



WRIA 29A WATERSHED PLANNING DETAILED IMPLEMENTATION PLAN

Approved by the Planning Unit July 17, 2015

Adoption by Skamania County November 24, 2015

*Funding for this plan was provided through grants from
the WA Department of Ecology (Grant #G1400581) and
WA Salmon Recovery Funding Board (Grant #13-1382)*

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CHAPTER I. INTRODUCTION

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1.1 PLAN BACKGROUND AND OVERVIEW

In 1998, the Washington State Legislature passed the Watershed Management Act. This law focuses on addressing water quality, water quantity, fish habitat, and instream flow at the local level. Under the act, the state grants funding to a Planning Unit, consisting of public agencies and non-governmental members, in each watershed. The WRIA 29-Wide Planning Unit worked together on watershed planning from autumn 1999 until June 2005, when – due to unresolvable points of disagreement – the group agreed to end WRIA-wide planning. The Legislature formally separated the planning process in 2007 dividing the groups as follows:

“For purposes of this chapter, WRIA 29 shall be divided such that the portion of the WRIA located entirely within the White Salmon subbasin and the subbasins east thereof shall be considered WRIA 29b and the remaining portion shall be considered WRIA 29a. Planning may be conducted separately for WRIA 29a and 29b.” [RCW 90.82.060 (c)]

The restructured Planning Unit met from September through December 2005 to complete the Western WRIA 29 Watershed Plan. The Planning Unit adopted the plan in December, 2005 and on November 28, 2006, in joint session, the Klickitat and Skamania County commissioners unanimously voted to:

“adopt the watershed management plan for western water resource inventory area 29 as submitted to this joint session with the stipulation that approval of the plan is based on the understanding that those portions of documents in the Plan’s appendices pertain to subbasins that are excluded from the Plan (i.e. the White Salmon River subbasin, the Jewett, Catherin and Major creeks subbasins, and the eastern portion of the tributaries to the Columbia Subbasin) are not relevant to the Plan and receive no endorsement or standing under the Plan; and further moved that any future Western WRIA 29 excluded from the adopted Western WRIA 29 Plan may not be addressed, included , or in any way affected by any such future implementation plans.”

Between 2006 and 2009 the group continued developing instream flow measures and recommendations for future rule-making. In June of 2009 the Planning Unit postponed further efforts. In 2013 the WRIA 29A Initiating Governments¹ re-established the Planning Unit to develop this Detailed

¹ City of Stevenson, Skamania County, Skamania County PUD and the Yakama Nation

Implementation Plan (DIP). Furthermore, the Lower Columbia Fish Recovery Board (LCFRB) agreed to assist in developing the DIP and facilitating the Planning Unit discussions.

1.2 LEGISLATIVE REQUIREMENTS FOR DETAILED IMPLEMENTATION PLANS

Plan Development Process and Content

Chapter 90.82 RCW does not require planning entities to develop a DIP as part of a watershed plan. However, in 2003 the Washington State Legislature amended the Watershed Planning grants program to provide Phase Four grants to support implementation of adopted watershed plans. The Legislature stipulated that entities that receive Phase Four grants must complete a DIP within one year of accepting the initial funding (RCW 90.82.043(1)).

RCW 90.82.043 and .048 provides guidance to the Planning Unit regarding the DIP content and process specifying that the DIP must address the following elements:

- Strive to meet the water needs of agriculture; municipal, commercial, industrial and residential uses; and instream flows;
- Timelines to achieve these strategies;
- Interim milestones to measure progress;
- Coordination and oversight responsibilities;
- Needed interlocal agreements, rules, ordinances, administrative approvals and permits;
- Consultation and coordination with other planning entities; and
- Funding mechanisms.

Inchoate Water Rights Assessment

The Phase Four requirements also address planning for “inchoate water rights.” Per RCW 90.82.048, the DIP “must address the planned future use of existing water rights for municipal water supply purposes, as defined in RCW 90.03.015, that are inchoate, including how these rights will be used to meet the projected future needs identified in the watershed plan, and how the use of these rights will be addressed when implementing instream flow strategies identified in the watershed plan.” In this DIP, the term “inchoate water rights” means those rights which are currently surplus to water demand as identified by the municipal water systems themselves through the water system planning process required by the Washington State Department of Health (DOH) under WAC 246-290. RCW 90.82.048 further requires that the timelines and interim milestones in a detailed implementation plan address the planned future use of existing municipal water rights, as defined by RCW 90.03.015 that are inchoate. Planning Units are called upon to describe how these inchoate rights will be used to meet the projected future needs identified in their respective watersheds, and how the use of these rights will be addressed when implementing established instream flow strategies. Planning Units and lead agencies are required to ensure that holders of inchoate water rights are asked to participate in defining the timelines and interim milestones to be included in the DIP. A list of the Group A municipal water providers in WRIA 29A was developed. There are 14 water service providers. Current information for 2 providers was not available. Of the 12 remaining, 10 were invited to serve on the Planning Unit. The 3 transient noncommunity systems² are located in the Columbia tributaries. It is anticipated that these systems will

² Transient non-community water systems provide drinking water to a population that changes day to day such as campgrounds, hotels, rest areas, and restaurants with their own water supplies.

not be affected by instream flow measures. Water availability, future water rights and stream flow measures for the other systems are discussed in Chapter 2.

Group A Providers	Subbasin	Type	Status**
Skamania PUD #1	Wind	Municipal	C
City of Stevenson	Rock	Municipal	C
Underwood (Skamania PUD #1)	Columbia Tributaries	Municipal	C
Home Valley Water District	Little Wind	Municipal	C
Camp Arrowhead (GSA)	Columbia Tributaries	Private	TNC
Maple Hill Water Company	Columbia Tributaries	Private	C
Mill A Water Co	Little White Salmon	Private	C
Mountain View*	Columbia Tributaries	Private	C
Skamania Coves Resort	Columbia Tributaries	Private	TNC
Wauna Lake	Columbia Tributaries	Association	TNC
Willard	Little White Salmon	Association	C
Wind River Community*	Wind	Association***	C
US Fish and Wildlife Service	Little White Salmon & Columbia Tributaries	Federal	
US Forest Service	Wind & Little White Salmon	Federal	
*Information not available			
**C=Community, NTNC=Non-transient non-community, TNC= transient noncommunity			
***Associations = private, not-for-profit			

Habitat Elements

The Legislature also provided specific guidance for addressing the optional habitat element in plan development and implementation (RCW 90.82.100). If the Initiating Governments choose to include a habitat component, the watershed plan must be coordinated or developed to protect or enhance fish habitat in the management area. Such planning must rely on existing laws, rules, or ordinances created for the purpose of protecting, restoring, or enhancing fish habitat, including the Shoreline Management Act, Chapter 90.58 RCW, the Growth Management Act, Chapter 36.70A RCW, and the Forest Practices Act, Chapter 76.09 RCW. Watershed planning must be integrated with strategies developed under other processes to respond to potential and actual listings of salmon and other fish species as being threatened or endangered under the federal Endangered Species Act (ESA). The statute further requires that where habitat restoration activities are being developed under the Salmon Recovery Act (Chapter 77.85 RCW), such activities must be relied upon as the primary non-regulatory component for fish habitat within the watershed management plans. In developing the watershed management plan the Planning Unit relied on data and information published in the Lower Columbia Salmon Recovery Plan (Recovery Plan).³

Monitoring

The Legislature also provides guidance for monitoring activities related to detailed implementation plans (RCW 90.8.090). Specifically, the statute states that in conducting assessments and other studies

³ Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan, LCFRB 2004 (1st edition)

that include monitoring components or recommendations, Planning Units must implement the monitoring recommendations developed under the Salmon Recovery Act (RCW 77.85.210). The Planning Unit has developed specific monitoring activities that are consistent with the provisions of the Salmon Recovery Act.

Coordination of Efforts

RCW 90.82.043 requires that in developing an implementation plan, Planning Units must take steps to avoid duplicative or inconsistent activities. Specifically, Subsection 3 of the statute states the following:

“In developing the implementation plan, the planning unit must consult with other entities planning in the watershed management area and identify and seek to eliminate any activities or policies that are duplicative or inconsistent.”

This statute is designed to ensure that to the extent feasible, procedural and substantive requirements of the implementation plan are merged with related programs, so additional steps needed to implement the plan will be minimized. The Planning Unit placed a high priority in collaboration and has addressed this requirement in its actions.

1.3 DIP DEVELOPMENT PROCESS

Transition and Reorganization

In 2013 the Initiating Governments met to consider developing a DIP. In September 2013 they reconvened the Planning Unit to assess the interest level of the members, identify additional members and develop an agreement for the LCFRB to serve as Lead Agency.

In March 2014 the Planning Unit secured Phase Four funds from the Washington Department of Ecology (Ecology) for completing the DIP, which initiated the one-year completion time table specified in statute. As recommended in the Watershed Plan, the Initiating Governments solicited the original planning unit membership and identified additional planning unit representation for continued participation during Phase Four and DIP preparation. Because of the division between WRIA 29A and 29B boundaries only 13 of the 27 WRIA 29-wide seats were retained. The LCFRB resigned its seat to assume the role of facilitating the planning process. The Planning Unit met on a monthly basis throughout the DIP development process. Initially the group established guiding principles to begin crafting the DIP including:

- Established guiding principles for development of the DIP (Appendix A);
- Established ground rules and operating principles (Appendix B); and
- Established criteria for prioritizing actions (Appendix C).

Phase Four operating principles specify that all participants accept the responsibility of keeping their associates, organization, or constituency informed of progress and issues under discussion. Each member also accepts the responsibility of representing the needs and interests of their associates, organizations, or constituencies. Adequate time was provided prior to major decisions to allow participants to consult with their associates, organization, or constituency. Strategic checkpoints were

established to allow participants to review progress made, and report back any concerns, potential inconsistencies or coordination needs to the group.

A substantial element of the Phase Four transition and reorganization involved a scoping process to refine watershed plan actions that are addressed in this DIP. This process included reviewing the adopted recommendations, identifying emerging needs and considerations, and identifying recommendations that were completed between the time the plan was adopted and at the time of this writing. Responsible organizations were tentatively identified, and actions were prioritized based upon the approved criteria.

Planning Unit Organization

As described above, the Watershed Management Act requires that in developing the DIP, the Planning Unit must consult with other entities planning in the watershed management area and identify and seek to eliminate any activities or policies that are duplicative or inconsistent. The Planning Unit primarily approached this requirement by soliciting participation on the Planning Unit. In reorganizing the Planning Unit for Phase Four, steps were taken to ensure the membership included those entities that are actively engaged in watershed planning and implementation activities within the watershed management area. In addition 13 seats were retained for Phase Four planning. Efforts were made to contact the following groups and organization requesting their participation. Four of the ten organizations agreed to participation. Of the remaining six, four formally declined the offer and two did not respond.

Planning Unit Representation

Skamania County
Skamania County PUD
Yakama Nation
City of Stevenson
Port of Skamania
Underwood Conservation District
WA Department of Ecology

Environmental Community Representative
Recreation Community Representative
Home Valley Water System Representative
Mill A, Maple Hill and Willard Water Systems Representative
Mid-Columbia Fisheries Enhancement Group
Stabler Community Council

Declined

Land Developer Representative
Gifford Pinchot Accountability Group
South Gifford Pinchot Collaborative
Timber Representative (WKO)

No Response

Underwood Community Council
Clark Skamania Flyfishers

Additionally, three advisory (non-voting) seats were retained from the watershed planning process. These agencies included technical personnel from the US Forest Service, US Fish and Wildlife Service, and the WA Department of Fish and Wildlife.

Policy and Strategy Framework

In developing the DIP, the Planning Unit ensured that the objectives, ground rules and operating principles were followed. In addition, they established the following guiding principles for their work:

- Strive to meet the water needs of agriculture; municipal, commercial, industrial and residential uses and instream flows;
- Promote the efficient use of water;
- Plan for a 20-year horizon that includes a strategy for reopener triggers to update the plan;
- Strive to maintain the overall balance of the watershed plan in identification and prioritization of implementation actions;
- Focus efforts on identifying and prioritizing actions that achieve multiple objectives;
- Achieve goals and objectives in the most cost-effective and efficient manner possible;
- Strive to ensure that overlap and duplication of efforts is avoided;
- Ensure actions are coordinated and integrated with other planning efforts in the watershed and other activities adjacent to the planning area;
- Facilitate and promote active participation by those entities affected by actions and key decisions;
- Keep affected entities informed of key decisions and outcomes;
- Work cooperatively to achieve all goals and objectives of the plan;
- Strive to ensure planning actions are integrated into federal, state and local decision-making processes;
- Work to broaden public awareness and support of the plan during and after the DIP is approved; and
- Identify and pursue early implementation opportunities.

Action Schedule Development

One of the Planning Unit's primary tasks in preparing the DIP was to develop "Action Schedules" for each of the recommendations presented in the Watershed Plan, using a template prepared during the Phase Four transition period. For each recommendation outlined in the Watershed Plan, these Action Schedules describe the following information:

- Title and description
- Status
- Goals
- Expected Outcomes
- Supporting Tasks
- Supporting Strategy and Policies
- Oversight Responsibility
- Cooperating Partners

- Cost and Funding Outlook
- Constraints and Uncertainties

Collectively, these Action Schedules are intended to serve as the framework for implementing the various Watershed Plan objectives, policies and recommendations in an integrated, coordinated and efficient manner. Action Schedules are designed to provide implementing partners with a blueprint for their associated actions, and identify the basic steps necessary to achieve them. They are intended to be specific enough to identify a clear pathway for implementation, yet general enough to permit flexibility in carrying them out. A summary of the actions, tasks, lead and coordinating partners and, costs are listed in Section 1.5 below.

The Planning Unit recognizes that some DIP actions will require further investigation prior to full implementation, and that others will be contingent upon the availability of funding and other resources. While specific tasks and cost estimates may need further refinement over time, it is expected that these Action Schedules will serve as the starting point for implementation.

Future Water Supply and Stream Flow Measures

In addition to the action schedules the Planning Unit developed water supply and stream flow measures for each subbasin (Chapter 2). To achieve the objectives listed above, the Planning Unit carried out a detailed assessment of water resource conditions, collected an inventory of water rights and projected future demands in each subbasin. This work provided the framework for establishing watershed measures identified in the following chapters. These measures were developed to provide guidance when Ecology proceeds with the formal rule-making process.

DIP Adoption Process

Although the Legislature established a fourth phase of planning in 2003, the “Implementation Phase,” no procedural guidance or requirements were provided for formal adoption of a DIP. Absent statutory guidance, the Planning Unit developed the DIP following the same general procedures used for development of the original Watershed Plan. However, because the DIP established watershed management measures for the allocation of future water rights, the DIP was submitted to Skamania County as the legislative body.

1.4 ORGANIZATION OF THE DIP

This DIP addresses the overall implementation requirements outlined in statute. It is built upon existing requirements and guidance, as well as the recommendations provided in Chapter 7 of the adopted Watershed Plan, to create a cohesive approach to coordinating implementation of water supply measures, stream flow management, water quality, habitat, and Planning Unit succession. The following is an organizational summary for the remaining sections of this DIP:

- Chapter 2 describes water management measures for water supply and stream flows by subwatersheds in WRIA 29A
- Chapter 3 outlines water quality issues and actions for improvement
- Chapter 4 describes habitat improvement needs and actions
- Chapter 5 provides a comprehensive public information plan to build support and help sustain activities

Chapter 6 describes future implementation and Planning Unit support

Within each chapter implementation actions and tasks are described in detail. Section 1.5 below provides an overview of all the actions outlined throughout the plan.

1.5 SUMMARY OF ACTIONS AND TASKS

Priority ⁽¹⁾		Actions and Tasks	Lead Implementer ⁽²⁾	Cost ⁽³⁾	1x or Annual	Potential funding sources ⁽⁴⁾
WATER SUPPLY AND STREAM FLOW						
Medium	1	Implement Surface and Groundwater Monitoring				
	1.1	Implement the Level 2 Groundwater and Surface Water Monitoring Strategies	Skamania County	Low	1x	TBD
	1.2	Conduct Hydrogeology Studies to Gather Information on Hydraulic Continuity and Aquifer Recharge	Ecology	Low	1x	Skamania County, other
	1.3	Prepare Hydrographs for Bear and Panther creeks and Other Wind River tributaries	Ecology	Low	1x	Ecology
	1.4	Prepare Hydrographs for Rock Creek and Its Tributaries by Synthesizing or Extrapolating Data from Stream Gauges on Other Similar Streams	Ecology	Low	1x	Ecology
	1.5	Install New Gauges at Trout and Martha creeks and Maintain Existing Gauges to Monitor Stream Flows	Ecology	Low	annual	Ecology, BPA, other
	1.6	Reconcile Bear Creek low flow measurements	Skamania PUD	Low	1x	PUD, USFS
High	2	Establish a Program for Addressing Unauthorized Water Withdrawals				
	2.1	Conduct stream surveys to identify unauthorized withdrawals	Ecology	Med	Annual	Ecology, Skamania County, Stevenson
	2.2	Provide landowner assistance to reduce unauthorized uses	Ecology	Med	Annual	Ecology, Skamania County, Stevenson
	2.3	Implement enforcement measures and fines	Ecology	Med	Annual	Ecology, Skamania County, Stevenson
High	3	Adopt Water Management Measures for State Rule				
	3.1	Develop water management measures	Planning Unit	Low	1x	Ecology
	3.2	Adopt water management measures in state rule	Ecology	High	1x	Ecology
	3.3	Establish an agreement between Ecology, City of Stevenson and Skamania County to facilitate the implementation of the water management measures	Planning Unit	Low	1x	Ecology
	3.4	Request funding from Ecology for an instream flow process	Planning Unit	Low	1x	Ecology

Priority ⁽¹⁾	Actions and Tasks		Lead Implementer ⁽²⁾	Cost ⁽³⁾	1x or Annual	Potential funding sources ⁽⁴⁾
Medium	4	Implement Water Supply Actions				
	4.1	Support Stevenson's efforts to replace the LaBong/Rock Creek surface water source with a groundwater source in the same basin	Stevenson	High	1x	DOH, Ecology
	4.2	Support Skamania PUD's efforts to move from surface water to groundwater sources for the Carson Water System	Skamania PUD	High	1x	
	4.3	Consider climate change projections when making water resource planning decisions and consider developing adaptive capacity	All	Low	Annual	TBD
	4.4	Support City of Stevenson's effort to provide municipal water to unserved areas in the Stevenson Urban Area	Stevenson	High	1x	Stevenson Water Utility, DOH, Ecology, Commerce, USDA
	4.5	Complete an aquifer mapping study. Priority should be given to the Stabler and Kanaka Creek areas.	Planning Unit	Low	1x	Ecology, foundations
WATER QUALITY						
Medium	5	Implement Water Quality Monitoring				
	5.1	Conduct water quality monitoring and assess the causes for pollution in the Rock Creek subbasin.	Stevenson	Low	Annual	Ecology, DOH, DFW, Skamania County
	5.2	Conduct water quality monitoring in the Wind River subbasin and identify solutions to improve conditions	Skamania County	Low	Annual	Ecology, DOH, DFW, Skamania County
	5.3	Conduct water quality monitoring in the Little White Salmon subbasin and identify solutions to improve conditions	Skamania County	Low	Annual	Ecology, DOH, DFW, Skamania County
	5.4	Conduct water quality monitoring in the Western Tributaries to the Columbia River to plan for future growth	Skamania County	Low	Annual	Ecology, DOH, DFW, Skamania County
Medium	6	Implement Septic System Management Improvements				
	6.1	Develop a comprehensive septic system improvement program	Skamania County	Low	1x	Skamania County
	6.2	Expand the frequency and scope of water quality sampling and determine sources of fecal coliform.	Skamania County	Low	1x	Ecology, DOH, Skamania County, Stevenson
	6.3	Develop a County ordinance that requires septic system inspection at the time of sale or transfer of property	Skamania County	Low	1x	Skamania

Priority ⁽¹⁾	Actions and Tasks		Lead Implementer ⁽²⁾	Cost ⁽³⁾	1x or Annual	Potential funding sources ⁽⁴⁾
	6.4	Pursue funding and landowner incentives to improve septic systems	Skamania County	Low	Annual	Ecology, DOH, Skamania County, Stevenson
	6.5	Implement Stevenson's HEALing SCARS Program	Stevenson	Low	Annual	Stevenson Sewer Utility, Ecology, DOH
Medium	7	Improve Road Maintenance as it Pertain to Water Quality and Sediment				
	7.1	Pursue funding to identify and rectify problems associated with roads	Skamania County	Low	Annual	Skamania County, Stevenson, USFS
	7.2	Pursue funding to support financial assistance to landowners	Skamania County	Low	Annual	Skamania County, Stevenson, USFS
Low	8	Implement Vegetation Management				
	8.1	Implement the Skamania County Integrated Aquatic Vegetation Management Plan		Low	Annual	
Medium	9	Improve Stormwater Management				
	9.1	Consider adopting a stormwater plan or ordinance	Skamania	Low	Annual	Skamania
	9.2	Endorse Stevenson's Storm Water Utility Mapping Project	Stevenson	Low	1x	Stevenson, Ecology
HABITAT						
Medium	10	Improve Habitat Conditions				
	10.1	Support designing habitat projects throughout WRIA 29A	LCFRB	Med	Annual	SRFB, BPA
	10.2	Evaluate and develop a habitat restoration strategy for the Lower Wind River and Trout Creek	LCFRB	Med	Annual	SRFB
	10.3	Implement habitat restoration projects throughout WRIA 29A	UCD, USFS, MCFEG	High	1x	Stevenson, Ecology, DOT
	10.4	Support the City of Stevenson's Rock Creek Bridge land acquisition and restoration	Stevenson	Med	Annual	SRFB, BPA
	10.5	Monitor Habitat Status and Trends throughout WRIA 29A	UCD, USFS	Med	Annual	Ecology, SRFB, NMFS, Skamania, BPA and others
	10.6	Work with Ecology to develop a pilot project for storage and retrieval of wetlands delineations and rating sheets on a county- or WRIA-wide basis.	Stevenson	Low	Annual	Ecology, Commerce, others
OUTREACH						
Medium	11	Implement Public Information and Outreach Activities				
	11.1	Develop and implement a comprehensive communication strategy throughout the county	Planning Unit	Low	Annual	TBD
COORDINATION						
Medium	12	Continue Planning Unit Organization				

	Priority ⁽¹⁾	Actions and Tasks		Lead Implementer ⁽²⁾	Cost ⁽³⁾	1x or Annual	Potential funding sources ⁽⁴⁾
		12.1	Work with Ecology to provide funding to maintain the Planning Unit	Initiating Governments	Low	Annual	TBD
		12.2	Identify a Lead Agency to Maintain Planning Unit work products and GIS	Initiating Governments	Low	Annual	TBD

⁽¹⁾High, Medium or Low as scored by the Planning Unit.

⁽²⁾ Lead implementer would take responsibility for organizing action efforts including pursuing funding.

⁽³⁾ Preliminary, generalized estimates of financial or economic cost of the action. Expressed as total cost, whether up-front or over a period of time up to ten years. High: greater than \$500,000; Medium: \$50,000 to \$500,000; Low: less than \$50,000.

⁽⁴⁾Funding sources that have been identified at this time. Other sources to be developed. TBD= Sources not yet determined.

WA agency abbreviations: DOH= Department of Health, Ecology = Department of Ecology, SRFB = Salmon Recovery Funding Board, Commerce = Department of Commerce, DOT = Department of Transportation, DFW = Department of Fish and Wildlife. Other abbreviations: BPA= Bonneville Power Administration, NMFS= National Marine Fisheries Service; USDA= US Department of Agriculture; USFS=US Forest Service

2.1. INTRODUCTION**2.2. IMPLEMENTATION OVERSIGHT AND COORDINATION****2.3. FUTURE UPDATES****2.4. WRIA-WIDE ACTIONS****2.5. SUBBASIN WATER MANAGEMENT MEASURES**

- a. INTRODUCTION
- b. SUMMARY OF SUBWATERSHED CONCLUSIONS AND RECOMMENDATIONS
- c. ROCK CREEK SUBBASIN
- d. WIND RIVER SUBBASIN
- e. LITTLE WHITE SALMON SUBBASIN
- f. OTHER COLUMBIA RIVER TRIBUTARIES

2.1 INTRODUCTION

Water is a vital natural resource. It is also by state law a public resource.⁴ We rely on abundant clean water to meet our drinking water and domestic needs. Our businesses, industries, and farms depend on it. It sustains our natural environment and is critical to the health of our regions' fish and wildlife. While water is relatively plentiful in Skamania County, our demand for water is expected to grow significantly in the coming decades. Careful management and stewardship is needed to ensure that water supplies are adequate to meet our future needs.

Ecology is charged with the management of the state's water resources including the issuance of water rights. The Washington legislature found in RCW 90.82.010 that the management of water resources could be enhanced through the participation of local interests with knowledge of their watersheds and water needs and established the watershed planning process. The watershed plan developed by the Planning Unit and adopted by the Skamania County is a product of that planning process.

This chapter provides a framework for the future management of our water resources. The recommended water management actions and measures do not change or alter Ecology's statutory responsibilities for managing water resources, but rather define how Ecology and WDFW will collaboratively work with the Yakama Nation, local governments and the public to most effectively manage water resources.

⁴ Chapter 90.54 RCW, Water Resources Act OF 1971

In identifying recommended water management actions and measures, the Planning Unit:

- Inventoried existing water rights and claims and examined current water uses;
- Assessed the condition of water supplies and stream flows; and
- Evaluated anticipated future needs for water and the ability of our supplies to meet those varied and sometimes competing needs.

Recommended management actions include continued monitoring of ground and surface water supplies, development of more reliable water supplies, and protection of stream flows. Water management measures are identified for specific watersheds. They may include reservations of water to meet future needs, minimum stream flows for fish and specific priorities or mechanisms to make more efficient use of water. These measures provide guidance to Ecology for use in developing and adopting a formal water management rule. No action or measure proposed in this plan would affect any existing water right or permit exempt well.

The recommended management actions and measures are based on the best available information. The Planning Unit believes they provide sound basis for managing our water resources. However, our knowledge of water resources is incomplete and our ability to predict water needs up to 20 years in the future is imprecise. To address these limitations, the plan calls for the periodic review and, when appropriate, revision of water management strategies and measures.

Finally, effective management and stewardship of our water resources will require the ongoing participation and cooperation of state agencies, local governments, the Yakama Nation, our communities, businesses and landowners. This chapter calls for the continuing involvement of the Planning Unit and the public in making water management decisions.

2.2 IMPLEMENTATION OVERSIGHT AND COORDINATION

The Planning Unit will coordinate and oversee the functions associated with the implementation of the water management measures, including:

- Monitoring the implementation actions to ensure consistency and compatibility with the intent of the water management measures;
- Advising Ecology on rule-making and implementation, including the granting or transferring of water rights;
- Coordinating efforts to monitor water supplies, stream flows, and water uses;
- Reviewing and, as needed, recommending changes to water management measures to address new information and statutory changes; and

- Providing the public the opportunity to participate in water management discussions and decision-making.

If the Planning Unit is not continued, the Initiating Governments should, in consultation with Ecology and WDFW, periodically appoint a work group to conduct the above functions, particularly the reopening and review of the water management measures. In addition to WRIA 29A Initiating Governments within the management area other public water purveyors, and other groups or interests, as appropriate, should be invited to participate. An operating charter may be useful in defining how and when an ad hoc work group would be convened, how the role and responsibilities of the work group would be defined, and how administrative support would be provided. A sample charter is provided in Appendix D.

2.3 FUTURE UPDATES

Review and Revisions to the Water Management Measures

The water management measures will be reviewed and revised, as necessary, to ensure that water resources in WRIA 29A meet the present and future needs of the people, communities, local economies, and, fish and wildlife. It is the intent of the reopener process to identify and resolve emerging issues before they result in hardship for people or adverse impacts for fish.

The water reservations proposed for certain subwatersheds are intended to provide adequate water supplies for development through 2035 while also maintaining stream flows for fish. The various assumptions used to generate the reservations, e.g., daily consumptive use, amounts of return flows, and, stream flow and fish habitat impacts shall be checked and verified or updated. Updated assumptions may lead to a recommendation to increase or decrease the size of the reservation.

If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right. Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313 gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.

The WRIA 29A water management measures will be reopened for review and revision as necessary at least once every 10 years. The watershed measures for a given subbasin will also be reviewed when its reservation(s) have been depleted by 75 percent. In addition the measures may also be reopened at any time upon the request of Ecology, WDFW, one of the Initiating Governments or a Planning Unit (or its successor) member with the concurrence of the group when it is determined that doing so is warranted based on statutory changes or new information indicating significant or unanticipated changes in population growth or land use trends, water supply needs, water quality, stream flows, ground water levels or habitat conditions.

The Planning Unit (or its successor), in consultation with Ecology and WDFW, will determine the scope of the review and develop a plan and schedule for conducting the review. Public notice of the review will be given and opportunities for public involvement and participation will be provided.

In conducting a review, the Planning Unit will consider the following information as appropriate:

1. New stream flow and groundwater data if available;
2. Assumed relationship among water use, stream flow, and water reserves/allocation;
3. Water allocated through new water rights and permit exempt wells;
4. Trends and forecasts in land use, projected population growth, and water demand;
5. Review of ESA-listed fish population and, habitat status and trends;
6. Changes in applicable state and local laws, and land use plans;
7. Watershed Plan assumptions and information regarding water supplies, consumptive uses, stream flows, water quality and habitat; or
8. Other new data or information the Planning Unit deems relevant to the review.

If a review involves a reservation that has been depleted by 75 percent or more, Ecology in consultation with the Planning Unit (or its successor) shall determine whether additional water is available within the subject subwatershed within 6 months of the initiation of the review.

Based on its review, the Planning Unit (or its successor) shall document its findings and, as necessary, adopt recommended amendments to the DIP. The Planning Unit shall forward its findings and recommendations to the legislative authority, Skamania County, for consideration and adoption in accordance with RCW 90.82.130.

Review and Amendment of the Water Management Rule

Ecology, in consultation with Skamania County, other state agencies, the Initiating Governments and the Planning Unit (or its successor), shall initiate a review, and a modification of the water management rule as appropriate, including when:

- Applicable statutory changes are enacted;
- Significant new information becomes available;
- Significant changes in conditions such as population growth and land use trends, water supply needs, stream flows, and ground water levels; and
- Requests based on the findings and recommendations resulting from the Planning Unit review of the water management measures in the DIP.

2.4 WRIA-WIDE ACTIONS

Action #1	Implement Surface and Ground Water Monitoring		
Action Type	<input checked="" type="checkbox"/> Water Supply/Stream Flow <input type="checkbox"/> Water Quality <input type="checkbox"/> Habitat	<input type="checkbox"/> Education <input type="checkbox"/> Implementation	Priority: Medium
Subbasin(s)	<input checked="" type="checkbox"/> All <input type="checkbox"/> Wind <input type="checkbox"/> Rock Creek <input type="checkbox"/> Little White Salmon <input type="checkbox"/> Columbia Tributaries		
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input checked="" type="checkbox"/> Complete by 2020		<input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2030
Description	<p>The people, fish and wildlife of WRIA 29A depend on the availability of clean water. Human activities and natural events can affect water quality, aquifer recharge, and stream flows. Adequate information regarding the status and trends of ground and surface water quantity and quality is required to effectively management the use and stewardship of the WRIA's water resources. For this reason, ground and surface water monitoring needs to be a long-term commitment. The watershed management plan found that:</p> <ul style="list-style-type: none"> • Significant surface and groundwater quantity and quality data gaps exist in WRIA 29A. • No stream flow or groundwater quantity data exist in the Rock Creek sub-basin. • More stream flow data are needed in the Wind River subbasin. • No stream flow or water-quality data exist for the small drainages in the Western Tributaries to the Columbia subbasin. <p>The Planning Unit believes that implementing both the surface and groundwater monitoring strategies developed during the Level 2 assessment (Envirovision, 2004) is a priority.</p>		
Strategies & Measures	<p>2.4.1 Implement the groundwater quality and quantity monitoring strategy developed in the Level 2 assessment.</p> <p>2.4.2 Implement the surface water quality and quantity monitoring strategy developed in the Level 2 assessment.</p> <p>2.4.3 Conduct hydrogeology studies to gather information on hydraulic continuity and aquifer recharge.</p> <p>2.4.36 Encourage the Department of Ecology and others to review the Characteristic Uses assigned to Western WRIA 29 water bodies.</p> <p>3.4.1 Prepare hydrographs for Rock Creek and its tributaries.</p> <p>4.4.1 Prepare hydrographs for Bear, Creek, Panther creeks and the Wind River tributaries.</p>		
Expected Outcome	<p>Groundwater and surface water monitoring will fill an essential data gap that will help guide future planning and development so that adequate clean water can be available to communities without affecting existing water users and fish habitat.</p>		

Task 1.1 - Implement the Level 2 Groundwater and Surface Water Monitoring Strategies

Lead: Skamania County

Coordinating: Planning Unit, Underwood Conservation District, Skamania PUD and City of Stevenson

Status ☒ Planned ☐ Active ☐ CompleteTime frame for completion
☒ Ongoing
☐ Complete by 2015
☐ Complete by 2020
☐ Complete by 2025
☐ Complete by 2030

Description

The Planning Unit believes that surface and groundwater data are lacking in the area which hinder planners' ability to assess the current conditions, monitor changes, and evaluate effectiveness of any implemented effort. In 2004, the Planning Unit completed a groundwater and surface water strategies (Envirovision, 2004) to guide monitoring. However, due to limited funding at that time, additional surface and groundwater studies were proposed for future monitoring. Implementing these strategies is a priority for the Planning Unit.

Cost
☐ High (Greater than \$500,000)
☒ Medium (\$50,000-\$500,000)
☐ Low (Less than \$50,000)
☒ Per year
☐ One timeIs the task funded? ☐ Yes ☒ No ☐ Partially

Funding Source Unknown

Constraints & Uncertainties

Over the past several years Skamania County resources have been drastically cut. State funding is needed to sustain this task.

Task 1.2 - Conduct Hydrogeology Studies to Gather Information on Hydraulic Continuity and Aquifer Recharge

Lead: Skamania County

Coordinating: Ecology, WDFW, Skamania PUD, City of Stevenson

Status ☐ Planned ☒ Active ☐ CompleteTime frame for completion
☐ Ongoing
☐ Complete by 2015
☒ Complete by 2020
☐ Complete by 2025
☐ Complete by 2030

Description

Little information is known about the hydraulic continuity between surface water and groundwater in the watershed. The information is important for understanding aquifer recharge as well as tracking the movement of pollutants. The Planning Unit recommends conducting a study in the Wind River and Rock Creek (geothermal) subbasins to identify areas where there is high connectivity between surface water and groundwater, and, where groundwater enters streams (including geothermal inflow). The study should also identify the location and size of aquifers and examine the area and rate of recharge.

Cost
☐ High (Greater than \$500,000) ☐ Per year
☐ Medium (\$50,000-\$500,000)
☒ Low (Less than \$50,000) ☒ One timeIs the task funded? ☐ Yes ☐ No ☒ Partially

Funding Source Skamania County

Constraints & Uncertainties

Over the past several years Skamania County resources have been drastically cut. State funding is needed to sustain this task.

Task 1.3 - Prepare Hydrographs for Bear and Panther Creeks and Other Wind River tributaries			
Lead: Ecology			
Coordinating: Skamania County, City of Stevenson, US Forest Service and WDFW			
Status	<input type="checkbox"/> Planned <input type="checkbox"/> Active <input checked="" type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input checked="" type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	Preparing hydrographs is an essential first step for recommending instream flows, or minimum flows that must be met in a stream to protect the resources and benefits that stream provides. For Bear and Panther creeks and other Wind River tributaries hydrograph data will need to be synthesized or extrapolated from stream gauges on other similar streams.		
Cost	<div> <input type="checkbox"/> High (greater than \$500,000) <input type="checkbox"/> Per year </div> <div> <input type="checkbox"/> Medium (\$50,000-\$500,000) </div> <div> <input checked="" type="checkbox"/> Low (Less than \$50,000) <input checked="" type="checkbox"/> One time </div>		
Is the task funded?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Ecology		
Constraints & Uncertainties	None		

Task 1. 4 - Prepare Hydrographs for Rock Creek and its Tributaries by Synthesizing or Extrapolating Data from Stream Gauges on Other Similar Streams

Lead: Ecology

Coordinating: City of Stevenson, Skamania PUD, Skamania County, US Forest Service, and WDFW

Status ☐ Planned ☐ Active ☒ Complete

Time frame for completion ☐ Ongoing ☒ Complete by 2015 ☐ Complete by 2020 ☐ Complete by 2025 ☐ Complete by 2030

Description Preparing hydrographs is an essential first step for recommending instream flows, or minimum flows that must be met in a stream to protect the resources and benefits that stream provides. For Rock Creek and its tributaries hydrograph data will need to be synthesized or extrapolated from stream gauges on other similar streams.

Cost ☐ High (Greater than \$500,000) ☐ Per year ☐ Medium (\$50,000-\$500,000) ☒ Low (Less than \$50,000) ☒ One time

Is the task funded? ☒ Yes ☐ No ☐ Partially

Funding Source Ecology

Constraints & Uncertainties None

Task 1.5 - Install New Permanent Gauges and Maintain Existing Gauges to Monitor Stream Flows			
Lead: Ecology			
Coordinating: Skamania County, Yakama Nation, City of Stevenson, Underwood CD and US Forest Service			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	<p>In order to manage flows, streams must be monitored consistently over time. Currently there are too few gauges in the watershed and the number continues to decline. In the past the US Forest Service, Ecology and US Geological Service maintained gauges. Currently there is only one active gauge in the watershed. Without adequate monitoring points planning for future needs will be difficult. The Planning Unit recognizes that stream monitoring is a high priority and supports the installation of additional gauges on the major tributaries in the watershed. The Planning Unit urges Ecology, along with the USFS, and the USGS to maintain active stream gauges to ensure long-term data will be available for future planning.</p>		
Cost	<div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> High <input checked="" type="checkbox"/> Medium <input type="checkbox"/> Low </div> <div> (Greater than \$500,000) (\$50,000-\$500,000) (Less than \$50,000) </div> <div> <input checked="" type="checkbox"/> Per year <input type="checkbox"/> One time </div> </div>		
Is the task funded?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Partially		
Funding Source	BPA, Ecology, Local sources		
Constraints & Uncertainties	Funding from BPA is uncertain. Ecology's stream gauge program has been reduced over the past several years. Future state general and capital funds are uncertain.		

Task 1.6 – Reconcile Bear Creek Low Flow Measurements

Lead: Skamania PUD

Coordinating: US Forest Service

Status ☐ Planned ☐ Active ☒ CompleteTime frame for completion
☐ Ongoing
☒ Complete by 2015
☐ Complete by 2020
☐ Complete by 2025
☐ Complete by 2030Description
The Planning Unit has recommended that the USFS and the Skamania County PUD work together to reconcile the measurement methods, timing, and location of their two datasets regarding Bear Creek low-flows prior to beginning any instream flow process. This work was completed in 2010.Cost
☐ High (Greater than \$500,000) ☐ Per year
☐ Medium (\$50,000-\$500,000)
☒ Low (Less than \$50,000) ☒ One timeIs the task funded? ☒ Yes ☐ No ☐ Partially

Funding Source Skamania PUD and USFS

Constraints & Uncertainties
None

Action #2 – Establish a Program for Addressing Unauthorized Water Withdrawals

Action Type	<input checked="" type="checkbox"/> Water Supply/Stream Flow <input type="checkbox"/> Water Quality <input type="checkbox"/> Habitat	<input type="checkbox"/> Education <input type="checkbox"/> Implementation	Priority: High
Subbasin(s)	<input checked="" type="checkbox"/> All <input type="checkbox"/> Wind <input type="checkbox"/> Rock Creek <input type="checkbox"/> Little White Salmon <input type="checkbox"/> Columbia Tributaries		
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input checked="" type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	<p>The unauthorized use of water can impact stream flows, water quality and aquatic habitat. The following are all misdemeanors under Washington law (RCW 90.03 and 90.04):</p> <ul style="list-style-type: none"> • Unauthorized use of water to which another person is entitled, or the willful or negligent waste of water that harms another person. • Interference with, destroying, or altering water diversion structures such as dams or weirs. • Destruction, interference, or alteration of structures with the intent to divert water illegally. • Unauthorized use or waste of groundwater. The law provides for the Department of Ecology to assess fines of up to \$100 per day for each violation. <p>The Planning Unit recognizes there is a need to better understand and quantify unauthorized water uses. In partnership with Ecology, the Planning Unit believes that a program to address illegal water use is in the best interest of our growing communities and will help protect water supply.</p>		
Strategies & Measures	2.4.35 Request that the Department of Ecology identify and increase enforcement of illegal water withdrawals		
Expected Outcome	Improved public information and awareness. Reduction in unauthorized water withdrawals.		

Task 2.1 – Conduct Stream Surveys to Identify Unauthorized Withdrawals			
Lead: Ecology, City of Stevenson, Skamania County, Planning Unit			
Coordinating: Yakama Nation, Underwood Conservation District			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input checked="" type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	In order to develop effective public outreach information it will be important to understand the degree of misconduct occurring. Surveying and identifying properties affecting the stream will be used to craft a message to make the community aware of the problem and to understand ways to reduce the number of incidents of unauthorized water use through self-management and enforcement.		
Cost	<div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> High (Greater than \$500,000) <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) </div> <div> <input type="checkbox"/> Per year <input checked="" type="checkbox"/> One time </div> </div>		
Is the task funded?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Ecology		
Constraints & Uncertainties	Limited funding is available for this action. This program can only be implemented if a grant funding is secured.		

Task 2.2 – Provide Landowner Assistance to Reduce Unauthorized Uses			
Lead: City of Stevenson, Skamania County, Underwood Conservation District			
Coordinating: Ecology, Planning Unit			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input checked="" type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	One-on-one consultations with landowners can explore incentives and other ways to reduce the number of incidents. These discussions may be initiated through city or county permit activities and with the conservation district to in their efforts to improve best management practices.		
Cost	<div> <input type="checkbox"/> High (Greater than \$500,000) <input checked="" type="checkbox"/> Per year </div> <div> <input type="checkbox"/> Medium (\$50,000-\$500,000) </div> <div> <input checked="" type="checkbox"/> Low (Less than \$50,000) <input type="checkbox"/> One time </div>		
Is the task funded?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Ecology		
Constraints & Uncertainties	Limited funding is available for this action. This program can only be implemented if a grant funding is secured.		

Task 2.3 – Implement Enforcement Measures and Fines			
Lead: Ecology			
Coordinating: City of Stevenson, Skamania County			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input checked="" type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	State law permits Ecology to assess a fine for offenders. The Planning Unit encourages Ecology to maintain and expand their enforcement measures.		
Cost	<input type="checkbox"/> High (Greater than \$500,000) <input checked="" type="checkbox"/> Per year <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) <input type="checkbox"/> One time		
Is the task funded?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Partially		
Funding Source	Ecology		
Constraints & Uncertainties	Ecology's enforcement program capacity is limited. This task can only be implemented if the department increases its resources.		

Action #3		Adopt Water Management Measures for State Rule	
Action Type	<input checked="" type="checkbox"/> Water Supply/Stream Flow <input type="checkbox"/> Water Quality <input type="checkbox"/> Habitat	<input type="checkbox"/> Education <input type="checkbox"/> Implementation	Priority: High
Subbasin(s)	<input checked="" type="checkbox"/> All <input type="checkbox"/> Wind <input type="checkbox"/> Rock Creek <input type="checkbox"/> Little White Salmon <input type="checkbox"/> Columbia Tributaries		
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input checked="" type="checkbox"/> Complete by 2020		
Description	<p>Instream and future out of stream water needs and water availability will be assessed. Establishing water management measures may include: 1) identifying specific stream closures that result from setting instream flows; and 2) identifying specific reservations for future needs. Instream flows established in Ecology's rule become a water right and thereby may condition any water right applications made thereafter. If stream flows are lower than the established minimum instream flow, a basin may be closed to further water appropriation. It is important to recognize that instream flows have no effect on water rights that existed before the instream flow was set (first in time, first in right). Instream flows are junior to all existing water rights at the time of their adoption (Rushton, 2003) and may be junior to water reservations for out-of-stream uses.</p>		
Strategies & Measures	<p>W-14 There is some concern about the watershed's ability to meet future water demands.</p> <p>W-15 Reduced snowpack, increased rain-on-snow events, and conversion of forestland to other uses may alter the timing and quantity of stream flow.</p> <p>2.4.26 Make instream flow recommendations or rules.</p> <p>2.4.41 Request the Department of Ecology appoint a water master in Western WRIA 29.</p>		
Expected Outcome	<p>Establishing water availability, setting reservations and instream flows will reduce uncertainty in meeting future water needs.</p>		

Task 3. 1 – Develop Water Management Measures			
Lead: Planning Unit			
Coordinating: Ecology			
Status	<input type="checkbox"/> Planned <input checked="" type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2025 <input checked="" type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2030 <input type="checkbox"/> Complete by 2020		
Description	<p>In 2014 the Planning Unit began evaluating current water rights, population growth estimates, water availability for beneficial uses and future water needs to establish water management measures that will inform Ecology’s rule-making process. This work builds on past efforts to collect and assess stream flow data and evaluate instream water needs (fish, recreation, etc.) The management measures may include; 1) recommended instream flows, reservations and closures; 2) an adaptive management process to re-examine flows, reservations and closures based on new information and legislative changes; and 3) mitigation measures.</p>		
Cost	<input type="checkbox"/> High (Greater than \$500,000) <input type="checkbox"/> Per year <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) <input checked="" type="checkbox"/> One time		
Is the task funded?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Ecology		
Constraints & Uncertainties	None		

Task 3.2 – Adopt Water Management Measures in State Rule

Lead: Ecology

Coordinating: Planning Unit, WDFW

Status ☒ Planned ☐ Active ☐ Complete

Time frame for completion ☐ Ongoing ☐ Complete by 2025
☐ Complete by 2015 ☐ Complete by 2030
☒ Complete by 2020

Description Following the adoption of the Planning Unit's Detailed Implementation Plan, the Department of Ecology can begin the rule-making process. However due to recent court actions and reduction of the department's resources and capacity, rule-making is unlikely to begin in the near future. As an alternative, Ecology's Water Resources Program, Skamania County and the City of Stevenson may enter into an agreement to provide a mechanism for processing the backlog of water rights applications. See Task 3.3.

Cost ☒ High (Greater than \$500,000) ☐ Per year
☐ Medium (\$50,000-\$500,000)
☐ Low (Less than \$50,000) ☒ One time

Is the task funded? ☐ Yes ☒ No ☐ Partially

Funding Source Ecology

Constraints & Uncertainties Due to the 2013 Swinomish court ruling, Ecology has curtailed rule-making efforts throughout the state. This task is contingent upon Ecology resolving several legal ramifications before rule-making can proceed.

Task 3.2 –Adopt an MOA Between Ecology, City of Stevenson and Skamania County to Facilitate the Implementation of the Water Management Measures

Lead: Ecology, Skamania County, City of Stevenson

Coordinating: Planning Unit, WDFW

Status ☒ Planned ☐ Active ☐ Complete

Time frame for completion ☐ Ongoing ☐ Complete by 2025
☐ Complete by 2015 ☐ Complete by 2030
☒ Complete by 2020

Description

Due to recent court actions and reduction of the department’s resources and capacity, rule-making is unlikely to begin in the near future. As an alternative, Ecology’s Water Resources Program, Skamania County and the City of Stevenson may enter into an agreement to provide a mechanism for processing the backlog of water rights applications. The memorandum of agreement may include the following elements:

- Ecology will process water right applications in WRIA 29A, based on priority date of application received.
- Ecology will track the number of permit exempt wells in WRIA 29.
- Skamania County will provide Ecology with building permit-related information to assist Ecology in tracking permit-exempt wells.
- Ecology will attend and participate in future Planning Unit implementation meetings.
- Skamania County will be responsible for determining the legal availability of water within its jurisdiction, as required in Chapter 19.27.097 RCW and Chapter 58.17 RCW.
- Planning Unit will advise Ecology on the issuance of new water rights.
- Planning Unit will make recommendations for mitigation measures.

A sample agreement is provided in Appendix E In developing the MOA Planning Unit meetings can provide a useful forum to finalize the agreement language.

Cost ☐ High (Greater than \$500,000) ☐ Per year
☐ Medium (\$50,000-\$500,000)
☒ Low (Less than \$50,000) ☒ One time

Is the task funded? ☐ Yes ☒ No ☐ Partially

Funding Source Skamania County, City of Stevenson, Ecology

Constraints & Uncertainties None

Task 3.4 – Request Funding from Ecology for an Instream Flow Process			
Lead: Initiating Governments			
Coordinating: Planning Unit			
Status	<input type="checkbox"/> Planned <input type="checkbox"/> Active <input checked="" type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input checked="" type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2020		
	<input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2030		
Description	In 2013 the Initiating Governments expressed an interested in commencing Phase 4 planning. Setting instream flows is a required element as part of the planning process. In 2014 the Planning Unit was reconvened and successfully applied for and received funding to complete this work.		
Cost	<input type="checkbox"/> High (Greater than \$500,000) <input type="checkbox"/> Per year <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) <input checked="" type="checkbox"/> One time		
Is the task funded?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Ecology		
Constraints & Uncertainties	None		

Action #4		Implement Water Supply Actions	
Action Type	<input checked="" type="checkbox"/> Water Supply/Stream Flow <input type="checkbox"/> Water Quality <input type="checkbox"/> Habitat	<input type="checkbox"/> Education <input type="checkbox"/> Implementation	Priority: Medium
Subbasin(s)	<input type="checkbox"/> All <input checked="" type="checkbox"/> Wind <input checked="" type="checkbox"/> Rock Creek <input type="checkbox"/> Little White Salmon <input type="checkbox"/> Columbia Tributaries		
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	<p>The Planning Unit believes the pressure on water supplies throughout the watershed, especially for the City of Stevenson and the Skamania PUD is growing. Both water purveyors are planning for expansion to accommodate growth. Both rely on surface water withdrawals for their water supply. Planning is also underway to transfer surface water rights to groundwater to aid development of a portion of the former Wind River Nursery lands in Stabler, and the Home Valley, Mill A, and Underwood water systems to meet future demand estimates. Water source considerations must be developed in concert with setting instream flows, establishing stream closures and determining water reservations.</p> <p>Changes in climate will also impact water supply. Reduced snowpack and seasonal temperature variations affect summer low stream flows. In making planning decisions the Planning Unit recommends that water purveyors consider developing adaptive capacity to meet future needs.</p>		
Strategies & Measures	<p>W-14 There is some concern about the watershed's ability to meet future water demands.</p> <p>W-15 Reduced snowpack, increased rain-on-snow events, and conversion of forestland to other uses may alter the timing and quantity of streamflow.</p> <p>2.4.27 Develop adaptive capacity to manage impacts of climate change on water supply</p>		
Expected Outcome	<p>Developing new water sources will reduce the impacts on instream flows while meeting the future needs of the communities.</p>		

Task 4.1 – Support the City of Stevenson’s Efforts to Move from Surface Water to Groundwater Sources in the Same Basin

Lead: City of Stevenson

Coordinating: Planning Unit

Status ☒ Planned ☐ Active ☐ Complete

Time frame for completion ☐ Ongoing ☐ Complete by 2015 ☐ Complete by 2020 ☐ Complete by 2025 ☒ Complete by 2030

Description

The Stevenson Water System receives surface water from a diversion on La Bong Creek, a Rock Creek tributary. During low flow conditions these water withdrawals must be supplemented by another surface water withdrawal in the Rock Creek mainstem. During turbidity-generating high flow conditions, these water withdrawals are halted and replaced by groundwater withdrawals from the Hegewald Well, a well operated by the City on County-owned land. To simplify this system, the City prefers to transition entirely to groundwater sources, a task that will require:

- Locating reliable groundwater in the Rock Creek Basin,
- Installing a production well(s) at the source(s),
- Consolidating City ownership of the Hegewald Well.

Cost ☒ High (Greater than \$500,000) ☐ Per year ☐ Medium (\$50,000-\$500,000) ☒ One time ☐ Low (Less than \$50,000)

Is the task funded? ☐ Yes ☐ No ☒ Partially

Funding Source

This task will most likely cost approximately \$1 million and require incremental funding over a 4-year timeframe. The Stevenson Water Utility, WA Departments of Health and Ecology, and other unknown sources are likely candidates for funding.

Constraints & Uncertainties

Funding from DOH and Ecology is uncertain. Groundwater sources, productivity, and reliability have not yet been determined.

Task 4.2 – Support Skamania PUD’s efforts to move from surface water to groundwater sources for the Carson Water System			
Lead: Skamania PUD			
Coordinating: Skamania County, Planning Unit			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input checked="" type="checkbox"/> Complete by 2020		
Description	<p>Skamania PUD would like to find and develop adequate groundwater sources that would fulfill current and future supply demand for the Carson Water System while improving base flows in Bear Creek and the Wind River. Currently the PUD’s primary water supply for the community of Carson is a 2.0 cfs surface water right on Bear Creek, a tributary of the Wind River. These water withdrawals can significantly affect summertime low flows on Bear Creek, which were recently recorded as low as 1.5 cfs, as well as having downstream impacts on the Wind River. The 10-foot-high intake diversion structure on Bear Creek also blocks upstream passage of resident fish.</p> <p>The effort to move from surface water to groundwater sources would occur in five phases:</p> <p>Phase 1: Conduct hydrogeologic study of the lower Wind River Valley (complete)</p> <p>Phase 2: Permit, install, and monitor test well and complete well report</p> <p>Phase 3: Preliminary engineering report and apply for water rights</p> <p>Phase 4: Design, permit, and construct infrastructure improvements</p> <p>Phase 5: Decommission surface water infrastructure and remove Bear Creek dam and intake structure</p> <p>In 2015, the PUD completed the Phase 1 hydrogeologic study. The study identified potential test well locations in the lower Wind River Valley that would access groundwater discharging to the Columbia River. The transition away from the Bear Creek surface water source will be contingent on 1) locating a proven source of groundwater to meet the needs of the Carson water system to full build-out of the area and 2) being able to transfer Bear Creek water rights to the ground water source and obtain sufficient new rights to meet Carson water system needs to build out.</p>		
	Cost	<input type="checkbox"/> High (Greater than \$500,000) <input checked="" type="checkbox"/> Medium (\$50,000-\$500,000) <input type="checkbox"/> Low (Less than \$50,000)	
Is the task funded?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Partially		
Funding Source	Ecology, Skamania PUD		
Constraints & Uncertainties	The quantity and quality of groundwater at the potential test well locations is unknown. Funding for the task has not been identified.		

Task 4.3 –Support Stevenson’s Effort to Provide Municipal Water to Unserved Areas in the Stevenson Urban Area			
Lead: City of Stevenson, Skamania County			
Coordinating: Planning Unit			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input checked="" type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	<p>Current City policies prevent the extension of water service outside of City limits. Much of the unincorporated Stevenson Urban Area lies in basins closed for further water withdrawals, including withdrawal from permit exempt wells. Smart growth within the Stevenson Urban Area will require land uses to be coordinated with the extension of municipal utilities. Encouraging this smart growth will require:</p> <ul style="list-style-type: none"> ▪ Engaging water resources consultant support regarding current City water service policies; ▪ Adopting a land use subarea plan and interlocal agreement between Stevenson and Skamania County to coordinate land development in the unincorporated Stevenson Urban Area; ▪ Establishing a program to allow pre-annexation agreements for properties outside city limits to extend utilities or to allow a fee in lieu of extension until utilities can be extended; and ▪ Constructing a reservoir(s) to serve additional pressure zones above the current system limits. 		
Cost	<input checked="" type="checkbox"/> High (Greater than \$500,000) <input type="checkbox"/> Per year <input type="checkbox"/> Medium (\$50,000-\$500,000) <input type="checkbox"/> Low (Less than \$50,000) <input checked="" type="checkbox"/> One time		
Is the task funded?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Stevenson Water Utility, WDOH, Commerce & Ecology, USDA Rural Development		
Constraints & Uncertainties	Funding sources and political will are uncertain.		

Task 4.4 – Include Adaptive Management Measures in Planning for Future Water Resource Management

Lead: City of Stevenson, Skamania County, Skamania PUD, Home Valley Water System, Mill A Water System, Port of Skamania

Coordinating: Planning Unit

Status	<input type="checkbox"/> Planned <input checked="" type="checkbox"/> Active <input type="checkbox"/> Complete
Time frame for completion	<input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030
Description	Planning for the future of our communities relies on information available at the time decisions are made. However, unforeseen circumstances may arise requiring a change in course to meet future water needs. The Planning Unit believes that planning activities should be as flexible as possible and developed in a manner that allows for changes and outlines adaptive manage measures.
Cost	<input type="checkbox"/> High (Greater than \$500,000) <input checked="" type="checkbox"/> Per year <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) <input type="checkbox"/> One time
Is the task funded?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially
Funding Source	Water purveyors as part of their planning efforts
Constraints & Uncertainties	None

Task 4.5 – Complete an Aquifer Mapping Study for the Watershed. Priority should be given to the Stabler and Kanaka Creek Areas

Lead: Planning Unit

Coordinating: Skamania County and Stevenson

Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input checked="" type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030
Description	Groundwater withdrawals will affect water supply needs throughout watershed. In particular water withdrawal from Martha Creek will reduce flows during the summer months and eventually extend the dry period. Similar concerns exist in Kanaka Creek. Data relating to the location and use of aquifers are minimal, at best. In order to plan for expected impacts the Planning Unit believes that an aquifer mapping study is the first step to identifying alternative water sources in these areas.
Cost	<input type="checkbox"/> High (Greater than \$500,000) <input checked="" type="checkbox"/> Per year <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) <input type="checkbox"/> One time
Is the task funded?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Partially
Funding Source	Ecology, Foundations
Constraints & Uncertainties	Funding for this study is limited.

2.5 SUBBASIN WATER MANAGEMENT MEASURES

Specific water management measures have been developed for the following subwatersheds:

- Rock Creek
- Wind River
- Little White Salmon
- Other Columbia River Tributaries (Wauna area, Kanaka, Nelson, Carson, Collins, and Dog creeks, Home Valley and Underwood areas)

Depending on the conditions and needs of a subwatershed, water management measures may include:

- A reservation or set aside available water to meet anticipated domestic, municipal, commercial, and industrial needs through 2035;
- A minimum stream flow needed to protect salmon, steelhead, and resident fish; and, or
- Specific strategies for addressing water needs where water availability is limited.

In no instance would any existing water right or permit exempt well be impair or affected by the recommended measures.

In developing management measures for each subwatershed, the Planning Unit:

- Inventoried existing water rights and claims and assessed current water uses;
- Considered fish usage and habitat needs;
- Evaluated water supplies and stream flows;
- Estimated water needs through 2035; and
- Evaluated the availability of water to meet varied and sometimes competing needs.

Ecology's online Water Rights Explorer database⁵ provided basic information on existing water right certificates, permits, claims and applications, including the location of a diversion or withdrawal, the water uses, the quantity of water granted and the rate of withdrawal or diversion. In addition to the state water right records, the Yakama Nation maintains an unquantified Stevens Treaty water right with a priority date of time immemorial for sufficient instream flows to support fish and aquatic life.⁶

Information on fish usage and habitat needs were obtained from WDFW's online SalmonScape database⁷ and the Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan⁸ (Recovery Plan).

Ecology provided hydrographs and flow assessments for key rivers and streams using Ecology's new toe-width method (Appendix F).⁹ Flow information was not available for Dog and Collins creeks or the small tributaries in the Wauna, Home Valley, or Underwood areas. The agencies also recommended instream flows needed to protect fish. For all hydrographs if there is a single instream flow, it is based

⁵ <http://www.ecy.wa.gov/programs/WR/info/webmap.html>

⁶ Osborn, 2010

⁷ <http://apps.wdfw.wa.gov/salmonscape/>

⁸ LCFRB, 2010

⁹ Pacheco (draft), 2014

on habitat. If there are two numbers, the first is the 10% exceedance and the habitat-based instream flow is in parentheses.

Estimates of future water demand through 2035 were obtained from several sources. Water system plans provided estimates of future water demand for the Stevenson, Carson, Home Valley, and Underwood water districts. These plans also provided assessments of the adequacy of existing water rights to meet those demands. In the unincorporated areas where no formal water system plans were available, the Planning Unit developed an estimate of future water demand by first developing an estimate of an individual household's consumptive water use Permit Exempt Well Consumptive Use Estimate (PEW Estimator) (Appendix G)¹⁰ and then estimating the increase in the number of households between 2015 and 2035 using census data, high population growth estimates from the Washington Office of Financial Management (OFM) and Skamania county land use and zoning information. Details on how subbasin population and water demand estimates were determined using these information sources are in each of the individual subbasin sections.

Guidelines by Ecology and WDFW (Ecology/WDFW Guidance) use 1 to 2 percent of the 90 percent exceedance low flow to determine the amount of water available to meet future out-of-stream demands.¹¹ The 90 percent exceedance low flow is a measure of low flow conditions that would occur only 10 percent of the years and usually in the late summer months when out-of-stream water demands are the greatest. A 1 to 2 percent reduction in flow condition would result in a corresponding 1 to 2 percent loss of fish habitat. For more information see Appendix H.

It was assumed that any future water withdrawal would result in an immediate and equal reduction in stream flows. While this is clearly the case for surface water diversions, groundwater withdrawals seldom have an immediate impact. The impact of a groundwater withdrawal depends on the location of the withdrawal, water returns through onsite septic systems and infiltration, distance to the stream, the geology and aquifer characteristics. These factors can vary widely throughout a subbasin, making it impossible to precisely predict the timing and extent of groundwater withdrawal impacts on stream flows. Assuming that water withdrawals have an immediate impact on stream flows provides the most conservative estimate of potential stream flow depletion.

None of the water management measures would limit the availability of water from the Columbia River or groundwater in connection with the Columbia River for use in meeting future water demands. Applications for such water withdrawals would be handled under existing state rules and procedures for processing water right applications.

Based on available information and the assumptions made regarding the growth of water demand and potential impacts to stream flows, the Planning Unit found in most instances that sufficient water will be available to meet the future needs for people while maintaining stream flows needed by fish. In areas where water is plentiful and future demands are not expected to impact stream flows important to fish, no active management measures are proposed. These include the Wauna, Home Valley and Underwood areas. There are, however, locations where water supplies needed to meet anticipated future demands are limited or not available. In particular, these locations include Rock Creek, Kanaka Creek, Nelson Creek, and Martha Creek. But, even in these instances, there are options available to secure needed water and protect stream flows. Finally, there are also locations where the Planning Unit

¹⁰ Planning Unit, 2015

¹¹ Beecher, 2006

felt that future water demands could potentially compete with needed stream flows. These locations include the Wind River and a number of its major tributaries. In these locations, reservations of water needed to meet anticipated future needs are proposed. A reservation is also proposed for the Little White River even though water is relatively plentiful in this watershed. This was done to provide the community with certainty that water will be available to meet its future needs. The Planning Unit maintains that reservations would have priority or seniority over proposed minimum instream flows. In all cases, the proposed reservations are within the 1 to 2 percent of the 90 percent exceedance low flow guidance provided by Ecology and WDFW.

A summary of the water management measures recommended for each subwatershed area are provided below. The assessment of water resources and anticipated future demands and the management measures are discussed in greater detail in the following subbasin sections and subwatershed areas. Reoccurring acronyms used in this chapter include:

ADD	Average Daily Demand
C/I/I	commercial/Industrial/institutional
Cfs	Cubic Feet per second
gpd	Gallons per day
gpm	Gallons per minute
ERU	Equivalent Residential Unit
MDD	Maximum Daily Demand
OFM	Office of Financial Management
Qi	Instantaneous demand rate – <i>For all tables, to facilitate comparison, instantaneous demand for both surface and groundwater sources are given cubic feet per second (cfs).</i>

2.6 SUMMARY OF SUBWATERSHED CONCLUSIONS AND RECOMMENDATIONS

<i>Subwatershed</i>	<i>Conclusions and Recommendations</i>
<i>Wauna</i>	<p>Existing water rights and permit exempt wells will not be impaired or changed by this Plan.</p> <p>The estimated increase in water demand through 2035 of 0.007 cfs or 4,524 gpd will not have a significant impact on existing water supplies or stream flows in Ash Creek.</p> <p>No reservations, instream flows or closures are recommended for the Wauna area.</p>
<i>Rock Creek</i>	<p>Existing water rights and permit exempt wells cannot be changed or impaired by this Plan.</p> <p>If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right.</p>

Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313 gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.

The anticipated future water needs of the City of Stevenson through 2035 can be satisfied by its existing water rights, leaving 3.23 cfs and 776 af remaining to meet Stevenson's needs beyond 2035.

The City's water right not fully developed or utilized by 2035 shall continue to be available to meet needs beyond that time.

Given the estimated potential stream flow depletion, insufficient water is available to meet new needs in the Rock Creek subbasin outside the City water system service area.

To assist in meeting the needs for water outside of the its water service area, the City of Stevenson should develop the process and protocols to:

- Transfer portions of its existing water rights in excess of its anticipated needs to new users within the Rock Creek subbasin outside the service area; and
- Allow permit exempt rights retired through extension of city water service to be consolidated with the City's water rights pursuant to RCW 90.44.105 and increase the City's rights at a rate of 800 gpd per retired permit exempt right.

Water from reaches of the Rock Creek backwatered by the Columbia River or from the Columbia River or from groundwater in connection with the Columbia River and not the Rock Creek or its tributaries is available for appropriation. It is not subject to any of the instream flows or closures recommended for the Rock Creek subwatershed. Applications for such water withdrawals would be handled under routine procedures for processing water right applications.

Set instream flows for Rock Creek at Stevenson.

Kanaka Creek

Existing water rights and permit exempt wells will not be impaired or changed by this Plan. Fish use is limited due to the effect of development, particularly in the lower reaches of Kanaka Creek.

The estimated increase in consumptive water demand and stream flow depletion through 2035 of 0.008 cfs or 5,170 gpd. Extension of Stevenson water services to existing homes within the service area could help reduce the potential stream flow depletion by 0.005 cfs to 0.003 cfs.

Based on the Ecology/WDFW guidance only 0.0002 cfs is available to meet future out-of-stream water needs. This is insufficient to meet estimated future demand.

To meet anticipated future demand consideration should be given to:

- Extending the Stevenson water service beyond the 20-year growth boundary in the Kanaka Creek subwatershed, or
- Making water from the Stevenson water system available to small community systems outside the service area through interlocal operating agreements.

A reservation for permit exempt wells and community water systems should be established and should be credited with 313 gpd or 0.0004 cfs for each household converted from the Kanaka Creek source to the Stevenson water system; provided that wells or diversions drawing water from Kanaka Creek are decommissioned.

If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right.

Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313 gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.

Impacts to flows from any additional demand resulting from further residential development adjacent to the Columbia River will be inconsequential.

Water from reaches of the Kanaka Creek backwatered by the Columbia River or from the Columbia River or from groundwater in connection with the Columbia River and not Kanaka Creek is available for appropriation. It is not subject to any of the reservations and instream flows recommended for the Kanaka Creek watershed. Applications for such water withdrawals would be handled under routine procedures for processing water right applications.

Set instream flows at Kanaka Creek River Mile 0.1.

Nelson Creek

Existing water rights and permit exempt wells will not be impaired or changed by this Plan. The estimated increase in consumptive water demand through 2035 is 0.0016 cfs or 1038 gpd.

Water from reaches of the Nelson Creek backwatered by the Columbia River or from the Columbia River or from groundwater in connection with the Columbia River and not Nelson Creek is available for appropriation. It is not subject to any of the reservations and instream flows recommended for the Nelson Creek watershed. Applications for such water withdrawals would be handled under routine procedures for processing water right applications.

Based on the Ecology/WDFW guidance, there is insufficient water available in the Nelson Creek subwatershed to meet estimated future demand. Future water needs could be met through extension of the Stevenson water service or through drawing from water in connection with the Columbia River.

If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right.

Impacts to flows from any additional demand resulting from further residential development adjacent to the Columbia River will be inconsequential.

Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313 gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.

A reservation for permit exempt wells and small community water systems should be established and credited water made available due to the voluntary abandonment of a permitted or permit exempt water right.

Set instream flows at River Mile 0.2.

***Carson
Creek***

Existing water rights and permit exempt wells will not be impaired or changed by this Plan.

The Carson water system service within the Carson Creek subwatershed could generate a net positive water inflow to the subwatershed of 0.0084 cfs.

The estimated increase in consumptive water demand through 2035 of 0.0008 cfs or 518 gpd will not have a significant impact on existing water supplies or stream flows in Carson Creek.

Reserve 0.001 cfs for estimated future growth in the Carson Creek subwatershed outside the Carson water system service area. This reservation would be sufficient to support 2 additional households.

Water from reaches of Carson Creek backwatered by the Columbia River or from the Columbia River or from groundwater in connection with the Columbia River and not Carson Creek is available for appropriation. It is not subject to any of the reservations and instream flows recommended for the Carson Creek watershed. Applications for such water withdrawals would be handled under routine procedures for processing water right applications.

	<p>If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right.</p> <p>Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313 gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.</p> <p>Impacts to flows from any additional demand resulting from further residential development adjacent to the Columbia River will be inconsequential.</p> <p>Set instream flows at River Mile 0.5.</p>
<i>Dog & Collins Creeks</i>	<p>Existing water rights and permit exempt wells will not be impaired or changed by this Plan.</p> <p>No instream flows or water reservations are proposed.</p> <p>It is assumed that, given the relatively small size of these subwatersheds, Dog and Collins experience low summer flows that would significantly limit water availability. Any future water right applications should be carefully evaluated to determine their potential impact on stream flows.</p> <p>Given public land ownership and CRGNSA land use restrictions, it is very unlikely that any significant development and accompanying demand for water will occur in the Dog Creek subwatershed or in those areas adjacent to the Columbia River.</p> <p>The pending water right Girl Scout water right application could, if granted, have a significant impact on summer low flows in Collins Creek. The potential depletion of such a withdrawal should be carefully evaluated. The adequacy of current water rights to meet the additional needs of the Girl Scout camp should be considered.</p>
<i>Home Valley</i>	<p>Existing water rights and permit exempt wells will not be impaired or changed by this Plan.</p> <p>No instream flows or water reservations are proposed.</p> <p>It is assumed that, given the relatively small size of the subwatersheds, the 2 small tributary streams likely experience low summer flows that would significantly limit water availability. Any future water right applications should be carefully evaluated to determine their potential impact on stream flows.</p> <p>The Home Valley Water District current Blyn Springs water right will likely not be sufficient to meet the communities projected growth. The district should pursue development of a water source in connection with the Columbia River to meet its future needs.</p>

<i>Upper Wind River</i>	<p>Water rights transferred from the USFS to Skamania County are sufficient to meet anticipated water needs associated with Wind River nursery development plans. Remaining portions of the USFS nursery water rights could help meet other future water needs, including those of the Carson Water System. Ecology should determine the extent and validity of the remaining USFS rights. The USFS should consider transfer of remaining rights exceeding its requirements to satisfy other water supply needs in the Wind River subbasin.</p> <p>Overall future residential development in the upper Wind River subwatershed is not expected to result in a significant increase in water demand or potential stream flow depletion. However, development in proximity to Martha Creek is an exception. Additional water withdrawals could extend periods during which the creek has no surface flow. An aquifer survey should be conducted to assess whether groundwater supplies exist that can be withdrawn without affecting flows in Martha and Trout creeks. Consideration should also be given to the development of a community water system drawing from available water in the mainstem Wind River either by surface diversion or by well drawing water from an aquifer in connection with the mainstem. Such a system could reduce or eliminate flow impacts of growth in the lower Martha and, possibly, Trout Creek areas.</p> <p>Reserve 0.2 cfs for permit exempt wells, community water systems, and small scale commercial development in the upper Wind River subwatershed. This reservation is senior to proposed instream flows.</p> <p>Set instream flows for Bear Creek at River Mile 0.4, Trout Creek at Stabler River Mile 0.6, Panther Creek at the mouth, Martha Creek at the mouth and Wind River at Stabler River Mile 11.5.</p>
<i>Lower Wind River</i>	<p>Water availability in the Lower Wind River subwatershed is more than sufficient to meet the estimated needs of the Carson Water System.</p> <p>Existing Carson Water System water rights are expected to be sufficient to meet residential, commercial, industrial, and institutional needs through 2035 but will not be sufficient to support full build-out within the service area.</p> <p>The Skamania PUD is concerned that maintaining the aging Bear diversion and related infrastructure may not be a feasible or cost effective in the long-term. The PUD has applied for additional water rights to meet future needs and is exploring alternative water sources. The PUD should pursue alternative sources that will meet the water district's needs while minimizing impacts on stream flows within Wind River subbasin. The planning for and development of such an alternative should be a high priority for WRIA 29A. The PUD should consider partnering with other major water users in the Wind River subbasin, such as WKO, Inc., in developing an alternative source.</p> <p>Reserve 1.02 cfs to meet Skamania PUD's estimated full build-out needs.</p>

	<p>Reserve 0.48 cfs to meet future needs not anticipated by the Carson Water System Plan. The water would be available for appropriation only upon adoption of a water allocation plan by the Skamania County Board of Commissioners. The allocation plan would be developed in consultation with the Planning Unit or its successor and adopted by the Board of Commissioners through a public process.</p> <p>Set instream flows for the Wind River near Carson at River Mile 1.9.</p>
<i>Little Wind River</i>	<p>Reserve 0.005 cfs to meet the estimated growth of 10 households in the Little Wind River watershed.</p> <p>Water from reaches of the Wind River backwatered by the Columbia River or the in connection with the Columbia River is available for appropriation subject to existing state laws and administrative rules and is not be subject to reservations, instream flows, or closures recommended for the Little Wind River subwatershed.</p>
<i>Wind River General</i>	<p>Recommended reservations are intended to be senior to proposed instream flows.</p> <p>Water systems should be maintained to minimize water losses.</p> <p>Skamania County, Skamania County PUD, and other water system operators should be encouraging water conservation measures.</p> <p>Consideration should be given to the use and/or storage of water available on seasonal interruptible basis where practical. Approaches to storage could include infiltration galleries, pump and dump, aquifer recharge and reservoirs.</p> <p>Water from reaches of the Wind River backwatered by the Columbia River or from the Columbia River or from groundwater in connection with the Columbia River and not the Wind River or its tributaries is available for appropriation. It is not subject to any of the reservations, instream flows, or closures recommended for the Wind River subbasin. Applications for such water withdrawals would be handled under routine procedures for processing water right applications.</p> <p>The lower reaches of the Wind River that are backwatered by the Bonneville Pool would not be subject to minimum instream flows, reservations, or closures.</p> <p>The Carson Water System has inchoate water rights sufficient to meet its anticipated needs through 2035. The Home Valley Water System inchoate water rights in the Little Wind River watershed may only be sufficient to meet anticipated needs through 2020.</p> <p>If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right.</p> <p>Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313</p>

	<p>gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.</p>
<p><i>Little White Salmon River</i></p>	<p>Existing water rights and permit exempt wells will not be impaired or changed by this Plan.</p> <p>Recommended reservations are intended to be senior to proposed instream flows.</p> <p>Reserve 0.05 cfs for future out-of-stream uses, including permit exempt wells, community water systems, and commercial uses. The reservation is less than the 1 percent of the 90 percent exceedance low flow water availability guideline, but is sufficient to meet estimated demands through 2035. This is equivalent to 103 ERUs based on a consumptive use estimate of 313 gpd per ERU. Although the number of residential ERUs is expected to increase by 36, the reservation provides for limited commercial uses, and need for community water system to provide for fire flows, system maintenance and leakage.</p> <p>If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right.</p> <p>Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313 gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.</p> <p>Given the number of existing water right certificates and claims in the Rock, Squaw, and Bunker creeks, current and future community water systems in the Mill A Flats should be encouraged to draw water in connection with the mainstem Little White Salmon River.</p> <p>Set instream flows for the Little White Salmon at River Mile 6.5 and near Cook.</p>
<p><i>Underwood</i></p>	<p>Existing water rights and permit exempt wells will not be impaired or changed by this Plan.</p> <p>No instream flows or water reservations are proposed.</p> <p>There are no significant tributaries to the Columbia River within the Underwood subwatershed area.</p> <p>Future water withdrawals will have no significant impact on stream flows or fish.</p> <p>Future development is limited by CRGNSA and Skamania County land use regulations.</p> <p>The Skamania County PUD seek to increase the instantaneous withdrawal rate of its Shaddox spring water right to meet the anticipated demand.</p>

ROCK CREEK SUBBASIN

SUBBASIN DESCRIPTION AND CHARACTERISTICS



Figure 1. Rock Creek subbasin within the Lower Columbia Region

The Rock Creek subbasin encompasses nearly 43 square miles. From its headwaters at an elevation of over 4,000 feet, Rock Creek flows approximately 15 miles to its confluence with Columbia River at an elevation of 80 feet. Mean annual precipitation is 104 inches, ranging from 85 inches near the mouth to 125 inches in the upper subbasin. There are two principle aquifers in the subbasin: the Bonneville landslide and the Stevenson Ridge Volcanics. The Bonneville Landslide is quite permeable and provides much of the base flow for LaBong Creek, the primary water source for the City of Stevenson. The Stevenson Ridge Volcanics, comprised largely of bedrock, underlies most of the subbasin. It has low permeability, but wells intersecting open fracture zones may be productive.

Over 95 percent of the subbasin is in federal, state, and private forest land. Rural residential land use occurs in the lower portion of the subbasin and the City of Stevenson occupies a small area of the subbasin at the mouth of Rock Creek. The areas in and adjacent to the City of Stevenson

are located within the Columbia River Gorge National Area (CRGNSA) designated Stevenson Urban Area (UA). The UA also includes the Kanaka and Nelson Creek watersheds¹².

Urban areas are those areas within the National Scenic Area where high density residential, commercial and industrial growth can occur. The Stevenson water system serves the lower portion of the UA and is expected to expand its service over the next 20 years. The water system draws water from the Rock Creek subbasin and delivers it to residential, commercial and industrial users in the Rock Creek, Kanaka Creek and Nelson Creek watersheds. The Rock Creek subbasin is expected to supply water to its adjacent watersheds via the City's water system.¹³

STREAM FLOWS

Ecology has prepared a hydrograph characterizing flow patterns and volumes in Rock Creek (Figure 2). Highest flows occur during the months of November through April. During this period flows can

¹² These creeks are described in the Other Columbia River Tributaries section

¹³ Email, B. Shumaker, January 22, 2015

routinely range from approximately 320 to 420 cubic feet per second (cfs), but can on occasion exceed 1,600 cfs or be less than 75 cfs. Low flows occur from July through October. Flows during this period can routinely range from 10 to 59 cfs, but can occasionally be lower than 7 cfs.

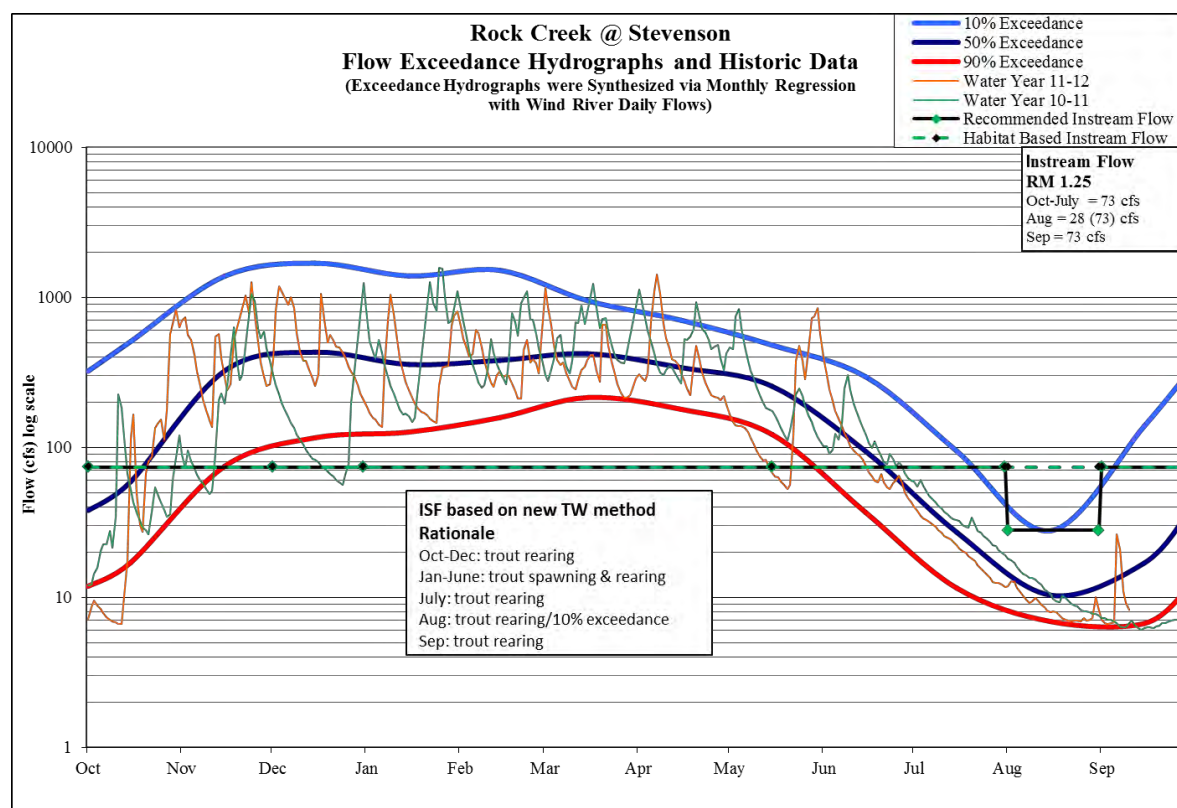


Figure 2. Rock Creek Hydrograph¹⁴

FISH USE

Upper Gorge tributaries such as Rock Creek historically supported Chinook, chum, and coho salmon and summer and winter steelhead. These salmonid species are currently listed as threatened under the ESA. Salmon and steelhead use of Rock Creek is confined to the lower mile of the creek below an impassible falls. Cutthroat and rainbow trout are found above the falls. Lamprey may also be present in Rock Creek.

Given the limited salmonid use of the subbasin, WDFW and Ecology have proposed setting instream flows to protect resident trout spawning and rearing habitat. The proposed instream flow would be 73 cfs from September through July and 28 cfs in August. Twenty-eight cfs represents the 10 percent exceedance flow for Rock Creek in August, meaning that flows would be expected to exceed this level in only 10 percent of the wettest years.

¹⁴ For all hydrographs if there is a single instream flow, it is based on habitat. If there are two numbers, the first is the 10% exceedance and the habitat-based instream flow is in parentheses.

WATER RIGHTS & CLAIMS

Based on Ecology's Explorer, the Rock subbasin has a total of 18 water rights, 1 permit and 1 pending application. The largest allocation of water is to the City of Stevenson for municipal use. The City's 2 water rights in the subbasin are for surface water and have a total diversion of 4.74 cfs. With the exception of 1 certificate and 1 permit for irrigation use, the remaining certificates allocate water for domestic use. There are also 34 for water right claims within the Rock Creek subbasin. These claims are principally for domestic and limited irrigation use. Table 1 summarizes the water allocated by the certificates within the subbasin.

Table 1. Rock Creek Water Rights Certifications

Primary Use	All Certificates		Surface Water Certificates			Ground Water Certificates		
	No.	Annual Volume (af)	No.	Diversion Rate (cfs)	Annual Volume (af)	No.	Withdrawal Rate (gpm)	Annual Volume (af)
Domestic	10	11.55	8	0.145	8.55	2	15.0	3.00
Municipal	2	600.00	2	4.740	600.00	0	0	0
Irrigation/Stock	6	31.95	2	0.120	14.50	4	106.0	17.45
Total	18	643.50	12	5.005	623.05	6	121.0	20.45

WATER DEMAND

City of Stevenson

The 2015 to 2035 water supply needs of the City of Stevenson are estimated based on the city's 2007 Water Supply Plan (WSP) Update.¹⁵ The city currently encompasses about 1100 acres but the water service area is expected to grow to over 1800 acres by 2027.

Water demand is expressed in Equivalent Residential Units (ERUs). A residential water connection is considered to be 1 ERU. The WSP calculates that the base demand for a single-family residence or an ERU to be 195 gallons per day (gpd). This was done by dividing the average volume of water used daily for residential purposes in 2004 (116,630 gallons) by the number of residential connections (599). The water demand for C/I/I uses is converted to ERUs by dividing the 2004 average daily water usage (101,644 gallons) by 195 gpd. Based on this approach, Stevenson water system served 599 residential ERUs and 522 C/I/I ERUs in 2004. Collectively, these 1121 ERUs used about 218,275 gpd or 80 million gallons per year.

Beginning 2007, the WSP estimates residential ERUs will grow at a rate of 1.7 percent per year. The plan estimates that commercial ERUs will grow at an annual rate of 3 percent and public institution ERUs at 1 percent. This results in an average overall C-I-I growth rate of approximately 2.34 percent per year.

Although base demand was calculated to be 195 gpd/ERU, the WSP uses an average daily demand (ADD) of 300 gpd/ERU to estimate the volume of water needed to meet future needs and a maximum

¹⁵ Wallis Engineering, 2007

daily demand of 600 gpd/ERU in estimating peak or instantaneous demand. The ADD provides an allowance for unaccounted water and water losses from leaks, system flushing and construction. Peak or maximum daily demand (MDD) reflects peak daily demand during the summer months.

Table 2 provides estimated ADD and MDD volumes through 2035. The WSP only provides estimates of water needs through 2027. Those estimates have been extended through 2035 using the annual growth rates used in the plan.

Table 2. Average and maximum daily demand for the City of Stevenson

Year	Population/ERU		Water Demand - ADD			Water Demand - MDD		
	Res Pop	ERU	gpd	gpm	cfs	gpd	gpm	cfs
2013								
Residential	1645	689	199,987	139	0.31	399,974	278	0.62
Com/Ind/Ins		619	189,988	132	0.29	379,976	264	0.59
Total		1308	389,975	271	0.60	779,950	542	1.21
2015								
Residential	1702	710	213,000	148	0.33	426,000	296	0.66
Com/Ind/Ins		648	194,400	135	0.30	388,800	270	0.60
Total		1358	407,400	283	0.63	814,800	566	1.26
2020								
Residential	1851	766	229,800	160	0.36	459,600	319	0.71
Com/Ind/Ins		727	218,100	151	0.34	436,200	303	0.67
Total		1493	447,900	311	0.69	895,800	622	1.39
2025								
Residential	2013	828	248,400	173	0.38	496,800	345	0.77
Com/Ind/Ins		817	245,100	170	0.38	490,200	340	0.76
Total		1645	493,500	343	0.76	987,000	685	1.53
2030								
Residential	2190	894	268,200	186	0.41	536,400	373	0.83
Com/Ind/Ins		916	274,800	191	0.43	549,600	382	0.85
Total		1810	543,000	377	0.84	1,086,000	754	1.68
2035								
Residential	2383	966	289,800	201	0.45	579,600	403	0.90
Com/Ind/Ins		1029	308,700	214	0.48	617,400	429	0.96
Total		1995	598,500	416	0.93	1,197,000	831	1.85
Net Change 2013-2035	738	687	208,525	145	0.33	417,050	289	0.64

While most of the Stevenson's population and businesses are located outside the Rock Creek subbasin, the City draws its municipal water from the subbasin. Given that the City is served by a municipal sewer system discharging to the Columbia River, all water withdrawn by the City is effectively exported from the subbasin.

Stevenson has water rights for 4 sources: LaBong-Lindis Springs, Rock Creek, Hegewald Well, and Iman Springs. While all 4 sources fall within the Rock Creek subbasin as mapped by Ecology, the

Hegewald Well and Iman Springs sources are very low in the watershed and near the western watershed boundary¹⁶ suggesting these sources would have little effect on stream flows in Rock Creek. The Rock Creek and Iman Springs sources are designated as supplementary sources available for use to the extent that the water right for the LaBong-Lindis Springs and Hegewald Well sources are not fully utilized. Table 3 provides a summary of the City's water rights.

Table 3. City of Stevenson Water Rights

Certificate No.	Source	Permit Provisions	Maximum Flow Rate		Allowable Annual Withdrawal (af)
			gpm	cfs	
1092	Labong-Landis Springs	Primary	450	1.00	720
S2-24320C	Rock Creek	Supplementary	1679	3.74	600
G2-00921c	Hegewald Well	Primary	600	1.34	726
S2-23749C	Iman Springs	Supplementary	76	0.18	122

Table 4 below compares the City's total water right capacity to the estimated year 2035 demand in terms of both instantaneous demand (maximum flow rate) and annual withdrawal quantity (volume). Based on the provisions of its primary and supplementary water rights, the City has a combined instantaneous demand capacity 2,279 gpm or 5.08 cfs and allowed annual volume of 1,446 af. This capacity exceeds estimated demands through 2035 and with the capacity to supply an additional 2308 households or ERUs the surplus may be sufficient to meet full build-out water needs within the UA.

Table 4. City of Stevenson Required versus Available Water Supply

		Required Supply		Available Supply		Surplus	
Year	ERUs	Instantaneous Demand (cfs)	Annual Quantity (af)	Instantaneous Demand (cfs)	Annual Quantity (af)	Instantaneous Demand (cfs)	Annual Quantity (af)
2015	1358	1.26	456	5.08	1446	3.82	990
2020	1493	1.39	502	5.08	1446	3.69	944
2025	1645	1.53	553	5.08	1446	3.55	893
2030	1810	1.68	608	5.08	1446	3.40	838
2035	1995	1.85	670	5.08	1446	3.23	776

Unincorporated Areas

As noted earlier, over 95 percent of the subbasin is federal, state, or private forest lands. Residential land uses in the unincorporated area of the Rock Creek subbasin is located in the lower portion of the basin adjacent to the City of Stevenson. Based on census information and the Stevenson WSP, it is estimated that the 2015 population of the unincorporated area of the subbasin is around 727 people.

¹⁶ NW 1/4 of Section 2, Township 2N, Range 7E

In estimating future water needs for the unincorporated area it is assumed that future growth will occur within the CRGNSA UA. It is also assumed that growth will be residential with future commercial and industrial uses occurring within the service area of the Stevenson water service area. It is further assumed that each residential household outside the Stevenson water system service area will be served by an individual well and an onsite septic system.

The population in the existing unincorporated area is expected to grow to as many as 740 people by 2035. However, given that the City's water service is expected to expand by over 600 acres by 2027, some of the current and future households in the existing unincorporated area will be served by the Stevenson's water system in the future. Based on the Stevenson water system plan estimated growth rate, population in the unincorporated not served by the City's water system area may only increase to 587 people in 2035.

To account for the expansion of the Stevenson's water service area, the unincorporated area population is calculated by subtracting the Stevenson water system plan population estimate for a given year from OFM "high" population growth estimate for the Rock Creek Subbasin. Potential households or ERUs are calculated using 2.5 people per household. Consumptive water use per household during the high use months of May through September is estimated at 313 gpd based on the PEW Estimator. Estimated water needs for the unincorporated area are shown in Table 5.

Table 5. Estimated water needs for the unincorporated area of Rock Creek

Year	Population	ERUs	Estimated Water Demand		Consumptive Water Use	
			gpm	cfs	gpm	cfs
2015	727	291	94	0.21	63	0.14
2020	686	274	88	0.20	60	0.13
2025	677	271	87	0.19	59	0.13
2030	645	258	83	0.19	56	0.12
2035	587	235	76	0.17	51	0.11
Net Change 2015-2035	(140)	(56)	(18)	(0.04)	(12)	(0.03)

TOTAL ESTIMATED DEMAND AND POTENTIAL STREAM FLOW DEPLETION

Since the MDD occurs during summer low stream flow periods, it is used to determine the impact water withdrawals or diversions may have on stream flows. For Stevenson the full MDD is used because the water withdrawn is not returned to the subbasin. For permit exempt wells in the unincorporated area, the maximum daily consumptive demand of 313 gpd is used given that some of the water withdrawn is returned to the subbasin via onsite septic systems.

It is assumed that both surface water diversions and groundwater withdrawals will have an immediate impact on stream flows. While this is clearly the case for surface water diversions, groundwater withdrawals seldom have an immediate impact. The impact of a groundwater withdrawal depends on the location of the withdrawal, the distance to the stream, and the geology and aquifer characteristics. These factors can vary widely throughout the subbasin, making it impossible to precisely predict the timing and extent of a groundwater withdrawal on stream flows. Given this variability, it is

assumed that the immediate impact provides the most conservative estimate. Table 6 shows the 2013 and 2035 potential stream flow impacts.

Table 6. Potential stream flow depletion for the Rock Creek Subbasin

	2015 Consumptive Demand (cfs)	2035 Consumptive Demand (cfs)	Increase (cfs)
City of Stevenson	1.21	1.83	0.62
Unincorporated Rock Creek	0.14	0.11	(0.03)
Total	1.35	1.94	0.59

It should be noted that water withdrawals by the City of Stevenson are allowed under its existing water rights and the increase in future consumptive use within the water system service area does not represent a new or additional allocation or commitment of water resources within the Rock Creek subbasin. Expansion of the city water service could offset the impact on stream flow resulting from future new withdrawals in the subbasin. However the magnitude and duration of such offsets depends on the extent to which city sewer service expands. If water is extended without sewer, the additional offset or return would be equal to 151 gpd per the PEW Estimator. If sewer services are extended with water service, there would be no additional offset or return generated since the sewer discharges to the Columbia River and not the Rock Creek subbasin. Since it is likely that the extension of sewer services will occur to some degree, the extension of city water services cannot be relied upon to offset the stream impact of future new withdrawals.

WATER AVAILABILITY WITHIN THE ROCK CREEK SUBBASIN

Per Ecology/WDFW guidance that a 1 to 2 percent reduction in the 90% exceedance low flow would generally result in a tolerable level of habitat reduction. Based on estimated future water needs and the Ecology/WDFW guidance, demand will exceed availability. See Table 7.

Table 7. Estimated future demand for the Rock Creek subbasin

2035 Estimated Additional Demand	Available Water 1% of 90% exceedance low flow	Available Water 2% of 90% exceedance low flow	Surplus (Deficit)
0.59 cfs	0.06 cfs	0.12 cfs	(0.47 to 0.53 cfs)

Nearly all the estimated future demand is within the City of Stevenson water service area boundary and will be met through the City's existing water rights. These water rights have source locations very low in the subbasin and will have no effect on fish habitat above confluence of LaBong and Rock Creek at approximately Rock Creek River Mile (RM) 1.4. Future water needs in the unincorporated area of the subbasin will have a minimal, and potentially decreasing affect, on Rock Creek flows. Nevertheless, the additional water withdrawals by the City of Stevenson pursuant to its existing water rights will can be expected to result in a stream flow depletion and that depletion could be large enough that additional water would not be available for new withdrawals.

In order to meet potential future water needs outside the city water system service area, the City of Stevenson could transfer a portion of one of its existing water rights to a new user. While this would not

reduce stream flow depletion, it would satisfy these additional needs without increasing the current total allocation of water within the Rock Creek subbasin. Moreover the City's capacity to affect such transfers could be enhanced through the extension of its water service to current residential water users on permit exempt wells. If use of a permit exempt well is discontinued and the well is decommissioned, RCW 90.44.105 allows the permit exempt right to be consolidated with an existing water right permit or certificate. By extending city water service, the city's current water rights could be increased by a minimum of 800 gpd for each existing permit exempt well retired in accordance with the provisions of the RCW.

Based on information provided by the City, there are currently 39 developed parcels within the current water system service area that are not connected to the water system. Assuming these parcels are using permit exempt wells, extension of city water to these users could potentially increase the City's water rights by up to 31,200 gpd or, based on the City's MDD of 600 gpd, enough water for an additional 52 households.

By transferring a portion of an existing water right to new users outside the City's water service area and consolidating retired permit exempt rights into the City's water rights, it appears that future water needs within the Rock Creek subbasin could be met with existing water rights.

CONCLUSIONS/RECOMMENDATIONS

1. Existing water rights and permit exempt wells cannot be changed or impaired by this Plan.
2. If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right.
3. Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313 gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.
4. The anticipated future water needs of the City of Stevenson through 2035 can be satisfied by its existing water rights, leaving 3.23 cfs and 776 af remaining to meet Stevenson's needs beyond 2035.
5. The City's water right not fully developed or utilized by 2035 shall continue to be available to meet needs beyond that time.
6. Given the estimated potential stream flow depletion, insufficient water is available to meet new needs in the Rock Creek subbasin outside the City water system service area.

7. To assist in meeting the needs for water outside of the its water service area, the City of Stevenson should develop the process and protocols to:
 - a. Transfer portions of its existing water rights in excess of its anticipated needs to new users within the Rock Creek subbasin outside the service area; and
 - b. Allow permit exempt rights retired through extension of city water service to be consolidated with the City's water rights pursuant to RCW 90.44.105 and increase the City's rights at a rate of 800 gpd per retired permit exempt right.
8. Water from reaches of the Rock Creek subbasin backwatered by the Columbia River or from the Columbia River or from groundwater in connection with the Columbia River and not the Rock Creek or its tributaries is available for appropriation. It is not subject to any of the instream flows or closures recommended for the Rock Creek subbasin. Applications for such water withdrawals would be handled under routine procedures for processing water right applications.
9. Water conservation should be encouraged and the development of alternative water sources that minimize or avoid stream flow impacts in the Rock Creek subbasin will be encouraged.
10. Set the following instream flows:

Subbasin	Instream Flow*	Rationale
Rock Creek at Stevenson	Oct-July = 73 cfs	Oct-Dec: trout rearing
	Aug = 28 (73) cfs	Jan-June: trout spawning & rearing
	Sep = 73 cfs	July: trout rearing
		Aug: trout rearing/10% exceedance
		Sep: trout rearing

**Based on new toe-width method*

WIND RIVER SUBBASIN

SUBBASIN DESCRIPTION AND CHARACTERISTICS

The Wind River subbasin encompasses nearly 225 square miles. From its headwaters at an elevation of over 4,000 feet, Wind River flows approximately 31 miles to its confluence with Columbia River at RM 154.5. Mean annual precipitation is 103 inches, ranging from 63 inches near the mouth to 125 inches in the upper subbasin. The subbasin falls into three precipitation zones: rain dominated (30%), rain-on-snow dominated (46%) and snow dominated (23%). Major tributaries include Trout Creek, Panther Creek, Bear Creek, and Martha Creek. Other tributaries include Trapper Creek, Falls Creek, Dry Creek, and the Little Wind River.¹⁷

The primary geologic foundation underlying the subbasin is the Ohanapecosh Formation. Weathering and the resulting thick layer of decomposed rock (saprolite) reduces water infiltration and promotes runoff. Fracture zones promote local permeability and control groundwater flow. Tuff and tuff breccias that overlie the Ohanapecosh Formation have higher permeability. Potential for hydraulic continuity is low to moderate.¹⁸

Quaternary lavas in the northeast corner of the subbasin are permeable and precipitation percolates readily. The potential for hydraulic continuity with surface water is high to moderate. The intracanyon Trout Creek Hill basalt has low permeability, but buried ancient Wind River gravels have a high potential for hydraulic continuity with the lower Wind River. Unconsolidated Quaternary alluviums of the upper Wind River and Trout Creek valley bottoms and upstream of the Trout Creek Hill basalt are shallow unconfined aquifers with high to moderate potential for hydraulic continuity with surface.¹⁹

Ninety-two percent of the subbasin is forested. Ninety-one percent of the subbasin is in state or federal ownership. Development is concentrated in the unincorporated communities of Carson and Stabler. Low density residential development occurs along the Wind River between the two communities and north of Stabler.

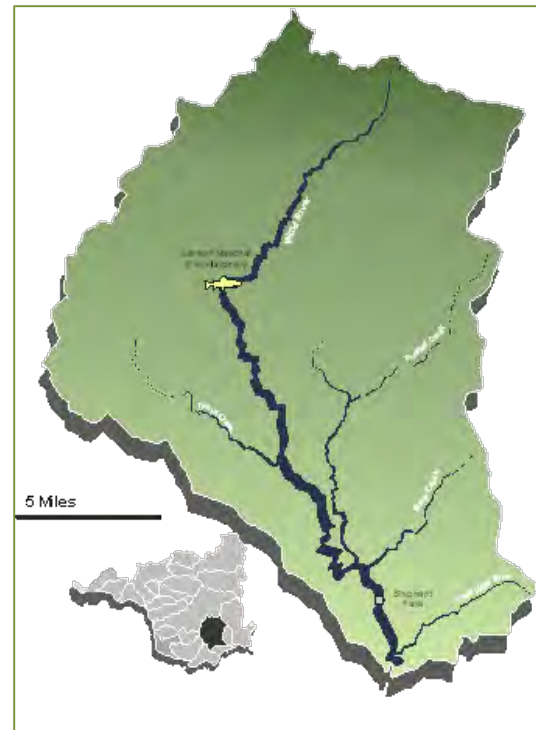


Figure 3. Wind River Subbasin within the Lower Columbia Region

¹⁷ WRIA 29A Watershed Management Plan

¹⁸ Envirovision, 2002

¹⁹ Ibid.

STREAM FLOWS

Ecology has prepared hydrographs characterizing flow patterns and volumes at Wind River at Stabler RM 11.5 (figure 4); Trout Creek at RM 0.6 (figure 5); Martha Creek at its mouth (figure 6); Panther Creek at its mouth (figure 7); Bear Creek at RM 0.4 (figure 8); and Wind River near Carson (figure 9).

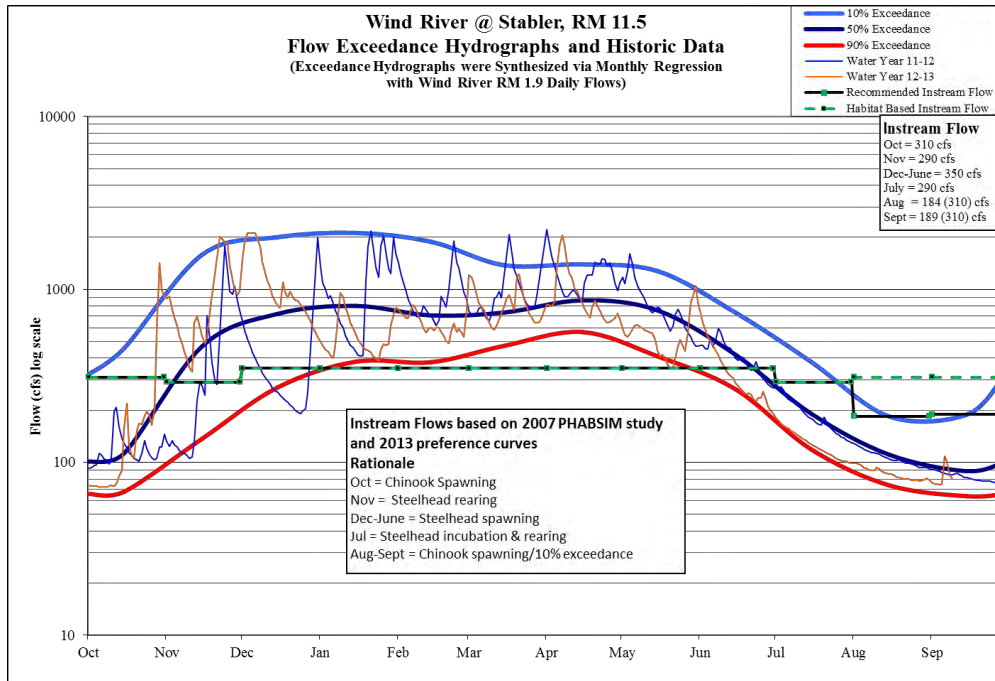


Figure 4. Wind River at Stabler

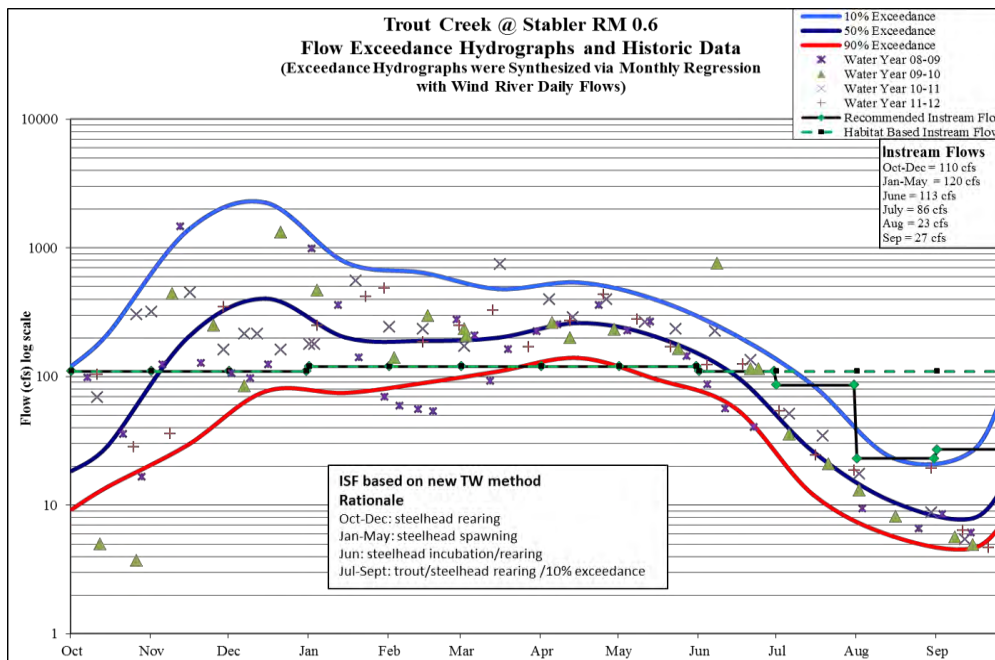


Figure 5. Trout Creek at RM 0.6

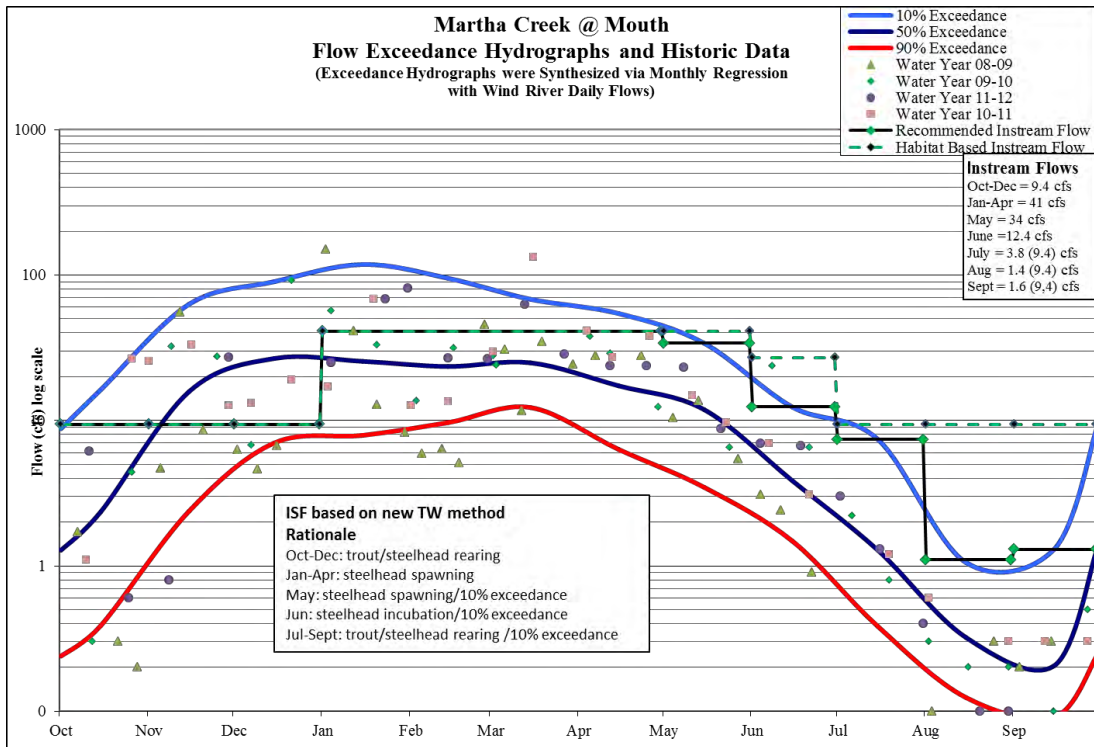


Figure 6. Martha Creek at its mouth

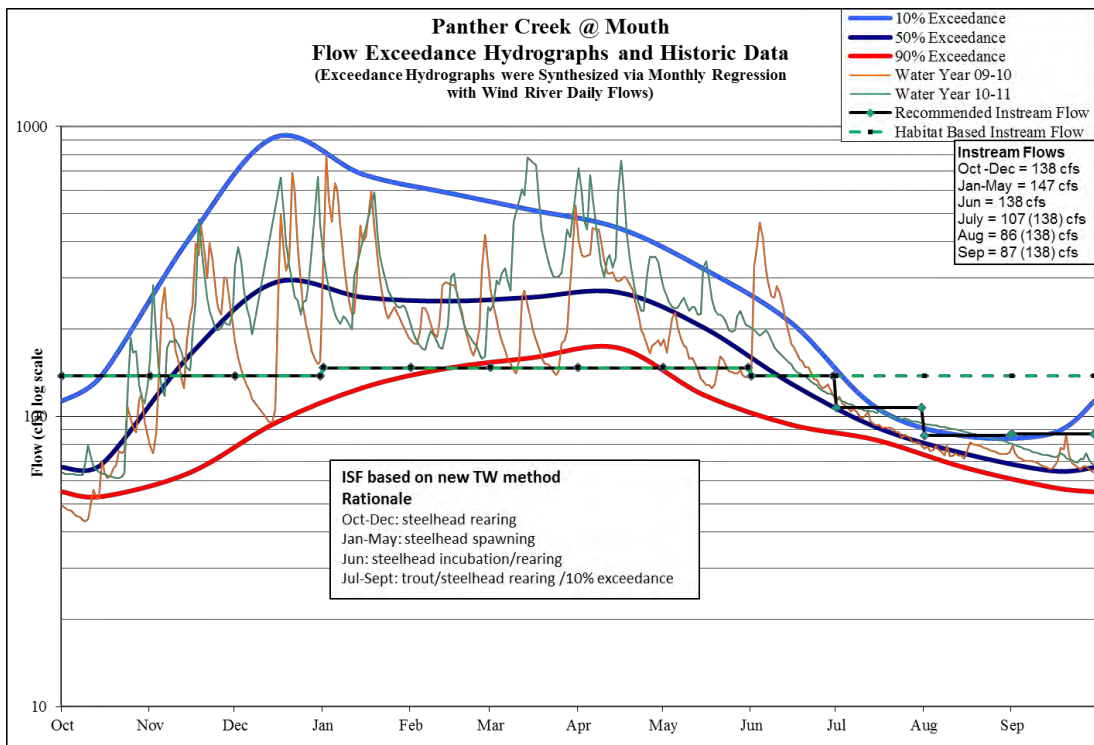


Figure 7. Panther Creek at its mouth

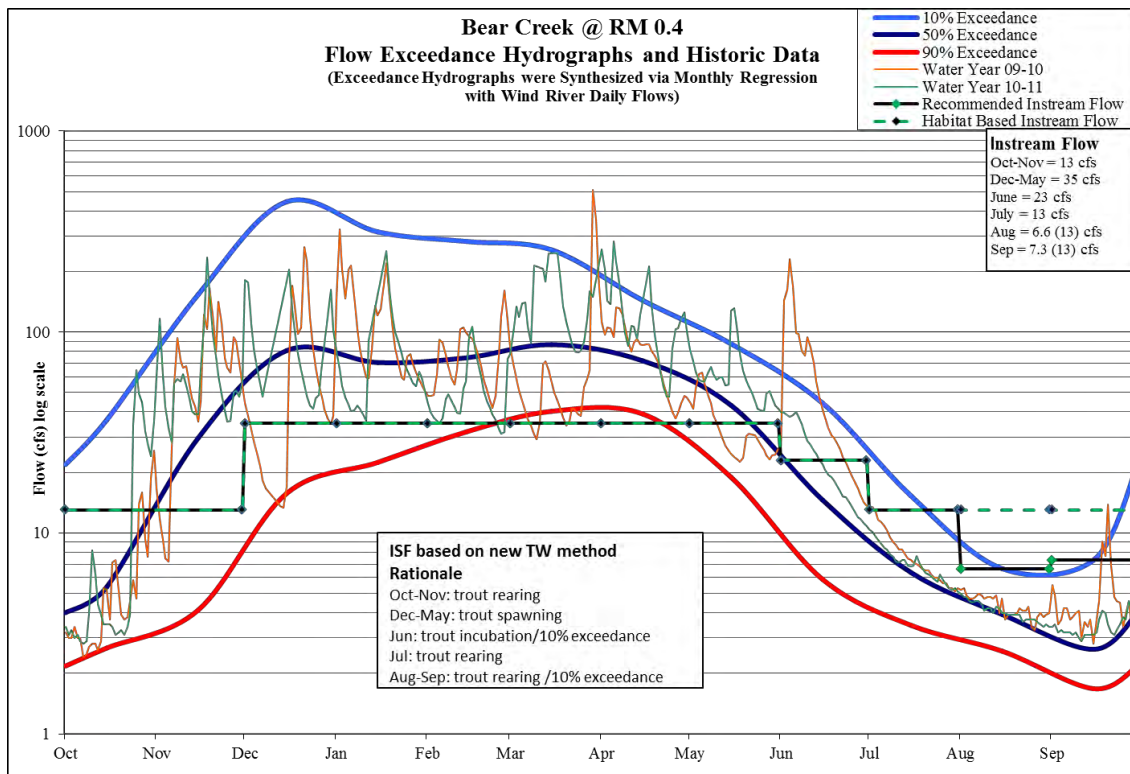


Figure 8. Bear Creek at RM 0.4

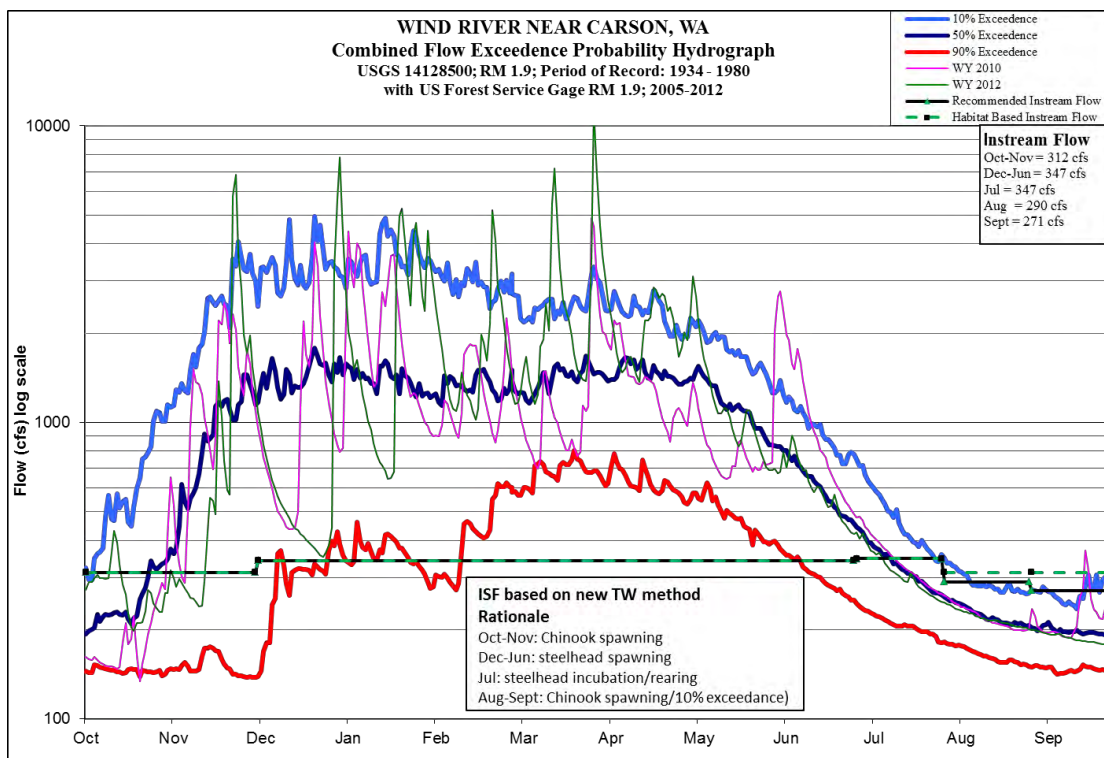


Figure 9. Wind River near Carson

FISH USE

The Wind River subbasin historically supported populations of fall Chinook, chum, coho and, winter and summer steelhead. These populations are listed as threatened under the federal Endangered Species Act (ESA). Population numbers have declined to a fraction of historic levels. The extinction risk is very high for fall Chinook, chum, and coho, high for winter steelhead and low for summer steelhead. The Recovery Plan calls for returning summer steelhead to a very low extinction risk, coho to a low extinction risk, and fall Chinook and chum to moderate extinction risk. The subbasin also support spring Chinook (hatchery origin). This population was introduced in 1956 and was not historically found in the subbasin. It is not ESA listed. The lower reaches also offer thermal refugia to out of basin stocks migrating upriver to their natal streams.

Although observed as far upstream as the Carson National Fish Hatchery (RM 18), fall Chinook spawning occurs largely in the lower 2 miles of the Wind River and possibly in the Little Wind River. Natural spawning returns of chum salmon are very low and spawning would likely occur below Shipperd Falls. Summer steelhead are widely distributed throughout the Wind River subbasin, including the mainstem, Little Wind River, Panther Creek, Bear Creek, Trout Creek, Trapper Creek, Dry Creek, and Paradise Creek. Summer steelhead enter the river May through November. Spawning occurs generally from early March through May. Juvenile summer steelhead will rear in the subbasin for up to 2 years. Winter steelhead have a more limited distribution, occurring in the lower mainstem Wind River and Trout Creek. Like Summer Steelhead, juvenile winter steelhead generally rear in fresh water for 2 years.

Principal factors limiting the viability of these salmon and steelhead populations include: fine sediments, lack of habitat diversity and quantity, high water temperature, harassment, insufficient low flows, excessive high flows, competition, channel instability, and predation.

WATER RIGHTS & CLAIMS

Based on Ecology's Explorer database, the Wind River subbasin has a total of 91 water right certificates, 2 permits, 91 claims and 18 pending applications. The largest allocation of water is for fish propagation. Nine surface water right certificates have been issued for fish propagation, with a total instantaneous demand of 291.04 cfs and quantity of 2,896 af. While these rights can have a localized impact on stream flow, they are considered non-consumptive. Irrigation water rights constitute the second largest allocation of water with 11 certificates issued for 35.6 cfs and 1357 af. Four of these water rights were originally awarded for irrigation associated with the former US Forest Service Wind River tree nursery. Portions of 3 of these rights have been subsequently transferred to Skamania County and one for 14.5 cfs and 548 af has been relinquished.

Tables 8-12 summarize water right certificates, permits, claims, and applications for surface and groundwater have been prepared for Upper Wind River, Middle Wind River including Trout and Martha creeks, Upper Panther and Bear creeks, Lower Wind River and the Little Wind River (see figure 10) are provided below.

Table 9. Middle Wind River, Trout Creek and Martha Creek Water Right Certifications, Claims and Applications

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Single Domestic	32	0.85	41.2
	Multiple Domestic	8	2.29	42.6
	Irrigation	10	35.50	1343.2
	Recreation	1	0.0	120.0
	Fish Propagation	2	4.04	2896.0
	Power	1	0.24	0.0
	Total	54	42.92	4443.0
Claims	Single Domestic	43	5.85	181.0
	Multiple Domestic	3	0.19	10.0
	Irrigation	1	0.18	36.0
	Total	47	6.22	227.0
Applications	Single Domestic	2	0.07	3.2
	Multiple Domestic	4	0.40	3.0
	Irrigation	1	0.02	0.0
	Power	1	4.00	2500.0
	Total	8	4.49	2506.2

Table 10. Upper Panther and Upper Bear Creek Water Rights Certifications, Claims and Applications

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Single Domestic	5	0.09	6.5
	Multiple Domestic	2	2.02	352.0
	Irrigation	1	0.09	13.6
	Recreation	1	0.01	-
	Total	9	2.21	372.1
Claims	Single Domestic	5	0.15	18.5
Applications	Municipal	1	2.35	715

Table 11. Lower Wind River Water Right Certifications, Permits, Claims and Applications

Record Type	Use	No. of Records	Instantaneous demand Qi (cfs)	Quantity Qa (af)	Ground Water	Surface Water
Certificate	Single Domestic	6	0.10	7.0	1	5
	Multiple Domestic	3	0.18	38.9	1	2
	Comm/Industrial	3	0.80	278.0	1	2
	Fish Propagation	3	120.0	0.0	0	3
	Municipal	0	0.0	0.0	0	0
	Total	15	121.1	323.9	3	12

Permits	Comm/Industrial	2	1.1	279.6	2	0
Claims	Single Domestic	13	0.26	19.5	5	8
	Multiple Domestic	2	1.20	41.0	1	1
	Irrigation	6	1.38	63.5	3	3
	Stock Watering	0	0.00	0.0	0	0
	Comm/Industrial	2	50.00	20.0	0	2
	Fire Protection	1	0.02	2.0	0	1
	Total	24	52.86	146.0	9	15
Applications	Single Domestic	1	0.08	56.0	1	0
	Comm/Industrial	3	5.68	2799.5	3	0
	Municipal	2	4.50	1260.0	2	0
	Total	6	10.26	4115.5	6	0

Table 12. Little Wind River Water Rights Certifications, Claims and Applications

Record Type	Use	No. of Records	Instantaneous demand Qi (cfs)	Quantity Qa (af)	Ground Water	Surface Water
Certificate	Single Domestic	4	0.05	6.5	1	3
	Irrigation	2	0.40	152.0	0	2
	Municipal	1	0.50	63.5	0	1
	Total	7	0.90	222.0	1	6
Claims	Single Domestic	9	0.11	8.0	1	8
	Multiple Domestic	3	0.89	47.0	0	3
	Irrigation	2	0.02	25.0	0	2
	Stock Watering	2	0.03	1.0	0	2
	Total	16	1.05	81.0	1	15
Applications	Single Domestic	0	0.00	0	0	0
	Municipal	1	1.10	-	1	0
	Total	1	1.10	0	1	0

WATER DEMAND AND EXISTING SUPPLIES

Lower Wind River - Carson Water Service Area

The Carson water service area includes the Carson community planning area and the existing area served by the Carson water system and extending approximately 3 miles north of High Bridge (figure 11). The Carson community planning area is substantially developed encompassing residential, commercial, institutional (school) and industrial land uses. It extends north from State Route 14 to High Bridge; it is bound on the east by Wind River and the west by the steep slopes of Stevenson Ridge. The area north of High Bridge is characterized by scattered rural residences and a small industrial park at its northern boundary along Old State Road. Water right certificates, permits, applications and claims for this area are summarized in table 11 above.

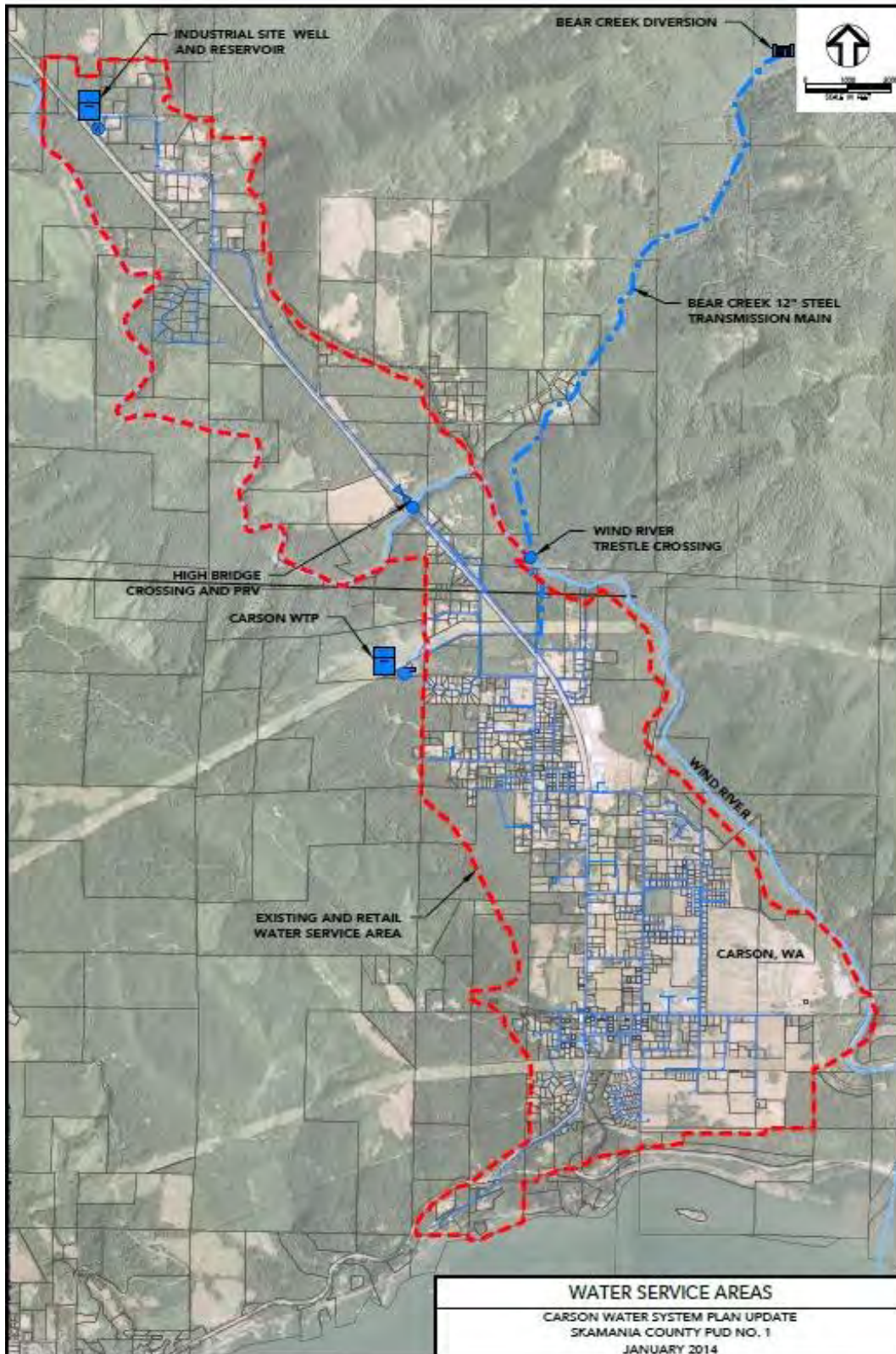


Figure 11. Carson Water Service Areas

The entire area is served by the Carson Water System, operated by Skamania County PUD No.1. The 2015 to 2035 water supply needs are estimated based on The 2013 Carson Water Supply Plan (WSP) Update²⁰ and was used to assess water needs through 2035 and current water supplies. The WSP estimates future water needs based on current water uses and projected population growth.

The WSP provides estimates of water needs through 2030. The population of the Carson community planning area is estimated to grow by an average annual rate of 0.97 percent. North of High Bridge an average annual growth rate of 7.00 percent was used based on undeveloped platted lots and County zoning. The population estimates were extended through 2035 using the WSP average annual growth rate from 2026-2030 of 0.78 percent for the Carson community planning area and 7.00 percent for the service area north of High Bridge.

Residential water demand is expressed in Equivalent Residential Units (ERU)

An ERU is defined as the amount of water used by a typical full-time single-family residence in gallons per day (gpd), gallons per minute (gpm) or cubic feet per second (cfs)

1 residential water connection = 1 ERU

Residential water demand is expressed in Equivalent Residential Units (ERUs). A residential water connection is considered to be 1 ERU. An ERU service unit is defined as the amount of water used by a typical full-time single-family residence in gallons per day (gpd), gallons per minute (gpm) or cubic feet per second (cfs). In 2010, the system had 992 residential connections or ERUs. Assuming 3 people per active residential service connection or ERU, the population served by the Carson water system was 2,766. In subsequent years, the number of ERUs was calculated by dividing the estimated population for a given year by 3 people per ERU. It should be noted that the number of residential ERUs in 2010 does not include households not served by the Carson water system. For example, the WSP estimates there will be 14 ERUs served in the area north High Bridge by 2014. A count of residential structures data from the Skamania County Assessor's Office indicates there are approximately 38 households in the area North of High Bridge, suggesting there maybe 24 homes or ERUs served by other water sources, most likely individual wells.

Based on the number of 2010 residential connections and water sales, the WSP estimates that base demand is 192 gallons per day (gpd) per ERU. The plan proposes an average daily demand (ADD) of 260 gallons/ERU. This provides an allowance for unaccounted water and water losses from leaks, system flushing and construction. Peak or maximum daily demand (MDD) is set at 600 gallons/ERU, reflecting peak daily demand during the summer months.

Demand estimates for commercial/Industrial/Institutional (C/I/I) uses are also expressed in ERUs. Water sales for C/I/I uses in 2010 were divided by 192 gpm to establish a base of 323 ERUs. In subsequent years, the growth in C/I/I ERUs was calculated using population growth rates. The number of ERUs for Carson Hot Springs Resort was an exception to this method of calculation. ERUs for the resort were held at 75 for all years based water demand projections.

In addition to estimating water needs based on anticipated population growth, the Carson WSP provided an estimate of the water needed to support full buildout based on existing land use plans.

²⁰ Wallis Engineering, 2013

Table 13 provides both the ADD and MDD based on average and peak daily flows or water production through 2035 and also for full buildout.

Table 13. Average and maximum daily demand for the Carson Water System

Population/ERU			Demand - ADD			Demand - MDD		
Year	Population	ERU	gpd	gpm	cfs	gpd	gpm	cfs
2013								
Residential	2,871	957	248,820	173	0.39	574,200	399	0.89
Com/Ind/Ins		376	97,760	68	0.15	225,600	157	0.35
Total		1333	346,580	241	0.54	799,800	555	1.24
2015								
Residential	2,939	979	254,540	177	0.39	587,400	408	0.91
Com/Ind/Ins		408	106,080	74	0.16	244,800	170	0.38
Total		1387	360,620	250	0.56	832,200	578	1.29
2020								
Residential	3,108	1037	269,620	187	0.42	622,200	432	0.96
Com/Ind/Ins		426	110,760	77	0.17	255,600	178	0.40
Total		1463	380,380	264	0.59	877,800	610	1.36
2025								
Residential	3,278	1092	283,920	197	0.44	655,200	455	1.01
Com/Ind/Ins		442	114,920	80	0.18	265,200	184	0.41
Total		1534	398,840	277	0.62	920,400	639	1.42
2030								
Residential	3,441	1148	298,480	207	0.46	688,800	478	1.07
Com/Ind/Ins		457	118,820	83	0.18	274,200	190	0.42
Total		1605	417,300	290	0.65	963,000	669	1.49
2035								
Residential	3,627	1209	314,340	218	0.49	725,400	504	1.12
Com/Ind/Ins		472	122,720	85	0.19	283,200	197	0.44
Total		1681	437,060	304	0.68	1,008,600	700	1.56
Full Buildout	NA	3975	1,033,500	718	1.60	2,385,000	1,656	3.69

The Carson Water System draws water from 2 sources, a diversion from Bear Creek approximately 2.5 miles from the service area and the Industrial Site Well located at the northern end of the service area near the intersection of the Wind River Highway and Old State Road (see figure 10). The Skamania County PUD has applied for 3 additional water rights to meet anticipated future demand. One application is requesting an increase in the existing Bear Creek diversion and another is requesting additional withdrawal at the Industrial Site Well. The third proposes groundwater withdrawals at 2 sites in the service area above High Bridge. Water right certificates and applications for the Carson water system are summarized in Table 14.

Table 14. Carson Water System – Water Rights and Applications

Certificate No.	Holder	Source	Permit Provisions	Maximum Rate (gpm/cfs)	Quantity (af)
S2-00400C	Skamania Co PUD	Bear Creek	Primary	898/2.0	350
G2-26448C	Port of Skamania Co	Well	Primary	300/0.67	267

Application No.	Applicant	Source	Related Certificates	Maximum Rate (gpm/cfs)	Quantity (af)
S2-30157	Skamania Co PUD	Bear Creek	S2-00400C	1055/2.35	715
G2-30459	Skamania Co PUD	Wells	None	1970/4.39	1077
G2-30541	Skamania Co PUD	Well	G2-26448C	50/0.11	183

Table 15 below compares the total water right capacity of the Carson water system to the estimated demand in 2035. The demand is expressed in terms of both instantaneous demand (maximum flow rate) and annual withdrawal quantity (volume) in ERUs. In exercising its water rights, the Carson water system cannot exceed either the instantaneous demand capacity or annual withdrawal capacity. While the water rights appear to be sufficient to meet supply needs through 2035, they would be not sufficient to satisfy the estimated full build-out water need.

Table 15. Water rights versus 2035 demand estimate for the Carson Water System

		Required Supply		Available Supply		Surplus(Deficit)	
Year	ERUs	Instantaneous Demand (cfs)	Annual Quantity (af)	Instantaneous Demand (cfs)	Annual Quantity (af)	Instantaneous Demand (cfs)	Annual Quantity (af)
2015	1387	1.29	404	2.67	617	1.38	213
2020	1463	1.36	426	2.67	617	1.31	191
2025	1534	1.42	447	2.67	617	1.25	170
2030	1605	1.49	467	2.67	617	1.18	150
2035	1681	1.56	490	2.67	617	1.11	127
Full Build-out	3975	3.69	1158	2.67	617	(1.02)	(541)

The Skamania PUD is concerned that maintaining the aging Bear diversion and related infrastructure may not be feasible or cost effective in the long-term. Moreover, the continued operation of the diversion is subject to a US Forest Service special use permit and WDFW fish passage requirements. The PUD is actively seeking new water sources that will be sufficient to meet full its estimated full build-out need.

Since the service area is not served by a community sewer system, much of the water withdrawn is returned to the ground through onsite septic systems and infiltration. It is assumed that the water returned to the ground would be the same percentage or proportion of the daily household demand as that estimated for a permit exempt well or 33 percent. Correspondingly, the consumptive rate would be 67 percent of daily demand. Using this consumptive rate and 428 gpd average peak month daily demand in the WSP, consumptive use per ERU would be 287 gpd. It must be noted that not all

residential water use occurs in the Wind River subbasin. The Carson water system supplied water to approximately 200 residences in the Carson Creek subwatershed in 2014. None of the water used by these residences is returned to the Wind River subbasin. Accordingly, consumptive water use for these out of subbasin residences or ERUs would be the average peak month daily demand or 428 gpd. It is assumed that the proportion of households served by the Carson water system in the Carson Creek subwatershed will remain the same in 2035.

Similarly much of the water used by C/I/I entities served by the Carson water system would also be returned to groundwater. While the amount of water returned will vary depending of the specific C/I/I uses, consumptive water use is estimated to be 287 gpd per ERU.

Based on an increase of 294 ERUs by 2035, consumptive water use within the Carson water service area is estimated to increase by 0.14 cfs. Table 16 summarizes the increase in estimated consumptive water use within the within the Carson water service area between 2015 and 2035.

Stabler and Unincorporated Areas North of Carson

As noted earlier, over 91 percent of the subbasin is federal and state ownership. Development in the areas north of the Carson water service area occur primarily in or around the Stabler community with smaller areas of rural residential development occur along the mainstem Wind River north of Stabler and in the lower portions of Panther Creek and Bear Creek subwatersheds. Lands in the central area of Stabler are zoned for lot sizes of 2 acres with a well and onsite sewage disposal and down to 12,500 square feet for lots served by a public water system with onsite sewage disposal. Other areas are zoned for 2 acre lots. Water right certificates, permits, applications and claims for this area are summarized in Tables 8, 9, and 10 above.

Unlike the Lower Wind, there is no municipal water supplier and, therefore, there is no water system plan providing estimates of future growth and water needs. Population estimates are based on data from the US Census, OFM and the Skamania County Assessor's office. Estimates of average and consumptive residential water uses are based on WRIA 29A PEW Estimator.

Table 16. Estimated Consumptive Water Use for the Carson Water System

Year	Population/ERU		Consumptive Use		
	Population	ERU	gpd	gpm	cfs
2015					
Wind River	2,939	1187	340,669	237	0.53
Carson Creek		200	85,600	59	0.13
Total		1387	426,269	296	0.66
2020					
Wind River	3,108	1,252	359,334	250	0.56
Carson Creek		211	90,293	63	0.14
Total		1,463	449,627	312	0.70
2025					
Wind River	3,278	1,313	376,773	262	0.58
Carson Creek		221	94,675	66	0.15
Total		1,534	471,448	327	0.73

2030					
Wind River	3,441	1,374	394,211	274	0.61
Carson Creek		231	99,057	69	0.15
Total		1,605	493,268	343	0.76
2035					
Wind River	3,627	1,439	412,878	287	0.64
Carson Creek		242	103,747	72	0.16
Total		1,681	516,625	359	0.80
Full Build-Out					
Wind River	NA	3402	976,318	678	1.51
Carson Creek		573	245,327	170	0.38
Total		3975	1,221,645	848	1.89
Net Change 2035	688	294	90,356	63	0.14
Full Build-Out	NA	2588	795,376	552	1.23

Based on population estimates for the Wind River Census Block and the Carson Census Designated Place, the population of the Stabler and the unincorporated areas north of Carson water system service area was estimated to be 455 people in 2014. Annual population estimates were extended through 2035 using the 2012 OFM high growth rates for Skamania County.

Using OFM estimate of 2.5 people per household in unincorporated Skamania County and an estimated population of 460 in 2015, the number of ERUs would be 184. However, a count of residential structures using data from the Skamania County Assessor indicated that approximately 208 residential structures in the same area. Using the estimate of 2.5 people per household, the residential parcel count would suggest a population of 520. This higher population estimate may be largely due to the fact that a number of the homes in the area are part-time residential homes and people using those homes would not be counted in census data. Nevertheless, these part-time households or ERUs would be using surface or groundwater during summer low flow periods and need to be accounted for in estimating future demand.

The number of 2014 part-time ERUs is estimated to be 24 and was calculated by subtracting the 184 full-time ERUs from the 208 residential structures counted. As with the population estimates, the estimate of the number of part-time ERUs was extended through 2035 using the 2012 OFM high growth rates for Skamania County.

The ADD during the high demand months of May through September is 464 gpd per ERU. Consumptive water use per full-time household is estimated at 313 gpd based on PEW Estimator. Consumptive water use per part-time household is also estimated at 313 gpd, since this amount is based on maximum use during the May to September higher use period. The overall consumptive water demand for residential use through 2035 is estimated to increase by 0.02 cfs. Table 17 summarizes estimated population growth and residential water needs through 2035.

Table 17. Estimated Daily Residential Water Demand for Stabler and Unincorporated Areas North of Carson

	Population	Full-time	Part-Time	Total	Average Daily Demand		Daily Consumptive Water Use	
Year		ERUs	ERUs	ERUs	gpm	cfs	gpm	cfs
2015	460	184	24	208	67	0.15	45	0.10
2020	479	192	25	217	70	0.16	47	0.10
2025	506	203	27	229	74	0.16	50	0.11
2030	532	213	28	241	78	0.17	52	0.12
2035	556	222	29	252	81	0.18	55	0.12
Net Change 2015-2035	96	38	5	44	14	0.03	10	0.02

In 2002, following the closure of the US Forest Service Wind River Nursery in Stabler, 188 acres of the former nursery along with a portion of the water rights appurtenant to the property was transferred to Skamania County. The Wind River Nursery Site and Facility Plan²¹ published by the County estimates that future development will require 937 gpm/2.01 cfs and 76 af of water. Ecology transferred a portion of the US Forest Service water rights to Skamania County equivalent to this estimated need.

Little Wind River

The Little Wind River is the lowest tributary to the Wind River subbasin, entering the mainstem at 1.2 miles above its confluence with the Columbia River. Its watershed encompasses about 5,900 acres or 9.2 square miles. Much of the watershed is within the CRGNSA. Federal, state, and private timberland comprise over 92 percent of the watershed. Only 34 residences are located in the watershed. Nearly all of the Little Wind watershed is zoned for open space, commercial forest, and small woodland uses. Only about 142 acres are zoned for 5-acre residential development. Table 12 above summarizes the Little Wind River water right certificates, claims and applications.

Estimates of population growth and future water needs are based on OFM, Skamania County Assessor and the PEW Estimator for residential water used within the watershed; and the 2001 draft Home Valley Water District Water System Plan²² for water exported from the watershed by the water district.

Using the OFM estimate of 2.5 people per household in unincorporated Skamania County and a count of residential structures based on information from the Skamania County Assessor the 2015 population within the Little Wind River watershed would be about 85 people. Using the OFM 2012 high range growth rates for unincorporated Skamania County, the population could grow to 103 people or 41 ERUs by 2035.

Based on current land use and zoning, it is assumed that future growth in the Little Wind River watershed will be residential development. While it is possible that the Home Valley Water District could extend service into the southern portion of the watershed (north of Berge Road), it is further

²¹ Portico Group, 2000

²² Tanner Engineering, 2001

assumed that water needed for this growth will be supplied by permit exempt wells or small community water systems with on-site septic systems.

Based on the PEW Estimator, the ADD during the high use months of May through September would be 464 gpd per residence of ERU. The consumptive water use per ERU is estimated to be 313 gpd. This amount accounts for water returned to basin through on-site septic systems and irrigation infiltration. Using the 313 gpd rate, the estimated consumptive water demand for residential use within the Little Wind watershed through 2035 is estimated to increase by 0.004 cfs. See Table 18.

Table 18. Estimated Residential Water Demand within the Little Wind River

			Average Daily Demand		Consumptive Use	
Year	Population	ERUs	gpm	cfs	gpm	cfs
2015	85	34	11	0.024	7	0.016
2020	89	36	12	0.026	8	0.017
2025	94	38	12	0.027	8	0.018
2030	99	40	13	0.029	9	0.019
2035	103	41	13	0.029	9	0.020
Net Change 2015-2035	18	7	2	0.005	2	0.004

In addition to residential water used within the watershed, the Home Valley Water District exports water from the Little Wind River watershed. The District holds a right within the Little Wind River Watershed (Blyn Springs) to withdraw 63.5 af annually at a maximum rate of 0.5 cfs. At this time the District is not fully utilizing its right. The District has applied for an additional groundwater right, but the application is designated as inactive by Ecology.

The draft 2001 Home Valley Water District Water Supply Plan was used to estimate current and anticipated demand. The plan is being updated but was not available for use in preparing this assessment. The annualized population growth rate used in the water supply plan for 2005 through 2019 is approximately 2.0 percent. Based on this rate, the estimated service population in 2015 is 476. Although this estimate may overstate the actual population of the water district, it is used as the baseline for estimating population growth and potential water needs through 2035. Using the OFM 2012 high range growth rates for unincorporated Skamania County, the water district population could grow from 476 in 2015 to 575 people by 2035. This would be an increase of 33 ERUs based on the water system plan's estimate of 3 people per household. The plan uses 275 gallons per ERU as ADD and 800 gallons per ERU as MDD. Using this information, the water district MDD would increase by 0.04 cfs from 0.25 cfs in 2015 to 0.29 cfs in 2035. Since this water is exported from the watershed, this would also be the consumptive use. The 0.29 cfs withdrawal rate is well below 0.5 cfs maximum allowed in the water right. However, the water district could reach the maximum annual quantity of 63.5 af of its water right by 2020 and could exceed it by 9.3 af by 2035. Table 19 summarizes the estimated Home Valley Water District population growth and estimated water needs from 2015 through 2035.

Table 19. Estimated Home Valley Demand

Year	Population	Residential ERU	Non-Residential & Loss ERU	Total ERU	Max Daily Demand (Consumptive Use)		Annual Quantity
					gpm	cfs	
2015	476	159	45	204	113	0.25	62.6
2020	496	165	45	210	117	0.26	64.7
2025	524	175	45	220	122	0.27	67.5
2030	551	184	45	229	127	0.28	70.3
2035	575	192	45	237	131	0.29	72.8
Net Change 2015-2035	99	33	0	33	18	0.04	10.2

The increase in the total consumptive water use within the Little Wind River watershed is shown in table 20 below.

Table 20. Total Estimated Little Wind River Watershed Consumptive use (cfs)

Year	In-Basin	Home Valley	Total
2015	0.016	0.25	0.269
2020	0.017	0.26	0.278
2025	0.018	0.27	0.290
2030	0.019	0.28	0.302
2035	0.020	0.29	0.313
Net Change 2015-2035	0.004	0.04	0.044

POTENTIAL STREAM FLOW DEPLETION

Water withdrawals and diversions peak in the late summer when stream flows are at their lowest. It is assumed that both surface water diversions and groundwater withdrawals will have an immediate impact on stream flows. While this is clearly the case for surface water diversions, groundwater withdrawals seldom have an immediate impact. The timing of a groundwater withdrawal impacts depends on the location of the withdrawal, water returns through onsite septic systems and infiltration, distance to the stream, the geology and aquifer characteristics. These factors can vary widely throughout the subbasin, making it impossible to precisely predict the timing and extent of groundwater withdrawal impacts on stream flows.

Given this variability, the following assumptions provide the most conservative estimate of potential stream flow depletion:

1. Both surface diversions and groundwater withdrawals have an immediate impact on stream flows; and
2. The net impact of water diversions and withdrawals on streams is the consumptive use of water, since some water is returned to the stream direct discharge or through on-site septic systems and infiltration.

Lower Wind River - Carson Water Service Area

As shown in table 16 above, consumptive water use in the Lower Wind – Carson Water Service Area is estimated to increase by 0.14 cfs by 2035 and by 1.23 cfs at full build out.

Water withdrawals from Bear Creek by the Carson water system affect flows in lower Bear Creek and the Wind River below the Bear Creek confluence. Since these are surface water withdrawals their impact on stream flows is immediate. Under its current water right, the PUD may draw up to 2 cfs. The 90 percent exceedance low flow in September is 2 cfs. The maximum permitted rate of water withdrawals from the Industrial Site Well is 0.67 cfs. Withdrawals at this site could affect flows in the Wind River and lower Panther Creek. However any impact would be small relative to summer low flows. The September 90 percent exceedance low flow in the Wind River upstream at Stabler is 64 cfs and in Panther Creek is 57 cfs.

In addition to the existing permitted water rights for the Carson Water System, there are 5 pending water right applications, several of which if approved could affect flows in the lower Wind River. However, it is not possible at this time to assess the validity of these applications or the extent of their potential impact on stream flows.

The Skamania County PUD on behalf of the Carson Water System has filed 2 of the 5 applications. While existing water rights appear to be sufficient to meet the needs of the water system through 2035, the 2 additional groundwater rights are for 1260 af annually at a maximum rate of 4.50 cfs. One application would increase withdrawals from an existing well at the north end of the service area by 183 af annually and have a maximum withdrawal rate of 0.11 cfs. The other application is for 1077 af annually and a maximum rate of 4.39 cfs. Water requested in this application would be withdrawn from wells at 2 locations at the north end of the service area and could affect flows in lower Wind River and possibly lower Panther Creek.

Wilkins, Kaiser & Olsen (WKO) has applied for a surface water right to divert 243 af annually from the Wind River at Carson with a maximum rate of 0.67 cfs. The diversion would occur at a RM 3.0 and would affect mainstem flows downstream. The September 90 percent exceedance low flow in the Wind River at Carson is 156 cfs.

The Columbia Gorge Hot Springs filed the remaining 2 applications. One is for the withdrawal 806.5 af annually of groundwater and a maximum withdrawal rate of 1.11cfs. This application proposes to withdraw geothermally heated water from a depth of about 2000 feet. The second application is for 1,750 af annually of ground water and a maximum rate of 3.9 cfs. This application would use existing wells to supply water for irrigation, domestic, and commercial uses. The withdrawals proposed in both applications occur near the confluence of Wind River and the Columbia River. Since the Wind River in this area is back watered by the Bonneville, these withdrawals would likely have little impact on Wind River flows.

Stabler and Upper Wind River

For permit exempt wells in Stabler and the unincorporated areas of the Upper Wind River subwatershed, the daily consumptive demand of 313 gpd is used to calculate potential stream flow depletion given that much of the water withdrawn is returned to the subwatershed via onsite septic systems or infiltration. Based current land use patterns and county zoning, future development and

increased water demand will likely have the greatest impact on stream flows in lower Trout and Martha creeks and the mainstem Wind River flows upstream approximately a mile from the confluence with Trout creek in sections 23, 26, 27, and 35, township 2 north, range 7 east. Stream flows in Panther and Bear creeks could also be affected to a lesser degree due to future residential development. Collectively, however, these affects would be relatively small, less than 0.02 cfs. See table 17. Future commercial/industrial water needs for the redevelopment of the US Forest Service Wind River Nursery are estimated to be 2.01 cfs. However this demand will be met through water rights transferred to the County from the US Forest Service and as such would not represent a net increase in stream flow depletion.

The Skamania County PUD has filed an application to expand its existing surface water right on Bear Creek by 715 af annually and maximum rate of 2.35 cfs. Given flow limitations on Bear Creek and the PUD's interest in other sources, it is uncertain whether this application will be pursued.

Little Wind

Future residential development within the Little Wind watershed will likely have a negligible effect (0.004 cfs, table 20) on Little Wind River flows. Since water withdrawn in the Little Wind River subwatershed by the Home Valley water system is exported from the Wind River subwatershed, the total potential stream depletion potential for the Little Wind River is estimated be to the increase in total system MDD or 0.04 cfs by 2035. Stream flows in the lowest 1.25 miles of Wind River would also be affected by water withdrawals in the Little Wind River subwatershed.

Wind River Subbasin Summary

Table 21 provides a summary of the potential stream flow depletion resulting from future water withdrawals in the Wind River subbasin. These estimates of stream flow depletion do not include pending water right applications in the Wind River subbasin. Collectively the pending applications request total withdrawal rate of 17.1 cfs and a quantity of 7,337 af. These quantities are the total gross request, the potential consumptive use or impact on stream flows would be less. Nevertheless, these requests represent an anticipated demand but full extent and validity of the needs cannot be determined at this time.

Table 21. Estimated Potential Stream Flow Depletion in cfs

	2014 Estimated Depletion	2035 Estimated Depletion	Net Change
Lower Wind - Carson Water Service Area	0.62	0.83	0.21
Upper Wind River	0.08	0.09	0.02
Little Wind River	0.26	0.31	0.04
Subwatershed Total	0.96	1.23	0.27

WATER AVAILABILITY VERSUS ESTIMATED POTENTIAL STREAM FLOW DEPLETION

A reduction in stream flow will result in a corresponding reduction in fish habitat. Based on the Ecology/WDFW guidance low flows would generally result in a tolerable level of habitat reduction. With

the exception of the Little Wind River, the 90% exceedance low flow levels are based on the flow analysis conducted Ecology. Since the Ecology did not evaluate Little Wind River flows, a draft hydrologic analysis²³ prepared for the Underwood Conservation District was used. That analysis estimated Little Wind River flows based on flow data for Panther and Bear creeks. The analysis stated that “the Bear Creek gage is probably a better surrogate for the Little Wind River than is Panther Creek.” The estimated 90% exceedance low flow for the Little Wind River based on Bear Creek data is 1.9 cfs.

Table 22 compares the estimated potential increase stream flow depletion that could result from anticipated demand in 2035 with the available water based on the Ecology/WDFW guidance. Water availability year round in the Upper and Lower Wind should be adequate overall to meet the anticipated increase in demand. However, consideration must be given to local conditions. Growth in the Stabler area could further affect flows in Martha Creek which based on the Ecology/WDFW guidance has no water available for use during the summer low flow months. It should also be noted that reductions in flows resulting from withdrawals or diversion in the Upper Wind River would result in a corresponding and equal reduction in water available in the Lower Wind. In the Little Wind watershed, estimated future residential development and the full utilization of the Home Valley Water District water right would utilize the full amount of water available based on the Ecology/WDFW guidance on water availability during the summer low flow months.

Finally, additional water could be available on an interruptible basis during periods when flows exceed instream flow requirements, generally October/November through May/June depending on the stream. Ecology has estimated the quantities of additional water and the percent of time these quantities may be available in a Wind River and selected tributaries.²⁴

Table 22. Estimated Demand versus Water Available for Consumptive Use

	Estimated Increase in Depletion by 2035 (cfs)	1% of Low Flow (cfs)	2% of Low Flow (cfs)
Upper Wind			
Mainstem Wind		0.64	1.27
Trout Creek		0.05	0.09
Martha Creek		0.00	0.01
Panther Creek		0.53	1.06
Bear Creek		0.02	0.03
Subtotal - Upper Wind	0.02	1.23	2.47
Lower Wind	0.21	1.45	2.91
Little Wind	0.04	0.02	0.04

Based on the analysis of future water needs and availability, it is recommended that water be reserved to meet anticipated future out-of-stream uses. Reservations would be senior to instream flow proposed or established by rule. Specific water reservations for the Wind River subbasin are:

²³ Draft Little Wind River Habitat Restoration, Hydrologic Analysis, November 2010.

²⁴ Exploring the Allocation Limit for New Water: How Often is it Available for Use; Jim Pacheco, Washington Department of Ecology, November 2014.

- Upper Wind River: 0.2 cfs for permit exempt wells, community water systems and small scale commercial development.
- Lower Wind River: 1.02 cfs to meet the Carson Water System full build-out estimated need and 0.48 cfs that would be available for appropriation upon the adoption of a water allocation plan adopted by the Skamania Board of County of Commissioners.
- Little Wind River: 0.005 cfs to provide for anticipated residential growth through 2015.

The lower portion of the Wind River is subject to being backwatered by the Columbia River. Water from reaches backwatered by the Columbia, the Columbia River or from groundwater in connection with the Columbia River and not the Wind River or its tributaries is available for appropriation. It is not subject to the reservations, instream flows, or closures recommended for the Wind River subbasin. Applications for such water withdrawals would be handled under routine procedures for processing water right applications.

CONCLUSIONS

General

1. Existing water rights and permit exempt wells will not be impaired or changed by this Plan.
2. Recommended reservations are intended to be senior to proposed instream flows.
3. Water systems should be maintained to minimize water losses.
4. Skamania County, Skamania County PUD, and other water system operators should be encouraging water conservation measures.
5. Consideration should be given to the use and/or storage of water available on seasonal interruptible basis where practical. Approaches to storage could include infiltration galleries, pump and dump, aquifer recharge and reservoirs.
6. Water from reaches of the Wind River backwatered by the Columbia River or from the Columbia River or from groundwater in connection with the Columbia River and not the Wind River or its tributaries is available for appropriation. It is not subject to any of the reservations, instream flows, or closures recommended for the Wind River subbasin. Applications for such water withdrawals would be handled under routine procedures for processing water right applications.
7. The lower reaches of the Wind River that are backwatered by the Bonneville Pool would not be subject to minimum instream flows, reservations, or closures.
8. The Carson Water System has inchoate water rights sufficient to meet its anticipated needs through 2035. The Home Valley Water System inchoate water rights in the Little Wind River watershed may only be sufficient to meet anticipated needs through 2020.
9. If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited

with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right.

10. Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313 gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.

Upper Wind River Subbasin

1. Water rights transferred from the USFS to Skamania County are sufficient to meet anticipated water needs associated with Wind River nursery development plans. Remaining portions of the USFS nursery water rights could help meet other future water needs, including those of the Carson Water System. Ecology should determine the extent and validity of the remaining USFS rights. The USFS should consider transfer of remaining rights exceeding its requirements to satisfy other water supply needs in the Wind River subbasin.
2. Overall future residential development in the upper Wind River subwatershed is not expected to result in a significant increase in water demand or potential stream flow depletion. However, development in proximity to Martha Creek is an exception. Additional water withdrawals could extend periods during which the creek has no surface flow. An aquifer survey should be conducted to assess whether groundwater supplies exist that can be withdrawn without affecting flows in Martha and Trout creeks. Consideration should also be given to the development of a community water system drawing from available water in the mainstem Wind River either by surface diversion or by well drawing water from an aquifer in connection with the mainstem. Such a system could reduce or eliminate flow impacts of growth in the lower Martha and, possibly, Trout Creek areas.
3. Reserve 0.2 cfs for permit exempt wells, community water systems, and small scale commercial development in the upper Wind River subwatershed. This reservation is senior to proposed instream flows.
4. Establish the following instream flows:

Upper Wind River	Instream Flow*	Rationale
Bear Creek @ RM 0.4	Oct-Nov = 13 cfs	Oct-Nov: trout rearing
	Dec-May = 35 cfs	Dec-May: trout spawning
	June = 23 cfs	Jun: trout incubation/10% exceedance
	July = 13 cfs	Jul: trout rearing
	Aug = 6.6 (13) cfs	Aug-Sep: trout rearing /10% exceedance
	Sep = 7.3 (13) cfs	
Trout Creek @ Stabler RM 0.6	Oct-Dec = 110 cfs	Oct-Dec: steelhead rearing
	Jan-May = 120 cfs	Jan-May: steelhead spawning
	June = 113 cfs	Jun: steelhead incubation/rearing
	July = 86 cfs	Jul-Sept: trout/steelhead rearing /10% exceedance

Panther Creek @ Mouth	Aug = 23 cfs	
	Sep = 27 cfs	
	Oct -Dec = 138 cfs	Oct-Dec: steelhead rearing
	Jan-May = 147 cfs	Jan-May: steelhead spawning
	Jun = 138 cfs	Jun: steelhead incubation/rearing
	July = 107 (138) cfs	Jul-Sept: trout/steelhead rearing /10% exceedance
Martha Creek @ Mouth	Aug = 86 (138) cfs	
	Sep = 87 (138) cfs	
	Oct-Dec = 9.4 cfs	Oct-Dec: trout/steelhead rearing
	Jan-Apr = 41 cfs	Jan-Apr: steelhead spawning
	May = 34 cfs	May: steelhead spawning/10% exceedance
	June =12.4 cfs	Jun: steelhead incubation/10% exceedance
Wind at Stabler RM 11.5 <i>ISF based on 2007 PHABSIM study and 2013 preference curves</i>	July = 3.8 (9.4) cfs	Jul-Sept: trout/steelhead rearing /10% exceedance
	Aug = 1.4 (9.4) cfs	
	Sept = 1.6 (9,4) cfs	
	Oct = 310 cfs	Oct = Chinook Spawning
	Nov = 290 cfs	Nov = Steelhead rearing
	Dec-June = 350 cfs	Dec-June = Steelhead spawning
	July = 290 cfs	Jul = Steelhead incubation & rearing
	Aug = 184 (310) cfs	Aug-Sept = Chinook spawning/10% exceedance
	Sept = 189 (310) cfs	

**based on new TW method with the exception of Wind at Stabler RM 11.5*

First number is the 10% exceedance (number in parentheses is habitat based ISF)

Lower Wind River

1. Water availability in the Lower Wind River subwatershed is more than sufficient to meet the estimated needs of the Carson Water System.
2. Existing Carson Water System water rights are expected to be sufficient to meet residential, commercial, industrial, and institutional needs through 2035 but will not be sufficient to support full build-out within the service area.
3. The Skamania PUD is concerned that maintaining the aging Bear diversion and related infrastructure may not be a feasible or cost effective in the long-term. The PUD has applied for additional water rights to meet future needs and is exploring alternative water sources. The PUD should pursue alternative sources that will meet the water districts while minimizing impacts on stream flows within Wind River Water subbasin. The planning for and development of such an alternative should be a high priority for WRIA 29A. The PUD should consider partnering with other major water users in the Wind River subbasin, such a WKO, Inc., in developing an alternative source.
4. Reserve 1.02 cfs to meet the PUD's estimated full build-out needs.

5. Reserve 0.48 cfs to meet future needs not anticipated by the Carson Water System Plan. The water would be available for appropriation only upon adoption of a water allocation plan by the Skamania County Board of Commissioners. The allocation plan would be developed in consultation with the Planning Unit or its successor and adopted by the Board of Commissioners through a public process.
6. Establish the following instream flows:

Lower Wind River*	Instream Flow*	Rationale
Wind R Near Carson @ RM 1.9	Oct-Nov = 323 cfs	Oct-Nov: Chinook spawning
	Dec-Jun = 347 cfs	Dec-Jun: steelhead spawning
	Jul = 347 cfs	Jul: steelhead incubation/rearing
	Aug = 290 cfs	Aug-Sept: Chinook spawning/10% exceedance)
	Sept = 271 cfs	

**based on new TW method*

Little Wind River

1. Reserve 0.005 cfs to meet the estimated growth of 10 households in the Little Wind River watershed.
2. Water from reaches of the Wind River backwatered by the Columbia River or the in connection with the Columbia River is available for appropriation subject to existing state laws and administrative rules and is not be subject to reservations, instream flows, or closures recommended for the Little Wind River subwatershed.

LITTLE WHITE SALMON SUBBASIN

SUBBASIN DESCRIPTION AND CHARACTERISTICS

The Little White Salmon (LWS) River subbasin encompasses nearly 135 square miles. From its headwaters at an elevation of over 5,300 feet, the LWS River flows approximately 21.3 miles to its confluence with Columbia River at Drano Lake. Mean annual precipitation is 74 inches, ranging from 33 inches near the mouth to 113 inches in the upper subbasin. The subbasin falls primarily into two precipitation zones: rain-on-snow dominated (35%) and snow dominated (42%). Most of the remaining acres are in the rain-dominated zone (19%) in the lower subbasin. Important tributaries include Lusk, Lost, Little Huckleberry, Berry, Lapham, Cabbage, Lava, Moss, and Rock creeks.²⁵

The primary geologic foundation underlying the subbasin is the Ohanapecosh Formation. Weathering and the resulting thick layer of decomposed rock (saprolite) reduces water infiltration and promotes runoff. Fracture zones promote local permeability and control groundwater flow. Tuff and tuff breccias that overlie the Ohanapecosh Formation have higher permeability. Potential for hydraulic continuity is low to moderate.²⁶

The Quaternary volcanics in the northern and central portion of the watershed are permeable and precipitation readily percolates. Groundwater movement within these volcanics will be controlled by cooling fractures, interflow zones and the buried topography beneath it. Where volcanics have flowed down the ancient Little White Salmon River valley there are likely to be saturated buried gravels with high permeability. The Quaternary volcanics and buried gravels have a moderate to high potential for hydraulic continuity with surface water.²⁷

Eighty-five percent of the subbasin is forested. Eighty-three percent of the subbasin is in state or federal ownership. The major population centers are Willard, Cook, and Mill A. The year 2000 population, estimated at 513 persons, is forecasted to increase to 753 by 2020 (WRIA 29 Water Rights and Water Use Assessment, Watershed Professionals, January 2003). Continued population growth will increase pressures for conversion of forest land uses to residential uses, with potential impacts to habitat conditions.

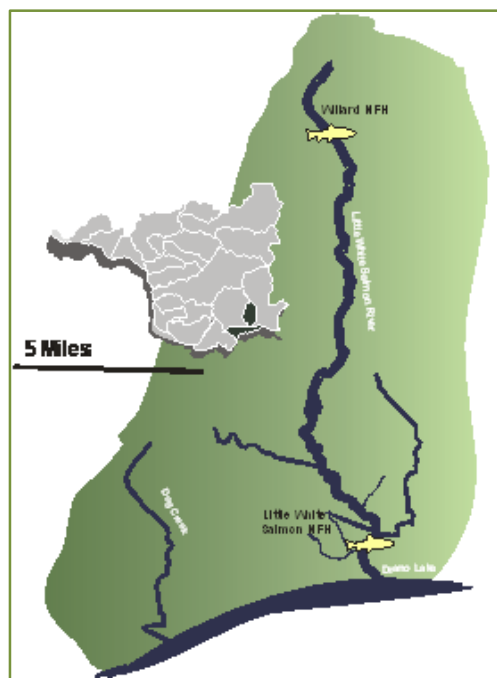


Figure 12. Little White Salmon Subbasin in the Lower Columbia Region

²⁵ WRIA 29A Watershed Plan, 2006

²⁶ Envirovision, 2002

²⁷ Ibid.

STREAM FLOWS

Ecology has prepared hydrographs characterizing flow patterns and volumes at following locations
Little White Salmon River near Cook, WA (figure 13) and Little White Salmon Creek at RM 6.5 (figure 14).

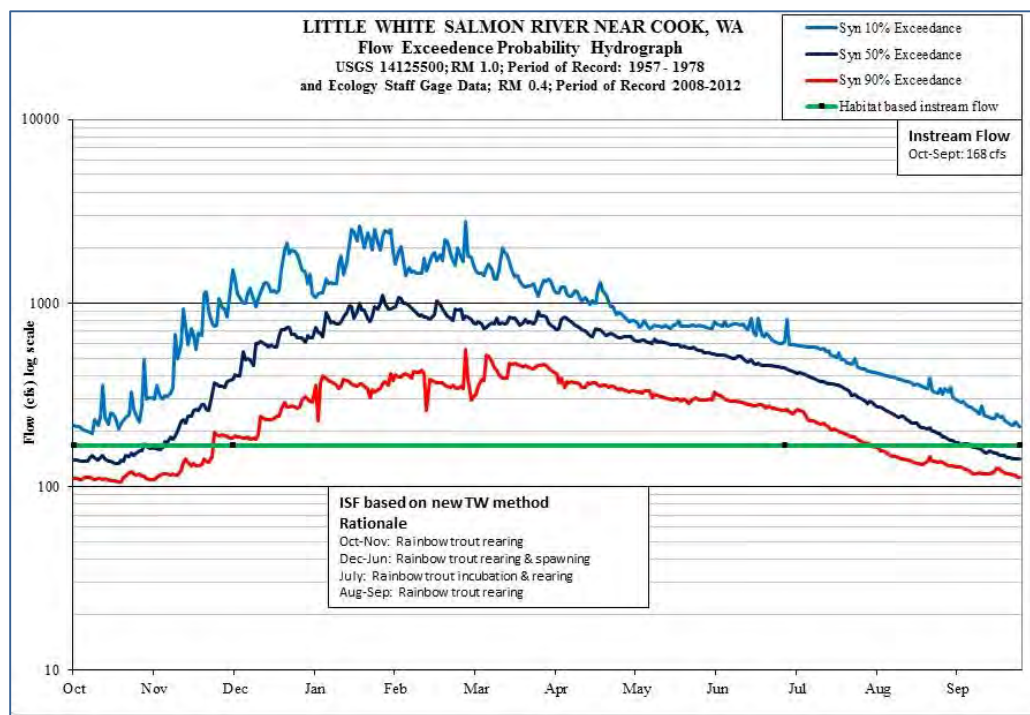


Figure 13. Little White Salmon River Near Cook, WA

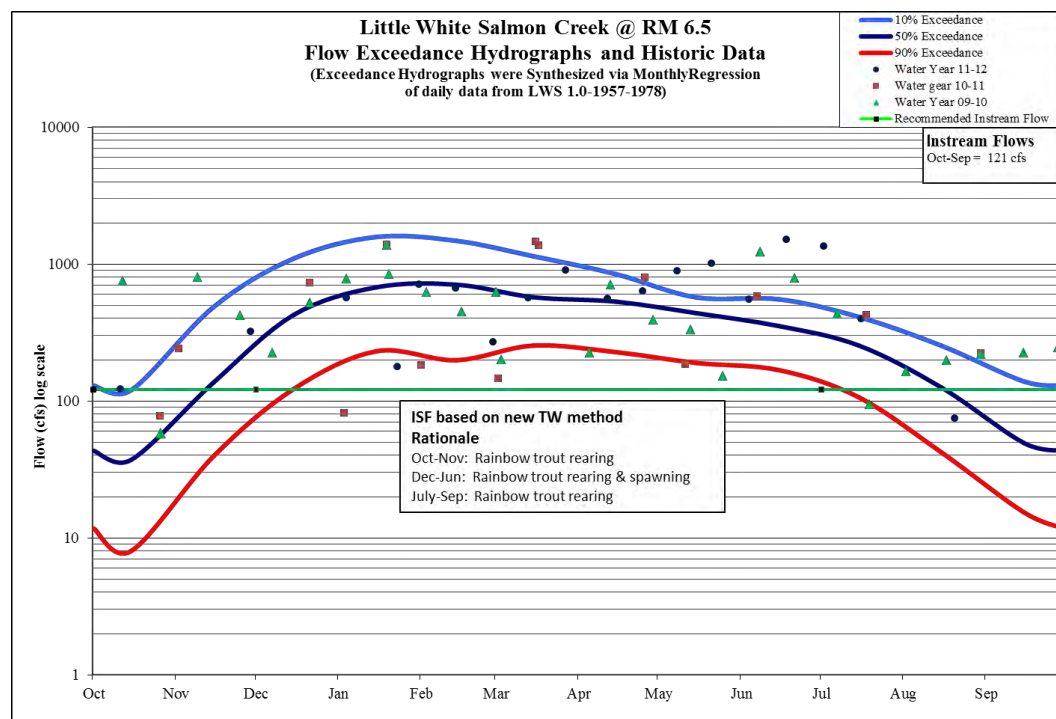


Figure 14. Little White Salmon Creek at RM 6.5

FISH USE

The Little White Salmon River subbasin historically supported populations of spring Chinook, tule fall Chinook and coho in the lower subbasin up to RM 3.0 where a barrier falls (Spirit Falls) blocked upstream passage. These populations are listed as threatened under the ESA. When considering biological objectives for recovery, the fall Chinook are combined with Wind River fall Chinook to form the Upper Gorge fall Chinook population, and the coho are combined with the Wind and Upper Gorge tributaries population to form the Upper Gorge coho population. Bull trout do not occur in the subbasin, however, individual bull trout (likely from the Hood River basin) have been observed in Drano Lake on occasion. Salmon numbers have declined to only a fraction of historical levels. Extinction risks are significant for these species – the current health or viability is very low for all species.

The historical Little White Salmon adult tule fall Chinook population is estimated from 4,000-5,000 fish. Current natural spawning returns are 100-200 fish. The Little White Salmon Hatchery produces up river bright (URB) fall Chinook which are not part of the lower Columbia ESU. Fall Chinook spawning occurs in a quarter mile stretch of river downstream from the Little White Salmon Hatchery and upstream of Drano Lake. Tule fall Chinook spawning occurs from mid-September to mid-October. The URB fall Chinook spawn from late October through November. Juvenile rearing occurs near and downstream of the spawning areas. Juveniles migrate from the Bonneville tributaries in the spring and early summer of their first year. Principal factors limiting the viability these species include: access, fine sediments, lack of habitat diversity and quantity, high water temperature, flow, and channel instability. The lower reaches also offer thermal refugia to out of basin stocks migrating upriver to their natal streams.

WATER RIGHTS & CLAIMS

Based on Ecology's Explorer, the Little White Salmon River subbasin has a total of 66 water right certificates, 59 claims and 9 pending applications. Of the 134 certificates, claims, and applications, 120 are for surface water.

Fish propagation is the largest certificated use of water in the subbasin. Nine certificates have been issued to the US Fish and Wildlife Service for fish propagation at the Willard and Little White Salmon National Fish hatcheries. Water rights for fish propagation at the Willard hatchery are for a total maximum instantaneous withdrawal of 53.3 cfs and annual quantity of 2720 af. Water rights for fish propagation at the Little White Salmon hatchery are for a total maximum instantaneous withdrawal of 57.72 cfs and annual quantity of 323 af. While these rights may have a localized impact on stream flows, fish propagation is considered a non-consumptive use. Since 3 of 4 certificates for the Willard hatchery are for ground water, water use at this facility may augment stream flows. In addition to the certificated water rights, 2 applications requesting water for fish propagation have been filed, one by the USFWS and the other by a private party.

The largest claims for water have been filed by the Broughton Lumber Company. Two claims with a total maximum instantaneous withdrawal of 60 cfs and annual quantity of 43,619 af are for the operation of the former Willard lumber mill and lumber flume. Since both uses have been discontinued, they have no current impact on stream flows.

Separate from the fish propagation certificates, the largest number of water right certificates and claims within the subbasin are for domestic, irrigation and stock watering uses. A total of 56 certificates with a total maximum allowable instantaneous withdrawal of 9.9 cfs and annual quantity of 483.4 af have been issued for these uses. The 56 claims for these uses are for a maximum allowable withdrawal of 20.76 cfs and annual quantity of 959.5 af. Most of the certificates and claims are for diversions or withdrawals in the Mill A Flats area of the subbasin. Moreover, most of the certificates and claims are for surface water withdrawals from tributaries to the Little White Salmon River, including (Little) Rock, Squaw, Bunker, Berry, and Lapham creeks. Table 23 summarizes the surface and ground water right certificates, claims, and applications for the Little White Salmon area.

Table 23. Little White Salmon River

Record Type	Use	No. of Records	Instantaneous demand Qi (cfs)	Quantity Qa (af)	Ground Water	Surface Water
Certificate	Single Domestic	28	6.52	221.5	1	27
	Multiple Domestic	16	1.31	137.1	4	12
	Irrigation	12	2.08	124.8	0	12
	Fish Propagation	10	112.6	3,052.0	4	6
	Total	66	122.5	3,535.4	9	57
Claims	Single Domestic	22	1.12	85.5	2	20
	Multiple Domestic	5	13.42	379.0	0	5
	Irrigation	21	5.13	481.5	3	18
	Stock Watering	8	1.10	13.5	0	8
	Comm/Industrial	3	65.00	47,239.0	0	3
	Total	59	85.76	48,198.5	5	54
New Apps	Multiple Domestic	1	0.08	15.4	0	1
	Irrigation	6	0.47	44.5	0	6
	Fish Propagation	2	1.62	1.6	0	2
	Total	9	2.17	61.5	0	9

WATER DEMAND AND EXISTING SUPPLIES

The population of the Little White Salmon subbasin was estimated to be 513 in 2000 and projected to grow to 753 in 2020.²⁸ However, the use of data from the Skamania County Assessor and DOH suggests a significantly lower growth in population. Data from the Assessor indicated that the subbasin had approximately 160 residential structures in 2014. The DOH Group A water system records identifies an additional 16 residential water connections located at the USFWS hatchery sites, bringing the estimated total number of residential structures in the subbasin to 176. Based the OFM estimate of 2.5 people per household in unincorporated Skamania County, it is estimated that the subbasin population in 2014 was 440 people. Using 2014 population estimate and the 2012 OFM high growth rates for Skamania County the population in 2035 is projected to be 548 or 220 ERUs.

²⁸ Watershed Professionals, 2003

As shown in Table 24, the Little White Salmon subbasin contains 7 Group A community water systems. Collectively these systems serve an estimated 249 persons in 107 households. The Mill A water system is the largest in the subbasin. It currently has a water right for 40 gpm and 5.6 af. It has applied for an additional 15.4 af in order to adequately serve its existing 81 connections. Further expansion of the Mill A water system would require additional water rights. The Willard Homeowners Association has a water right for 55 gpm and 8.5 af. If the population served by the Willard system were to grow at the OFM high growth rate for unincorporated Skamania County the existing water right would likely be adequate through 2025 based the estimated ADD for a permit exempt well. Two additional Group A systems serve residences at the Little White Salmon and Willard Fish Hatcheries.

Table 24. Little White Salmon subbasin Group A community water systems

System Name	Residential Population Served	Residential Connections	Other Connections	Total Connections
Mill A Water Company	175	73	8	81
Willard	46	18	0	18
Little White Salmon Nat'l Fish Hatchery	15	7	4	11
Willard Nat'l Fish Hatchery	13	9	2	11
Big Cedars County Park	0	0	1	1
USFS Oklahoma Campground #1	0	0	1	1
USFS Oklahoma Campground #2	0	0	1	1

Since all residences are served by permit exempt wells or small community water systems with on-site septic systems, estimated residential water demand in the Little White Salmon subbasin is based on the PEW Estimator. Table 25 provides estimated daily demand and consumptive use through 2035. No increase in water demand for commercial, industrial, and institutional uses is estimated. The USFWS has a pending water right application for 1.17 cfs for fish rearing. This use would not be consumptive.

Table 25. Little White Salmon River Estimated Residential Water Demand

			Estimated Daily Demand			Consumptive Use		
Year	Population	ERUs	gpd	gpm	cfs	gpd	gpm	cfs
2015	440	176	81,664	56.71	0.13	55,088	38.26	0.09
2020	458	183	85,024	59.04	0.13	57,355	39.83	0.09
2025	484	194	89,857	62.40	0.14	60,615	42.09	0.09
2030	509	204	94,447	65.59	0.15	63,711	44.24	0.10
2035	531	212	98,590	68.47	0.15	66,506	46.18	0.10
Net Change 2015-35	91	36	16,926	11.76	0.02	11,418	7.92	0.01

TOTAL POTENTIAL STREAM FLOW DEPLETION

Water withdrawals and diversions peak in the late summer when stream flows are at their lowest. It is assumed that both surface water diversions and groundwater withdrawals will have an immediate impact on stream flows. While this is clearly the case for surface water diversions, groundwater

withdrawals seldom have an immediate impact. The timing of a groundwater withdrawal impacts depends on the location of the withdrawal, water returns through onsite septic systems and infiltration, distance to the stream, the geology and aquifer characteristics. These factors can vary widely throughout the subbasin, making it impossible to precisely predict the timing and extent of groundwater withdrawal impacts on stream flows.

Given this variability, the following assumptions provide the most conservative estimate of potential stream flow depletion:

1. Both surface diversions and groundwater withdrawals have an immediate impact on stream flows; and
2. The net impact of water diversions and withdrawals on streams is the consumptive use of water, since some water is returned to the stream direct discharge or through on-site septic systems and infiltration.

Over the 20-year planning period daily residential water demand is estimated to increase by 0.02 cfs and daily consumptive use or potential stream flow depletion by 0.01 cfs (Table 23 above). Given current land use and ownership patterns, it can be expected that most of the future residential growth will occur in the Mill A and Willard communities and would affect flows in Rock, Squaw, and Bunker creeks and in the lower 4.25 miles of the Little White Salmon River.

With the closure of the lumber mill in Willard, sizeable water withdrawals for the operation of the mill and the associated lumber flume have ended. The operation of the flume was a significant consumptive use since water was diverted out of the Little White Salmon subbasin. No increase in industrial water demand is projected through 2035 and, therefore, would not result in further stream flow depletion. Limited commercial development supporting local residents and recreational visitors may occur but is not likely to have a significant impact on stream flows.

WATER AVAILABILITY

A reduction in stream flow will result in a corresponding reduction in fish habitat. The Ecology/WDFW guidance states that a 1 to 2 percent reduction in the 90% exceedance low flow would generally result in a tolerable level of habitat reduction. Ecology calculated the 90% exceedance low flow for the Little White Salmon at RM 0.4 to be 111 cfs. Table 26 compares the estimated increase in stream flow depletion through 2035 with the 1% and 2% of 90% exceedance low flow. Based on the Ecology/WDFW guidance, estimated future out-of-stream water demand through 2035 should not result in a significant reduction in stream flow or habitat available.

Table 26. Little White Salmon River Estimated Demand versus Water Available for Consumptive Use

Estimated Increase in Stream Depletion through 2035 (cfs)	90% Exceedance Low Flow (Sept/Oct) (cfs)	1% of 90% Exceedance Low Flow (cfs)	2% of 90% Exceedance Low Flow (cfs)
0.01	111	1.1	2.2

CONCLUSIONS

1. Existing water rights and permit exempt wells will not be impaired or changed by this Plan.
2. Recommended reservations are intended to be senior to proposed instream flows.
3. Reserve 0.05 cfs for future out-of-stream uses, including permit exempt wells, community water systems, and commercial uses. The reservation is less than the 1 percent of the 90 percent exceedance low flow water availability guideline, but is sufficient to meet estimated demands through 2035. This is equivalent to 103 ERUs based on a consumptive use estimate of 313 gpd per ERU. Although the number of residential ERUs is expected to increase by 36, the reservation provides for limited commercial uses, and need for community water system to provide for fire flows, system maintenance and leakage.
4. If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right.
5. Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313 gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.
6. Given the number of existing water right certificates and claims in the Rock, Squaw, and Bunker creeks, current and future community water systems in the Mill A Flats should be encouraged to draw water in connection with the mainstem Little White Salmon River.
7. Establish the following instream flows:

Little White Salmon River	Instream Flow*	Rationale
LWS at RM 6.5	Oct-Sep: 121 cfs	Oct-Nov: Rainbow trout rearing
		Dec-Jun: Rainbow trout rearing & spawning
		Jul-Sep: Rainbow trout rearing
LWS near Cook	Oct-Sep: 168 cfs	Oct-Nov: Rainbow trout rearing
		Dec-Jun: Rainbow trout rearing & spawning
		July: Rainbow trout incubation & rearing
		Aug-Sep: Rainbow trout rearing

**Based on new toe-width method*

OTHER COLUMBIA RIVER TRIBUTARIES

SUBBASIN DESCRIPTION AND CHARACTERISTICS

The other Columbia River tributaries are relatively small and primarily spring fed watersheds. Collectively, they encompass 66.7 square miles. They are located in 5 distinct areas: Wauna, Kanaka/Nelson/Carson, Home Valley, Dog Creek, and Underwood. Some areas have experienced considerable development and are expected to grow in population throughout the planning period. These include the Kanaka/Nelson/Carson area which extends into the Stevenson and Carson UAs and the Home Valley area which encompasses a developed rural community. Other areas such as Wauna and Underwood have some residential use primarily include forest and agricultural lands. The Dog Creek area has very little residential and commercial development and the Columbia River Gorge National Scenic Area (CRGNSA) regulations severely limit or preclude future development.²⁹

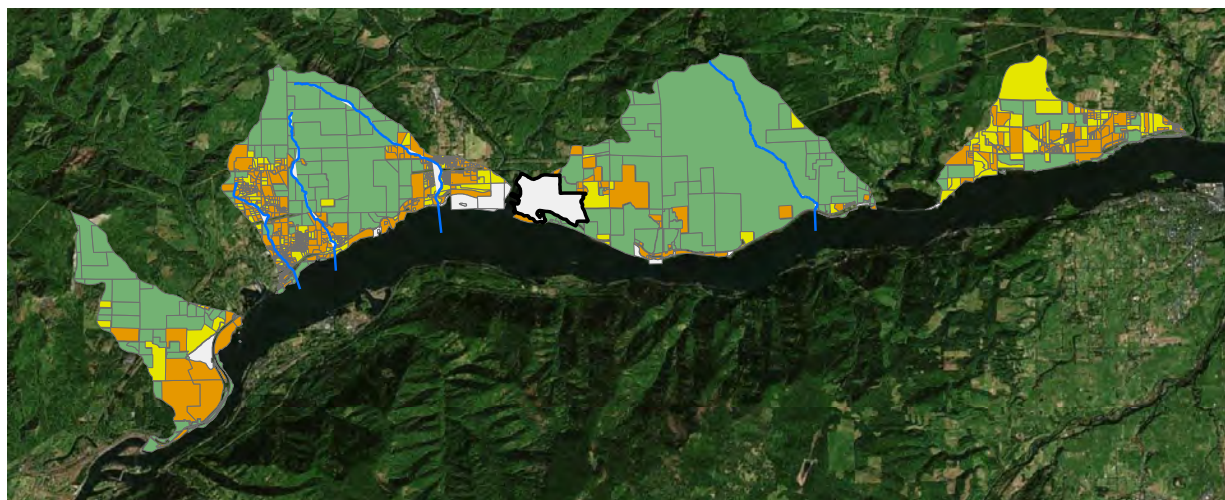
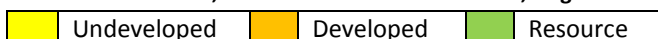


Figure 15. Columbia River tributaries from west to east: Wauna area, Kanaka-Carson-Nelson Creeks, Dog-Collins Creek, Home Valley and Underwood areas.



In evaluating these small tributary areas, watershed boundaries were approximated based on mapped topography. The location given for water diversions or withdrawal in a water right certificate, permit, claim or application may not be precise. While care was taken to identify a water right certificate, permit, claim or application with the appropriate watershed, there may be instances where a point of withdrawal or diversion may have been misplaced or omitted.

FISH USE

Fish usage in these small tributaries is limited and confined primarily to coho and steelhead. There is currently little or no use of these small tributaries by Chinook or chum salmon. The Lower Columbia salmon Recovery Plan classifies summer steelhead and coho as Primary populations, Fall Chinook and chum as Contributing populations, and winter steelhead as a Stabilizing population for recovery. Population classifications are defined in Table 27 below. Salmon recovery opportunities in the Gorge are limited by the small fish runs and the high uncertainty of restoration feasibility.

²⁹ WRIA 29A Watershed Plan, 2006

Table 27. Lower Columbia Salmon and Steelhead Recovery Goals

Species	Population Classification	Viability Goal	Extinction Risk Goal	Persistence Probability ¹
Sum. Steelhead	Primary	High (H)	Low (negligible) risk of extinction	95-99%
Coho	Primary	High (H)	Low (negligible) risk of extinction	95-99%
Fall Chinook	Contributing	Medium (M)	Medium risk of extinction	75-94%
Chum	Contributing	Medium (M)	Medium risk of extinction	75-94%
Win. Steelhead	Stabilizing	Low (L)	Stable, but relatively high risk of extinction	40-74%

¹100-year persistence probability

Wauna

DESCRIPTION

The Wauna area extends from the North Bonneville UA east to the Stevenson UA. It is bound on the north by Table Mountain, Red Bluff. The area encompasses approximately 3400 acres and is comprised of landslide debris and has numerous small spring feed lakes. Ash Creek is the only tributary to the Columbia. It is a perennial stream but no flow data is available. The primary land uses are recreational residences, commercial forestlands, and surface mining. The Wauna area falls within the CRGNSA General Management Area (GMA), which limits future development.

FISH USE

There is documented presumes the presences of winter steelhead in Blue Creek.

STREAM FLOWS

No streamflow records are available for Blue Creek or Ash Creek in the Wauna area.

WATER RIGHTS & CLAIMS

Based on Ecology's Explorer, the Wauna area has a total of 11 water right certificates and 42 claims. Twenty-two are for surface water and 31 for ground water with a total instantaneous demand of 17 cubic feet per second (cfs) and quantity of 844 acre feet (af). There are no pending applications. Seven certificates and 39 claims are for domestic or residential uses. In total, they represent an instantaneous demand of 1.26 cfs and an annual quantity of 146.2 af. The largest allocation of water is for irrigation and fire protection. There are 6 certificates and claims for these uses totaling 15.4 cfs and 697.5 af. The second largest allocation is for the Wauna Community Association, a Group A water supplier that holds 2 certificates and 24 claims for single domestic use and fire protection with a total allocation of 1.74 cfs and 60 af. Table 28 summarizes the surface and ground water right certificates and claims.

Table 28. Wauna Area Water Rights Certifications and Claims

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Single domestic	4	0.08	3.00
	Multiple domestic	3	0.30	19.50
	Irrigation, Fire Protection	4	15.15	688.00
	Total	11	15.53	710.50
Claims	Single domestic	39	0.88	123.70
	Irrigation, stock watering	2	0.25	9.50
	Total	42	1.13	133.20
	Grand Total	53	16.66	843.70

WATER DEMAND AND EXISTING SUPPLY

Based on data from the Skamania County Assessor, there are about 70 residential structures in the Wauna area. It is estimated that 65 of these structures are part-time recreational homes. The residential homes would be using surface or groundwater during summer low flow periods and need to be accounted for in estimating future demand.

Based on the OFM estimate of 2.5 persons per household in unincorporated Skamania County, the seasonal peak population of the area could be approximately 175 people. Using the OFM high growth rates for Skamania County, the season peak could grow to 211 people in 2035, a potential increase of 15 households. This estimate may be high given land use restrictions within the CRGNSA GMA.

Since all residences are served by on-site septic systems, the estimated consumptive residential water demand in the is based on the PEW Estimator. Table 29 provides estimated daily demand and consumptive use through 2035.

Table 29. Wauna Area Estimated Water Demand

Year	Full-time		Estimated Water Demand			Consumptive Water Use		
	Population	ERUs	gpd	gpm	cfs	gpd	gpm	cfs
2015	175	70	32,472	23	0.050	21,875	15	0.034
2020	182	73	33,808	23	0.052	22,775	16	0.035
2025	193	77	35,730	25	0.055	24,070	17	0.037
2030	202	81	37,555	26	0.058	25,300	18	0.039
2035	211	85	39,202	27	0.061	26,409	18	0.041
Net Change 2015-2035	36	15	6,730	4	0.011	4,534	3	0.007

POTENTIAL STREAM FLOW DEPLETION

Over the 20-year planning period peak daily residential water demand during the months of May through September is estimated to increase by 0.011cfs and daily consumptive use by 0.007cfs. Given current land use and ownership patterns, it can be assumed that most of the future residential growth

will not occur within the Blue Creek and Ash Creek watersheds, and, therefore, would not deplete flows in the stream.

WATER AVAILABILITY

A reduction in stream flow will result in a corresponding reduction in fish habitat. The Ecology/WDFW guidance states that a 1 to 2 percent reduction in the 90% exceedance low flow would generally result in a tolerable level of habitat reduction. However, since no flow data is available for Blue and Ash creeks, it is not possible to determine the amount of water available from the creeks.

CONCLUSIONS & RECOMMENDATIONS

1. Existing water rights and permit exempt wells will not be impaired or changed by this Plan.
2. The estimated increase in water demand through 2035 of 0.007 cfs or 4,524 gpd will not have a significant impact on existing water supplies or stream flows in Ash Creek.
3. No reservations, instream flows or closures are recommended for the Wauna area.

Kanaka Creek

DESCRIPTION

Kanaka Creek is less than 2 miles in length and its watershed lies within the CRGNSA Stevenson UA. Over half of the watershed is within the Stevenson water system 20-year growth boundary, but only about a quarter of the watershed is within the city limits. The area within the city limits is primarily high (1/4 acre) to medium density (2 acre) residential use with some commercial and industrial uses. Outside the city limits, the land use is primarily medium to low density (5 acre) residential. Those lands immediately to the north of the 20-year water system boundary are zoned for a minimum lot size of 2 acres, if a lot uses a well and on site sewage disposal. A lot size of 12,500 sf is allowed if a lot is served by public water and sewer. Further north within the UA zoning, transitions to 2-acre and then 5-acre minimum lot sizes.

FISH USE

Small amounts of habitat are found along Kanaka Creek. The stream is impacted by channel modifications, passage limitations, and riparian habitat degradation associated with urbanization and road/railroad corridors along the Columbia River. Coho are documented in the lower 0.4 miles of Kanaka Creek and are presumed to be present for another 0.5 miles upstream. Low summer flows are a significant limiting factor for coho rearing. No Chinook, chum, or steelhead presence is documented.

STREAM FLOWS

Ecology has prepared hydrographs characterizing flow patterns and volumes at Kanaka Creek at RM 0.1 (figure 16).

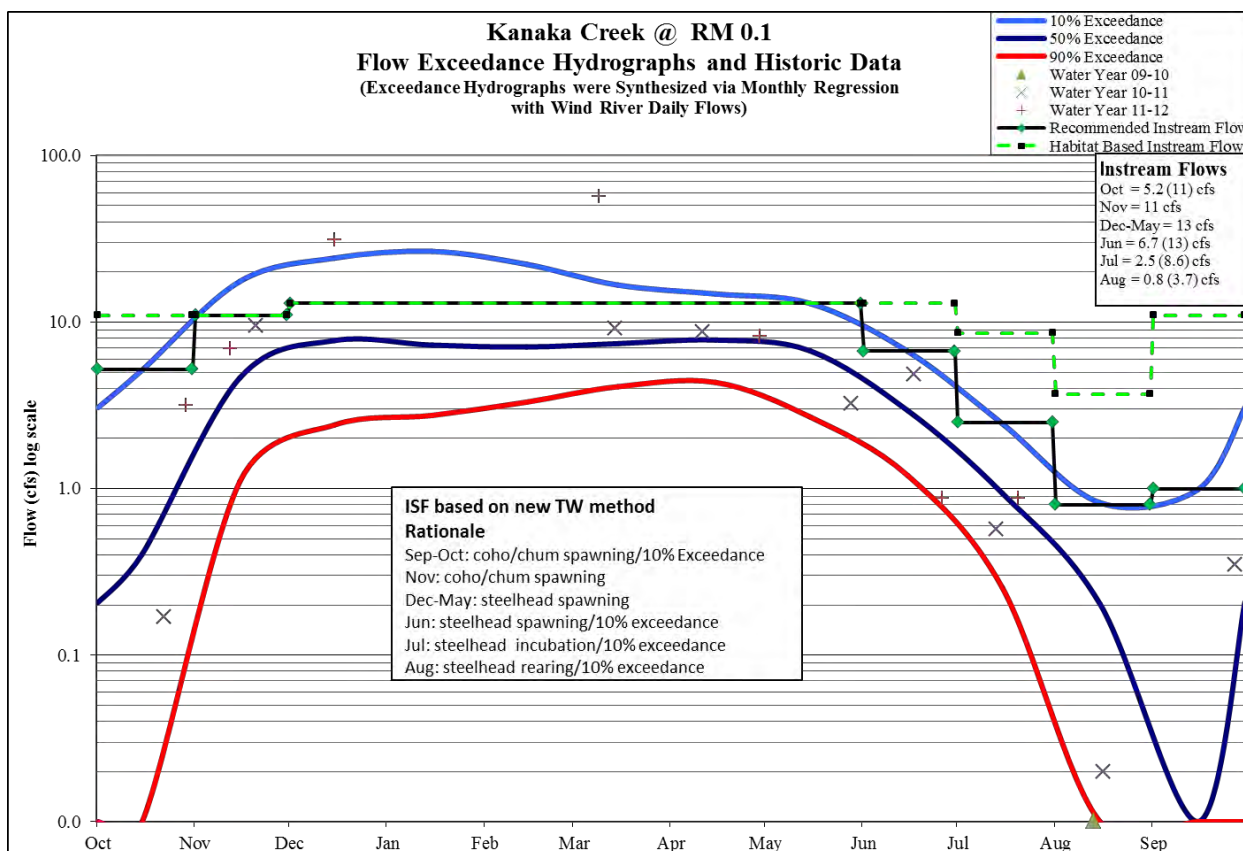


Figure 16. Kanaka Creek at RM 0.1

WATER RIGHTS & CLAIMS

Based on Ecology's Explorer, the area has a total of 26 water right certificates, 31 claims and one pending water application. Sixteen certificates, 8 claims and the application are for surface water with a total instantaneous demand of 1.13 cfs and quantity of 70.90 af. There are 9 certificates and 24 claims for ground water with a total instantaneous demand of 0.65 cfs and quantity of 109.5 af. The largest allocation of water is for domestic use, totaling 1.16 cfs and 127.9 af. The second largest allocation of water is for irrigation and fire protection. The 21 certificates and claims for these uses have a total instantaneous demand of 0.61 cfs and annual quantity of 52.5 af. Table 30 summarizes the surface and ground water right certificates and claims.

Table 30. Kanaka Area Water Rights Certification, Claims and Applications

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Single domestic	9	0.15	9.00
	Multiple domestic	7	0.63	36.50
	Irrigation	10	0.41	25.40
	Total	26	1.19	70.90
Claims	Single domestic	20	0.34	82.40
	Irrigation, stock watering	11	0.20	27.10
	Total	31	0.54	109.50
Application	Multiple domestic	1	0.04	-
	Total	1	0.04	-
	Grand Total	58	1.77	180.40

In addition to those certificates, claims, and application for water within the Kanaka Creek watershed, there are 3 certificates outside the watershed adjacent to the Columbia River. These certificates are for withdrawals or diversions of water between the river and State Route 14. They are summarized in Table 31.

Table 31. Adjacent Columbia River Area Water Rights Certification

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Single domestic	1	0.03	-
	Multiple domestic	1	0.02	8.00
	Irrigation	1	0.02	3.00
	Total	3	0.07	11.00
	Grand Total	3	0.07	11.00

WATER DEMAND AND EXISTING SUPPLY

In estimating future demand, it is assumed the Stevenson system will serve all demand within the 20-year growth boundary. The Stevenson system water source is located outside the Kanaka Creek watershed in the Rock Creek subbasin. Data provided by the City of Stevenson indicates in 2015 there are 384 parcels in the Kanaka Creek watershed that are within the 20-year water system growth boundary. Of the 384 parcels, 262 are connected to the Stevenson water system and 10 are developed but not connected to the system for a total 272 residences. The remaining 117 parcels are undeveloped. Using the Stevenson Water System Plan estimated residential growth rate of 1.7 percent per year, the number of households within the City water service area in the Kanaka watershed could increase 109 households for a total of 381. This increase demand will be met with water from the Rock Creek subbasin.

Outside the 20-year growth area, it is estimated that there are currently about 174 parcels and 84 residences. These residences are served by individual wells or small community water systems. Based

on the OFM estimate of 2.5 persons per household in unincorporated Skamania County, the population outside the 20-year growth area would be approximately 210 people in 2015. Using the OFM high growth rates for Skamania County, the population of the watershed would grow to 254 people, an increase of 18 households. The estimated increase in households seems consistent with the current land use and zoning.

It is assumed that future growth outside the 20-year Stevenson water system growth boundary will be served by permit exempt wells or small community water systems. The residential daily consumptive water use in the Kanaka Creek watershed outside the Stevenson water service boundary is calculated using 313 gpd per household estimate using the PEW Estimator. Table 32 provides estimated daily demand and consumptive use through 2035. For that area within the Stevenson water system service area see the Rock Creek subbasin summary.

Table 32. Kanaka Creek Estimated Water Daily Demand outside Stevenson 20-year Water Service Area

Year	Population	Full-time	Estimated Water Demand			Consumptive Water Use		
	ERUs		gpd	gpm	cfs	gpd	gpm	cfs
2015	210	84	38,966	27	0.060	26,250	18	0.041
2020	219	87	40,570	28	0.063	27,331	19	0.042
2025	231	92	42,876	30	0.066	28,884	20	0.045
2030	243	97	45,066	31	0.070	30,360	21	0.047
2035	254	101	47,043	33	0.073	31,691	22	0.049
Net Change 2015-2035	44	17	8,076	6	0.013	5,441	4	0.008

POTENTIAL STREAM FLOW DEPLETION

Outside the Stevenson water system service area, it is estimated that, over the 20-year planning period, the peak daily residential water demand during the months of May through September will increase by 0.013 cfs and daily consumptive use by 0.008 cfs. Based on the assumption that consumptive water use represents an immediate decrease in stream flow, the anticipated demand would reduce stream flows by 0.008 cfs.

The extension of the Stevenson water system beyond its current 20-year growth boundary would help accommodate future growth and avoid potential stream flow depletion since the system draws its water from the Rock Creek subbasin. Future homes in the Kanaka watershed connected to the city water system would not reduce Kanaka Creek flows. In some instances the extension of city water service could increase return flows to the Kanaka Creek watershed. However, it is not possible to accurately predict the timing, magnitude and duration of such offsets since they are affected by:

1. Whether an existing permit exempt well is retired and,
2. The extent to which sewer services are expanded.

For example, existing homes converted from permit exempt wells to city water would result in a return flow to the watershed of 464 gpd per household or ERU without sewer and 313 gpd with sewer service based on the PEW Estimator. For new homes served by city water where no permit exempt well

is retired, the offset would be 151 gpd per household or ERU without sewer and 0 gpd if accompanied sewer service.

Impacts to flows from any additional demand resulting from further residential development adjacent to the Columbia River will be inconsequential.

WATER AVAILABILITY

A reduction in stream flow will result in a corresponding reduction in fish habitat. The Ecology/WDFW guidance states that a 1 to 2 percent reduction in the 90% exceedance low flow would generally result in a tolerable level of habitat reduction. Ecology calculated the 90% exceedance low flow for the Kanaka Creek at RM 0.1 to be 0.010 cfs. The hydrograph for Kanaka Creek indicates that there is no surface flow in September in 50 percent or more of the years. Table 33 compares the estimated increase in stream flow depletion through 2035 with the 1% and 2% of 90% exceedance low flow. Based on the Ecology/WDFW guidance, there is insufficient water available in the Kanaka watershed to meet estimated future out-of-stream water demand through 2035.

Table 33. Kanaka Creek Water Availability

Estimated Increase in Stream Depletion through 2035 (cfs)	90% Exceedance Low Flow (Sept/Oct) (cfs)	1% of 90% Exceedance Low Flow (csf)	2% of 90% Exceedance Low Flow (cfs)
0.008	0.010	0.0001	0.0002

As noted earlier, extending Stevenson water service beyond the current 20-year service boundary could help accommodate future development in 2 ways. First, the estimated stream flow depletion is reduced for every new residence which is served by the city water system instead of a permit exempt well. Second, if the extension of city water results in the retirement of existing wells, water availability is increased within the watershed. The estimate of future consumptive water use or potential stream flow depletion is based on an increase of 17 ERUs outside the city's current 20-year service boundary by 2035. Extension of city water service to any or all of these future residences would avoid some or all of the estimated stream flow depletion. In addition, there are currently 10 residences in the Kanaka watershed within the city water service area that are not connected to the water system. If these residences were to be converted city water and sewer service, it would reduce the potential stream flow depletion by 0.005 cfs from 0.008 cfs to 0.003 cfs.

In conclusion, while there is insufficient additional water within the Kanaka watershed to meet anticipated growth through 2035, extension of the city water service and retirement of existing permit wells could ensure that existing water supplies are adequate to meet the future need.

CONCLUSIONS & RECOMMENDATIONS

1. Existing water rights and permit exempt wells will not be impaired or changed by this Plan.
2. Fish use is limited due to the effect of development, particularly in the lower reaches of Kanaka Creek.

3. The estimated increase in consumptive water demand and stream flow depletion through 2035 of 0.008 cfs or 5,170 gpd. Extension of Stevenson water services to existing homes within the service area could help reduce the potential stream flow depletion by 0.005 cfs to 0.003 cfs.
4. Based on the Ecology/WDFW guidance only 0.0002 cfs is available to meet future out-of-stream water needs. This is insufficient to meet estimated future demand.
5. To meet anticipated future demand consideration should be given to:
 - a. Extending the Stevenson water service beyond the 20-year growth boundary in the Kanaka Creek subwatershed, or
 - b. Making water from the Stevenson water system available to small community systems outside the service area through interlocal operating agreements.
6. A reservation for permit exempt wells and community water systems should be established and should be credited with 313 gpd or 0.0004 cfs for each household converted from Kanaka Creek source to the Stevenson water system; provided that wells or diversions drawing water from Kanaka Creek are decommissioned.
7. If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right.
8. Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313 gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.
9. Impacts to flows from any additional demand resulting from further residential development adjacent to the Columbia River will be inconsequential.
10. Water from reaches of the Kanaka Creek backwatered by the Columbia River or from the Columbia River or from groundwater in connection with the Columbia River and not Kanaka Creek is available for appropriation. It is not subject to any of the reservations and instream flows recommended for the Kanaka Creek watershed. Applications for such water withdrawals would be handled under routine procedures for processing water right applications.
11. Set instream flow:

Subbasin	Instream Flow*	Rationale
Kanaka Cr at RM 0.1	Oct = 5.2 (11) cfs	Sep-Oct: coho/chum spawning/10% Exceedance
	Nov = 11 cfs	Nov: coho/chum spawning
	Dec-May = 13 cfs	Dec-May: steelhead spawning
	Jun = 6.7 (13) cfs	Jun: steelhead spawning/10% exceedance
	Jul = 2.5 (8.6) cfs	Jul: steelhead rearing/10% exceedance
	Aug = 0.8 (3.7) cfs	Aug: steelhead rearing/10% exceedance

**Based on new TW method*

DESCRIPTION

Encompassing over 2000 acres, the Nelson Creek watershed falls predominately within the CRGNSA GMA. The primary land use is commercial forestry and over 85 percent of the watershed is zoned for forest use. The remaining 15 percent is zoned for residential use. This includes 150 acres in the upper watershed within the CRGNSA Stevenson UA boundary that is zoned for 5-acres residential use and about 100 acres in the lower mile of the watershed of which 40 acres are in the UA and are zoned for 12,500 lots with public water supplies and 60 acres are in the GMA and are zoned for 5-acre lots. There are 19 residences in the watershed; seven in the upper watershed and 12 in the lower watershed. There are 3 residences in the lower watershed within the UA of which 2 are served by city water.

FISH USE

Small amounts of habitat are found along Nelson Creek. The stream is impacted by channel modifications, passage limitations, and riparian habitat degradation associated with residential development and road/railroad corridors along the Columbia River. Coho are documented in the lower 0.3 miles Nelson Creek. No steelhead, Chinook, or chum presence has been documented.

STREAM FLOWS

Ecology has prepared hydrographs characterizing flow patterns and volumes at Nelson Creek at RM 0.2 (figure 17).

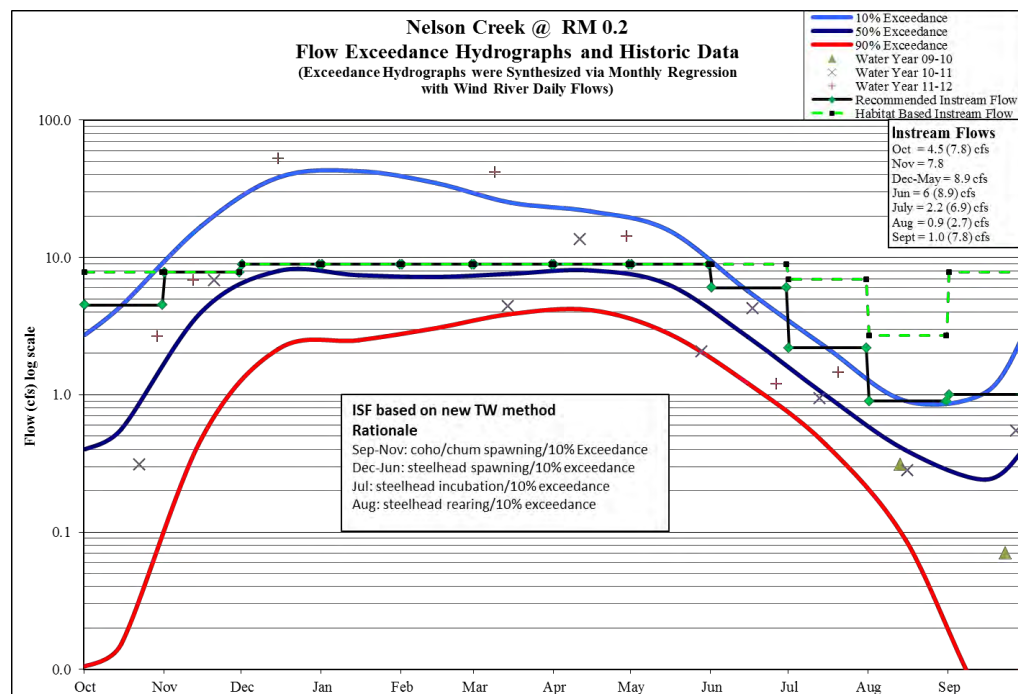


Figure 17. Nelson Creek at RM 0.2

WATER RIGHTS & CLAIMS

Based on Ecology's Explorer, Nelson Creek has a total of 14 water right certificates and 12 claims. There is one pending application. Twenty are for surface water with a total instantaneous demand of 0.68 cfs and quantity of 51.02 af. Seven are for ground water with a total instantaneous demand of 0.36 cfs and quantity of 31.1 af. The largest allocation of water is for irrigation and stock watering. The second largest group is for single domestic use with 6 certificates and 5 claims issued for 0.57 cfs and 33.10 af. All but 5 of the certificates, claims and applications are in the lower mile of the watershed (section 36, township 3 north, range 7.5 east). Table 34 summarizes the surface and ground water right certificates and claims.

Table 34. Nelson Area Water Rights Certification, Claims and Applications

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Single domestic	6	0.30	9.50
	Multiple domestic	1	0.05	1.50
	Irrigation, stock watering	7	0.33	41.00
	Total	14	0.68	52.00
Claims	Single domestic	5	0.27	23.60
	Irrigation, stock watering	3	0.08	6.50
	No Record	4		
	Total	12	0.35	30.10
Applications	Multiple domestic	1	0.01	0.02
	Total	1	0.01	0.02
	Grand Total	27	1.04	82.12

In addition to those certificates, claims, and applications for water within the Nelson Creek watershed, there are a number found outside the watershed adjacent to the Columbia River. These certificates, claims and applications are often for withdrawals or diversions of water between the river and State Route 14. They are summarized in Table 35.

Table 35. Adjacent Columbia River Area Water Rights Certification, Claims and Applications

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Single domestic	1	0.19	19.50
	Irrigation, stock watering	1	0.02	1.00
	Total	2	0.21	20.50
Claims	Single domestic	3	0.06	5.00
	Multiple domestic	3	0.14	21.21
	Irrigation, stock watering	3	0.81	508.96
	Total	9	1.01	535.17
Applications	Irrigation, stock watering	1	0.02	0.50
	Total	1	0.02	0.50
	Grand Total	12	1.24	556.17

WATER DEMAND AND EXISTING SUPPLY

It is assumed that in the future, the Stevenson water system will serve all demand in that area of the Nelson Creek watershed falling within the system's 20-year growth boundary. Outside the 20-year boundary, it is estimated there are 16 residential structures based on data from the Skamania County Assessor.

Given landownership and CRGNSA restrictions and land use and ownership patterns it is unlikely that the watershed will see significant additional residential development outside the UA. Based on the OFM estimate of 2.5 persons per household in unincorporated Skamania County, the population of the outside the UA in 2015 would be approximately 40 people. Using the OFM high growth rates for Skamania County, the population of the watershed would grow to 48 people in 2035, a potential increase of 3 households.

It is assumed that future development outside the Stevenson UA will be low density residential and that all residences in this area are and will continue to be served by on-site septic system. For this reason, the estimated consumptive residential water demand in the Nelson Creek watershed outside the Stevenson UA is based on 313 gpd per household from the PEW Estimator. Table 36 provides estimated daily demand and consumptive use through 2035. For that Nelson Creek watershed within the Stevenson water system service area see the Rock Creek subbasin summary.

Table 36. Nelson Creek Estimated Water Demand outside Stevenson UA

Year	Population	Full-time	Estimated Water Demand			Consumptive Water Use		
		ERUs	gpd	gpm	cfs	gpd	gpm	cfs
2015	40	16	7,422	5	16.5	5,008	3	0.0077
2020	42	17	7,728	5	17.2	5,214	4	0.0081
2025	44	18	8,167	6	18.2	5,510	4	0.0085
2030	46	19	8,584	6	19.1	5,792	4	0.0089
2035	48	19	8,961	6	20.0	6,046	4	0.0093
Net Change 2015-2035	8	3	1,538	1	3.4277	1038	1	0.0016

POTENTIAL STREAM FLOW DEPLETION

Outside the Stevenson water system service area, it is estimated that the peak daily residential water demand during the months of May through September will increase by 0.002cfs and daily consumptive use by 0.0016 cfs over the 20-year planning period. Based on the assumption that consumptive water use represents an immediate decrease in stream flow, the anticipated demand would reduce stream flows by 0.0016 cfs. This potential depletion may be offset in part by return flows from future residences served by the Stevenson water system, which draws its water from the Rock Creek subbasin. However, given the relatively small area of the watershed falling within the water system's 20-year growth boundary, the offset may be negligible.

Impacts to flows from any additional demand resulting from further residential development adjacent to the Columbia River will be inconsequential.

WATER AVAILABILITY

A reduction in stream flow will result in a corresponding reduction in fish habitat. The Ecology/WDFW guidance states that a 1 to 2 percent reduction in the 90% exceedance low flow would generally result in a tolerable level of habitat reduction. Ecology calculated the 90% exceedance low flow for the Nelson Creek at RM 0.2 to be 0.006 cfs. Table 37 compares the estimated increase in stream flow depletion through 2035 with the 1% and 2% of 90% exceedance low flow. Based on the Ecology/WDFW guidance, there is insufficient water available to meet estimated future out-of-stream water consumptive water use of 0.0013 cfs in 2035. Demand exceeds available water by 0.0015cfs or 969 gpd.

Table 37. Nelson Creek Water Availability

Estimated Increase in Stream Depletion through 2035 (cfs)	90% Exceedance Low Flow (Sept) (cfs)	1% of 90% Exceedance Low Flow (cfs)	2% of 90% Exceedance Low Flow (cfs)
0.0016	0.006	0.00006	0.0001

CONCLUSIONS & RECOMMENDATIONS

1. Existing water rights and permit exempt wells will not be impaired or changed by this Plan.
2. The estimated increase in consumptive water demand through 2035 is 0.0016 cfs or 1038 gpd.
3. Water from reaches of the Nelson Creek backwatered by the Columbia River or from the Columbia River or from groundwater in connection with the Columbia River and not Nelson Creek is available for appropriation. It is not subject to any of the reservations and instream flows recommended for the Nelson Creek watershed. Applications for such water withdrawals would be handled under routine procedures for processing water right applications.
4. Based on the Ecology/WDFW guidance, there is insufficient water available in the Nelson Creek subwatershed to meet estimated future demand. Future water needs could be met through extension of the Stevenson water service or through drawing from water in connection with the Columbia River.
5. If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right.
6. Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313 gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.

7. A reservation for permit exempt wells and small community water systems should be established and credited water made available due to the voluntary abandonment of a permitted or permit exempt water right.
8. Impacts to flows from any additional demand resulting from further residential development adjacent to the Columbia River will be inconsequential.
9. Set the following instream flows:

Subbasin	Instream Flow*	Rationale
Nelson at RM 0.2	Oct = 4.5 (27) cfs	Sep-Nov: coho/chum spawning/10% Exceedance
	Nov = 20 (27) cfs	Dec-Jun: steelhead spawning/10% exceedance
	Dec = 38 (48) cfs	Jul: steelhead incubation/10% exceedance
	Oct = 4.5 (7.8) cfs	Aug: steelhead rearing/10% exceedance
	Nov = 7.8 cfs	
	Dec-May = 8.9 cfs	
	Jun = 6 (8.9) cfs	
	July = 2.2 (6.9) cfs	
	Aug = 0.9 (2.7) cfs	
	Sept = 1.0 (7.8) cfs	

**ISF based on old TW method*

Carson Creek

DESCRIPTION

The Carson Creek watershed falls within the CRGNSA GMA with the exception of the lower 0.75 miles of the creek that is adjacent to or within the Carson UA and Carson water system service area. Within the UA the land use is residential with some commercial uses occurring along Wind River Highway. Outside the UA, the predominant land use is combination of commercial and small forest lands.

FISH USE

Small amounts of habitat are found along lower Carson Creek. The stream is impacted by channel modifications, passage limitations, and riparian habitat degradation associated with urbanization and road/railroad corridors along the Columbia River. Coho are documented in the Carson Creek below State Route 14. About 0.8 miles of blocked potential coho habitat exists above State Route 14. Winter steelhead have been documented in the lower 0.5 miles of Carson Creek. Potential habitat above that point is blocked. No Chinook or chum presence has been documented in Carson Creek.

STREAM FLOWS

Ecology has prepared hydrographs characterizing flow patterns and volumes at Carson Creek at RM 0.5 (figure 18).

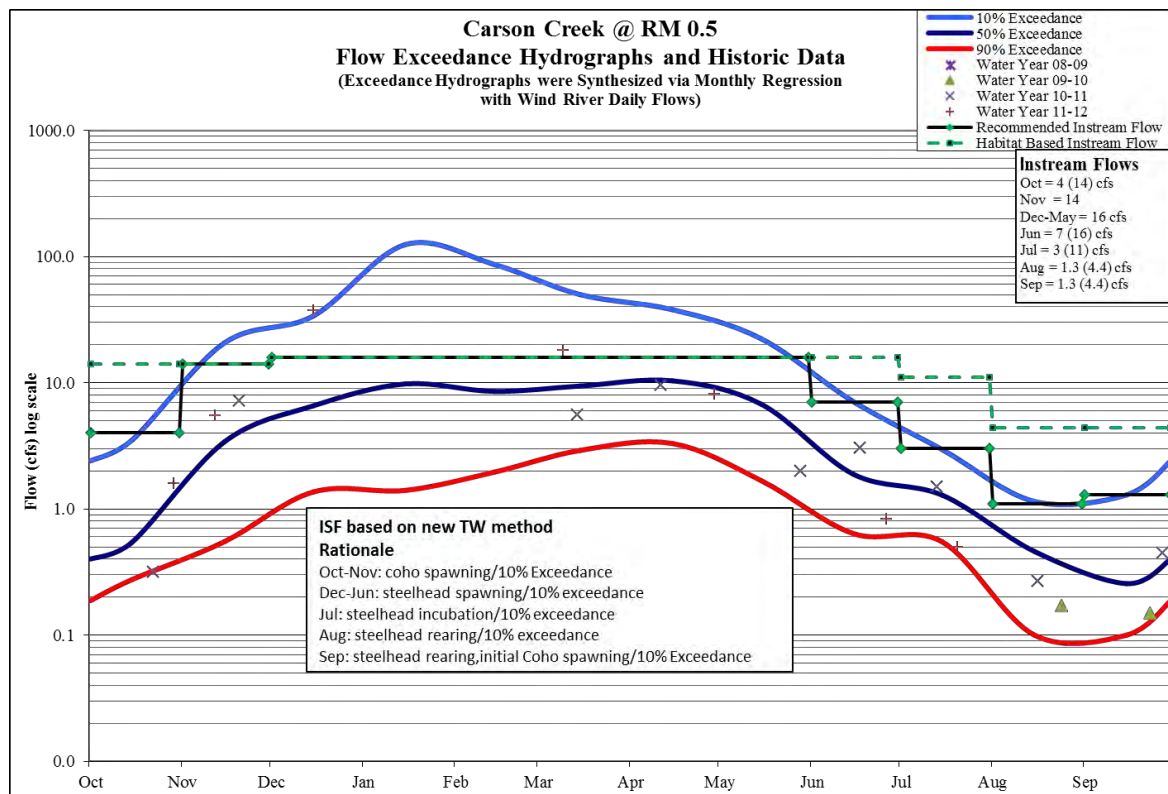


Figure 18. Carson Creek at RM 0.5

WATER RIGHTS & CLAIMS

Based on Ecology's Explorer, Carson Creek has a total of 2 water right certificates and 11 claims. There is one pending water right application. The largest allocation of water is for irrigation and fire protection often associated with small domestic use. All 14 are for surface water rights. They are summarized in Table 38.

Table 38. Carson Area Water Rights Certification, Claims and Applications

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Single domestic	2	0.03	4.40
	Total	2	0.03	4.40
Claims	Single domestic	2	0.04	3.00
	Multiple domestic	2	0.06	1.16
	Irrigation, stock watering	6	0.07	17.74
	Total	11	0.17	21.90
	Grand Total	14	0.33	30.30
Applications	Irrigation, stock watering	1	0.13	4.00
	Total	1	0.13	4.00

In addition to those certificates, claims, and applications for water within the Carson Creek watershed, there are a number found outside the watershed adjacent to the Columbia River. These certificates, claims and applications are often for withdrawals or diversions of water between the river and State Route 14. They are summarized in table 39.

Table 39. Adjacent Columbia River Area Water Rights Certification and Applications

Record Type	Use	No. of Records	Instantaneous Demand (Qi cfs)	Quantity Qa (af)
Certificate	Single domestic	3	0.03	-
	Multiple domestic	1	0.02	2.00
	Irrigation, stock watering	3	0.46	21.00
	Total	7	0.51	23.00
Applications	Irrigation	1	0.01	0.50
	Total	1	0.01	0.50
	Grand Total	8	0.52	23.50

WATER DEMAND AND EXISTING SUPPLY

It is assumed that in the future, the Carson water system will serve all demand in that area of the Carson Creek watershed falling within the system's service area. The Carson water system draws water from the Wind River subbasin.

Outside the service area, it is assumed that any future residential use would use permit exempt wells. It is estimated there are 8 residential structures in this area based on data from the Skamania County Assessor. Given landownership and CRGNSA restrictions it is unlikely that the watershed will see significant additional residential development. Moreover, any further residential growth will likely occur near or adjacent to the Carson UA. Based on the OFM estimate of 2.5 persons per household in unincorporated Skamania County, the population of the area in 2015 would be approximately 20 people. Using the OFM high growth rates for Skamania County, the population of the watershed would grow to 24 people in 2035, a potential increase of 2 households.

Since all residences are served by on-site septic systems, the estimated consumptive residential water demand in the Carson Creek watershed, outside the Carson water system service area, is based on the PEW Estimator. Table 40 provides estimated daily demand and consumptive use through 2035. Estimated water demand and consumptive use for that portion of the Carson Creek watershed, within the Carson water system service area, can be found in the Wind River subbasin summary.

Table 40. Carson Creek Watershed Estimated Water Demand Outside Carson Water Service Area

Year	Full-time		Estimated Water Demand			Consumptive Water Use		
	Population	ERUs	gpd	gpm	cfs	gpd	gpm	cfs
2015	20	8	3711	2.6	0.006	2500	1.7	0.0039
2020	21	8	3864	2.7	0.006	2603	1.8	0.0040
2025	22	9	4083	2.8	0.006	2751	1.9	0.0043
2030	23	9	4292	3.0	0.007	2891	2.0	0.0045
2035	24	10	4480	3.1	0.007	3018	2.1	0.0047
Net Change 2015-2035	4	2	769	0.5	0.001	518	0.4	0.0008

Additional development along the Columbia River is constrained by topography and CRGNSA and county land use regulations. It is unlikely that future development will result in a substantial increase in water demand.

POTENTIAL STREAM FLOW DEPLETION

Outside the Carson water system service area, the peak daily residential water demand area during the months of May through September is estimated to increase by 0.001cfs and daily consumptive use or potential stream flow depletion by less than 0.0008 cfs over the 20-year planning period.

Further increases in water use within the Carson water system service area will likely more than offset the consumptive use outside the service area. Water used within the Carson water system service area is imported from outside the Carson Creek watershed. Any return flows from on-site septic systems and irrigation infiltration within Carson water system service area would potentially increase flows in the lower 0.75 miles of Carson Creek.

It is estimated that there are approximately 200 residential structures within the Carson Creek watershed and the Carson water system supply area in 2015. It is assumed that the number of households in this area will grow to 242 by 2035 based on the OFM high growth rates for Skamania County.

The water system plan states that the average peak month daily demand is 428 gpd per ERU. Using the PEW Estimator, it is estimated that 33 percent of this total demand is returned to the ground through on-site septic systems. Based on this information, the Carson water system would return an additional 0.009 cfs to the Carson Creek watershed by 2035. This amount would be more than 10 times greater than the anticipated increase in consumptive use outside the Carson water system service area.

As shown in table 41, over the twenty-year planning period, estimated growth in the Carson Creek watershed could increase return flows to the Carson Creek watershed by 0.0092 cfs.

Table 41. Carson Creek Watershed Estimated Stream Flow Depletion.

Year	Consumptive use outside Carson Service Area	Return Flow within Carson Service Area	Potential Flow Depletion
2015	0.0039	0.0437	(0.0398)
2020	0.0040	0.0461	(0.0421)
2025	0.0043	0.0483	(0.0440)
2030	0.0045	0.0505	(0.0460)
2035	0.0047	0.0529	(0.0482)
Net Change 2015-2035	0.0008	0.0092	(0.0084)

WATER AVAILABILITY

A reduction in stream flow will result in a corresponding reduction in fish habitat. The Ecology/WDFW guidance states that a 1 to 2 percent reduction in the 90% exceedance low flow would generally result in a tolerable level of habitat reduction. Ecology calculated the 90% exceedance low flow for the Carson Creek at RM 0.4 to be 0.10 cfs. Table 42 compares the estimated increase in stream flow depletion through 2035 with the 1% and 2% of 90% exceedance low flow. Based on the Ecology/WDFW guidance, estimated future out-of-stream water demand through 2035 should not result in a significant reduction in stream flow or habitat available. A reservation of 0.001 cfs or 1 percent of the 90 percent exceedance low is recommended for 2 additional households outside the Carson water system service area.

Table 42. Carson Creek Water Availability

Estimated Increase in Stream Depletion through 2035 (cfs)	90% Exceedance Low Flow (Sept) (cfs)	1% of 90% Exceedance Low Flow (cfs)	2% of 90% Exceedance Low Flow (cfs)
(0.008)	0.100	0.001	0.002

CONCLUSIONS & RECOMMENDATIONS

1. Existing water rights and permit exempt wells will not be impaired or changed by this Plan.
2. The Carson water system service within the Carson Creek subwatershed could generate a net positive water inflow to the watershed of 0.0084 cfs.
3. The estimated increase in consumptive water demand through 2035 of 0.0008 cfs or 518 gpd will not have a significant impact on existing water supplies or stream flows in Carson Creek.
4. Reserve 0.001 cfs for estimated future growth in the Carson Creek watershed outside the Carson water system service area. This reservation would be sufficient to support 2 additional households.

5. Water from reaches of the Carson Creek backwatered by the Columbia River or from the Columbia River or from groundwater in connection with the Columbia River and not Carson Creek is available for appropriation. It is not subject to any of the reservations and instream flows recommended for the Carson Creek watershed. Applications for such water withdrawals would be handled under routine procedures for processing water right applications.
6. If a water right is being voluntarily abandoned and is not transferred or used to satisfy a pending water right application pursuant to state regulations, Ecology will attempt to transfer the water right into the reservation or a mitigation bank. The reservation or mitigation bank will be credited with the actual amount of water being abandoned based on Ecology's determination of the extent and validity of the right.
7. Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation shall be credited with 313 gpd/household. In lieu of crediting the reservation, an abandoned or retired permit exempt groundwater right can be consolidated with a valid water right certificate or permit for groundwater pursuant to the provisions of RCW 90.44.105.
8. Impacts to flows from any additional demand resulting from further residential development adjacent to the Columbia River will be inconsequential.
9. Set the following instream flows:

Subbasin	Instream Flow	Rationale
Carson Cr @ RM 0.5	Oct = 4 (14) cfs	Oct-Nov: coho spawning/10% Exceedance
	Nov = 14 cfs	Dec-Jun: steelhead spawning/10% exceedance
	Dec-May = 16 cfs	Jul: steelhead incubation/10% exceedance
	Jun = 7 (16) cfs	Aug: steelhead rearing/10% exceedance
	Jul = 3 (11) cfs	Sep: steelhead rearing, initial coho spawning/10% exceedance
	Aug = 1.3 (4.4) cfs	
	Sep = 1.3 (4.4) cfs	

**Based on new TW method*

Dog and Collins Creeks

DESCRIPTION

Dog Mountain contains the thickest (over 4,000 feet) section of Grande Ronde Basalt in western Washington. It is located on the Columbia River at RM 161, 13 miles upstream of Stevenson. Just downstream from Dog Mountain is Wind River and Wind Mountain. Upstream lies Cook Hill and the Little White Salmon River. The Dog Creek area contains 2 Columbia River tributaries, Dog Creek and Collins Creek.

With the exception of a Girl Scout camp, a timber inholding and 2 residential structures, the Collins Creek watershed is owned by the US Forest Service. The entire Dog Creek watershed is held by the US Forest Service. Scattered residences are found along the Columbia River from Wind Mountain on the

west to the Little White Salmon subbasin on the east with most located in the community of Cook. Outside the community of Cook, the Dog Creek area is within a CRGNSA Special Management Area (SMA) which essentially precludes further residential development and commercial development.

FISH USE

Collins Creek (Columbia RM 157.9) has a culvert under the railroad that may create a partial passage barrier. Passage may be limited at the mouth of Dog Creek due to sediment buildup and by a falls just upstream of State Route 14. Small amounts of habitat are found in Dog Creek. The stream is impacted by channel modifications, passage limitations, and riparian habitat degradation associated with road/railroad corridors along the Columbia River. Winter steelhead and coho have been documented in the lower mile of Collins Creek and are presumed to be present further upstream. Chinook, and chum salmon are not documented in Collins Creek. Chinook and summer steelhead are documented in the lower mile of Dog Creek. The presence and spawning of winter steelhead is documented in the lower 0.4 miles of Dog Creek and their presence is presumed to extend another 0.6 miles upstream. Coho are present in the lower 0.1 of mile of Dog Creek. No chum salmon have been documented in Dog Creek.

STREAM FLOWS

No streamflow records are available for Dog and Collins creeks.

WATER RIGHTS & CLAIMS

Water rights and claims within the Dog Creek area and divided into three categories. Those rights and claims within the Dog watershed, those within the Collins watershed, and those adjacent to the Columbia River.

Based on Ecology's Explorer, Dog Creek has a total of 1 water right certificate and 1 claim. The water right certificate was issued to Spokane, Portland and Seattle Railroad in 1928 for "domestic use and locomotive supply." The claim is for surface water near the mouth of Dog Creek for the purposes of irrigation, fire protection and stock watering. Table 43 summarizes the surface and ground water right certificates and claims in the Dog Creek watershed.

Table 43. Dog Creek Watershed Water Rights Certifications and Claims

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Railway	1	0.50	-
	Total	1	0.50	-
Claims	Irrigation, stock watering	1	11.50	4.50
	Total	1	11.50	4.50
	Grand Total	2	12.00	4.50

Collins Creek has a total of 8 water right certificates, 10 claims and 2 pending applications. The certificates were issued in the 1940's and 50's. The claims were filed in the 1970's. The water right applications were filed after 2000. One is for the Girl Scout camp and the other is for wildlife

restoration. The largest water use category is for irrigation and stock watering. Table 44 summarizes the surface and ground water right certificates and claims in the Collins Creek watershed.

Table 44. Collins Creek Watershed Water Rights Certifications, Claims and Applications

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Single domestic	2	0.01	1.00
	Multiple domestic	3	0.35	-
	Irrigation, fire, stock watering	3	0.37	28.00
	Total	8	0.73	29.00
Claims	Irrigation, stock watering	10	7.18	329.00
Applications	Multiple domestic	1	0.16	
	Wildlife	1	-	
	Total	2	0.16	-
	Grand Total	20	8.07	358.00

The Dog Creek area includes 5 miles of the Columbia River shoreline. There are 10 water right certificates, 1 permit, and 3 claims adjacent to the Columbia River and outside either the Collins or Dog creek watersheds. Water sources for these certificates and claims include the Columbia River, small unnamed streams and springs often between State Route 14 and the river. Table 45 summarizes these Columbia River adjacent surface and ground water right certificates and claims.

Table 45. Columbia River Adjacent Water Rights Certifications, Permits and Claims

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Single Domestic	2	0.02	-
	Irrigation, stock watering	8	0.45	51.75
	Total	10	0.47	51.75
Claims	Single Domestic	3	0.05	4.20
	Total	3	0.05	4.20
Permit	Single Domestic	1	0.11	6.00
	Total	1	0.11	6.00
	Grand Total	14	0.63	61.95

WATER DEMAND AND EXISTING SUPPLY

Given the absence of residences and the nature of the existing water right and claim, it is assumed that water demand within the Dog Creek watershed is negligible. Further, given that watershed is almost exclusively in public ownership and located in the CRGNSA SMA, it is unlikely that there will be a demand for additional water in the future.

In the Collins Creek watershed, the Girls Scout camp is the single most significant water user. No data is available regarding current water use. The Girl Scouts currently have 3 water right certificates with a total allowable instantaneous demand from Collins Creek of 0.35 cfs and a pending application for

an additional groundwater withdrawal with an instantaneous demand of 0.16 cfs. The extent and validity of irrigation and stock watering certificates and claims is uncertain given that the US Forest Service has acquired most of the private land in the watershed. Given that watershed is almost exclusively in public ownership and located in the CRGNSA SMA, it is unlikely that there will be a demand for additional water in the future beyond the pending Girl Scout application.

Those lands outside the Collins and Dog Creek watersheds are also within the SMA making it unlikely that there will be any significant future demand for water. Existing residential development is located primarily between State Route 14 and the Columbia River. Any growth in these areas will be negligible and water supplies for these uses will likely continue to come from the Columbia River, small unnamed tributary streams and groundwater in connection with the Columbia River.

POTENTIAL STREAM FLOW DEPLETION

Given that it is unlikely there will be a demand for additional water in the Dog Creek watershed, the potential for additional streamflow depletion is very low to non-existent. It is unlikely that there will a significant potential for additional stream flow depletion in Collins Creek with the possible exception of pending application by the Girl Scouts for a groundwater withdrawal with an instantaneous demand of up to 0.16 cfs. It is assumed that there will be no significant demand for additional water in those areas adjacent to the Columbia River and any impact of Columbia River flows would be negligible.

WATER AVAILABILITY

A reduction in stream flow will result in a corresponding reduction in fish habitat. The Ecology/WDFW guidance states that a 1 to 2 percent reduction in the 90% exceedance low flow would generally result in a tolerable level of habitat reduction. It is not possible to determine the 90% exceedance low flow and the amount of available water in the Collins and Dog creek watersheds since no stream flow records or analysis is available. However, given the relatively small size of these streams and watersheds it can be expected that summer flows may significantly limit water availability. Given that there is little potential for additional water demand in the Dog Creek watershed, water availability is probably not an issue. However, the Girl Scout request for an additional instantaneous demand of up to 0.16 cfs could have a significant impact on low flows in Collins Creek.

CONCLUSIONS

1. Existing water rights and permit exempt wells will not be impaired or changed by this Plan.
2. No instream flows or water reservations are proposed.
3. It is assumed that, given the relatively small size of their watersheds, Dog and Collins experience low summer flows that would significantly limit water availability. Any future water right applications should be carefully evaluated to determine their potential impact on stream flows.
4. Given public land ownership and CRGNSA land use restrictions, it is very unlikely that any significant development and accompanying demand for water will occur in the Dog Creek watershed or in those areas adjacent to the Columbia River.

5. The pending Girl Scout water right application could, if granted, have a significant impact on summer low flows in Collins Creek. The potential depletion of such a withdrawal should be carefully evaluated. The adequacy of current water rights to meet the additional needs of the Girl Scout camp should be considered.

Home Valley

DESCRIPTION

The Home Valley area encompasses more than 600 acres and extends from the Wind River subwatershed on the west to the Wind Mountain to east. It is bound on the north by the Little Wind River watershed and the Columbia River on south. It rises from an elevation of 100 feet at the Columbia River to over 400 feet. Within the Home Valley community there are two small streams (Wilson/unnamed). Both are tributaries to the Columbia River and are little more than a mile in length.

The area falls within the CRGNSA Home Valley UA. The primary land use north of State Route 14 is residential. South of State Route 14 along the Columbia River land uses are industrial (High Cascade veneer mill) and, recreational (county park).

FISH USE

Coho salmon, listed as threatened under the ESA, have been documented in the first half mile of each stream. The Recovery Plan notes that Upper Gorge coho is Primary population with an improvement goal of high viability providing for a 95% chance of persistence over 100 years.

STREAM FLOWS

No streamflow records are available the Home Valley area.

WATER RIGHTS & CLAIMS

Based on Ecology's Explorer, the Home Valley area has a total of 17 water right certificates, 1 permit and 19 claims. The largest allocation of water is for commercial/industrial use with a total maximum instantaneous demand of 0.92 cfs and an annual quantity of up to 282 af. The second largest allocation is irrigation and stock watering with a total maximum instantaneous demand of 0.63 cfs and an annual quantity of up to 229 af. There are 18 certificates, permits and claims for surface water and 9 for ground water. Table 46 summarizes the surface and ground water right certificates, permits and claims in Home Valley.

Table 46. Home Valley Watershed Water Rights Certifications, Claims and Permits

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Single domestic	6	0.14	14.60
	Multiple domestic	5	0.23	16.00
	Irrigation, fire	2	0.13	22.50
	Commercial/Industrial	4	0.62	62.00
	Total	17	1.12	115.10
Claims	Single domestic	7	0.13	21.60
	Multiple domestic	5	0.44	23.00
	Irrigation, stock watering	5	0.32	178.50
	Commercial/Industrial	2	0.30	220.00
	Total	19	1.19	443.10
Permits	Irrigation, stock watering	1	0.18	28.00
	Total	1	0.18	28.00
	Grand Total	36	2.49	586.20

WATER DEMAND AND EXISTING SUPPLIES

Home Valley is served by a public water system. The Home Valley Water District holds a right within the Little Wind River Watershed (Blyn Springs) to withdraw 63.5 acre feet annually at a maximum rate of 0.5 cfs. At this time the District is not fully utilizing its right. In addition to the water system it is likely that some portion of the current demand for is being served by other private sources given the number of water rights and claims outstanding in Home Valley.

The water district is currently updating its water system plan, but the revised draft was not available for use in this plan. Instead, the draft 2001 Home Valley Water District Water Supply Plan was used to estimate current and anticipated demand. Further in estimating future demand it is assumed that all households will be served by the water system, but that the county park and High Cascade veneer plant will draw from their own dedicated sources.

The annualized population growth rate used in the water supply plan for 2005 through 2019 is approximately 2.0 percent. Based on this rate, the estimated service population in 2015 is 476. Although this estimate may overstate the actual population of the water district, it is used as the baseline for estimating population growth and potential water needs through 2035. Using the OFM 2012 high range growth rates for unincorporated Skamania County, the water district population could grow from 476 in 2015 to 575 people or 192 households by 2035. This would be an increase of 33 ERUs based on the water system plan's estimate of 3 people per household. The plan uses 800 gallons per ERU as MDD and 275 gallons per ERU as ADD. Using this information, the Water District maximum consumptive use would increase from 0.25 cfs in 2015 to 0.29 cfs in 2035. This rate is well below 0.5 cfs maximum allowed in the water right. However, the District could reach the maximum annual quantity of 63.5 af of its water right by 2020 and could exceed it by 9.3 af by 2035. To accommodate future growth additional water sources will be required. Table 47 summarizes the estimated Home Valley Water District population growth and estimated water needs from 2015 through 2035.

Table 47. Estimated Home Valley Demand Based on Draft Water System Plan

Year	Population	Residential ERU's	Non-Residential & Loss	Total ERUs	Max Daily Demand		Annual Quantity
					gpm	cfs	
2015	476	159	45	204	113	0.25	62.6
2020	496	165	45	210	117	0.26	64.7
2025	524	175	45	220	122	0.27	67.5
2030	551	184	45	229	127	0.28	70.3
2035	575	192	45	237	131	0.29	72.8
Net Change 2015-2035	99	33	0	33	18	0.04	10.1

POTENTIAL STREAM FLOW DEPLETION

The Home Valley water system currently draws its water from the Little Wind River watershed. Assuming the water district fully utilizes its current water right to satisfy estimated growth, stream flow depletion in the Little Wind River could reach 0.04 cfs. No hydrogeologic analysis has been conducted within the Home Valley area nor have the flows in its 2 small tributary streams been analyzed. Given that Home Valley is located on the Columbia River and most development is located less than 0.75 of a mile from the river, much of the groundwater in the area may be in connection with the river or the two small tributary streams. Any depletion in Columbia River flows from additional water withdrawals or diversions within Home Valley would be inconsequential. Without additional analysis it is not possible to estimate the extent to which additional water withdrawals could affect flows in the tributaries.

WATER AVAILABILITY

A reduction in stream flow will result in a corresponding reduction in fish habitat. The Ecology/WDFW guidance states that a 1 to 2 percent reduction in the 90% exceedance low flow would generally result in a tolerable level of habitat reduction. Based on this guidance no additional water would be available in the Little Wind River watershed beyond the water district's current Blyn springs water right to meet the future needs of Home Valley. It is not possible to determine the 90% exceedance low flow and the amount of available water in the 2 small tributary streams since no stream flow records or analysis is available. There is sufficient water in connection with the Columbia River to meet the communities future needs.

CONCLUSIONS

1. Existing water rights and permit exempt wells will not be impaired or changed by this Plan.
2. No instream flows or water reservations are proposed.
3. It is assumed that, given the relatively small size of these subwatersheds, the 2 small tributary streams likely experience low summer flows that would significantly limit water

availability. Any future water right applications should be carefully evaluated to determine their potential impact on stream flows.

4. The Home Valley Water District current Blyn Springs water right will likely not be sufficient to meet the communities projected growth. The district should pursue development of a water source in connection with the Columbia River to meet its future needs.

Underwood

DESCRIPTION

The Underwood area encompasses the south facing slopes of Underwood Mountain from the Little White River subbasin on the west to the White Salmon River subbasin on the east. The area has no significant Columbia River tributaries. Steep bluffs parallel the Columbia River. Orchards and other agricultural lands and rural residential development characterize the slopes of Underwood Mountain above the bluffs. State Route 14 and the railroad run along the Columbia River below the bluffs. There is scattered residential development in this area. The Spring Creek National Fish Hatchery and recreational sites are located on Columbia River as is the former Broughton lumber mill.

FISH USE

The Columbia River in the Underwood area serves as migration corridor for juvenile and adult salmon and steelhead. There is no documented spawning or rearing use by salmon and steelhead in the smaller streams.

STREAM FLOWS

No streamflow records are available Underwood area.

WATER RIGHTS AND CLAIMS

Based on Ecology's Explorer, the area has a total of 16 water right certificates, 1 permit, 18 claims and 1 pending application. Five certificates, 1 permit and 11 claims are for groundwater with a total instantaneous demand of 3.80 cfs and an annual quantity of 1,018.5 af. Eleven certificates, 7 claims and 1 application are for surface water with a total instantaneous demand of 27.84 cfs and an annual quantity of 272.79 af. Table 48 summarizes the surface and ground water right certificates and claims.

Table 48. Underwood Area Water Rights Certification, Claims, Permits and Applications

Record Type	Use	No. of Records	Instantaneous Demand Qi (cfs)	Quantity Qa (af)
Certificate	Single domestic	4	0.06	2.50
	Multiple domestic	3	0.23	13.00
	Fish Propagation	5	29.37	568.00
	Irrigation, stock watering	3	0.09	10.94
	Municipal	1	0.60	166.00
	Total	16	30.36	760.44
Claims	Single domestic	8	0.40	243.00
	Multiple domestic	4	0.20	111.00
	Irrigation, stock watering, Hwy	6	0.38	9.00
	Total	18	0.98	363.00
Permit	Municipal	1	-	158.00
	Total	1	-	158.00
Applications	Irrigation, stock watering	1	0.30	9.85
	Total	1	0.30	9.85
	Grand Total	36	31.64	1291.29

The largest allocation of water is for fish propagation at the Spring Creek National Fish Hatchery with a maximum rate of withdrawal of 29.37 cfs and an annual quantity of 568 af. The hatchery draws water from the Columbia River and unnamed creeks and springs adjacent to the Columbia River. This use is not consumptive.

The second largest allocation of water is for the Underwood water system operated by the Skamania PUD. The system service area encompasses most of the Underwood watershed and a nearly equal area in the White Salmon subbasin. The water system draws water from Shaddox and Galligan springs and a well adjacent to the Columbia River in section 30, township 3 north, range 10 east. The PUD water rights provide for a total instantaneous withdrawal of 270 gpm or 0.60 cfs and an annual quantity of 324 af.

WATER DEMAND AND EXISTING SUPPLIES

The 2013 Underwood Water System Plan³⁰ (WSP) update stated the water system had 370 connections in 2011, serving an estimated population of 999. Under county and CRGNSA regulations limits, the estimated maximum number of buildable lots within the service area is 461. It further estimated that full buildout would be reached by 2029, increasing the number of service connections by 61 to a total of 461. Based on the number of connections and water production between 2006 and 2011, the water system plan establishes an average daily (ADD) of 450 gpd and a maximum daily demand of 900 gpd. Table 49 compares estimated water supply requirements to available supply under existing water rights.

³⁰ Wallis Engineering, 2013

At full buildout, the annual quantity allowed by the existing water rights would be more than sufficient to meet anticipated needs, but the instantaneous withdrawal rate would not. The WSP recommends that Skamania County PUD seek to increase the instantaneous withdrawal rate of its Shaddox spring water right to meet the anticipated demand.

The Underwood water system does not supply most of the area between the base of the bluffs and the Columbia River. With the exception of the possible redevelopment of the Broughton mill site for commercial tourist use, topography and county and CRGNSA land use regulations will limit future development. There are currently 15 certificates and 6 claims for water in this area. Most draw from wells or springs adjacent to the Columbia River. It is assumed that any future water need in this area will likely draw from water in connection with the Columbia River.

Table 49. Underwood Water System – Required and Available Water Supplies

Year	Population	System Connections	Required Supply		Available Supply	
			Instantaneous Demand (cfs)	Annual Quantity (af)	Instantaneous Demand (cfs)	Annual Quantity (af)
2011	999	370	0.54	187	0.60	324
2017	1072	397	0.58	200	0.60	324
2029	1245	461	0.68	232	0.60	324
Net Change 2011-2029	246	91	0.13	46	0.00	0.00

POTENTIAL STREAM FLOW DEPLETION

There are no significant tributaries to the Columbia River within the Underwood watershed area. No hydrogeologic analysis was conducted for the area during the watershed planning process. It is assumed that withdrawals in that area between the Columbia River and the base of the Underwood bluff would likely be from surface or groundwater in connection with the Columbia River and any flow depletion would inconsequential.

WATER AVAILABILITY

There are no significant tributaries to the Columbia River within the Underwood watershed area. Current and future water uses in the area will not have significant impact on stream flows or available fish habitat.

CONCLUSIONS

1. Existing water rights and permit exempt wells will not be impaired or changed by this Plan.
2. No instream flows or water reservations are proposed.

3. There are no significant tributaries to the Columbia River within the Underwood subwatershed area.
4. Future water withdrawals will have no significant impact on stream flows or fish.
5. Future development is limited by CRGNSA and county land use regulations.
6. The Skamania County PUD will seeks to increase the instantaneous withdrawal rate of its Shaddox spring water right to meet the anticipated demand.

CHAPTER III. WATER QUALITY

3.1 INTRODUCTION

3.2 SEPTIC SYSTEMS

3.3 ROAD MAINTENANCE

3.4 VEGETATION MANAGEMENT

3.5 STORMWATER MANAGEMENT

3.6 MONITORING

3.7 ACTIONS

3.1 INTRODUCTION

Water quality either reflects or affects virtually every habitat characteristic in a watershed and stream function. These factors can have wide ranging effects on fish populations (e.g. temperature changes/alters species distribution and persistence) as well as discrete point source impacts (e.g. chemical discharge at lethal toxicity levels).

The Planning Unit believes the following measures should be addressed to help improve water quality.

- Septic System Improvements
- Road Maintenance as it pertains to water quality and sediment
- Vegetation Management
- Stormwater Management
- Water Quality Monitoring

3.2 SEPTIC SYSTEMS

Sewage typically contains high levels of nitrogen. Even with new technologies, on-site sewage (septic) treatment systems generally have limited ability to remove nitrogen from wastewater. This can result in increased nitrate concentrations, or "nitrogen loading" in ground and surface water. High nitrate levels in drinking water can affect human health and excess nitrogen fuels the growth of algae. As algae dies and decays, it consumes oxygen. This process contributes to the depletion of dissolved oxygen and can harm aquatic life.

Septic system failure can be caused by bad system design, improper maintenance, or simply because the system has reached the end of its life expectancy. In some cases system owners may be unaware the system is failing. DOH provides guidance³¹ for maintaining both on-site septic systems (up to 3,500 gal/day) and large on-site septic systems that serve 10 to 370 individual residences.³² Do-it-Yourself

³¹ <http://www.doh.wa.gov/CommunityandEnvironment/WastewaterManagement>

³² Chapter 246-272A WAC

System Inspection and a short course, Septic System 101, are available on the DOH website. The Planning Unit has identified several recommendations pertaining to septic system management:

- Expand efforts to assess fecal coliform in areas of concern
- Continue research to improve septic system operation
- Consider establishing community septic/sewer systems
- Pursue funding to establish incentives for sewer or septic system upgrade and repair
- Support preparation of an action plan to upgrade failing and out-of-compliance septic systems
- Consider adopting an ordinance to require septic inspection or certification upon the sale or transfer of property

3.3 ROAD MAINTENANCE AS THEY PERTAIN TO WATER QUALITY AND SEDIMENT

Studies have shown that road construction and maintenance can be a source of sediment that can impair water quality and affect stream habitat. Measures are needed to reduce erosion in upland areas disturbed by roads and to limit sediment delivery to stream channels. Decommissioning road, removing or replacing culverts, regulating seasonal use and gating road and trails can help reduce the impacts. The Planning Unit recommends that coordination and communication among the various partners is an important first step in managing impacts. Steps should be taken to pursue funding to identify and rectify road problems. Reaching out to private landowners to offer technical support and financial assistance (where available) should also be pursued.

3.4 VEGETATION MANAGEMENT

Invasive plant species continues to be a major problem throughout the watershed. In particular milfoil continues to spread and becomes most prolific during low stream flow periods. Effective management is a long-term prospect. The US Geological Survey's Columbia River Research Laboratory continues to map milfoil infestations. The Planning Unit believes that continued research, mapping and implementing best management practices to eradicate the weed needs to be sustained throughout application implementation.

The Skamania County vegetation management plan³³ recommends dredging the mouth of the Wind River to a depth of 15 feet to control milfoil and remove enough sediment to ensure boat access between the public boat ramp and in-water fishing areas. The Planning Unit endorses this activity.

3.5 STORMWATER MANAGEMENT

Stormwater management plans and ordinances can help control the quantity and quality of stormwater produced by development to support meeting water quality standards while not significantly affecting receiving waters. To assist local jurisdictions in their efforts, Ecology has developed a Stormwater Management Manual for Western Washington that offers technical standards and guidance on stormwater management measures. This manual applies to Skamania County.³⁴ Currently

³³ Pfauth and Sytsma, 2004

³⁴ WA Department of Ecology publication number 14-10-055

Skamania County does not have a stormwater ordinance.³⁵ The City of Stevenson has adopted the Puget Sound stormwater management manual³⁶

3.6 MONITORING

The Legislature also provides guidance for monitoring activities related to detailed implementation plans (RCW 90.8.090). Specifically, the statute states that in conducting assessments and other studies that include monitoring components or recommendations, Planning Units must implement the monitoring recommendations developed under the Salmon Recovery Act (RCW 77.85.210). The Planning Unit has developed specific monitoring activities that are consistent with the provisions of the Salmon Recovery Act. Water quality monitoring focuses on determining the effects of:

- Human health for drinking water systems relying on surface water.
- Human health through contact recreational activities.
- Fish species listed under the Endangered Species Act and other aquatic life.

Most of the major water bodies in the Wind and Little White Salmon Rivers indicate water temperatures often exceeded water quality standards. The warmest temperatures in the Wind River watershed were recorded in the lower portion of Trout Creek. Those temperatures were frequently measured near or above the lethal limit for steelhead (above 75°F). High water temperatures are frequently the result of decreased riparian vegetation with a resultant loss of stream shade, increased width-to-depth ratios that increase the amount of surface area exposed to sunlight, and reduced summertime base flows. Stream temperatures also affect organism growth and reduce the amount of dissolved oxygen that fish and other aquatic life need to survive.

Table 50. 303(d) listings (Ecology, 2008)

Bear Creek	Temperature
Little White Salmon River	Temperature
Little Wind River	Temperature
Martha Creek	Temperature
Panther Creek	Temperature
Trapper Creek	Temperature, pH
Trout Creek	Temperature, Bacteria
Wind River	Temperature, DO, pH, Bacteria

As noted earlier, water quality monitoring should be conducted so that results can be shared between data managers. Coordinating the collection of data in a consistent and integrated manner supports efficiencies in analyzing and reporting results. Ecology's Water Quality Improvement Program³⁷ performed intensive monitoring in the watershed between 1994 and 2000. With the six years of data and additional modeling Ecology issued a report in 2002 on the amount of shade that would be

³⁵ Section 13.25 repealed.

³⁶ City of Stevenson Engineering Standards for Public Works Construction, 1999

³⁷ <http://www.ecy.wa.gov/programs/wq/tmdl/WindRiver/WindRvrTMDL.html>

required to meet EPA water quality standards. Following this, Ecology developed a TMDL detailed implementation plan³⁸ that generally describes clean up measures, the agencies involved, and activities being implemented. Since then the Underwood Conservation District and the U.S. Forest Service, have continued monitoring stream temperatures and implemented riparian restoration projects. Moving forward the Planning Unit supports the need to continually monitor water quality.

³⁸ Detailed Implementation Plan for the Wind River watershed, Ecology, 2004

3.7 ACTIONS

Action #5		Implement Water Quality Monitoring	
Action Type	<input type="checkbox"/> Water Supply/Stream Flow <input checked="" type="checkbox"/> Water Quality <input type="checkbox"/> Habitat	<input type="checkbox"/> Education <input type="checkbox"/> Implementation	Priority: Medium
Subbasin(s)	<input checked="" type="checkbox"/> All <input type="checkbox"/> Wind <input type="checkbox"/> Rock Creek <input type="checkbox"/> Little White Salmon <input type="checkbox"/> Columbia Tributaries		
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2020		<input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2030
Description	<p>The Planning Unit agrees that the highest priority for planning is to collect additional water quality data across the watershed. Clear and specific planning initiatives will depend upon consistent and long-term data collection. Standardized metrics and collection protocols will be important in determining adaptive management strategies to improve water quality.</p>		
Strategies & Measures	<p>2.4.4 Expand the frequency and scope of water quality sampling and determine sources of fecal coliform.</p> <p>W-2 Past measurements have resulted in several streams in WRIA 29A being listed on the 303(d) list of impaired water bodies.</p> <p>3.4.2 Conduct further temperature assessments in the Rock Creek subbasin</p> <p>3.4.4 Conduct water quality monitoring of potential impacts from the golf course and the old county landfill.</p> <p>RC-2 Few water quality data exists in the Rock Creek subbasin.</p> <p>RC-3 High water temperatures are observed in lower Rock Creek.</p> <p>RC-4 The golf course and the old County landfill are possible sources of potential pollution at the mouth of Rock Creek.</p> <p>4.4.2 Encourage expanded implementation of temperature monitoring.</p> <p>WR-1 More water-quality data are needed in the Wind River subbasin, particularly during late summer.</p> <p>WR-3 Some tributaries of the Wind River have been included on the 303(d) list for high temperatures.</p> <p>5.4.1 Assess the severity of the turbidity and total suspended sediment problem in the Little White Salmon River subbasin and develop a plan to address it.</p> <p>LWS 1 Few water quality data exists in the LWS River subbasin.</p> <p>T-1 Growth in the western tributaries to the Columbia could affect habitat, water quality and water demand.</p>		
Expected Outcome	Ensure that the future water supply meets water quality standards.		

Task 5.1 – Conduct Water Quality Monitoring and Assess the Causes for Pollution in the Rock Creek Subbasin

Lead: City of Stevenson

Coordinating: Skamania County, Ecology, WDFW

Status ☒ Planned ☐ Active ☐ Complete

Time frame for completion ☒ Ongoing ☐ Complete by 2015 ☐ Complete by 2020 ☐ Complete by 2025 ☐ Complete by 2030

Description Water quality monitoring in the Rock Creek area is important to evaluate the causes of high stream temperature, turbidity and sedimentation. The golf course may be a source of nutrient and pesticide runoff due to turf maintenance. Skamania Lodge was built on the old landfill site and impacts to the ground water are relatively unknown. The City's road density level and some structural issues to the Rock Creek Bridge may also be factors that contribute to sediment overload in the watershed. The City of Stevenson has conducted baseline monitoring and some follow-up evaluation; however, to ensure that future planning accounts for these limiting factors it is important to provide clean water to the community it serves.

Cost ☐ High (Greater than \$500,000) ☒ Per year
☐ Medium (\$50,000-\$500,000)
☒ Low (Less than \$50,000) ☐ One time

Is the task funded? ☐ Yes ☒ No ☐ Partially

Funding Source Ecology, DOH, City of Stevenson

Constraints & Uncertainties None

Task 5.2 – Conduct Water Quality Monitoring in the Wind River Subbasin and Identify Solutions to Improve Conditions			
Lead: Skamania County			
Coordinating: Underwood Conservation District, USFWS, USFS, WDFW, Ecology			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2030 		
Description	<p>The Wind River system and some of its tributaries such as Martha, Panther and Trout creeks are listed on Ecology's 303(d) list for temperature. At this time there is very little data collected on turbidity, dissolved oxygen and sediment. A TMDL implementation plan was published in 2004. Water quality monitoring is identified as an important first step in assessing and resolving water quality issues. Skamania County, in cooperation with the Underwood Conservation District, US Forest Service and other interest groups will continue to implement actions identified in the plan.</p>		
Cost	<div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> High (Greater than \$500,000) <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) </div> <div> <input checked="" type="checkbox"/> Per year <input type="checkbox"/> One time </div> </div>		
Is the task funded?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Ecology, DOH, Skamania County		
Constraints & Uncertainties	Over the past several years Skamania County resources have been drastically cut. State funding is needed to implement monitoring.		

Task 5.3 – Conduct water quality monitoring in the Little White Salmon subbasin and identify solutions to improve conditions			
Lead: Skamania County			
Coordinating: Underwood Conservation District, USFWS, USFS, WDFW, Ecology			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	<p>With the exception of monitoring performed by the US Fish and Wildlife Service hatcheries, little water quality data has been collected. Water quality in the Little White Salmon subbasin is affected by temperature, turbidity and sediment. Furthermore, slope failures in the Gifford-Pinchot National Forest have contributed to the increased sediment load as it moves down river. Long-term monitoring and assessment of the Little White Salmon subbasin is needed to develop a plan for improving water quality.</p>		
Cost	<div> <input type="checkbox"/> High (Greater than \$500,000) <input checked="" type="checkbox"/> Per year </div> <div> <input type="checkbox"/> Medium (\$50,000-\$500,000) </div> <div> <input checked="" type="checkbox"/> Low (Less than \$50,000) <input type="checkbox"/> One time </div>		
Is the task funded?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Ecology, DOH, Skamania County		
Constraints & Uncertainties	Over the past several years Skamania County resources have been drastically cut. State funding is needed to implement monitoring.		

Task 5.4 – Conduct Water Quality Monitoring in the Western Tributaries to the Columbia River to Plan for Future Growth			
Lead: City of Stevenson, Skamania County			
Coordinating: Underwood Conservation District, USFWS, USFS, WDFW, Ecology			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2020 <input checked="" type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2030		
Description	Growth in this area will be limited to areas within the city boundaries and the National Scenic Area Urban Areas. To date there has been no data collected on water quality with the exception of a few streams near the Wind River. It is expected the growing use of on-site septic systems is and will continue to be a limiting factor of water quality. Future growth planning will need to consider factors that affect water quality to continue to provide sufficient clean water to the community.		
Cost	<input type="checkbox"/> High (Greater than \$500,000) <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) <input checked="" type="checkbox"/> Per year <input type="checkbox"/> One time		
Is the task funded?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Ecology, DOH, Skamania County and City of Stevenson		
Constraints & Uncertainties	Over the past several years Skamania County resources have been drastically cut. State funding is needed to implement monitoring.		

Action #6		Implement a Septic System Improvements	
Action Type:	<input type="checkbox"/> Water Supply/Stream Flow <input checked="" type="checkbox"/> Water Quality <input type="checkbox"/> Habitat	<input type="checkbox"/> Education <input type="checkbox"/> Implementation	Priority: Medium
Subbasin(s)	<input checked="" type="checkbox"/> All <input type="checkbox"/> Wind <input type="checkbox"/> Rock Creek <input type="checkbox"/> Little White Salmon <input type="checkbox"/> Columbia Tributaries		
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input checked="" type="checkbox"/> Complete by 2020		
Description	<p>The Planning Unit believes that new policies and actions targeted at reducing water pollution from failing or failed and out-of-compliance septic system is critical to maintaining and improving water quality. The Planning Unit strongly encourages developing a comprehensive septic system improvement program that includes an outreach campaign to inform the public about the issue and a plan for implementing creative solutions such as periodic inspections, landowner incentive programs, and establishing local improvement districts.</p>		
Strategies & Measures	<p>W3 Sewage treatment systems can contribute to water quality problems.</p> <p>2.4.4 Expand the frequency and scope of water quality sampling and determine sources of fecal coliform.</p> <p>2.4.8 Encourage continued research to improve septic system operation.</p> <p>2.4.13 Conduct education and outreach on inspection and care of septic systems.</p> <p>2.4.18 Identify areas that need a community septic or sewer system and support the transition.</p> <p>2.4.19 Identify sources to support sewer and septic system inspection and upgrades.</p> <p>2.4.20 Facilitate the Identification of failing and out-of-compliance septic systems.</p> <p>2.4.21 Establish incentives for septic system upgrade or repair.</p> <p>2.4.22 Require septic inspection or certification upon the sale or transfer of property.</p> <p>2.4.34 Encourage cooperative, voluntary corrective actions to reduce fecal coliform.</p>		
Expected Outcome	<p>Improve ground and surface water quality by reducing the frequency and number of failed and out-of-compliance septic systems.</p>		

Task 6.1 – Develop a Comprehensive Septic System Improvement Program			
Lead: Skamania County			
Coordinating: Planning Unit			
Status	<input type="checkbox"/> Planned <input checked="" type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2030 		
Description	Skamania County will maintain an active on-site sewage program as part of the services provided by the County's Community Development Office. The goal of the program is to "protect public health and the environment from the adverse effects and impacts of failing or inadequate on-site sewage systems by ensuring the proper design, installation, and maintenance of on-site sewage systems." Important information such as a property owner's guide to septic system installation and maintenance and a step-by-step permitting process will be updated regularly.		
Cost	<div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> High (Greater than \$500,000) <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) </div> <div> <input type="checkbox"/> Per year <input checked="" type="checkbox"/> One time </div> </div>		
Is the task funded?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Skamania County		
Constraints & Uncertainties	Over the past several years Skamania County resources have been drastically cut. State funding is needed to implement this program.		

Task 6.2 – Expand the Frequency and Scope of Water Quality Sampling and Determine Sources of Fecal Coliform

Lead: Skamania County

Coordinating: Underwood Conservation District, USFWS, USFS, WDFW, Ecology, City of Stevenson

Status ☒ Planned ☐ Active ☐ Complete

Time frame for completion ☐ Ongoing ☐ Complete by 2015 ☐ Complete by 2025 ☒ Complete by 2020 ☐ Complete by 2030

Description This activity will be performed in conjunction with water quality monitoring activities (See Action #5)

Cost ☐ High (Greater than \$500,000) ☒ Per year ☐ Medium (\$50,000-\$500,000) ☐ One time ☒ Low (Less than \$50,000)

Is the task funded? ☐ Yes ☒ No ☐ Partially

Funding Source Ecology, DOH, Skamania County, City of Stevenson

Constraints & Uncertainties Over the past several years Skamania County resources have been drastically cut. State funding is needed to implement this program.

Task 6.3 – Develop a County Ordinance that Requires Septic System Inspection at the Time of Sale or Transfer of Property

Lead: Skamania County

Coordinating: None

Status ☒ Planned ☐ Active ☐ Complete

Time frame for completion ☐ Ongoing ☐ Complete by 2015 ☐ Complete by 2025 ☒ Complete by 2020 ☐ Complete by 2030

Description Skamania County will adopt an ordinance in the County's code requiring the inspection of on-site sewage systems at the time of sale or property transfer.

Cost ☐ High (Greater than \$500,000) ☐ Per year ☐ Medium (\$50,000-\$500,000) ☒ Low (Less than \$50,000) ☒ One time

Is the task funded? ☒ Yes ☐ No ☐ Partially

Funding Source Skamania County

Constraints & Uncertainties None

Task 6.4 – Pursue Funding and Landowner Incentives to Improve Septic Systems			
Lead: Skamania County, City of Stevenson			
Coordinating: Planning Unit, Underwood Conservation District			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input checked="" type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2030		
Description	Funding is a necessary first step to providing incentives to landowners for improving their septic system. Landowner funding could be used to improve failing systems, help fund connecting homes to public sewer mains or decommissioning systems all together.		
Cost	<input type="checkbox"/> High (Greater than \$500,000) <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) <input checked="" type="checkbox"/> Per year <input type="checkbox"/> One time		
Is the task funded?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Ecology, DOH, Skamania County, City of Stevenson		
Constraints & Uncertainties	None		

Task 6.5 – Implement Stevenson’s HEALing SCARS Program			
Lead: City of Stevenson, Skamania County Environmental Health			
Coordinating: Planning Unit, Ecology			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input checked="" type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2030		
Description	<p>Helping Encourage Adjacent Landowners’ Sewer Connection and Replumbing Stipend (HEALing SCARS) involves a small number of existing homes in the City’s sewer service area. A septic-to-sewer program, this project will focus on reducing groundwater contamination by developing partnerships with private landowners adjacent to existing sewer lines. Completing this program will require:</p> <ul style="list-style-type: none"> • Replumbing and/or connecting existing homes to public sewer mains, • Decommissioning existing septic systems. 		
Cost	<input type="checkbox"/> High (Greater than \$500,000) <input type="checkbox"/> Per year <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) <input checked="" type="checkbox"/> One time		
Is the task funded?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Stevenson Sewer Utility, Ecology, DOH		
Constraints & Uncertainties	Private partners may not be willing.		

Action #7		Improve Road Maintenance as it Pertain to Water Quality and Sediment	
Action Type:	<input type="checkbox"/> Water Supply/Stream Flow <input checked="" type="checkbox"/> Water Quality <input type="checkbox"/> Habitat	<input type="checkbox"/> Education <input type="checkbox"/> Implementation	Priority: High
Subbasin(s)	<input checked="" type="checkbox"/> All <input type="checkbox"/> Wind <input type="checkbox"/> Rock Creek <input type="checkbox"/> Little White Salmon <input type="checkbox"/> Columbia Tributaries		
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input checked="" type="checkbox"/> Complete by 2020		
Description	<p>Roads are a principle source of sediment and can impact water quality. Care in their construction, use and maintenance is needed. In managing its roads program, Skamania County will continue to maintain and update its best management practices to ensure safe roads in such a way as to limit effects to the streams and habitat.</p> <p>As part of the USFS Habitat Conservation Plan, road maintenance and decommissioning will be implemented on a priority scale.</p>		
Strategies & Measures	2.4.24 Encourage implementation of a coordinated, Western WRIA 29 road maintenance effort		
Expected Outcome	Proper road construction, maintenance and decommissioning will help protect streams and, fish and wildlife.		

Task 7.1 – Pursue Funding to Identify and Rectify Problems Associated with Roads			
Lead: Skamania County, City of Stevenson			
Coordinating: Planning Unit			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input checked="" type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	Funding for road construction, maintenance and decommissioning is key to implementation. Skamania County and the City of Stevenson will pursue securing funding for this work. The USFS maintains annual funding to maintain and decommission forest roads.		
Cost	<div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> High (Greater than \$500,000) <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) </div> <div> <input checked="" type="checkbox"/> Per year <input type="checkbox"/> One time </div> </div>		
Is the task funded?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	City of Stevenson, Skamania County, USFS		
Constraints & Uncertainties	None		

Task 7.2 – Pursue Funding to Support Financial Assistance to Landowners

Lead: Skamania County, City of Stevenson

Coordination: Planning Unit

Status ☒ Planned ☐ Active ☐ CompleteTime frame for completion
☐ Ongoing
☐ Complete by 2015 ☐ Complete by 2025
☒ Complete by 2020 ☐ Complete by 2030Description
Landowner financial support and technical assistance is needed for evaluating and improving roads that intersect with public rights-of-way. Efforts to secure funding in Task #1 should identify technical assistance and funding for landowners as well.Cost
☐ High (Greater than \$500,000) ☒ Per year
☐ Medium (\$50,000-\$500,000)
☒ Low (Less than \$50,000) ☐ One timeIs the task funded? ☒ Yes ☐ No ☐ Partially

Funding Source Skamania County, City of Stevenson

Constraints & Uncertainties
None

Action #8		Implement Vegetation Management	
Action Type:	<input type="checkbox"/> Water Supply/Stream Flow <input checked="" type="checkbox"/> Water Quality <input type="checkbox"/> Habitat	<input type="checkbox"/> Education <input type="checkbox"/> Implementation	Priority: Low
Subbasin(s)	<input checked="" type="checkbox"/> All <input type="checkbox"/> Wind <input type="checkbox"/> Rock Creek <input type="checkbox"/> Little White Salmon <input type="checkbox"/> Columbia Tributaries		
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2030		
Description	<p>The Planning Unit supports the implementation of Skamania County's Integrated Aquatic Vegetation Management Plan (Pfauth and Sytsma, 2004) and encourages the County to continue pursuing funding to maintain this work. Of particular concern is the presence of milfoil at the mouths of the watersheds. This invasive species spreads quickly and impacts recreational river uses as well as salmon habitat. The Planning Unit encourages continued research on effective eradication techniques and supports federal and state agencies to fund milfoil control projects.</p> <p>In 1991, the WA Legislature established the Freshwater Aquatic Weeds Account to provide financial and technical support. The program is administered by Ecology who offers technical assistance, public education and grants to help control aquatic weeds. Revenue from this account comes from a \$3 increase in annual license fees for boat trailers. Generally \$400,000 is available for grant awards annually.</p> <p>The WA Invasive Species Council, administered by the Recreation and Conservation Office, has helped secure Congressional funds through the Farm Bill to implement an education and outreach program in schools.</p>		
Strategies & Measures	<p>W-8 Invasive aquatic species threaten Western WRIA 29 water bodies and riparian areas.</p> <p>2.4.37 Encourage Skamania County to implement its integrated aquatic vegetation management plan</p> <p>4.4.8 Support Skamania County's proposal to dredge the mouth of the Wind River</p>		
Expected Outcome	Reducing invasive plant species will help improve watershed conditions for people, and, fish and wildlife.		

Task 8.1 – Implement the Skamania County Integrated Aquatic Vegetation Management Plan			
Lead: Skamania County			
Coordination: Ecology			
Status	<input type="checkbox"/> Planned <input checked="" type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	Skamania County's roads division of the public works department implements vegetation management. This work focuses on county road rights-of-way, bridges and ditches. The goal of the program is to enhance road safety, reduce fire hazard and protect the environment. Each year the division services approximately 450 miles of rights-of-way using best management practices. In the past Skamania County has received funding for this program through the USFS Title II Secure Rural Schools and Communities Program as well as grants from Ecology.		
Cost	<input type="checkbox"/> High (Greater than \$500,000) <input checked="" type="checkbox"/> Per year <input type="checkbox"/> Medium (\$50,000-\$500,000) <input checked="" type="checkbox"/> Low (Less than \$50,000) <input type="checkbox"/> One time		
Is the task funded?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Partially		
Funding Source	Skamania County, USFS, Ecology, landowner cooperative agreements		
Constraints & Uncertainties	Funding for this program continues to decline. In the past the USFS Title II program has been a large source of funding. This program was discontinued in 2013.		

Task 8.2 – Support Skamania County’s Proposal to Dredge the Mouth of the Wind River

Lead: Skamania County

Coordinating: Planning Unit

Status ☒ Planned ☐ Active ☐ Complete

Time frame for completion ☐ Ongoing ☐ Complete by 2015 ☐ Complete by 2020 ☐ Complete by 2025 ☐ Complete by 2030

Description The Skamania County Integrated Aquatic Vegetation Management Plan recommends dredging the mouth of the Wind River to a depth of 15 feet to control milfoil and remove enough sediment to ensure boat access between the public boat ramp and in-water fishing areas. Dredging will also remove accumulated sediment, although it would not prevent future sedimentation. The last time this was completed was in 1996 in cooperation with the Port of Skamania and the Skamania Economic Development Council (EDC). Skamania County will actively pursue periodic dredging in cooperation with the Port and EDC.

Cost ☐ High (Greater than \$500,000) ☐ Per year ☐ Medium (\$50,000-\$500,000) ☒ Low (Less than \$50,000) ☒ One time

Is the task funded? ☐ Yes ☒ No ☐ Partially

Funding Source Skamania County, Port of Skamania and the Skamania EDC

Constraints & Uncertainties Permitting will be required for this work.

Action #9		Improve Stormwater Management	
Action Type:	<input type="checkbox"/> Water Supply/Stream Flow <input checked="" type="checkbox"/> Water Quality <input type="checkbox"/> Habitat	<input type="checkbox"/> Education <input type="checkbox"/> Implementation	Priority: Medium
Subbasin(s)	<input checked="" type="checkbox"/> All <input type="checkbox"/> Wind <input type="checkbox"/> Rock Creek <input type="checkbox"/> Little White Salmon <input type="checkbox"/> Columbia Tributaries		
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input checked="" type="checkbox"/> Complete by 2020		
Description	<p>Land use actions can cause significant alterations to stormwater runoff that can affect the environment and health of the community. The Planning Unit has recommended that Skamania County adopt stormwater management policies and any planning effort consider the effects of urbanization and stormwater runoff. In 2007 the County updated its Comprehensive Plan and designating several land use ordinances addressing stormwater and runoff management. Skamania County is guided by the Stormwater Management Manual for Western Washington (Ecology, 2012). This 5-part manual provides technical requirements, site planning guidance, construction measures for stormwater pollution prevention, hydrologic analysis and flow control designs standards and runoff treatment practices. Land use practices in special subareas such as Swift and West End are included in the Comprehensive Plan and reference more detailed plans updated regularly for these areas.</p> <p>Likewise the City of Stevenson has adopted the Puget Sound stormwater management manual. Stevenson regularly updates its policies for managing stormwater runoff and requires site planning for new development.</p>		
Strategies & Measures	<p>W-4 Stormwater can affect Western WRIA 29's water resources.</p> <p>2.4.17 Encourage Skamania County to adopt a stormwater plan or ordinance and to update its critical areas ordinance to meet best available science requirements.</p> <p>2.4.45 Encourage jurisdictions to continue to plan for the impact of growth on water supply and water quality.</p> <p>T-2 Growth in the Western Tributaries to the Columbia subbasin could affect habitat, water quality, and water demand.</p>		
Expected Outcome	Managing stormwater runoff will reduce potential pollution in streams and receiving waters.		

Task 9.1 – Consider Adopting a Stormwater Plan or Ordinance

Lead: Skamania County, City of Stevenson

Coordination: Ecology

Status ☐ Planned ☒ Active ☐ CompleteTime frame for completion
☒ Ongoing
☐ Complete by 2015
☐ Complete by 2020
☐ Complete by 2025
☐ Complete by 2030Description
Skamania County implements stormwater management measures and has adopted the Stormwater Management Manual for Western Washington (Ecology, 2012).
The City of Stevenson implements stormwater management measures and has adopted the Puget Sound Stormwater Manual.Cost
☐ High (Greater than \$500,000) ☐ Per year
☐ Medium (\$50,000-\$500,000)
☒ Low (Less than \$50,000) ☒ One timeIs the task funded? ☒ Yes ☐ No ☐ Partially

Funding Source Skamania County, City of Stevenson

Constraints & Uncertainties None

Task 9.2 – Endorse Stevenson’s Stormwater Utility Mapping Project

Lead: City of Stevenson, Skamania County

Coordinating: Planning Unit

Status ☐ Planned ☒ Active ☐ CompleteTime frame for completion
☐ Ongoing
☐ Complete by 2015 ☐ Complete by 2025
☒ Complete by 2020 ☐ Complete by 2030

Description

Stevenson’s storm water system maps are incomplete and paper-based. This project will focus on collecting and mapping the City’s stormwater conveyance, ditch, treatment, and culvert systems in advance of the City’s adoption of a stormwater plan and/or stormwater utility district. Mapping will occur in AutoCAD- and GIS-compatible format for ease of future use and identify problem culverts/systems for immediate repair.

Cost
☐ High (Greater than \$500,000) ☐ Per year
☐ Medium (\$50,000-\$500,000)
☒ Low (Less than \$50,000) ☒ One timeIs the task funded? ☐ Yes ☒ No ☐ Partially

Funding Source City of Stevenson, Ecology

Constraints & Uncertainties
Funding has not yet been secured.

CHAPTER IV. HABITAT

- 4.1 INTRODUCTION
- 4.2 ASSESSMENT AND IMPLEMENTATION
- 4.3 ACTIONS

4.1 INTRODUCTION

The Initiating Governments chose to include a habitat component in the watershed plan. As a result, watershed planning must be integrated with strategies developed under other processes to respond to potential and actual listings of salmon and steelhead species as being threatened or endangered under the federal Endangered Species Act (ESA). The statute further requires that where habitat restoration activities are being developed under the Salmon Recovery Act (Chapter 77.85 RCW), such activities must be relied upon as the primary non-regulatory component for fish habitat within the watershed management plans. In developing the WRIA 29A watershed management plan the Planning Unit drew from data and information published in the Recovery Plan.³⁹ Over the next decade the Lower Columbia Fish Recovery Board continued to assess each watershed on a reach-level basis using the Ecosystem Diagnosis and Treatment (EDT) salmon life cycle model. In 2010 the Recovery Plan was updated to include the new listing of coho salmon. That same year the LCFRB launched its online habitat strategy, SalmonPORT, where project proponents can identify, develop and implement habitat projects in key streams. Key limiting factors affecting the salmon and steelhead include:

- ✚ Dams that require regulated stream flow
- ✚ Passage due to failing culverts, tide gates and other barriers
- ✚ Seasonal variations in high and low flows affecting water quality and temperature
- ✚ Loss of channel stability and migration corridors
- ✚ Limited off channel spawning and rearing areas
- ✚ Loss of habitat complexity that provides protection from predators
- ✚ Loss of nutrients that support juvenile survival

It is estimated that fish habitats have declined anywhere from 30 to 90 percent over time in the region. While restoration of all lost habitat is neither practical nor necessary, success in recovering Lower Columbia salmon and steelhead will require significant habitat restoration as well as maintenance and stewardship of remaining functional habitat.

The Planning Unit believes that partners are essential to improving habitat conditions. A significant portion of WRIA 29A resides in the Gifford Pinchot

Species	Estimated Habitat Loss in WRIA 29A
Spring Chinook	↓75%
Fall Chinook	↓70%
Chum	↓75%
Coho	↓40%
Steelhead	↓60%

³⁹ LCFRB, 2004

National Forest. In 2009, the USFS removed Hemlock Dam on Trout Creek and opened 15 miles of spawning and rearing habitat for salmon and steelhead. Historically, the Underwood Conservation District and the Mid-Columbia Fisheries Enhancement Group have been key sponsors implementing restoration projects in cooperation with the USFS.

4.2 ASSESSMENT

To ensure consistency in data collection protocols and methods, the WRIA 29A will continue to draw upon the work of the LCFRB to implement projects. SalmonPORT habitat strategy map is reviewed regularly and provide detailed information to help address key habitat limiting factors (Table 51) for essential life history stages of salmon and steelhead.

In 2015, the LCFRB received a grant from the WA Salmon Recovery Funding Board to develop a community-based habitat strategy for the lower Wind River and portions of Trout Creek. The project will analyze existing data for the Wind River from the mouth to the hatchery and Trout Creek. The strategy will identify and prioritize a list of restoration projects that can be implemented in the future.

Since the adoption of the watershed management plan the City of Stevenson has been investigating options for the Rock Creek Drive bridge structure that has become structurally threatened due to sedimentation and high peak flows. The city is concerned with impacts to the surrounding habitat and is pursuing land acquisition on which to install a free-span structure. Restoration of this area was identified as a priority in the plan.

Table 51. Habitat Limiting Factors⁴⁰

	Lower Wind	Upper Wind	Trout Creek	Little White Salmon Lower	Little White Salmon Main	Rock Creek	Other Columbia River Tribes.
<i>Habitat connectivity</i>							
Blockages to channel habitats		✓	✓	✓		✓	✓
<i>Habitat diversity</i>							
Lack of stable instream woody debris	✓	✓	✓	✓	✓	✓	✓
Altered habitat unit composition	✓	✓	✓	✓	✓	✓	✓
Loss of off-channel and/or side-channel habitats	✓	✓	✓	✓	✓		
<i>Riparian function</i>							
Reduced stream canopy cover	✓	✓	✓	✓	✓	✓	✓
Reduced bank/soil stability	✓	✓	✓				
Exotic and/or noxious species	✓	✓				✓	✓
Reduced wood recruitment	✓	✓	✓	✓	✓	✓	✓
<i>Floodplain function</i>							
Altered nutrient exchange processes	✓	✓	✓	✓	✓		
Reduced flood flow dampening	✓	✓	✓	✓	✓		
Restricted channel migration	✓	✓	✓	✓	✓		
Disrupted hyporheic processes	✓	✓	✓	✓	✓		
<i>Stream flow</i>							
Altered magnitude, duration, or rate of change	✓	✓	✓			✓	✓
<i>Water quality</i>							
Altered stream temperature regime	✓	✓	✓			✓	
Bacteria	✓	✓					
<i>Substrate and sediment</i>							
Embedded substrates	✓	✓	✓			✓	✓
Excessive fine sediment	✓	✓	✓	✓	✓	✓	✓
Lack of adequate spawning substrate						✓	
<i>Channel stability</i>							
Bed and bank erosion	✓	✓	✓				
Channel down-cutting (incision)	✓	✓	✓				

⁴⁰ LCFRB 2010

4.3 ACTIONS

Action #10		Improve Habitat Conditions	
Action Type:	<input type="checkbox"/> Water Supply/Stream Flow <input type="checkbox"/> Water Quality <input checked="" type="checkbox"/> Habitat	<input type="checkbox"/> Education <input type="checkbox"/> Implementation	Priority: Medium
Subbasin(s)	<input type="checkbox"/> All <input checked="" type="checkbox"/> Wind <input checked="" type="checkbox"/> Rock Creek <input checked="" type="checkbox"/> Little White Salmon <input type="checkbox"/> Columbia Tributaries		
Status	<input type="checkbox"/> Planned <input checked="" type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	<p>The Planning Unit expects habitat restoration to continue in support of restoring key spawning and rearing areas for salmon and steelhead. The highest priority areas include the Wind River and its major tributaries including Trout Creek and the Little Wind River, and the Little White Salmon River. Additionally, the Rock Creek bridge structure is a key limiting factor contributing to sediment buildup at the mouth of Rock Creek. Some studies have been completed however considerable data gaps remain and the Planning Unit encourages ongoing studies that will help identify key habitat restoration opportunities throughout the watershed and promote securing funding for projects.</p>		
Strategies & Measures	<p>W-5 Wildfires can burn vegetation and result in increased erosion.</p> <p>W-8 Invasive aquatic species threaten Western WRIA 29 water bodies and riparian areas.</p> <p>W-9 Sediment levels in streams, sediment deposition near stream mouths, and fine sediment deposition in pools and spawning habitat is a concern in many Western WRIA 29 streams.</p> <p>W-10 Poorly designed and maintained culverts obstruct or block fish passage.</p> <p>W-11 Aquatic and riparian habitat has been degraded in a number of streams in Western WRIA 29.</p> <p>W-16 Air quality can affect water quality when air pollutants are deposited onto the surface of water bodies or land within a watershed.</p> <p>2.4.9 Encourage studies to determine effects on non-ESA-listed species.</p> <p>2.4.14 Inventory and address problem culverts.</p> <p>2.4.33 Encourage projects to increase stream shading, reduce temperatures, and improve habitat, as needed.</p> <p>2.4.43 Support fish restoration activities.</p>		

Task 10.1 – Support Designing Habitat Restoration Projects throughout WRIA 29A

Lead: Lower Columbia Fish Recovery Board

Coordination: Underwood Conservation District, Mid-Columbia Fisheries Enhancement Group, Skamania County, Yakama Nation and the USFS

Status ☒ Planned ☐ Active ☐ Complete

Time frame for completion ☐ Ongoing ☒ Complete by 2025
☐ Complete by 2015 ☐ Complete by 2030
☐ Complete by 2020

Description To be competitive in securing funding to implement habitat restoration work project concepts and designs should be developed. A coordinated effort between partners will also support project implementation.

Cost ☐ High (Greater than \$500,000) ☒ Per year
☒ Medium (\$50,000-\$500,000)
☐ Low (Less than \$50,000) ☐ One time

Is the task funded? ☐ Yes ☒ No ☐ Partially

Funding Source Varies (possibly BPA or the WA Salmon Recovery Funding Board and Ecology)

Constraints & Uncertainties Design work is considered an eligible project in some funding sources however funding allocated for the Lower Columbia region is limited.

Task 10. 2 – Evaluate and Develop a Habitat Restoration Strategy for the Lower Wind River and Trout Creek

Lead: Lower Columbia Fish Recovery Board

Coordination: Underwood Conservation District, Mid-Columbia Fisheries Enhancement Group, Skamania County, Yakama Nation and the US Forest Service

Status ☐ Planned ☒ Active ☐ CompleteTime frame for completion
☐ Ongoing
☐ Complete by 2015
☒ Complete by 2020
☐ Complete by 2025
☐ Complete by 2030Description
The LCFRB has received funding to assess the Wind River, identify and prioritize habitat restoration opportunities and complete two preliminary designs for interested sponsors to implement in the future. In 2015 and 2016 the LCFRB will convene a community group to guide the strategy development.Cost
☐ High (Greater than \$500,000)
☒ Medium (\$50,000-\$500,000)
☐ Low (Less than \$50,000)
☐ Per year
☒ One timeIs the task funded?
☒ Yes ☐ No ☐ Partially

Funding Source WA Salmon Recovery Funding Board

Constraints & Uncertainties
None

Task 10.3 – Implement Habitat Restoration Projects throughout WRIA 29A

Lead: Underwood Conservation District, US Forest Service and Mid-Columbia Fisheries Enhancement Group

Coordinating: Skamania County, Yakama Nation, City of Stevenson

Status ☐ Planned ☒ Active ☐ Complete

Time frame for completion ☒ Ongoing ☐ Complete by 2015 ☐ Complete by 2020 ☐ Complete by 2025 ☐ Complete by 2030

Description While restoration of all lost habitat is neither practical nor necessary for salmon recovery, the success in recovering ESA-listed salmon and steelhead will require significant habitat restoration as well as maintenance and stewardship of remaining functional habitat. Habitat restoration should focus on the most important river reaches in the watershed. Project sponsors should consult the Lower Columbia Habitat Strategy (www.lowercolumbiasalmonrecovery.org) to identify reaches with the most potential. Although it is important to sequence work properly, sponsor should be flexible to take advantage of willing landowner opportunities as they become available.

Cost ☐ High (Greater than \$500,000) ☒ Per year ☒ Medium (\$50,000-\$500,000) ☐ One time ☐ Low (Less than \$50,000)

Is the task funded? ☐ Yes ☒ No ☐ Partially

Funding Source varies

Constraints & Uncertainties Depending on the size, complexity and partners involved in the project, funding may be limited.

Task 10.4 – Support the City of Stevenson’s Rock Creek Bridge Land Acquisition and Restoration

Lead: City of Stevenson, Skamania County

Coordination: Planning Unit

Status ☒ Planned ☐ Active ☐ CompleteTime frame for completion
☐ Ongoing
☐ Complete by 2015
☐ Complete by 2020
☒ Complete by 2025
☐ Complete by 2030

Description

The Rock Creek Drive Bridge is a four-piered structure constructed in 1921 carrying several critical utility lines. Since completion of the Bonneville Dam in 1938, Rock Creek has been steadily aggrading and the freeboard under the bridge is minimal in high flow events. Flooding threatens the bridge and utilities on it and is scheduled to be replaced with a free-spanning structure to the north of the current bridge. Completing the land acquisition component of this process will involve purchasing up to five properties (or portions thereof), removing structures from up to three properties, and restoring habitat values and flood conveyance of purchased properties prior to construction of a new bridge structure.

Cost
☒ High (Greater than \$500,000) ☐ Per year
☐ Medium (\$50,000-\$500,000)
☐ Low (Less than \$50,000) ☒ One timeIs the task funded? ☐ Yes ☒ No ☐ Partially

Funding Source City of Stevenson, Ecology and WDOT

Constraints & Uncertainties
None

Task 10.5 – Monitoring Habitat Status and Trends throughout WRIA 29A

Lead partner: Underwood Conservation District, USFS

Coordinating: LCFRB, USFWS

Status ☐ Planned ☐ Active ☒ CompleteTime frame for completion
☒ Ongoing
☐ Complete by 2015
☐ Complete by 2020
☐ Complete by 2025
☐ Complete by 2030

Description

Habitat status and trends monitoring (HSTM) can be implemented in conjunction with water quality monitoring. The LCFRB is partnering with Ecology and others such as stormwater permittees, the USFS and USGS to develop monitoring protocols, an implementation plan and a quality assurance program for monitoring practitioners to implement as funding is needed. Ecology performs watershed health monitoring on a 4-year rotating basis. The LCFRB will continue to seek funding to implement HSTM.

Cost
☐ High (Greater than \$500,000)
☒ Medium (\$50,000-\$500,000)
☐ Low (Less than \$50,000)
☒ Per year
☐ One timeIs the task funded?
☐ Yes ☒ No ☐ Partially

Funding Source Ecology, WDFW, SRFB, NMFS, PSMFC, Skamania County, BPA

Constraints & Uncertainties
Monitoring is a long-term and costly proposition that will require a commitment and sustained funding source.

Task 10.6 – Work with Ecology to Develop a Pilot Project for Storage and Retrieval of Wetlands Delineations and Rating Sheets on a County- or WRIA-Wide Basis			
Lead partner: City of Stevenson			
Coordinating: Planning Unit			
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input checked="" type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	<p>The implementation of Critical Areas Ordinances (City & County) and Clean Water Act (Federal & State) policies requires project proponents to produce wetland delineations and completion of standardized rating sheets for suspected wetlands. Storage, review, retrieval, and long-term evaluation of these delineations and ratings is unorganized and uncoordinated among jurisdictions. As a small WRIA producing relatively few reports, 29A or a partnership between 29A and other WRIAs in Skamania County could serve as the beta testing site for a statewide clearinghouse for storage and retrieval of the required reports.</p>		
Cost	<input type="checkbox"/> High (Greater than \$500,000) <input checked="" type="checkbox"/> Per year <input checked="" type="checkbox"/> Medium (\$50,000-\$500,000) <input type="checkbox"/> Low (Less than \$50,000) <input type="checkbox"/> One time		
Is the task funded?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Partially		
Funding Source	Ecology and Commerce, and other sources not yet identified		
Constraints & Uncertainties	Lead agency and funding sources have not been identified.		

CHAPTER V. PUBLIC OUTREACH

- 5.1 INTRODUCTION
- 5.2 PARTNERSHIPS AND INVOLVEMENT
- 5.3 ACTIONS

5.1 INTRODUCTION

A well-developed public outreach strategy will help convey to the community that water is too precious to waste. Ongoing community support will be important to implementing the objectives of the plan. The Planning Unit believes that developing and implementing an outreach program should be done collaboratively among the various partners. It should provide a comprehensive view of the importance of sustaining water supply and improving watershed health. It should include a schedule and benchmarks to measure success and identify target audiences. It should include customizing information to specific water users in the broader context of providing water for people and, fish and wildlife. Key messages the Planning Unit has identified are:

- Water conservation measures and incentives
- Water quality concerns
- Benefits of measuring water use
- Responsible land stewardship
- Proper care of sewer and septic systems
- Encouraging cooperative, voluntary corrective actions to reduce fecal coliform
- Wildfire prevention, hazards, and preparedness

5.2 PARTNERSHIPS AND INVOLVEMENT

The Planning Unit believes that forming partnerships, providing technical assistance and pursuing incentive programs will help improve in- and out-of-stream water uses. School or volunteer water quality monitoring projects may be a useful tool and provide a cost effective way to gather information. Furthermore as additional information is collected and other studies are completed it will be beneficial to maintain a central clearinghouse or web-based center to maintain the data. The Planning Unit envisions supporting various Geographic Information System (GIS) data as well. Together this information can be a consistent way to track and measure success.

5.3 ACTIONS

Action #11		Implement Public Information and Outreach Activities	
Action Type:	<input type="checkbox"/> Water Supply/Stream Flow <input type="checkbox"/> Water Quality	<input type="checkbox"/> Habitat <input checked="" type="checkbox"/> Education <input type="checkbox"/> Implementation	Priority: Medium
Subbasin(s)	<input checked="" type="checkbox"/> All <input type="checkbox"/> Wind <input type="checkbox"/> Rock Creek <input type="checkbox"/> Little White Salmon <input type="checkbox"/> Columbia Tributaries		
Status	<input checked="" type="checkbox"/> Planned <input type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	<p>The Planning Unit believes it is essential to communicate water-related issues to gain support in conserving and protecting water supplies. Outreach should include printed materials, workshops and 1-on-1 technical support. The Planning Unit has identified a number of topics such as water conservation, septic system management, road maintenance, invasive weed control, responsible stewardship and wildfire awareness. Information should focus on both in- and out- of stream uses and help connect people with programs and information to improve understanding and support.</p>		
Strategies & Measures	<p>2.4.10 Conduct education and outreach on water conservation 2.4.11 Educate watershed residents on the benefits of measuring water use 2.4.12. Educate private landowners on proper land stewardship, Including use and effects of pesticides and fertilizers 2.4.13 Conduct education and outreach on inspection and care of septic systems 2.4.21 Establish incentives for septic system upgrade or repair 2.4.32 Encourage water conservation in irrigation and water transport, where feasible and practical, based on water rights, and use level 2 assessment recommendations</p>		
Expected Outcome	<p>A public information program will improve water use and water quality and help protect stream flows for fish and wildlife.</p>		

Task 11.1 – Develop and Implement a Comprehensive Communication Strategy throughout the County

Lead: Planning Unit

Coordination: Skamania County, Skamania PUD, City of Stevenson, Underwood Conservation District

Status ☒ Planned ☐ Active ☐ CompleteTime frame for completion
☐ Ongoing
☐ Complete by 2015 ☐ Complete by 2025
☒ Complete by 2020 ☐ Complete by 2030

Description

In cooperation with the Planning Unit and other partners a detailed communication and outreach strategy should be developed. This is an ongoing activity that can provide information on water-related issues. The Plan should identify key messages, target audiences and methods for disseminating information. The strategy may also provide for technical support and incentive programs to assist landowners and residents.

Cost

<input type="checkbox"/> High	(Greater than \$500,000)	<input checked="" type="checkbox"/> Per year
<input type="checkbox"/> Medium	(\$50,000-\$500,000)	
<input checked="" type="checkbox"/> Low	(Less than \$50,000)	<input type="checkbox"/> One time

Is the task funded?

☐ Yes ☒ No ☐ Partially

Funding Source Unidentified

Constraints & Uncertainties

Funding for public outreach is very limited. The Planning Unit will work with partners to identify possible funding sources.

CHAPTER VI. IMPLEMENTATION

- 6.1 INTRODUCTION
- 6.2 GENERAL FUNDING STRATEGY FOR IMPLEMENTING ACTIONS
- 6.3 ACTIONS

6.1 INTRODUCTION

The recommendations and actions presented in the watershed plan and DIP span a range of natural resources, activities and organizations. Actions are identified for Skamania County, the City of Stevenson, public water systems, state and federal agencies, the Yakama Nation and the Planning Unit as a group. The intent has been to provide a balanced mix of actions that collectively achieve the objectives of the watershed plan.

Because of the organizations involved, funding constraints, and an implementation period spanning several years, it will be important to put in place some mechanism for coordination and oversight. Activities may include:

- Tracking implementation of DIP actions to ensure they are being carried out in a timely fashion and that the most important priorities defined by the Planning Unit are being addressed;
- Coordinating efforts to seek funding for DIP actions, to avoid duplication of effort and ensure the State legislature and funding agencies see a well-organized and unified support for funding requests on an ongoing basis;
- Providing information to the public on implementation and resulting improvements in watershed conditions;
- Providing early warning signs and joint responses to changing conditions, including physical conditions in the watershed and new regulatory developments;
- Monitoring watershed conditions;
- Coordinating data management and providing access data; and
- Periodic review and revisions if warranted.

Effective implementation will require a mutual understanding and commitment to coordinate decisions-making and ensure consistency in land use planning. Inter-governmental agreements may be a useful tool to help define roles and responsibilities. To provide for this work an organized and collaborative approach will be used to maintain interest and help in securing resources to carry out the overall objects. Efforts will be made to continue the Planning Unit and assign a lead agency.

6.2 GENERAL FUNDING STRATEGY FOR IMPLEMENTING ACTIONS

Each action includes a preliminary estimate of the magnitude of costs and staffing implications. In some cases potential funding sources have not been identified. Funding may be provided through the following options:

- Appropriations from the Washington State Legislature for state agency capital and operating budgets. This would provide funding and/or staffing that could be utilized under existing state programs;
- Direct appropriations from the Washington State Legislature for specific projects in WRIA 29A;
- Appropriations from the U.S. Congress for federal agency budgets (USGS, USFS) under existing programs;
- Grants or low interest loans from existing funding programs, such as the Public Works Trust Fund, State Revolving Fund for Drinking Water, Salmon Recovery Fund, and others;
- Rates and hookup charges collected from customers by public water systems;
- County permitting fees or general fund revenues;
- Private industry funds for voluntary projects at selected industrial facilities (supplemented by public funds where possible); and
- Landowners for voluntary projects at selected sites (supplemented by public funds where possible).

It is important to recognize there may be overlap with currently funded programs that align closely with the objectives and recommendations of the plan or DIP actions. There may be cases where existing budgets can be effectively integrated with specific actions to help reduce the overall financial impact.

In developing a funding package for implementing the DIP, it is important to match funding to benefits. Some of the actions listed in the DIP, such as Stevenson's HEALing SCARS Program will benefit a specific community. In these cases, it is appropriate that the community contribute a large share of the cost. In other cases an action may be carried out by one community, but serve a broader benefit throughout the watershed. For example, if a local community voluntarily wishes to switch from an existing water supply source to a new one to help restore populations of listed species, there will likely be considerable costs. The purpose of a project of this nature is to restore fish populations for the good of the WRIA 29A. In this case, it is not equitable for a local community to bear the cost alone. While some cost burden may be acceptable at the local level, the majority of funding for this type of project should come from regional, state or federal sources.

6.3 ACTIONS

Action #12		Continue the Planning Unit Organization	
Action Type:	<input type="checkbox"/> Water Supply <input type="checkbox"/> Water Quality <input type="checkbox"/> Stream Flow	<input type="checkbox"/> Habitat <input type="checkbox"/> Education <input checked="" type="checkbox"/> Implementation	Priority: Medium
Subbasin(s)	<input checked="" type="checkbox"/> All <input type="checkbox"/> Wind <input type="checkbox"/> Rock Creek <input type="checkbox"/> Little White Salmon <input type="checkbox"/> Columbia Tributaries		
Status	<input type="checkbox"/> Planned <input checked="" type="checkbox"/> Active <input type="checkbox"/> Complete		
Time frame for completion	<input checked="" type="checkbox"/> Ongoing <input type="checkbox"/> Complete by 2015 <input type="checkbox"/> Complete by 2025 <input type="checkbox"/> Complete by 2020 <input type="checkbox"/> Complete by 2030		
Description	<p>The watershed management plan anticipated support for future implementation. At the time the plan was adopted, Ecology provided Phase IV funding to planning units desiring to move into implementation. However, at this writing, for the FY15-17 biennium the Governor's budget proposes eliminating Ecology's funding for ongoing planning unit work.</p> <p>The Planning Unit believes that continuity in planning will be important to improve watershed conditions. Given the fiscal uncertainties, the Planning Unit encourages the Initiating Governments to remain active during implementation and to convene the Planning Unit regularly to act as an advisory group as issues arise.</p>		
Strategies & Measures	<p>2.4.28 Compile a list of recommended studies and provide it to regional colleges and universities</p> <p>2.4.29 Encourage Skamania County to develop GIS capability</p>		
Expected Outcome	<p>Support for the Planning Unit will foster a forum for responding to early warning signals that may arise. Maintaining an implementation group will also provide continuity if reopening the plan becomes necessary.</p>		

Task 12.1 – Work with Ecology to Provide Funding to Maintain the Planning Unit

Lead: Planning Unit

Coordination: Ecology

Status ☐ Planned ☒ Active ☐ Complete

Time frame for completion

<input checked="" type="checkbox"/> Ongoing	<input type="checkbox"/> Complete by 2025
<input type="checkbox"/> Complete by 2015	<input type="checkbox"/> Complete by 2030
<input type="checkbox"/> Complete by 2020	

Description	<p>It is the vision of the legislature to provide a local structure for managing watershed health, planning for future water needs and monitoring results in a coordinated fashion that will meet the needs of the communities while protecting at-risk salmon and steelhead runs. Continuity in leadership is important to see that actions are implemented and to advise Ecology on water management issues as they arise. The Planning Unit can serve as a supportive forum to air concerns and explore alternatives.</p>
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Cost	<input type="checkbox"/> High	(Greater than \$500,000)	<input checked="" type="checkbox"/> Per year
	<input type="checkbox"/> Medium	(\$50,000-\$500,000)	
	<input checked="" type="checkbox"/> Low	(Less than \$50,000)	<input type="checkbox"/> One time

Is the task funded? ☐ Yes ☒ No ☐ Partially

Funding Source	Unknown
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Constraints & Uncertainties	With the reduction in Ecology's funding, other sources will need to be identified.
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Task 12.2 – Identify a Lead Agency to Maintain Planning Unit Work Products and GIS

Lead: Initiating Governments

Coordinating: Planning Unit

Status ☒ Planned ☐ Active ☐ CompleteTime frame for completion
☐ Ongoing
☒ Complete by 2015 ☐ Complete by 2025
☐ Complete by 2020 ☐ Complete by 2030

Description

Currently the Lower Columbia Fish Recovery Board serves as the lead agency. This arrangement may or may not continue after approving the Detailed Implementation Plan. Coordinating continued support will be led by the Initiating Governments in consultation with the Planning Unit.

The Planning Unit agrees that a central clearinghouse will help to maintain watershed planning information and disseminate information as needed. This work should be coordinated with other public information and outreach activities

Cost
☐ High (Greater than \$500,000) ☐ Per year
☐ Medium (\$50,000-\$500,000)
☒ Low (Less than \$50,000) ☒ One timeIs the task funded?
☒ Yes ☐ No ☐ Partially

Funding Source Funding sources have not been identified.

Constraints & Uncertainties Funding for this work may be integrated into other planning and monitoring efforts to gain cost efficiencies.

- A. Guiding Principles
- B. Ground Rules
- C. Criteria for Prioritizing Actions
- D. Sample Operating Charter
- E. Sample Memorandum of Agreement
- F. Comparison of Old and New Toe-Width Method
- G. WRIA 29A Permit Exempt Well Consumptive Water Use Estimate
- H. Rationale for WDFW-Ecology recommendations for instream flows and flow reserves in Watershed Management Planning

APPENDIX A

WRIAs 29A Guiding Principles for Developing the Detailed Implementation Plan

In developing the Detailed Implementation Plan, the Planning Unit will ensure that the mission statement, objectives, ground rules and operating principles outlined in the Watershed Management Plan are followed. In addition, we agree to operate under the following guiding principles:

In developing the Detailed Implementation Plan, the Planning Unit will:

- Strive to meet the water needs of agriculture; municipal, commercial, industrial and residential uses; and instream flows;
- Promote the efficient use of water;
- Plan for a 20-year horizon that includes a strategy for reopener triggers to update the plan.
- Strive to maintain the overall balance of the watershed plan in identification and prioritization of implementation actions;
- Focus efforts on identifying and prioritizing actions that achieve multiple objectives;
- Achieve goals and objectives in the most cost-effective and efficient manner possible;
- Strive to ensure overlap and duplication of efforts is avoided;
- Ensure actions are coordinated and integrated with other planning efforts in the watershed and other activities adjacent to the planning area;
- Facilitate and promote active participation by those entities affected by actions and key decisions;
- Keep affected entities informed of key decisions and outcomes;
- Work cooperatively to achieve all goals and objectives of the plan;
- Strive to ensure planning actions are integrated into federal, state and local decision-making processes;
- Work to broaden public awareness and support of the plan during and after the DIP is approved; and
- Identify and pursue early implementation opportunities.

APPENDIX B

WRIA 29A Watershed Planning Unit Ground Rules

Introduction

The WRIA 29A watershed management plan was adopted in 2005. Upon completion of the plan additional stream flow data was collected by the Department of Ecology (Ecology). As a result of this new information the initiating governments believe it is in their interest to develop a detailed implementation plan pursuant to RCW 90.82.043 and assist Ecology in crafting a streamflow rule. To this end, the initiating governments have reestablished the planning unit. The following ground rules will provide the foundation for facilitating the work.

Meetings

Meetings shall occur at least monthly to accomplish the requirements of the Watershed Planning Act. These meetings shall be used to discuss and determine how the Planning Unit will conduct and organize itself in order to best fulfill its obligations and best utilize its resources. During Planning Unit meetings Planning Unit members should sit at tables and non-members should sit off to the side to avoid confusion in decision-making. Non-members may participate in discussions but not in decision making.

Decision Making

Consensus agreement is best for the group as a whole.

1. We commit to making decisions based on consensus. If an issue or decision cannot be resolved through consensus, a vote shall be used in order to move the decision-making forward. Voting shall be used only as a last resort.
2. Consensus decision-making shall be applied as illustrated in the Definition of Consensus table, Attachment 1. Planning Unit members shall have the option to utilize any of the seven options within the continuum. Decisions will be recorded as part of the Planning Unit and Committee meeting minutes.
3. We agree that a time limit of 30 minutes should be placed on each decision. If consensus is not reached by that time, the decision should be tabled until the next regularly scheduled meeting. Discussion of that decision shall be limited to 30 minutes. At that time consensus shall be agreed upon or a vote shall be taken.
4. We agree to brainstorm and conduct small group discussions in order to generate ideas and encourage participation by group members. Ideas from brainstorming and small discussion should be assessed by the Planning Unit and considered in the decision-making process.
5. For a quorum, 60 percent of the membership and four initiating governments shall be present (participation may be by phone). In the event the planning unit cannot reach consensus, it will make decisions by voting. To pass a motion, a vote must be unanimous by all initiating governments and 60 percent of the members present.

6. In the event that poor attendance by Planning Unit members affects the Planning Unit's ability to reach quorum for two (2) consecutive Planning Unit meetings, the following procedures will be followed by the lead agency:
 - The appropriate representative will be contacted and informed that improved attendance is necessary.
 - If the representative misses a third consecutive meeting without contacting the lead agency they will be informed that new representation is being sought.
 - The lead agency will inform the interest group that new representation is needed.
 - The interest group will recommend a new representative to the initiating governments.
 - The initiating governments will approve new Planning Unit members.

Ground Rules

1. We will focus our discussions on the issues associated with developing a plan for the management and use of the watershed. We will avoid debating issues beyond the scope of that effort.
2. We represent a broad range of interests, each having an interest in how our water resources are used and protected. We recognize the legitimacy of each other's interests and concerns in our efforts to forge an effective and viable management plan. We will listen carefully. We will respect each other's right to disagree.
3. All participants will be treated with respect and dignity. We will not tolerate personal attacks directed at individuals and agencies.
4. We commit not to characterize each other's motivations, values, or positions in any discussions that we may have with the press. We will not attribute specific statements or positions to a participant without their prior approval and we will seek such approval during the course of our meetings whenever possible. We commit to work out our differences at the table rather than in the press.
5. We commit to search for opportunities and creative solutions. We will focus on problem solving, rather than stating our positions.
6. We agree that this planning effort is a priority in terms of committing our time and resources. We agree that consistency in participation is critical and we commit to make every effort to attend meetings of the Planning Unit. However, in recognition that events may arise that prevent attendance, each participant may name an alternate to attend meetings on his or her behalf. The participants shall be responsible for ensuring their alternate is informed.
7. The use and protection of our water resources is an important public issue. Our meetings will be open to the public and we will make time available at each meeting for the members of the public to share their concerns, interests and suggestions.
 7. We will keep minutes of our meetings. The minutes shall summarize the discussions and document the decisions of the Planning Unit.

Definition of Consensus

DEFINITION OF CONSENSUS FOR WRIA 29A						
Consensus is defined in terms of agreement along a continuum. Planning Unit members may register the degree of their agreement with the language in any of the first six columns:						
Endorse	Endorse with a minor point of contention	Agree with reservation	Abstain	Stand aside	Formal disagreement but will go with the majority	Block
"I like it"	"Basically I like it"	"I can live with it"	"I have no opinion"	"I don't like it but I don't want to hold up the group"	"I want my disagreement to be noted in writing but I'll support the decision"	"I veto this proposal"
The last (shaded) column on the right side of the continuum is <i>not</i> considered acceptable for consensus in this process. However, anything to the left could be considered "agreement by consensus."						

APPENDIX C

WRIA 29A Detailed Implementation Plan

Action Scoping Process

Identify existing Plan recommendations.

Identify additional or emerging needs and considerations relating to Plan actions and recommendations.

Based on existing actions, recommendations, and existing/emerging needs and considerations, develop task for implementation.

Prioritize actions into High, Medium and Low categories based upon the degree to which the action:

- Addresses multiple Plan objectives and priorities;
- Addresses high priority needs;
- Provides resource and community benefits over a broad area;
- Addresses community water supply and streamflow needs;
- Addresses an threat to water quality, water supply or habitat;
- Is a necessary step toward subsequent actions (other actions depend on completion of it);
- Is complimentary with other ongoing or proposed management actions/programs, or builds upon time-sensitive or emerging opportunities;
- Is a legal requirement of the Watershed Planning Act; and
- Is feasible from a funding perspective?

Populate the Action Table with tasks based on the above process. The Action Table will identify the prioritized suite of actions to be addressed in the DIP.

APPENDIX D

Sample Operating Charter

Purpose: The purpose of the planning unit is to further the management of water resources through the implementation of the WRIA 29A Watershed Management Plan and the supporting Detailed Implementation Plan. Toward this end, the planning unit will:

- Coordinate, facilitate, and advise implementation efforts by state agencies, counties, cities, public water purveyors, and other water related interests within the planning area;
- Will promote and support cooperation and partnerships among parties to implement the Watershed Management Plan;
- Monitor and assess the implementation of the Watershed Management Plan;
- Propose revisions to the Watershed Management Plan and the supporting Detailed Implementation Plan as deemed necessary to ensure the prudent use of the region's water resources.

Background: Pursuant to RCW 90.82, the WRIA 29A Watershed Management Plan was prepared by the planning unit and adopted by Skamania County as the implementing authority. The goal of the planning unit was to "develop and implement a watershed management plan for the responsible use of water to balance the needs of people and natural resources." Planning unit members included the City of Stevenson, Skamania County, Skamania PUD and the Yakama Nation as initiating governments, and, state and federal agencies, the Port of Skamania and other water-related interests within the planning area. The final plan was adopted by the Boards of County Commissioners of Skamania County on November 28, 2006. Following adoption of the plan, the planning unit adopted a Detailed Implementation Plan (DIP) in 2015.

The Watershed Management Plan addresses water quantity and quality, stream flow, and fish habitat. It set the following objectives for the management of water resources and the enhancement of watersheds:

- Provide long-term reliable and predictable water supplies for human uses.
- Improve certainty, timeliness, and efficiency in water rights decisions.
- Manage stream flows to effectively support fish recovery and habitat enhancement plans.
- Provide for improved stormwater and flood control through improved land use practices
- Protect surface water quality for designated uses, with an emphasis on protection of fish and supporting aquatic biota.
- Protect surface and ground water quality needed for public drinking water supplies.

- Maintain productive habitat and enhance degraded habitat for indigenous/native fish species in all life stages.
- Ensure public waters are accessible for recreational uses.

The Plan also set forth the following implementation objectives:

- Manage water resources in a cost-effective manner, taking into account existing programs, potential partnerships, cost/benefit principles, and opportunities to achieve multiple objectives.
- Ensure fairness in distributing costs and burdens of water-resource management actions.
- Improve public understanding of water resources and encourage responsible stewardship.
- Provide for extensive and meaningful public participation.
- Improve scientific basis for decision-making on water-resource issues, through sound data, accepted technical methods, and effective quality assurance/quality control protocols.
- Develop effective protocols, administrative arrangements and funding sources for long-term monitoring to support adaptive management of water resources.

With the completion of this work, the focus of the planning unit has shifted to implementation of the various strategies and actions. The purpose of this document is to provide a framework through which key implementing partners and interested parties will work together to implement the Plan.

Participants: Core membership in the planning unit will consist of:

- The initiating governments: Skamania County, the City of Stevenson, Skamania PUD and the Yakama Nation;
- *[Are there others?]*

Other water-related interests may become members with the consent to the initiating governments.

Planning Unit Convener: To the extent that resources are available, the _____ shall serve as the planning unit convener and, in doing so, shall:

- Develop meeting agendas in consultation with the planning unit;
- Arrange and provide notice of meetings;
- Facilitate quarterly meetings;
- Distribute meeting materials and serve as an information clearinghouse;

- Will apply for, receive, and administer funds received for the operations of the planning unit or to conduct any projects undertaken collectively by the planning unit.

Functions: The planning unit will perform the following functions:

- Advise the Washington Department of Ecology on matters relating to the implementation of the WRIA 29A Water Management rule or other cooperative agreements that may be developed and associated mitigation strategy, including the issuance or transfer of water rights and review and revision of the rule;
- Coordinate, facilitate, and advise implementation efforts by state agencies, counties, cities, public water purveyors, and other water related interests within the planning area;
- Report annually to the implementing authority, Skamania of the planning unit's progress;
- Will promote and support cooperation and partnerships among parties to implement the Watershed Management Plan and Detailed Implementation Plan;
- Coordinating efforts to seek funding for Plan actions, to avoid duplication of effort and ensure the State legislature and funding agencies see well-organized and unified support for funding requests on an ongoing basis;
- Promote public understanding of and participation in water resource issues and encourage responsible stewardship;
- Providing information to the public on Plan implementation and resulting improvements in watershed conditions;
- As funding allows, undertake studies or assessments needed to address key issues or uncertainties associated with the implementation of the Watershed Management Plan
- Provide a forum for the discussion of water management issues within the planning area;
- Track and assess implementation of Plan actions by the many organizations involved, to ensure actions are being carried out in a timely fashion; that the balanced nature of the plan is retained as actions are implemented; and that the most important priorities defined by the planning unit are being addressed;
- Monitor watershed conditions across jurisdictional boundaries, facilitate appropriate data management, and provide appropriate data access; and
- Propose revisions to the Watershed Management Plan and the supporting Detailed Implementation Plan as deemed necessary to further the prudent use of the region's water resources.

Ground Rules and Decision Making: The planning unit shall operate under the ground rules in Attachment A. Decisions will be made by consensus as defined in Attachment B. Meetings will be held once a quarter provided that the planning unit may choose to meet more frequently if necessary.

Funding: To the extent that funding is available, the _____ will provide the services of the planning unit convener. Each participant shall be responsible for the costs associated with its participation in planning unit meetings. Grant funding will be sought to support planning operations and projects. The planning unit members may choose to contribute to the operation of the planning unit or specific projects. Such contributions are voluntary.

Attachments:

Ground Rules

Definition of Consensus

APPENDIX E
Sample Memorandum of Agreement

Proposed Elements
Between the Department of Ecology – Water Resources Program
and
xxxxxxx
Regarding
Implementation of the WRIA 29A Watershed Management Plan
and
Detailed Implementation Plan

- Recommend that this MOA is an inter government agreement between Ecology's Water Resources Program and Skamania County Government.
- To the extent permissible under current state statutes and administrative rules, Ecology will process water applications in accordance with the applicable provisions of the WRIA 29A Watershed Plan and Detailed Implementation Plan. Ecology will consult with the WRIA 29A Planning Unit //or Initiating Governments when necessary to clarify the intent or meaning of the plans. Ecology may consult with or seek the advice of the WRIA 29A Planning Unit//or Initiating Governments in processing a water right application.
- Ecology shall advise the county and the WRIA 29A Planning Unit//or Initiating Governments annually of the status of water right application processing in WRIA 29A.
- Ecology will process water right applications within each WRIA 29A subwatershed, based on priority date of application received.
- Ecology and the county will cooperate to track the utilization water reservations.
 - Ecology will track the number of permit exempt and Group B wells in WRIA 29A.
 - Skamania County will provide Ecology with building permit related information to assist Ecology in tracking permit-exempt wells.
- Ecology will attend and participate in meetings called by the WRIA 29A Initiating Governments.
- Skamania County is responsible for determining the legal availability of water within its jurisdiction, as required in Chapter 19.27.097 RCW and Chapter 58.17 RCW.

APPENDIX F

Comparison of the Old and New Toe-Width Method Spreadsheet

Jim Pacheco, Ecology

December 11, 2014

The numbers in the table represent the preferred discharge (aka the Habitat base in stream flow) by species and life stage calculated from the Toe-Width number in each row. The table on the left is the original method, the table on the right in the current version of the updated TW method (and will be subject to further revision in the future). We hope to be finished this summer.

The Toe-Width Method (Swift 1976 and 1979) was a successful short-cut method for estimating results or a more detailed habitat study. Instead of taking 2-4 months of data collection and a week of analysis, a Toe-Width (TW) study could be completed in a matter of hours. Over the years, the TW method has been used hundreds of times in streams statewide by Ecology and WDFW biologists and analysts for determining the preferred discharge for spawning and rearing fish and has been successfully defended in court as a reasonable and acceptable method for determining ISFs (Mead v. Ecology 2004). The simplicity, time effectiveness, and reasonably accurate relation to the more expensive and time intensive habitat model (e.g. Physical habitat simulation model, PHABSIM) has made the TW method a good short-cut method for determining a preferred stream flow for fish.

Original Study Design (rewritten)

Swift 1976 measured the area of preferred depth and velocity for steelhead along 4 transects, on 54 different reaches, in 18 Washington State streams, at 8 to 10 different stream flows. At each reach they determined the stream flow that provided the greatest area of preferred depth and velocity, called it the preferred discharge. Then they conducted a multivariate regression analysis comparing the preferred discharge to drainage area, reach altitude, mean basin altitude, channel slope, and toe-width to see if there was a simple measurement that correlated to the results of the time intensive habitat study.

In 1979, Swift conducted a similar analysis for the five species of Pacific salmon in 84 study reaches on 28 streams but also included the factors of water-surface slope within the reach, maximum depth of water below toe-of-bank, top of bank channel width, and hydraulic radius for the channel within the top of banks.

Both studies showed the Toe-Width measurement provided the best relationship with a standard error of 28% for steelhead and 40-48% for salmon spawning, and 56% and 57% for steelhead and salmon rearing, respectively (Swift 1976 and 1979).

Drawbacks

Despite all its benefits, the Swift TW method suffers from a number of limitations. First, the method is limited to Pacific salmon and steelhead. For salmon, Chinook, chum and pink were consolidated into one spawning category with coho and sockeye in another. Since there were no TW equations for

resident rainbow trout, cutthroat, or bull trout, we have been unable to use the TW method for these important species.

Second, over the years, WDFW and Ecology biologists and instream flow consultants have conducted numerous Habitat Suitability Criteria (HSC) studies which have greatly improved our knowledge of the depths and velocities preferred by spawning and rearing fish. In addition, substrate and cover are now considered important factors in calculating the preferred discharge (Bovee 1986) and modern habitat models (e.g. PHABSIM) include options for substrate and cover as factors when calculating a preferred discharge. Ecology and WDFW maintain a database of HSC studies and have published state-wide composite preference curves for use in PHABSIM studies. Originally published in 2002, the Instream Flow Study Guidelines is periodically updated as new HSC studies are analyzed and added to the database. The current version was published in April of 2013. Because changes in HSCs can lead to changes in the fish habitat to stream flow relationship (Bovee 1986??), the relationships used by Swift may not be accurate.

Third, there has been much debate and confusion over how and where to accurately measure a toe-width. Swift determined the width of the channel at each cross section by “measuring horizontally from the point where the streambed and one bank join (point of TB in figure shown below) to the ground surface on the other bank. The width of gravel bars, if present, is included,” and if the channel has a distinct toe on each bank, the lower toe is used (Swift 1976, p 41 & 1979 p26).

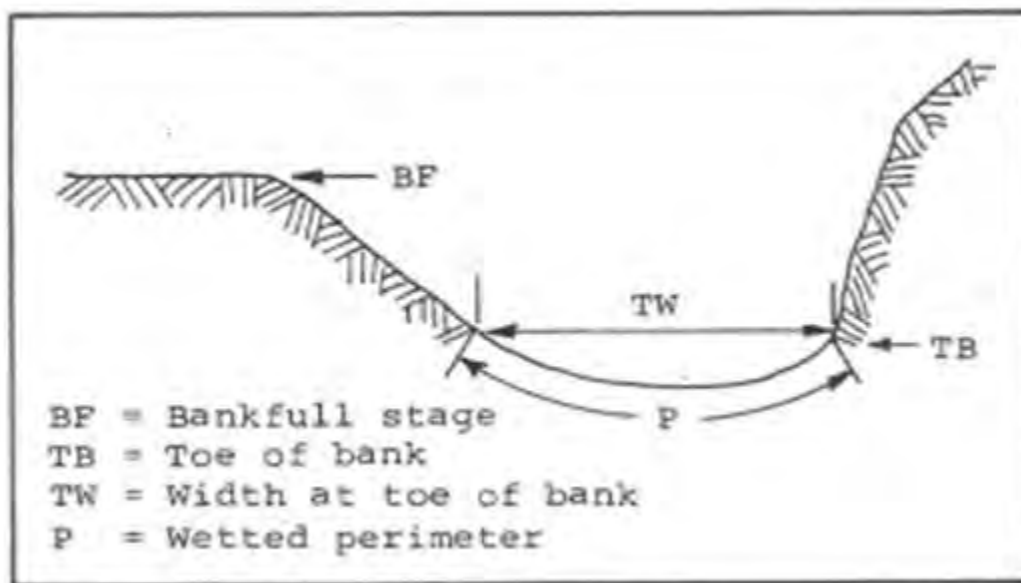


Figure 1. Original Figure 2 from Swift 1976 and Figure 5 (Swift 1979).

The definition and picture (Figure 1) are unclear for a number of reasons. For example, wetted perimeter varies with flow, but the picture shows it being the lower boundary of the toe-of-bank (TB). The hash marks are undefined, but appear important as they form the upper boundary of the TB. The definition gives no clues on how to determine where the bed stops and the bank starts. This

combined with the direction to measure horizontally to the opposite bank, lead some researchers we recently reviewed to use the width of the thalweg as a TW measurement. Based on our own experiences, a thalweg cross section measurement would be in error and underestimate the true toe-width.

Finally, the percent standard error was relatively high for the salmon spawning equations and even worse for the salmon and steelhead rearing equations, possibly because of the lumping of the different species into a single category.

Given these limitations of the existing TW method, biologists from Ecology and WDFW decided to pursue an update using modern habitat models with current HSC, and a clearer definition of a TB and TW. Our goal is to use Weighted Usable Area (WUA) peak results from PHABSIM studies conducted all over the state of Washington to determine the preferred streamflow for a variety of spawning and rearing fish species. Following the original TW procedure, this preferred streamflow will be regressed against the average TW at the location of the study. With species specific WUA curves, and a clearer definition of a TW, we believe the new regression equations will provide more accurate estimates of a stream flow that produces the most preferred fish habitat.

APPENDIX G

WRIA 29A Permit Exempt Well Consumptive Water Use Estimate

Introduction

The Planning Unit for Water Resource Inventory Area (WRIA) 29A – Wind River watershed is developing a plan and recommendations for water supplies and stream flows. A key step in this planning effort is estimating future water supply needs. Permit exempt or domestic wells are the primary water source for homes and small scale commercial and agriculture uses in areas not served by community water systems. This paper documents the data, assumptions and methods proposed to serve as the basis for estimating future water use by permit exempt wells in WRIA 29A.

Objective

To estimate an average daily water consumption value for residences reliant on permit exempt wells in WRIA 29A, for use in establishing water reservations and for debiting the reservation to account for future permit exempt well water use.

Methodology

Water withdrawals and the associated consumptive water use can deplete stream flows, reduce available habitat for fish, and adversely affect other instream water uses. These impacts are of greatest concern during dry summer months when stream flows are at their lowest and when water withdrawals peak primarily due to irrigation needs. An estimate of consumptive water use is needed in order to assess the potential impact of consumptive water withdrawals on stream flows. The methodology described below provides a tool for estimating consumptive water use related to permit exempt wells.

Many factors influence water consumption including outdoor irrigation, the number of people in the household, season, water cost, rainfall patterns, geology, land use, leakage rates, pumping rates, etc. To account specifically for all these factors across the WRIA is not practical or feasible. The methodology outlined below provides an approach that draws upon the best available data in an attempt to estimate permit exempt well water use. Where possible, the data used are specific to the planning area. Data sources are identified and all assumptions and methods are explained in order to allow the reader to clearly and fully understand how the water use estimates were derived.

The estimate of water use is based on the combination of household indoor use and outdoor (irrigation) use.

Household indoor water use:

A study completed by American Water Works Association (AWWA, 1999) looked at 12 study sites across the U.S. encompassing 1188 homes in order to determine how water is used in homes. Although indoor consumption rates vary, the *mean* per capita indoor daily water use was determined to be 69.3 gallons (including leakage). Other studies have also estimated indoor water use but this AWWA study is considered to be more accurate because water use was calculated using specific data loggers, rather than billing records which is the more common way to estimate water use.

To estimate household indoor water use, an estimate of the average number of persons per household is needed. The Washington State Office of Financial Management (OFM) estimates that an average Skamania County household consisted of 2.44 persons in 2010. The average size of a household in the unincorporated areas of the county in 2010 was estimated to 2.497 persons. The U.S. Census Bureau estimates the average Skamania County household size to be 2.51 people. Thus, the estimated household indoor water use (average daily water use {gpd} x the average number per household) would range from 169 to 174 gallons per home per day.

Calculations in this paper are based on an estimated household indoor water use of 174 gallons per day (gpd). This amount is based on the AWWA indoor water use per capita estimate of 69.3 gallons per day (gpd) and an average household size of 2.5 people. Daily indoor water use is assumed to remain constant throughout the year.

It is recognized that a portion of the water used, returns to groundwater via infiltration and septic system return flow. It is necessary to account for this return flow in order to calculate the total estimated consumptive use of water for a household. Studies (Drost 1999, Sapik 1988, Van Heeswijk 2002, Vaccaro and Olsen 2009) have shown return rates from indoor use to be quite high ranging from 73% to 90%. An 87% return flow was assumed for indoor use (13% consumptive use) based on a study completed by USGS in the Lower Skagit Basin (Johnson and Savoca 2010). Based on the estimated indoor water demand per household of 174 gallons per day and an 87% return rate, estimated indoor consumptive use would be approximately 23 gallons per day.

Outdoor water use:

It is assumed that across the WRIA, the outdoor water use is primarily for irrigation of lawns, trees, shrubs and gardens. Information from a study completed by American Water Works Association (AWWA, 1999) and the Oregon Crop Water Use and Irrigation Requirements (OSU Extension Service, 1992) were used to estimate household outdoor water use.

It is assumed that 0.15 acres or 6,548 square feet per household would be irrigated. The AWWA study found the average irrigable area for residential lots in Seattle, WA and Eugene, OR to be 6,058 and 6,863 square feet respectively. A residential water use survey conducted in Spokane County between October 2009 and April 2010 found an average irrigated area of 8,000 square feet (0.18 acres) (Spokane County Water Resources 2010). While these irrigable areas are for urban residential lots, it is assumed that owners of larger rural properties would likely have similar irrigable areas. Also, while permit exempt wells may be used to irrigate up to 0.5 acres, it was assumed that few rural water users would utilize this maximum amount.

The Oregon Crop Water Use and Irrigation Requirements (OSU Extension Service, 1992) provides irrigation requirements for various crops in the Columbia Gorge below Hood River takes into account local precipitation trends. Crops covered by the guidance include fruits, vegetables, nuts, grains, and grasses. Pasture grass was selected for use based on the assumption that it would be the most representative of rural household irrigation or outdoor water use in WRIA 29A. Monthly net irrigation requirements for pasture grass for 8 out of 10 years were used. The net irrigation requirement is the crop consumptive water need less effective precipitation. More simply, the net irrigation requirement is the estimated amount of water that must be delivered to the crop monthly by irrigation for optimum growth. The AWWA study found that few homeowners apply the full net irrigation requirement. However, the study did find a strong relationship between climate and

average irrigation applications. Specifically, the average household irrigation application was found to be about 55 percent of the net irrigation requirement for their location.

Using this information, the household outdoor water use was estimated to be 55 percent of the net irrigation requirement for 0.15 acres of pasture grass. Monthly estimates were for the months with the highest irrigation requirements: May, June, July, August, and September. No adjustments were made for the efficiency of irrigation methods or practices. Irrigation or outdoor water use estimates for the remaining months are shown below.

Estimated Household Outdoor Water Use (gpd)				
May	June	July	August	September
179	291	426	352	200

Since irrigation application is less than the net irrigation requirement, all water applied would be used by the plant, there would be no return to groundwater. Therefore the outdoor use estimates also represent consumptive water use.

Estimated average daily water demand:

The table below shows the estimated average household indoor and outdoor water demand. It does not reflect the volume of water returned to groundwater through on-site septic systems or infiltration. The average household demand for the high need months of May through September is 464 gpd.

Estimated Average Household Water Demand (gpd)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Indoor	174	174	174	174	174	174	174	174	174	174	174	174
Outdoor	0	0	0	41	179	291	426	352	200	18	0	0
Total	174	174	174	215	353	465	600	526	374	192	174	174

Estimated total daily consumptive use:

The table below combines indoor and outdoor consumptive water estimates to provide a total household estimate of daily consumptive water use. As can be seen, the highest consumptive water use occurs in the months when stream flows are likely to be at their lowest.

Estimated Total Household Consumptive Water Use (gpd)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Indoor	23	23	23	23	23	23	23	23	23	23	23	23
Outdoor	0	0	0	41	179	291	426	352	200	18	0	0
Total	23	23	23	64	202	314	449	375	223	41	23	23

The depth of a well, distance to a stream and underlying geology are some of the many factors that influence impacts of water withdrawals on the stream flows during the low flow months. To be conservative, it is assumed that the impact to a stream from water withdrawal is immediate. An average daily consumptive use was calculated by using the high need months of May through September. This yields an ***average total consumptive use of 313 gallons per day per household***. Consumptive water use is 67 percent of the overall household demand. The consumptive use value will be used to ensure that an adequate quantity of water is reserved for rural uses. This value will also be used to debit the reservation, if a Water Management Rule is adopted.

Conclusion

Although there are many uncertainties related to calculating specific water consumption values for households in such a broad geographic range, some assumptions can be made to develop a conservative estimate for planning purposes. Some households will use more water and some less. Some wells will impact streams almost immediately while others may have days or months delay in impacts. Considering this wide range of possibilities, this conservative estimate of an average daily consumption rate of 313 gallons per day per household is reasonable.

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APPENDIX H
Rationale for WDFW-WDOE recommendations for instream flows
and flow reserves in Watershed Management Planning (RCW 90.82/ESHB 2514)

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5 July 2006; clarifying note from 4 October 2004

WDFW and Ecology have worked to identify and protect instream flows to protect instream resources, including fish. For streams where we had IFIM/PHABSIM study results, we used those results for recommending instream flows. In other streams we used the toe-of-bank width (“toe-width”) method. Output from the two methods differs. IFIM/PHABSIM produces a habitat index for each flow simulated; from these results we can recommend the flow that maximizes habitat, as indicated by the index. Toe-width generates a flow recommendation in cubic feet per second (cfs) without any indication of how much habitat is provided at that flow relative to other flows.

We compare our initial instream flow recommendations with hydrological information, where available. No value is obtained by setting instream flows higher than can occur often enough and long enough to provide usable habitat for fish, and high instream flow recommendations (relative to hydrology) lead to confusion over expectations.

If we have hydrological information, we use that to keep our recommendations consistent with hydrology, particularly during low flow in late summer and early fall (salmon and steelhead juvenile rearing and Chinook salmon spawning). We limit our instream flow recommendations to flows that are hydrologically realistic – they occur frequently enough (every few generations) for long enough (roughly a week) that they would have real benefit to the long-term survival of a population of fish. Thus we would expect these flows, though higher than normal, to benefit fish populations when the flows occur.

Specifically, we develop preliminary instream flow recommendations based on the relationship between habitat and flow. If preliminary instream flow recommendations are higher than the 10% exceedence flow (calculated on a monthly or half monthly basis), we reduce our instream flow recommendation to the 10% exceedence flow.

Late summer – early fall low flows limit fish habitat - Our concerns with the ceiling on our instream flow recommendations during low flow emphasize the importance of low flows as a limiting factor for fish. For both coho salmon and steelhead we have evidence that more flow during summer low flow results in better production of these fish. Conversely, less flow results in less production. Further reduction of flow in late summer and early fall can be expected to adversely impact production of these fish, reducing population viability and harvestable numbers (if applicable).

During late summer-early fall, we recommend instream flows to protect the full natural potential for fish habitat, as discussed above. This results in recommending flows that preclude additional out-of-stream water appropriation (new water rights) – i.e., closure.

Flow reserves – We recognize that protecting fish habitat through instream flows and closures may involve some compromise; flow reserves are such a compromise. WDFW does not advocate such flow reductions, but they may be part of a water management package that can be acceptable to WDFW. How much water can be exempt from instream flows while still fulfilling the purpose of instream flows?

We considered the case of driest streams at the low flow season, the time when flows are the greatest stressor for fish. At such a season, it is difficult to say that any flow reduction is acceptable, but we evaluated several habitat or flow reductions. Habitat reductions of 50%, 25%, 10%, and 5% were considered too extreme under already severe conditions. Reductions of 1-2% were considered tolerable, although it does represent a real loss of fish, including ESA-listed species, and is only tolerable if additional flow protection (adoption and implementation of instream flows and closures) goes with it.

To determine an acceptable flow reserve, we determined flows that equate to 1-2% reductions in WUA for juvenile steelhead and Chinook salmon spawning at the 90% exceedence flows in September-October. The reduction in WUA was not identical for all species and life-stages, but they were similar (e.g., 1.7% for steelhead juveniles and 0.9% for Chinook salmon spawning for a given flow reduction); hence the range of 1-2%, rather than a single figure. We are looking at the very dry conditions (9 out of 10 are as wet or wetter for that date) at the driest season. For fish (or any other water user) this is the most stressful condition.

Because some streams did not have WUA (i.e., no IFIM/PHABSIM studies), we considered how flow might be used as a surrogate for the habitat index (WUA). At several study sites the relationship between WUA and flow was nearly linear, so we used flow as a surrogate for habitat where no IFIM/PHABSIM study was conducted; we have used a 1-2% reduction in flow from the 90% exceedence flow at the low flow season as the reserve recommendation.

In small streams, we recommend no reserve. These small streams are too sensitive to flow reduction.

Summary – For late summer instream flow recommendations we focus on the wettest conditions to allow fish to benefit from relatively wetter conditions when they occur. For flow reserves, we focus on the driest late summer flows to assess worst-case (for fish) habitat impacts of exempting withdrawals from instream flows and closures.

CHAPTER VIII. REFERENCES

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Agency Abbreviations

BPA	Bonneville Power Administration
Commerce	Washington Department of Commerce
Ecology	Washington Department of Ecology
GSRO	Washington Governor's Salmon Recovery Office

LCFRB	Lower Columbia Fish Recovery Board
NRCS	Natural Resources Conservation Service
NPCC	Northwest Power and Conservation Council
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OFM	Washington Office of Financial Management
SRFB	Washington Salmon Recovery Funding Board
USDA	US Department of Agriculture
USFS-GP	US Forest Service, Gifford Pinchot National Forest
USGS	US Geological Service
USFWS	US Fish and Wildlife Service
USEPA	US Environmental Protection Agency
WSDA	Washington State Department of Agriculture
WDOH	Washington Department of Health
WDOT	Washington Department of Transportation
WDFW	Department of Fish and Wildlife

Acronyms

ADD	Average day demand
af	Acre feet per
AWWA	American Water Works Association
APA	Aquifer Protection Area
ASR	Aquifer Storage and Recovery
BMP	Best Management Practice
CARA	Critical Aquifer Recharge Area
cfs	Cubic feet per second
C/I/I	Commercial/Industrial/Institution
CIR	Crop Irrigation Demand
CRGNSA	Columbia River Gorge National Scenic Area
CWA	Clean Water Act
DO	Dissolved Oxygen
EAP	Environmental Assessment Program
ERU	Equivalent Residential Unit
ESA	Endangered Species Act
FC	Fecal Coliform
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GMA	General Management Area
gpm	Gallons per minute
GPS	Global Positioning System
IFIM	Instream Flow Incremental Methodology
ISF	Instream Flow
LFA	Limiting Factors Analysis
LWD	Large Woody Debris
MDD	Maximum Day Demand
MOU	Memorandum of Understanding

NSA	National Scenic Act
NPDES	National Pollutant Discharge Elimination System
PHABSIM	Physical Habitat Simulation
PDO	Pacific Decadal Oscillation
PWS	Public Water System
Qa	Authorized annual withdrawal/diversion
Qi	Authorized instantaneous withdrawal/diversion
RM	River Mile
SMA	Special Management Area
SWSL	Surface Water Source Limitation
SWTR	Surface Water Treatment Rule
TMDL	Total Maximum Daily Load
TW	Toe-width
WAU	Weighted Usable Area
WMA	Watershed Management Act
WRIA	Water Resource Inventory Area

Conversion Table

Water Measurement Conversions		
Quantity - volume	1 cf of water = 7.48 gallons	1 af = 325,851 gallons
		1 af = 43,560 cubic feet
Flow rates	1 cfs = 448.8 gpm	1 gpm = 1,440 gpd (24 period)
	1 cfs = 646,272 gpd	1 gpm = 1.61 af per year
	1 cfs for 24 hours = 1.98 af per day	1 gpm = 0.00223 cfs
	1 cfs for 1 year = 723,966 af per year	
	1 mgd = 1.55 cfs	0.01 cfs = 6,463.2 gpd
	1 mgd = 694.4 gallons per minute	0.02 cfs = 12,926.4 gpd
Calculations	cfs = gpm ÷ 448.8	gpm = cfs x 448.8
	cfs = gpm ÷ 226.67 af/day	gpm = af/day x 226.67
	cfs = mgd x 1.55	af/day = cfs x 1.98
	cfs = af/day ÷ 1.98	mgd = af ÷ 1,118

Visualize:

- 1 acre foot of water = 1 foot of water covering 1 acre of land
- 1 acre-foot is approximately enough water to supply two families of four for one year.
- 1 million gallons is equivalent to a pool about 267 feet long (almost the size of a football field), 50 feet wide and 10 feet deep.
- 1 cubic foot per second is equivalent to 150 garden hoses being sprayed at the same time (assuming a typical garden hose provides 3 gallons per minute)