SVWID – Request for Qualifications / Request for Proposals

Water Banking 2.0: Strategic Planning, Supply Development, and Operations Modernization

1. Introduction

The Snoqualmie Valley Watershed Improvement District (SVWID), a Washington special-purpose district authorized under RCW 87.03, is requesting qualifications and proposals from consulting firms with demonstrated expertise in water banking, water-rights analysis, hydrogeology, agricultural water demand forecasting, and Ecology regulatory processes. The selected consultant will support SVWID in developing **Water Banking 2.0**, a comprehensive modernization of the District's water bank.

2. Administrative Information

Issuing Agency

Snoqualmie Valley Watershed Improvement District
PO Box 1148, Carnation, WA 98014

Project Manager / Point of Contact

Erin Ericson, Executive Director
erin@svwid.com
425-549-0316

Procurement Authority

This solicitation is issued pursuant to RCW 87.03 and SVWID's adopted procurement policies. SVWID reserves the right to reject any or all proposals, waive informalities, and negotiate scope, schedule, and budget.

3. Project Overview

SVWID seeks a qualified consultant to:

- Update irrigation and mitigation demand forecasts (5–10 years)
- Assess SVWID's water-right portfolio and identify whether additional hydrogeologic or water-right feasibility analysis may be warranted
- Identify and prioritize water-supply development pathways
- Modernize water-bank policies, procedures, and irrigation-efficiency strategies

4. Scope of Work

The full scope of work is provided in **Attachment A – Scope of Work**.

5. Proposal Submittal Requirements

A. Letter of Interest

- Firm introduction
- Statement of understanding of SVWID's needs

- Primary contact information

B. Firm Qualifications

- Relevant experience with water banking, water-rights changes, hydrogeologic analysis, agricultural demand forecasting, and Ecology regulatory processes
- Description of similar projects completed in the last five years

C. Project Team

- Organizational chart
- Key personnel and roles
- Resumes (2 pages max each)
- Subconsultants (if applicable)

D. Project Approach

- Narrative describing approach to Tasks 1–3
- Methodologies and analytical frameworks
- Anticipated challenges and mitigation strategies

E. Schedule

- Proposed timeline for major tasks and deliverables

F. Budget

- Cost proposal by task and subtask
- Hourly rates and estimated hours
- Budget may be refined during contract negotiation based on recommended follow-on tasks

G. References

- Three relevant project references

6. Procurement Schedule

Milestone	**Date**
RFP Issued	July 29, 2026
Pre-Proposal Meeting	August 12, 2026
Deadline for Questions	August 19, 2026
Proposals Due	August 26, 2026
Selection & Notice of Intent to Award	September 16, 2026
Anticipated Notice to Proceed	September 30, 2026

7. Pre-Proposal Meeting

A non-mandatory pre-proposal meeting will be held to provide background on SVWID's water bank, answer questions, and clarify the scope of work.
Date: August 12, 2026
Time: 10:00 AM
Location: SVWID Zoom Meeting Link
Meeting Room: 8795810071
Password: SVWID
Firms are encouraged to attend. Attendance is not required to submit a proposal. Responses to questions raised during the meeting will be documented and issued as an addendum.

8. Evaluation Criteria & Scoring Matrix

SVWID will evaluate proposals using the following criteria:

Evaluation Matrix (100 points total)

Category	Points	Evaluation Factors
Firm Qualifications & Experience	30	Relevant experience with water banking, water-rights changes, hydrogeologic analysis, Ecology processes
Project Team & Key Personnel	25	Expertise of proposed staff, clarity of roles, experience with similar projects
Project Approach & Technical Understanding	25	Quality of methodology, alignment with SVWID needs, clarity of work plan
Schedule & Capacity	10	Ability to meet timeline, current workload, staffing availability
Cost Proposal	10	Cost competitiveness, clarity of budget, alignment with scope

SVWID may conduct interviews with top-ranked firms if needed.

9. Proposal Submission Instructions

Format

- PDF format
- Maximum 25 pages (excluding resumes and cover letter)
- 8.5x11, single-sided, minimum 11-point font

Submission Method

Email proposals to: **info@svwid.com**
Subject line: **SVWID Water Banking 2.0 Proposal – [Firm Name]**

Deadline

Proposals must be received by **August 26, 2026, 11:59 PM**.
Late submissions will not be accepted.

10. Contract Terms

SVWID will negotiate a professional services agreement with the selected consultant. The District may request modifications to scope, schedule, or budget during negotiations.

11. SVWID Rights

SVWID reserves the right to:

- Reject any or all proposals
- Waive informalities
- Request clarification
- Conduct interviews
- Negotiate with the top-ranked firm
- Cancel the solicitation

12. Attachments (Reference Materials)

The following documents are provided to support proposer understanding of SVWID's water-bank history, existing operations, and technical context. Unless otherwise noted, these materials are reference only.

Attachment A – Scope of Work

Defines the tasks, objectives, and deliverables for the Water Banking 2.0 project.

Attachment B – 2018 Water Right Evaluation – Reference

Provides background on SVWID's existing water-right portfolio and prior extent and validity analysis. Included to support Task 1 review of water-right conditions and identification of potential follow-on feasibility work.

Attachment C – 2017 Water Bank Guidance Manual – Reference

Summarizes historic policies and procedures used during early water-bank operations. Included to support Task 3 review of existing operational practices and identification of modernization needs.

Attachment D – Initial Conditions & Needs Assessment (2016) – Reference

Provides historic demographic, agricultural, hydrologic, and water-resource context that informed early water-bank design. Included to support consultant understanding of long-term drivers of demand and supply conditions.

Attachment A – Draft Scope of Work

Task 1 — Water Bank Demand Analysis Update

Objective

Develop an updated 5–10-year forecast of irrigation and mitigation demand within the SVWID service area to support long-term water-bank planning.

Scope

The consultant will prepare a forward-looking assessment of anticipated water demand, including spatial and seasonal patterns of irrigation growth. The analysis should incorporate relevant climate, cropping, and land-use trends and apply methodologies consistent with Washington Department of Ecology expectations for water-right changes, mitigation planning, and watershed planning. As part of this task, the consultant will review SVWID's existing water-right portfolio and identify whether additional hydrogeologic or water-right feasibility analysis may be warranted to support future water-right transfers or water-bank operations. If such needs are identified, the consultant will provide recommendations for the scope, purpose, and level of effort associated with potential follow-on technical analyses. Any hydrogeologic feasibility work would be conducted under a separate, subsequent task or contract amendment.

Deliverable

- Water Bank Demand Analysis Memo (including recommendations regarding any additional hydrogeologic analysis needs)

Task 2 — Water Supply Development & Analysis

Objective

Identify, evaluate, and prioritize potential water-supply sources and management strategies capable of meeting forecasted demand and supporting the SVWID Water Bank.

Scope

The consultant will assess potential water-supply opportunities and compare them against projected demand from Task 1. Work should include identifying supply types that align with geographic, seasonal, and volumetric needs and developing a general framework for supply and demand matching. The consultant will review the SVWID's existing water-right portfolio and identify water-right-based supply options that may warrant further evaluation, including extent and validity considerations, transferability, and regulatory risks. As part of this task, the consultant will also identify whether additional work, such as detailed extent and validity reviews, development of a landowner participation agreement, or regulatory feasibility assessments may be beneficial to support future water-bank operations. If such needs are identified, the consultant will provide recommendations for the scope and purpose of potential tasks. The consultant will also provide high-level screening of additional or emerging supply concepts and identify which concepts may merit deeper evaluation.

Deliverable

- Water Supply Development & Prioritization Report (including recommendations regarding any additional supply-related analyses, agreement development, or regulatory feasibility work)

Task 3 — Water Bank Design, Operations, and Irrigation Efficiency Improvements

Objective

Modernize SVWID's water-bank operations, policies, and irrigation-efficiency strategies to improve reliability, transparency, and compliance.

Scope

The consultant will review SVWID's existing water-bank policies, procedures, and operational practices, and identify gaps, inefficiencies, or compliance risks. Based on this review, the consultant will recommend updates consistent with Ecology guidance and best practices. The consultant will also identify opportunities for irrigation-efficiency improvements and water-sharing strategies. Opportunities should be prioritized based on feasibility, cost, and potential water savings. As part of this task, the consultant will identify whether additional work, such as development of detailed operational procedures, efficiency program design, or landowner engagement materials are recommended additional tasks.

Deliverables

- Water Bank Operations & Policy Recommendations Memo
- Irrigation Efficiency & Water-Sharing Opportunities Summary

Attachment B – 2018 Water Right Evaluation – Reference

February 19, 2018
Project No. 170052H001

Snoqualmie Valley Watershed Improvement District
4621 Tolt Avenue
Carnation, Washington 98014

Attention: Cynthia Krass - Executive Director

Subject: FINAL DRAFT Report
Water Right Evaluation
King County, Washington

Introduction and Purpose

This FINAL DRAFT report provides the results of our assessment of the Tokul Creek surface water right (S1-*01933C), owned by the Snoqualmie Valley Watershed Improvement District (SVWID), and two privately owned ground water claims (Tall Chief Claims G1-126873CL and G1-125318CL) all located in King County, Washington. We understand that the SVWID and the Snoqualmie Valley Preservation Alliance (SVPA) have recently developed a Water Bank to facilitate the seasonal exchange and use of water rights located within the SVWID for irrigation purposes.

The SVWID consists of approximately 13,500 acres of mostly agricultural property located in the Snoqualmie River Valley, extending from roughly two miles upstream of Fall City, downstream (north) to the King/Snohomish County line. The approximate location of the SVWID is shown on the attached *Figure 1 – Tokul Creek and Tall Chief Transfers to Snoqualmie River* map. The approximate locations of the current points of withdrawal (POW) for the Tall Chief water right claims are also shown on Figure 1. The original point of diversion (POD) for the Tokul Creek surface water right was located on Tokul Creek, which flows into the Snoqualmie River upstream of the SVWID (Figure 1).

In the recent past, the water rights that are the subject of this report have been considered for seasonal transfer by the SVWID through the Water Bank. However, there have been some significant limitations to the proposed change/transfers with regard to the locations of additional POWs, PODs and the Place of Use (POU) due to a lack of available analyses regarding potential impacts from the proposed changes. One of the primary challenges associated with establishing additional POWs and PODs is the potential to impact one or more of the significant number of "regulated streams" (streams that are subject to minimum instream flow requirements, low flow limitations, and/or administrative closure) located in the SVWID (Figure 1).

The primary purpose of this report is to streamline future change/transfers of the three identified water rights by establishing a conservative/defensible methodology for delineating areas within the SVWID where additional POWs and PODs can be established for the rights (Table 1). It follows that once an acceptable methodology has been established, it should be possible to apply the same methodology to other ground and surface water rights identified by the SVWID for future Water Bank consideration. The attributes of the three water rights currently proposed to be used within the Water Bank are summarized in Table 1.

Table 1
Proposed Water Bank Water Rights

Water Right		Qi		Qa (acre-feet)	Period of Use
Name	Number	gpm	cfs		
Tokul Creek	S1-*01933C	933.5	2.08	56.71	Continuous
Tall Chief	G1-126873CL	150.0	0.33	96.90	Mar 1 – Nov 1
Tall Chief	G1-125318CL	25.0	0.06	4.00	Continuous
Total		1,108.5	2.47	157.61	

We understand that the information presented in this report may be used in part for the development of reports of examination (ROE) by the Washington State Department of Ecology (Ecology) regarding seasonal change/transfer applications for the three subject water rights and possibly other water rights that may be identified in the future. This report was developed in part based on discussions with and technical input from the SVWID, AMP Insights, Ecology, the Tulalip Tribes and the Snoqualmie Tribe.

Geology and Hydrogeology of the SVWID

The primary source of geologic/hydrogeologic information for the SVWID is a United States Geological Survey (USGS) report (Turney, et al., 1995). Detailed maps showing the surficial geology, ground water contours, and the geographical distribution of aquifer parameters and depth to ground water within the SVWID are available in the USGS report. The geologic/hydrogeologic information presented in the USGS report was used as the basis for the analyses discussed in this report and is summarized below.

- The proposed ground water withdrawals associated with the water rights are from a shallow unconfined aquifer system located within the recent alluvial sediments in the Snoqualmie Valley.

- The thickness of the shallow unconfined aquifer ranges between 60 and 80 feet, with an average thickness of approximately 70 feet, within the boundaries of the SVWID.
- Aquifer specific yield (storage) of an unconfined aquifer is the ratio of the volume of water an aquifer will yield by gravity drainage to the volume of the soil and typically ranges between 0.10 and 0.30. An average specific yield of 0.10 was assumed for the analyses discussed in this report.
- Hydraulic conductivity is a measure of the ability of water to move through an aquifer. The hydraulic conductivity of the shallow unconfined aquifer ranges between 1.1 feet per day (ft/d) and 1,800 ft/d based on specific capacity data for 24 wells located throughout the SVWID (Turney, et al., 1995).
- Aquifer transmissivity is the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient and can be estimated as the product of the aquifer hydraulic conductivity and the aquifer saturated thickness. The range of hydraulic conductivity values and an assumed average aquifer thickness of 70 feet correspond to aquifer transmissivities ranging between 77 square feet per day (ft^2/d) and 126,000 ft^2/d.
- The aquifer transmissivity data have an average of 19,400 ft^2/d and a median value of 13,300 ft^2/d.
- Ground water in the shallow aquifer generally flows north in the central portion of the valley and likely towards the Snoqualmie River on the margins of the valley.
- The hydraulic gradient of the aquifer in the central portion of the Snoqualmie River valley is relatively flat and ranges from approximately 0.0003 (1.6 feet per mile) between Carnation and Duvall to roughly 0.0011 (5.8 feet per mile) between Fall City and Carnation.
- The shallow aquifer likely receives most of its recharge directly from precipitation (rain and snow) falling on the valley bottom and a lesser amount from the infiltration of surface water runoff off the nearby hills.

Water Right Seasonal Change/Transfers

<u>General</u>

The practical use of the subject water rights in the SVWID Water Bank will require Ecology to approve permanent and/or seasonal changes to the following water right attributes.

- Place of use (POU)
- Allowable irrigation acreage
- Purpose of use
- Points of withdrawal (POW) – Relevant to ground water rights

- Points of diversion (POD) – Relevant to surface water rights

It is our understanding that Ecology will be evaluating the potential to change the water right POUs and, as necessary, the water right purpose of use to facilitate the use of the appropriated water throughout the SVWID for irrigation purposes.

The following sections of this report address issues associated with adding additional POWs and/or PODs to the subject water rights within the SVWID boundaries under the six scenarios listed below. It should be noted that none of the scenarios for adding POWs and PODs to the subject water rights discussed in this report will result in an increase to the water rights' instantaneous quantity (Qi), annual/seasonal quantity (Qa), and/or consumptive use (Table 1).

- Scenario A - Tokul Creek surface water right transfers to Snoqualmie River
- Scenario B - Tall Chief ground water claim G1-125318CL transfers to Snoqualmie River
- Scenario C - Tall Chief ground water claim G1-126873CL transfers to Snoqualmie River
- Scenario D - Tokul Creek surface water right transfers to ground water POWs
- Scenario E - Tall Chief ground water claim G1-125318CL transfers to ground water POWs
- Scenario F - Tall Chief ground water claim G1-126873CL transfers to ground water POWs

Areas where it is proposed that additional POWs and PODs can be added to the subject water rights within the SVWID boundaries, based on the data and analyses presented in this report, are shown on Figure 1 and *Plate 1 - Tokul Creek and Tall Chief Transfers to Ground Water*. Areas where additional POWs and PODs may be allowed pending the collection and analysis of more site-specific data are also shown on Plate 1.

Scenario A - Tokul Creek Surface Water Right Transfers to Snoqualmie River

The original POD for the Tokul Creek surface water right was located on Tokul Creek, which flows into the Snoqualmie River upstream of the SVWID (Figure 1). Adding additional PODs for the Tokul Creek surface water right to the Snoqualmie River within the SVWID boundaries is essentially a downstream transfer of a perfected surface water right and will result in the following.

- No increased impact to the Snoqualmie River because the original POD for the right is located upstream of the SVWID.
- No impact to other regulated streams in the SVWID because the withdrawals will only be from the Snoqualmie River.

- No impact timing/period of use issues because the Tokul Creek surface water right is for continuous, year-round use.

Therefore, adding additional PODs to the Tokul Creek surface water right as described in Scenario A should be approvable by Ecology. The reach of the Snoqualmie River within the SVWID boundaries where the additional PODs for the Tokul Creek surface water right can be established is shown on Figure 1.

Scenario B - Tall Chief Ground Water Claim G1-125318CL Transfers to Snoqualmie River

The original POW for G1-125318CL is located roughly 1,700 feet west of the Snoqualmie River and roughly 1,800 feet south/upstream of Stickney Slough (Figure 1). It is conservatively assumed that Stickney Slough is in direct hydraulic continuity with the Snoqualmie River. The ground water flow direction near the original POW is to the north, towards Stickney Slough (Turney, et al., 1995), indicating that surface water impacts from the original use of G1-125318CL would occur in the Snoqualmie River no further upstream than the north end of Stickney Slough. Adding PODs for the Tall Chief ground water claim G1-12531CL on the Snoqualmie River downstream of the north end of Stickney Slough (Figure 1) and within the SVWID boundaries is essentially a down-basin transfer of a ground water claim and will result in the following.

- No increased impact to the Snoqualmie River because the original POW for the claim is located upstream of the area where the Snoqualmie River would be impacted.
- No impact to other regulated streams in the SVWID because the withdrawals will only be from the Snoqualmie River.
- No impact timing/period of use issues because ground water claim G1-125318CL is for continuous, year-round use.

Therefore, adding additional PODs to Tall Chief ground water claim G1-125318CL as described in Scenario B should be approvable by Ecology. The reach of the Snoqualmie River where the additional PODs for Tall Chief ground water claim G1-12531CL can be established is shown on Figure 1.

Scenario C - Tall Chief Right G1-126873CL Transfer to Snoqualmie River

The original POWs for G1-126873CL are located roughly 1,100 feet west of the Snoqualmie River and roughly 1,800 feet south/upstream of Stickney Slough (Figure 1). As previously discussed, it is conservatively assumed that Stickney Slough is in direct hydraulic continuity with the Snoqualmie River. The ground water flow direction near the original POW is to the north, towards Stickney Slough (Turney, et al., 1995), indicating that surface water impacts from the original use of G1-126873CL would occur in the Snoqualmie River no further upstream than the north end of Stickney Slough.

Water right claim G1-126873CL is seasonal (March 1 – November 1, Table 1). Therefore, the impact to the Snoqualmie River from a transferred use of this claim directly from the river cannot occur outside of the time period of the impact that occurred to the river during the use of the original POWs for G1-126873CL. It should be noted that the timing of the impact to the river from the use the original POW would be delayed by a certain time period that is primarily based on the distance between the river and the original POW and the properties of the shallow unconfined aquifer. For the purposes of this analysis, we estimated the delay timing of the impact to the Snoqualmie River from the use of the original POW using the stream depletion (SD) methodology outlined by Massmann (2008) and described by the equation below.

$$SD = (L^2 \text{ X } S)/T$$

Where:

SD = Time required for the effect of pumping to reach the stream (days)
L = Distance from well to river (feet)
S = Aquifer specific yield
T = Aquifer Transmissivity

As discussed previously, the original POWs for G1-126873CL are located approximately 1,100 feet from the Snoqualmie River (L). Assuming an average aquifer specific yield (S) of 0.10, and an aquifer transmissivity (T) value that is equal to the median value (13,300 ft^2/d) of the available data set, the stream depletion impact timing to the Snoqualmie River (SD) is nine days.

To ensure that the impact to the river from a transfer under Scenario C will not occur prior to when the river was impacted from the original use of the claim, the start date of the transferred portion of the claim should be changed from March 1 to March 10. Furthermore, the end date of the period of use for the transferred portion could be extended from November 1 to November 10 to account for the delayed impact to the river. However, we understand the SVWID is conservatively proposing to maintain the ending date of the period of use at November 1 for all ground water to surface water transfers for G1-126873CL.

If the impact to the river timing issues is corrected by adjusting the period of use start/end dates as described above, adding PODs for the Tall Chief ground water claim G1-126873CL on the Snoqualmie River downstream of the north end of Stickney Slough (Figure 1) and within the SVWID boundaries will essentially be a down-basin transfer of the ground water claim and will result in:

- No increased impact to the Snoqualmie River because the original POW for the right is located upstream of the impact area to the river.
- No impact to other regulated streams in the SVWID because the withdrawals will only be from the Snoqualmie River.
- No impact timing issues because the water right period of use issues will be adjusted to account for the lag time of impact to the river.

Therefore, adding additional PODs to Tall Chief ground water claim G1-126873CL as described in Scenario C should be approvable by Ecology. The reach of the Snoqualmie River where the additional PODs for Tall Chief ground water claim G1-126873CL can be established is shown on Figure 1.

<u>Scenario D - Tokul Creek Surface Water Right Transfer to Ground Water POWs</u>

The primary restriction for transferring the Tokul Creek surface water right to POWs (wells) located within the SVWID is the potential impact to the numerous nearby regulated streams (Figure 1, Plate 1). For the purposes of conservatively identifying where additional POWs to the Tokul Creek right under Scenario D can be located without the potential to impact regulated streams, we have made the following assumptions.

- The Snoqualmie River forms a boundary to ground water flow in the shallow unconfined aquifer.
- Ground water flow direction in the Snoqualmie River valley within the SVWID area is predominantly parallel to the general northward flow of the river.

Based on these two simplifying/conservative assumptions, areas of the SVWID located directly hydraulically upgradient of and on the same side of the river as regulated streams were removed for consideration for the location of POWs under Scenario D due to the potential to impact the regulated streams (Plate 1). It is possible that, with additional site-specific data and analyses, POWs could be located in portions of these excluded areas.

The pumping from a POW results in a cone of depression or water level drawdown around the well. The size and shape of the cone of depression are dependent on the pumping rate of the POW and specific aquifer parameters. Impact to a regulated stream can occur if the cone of depression of a POW extends far enough away from the well to reach the stream.

The Theis equation was used to estimate potential water level drawdown at distance from a POW as a means to estimate an acceptable hydraulically downgradient setback distance from a regulated stream. The Theis equation requires information regarding the well pumping rate, duration and aquifer parameters (specific yield and transmissivity) to estimate water level drawdown at distance from the pumping well.

Information provided by Cynthia Krass (SVWID Executive Director) indicates that the volume of irrigation water brokered by the SVWID through the water bank has ranged between 3 and 10 acre-feet, and that irrigation water use in the valley generally occurs between June and September (122 days). For the Theis analyses, it was assumed that 15 acre-feet of water will be pumped from a POW on a continuous basis (28 gallons per minute) for 122 days. The pumping rate and duration assumptions are conservative because the maximum volume of water previously brokered by the SVWID has been 10 acre-feet, and typical irrigation practices would not involve continuous pumping of the well for more than a few days at a time.

An average aquifer specific yield of 0.10 and an aquifer transmissivity value that is equal to the median value (13,300 ft^2/d) of the available data set were assumed for the Theis analysis. The Theis analysis using the above input parameters indicates that there would be no water level drawdown (no impact) in the shallow unconfined aquifer at a distance of 1,250 feet from the POW. Therefore, for the purpose of eliminating the potential to impact regulated streams located in the SVWID area, a conservative setback distance of 1,500 feet hydraulically downgradient of all regulated streams was established for Scenario D water right transfers (Plate 1).

Adding POWs to the Tokul Creek surface water right within the areas described above and shown on Plate 1 is essentially a down-basin transfer of a perfected ground water right and will result in the following.

- No increased impact to the Snoqualmie River because the original POD for the surface water right is located upstream of the SVWID.
- No impact to other regulated streams because the POWs will be located in the specific areas of the SVWID described above (Plate 1) to avoid the potential capture of ground water that may recharge the regulated streams.
- No impact timing/period of use issues because the Tokul Creek water right is for continuous, year-round use.

Therefore, adding additional POWs to Tokul Creek surface water right as described in Scenario D should be approvable by Ecology. The areas of the SVWID where POWs for the Tokul Creek right can be located are shown on Plate 1.

<u>Scenario E - Tall Chief Ground Water Claim G1-125318CL Transfers to POWs</u>

The POW location limitations described for Scenario D also apply to Scenario E. The areas approvable for the location of POWs under Scenario E will be further restricted to areas located

where the assumed ground water flow direction indicates that potential impacts from the ground water withdrawal will not affect the Snoqualmie River hydraulically upgradient of the north end of Stickney Slough, as described in detail for Scenarios B and C (Plate 1).
With the inclusion of the location limitations described for Scenario E, adding POWs to Tall Chief ground water claim G1-12531CL is essentially a down-basin transfer of a ground water claim and will result in the following.

- No increased impact to the Snoqualmie River because the location of the impact to the river will not be changed from where it occurred during the use of the original POW for the right.
- No impact to other regulated streams because the POWs will be located in the specific areas of the SVWID described above (Plate 1) to avoid the potential capture of ground water that may recharge the regulated streams.
- No impact timing/period of use issues because water right G1-125318CL is for continuous, year-round use.

Therefore, adding additional POWs to Tall Chief ground water right G1-125318CL as described in Scenario E should be approvable by Ecology. The areas of the SVWID where the additional POWs for Tall Chief ground water right G1-12531CL can be established are shown on Plate 1.

<u>Scenario F - Tall Chief Ground Water Claim G1-126873CL Transfers to POWs</u>

The POW location limitations described for Scenarios D and E also apply to Scenario F. However, because claim G1-126873CL is seasonal (March 1 through November 1), the delay timing of the potential impact to the Snoqualmie River must also be accounted for by adjusting the water right period of use using the methodology described in Scenario C.

Under Scenario C, it was established that the impact to the Snoqualmie River from the use of the original POW for claim G1-126873CL was delayed nine days. Therefore, the time period of impact to the Snoqualmie River from the use of the original POW for G1-126873CL is March 10 through November 10. Any ground water withdrawal from a new POW under this claim cannot impact the river outside of the March 10 through November 10 time period. The SVWID has indicated that it will agree to not extend the current period of use end date (November 1) for any transfers of portions of claim G1-126873CL.

The stream depletion methodology indicates that the impact to the river from the use of POWs located further from the river than the original POWs would result in a stream depletion delay factor that is greater than nine days. Therefore, it is not necessary to change the March 1 period of use start date in this situation because the impact to the river would occur after March 10. However, because the impact delay is greater than nine days, it would be necessary to end the period of use prior to November 1 to avoid impacting the river after November 10. For example, the stream depletion factor for a new POW located 1,500 feet from the river (400 feet further away than the original POWs), is approximately 17 days. Therefore, the use of the POW would have to be terminated no later than October 24 to ensure that any residual impact to the river would not occur after November 10. Consequently, the period of use for a portion of G1-126873CL that is transferred to a POW located 1,500 feet from the river would be March 1 through October 24.

The stream depletion delay for POWs located closer to the river than the original claim POWs would be less than nine days. Therefore, the period of use start date could be adjusted to account for the shorter delay time. For example, the stream depletion factor for a new POW located 700 feet from the river (400 feet closer to the river) is four days. Therefore, the start date of the period of use could be no earlier than March 6 to ensure that any impact to the river from the withdrawal would not occur prior to March 10. Also there would be no residual impact to the river after November 10 if the use of the new POW was terminated on November 1. Consequently, the period of use for a portion of G1-126873CL that is transferred to a POW located 700 feet from the river would be March 6 through November 1.

With the inclusion of the location limitations described for Scenario E and with adjustment to the water right period of use as described in Scenario F, adding POWs to Tall Chief ground water claim G1-126873CL is essentially a down-basin transfer of a ground water claim and will result in the following.

- No increased impact to the Snoqualmie River because the location of the impact to the river will not be changed from where it occurred during the use of the original POW for the right.
- No impact to other regulated streams because the POWs will be located in the specific areas of the SVWID described above (Plate 1) to avoid the potential capture of ground water that may recharge the regulated streams.
- No impact timing issues because the water right period of use issues will be adjusted to account for the lag time of impact to the river.

Therefore, adding additional POWs to Tall Chief ground water right G1-126873CL as described in Scenario F should be approvable by Ecology. The areas of the SVWID where the additional POWs for Tall Chief ground water right G1-126873CL can be established are shown on Plate 1.

CLOSURE

This letter report has been prepared for the exclusive use of the SVWID and their agents for specific application to this project. Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted hydrogeologic practices in effect in this area at the time our letter report was prepared. No other warranty, express or implied, is made.

We appreciate the opportunity to be of continued service to the SVWID. If you have any questions or require additional information, please contact us at your earliest convenience.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
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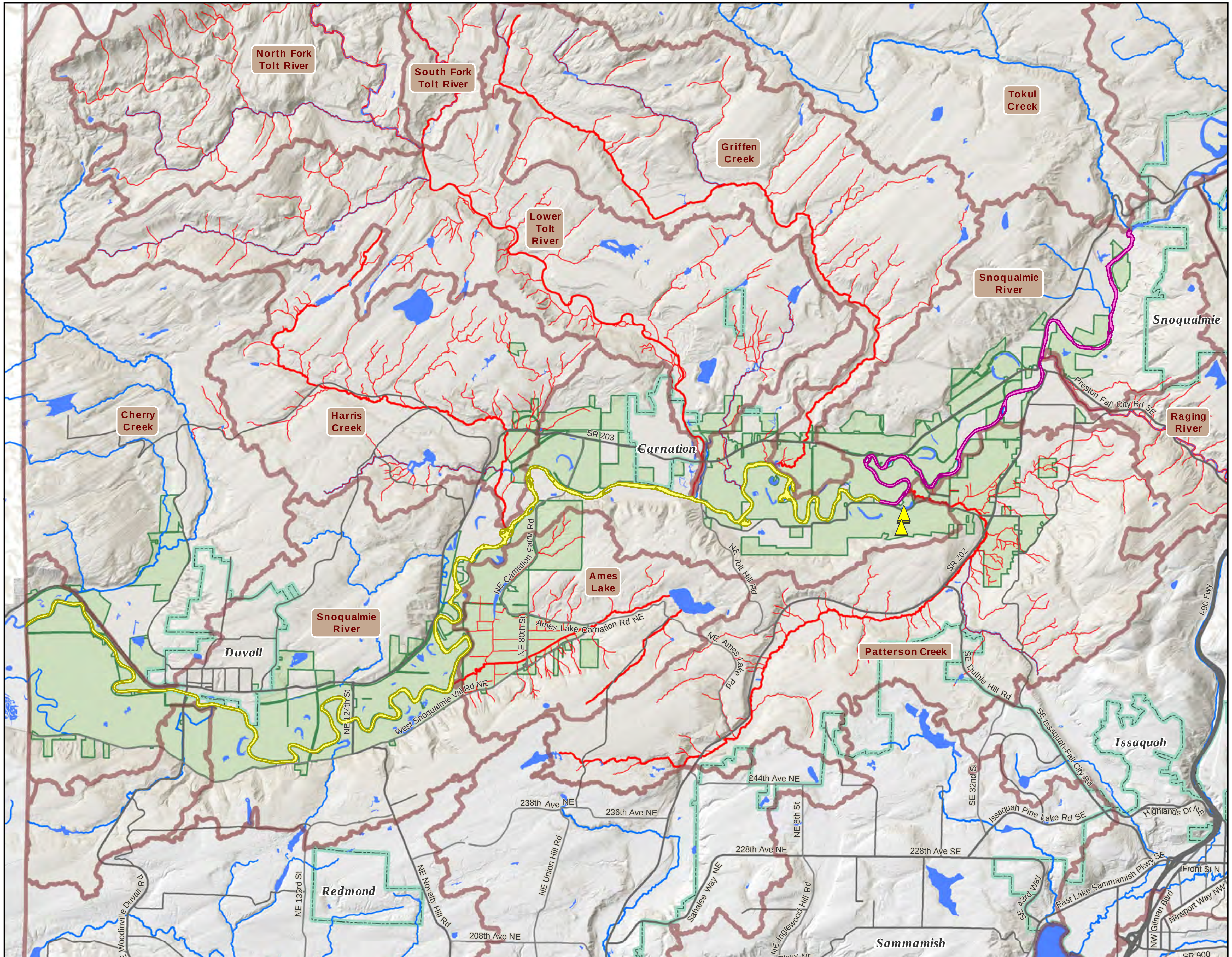
Attachments:	Figure 1:	Tokul Creek and Tall Chief Transfers to the Snoqualmie River
	Plate 1:	Tokul Creek and Tall Chief Transfers to Ground Water

REFERENCES

Massmann, J., 2008, Improving the Quality and Quantity of In-Stream Habitat by Resting Groundwater Extraction Wells, prepared for King County Regional Water Supply Planning Process Tributary Streamflow Technical Committee, May.

Turney, G.,L., S.C. Kahle, and N.P. Dion, 1995, Geohydrology and Ground-Water Quality of East King County, Washington, U.S. Geological Survey Water-Resources Investigations Report 94-4082.



LEGEND:

- TALL CHIEF ORIGINAL POINT OF WITHDRAWAL
- REGULATED STREAM
- TOKUL CREEK AND TALL CHIEF TRANSFER ALLOWED
- TOKUL CREEK TRANSFER ALLOWED
- SNOQUALMIE VALLEY WATERSHED IMPROVEMENT DISTRICT
- DRAINAGE BASIN
- CITY

DATA SOURCES / REFERENCES:
KING CO: ROADS 01/17, CITIES 01/17, HYDRO 01/17
SVWID: SVWID BOUNDARY 2/17

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE

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BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

associated earth sciences incorporated

TOKUL CREEK AND TALL CHIEF TRANSFERS TO THE SNOQUALMIE RIVER

SNOQUALMIE VALLEY WID
KING COUNTY, WASHINGTON

PROJ NO.	DATE:	FIGURE:
170042/170052	1/18	1

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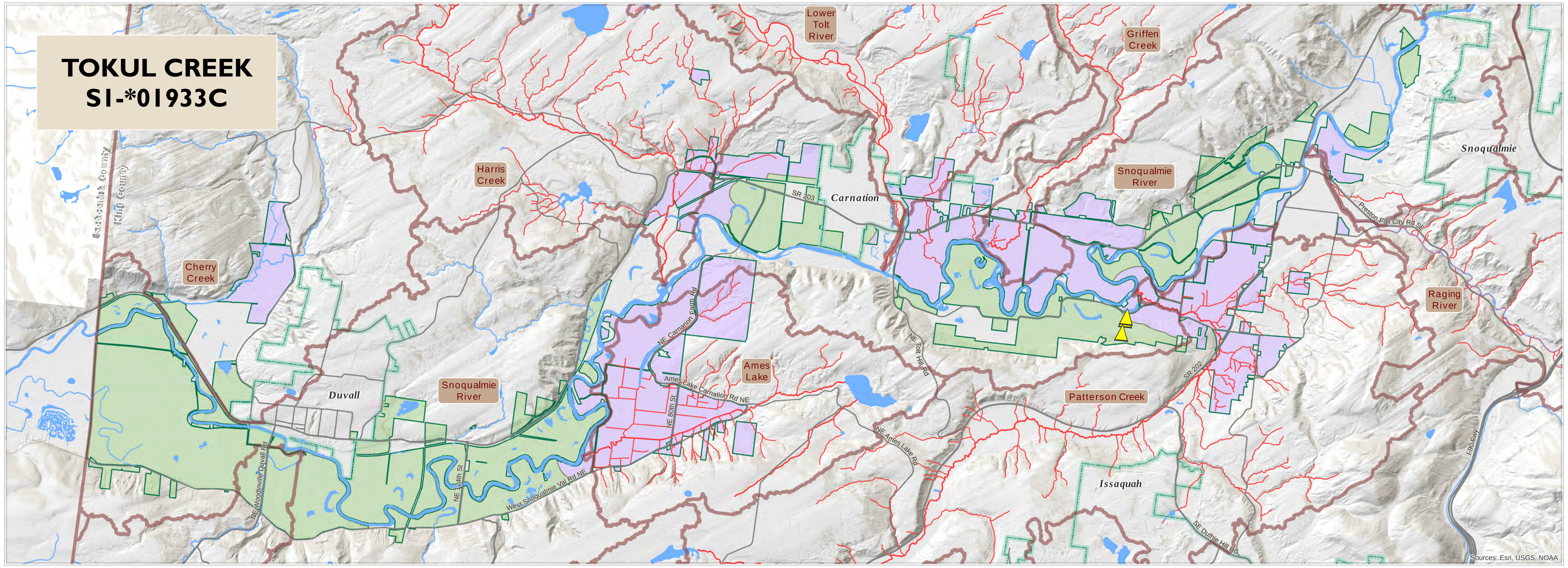
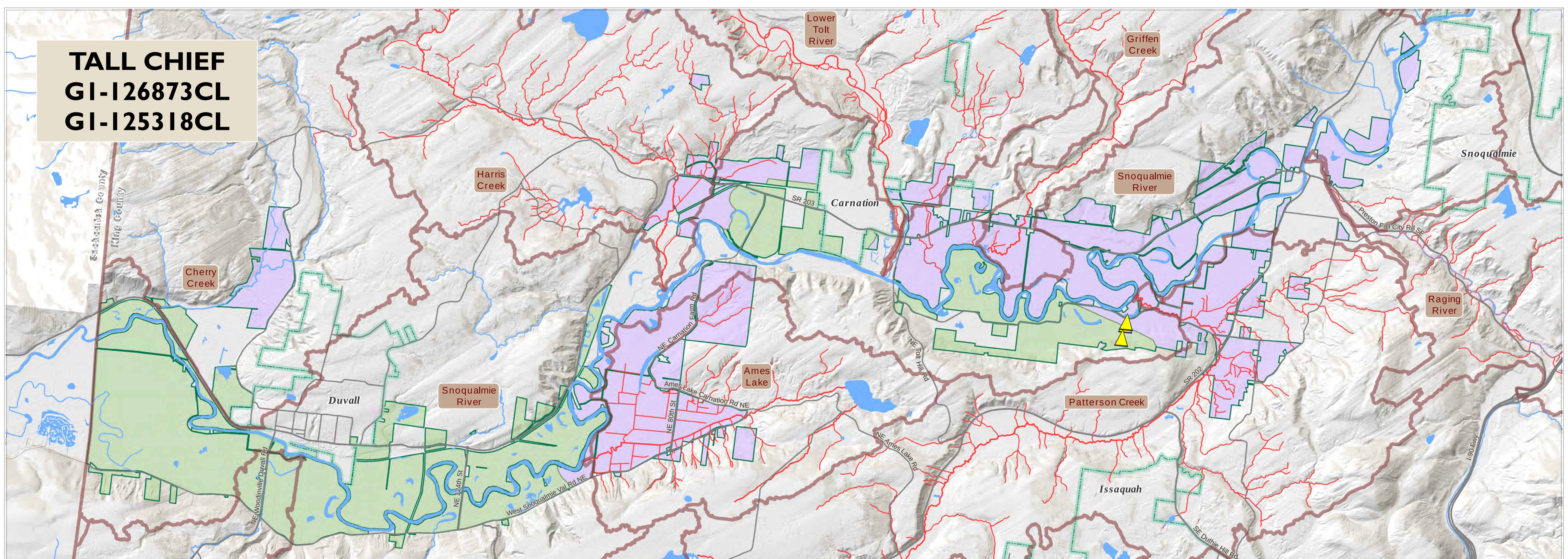




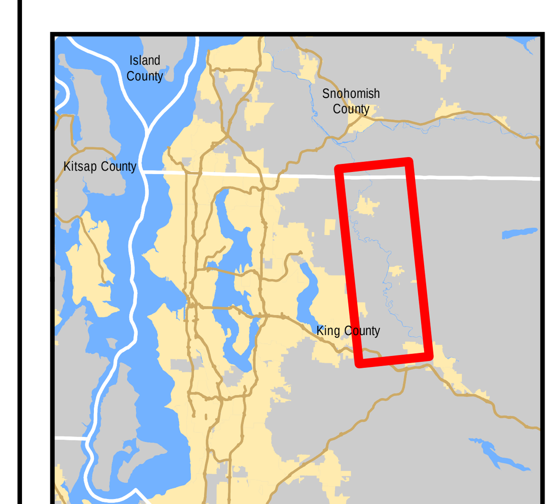
LEGEND:

- TALL CHIEF EXISTING POINT OF WITHDRAWAL
- REGULATED STREAM
- TRANSFER ALLOWED
- FURTHER ANALYSIS NEEDED
- SNOQUALMIE VALLEY WATERSHED IMPROVEMENT DISTRICT
- DRAINAGE BASIN
- CITY

ADDITIONAL TIMING RESTRICTIONS APPLY TO TALL CHIEF GROUND WATER RIGHT G1-126873CL. SEE REPORT TEXT.

DATA SOURCES / REFERENCES:
KING CO: ROADS 01/17, CITIES 01/17, HYDRO 01/17
SVWID: SVWID BOUNDARY 2/17

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



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BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

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TOKUL CREEK AND TALL CHIEF TRANSFERS TO GROUND WATER

SNOQUALMIE VALLEY WID
KING COUNTY, WASHINGTON

PROJ NO.	DATE:	SHEET:
170042/170052	1/18	1

Attachment C – 2017 Water Bank Guidance Manual – Reference

Snoqualmie Valley Watershed Improvement District

Water Bank Guidance Manual

September 2017

Table of Contents

1. Introduction

The Snoqualmie Valley Watershed Improvement District (WID) is developing an agricultural water bank (the Snoqualmie Valley Water Bank or bank) to provide irrigation water to its members. The WID hired AMP Insights to assist in planning, piloting and designing the bank. AMP worked with the WID to develop a comprehensive water bank plan and design in August 2017.This guidance document distills the comprehensive plan and design into a manual of policies and procedures related to participation in the water bank for the next three to five years, beginning in the fall of 2017.

2. Water Banking: Policies and Procedures

This section outlines specific policies and procedures the WID will follow in operating the water bank each year.

2.1 Allocating Water

This section details how the bank will market and provide water to interested buyers.

Eligibility.The water bank will prioritize marketing water to WID members, however once members are served, requests from non-WID members may be considered by action of the WID Board of Commissioners (the WID Board). If the WID Board decides to market water to non-WID members these transfers will be limited to one-year leases and all transaction and administrative costs must be paid by the lessee. WID members must be in good standing to receive water from the bank. To remain in good standing, WID members must be current in paying their assessment and must comply with the terms of any water lease agreements with the WID (including paying outstanding invoices, and any requirements imposed by Ecology). In developing contracts with water bank buyers, the WID may also include additional conditions to be met for members to maintain good standing and to ensure smooth bank operations, fairness to all WID members and protection of water bank supply water right extent and validity.

Requirement to Use and Measure Leased Water. It is critical that water bank buyers only purchase water they are reasonably certain they will use. This helps preserve supply for others and ensures that WID-owned water rights and water rights leased to the bank will not be put in jeopardy of relinquishment for non-use. Therefore, the WID requires that buyers maintain a track record of using most or all the water they purchase from the bank. Ecology will also require buyers to install a water meter to measure their water use and agree to report use to the WID and Ecology (WAC 173-173).

Water bank processes for WID members to purchase water will vary with the length of time they need water. In the next three to five years, the bank will market water rights to customers for periods of one or more years. The following sections describe the process for buyers of short and long-term water right leases.

2.1.1 Short-term Transfers

Short-term transfers refer to agreements in which WID members acquire water for a period from one to five years.

Timing and Notice. Each year, the bank will have one or more dedicated periods during which water supplies for the next irrigation season will be offered to WID members. This period is called the *marketing window*. The timing of the marketing window each year must balance the needs of the bank to have adequate time to process buyer requests and administrative water right changes with the needs of farmers to plan for the coming irrigation season. To accomplish this balance, the marketing window for short-term transfers from the bank each year will begin October 15th and last through December 1st.

Prior to October 15th, the WID will provide notice to members of the coming marketing window through direct communication, email, direct mail or some combination of these communication methods. The WID may also provide reminders during the marketing window to ensure the broadest possible participation each year. While members are free to indicate their need for water prior to the marketing window, they will be required to submit their official requests only during the marketing window. Members who ask for water once the marketing window has closed are unlikely to be accommodated, though the WID may, at its sole discretion, attempt to help those members if possible given supply constraints and processing timelines. Such transactions may include additional administrative fees, including but not limited to public notice expenses charged by the department of Ecology.

At the beginning of the marketing window, the WID will provide all necessary materials for members who need water beginning the next irrigation season. These materials will detail all necessary requirements for any WID member hoping to access available water supplies (described further below). Materials will be provided through email or the postal service directly to members who have expressed interest. Paper copies will also be available in the WID office and will be posted on the WID web site. Completed materials must be submitted to the WID by close of business on December 1st. If the 1st falls on a weekend day, completed materials must be submitted by close of business on the Monday following the weekend.

Allocation. In marketing short-term water, the bank will potentially use two different approaches to allocate available water:

1. Allocate water to all customers at a fixed offer price, subject to demand not exceeding the available supply of water.
2. If demand exceeds available supply, the WID will first attempt to acquire additional supply. If this is not possible, the WID Board will determine an alternate allocation procedure. Any process that differs from #1 above will be clearly communicated to WID members.

For 2018, the WID will use the market price determined through the 2017 water lease auction ($125 per acre-foot) as the fixed water sale price (see more below in section 2.4.1 for information about additional costs and fees). The WID Board will reconsider the annual water sale price before each new marketing window.

Finally, it is important to note that some members whose request for water is filled through the processes above may nonetheless not receive water if the Department of Ecology determines that their land is not a suitable transfer destination for available supplies under Washington water law and Department of Ecology regulations and procedures.

Buyer Information. A range of information from potential buyers is required by the WID to complete the short-term transfer process each year. This information may be solicited on one single form, or several, depending on the WID's preferences in each year. The form and content of the materials distributed each year may vary depending on prior year's experiences and any changes in water availability, law and policy or other circumstances. The WID may require the following information from each potential buyer:

- Amount of water requested (in acre-feet per year)
- Duration of water requested (up to five years)
- Specific description (using the public land survey or parcel number) of lands to be irrigated, including total irrigated acres

- Proposed point of diversion for surface water diversions
- Proposed well location for groundwater uses
- Proposed pump specifications for surface and groundwater diversions
- Well capacity and specifications (depth, etc.) for groundwater uses
- A copy of the well log, if applicable (available at Department of Ecology's webpage)
- Agreement to install/maintain a functioning water meter for water use measurement
- Agreement to install adequate fish screens for surface water diversions, and to seek assistance from WID if necessary.

2.1.2 Long-term Transfers

Policies and procedures for long-term transfers – defined as transfers for longer than five years – are largely like those for short-term transfers with some key exceptions, as described below. Long-term transfers require significant commitment on the part of the WID and buyers and the WID can only offer long-term transfers if corresponding long-term supply agreements or WID-owned water rights are in place. Therefore, the WID Board will decide annually whether to offer a long-term transfer marketing window each year based on supply and potential for demand. The WID Board will also decide in any year it will offer long-term supply how much supply to make available.

Timing. Long-term transfers take more time to process through Ecology because they involve more in-depth water right reviews. Therefore, the bank will establish an earlier marketing window for these transfers. Though the precise timing of this marketing window is not known, the WID will clearly communicate such a window to WID members if the WID Board decides to make long-term supply available.

Allocation. A competitive auction process will be used for initial efforts to market long-term transfers. The WID will negotiate long-term supply agreements directly with sellers in advance and the prices of this water to the WID will set a "floor supply price" for the auction. This floor price will be announced to potential buyers in the auction and the water that is available will be allocated to the highest bids, at or above the floor price.

As with short-term transfers, the WID will seek to recoup transaction costs. For long-term transfers, the WID Board will set a fixed percentage of the water price as a brokerage fee, and also set a revenue sharing percentage on net gains from transactions to share these gains between suppliers and the WID. The WID Board of Commissioners will determine and announce the yearly fee structure in advance of any opening of a long-term transfer window.

The auction process would be relatively simple: after the WID announces the floor price and fee structure, buyers will submit sealed bids containing all necessary information for the WID to compare bids and select auction winners; the WID will unseal all bids simultaneously and determine which bids can be satisfied by available supply according to water law and Department of Ecology rules and regulations; and then the WID will prioritize bids that can be satisfied by price or duration of request or another factor or combination of factors.

Buyer Information. If the WID decides to offer long-term transfers through the bank, the offer will be clearly communicated to members including what the relevant marketing window is and how much water will be offered. Much like for short-term transfers, the WID will develop specific materials to solicit necessary information for these transfers. The specific information required includes the same list of information as above for short-term transfers. In addition to this list, the more rigorous review procedures for long-term transfers means that members may also need to provide additional information to complete the water right transfer process through the Department of Ecology.

2.2 Supplier Contracts

For temporary and long-term leases of water to the WID for water bank supply purposes, sellers will sign a contract with the WID detailing the terms of the lease to supply water for the bank to transfer to other lands. The contract format will be based on past WID contracts developed by the WID's legal counsel. There will be some variability between contracts based on individual negotiations with sellers and unique characteristics of water rights but there are several key contract terms that will always be included which are discussed below. It is also important to emphasize that even though the WID is entering into contracts with individual water right holders, all water right transfers must be reviewed and approved by the Department of Ecology. Ecology maintains all its responsibilities and authorities granted under Washington law and the WID and bank staff do not assume any regulatory authority when entering seller agreements.

Four key terms that will be included in seller contracts are briefly outlined below.

- Contracts will specify whether the WID must pay the seller regardless of the bank's ability to market the water to buyers or if the WID will only pay for the water if it is able to sell the water.
- The timing of the payment will be specified (upon contract execution, upon Ecology approval for transfer and after the irrigation season etc).
- For multi-year contracts, agreements will specify whether payment is made from the WID all up front or on a yearly basis.
- Supply agreements will grant the WID limited access to seller's property(ies) and or point of diversion so that WID staff can visit the property and ensure that water that has been leased or sold to the bank is not being used.

Measuring and Monitoring of Water Use. If a seller leases or sells all of their water right (s) then metering of water use is not required. In the event that a seller retains a portion of their water right for irrigation, collection of metering data may be required by the WID.

Compliance and Enforcement. The WID will undertake limited contract compliance actions to ensure that bank transactions run smoothly. The term *limited* is used because it is important to point out that the WID is not a regulatory body and much of what the bank enables in terms of water use and water right changes is under the regulatory purview of the Department of Ecology. The WID will focus its limited enforcement actions on ensuring compliance with key terms of its contracts with sellers. Contract compliance may include visits to supplier properties to verify that irrigation has ceased on any acres used for water bank supply.

2.3 Buyer Contracts

Members who will receive water from the bank, regardless of the allocation process, will be required to sign contracts with the WID for provision of the water. The contracting process will take place once successful buyers have been identified through the annual marketing process. Buyers will be required to sign an agreement with the WID soon after their request for water has been accepted by the WID. It is important to note that this means buyers will commit to purchasing the water from the bank before going through the Ecology administrative process to transfer the water to their land. Buyers will be required to pay for their water only once Ecology has approved the application during the first year of a transfer and by October 15th of a subsequent year if the transfer is for more than one year. Buyers will also be required to pay the Department of Ecology's administrative processing fee or to reimburse the bank for these costs if buyer payments are made due only upon approval of their transfer application.

There are several key terms and conditions that buyer contracts will contain:

- Contracts must clearly state the bank can only provide water to the buyer if the Department of Ecology approves the transfer and it is the responsibility of the buyer to work with the WID staff to provide all necessary documentation and other materials required by Ecology.
- Contracts must clearly lay out what happens if Ecology does not approve a transfer. Contracts will simply state that in the event Ecology does not approve a transfer, the agreement becomes null and void.
- Buyers must acknowledge that even though they are getting water through the bank, they are bound by Washington water law and Department of Ecology rules and regulations, and that Ecology, not the WID or the bank has jurisdiction to regulate their or others' water use.
- Under Washington water law and relevant regulations, buyers will be required to install measurement and metering devices on their point of diversion while they are using water from the bank. While the WID will not enforce this requirement, the WID will require buyers to submit a report on their water use for record keeping purposes.
- Buyers must agree to make all reasonable effort to use all the water they are purchasing. This is especially important in the case of any transfer for longer than five years where non-use on the part of the buyer could put the underlying water rights at risk of forfeiture.
- For multi-year agreements, buyers will be required to pay annually.

Measuring and Monitoring of Water Use. All buyers must record use of their leased water with an approved meter according to the Department of Ecology. Details on requirements for measuring and reporting water use can be found under WAC 173-173. The WID will require buyers to use the Ecology reporting form (ECY 070-171) to record and report their water use. This form is due to the WID on October 15th. Consistent and accurate recording and reporting of water use is a required to keep a buyer in good standing to be eligible to purchase water from the water bank in future years.

Compliance and Enforcement. The WID will undertake limited contract compliance actions to ensure that bank transactions run smoothly. The term *limited* is used because it is important to point out that the WID is not a regulatory body and much of what the bank enables in terms of water use and water right changes is under the regulatory purview of the Department of Ecology. The WID will focus any enforcement actions on ensuring compliance with key terms of its contracts with buyers.

2.4 Pricing of WID Water Supplies and Transaction Cost Recovery

When acquiring water for bank supply, the WID will use different strategies for pricing water supplied to the bank depending on the length of the supply agreement. The WID may be able to cover some or all the transaction costs of operating the bank through assessments or available grant monies or the bank may need to include some or all transaction costs in water prices.

2.4.1 Seasonal Water Supplies

The WID 2017 two-way lease auction revealed a market price of $125/AF for one year of water supply. This figure was developed by analyzing both buyer willingness to pay and sellers' willingness to accept. The WID supported the transaction costs of the auction and subsequent paperwork from the Ecology grant for the water bank. The supply and demand price in this case were therefore both $125/AF.

This $125/AF price will be the water price for short-term transfers for 2018. The WID will also require that buyers cover application and processing costs of the Department of Ecology's administrative process for transferring water rights to their property ($50.00). Finally, the WID will charge a water bank administration fee to help cover the WID's costs to manage the water bank. This fee will be set at $250 per transaction for 2018 and is subject to revision at the WID Board's discretion in future years.

2.4.2 Pricing of Long-term and Permanent Water Supplies

Because they represent larger financial commitments, long-term and permanent acquisitions require a separate allocation and pricing strategy. If the WID decides to make any water available long-term it will use an auction process for buyers of long-term transfers. At its discretion, the WID board may elect to use a set price marketing offer after a year or more of auctions for long-term transfers. As discussed above, the WID will add a brokerage fee to long-term transactions (set as a percentage of the water price, as determined by the WID Board) as well as requiring buyers to pay for Department of Ecology processing and administrative fees.

2.5 Administrative processing of water bank transfers through the Department of Ecology

To receive water from the bank, the WID will need to work with successful bank buyers to transfer water to the land they will irrigate. Depending on the nature and length of the transfer a different administrative process through the Department of Ecology will be required. This section is not meant to fully detail all the legal and regulatory procedures of these administrative processes, but rather to provide a brief description of the processes as relevant to water bank operations.

2.5.1 Short-term Seasonal Transfer administrative process

There are four legal tests that all changes to water rights must pass prior to approval. First, the water right being transferred must be found to be valid, it must be beneficially used, the change must be found to not impair existing water rights, and the change also cannot be detrimental to the public welfare. Seasonal changes are designed to be processed much faster than long-term changes and Ecology's review of the water right change is less exhaustive for seasonal changes. Public notice is required along with a $50 application fee, and there is no required appeal period for seasonal changes.

2.5.2 Temporary and Permanent Transfer Administrative Process

The review for non-seasonal water right changes (any period of more than one year or permanent changes) must also meet the four-part test for water right validity, beneficial use, avoidance of impairment and no detriment to the public welfare. Ecology also must confirm that the amount of the water use after the transfer will not be increased in any way (for example by irrigating more acres, irrigating for a longer irrigation season, etc.; called enlargement). Change applications may take six months to several years to process depending on the number of applications already in line and the complexity associated with any proposed water right change. To evaluate the proposed change application, Ecology will perform a tentative determination of the extent and validity of the water right which will include examining evidence of the history of use of the water right to ensure that there is no period of five years or more of nonuse of all or a portion of the water right. If there is some nonuse of the water right it is possible that a sufficient cause for nonuse may apply (RCW 90.14.140). As with short term changes, a public notice is required for long-term water right changes but unlike seasonal changes, there is a 30-day public appeal period for long-term water right changes. There is a $50 application fee for processing water right changes.

2.5.3 The Trust Water Rights Program

The Trust Water Right Program provides a mechanism for protecting water rights from relinquishment while they are not in use. A water right can be transferred into the Program temporarily or permanently in its entirety or partially. Water rights in trust retain their priority date and exit the program in the same quantity or status with which they entered the program. An application and a $50 filing fee are required to transfer all or a part of a water right to the program. Trust water right changes are subject to extent and validity reviews under RCW 90.03.380. The WID may use the Trust Water Rights Program in several different ways to protect WID-owned and leased water rights from relinquishment and also provide information to WID-members upon request if they wish to protect their individual water rights through the program.

3. Conclusion

This manual outlines policies and procedures by which the WID will operate the water bank, including how it will acquire and market water supplies for varying lengths of time. This manual is meant to provide guidance for three to five years from its adoption in September of 2017. The Manual will be revised and updated as needed to reflect any policy or programmatic changes. However, there are a number of policies and procedures that are subject to the discretion of the WID Board and could change over this time horizon or beyond. This manual is meant to provide a solid but adaptable foundation to guide the WID in operating the water bank in a way that best meets the needs of WID members. The WID Board is committed to fairness and maximizing access to the benefits of the water bank to all interested WID members.

Attachment D – Initial Conditions & Needs Assessment (2016) – Reference

Initial Conditions and Needs Assessment for Design of a Snoqualmie Valley Water Bank

A Report for The Snoqualmie Valley Watershed Improvement District

FINAL DRAFT

December 2016

Davíd Pilz
Amanda Cronin
Bruce Aylward
Rachel O'Connor

AMP Insights

Table of Contents

List of Figures

List of Tables

1. Introduction

This report provides an Initial Conditions and Needs Assessment (ICNA) to inform design of a Snoqualmie Valley water bank. AMP Insights is assisting the Snoqualmie Valley Watershed Improvement District (WID) in the design of a water bank that has the objectives of meeting existing and future water needs for farmers within the WID and preserving and restoring streamflow in the Snoqualmie River and its key tributaries. Designing and implementing a successful water bank requires careful analysis of existing demographic, economic, legal, policy, and hydrographic conditions as well as an understanding of the driving forces behind current and future water needs. This ICNA is meant to provide the starting point for water bank design by analyzing these and other factors that will be critical in making decisions about how to develop and operate a water bank within the WID.

This assessment begins with a brief overview of the goals of the water bank. Next, it covers a range of present conditions in the Snoqualmie Valley at a high level to help characterize the physical setting, demographics, human impacts on the Valley, agriculture in the Valley and the presence and status of fish species in the Valley's rivers. The next section provides an overview of the Snoqualmie Valley's water resources. This discussion includes historic flow records for the Snoqualmie River, instream flow requirements set by the Department of Ecology (Ecology), climate change impacts and water rights and consumptive water use. The ICNA then proceeds to a discussion of desired outcomes for the water bank for both agriculture and the aquatic environment, including a discussion of several important economic issues related to meeting these objectives. This section also discusses both existing and potential future sources of water supply for the water bank. Before concluding, a final section reviews several different conditions that can contribute or detract from the success of a water bank in the Valley. These conditions include a range of social, cultural and environmental factors, as well as key regulatory, market, and administrative enabling conditions, and finally driving forces that are leading to the need to develop a water bank.

This assessment brings together diverse and necessary existing information into a framework that can help the WID and its stakeholders ask and answer the necessary questions to arrive at a functional water bank.

1.1 Goals of the Snoqualmie Valley Water Bank

At a high level, the goals of the SVWB are to ensure water availability for present and future irrigated agriculture within the WID and encourage efficient use of water while respecting the importance of the river to non-agricultural users including local tribes and aquatic species. By extension, a successful SVWB can help maintain the agricultural character of the Snoqualmie Valley that has multiple benefits including (but certainly not limited to):

- boosting the farm economy of the Snoqualmie Valley and King County;
- supporting new farmers growing diverse crop types to meet increased demand for local food;
- reducing development pressure on farm land adjacent to the large and rapidly growing Seattle-Tacoma metropolitan area;
- keeping open space open and ensuring the sustainability of the environmental, aesthetic, and recreational benefits that come with open space;
- providing locally-sourced food for the region and the benefits that come with such a food source (lower carbon-footprint, greater health and nutritional benefits, etc.).

By promoting efficient water use and respecting non-agricultural water uses, the SVWB will also have additional benefits such as:

- helping maintain aquatic habitat for fish species listed under the Endangered Species Act and for numerous other fish species that call the Snoqualmie River and its tributaries home;
- supporting tribal water values;
- providing a suite of ecosystem services to the Valley and the region.

As a final overarching goal, the SVWB will strive to achieve its goals in a transparent, inclusive and collaborative way while respecting the rights of private landowners and tribes.

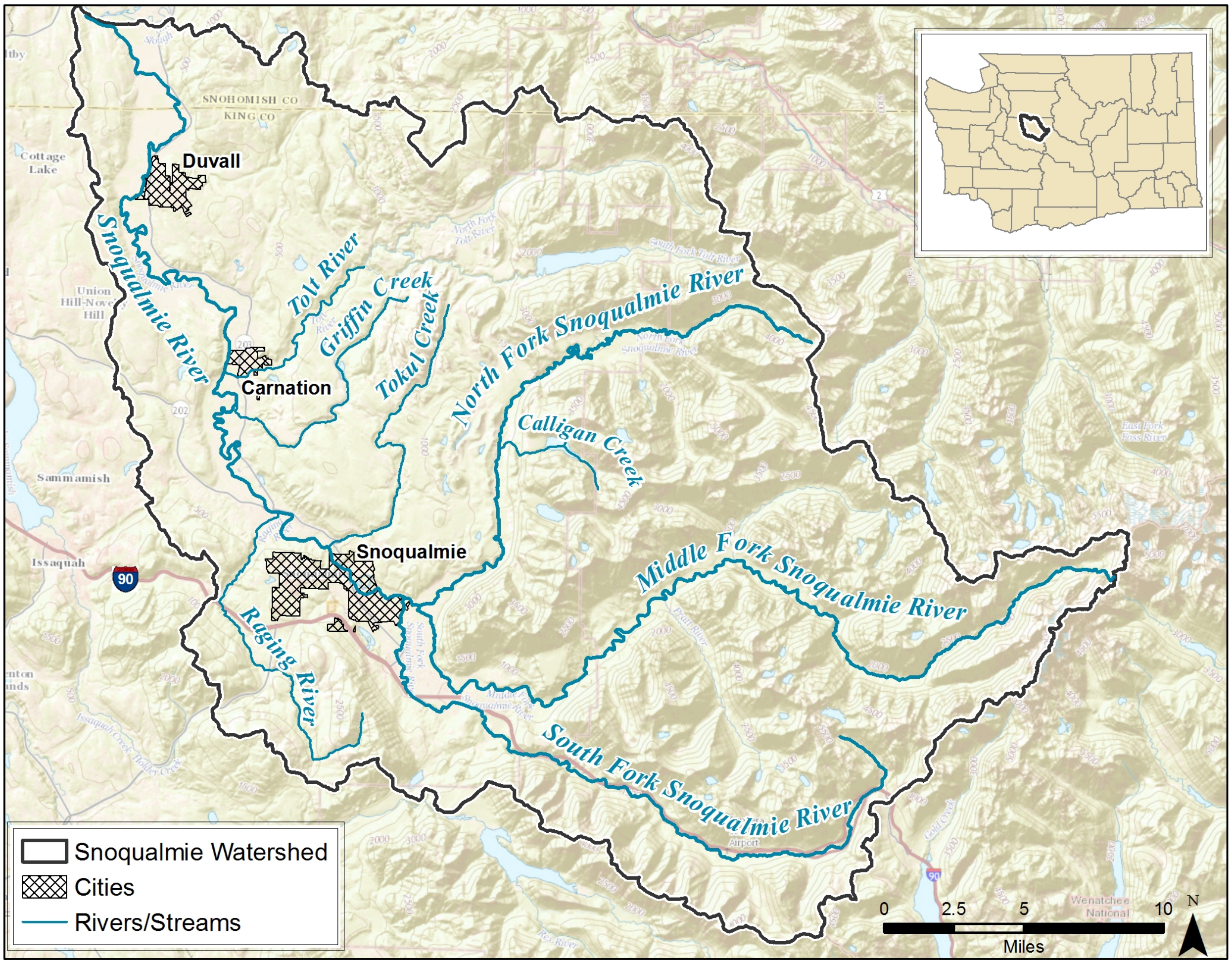
2. Present Conditions

This section provides a brief physical, hydrologic, climatic, and demographic overview the Snoqualmie Valley with a focus on those factors that will inform the development of the SVWB.

2.1 Snoqualmie Valley Setting

The Snoqualmie watershed covers approximately 700 square miles from the Cascade Mountains in the southeast part of the watershed, to the confluence of the Snoqualmie and Skykomish Rivers to form the Snohomish River near Monroe, WA (Kubo 2016). The Snoqualmie River's drainage area is part of Washington Resource Inventory Area (WRIA) 7, also called the Snohomish Watershed. The watershed is located primarily in King County, also home to the Seattle metropolitan area. Figure 1 below shows the Snoqualmie River watersheds.

FIGURE 1: OVERVIEW MAP OF THE SNOQUALMIE RIVER WATERSHED

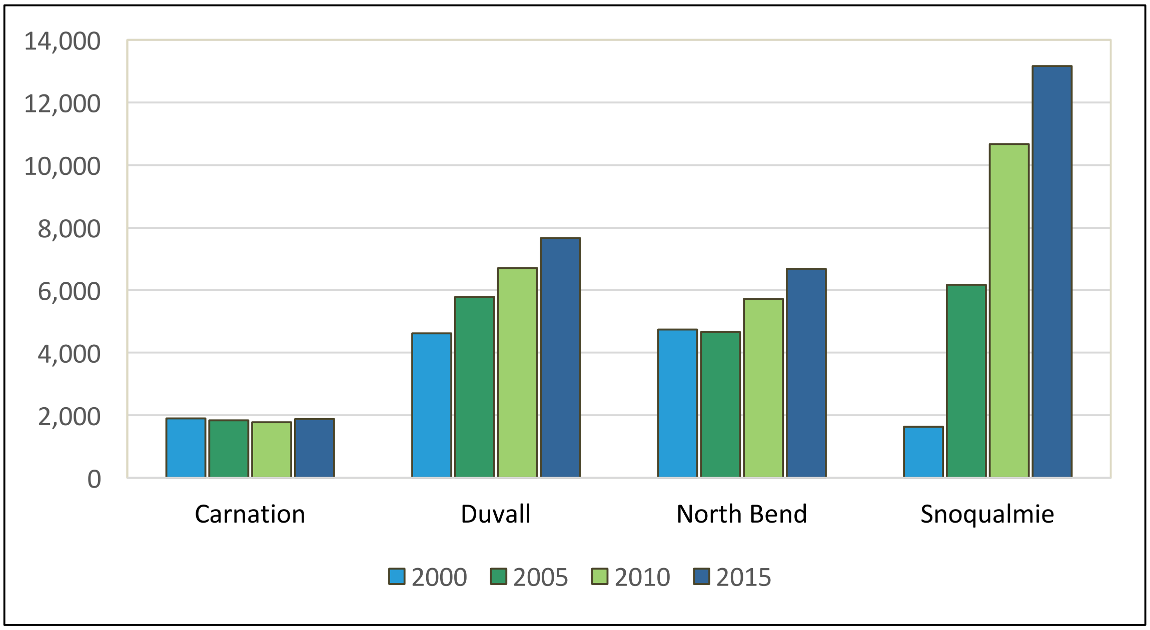


The Snoqualmie Valley consists largely of the Snoqualmie River floodplain from the town of North Bend near the confluence of the North, Middle, and South Forks of the Snoqualmie River, north through the towns of Snoqualmie, Carnation, and Duvall. The upper parts of the watershed are located in the Mount Baker Snoqualmie National Forest and are dominated by a mixture of public and private forest land (Kubo 2016).

2.2 Snoqualmie Valley Demographics

Despite its location adjacent to Seattle, the Snoqualmie Valley is a rural landscape. Approximately 98% of the watershed is rural, however cities in the valley account for almost 40% of the population, or a combined 23,420 people (King County 2013). According to King County, in 2013 the unincorporated area population was approximately 38,100 and has remained relatively stable since the 2000 census. As seen in Figure 2 cities in the valley, especially the city of Snoqualmie, almost doubled in total population from 2000 to 2010, with growth continuing in 2015 (King County 2013). Carnation's population however, has remained relatively stable over the last fifteen years.

FIGURE 2: POPULATION IN CITIES IN THE SNOQUALMIE VALLEY 2000 TO 2015



The Snoqualmie watershed's location near to the large and rapidly growing Seattle area is one of its defining features in many ways. The watershed is a popular recreation and tourism destination, and faces development pressure from nearby expanding metro areas and residents seeking to move from large cities to the highly accessible rural landscape of the Valley.

Median incomes in the Snoqualmie Valley are not representative of typical rural areas. Median incomes in the Valley are from a low of $60,000 in Carnation to $123,955 in the city of Snoqualmie (URBDP 506 2015). Census data shows that the Valley's cities are largely commuter towns, with 81% of workers 16 years and older working outside of the region where they live (U.S. Census Bureau 2012). According to the same census data, only approximately 2% of the population worked in agriculture in 2012.

2.3 Historic Impacts on Natural Resources in the Snoqualmie Basin

Like most developed land in this region, prior to settlement, much of the Snoqualmie floodplain was forested. When the Valley was settled, and as it grew over time, conversion of forest and wetland areas to agriculture changed the Valley. For example, forested areas below Snoqualmie Falls (located at river mile 38.5 near the town of Snoqualmie) are currently estimated to be around 16% of pre-European settlement levels (Collins and Sheikh 2002). These changes are not unique to the Snoqualmie Valley, and have occurred throughout the region.

Surprisingly, flood control infrastructure in the Valley and the watershed is minimal. There are no major flood control reservoirs in the Snoqualmie River watershed (though there is a significant reservoir on the South Fork Tolt River for municipal supply) nor is the mainstem Snoqualmie channelized and hemmed in by large dikes. The result is that flooding in the Valley, which occurs multiple times a year, has significant impacts on both the cities and farms in the Valley.

As in many agricultural watersheds in the region and the West more broadly, settlement and ongoing development of the Valley has also impacted aquatic habitat in the Snoqualmie River and its tributaries. Removal of wetlands and historic river side channels and oxbows, combined with removal of large wood structures, reduces the useable habitat for fish in the Valley's rivers and streams (Kubo 2016). The Snoqualmie River's water quality has also been impacted by deforestation in the upper reaches of the watershed.

2.4 Overview of Current Agriculture in the Snoqualmie Valley

While the number of people farming in the Snoqualmie Valley is small relative to the area's overall population, agriculture is vitally important to the Valley and the region. Farms in the Valley drive tourism from nearby urban areas, provide food both at a commercial scale and to individual restaurants and markets, and help maintain open space in the Valley. Recognizing these and other benefits, the 1985 King County Comprehensive Plan designated approximately 40,000 acres of land in King County as Agricultural Production Districts (APDs). Of these 40,000 acres, 14,560 acres are located in the Snoqualmie Valley (King County 2009). The APD designation means that the principal land use within the District should remain in agriculture and that land uses adjacent to APDs should be designed to limit conflicts with agriculture (King County 2009; King County 1985). APD zoning is based on four criteria (King County 1985, 113):

1. Soils are capable of productive agriculture (Class II and III soils);
2. Land is undeveloped or contains only farm-related structures;
3. Parcel sizes are predominantly 10 acres or larger; and
4. Much of the land is used for agriculture, or has been in agricultural use in the recent past.

Agriculture in the Snoqualmie APD is diverse and changing. Historically the Valley was dominated by dairy farms, however only four dairies remain in production in the Valley today. In the FARMS report (2009), King County found that 11% of the land use in the APD was for market crops (vegetables and flowers), 33% was dedicated to livestock/forage and the rest was dedicated to forest or other uses. Notably, from 2006 to 2009, market crop acreage grew from 1,138 acres to 1,584 acres, dropping to 1,293 acres in 2013. As of 2009, acreage for market crops in the Snoqualmie APD were equal to the total acreage in market crops for all other King County APDs combined (King County 2009). Market crops in the Valley are notable for several reasons. The Valley is one of the closest agricultural areas to Seattle. Seattle residents visit the valley in the summer to pick berries and visit farmer's markets, and in the fall to pick pumpkins. Seattle restaurants, like those in many other cities, are also relying more and more on local produce for quality and freshness, sustainability, and for the marketing benefits they provide. The Snoqualmie Valley, in other words, is a critical piece of Seattle's food ecosystem and market crops are at the ecosystem's heart.

In addition to the APD program, King County has also enacted other significant efforts aimed at protecting agriculture. In 1979, King County voters approved a $50 million bond issue to purchase development rights on high quality farmland in the county (King County 2009). This bond measure resulted in creation of the Farmland Preservation Program, a program to purchase development rights from willing sellers within King County APDs. 33% of the Snoqualmie APD is enrolled in the Farmland Preservation Program (King County 2009).

Climate in the Snoqualmie Valley is typical of western Washington, with dry summers and wet, mild winters. Precipitation in the watershed is highly variable with the highest precipitation in the high elevations of the watershed. Despite it's generally wet and mild climate, many crops will only flourish with irrigation to help make up for the lack of precipitation during the summer months. Countywide, irrigated agriculture is growing. The number of farms irrigated in King County increased 66% from 221 farms in 1992 to 366 in 2007 (King County 2009). According to the USDA's 2012 farm census, the number of King County irrigated farms increased again in 2012 to 482 (U.S. Department of Agriculture 2012).

2.5 Historic Agriculture in the Snoqualmie Valley

Early farm settlers reached the Snoqualmie Valley in 1875 and in 1880 commercial agriculture began to grow rapidly with the introduction of hops as a high-value crop. Yields were 1,000 to 3,000 pounds per acre and were sold for $0.75 to $1.00 per pound (Omdahl and Newell 1956). During the 1800's, upper Snoqualmie Valley near North Bend and Snoqualmie was in one company-owned hop farm with over 1,000 acres. Although the hop boom began its decline in 1890, the Alaskan Gold Rush, construction of railways and roads, and growth of Seattle resulted in a shift of commercial agriculture from hops to truck crops and dairy products (Omdahl and Newell 1956).

In 1909, Carnation Farms was established near Carnation (then Tolt), which became one of the country's largest Holstein cattle farms. For several decades, numerous dairies sprung up in the area. However, the 1940's and 50's saw a transition from the growth of dairies to the establishment of more truck crops, berries, flowers, bulbs, and poultry farming as these industries provided a higher return per acre than dairy. This transition can be tied to the rapid population growth and industrialization of the region resulting from World War II (Omdahl and Newell 1956).

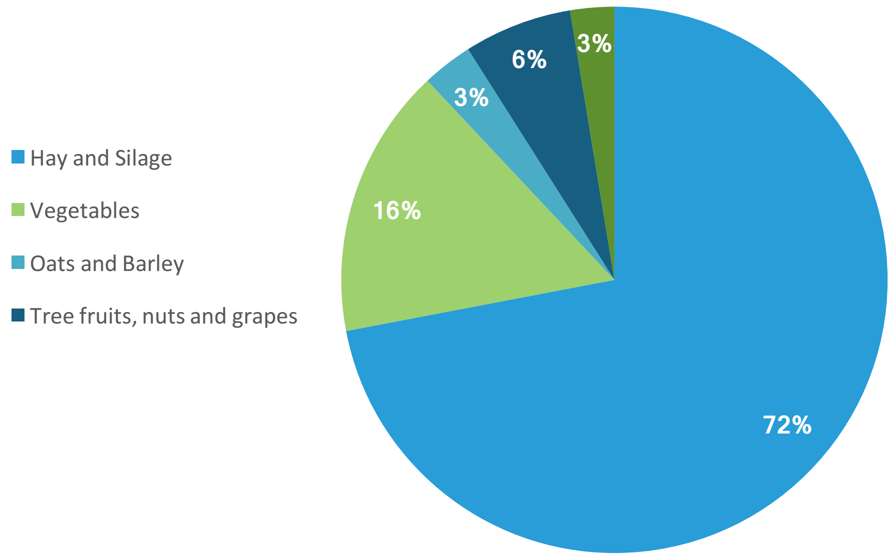
The 1954 Census of Agriculture of King County revealed that there were 5,181 properties classified as farms, with 86% less than 50 acres in size. During the time of the census, King County ranked second in the smallest farms throughout the state. This was likely due to a variety of factors such as land purchase methods, high land values, suburban living, and intensive farming (Omdahl and Newell 1956). Excluding the miscellaneous and unclassified farms, Table 1 shows that most farms in the county were dairy and poultry farms, followed by vegetable farms.

TABLE 1. TYPES OF FARMS IN KING COUNTY, 1954

Type of Farm	Number of Farms
Total farms in county	5,178
Field-crop farms	5
Cash-grain	0
Other field-crop	5
Vegetable farms	175
Fruit-and-nut farms	140
Dairy farms	686
Poultry farms	455
Livestock farms other than dairy and poultry	146
General farms	15
Primarily crop	5
Primarily livestock	5
Crop and livestock	5
Miscellaneous and unclassified farms	3,566

In 1954, 72% of the cropland in King County produced hay and silage used as feed for dairy, poultry, and livestock farming, 18.6% was used for market crops (vegetables, berries, and flowers) while other cropland was dedicated to oats and barley and tree fruits (Figure 3) (Omdahl and Newell 1956). Comparing the 1954 Census to the 2009 FARMS report reveals that while the acreage in agricultural production in King County has increased from 33,000 in 1954 to 41,000 in 2009, the cropland used for both hay/silage and market crops has decreased (23,700 to 19,300 acres and 6,141 to 3,138 acres, respectively).

FIGURE 3. PERCENT OF TOTAL CROPLAND IN LEADING CROPS, KING COUNTY 1954



As farmers began to transition to more intensive crops and sought higher yields, there was an increase in the number of irrigated acres (Table 2). Most irrigation occurred on commercial vegetable farms in the Green, Sammamish, and Snoqualmie Valleys (Omdahl and Newell 1956). The number of irrigated farms has since increased from 282 in 1954 to 482 in 2012 (U.S. Department of Agriculture 2012), though this jump happened more recently as there were 221 irrigated farms in 1992.

TABLE 2. KING COUNTY FARMS IN IRRIGATION, 1950 AND 1954

Item	1950	1954
Number of irrigated farms	239	282
Land in irrigated farms (acres)	13,292	15,287
Land irrigated	4,847	5,503
Irrigated land in farms according to use:		
Farms irrigation crops	109	176
Farms irrigation pasture	74	83
Acres of crops irrigated	3,136	3,603
Acres of pasture irrigated	1,600	1,900

2.6 Crop Water Requirements

The amount of irrigation needed for a given farm varies by crop mix and depends on annual climate variability. The Washington Irrigation Guide (WIG) contains estimates for the monthly net irrigation requirement (NIR) for two locations relevant to the Snoqualmie Valley: the towns of Monroe near the confluence of the Sonqualmie and Skykomish Rivers and Snoqualmie Falls near the top of the Snoqualmie Valley. Table 3 and Table 4 show the average temperature and precipitation data used in the WIG to estimate NIR (NRCS 1997).

Table 3. Temperature and Precipitation in Monroe

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Mean Temp (F)	38.3	42.4	44.3	49.4	55.3	60.3	64.2	63.9	59.7	52.3	44.1	40.4	
Total Precip. (In)	6.66	4.89	4.7	3.57	2.82	2.46	1.28	2	2.83	4.28	6.14	6.87	**48.5**
Effective Precip. (In)[1]	0.2	0.7	1.48	2.21	1.99	1.85	0.96	1.43	1.88	1.44	0.39	0.09	**14.62**

1. That portion of precipitation falling during the crop growing season that infiltrates the soil surface and is available for plant consumptive use.

Table 4. Temperature and Precipitation in Snoqualmie Falls

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Mean Temp (F)	38.1	41.9	43.2	47.9	53.7	58.6	62.9	62.5	58.1	50.9	43.8	40.2	**-**
Total Precip. (In)	9.07	6.49	5.97	4.5	3.21	2.81	1.43	1.86	3.17	5.19	8.13	9.54	**61.37**
Effective Precip. (In)	0.08	0.69	1.46	2.72	2.25	2.07	1.08	1.35	2.1	1.51	0.4	0.05	**15.77**

This information is used to develop NIR estimates for a variety of crops. NIR is the annual amount of water required over and above natural precipitation to grow a crop. Values for the two Snoqualmie Valley locations range from a NIR of almost zero inches (0.01) for radishes in Snoqualmie Falls, to a high of 17.96 inches (approximately 1.5 acre-feet) for raspberries in Snoqualmie Falls (NRCS 1997). Table 5 shows the annual NIR requirements for crops in both locations. The mix of crops includes some nursery crops such as apples, some traditional livestock feed crops like pasture/turf, alfalfa and spring grains, and several different row crops.

Table 5. NIR in Inches For Crops in Monroe and Snoqualmie Falls

Monroe		Snoqualmie Falls	
Crop	Season NIR (In.)	Crop	Season NIR (In.)
Radish	1.23	Radish	0.01
Strawberry	1.66	Spinach	0.81
Spinach	1.74	Strawberry	1.88
Green Onion	2.69	Green Onion	2.69
Cucumber	3.01	Crucifer	3.02
Squash	3.01	Winter Wheat	3.21
Crucifer	3.1	Green Beans	4.89
Winter Wheat	3.52	Squash	5.01
Green Beans	3.78	Cucumber	5.05
Peas	5.46	Spring Grain	5.18
Spring Grain	5.48	Peas	5.23
Carrots	5.98	Carrots	5.78
Tomato	6.53	Grapes	7.61
Grapes	6.83	Tomato	8.02
Sweet Corn	7.11	Sweet Corn	8.66
Field Corn	7.46	Field Corn	9.07
Potato	7.91	Potato	9.52
Apples w/out cover	9.57	Apples w/out cover	10.41
Alfalfa	9.66	Alfalfa	10.47
Dry Onion	10.48	Dry Onion	11.13
Pasture/Turf	11.68	Pasture/Turf	12.72
Clover	12.72	Clover	13.87
Apples w/Cover	15.18	Apples w/Cover	16.41
Raspberry	16.66	Raspberry	17.96

2.7 Snoqualmie Valley Fish Species Presence and Status

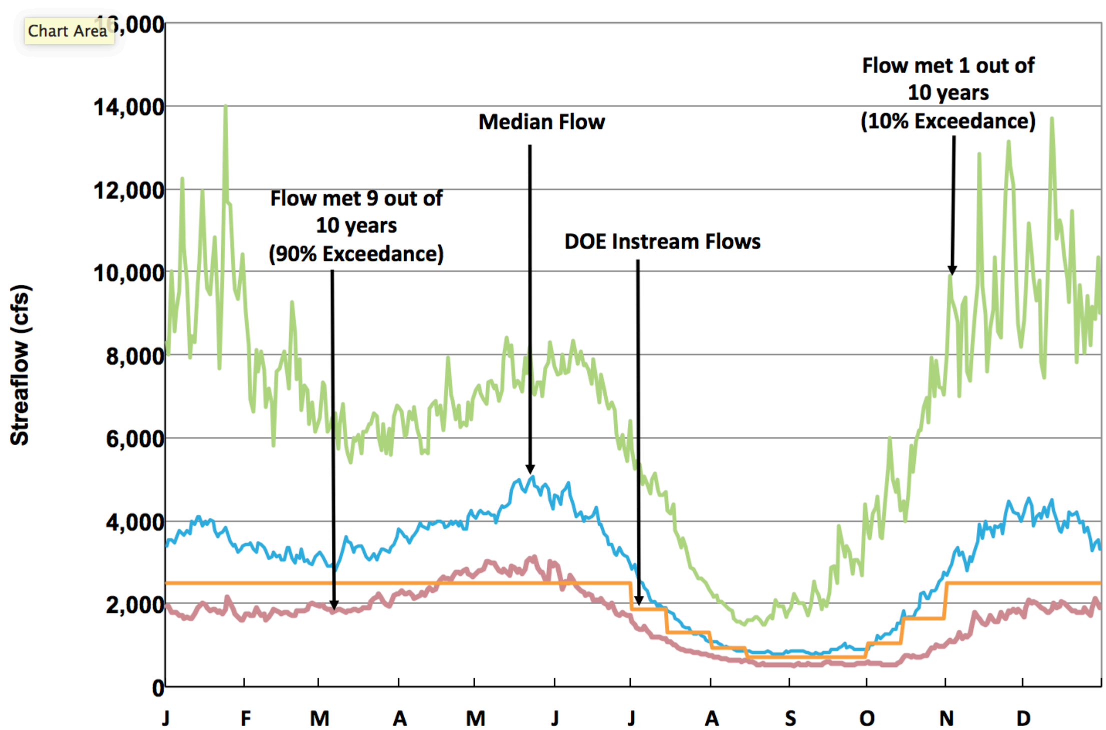
The Snoqualmie River watershed supports wild populations of Chinook (*Oncorhynchus tshawytscha*), chum (*Oncorhynchus keta*), Coho (*Oncorhynchus kisutch*), and pink salmon (*Oncorhynchus gorbuscha*); and steelhead (*Oncorhynchus mykiss*), rainbow (*Oncorhynchus mykiss*), brook (*Salvelinus fontinalis*), and cutthroat trout (*Oncorhynchus clarki*) (Kubo 2016). The Snoqualmie River and its tributaries are also in the historic ranges of Dolly Varden (*Salvelinus malma*) and bull trout (*Salvelinus confluentus*) though they are rarely seen in the watershed (Kubo 2016). Of the watershed's numerous fish species, Chinook, bull trout, and steelhead trout are listed as threatened under the Endangered Species Act (SRBSRF 2005). Salmonids spawn both within the mainstem Snoqualmie River below Snoqualmie Falls and throughout a number of tributaries including Cherry Creek, Tuck Creek, Harris Creek, Tolt River, Griffin Creek, Patterson Creek, Raging River, and Tokul Creek with spawning primarily concentrated in the Raging and Tolt rivers (Kubo 2016).

3. Water Resources of the Snoqualmie Valley

3.1 Snoqualmie River: Flows and Instream Requirements

Streamflow at the USGS Snoqualmie River gauge at Carnation range since 1930 suggests a mean annual flow volume of 2.7 million AF. The river is capable of frequent high, flooding flows, and low summer time flows. Flows range from lows in the 400 to 1,000 cubic foot per second (cfs) range during late summer and early fall to flood peaks in excess of 10,000 cfs in the winter. Winter flood stage regularly reaches 50,000 cfs or more several times a season. Figure 4 shows the river's hydrograph at Carnation over the period of record for the gage. In 1979, the Department of Ecology enacted the Instream Resource Protection Program for the Snohomish Basin (Chapter 173-507 WAC), setting minimum instream flows for the Snoqualmie River at Carnation, the Snohomish River at Monroe and a number of tributaries. Theoretically, water rights on the Snoqualmie River that are junior to the instream flows can be shut off when flows at either Carnation or Monroe (on the Snohomish River) drop below the minimum instream flow levels. In reality though, there are very few water rights with priority dates junior to 1979 and as a result Ecology does very little regulation to enforce the minimum instream flows set in the rule. The instream flows range from 2,500 CFS from January to July when instream flows steadily drop to their low point of 700 CFS. As shown in Figure 4, median daily flows approximate the Ecology instream flows during the summer months. During dry years, the instream flows are not met on a regular basis except for the peak snowmelt period in and around the month of May.

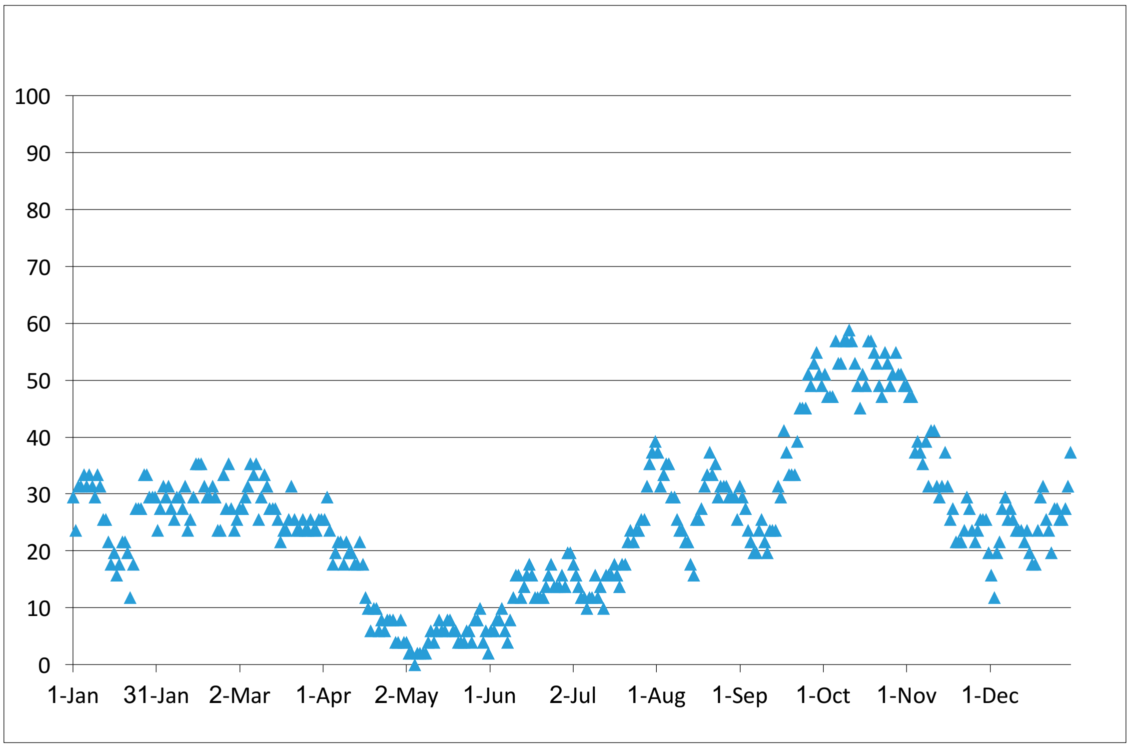
FIGURE 4. STREAMFLOW AND INSTREAM FLOWS AS SET BY ECOLOGY



A 2014 effort analyzed daily flows for the Snoqualmie River at Carnation and the Snohomish River at Monroe for the period from 1964 through 2014 in relation to the 1979 instream flows. Figure 5 below shows the results of this analysis. Based on this data, the chance on any given day that flows in either the Snoqualmie or Snohomish River will be below instream flow levels ranges from approximately 10-30% in January through mid-April, to 0-10% from mid-April through June. Beginning in July the chances of any day's discharge not meeting minimum instream flows steadily rises to around 40% from August to October. October and November are the months with the highest likelihood of discharge being below minimum instream flows, peaking between 50% and 60% on any given day in those months.

In addition to setting minimum instream flows on the Snoqualmie and Snohomish Rivers, Ecology also set minimum flows on many Snoqualmie River tributaries and closed some of these streams to further appropriation. This closure has been interpreted as applying to new surface and ground water rights but not to permit-exempt well water rights.

FIGURE 5. PERCENT TIME MINIMUM INSTREAM FLOWS NOT MET 1964-2014 AT EITHER SNOQUALMIE RIVER AT CARNATION OR SNOHOMISH RIVER AT MONROE



3.2 Impacts of Climate Change on the Region

Climate change will impact the Snoqualmie Valley in many ways, some positive and some negative. In a report on impacts of climate change to the Puget Sound region, the University of Washington Climate Impacts Group noted that changes in the region are consistent with global changes including increased air temperatures, a longer frost-free season, nighttime warming, and a potential increase in intensity of heavy rainfall events (Mauger et al. 2015). Per this same report, impacts on overall precipitation amount for the region are predicted to be generally small but with significant changes in timing such as decreases in summer precipitation (an average of -22% by the 2050s) and more severe heavy rainfall events (predicted to intensify, on average, by +22% by the 2080s). To date, the Puget Sound region has experienced temperature increases of between +0.7 and +1.9 degrees F from 1895 to 2014 (Mauger et al. 2015). Similarly, the frost-free season (closely associated with the growing season) in the region has lengthened by between +18 and +41 days from 1920 to 2014 (Mauger et al. 2015). Finally, all the Climate Impact Group's climate change scenarios for all seasons in the region project warming by the 2050s of between +4.2 and +5.5 degrees F.

In terms of climate change's specific impact on stream flows, the Climate Impacts Group generally predicts that Puget Sound region rivers will see earlier peak streamflow, especially in snowmelt-influenced systems like the Snoqualmie, and a decrease in summer streamflow. Specifically, the predicted impacts include between a -16% and -19% decrease in summer flows in the 2040s and -24% to -31% in the 2080s (Mauger et al. 2015). In terms of peak flow timing, the Snohomish watershed is predicted to see peak flows on average 37 days earlier than today by the 2080s with a range of between -49 and -29 days (Mauger et al. 2015). The Snohomish watershed is also modeled to see a significant reduction in peak seven-day minimum streamflow by the 2080s of between -17% and -33%.

In addition to flow magnitude and timing changes, climate change will also impact agriculture. Some of these changes are in the positive direction, though when combined with other factors, the net impacts on agriculture may still be negative. For example, increasing carbon dioxide concentrations and increasing air temperatures could increase productivity of certain crops and may make growing some crops, like grapes, that are not currently suited to region, viable alternatives (Mauger et al. 2015). However, Mauger et al. (2015) also predict that the combination of higher temperatures with increased water stress will also negatively impact some crops. For example, some varieties of berries will suffer from an insufficient chilling period that is necessary for fruiting and flowering. Elevated flood risk will also negatively impact agriculture in flood-prone areas like the Snoqualmie Valley.

3.3 Water Rights and Consumptive Water Use in the Snoqualmie Valley

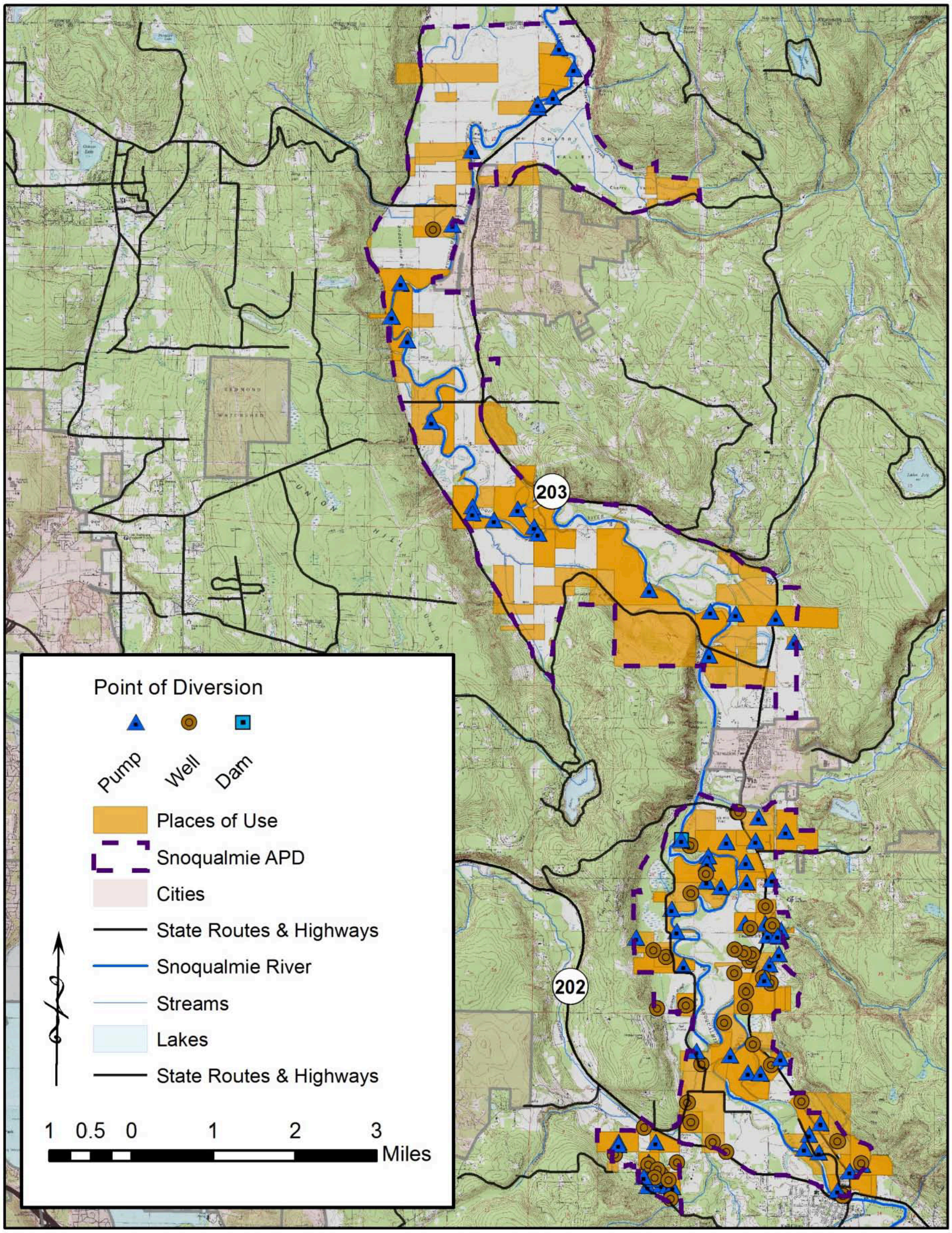
The Washington Water Trust conducted a water rights assessment of ground and surface water irrigation water rights within the Snoqualmie APD in 2013 and summarized their findings (Washington Water Trust 2013, 2):

> "GIS and aerial photos were used to determine the extent of water use within the APD. Departmental records research indicated there are 105 irrigation water rights/claims in the APD, accounting for 3,144 ac-ft/yr and 3,403 acres of authorized and asserted irrigated acreage. The places of use of these water rights were further examined using GIS and aerial photography to find the amount of potential irrigation occurring in association with these water rights/claims during the 2009 and 2011 irrigations seasons. WWT found that 1,644.70 acres of irrigation were possibly occurring under irrigation water rights/claims in 2009, with 987.33 acres receiving a low confidence rating, 402.48 acres receiving a medium confidence rating, and 254.88 acres receiving a high confidence rating. In 2011, WWT found approximately 2,081.40 acres of potential irrigation occurring under irrigation water rights/claims. Of these acres, 288.95 received a low confidence rating, 693.35 received a medium confidence rating, and 1,099.10 received a high confidence rating. Further, WWT classified rights/claims based on the amount of estimated irrigation. Through this exercise, WWT found many water rights and claims have weak evidence of beneficial use. Landowner education and water management strategies may be important for preserving water rights in the Snoqualmie APD."

Figure 6 illustrates the distribution of water rights including claims throughout the valley. The disparity of the results from WWT's 2009 and 2011 analysis are somewhat surprising with approximately 440 fewer acres that appear to be irrigated in 2009 versus 2011 (Table 6). WWT notes that timing of the aerial photos during the year is unknown. Alternatively, the difference could have been related to adjustments in irrigation methods or crop types or weather conditions. WWT's analysis only considered water right records with irrigation as a purpose of use and thus did not take into account other types of water rights such as stock water, commercial or industrial water rights that could be used a potential source of supply for the water bank as discussed further in Section 4.

The WWT report is however very useful as a quick reference for the likely status of irrigation water rights and claims in the valley. While the aerial photography analysis is now several years out of date the report gives a quick indication of whether a particular water right may have been used and if it might be a good candidate for a possible supply for the water bank or if the underlying landowner may need to seek additional supply if irrigation has not occurred in the recent past. Of course a more detailed analysis will be needed for any water rights that the WID considers as a possible source of supply.

Figure 6. Water Right and Claim Distribution, Snoqualmie APD



Source: WWT (2013)

Table 6. Amount (acres) of APD Water Right Irrigation, 2009 and 2011

Confidence Rating	2009 Irrigation Season	2011 Irrigation Season
Low	987.33	288.95
Medium	402.48	693.35
High	254.88	1,099.10
Total	**1,644.70**	**2,081.40**

Source: WWT (2013)

Table 7. APD Irrigation Water Use (acre-feet)

Category	2009 Low Confidence	2009 Med Confidence	2009 High Confidence	2011 Low Confidence	2011 Med Confidence	2011 High Confidence
Strong Evidence of Potential IR CU (ac-ft)	244.01	219.08	115.08	67.61	240.65	323.52
Intermediate CU (ac-ft)	211.55	4.09	0.00	71.53	91.16	165.23
Limited Evidence of Potential IR CU (ac-ft)	6.44	0.38	0.00	6.86	0.17	0.14
Total CU Water Use by Year & Confidence Rating (ac-ft)	**462.00**	**223.55**	**115.08**	**146.00**	**331.98**	**488.89**
Total Water Use (CU + NCU) by Year & Confidence Rating (ac-ft)	**616.00**	**298.07**	**153.44**	**194.67**	**442.64**	**651.85**

Note: IR = Irrigation; CU = consumptive use; ac-ft = acre-feet; NCU = non-consumptive use; Med = medium

Source: WWT (2013)

3.3.1 Diversion Types and Irrigation Methods

Most of the Snoqualmie River diversions are small in scale and consist of seasonal pumps with fish screens. Irrigation methods are somewhat varied across the valley depending on crop and scale. The three dairies in the valley rely on big gun style sprinklers and handlines (Steve Evans, Personal Communication. 10/25/16). Vegetables are typically irrigated with drip irrigation or smaller low flow overhead wobblers, but some row crop growers prefer and sometimes use overhead sprinklers because they require less labor.

3.3.2 Groundwater Use and Availability

AMP is working to acquire the most up-to-date information on groundwater use in the Snoqualmie watershed. However, a watershed assessment prepared in 1995 used preliminary USGS data to develop estimates of groundwater use (Table 8). Public supply and domestic uses are the largest users of groundwater in the basin, with irrigation and livestock also making up a significant portion of the 11,900 acre-feet of total groundwater use in 1995. The location of this groundwater use is somewhat unclear but taking the irrigation use in East King County and assuming half an acre-foot per acre suggests some 200 acres of groundwater irrigation.

TABLE 8: 1995 GROUNDWATER USES IN THE SNOHOMISH BASIN

	East King County Portion of the WRIA	Snohomish County Portion of the WRIA	Entire Snohomish WRIA
Public Supply	1380 af/yr	7,640 af/yr	9,020 af/yr
Domestic	1021 af/yr	1,995 af/yr	3,016 af/yr
Irrigation	401 af/yr	1,115 af/yr	1,516 af/yr
Livestock	251 af/yr	1,086 af/yr	1,337 af/yr
Industrial & Mining	83 af/yr	65 af/yr	148 af/yr
Total for All Uses	3,136 af/yr	11,901 af/yr	15,037 af/yr

Source: Pacific Groundwater Group (1995)

Irrigation withdrawals in the 1995 Report are estimates only and are not based on either water rights records or on pumping records.

3.3.3 Ground and Surface Water Interactions

The Snohomish Instream Resources Protection Rule (WAC 173-507-040) specifically states “In future permitting actions related to groundwater withdrawals, the natural interrelationship of surface and ground waters shall be fully considered in water allocation decisions to assure compliance with the meaning and intent of this regulation.” In other words, to the extent that surface and groundwater sources are hyrdologically connected, groundwater withdrawals will be regulated to prevent interference with the instream flows set by the rule. However, unlike some other more recently adopted instream flow rules in Washington, domestic and stock uses (except for feed lots) of groundwater are exempted from the rule’s restrictions. There may be other legal restrictions on exempt wells in the future as Ecology considers them exempt from permitting but not from regulation.

There are four primary aquifers in the Snohomish watershed with slightly varying estimated impacts from surface water pumping. The primary aquifer of interest for the Valley is the Quaternary Alluvium which underlies the watershed’s river valleys and varies in thickness from zero to 200 feet (Pacific Groundwater Group 1995). Hydraulic continuity between this aquifer and adjacent streams is high, meaning that pumping near the Snoqualmie River will result in direct impacts (in time and magnitude) to the river. In conversations with Ecology, it is not clear that Ecology has a specific methodology for addressing groundwater pumping and surface water impacts (for example a blanket requirement that any pumping within X feet of the river and/or at X depth will directly impact the river). However, hydrologic connectivity is a critical factor in future groundwater allocations in the basin and in potential transfers of water right between surface and groundwater points of diversion.

Throughout the Snoqualmie valley there are some areas of concern for groundwater quality. In particular, the USGS has found levels of arsenic exceeding drinking water standards in some valley wells between Carnation and Duvall (Cannon 2016). Naturally occurring Iron and Manganese are also found in groundwater in various locations across the Valley (Cannon 2016). High levels of Iron are a challenge for growing food crops and in areas with high iron levels groundwater may not be suitable for irrigating food crops without a filtration system. Effective iron filtration systems can be obtained for about $3000 and could be installed when groundwater use is the preferred use over surface water for new water supply (Cannon 2016).

4. Desired Outcomes for a Snoqualmie Valley Water Bank

4.1 Meeting Water Needs for Agriculture

The primary goal of the water bank is twofold: to ensure the sustainability of existing irrigated agriculture and to promote responsible growth of irrigated agriculture in the Snoqualmie Valley. For existing irrigated agriculture in the valley, this is primarily a matter of encouraging efficient and active use of water rights and providing resources necessary to help landowners maintain the viability of their water rights. Encouraging efficient use of existing water rights is not a direct objective of the water bank, but pricing the resource appropriately in a local market may lead to efficiency improvements. Ensuring that WID members understand their responsibilities to use their water rights or risk losing them is a general outreach task. However, the water bank can help maintain the viability of current water rights by helping landowners who may not need to use their rights each year to enroll them in the Trust Water Rights Program for compensation so that the water bank can use these supplies for other needs.

For currently non-irrigated land, the task is more difficult. For these lands, the water bank can play one of two different roles. The water bank may be able to provide senior water rights to lands that lack them on a temporary or permanent basis. Alternatively, the water bank may be able to provide water to lands in need of water rights by applying for new junior irrigation water rights that are mitigated by acquired senior water rights that act in affect like senior water rights. The mitigation provided by the water bank would mitigate for times when the instream flows are not met. At this point, it is not clear whether the water bank will only play one of these roles (providing senior water rights or providing mitigation) or will play both. Limiting the bank to only providing targeted mitigation will help stretch limited water bank supplies farther, but will also possibly come with additional regulatory restrictions. As discussed below, acquisition of the Tokul Creek Water right by the WID presents an opportunity to provide senior water rights to lands within the district either permanently or temporarily. This choice will be a critical element of water bank design going forward.

In addition to marketing water rights via the two methods described above, the WID may also consider alternative sources of new water supply such as rainwater collection, aquifer recharge or new water storage. Assistance from the WID with navigating the legalities of rainwater collection may be a good option for small-scale operations that have enough impervious surfaces to capture rainwater and the ability to store it for use during dry periods. Aquifer recharge may also be worth exploring possibly in connection with mitigation for new water rights. Thirdly, given the frequency of flood events and the problems associated with too much water during the winter, storing some high flows for use later in the year may be a long-term water supply option worthy of further exploration by the WID.

4.1.1 Current and Projected Agricultural Water Needs

AMP is working on building a tool to help forecast potential water bank supply needs. The amount of water required to meet WID members' needs over time will depend on whether the bank is supplying only mitigation water, or senior water rights or some combination of both. At this point, the best estimate of total possible water needs is very rough. Until AMP completes the forecasting tool, the best estimate is an estimate of the possible total water need for all land within the APD that could be converted to irrigated farming. Note that the APD and the WID have slightly different boundaries, with the WID having slightly more acres than the APD, but the best current data is for the APD.

A 2013 analysis by King County analyzed the use of all land within the Snoqualmie APD. This analysis broke land uses into eighteen different categories and determined the amount of land in acres dedicated to each category. To develop a rough, high end calculation of total potential water need, this analysis can be used to determine which categories of land use are likely to be currently un-irrigated *and* capable of being developed for irrigated agriculture. The categories from the King County analysis that fit this description include: livestock/forage, managed grassland, corn (field), unmanaged grassland, and horse. These categories can be added to the market crop category, some, but not all of which, is likely already irrigated, to arrive at the upper limit of what could be irrigable land in the APD. Table 9 shows all of the land use categories analyzed in the King County report with currently non-irrigated but potentially irrigable land highlighted in green.

Table 9: Land Use in the Snoqualmie APD

Land Use Category	Snoqualmie APD Acreage (2013)
Livestock/forage	4699
Managed grassland	370
Corn (field)	451
Market Crops	1293
Unmanaged grassland	753
Nursery	51
Tree farm	262
Managed orchard	1
Unmanaged orchard	0
Grapes	0
Sod farm	0
Forested	1906
Developed recreation	304
Too wet to farm	95
Topsoil production	12
Marsh or wetland	1312
Other	1806
Horse	1214
Total	**14529**

The green highlighted land use categories total 8,780 acres. Existing surface and groundwater irrigation (from prior sections) might total 2,200 acres. Approximately 6,500 acres may then lack irrigation rights. The range of NIR for crops in the Valley per the WIG is between 0.01 inches per year to 17.96 inches (approximately 1.5 acre-feet). Applied to the acreages above, total water need for the Valley varies widely depending on the mix of crops. If, on average, each acre needed 0.5 AF (6 inches), then the maximum need would be approximately 3,250 AF. It cannot be stressed enough that these are the roughest of estimates and are only provided here as placeholders until a more thorough analysis can be conducted. Not all the acres highlighted in green are likely to need water. Similarly, if the water bank is providing mitigation for new rights, the amount of water needed for irrigated land could be significantly lower as mitigation may only be needed when instream flows are not being met.

4.2 Economic Analysis of Agricultural Water Use

4.2.1 Current and Future Crop Mix

King County's 2013 analysis also provides a starting place for analyzing the current crop mix in the Valley. Table 9 above shows the mix of land uses as of 2013 in the Valley. The most significant categories of farm use in the table are livestock/forage (4,699 acres), field corn (451 acres) and market crops (1,293 acres). Based on qualitative information, observations, and preliminary discussions with WID members and others in the Valley, market crops represent the most likely land use to expand in coming years and the most likely source of increased water needs. Despite the wet and mild winters, many market crops require irrigation to thrive in the Snoqualmie Valley. One crop in particular, blueberries, have relatively high, unmet demands for irrigation. During AMP's preliminary visit to the Valley in September, 2016, two landowners explicitly mentioned a desire to add blueberry acreage to their land. Combined, these land owners would potentially develop 185 acres of new blueberry farming if they could have access to the necessary water supplies.

The water need forecast tool that AMP is currently developing will allow for analysis of future scenarios where differing crop mixes are grown in the valley and will predict the future need for water both in terms of total water need and mitigation need.

4.2.2 Expenses Attributable to Water and Water Use

While the benefits of irrigating can be clear for crop productivity, water use does have economic costs. The primary expenses attributable to an individual farm's use of water include irrigation infrastructure, power costs if the farm uses a pump in the river or on a non-artesian groundwater well, and labor costs of irrigation. These costs are highly variable depending on the method of irrigation and diversion. Flood irrigation requires almost no infrastructure and no power, but can be labor-intensive. At the other end of the spectrum, expensive infrastructure can largely automate the irrigation process and reduce labor costs, but comes with the obvious expense outlays for the infrastructure itself and for the power required to run such a system.

It is also worth pointing out that, should water bank formation be successful, farmers who do not currently have access to water or only have access to new junior, interruptible water supplies, will have the opportunity to buy water from the water bank. In addition to costs to buy or lease water, WID members also have an ongoing assessment obligation to the WID. The WID's annual assessment rate is $7 per acre for 2017. All acres within the WID pay this fee, regardless of whether they have water rights or not.

4.2.3 Willingness to Pay for Water

Many farmers, familiar with the tradition of obtaining water and water rights for free, find the concept of paying for water anathema. This is may be less of a hurdle in the Snoqualmie Valley due to the makeup of the farming community that includes many new farmers who are not accustomed by generations before them of getting all the water they need without payment. Another difference between the Valley and some farmers in agricultural areas in the eastern part of Washington State is that many Valley farmers are not subsistence farmers. In other words, farmers in the Valley are less likely to depend on farming for 100% their income than farms in eastern WA due to the Valley's location next to metropolitan areas and the nature of the Valley as a commuter community.

In both 2015 and 2016, the Snoqualmie Valley Preservation Alliance, the organization that organized and created the WID, provided water to farms in the Valley for $100 per AF. Farmers were readily able and willing to pay this amount. Additionally, one farmer AMP spoke with in the Valley indicated that he would be willing to pay upwards of $300 to $500 per AF and remain profitable. While this estimate must be taken with a large dose of salt, it does imply that the willingness to pay for water in the valley could be high and in any case, is likely to at least be $100 per AF.

4.2.4 Equity Concerns

One of the most important issues facing development of a water bank in the Snoqualmie Valley is designing a water bank that operates fairly while meeting the needs of farmers and avoiding impacts to instream resources. Equity and fairness in the case of operating the water bank are not straightforward concepts and will require the WID to make potentially difficult choices. The current operating assumption is that there is significant pent up demand for water in the Valley. Only time will tell if this assumption is true, but based on current knowledge, it is safe to assume that in the short term there will likely be some unmet demand for water. Until the bank has enough water to satisfy all demands, choices will need to be made about how to allocate supplies that are less than total demand.

At one of the spectrum, the water bank could choose to operate on a free-market basis. In this case, water would go to the highest bidders every year. At the other end of the spectrum, the bank could select who receives water based on a factor other than willingness to pay like financial need or something similar. The bank could choose to support new farmers rather than established farmers, or express preference for irrigation of some crops over others or various scales of farming operations. The bank could operate as a first come, first served market. The entire range of choices are too many to list, but at the end of the day, the WID will need to determine the way they feel best serves the goals of the water bank and the needs of the Valley. The choice need not be solely one way or the other and every effort will be made to design a bank that is responsive to market drivers while also not putting water out of reach for startup farms or farmers with limited resources. This discussion is not meant to propose an answer to the question of how to operate the bank equitably, but rather to flag the issue as important and to preview one of the many choices facing the WID in designing a water bank.

4.3 Respecting Non-Agricultural Water Values

The water bank is operating in a context where the Department of Ecology has set minimum instream flow water rights in both the mainstem Snoqualmie River and a number of its tributaries under the Snohomish water rule (WAC 173-507). These minimum flow water rights are junior to all established water rights in the valley, however if new water rights are granted they would be junior to the instream flow water rights and could thus be subject to regulation when instream flows drop below the legal minimum flows. The good news is that many of the types of transactions anticipated to take place in the bank can, by their nature provide some benefit. For example, when senior water rights are transferred downstream there can be some instream benefit as water that would have been diverted and consumed higher in the watershed is now shepherded to a more downstream point of diversion. Similarly, water bank water rights that are not used in any given year will likely be enrolled in the Trust Water Right Program and likewise remain instream providing some degree of flow benefit.

In addition to creating instream benefit as a coincidence of some bank transactions, the water bank could also take more purposeful steps. The WID, both through its general operations and through operation of the water bank can encourage efficient water use. As a corollary to operating the water bank, where WID members already use water, the WID can incentivize and perhaps help fund infrastructure upgrades to make diversions and end uses of water less wasteful. As a general matter, water use in the Valley is already fairly efficient and so the benefits of increasing efficiency may be marginal. The WID can also work with its patrons to ensure that water is only used under valid water rights. People who illegally use water on land without a water right rarely do so with malice. Often all that is required is education. However, operating the water bank will also open a new source of supply that people without water rights can turn to. Like greater efficiency, this is not likely to create large instream or aquifer benefits, but anything that moves the Valley toward sustainable, legal uses of water is important for respecting non-agricultural water values.

If the water bank is successful at meeting its primary goal of providing water for current and future agriculture and economic benefit, the bank could also consider allowing environmental interests to lease water during critical low flow years. Having the bank in place with functioning, well known pathways for putting water instream as well as known potential participants, would streamline critical low flow year response times and increase the likelihood of a successful response to such conditions. While not the primary goal of the water bank, engaging in proactive steps to support non-agricultural water values will help engender support for the bank from area tribes, agencies and others with an interest in helping fish and other species that rely on the river.

4.4 Sources of Water Bank Supply

This section discusses both existing and potential sources of supply for the water bank. The Snoqualmie Valley Preservation Alliance (SVPA) leased and temporarily transferred two groups of senior surface and ground water rights in 2015 and 2016 and both rights and transfers are discussed generally further below. Due to the possibility of additional negotiations with the landowners involved in the 2015 and 2016 transfers, the discussion does not implicate the specific people or water rights involved. The WID also successfully purchased senior water rights in 2016 (Tokul Creek Water Rights) and these rights are also discussed below. Finally, this section discusses other potential and likely sources of supply.

4.4.1 2015 and 2016 SVPA Temporary Transfers

Ground Water Rights: The total property involved in this season transfer is a 191 acre former dairy. The property has two valid groundwater water rights claims, one for a quantity of 81.7 acre feet (69.5 afy consumptive) and another for 100 gpm for irrigation of 51.6 acres or 2.2 afy and 25 gpm for stock watering. In 2013, the two groundwater rights were donated into the State Trust Water Right Program to protect them from relinquishment and preserve them for future use. In 2015, the SVPA entered into an agreement to seasonally transfer 5 acre feet of the 96.5 acre feet downstream for use as a surface water diversion by the Experience Farming Project which is mid-way between Carnation and Duvall. This seasonal transfer was again applied for and approved by Ecology in 2016. These water rights may be available in the future especially in the short-term for seasonal transfers depending on the future plans of the water right holder.

Surface Water Rights: SVPA applied and was approved to transfer a surface water right to three downstream locations during the drought year of 2015. Ecology approved a total of 18 acre-feet for transfer and the recipients of the transfer were Growing Things Farm, Goose and Gander Farm and Local Roots Farm. Ecology estimates that a total of 74 acre-feet and .37 cfs over 37 acres may be available under this water right but the Agency has not conducted a thorough Extent and Validity review of this amount. In 2016, SVPA again requested a seasonal transfer of the water right to the same recipients and it was approved by Ecology. Like the groundwater rights described above, these water rights may also be available for short-term transfer in the future depending on the plans of the water right holder.

4.4.2 Tokul Creek Water Rights

Tokul Creek is a tributary to the Snoqualmie River, two miles downstream of Snoqualmie Falls. The Snoqualmie Falls Lumber Co. operated a lumber mill (now owned by Weyerhaeuser) in the mid-1920s through the 1990s. A diversion from Tokul Creek at Mile 1.7, served as the water supply for the Mill under Surface Water Right Certificate 180 with a priority date of November 27, 1926. When the mill shut down in the 1990s, the water right was used for a variety of industrial uses by Weyerhaeuser and others including operation of a gravel pit. When in use, the water was diverted from Tokul Creek, pumped to a water treatment plant and then to storage tanks and lastly to a storage pond known as the Mill Pond. Ecology determined that, the overflow from the pond or tanks returns to the Snoqualmie River not to Tokul Creek. This means that the entire diverted quantity of 2 cfs was consumptive to Tokul Creek. The water right is currently in Ecology's Trust Water Rights Program. Ecology estimated a total of 2 cfs of water was diverted continuously from the Creek and a separate consultant generated report estimated 56.71 acre feet of consumptive use associated with industrial water use (Associated Earth Sciences 2010).

In the spring of 2016, Weyerhaeuser signed an agreement with the WID to sell the entire water right certificate. The water right has remained in trust since that time but all or a portion could be taken out of the Trust Water Right Program and used for out-of-stream use if and when the SVWID makes the request to Ecology. The Tokul Creek confluence with the Snoqualmie River is upstream of the Snoqualmie Valley which means these rights can be transferred downstream throughout the entire WID and also that downstream transfers of these rights have potential instream flow benefits from shepherding the water to new downstream points of diversion.

4.4.3 Other Likely Sources of Supply

The primary target for future water bank supply is likely to be existing senior water rights upstream of the WID or within the WID but high enough on the Snoqualmie or a tributary that the rights can be transferred downstream to WID lands. The water bank will likely access these water rights through a combination of seasonal, temporary, and permanent transfers with temporary transfers likely making up most transfers, especially in the short-term. It is likely that additional permanent acquisition opportunities will arise over time, however these will be fewer and farther between than temporary opportunities. While temporary supply is likely more readily available, it also poses some challenges to the water bank. If supply is only available on a year-to-year basis, it may be difficult to provide certainty to water bank customers who need reliable water for a longer time horizon. Blueberries provide an instructive example. After planting blueberries, it takes three to four years for the plants to produce berries. Each year after the first crop, blueberry bushes get more productive until they peak around year ten or twelve. Blueberry growers therefore, will not likely invest in planting bushes unless they know they have a reliable water supply for at least 10 years and preferably more. Temporary transfers need not be for only a year however, so it is possible for the water bank to build some level of certainty from longer (5 years or more) temporary transfers.

It is also important to point out that acquisitions or leases of senior agricultural water rights provide the bank with flexibility. These rights are capable of being used either directly on lands that currently don't have water rights, or as mitigation for junior water rights that may be cut off when instream flows are not met.

Another potential source of supply is a Seattle Public Utilities (SPU) reservoir on the South Fork of the Tolt River. The South Fork Tolt Reservoir system stores approximately 56,200 acre-feet of water. Water stored in this reservoir is for municipal drinking water use in Seattle. Due to its status as municipal water, it does not have the flexibility that agricultural water rights have. Under Washington's Municipal Water Law, municipal water rights cannot be used for irrigating crops (unless the municipality historically served agricultural interests which is not the case with SPU). However, SPU's municipal water rights can be used for fish and wildlife and instream flow enhancement, making them a potential candidate to provide water to mitigate for new irrigation water rights. SPU has indicated some willingness to discuss releasing water from their reservoir for mitigation and the WID is having ongoing conversations along this line. While this could be a very useful source of mitigation water, it is important to note that it will only be able to mitigate for water uses from the Snoqualmie River WID below the confluence of the Tolt and Snoqualmie Rivers. This is not a major hurdle however, as approximately 60% of the WID lands are below the Tolt River confluence.

4.4.4 Water Pricing

At issue in developing a new water market is the price at which water will trade. With only three transactions (mentioned above), there is very little market information in the Snoqualmie Valley on which to base water prices. Generally, there are three approaches are used either together or in combination to appraise water rights. It is important to note that within each approach, there is considerable variation and subtlety in specific application. The approaches include: comparable sales, land-price differential, and income approach.

Comparable Sales (Market Value): The most straightforward approach to valuing water is to consider market conditions and past transaction prices and set current prices based on the market. The obvious problem with this "comparable sales" approach is that there are very few water transactions in the immediate vicinity of the Snoqualmie Valley. Where transactions have occurred, price information may be confidential or difficult to obtain. Also, information on other transactions may not be relevant if the location, type of water right, term, or other aspects of the deals differ from the right(s) in question. Therefore, this approach often involves reference to a limited number of past transactions and/or markets outside of the location of the water right(s) being valued.

Land-Price Differential (Hedonic Value): This approach is primarily useful to provide a valuation data point when appraising the permanent sale or purchase of a water right. Where sufficient data is available, it is a simple analysis that consists of comparing the sale prices of land with and without water rights. The primary drawback to this approach is the lack of land sale activity in many places leading to limited data availability. In many rural agricultural areas where water transactions take place, land sales are not frequent, especially land sales involving senior irrigation water rights. The result is little information useful for the comparison of irrigated and non-irrigated land sales. Additionally, sometimes even when a data from sales could be used for comparison, it can be difficult to tease out the specific amount paid for irrigated land. Most irrigated land sales in rural areas include a mixture of irrigated and un-irrigated land combined with dwellings/barns/out-buildings etc. Yet the sale is likely reported only based on the final total sales price. Therefore, the best data points are sales that involve only irrigated land which are even more rare than sales generally.

To a limited extent, land price differential can also help inform leasing values as well. In the leasing context, the comparison is between the lease price paid between farmers/ranchers for irrigated versus un-irrigated land. However, since leases are not recorded or publicly reported, this information can be even more difficult to obtain than sale information. Sometimes this information can be obtained by word of mouth from local farmers/ranchers who lease land to or from others, but such self-reported information may not always be reliable.

Income Approach: This final approach to water valuation is the most commonly employed in situations where market data and land sale information are scarce. It involves modeling the contribution of water to a farm's/business's/ranch's income each year after considering all fixed and variable costs of using water. The approach is useful because it is flexible and can be employed to model both lease and permanent purchase values and can also model the impact of partial season fallowing on farm revenue. Difficulties with the approach include the problem of accurately replicating the marginal production value of just one of many inputs in a complex production process, the separability and treatment of fixed costs, and the series of assumptions that are necessary to appraise rights over long time frames (to provide purchase or sale appraisals). The income approach is more tractable for short-term leasing as it reduces the complexity of the modeling effort and reduces the scope and impact of assumptions (versus data).

In areas with limited market activity a combination of all three of the approaches listed above may be useful and may include other approaches not described as well. Understanding these three basic approaches however, provides some context to help explain the way water rights are traditionally appraised.

4.4.5 Approaches to Price Discovery

Without an active water market with comparable sale information there are strategies that can be used to tease out water pricing information. These strategies fall into four categories; individual negotiations, posted offers, reverse auctions and smart markets. The first three price discovery approaches can apply on both the supply or demand side, smart markets are designed to clear a market in which there are multiple offers to buy and sell.

The WWT Water Assessment discussed above indicates that there are several existing water rights that are in good standing because of their history of beneficial use. These water rights can be considered possible sources of supply. One approach to determining if there are willing sellers within in this list of water users is to approach them individually. Another approach is for the WID to decide on terms for a leasing or purchase program (type of water rights, size, location, priority date etc.) and post a standing offer to which eligible buyers and sellers could respond. A slightly different event-driven approach is to hold a reverse auction in which the buyer, the WID, decides on eligibility and criteria and then advertises the reverse auction to possible participants. Participants respond with a asking price that they would be willing to accept to lease or sell their water. This approach is called a reverse auction because the seller sets the price at which they are willing to part with their water. The WID can select those water rights that are lowest price and meet their pre-set criteria and proceed to use the acquired water rights for new water supplies. Contracts could be on a temporary or permanent basis and but likely would be temporary at least at first.

On the demand side, once the WID has water rights that are available for use by WID members, it could also decide to employ an auction model for distributing available water rights in which the highest bidders who meet pre-established criteria are awarded temporary, seasonal or permanent water rights. However, as was discussed previously in Section 4.2.5, equity issues for distribution of available water right rights are a chief concern of the WID and any approach used to allocate new water resources must be executed in a thoughtful and equitable matter until such times as all existing demand can be met.

A final alternative is to create a so-called “smart market”. A “smart” market is an electronic clearinghouse, which uses an algorithm to simultaneously match many buyers with many sellers in an automated fashion (Young 2016). Smart markets leverage the power of computer optimization to maximize the economic gains of trading activity and are customizable so that the rules of the game for trading and transfer of the rights are specified explicitly. A key benefit of a smart market is that the WID only has to set the price it is willing to accept for the rights it is offering, the smart market does the rest, and in doing so ensures that the gains from trade on any given transaction are split equitably between the buyer and the seller. These and other alternatives will be explored fully in the design phase of the project.

5. Initial Conditions and Needs Assessment Summary

This final section presents a brief summary of the overall conditions and needs for a water bank in the Snoqualmie Valley and a brief overview of next steps in the process of designing a water bank. Based on the preliminary analysis in this report and the authors’ knowledge and experience, the Snoqualmie Valley appears to have at least the minimum required conditions for a successful water bank and likely exceeds the minimum requirements in many ways. More specifically, there are some broad conclusions that can be drawn.

- Based on the demographic, economic and other information in this assessment, the socio-cultural environment in the Valley appears to be generally conducive to sustainable water management and to the promotion of instream flows leading to a favorable setting for increasing irrigated agriculture while at the same maintaining flows required for aquatic and riparian habitat and species.
- While issues such as equity in allocating water bank supplies will be critical in water bank design, there do not appear to be major socio-economic fatal flaws to operating a successful water bank in the Valley.
- Legal and regulatory enabling conditions in Washington generally and in the Valley in particular (as indicated by the limited number of transactions completed to date) do not appear to prevent water bank operation and while, as with other water banks and mitigation programs in

Washington, there are bound to be challenges, these are not fatal flaws in the necessary enabling policies.
- Driving forces in the valley such as land use change and changes in agriculture are generally aligned with the prospect of operating a water bank in the Valley.

Despite these positive indications there remain hurdles to surmount in designing and implementing the water bank.

5.1 Needs Assessment

As of the completion of this assessment, there are ongoing information needs remaining to inform water bank design and implementation. These needs are summarized here.

- Identifying and mapping water rights and lands eligible for participation in the bank
- Clearly establishing (with Ecology) the trading and mitigation rules for administratively "moving" water and water rights around within the WID.
- Assessment of mitigation water needs, including development of a forecasting model currently in development will help develop and analyze short, medium, and long term potential water need scenarios for the WID.

5.2 Next Steps

From this point, the water bank design process will be iterative, beginning with a new round of seasonal transactions in 2017. These transactions may be used to test different water bank elements (such as different price discovery techniques and outreach and communication strategies) and will also help develop additional knowledge about legal and regulatory pathways for water bank transactions, willingness to pay for water, and current levels of demand for water in the Valley. The next step in the design process is to take lessons learned from the 2017 transactions and use them to develop a long-term water bank design. There are several key steps to designing the water bank including:

- articulating the specific goals of the water bank, informed by concerns and input from stakeholders such as tribes, the state, county, municipalities, and others;

- identifying and analyzing all the transaction types that the bank may engage in to develop supply;

- identifying and clarifying sources and amounts of current demand and demand over multiple future time horizons (short, mid, and long-term);

- clarifying and deciding on the water bank's role in terms of providing mitigation for new water rights versus conducting seasonal transfers, permanent transfers, or a combination of one or more roles; and

- establishing institutional governance structures, policies, procedures and administration for the water bank.

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