AGENDA

Snohomish (WRIA 7)
Watershed Restoration and Enhancement Committee meeting
December 12, 2019 | 12:30pm – 3:30pm [WRIA 7 Committee Webpage]

Location
Willis Tucker Community Park
Gary Weikel Room,
6705 Puget Park Drive,
Snohomish

Committee Chair
Ingria Jones
Ingria.Jones@ecy.wa.gov
(425) 649-4210

Handouts
- Final subbasin delineation map & memo
- Draft growth projection & consumptive use memos
- Policy & regulatory actions Discussion guide
- Recommendations for water rights analysis
- Project screening criteria update and location priority considerations

Welcome, Introductions, and Standing Business

12:30 p.m. | 20 minutes | Facilitator | **Decision**

- Introductions
- Review agenda
- Approve November meeting summary
- Recommendation: Letters of support for streamflow restoration grant round
- Technical memo updates

Consumptive use results

12:50 p.m. | 50 minutes | Cynthia Carlstad, NHC |Questions and Discussion

- Objective: Provide committee with overview of consumptive use results
    - Presentation from technical consultants on consumptive use results
    - Consumptive use next steps
    - Technical Workgroup Update

Break

Policy and regulatory actions

1:50 p.m. | 45 minutes | Chair & Facilitator |Overview

- Objective: Discuss potential policy and regulatory actions to include in the WRE Plan
    - Small group break-out discussions
    - Discuss ideas and recommendations
    - Identify additional information needs

Projects

2:35 p.m. | 35 minutes | Committee | Discussion

- Objectives: continue discussions of the project inventory process; committee agreement on path forward for water rights acquisition assessment and project screening
    - Update on 4-Year Work Plan Process

- Project Subgroup Update
- Recommendation for water rights acquisition analysis focus areas
- Recommendation for project screening criteria path forward
- Discuss path forward to identify additional water offset projects

Public Comment

3:10 p.m. | 10 minutes | Facilitator

Next Steps and Action Items

3:20 p.m. | 10 minutes | Facilitator & Chair

- Next WRIA 7 Committee meeting: Thursday, February 13, Everett Public Library
- Next Technical Workgroup meeting: Thursday, January 23, 1:00-2:30
- Next Project Subgroup meeting: TBD

To request ADA accommodation, visit https://ecology.wa.gov/accessibility, call Ecology at 360-407-6831, Relay Service 711, or TTY 800-833-6384.

DRAFT Meeting Summary

Snohomish (WRIA 7)
Watershed Restoration and Enhancement Committee meeting
November 14, 2019 | 12:30 p.m. - 3:30 p.m. WRIA 7 Committee Webpage

Location
Brightwater Facility
Community Room,
22505 State Route 9 SE,
Woodinville

Committee Chair
Ingria Jones
Ingria.Jones@ecy.wa.gov
(425) 649-4210

Handouts
Glossary & resources
Subbasin delineation map and draft memo
Local approval process form
Draft plan outline
Adaptive management discussion guide

Attendance

Committee Representatives and Alternates *

Brant Wood *(Snohomish PUD)*
Mike Wolanek *(City of Arlington)*
Jordan Ottow *(City of Monroe)*
Matt Baerwalde *(Snoqualmie Indian Tribe)*
Julie Lewis (alternate) *(Snoqualmie Indian Tribe)*
Denise Di Santo *(King County)*
Dylan Sluder *(MBA of King & Snohomish Counties)*
Jim Miller *(City of Everett)*
Elissa Ostergaard *(Snoqualmie Watershed Forum) (ex officio)*
Jaime Burrell *(City of North Bend)*
Andy Dunn (alternate) *(City of Snoqualmie)*
Rich Norris *(City of Gold Bar) (phone)*
Paul Faulds *(City of Seattle) (ex officio)*
Kirk Lakey *(WA Dept. of Fish and Wildlife)*
Elizabeth Ablow (alternate) *(City of Seattle) (ex officio)*
Amanda Smeller *(City of Carnation)*
Daryl Williams *(Tulalip Tribes)*
Anne Savery (alternate) *(Tulalip Tribes) (phone)*
Matthew Eyer *(City of Marysville)*
Michael Remington *(City of Duvall)*
Cynthia Krass *(Snoqualmie Valley WID)*
Will Stelle (alternate) *(Washington Water Trust) (phone)*
Bobbi Lindemulder *(Snohomish CD)*
Terri Strandberg *(Snohomish County)*
Glen Pickus *(City of Snohomish)*
Stacy Vynne McKinstry (alternate) *(WA Dept. of Ecology)*
Ingria Jones *(WA Dept. of Ecology) (chair)*

Committee Representatives and Alternates in Not Attendance*

Town of Index
Snohomish Salmon Recovery Forum *(ex officio)*
City of Lake Stevens

Other Attendees

Susan O'Neil *(ESA) (facilitator)*
Angela Pietschmann *(Cascadia) (info manager)*
Bridget August *(GeoEngineers)*
John Covert *(WA Dept. of Ecology)*
Paulina Levy (*WA Dept. of Ecology)*
Yorik Stevens-Wajda *(Snohomish County Council) (phone)*
Kevin Lee *(WA Dept. of Fish & Wildlife)*

*Attendees list is based on sign-in sheet.

Welcome, Introductions, and Standing Business

Susan welcomed the group and began introductions.
Susan reviewed the agenda.

No revisions to the agenda.

The meeting summary was approved without changes.

Ingria provided updates and follow-up from October 10 meeting.

- Ingria invited committee members to use BOX, a secure file sharing program where Ecology and technical consultants will share large files and working documents. Notify Ingria if you are having issues accessing files on BOX.
- Draft subbasin delineation memo and map are in on BOX. Committee members please send feedback to Ingria by November 25th.
- GeoEngineers developed growth projections by subbasin for the Technical Workgroup to review. GeoEngineers will develop a draft growth projections memo for the December 12 Committee meeting.
- Technical consultants developed the consumptive use calculator for WRIA 7 and completed the irrigated footprint analysis. The calculator and preliminary results are on BOX in the Consumptive Use folder. The technical workgroup will discuss and technical consultants will provide a draft consumptive use memo and overview presentation of results at the December 12 Committee meeting.
- The glossary and resources handout (hard copy and on BOX here) includes acronyms frequently used during our planning process, links to resources, and key terms from the NEB guidance.

No additional updates from committee members.

Calendar and process

- Objective: Discuss evolution of process and discuss decision-making and timeline

Susan shared a process calendar with the key elements of the WRE Plan the Committee is developing this winter, spring, and summer.

- The calendar describes when we anticipate bringing elements of work to the workgroups and Committee.
- Original Committee calendar included many interim decisions, whereas the process calendar anticipates fewer, key interim decisions.
- The process calendar outlines four key parts: developing 20-year consumptive use estimates, identifying projects & actions, developing other plan elements, and writing the WRE Plan.
    - Consumptive use estimate: Anticipate a formal decision on consumptive use estimates by subbasin in February.
        - Supporting materials for the decision include subbasin delineation, growth projection, and consumptive use technical memos.
    - Identify projects and actions: The Committee will continue identifying projects and actions, including identifying new projects.
    - Develop other plan elements: The Committee will continue to develop recommended and optional plan elements this winter, spring, and summer.
        - At the September 12 meeting, the Committee broke into small groups to discuss recommended and optional elements of the Plan. The Committee will build off of the initial discussion.
        - This winter and early spring, the workgroups and Committee will develop recommendations for an offset target. Anticipate a formal decision on the Committee's offset target in spring.
    - Write the plan: The Committee is developing elements of the Plan throughout the planning process and reviewing technical memos as they are developed.
        - The WRE Plan is expected to be a short document with technical memos provided in appendices.

Reference Materials
- Committee process diagram (on BOX here)
- Committee Brochure (on BOX here)

Discussion and Considerations
- There were concerns that the calendar leaves important decisions for the end of the planning process. The calendar includes the minimum number of decisions that are seen as necessary for the final plan approval, but more can be added if warranted.
- Committee members want to be sure concerns and opinions are aired throughout the process and do not come as a surprise at the end of the planning process.
- There was a recommendation to begin discussions of policy and regulatory actions earlier, and a request to hear presentations on King County and Snohomish County's hook-up policies.
- Snohomish County Council budget review process takes place in October and November and it will be difficult to seek approval of the WRE Plan during this period.
- Committee members can send the chair recommendations for timing/sequencing of plan elements.

Ingria provided an overview of the plan local approval process form and requested voting committee members to return the completed form by February 7.

Reference Materials
- Local approval process form (on BOX here)

Discussion and Considerations
- All voting members of the WRIA 7 Watershed Restoration and Enhancement Committee must approve the plan before Ecology's review.
- The legislation does not require governments and organizations on the Committee to go through a formal internal approval process before approving the plan, however we recognize that as a representative of an entity you need time for your entity to review the final plan.
- Committee members should consult with their organization to determine their internal review process.
- Ingria may ask members to share information on internal plan approval processes and timelines at an upcoming committee meeting.
- There was a recommendation for a standard Plan overview presentation so all committee members are sharing consistent information.

Plan outline and adaptive management

- Objective: Review detailed plan outline and what adaptive management elements to include in WRIA 7 plan

Ingria provided an overview of the detailed WRE Plan Outline and requested feedback from Committee members by February 7.

Reference materials
- Detailed WRE Plan Outline (On BOX here)

Considerations
- Detailed Plan outline fleshes out the required, recommended and optional Plan elements shared with the Committee on September 12.

- The same template will be shared across 203 Committees (WRIA 7, 8, 9, 10, 12, 13, 14 and 15) and each Committee can tailor the outline and can add sections as more detail is developed for the recommended and optional components of the Plan.
- Ecology anticipates the 203 plans will look similar and have a similar structure and format, but Committees have the opportunity to tailor elements of the Plan content.
- The Plan is anticipated to be a short document with technical memos referenced in appendices.

Snohomish County provided an overview of PE well fee tracking.
- Snohomish County tracks building permits in an automated permitting tracking system called AMANDA.
- The tracking system can generate reports for fees collected for new homes relying on a PE well.
- Snohomish County has collected and tracked fees since January 2018.
- The County has the ability to track PE wells by subbasin, since they track parcel data associated with fees collected.
- Between January 2018 and September 2019, less than 100 new wells, with most in WRIA 7 and 8-9 wells in WRIA 8 (Bear Creek).

King County provided an overview of PE well fee tracking.
- King County has collected and tracked fees since January 2018.
- King County tracked 22 new building permits for homes relying on PE wells, two from January through June 2018 and 20 from July 2019 through June 2019. Ten of those wells are in WRIA 7.
- The County has the ability to track PE wells by subbasin. The breakdown for the 10 PE wells in WRIA 7 between January 2018 June 2019 is as follows:
    - Cherry/Harris: 4
    - Patterson: 1
    - Snoqualmie North: 3
    - Snoqualmie South: 2

Ecology provided an overview of PE well fee tracking.
- Ecology sends a letter annually to counties and jurisdictions identified in RCW 90.94.020 and 030 outlining the requirements and requesting submittal of fees and number of new permits issued by WRIA for homes relying on PE wells.
- Ecology has collected fees twice so far, from January 2018 through June 2018 and from July 2018 through June 2019.
- Ecology requests information annually by WRIA and the water resources fiscal office tracks information by WRIA. Ecology does not request or track information at a finer scale.
- The City of Auburn, located in WRIA 9, is the only city that has remitted fees to Ecology as of June 2019.

Susan introduced the adaptive management discussion guide and the Committee revisited adaptive management considerations following September breakout group discussions.

Reference materials
- Adaptive Management Discussion Guide (On BOX here)

Considerations
- The NEB Guidance strongly recommends committees include an adaptive management component in the WRE Plan.
- At this time, there is no funding for adaptive management. Consideration around adaptive management in the plan should identify potential funding sources.

- From the reports above, we know that King County and Snohomish County and Ecology will be tracking new permit-exempt wells which can form the minimum foundation of a monitoring and adaptive management section.
- Currently Ecology tracks the wells by WRIA, but the committee can request that Ecology request and provide information by sub-basin.
- This was an introductory discussion of adaptive management following up on some of the conversation generated in small groups in September, but will be revisited as part of plan development.

Discussion

- Committee members felt like it was hard to put specifics to an adaptive management program when we don't know who manages the Plan or what resources are available.
- The group suggested that Ecology develop a dashboard that could be used across WRIAs. There was a recommendation for Ecology to use existing staff and consultant resources to jumpstart a dashboard tool that committees could use going forward. The dashboard would show new PE wells and projects by subbasin. The trends would show if projects are implemented where wells are going in.
    - Committee members generally agreed Ecology should manage and update the dashboard annually with data on new PE wells from the counties and data on the projects from Ecology.
    - Ecology should develop metrics for the streamflow restoration grant program to track project benefits and include metric tracking in the dashboard.
    - There is also interest in tracking decommissioned wells, along with new PE well information. Ecology currently tracks decommissioning logs in the well log database.
- There was also interest in tracking or understanding habitat conditions by subbasin to inform the sequence or location of projects for more holistic management. The Snohomish Basin Salmon Recovery Forum (Snohomish Forum) was mentioned as both a venue to provide that information on habitat and potentially convene the discussion of adaptive management of the Plan.
- There was a suggestion that the committee may want to meet more frequently (annually) for the first few years and then taper off to less frequently (every 2-3 years). Using the Forum could reduce cost and time constraints; perhaps adding an hour to one of their meetings once per year for this topic and inviting jurisdictions that aren't formally represented on the Forum. It was noted that the Snohomish Forum representative wasn't present during this discussion, but members of that Forum seemed interested in this approach.
    - The committee could identify triggers in the Plan that would instigate a convening outside of the agreed upon frequency.
- Adaptive management of the project list could include a near-term shift in the sequence or prioritization of projects, and a longer-term adjustment to the actual project list.
- Determining habitat conditions and streamflow through existing or new monitoring efforts would require resources. Currently, the Snohomish Forum and the Snoqualmie Watershed Forum prepare status reports that include an analysis of monitoring data every 5 or 10 years. The next Snohomish Forum Status Update will be released soon.
- Snohomish and King Counties also track streamflow in various locations but analyzing this data would likely require additional resources.
- The committee discussed the distinction between implementation monitoring and effectiveness monitoring.
    - It will be difficult to separate project effects from a climate signal or even determining before and after effects of the projects and wells.
- Key takeaways from the discussion:

- Interest in tracking the basic assumptions of the plan annually – number and location of new wells and projects, ideally using a dashboard that Ecology develops and maintains.
- Interest in convening after 2021 – annually at first and using existing structures.
- Committee members would like to know about existing monitoring efforts.

Projects

- Objective: continue discussions of the project inventory process and discuss takeaways from existing inventory

Ingria provided an overview of project considerations from the NEB Guidance and the roles and key steps to building the project inventory and identifying and evaluating projects for the Plan.

Reference materials:

- Projects and Actions: Needs for WREC (On BOX here)
- Draft fatal flaw screening criteria (On BOX here)
- Project Inventory Overview – presentation
- Projects by Subbasin Map (on BOX here)

Questions and Discussion

- There was a question about how Ecology's targeted application processing relates to the Committee's project list and WWT's work to identify potential water right acquisitions.
  - Ingria replied that Ecology does not see a connection between the planning process and targeted application processing in WRIA 7.
  - For our process, we are interested acquiring water rights to put into permanent trust for instream flows. A water right application is an application for withdrawal, but under an application water has not yet been put to beneficial use. Ecology cannot permanently acquire applications for the trust water rights program.
  - The WRE Planning process does not affect Ecology's issuance of water rights permits, processing of change applications, or other permitting decisions.
- There was a comment there are two classes of projects: projects that provide water offset that can be calculated with a high level of certainty and other projects that have a high probability of improving streamflow, but where there is less certainty in quantifying the amount. If new studies and monitoring demonstrate streamflow benefits of habitat projects, the Committee may want to adjust project priorities and sequencing in the future.

Bridget provided an overview presentation of the WRIA 7 Project Inventory, fatal flaw filtering, and additional filtering completed by the technical consultants.

- There are 247 projects in the inventory. None of these are water offset projects.
- 117 of the projects in the inventory are programmatic or cover several WRIAs or subbasin and could not be tied to a specific subbasin.
- GeoEngineers filtered projects for the five following fatal flaw criteria:
  1. No Benefits to Streamflow or Habitat
  2. Already Required by Regulatory Obligation
  3. Inconsistent with Existing Rule/Law or Streamflow Restoration Policy
  4. Substantive Conflict with Another Watershed Plan
  5. Implemented Prior to January 2018
- 18 projects failed the fatal flaw filtering and 344 projects passed.
- GeoEngineers completed additional filtering and identified 100 habitat projects with water storage potential.

Questions and Discussion

- Committee members discussed the inverse relationship between the number of projects in each subbasin and projected growth.
    - Projects in the headwaters may provide a streamflow benefits for a longer reach of stream than projects located near the Estuary.
    - Protecting hydrologic processes in the headwaters provides resilience in the face of climate change.
    - There is still a need for streamflow benefits in portions of the lower watershed.
        - Tulalip Tribes noted the importance of improving streamflow to maintain the Tribes' hatchery.
- The Committee discussed the criteria "inconsistent with existing law" and whether projects were filtered due to inconsistency with the instream flow rule (See WAC 173-507).
    - No projects were filtered for inconsistency with the instream flow rule (ISF rule).
    - A project that involves an appropriation or re-timing of flows in a basin with a year-round closure would be inconsistent with ISF rule and would be filtered out.
    - The Committee may include recommended changes to the ISF rule in the Plan. All committee members must agree and approve the Plan.
- Technical consultants are identifying potential methods for quantifying streamflow benefits of habitat projects, such as floodplain reconnection or levee removal projects. They will share an overview with the Committee in the coming months.
- The project inventory includes projects from salmon recovery project lists, but does not include public works projects.

Susan proposed a water projects workshop in January to brainstorm water offset projects to diversify the Committee's project inventory.

- The project inventory does not currently include any water right acquisitions or non-acquisition water offset projects. The inventory only includes habitat and other projects.
- A project workshop could focus on identifying non-acquisition water offset projects that retime high flow season waters, including managed aquifer recharge, source switches, streamflow augmentation, off-channel storage, or stormwater projects.
    - For an example of a stormwater project with water offset benefits, , Ecology awarded funding to the Albany Street Stormwater Pond project in the Streamflow Restoration Pilot Grant Round In the Streamflow Restoration Pilot Grant Round. You can see the project on the list of projects approved for funding in the pilot grant round.
    - Ingria will coordinate with water quality staff at Ecology on any stormwater projects.
- There was a question about whether water conservation education could count as water offset. It is difficult to quantify water offset benefits of voluntary water conservation efforts or water conservation education.
    - Water conservation that included a policy change could potentially provide water offset.
    - The Streamflow Restoration Policy and Interpretive Statement states that "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."
- The Committee will make a decision in December about a project workshop.

Streamflow restoration grant guidance

- Objective: Provide committee with overview of 2020 streamflow restoration grant round

Paulina Levy, Ecology, presented on the streamflow restoration 2020 competitive grant guidance.

Reference materials:

- Streamflow Restoration Competitive Grants – Presentation
- Streamflow Restoration 2020 Competitive Grant Guidance

Considerations

- The grant program is statewide, but prioritizes projects in planning basins (including WRIA 7).
- The grant guidance is transparent in funding priorities and application expectations.
- The WRIA 7 Committee's project selection process does not impact funding decisions for this grant round. There are no points for projects on our project list. For the 2020 grant round, only projects in an Ecology adopted plan or rulemaking process under RCW 90.94 receive points (currently only WRIA 1 and WRIA 11).
- The grant guidance could change in later rounds to have different priorities and different scoring criteria, and will be consistent with the funding rule.
- Projects in the Plan will need to receive funding from a variety of sources. There is not currently sufficient funds in the grant program to fund all projects identified in the watershed plans.
- The grant guidance does not reference subbasins.
- A project that quantitatively improves streamflow that will benefit instream resources is more likely to be competitive.

Questions and Discussion

- Impervious surfaces impact groundwater recharge. Can streamflow restoration grant funding be used to create a funding pool for local governments or conservation districts to build low impact development infrastructure as new developments are built?
    - Snohomish and King Counties already require low impact development for new homes. If there were additive elements of low impact development that are not already required, may be eligible.
- Projects that can quantify streamflow benefit will likely be more competitive.
- Projects above and beyond existing requirements (include an additive element) may be eligible.
- There was interest in land acquisition of properties with a permit-exempt well.
    - Land acquisitions involving decommissioning a PE well would be eligible for streamflow restoration grant funding, however PE wells cannot be acquired through the trust water rights program. Demonstrating that a land acquisition is strategic and quantifying any streamflow benefits will make it more competitive.
    - Land acquisitions are not considered water offset projects for the Plan because there is high uncertainty that growth is prevented through land acquisitions, since growth may still occur in a nearby location.
- There was interest in developing a credit program for drought tolerant landscaping and green infrastructure.
    - This type of project would need consider how benefits will continue in perpetuity.

Public Comment

There was no public comment.

Action Items

- Committee members complete local plan approval process form and send to Ingria by February 7
- Committee members review detailed plan outline and send feedback by February 7
- Committee members send feedback on draft subbasin delineation memo by November 25
- Committee members identify potential projects from public works lists or other sources and develop new project ideas.
- Committee members contact Ingria if you have trouble accessing BOX

Next Steps

- Next WRIA 7 Committee meeting: Thursday, December 12, Willis Tucker Community Park, Snohomish
- Next Project Subgroup meeting: December 4, 1:00-2:30 pm, WebEx
- Next Technical Workgroup meeting: TBD

GeoEngineers

Memorandum

17425 NE Union Hill Road, Suite 250, Redmond, WA 98052 Telephone: 425.861.6000, Fax: 425.861.6050 www.geoengineers.com

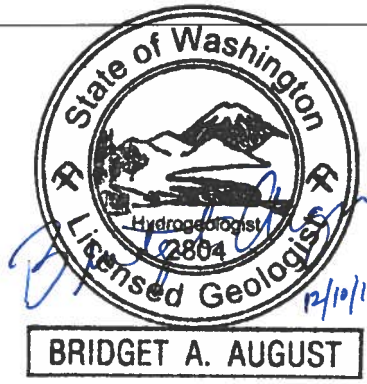
To: Ingria Jones, Washington State Department of Ecology

From: Bridget August, LG, LHG and John Monahan

Date: December 10, 2019

File: 0504-161-00

Subject: WRIA 7 Subbasin Delineations



INTRODUCTION

GeoEngineers, Inc. (GeoEngineers) is providing technical support to the Washington State Department of Ecology (Ecology) and the Watershed Restoration and Enhancement (WRE) Committees for Water Resource Inventory Areas (WRIAs) 7, 8 and 9. This memorandum provides a summary of the deliverable for Work Assignment GEO102, Task 2, WRIA 7 Subbasin Delineations.

BACKGROUND AND CONTEXT

The Streamflow Restoration Act (SRA, Chapter 90.94 Revised Code of Washington [RCW]) specifies that by June 30, 2021, Ecology must establish a WRE Committee and adopt a WRE Plan in the Snohomish Watershed (WRIA 7). The WRE Plan needs to address impacts on streamflows from consumptive use from new domestic permit-exempt wells anticipated between January 19, 2018 and January 18, 2038. Dividing the Snohomish WRIA into subbasins is an essential step in developing a plan that complies with the law. RCW 90.94.030(3)(b) states "The highest priority recommendations must include replacing the quantity of consumptive water use during the same time as the impact and in the same basin or tributary." The Final Guidance for Determining Net Ecological Benefit (GUID-2094; Ecology 2019) states that, "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."

WRIA 7 includes the Snohomish River, the Snoqualmie River, the Skykomish River, and associated tributaries. It also includes streams draining directly to Puget Sound between the City of Mukilteo and the City of Everett, on the Tulalip Plateau, and in the Marysville Trough.

The methods used to delineate subbasins in WRIA 7 are summarized below.

SUBBASIN DELINEATION METHODS

GeoEngineers worked with the WRIA 7 – Snohomish WRE Committee to delineate subbasins for WRIA 7. The WRIA 7 WRE Committee considered existing subwatershed units for their subbasin delineation, including hydrologic unit codes, King County drainage basins, and the Snohomish Basin Protection Plan's Protection Planning Units.

- Hydrologic unit codes (HUCs) refer to the U.S. Geological Survey (USGS) delineation of watersheds into successively smaller hydrologic units (USGS 2013). The USGS uses a nationwide system based on surface hydrologic features. This system divides the country into 21 regions (2-digit), 222 subregions (4-digit), 370 basins (6-digit), 2,270 subbasins (8-digit), ~20,000 watersheds (10-digit), and ~100,000 subwatersheds (12-digit). A hierarchical HUC consisting of 2 additional digits for each level in the hydrologic unit system is used to identify any hydrologic area. HUC-12 is at the subwatershed level (12-digit) of HUCs and there are over 60 HUC-12 subwatersheds in WRIA 7.
- King County drainage basins are similar in size to HUC-12s, but do not exactly match the HUC-12 boundaries. They are a boundary layer developed by King County using LiDAR technology to delineate drainage basins. There are 23 King County drainage basins in the King County portion of WRIA 7.
- The Snohomish Basin Protection Plan (Protection Plan) was developed "to identify protection strategies that prevent the degradation of hydrologic processes that support salmon or salmon habitat" and is intended to set a framework for "implementation and accounting of protection efforts by all Basin partners." There are 17 Protection Planning Units in WRIA 7. Protection Planning Units were determined based on critical flows for chinook and focal stream reaches, considering areas with similar hydrology and land uses.

Subbasin Selection Considerations

The WRIA 7 Committee used existing HUC-12s, King County drainage basins, and Protection Planning Units and applied the following guiding principles to develop subbasin delineations:

- Align subbasins with the Protection Plan as closely as possible.
- Combine HUC-12s and King County drainage basins with lower projected growth of new homes using permit-exempt domestic wells.
- Keep distinct subbasins for HUC-12s and King County drainage basins with higher projected growth of new homes using permit-exempt domestic wells.
- Consider important salmon habitat and potential location of offset projects and actions.
- Consider streams with known low flow issues.
- Consider streams with year-round closures[1].

[1] The following streams have year-round closures in WAC 173-507: Griffen Creek, Harris Creek, Little Pilchuck Creek, May Creek, Patterson Creek, Quilceda Creek, Raging River, and Bodell Creek.

WRIA 7 Subbasin Delineation

The WRIA 7 subbasin boundaries are based on HUC-12 subwatersheds in the Snohomish County portion of the watershed and King County stream basin boundaries in the King County portion of the watershed. GeoEngineers used existing HUC-12 shapefiles from the USGS (2016) and stream basin shapefiles from King County (2018) to develop a map and GIS shapefile for the WRE Committee's subbasins. The following adjustments were made:

- The Allen Creek drainage was added to Quilceda HUC-12.
- The Snoqualmie mainstem King County drainage basin was split where the Tolt River enters the Snoqualmie River.
- Stream basin boundaries were shifted to align with the boundary between WRIA 7 and WRIA 8.
- HUC-12 boundaries were extended to the Puget Sound.
- Hat Island and Jetty Island, located in Tulalip Bay within Snohomish County and WRIA 7, were added to the Estuary/Snohomish Mainstem subbasin.

The WRIA 7 subbasin delineations are shown on Figure 1.

WRIA 7 Subbasins

- The North, Middle, and South Fork Snoqualmie stream basins are combined (Upper Snoqualmie).
- The Raging River is one subbasin **(Raging River).**
- Patterson Creek is one subbasin **(Patterson Creek).**
- The South Fork Tolt, North Fork Tolt, and Lower Tolt stream basins are combined with nearby stream basins Tokul Creek, Griffen Creek, and the southern half of the Snoqualmie mainstem drainage basin **(Snoqualmie South)**.
- The northern half of the Snoqualmie mainstem drainage basin is combined with Tuck Creek, Cathart drainages, and Ames Lake **(Snoqualmie North)**
- Cherry Creek and Harris Creek are combined into one subbasin **(Cherry/Harris)**.
- The South Fork and North Fork Skykomish tributaries are combined **(Upper Skykomish).** This includes the following HUC-12 subwatersheds and drainage basins:
    - Foss River, Miller River, Tye River, South Fork Skykomish River, Beckler River, Rapid River, Upper Beckler River, Lower South Fork Skyomish River, Lower North Fork Skykomish River, Middle North Fork Skykomish River, and Upper North Fork Skykomish River.
- Wallace River and Olney Creek are combined **(Lower Mid-Skykomish)**.
- Elwell Creek-Skykomish River and McCoy Creek-Skykomish River are combined **(Skykomish Mainstem)**.
- Woods Creek is one subbasin **(Woods Creek)**.
- Upper, Middle, and Lower Sultan River are combined **(Sultan)**.
- Upper and Lower Pilchuck River are combined **(Pilchuck)**.

- Little Pilchuck is one subbasin **(Little Pilchuck)**.
- The Allen Creek drainage, which is part of the Snohomish River – Frontal Procession Sound HUC-12 subwatershed, is combined with the Quilceda Creek HUC-12 subwatershed to create one subbasin **(Quilceda-Allen)**.
- The Snohomish River, Evans Creek, and French Creek are combined **(Estuary/Snohomish Mainstem).**
- Tulalip Creek is one subbasin **(Tulalip).**

NEXT STEPS

- The WRIA 7 WRE Committee agreed to use the proposed 16 subbasins to estimate potential permit-exempt well growth and consumptive use by subbasin. The Committee can revisit the subbasin delineations later in the planning process, if needed.

REFERENCES

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, p. 131.

King County, 2018. GIS Open Data, *Basin boundaries derived from terrain data, King County only / topo basin kc area*. https://gis-kingcounty.opendata.arcgis.com/datasets/basin-boundaries-derived-from-terrain-data-king-county-only-topo-basin-kc-area, December 3, 2018.

Snohomish County Surface Water Management, King County Snoqualmie Watershed Forum Staff, and Tulalip Tribes Natural Resources Department, 2015. *Snohomish Basin Protection Plan*. Snohomish Basin Salmon Recovery Forum, Everett, Washington.

U.S. Geological Survey and U.S. Department of Agriculture, Natural Resources Conservation Service, 2013. Federal Standards and Procedures for the National Watershed Boundary Dataset (WBD) (4 ed.). U.S. Geological Survey Techniques and Methods 11-A3, 63 p.

U.S. Geological Survey, 2016. USGS National Hydrography Dataset (NHD) Downloadable Data Collection - National Geospatial Data Asset (NGDA) National Hydrography Dataset (NHD): USGS - National Geospatial Technical Operations Center (NGTOC): Rolla, MO and Denver, CO. http://nhd.usgs.gov, http://viewer.nationalmap.gov/.

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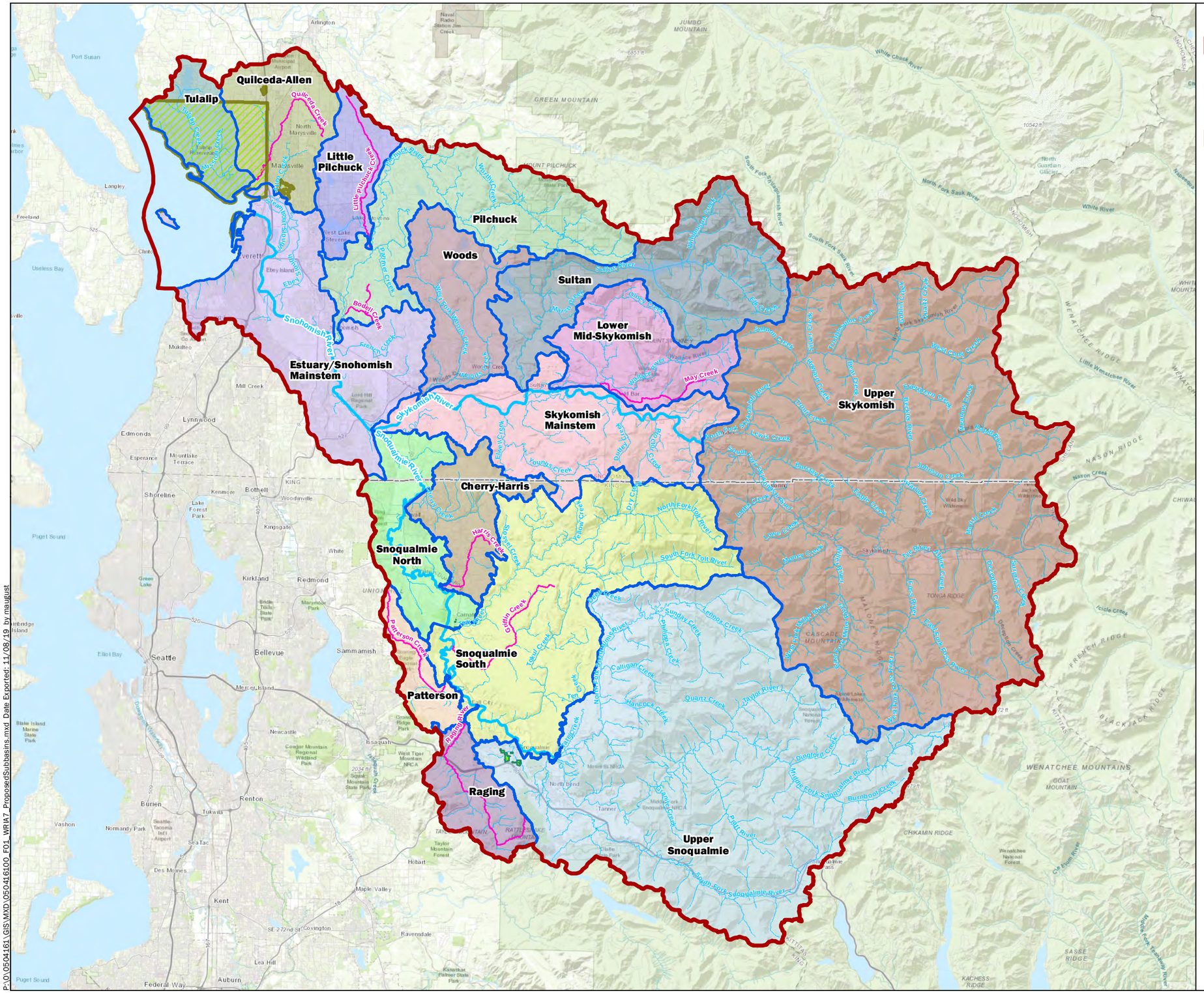
Attachment:
Figure 1. WRIA 7 – Snohomish Subbasin Delineation



Legend

- WRIA 7 Boundary
- Surface Water Closures[3]
- WRIA7 Proposed Subbasins
- Snoqualmie Tribe Reservation
- Tulalip Tribes Reservation

- Cherry-Harris
- Estuary/Snohomish Mainstem
- Little Pilchuck
- Lower Mid-Skykomish
- Patterson
- Pilchuck
- Quilceda-Allen
- Raging
- Skykomish Mainstem
- Snoqualmie North
- Snoqualmie South
- Sultan
- Tulalip
- Upper Skykomish
- Upper Snoqualmie
- Woods

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. Closed streams represent GeoEngineers' interpretation of the language in WAC 173-507 and this map is to only be used for planning purposes.

Data Source: ESRI Topographic Map Base

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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WRIA 7 - Snohomish Subbasin Delineation

Watershed Restoration and Enhancement Plan WRIA 7
Snohomish County, Washington

GeoEngineers

Figure 1

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GeoEngineers

Memorandum

17425 NE Union Hill Road, Suite 250, Redmond, WA 98052 Telephone: 425.861.6000, Fax: 425.861.6050 www.geoengineers.com

To:	Ingria Jones, Washington State Department of Ecology
From:	Bridget August and John Monahan (GeoEngineers, Inc.)
Date:	December 9, 2019
File:	00504-161-00
Subject:	WRIA 7 Growth Projections - DRAFT

INTRODUCTION

GeoEngineers, Inc. (GeoEngineers) is providing technical support to the Washington State Department of Ecology (Ecology) and the Watershed Restoration and Enhancement (WRE) Committees for Water Resource Inventory Areas (WRIAs) 7, 8 and 9. This memorandum provides a summary of the deliverable for Work Assignment GEO102, Task 3, WRIA 7 Growth Projections.

BACKGROUND AND CONTEXT

The Streamflow Restoration Act (SRA, Chapter 90.94 Revised Code of Washington) specifies that by June 30, 2021, Ecology must establish a WRE Committee and adopt a WRE Plan in the Snohomish Watershed (WRIA 7). The WRE Plan needs to address impacts on streamflows from consumptive use from new domestic permit-exempt wells anticipated between January 19, 2018 and January 18, 2038.

The WRE Plan must estimate growth projections for the watershed for January 2018 through January 2038 (at a minimum). Based on the projected growth, the plan will estimate the amount of rural growth and associated water use from new permit exempt well connections.

Ultimately, WRE Plan growth projections need to address the following two primary questions:

1. How many new permit-exempt domestic well connections (PE wells[1]) could be installed throughout the watershed over the next 20 years?
2. Where could the PE sourced growth occur at the subbasin level?

WRIA 7 includes parts of unincorporated King and Snohomish County and 18 incorporated cities and towns. The methods used to estimate the number and location of new wells in unincorporated and incorporated areas in WRIA 7 are summarized below.

[1] "PE wells" is used to refer to new homes associated with new permit-exempt wells and also new homes added to existing wells, including homes on group systems relying on permit-exempt wells.

GROWTH PROJECTION METHODS

GeoEngineers worked with the WRIA 7 – Snohomish WRE Committee to define growth projection methods and growth projections for WRIA 7. The WRIA 7 growth projection methods included using King and Snohomish County historical building permit and year-built data to predict potential PE well growth over the 20-year planning horizon. This methodology assumes that the rate and general location of past growth will continue over the 20-year planning horizon. Using past building permits to predict future growth is one of Ecology's recommended methods (Ecology 2019). King and Snohomish County completed their analyses in-house and the methods are described in detail in Attachments A and B, respectively, and summarized below.

GeoEngineers also completed an analysis of potential PE well growth within the incorporated and unincorporated Urban Growth Areas (UGAs) using Ecology's well log database. The methods and assumptions are also described below and GeoEngineers data tables are included in Attachment C.

In addition, King County also completed a PE Well Potential Assessment which identified potential parcels where growth could occur within rural King County. Snohomish County completed a similar assessment which they have referred to as a Rural Capacity Analysis. The PE Well Potential Assessment and Rural Capacity Analysis results were used to assess whether a subbasin (as identified by the WRE Committee) has the capacity to accommodate the number of PE wells in the 20-year growth projection. In those areas where the number of projected PE wells exceeded the potential parcels available, the wells were reallocated to the nearest subbasin with similar growth patterns and parcel capacity. The King County PE Well Potential methods are described in Attachment A and summarized below. The Snohomish County Rural Capacity Analysis methods are described in Attachment B and summarized below. The assumptions King and Snohomish County used for these analyses are included in Attachment D.

King County Unincorporated Area Past Trends Analysis

King County elected to complete the WRIA 7 historic growth analysis for the King County portion of the WRIA in-house using 2000 to 2017 building permit data from the King County Assessor's office. The analysis was completed to estimate the number of recently built homes that relied on PE wells as their water source in unincorporated King County, both inside and outside of water service areas. GeoEngineers then used the King County historic growth results to estimate the number of potential new PE wells per subbasin over the 20-year planning horizon. This method is referred to as the King County Past Trends Analysis and the general methodology used was as follows:

King County:

- Obtain available King County building permit and parcel data (2000 to 2017).
- Use centroid of parcel data to determine location information (e.g. WRIA, inside or outside water district service areas, King County stream basin, WRIA 7 subbasin, etc.).
- Link building permit data and parcel data.
- Use King County building permit parcel attribute data to determine public versus private water source (private water sources are PE wells).

- Determine the number of building permits that are:
  - Public (pub) water
  - Private (pvt) water (PE wells)
  - Other (unknown/null)
    - The "other" category includes parcels listing their water source as "unknown" (likely vacant land) and where building permit data and parcel attribute data did not match. King County used the "other" category to calculate an error of 6 percent (of the total number of building permits).
- Calculate the percentage of building permits for each type of water source (pub, pvt or other).

GeoEngineers:

- Use the annual average number of permits per year multiplied by the past percentage of growth per subbasin and percentage of building permits using a private water source (well) per subbasin to determine a projected number of PE wells per year for each subbasin.
- Multiply the number of PE wells per year per subbasin by 20 to calculate the estimated total of PE wells projected over the 20-year planning horizon for each subbasin.
- Add 6 percent error to 20-year growth projections per subbasin (error is based on the "other/null" category as described above).
- Tabulate the total growth projected over the 20-year planning horizon, including the 6 percent error, for each subbasin and sum to get the total of PE wells projected over the 20-year planning horizon in rural unincorporated King County.

King County historic growth projection data tables are provided in Attachment A for reference. King County used the time period 2000 through 2017 because those data were available. The building permit data for 2000 through 2017 includes both periods of high growth and periods of low growth. King County compared this data with information from Vision 2040 and population data and is confident in using the average of this time period to project into the future. This methodology assumes that the rate and location of past growth will continue over the 20-year planning horizon.

Snohomish County Unincorporated Past Trends Analysis

Snohomish County elected to complete the WRIA 7 growth projection analysis for the Snohomish County portion of the WRIA in-house. Snohomish County developed two growth projection scenarios by: 1) looking at past development trends in PE well areas for each HUC12[2] within its portion of WRIA 7 and using those trends to estimate the number and location of new homes over the planning horizon, and 2) using population projections from the Snohomish County 2015 Comprehensive Plan to estimate the number and location of new homes relying on wells over the planning horizon. The subbasins in the Snohomish County portion of WRIA 7 generally correspond to individual HUC12s or an aggregation of multiple HUC12s (Attachment B) and, for the purpose of growth projections in WRIA 7, the terms are used interchangeably. Similarly, the term "Housing Unit (HU)" refers

[2] HUC 12 is a level of Hydrologic Unit Code.

to a new home or new single-family residence that would rely on a PE well. The following sections will refer to HUs and PE wells per subbasin, for consistency.

In addition to the growth projection scenarios, Snohomish County developed a Rural Capacity Analysis that identified the total number of parcels that could be developed with a home relying on a PE well in each subbasin. The Rural Capacity Analysis was used to identify whether the number of available parcels that could be developed with homes relying on a PE well could accommodate the projected growth in each subbasin.

At the request of the WRE Committee, GeoEngineers developed a third growth projection scenario using the population growth rate from the 2012 Office of Financial Management (OFM) high population forecast for Snohomish County.

The WRE Committee discussed the three scenarios and agreed to move forward with the first scenario, the Snohomish County Past Trends Analysis, as the 20-year growth projection method for the Snohomish County portion of WRIA 7. The general methodology is as follows:

- Obtain available year-built data from the Snohomish County Assessor's Office for all new single-family residences (i.e. HUs) in the WRIA built between 2008 and 2018.
- Use parcel data to determine location information (e.g. WRIA, cities, UGAs, national and state forest lands, government property, tribal lands, subbasin, etc.).
- Assign the 2008-2018 HUs to "Public Water Service Areas" or "P_E Well areas" based on the distance to existing water mains (data derived from water system comprehensive plans).
    - HUs designated to "Public Water Service Areas" (i.e. will not rely on a PE well) include:
        - New homes that are not part of a subdivision and any portion of the property boundary is located within 100 feet of a water main.
        - New homes that are part of a rural cluster subdivision (RCS) and located within ¼ mile of a water main.
    - All other HUs designated to "P_E Well areas."
- Determine the number of HUs per subbasin for each type of water source (Public Water Service Areas and P_E Well Areas).
- Calculate the percentage of HUs per subbasin for each type of water source.
- Divide the total number of HUs for WRIA 7 by 11 to calculate the average number of SFRs per year over the past 11 years (2008-2018).
- Multiply the average number of HUs per year by 20 to calculate the estimated total of HUs projected over the 20-year planning horizon for rural unincorporated Snohomish County.
- Apply HU projections to WRIA 7 subbasins based on the past percentage of growth per subbasin and past percentage of HU for each type of water source.
- The projection of HUs located within P_E Well Areas represents the total number of PE wells projected over the 20-year planning horizon in rural unincorporated Snohomish County.

Snohomish County historic growth projection data tables are provided in Attachment B for reference. Year-built data was derived from the County's permit data as provided to the Assessor by Snohomish County Planning and Development Services (PDS) and includes all new single-family residences in the WRIA built between 2008 and 2018, located outside of cities, UGAs, national and state forest lands, government property and tribal lands. Snohomish County used the time period 2008 through 2018 because those data were available. This methodology assumes that the rate and location of past growth will continue over the 20-year planning horizon.

GeoEngineers UGA Well Log Spot Check

As described above, the King and Snohomish County Past Trends Analysis focused on the potential for PE wells to be installed within rural, unincorporated King and Snohomish Counties. The King and Snohomish County methods do not account for potential PE wells in cities or UGAs. However, early in the growth projection planning process, the WRIA 7 WRE Committee recommended looking at potential growth within UGAs. GeoEngineers completed an analysis of potential PE well growth within the incorporated and unincorporated UGAs using Ecology's Washington State Well Report Viewer database. The general methodology used was as follows:

- Obtain tabular and spatial data from Ecology's Washington State Well Report Viewer database (1998 through 2018). Ecology's complete Well Report Viewer database was filtered for water wells greater than 30 feet deep and 6- to 8-inch-diameter, which are typical depths and dimensions for domestic wells. Ecology does not have the ability to filter for permit-exempt domestic wells. Information in the database is based on records submitted by the well driller.
- Filter database for wells located within UGAs. Note that well locations were estimated to the nearest ¼-¼ section.
- Review randomly selected water well reports and note the well type (e.g. domestic, industrial, municipal, irrigation, test well, or other), and well location (physical address and/or parcel number).
- Determine the number of wells that were:
  - Domestic (assumed to be PE Wells)
  - Irrigation
  - Other (test, municipal, dewatering, industrial, mitigation, UIC, deepened or refurbished wells)
  - Incorrect (location, date, etc.)
- Calculate the percentage of each type of well (domestic, irrigation, other and incorrect).
- Multiply the percentage of domestic wells by the total number of wells located within UGAs to estimate the number of domestic wells installed over the past 20-year period.
- Cross-check the physical address of the wells with the UGA boundary to determine which subbasin the domestic wells were located in.
- Multiply the total number of domestic wells per subbasin by 20 to calculate the estimated number of PE wells located within the UGA projected over a 20-year period for each WRIA 7 subbasin.

UGA well log spot check data tables are included in Attachment C.

King County PE Well Potential Assessment

King County also completed a PE Well Potential Assessment which evaluated the parcels available for future growth in unincorporated King County. The purpose of the PE Well Potential Assessment was to determine if there would be enough parcels to accommodate the 20-year growth projection at the WRIA and subbasin level. In those areas where the number of projected PE wells exceeded the potential parcels available, GeoEngineers reallocated those wells to the nearest subbasin with similar growth patterns and parcel capacity. The general methodology used was as follows:

King County:

- Use assumptions and screening criteria to identify parcels with potential for future growth by subbasin. A table of assumptions made by King County are provided in Attachment D.
- Use centroid of parcel data to determine location information (e.g. WRIA, inside or outside water district service areas, WRIA 7 subbasin, etc.).
- Use King County parcel attribute data to determine total number of parcels and dwelling units per subbasin. A dwelling unit (DU) is a rough estimate of subdivision potential based on parcel size and zoning (e.g. a 22-acre parcel zoned RA-5 is assumed to have 4 dwelling units).
- Determine the number of parcels and dwelling units that would be inside or outside water district service boundaries.
- Calculate water use projections for public connections and PE sourced parcels:
  - Public connection parcels would be those located within water district service boundaries and were calculated based on historic rates of connection to public water within each subbasin.
  - The remaining number of parcels located within water district service boundaries that exceeded the historic rate of public water connection were assigned to be PE sourced (e.g. served by a PE well).
  - PE sourced parcels were calculated based on the number of parcels located outside water district service boundaries plus the remaining parcels from “inside” water district boundaries, as described above.
- Calculate the shortfall or surplus of available parcels to be sourced by PE wells by taking the total PE sourced DUs minus the 20-year growth projection from the King County past trends analysis.

GeoEngineers:

- If the projected PE well growth exceeds the total number of available PE sourced parcels, reallocate shortfall to adjacent subbasin with similar growth patterns and parcel capacity.

King County used historic rates of connection to water service because the County does not have county-wide information on the location of water lines. King County PE well potential data tables are included in Attachment A.

Snohomish County Rural Capacity Analysis

Snohomish County completed a Rural Capacity Analysis in 2011 that resulted in an assigned future capacity for each parcel in the rural area. Snohomish County updated their 2011 analysis for the purpose of WRE planning to determine if there would be enough parcels to accommodate the 20-year growth projection at the WRIA and subbasin level. In those areas where the number of projected PE wells exceeded the potential parcels available, GeoEngineers reallocated those wells to the nearest subbasin with similar growth patterns and parcel capacity. The general methodology used was as follows:

Snohomish County:

- Use assumptions and screening criteria to identify parcels with potential for future growth by subbasin. A table of assumptions made by Snohomish County are provided in Attachment D.
- For each parcel, obtain or calculate total acres, buildable acres, percent buildable acres and density based on land use designation (i.e. HUs per acre).
- Assign development status (e.g. vacant, partially used or re-developable).
- Calculate basic capacity based on development status and density (e.g. if vacant, future capacity = total acres x density).
- Deduct new HUs built after 2011 from the 2011 available capacity to create an estimate of the capacity remaining as of 2019.
- Assign parcels to "Public Water Service Areas" or "P_E Well Areas" per the methodology described in the Past Trends Analysis.
- Aggregate capacity data by subbasin. Parcels located on HUC boundaries were assigned based on the centroid of the parcel.
- Calculate the shortfall or surplus of available parcels to be sourced by PE wells by taking the total PE sourced parcels (P_E Well Areas) minus the 20-year growth projection from the Snohomish County past trends analysis.

GeoEngineers:

- If the projected PE well growth exceeds the total number of available PE sourced parcels, reallocate shortfall to adjacent subbasin with similar growth patterns and parcel capacity.

The parcels included in the Snohomish County Rural Capacity Analysis were selected based on a set of assumptions, which are outlined in Attachment D. The Snohomish County Rural Capacity methods and data tables are included in Attachment B.

GROWTH PROJECTON RESULTS

The King and Snohomish County Past Trends Analysis and GeoEngineers UGA Well Log Spot Check results were combined to determine the total number of projected PE wells per subbasin within WRIA 7. Using the King County PE Well Potential Assessment and Snohomish County Rural Capacity Analysis, total growth was reallocated to adjacent subbasins where potential growth in the unincorporated area exceeded the number of PE sourced parcels available for future growth. The results are summarized in Table 1 and shown on Figure 1.

GeoEngineers estimates 3,389 new permit-exempt domestic well connections in WRIA 7 over the 20-year planning horizon. The following is a brief summary of the calculations used to complete the WRIA 7 growth projection analysis:

- King County used the average number of building permits per year (104) for the 18-year period from 2000 to 2017, multiplied by the historic percentage of homes using PE wells (44.7 percent) to determine a projected number of new PE wells per year (46) in the WRIA 7 portion of rural unincorporated King County. The number of PE wells per year (46) was then multiplied by 20 to determine the estimated total of PE wells projected over the 20-year planning horizon (926) for rural unincorporated King County. (Note that due to rounding, the total number is 926).
- To estimate the 20-year PE well projection per subbasin, GeoEngineers used the average number of building permits per year (104), multiplied by the historic distribution of growth per subbasin. The average building permits per subbasin was then multiplied by the historic percentage of homes using PE wells to estimate the average number of PE wells per year per subbasin. The number of PE wells per year per subbasin was then multiplied by 20 to calculate the estimated total of PE wells over a 20-year period per subbasin. A 6 percent error was then added to each subbasin total. The total number of estimated PE wells, including the 6 percent error, is 980. See Attachment A for detailed results.
- Snohomish County used the total number of HUs built during the 11-year period from 2008-2018 (238), divided by 11 to determine the average number of HUs built per year (249) for rural unincorporated Snohomish County. The average number of HUs per year (249) was multiplied by 20 to estimate the total number of HUs projected over the 20-year planning horizon (4,980) for the Snohomish County portion of WRIA 7.
- The total number of HUs (4,980) was then multiplied by the historic percentage of HUs in P_E Well Areas per subbasin. The number of HUs in P_E Well Areas per subbasin was added together to determine the estimated total of PE wells (equivalent to HUs in P_E Well Areas) over a 20-year period in rural unincorporated Snohomish County (2,059).
- GeoEngineers also completed a UGA Well Spot Check for wells from the Ecology Well Report Viewer database that plot within the Urban Growth Area. When wells were plotted in WRIA 7, 126 wells were located within the UGA for 1998 through 2018. GeoEngineers checked about 61 percent of the wells by looking at the well logs and noting whether the wells were identified as being for domestic, irrigation, or other purposes (e.g. test, industrial, errors, etc.). About 30 percent of the wells were for domestic use.
- GeoEngineers took the number and distribution of wells from the 1998-2018 data and projected the same rate and distribution per subbasin for the 20-year planning horizon. The estimated number of PE wells within the UGA over the 20-year period is 38. See Attachment C for detailed results.
- King County completed a PE Well Potential Assessment and Snohomish County completed a Rural Capacity Analysis to determine whether a subbasin has capacity for the number of wells in our 20-year projection.
- The PE Well Potential Assessment showed a capacity shortfall of 22 parcels in the Upper Snoqualmie subbasin. Therefore, 22 of the projected PE wells in the Upper Snoqualmie subbasin were reallocated to the adjacent Snoqualmie South subbasin.

- The Snohomish County Rural Capacity Analysis did not show a capacity shortfall in any of the subbasins within the Snohomish County portion of WRIA 7. However, the Snohomish County past trends projection was modified by GeoEngineers based on information provided by the Snohomish County, Ecology, and the Tulalip Tribes.

- GeoEngineers added 275 new permit-exempt well areas to Snohomish County's Past Trends Analysis estimate based on the following assumptions:

    - Half of the projected growth for water service areas in the Quilceda-Allen subbasin (26) will use PE wells (part of the Quilceda area has water provided by Marysville/City of Everett and part of the area is within Seven Lakes water system service area, which is unable to extend service to new customers at this time).

    - All of the growth forecast for water service areas in the Tulalip subbasin (249) will use PE wells to account for the inability of the Seven Lakes water system to expand service at this time. The total exceeds the PE well areas, since it includes the potential for PE wells in the water service area.

    - Includes estimate of 20 potential new PE wells on Tulalip Tribal owned lands in the Quilceda-Allen subbasin and 15 potential new PE wells on Tulalip Tribal owned lands in the Tulalip subbasin.

TABLE 1. GROWTH PROJECTIONS FOR NEW PE WELLS IN WRIA 7 – SNOHOMISH 2018 TO 2038

Subbasins	King County Past Trends[1]	Snohomish County Past Trends[2]	UGA Well Log Spot Check[3]	Total PE Wells[4] per Subbasin[5]
1 - Tulalip	--	468	0	468
2 - Quilceda-Allen	--	330	8	338
3 - Estuary/Snohomish Mainstem	--	322	9	331
4 - Little Pilchuck	--	289	5	294
5 - Pilchuck	--	278	2	280
6 - Woods	--	224	0	224
7 - Sultan	--	53	2	55
8 - Lower Mid-Skykomish	--	60	0	60
9 - Skykomish Mainstem	0	183	2	185
10 - Upper Skykomish	48	53	2	103
11 - Cherry-Harris	200	11	3	214
12 - Snoqualmie North	240	98	0	338
13 - Snoqualmie South	147	0	0	147
14 - Patterson	104	--	0	104
15 - Raging	73	--	2	75
16 - Upper Snoqualmie	168	--	5	173
Totals	980	2,369	40	3,389

Notes:

1 = Based on 20-year estimate of potential new PE wells in unincorporated King County, plus 6% error.

2 = Based on 20-year estimate of potential new PE wells in unincorporated Snohomish County using the "past trends scenario." Assumes half of the projected growth for water service areas in the Quilceda-Allen subbasin (26) will use PE wells (part of the Quilceda area has water provided by Marysville/City of Everett.) Assumes all of the growth forecast for water service areas in the Tulalip subbasin (249) will use PE wells to account for the inability of the Seven Lakes water system to expand service at this time. The total exceeds the PE well areas, since it includes the potential for PE wells in the water service area. Includes estimate of 20 potential new PE wells on Tulalip Tribal owned lands in the Quilceda-Allen subbasin and 15 potential new PE wells on Tulalip Tribal owned lands in the Tulalip subbasin.

3 = Based on spot-check of Ecology Well Report Viewer database. Accounts for potential wells within the incorporated and unincorporated Urban Growth Areas (UGAs) over the 20-year planning period.

4 = "PE Wells" is used to refer to new homes associated with new permit-exempt wells and also new homes added to existing wells on group systems relying on permit-exempt wells.

5 = Includes redistribution of 22 wells from Upper Snoqualmie subbasin to Snoqualmie South subbasin in the King County portion of WRIA 7.

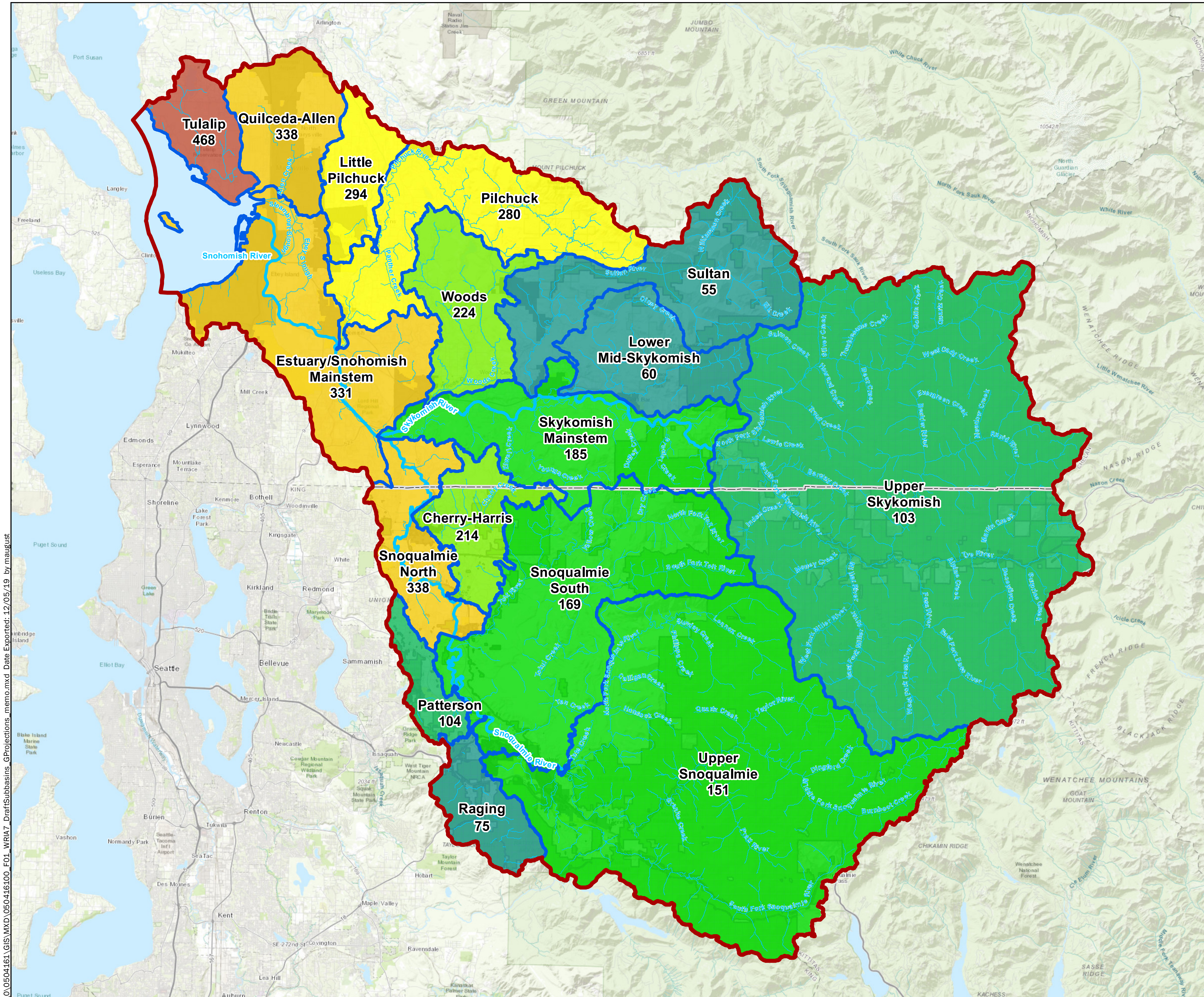
NEXT STEPS

- The WRIA 7 WRE Committee agreed to move forward with the WRIA planning process using 3,389 as the WRIA 7 20-year PE well growth projection without holding a formal vote. The Committee can revisit the growth projections later in the planning process, if needed.
- The Committee can also decide to apply an additional "safety factor" after estimating consumptive use.

REFERENCES

Department of Ecology, 2019. Final Guidance for Determining Net Ecological Benefit, GUID-2094 Water Resources Program Guidance. Washington State, Department of Ecology, Publication 19-11-079, p. 131.

Attachments:
Figure 1. WRIA 7 Distribution of Projected Permit-Exempt Wells 2018-2038
Attachment A. King County Growth Projections and Permit Exempt Well Potential Methods and Data Tables
Attachment B. Snohomish County Growth Projections and Rural Capacity Analysis Methods and Data Tables
Attachment C. GeoEngineers UGA Well Log Spot Check Data Tables
Attachment D. King and Snohomish County PE well Potential Assessment and Rural Capacity Analysis Assumptions Matrix



Legend

- WRIA 7 Boundary
- WRIA7 Proposed Subbasins

Washington State City Urban Growth Areas 2018

- Unincorporated
- Incorporated

Estimated Permit-Exempt Well Potential

- 0
- 1 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 250
- 251 - 300
- 301 - 350
- 351 - 400
- 401 - 450
- >450

Projected WRIA 7 PE Well Total = 3,389

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI Topographic Map Base

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

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WRIA 7 Distribution of Projected Permit-Exempt Wells 2018-2038

Watershed Restoration and Enhancement Plan
Snohomish and King Counties, Washington

GEOENGINEERS

Figure 1

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ATTACHMENT A

King County Growth Projections and Permit Exempt Well Potential Methods and Data Tables

King County - Unincorporated WRIA 7 Growth Projections

Draft 10/17/19

WRIA (Ecology Coverage)	(KC building permiting data)			permits
	2000-2009	2010-2017	total	per year
7	1495	369	1864	104

% of county-wide total
32%

WRIA 7	PE/yr	20 yr est
Future PE wells	46	926

Water District info	2000-2009	2010-2017	total
total	1495	369	1864
wtr dst (within water district)	1349	342	1691
no dst (outside water district)	146	27	173

APD	permits	% of WRIA total
WRIA 7	51	3%

FPD	permits	% of WRIA total
WRIA 7	29	2%

Historic		
Percentages	pub	0.490
	pvt	0.447

Water service info	(derived from KC parcel attribute data)		
public water system (pub)	762	152	914
well - private water (pvt)	706	127	833
other	27	90	117
total	1495	369	1864

Existing	2000-2009	2010-2017	
PE wells	706	127	833
error	2%	24%	6%

WRIA 7 - Snohomish - Historic Growth and Water Use by Sub-basin

Sub-basin delineation *v.17Oct2019*

Sub-basin (# of stream basins)	Number of permits	Distribution of growth
Snoqualmie - North (3)	399	21%
Cherry/Harris (2)	354	19%
Snoqualmie - South (6)	251	13%
Patterson (1)	310	17%
Raging (1)	90	5%
Upper Snoqualmie (4)	412	22%
Upper Skykomish (5)	48	3%
total	1864	100%

Water use by basin

pub	pvt	oth	%pub	%pvt
163	204	32	41%	51%
162	170	22	46%	48%
107	125	19	43%	50%
208	88	14	67%	28%
20	62	8	22%	69%
250	143	19	61%	35%
4	41	3	8%	85%
914	833	117	total	1864

WRIA 7 - 20 year PE Well Projection by Subbasin

permits/year 104

Calculations based on GeoEngineers work:

Permits per year	Wells per year (pvt)	Wells per year + 6% error	Total wells in 20 years + 6%	**20 year well total + 6% (rounded)**	Sub-basin	Distribution of PE Wells
22.2	11.3	12.0	240.3	**240**	Snoqualmie - North	24%
19.7	9.4	10.0	200.2	**200**	Cherry/Harris	20%
13.9	6.9	7.4	147.2	**147**	Snoqualmie - South	15%
17.2	4.9	5.2	103.6	**104**	Patterson	11%
5.0	3.4	3.7	73.0	**73**	Raging	7%
22.9	7.9	8.4	168.4	**168**	Upper Snoqualmie	17%
2.7	2.3	2.4	48.3	**48**	Upper Skykomish	5%
104	46	49	981.1	**980**		

WRIA 7 - Permit-Exempt Well Potential Assessment

Assessment of potential parcels for future growth *v:17Oct2019*

Sub-basin (number of stream basins)	Number of parcels	Number of Dwelling units (DU)	Water district boundaries: located inside parcels	located inside DU	located outside parcels	located outside DU
Snoqualmie - North (3)	348	547	280	453	68	94
Cherry/Harris (2)	421	702	264	409	157	293
Snoqualmie - South (6)	304	627	252	502	52	125
Patterson (1)	223	342	210	323	13	19
Raging (1)	116	141	105	128	11	13
Upper Snoqualmie (4)	251	347	238	331	13	16
Upper Skykomish (5)	163	227	0	0	163	227
total	1826	2933	1349	2146	477	787

Sub-basin	Water Use Projection: public connection parcels	public connection DU	PE sourced parcels	PE sourced DU	20 year well total + 6% (rounded)	Shortfall *(red if present)* in 20 year well projection	**Redistribution - 20 year well projection***
Snoqualmie - North	114	185	234	362	240	122	240
Cherry/Harris	121	187	300	515	200	315	200
Snoqualmie - South	107	214	197	413	147	266	**169**
Patterson	141	217	82	125	104	21	104
Raging	23	28	93	113	73	40	73
Upper Snoqualmie	144	201	107	146	168	***-22***	**146**
South Fork Sky	0	0	163	227	48	179	48
total	651	1032	1175	1901	980	---	980

total parcels 1826 | total DU 2933

*Moves 22 projected PE wells from Upper Snoqualmie subbasin to Snoqualmie - South Subbasin to account for a shortfall in available dwelling units in Upper Snoqualmie subbasin.

ATTACHMENT B

Snohomish County Growth Projections and Rural Capacity Analysis Methods and Data Tables

Snohomish County Methodology – housing unit growth forecasts by WRIA

1) Using year-built statistics from the Assessor database. This data is derived from the county's permit data as provided to the Assessor by Planning and Development Services (PDS).
    a. All new single-family residences (SFRs) in the WRIA (by HUC 12) built between 2008 and 2018, located outside of the cities, UGAs, national and state forest lands, government property and tribal lands.
2) Assigning the 2008-2018 SFRs to "Public Water Service Areas" or to "P_E Well areas"
    a. Depending on distance to existing water main – water main data is derived from system comprehensive plans:
        i. New homes not part of a subdivision located within 100' of a water main.
            1. 100' is selected due to lot sizes in the rural area, cost to extend water service, buy-in from rural water utilities as a reasonable assumption, and requirements in the county's draft water code.
        ii. New homes that were part of a rural cluster subdivision (RCS) within ¼ mile
            1. As of April, 2009, this is a requirement in county code for rural cluster subdivisions – (however, most RCS that have been built were grandfathered to the previous rules which did not include this requirement to connect to public water)
3) The distribution of future growth by WRIA and by HUC12 is assumed to mirror the distribution observed from past growth using (1) a straight line forecast, and (2) a forecast based on an adopted control total. The number of new homes expected over the next twenty years looks at two options:
    a. A straight line forecast based on the past housing unit change: average annual change 2008-2018 extended out an additional 20 years;
    - or -
    b. Housing Unit forecast based on County-adopted growth targets (2015 comprehensive plan), urban/rural growth share policy and observed (2008-2018) growth shares for each WRIA. Table 1 shows HU forecasts by WRIA for "PE Well Areas" and "Water Service Areas."

Table 1-2015 Comprehensive Plan Growth Forecast: Urban/Rural Growth Share and Projected New Housing Units in PE Well and Water Service Areas by WRIA

2015 Snohomish County Comp Plan			**Snohomish County population growth forecast (Pop. Change) 2018 to 2038**	**2016 Countywide Planning Policy Population Allocation**		**Rural/Resource growth share by WRIA (Based on rural growth share) 2008-2018**		
2011	**Adopted Growth Target 2035**	**Avg. Annual increase 2011-2035**		**Urban share 92.1%**	**Rural share 7.9%**	**WRIA 3 & 5 (33%)**	**WRIA 7 (62%)**	**WRIA 8 (5%)**
717000	955257	9927	198548	182862	**15685**	5176	9725	784
New Housing Units (HUs) by WRIA 2018-2038: (Rural Avg HU size* = 2.75)						1882	**3536**	**285**
Allocation of NEW HU based on SnoCounty Model for likely "Water Service Areas" and "P-E Well Areas"			Total Available HU Capacity (Sheet 1)				13994	646
			Growth Share in "Water Service Area" (Sheet 1)				59%	52%
			Growth Share in "P-E Well Area" (Sheet 1)				41%	48%

	New HU in "Water Service Area" 2018- 2038		2086	148
	New HU in "P-E Well Area" 2018- 2038		**1450**	**137**

* Rural Avg Housing Unit (HU) size is based on adopted growth targets; based on Population and HU increase 2011-2035.

Parcels included in the future capacity analysis were selected based on the following criteria:

1) All parcels .5 acre or larger marked as "vacant", or with "0" or "Null" in the improvement value field in the Assessor data base located within the unincorporated rural and resource areas (outside of cities and outside of the unincorporated UGA) –
   a) Includes agricultural areas and private forest lands (non-state and non-federal). Does not include tribal lands within the Tulalip Reservation – development in this area is under Tribal planning and jurisdiction.
   b) The lot size of .5 acre or larger will likely meet requirements for accommodating both a well and a septic system (sewer hook-up is not allowed outside the UGA). Wells and septic systems must be separated from each other a specified distance – this includes separation on a single parcel and from the systems on adjacent parcels. Lots under .5 acre in size are somewhat unusual in the rural area due to zoning code – most likely to occur as lot fragments created by right-of-way, or located around lakes due to legacy zoning (Waterfront Beach = WB).
   c) Within cities and UGAs, residential lot sizes are small (typically the minimum necessary to meet front, back and side yard setback requirements) and public water and sewer are available. The likelihood of new permit-exempt wells for domestic use is very low and possibly zero. County data since the state legislation was passed (RCW 90.94) in January 2018, shows that there have been zero new wells inside the unincorporated UGA; 99 new wells outside of the UGA. Cities typically report that new wells for domestic use are not allowed within city limits.
2) All parcels that are underdeveloped and large enough to subdivide (i.e. one house on ten or twenty acres in an R-5 acre zone)
3) All subdividable parcels where assumed to develop using the rural cluster option – this option achieves the highest density.
4) Parcels were assigned to "Public Water Service Areas" or to "P_E Well areas" per the methodology described above.
5) Land capacity analysis conducted in 2011 was used to assign the number of new housing units that could potentially be built on each parcel. This analysis considered future land use designation from the comprehensive plan with reductions for critical areas.
6) Capacity data was aggregated by HUC12 assigning parcels on HUC boundaries according to parcel centroid.
7) At the HUC12 level, new housing units built after 2011 were deducted from the 2011 available capacity to create an estimate of the capacity remaining as of 2019.

2011 Rural Capacity Analysis

The rural capacity analysis conducted using the 2011 Assessor data resulted in an assigned future capacity for each parcel in the rural area. It should be noted that this analysis of the rural area employed a similar, but less robust model than is used to determine future capacity within the UGAs.

The rural land capacity analysis is summarized as follows:

1) For each parcel the following data was obtained or calculated:
    a. Total acres
    b. Buildable acres (total acres less critical areas)
    c. Percent buildable acres (buildable / total) – if percent buildable is less than 35%, additional capacity is reduced per "f" below.
    d. Density based on land use designation (dwelling units per acre)
        i. For land use designations where Rural Cluster Subdivisions are allowed, density assumes maximum potential under RCS.
    e. Development status was assigned:
        i. Vacant = Improvement value less than $2000
        ii. Partially used = existing home and less than 1000 sq ft commercial
        iii. Redevelopable = improvement value / land value ratio is less than 1
    f. Calculate basic capacity:
        i. If vacant, future capacity = total acres * density (dwelling units/acre)
        ii. If partially used or redevelopable, future capacity = total acres * density – existing dwelling units (DUs)
        iii. If buildable area is less than 35% of total area, capacity is reduced to 75% and will be reduced further if buildable area is less than 20% (50% capacity); and further still if less than or equal to 10% (.25%)
        iv. If buildable area is zero, capacity is assigned as 1 (reasonable use criteria per property rights laws)
        v. Old substandard lots over ½ acre not otherwise accounted for in above steps, capacity = 1
        vi. Assign 0 new residential capacity for:
            1. Areas where residential is not allowed
            2. Existing use codes are incompatible with residential
            3. Government property
            4. Open space or Native Growth Protection Area (NGPA)
            5. Land value is less than $500
            6. Conservation Futures restrict residential development
            7. Other development moratoriums related to potable water availability
        vii. Pending project capacity from actual project applications

SNOHOMISH COUNTY WRIA 7 - HUC 12 Name	Growth Forecast Scenarios - New Homes						2019 Available Capacity			Capacity Surplus or Shortfall Current Trends Scenario			Capacity Surplus or Shortfall Comp Plan Targets		
	Current Trends			V 2040 Comp Plan Targets											
	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas
Little Pilchuck River	525	236	289	373	168	205	2142	834	1308	1617	598	1019	1769	666	1103
Quilceda Creek (1)	302	51	251	214	36	178	1213	466	747	911	415	496	999	430	569
Lower Pilchuck River	789	560	229	560	397	163	2309	1488	821	1520	928	592	1749	1091	658
Woods Creek	713	489	224	506	347	159	1904	1206	698	1191	717	474	1398	859	539
Tulalip Creek - Frontal Possession Sound (1)	453	249	204	321	177	145	603	379	224	150	130	20	282	202	79
French Creek	416	293	124	296	208	88	1093	904	189	677	611	65	797	696	101
Snohomish River - Frontal Possession Sound	480	362	118	341	257	84	574	382	192	94	20	74	233	125	108
Elwell Creek - Skykomish River	149	33	116	106	23	83	593	156	437	444	123	321	487	133	354
Evans Creek - Snohomish River	333	220	113	236	156	80	889	659	230	556	439	117	653	503	150
Peoples Creek - Snoqualmie River	116	18	98	83	13	70	404	50	354	288	32	256	321	37	284
McCoy Creek - Skykomish River	91	24	67	65	17	48	297	60	237	206	36	170	232	43	189
Wallace River	78	18	60	55	13	43	454	182	272	376	164	212	399	169	229
Lower Sultan River	145	93	53	103	66	37	254	82	172	109	-11	119	151	16	135
Upper Pilchuck River	327	278	49	232	197	35	1012	800	212	685	522	163	780	603	177
Lower South Fork Skykomish River	38	0	38	27	0	27	96	0	96	58	0	58	69	0	69
Lower North Fork Skykomish River	15	0	15	10	0	10	70	0	70	55	0	55	60	0	60
Cherry Creek - SnoCo Portion	11	0	11	8	0	8	35	0	35	24	0	24	27	0	27
Olney Creek	0	0	0	0	0	0	5	0	5	5	0	5	5	0	5
Upper Sultan River	0	0	0	0	0	0	2	0	2	2	0	2	2	0	2
Middle North Fork Skykomish River	0	0	0	0	0	0	45	0	45	45	0	45	45	0	45
Total WRIA 7	4981	2924	**2059**	3536	2075	**1463**	13994	7648	6346	9013	4724	4287	10458	5573	4883

(1) Connections to public water are likely to be over-estimated due to capacity issues with Seven Lakes Water Association.

Excluded HUCs: (all urban or all forest) Powder Mill Gulch - Frontal Possession Sound, Middle Sultan River, Upper North Fork Skykomish, Upper Beckler River, Lower Beckler River, Rapid River, Upper North Fork Tolt (SnoCo portion).

SNOHOMISH COUNTY WRIA 8 - HUC 12 Name	Growth Forecast Scenarios - New Homes						2019 Available Capacity			Capacity Surplus or Shortfall - Current Trends Scenario -			Capacity Surplus or Shortfall - Comp Plan Targets -		
	Current Trends			V 2040 Comp Plan Targets											
	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas
North Creek (2)	0	0	0	0	0	0	7	5	2	7	5	2	7	5	2
Bear Creek - Sammamish River	275	100	175	181	66	115	393	275	118	118	175	-57	212	209	3
Bear Creek	159	126	33	105	83	22	253	145	108	94	19	75	148	62	86
Total WRIA 8	434	226	208	286	149	137	653	425	228	219	199	20	367	276	91

(2) North Creek is located entirely within the county's Southwest Urban Growth Area (SWUGA) where connection to water providers is nearly certain. Providers have verified capacity in their water system comprehensive plans.

Additional changes to forecast not reflected here:

1. Revise allocations in HUCs where forecast exceeds available capacity.
2. Revise allocations within UGAs to add potential for limited number of new wells based on GeoEngineers analysis.
3. Revise connections to public water system in HUCs where public water service is already at capacity due to water rights.
4. Add growth forecasts from Tulalip Planning for WRIA 7.

Snohomish County - Unincorporated WRIA 7 Growth Projections

Draft 9/24/2019

Snohomish County-WRIA 7 HUC 12	SCENARIO 1 Past Trends			SCENARIO 2 V 2040 Comp Plan Targets			SCENARIO 3 OFM High Forecast (Developed by GeoEngineers)			SCENARIO 4 2019 Available Capacity			Capacity Surplus or Shortfall - Past Trends Scenario -			Capacity Surplus or Shortfall - Comp Plan Targets -			Capacity Surplus or Shortfall - OFM High Forecast* -			GeoEngineers Proposed PE Well Allocation
	Total[1]	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total[1]	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total	Water Service Areas	P-E Well Areas	Total PE Wells[2,3]
Little Pilchuck River	525	236	289	373	168	205	695	313	382	2142	834	1308	1617	598	1019	1769	666	1103	1447	521	926	289
Quilceda Creek[1]	302	51	251	214	36	178	399	67	332	1213	466	747	911	415	496	999	430	569	814	399	415	297
Lower Pilchuck River	789	560	229	560	397	163	1044	741	303	2309	1488	821	1520	928	592	1749	1091	658	1265	747	518	229
Woods Creek	712	488	224	506	347	159	943	647	296	1904	1206	698	1192	718	474	1398	859	539	961	559	402	224
Tulalip Creek - Frontal Possession Sound[3]	453	249	204	321	177	145	599	330	269	603	379	224	150	130	20	282	202	79	4	50	-45	468
French Creek	416	293	124	296	208	88	551	387	164	1093	904	189	677	611	65	797	696	101	542	517	25	124
Snohomish River - Frontal Possession Sound	480	362	118	341	257	84	635	479	156	574	382	192	94	20	74	233	125	108	-61	-97	36	118
Elwell Creek - Skykomish River	149	33	116	106	23	83	197	43	154	593	156	437	444	123	321	487	133	354	396	113	283	116
Evans Creek - Snohomish River	333	220	113	236	156	80	440	291	149	889	659	230	556	439	117	653	503	150	449	368	81	113
Peoples Creek - Snoqualmie River	116	18	98	83	13	70	154	24	130	404	50	354	288	32	256	321	37	284	250	26	224	98
McCoy Creek - Skykomish River	91	24	67	65	17	48	120	31	89	297	60	237	206	36	170	232	43	189	177	29	148	67
Wallace River	78	18	60	55	13	43	103	24	79	454	182	272	376	164	212	399	169	229	351	158	193	60
Lower Sultan River	145	92	53	103	66	37	192	123	70	254	82	172	109	-10	119	151	16	135	62	-41	102	53
Upper Pilchuck River	327	278	49	232	197	35	433	368	65	1012	800	212	685	522	163	780	603	177	579	432	147	49
Lower South Fork Skykomish River	38	0	38	27	0	27	51	0	51	96	0	96	58	0	58	69	0	69	45	0	45	38
Lower North Fork Skykomish River	15	0	15	10	0	10	19	0	19	70	0	70	55	0	55	60	0	60	51	0	51	15
Cherry Creek - SnoCo Portion	11	0	11	8	0	8	14	0	14	35	0	35	24	0	24	27	0	27	21	0	21	11
Olney Creek	0	0	0	0	0	0	0	0	0	5	0	5	5	0	5	5	0	5	5	0	5	0
Upper Sultan River	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	2	0	2	2	0	2	0
Middle North Fork Skykomish River	0	0	0	0	0	0	0	0	0	45	0	45	45	0	45	45	0	45	45	0	45	0
Total WRIA 7	4980	2922	2059	3536	2075	1463	6590	3867	2723	13994	7648	6346	9014	4726	4287	10458	5573	4883	7404	3781	3623	2369

Snohomish County Analysis Excluded HUCs: (all urban or all forest)

Powder Mill Gulch - Frontal Possession Sound

Middle Sultan River

Upper North Fork Skykomish

Upper Beckler River

Lower Beckler River

Rapid River

Upper North Fork Tolt River - Sno Co Portion

Notes:

Growth Forecast Scencarios - New Homes - Past Trends and 2019 Available Capacity prepared by Snohomish County.

Total new home forecast (4980) = calculated new residential dewllings per year (249) x WREC planning time period (20 years)

[1]Total Past Trends values for Woods Creek, French Creek, and Lower Sultan River adjusted to match Forecasts by HUC tab in Snohomish County data spreadsheet.

[2]Assume half of the Quilceda HUC growth will use PE wells (26). Part of the Quilceda area has water provided by Marysville/City of Everett and part is within Seven Lakes water service area. Includes an estimate of 20 potential new permit exempt wells on Tulalip tribal owned lands in Quliceda HUC.

[3]Assume all of the water service area growth forecast in the Tulalip HUC (249) will use PE wells to account for the Seven Lakes water system inability to expand service at this time.
Note that PE Well allocation exceeds PE Well Areas 2019 Capacity by 229. Includes an estimate of 15 potential new permit exempt wells on Tulalip tribal owned lands in Tulalip HUC.

ATTACHMENT C
GeoEngineers UGA Well Log Spot Check Data Tables

GeoEngineers - Incorporated (UGA) WRIA 7 Growth Projections

Draft 8/20/19

GeoEngineers - UGA Well Log Spot Check						
Period	Total	Total Spot Checked	Domestic (includes municipal and community wells)	Irrigation	Other (Test, Dewatering, Industrial, Mitigation, UIC, Deepened or Refurbished)	Incorrect (Location, Date, etc.)
1998-2007	80	46	17	2	13	14
2008-2018	46	31	6	6	8	11
Totals	126	77	23	8	21	25
Percent of Total		61%	30%	10%	27%	32%
Potential number of new wells based on percentage of past 20 year total (126)						
WRIA 7			**38**	**13**	**34**	**41**

GeoEngineers - Incorporated (UGA) WRIA 7 Growth Projections

Draft 8/20/19

	Spot Checked 1998-2007	Spot Checked 2008-2018	Total	Total Potential Wells in UGA in 20 years	Total Rounded	City UGA
King County Stream Basin						
Ames Lake	0	0	0	0.00	0	
Cherry Creek*	1	1	2	3.30	3	Duvall UGA
Coal Creek (Snoq.)*	0	0	0	0.00	0	
Griffen Creek	0	0	0	0.00	0	
Harris Creek	0	0	0	0.00	0	
Lower Tolt River*	0	0	0	0.00	0	
Middle Fork Snoqualmie River*	0	0	0	0.00	0	
Miller River	0	0	0	0.00	0	
North Fork Snoqualmie River	0	0	0	0.00	0	
Patterson Creek*	0	0	0	0.00	0	
Raging River*	1	0	1	1.65	2	Snoqualmie UGA
Snoqualmie River*	0	0	0	0.00	0	
South Fork Skykomish	1	0	1	1.65	2	Skykomish UGA
South Fork Snoqualmie River*	2	1	3	4.95	5	North Bend UGA
Tokul Creek	0	0	0	0.00	0	
Tuck Creek	0	0	0	0.00	0	
Snohomish County HUC 12						
Little Pilchuck River	2	1	3	4.95	5	Marysville UGA
Quilceda Creek	5	0	5	8.25	8	Marysville and Arlington UGAs
Lower Pilchuck River	0	0	0	0.00	0	
Woods Creek*	0	0	0	0.00	0	
Tulalip Creek - Frontal Possession Sound	0	0	0	0.00	0	
French Creek*	1	0	1	1.65	2	Monroe UGA
Snohomish River - Frontal Possession Sound	3	1	4	6.60	7	Snohomish and Lake Stevens UGAs
Elwell Creek - Skykomish River	0	0	0	0.00	0	
Evans Creek - Snohomish River	0	0	0	0.00	0	
Peoples Creek - Snoqualmie River	0	0	0	0.00	0	
McCoy Creek - Skykomish River	1	0	1	1.65	2	Sultan UGA
Wallace River	0	0	0	0.00	0	
Lower Sultan River*	0	1	1	1.65	2	Sultan UGA
Upper Pilchuck River	0	1	1	1.65	2	Granite Falls UGA
Lower South Fork Skykomish River	0	0	0	0.00	0	
Lower North Fork Skykomish River	0	0	0	0.00	0	
Cherry Creek - SnoCo Portion	0	0	0	0.00	0	
Olney Creek	0	0	0	0.00	0	
Upper Sultan River	0	0	0	0.00	0	
Middle North Fork Skykomish River	0	0	0	0.00	0	
Totals	17	6	23	37.95	40	

Notes:

This tables includes data for wells in Ecology's Well Report database, filtered for a depth greater than 30 feet and diameter 6-8 inches. Ecology does not have the ability to filter for permit-exempt domestic wells. Information in the database is based on records submitted by the driller. Well Report Data and Images released from the Department of Ecology are provided on an "AS IS" basis, without warranty of any kind.

* = a portion of this basin in the urban area

ATTACHMENT D

King and Snohomish County PE Well Potential Assessment and Rural Capacity Analysis Assumptions Matrix

DRAFT Permit-Exempt Well Potential Assessment and Rural Capacity Analysis - Assumptions Matrix

Based on parcel-scale GIS identification and classification of lands with potential for development of homes that will rely on a permit-exempt well. Requires a number of assumptions regarding how specific land categories are treated.

Screening Category	King County PE Well Potential Assessment	Justification	Snohomish County Rural Capacity Anlaysis	Justification
Current on-site development	<$10k appraised improvements[1]	Used as a proxy for vacant land that is unlikely to have an existing home or well	under developed parcels and vacant parcels[3]	
Current zoning	no exclusions		no exclusions	
Growth area	outside UGAs (incl cities)	Counties have jurisdiction for permitting in unincorporated areas. UGAs include both incorporated and unincorporated areas, however unincorporated areas inside UGAs are typically developed at high densities and accompanied by urban infrastructure, including public water service, roads, and drainage infrastructure. UGA boundaries have beeen relatively stable over 20 years, allowing time for water providers to install service lines.	outside UGAs (incl cities)	Counties have jurisdiction for permitting in unincorporated areas. UGAs include both incorporated and unincorporated areas, however unincorporated areas inside UGAs are typically developed at high densities and accompanied by urban infrastructure, including public water service, roads, and drainage infrastructure. UGA boundaries have beeen relatively stable over 20 years, allowing time for water providers to install service lines.
Water service	% within water service area likely to connect[2]	King County does not have county-wide data on water system infrastructure. They will look at historic rates of connection to water systems within water service areas in order to come up with a likelihood of connection for future development.	>100 ft from water distribution lines (single-family lot, not subdividable); >1/4 mi from water distribution lines (subdividable)[4]	Snohomish County has water system infrastructure data available for internal use only. Water purveyors think that 100 feet is a very conservative assumption for single-family connections.
Public ownership	not owned by public agencies		outside government property and parks	
Forest lands	outside forest production districts	King county has purchased development rights in many of the forest production districts. Zoning in those areas is very low density (80 acres).	outside state/national forest lands	
Agricultural lands	outside agricultural production districts; not enrolled in Farmland Preservation Program		did not exclude agricultural lands. Snohomish county does not have agricultural production districts.	
Critical areas	≥1 ac of parcel area outside floodway and severe channel migration hazard areas	Based on parcel size assumption and restrictions on building in critical areas.	Outside critical areas: wetlands, steep slopes, stream corridors, stream buffers. Did not exclude flood plains.	In most cases, would be restricted from building in critical areas.
Easements			Did not exclude TDR and easements. Snohomish County TDR program covers a smaller land area.	
Subdivision/zoning changes	"Parcel" PE well potential based on one unit per parcel. "Dwelling Unit" PE well potential based on subdividing to maximum density allowed by current zoning.		maximum density allowed by current zoning	
Parcel size	no parcels <1 acre	Based on assumption from water availability study, that it would be difficult to site a home, septic system, and well on a lot less than 1 acre.	no parcels under 1/2 acre	Snohomish County assumed it would be difficult to site a home, septic and well on a lot less than 1/2 acre.

[1] Information from County Assessor data.

[2] King County reviewed historic building permits and assessors data to estimate % of homes likely to connect to water service within water service areas. Parcels withoutside water service areas are projected to rely on a well.

[3] Information from County Assessor data; allows differentiation of permit data (e.g. residence vs. garage). Under developed parcels e.g. where there is one existing house on a 20-acre parcel in R5 zone, parcel is not vacant but could be divided into four separate parclels allowing three additional homes to be built. Capacity analysis would include these three homes.

[4] 1/4 mile for rural cluster subdivisions was enacted in code in 2009; 100 foot buffer is proposed code and would be from any boundary line (not the centroid)

DRAFT - Updated 10/18/19

Prepared by GeoEngineers from technical workgroup meeting notes. DRAFT - for internal used by WRIA 7, 8, & 9 WRECs and technical workgroups.

nhc
GeoEngineers

Memorandum

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To:	Ingria Jones, Washington State Department of Ecology
From:	Patty Dillon, Cynthia Carlstad, NHC; Bridget August, John Monahan, GeoEngineers
Date:	December 4, 2019
File:	0504-161-00
Subject:	WRIA 7 Consumptive Use Estimates –DRAFT

INTRODUCTION

The WRIA 7 Watershed Restoration and Enhancement Plan (Plan) must include projects and actions that offset the consumptive use from future domestic permit-exempt wells. Consumptive water use is water that is evaporated, transpired, consumed by humans, or otherwise removed from an immediate water environment. For watershed planning purposes, consumptive use is water that is drawn from groundwater via a domestic permit-exempt well and not replaced through the septic system, irrigation return flow, or other means.

Growth projections and projections for number and location of new domestic permit-exempt well connections within WRIA 7 were developed by King County, Snohomish County, and GeoEngineers (GeoEngineers, 2019) for purposes of the Plan. This memorandum summarizes the methods used to estimate consumptive water use associated with the new well connections and provides results for three water use scenarios. Methodology is based on Appendix A of the Department of Ecology's (Ecology's) Net Ecological Benefit guidance (Ecology, 2019) and documented in further detail in the Consumptive Use Estimates Workplan prepared by the GeoEngineers team.

CONSUMPTIVE WATER USE METHODOLOGY

Measurement of consumptive water use in any setting is difficult, and it is virtually impossible for residential groundwater use, which must account for both indoor and outdoor use. Permit-exempt wells are generally unmetered, so supply to each home is usually unknown, let alone the amount that is lost to the groundwater system. Therefore, we are limited to estimating consumptive use based on projections of future growth, local patterns and trends in water use, and generally accepted and reasonable assumptions. Water use data from local water purveyors may be useful as a check on calculated estimates but must be used with caution. Homes that pay for municipal water tend to exhibit different water use behaviors, including water saving appliances and reduced landscape watering, that reduce usage compared to homes on wells.

The two categories of household consumptive water use are indoor use and outdoor use. The methodology used to estimate these quantities for WRIA 7 are described in the following sections.

Indoor Consumptive Use

Indoor consumptive use was estimated using Ecology guidance, which was based on groundwater monitoring and modeling studies conducted by the U.S. Geological Survey in several areas of Washington. There are two basic elements to estimating indoor consumptive use:

- Amount of total water used. Ecology's guidance recommends an assumption of 60 gallons per person per day as a reasonable estimate of indoor water use. To estimate indoor usage per well, the per capita usage was multiplied by the average rural household size, estimated by King County and Snohomish County as 2.73 and 2.75 people per household, respectively. For analysis areas spanning both counties, a weighted value was estimated based on the number of projected permit-exempt well connections in each county. Table 1 summarizes the household sizes for each subbasin and for all of WRIA 7.
- Percentage of total water used that is consumptive. Ecology guidance recommends that 10% of the total indoor water use is considered consumptive when a home is on a septic system. (All indoor water use is considered consumptive for homes with sewer connections.) Areas projected to be served by permit-exempt wells are outside of sewer service areas, so the 10% assumption was applied for all projected indoor water use.

TABLE 1. AVERAGE RESIDENTS PER HOUSEHOLD

	% Projected Wells by County		Avg. People per Rural
Subbasin	**King**	**Snohomish**	**Household**
Tulalip		100%	2.75
Quilceda-Allen		100%	2.75
Estuary/Snohomish Mainstem		100%	2.75
Little Pilchuck		100%	2.75
Pilchuck		100%	2.75
Woods		100%	2.75
Sultan		100%	2.75
Lower Mid-Skykomish		100%	2.75
Skykomish Mainstem		100%	2.75
Upper Skykomish	49%	51%	2.74
Cherry-Harris	95%	5%	2.73
Snoqualmie North	71%	29%	2.74
Snoqualmie South	100%		2.73
Patterson	100%		2.73
Raging	100%		2.73
Upper Snoqualmie	100%		2.73
WRIA Total	**29%**	**71%**	**2.74**

Outdoor Consumptive Use

Outdoor water use is typically the larger portion of domestic single-family residential water use, with irrigation of lawn and garden being the dominant outdoor water use component. The GeoEngineers team conducted a subbasin-specific assessment to determine typical outdoor water use patterns, namely the typical size of irrigated lawn, garden, and landscaping areas associated with newer residential development and irrigation water needs, which vary by crop and climate. The consumptive use estimate assumes that current rural residential landscaping practices will continue over the 20-year planning horizon.

Irrigated Footprint Analysis

The GeoEngineers team conducted an aerial photo-based analysis of irrigated lawn and garden area for 393 parcels in the 16 WRIA 7 subbasins. Parcels used for the irrigated footprint analysis were selected based on recent (2006-2017) building permits for new single-family residential homes not served by public water. Permits for accessory dwelling units (ADUs) or reconstruction/remodel were excluded. There were nearly 1,600 permits in WRIA 7 meeting these criteria—more than could be reasonably evaluated for this project. A minimum 20-parcel sample per subbasin was targeted as a statistically representative sample size based on statistics from similar analyses in WRIAs 1,8, and 9. The target sample size was set to provide a 95% confidence level (i.e. 95% certainty of the sample capturing the true mean of the population). Sample parcels were selected by assigning a random number to each building permit, and then evaluating sites in rank order up to the target sample size. Using a random selection from the permit list avoids the bias that could be introduced if selecting from the imagery.

Each parcel was evaluated visually in Google Earth for irrigated lawn areas. Google Earth's historical imagery collection allowed for clearer identification of irrigated areas by comparing aerial photos spanning multiple seasons and years. Late summer imagery was particularly helpful in determining boundaries of irrigated (green) vs. non-irrigated (brown) grass areas. More often than not, the parcels did not demonstrate such a clear-cut distinction between green and brown spaces. It appears that many homeowners irrigate enough to keep lawns alive but not lush (or comparable to commercial turf grass/golf course green). Delineating these irrigated spaces is subjective, and the GeoEngineers team minimized potential for additional bias to the results by having one GIS analyst evaluate all of the selected parcels in the WRIA. The irrigated area was delineated for each parcel based on several key assumptions:

- Landscaped shrub/flower bed areas were included in the irrigated footprint (not just lawn areas).
- Homes that did not show visible signs of irrigation were tracked as zero irrigated footprint.
- Homes or landscaping still under construction in the most recent Google Earth imagery were excluded.
- Native forest or unmaintained grass/pasture were not included in the irrigated footprint.
- Pre-existing agricultural land use was not considered part of the residential irrigation footprint.

Figure 1 shows examples of irrigated area delineation for two representative parcels in the Patterson (left) and Upper Skykomish (right) subbasins. On each photo, the parcel boundary is shown in yellow and the area identified as irrigated in white. Large homes and extensive irrigated lawn and garden areas were much more common in the Patterson, Pilchuck, and Raging subbasins compared to the rest of the WRIA.

Figure 1. Example Irrigated Area Delineations, Patterson subbasin (left) and Upper Skykomish subbasin (right)

Results of the irrigated footprint analysis for all subbasins are summarized in Table 2. Note that more parcels than the target minimum sample were analyzed in each of the subbasins. When identifying the random list for analysis, the GeoEngineers team identified ten additional sites beyond the target minimum of 20 to allow for dropping parcels that did not meet the analysis criteria (e.g. construction not completed). The full list was analyzed, resulting in a few parcels above the target minimum in each subbasin.

TABLE 2. WRIA 7 IRRIGATED FOOTPRINT SUMMARY

Subbasin	Applicable Permit Parcels	Parcels Analyzed	Total Irrigated Area (ac)	Average Irrigated Area (ac)
Tulalip	116	21	2.0	0.09
Quilceda-Allen	160	26	3.8	0.15
Estuary/Snohomish Mainstem	207	26	7.6	0.29
Little Pilchuck	161	24	4.8	0.20
Pilchuck	153	25	9.1	0.37
Woods	123	28	3.5	0.12
Sultan	29	21	2.4	0.11
Lower Mid-Skykomish	33	22	3.1	0.14
Skykomish Mainstem	101	25	3.9	0.16
Upper Skykomish	52	27	1.3	0.05
Cherry-Harris	96	26	4.2	0.16
Snoqualmie North	146	22	4.6	0.21
Snoqualmie South	64	23	4.9	0.21
Patterson	49	23	9.3	0.41
Raging	29	27	11.7	0.43
Upper Snoqualmie	75	27	6.3	0.23
Full Analysis	**1,594**	**393**	**82.5**	**0.21**

Crop Irrigation Requirements

The amount of irrigation water required to grow and maintain vegetation depends on the crop, season, and local climate (temperature and precipitation) and thus varies by location throughout the WRIA. The Washington Irrigation Guide (WAIG) (NRCS, 1997) includes an appendix listing net irrigation requirements for various common crops for 89 locations throughout Washington, derived from water use and meteorological data from the 1970s and 1980s. Since lawn is a fairly water-intensive crop and the most common target of residential irrigation, irrigation requirements for turf were used to estimate outdoor water needs.

Using the three WAIG stations within WRIA 7 (Everett, Monroe, and Snoqaulmie Falls) and surrounding stations to the north and south, the GeoEngineers team spatially interpolated crop irrigation requirements (CIRs) across WRIA 7 by creating a triangulated irregular network (TIN) surface between the WAIG station points. Since there are no stations east of Snoqualmie Falls in the higher-elevation, higher-precipitation eastern subbasins, a lower value was imposed along the Cascade crest to enforce continued reduction in CIR with increasing precipitation. A value of 8 inches per year was used for the boundary value; this is believed to be a conservative value on nearby Cascade foothill station estimates from an unpublished irrigation data set being developed by Washington State University (Peters et al., 2019). Values from the resulting TIN surface were averaged over each subbasin to estimate the irrigation requirement for each subbasin. This analysis was performed for both annual and summer (June-July-August) irrigation requirements to provide information to compare peak summer water use to annual use estimates. Figure 2 shows the locations of WAIG irrigation data stations and the interpolated distribution of annual turf irrigation requirements across WRIA 7. **Error! Reference source not found.** summarizes the average values for both annual and summer CIRs for subbasins with projected permit-exempt well connections. Annual values were used for the consumptive use calculations described in this memo.

The CIR is the net amount of external water required by the crop, accounting for precipitation inputs. Since irrigation systems are not 100% efficient, additional water must be supplied to ensure that crop needs are met. The application efficiency varies by the type of system (drip irrigation, microsprinklers, pivot sprinklers, etc.). For WRIA 7, the Ecology-recommended value of 75% was used to determine the water applied for irrigation.

Outdoor water use for each home was then estimated as the applied water for irrigation (computed as a depth) times the average irrigation area. The consumptive use fraction is substantially higher for outdoor use than indoor use (to a septic system) because most of the applied water is taken up by plants or evaporated. Based on the Ecology guidance, a consumptive use fraction of 80% was applied to the total outdoor water use, meaning that 80% of water used for outdoor watering does not return to the local groundwater system.

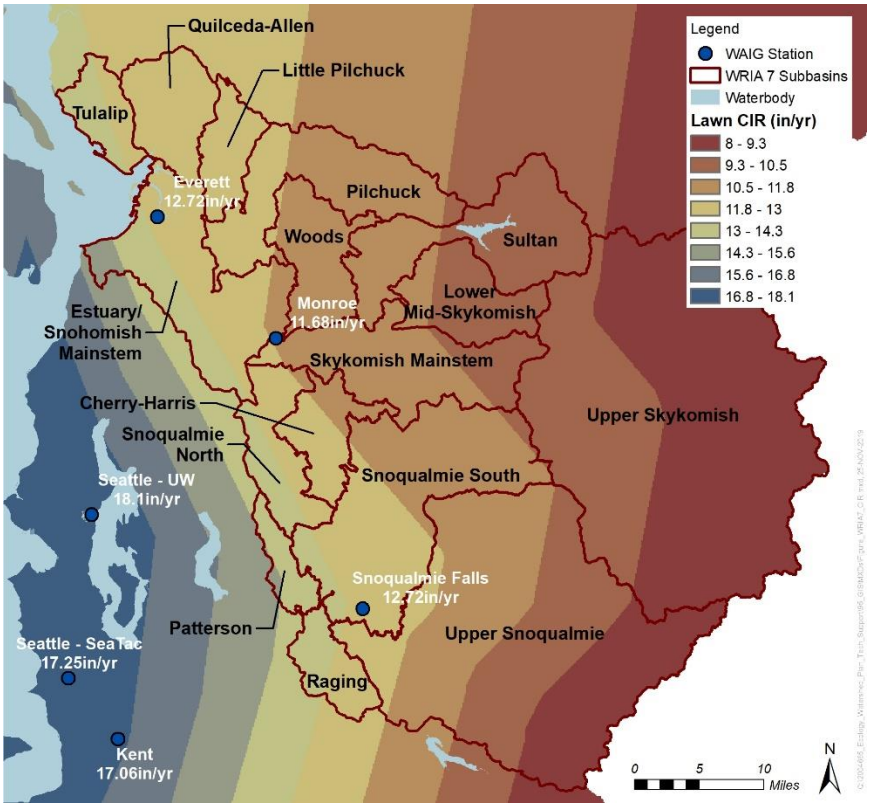

Figure 2. Spatial Distribution of Annual Turf Irrigation Requirement

TABLE 3. WRIA 7 CROP IRRIGATION REQUIREMENTS

Subbasin	Annual Turf CIR (in)	Summer (JJA) Turf CIR (in)
Tulalip	13.22	10.74
Quilceda-Allen	12.40	10.27
Estuary/Snohomish Mainstem	12.85	10.68
Little Pilchuck	12.25	10.16
Pilchuck	11.49	9.93
Woods	11.46	9.93
Sultan	10.22	9.26
Lower Mid-Skykomish	10.27	9.40
Skykomish Mainstem	10.90	9.69
Upper Skykomish	8.89	8.59
Cherry-Harris	11.99	10.46
Snoqualmie North	12.86	10.92
Snoqualmie South	11.78	10.32
Patterson	14.02	11.62
Raging	13.04	11.08
Upper Snoqualmie	10.18	9.35
WRIA Average	**10.66**	**9.57**

TOTAL CONSUMPTIVE USE

The methods described above were used to compute indoor and outdoor consumptive use per permit-exempt well connection. Totals for each subbasin were then computed by multiplying per home values by the projected number of permit-exempt well connections in each subbasin. The GeoEngineers team developed a consumptive use calculator (Excel spreadsheet) to compute consumptive use for projected permit-exempt well connections for each subbasin and the WRIA as a whole. Table 4 summarizes the consumptive use estimate, which assumes one home with the measured subbasin-average yard area per permit-exempt well. The WRIA-aggregated irrigated area in Table 4 is based on subbasin-average yard sizes weighted by projected permit-exempt well connections per subbasin and thus differs slightly from the average footprint in Table 2, which is the direct average of irrigated areas from all parcels analyzed. The consumptive use estimate for WRIA 7 is 797.4 acre-feet per year.

TABLE 4. ANNUAL CONSUMPTIVE USE FOR ONE HOME WITH SUBBASIN AVERAGE YARD

Subbasin ID	# PE Wells Anticipated in Subbasin	Irrigated Area per Well (ac)	Per Well Consumptive Use (gpd)			Total Consumptive Use (af/yr)
			Indoor	Outdoor	Total	
Tulalip	468	0.09	16.5	94.4	110.9	58.1
Quilceda-Allen	338	0.15	16.5	147.6	164.1	62.1
Estuary/Snohomish Mainstem	331	0.29	16.5	295.7	312.2	115.8
Little Pilchuck	294	0.20	16.5	194.4	210.9	69.5
Pilchuck	280	0.37	16.5	337.3	353.8	111.0
Woods	224	0.12	16.5	109.1	125.6	31.5
Sultan	55	0.11	16.5	89.2	105.7	6.5
Lower Mid-Skykomish	60	0.14	16.5	114.1	130.6	8.8
Skykomish Mainstem	185	0.16	16.5	138.4	154.9	32.1
Skykomish	103	0.05	16.4	35.3	51.7	6.0
Cherry-Harris	214	0.16	16.4	152.2	168.6	40.4
Snoqualmie North	338	0.21	16.4	214.3	230.7	87.4
Snoqualmie South	169	0.21	16.4	196.3	212.7	40.3
Patterson	104	0.41	16.4	456.1	472.5	55.0
Raging	75	0.43	16.4	444.9	461.3	38.8
Upper Snoqualmie	151	0.23	16.4	185.8	202.2	34.2
WRIA 7 Aggregated	**3,389**	**0.20**	**16.5**	**193.6**	**210.0**	**797.4**

CONSUMPTIVE WATER USE SCENARIOS

The consumptive use calculator was also used to explore additional consumptive use scenarios. “Default” input parameters and values discussed in the methods section above can be modified to explore the effect of changes or uncertainties in individual assumptions. Based on requests from the technical workgroup and Committee, two additional scenarios were computed, and annual consumptive use results are summarized in Table 5 and

Table 6:

1. One home with legal maximum 0.5-acre irrigated lawn area per permit-exempt well. Assumes 60 gallons per day per person indoor use and 0.5-acre outdoor irrigation use.
2. Legal right to water use of 950 gallons per day (annual average) per well connection for indoor and outdoor household use. Assumes 60 gallons per day per person and remainder to outdoor use.

TABLE 5. ANNUAL CONSUMPTIVE USE FOR ONE HOME WITH 0.5-AC YARD

Subbasin ID	# PE Wells Anticipated in Subbasin	Irrigated Area per Well (ac)	Per Well Consumptive Use (gpd)			Total Consumptive Use (af/yr)
			Indoor	Outdoor	Total	
Tulalip	468	0.50	16.5	524.5	541.0	283.6
Quilceda-Allen	338	0.50	16.5	492.0	508.5	192.5
Estuary/Snohomish Mainstem	331	0.50	16.5	509.8	526.3	195.2
Little Pilchuck	294	0.50	16.5	486.0	502.5	165.5
Pilchuck	280	0.50	16.5	455.9	472.4	148.2
Woods	224	0.50	16.5	454.7	471.2	118.2
Sultan	55	0.50	16.5	405.5	422.0	26.0
Lower Mid-Skykomish	60	0.50	16.5	407.5	424.0	28.5
Skykomish Mainstem	185	0.50	16.5	432.5	449.0	93.0
Skykomish	103	0.50	16.4	352.7	369.1	42.6
Cherry-Harris	214	0.50	16.4	475.7	492.1	118.0
Snoqualmie North	338	0.50	16.4	510.2	526.6	199.4
Snoqualmie South	169	0.50	16.4	467.4	483.7	91.6
Patterson	104	0.50	16.4	556.2	572.6	66.7
Raging	75	0.50	16.4	517.4	533.7	44.8
Upper Snoqualmie	151	0.50	16.4	403.9	420.3	71.1
WRIA 7 Aggregated	**3,389**	**0.50**	**16.5**	**480.0**	**496.5**	**1,884.9**

TABLE 6. ANNUAL CONSUMPTIVE USE FOR ANNUAL AVERAGE 950 GPD WATER USE PER CONNECTION

Subbasin ID	# PE Wells Anticipated in Subbasin	Irrigated Area per Well (ac)	Per Well Consumptive Use (gpd)			Total Consumptive Use (af/yr)
			Indoor	Outdoor	Total	
Tulalip	468	0.60	16.5	628.0	644.5	337.9
Quilceda-Allen	338	0.64	16.5	628.0	644.5	244.0
Estuary/Snohomish Mainstem	331	0.62	16.5	628.0	644.5	239.0
Little Pilchuck	294	0.65	16.5	628.0	644.5	212.3
Pilchuck	280	0.69	16.5	628.0	644.5	202.2
Woods	224	0.69	16.5	628.0	644.5	161.7
Sultan	55	0.77	16.5	628.0	644.5	39.7
Lower Mid-Skykomish	60	0.77	16.5	628.0	644.5	43.3
Skykomish Mainstem	185	0.73	16.5	628.0	644.5	133.6
Skykomish	103	0.89	16.4	628.5	644.9	74.4
Cherry-Harris	214	0.66	16.4	628.9	645.3	154.7
Snoqualmie North	338	0.62	16.4	628.7	645.1	244.3
Snoqualmie South	169	0.67	16.4	629.0	645.3	122.2
Patterson	104	0.57	16.4	629.0	645.3	75.2
Raging	75	0.61	16.4	629.0	645.3	54.2
Upper Snoqualmie	151	0.78	16.4	629.0	645.3	109.2
WRIA 7 Aggregated	**3,389**	**0.66**	**16.5**	**628.3**	**644.7**	**2,447.7**

Daily usage rates shown in Table 4 through Table 6 represent annual average values. While indoor use generally does not vary much from month to month, outdoor water needs range from zero during the winter rainy season to more than three times the annual average during the peak of the summer. Since streamflows are lowest in late summer for most western Washington streams, the Committee may consider peak summer water use along with annual use when developing the watershed restoration and enhancement plan. It is important to remember that pumping rates are not equivalent to consumptive use impacts on stream depletion.

Total Water Use and Comparison to Water Purveyor Data

Water use data from water purveyors to rural areas in the central Puget Sound were obtained as one benchmark for comparison with estimated permit-exempt well usage. Snohomish County Public Utilities District #1 (Snohomish County PUD), serving about 20,000 customers in central and northern Snohomish County, and Covington Water District, serving about 18,000 customers in southern King County, each provided metered water use data from 2015 and 2017. In addition, Snohomish County compiled annual water demand forecasts from water system plans for 17 water purveyors operating in the county. Table 7 (next page) summarizes the available water purveyor data. Reported values are total water use, not consumptive use. For the two metered systems providing data, the average annual use is approximately 220 gpd per household. About 160 gpd is attributed to indoor uses (year-round) and 50 to 70 gpd (averaged over twelve months) to outdoor uses. Note

that outdoor use is typically concentrated over about three months during the summer, which equates to rates of 150 to 200 gpd of outdoor watering for those three months.[1]

TABLE 7. WATER PURVEYOR HOUSEHOLD WATER USE DATA

Water Purveyor	Average Annual Water Use (gpd)	Average Winter Water Use (gpd)	Average Summer Water Use (gpd)
Metered Water Use Data†			
Snohomish County PUD‡	237	170	370
Covington Water District	200	150	300
Comprehensive Plan Forecast			
Alderwood	169		
Cross Valley*	234		
Edmonds	201		
Gold Bar	171		
Highland*	200		
Marysville	168		
Monroe	170		
Mukilteo	179		
Olympic View	189		
Roosevelt*	383		
Silver Lake	177		
Snohomish	190		
Snohomish County PUD*	190		
Stanwood	282		
Startup*	250		
Sultan	190		
Three Lakes*	191		
**Average Rural Non-City*	*241*		

†Data from 2015 and 2017 ‡Average use for parcels ≥1 acre *Rural water provider

Note: Reported values are total water use, not consumptive use.

Since most water purveyors charge customers by the amount of water delivered (not just consumptively used)—and in some cases at increased rates as water use goes up—metered water users may exhibit more water conservation behaviors than unmetered users. Total water use breakdowns for the projected permit-exempt well scenarios are presented in Table 8. Estimated indoor use of 165 gpd for the permit-exempt well scenarios is very consistent with the water purveyor data (based on metered winter water use), between 150 and 170 gpd.

[1] 50 gpd over 12 months is equivalent to 200 gpd over 3 months, both totaling about 18,000 gallons

Average annual total use for permit-exempt wells estimated from this analysis (see Table 8) are considerably higher, however, due to outdoor use estimates 4 to 6 times greater than average metered use: 240 gpd estimated for permit-exempt wells versus 50 to 70 gpd for metered users on an average annual basis or 820 gpd estimated for permit-exempt wells versus 150 to 200 gpd[2] for metered users on average during the summer. The magnitude of this difference seems unlikely to be accounted for strictly by price pressures and thus suggests that assumptions in this analysis regarding watering behavior are generally conservative. For example, studies have shown that most residential lawn watering is conducted at a deficit level to maintain some growth and green color (Water Research Foundation, 2016), versus the assumption of watering for optimal growth of commercial crops (like a sod farm for turf grass) implicit in the WAIG crop irrigation requirements.

TABLE 8. ESTIMATED PERMIT-EXEMPT WELL TOTAL WATER USE

Scenario	Average Annual Water Use (gpd)	Average Indoor Use (gpd)	Average Annual Outdoor Use (gpd)	Average Summer Outdoor Use (gpd)
1 home, average measured yard	407	165	242	817
1 home, 0.5 ac yard	765	165	600	2,026
1 home using 950 gpd (annual average)	950	165	785	n/a

Note: Reported values are total water use, not consumptive use.

REFERENCES

Department of Ecology (Ecology), 2019. Final Guidance for Determining Net Ecological Benefit: GUID-2094 Water Resources Program Guidance, Appendix A: Streamflow Restoration Recommendations for Water Use Estimates. Publication 19-11-079, July 2019.

GeoEngineers, 2019. WRIA 7 Growth Projections. Technical memorandum prepared for Washington State Department of Ecology. October 2019.

Natural Resources Conservation Service (NRCS), 1997. Irrigation Guide. National Engineering Handbook, Part 652. U.S. Department of Agriculture, Natural Resources Conservation Service. Issued September 1997.

Peters, R.T., L. Nelson, and T. Karimi, 2019. Consumptive Use and Irrigation Water Requirements for Washington. Washington State University Irrigated Agriculture Research and Extension Center. Not yet published, provided 26 September 2019. Associated database: WA Irrigation Water Reqs.mdb.

RH2 Engineering, 2018. Potential Consumptive Use Impacts of Domestic Groundwater Permit-Exempt Wells Over the Next 20 Years in WRIA 1 – FINAL UPDATED. Technical memorandum prepared for Washington Department of Ecology, August 2018.

Water Research Foundation, 2016. Residential End Uses of Water, Version 2. Executive Report. Published April 2016.

[2] Metered summer usage for several individual homes in the Covington Water District showed outdoor usage ranging from 25 gpd to 2,693 gpd for July-August 2015.

Discussion Guide: Policy and Regulatory Actions

Snohomish (WRIA 7) WREC Meeting December 12, 2019

Purpose of Discussion

The WRE Committee will need to decide if they want to recommend regulatory or policy actions in the WRE plan in addition to projects to offset consumptive use and achieve NEB. The purpose of today's discussion is to initiate a brainstorm and conversation of the types of policy changes and regulatory actions that could be considered, and to identify a process to identify these potential recommendations as we move ahead in the planning process. The options laid out in this document are intended as ideas to start discussion and are not recommendations from Ecology or the consultant teams.

Background

The Streamflow Restoration law (90.94.030) lays out minimum requirements for WRE Plans. The law does not require the plan to include any policy or regulatory actions. The law does include a list of optional elements for committees to consider (90.94.030 (3)(f))[1]. These include:

- Establish higher or lower fees for building permits and subdivision approvals. The streamflow restoration law established a fee of $500 for new homes that rely on new wells[2].
- Change the gallon per day withdrawal limits from the current requirements. For our watershed, the streamflow restoration law set an annual average limit of 950 gallons per day over the course of a year[3] AND the groundwater code set a limit of 5000 gallons on any given day[4]). During drought emergencies, this may be limited to no more than 350 gallons per day, for indoor use only. Note: the committee can recommend changes higher or lower than the 950 gallon per day average, but the statute does not allow committees to increase the 5000 per day maximum (though they can recommend lowering it).
- Specific conservation requirements for new water users.
- Other approaches to manage water resources for the WRIA or a portion of the WRIA.

The committee could also consider recommending other policy actions, including such things as:

- New laws or regulations (state or local).
- Amendments to state laws.
- Amendments to state rules.
- Amendments to local ordinances.

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[1] (f) The watershed restoration and enhancement plan may include:

(i) Recommendations for modification to fees established under this subsection;

(ii) Standards for water use quantities that are less than authorized under RCW 90.44.050 or more or less than authorized under subsection (4) of this section for withdrawals exempt from permitting;

(iii) Specific conservation requirements for new water users to be adopted by local or state permitting authorities; or

(iv) Other approaches to manage water resources for a water resource inventory area or a portion thereof.

[2] 90.94.030(4)(a)(vi)(A)

[3] 90.94.030(4)(a)(vi)(B).

[4] 90.44.050

- Education and incentive programs.

Note that a recommendation to change the building permit fee or gallon per day allocation requires rulemaking.[5]

Considerations for the Committee

As this process moves forward, committee members—individually or as a group—are encouraged to share ideas for possible changes to state or local laws and regulations that could enhance the watershed plan and achievement of NEB. As needed, the chair will provide time on meeting agendas for briefings on these topics and committee discussion.

WRE Committees throughout the state may work together on recommendations for changes to laws or regulations and provide a unified request. There are potential benefits to committees coordinating on policy recommendations to state and local governments in order to show broad support for specific proposals. If committees across Puget Sound show interest in similar recommendations, a process for coordination can be established through the facilitation team with leadership from each committee.

Questions for the Committee

1. Do you think the committee should consider including recommendations for policy or regulatory actions in the plan?
    a. What, if any, concerns do you have about policy or regulatory recommendations?
    b. Are there policies and actions listed above or discussed by the Committee that your entity would not support?
2. Do you have a preferred process for developing an initial list of ideas for potential policy recommendations? Options include:
    - Dedicated brainstorming and discussion time at committee meetings.
    - Create an evolving list that committee members may add to at any time.
    - Ask members to individually keep a list and share at an upcoming meeting.
    - Other ideas?
3. Do you have any ideas for policy and regulatory actions you would like to share with the committee? *note an initial group discussions on optional elements for the WRE Plan at the September 12 meeting (see meeting summary)
4. Do you have any preferences on how and or when these ideas are brought to the committee for discussion on whether to include the action in the plan? The Committee will need to balance the need to focus on projects with opportunities for briefings and discussion along the way. Options include:
    - A standing agenda item at Committee meetings.
    - Initial discussions at workgroup meetings and workgroup recommendations shared at committee meetings.
    - Committee members share recommendation with chair and request time on the agenda at an upcoming meeting.

[5] 90.94.030(3)(g)

DRAFT

Target Areas for Preliminary Water Rights Analysis

Washington Water Trust Recommendations to WRIA 7 Committee

1. Little Pilchuck
2. Quilceda Creek
3. Lower/Middle Pilchuck (HUC 21)

Methodology:

1. First Filter: Hydrologic Need- Utilized Snohomish Basin Salmon Conservation Plan Table 13.1 Known Low-Flow Problems (Includes 41 reaches/streams)
    a. Identified Closed Basins (8: Little Pilchuck, May, Bodell (Pilchuck trib), Quilceda, Harris, Griffin, Patterson, Raging)
    b. Identified flow limited reaches with high salmon value (2: Lower Tolt, Lower Sultan)
    c. Identified areas recommended by WREC partners, SBPP, SCSWD (3: Catherine, Tulalip, Upper Skykomish)
2. Second Filter: Rough Analysis of Presence of Water Rights (Analyzed 13 areas identified in previous step)
    a. Lower/Middle Pilchuck, Little Pilchuck, and Quilceda were only basins with land use that represented irrigation. Quilceda opportunities may be much smaller in scale.
    b. Raging, Harris, May, Lower Sultan, Lower Tolt, Upper Skykomish and Tulalip aerial all show primarily forestry land use
    c. Patterson showed primarily developed and wetland however there may be small potential near the confluence.
3. Third Filter: Growth Expected
    a. Quilceda, Little Pilchuck, Lower/Middle Pilchuck all have expected high growth in order of scale.

Additional Ecology Requests: Near Reclaimed Water, Current Temporary Water Right Donations

Update and Recommendations for Project Screening Criteria

WRIA 7 v121019

Background

Technical consultants developed draft project screening criteria to support WRIAs 7, 8, 9, 10, 12, 13, 14, and 15. The intent of the screening criteria is to provide a tool that can evaluate relevant attributes of candidate projects for further evaluation and potential inclusion in the WRE plan. A subset of projects, identified by the committee, will be brought forward for further evaluation by the technical consultants, as necessary for inclusion in the WRE Plan. The intent of the screening criteria is to provide a tool that can evaluate relevant attributes of candidate projects and prioritize the most valuable projects for further evaluation and potential inclusion in the WRE plan for each respective WRIA. In this context, the value of a project refers to its ability to offset, in perpetuity, the anticipated impact of permit-exempt domestic wells on streamflow and improve aquatic species habitat. The screening criteria is designed to identify projects with the most potential to provide water offset for the WRE Plan.

The WRIA 7 Project Subgroup recommended initial fatal flaw criteria to the committee in September. Projects in the WRIA 7 project inventory were screened for fatal flaws and results were presented to the committee on November 14.

The project subgroup continued to discuss project screening criteria at its November 4 and December 4 meeting. The subgroup developed recommendations to further modify the fatal flaw criteria and recommendations for revised streamflow benefit criteria. The subgroup also recommended a phased approach to further development and application of the screening criteria.

Recommended Approach for developing and applying prioritization screening attributes

Screening criteria include the evaluation of project attributes that are relevant to 1) streamflow benefit 2) benefit to salmon, 3) project feasibility, and 4) project implementation. The project subgroup recommends that prioritization screening be completed in stages.

Projects will be first screened for their streamflow benefit and timing and location benefit. This will allow for identification of the most promising water offset projects while benefit to salmon criteria are further refined, in coordination with the Snoqualmie Watershed Forum and Snohomish Basin Salmon Recovery Forum. Finally, some projects in the WRIA 7 project inventory lack sufficient information to screen for feasibility and implementation criteria. Once a subset of projects is identified through screening for streamflow, timing and location, and benefit to salmon criteria, additional available information can be gathered to implement the feasibility and screening criteria to a subset of projects.

Recommended Modification to Fatal Flaw Screening Criteria

The project subgroup recommended modifying fatal flaw criteria 4. Fatal Flaw criteria 1, 2, 3, and 5 remain the same and criteria 4 is revised as shown below.

Each project will be evaluated with the following fatal flaw screening criteria on a binary (yes or no) basis. Any “yes” answer will disqualify a project. The reason for disqualification will be identified in the project inventory.

1) **No benefits to streamflow or habitat**

2) **Already required by regulatory obligation (i.e. double counting)**[1]

3) **Inconsistent with existing law or policy**

4) **Substantive conflict with another watershed plan**

- The project subgroup recommends changing this criteria to: **Substantive conflict with another watershed plan or negative impacts to ecological functions or critical habitat.**
- The project cannot be in substantive conflict with another watershed plan. Qualifying projects must be specifically designed to enhance streamflows and not result in negative impacts to ecological functions or critical habitat. For example, the project may not harm sensitive salmonid stocks or priority species.
- The Subgroup noted that RCW 90.04.030 (3) (a) includes specific language about qualifying projects and recommended including this language to ensure no harm to species or habitat.

5) **Implemented prior to January 2018**[2]

Recommendation for Streamflow Benefit Prioritization Screening Attributes

The Streamflow Benefit criteria assess whether the project benefits streamflow and how quantifiable and reliable the streamflow benefit is, whether the project is located in a priority subbasin, whether the project is located in a reach with known low flow issues, when the streamflow benefit occurs; and the proportion of benefits in relation to the stream benefitting. The term streamflow benefit is meant to encompass projects with a "water offset" benefit that help us offset our consumptive use estimate as well as projects beyond that that have a streamflow benefit (water offset benefit). Quantifiable refers to a project-level or site-specific estimate of streamflow increase, not whether streamflow benefit can be detected in the subject stream with standard streamflow measuring equipment.

The project subgroup recommended the following subbasins as high priority for streamflow benefit: Upper Skykomish, Upper Snoqualmie, Raging River, Snoqualmie South, Tulalip, and Quilceda-Allen. Medium and low priority subbasins have not yet been defined. Table 1a and 1b show the recommended streamflow benefit prioritization criteria.

The project subgroup proposes to apply the streamflow benefit criteria to projects in the WRIA 7 Project Inventory, in coordination with technical consultants. Project subgroup members will seek agreement on resources and information that will be used to apply the screening criteria.

[1] See Section 7 of the Streamflow Restoration Policy and Interpretive Statement (POL-2094) for under "Acceptable projects and actions."
[2] See Section 7 of the Streamflow Restoration Policy and Interpretive Statement (POL-2094) for under "Acceptable projects and actions."

Table 1a

Streamflow Benefit Criteria	Description of Criteria
Streamflow Benefit	Does the project provide certain and reliable streamflow benefits??
Project located in a priority subbasin for streamflow benefit.	Is the project located in a priority subbasin for streamflow benefit projects?
Project located in a reach with known low flows issues.	Is the project located in a stream reach with known low flow issues?
Timing of benefits	Does the project improve streamflow during the critical flow period?
Proportion of benefit	What is the proportion of streamflow benefit to the size of the benefitting stream?

Table 1b. Streamflow benefit criteria

Rating	Rating Score	Streamflow Benefit	Priority Subbasin[3]	Low flow issues	Timing of Benefits	Proportion of Benefits
Low (Least Beneficial)	1	Does not provide streamflow benefit.	Project located in a low priority subbasin for streamflow benefit.	Project located in a stream or reach that does not have known flow issues and/or flow issues are unknown.	Does not provide streamflow benefits during the critical flow period or timing of benefits and/or critical flow period is unknown.	Does not provide streamflow benefits or streamflow benefits are small relative to stream benefitting (e.g. small quantity on mainstem river) or benefit is unknown.
Medium	3	Provides streamflow benefit, but quantity is uncertain and/or unreliable.[4]	Project located in a medium priority subbasin for streamflow benefit.	N/A	N/A	N/A
High (Most Beneficial)	5	Provides streamflow benefit and quantity is certain and reliable.	Project located in a high priority subbasin for streamflow benefit.	Project located in a stream or reach that has known flow issues.	Provides streamflow benefits during the critical flow period.	Streamflow benefits are large relative to stream benefitting (e.g. benefits tributary).

[3] High priority subbasins for streamflow benefit include: Upper Skykomish, Upper Snoqualmie, Raging River, Snoqualmie South, Tulalip, and Quilceda-Allen. Medium and low priority subbasins have not yet been defined.

[4] An assessment of reliability considers whether the project benefits occur every year and whether they are dependent on other factors that may change from year to year or within a season or year. Reliable project benefits will be sustained year to year and during droughts.

Recommendation for Target Areas for Water Rights Analysis[1]

- Quilceda-Allen
  - High growth projection for PE wells (338)
  - Includes closed stream: Quilceda Creek
  - Irrigated areas indicates opportunities for acquisitions; opportunities may be at a smaller scale.
  - Known low-flow issues.
- Little Pilchuck
  - High growth projection for PE wells (294)
  - Includes closed stream: Little Pilchuck
  - Significant irrigated area indicates opportunities for acquisitions
  - Known base flow and low flow issues, including Catherine Creek (tributary)
- Pilchuck (focus on middle and lower Pilchuck)
  - High growth projection for PE wells (280)
  - Includes closed stream: Bodell Creek
  - Significant irrigated area indicates opportunities for acquisitions
  - Known low flow issues in Middle Pilchuck

Preliminary Recommendation for High Priority Subbasins for Streamflow Benefit[2]

- Upper Skykomish
  - Upper watersheds of Skykomish basin, in particular South Fork Skykomish, and Upper North Fork Skykomish contain significant proportions of assessment units ranked highest or moderate-high in the watershed characterization model for importance to overall water flow processes in the watershed.
  - Known low flow issues in Upper Mainstem and Upper SF, and Star Creek and Lewis Creek in Upper NF.
- Upper Snoqualmie
  - The Upper Snoqualmie watershed contains several assessment units ranked highest or moderate-high in the watershed characterization model for importance to overall water flow processes in the watershed.
- Raging River
  - Includes closed stream: Raging River
  - Headwaters rank moderately high in importance to basin hydrology.
  - Known low flow issues in lower Raging River.
- Snoqualmie South
  - Medium growth projection for PE wells (169)
  - Known flow issues in Snoqualmie Mid and Upper Mainstem.
  - Headwaters of Tokul Creek (Canyon Creek, Beaver Creek, and Ten Creek drainages) and western portions of Griffin Creek drainage ranked important for overall water flow processes.
  - Known flow issues in Snoqualmie -Mid & Upper Mainstem, Lower Tolt River, and Langlois Creek.
- Tulalip
  - Highest growth projection for PE wells (468)
  - Tulalip Creek and Mission Creek drainages (on Tulalip reservation) ranked high for overall flow importance.
  - Known low flow issues.
- Quilceda-Allen
  - High growth projection for PE wells (338)
  - Includes closed stream: Quilceda Creek
  - East Fork Quilceda Creek ranked as important for overall flow processes in the watershed.
  - Allen Creek drainage ranked high for overall flow importance in the watershed.

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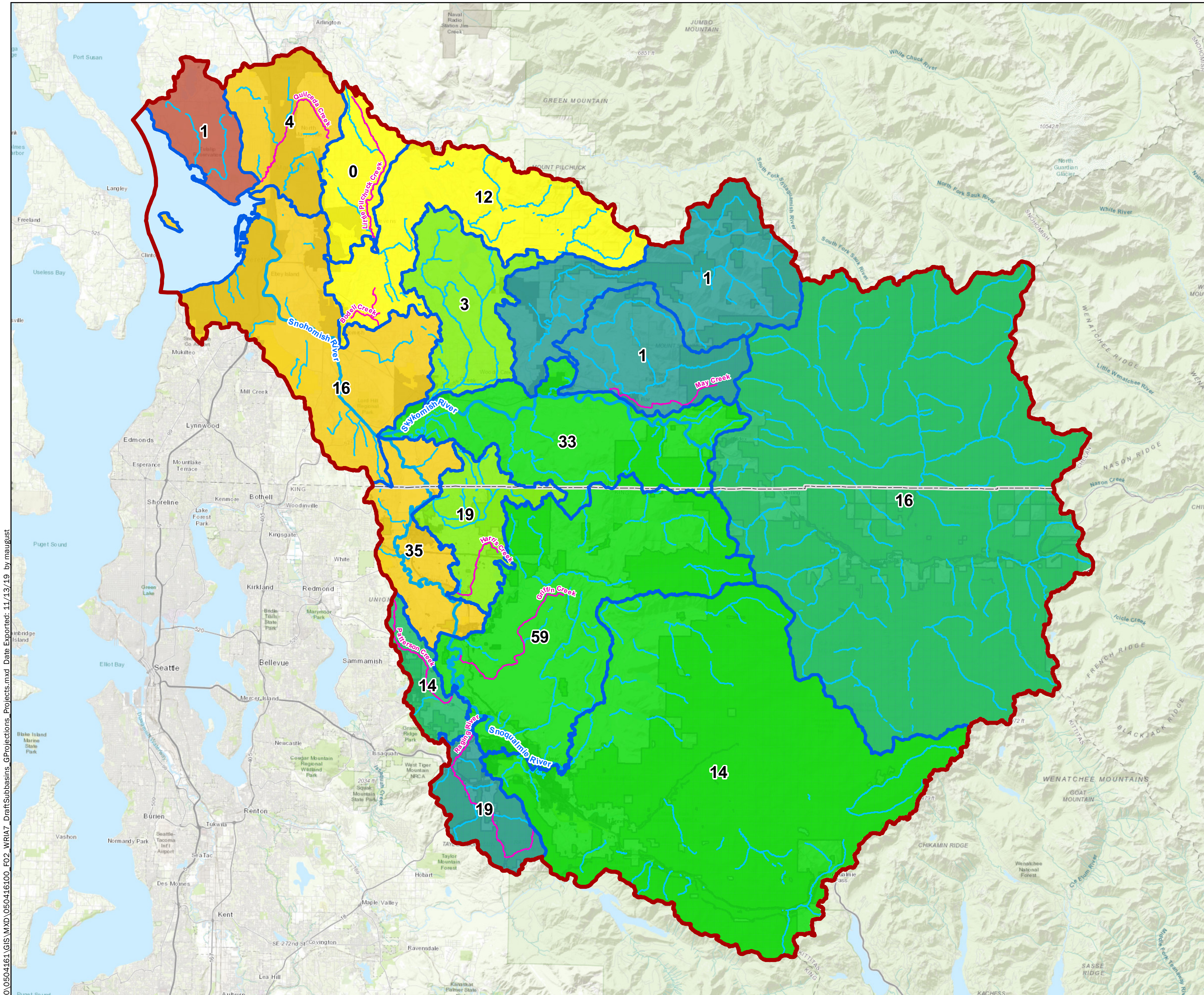
[1] Reference: Target Areas for Preliminary Water Rights Analysis

[2] Reference: Tables 1-3 in Snohomish Basin Protection Plan; Table 13.1 in WRIA 7 Salmon Conservation Plan. The term streamflow benefit is meant to encompass projects with a "water offset" benefit that help us offset our consumptive use estimate as well as projects beyond that that have a streamflow benefit (water offset benefit).



Legend

WRIA 7 Boundary

WRIA7 Proposed Subbasins

Surface Water Closures[3]

Washington State City Urban Growth Areas 2018

Unincorporated

Incorporated

Estimated Permit-Exempt Well Potential

0

1 - 50

51 - 100

101 - 150

151 - 200

201 - 250

251 - 300

301 - 350

351 - 400

401 - 450

>450

14 - Number of Projects by Subbasin

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. Closed streams represent GeoEngineers' interpretation of the language in WAC 173-507 and this map is to only be used for planning purposes.

Data Source: ESRI Topographic Map Base

Projection: NAD 1983 StatePlane Washington North FIPS 4601 Feet

N W E S

5 0 5

Miles

WRIA 7 Growth Projections and Identified Projects by Subbasin as of November 14, 2019

Watershed Restoration and Enhancement Plan WRIA 7
Snohomish County, Washington

GeoEngineers

Figure 2

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