

WRIAs are large watershed areas formalized under Washington Administrative Code for the purpose of administrative management and planning. WRIAs encompass multiple landscapes, hydrogeologic regimes, levels of development, and variable natural resources. To allow meaningful analysis of the relationship between new consumptive use and offsets per Ecology's Final NEB Guidance,[25] this plan divides WRIA 12 into three subbasins. The subbasins help describe the location and timing of projected new consumptive water use, the location and timing of impacts to instream resources, and the necessary scope, scale, and anticipated benefits of projects. In some instances, subbasins may not correspond with hydrologic or geologic basin delineations (e.g., watershed divides).[26]

3.2 Approach to Develop Subbasins

This plan divides WRIA 12 into three subbasins to assess population growth, consumptive use, and project offsets.[27] The basic considerations in delineating subbasin boundaries for this planning process were:

- Surface hydrology based on USGS hydrologic unit codes.
- Surface topography.
- Location of salmon use within the watershed.

Other considerations were:

- Areas outside of Group A water systems.
- Areas within Group A water systems.

A more detailed description of the subbasin delineation is in the technical memo available in Appendix D.

3.3 Subbasin Map

The WRIA 12 subbasin delineations are shown on Figure 2 and summarized below in Table 4:

[25] "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.
[26] Washington State Department of Ecology (Ecology), 2019. Final Guidance for Determining Net Ecological Benefit, GUID-2094 Water Resources Program Guidance. Washington State, Department of Ecology, Publication 19-11-079.
[27] This is consistent with Final NEB Guidance that defines subbasins as a geographic subarea within a WRIA. A subbasin is equivalent to the words "same basin or tributary" as used in RCW 90.94.020(4)(b).

Table 4 WRIA 12 Subbasins

Subbasin Name	Primary Rivers and Tributaries	County
Chambers	Chambers Creek, lower portion of Clover Creek (downstream of the confluence with Clover Creek and Morey Creek); Gravelly Lake, Steilacoom Lake; Point Defiance and nearshore areas.	Pierce County
Clover	Clover Creek upstream of the confluence with Morey Creek; Morey Creek and Spanaway Creek: Spanaway Lake	Pierce County
Sequalitchew	Sequalitchew Creek and American Lake; Sequalitchew Lake: Nearshore areas.	Pierce County

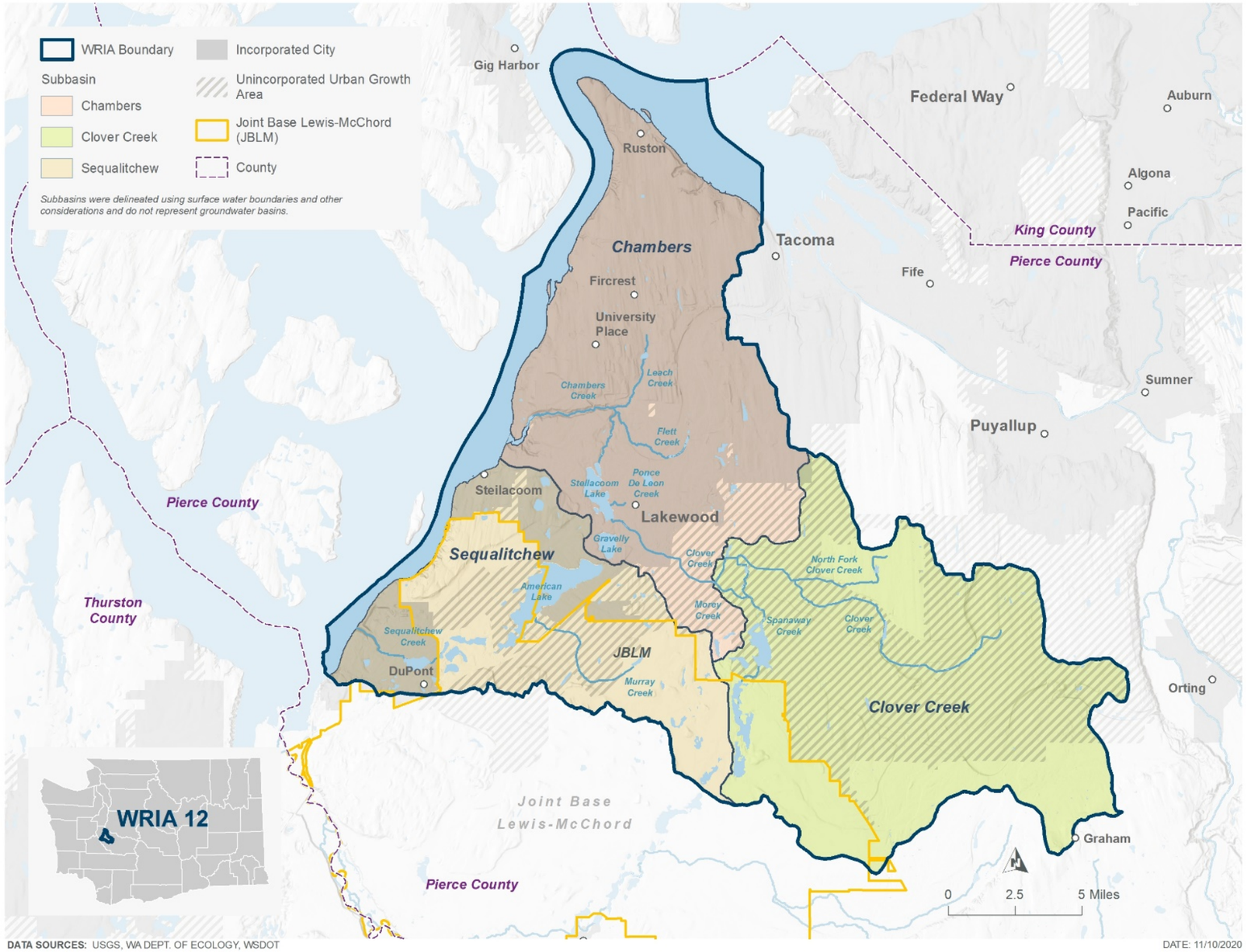

Figure 3 WRIA 12 Subbasin Delineation

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, including withdrawals exempt from permitting under RCW 90.44.050" (RCW 90.94.030(3)(e)).[28] This chapter follows Ecology's Streamflow Restoration Policy and Interpretive Statement and Final NEB Guidance and describes the projections of new PE well connections and their associated consumptive use over the planning horizon for the entire WRIA and each subbasin.[29] This chapter also summarizes information from the technical memo (Appendix G) prepared for this plan.

4.2 Projection of PE Well Connections (2018–2038)

This plan's moderate projection of 145 PE wells over the planning horizon is the most likely scenario. The projects listed in Chapter 5 will offset the consumptive use from the high growth projection of 227 PE wells over the planning horizon. The majority of WRIA 12 is served by Group A water systems. Many of the PE wells are likely to be installed in the eastern portion of the Clover Creek subbasin that is not served by Group A water systems. Areas served by Group A systems may still see PE wells installed where water service is neither timely nor available.

The number of new PE wells projected over the planning horizon in WRIA 12 is part of the formula that estimates new consumptive water use. The method was based on recommendations from Appendix A of Ecology's Final NEB Guidance. The following sections provide the 20-year projections of new PE wells for each subbasin within WRIA 12, the methods used to develop the projections, and the uncertainties associated with the projections.

4.2.1 PE Well Connections Projection by Subbasin

This WRIA 12 watershed plan compiles the growth projection data both at the WRIA scale and by subbasin. The projection for new PE wells in WRIA 12 by subbasin is shown in Table 5 and Figure 3.

[28] Some committee members have a different interpretation of 90.94 RCW. See the compendium for additional information: https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA12/Final%20Plan/WRIA%2012%20WRE%20Plan%20Compendium.pdf

[29] 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 of 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" and "home" refer to any permit-exempt domestic groundwater use, including other ERUs.

The growth projections resulted in approximately 145 PE wells within incorporated cities and unincorporated areas of WRIA 12 over the planning horizon, assuming moderate growth. The high growth scenario projection resulted in 227 new PE wells in the same geographical area.

4.2.2 Methodology

The planning process deferred to Pierce County to identify the most appropriate method of projecting PE wells within their jurisdiction. Pierce County took part in the development of multiple watershed restoration and enhancement plans. It was important for the county to use the same method for calculating new PE wells within their jurisdiction across the plans.

The PE well projection method used historical well permit data. This method is summarized below, and the technical consultant developed a WRIA 12 Permit-Exempt Growth and Consumptive Use Summary, provided in Appendix G, which offers a more detailed description of the method.

Growth Projection Methodology

The projection method used PE well installation data from the Tacoma-Pierce County Health Department (TPCHD) between 1999 and 2018 to project the number of new PE wells over the planning horizon. This method has several advantages:

- The TPCHD location data is accurate to parcel level and includes individual and Group B wells.[30]
- The database includes all wells in the county, including wells constructed within city limits and within Group A water service area boundaries.
- This dataset includes attributes such as the year the well was installed and the parcel on which the well was installed.

The Committee used the following steps to project growth of PE wells over the planning horizon:

1. Calculate historical growth rates of PE wells for each subbasin using the TPCHD well database (1999–2018).
2. Calculate the moderate growth projection using the average growth rate from 1998-2018.
3. Calculate the high growth projection using the average growth rate from 1998-2008.
4. Project future PE wells by subbasin for the planning horizon, based on the subbasin-specific historical growth rate.

A mapping exercise reviewed potential locations of new PE wells in the watershed to validate the PE well projection and to identify the areas most likely to have new PE wells. The exercise looked at parcels available for residential development outside of the water service areas. The

[30] The Tacoma-Pierce County Health Department (TPCHD) permits PE wells during the subdivision and building permit process. TPCHD imposes limits on well withdrawals that are lower than the 950-gallon limit for subdivision projects. Based on their information, average water use is 400 gallons per day. TPCHD allows up to twelve lots in a subdivision if each lot is served by an individual well. Those wells are limited to using 400 gallons per day. Subdivisions served by Group B PE wells can have up to six connections, and each connection can use up to 750 gallons per day.

analysis showed very few parcels available for residential development outside of water system service areas reflecting the extent of urbanization in the watershed. Appendix H provides more information on the mapping exercise. The analysis demonstrates the difference between projection methods based on historical trends and projection methods based future development opportunities. This plan acknowledges that PE wells will be installed within the Group A service areas. Figure 3 shows the most likely areas in which new residential development dependent on PE wells will occur. Most opportunity for new PE wells is in the eastern portion of the Clover Creek subbasin.

4.2.3 Summary of Limitations and Scenarios

The projection method includes uncertainties and limitations. While this projection method eliminated some uncertainties, uncertainties are inherent to the planning process. This section presents the uncertainties and limitations considered during the planning process and the steps taken address the uncertainties.

One limitation is the assumption that water lines and water service areas will remain the same. Areas that were not served by public water in 2000 might be served now or within the planning horizon, shrinking the areas where PE wells may be installed. Since spatial water line data is not readily available, the analysis was not able to compare actual water lines with the historical data to see where the water service has expanded in the past 20 years.

Another limitation is the reliance on historical data. This method assumed that historical growth trends would continue into the future. However, many factors play into homebuilding trends. To address this uncertainty, the Committee developed PE well growth rates using different time-periods in the historical TPCHD well database. These time periods reflected the rapid rural development from 1999-2008 and the slower rural development from 2009-2018 (Table 5).

This plan uses the moderate growth scenario for the more likely estimate of growth, and uses the high growth scenario as the basis for an offset target. The analysis of parcels available for residential development outside of the water system service areas did not affect the moderate or high growth projections.

Table 5 Number of PE Wells Projected between 2018 and 2038

Subbasin	Moderate Growth (1999-2018)	High Growth Scenario (1999-2008)	Low Growth Scenario (2009-2018)
Chambers	4	7	2
Clover Creek	141	220	76
Sequalitchew	--	--	--
Total	**145**	**227**	**78**

4.2.4 Projected Growth Map

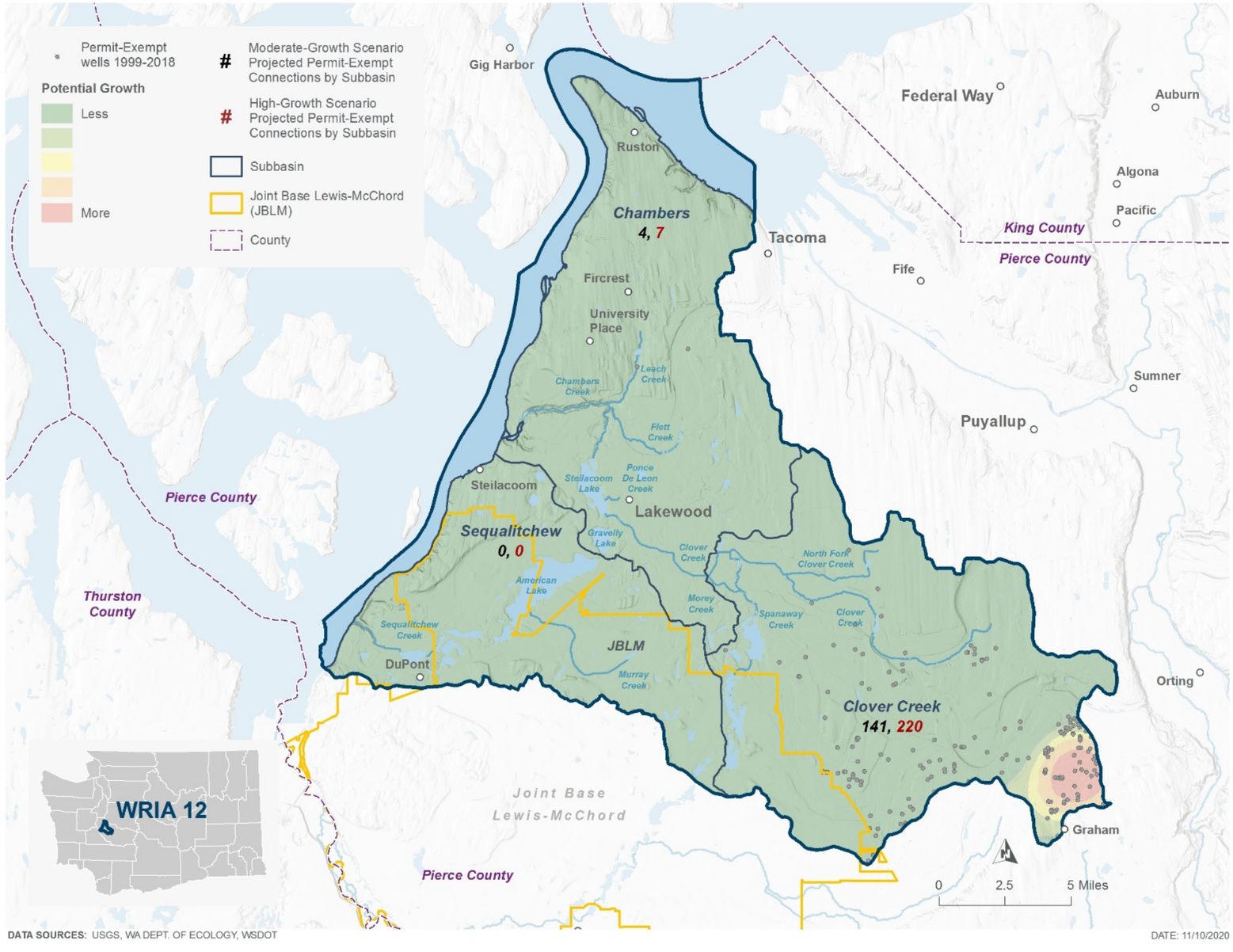

Figure 4 WRIA 12 Distribution of Projected PE Wells

4.3 Impacts of New Consumptive Water Use

This plan uses the "moderate" (145) projection as the most likely estimate and the "high" (227) projection of new PE wells to estimate the consumptive water use that this watershed plan must address and offset. This plan estimates that average consumptive use from each PE well is 353 gallons per day. By the end of the planning horizon, new consumptive use would average 57.4 acre-feet per year (0.08 cfs) under the moderate growth scenario and 89.9 acre-feet per year (0.12 cfs) under the high growth scenario. This section includes an overview of the method used to estimate new consumptive water use (consumptive use), an overview of the anticipated impacts of new consumptive use in WRIA 12 at the end of the planning horizon, and other considerations such as assumptions and uncertainties. The WRIA 12 Permit-Exempt Growth and Consumptive Use Summary provides a more detailed description of the analysis and alternative scenarios considered (Appendix G).

Consistent with the Final NEB guidance, this plan assumes impacts from consumptive use on surface water are steady-state, meaning that impacts on the stream from pumping do not change over time. This assumption is based on the distribution of future well locations and depths across varying hydrogeological conditions. As Appendix B of the Final NEB Guidance notes, the lag time between when the pumping occurs and when it impacts the stream makes estimating the temporal impacts of PE wells complicated to estimate.

4.3.1 Methodology 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. The portion of water that is consumptive (the consumptive use factor) varies for indoor and outdoor water use. Appendix A of the Final NEB Guidance describes a method (referred to in this plan as the Irrigated Area Method) which assumes average indoor water use per person per day, and reviews aerial imagery to provide a basis to estimate irrigated area of outdoor lawns and gardens. The Irrigated Area Method accounts for indoor and outdoor consumptive use variances by using separate approaches to estimate indoor and outdoor consumptive use.

To calculate the consumptive use estimate, the analysis used the Irrigated Area Method and relied on assumptions for indoor use and outdoor use from Appendix A of the Final NEB Guidance (Ecology 2019b). This chapter provides a summary of the technical memo, which is available in Appendix G.

New Indoor Consumptive Water Use

Indoor water use refers to the water that households use in kitchens, bathrooms, and laundry.[31] The analysis used Ecology's recommended assumptions for indoor daily water use per person and local data to estimate the average number of people per household, and

[31] USGS 2012 https://pubs.usgs.gov/sir/2012/5163/sir12_5163.pdf

applied Ecology's recommended consumptive use factor (CUF) to estimate new indoor consumptive water use (Ecology 2019b):

- 60 gallons per day (gpd) per person.
- 2.5 persons per household assumed for rural portions of WRIA 12 (OFM 2019).
- 10 percent of indoor use is consumptively used (or a CUF of 0.10), based on the assumption that homes on PE wells are served by on-site sewage systems. On-site 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 2.5 people per house x 0.10 CUF

This results in an annual average of 15 gpd (0.017 AF,[32] 0.000023 cfs[33]) indoor consumptive water use per PE well.

New Outdoor Consumptive Water Uses

Most outdoor water irrigates 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 on-site sewage systems, but instead infiltrates into the ground or is lost to the atmosphere through evapotranspiration (Ecology 2019b).

The analysis used aerial imagery to measure the irrigated areas of 80 randomly selected parcels served by PE wells to develop an average outdoor irrigated area. This analysis returned a large portion of parcels with no visible irrigation; these parcels were given irrigated area values of zero. To account for undetected irrigation and potential outdoor water use other than irrigation, the analysis replaced the zero values with a value of 0.05 acres. An imputed value of 0.05 acres was the lower end (i.e., less than the 10th percentile) of measurable irrigated areas in WRIA 12. Using the replacement value of 0.05 acres, the average (mean) irrigated area for the 80 randomly selected parcels was 0.17 acres. The analysis then calculated the 95 percent upper confidence limit (UCL)[34] of the mean to account for uncertainty associated with the limited survey of parcels with existing PE wells. The 95 percent UCL equaled 0.21 acres. The analysis used 0.21 acres in the CU equation with the expectation that the larger value would be a conservative estimate of the irrigated acreage (i.e., more protective of the resource). This method is further summarized in Appendix G.

[32] Acre-Foot (AF) is a unit of volume for water equal to a sheet of water 1 acre in area and 1 foot in depth. It is equal to 325,851 gallons of water; 1 acre-foot per year is equal to 893 gallons per day.

[33] Cubic feet per second (cfs) is a rate of the flow in streams and rivers. It is equal to a volume of water 1 foot high and 1 foot wide flowing a distance of 1 foot in 1 second; 1 cubic foot per second is equal to 646,317 gallons per day.

[34] The 95 percent UCL is the calculated mean plus the 95 percent confidence error. Therefore, there is a 95 percent chance that the true mean is equal to or less than the 95 percent UCL.

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

- Crop irrigation requirements (IR) for turf grass according to Washington Irrigation Guide (WAIG) (NRCS 1997): 20.3 inches (weighted average for the Tacoma and Puyallup WAIG weather stations). This value represents the amount of water needed to maintain commercial turf grass.
- An irrigation application efficiency (AE) to account for water that does not reach the turf: 75 percent. This increases the amount of water used to meet the crop's irrigation requirement by 25 percent.
- Consumptive use factor (CUF) of 0.8, reflecting 80 percent consumption for outdoor use. This means that 20 percent of outdoor water is returned to the immediate water environment.
- Outdoor irrigated area based on existing homes using PE wells: 0.21 acre (95 percent upper confidence limit of the average observed irrigated area).

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

$$20.3 \text{ IR (inches)} \div 0.75 \text{ AE} \times 0.21 \text{ (acres)} \times 0.80 \text{ CUF}$$

First, water loss was accounted for by multiplying the irrigation requirement (IR) by the application efficiency (AE). Next, the total water volume used to maintain commercial turf grass was multiplied by the irrigated area. Finally, the volume of water was multiplied by the CUF (80 percent) to produce the outdoor consumptive water use. After applying appropriate unit conversions, the results are an annual average of 338 gpd (0.38 AF; 0.0005 cfs) outdoor consumptive water use per PE well.

This calculation resulted in a total (indoor and outdoor) consumptive use of 353 gpd (0.4 AF per year; 0.0005 cfs) per PE well for the WRIA. However, this consumptive use estimate represents an average for the year. The Committee expects that more water use will occur in summer than in other months. The impacts to the stream are expected to be relatively constant because distance from the stream and lag time spread out the effects of pumping (Ecology 2019b).

4.3.2 Uncertainties and Limitations

Every step of the Irrigated Area Method includes assumptions and estimates that introduce uncertainty. The Committee discussed many of these uncertainties and limitations and determined that using the high growth scenario would be more protective of the resource and would be appropriate for addressing uncertainty. This section describes the uncertainties and limitations, and the actions taken to resolve, address, or acknowledge those uncertainties and limitations.

To address uncertainty, the analysis relied on existing data to the extent possible, such as the average number of people per household and information from studies that estimate average indoor water use per person. However, the Committee recognized that the method assumed that future indoor water use patterns will remain relatively constant.

The outdoor consumptive use calculation contains the most uncertainty. Some Committee members voiced concern about the lack of scientific rigor in the outdoor irrigated area analysis. The average outdoor irrigated area analysis relied on a sample of 80 parcels distributed by location and property values. The sample size was not assessed for statistical significance. To acknowledge the concern, this plan uses the 95 percent upper confidence limit with the expectation that the average irrigated area would likely be lower than the 95 percent upper confidence limit.

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 (i.e., watering at rates that meet crop irrigation requirements per the Washington Irrigation Guide). The irrigated area analysis demonstrated that many people irrigate their lawns enough to keep the grass alive through the dry summers, not at the levels required by commercial turf grass. Therefore, this plan views the assumption as conservative (a high estimate of water use).

Future climate conditions are another source of uncertainty in the analysis. Anticipated changes in climate, especially hotter, drier summers, may increase both outdoor irrigation needs and loss of water due to increased evapotranspiration (Technical Advisory Group 2019). These changes may lead to increased outdoor irrigation and increased consumptive use as a result. If dry summers lead to drought declarations, outdoor consumptive use might decrease due to drought restrictions set by RCW 90.94.030(4)(b).

The analysis accounted for the uncertainties and limitations in this method by applying three factors of safety: assuming 0.05 acres of outdoor irrigation instead of zero; using the 95 percent UCL; and assuming irrigation application rates for commercial turf grass. Using the high growth scenario added a fourth factor of safety. This approach provides assurance that if projects and actions in the plan are successfully implemented, the projects will offset more than the actual water consumed.

4.3.3 Summary of Consumptive Use Estimates

The moderate growth consumptive use estimate for WRIA 12 is 57.4 acre-feet per year (0.08 CFS). The high growth consumptive use estimate is 89.9 acre-feet per year (0.12 CFS). The total consumptive use estimate for WRIA 12 is the PE wells projection (see Section 4.2) multiplied by the total indoor and outdoor consumptive use per PE well. Tables 6 and 7 summarize the estimated indoor and outdoor consumptive use by subbasin. The highest consumptive use is expected to occur in the subbasin with the most anticipated new PE wells, as presented in Figure 4.

Table 6 Indoor and Outdoor Consumptive Use Estimates by Subbasin (Moderate Growth)

Subbasin	Projected PE wells	Indoor CU		Outdoor CU		Total CU/year in 2038	
		AFY	GPD	AFY	GPD	AFY	GPD
Chambers	4	0.1	89	1.5	1,139	1.6	1,428
Clover Creek	141	2.4	2,143	53.4	47,672	55.8	49,815
Sequalitchew	-	0	0	0	0	0	0
TOTAL	**145**	**2.5**	**2,232**	**54.9**	**49,101**	**57.4**	**51,243**

Table 7 Indoor and Outdoor Consumptive Use Estimates by Subbasin (High Growth)

Subbasin	Projected PE wells	Indoor CU		Outdoor CU		Total CU/year in 2038	
		AFY	GPD	AFY	GPD	AFY	GPD
Chambers	7	0.1	89	2.7	2,410	2.8	2,500
Clover Creek	220	3.7	3,303	83.4	74,455	87.1	77,758
Sequalitchew	-	0	0	0	0	0	0
TOTAL	**227**	**3.9**	**3,482**	**86.1**	**76,865**	**89.9**	**80,258**

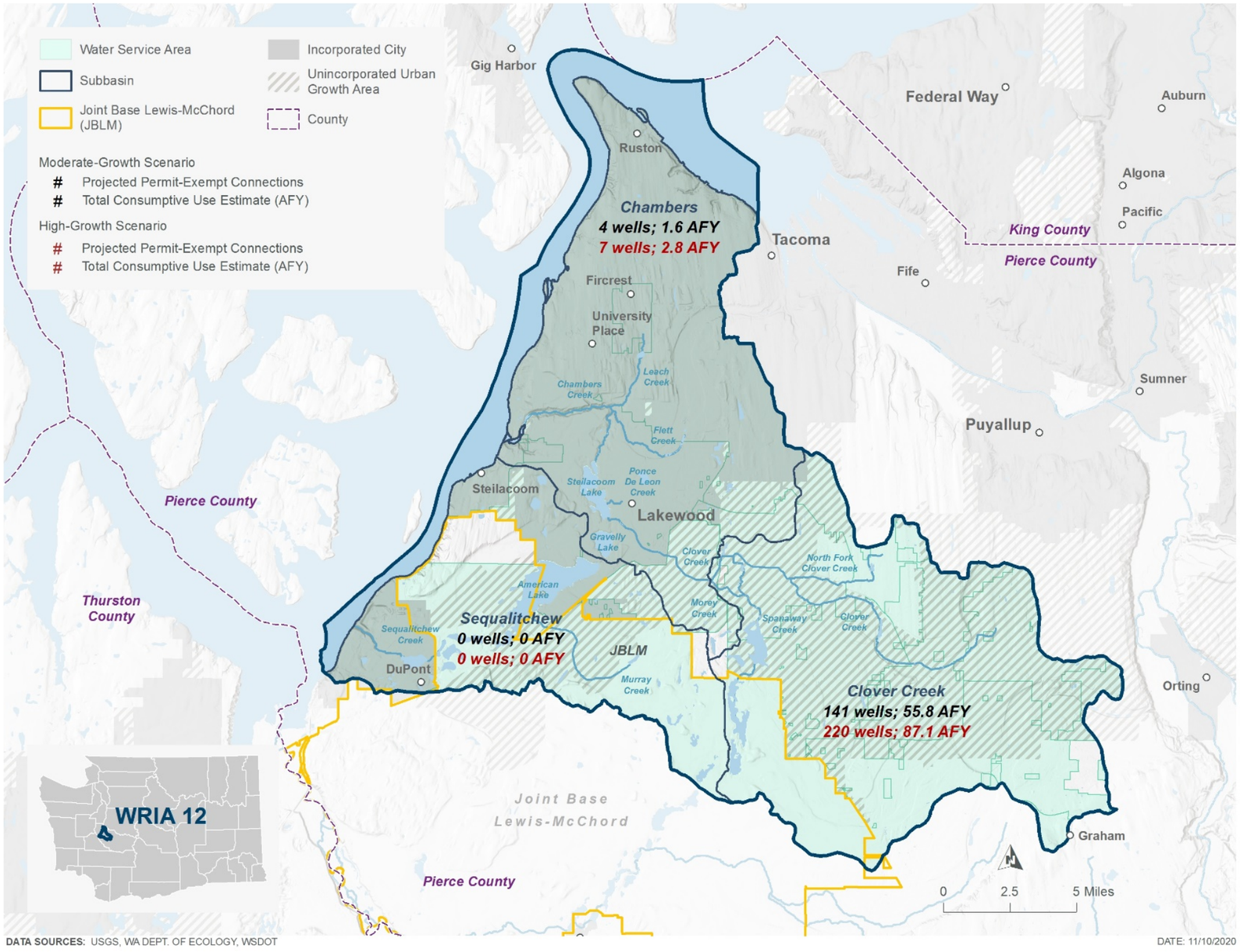

Figure 5 WRIA 12 Estimated Consumptive Use by Subbasin for 2018-2038

Chapter Five: Projects and Actions

5.1 Description and Assessment

Watershed plans must identify projects that offset the potential impacts future PE wells will have on streamflows, and provide a net ecological benefit to WRIA 12. This chapter provides recommendations for projects and actions to offset consumptive use and meet NEB. This chapter classifies projects as water offset projects, habitat projects, and programmatic actions. 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, this plan does not rely on habitat projects to contribute toward offsetting consumptive use, however it recognizes they are still of value and therefore should be included in the plan. Programmatic actions are non-capital projects that are implemented at a subbasin or larger scale, increase knowledge of water use in the WRIA, and contribute to water conservation. While programmatic actions may contribute to a lower overall consumptive use in the watershed, the benefits of these actions are widely dispersed and difficult to quantify.

This chapter provides recommendations for projects to offset consumptive use and meet NEB. To identify the projects summarized in this chapter, as well as the complete project inventory in Appendix I, Committee members and partners brought project suggestions forward to the workgroup and Committee for discussion. Committee members also identified projects with potential streamflow benefit from the Puget Sound Action Agenda, and salmon recovery lead entity four-year workplans. The Committee used a project inventory to capture and track all project ideas, no matter their phase of development, throughout the planning process. Ecology sought feedback on projects that align with other planning processes from Committee members that also represented the conservation district, LIO, and salmon recovery lead entity in WRIA 12.

The plan focuses on projects or project phases planned for future construction, and removed projects that did not directly contribute to water offset or NEB. Committee members and partners proposed a number of water offset and habitat projects to include on the project inventory. The Committee identified a subset of projects for the technical consultants to develop detailed analysis on, including the offset value to attribute to each project as applicable. The plan does not include projects that conflicted with current laws, rules, or case law. At any point in the process, Committee members or partners could identify projects of concern for inclusion in the watershed plan and recommend removal of the project from the project inventory.

5.2 Projects

5.2.1 Water Offset Projects

Committee members and partners identified two water offset projects with high likelihood of implementation in the Chambers and Sequalitchew subbasins. Since the Chambers and Sequalitchew subbasins provide the best habitat and opportunities for salmonids, the Committee was comfortable with the offset projects occurring in those subbasins.

Since most PE wells and impacts are anticipated to occur in the Clover subbasin, the Committee devoted some of their energy on finding suitable offset projects in the Clover subbasin. A number of unique characteristics make the Clover subbasin challenging for potential offset projects. Because of the reach of Clover Creek that goes under the McChord airfield and the reaches that dry up during the summer, projects in the Clover subbasin would have limited benefit to salmonids until those barriers are addressed. High groundwater and flooding concerns limited options for off-channel storage projects like managed aquifer storage projects. Potential toxic contamination[35] limited investigation of potential projects near JBLM. The Committee assessed the soil suitability for infiltration projects in Clover Creek, and detailed GIS mapping[36] to identify opportunities for floodplain reconnection projects.

The Committee also conducted a water right assessment to identify water right acquisition opportunities. Water right acquisitions are highly desirable as water offset projects because they are quantifiable and legally protected. However, many water right projects take years of outreach, negotiation, and investigation to achieve a level of certainty appropriate to count as a water offset for this project. Due to the sensitive nature of water rights, only water rights held by a willing landowner are referred to by a project name.

The projects presented in Table 8 have quantifiable streamflow benefit. The plan identified these projects as having the greatest potential for implementation and meeting NEB. The complete project inventory in Appendix I includes other projects that benefit streamflow and habitat in WRIA 12, but which the Committee did not have the time and resources to further develop and assess during this planning process. The Committee recommends implementation of all projects included in this chapter and in the project inventory. Project sponsors provided the information presented in this watershed plan for those projects.

[35] Especially chemicals of emerging concern, such as flame retardants.
[36] LiDAR (Light Detection And Ranging).

Table 8 WRIA 12 Offset Projects

Project Number	Project Name	Project Type and Brief Description	Subbasin(s)	Water Offset (AFY)	Timing of Benefits	Additional Benefits	Project Sponsor
12-S-W1	Repair Diversion Structure at Lake Sequalitchew	Install a diversion structure to regulate flow between Sequalitchew Creek and stormwater canal, install a gaging station, remove cross culvert, reroute stormwater, install berm, remove fish screen and install beaver control.	Sequalitchew	724	Year-round	Increased aquatic habitat for salmonids and other aquatic life.	JBLM and South Puget Sound Salmon Enhancement Group
12-Ch-W2	South Tacoma Channel Stormwater Infiltration Project	Direct stormwater flows to large-scale infiltration facilities within the South Tacoma Channel (STC) (Sites 1 and 2) to enhance streamflow and function of lower Flett Creek and Flett Wetland (Site 3).	Chambers	701	Year-round	Increase baseflow in summer in lower Flett Creek and Flett Wetland (Site 3) by about 0.5 cfs. Reduce water temperatures.	City of Tacoma
12-W3	Reclaimed Water Infiltration	Infiltrate reclaimed water or treated wastewater on location at satellite treatment plants.	All	TBD	Year-round	Reduce nutrients entering Puget Sound	Potential sponsors include JBLM or local governments
12-Cl-W4	Water right acquisition	Acquire water rights from PGG assessment and put into trust either through a direct transaction or through water conservation and efficiency upgrades. Anticipate a fraction of reviewed rights will be counted as offset.	Clover	TBD	Irrigation season		TBD

Project Number	Project Name	Project Type and Brief Description	Subbasin(s)	Water Offset (AFY)	Timing of Benefits	Additional Benefits	Project Sponsor
12-W5	Green Stormwater Infrastructure (GSI) Program	Provide financial assistance for property owners to install GSI through traditional means or through a revolving loan fund. Certain soils, certain areas of the basin. North Fork Clover prioritized. Anticipated offset of 0.15 AFY per facility.	Clover and WRIA-Wide	TBD	Year-round	Water quality improvements	Pierce Conservation District
WRIA 12 Total Water Offset				1,425 AFY			
WRIA 12 Consumptive Use Estimate				89.9 AFY (0.12 cfs)			

Sequalitchew Creek Subbasin

Project Name: Repair Diversion Structure at Lake Sequalitchew

Project Description: Joint Base Lewis McChord (JBLM) is proposing to modify an existing weir and diversion structure at the outlet of Sequalitchew Lake to protect their drinking water source and repair a failed storm system. As part of these modifications, surface flow exiting Sequalitchew Lake and surface flow from adjacent wetland drainages will be re-directed from the drainage canal back to the Sequalitchew Creek channel. A flow control structure would still divert flood flows (100 year flood flows and greater).

Average flow discharging from Sequalitchew Lake is expected to be 6 – 7 cfs (4,300 – 5,000 acre-feet/year) (Aspect 2009). This estimate was based on hydrologic modeling of Sequalitchew Lake. This flow would be re-directed to the natural channel of Sequalitchew Creek. Restored flows will directly benefit Sequalitchew Creek downstream of Sequalitchew Lake. This is approximately 3.2 miles of stream habitat. Sequalitchew Creek primarily supports cutthroat trout, coho, and chum salmon. These species currently use the most downstream portion of the Creek, where base flows are supported by groundwater inflow.

Restoring flow to the entire channel length downstream of Sequalitchew Lake may provide new aquatic habitat suitable for spawning, if adequate velocity, depth, temperature and sediment composition is formed with the restored flows. Suitable spawning habitat may be limited in the creek, as it winds through the marshes, because of the low gradient nature. The habitat may be suitable for chum, given their affinity for groundwater influence. The lower portion of the Creek likely has suitable spawning habitat for coho salmon, cutthroat trout, and chum salmon, and will likely be improved with increasing flows.

Chambers Creek Subbasin

Project Name: South Tacoma Channel

Project Description: The City of Tacoma (City) is proposing a multi-site project to enhance streamflow in the Flett Creek Watershed. The project will direct stormwater flows to large-scale infiltration facilities within the South Tacoma Channel (Sites 1 and 2) to enhance streamflow and function of lower Flett Creek and Flett Wetland (Site 3). The project would enhance instream flows that have been negatively impacted over time by the progressive increase in urbanization, the City's historical stormwater management practices, and out-of-basin pumping of surface water to marine outfalls. Source stormwater would originate from throughout the Flett Creek Watershed and also from a redirection of current cross-basin flows from the Leach Creek Regional Stormwater Holding Basin to the Thea Foss Waterway (Commencement Bay outfall).

Based on the results of the groundwater model (Landau Associates 2020), estimated streamflow enhancement to Flett Creek due to infiltration at Sites 1 and 2 may be on the order of 0.8 to 1.1 CFS, with the highest magnitude benefits occurring in the dry-season (summer) months. The modeling indicates that Flett Creek streamflows may be enhanced both in terms of overall magnitude and timing of groundwater baseflow to provide targeted benefit during the

dry-season months. The water offset quantity for the WRIA 12 Watershed Plan is estimated to be 701 acre-feet per year.

Clover Creek Subbasin

Project Name: Water Right Acquisition

Project Description: Water right acquisitions present a reliable and legally protected water offset. Pacific Groundwater Group conducted a filtering exercise to identify active water right certificates or permits for commercial and industrial, stockwater, and irrigation uses with an instantaneous quantity of at least 0.1 cfs and an annual quantity of at least 10 acre-feet per year. The assessment removed all rights with a priority date later than adoption date of the instream flow rule. The work centered on water rights in the upper Clover Creek subbasin, where most of the new PE wells are anticipated. The analysis returned 25 water rights in the Clover Creek subbasin that met the criteria.

For the purposes of this plan, it is expected that only a small percentage of the total water represented by these rights will be reviewed for extent and validity and placed into trust as either a direct transaction or through water conservation and efficiency upgrades. The full list of water rights is available for prospective project sponsors to review and start outreach activities.

WRIA-Wide/Multi-Subbasin

Project Name: Reclaimed Water Infiltration

Project Description: The Joint Base Lewis McChord (JBLM) and Pierce County may infiltrate reclaimed water back to local aquifers in the future, though there are no current plans. Infiltration of reclaimed water into local aquifers would result in local aquifer recharge and would offset local PE well consumptive use.

JBLM currently produces Class A Reclaimed Water at the JBLM Solo Point Wastewater Treatment Plant (WWTP). The JBLM Solo Point WWTP is authorized to discharge reclaimed water to Puget Sound through an EPA administered National Pollutant Discharge Elimination System Permit (Permit No. WA-002195-4). In 2012, a Project Definition Report was prepared for the United States Army Corps of Engineers Seattle District (HDR 2012) to construct facilities needed for Class A reclaimed water production and recharge. The analysis included a new booster pumping stations, storage tanks, and distribution system for Class A reclaimed water produced at JBLM Solo Point WWTP to locations throughout JBLM for water reuse to reduce potable water consumption and to recharge upstream aquifers. There are currently no infrastructure or plans to distribute reclaimed water to locations throughout JBLM for reuse and upstream aquifer recharge.

Pierce County does not currently produce reclaimed water at their Chambers Creek Regional Wastewater Treatment Plant.

Project Name: Green Stormwater Infrastructure Retrofit Projects

Project Description: The Pierce Conservation District and participating cities may support and incentivize stormwater retrofits to increase stormwater infiltration on public and private property. Elements of these projects include rain gardens, planter boxes, bioswales, permeable pavements, and green streets, and would be distributed across the watershed. The program would be available for existing development not required to follow Low Impact Development guidance. Each individual project would produce an estimated average 0.15 acre-feet per year of infiltration into the groundwater during the wet seasons. Each project would include an estimate of potential infiltration based on the size, design, soil profile, and expected stormwater inputs. The Pierce Conservation District anticipate the capacity to facilitate projects in WRIA 12, especially in Lakewood, Tacoma, Fircrest, and unincorporated Pierce County in the Clover Creek subbasin.

5.2.2 Habitat Projects

A number of habitat restoration projects were identified in each subbasin. Although they are not included on Table 9, the water offset projects in Sequalitchew and Chambers subbasins will enhance instream resources and improve watershed functions beyond the water offset they contribute. Many of these habitat projects listed as Salmon Recovery projects of Near Term Actions. While several of these projects may produce a marginal offset benefit by increasing seasonal storage, the benefits were too small and too complex to estimate. In general, these projects increase stream complexity, reconnect floodplains, and enhance natural processes that had been lost to the benefit of salmonids and other aquatic species. Appendix I includes additional projects supported by the Committee.

Table 9 WRIA 12 Habitat Projects

Project Number	Project Name	Project Type and Brief Description	Subbasin	Additional Benefits	Project Sponsor	Project Stage
12-Cl-H1	Clover Creek Floodplain Restoration	Floodplain restoration in a number of potential locations as identified by the Committee. Projects would include: Floodplain reconnection, pavement removal, log jams.	Clover	Off-channel rearing, high flow refugia, instream cover, instream habitat complexity.	Potential: Puyallup Tribe, Pierce County	Conceptual
12-Cl-H2	Habitat Assessment	Conduct habitat assessment for riparian buffers, floodplain reconnections, and stream channel improvements.	Clover	Identify needs and opportunities for habitat projects, identifying appropriate treatments for each reach.	Potential: Puyallup Tribe	Conceptual
12-Ch-H3	Clover Creek Springbrook Restoration Project	Restore up to 1600 lineal feet of Clover Creek in the Springbrook neighborhood of the City of Lakewood.	Chambers	Improve/restore habitat.	City of Lakewood	Feasibility
12-Ch-H4	Protect and Restore mainstem Chambers Creek habitat	Implement a variety of stream treatments as identified through an assessment conducted by the Puyallup Tribe.	Chambers	Restoration of floodplains, placement of large woody debris, off-channel refugia. Potential to quantify storage opportunities.	Puyallup Tribe	Design
12-Ch-H5	Peach Creek	Roughening and hyporheic exchange. Addressing stream incision, erosion.	Chambers	Habitat improvements	Potential: Pierce County	Conceptual

Project Number	Project Name	Project Type and Brief Description	Subbasin	Additional Benefits	Project Sponsor	Project Stage
12-Ch-H6	Chambers Bay Estuarine and Riparian Enhancement	Restore and enhance the estuarine habitat structure within Chambers Bay, including removal of the Chambers Dam, removal of shoreline armoring, addition of large woody debris, enhancement of riparian vegetation.	Chambers		South Puget Sound Salmon Enhancement Group	Planning/ Design
12-Ch-H7	Titlow Estuary Restoration	Restore Titlow Lagoon to a connected and productive estuary.	Chambers	Increase habitat, remove fish barriers, expand lagoon, and install woody habitat structure.	South Puget Sound Salmon Enhancement Group	Planning/ Design
12-Cl-H8	Streambed pavement removal	Restore Clover Creek by removing the asphalt.	Clover	Removing asphalt enhances the habitat, but may also create space for infiltration.	Pierce County	Conceptual .

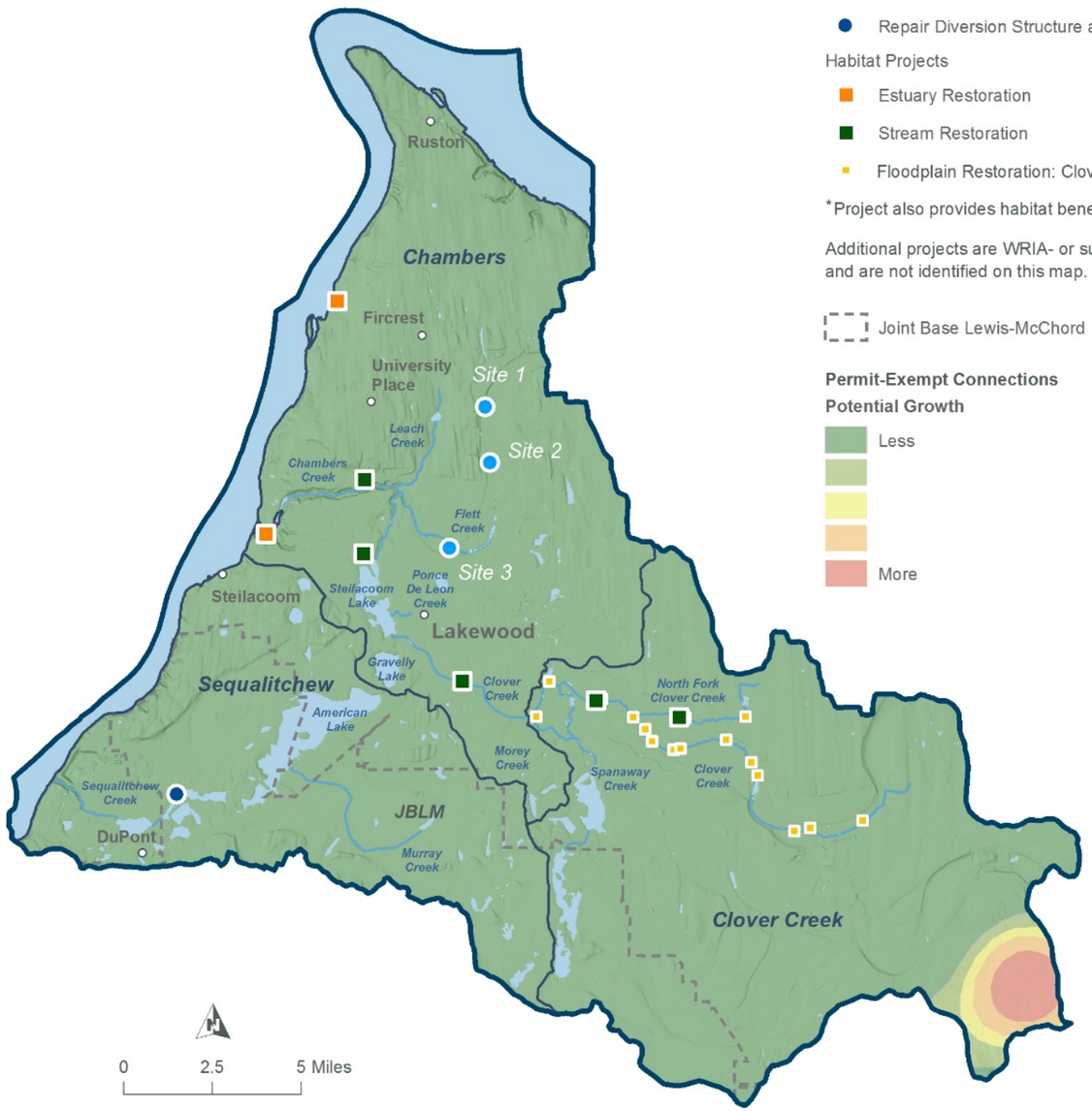

Figure 6 Proposed Projects

5.2.3 Programmatic Action

In addition to the projects described above, the plan identifies a programmatic action that will increase the knowledge of PE well water use in the watershed and increase water conservation throughout the WRIA. This programmatic action does not have specific locations, but would improve PE well water management through voluntary actions and improved data collection:

Statewide Water Conservation Education and Incentives Program

This plan supports Ecology to partner with Pierce County and the Pierce Conservation District to develop and implement education and outreach, technical assistance, 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.

This program would raise awareness of the impacts PE well water usage has on groundwater levels and the connection to streams and rivers. This program would supplement water offset and restoration projects, especially in subbasins important for fish and where water offsets were difficult to find.

Such a program would require long-term, multi-year funding for it to be established and effective. Funding for this program could come from a number of sources, including grant funds, conservation district and Ecology operating funds, or legislative appropriation. This plan supports a legislative appropriation to implement this program statewide.

5.3 Project Implementation Summary

5.3.1 Summary of Projects and Benefits

Per RCW 90.94.030(3), this plan must include actions necessary to offset potential impacts to instream flows associated with new PE well water use and result in a net ecological benefit to instream resources within the WRIA. As specified in Chapter 4, this plan aims to offset 89.9 acre-feet per year of consumptive use from new PE wells over the planning horizon. The projects included in Table 8 provide an estimated offset of 1,425 acre-feet per year and exceed the consumptive use estimate. These two projects are also expected to enhance streamflows. The South Tacoma Channel Stormwater Infiltration Project is expected to increase flows in Flett Creek by 0.8-1.1 cfs. The Repair Diversion Structure at Lake Sequalitchew is expected to increase flows in Sequalitchew Creek by 6-7 cfs.

A total of eight habitat projects have been identified by the Committee and are included in Table 9. Ecological benefits associated with these projects include floodplain restoration, wetland reconnection, availability of off-channel habitat for juvenile salmonids, increase in groundwater levels and baseflow, and increase in channel complexity. While many of these projects have potential streamflow benefits, this plan does not account for the water offset from habitat projects. The ecological and streamflow benefits from habitat projects are supplemental to the quantified water offsets.

One programmatic action is included in section 5.2.3. This action will contribute offset by reducing the amount of water used.

5.3.2 Cost Estimate for Offsetting New PE Well Use Over 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, this plan includes planning-level cost estimates for each of the water offset projects listed in Table 8. Table 8 also includes costs estimates for habitat projects when that information was readily available.

The estimated cost for implementing individual water offset projects range from $2.7 million for the Repair Diversion Structure at Lake Sequalitchew project to $3.9 million for South Tacoma Channel Stormwater Infiltration project. This plan includes by reference a list of potential water right acquisitions. Water rights cost between $2000 and $4000 per acre-foot, with an average cost of about $2600 per acre-foot. The total estimated cost for implementing the two water offset projects listed and described in this chapter is $6.53 million.

The estimated cost for implementing individual habitat projects range from $150,000 for initial feasibility for the Clover Creek Springbrook Restoration project to $7 million for the Titlow Estuary Restoration project. Several projects are in the early development phase and do not yet have cost estimates. The total estimated cost for implementing the habitat projects listed and described in this chapter is $14.65 million.

Table 10 Project Cost Estimates

Project Number	Project Name	Subbasin	Estimated Costs
12-S-W1	Repair Diversion Structure at Lake Sequalitchew	Sequalitchew	$2.68 million
12-Ch-W2	South Tacoma Channel Stormwater Infiltration Project	Chambers Creek	$3.85 million
12-Ch-H3	Clover Creek Springbrook Restoration Project	Chambers Creek	$150,000
12-Ch-H4	Chambers Creek Restoration	Chambers Creek	$2.5 million
12-Ch-H5	Peach Creek	Chambers Creek	TBD
12-Ch-H6	Chambers Bay Estuarine and Riparian Enhancement	Chambers Creek	$5 million
12-Ch-H7	Titlow Estuary Restoration	Chambers Creek	$7 million
12-Cl-W4	Water right acquisition	Clover Creek	$2600/acre-foot
12-Cl-H8	Streambed Pavement Removal	Clover Creek	TBD
12-Cl-H1	Clover Creek Floodplain Restoration	Clover Creek	TBD
12-Cl-H2	Habitat Assessment	Clover Creek	TBD
12-WW-W3	Reclaimed Water Infiltration	WRIA-Wide	TBD
12-WW-W5	Green Stormwater Infrastructure Program	WRIA-Wide	TBD

5.3.3 Certainty of Implementation

The Repair Diversion Structure at Lake Sequalitchew and South Tacoma Channel Stormwater Infiltration projects, located in the Sequalitchew and Chambers subbasins, respectively, have project sponsors and the highest likelihood of implementation. The project sponsors are motivated to implement the projects. The Repair Diversion Structure at Lake Sequalitchew project is nearing the end of the project design phase. In 2020, South Tacoma Channel Stormwater Infiltration project received funding from Ecology's Streamflow Restoration Competitive Grants for a feasibility study. Both of these projects have momentum and are expected to be fully implemented during the planning horizon. In addition, Pierce Conservation District is likely to implement raingardens or other green stormwater infrastructure in WRIA 12 since Clover Creek and other areas within WRIA 12 are high priority areas for their program.

The Puyallup and Chambers Salmon Recovery Lead Entity, whose participants overlap with the WRIA 12 Committee, has a history of successful collaboration and project implementation. With several habitat projects also identified as salmon recovery priorities, there is a high likelihood that many of these projects these projects will be implemented. Chapter 6 describes the adaptive management recommendations and specific actions that several committee organizations will take to support implementation of the plan. These recommendations and actions will increase reasonable assurance that the projects and actions in the plan will be implemented.

Chapter Six: Additional Plan Recommendations

6.1 Plan Implementation and Adaptive Management Recommendations

This plan recommends long-term actions for implementation of the WRIA 12 watershed plan that include an adaptive management process. Adaptive management is defined in the Final NEB Guidance as "*an interactive and systematic decision-making process that aims to reduce uncertainty over time and help meet project, action, and plan performance goals by learning from the implementation and outcomes of projects and actions*."

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

Opportunities

Throughout the planning process, the WRIA 12 Committee identified opportunities to better understand streamflows and the impacts of PE wells, and successfully implement the plan. The plan seeks to address these considerations through monitoring and adaptive management:

- The plan includes recommendations, but does not obligate Committee members to implement it.[37] Successful implementation of the plan, including adaptive management activities, will depend on future commitments and identifications of resources.
- The watershed plan includes projected PE well water use by subbasin. Monitoring the number of new PE wells, PE well water use, and associated consumptive water use would provide data for comparison and adjustments. Understanding historical water use and new water service connections would also provide data for comparison.
- The watershed plans include water offset and habitat projects, and estimated benefits associated with each, by subbasin. Measuring and tracking achieved water offsets by subbasin, to the extent possible, is needed to verify intended streamflow benefits.
- 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. Ongoing monitoring could track these related factors.
- Projects identified in the plan are expected to protect or enhance stream flows and provide aquatic habitat benefits. Water offset projects should be assessed and monitored after completed. These steps will determine project effectiveness and ensure

[37] Some committee members have a different interpretation of 90.94 RCW. See the compendium for additional information: https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA12/Final%20Plan/WRIA%2012%20WRE%20Plan%20Compendium.pdf

that projects continue to offset new PE wells and support stream flows. The WRIA 12 Committee applied methodology with conservative assumptions to address these concerns, particularly as related to the estimate of the amount of consumptive water use to offset. However, these assumptions do not address the possibility that a project might not function as expected. The adaptive management recommendations in this plan will help to monitor and assess the offset projects, in order to determine which projects are complete and how they are functioning compared to the estimated benefits in the plan, and to allow for modifications to implementation when needed.

- Existing groundwater information varies across the watershed – some areas have a greater density of groundwater information than others. As information expands on critical recharge zones and flow paths and rates, conceptual project ideas may become project opportunities. Expanded geological and hydrological assessment, including groundwater monitoring and improvements of regional groundwater models (such as the updated USGS groundwater model), will provide better data for current and future projects.

To address the above challenges, the WRIA 12 Committee recommends the following adaptive management strategies.

6.1.1 Tracking and Monitoring

This plan recommends that Ecology monitor assumptions within this plan and implement this plan using data collected from WDFW and Pierce County.

- Track annual new PE wells by subbasin.
    - Track new PE wells within and outside of water service areas.
- Track project implementation by subbasin.
- Track progress with policy and regulatory recommendations.
- Develop a process to adaptively manage implementation if offsets and NEB are not on track to being achieved.

This plan recommends WDFW, in collaboration with Ecology and the Recreation and Conservation Office (RCO), pilot the Salmon Recovery Portal,[38] managed by RCO, for tracking streamflow restoration projects and new PE wells. To improve harmonization of streamflow restoration with ongoing salmon recovery actions, local salmon recovery Lead Entity Coordinators shall be consulted prior to initial data uploads. University of Washington data stewards will be employed to conduct data entry, quality assurance, and quality control.[39]

Tracking streamflow restoration projects and new PE wells will:

- Improve the capacity to conduct implementation monitoring of streamflow restoration projects and actions.

[38] https://srp.rco.wa.gov/about.

[39] More details on the Project Tracking proposal are available in the compendium: https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA12/Final%20Plan/WRIA%2012%20WRE%20Plan%20Compendium.pdf

- Build grant funding opportunities and track streamflow restoration associated costs.
- Provide a template for adaptively managing emergent restoration needs.
- Document success in achieving offsets and NEB.

Within the first five years of plan implementation, this plan recommends that Ecology develop a monitoring and research strategy to provide an overarching guidance to work over the planning horizon that will provide data to support plan implementation and long-term water management. Information in the strategy can include:

- Status of water rights including current and projected future water use, unused inchoate water, and the amount of each water right that is mitigated.
- Location, number, and estimated water use of existing PE wells.
- Hydrologic assessment, including streamflow monitoring, hydrologic modeling, and a water budget for the basin.
- Hydrogeologic studies, including improved mapping of subsurface geology, ground water monitoring, and improved ground water models.
- Research into other questions specific to the unique geology and hydrology of this WRIA.

Table 11 summarizes the entities responsible for carrying out this recommendation and associated funding needs.

Table 11 Implementation of Tracking and Monitoring Recommendation

Action	Entity or Entities Responsible	Funding Considerations
Track building permits issued with PE wells.	Ecology (via reporting from Pierce County 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.
Document the completion of offset projects and estimate the "as-built" benefits of the project, both in terms of quantity of offset water and NEB.	WDFW, Ecology, and Project Sponsors	WDFW and Ecology may need additional funding. Project Sponsors may include monitoring in proposal for Ecology streamflow funding.
Track and assess completed offset projects to determine their on-going viability and effectiveness.	Ecology and Project Sponsors	Ecology may need additional funding. Project Sponsors may include project assessment in grant funding proposal.
Develop and implement a monitoring and research strategy	Ecology	Ecology will need additional funding to complete this action.

6.1.2 Oversight and Adaptation

This plan recommends Ecology complete a progress report on plan implementation every five years. This report should detail the success, challenges, and gaps related to implementation of the watershed plan. Specifically, the report should:

- Compare cumulative totals of PE well connections since 2018 by subbasin to the cumulative total of offset water benefits achieved by subbasin.
- Provide monitoring information, including available gaged streamflow information, and any updates to original plan assumptions.
- Include information on any discretionary programs that were implemented, including for example, water conservation education and outreach and incentives for public water service connections.
- Describe any unforeseen challenges to project implementation.
- Outline opportunities on conceptual or less developed projects and actions.

The report should consider whether implementation is on track to achieve the water offsets and net ecological benefit. This consideration should be based on overall progress on projects, unforeseen challenges or barriers, and unexpected opportunities.

Ecology's report should include recommended actions if water offsets and NEB are not on track to being achieved within the planning horizon. These actions could include:

- Prioritize conceptual projects by seeking out sponsors, providing case studies or demonstrations of successful similar projects, and encouraging project development.
- Estimate water offsets of habitat, programmatic, or conceptual projects.
- Collaborate with project sponsors to discuss potential alterations or additions to achieve offset needs.
- Revise the Ecology Streamflow Restoration Grant Guidance to prioritize or give preference to projects in watersheds that have not yet offset consumptive use from PE wells.
- Identify barriers to project completion.
- Other actions as needed to achieve offsets.

Ecology should send a notice of action that includes the recommendations to member organizations of the WRIA 12 Committee for comment. Members of the WRIA 12 Committee are not expected to reconvene after approving the plan, but they may choose to reconvene by mutual agreement. Reasons to reconvene may include review plan progress, further develop conceptual projects or grant applications, receive project updates, and receive training on project tracking systems. Any changes to the projects would be described in Ecology's report. Final actions shall be at the sole determination of Ecology after member organization input.

Ecology will distribute the report to all member organizations of the WRIA 12 Committee, Pierce County Council, all local jurisdictions within the watershed, and any additional stakeholders identified at the time of reporting. In addition, Ecology will post the report on Ecology's website.

Table 12 summarizes the entities responsible for carrying out this recommendation and associated funding needs.

Table 12 Implementation of Oversight and Adaptation Recommendation

Action	Entity or Entities Responsible	Funding Considerations
Develop and distribute report, including any recommended actions.	Ecology	Ecology may need additional funding to support development of the 2032 and 2037 reports.
Upload report and relevant information to Ecology's website.	Ecology	No additional funding is needed.
Revise Streamflow Restoration Grant Guidance to prioritize projects in watersheds that have not offset permit-exempt water use.	Ecology	No additional funding is needed.

6.1.3 Funding

The Committee recommends funding implementation and adaptive management from a variety of sources, including the Streamflow Restoration Grant Program administered by Ecology, Washington State Legislature, and other sources of public and private funding. 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 recognizes that no single source of funding is available that could implement every project contained in this plan and multiple funding sources will be required. The funding sources may have objectives different than solely streamflow restoration, such as habitat restoration, flood reduction, water quality, open space protection, and others. The Committee also urges the legislature to fund Ecology and WDFW to ensure plan implementation and monitoring, streamflow benefits, water offsets, and NEB.

6.1.4 Assurance of Plan Implementation

WRIA 12 Committee members and participating entities strongly advocate for implementation of the watershed plan. Members of the Committee provided the following statements voluntarily.

- Pierce County
    - Pierce County approves this watershed plan by resolution, formalizing their support of the plan contents.
    - Pierce County will use the plan as a source document for new projects, to be considered bi-annually for inclusion in the Surface Water Improvement Plan (SWIP)..
- Department of Ecology
    - Ecology follows NEB Guidance in reviewing the watershed plan and considering plan adoption.
    - Ecology administers the streamflow restoration competitive grant program as authorized under RCW 90.94.060 and chapter 173-566 WAC.
    - Ecology considers watershed plan recommendations where Ecology is identified as the lead.
    - Ecology reports to the legislature as required under RCW 90.94.050 in 2020 and 2027.
- Squaxin Island Tribe
    - Squaxin Island Tribe supports and participates in implementation activities as staff capacity allows, including:
        - Support project development and seek project opportunities.
        - Seek and support funding opportunities that support implementation.
        - Monitor implementation and identify areas for improvement.

All member organizations may support the plan by implementing projects and actions, securing funding, providing letters of support, reviewing periodic reports, and providing feedback and recommendations to improve the plan implementation.

6.2 Policy and Regulatory Recommendations

The Streamflow Restoration law lists 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)).[40] The WRIA 12 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 in multiple watershed plans, the WRIA 12 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 12 Committee intended to count toward the required consumptive use offset or NEB are included in Chapter 5: Projects and Actions.[41]

As required by the NEB Guidance, the 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 12 Committee initially identified a list of potential policy and regulatory recommendations. Appendix J contains the full list of policy and regulatory recommendations the Committee submitted and considered. 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 12 Committee members and is not endorsed or opposed by Ecology.

The WRIA 12 Committee supports the following recommendations described below.

[40] Some committee members have a different interpretation of 90.94 RCW. See the compendium for additional information:
https://www.ezview.wa.gov/Portals/_1962/images/WREC/WRIA12/Final%20Plan/WRIA%2012%20WRE%20Plan%20Compendium.pdf

[41] "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

6.2.1 Well Reporting Upgrades

Proposed Implementing Entity

Ecology.

Recommendation

Change the Ecology well tracking system in the following ways, in order to efficiently and transparently track the number and location of PE 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 that automatically provides the Public Lands Survey (PLS) location and coordinates for a new well.
- Identify PE wells on well report forms.
- Provide Well ID Tag numbers to older wells, and associate well decommissioning, replacement, or other well activities with the Well ID Tag.

Appendix K provides the full proposal.

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 PE wells will support the Committee's desire to engage in monitoring and adaptive management after adoption of the watershed plan.

Funding Source

Leverage existing resources and actions 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.

6.2.2 Fund Improvements and Connections to Small Public Water Systems

Proposed Implementing Entity

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

Recommendation

- Investigate the feasibility of establishing and operating a revolving loan/grant fund for Group A public water systems to offset costs for potential new PE wells to connect to a system.
- Funding would be available when the increased cost of connecting to a Group A system (instead of constructing a PE well) creates an economic barrier for applicants.

- Use of the fund would be subject to case-specific feasibility, such as availability of a sufficient water right, consistency with the relevant Water System Plan, and other applicable rules and regulations.
- Details of the fund, such as criteria for its use, application procedures, or default procedures, would be developed during the initial feasibility investigation phase.

Purpose

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

Funding Source

Grant programs; fees collected through local permitting processes; state or local rate increases or taxes.

6.2.3 Drought Response Limits

Proposed Implementing Entity

Ecology and local governments.

Recommendation

- This plan supports the existing language in 90.94.030(4)(b) that limits the PE well water use to no more than 350 gallons per day per connection for indoor use only upon the issuance of a drought emergency order under RCW 43.83B.405.
- Ecology should consider adding exemptions for growing food and supporting environmental restoration projects to the 90.94.030(4)(b) exemption in addition to maintaining a fire control buffer.
- Local governments should review existing drought response plans and incorporate PE well use considerations where feasible.

RCW 90.94.030(4)

(b) Upon the issuance of a drought emergency order under RCW **43.83B.405**, the department may curtail withdrawal of groundwater exempt from permitting under RCW **90.44.050** and approved under this subsection (4) to no more than three hundred fifty gallons per day per connection for indoor use only. Notwithstanding the limitation to no more than three hundred fifty gallons per day per connection for indoor use only, an applicant may use groundwater exempt from permitting to maintain a fire control buffer during a drought emergency order.

Purpose

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

Funding Source

Allocation of Ecology resources.

6.3 Rulemaking and Legislative Request Recommendations

This watershed plan has identified the following opportunities for rulemaking[42] and specific legislative requests that would support successful plan implementation:

- Update chapter 173-512 WAC to include PE well drought water use restrictions of 350 gpd for indoor only with exceptions for fire protection, food production, and environmental protection.
- Update chapter 173-512 WAC to add exemptions to stream closures to allow for the diversion of water during the highest flows for environmental projects if necessary.
- Request legislature to consider implementing a statewide water conservation program in unincorporated areas that includes drought response measures.
- Request legislative funding to implement recommendations contained within this watershed plan. The recommendations in this plan that may require legislative funding are the projects, adaptive management measures, and policy and regulatory recommendations.

[42] 90.94.030(3)(g) gives Ecology authority "to incorporate recommendations into rules adopted under this chapter or under chapter 90.22 or 90.54 RCW."

Chapter Seven: Net Ecological Benefit

7.1 Water Offsets

The WRIA 12 plan establishes a moderate projection of 145 new PE wells and a high growth projection of 227 PE wells to be installed within WRIA 12 over the planning horizon. Although the moderate projection is a more probable scenario, the project offsets listed in Chapter 5 will be compared to the consumptive water use associated with the high growth projection as a conservative measure. The plan uses this 20-year PE well high growth projection to estimate 89.9 acre-feet per year (0.12 cfs) of new consumptive water use in WRIA 12, as described in detail in Chapter 4. The WRIA 12 Committee sought projects to offset the 89.9 acre-feet per year.

Using an offset target associated with the high growth projection addresses uncertainties in the planning process related to the PE well projection, consumptive use assumptions, and project implementation. The plan projects a total water offset of 1,425 acre-feet per year from five water offset projects (described in Chapter 5 and listed in Table 13), a surplus offset of 1,335.1 acre-feet per year above the high growth consumptive use estimate and offset target. Through this comparison, the WRIA 12 Committee has determined that this plan succeeds in quantitatively offsetting consumptive use impacts at the WRIA-scale.

Table 13 Summary of WRIA 12 Water Offset Projects included in NEB analysis

Project Number	Project Name	Project Short Description	Subbasin	Estimated Offsets (AFY)	Timing of Benefits	Additional Benefits
12-S-W1	Repair Diversion Structure at Lake Sequalitchew	Install a diversion structure to regulate flow between Sequalitchew Creek and stormwater canal, install a gaging station, remove cross culvert, reroute stormwater, install berm, remove fish screen and install beaver control.	Sequalitchew	724	Year-round	Increased aquatic habitat for salmonids and other aquatic life
12-Ch-W2	South Tacoma Channel Stormwater Infiltration Project	Direct stormwater flows to large-scale infiltration facilities within the South Tacoma Channel (STC) (Sites 1 and 2) to enhance streamflow and function of lower Flett Creek and Flett Wetland (Site 3).	Chambers	701	Year-round	Increase baseflow in summer in lower Flett Creek and Flett Wetland (Site 3) by about 0.5 cfs. Reduce water temperatures.
12-W3	Reclaimed Water Infiltration	Infiltrate reclaimed water or treated wastewater on location at satellite treatment plans.	All	TBD	Year-round	Increase groundwater recharge. Reduce water temperatures.
12-Cl-W4	Water right acquisition	Acquire water rights from PGG assessment and put into trust either through a direct transaction or through water conservation and efficiency upgrades. Anticipate a fraction of reviewed rights will be counted as offset.	Clover Creek	TBD	Irrigation season	Aquatic habitat improvements during critical flow periods. Reduction in groundwater withdrawals.
12-W5	Green Stormwater Infrastructure Program	Provide financial assistance for property owners to install GSI through traditional means or through a revolving loan fund. Certain soils, certain areas of the basin. North Fork Clover prioritized.	Clover Creek and WRIA-Wide		Year-round	Increased baseflow. Water quality improvements
WRIA 12 Total Water Offset			**Total**	**1,425 AFY**		
WRIA 12 Consumptive Use Estimate (high growth projection)				**89.9 AFY**		

The Repair Diversion Structure at Lake Sequalitchew and South Tacoma Channel Stormwater Infiltration projects, located in the Sequalitchew and Chambers subbasins, respectively, have project sponsors and the highest likelihood of implementation. The project sponsors are motivated to implement the projects. The Repair Diversion Structure at Lake Sequalitchew project is nearing the end of the project design phase. In 2020, South Tacoma Channel Stormwater Infiltration project received funding from Ecology's Streamflow Restoration Competitive Grants for a feasibility study. Both of these projects have momentum and are expected to be fully implemented during the planning horizon.

The two projects will offset consumptive use for the full WRIA over 20 years. These projects are anticipated to add water directly to the streams, resulting in increased streamflows in their respective streams. The projects are located in the Sequalitchew and Chambers subbasins, which currently provide the best habitat and opportunities for salmonids. The Repair Diversion Structure project is expected to enhance streamflow in Sequalitchew Creek by 6 to 7 cfs. The South Tacoma Channel project is expected to enhance streamflow in Flett Creek by 0.8-1.1 cfs, with the highest magnitude benefits during the dry season. Table 3 in Chapter 2 shows the current presence of salmon by subbasin. Offset projects in these two basins will provide the most benefit to salmon. The WRIA 10/12 Salmon Recovery Lead Entity has identified high priority barrier removal projects in the Chambers and Sequalitchew subbasins, including the Chambers Dam and a railroad culvert. The offset projects, in combination with the barrier removal projects, will enhance the available salmon habitat in the most productive salmon streams in the WRIA.

Most of the PE wells and associated impacts are anticipated to occur in the Clover Creek subbasin. The WRIA 12 Committee identified three potential projects that could be implemented in Clover Creek to enhance streamflows. Those three projects are conceptual and do not have water offsets estimated at this point. If implemented, these projects could contribute to enhanced streamflow and improved instream resources. The plan also includes a recommendation to fund improvements and connections to small water systems, which could improve streamflows by reducing the number of PE wells in the subbasin. As these projects are further developed, a better understanding of their water offset contribution will emerge. Combined with habitat projects in this plan and the barrier removal project at McChord Field runway, the offset projects in the Clover Creek subbasin will help salmon return to Clover Creek. The projects in Table 13 provide a total water offset of 1,425 acre-feet per year.

Consumptive use and water offsets are compared at the subbasin scale in Table 14. Surplus water offset is achieved in Chambers and Sequalitchew subbasins. The surplus water is expected to enhance and restore streamflows in both subbasins. A deficit in water offset occurs the Clover Creek subbasin because projects in that subbasin do not have offset estimates yet. Once implemented, those projects will provide additional offset amounts and enhanced streamflows in the Clover Creek subbasin. Figure 6 in Chapter 5 shows the water offset projects by subbasin.

Table 14 Subbasin Water Offset Totals Compared to High Growth Consumptive Use Estimate

Subbasin	Offset Project Totals (AFY)	Permit-Exempt Well Consumptive Use (AFY)[1]	Surplus/Deficit (AFY) [2,3]
Chambers	701	2.8	+698.2
Clover Creek	TBD	87.1	-87.1
Sequalitchew	724	0	+724
WRIA 12 Total Consumptive Use	**1425**	**89.9**	**+1335.1**

Notes:
[1] High growth scenario.
[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 13 provide additional benefits to instream resources beyond those necessary to offset the impacts from new consumptive water use within the WRIA. The offset projects in Sequalitchew and Chambers subbasins improve the instream habitats. For the project types planned in WRIA 12, additional benefits include:

- **Direct flow restoration**: increased flow and usable aquatic habitat year-round. Reduced fish passage barriers during the low flow period (i.e. from lack of flow in losing reach). Increased water quality from increased flow.
- **Stormwater infiltration projects**: Increased baseflow in summer in creeks and wetlands. Reduction of water temperatures and other water quality improvements.
- **Water right acquisition projects**: Aquatic habitat improvements during critical flow periods; reduction in groundwater withdrawals and associated benefit to aquifer resources.
- **Reclaimed water infiltration**: Reduce nutrients entering Puget Sound. Aquatic habitat improvements during critical flow periods; increased groundwater recharge; reduction in summer/fall stream temperature; increased groundwater availability to riparian and near-shore plants.
- **Stormwater Infrastructure Programs**: Water quality improvements.

7.2 Habitat Benefits

Eight habitat improvement projects are included within the plan, as summarized in Tables 15 and 16, and shown in Figure 6 in Chapter 5. Significant habitat benefits will also result from water offset projects 12-S-W1 and 12-Ch-W2 (Table 13). Habitat improvement benefits associated with these projects include a combination of increased stream complexity, floodplain reconnection and enhanced natural processes for salmonids. Many of the habitat improvement projects include more than one of these elements. Project distribution is summarized by the following:

- Three projects (12-Cl-H1, 12-Cl-H2, and 12-Cl-H8) in the Clover subbasin, benefiting Clover Creek and associated floodplains.

- Five projects (12-Ch-H3, 12-Ch-H4, 12-Ch-H5, 12-Ch-H-6, and 12-Ch-H7) in the Chambers subbasin, benefiting Chambers Creek, Chambers Bay, Flett Creek, Leach Creek, and other tributaries.

These projects provide additional benefits to instream resources that, together with direct water offsets, are beyond those necessary to offset the impacts from new consumptive water use within the WRIA. Each project listed in Tables 15 and 16 addresses one or more of the salmonid habitat limiting factors for Chambers Creek and Clover Creek as defined by the WRIA 12 Lead Entity (2018) and Marcantonio and Mahan (2003). While not listed on Tables 15 or 16, the Repair Diversion Structure at Lake Sequalitchew project also addresses several limiting factors:

- Partial fish passage barriers from beaver dams in the Edmond and Hamer Marsh reaches (RM 0.6 - 2.6).
- Fish passage barrier at the outlet of Sequalitchew Lake.
- Diversion of flow from Sequalitchew Lake and Edmond marsh to a diversion canal.
- Fish entrainment into the diversion canal.
- Channelizing of the upper reaches limits the lateral movement of the creek within its natural floodplain.

Table 15 Summary of Clover Creek Habitat Improvement Projects

Project Number	Project Name	Project Short Description	Floodplain and riparian function	Invasive plants reducing habitat function	Channel straightening and hydromodifications, including paving sections of the stream bed	Water quality impairment from stormwater runoff, reduced riparian function, low instream flows, wetland losses, and livestock waste.	Channel complexity and riparian function	Lack of instream habitat
12-Cl-H1	Clover Creek Floodplain Restoration	Floodplain restoration in a number of locations as identified by the Committee. Projects would include: Floodplain reconnection, pavement removal, log jams,	X	X	X	X		X
12-Cl-H2	Habitat Assessment	Conduct habitat assessment for riparian buffers, floodplain reconnections, and stream channel improvements	X	X	X	X		
12-Cl-H8	Streambed pavement removal	Restore reaches of Clover Creek by removing asphalt that lines the streambed.			X		X	X

Table 16 Summary of Chambers Creek Habitat Improvement Projects

Project Number	Project Name	Project Short Description	Channel complexity and riparian function	Floodplain and shoreline hydromodifications	Modified hydrology from drainage modifications, high percentages of impervious surfaces in the watershed, and water use that lowers the regional water table in	Viable habitat that provides connective corridors between riverine and estuarine habitats and between estuarine and open water	Fish passage barrier at the mouth of Chambers Creek (dam)
12-Ch-H3	Clover Creek Springbrook Restoration Project	Restore up to 1600 lineal feet of Clover Creek in the Springbrook neighborhood of the City of Lakewood.	X	X	X	X	
12-Ch-H4	Protect and Restore mainstem Chambers Creek habitat	Implement a variety of stream treatments as identified through an assessment conducted by the Puyallup Tribe.	X	X	X	X	
12-Ch-H5	Peach Creek	Roughening and hyporheic exchange. Addressing stream incision, erosion.	X	X	X	X	
12-Ch-H6	Chambers Bay Estuarine and Riparian Enhancement	Restore and enhance the estuarine habitat structure within Chambers Bay.	X	X	X	X	X
12-Ch-H7	Titlow Estuary Restoration	Restore Titlow Lagoon to a connected and productive estuary.		X		X	

7.3 Adaptive Management

The WRIA 12 plan recommends actions that will be implemented over the planning horizon along with an adaptive management process. This plan recommends adaptive management measures for the purpose of addressing uncertainty in plan implementation and better understanding streamflows and impacts of PE wells. Adaptive management measures include PE well tracking, project implementation tracking, and periodic watershed plan implementation reporting, with recommended actions if offsets are not being achieved.

This plan recommends a programmatic action and three policy and regulatory actions. These recommendations include developing a water conservation education and incentive program, updating Ecology's PE well tracking system, funding water connections to small water systems, and improving drought response measures. These recommendations, when implemented, are expected to reduce the amount of water consumptively used, therefore reducing impacts to streamflows and fish. The recommendations also increase the resiliency of the plan by addressing consumptive use and providing education opportunities. This plan recognizes that legislative funding may be needed to implement the projects, programs, and policy and regulatory actions. Funding is necessary to achieve the benefits identified in this plan.

These measures, in addition to the surplus water offset, increased streamflows, and supplemental habitat improvement projects described above, demonstrate that the plan will be implemented. When implemented, the projects and actions in the plan will restore and enhance streamflows and adequately offset new consumptive use from PE wells anticipated during the planning horizon.

7.4 NEB Evaluation Findings

The WRIA 12 watershed plan identifies projects and actions that are expected to offset an estimated 89.9 Acre-feet per year of new consumptive water use in WRIA 12. These projects, when implemented, are expected to achieve and surpass this offset with a cumulative offset estimate of 1,425 acre-feet per year and high certainty of completion. The projected total water offset yields a surplus offset of 1,335.1 acre-feet per year above the consumptive use estimate of 89.9 acre-feet per year for the high growth scenario in WRIA 12. These projects will enhance streamflows by adding 0.8 cfs to 1.1 cfs to Flett Creek in Chambers subbasin and 6 to 7 cfs in Sequalitchew Creek. Once realized, the conceptual projects in the Clover subbasin will provide additional offsets and contribute to improved salmon habitat in Clover Creek. The projected total water offset far surpasses the consumptive use estimate associated with the high growth scenario in the WRIA.

Within this plan, water offset projects are complimented by a total of eight habitat improvement projects, which provide numerous additional benefits to aquatic and nearshore habitat and address several salmon limiting factors. While some of these habitat improvement projects may have potential streamflow benefits, those benefits are difficult to estimate and not included in this plan's accounting.

This plan recommends implementation and adaptive management measures necessary to address uncertainty in the plan, track implementation, and respond to unforeseen challenges and barriers. The policy or regulatory recommendations are expected to reduce the amount of water consumptively used in the watershed. These measures demonstrate that the plan will be implemented. When implemented, the projects and actions in the plan will restore and enhance streamflows and adequately offset new consumptive use from PE wells anticipated during the planning horizon.

This plan was developed in the spirit of the precautionary principle. The plan uses a high consumptive use estimate as a target for offset projects, includes a robust list of projects, and outlines anticipated implementation actions from several organizations. These steps provide a factor of safety, address uncertainty within the plan, and make the actions and recommendations in the plan more protective of the resource.

Based on the information and analyses summarized in this plan and the intention that projects in the plan will be implemented, the WRIA 12 Committee finds that this plan, when implemented, will enhance streamflows in several important salmon streams and, for the WRIA as a whole, offset new consumptive use from PE wells anticipated during the planning horizon.

Appendices

WRIA 12 Chambers-Clover Watershed

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

https://apps.ecology.wa.gov/publications/SummaryPages/2111012.html

Appendix A – References

Appendix B – Glossary

Appendix C – Committee Roster

Appendix D – Aquifer Units in WRIA 12

Appendix E – WRIA 12 Hydrographs

Appendix F – 303d Listed Streams in WRIA 12

Appendix G – Subbasin Delineation Memo

Appendix H – Permit-Exempt Growth and Consumptive Use Summary

Appendix I – Projects

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Appendix K – Policy and Regulatory Actions Considered by the Committee

Appendix L – Proposed Improvements to Department of Ecology's Well Reporting Processes