

GRAYS-ELOCHOMAN AND COWLITZ RIVER WATERSHED PLANNING

WATER RESOURCE INVENTORY AREAS (WRIAS) 25 AND 26

# WRIA 26 WATER SUPPLY AND STREAM FLOW REVIEW

## FINDINGS AND RECOMMENDATIONS

PREPARED BY THE LOWER COLUMBIA FISH RECOVERY BOARD

ADOPTED BY THE COUNTIES ON JUNE 17, 2014

APPROVED BY THE PLANNING UNIT ON NOVEMBER 14, 2013

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## List of Attachments

**Attachment A** – Lewis County Full Build-out Scenario Methodology [Approved by the Planning Unit, March 10, 2011]

**Attachment B** – Estimate of Water Use for Exempt Wells in WRIAs 25 and 26 [Approved by the Planning Unit on April 14, 2011]

**Attachment C** – WRIA 26 Lewis County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs [approved by the Planning Unit on August 11, 2011]

**Attachment D** – WRIA 26 Cowlitz County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs [Approved by the Planning Unit on August 11, 2011]

**Attachment E** – Lewis County, estimates of commercial, tourism, and industrial water demand were assembled from the Water Analysis and Demand Forecast completed by BHC Consultants (2010) [South Lewis County Subarea Plan]

**Appendix F** – Water Demand for Commercial, Industrial, Tourist, and Recreation Uses in Unincorporated Cowlitz County Portions of the Lower Cowlitz, Toutle, and Coweeman Subbasins

**Attachment G** – Fish and Flow Work Group- Methods for Identification of Tributaries of Concern

**Attachment H** – Calculating 1-2% of the Low Flow

**Attachment I** – Flow Measurements August and September 2011

# INTRODUCTION

This report is an initial product of the WRIA 25/26 Planning Unit (Planning Unit) review of certain water supply and stream flow provisions of the WRIA 25/26 Watershed Management Plan (Plan) adopted in 2006. Specifically, it documents the results of the Planning Unit's review of Plan provisions applicable to the Cowlitz River Basin regarding:

- The establishment of water reservations for cities, water districts, communities, rural domestic wells and other beneficial uses;
- The closure of watersheds to further water appropriations beyond recommended reservations; and
- The setting of instream flows to further the protection of fish, aquatic resources, and other beneficial instream uses.

The review was undertaken in response to public concerns that the Plan's recommended water reservations would be inadequate to meet the future needs of the people, cities and towns, communities, and businesses of Cowlitz River Basin. The concerns were voiced at the 2010 public hearings on a proposed Department of Ecology (Ecology) administrative rule implementing reservations, closures and stream flows recommended in the Watershed Plan.

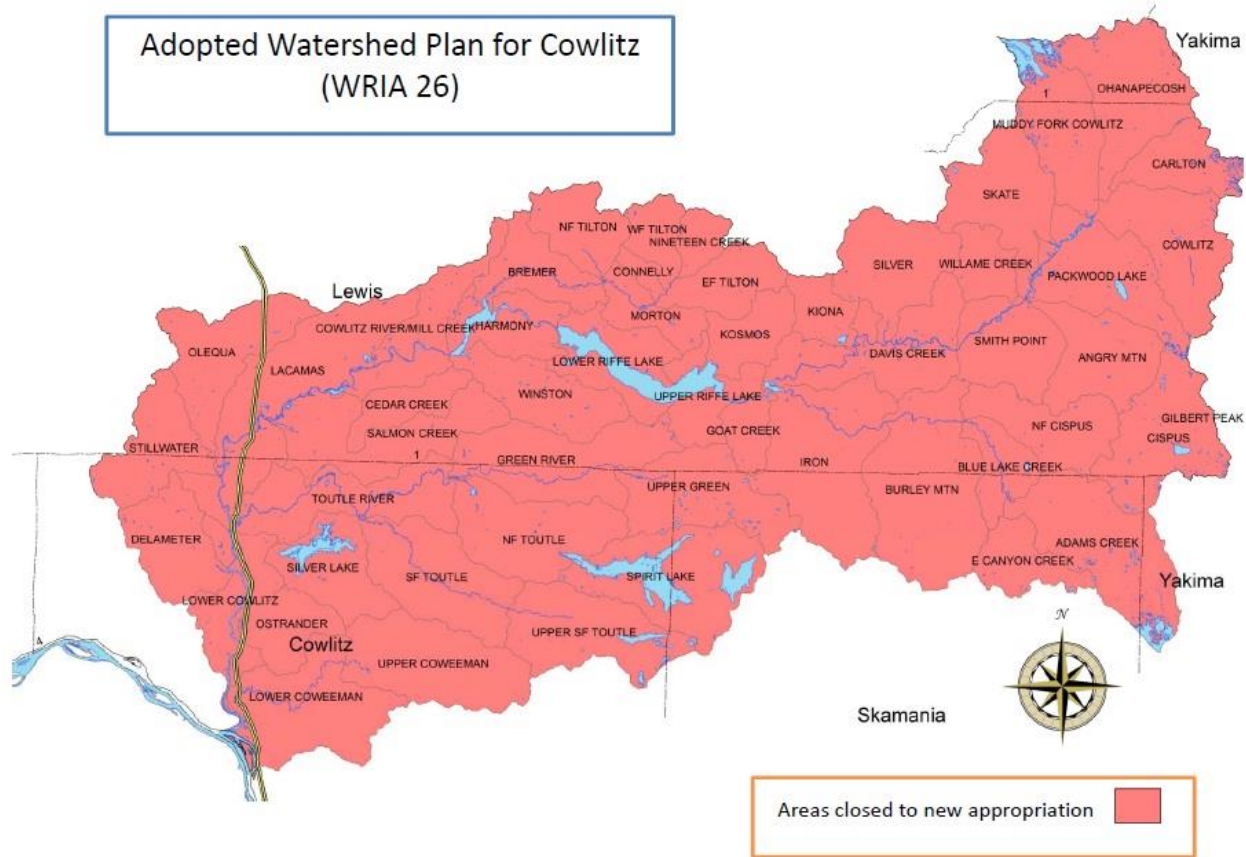
In conducting the review, it was the goal of the Planning Unit to ensure that water resources be managed to meet the present and future needs of the region's people and, fish and wildlife. The Planning Unit worked to ensure that the review was conducted in an open, transparent manner. Planning Unit meetings were open to the public with advance notice. Public comment was taken at all meetings. Materials, information, and reports considered or used by the Planning Unit were made available to the public. All decisions by the Planning Unit were made in public meetings. Additional members were added to the Planning Unit to ensure broader citizen participation.

Based on its review, the Planning Unit is recommending significant changes to 2006 Plan's water supply and stream flow provisions. The recommendations contained in this report are intended to supercede and replace the closure, reservation, and stream flow recommendations contained in the 2006 WRIA 25/26 Watershed Management Plan. They do not represent a complete review and update of all water supply or stream flow provisions of the Plan.

Adoption of these Planning Unit recommendations as revisions to the 2006 watershed management plan requires the approval of the boards of county commissioners of Lewis, Cowlitz, Skamania, and Wahkiakum counties.

# SUMMARY OF PROPOSED REVISIONS TO THE WATER PLAN

The Plan recommended that **all** subbasins in the Cowlitz River basin be closed to further groundwater appropriation beyond specific water reservations for cities, water districts, communities, rural domestic wells and other beneficial uses (Map 1). Reservations in the closed subbasins were based on estimates of projected future water needs for a 20-year period. Only the tidally influenced areas of the Cowlitz and Coweeman rivers were left open since future water appropriations in these areas would have no effect on instream flows. The Plan further recommended that most of the rivers and streams in the Cowlitz River Basin be closed to further surface water appropriations and that minimum instream flows be established for 10 rivers and streams.



Map 1 Closures as identified in the 2006 Watershed Management Plan

Based on its review of estimated water demands through 2030 and streams flows necessary to support threatened salmon and steelhead populations, the Planning Unit recommends that the 2006 Watershed Plan be revised as follows:

- The Upper Cowlitz, Cispus, Tilton, Mayfield, Toulte and Upper Coweeman subbasins should be open for further water appropriations with no reservations or restrictions on rural domestic (permit-exempt) wells with the following exceptions:
  - A reservation is recommended for City of Mossyrock to earmark water to meet the city's future needs; and
  - restrictions on permit exempt wells in the Hall/Snyder Creek, Upper Tilton River, and Minnie/Lake Creek.
- The Lower Cowlitz mainstem below the barrier dam should be open to future appropriations with specific water reservations for Cowlitz and Lewis counties and the cities of Castle Rock, Winlock, and Toledo;
- The establishment and maintenance of regional water supply systems drawing on Cowlitz River water to meet municipal and community water needs in Cowlitz and Lewis counties should be designated the highest water infrastructure priority in WRIA 26.
- Due to concerns over potential impacts on streamflows, the Olequa, Lacamas, Salmon, Arkansas/Delameter/ Monahan, Ostrander, Leckler and Owl subwatersheds in the Lower Cowlitz subbasin should be closed to further water appropriations beyond specific water reservations sufficient to meet anticipated domestic needs through 2030.
- Instream flows should be established for Olequa, Lacamas, Salmon, Arkansas/Delameter/ Monahan, Ostrander, Leckler and Owl Creeks.

The tidally influenced areas of the Columbia, Cowlitz and Coweeman rivers should remain open to future water appropriations as set forth in the 2006 watershed plan.

Table 1 provides a summary of specific subbasin recommendations. Map 2 illustrates those subbasins proposed to remain open to future water allocations. A more detailed discussion of these recommendations can be found in the individual subbasin sections of this report.

Given the uncertainties regarding available water supplies and future water demands, the Planning Unit recommends specific measures for reviewing and revising the Watershed Plan, as necessary, to address emerging issues. The goal of these measures is to address water supply and stream flow issues before they become problems which would impose hardship on the people and communities of the Cowlitz River Basin and/or adversely effecting threatened salmon and steelhead populations. It is recommended that the Planning Unit (or its successor), cities and counties, Ecology, WDFW, water purveyors and other federal and state agencies as appropriate should review reservations, instream flows, and closures for a subbasin when 75 percent of its reserve is depleted. In addition, the watershed plan, in its entirety, should be reviewed every 10 years. A review of the Plan would consider new information, changing conditions, or statutory modifications. Ecology may initiate a modification of the Watershed Management Rule based on the conclusions and recommendations of the Plan review. These recommendations are discussed in greater detail in the Implementation section of this report.

Subbasin	Subwatersheds	Closure	Instream Flow	Reservations	Comments
<b>Upper Cowlitz</b>	Silver Creek	Yes, SWSL	10 cfs (See comments)	None	SWSL - 10 cfs in natural channel at point of diversion at all times.
	Hall/Synder Creek	Yes, SWSL	No	0.042cfs - Permit exempt wells & small systems	SWSL - No water beyond that needed for domestic use should be granted. Reservation based on Lewis County full build-out of 117 households.
	All Remaining	No	No	No	
<b>Cispus</b>	All	No	No	No	
<b>Mayfield</b>	All	No	No	0.59cfs - Mossyrock	Reservation based on City estimate
<b>Tilton</b>	Upper Tilton Above confluence with East Fork	No	SWSL: 3.0 cfs	0.003cfs	Reservation based on Lewis County full build-out of 7 households. Additional water beyond reservation could be granted provided flows remain above SWSL recommended low flows.
	Minnie Creek/Lake Creek	No	SWSL: 1.0 cfs	0.048cfs	Reservation based on Lewis County full build-out of 131 households. Additional water beyond reservation could be granted provided flows remain above SWSL recommended low flows.
	All Remaining	No	No	No	
<b>Toutle</b>	All	No	No	No	Silver Lake, its tributaries, and Outlet Creek: <ul style="list-style-type: none"> <li>• Recommend future development, especially commercial development, use Toutle Regional Water system when within service area.</li> <li>• Track households served by wells and small systems relative to planning assumption of 250 households in subwatershed over next 20 years.</li> <li>• Evaluate future water right applications for potential impacts on water quality.</li> </ul>

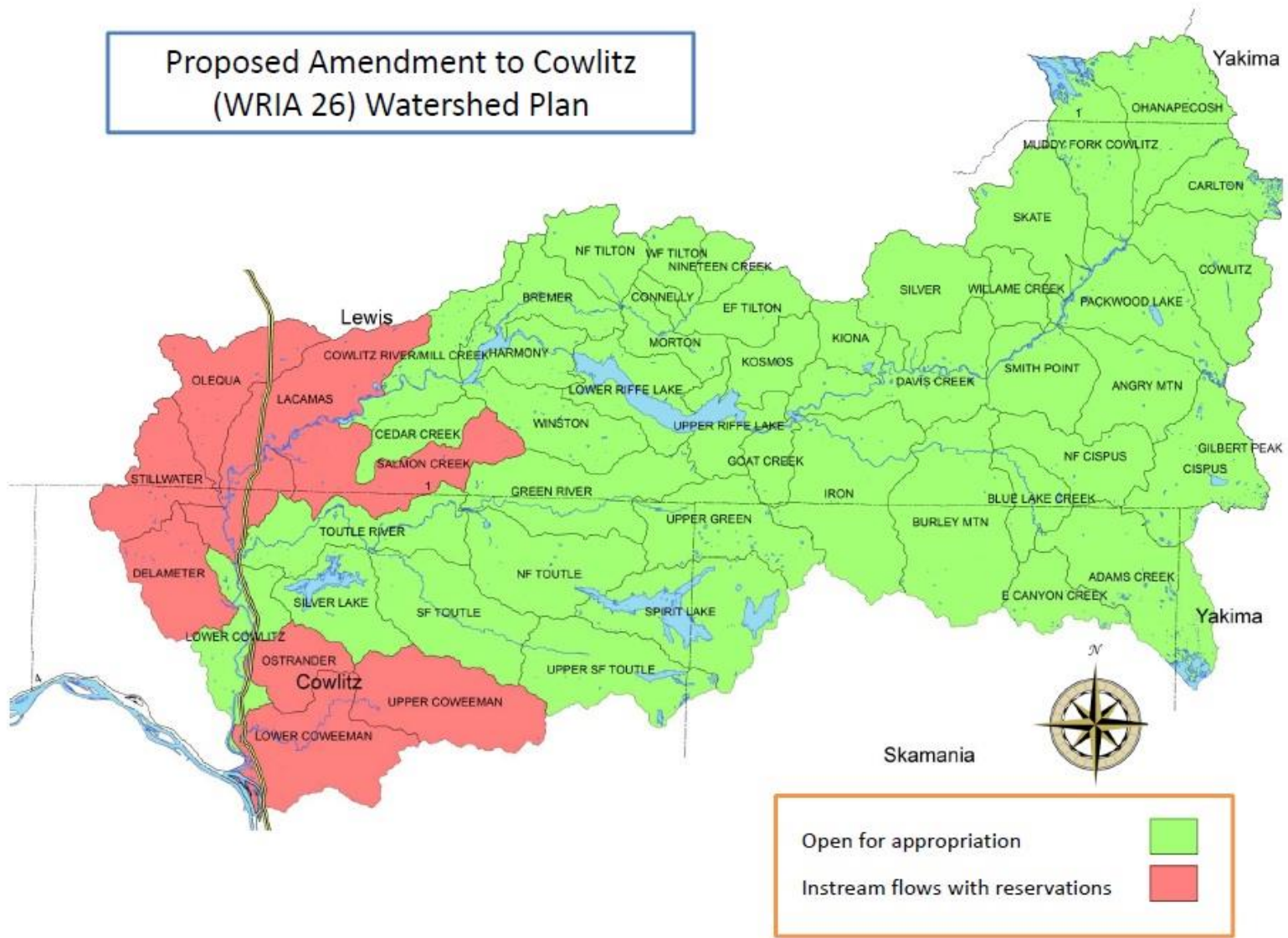
TABLE 1 WRIA 26 SUBBASIN SUMMARY TABLE

Subbasin	Subwatersheds	Closure	Instream Flow	Reservations	Comments
Lower Cowlitz	Mainstem	No	None, other than those currently required pursuant to hydro license.	6.60cfs – Lewis County 6.42cfs – Cowlitz County 0.47cfs – Toledo 1.80cfs – Winlock 4.08cfs – Castle Rock (incl. communities of Toutle and Silver Lake).	<ul style="list-style-type: none"> <li>Allocation of the Lewis County and Cowlitz County reservations will be recommended by the county boards of commissioners.</li> <li>No reservation proposed for Vader. Existing water rights for Vader expected to be adequate to meet 20-year demand.</li> </ul>
	Mill	Yes	Yes	0.055cfs - Permit exempt wells & small systems	Reserve 0.055 cfs for permit-exempt wells and small systems in the Mill Creek subwatershed based on 2% of the 90% exceedence flow during the summer low flow period (2.73 cfs). It is estimated that this quantity will support a population growth of 384 people or 150 additional households. The estimated 20-year growth is 150 people or 58 households.
	Salmon	Yes	Yes	0.037cfs - Permit exempt wells & small systems	Reserve 0.037 cfs for permit-exempt wells and small systems in the Salmon Creek subwatershed based on 2% of the 90% exceedence flow during the summer low flow period (1.86 cfs). It is estimated that this quantity will support a population growth of 262 people or 102 additional households. The estimated 20-year growth is 160 people or 62 households.
	Lacamas	Yes	Yes	0.072cfs - Permit exempt wells & small systems	Reserve 0.072 cfs for permit-exempt wells and small systems in the Lacamas Creek subwatershed based on 2% of the 90% exceedence flow during the summer low flow period (3.59 cfs). It is estimated that this quantity will support a population growth of 505 people or 197 additional households. The estimated 20-year growth is 434 people or 169 households.
	Olequa	Yes	Yes	0.223cfs - Permit exempt wells & small systems	Reservation based on 20-year growth estimate of 1571 people/ 611 households in unincorporated areas.
				0.33cfs - Winlock	Olequa and Lower Cowlitz reservations based on City's 60% build-out
	Arkansas/ Delameter/ Monahan	Yes	Yes	0.077cfs – Permit exempt wells & small systems - Arkansas	Reserve 0.077 cfs for permit-exempt wells and small systems in the Arkansas subwatershed based on 2% of the 90% exceedence flow during the summer low flow period (3.83 cfs). It is estimated that this quantity will support a population growth of 539 people or 210 additional households. The estimated 20-year growth is 141 people or 55 households.
				0.050cfs – Permit exempt wells & small systems Delameter/Monahan	Reserve 0.050 cfs for permit-exempt wells and small systems in the Delameter/Monahan subwatershed based on 2% of the 90% exceedence flow during the summer low flow period (2.50 cfs). It is



					estimated that this quantity will support a population growth of 352 people or 137 additional households. The estimated 20-year growth is 282 people or 110 households.
	Leckler	Yes	Yes	0.040cfs - Permit exempt wells & small systems	Reservation based on 20-year growth estimate of 302 people/ 114 households
	Ostrander	Yes	Yes	0.060cfs - Permit exempt wells & small systems	Reservation based on 20-year growth estimate of 461 people/ 174 households
	Owl	Yes	Yes	0.050cfs - Permit exempt wells & small systems	Reservation based on 20-year growth estimate of 380 people/ 143 households
	Other Tributaries to the Cowlitz	No	No	No	
<b>Coweeman</b>	All	Yes	Yes	0.60cfs - Permit exempt wells & small systems	Reserve 0.6 cfs for permit-exempt wells and small systems in the Coweeman subbasin based on 2% of the 90% exceedence flow during the summer low flow period (30 cfs). It is estimated that this quantity will support a population growth of 4,223 people or 1,643 additional households. The estimated 20-year growth is 774 people or 301 households.

Proposed Amendment to Cowlitz  
(WRIA 26) Watershed Plan



Map 2 - Proposed Areas Open to Appropriation

# PLANNING UNIT REVIEW PROCESS

In May 2010, the Department of Ecology held public hearings in Longview and Morton on proposed water management rules for WRIA 25 (Grays-Elochoman) and WRIA 26 (Cowlitz). The draft rules were based on recommendations set forth in the 2006 WRIA 25/26 Watershed Management Plan (Plan). At these hearings, widespread concern was voiced over the adequacy of proposed water reservations to meet the future needs of the people, cities and towns, communities, and businesses of Cowlitz River Basin. In response to these concerns, the WRIA 25/26 Planning Unit requested and Ecology agreed to discontinue the rule process until the Planning Unit could review the water supply and stream flow provisions of the Plan and, if warranted, recommend changes to those provisions.

As a first step in the review process, the Planning Unit increased its outreach efforts and attempted to renew participation among inactive Planning Unit members. The Planning Unit added three citizen members to the Planning Unit, including a representative from Lewis County and two from Cowlitz County. Meeting notices were distributed to over 200 interested parties electronically or by mail. Meeting materials were made available to public and comments were taken at all meetings.

The initial Planning Unit meetings were committed to taking public comment and reviewing the water management measures contained in the 2006 watershed management plan, including the methods and data used to generate population projections, water demand estimates, and instream flow recommendations. The Planning Unit questioned the adequacy of the data used in the 2006 plan and also found that the planning assumptions and methods used were not clear. As a result, it was decided that up to date information on water supply needs, fish resources, and stream flows should be gathered and analyzed. The Planning Unit also decided that all planning assumptions and analytical methods should be fully and clearly documented.

In conducting its original analyses, the Planning Unit assumed that groundwater withdrawals would have an instantaneous impact on stream flow, and the amount of consumptive use would be equivalent to the stream flow depletion (based on legal decisions at the time). The Planning Unit recognizes that the impact of water withdrawals seldom has an instantaneous impact of stream flows. It is further recognized that groundwater withdrawals may in some instances have little or no adverse impact on stream flows. However, given size of the Cowlitz watershed and the tremendous variation and diversity in geologic and hydrogeologic conditions, it is not possible to precisely predict the effect of future withdrawals on local stream flows. Accordingly, the Planning Unit agreed to use the 'instantaneous impact' premise for planning purposes, as it represents an estimate of maximum potential impact to stream flows. All demand estimates are in units of cubic feet per second, the common measure of streamflow, to facilitate comparisons.

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## FUTURE WATER SUPPLY NEEDS

The Planning Unit developed estimates of water supply needs through 2030 for the following Cowlitz watershed subbasins:

- Upper Cowlitz
- Cispus
- Tilton
- Mayfield
- Lower Cowlitz
- Toutle
- Coweeman

To allow for better analysis of local water supply and stream flow issues, each subbasin was further broken down into subwatersheds.

Municipal water suppliers provided updated demand estimates for the cities, towns, and several unincorporated communities. In Lewis County, demand estimates were obtained from Randle (Lewis County Water District #1), Packwood (Lewis County Water District #3), Mossyrock, Mayfield (Lewis County Sewer District #6), Winlock, Toledo, and Vader. In Cowlitz County, updated demand information was received from Castle Rock (including the Toutle Regional Water System), Beacon Hill Water and Sewer District, and Kelso. Updated demand information was not obtained from the City of Longview. Since the Longview water system draws from the tidally-influenced area, the withdrawal is assumed to not impact stream flows.

Because Lewis County is covered under the Growth Management Act (GMA), the county was able to provide zoning information to support growth and water demand projections in unincorporated areas. To develop these projections, Lewis County's Geographic Information Systems (GIS) department performed a build-out scenario analysis of potential development or new households in unincorporated areas. The methodology for this analysis can be found in Attachment A.

In Cowlitz County, only portions of the county are zoned, so a similar analysis could not be completed. For Cowlitz County, the Planning Unit revised population estimates based on the Washington Office of Financial Management's (OFM's) Small Area Estimates Program (SAEP). The SAEP distributes population estimates to special geographic areas, such as subbasins. The population estimates for each subbasin were then used to generate population projections to 2030 using OFM's medium growth rate for Cowlitz County. The population projections were then converted to number of households using OFM's average household size for Cowlitz County. The same approach was used to estimate the number of households in the lower Cowlitz tributary subwatersheds in Lewis County.

For both counties, the number of potential lots or households was then used to determine potential water demand from growth in unincorporated areas. The Planning Unit developed an estimate of water use for permit-exempt wells that included estimates of household indoor water use, outdoor use, and what portion of those uses are consumptive. The average total consumptive use was estimated at 236 gallons per day per household. The complete methodology can be found in Attachment B.

Water demand was also estimated for agricultural use in both counties. Background information was gathered from organizations associated with farming or agriculture in the region. It included information about past, present, and anticipated future conditions related to acreage of land in farms, average farm size, water use, and crops. With limited quantitative data available about potential agricultural growth, the Planning Unit applied a range of potential growth rates to irrigated acreage estimates from the 2007 Census of Agriculture (USDA 2007) in each county to determine potential increases in irrigated acreages by 2030. A standard irrigation rate was applied to each estimate of acreage growth to determine potential water demands associated with the increase in irrigated acreage. The complete details of the analysis can be found in Attachment C and D.

In Lewis County, estimates of commercial, tourism, and industrial water demand of unincorporated areas were assembled from the Water Analysis and Demand Forecast completed by BHC Consultants (2010) as part of the South Lewis County Subarea Plan (Attachment E). The range of potential water demand for these uses was modified slightly to account for acreage within Winlock's urban growth area

that was also included in Winlock's water demand estimate. In Cowlitz County, because no similar water demand forecast has been done for unincorporated areas and consistent zoning is not available throughout the unincorporated areas, commercial, industrial, tourist, and recreation (C/I/T/R) water demand was estimated based on projected population growth. Specifically, a ratio of the existing number of C/I/T/R acres to support the existing population was applied to the projected growth to 2030 in each Cowlitz County subbasin. A range of potential water demand was then applied based on the range used in the Lewis County Water Analysis and Demand Forecast (BHC Consultants 2010). Documentation of this methodology can be found in Attachment F.

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## FISH RESOURCES AND STREAM FLOWS

The Planning Unit established a Fish and Flow Work Group in 2011 to further evaluate the needs of fish in relation to flows and habitat in the streams in WRIA 26. Lower Columbia Chinook, Coho, and Chum salmon and Steelhead trout are listed as threatened under the federal Endangered Species Act (ESA). In the Cowlitz watershed, these listed species are comprised of 24 distinct populations, more than any other watershed in the Lower Columbia.

The Fish and Flow Work Group initially included staff from the LCFRB, Ecology and the Washington Department of Fish and Wildlife (WDFW), and two citizen representatives and a citizen alternate from the Planning Unit. As the group made progress, additional Planning Unit members and interested parties participated, including the mayor of Winlock and representatives from the Lewis and Cowlitz planning departments and the Cowlitz Conservation District.

The Work Group began its work by reviewing the water and habitat needed by local salmon population for migration, spawning, and rearing. The Group then focused their analysis on identifying tributaries in WRIA 26 where conflicts might occur between habitat and flow needed for fish and potential out of stream water uses.

The Fish and Flow Work Group developed a categorization of streams in WRIA 26 based on importance to fish, existing conditions, flow observations, existing development, potential future development, current land use and ownership, and other factors. The categorization was used to identify tributaries where water withdrawals could have a potential adverse impact on stream flows needed for fish. The detailed methods used to develop this categorization, as well as the categorization itself can be found in Attachment G.

The Department of Ecology provided some updated hydrographs for tributaries in WRIA 26. These updated hydrographs include gage data from USGS and Ecology gages. WDFW and Ecology use the 90% exceedence flow, a measure of low flow conditions that are the greatest stressor for fish, to determine water available to allocate to other uses. As a guideline, these agencies use 1-2% of the 90% exceedence flow as a tolerable reduction of flow and thus available habitat for fish. For details on calculating the 1% of the 90% exceedence flow, see Attachment H. Where gage data was not available, WDFW and Ecology staff collected flow measurements at several streams of concern. While these flows are generally represented by one or two single measurement points, they provided useful information for the Fish and Flow Work Group to use as a measure of the magnitude of low flows in these streams. These flow measurements can be found in Attachment I.

After identifying potential tributaries of concern, the Fish and Flow Work Group further refined their analysis to focus on smaller subwatershed areas, or areas that drain to a particular tributary of concern. For Lewis County subwatersheds, the Lewis County GIS Department refined their full build-out analysis of unincorporated areas using subwatershed boundaries provided by LCFRB staff. The GIS data provided by Lewis County includes the number of potentially developable parcels in each subwatershed. Similar to the initial water demand analysis, the Fish and Flow Work Group then applied the 236 gallon per day per household consumptive use estimate to these parcels to determine potential demand, and thus potential streamflow impact, in each subwatershed.

In Cowlitz County, OFM provided population estimates from the SAEP based on the subwatershed boundaries provided by LCFRB staff. OFM did caution that the quality of these estimates is reduced because of the small size of the area. Using these population estimates for each subwatershed, the Fish and Flow Work Group applied OFM's medium growth rate to project population growth to 2030 for each subwatershed. These projections were converted to number of households using OFM's average household size for Cowlitz County. The Fish and Flow Work Group then applied the 236 gallon per day per household consumptive use estimate to these households to determine demand, and thus potential streamflow impact, in each subwatershed.

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## WATER MANAGEMENT RECOMMENDATIONS

The Fish and Flow Work Group developed initial water management reports for each of the 7 subbasins in the Cowlitz watershed. The reports summarized projected future water needs, water availability, fish resources and stream flows and made recommendations regarding whether a subbasin or subwatershed should be closed to further water appropriations, whether water should be reserved for future development and land uses, and whether instream flows should be established to help protect fish resources.

The Planning Unit considered the draft reports and provided feedback to the Fish and Flow Work Group. The Planning Unit also took public comments on the drafts. The Fish and Flow Work Group refined the drafts based on the comments from the Planning Unit and public. The Planning Unit reached tentative agreement on water management recommendations for the Upper Cowlitz, Cispus, Tilton, Mayfield and Toutle subbasins in June 2012.

Unable to reach consensus on the water management recommendations for the Lower Cowlitz and Coweeman subbasins, the Planning Unit asked the Lewis and Cowlitz county commissioner members of the Planning Unit to work with Ecology, WDFW, and the City of Winlock to develop a recommendation addressing the outstanding issues. The issues included closures, minimum instream flows, and reservations for Lower Cowlitz subwatersheds and the Coweeman subbasin, and the availability of water to meet the future needs of the City of Winlock.

The Lower Cowlitz and Coweeman subbasin recommendations were revised based on the discussions between the county commissioners, the City of Winlock, and the state agencies and resubmitted to the Planning Unit in July 2013.

At the conclusion of the July Planning Unit meeting, several unresolved issues remained. These included watershed plan and rule reopener provisions, the City of Castle Rock reservation, the

Arkansas/Delameter/Monahan reservation and instream flow, the Coweeman reservation and instream flow, and the Cowlitz County reservation for future allocation. On October 24, 2013, the Lewis and Cowlitz county commissioner members of the Planning Unit and representatives of Ecology, WDFW, Cowlitz Conservation District, and the City of Castle Rock met and agreed to revisions of the Lower Cowlitz water management recommendations and watershed plan/rule reopener language addressing the remaining outstanding issues. The July draft of this report was revised to incorporate the revised language and was submitted to the Planning Unit for approval at its November 14, 2013 meeting.

# WATER MANAGEMENT MEASURES IMPLEMENTATION

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## 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 2006 intent of the water management measures;
- Advising the Department of 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, Cowlitz, Lewis, Wahkiakum, and Skamania counties 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 Cowlitz, Lewis, Wahkiakum and Skamania counties, Ecology, and WDFW, the cities within WRIs 25 and 26, other public water purveyors, and other groups or interests, as appropriate, should be invited to participate. An Interlocal agreement may be useful in defining how and when the counties would convene an ad hoc work group, how the role and responsibilities of the work group would be defined, and how administrative support would be provided.

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## REOPENING AND REVISING WATER MANAGEMENT MEASURES

The water management measures will be reviewed and revised, as necessary, to ensure that water resources in WRIs 25 and 26 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 2030 while also maintaining stream flows for fish. It is understood that additional water for out-of-stream uses will be available in a subwatershed to the extent that Water



withdrawals have not resulted in a stream flow reduction which indicates a significant adverse impact on fish or other instream resources or water quality for the past 6 years.<sup>1</sup>

Further, if a water right or claim is abandoned or relinquished, the reservation for the applicable subwatershed shall be credited with the actual amount of water right not being used and subject to relinquishment based on Ecology's determination of the extent and validity of the right or claim. Upon demonstration to Ecology through written certification that a permit exempt well has been abandoned and decommissioned, the reservation for the applicable subwatershed shall be credited with the standard amount of water debited from the reservation for a permit exempt well.

The water management measures will be reopened for review and revision as necessary at least once every 10 years and when any reservation adopted by rule has been depleted by 75 percent. In addition the measures may also be reopened at any time upon the request of Ecology, WDFW, a city or county, or recognized or treaty tribes, provided that the Planning Unit (or its successor) determines 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 where 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, 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 Plan. The Planning Unit shall forward its findings and recommendations to the legislative authority of each of the counties within WRIs 25 and 26 for consideration and adoption in accordance with RCW 90.82.130.

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<sup>1</sup> In assessing impacts, the 6-year trend will consider the number of smolt and spawners.

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## REVIEW AND AMENDMENT OF THE WATER MANAGEMENT RULE

Ecology, in consultation with the counties, other state agencies, and the WRIA 25/26 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.
- Requested by Cowlitz, Lewis, Wahkiakum, and Skamania counties based on the findings and recommendations resulting from the Planning Unit review of the water management measures in the watershed plan.

# SUBBASIN SUMMARIES AND RECOMMENDATIONS

## UPPER COWLITZ

### WATER DEMAND

Water demand in the Upper Cowlitz subbasin includes potential demand from municipal systems, agriculture, and residential growth in unincorporated areas. The Packwood and Randle water systems have adequate current water rights to meet their anticipated demand through the 20-year planning horizon. There is a potential for development of 1,011 additional parcels<sup>i</sup> in unincorporated areas in Lewis County. This yields a potential streamflow depletion of 0.37cfs. Water demand from agriculture was estimated using a range of potential growth rates.<sup>ii</sup>

Demand Category	Demand Estimate	Notes
Randle (Lewis Co #1)	0	Adequate water rights to 2030
Packwood (Lewis Co #3)	0	Adequate water rights to 2030
Unincorporated Areas	0.37cfs	Based on Lewis County’s build-out scenario estimating the potential for development of 1,011 additional parcels.
Agriculture	0.7cfs – 3.5cfs	Range based on ag growth rates of 0.5% to 2%

### STREAM CONSIDERATIONS AND WATER AVAILABILITY

Based on WDFW and Ecology guidelines of using 1% of the 90% exceedence flow as a measure of acceptable habitat loss and water availability, the water availability estimate for the mainstem Upper Cowlitz is 3.95cfs (measured at the Cowlitz River near Randle, RM 102.9).<sup>iii</sup>

The Upper Cowlitz subbasin supports populations of winter steelhead, fall Chinook, spring Chinook, and coho. All are listed as Threatened under the Federal Endangered Species Act (ESA). Winter steelhead, spring Chinook, and coho populations in the Upper Cowlitz are Primary populations for salmon recovery.<sup>iv</sup> Based on review by WDFW biologists<sup>v</sup> and evaluation of development potential<sup>vi</sup>, the Fish and Flow Workgroup felt many streams in this subbasin were of low concern of streamflow impacts from development, and categorized them as Category A – of low concern. Some streams had higher levels of potential development and were categorized as Category B – monitoring and adaptive management recommended (no immediate concern). These streams include Butter Creek, Coal Creek, Hinkle Tinkle Creek, Kiona Creek, Lake Creek, Siler Creek, and Skate Creek. Silver and Hall/Snyder creeks have an existing Surface Water Source Limitation (SWSL) designation, and the Fish and Flow subgroup recommended retaining that designation; thus, they categorized those streams as Category E – active protective measure in place.

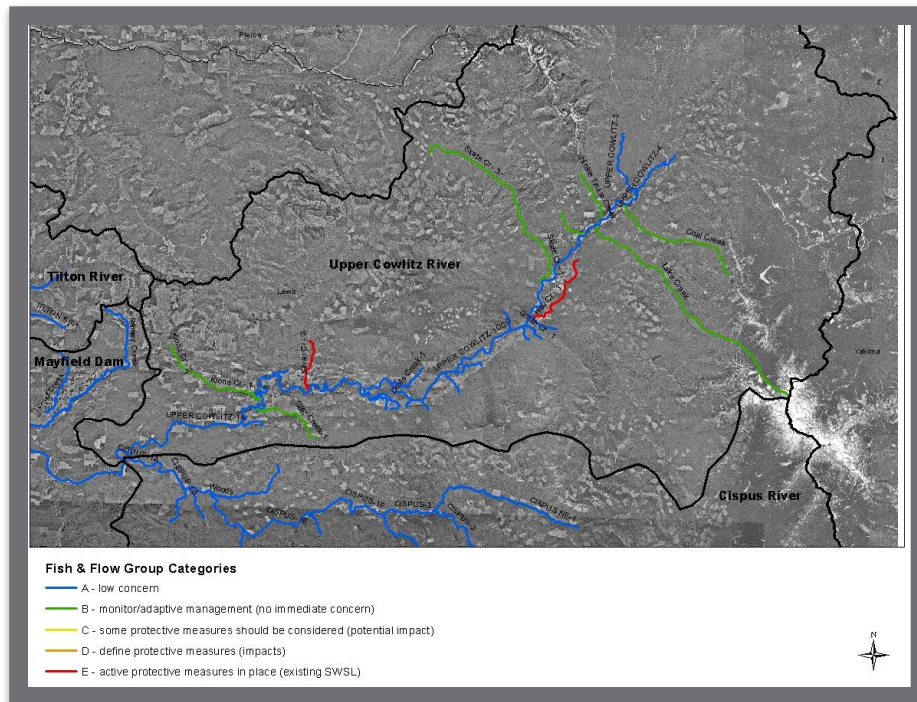


Figure 1. Map of Fish and Flow Group categories of concern for streams in the Upper Cowlitz subbasin.

## WATER MANAGEMENT RECOMMENDATIONS AND IMPLICATIONS

Based on the potential demand compared to estimate of water availability, the Planning Unit recommends the following for the Upper Cowlitz subbasin:

- Existing water rights and permitted exempt wells are not affected
- No closures except Silver Creek and Hall/Snyder Creek, where existing SWSLs are in place
- Reservation of 0.042cfs for the Hall/Snyder Creek subwatershed for permit-exempt wells and small systems to support the full build-out potential of 117 parcels<sup>vii, viii</sup>
- Retain existing 10cfs SWSL stream flow in Silver Creek
- Water withdrawals within the Cowlitz River alluvial aquifer would not be subject to the existing SWSLs. The boundaries of the alluvial aquifer are determined to be the point where the topography changes from being “floodplain” (area of historical flows of the Cowlitz River) to “slope” (where the topography steepens).

## ADDITIONAL NOTES

Tacoma Power has water rights to much of the water that enters their reservoirs from the Upper Cowlitz Basin. Some of these water rights date back to the 1920’s but include an exception allowing 20cfs be granted for community growth. Ecology has issued approximately 62cfs in water rights in the Upper Cowlitz basin. Tacoma Power has voiced no objection to the granting of these rights or to the granting of additional rights for future development in the Upper Cowlitz basin.

The Planning Unit has determined there is no conflict between instream and anticipated out-of-stream uses in most areas in the Upper Cowlitz. The Planning Unit recommends that the 62 cfs of water currently granted

under existing rights be reserved for use in the Upper Cowlitz. Ecology should account for any volume of water no longer being used under the current water rights and should be willing to issue future water rights up to the volume no longer being used under current water rights, assuming the location of the future water rights does not result in conflicts at the subwatershed level (i.e., does not impair existing rights or exceed water availability estimates for that subwatershed).

There is a high level of uncertainty in many of the demand and availability estimates, as well as uncertainty in projecting growth.

Once every 10 years or when 75 percent of a reservation has been used, the WRIA 25/26 Planning Unit or its successor, the Department of Ecology, and other interested parties will convene to:

- Review status of water reservations and streams flows;
- Consider new information regarding water needs, water availability, and stream flows;
- Develop options for additional future water supply, if needed; and
- Amend the Watershed Plan if necessary.

Ecology may initiate a modification of the Water Management Rule based on the conclusions of such a review.

See the WRIA 25/26 Water Management Measure Implementation section for a more thorough discussion of reopeners and plan/rule amendments.

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<sup>i</sup> Lewis County WRIA 26 Subbasins Domestic Water Use In Unincorporated Areas Potential Streamflow Depletion based on Development Potential at Build-Out Approved by the Planning Unit June 9, 2011; Revised June 7, 2013

<sup>ii</sup> 'WRIA 26 Lewis County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs' approved by the WRIA 25/26 Planning Unit, August 11, 2011. Agriculture acreage was divided among subbasins using current Lewis County zoning.

<sup>iii</sup> Values provided by Jim Pachecos, Department of Ecology, January 31, 2011 email to Scott McKinney and Brad Caldwell, Department of Ecology.

<sup>iv</sup> Primary populations are those that are targeted for restoration to a high or greater level of viability in the *WA Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan* (LCFRB 2010).

<sup>v</sup> 'Tributary Prioritization Spreadsheet' developed by the Fish and Flow Workgroup, updated November 9, 2011.

<sup>vi</sup> Development potential was estimated by reviewing Lewis County's zoning GIS layer, adopted by Lewis County December 14, 2009 and amended December 27, 2010.

<sup>vii</sup> Lewis County GIS performed an analysis of potential build-out by LCFRB's subwatersheds. This demand estimate was based on that analysis ('Lewis County Unincorporated Area Water Demand Estimate by Subwatershed/Stream Impacted', September 16, 2011).

<sup>viii</sup> Small systems include water systems under fifteen connections (or the equivalent water use) providing water for human consumption. This may include domestic use as well as small commercial uses.

# CISPUS

## WATER DEMAND

Water demand in the Cispus subbasin includes a potential for development of 40 additional parcels in unincorporated areas in Lewis County. This yields a potential streamflow depletion of 0.015cfs<sup>ix</sup>. There is no anticipated municipal or agricultural water demand in the Cispus subbasin.

Demand Category	Demand Estimate	Notes
Unincorporated Areas	0.015cfs	Based on Lewis County's build-out scenario indicating potential development of 40 parcels

## STREAM CONSIDERATIONS AND WATER AVAILABILITY

Based on WDFW and Ecology guidelines of using 1% of the 90% exceedence flow as a measure of acceptable habitat loss and water availability, the water availability estimate for the mainstem Cispus is 2.86cfs (measured at the Cispus River near Randle, RM 15.8).

The Cispus subbasin supports populations of winter steelhead, fall Chinook, spring Chinook, and coho. All are listed as Threatened under the Federal Endangered Species Act (ESA). Winter steelhead, spring Chinook, and coho populations in the Cispus are Primary populations for salmon recovery<sup>x</sup>. WDFW recommended high protection for streams in this basin because of the importance to fish populations<sup>xi</sup>. Because the basin is primarily zoned for forest use, the Fish and Flow Workgroup felt there was low concern of streamflow impacts from development; thus, they categorized all streams in this basin as Category A – of low concern.

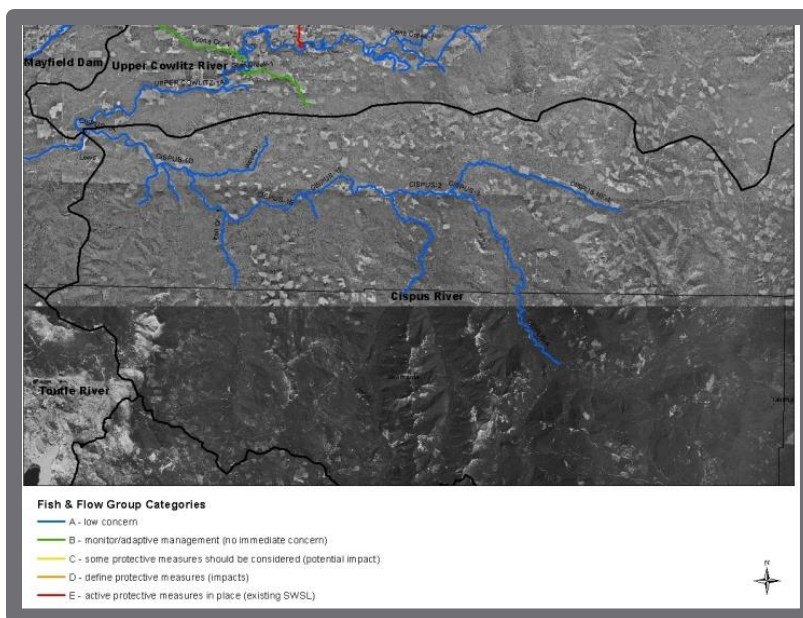


Figure 2. Map of Fish and Flow Group categories of concern for streams in the Cispus subbasin.

## WATER MANAGEMENT RECOMMENDATIONS AND IMPLICATIONS

Based on the low potential demand compared to estimate of water availability, the Planning Unit recommends the following for the Cispus subbasin:

- Existing water rights and permitted exempt wells are not affected
- No closures and no instream flows
- No reservations

Under this scenario, water right applications would be processed in the order they are received.

## ADDITIONAL NOTES

The Planning Unit recognizes the high level of uncertainty in many of the demand and availability estimates, as well as uncertainty in projecting growth.

Once every 10 years or when 75 percent of a reservation has been used, the WRIA 25/26 Planning Unit or its successor, the Department of Ecology, and other interested parties will convene to:

- Review status of water reservations and streams flows;
- Consider new information regarding water needs, water availability, and stream flows;
- Develop options for additional future water supply, if needed; and
- Amend the Watershed Plan if necessary.

Ecology may initiate a modification of the Water Management Rule based on the conclusions of such a review.

See the Watershed Management Measure Implementation section for a more thorough discussion of reopeners and plan/rule amendments.

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<sup>ix</sup> Lewis County WRIA 26 Subbasins Domestic Water Use In Unincorporated Areas Potential Streamflow Depletion based on Development Potential at Build-Out Approved by the Planning Unit June 9, 2011; Revised June 7, 2013

<sup>x</sup> Primary populations are those that are targeted for restoration to a high or greater level of viability in the *WA Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan* (LCFRB 2010).

<sup>xi</sup> 'Tributary Prioritization Spreadsheet' developed by the Fish and Flow Workgroup, last update November 9, 2011.

# MAYFIELD

## WATER DEMAND

Water demand in the Mayfield subbasin includes potential demand from the Mossyrock and Mayfield municipal systems, agriculture, and residential growth in unincorporated areas. Mayfield has adequate current water rights to meet their anticipated demand. Mossyrock expects to need additional water rights within the 20-year planning horizon. There is a potential for development of 1,964 additional parcels<sup>xii</sup> in unincorporated areas in Lewis County. This yields a potential streamflow depletion of 0.72cfs. Water demand from agriculture was estimated using a range of potential growth rates.<sup>xiii</sup>

Demand Category	Demand Estimate	Notes
<b>Mossyrock</b>	0.59cfs	Based on City estimate
<b>Mayfield (Lewis Co Sewer District #6)</b>	0	Adequate rights to meet current demand estimate
<b>Unincorporated Areas</b>	0.72cfs	Based on Lewis County's build-out scenario indicating 1,964 potential developable parcels
<b>Agriculture</b>	0.7cfs – 3.2cfs	Range based on ag growth rates of 0.5% to 2%

## STREAM CONSIDERATIONS AND WATER AVAILABILITY

Based on WDFW and Ecology guidelines of using 1% of the 90% exceedence flow as a measure of acceptable habitat loss and water availability, the water availability estimate for the mainstem Cowlitz River at Mayfield Dam is 23.1cfs (measured at Mayfield Dam, RM 50.6).<sup>xiv</sup> This value is inclusive of any flows from upstream measurement points and tributaries; thus, comparing this value to demand in this subbasin should also include analysis of potential upstream depletion.

The Mayfield subbasin supports populations of winter steelhead, fall Chinook, spring Chinook, and coho that are part of upstream populations in the Tilton, Cispus, and Upper Cowlitz. All are listed as Threatened under the Federal Endangered Species Act (ESA). Winter steelhead, spring Chinook, and coho populations in the Cispus and Upper Cowlitz are Primary populations for salmon recovery.<sup>xv</sup> Based on review by WDFW biologists<sup>xvi</sup> and evaluation of development potential<sup>xvii</sup>, the Fish and Flow Workgroup felt that streams in this subbasin were of low concern of streamflow impacts from development, and categorized them as Category A – of low concern. Although several streams, Frost Creek, Rainy Creek, and Swofford/Sulphur Creek, had existing Surface Water Source Limitations (SWSLs), the Fish and Flow Workgroup recommended recategorizing them as Category A – of low concern after reviewing demand information on a subwatershed level.<sup>xviii</sup>



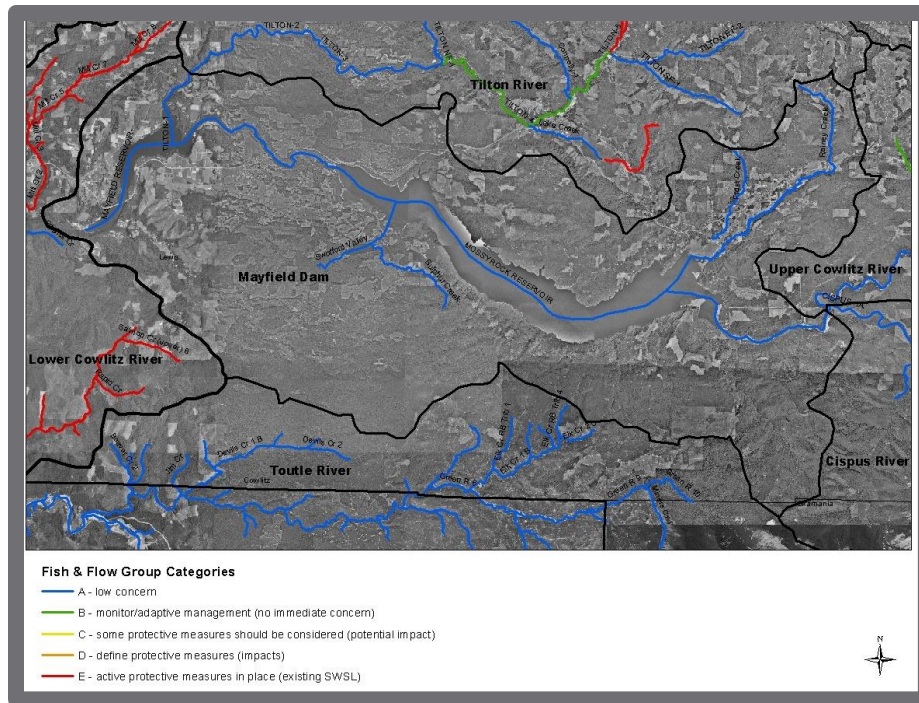


Figure 3. Map of Fish and Flow Group categories of concern for streams in the Mayfield subbasin.

## WATER MANAGEMENT RECOMMENDATIONS AND IMPLICATIONS

Based on the potential demand compared to estimate of water availability, the Planning Unit recommends the following for the Mayfield subbasin:

- Existing water rights and permitted exempt wells are not affected
- No closures and no instream flows
- Reservation for Mossyrock of 0.59cfs. This reservation would be an acknowledgement by the Department of Ecology that 0.59 cfs is available to Mossyrock. Since the subbasin would be open to further water appropriations, the reservation would not represent a limit on the amount of water available to Mossyrock. However, in seeking water rights for quantities beyond the reservation the applicant would need to demonstrate that additional water is available as is currently required.

## ADDITIONAL NOTES

The Planning Unit recognizes the high level of uncertainty in many of the demand and availability estimates, as well as uncertainty in projecting growth.

Once every 10 years or when 75 percent of a reservation has been used, the WRIA 25/26 Planning Unit or its successor, the Department of Ecology, and other interested parties will convene to:

- Review status of water reservations and streams flows;

- Consider new information regarding water needs, water availability, and stream flows
- Develop options for additional future water supply, if needed; and
- Amend the Watershed Plan if necessary.

Ecology may initiate a modification of the Water Management Rule based on the conclusions of such a review.

See the Watershed Management Measures Implementation section for a more thorough discussion of reopeners and plan/rule amendments.

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<sup>xii</sup> Lewis County WRIA 26 Subbasins Domestic Water Use In Unincorporated Areas Potential Streamflow Depletion based on Development Potential at Build-Out Approved by the Planning Unit June 9, 2011; Revised June 7, 2013

<sup>xiii</sup> 'WRIA 26 Lewis County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs' approved by the WRIA 25/26 Planning Unit, August 11, 2011. Agriculture acreage was divided among subbasins using current Lewis County zoning.

<sup>xiv</sup> Values provided by Jim Pachecos, Department of Ecology, January 31, 2011 email to Scott McKinney and Brad Caldwell, Department of Ecology.

<sup>xv</sup> Primary populations are those that are targeted for restoration to a high or greater level of viability in the *WA Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan* (LCFRB 2010).

<sup>xvi</sup> 'Tributary Prioritization Spreadsheet' developed by the Fish and Flow Workgroup, updated November 9, 2011.

<sup>xvii</sup> Development potential was estimated by reviewing Lewis County's zoning GIS layer, adopted by Lewis County December 14, 2009 and amended December 27, 2010.

<sup>xviii</sup> Lewis County GIS performed an analysis of potential build-out by LCFRB's subwatersheds. This demand estimate was based on that analysis ('Lewis County Unincorporated Area Water Demand Estimate by Subwatershed/Stream Impacted', September 16, 2011).

# TILTON

## WATER DEMAND

Water demand in the Tilton subbasin includes potential demand from the Morton municipal system, agriculture, and residential growth in unincorporated areas. Morton has adequate current water rights to meet their anticipated demand through the 20-year planning horizon. There is a potential for development of 509 additional parcels in unincorporated areas in the Tilton subbasin. This yields a potential streamflow depletion of 0.23cfs.<sup>xix</sup> Water demand from agriculture was estimated using a range of potential growth rates.<sup>xx</sup>

Demand Category	Demand Estimate	Notes
Morton	0	Adequate water rights to 2030
Unincorporated Areas	0.23cfs	Based on Lewis County's build-out scenario potential to develop 509 additional parcels
Agriculture	0.1cfs – 0.5cfs	Range based on ag growth rates of 0.5% to 2%

## STREAM CONSIDERATIONS AND WATER AVAILABILITY

Based on WDFW and Ecology guidelines of using 1% of the 90% exceedence flow as a measure of acceptable habitat loss and water availability, the water availability estimate for the mainstem Tilton River is 0.62cfs (measured at Tilton River, RM 7.1)<sup>xxi</sup>.

The Tilton subbasin supports populations of winter steelhead, fall Chinook, spring Chinook, and coho. All are listed as Threatened under the Federal Endangered Species Act (ESA). Based on review by WDFW biologists<sup>xxii</sup> and evaluation of development potential<sup>xxiii</sup>, the Fish and Flow Workgroup felt most streams in this subbasin were of low concern of streamflow impacts from development, and categorized them as Category A – of low concern. One reach of the Tilton (Tilton-4) had higher levels of potential development and was categorized as Category B – monitoring and adaptive management recommended (no immediate concern). Several areas have an existing Surface Water Source Limitation (SWSL)<sup>2</sup> designation, and the Fish and Flow subgroup recommended retaining the low flow recommendation from those SWSLs; thus, they categorized those streams as Category E – active protective measure in place. These streams and/or reaches include Minnie Creek, Tilton-5, and Tilton-6.

<sup>2</sup> See Appendix H of the 2006 watershed management plan, Table H-4.

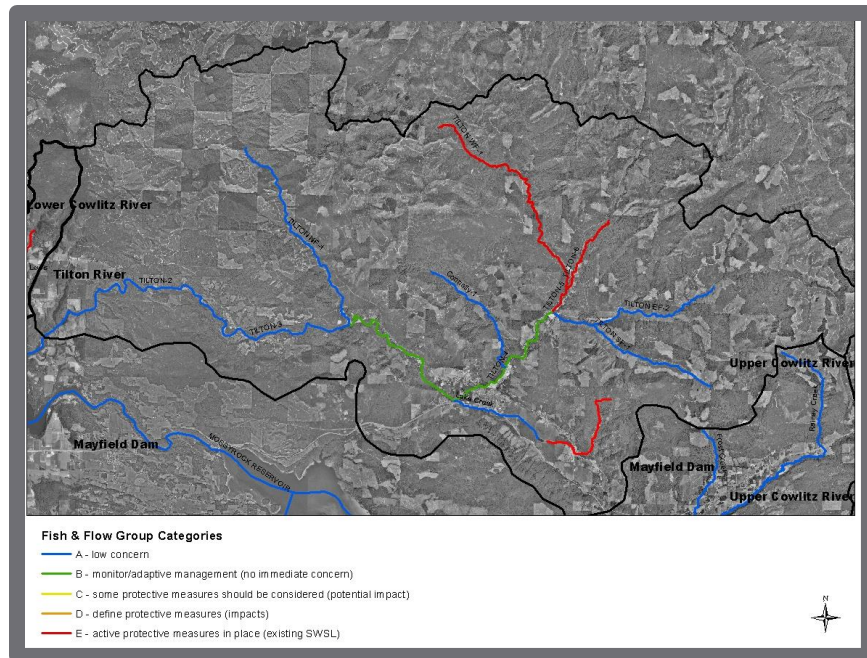


Figure 4. Map of Fish and Flow Group categories of concern for streams in the Tilton subbasin.

## WATER MANAGEMENT RECOMMENDATIONS AND IMPLICATIONS

Based on the potential demand compared to estimate of water availability, the Planning Unit recommends the following for the Tilton subbasin:

- Existing water rights and permitted exempt wells are not affected
- No closures
- Minnie Creek, Tilton-5, and Tilton-6 –
  - Use SWSL recommended low-flows:
    - Upper Tilton above the confluence with the East Fork (approx. RM 22) – low flow of 3.0cfs
    - Minnie Cr – low flow of 1.0cfs;
  - Reserve 0.048cfs for the Minnie Creek/Lake Creek subwatershed for permit-exempt wells and small systems sufficient to meet estimated potential full build-out of 131 parcels<sup>xxiv, xxv</sup>; and
  - Reserve 0.003cfs for the Upper Tilton above the confluence with the East Fork for permit-exempt wells and small systems sufficient to meet estimated potential full build-out of 7 parcels<sup>xxvi, xxvii</sup>
  - Demand beyond the reservations could be allowed if it does not cause flows to go below SWSL recommended low-flows.

## ADDITIONAL NOTES

The Fish and Flow Subgroup recognizes the high level of uncertainty in many of the demand and availability estimates, as well as uncertainty in projecting growth.

Once every 10 years or when 75 percent of a reservation has been used, the WRIA 25/26 Planning Unit or its successor, the Department of Ecology, and other interested parties will convene to:

- Review status of water reservations and streams flows;
- Consider new information regarding water needs, water availability, and stream flows
- Develop options for additional future water supply, if needed; and
- Amend the Watershed Plan if necessary.

Ecology may initiate a modification of the Water Management Rule based on the conclusions of such a review.

See the Watershed Management Measures Implementation section for a more thorough discussion of reopeners and plan/rule amendments.

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<sup>xxix</sup> Lewis County WRIA 26 Subbasins Domestic Water Use In Unincorporated Areas Potential Streamflow Depletion based on Development Potential at Build-Out Approved by the Planning Unit June 9, 2011; Revised June 7, 2013

<sup>xxx</sup> 'WRIA 26 Lewis County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs' approved by the WRIA 25/26 Planning Unit on August 11, 2011. Agriculture acreage was divided among subbasins using current Lewis County zoning.

<sup>xxxi</sup> Values provided by Jim Pachecos, Department of Ecology, January 31, 2011 email to Scott McKinney and Brad Caldwell, Department of Ecology.

<sup>xxxii</sup> 'Tributary Prioritization Spreadsheet' developed by the Fish and Flow Workgroup, updated November 9, 2011.

<sup>xxxiii</sup> Development potential was estimated by reviewing Lewis County's zoning GIS layer, adopted by Lewis County December 14, 2009 and amended December 27, 2010.

<sup>xxxiv</sup> Lewis County GIS performed an analysis of potential build-out by LCFRB's subwatersheds. This demand estimate was based on that analysis ('Lewis County Unincorporated Area Water Demand Estimate by Subwatershed/Stream Impacted', September 16, 2011).

<sup>xxxv</sup> Small systems include water systems under fifteen connections (or the equivalent water use) providing water for human consumption. This may include domestic use as well as small commercial uses.

<sup>xxxvi</sup> Lewis County GIS performed an analysis of potential build-out by LCFRB's subwatersheds. This demand estimate was based on that analysis ('Lewis County Unincorporated Area Water Demand Estimate by Subwatershed/Stream Impacted', September 16, 2011).

<sup>xxxvii</sup> Ibid.

# TOUTLE

## WATER DEMAND

Water demand in the Toutle subbasin includes potential demand from agriculture and residential growth in unincorporated areas, as well as commercial, industrial, and office demand. The potential growth in unincorporated area was based on population projections through 2030. Based on the projections population would by grow an estimated 1,428 and potentially 529 new households. Water demand for this growth would result in a potential streamflow depletion of 0.19cfs.<sup>xxviii</sup> Water demand from agriculture was estimated using a range of potential growth rates. A range of potential commercial, industrial, tourist and recreation water demand was estimated based on an increase in acreage of those land uses.<sup>xxix</sup>

Demand Category	Demand Estimate	Notes
<b>Commercial/Industrial/Tourist Recreation Use in Unincorporated Areas</b>	0.47cfs – 9cfs	Range based on low to high use estimates
<b>Unincorporated Areas Domestic Use</b>	0.19cfs	Based on projected population growth of 1,428 people or 529 households by 2030
<b>Agriculture</b>	0.013cfs – 1.59cfs	Range based on ag growth rates of 0.5% to 2%

## STREAM CONSIDERATIONS AND WATER AVAILABILITY

Based on WDFW and Ecology guidelines of using 1% of the 90% exceedence flow as a measure of acceptable habitat loss and water availability, the water availability estimate for the mainstem Toutle River is 2.89cfs (measured at RM 6.5).<sup>xxx</sup>

The Toutle subbasin supports populations of winter steelhead, fall Chinook, spring Chinook, chum, and coho. All are listed as Threatened under the Federal Endangered Species Act (ESA). The coho, winter steelhead, and fall Chinook populations in the Toutle are Primary populations for salmon recovery.<sup>xxxi</sup> Based on review by WDFW biologists<sup>xxxii</sup> and evaluation of development potential<sup>xxxiii</sup>, the Fish and Flow Workgroup felt that many areas in this subbasin were of low concern of streamflow impacts from development, and categorized them as Category A – of low concern. The Silver Lake subwatershed was an area where a conflict was noted between potential development impacts and streamflow protection. The Fish and Flow Workgroup evaluated impacts on a subwatershed level, and based on their review, made specific recommendations listed below.

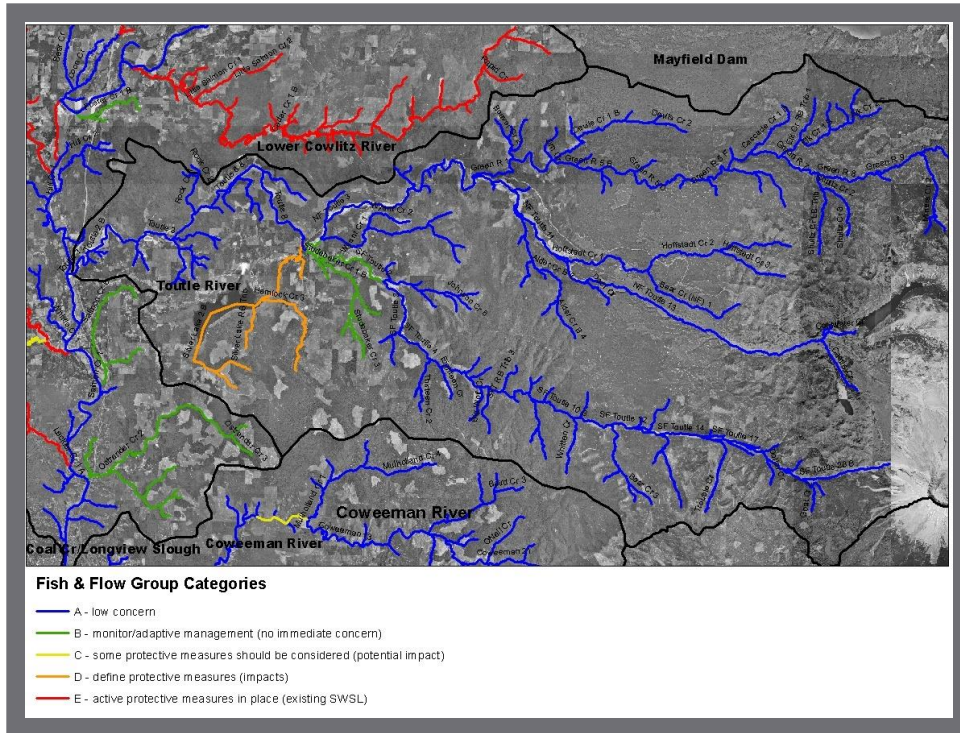


Figure 5. Map of Fish and Flow Group categories of concern for streams in the Toutle subbasin.

## WATER MANAGEMENT RECOMMENDATIONS AND IMPLICATIONS

Based on the potential demand compared to estimate of water availability, the Planning Unit recommends the following for the Toutle subbasin:

- Existing water rights and permitted exempt wells are not affected
- All areas – no closures, no instream flows, no reservations
- Silver Lake, its tributaries, and Outlet Creek–
  - Recommend future development in subwatershed, especially commercial development, hook up to the Toutle Regional Water system within the service area
  - Ensure the number of wells and small systems be carefully tracked relative to the planning assumptions that project approximately 250 households in the subwatershed over the next 20 years; and
  - Recommend additional water right applications be evaluated for impacts to water quality.

Although the total Toutle demand estimate exceeds the water availability estimate, the Planning Unit recognizes that the Toutle Regional Water System, which draws water from the Cowlitz River, could offset some of the demand impacts.

## ADDITIONAL NOTES

The Planning Unit recognizes the high level of uncertainty in many of the demand and availability estimates, as well as uncertainty in projecting growth.

Once every 10 years or when 75 percent of a reservation has been used, the WRIA 25/26 Planning Unit or its successor, the Department of Ecology, and other interested parties will convene to:

- Review status of water reservations and streams flows;
- Consider new information regarding water needs, water availability, and stream flows
- Develop options for additional future water supply, if needed; and
- Amend the Watershed Plan if necessary.

Ecology may initiate a modification of the Water Management Rule based on the conclusions of such a review.

See the Watershed Management Measures Implementation section for a more thorough discussion of reopeners and plan/rule amendments.

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<sup>xxviii</sup> Cowlitz County WRIA 26 Subbasins Domestic Water Use In Unincorporated Areas from permit-exempt wells

Potential Streamflow Depletion based on Population Growth Projections to 2030, October 13, 2011, revised June 2013

<sup>xxix</sup> 'Water Demand for Commercial, Industrial, Tourist, and Recreation Uses in Unincorporated Cowlitz County Portions of the Lower Cowlitz, Toutle, and Coweeman Subbasins' provided by Cowlitz County December 29, 2011.

<sup>xxx</sup> Values provided by Jim Pachecos, Department of Ecology, January 31, 2011 email to Scott McKinney and Brad Caldwell, Department of Ecology.

<sup>xxxi</sup> Primary populations are those that are targeted for restoration to a high or greater level of viability in the *WA Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan*, (LCFRB 2010).

<sup>xxxii</sup> 'Tributary Prioritization Spreadsheet' developed by the Fish and Flow Workgroup, updated November 9, 2011.

<sup>xxxiii</sup> Development potential and subwatershed-level impacts were estimated by reviewing population projections to 2030 in each LCFRB subwatershed ('Cowlitz County WRIA 26 Select Subwatershed Domestic Water Use in Unincorporated Areas from Permit-exempt Wells Potential Streamflow Depletion based on Population Growth Projections to 2030', reviewed by the Fish and Flow Workgroup, November 7, 2011).



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# LOWER COWLITZ

## WATER DEMAND

The Lower Cowlitz subbasin encompasses the Cowlitz watershed below Mayfield dam, excluding the Toutle and Coweeman subbasins. Water demand in the Lower Cowlitz subbasin is driven by the needs of several municipal water systems, agriculture, residential uses in unincorporated areas, as well as commercial, industrial, and office uses.

In the unincorporated areas of Lewis County there is a full build-out potential for development of 5,717 additional parcels or possible households under the County's current Comprehensive Plan.<sup>xxxiv</sup> The estimated full build-out water need is 2.10 cfs. Based on a 20-year growth projection, it is estimated that 0.38 cfs would be needed to support a population increase of 2,642 or 1048 additional households.<sup>xxxv</sup> The town of Vader indicates it has adequate water rights to meet their anticipated demand through the 20-year planning horizon. Winlock projects it will require an additional 2.14 cfs within the 20-year planning horizon and Toledo projects a need for an additional 0.47 cfs. Lewis County indicates a potential additional water demand for commercial, industrial, and office uses based on the South Lewis County Water Analysis and Demand Forecast.<sup>xxxvi</sup>

In Cowlitz County, population in the unincorporated areas is expected to grow by 6,449 people, creating 2,434 new households by 2030 and a potential water need of 0.89 cfs.<sup>xxxvii</sup> A range of potential commercial, industrial, tourist and recreation water demand in unincorporated areas was estimated based on a projected increase in acreage dedicated to those land uses.<sup>xxxviii</sup> The City of Castle Rock operates a regional water system that serves the residents of the City as well as the communities of Toutle and Silver Lake in the Toutle River subbasin. Castle Rock estimates that an additional 4.08 cfs will be needed to meet the needs of the regional water system through 2030. Other municipal water providers, Beacon Hill Water and Sewer District, Kelso, and Longview, have water sources within the tidally-influenced areas of the Cowlitz and Columbia Rivers, where additional withdrawals are not expected to impact stream flows.

For both Lewis and Cowlitz Counties, water demand from agriculture was estimated using a range of potential growth rates.<sup>xxxix</sup> A detailed list of the Lower Cowlitz water demand estimates is shown in Table 1 below.

Table 2 WRIA 26 Water Demand Estimates

Demand Category	Demand Estimate	Notes
<b>Lewis County</b>		
<b>Winlock</b>	2.14cfs	Based on 60% buildout <sup>xi</sup>
<b>Toledo</b>	0.47cfs	Although anticipated demand through 2028 is 0.34cfs, Toledo asks that 2006 Plan demand estimate of 0.47 be maintained <sup>xii</sup>
<b>Vader</b>	0	Existing water rights adequate to meet anticipated demand through 2030 <sup>xiii</sup>
<b>C/I/T/R</b>	1.68cfs – 3.11cfs	Demand estimate range from South Lewis County Subarea Plan <sup>xiii</sup>
<b>Unincorporated Areas Domestic Use</b>	0.38cfs	Based 20-year population increase of 2,642 people and 1,028 households <sup>xiv</sup> . Lewis County full build-out scenario projects a development potential of 5,749 parcels requiring 2.10 cfs <sup>xv</sup>
<b>Agriculture</b>	3.4cfs – 16cfs	Demand estimate range based on ag growth rates of 0.5% to 2% <sup>xvi</sup>
<b>Demand Category</b>		
<b>Cowlitz County</b>		
<b>Castle Rock</b>	4.08cfs	60% of full build-out to occur within 40 years. Service area includes City of Castle Rock and communities of Toutle and Silver Lake. <sup>xvii</sup>
<b>BHWSD</b>	NA	Water source is in tidally-influenced area
<b>Kelso</b>	NA	Water source is in tidally-influenced area
<b>Longview</b>	NA	Water source is in tidally-influenced area
<b>C/I/T/R Use in Unincorporated Areas</b>	0.16cfs – 3.4cfs	Demand estimate range based on low to high use estimates <sup>xviii</sup>
<b>Unincorporated Areas Domestic Use</b>	0.89cfs	Based on population growth projections to 2030 <sup>xix</sup>
<b>Agriculture</b>	0.031cfs – 3.81cfs	Demand estimate range based on ag growth rates of 0.02% to 2% <sup>i</sup>

## STREAM CONSIDERATIONS AND WATER AVAILABILITY

WDFW and Ecology use 1-2% of the 90% exceedence flow during the summer low flow period as a general measure of acceptable habitat loss and water availability. Based on 1% of the summer 90% exceedence flow this measure, the water availability estimate for the mainstem Lower Cowlitz River is 25.76cfs (measured at Castle Rock, RM 17.3)<sup>ii</sup>. This value is inclusive of any flows from upstream measurement points and tributaries; thus, comparing this value to demand in this subbasin should also

include analysis of potential upstream depletion, including estimated future demand in the Upper Cowlitz and Cispus subbasins.

The importance of the lower Cowlitz River and its tributaries to ESA-listed salmon and steelhead was also considered in assessing availability of water for out of stream uses. The Lower Cowlitz subbasin supports populations of winter steelhead, fall Chinook, chum and coho, all of which are listed as threatened under the ESA. The coho population in the Lower Cowlitz is a Primary population for salmon recovery.<sup>lii</sup> The Fish and Flow Workgroup and WDFW biologists evaluated fish use and flows for the mainstem Cowlitz and individual Cowlitz tributaries or subwatersheds.<sup>liii</sup> Development potential, estimated water needs and potential streamflow impacts for individual subwatersheds were also analyzed by Workgroup and WDFW and Ecology.<sup>liv, lv</sup>

The potential impacts of future water appropriations on lower mainstem Cowlitz flows are of low concern given that flows are regulated and substantial in comparison to anticipated future demands. Given the relatively plentiful water available, no closure is proposed for the lower Cowlitz mainstem. The potential impacts of future water appropriations on flows in the major tributaries to the lower Cowlitz are of greater concern (see figure 6). Eight lower Cowlitz subwatersheds are proposed for closures with instream flows and reservations. A minimum of 2% of the 90% exceedance flow for the summer low flow period was used in setting reservations for 4 of the lower Cowlitz tributaries. For the remaining subwatersheds, the recommended reservations exceed the 2% of the 90% exceedance flow for the summer low flow period. These recommendations are based on the evaluations conducted by the Workgroup and the WDFW and Ecology. The recommended reservations are not expected to significantly impact streams flows needed to support Lower Cowlitz salmon and steelhead populations.”

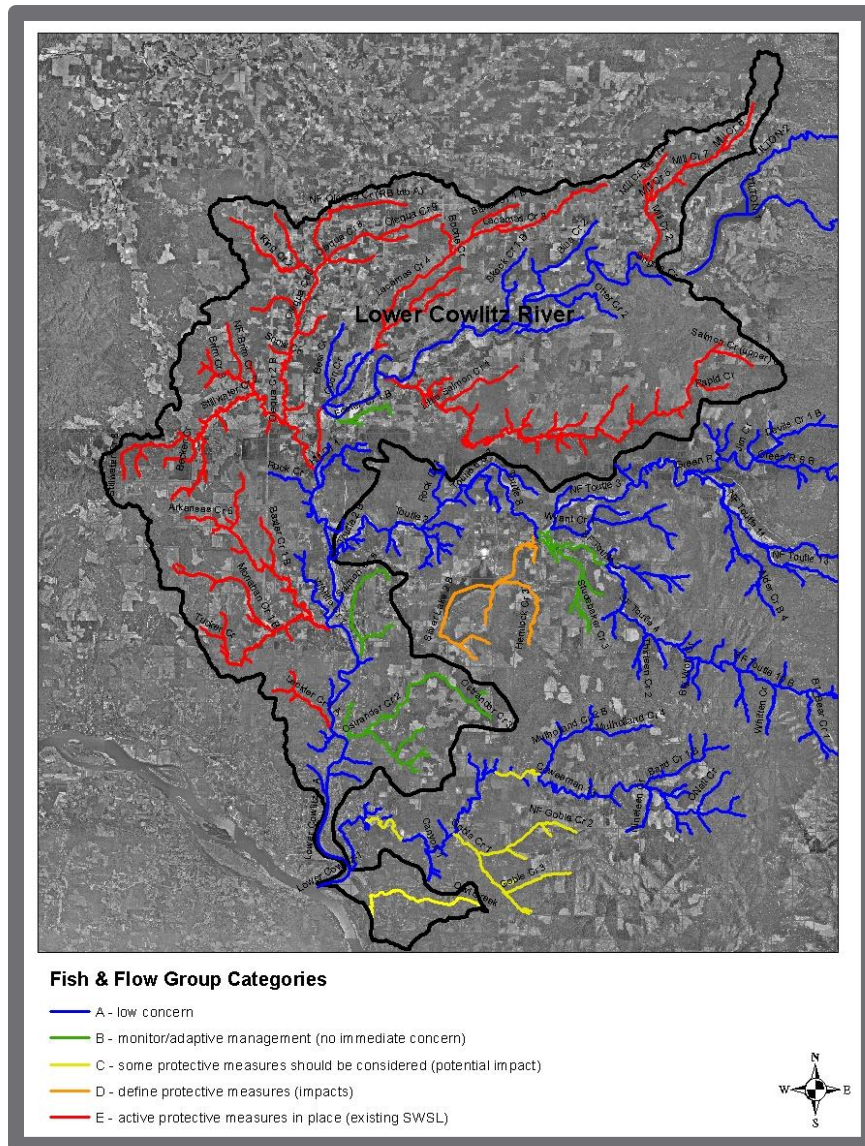


Figure 6. Map of Fish and Flow Group categories of concern for streams in the Lower Cowlitz subbasin (outlined in black).

## WATER MANAGEMENT RECOMMENDATIONS AND IMPLICATIONS

The following recommendations are based on the potential water demand compared to estimate of water availability:

- General Subbasin provisions:
  - By law, no existing water right and permit exempt wells would be subject to or affected by any recommendation in this summary or any subsequent water management rule.
  - The following subwatersheds are closed to further water appropriation beyond the specific subwatershed reservations set forth below:

- Mill Creek
  - Salmon Creek
  - Lacamas Creek
  - Olequa Creek
  - Arkansas/Monahan/Delameter Creeks
  - Leckler Creek
  - Ostrander Creek
  - Owl Creek
- Instream flows, listed in Table 2, would be established for the following subwatersheds:
  - Mill Creek
  - Salmon Creek
  - Lacamas Creek
  - Olequa Creek
  - Arkansas/Monahan/Delameter Creeks
  - Leckler Creek
  - Ostrander Creek
- If a reservation is depleted in a subwatershed with instream flow restrictions, new permit exempt wells will be allowed for in-house use only. “Domestic use” means use of water associated with human health and welfare needs, including water used for drinking, bathing, sanitary purposes, cooking, laundering, and other incidental household uses. The incidental uses must minimize the consumptive use of water. Examples of incidental household uses include, but are not limited to: Washing windows, car washing, cleaning exterior structures, care of household pets, and watering potted plants. Domestic use does not include other uses allowed under the groundwater permit exemption: Outdoor irrigation of up to one-half acre of noncommercial lawn or garden, stockwatering, and industrial use.
- The infrastructure to deliver Cowlitz River water to the City of Winlock and the unincorporated areas of Lewis County is recognized as the highest priority water infrastructure need in WRIA 26 by Ecology, WDFW, and the members of the WRIA 25/26 Planning Unit. Ecology, the City of Winlock, and Lewis County will work together to plan, secure funding, and develop the needed infrastructure in a timely manner.
- Mainstem Lower Cowlitz (below Mayfield Dam)
  - The Mainstem Lower Cowlitz subwatershed is open to future water appropriation with no limits on permit exempt wells. The “open to appropriation” portion of the Cowlitz Mainstem alluvial aquifer extends from the confluence of Mill Creek and the Cowlitz River (located about 2.5 miles west of Mayfield Dam at approximately River Mile 49.5) west and south along the Cowlitz River floodplain to River Mile 7, which is near Rocky Point (a promontory located on the east side of the Cowlitz River just north of Kelso and just south of Lexington). In between River Mile 7 to River Mile 49.5 the Cowlitz River and the alluvial aquifer beneath the Cowlitz River is open to appropriation with no restrictions.

The boundaries of the alluvial aquifer are determined to be the point where the topography changes from being “floodplain” (areas of historical flows of the Cowlitz River) to “slope” (where the topography steepens). The accompanying maps (see section, Lower Cowlitz Mainstem Areas Open to Future Water Appropriations, page 44) that show the areas “open for appropriation” along the Cowlitz floodplain are delineated by the clear change in topography from “floodplain” to “slope” on both sides of the River’s mainstem where floodplain occurs. Within the floodplain, it is assumed that groundwater is in direct hydraulic connection with the surface water flows of the Cowlitz River Mainstem. Cowlitz River Mainstem flows are regulated below Mayfield Dam by the Dam and are of historical discharge quantities that direct withdrawal from either the Cowlitz River Mainstem or from the alluvial aquifer will not impair the flows of the Cowlitz River.<sup>lvi</sup>

- The Mainstem Lower Cowlitz reservations are an acknowledgement by Ecology of the water available for appropriation within the jurisdiction of the applicable county or city. Since the subbasin would be open to further water appropriations, the reservation is not a limit on the amount of water available. However, in seeking water rights for quantities beyond the reservation, it would need to be demonstrated that additional water is available as is currently required by law.
- The specific amounts of water identified below are reserved for future allocations within Lewis and Cowlitz counties. The water would only be available for appropriation upon adoption of a water allocation plan by the county where the reservation applies. The allocation plan would be developed in consultation with the Planning Unit or its successor and adopted by the county through a public process.
  - Lewis County: 6.6 cfs (from mainstem Cowlitz).
  - Cowlitz County: 6.42 cfs (from mainstem Cowlitz).<sup>lvii</sup>
- The specific amounts of water identified below are reserved for cities within the Lower Cowlitz subbasin:
  - City of Winlock: 1.80 cfs (from mainstem Cowlitz).<sup>lviii</sup>
  - City of Toledo: 0.47 cfs reservation (from mainstem Cowlitz).
  - City of Vader: No reservation needed. Existing water rights expected to be adequate to meet 20-year demand estimate.
  - City of Castle Rock: 4.08 cfs reservation (from mainstem Cowlitz). Service area includes City of Castle Rock and communities of Toutle and Silver Lake.<sup>lix</sup>
- Mill Creek subwatershed
  - Reserve 0.055 cfs for permit-exempt wells and small systems<sup>lx</sup> based on 2% of the 90% exceedence flow during the summer low flow period (2.73cfs). It is estimated that this quantity will support a population growth of 384 people or 150 additional households. The projected 20-year growth is 150 people or 58 households<sup>lxi</sup>.
- Salmon Creek subwatershed
  - Reserve 0.037 cfs for permit-exempt wells and small systems<sup>lxii</sup> based on 2% of the 90% exceedence flow during the summer low flow period (1.86cfs). It is estimated that this

quantity will support a population growth of 262 people or 102 additional households. The estimated 20-year growth is 160 people or 62 households.

- Lacamas Creek subwatershed
  - Reserve 0.072 cfs for permit-exempt wells and small systems subwatershed based on 2% of the 90% exceedence flow during the summer low flow period (3.59 cfs). . It is estimated that this quantity will support a population growth of 505 people or 197 additional households. The estimated 20-year growth is 434 people or 169 households<sup>lxiii</sup>.
- Olequa Creek subwatershed
  - Reserve 0.223 cfs for permit-exempt wells and small systems<sup>lxiv</sup> to fully satisfy the 20-year unincorporated residential growth estimate 1,571 people of 611 households<sup>lxv</sup>.
  - City of Winlock:
    - Estimated 20-year demand is 2.14 cfs (60% build out).
    - Reserve 0.33 cfs from Olequa Creek for future demand.
    - Reduce 40% water system leakage (.27 cfs) to increase available water supply.
    - Evaluate the capacity of the Logan Hill aquifer to help meet future water needs.
    - Develop a regional water supply drawing from the Cowlitz River to assist in meeting future needs.
  - The total reservation for the Olequa subwatershed, including the City of Winlock, is 0.553 cfs or 6.3% of the 90% exceedence flow during the summer low flow period.
- Arkansas, Delameter, Monahan Creeks subwatershed (see figure 7)
  - Reserve 0.077 cfs for permit-exempt wells and small systems in the Arkansas subwatershed based on 2% of the 90% exceedence flow during the summer low flow period (3.83 cfs). It is estimated that this quantity will support a population growth of 539 people or 210 additional households. The estimated 20-year growth is 141 people or 55 households.<sup>lxvi</sup>
  - Reserve 0.050 cfs for permit-exempt wells and small systems in the Delameter/Monahan subwatershed based on 2% of the 90% exceedence flow during the summer low flow period (2.50 cfs). It is estimated that this quantity will support a population growth of 352 people or 137 additional households. The estimated 20-year growth is 282 people or 110 households.<sup>lxvii</sup>
- Leckler Creek subwatershed
  - Reserve 0.040 cfs for permit-exempt wells and small systems<sup>lxviii</sup> to fully satisfy the 20-year residential growth estimate of 302 people or 114 households.
  - The reservation for the Leckler Creek subwatershed 4% of the 90% exceedence flow during the summer low flow period.
- Ostrander Creek:

- Reserve 0.060 cfs for permit-exempt wells and small systems<sup>lxix</sup> to fully satisfy the 20-year residential growth estimate of 461 people or 174 households.
- The reservation for the Ostrander Creek subwatershed 14.3% of the 90% exceedence flow during the summer low flow period.
  
- Owl Creek subwatershed
  - Reserve 0.050 cfs for permit-exempt wells and small systems<sup>lxxx</sup> to fully satisfy the 20-year residential growth estimate of 380 people or 143 households.
  - The reservation for the Owl Creek subwatershed 7.8% of the 90% exceedence flow during the summer low flow period.



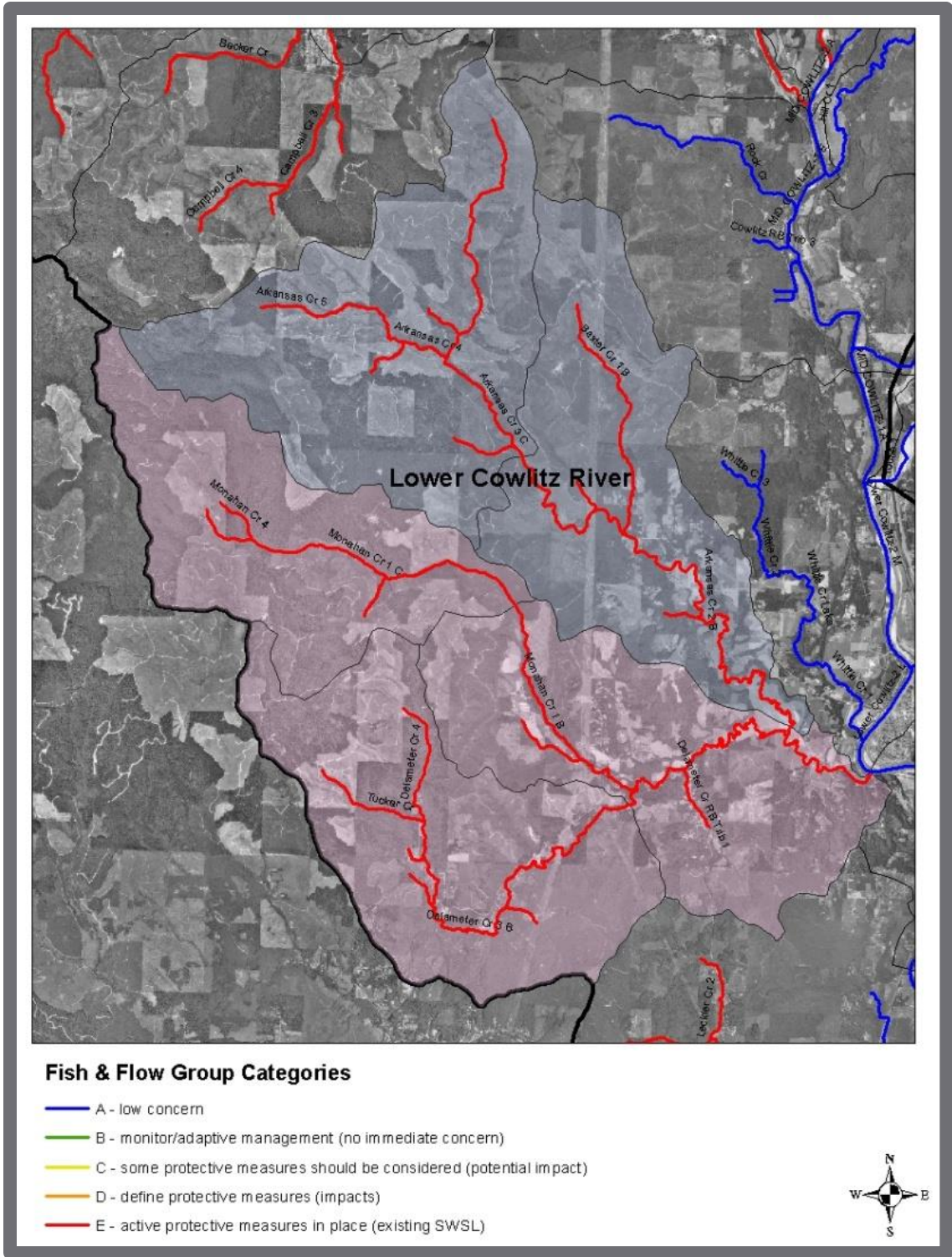


Figure 7. Map of the Arkansas Creek subwatershed and the Monahan/Delameter subwatershed.

**Table 3 Instream Flows in the Lower Cowlitz Basin Tributary Streams (cubic feet per second)**

Month	Stream and Management Control Point							
	Lacamas Creek, RM 0.3	Leckler Creek, RM 0.5	Mill Creek, RM 0.0	Olequa Creek, RM 6.5	Ostrander Creek, RM 0.6	Salmon Creek, RM 1.7	Arkansas Creek RM 2.7	Monahan/ Delameter Creeks RM 1.75
JAN	93	9	47	129	69	145	19	67
FEB	118	18	79	160	90	178	36	108
MAR	118	18	79	160	90	178	36	108
APR	118	18	79	160	90	178	36	108
MAY	118	18	79	160	90	178	36	96/55
JUN	79	12	53	107	60	118	24	41/25
JUL	79	12	53	107	60	118	24	17/12
AUG	33	3	20	48	23	55	8	12/13
SEP	140	3	20	193	104	217	8	15/30
OCT	140	9	47	193	104	217	19	67
NOV	140	9	47	193	104	217	19	67
DEM	93	9	47	129	69	145	19	67

In cells with 2 numbers, the first number applies to the first half of the month and the second number applies to the second half of the month.

## ADDITIONAL NOTES

Once every 10 years or when 75 percent of a reservation has been used, the WRIA 25/26 Planning Unit or its successor, the Department of Ecology, and other interested parties will convene to:

- Review status of water reservations and streams flows;
- Consider new information regarding water needs, water availability, and stream flows
- Develop options for additional future water supply, if needed; and
- Amend the Watershed Plan if necessary.

Ecology may initiate a modification of the Water Management Rule based on the conclusions of such a review.

See the Watershed Management Measures Implementation section for a more thorough discussion of reopeners and plan/rule amendments.

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<sup>xxxiv</sup> 'Lewis County WRIA 26 Subbasins Domestic Water Use In Unincorporated Areas Potential Streamflow Depletion based on Development Potential at Build-Out Approved by the Planning Unit June 9, 2011; Revised June 7, 2013 and the 'Lewis County Unincorporated Area Water Demand Estimate by Subwatershed/Streams Impacted', September 2011.

<sup>xxxv</sup> Population Estimates, Household, and Water use Projections for Lower Cowlitz, Lewis County, June 7, 2013.

<sup>xxxvi</sup> South Lewis County Water Analysis and Demand Forecast (February 2010).

<sup>xxxvii</sup> Cowlitz County WRIA 26 Subbasins Domestic Water Use In Unincorporated Areas from permit-exempt wells Potential Streamflow Depletion based on Population Growth Projections to 2030; October 13, 2011, revised June 2013.

<sup>xxxviii</sup> 'Water Demand for Commercial, Industrial, Tourist, and Recreation Uses in Unincorporated Cowlitz County Portions of the Lower Cowlitz, Toutle, and Coweeman Subbasins' provided by Cowlitz County December 29, 2011. Agriculture acreage was divided among subbasins using current proportions based on 2010 Land Use data from Ecology.

<sup>xxxix</sup> For Lewis County, based on 'WRIA 26 Lewis County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs' approved by the WRIA 25/26 Planning Unit on August 11, 2011. Agriculture acreage was divided among subbasins using current Lewis County zoning.

For Cowlitz County, based on 'WRIA 26 Cowlitz County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs' approved by the WRIA 25/26 Planning Unit on August 11, 2011. Agriculture acreage was divided among subbasins using current proportions based on 2010 Land Use data from Ecology.

<sup>xl</sup> City of Winlock, Washington, Buildable Land Inventory, Build out Analysis, and Future Water Needs, 2011.

<sup>xli</sup> City of Toledo, Water System Plan, November 2009.

<sup>xlii</sup> Informal communication with Shirley Cook, May 23, 2011. 2006 Watershed Plan indicates existing water rights sufficient to meet 20-year demand.

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<sup>xliii</sup> South Lewis County Water Analysis and Demand Forecast (February 2010).

•For Lewis County, based on ‘WRIA 26 Lewis County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs’ approved by the WRIA 25/26 Planning Unit on August 11, 2011. Agriculture acreage was divided among subbasins using current Lewis County zoning.

•For Cowlitz County, based on ‘WRIA 26 Cowlitz County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs’ approved by the WRIA 25/26 Planning Unit on August 11, 2011. Agriculture acreage was divided among subbasins using current proportions based on 2010 Land Use data from Ecology.

<sup>xliv</sup> Population Estimates, Household, and Water use Projections for Lower Cowlitz, Lewis County, June 7, 2013.

<sup>xlv</sup> 236gpd consumptive use estimate for permit-exempt wells, *Estimate of Water Use for Exempt Wells in WRIAs 25 and 26* memo adopted by the WRIA 25/26 Planning Unit on April 14, 2011, applied to the Lewis County Full Build-out Scenario and approved by the Planning Unit on March 10, 2011.

<sup>xlvi</sup> •For Lewis County, ‘WRIA 26 Lewis County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs’ approved by the WRIA 25/26 Planning Unit on August 11, 2011. Agriculture acreage was divided among subbasins using current Lewis County zoning.

•For Cowlitz County, based on ‘WRIA 26 Cowlitz County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs’ approved by the WRIA 25/26 Planning Unit on August 11, 2011. Agriculture acreage was divided among subbasins using current proportions based on 2010 Land Use data from Ecology.

<sup>xlvii</sup> Data provided by the City of Castle Rock, May 2, 2013.

<sup>xlviii</sup> Water Demand for Commercial, Industrial, Tourist, and Recreation Uses in Unincorporated Cowlitz County Portions of the Lower Cowlitz, Toutle, and Coweeman Subbasins, December 29, 2011.

<sup>xlix</sup> Cowlitz County WRIA 26 Subbasins Domestic Water Use In Unincorporated Areas from permit-exempt wells Potential Streamflow Depletion based on Population Growth Projections to 2030, October 13, 2011, revised June 2013.

<sup>l</sup> WRIA 26 Cowlitz County Agriculture Lands And Water Analysis Of Current Condition, Pending Water Rights, And Future Needs memo approved by the Planning Unit, August 11, 2011.

<sup>li</sup> Values provided by Jim Pachecos, Department of Ecology, January 31, 2011 email to Scott McKinney and Brad Caldwell, Department of Ecology

<sup>lii</sup> Primary populations of fish are those that are targeted for restoration to a high or greater level of viability in the *WA Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan* (LCFRB 2010).

<sup>liii</sup> ‘Tributary Prioritization Spreadsheet’ developed by the Fish and Flow Workgroup, updated November 9, 2011.

<sup>liv</sup> Development potential by Lewis County’s zoning GIS layer, adopted by Lewis County December 14, 2009 and amended December 27, 2010.

<sup>lv</sup> Lewis County GIS performed an analysis of potential build-out by LCFRB’s subwatersheds (*Lewis County Unincorporated Area Water Demand Estimate by Subwatershed/Stream Impacted*, September 16, 2011). Development potential and subwatershed-level impacts in Cowlitz County were estimated by reviewing population projections to 2030 in each LCFRB subwatershed (*Cowlitz County WRIA 26 Select Subwatershed Domestic Water Use in Unincorporated Areas from Permit-exempt Wells Potential Streamflow Depletion based on Population Growth Projections to 2030*, reviewed by the Fish and Flow Workgroup on November 7, 2011).

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<sup>lvi</sup> Ecology Memorandum, Mike Gallagher to Jennifer Holderman, Documentation of How the Map Determinations of Alluvial Aquifer Adjacent to the Cowlitz River Mainstem was Determine, June 29, 2013.

<sup>lvii</sup> Total:6.42 cfs based on:

- Castle Rock: 2.72 cfs – Castle Rock is a regional water system serving Castle Rock, Toutle, and Silver Lake.

- C/I/T/R: 1.78 cfs – This would provide for commercial/industrial/tourist uses in unincorporated Cowlitz County.

1.78 cfs is the midpoint of the estimated demand range

-Agriculture :1.92 cfs – This is the midpoint of the estimated demand range

<sup>lviii</sup> Reservation represents the estimated water needed to support 60% build out.

<sup>lix</sup> Ibid.

<sup>lx</sup> Small systems include water systems under fifteen connections (or the equivalent water use) providing water for human consumption. This may include domestic use as well as small commercial uses.

<sup>lxi</sup> Population Estimates, Household, and Water use Projections for Lower Cowlitz, Lewis County - June 7, 2013

<sup>lxii</sup> Small systems include water systems under fifteen connections (or the equivalent water use) providing water for human consumption. This may include domestic use as well as small commercial uses.

<sup>lxiii</sup> Ibid.

<sup>lxiv</sup> Small systems include water systems under fifteen connections (or the equivalent water use) providing water for human consumption. This may include domestic use as well as small commercial uses.

<sup>lxv</sup> Ibid.

<sup>lxvi</sup> Small systems include water systems under fifteen connections (or the equivalent water use) providing water for human consumption. This may include domestic use as well as small commercial uses.

<sup>lxvii</sup> Based on Caldwell/Beecher stream flow recommendations, April 30, 2013 and estimated consumptive use is 236 gpd/household. Estimated number of people/household is 2.57.

<sup>lxviii</sup> Small systems include water systems under fifteen connections (or the equivalent water use) providing water for human consumption. This may include domestic use as well as small commercial uses.

<sup>lxix</sup> Small systems include water systems under fifteen connections (or the equivalent water use) providing water for human consumption. This may include domestic use as well as small commercial uses.

<sup>lxx</sup> Small systems include water systems under fifteen connections (or the equivalent water use) providing water for human consumption. This may include domestic use as well as small commercial uses.

# COWEEMAN

## WATER DEMAND

Water demand in the Coweeman subbasin includes potential demand from agriculture and residential growth in unincorporated areas, as well as commercial, industrial, and office demand. The potential growth water demand in unincorporated area was based on an estimated population growth of 796 people or 305 new households through 2030 and estimated rate of consumptive water use of 236 gallons per day per residence<sup>lxxi</sup>. Water demand from agriculture was estimated using a range of potential growth rates<sup>lxxii</sup>. A range of potential commercial, industrial, tourist and recreation water demand was estimated based on an increase in acreage of those land uses<sup>lxxiii</sup>.

Demand Category	Demand Estimate	Notes
<b>Commercial/Industrial/Tourist Recreation Use in Unincorporated Areas</b>	0.03cfs – 0.64cfs	Range based on low to high use estimates
<b>Unincorporated Areas Domestic Use</b>	0.11cfs	Based on projected population growth of 796 or 305 additional households by 2030
<b>Agriculture</b>	0.002cfs – 0.238cfs	Range based on ag growth rates of 0.5% to 2%

## STREAM CONSIDERATIONS AND WATER AVAILABILITY

WDFW and Ecology use 1-2% of the 90% exceedence flow during the summer flow period as a general measure of acceptable habitat loss and water availability. Based on this guidance, the water available in the mainstem Coweeman River is between 0.3 and 0.6 cfs (measures at RM 7.0).<sup>lxxiv</sup>

The Coweeman subbasin supports populations of winter steelhead, fall Chinook, chum, and coho. The coho, winter steelhead, and fall Chinook populations in the Coweeman are Primary populations for salmon recovery<sup>lxxv</sup>. Based on review by WDFW biologists<sup>lxxvi</sup> and evaluation of development potential<sup>lxxvii</sup>, the Fish and Flow Workgroup felt that many areas in this subbasin were of low concern of streamflow impacts from development, and categorized them as Category A – of low concern. The Goble Creek subwatershed and some reaches of the Coweeman River mainstem (Coweeman 3, 4, 10, 11, and 12) had higher levels of potential impact and were categorized as Category C – some protective measures should be considered (potential impact). The Fish and Flow Workgroup evaluated impacts on a subwatershed level.

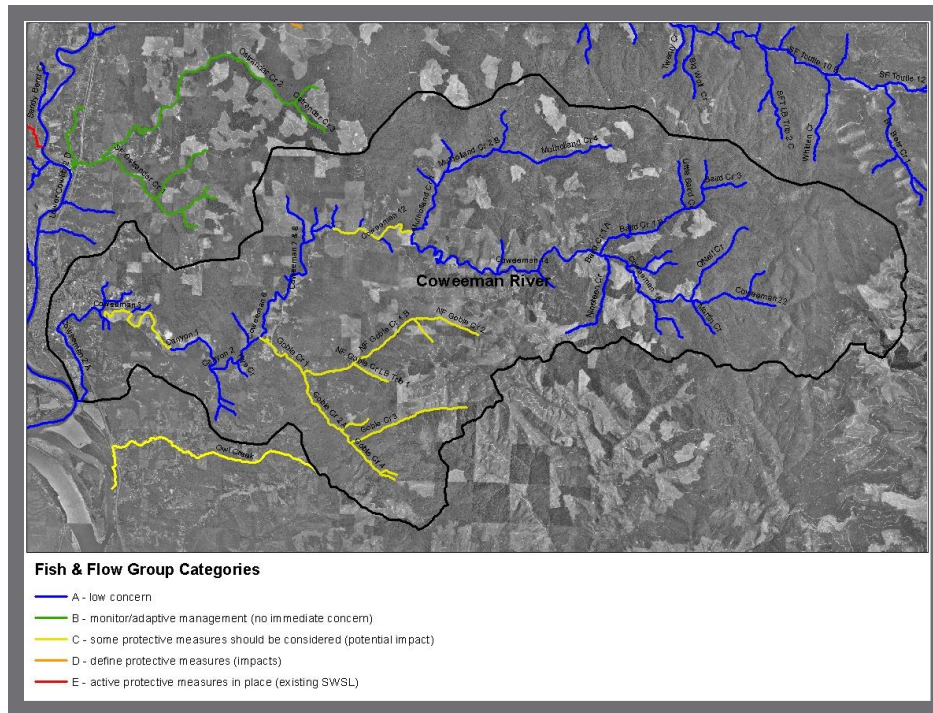


Figure 8. Map of Fish and Flow Group categories of concern for streams in the Coweeman subbasin (black boundary)

## WATER MANAGEMENT RECOMMENDATIONS AND IMPLICATIONS

The following recommendations are based on the potential water demand compared to estimate of water availability:

- Closed to future appropriation of water beyond the reservations specified below.
- Existing water rights and permit exempt wells are not affected.
- Water available based on the 2% of the 90% exceedence flow is 0.6 cfs.
- Reserve 0.6 cfs for permit-exempt wells and small systems in the Coweeman subbasin based on 2% of the 90% exceedence flow during the summer low flow period (30 cfs). It is estimated that this quantity will support a population growth of 4,223 people or 1,643 additional households. The estimated 20-year growth is 774 people or 301 households.<sup>lxxviii</sup>
- When the reservation is depleted in areas with instream flows, new permit exempt wells would be allowed for in-house use only. "Domestic use" means use of water associated with human health and welfare needs, including water used for drinking, bathing, sanitary purposes, cooking, laundering, and other incidental household uses. The incidental uses must minimize the consumptive use of water. Examples of incidental household uses include, but are not limited to: Washing windows, car washing, cleaning exterior structures, care of household pets, and watering potted plants. Domestic use does not include other uses allowed under the groundwater permit exemption: Outdoor irrigation of up to one-half acre of noncommercial lawn or garden, stockwatering, and industrial use.

- Adopt the following stream flows<sup>lxxix</sup> from RM 3.6 to the headwater, including all tributaries, with the control point located in the vicinity of RM 5:
  - January 1 through January 31: 193 cfs
  - February 1 through May 31: 234 cfs
  - June 1 through June 30: 156 cfs
  - July 1 through July 31: 130 cfs
  - August 1 through September 15: 76 cfs
  - September 16 through September 30: 203 cfs
  - October 1 through December 31: 290 cfs

## ADDITIONAL NOTES

Uncertainty exists in population growth projections and water demand and availability estimates.

Once every 10 years or when 75 percent of a reservation has been used, the WRIA 25/26 Planning Unit or its successor, the Department of Ecology, and other interested parties will convene to:

- Review status of water reservations and streams flows;
- Consider new information regarding water needs, water availability, and stream flows
- Develop options for additional future water supply, if needed; and
- Amend the Watershed Plan if necessary.

Ecology may initiate a modification of the Water Management Rule based on the conclusions of such a review.

See the Watershed Management Measures Implementation for a more thorough discussion of reopeners and plan/rule amendments.

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<sup>lxxi</sup> Cowlitz County WRIA 26 Subbasins Domestic Water Use In Unincorporated Areas from permit-exempt wells Potential Streamflow Depletion based on Population Growth Projections to 2030, June 2013.

<sup>lxxii</sup> 'WRIA 26 Cowlitz County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs' approved by the WRIA 25/26 Planning Unit, August 11, 2011. Agriculture acreage was divided among subbasins using current proportions based on 2010 Land Use data from Ecology.

<sup>lxxiii</sup> 'Water Demand for Commercial, Industrial, Tourist, and Recreation Uses in Unincorporated Cowlitz County Portions of the Lower Cowlitz, Toutle, and Coweeman Subbasins', Cowlitz County, December 29, 2011.

<sup>lxxiv</sup> Values provided by Jim Pachecos, Department of Ecology, January 31, 2011 email to Scott McKinney and Brad Caldwell, Department of Ecology.

<sup>lxxv</sup> Primary populations are those that are targeted for restoration to a high or greater level of viability in the *WA Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan* (LCFRB 2010).

<sup>lxxvi</sup> 'Tributary Prioritization Spreadsheet' developed by the Fish and Flow Workgroup, updated November 9, 2011.



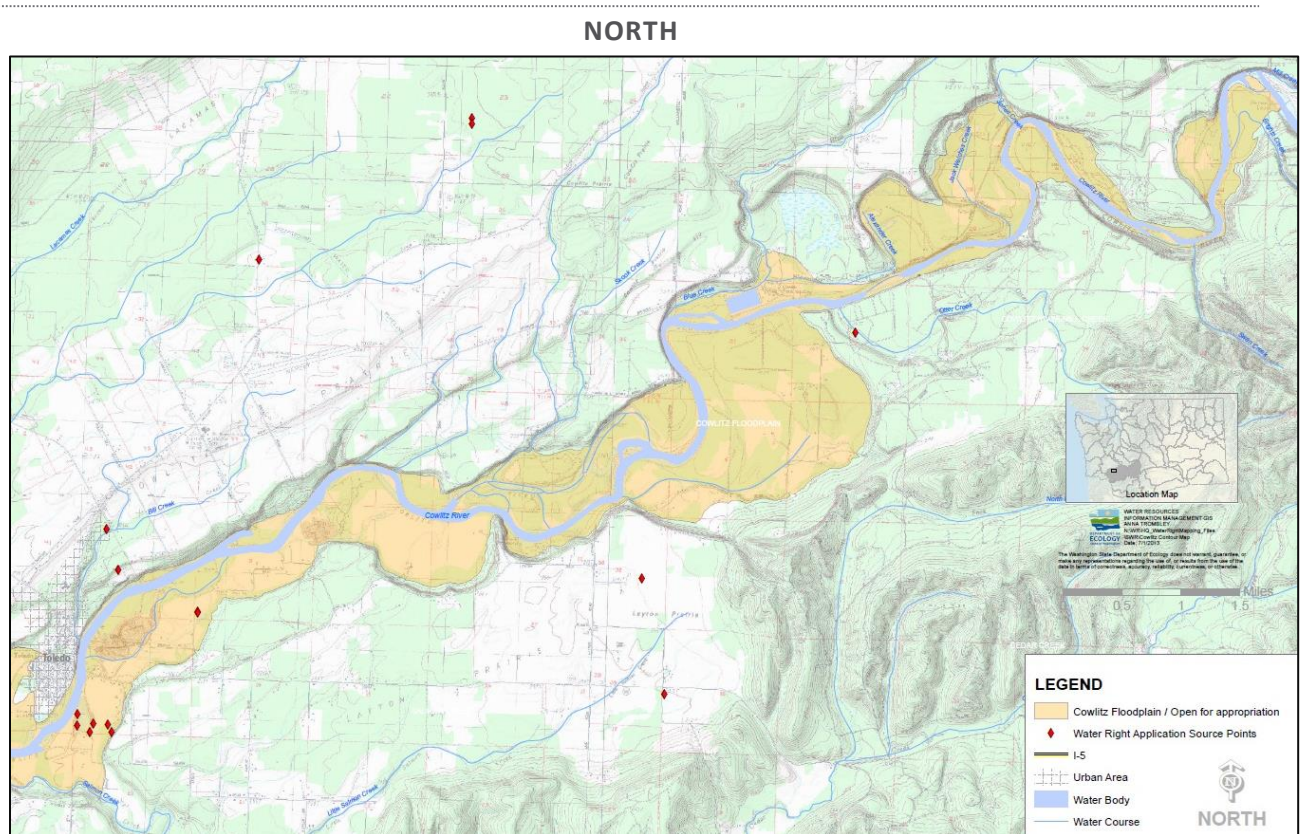
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<sup>lxxvii</sup> Development potential and subwatershed-level impacts were estimated by reviewing population projections to 2030 in each LCFRB subwatershed ('Cowlitz County WRIA 26 Select Subwatershed Domestic Water Use in Unincorporated Areas from Permit-exempt Wells Potential Streamflow Depletion based on Population Growth Projections to 2030', reviewed by the Fish and Flow Workgroup, November 7, 2011).

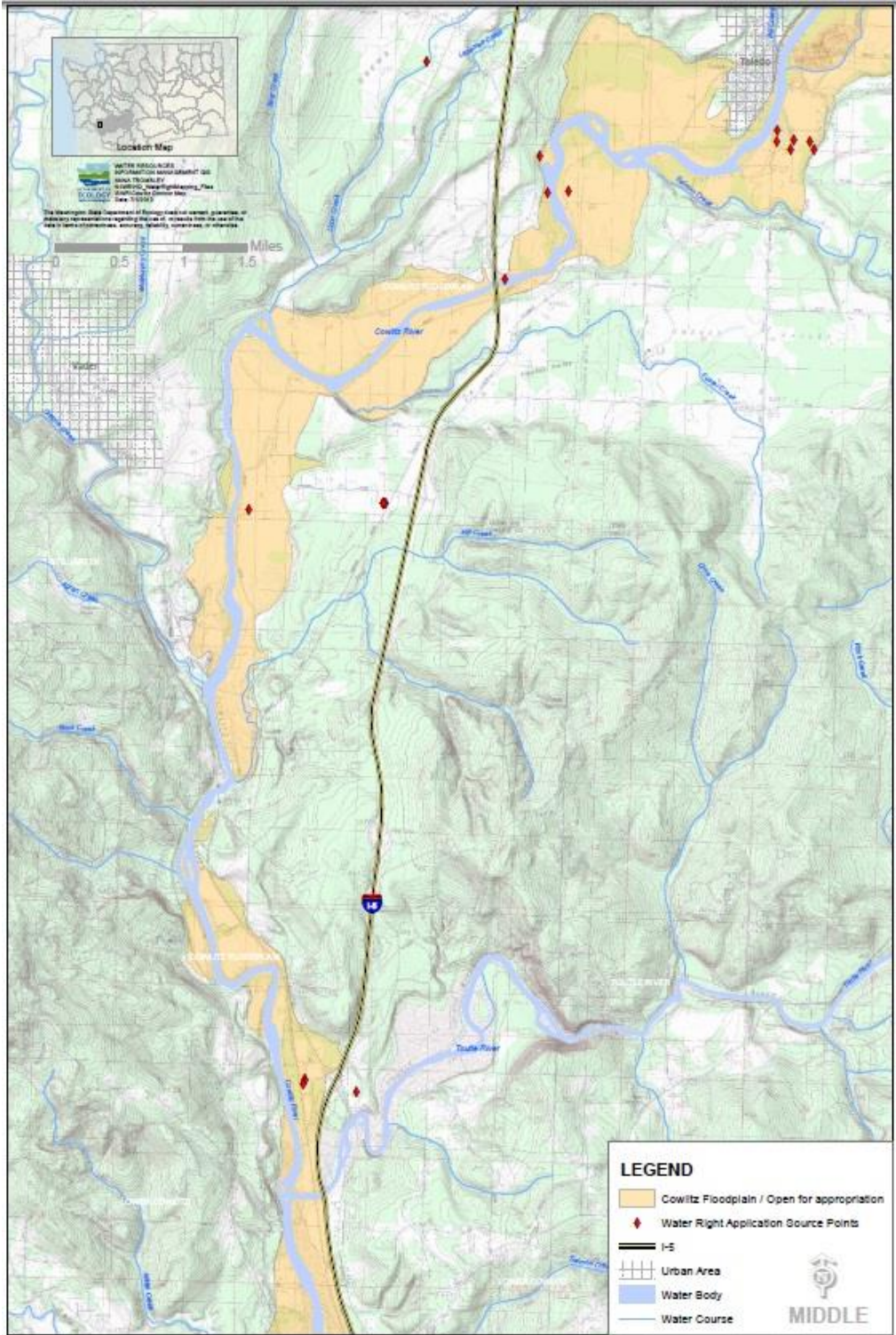
<sup>lxxviii</sup> Small systems include water systems under fifteen connections (or the equivalent water use) providing water for human consumption. This may include domestic use as well as small commercial uses.

<sup>lxxix</sup> 'Proposed Instream Flows for WRIAs 25 and 26', Table I-4, WRIA 25/26 Watershed Management Plan, July 2006.

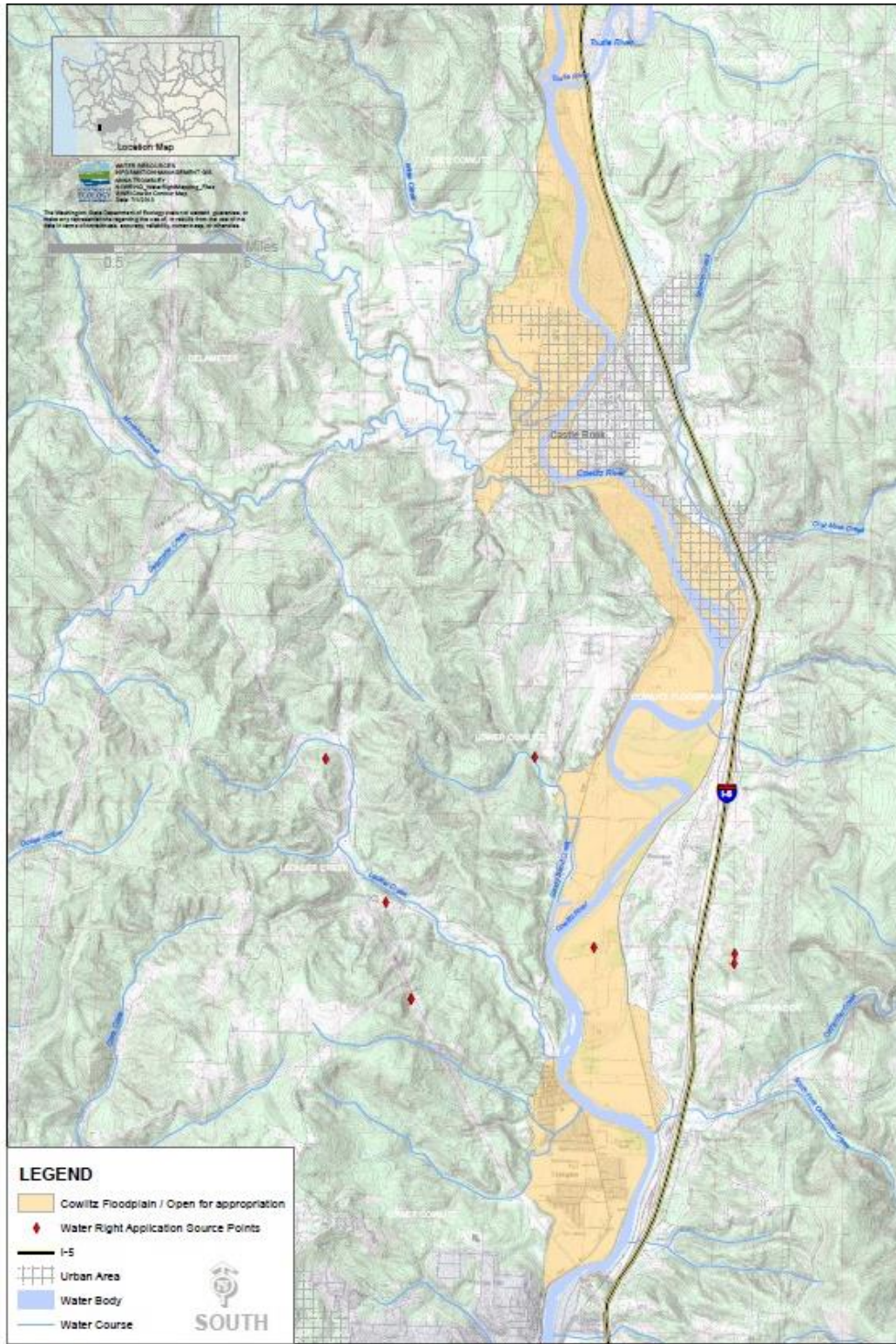
# LOWER COWLITZ MAINSTEM AREAS OPEN TO FUTURE WATER APPROPRIATIONS



# MIDDLE



# SOUTH



# REFERENCE DOCUMENTS FOR THE SUBBASIN SUMMARIES

2006 Watershed Plan recommends a reserve of 0.38 cfs for permit exempt wells. This reserve exceeds the estimated demand of 0.11 cfs based on population growth through 2030.

236gpd consumptive use estimate for permit-exempt wells, Estimate of Water Use for Exempt Wells in WRIAs 25 and 26 memo adopted by the WRIA 25/26 Planning Unit on April 14, 2011, applied to the Lewis County Full Build-out Scenario and approved by the Plan.

City of Toledo, Water System Plan, November 2009.

City of Winlock, Washington, Buildable Land Inventory, Buildout Analysis, and Future Water Needs, 2011.

Cowlitz County WRIA 26 Select Subwatersheds Domestic Water Use in Unincorporated Areas from permit-exempt wells Potential Streamflow Depletion based on Population Growth Projections to 2030, May 2012.

Cowlitz County WRIA 26 Subbasins Domestic Water Use in Unincorporated Areas from permit-exempt wells.

Data provided by the City of Castle Rock, May 2, 2013.

Development potential and subwatershed-level impacts were estimated by reviewing population projections to 2030 in each LCFRB subwatershed ('Cowlitz County WRIA 26 Select Subwatershed Domestic Water Use in Unincorporated Areas from Permit-exempt Wells Pot.

Development potential by Lewis County's zoning GIS layer, adopted by Lewis County December 14, 2009 and amended December 27, 2010.

Informal communication with Shirley Cook, Planning Unit member, May 23, 2011. 2006 Watershed Plan indicates existing water rights sufficient to meet 20-year demand.

Lewis County GIS performed an analysis of potential build-out by LCFRB's subwatersheds (Lewis County Unincorporated Area Water Demand Estimate by Subwatershed/Stream Impacted, September 16, 2011). Development potential and subwatershed-level impacts in Cowlitz County were estimated by reviewing population projections to 2030 in each LCFRB subwatershed (Cowlitz County WRIA 26 Select Subwatershed Domestic Water Use in Unincorporated Areas from Permit-exempt Wells Potential Streamflow Depletion based on Population Growth Projections to 2030, reviewed by the Fish and Flow Workgroup on November 7, 2011).

'Lewis County WRIA 26 Subbasins Domestic Water Use In Unincorporated Areas Potential Streamflow Depletion based on Development Potential at Build-Out Approved by the Planning Unit June 9, 2011; Revised June 7, 2013.

'Lewis County Unincorporated Area Water Demand Estimate by Subwatershed/Streams Impacted', September 2011.

Lower Cowlitz North Half and South Half Floodplain/Open Area Maps, Department of Ecology, June 2013.

Population Estimates, Household, and Water use Projections for Lower Cowlitz, Lewis County, June 7, 2013.

Primary populations are those that are targeted for restoration to a high or greater level of viability in the WA Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan (LCFRB 2010).

Small systems include water systems under fifteen connections (or the equivalent water use) providing water for human consumption. This may include domestic use as well as small commercial uses.

South Lewis County Water Analysis and Demand Forecast (February 2010).

Values provided by Jim Pachecos, Department of Ecology, January 31, 2011 email to Scott McKinney and Brad Caldwell, Department of Ecology.

Potential Streamflow Depletion based on Population Growth Projections to 2030; October 13, 2011, revised June 2013.

'Proposed Instream Flows for WRIAs 25 and 26', Table I-4, WRIA 25/26 Watershed Management Plan, July 2006.

'Tributary Prioritization Spreadsheet' developed by the Fish and Flow Workgroup, last update November 9, 2011.

'Water Demand for Commercial, Industrial, Tourist, and Recreation Uses in Unincorporated Cowlitz County Portions of the Lower Cowlitz, Toutle, and Coweeman Subbasins' provided by Cowlitz County December 29, 2011.

WRIA 26 Cowlitz County Agriculture Lands And Water Analysis Of Current Condition, Pending Water Rights, And Future Needs memo approved by the Planning Unit, August 11, 2011.

'WRIA 26 Lewis County Agriculture Lands and Water Analysis of Current Condition, Pending Water Rights, and Future Needs' approved by the WRIA 25/26 Planning Unit on August 11, 2011. Agriculture acreage was divided among subbasins using current Lewis County.

### **Lewis County Full Build-out Scenario Methodology:**

Purpose: To estimate the potential number of parcels yet to be developed in each Lewis County subbasin in WRIA 26 (Upper Cowlitz, Cispus, Tilton, Lower Cowlitz, and Toutle). This analysis focused on unincorporated land, and did not include areas in any incorporated towns or cities.

Steps:

1. Selected parcels in each of the WRIA 26 subbasins (Upper Cowlitz, Cispus, Tilton, Lower Cowlitz, and Toutle) in Lewis County. The parcel GIS layer used for this analysis was from mid-December 2010. The parcel layer is updated on a weekly basis.
2. The parcel layer was intersected with a zoning coverage. The zoning layer that was used was adopted December 14, 2009 and amended December 27, 2010 with minor changes in the Cowlitz Basin.
3. Selected out parcels that are zoned Rural Development District (RDD)-5, RDD-10, RDD-20 and Agricultural Resource Lands. RDD-5 lands have maximum density of 1 unit per 5 acres; RDD-10 lands have a maximum density of 1 unit per 10 acres; RDD-20 lands have a maximum density of 1 unit per 20 acres, and Agricultural Resource Lands have a maximum density of 1 unit per 20 acres. If a parcel has multiple zonings it is considered as the least intense of the zoning classifications (i.e., if it is Ag and RDD-10, it would be counted as Ag with a minimum lot size of 20 acres, or if it is zoned RDD-20 and RDD-5 it is considered as RDD-20). It was assumed that no development would occur on Forest Resource Lands and Mineral Resource Lands. LAMIRD zones (small, unincorporated towns, cross-road commercial areas, rural residential areas (large subdivisions)) were excluded since those areas typically rely on some sort of public water supply, either from a water district, such as in the small towns of Mineral and Randle, Lake Mayfield Village (large subdivision with its own water and sewer LID). These areas are not usually developed with individual wells.
4. Used Assessors records to determine if a parcel is already developed. Where the assessors records were not clear, aerial photographs were evaluated to determine if the parcel was developed.
5. For each undeveloped parcel a development potential was determined. For example an 8.37 ac parcel zoned RDD-5 would have a potential of 1, a 42.55 acre parcel zoned as Ag Resource Land would have a potential of 2. No parcel can have a potential more than 6<sup>1</sup>.

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<sup>1</sup> Under the State Supreme Court Case between Yakima and DOE, the court determined that only one exempt water right could be used for a development, regardless of the number of acres in the development. Any subdivision of land for the purpose of transfer of title is a development. Under the court findings, no development could be allowed that required more than 5000 gallons of water per day without a water right. Based on the average water needed for a septic system (we use 800 gal per day – 6X800 = 4800 gal per day), which is typical in rural areas, you can permit no more than six homes on an exempt water right and still meet the minimum flow requirements for a typical on-site-septic system. By policy, consistent with our understanding of the Supreme Court case, Lewis County allows a maximum of six parcels in a development proposal using an exempt well. Otherwise, the developer must have a water right consistent with the number of lots proposed.

6. The critical areas<sup>2</sup> were all lumped together into one GIS coverage.
7. Then it was determined whether a parcel was completely in, completely out, or part in and part out of the critical areas. Table 1 shows the total number of undeveloped parcels (Undeveloped Parcels), the number of parcels that fall completely within critical areas and can't be developed (Completely in Critical Area), those that fall completely outside of the critical areas and could be developed (Completely Out of Critical Area), and parcels that are partially in and partially out of the critical areas (Part Out Critical Area).
8. The recommended 'full build-out scenario' is based on the development potential of lands that fall outside of the critical areas. For full build-out (Build Out Potential Parcels), it was assumed that all of the parcels outside of critical areas would be developed (Completely Out of Critical Area), and that approximately half of those partially outside of the critical areas (Part Out Critical Area) would be developed.

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<sup>2</sup> Our Critical Areas Ordinance 1204, codified as LCC 17.35A, was adopted 12/22/08. Critical areas are defined as: 17.35A.150 Critical areas. "Critical areas" means all wetlands, frequently flooded areas, aquifer recharge areas, fish and wildlife habitat conservation areas, and geologically hazardous areas, as those terms are used and defined herein. [Ord. 1204 Exh. A § 2, 2008] This study also included the FEMA 100 year flood plain, National Wetlands Inventory, and Steep Slopes.



**Table 1. Lewis County WRIA 26 Build Out Scenario**

	<b>Undeveloped Parcels</b>	<b>Completely in Critical Area</b>	<b>Completely Out of Critical Area</b>	<b>Part Out Critical Area</b>	<b>Build Out Potential Parcels</b>	<b>Build Out Population Increase</b>
<b>Upper Cowlitz Basin</b>						
Already Developed	N/A	136	300	320	N/A	N/A
Additional Development Potential	2124	522	420	1182	1,011	2,598
<b>Cispus River Basin</b>						
Already Developed	N/A	0	3	4	N/A	N/A
Additional Development Potential	68	4	11	53	38	96
<b>Tilton River Basin</b>						
Already Developed	N/A	24	191	158	N/A	N/A
Additional Development Potential	893	45	170	678	509	1,308
<b>Mayfield Dam Basin</b>						
Already Developed	N/A	7	755	431	N/A	N/A
Additional Development Potential	3055	20	892	2143	1,964	5,046
<b>Lower Cowlitz Basin</b>						
Already Developed	N/A	82	2820	1351	N/A	N/A
Additional Development Potential	7906	138	3666	4102	5,717	14,693
<b>Toutle River Basin</b>						
GIS analysis indicates no developable parcels in Lewis County in the Toutle River Basin.						
<b>Total in Lewis County</b>						
Already Developed	N/A	249	4069	2264	N/A	N/A
Additional Development Potential	14046	729	5159	8158	9,238	23,742

**Notes:**

1. Build Out Potential Parcels equals parcels completely out of Critical Areas and half of the parcels partly out of Critical Areas.
2. Build out population estimate equals the number of potential build out parcels times 2.57 persons per household (2000 US Census).
3. Does not include incorporated cities or unincorporated Small Towns zoned areas served by community water systems/disrtricts

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**MEMORANDUM**

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**TO:** SCOTT MCKINNEY – ECOLOGY AND WRIA 25/26 PLANNING UNIT  
**FROM:** STAFF AT LOWER COLUMBIA FISH RECOVERY BOARD (LCFRB)  
**SUBJECT:** ESTIMATE OF WATER USE FOR EXEMPT WELLS IN WRIAS 25 AND 26  
**DATE:** 4/7/2011  
**CC:** TRAVIS BURNS, TOM LORANGER, DAVE NAZY - ECOLOGY

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**INTRODUCTION:**

The Planning Unit for Water Resource Inventory Areas (WRIAs) 25 and 26 in Southwestern Washington is re-evaluating selected data, assumptions and methods used to develop the 2006 Watershed Plan and the proposed Grays-Elochoman and Cowlitz Water Management Rules. One of the primary issues has been the allocation of water for permit exempt wells. This memorandum documents the data, assumptions and methods proposed to serve as the basis for estimating future water use by exempt wells in the region.

**OBJECTIVE:**

To estimate an average daily water consumption value for residences reliant on permit exempt wells in WRIAs 25 and 26, 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 WRIAs 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 is 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.

1. Estimate household indoor water use.

A study completed by American Water Works Association (AWWA, 1999) looked at 12 study sites across the U.S. 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 Meter-Master data loggers, rather than simply billing records which is the more common way to estimate water use.

To estimate household indoor water use, the number of persons per household was obtained from the 2000 U.S. Census. For Lewis County, the Census estimated 2.57 persons per household. Thus, the estimated household indoor water use is 178 gallons per home per day.

2. Estimate outdoor water use.

It is assumed that across the region, the amount of water used for outdoor uses is variable depending on a household's irrigation needs. The assumptions used to develop the following estimate are conservative. It is assumed that 0.15 acres would be irrigated. It was felt that this would be reasonable middle point between those that would use their full permit exempt right to irrigate 0.5 acre and those that would not irrigate at all. In addition, a residential water use survey conducted in Spokane County between October 2009 to April 2010 resulted in an average irrigated area of 8,000 square feet (0.18 acres) (Spokane County Water Resources 2010).

The pasture/turf monthly crop irrigation requirement from Appendix B of the Washington State Irrigation Guide was used under the assumption that this crop may be most representative (USDA 1992). The guide provides crop irrigation requirements for Longview, Toledo, and Packwood in this WRIA. The requirements for Toledo were used since the town may be more representative of the Cowlitz Basin than either Packwood or Longview. Outdoor water use requirements for Longview are higher than Toledo while Packwood is similar to Toledo.

The outdoor water use was estimated for each month by multiplying the irrigated area (0.15 acres) by the water duty for the month (crop irrigation requirement for pasture/turf for Toledo per month) divided by the number of days in the month. The resulting acre feet per day figures were then converted to gallons per day. These results were 0 gallons required for January, February, March, October, November and December. For the remaining months, results are: April – 83 gallons per day (gpd), May – 293 gpd, June – 407 gpd, July – 657 gpd, August 435 gpd, September 258 gpd.

3. Estimate monthly total consumptive use.

It is recognized that a portion of the water used, returns to the system 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, which has similar conditions to the Cowlitz Basin (Johnson and Savoca 2010). Based on the estimated indoor water demand per household of 178 gallons per day and an 87% return rate, estimated indoor consumptive use would be approximately 23 gallons per day.

Return rates from outdoor use are much less due to water needs of the plants and evapotranspiration. Based on the Lower Skagit Basin study, a 40% return flow was assumed for outdoor use (60% consumptive use) (Johnson and Savoca 2010). The estimated return flow was calculated by multiplying the Toledo 0.15 acre irrigation need for each month by 60%. The combined indoor/outdoor total consumptive use yields the following results (gpd):

Town	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Toledo	23	23	23	73	199	268	417	284	178	23	23	23

4. Determine an average indoor/outdoor consumptive value for planning purposes.

As is clear from the previous table, the highest water use occurs in the months when streamflow are likely to be at their lowest. Clearly the depth of a well, distance to a stream and underlying geology are some of the many factors that influence impacts to the stream during these critical times. 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 April – September. This yields an average total consumptive use of 236 gallons per day per household. This 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, it seems reasonable to use this conservative methodology to estimate an average daily consumption rate of 236 gallons per day per household.

## REFERENCES

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## WRIA 26 LEWIS COUNTY AGRICULTURE LANDS AND WATER

### ANALYSIS OF CURRENT CONDITION, PENDING WATER RIGHTS, AND FUTURE NEEDS

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#### **INTRODUCTION:**

The Planning Unit for Water Resource Inventory Areas (WRIAs) 25 and 26 in Southwestern Washington is re-evaluating selected data, assumptions and methods used to develop the 2006 Watershed Plan and the proposed Grays-Elochoman and Cowlitz Water Management Rules. In the course of this review several questions have been raised with regard to agricultural water needs, specifically:

- How much water will be needed for agriculture over the next 20 years;
- To what extent may existing agricultural water rights help to meet future needs;
- How much water has been requested through pending water rights applications; and
- Is there a need to set aside water in the water reservations for future agricultural needs and, if so, how much?

This memorandum documents the organizations contacted, data collected and scenarios explored in an attempt to evaluate potential future agriculture water needs and supplies.

#### **ORGANIZATIONS CONTACTED:**

In order to obtain as much information as possible, organizations that are associated with farming or agriculture in the region were contacted, including:

- Cowlitz County Extension
- Cowlitz/Wahkiakum Conservation District
- Clark County Extension
- Clark-Cowlitz Farm Bureau
- Lewis County Conservation District
- U.S. Department of Agriculture
- Washington State Conservation Commission
- Washington State Department of Agriculture
- Washington State Department of Ecology
- Washington State University Extension

These organizations were asked for information specific to past, present and future conditions related to total acreage of land in farms, average farm size, water use/demand and crops. While several organizations were able to provide observations and professional opinions on agricultural trends within WRIAs 25 and 26, little quantitative information was available. The organizations contacted frequently referred to the U.S. Department of Agriculture (USDA) Census of Agriculture as the best overall compilation of information.

#### **AGRICULTURE TRENDS IN LEWIS COUNTY:**

The USDA Census of Agriculture for 1997 to 2007 was used to develop a picture of trends in agriculture in Lewis County. The USDA conducts the Census every five years by mailing forms to every farmer and rancher – regardless of the size or type of operation. Participation in the Census is required by law, and the information provides data on U.S. farms, ranches and the people who operate them which is helpful to those who provide services to farmers and rural

communities. Although the USDA Census of Agriculture appears to be the leading source of facts and figures about agriculture, several individuals advised that the data should be reviewed with some caution. Participation in the Census, although required by law, may be variable. Small details may not be picked up by the Census, for example small farms and minority farmers have historically been overlooked or under represented. However the USDA, in its last Census in 2007, has reportedly made a significant effort to collect information from these groups.

For all of Lewis County, the following trend information (Table A) for 1997 to 2007 was obtained from the latest Census (USDA 2007):

<b>Table A: USDA Census of Agriculture Summary for 1997 – 2007 Lewis County<sup>a</sup></b>					
	<b>1997</b>	<b>2002</b>	<b>2007</b>	<b>% Diff. 1997-2002</b>	<b>% Diff. 2002-2007</b>
Total Acreage in farms (acres)	117,677	130,950	131,554	+11.3%	+0.5%
Median Size of farm (acres)	45	46	33	+2.2%	-28.3%
Number of farms	1,117	1,402	1,717	+25.5%	+22.5%
Number of farms with irrigated lands	127	212	220	+70%	+3.7%
Percent of farms with irrigated lands	11.4%	15.1%	12.8%		
Land being irrigated (acres)	5,765	9,242	7,292	+60.3%	-21.1%
<i>Harvested cropland being irrigated (acres)</i>	<i>4,842</i>	<i>5,639</i>	<i>5,491</i>	<i>+16.5%</i>	<i>-2.6%</i>
<i>Pastureland and other land being irrigated (acres)</i>	<i>923</i>	<i>3,603</i>	<i>1,801</i>	<i>+290%</i>	<i>-50.0</i>
Percent of total acreage in farms being irrigated	4.9%	7.1%	5.5%		

<sup>a</sup>The information in this table is for all of Lewis County – including the Chehalis Basin.

The Census of Agriculture data indicates that although there was an increase in total acreage in farms from 1997-2002, it remained fairly constant from 2002-2007 with the median size of a farm actually decreasing. The number of farms continues to increase over time. The number of farms with irrigated lands grew dramatically from 1997-2002 but then remained relatively constant from 2002-2007. Fewer than 13% of the farms irrigate their lands, and less than 10% of the total farm acreage is irrigated. There was a 60% increase in the land being irrigated from 1997-2002 but then a 21% decrease in the land being irrigated from 2002-2007. In Lewis County in 2007, 74% of the market value of products was livestock – mostly chickens, which may explain why such a small percentage of the total acreage in farms is being irrigated. The top three crop items by acreage were forage (hay, haylage, grass silage, greenchop), cut Christmas trees and vegetables harvested for sale (in 2007).

In addition to the Census of Agriculture, other sources of information were also pursued for trend information with respect to agriculture in the County. The Lewis County Conservation District has observed increases in small farm production specifically small vegetable farms supplying restaurants, farmers markets, community supported agriculture operations and other specialized crops. These are similar trends in small scale agriculture that were also observed in Cowlitz County by the Cowlitz Conservation District. Dairies have held steady with around 35 over the past 10 years. Crop farming shifts up and down – in response to prices (Amrine, personal communication, 2010). The number of Washington State certified organic producers also has fluctuated since 2004 – with a total of 27 in 2010 (WSDA 2010).

The Lewis County Comprehensive Plan, which describes how the county has chosen to plan over the next 20 years, contains a land use element that designates the uses of land. Review of the Comprehensive Plan resulted in little indication that any large scale increase in agriculture is forecast or planned for the county (Lewis County 2002).

### **ZONED AGRICULTURE RESOURCE LANDS IN LEWIS COUNTY**

According to the Growth Management Act (GMA – RCW 36.70A.170), many counties and cities in Washington state are required to designate and conserve resource lands since they are important to support local economies. When Lewis County updated their Comprehensive Plan, they analyzed existing data and trends to develop their zoning designations that identify where specific land uses are allowed and encouraged. The “Agriculture Resource Lands” zone includes land currently used for production as well as land that is envisioned to be used in the future for agriculture production. The zoned agriculture lands are also based on classes of agriculture lands described by the USDA Land Capability Classification System and consider growing capacity, productivity and soil composition.

To calculate the acreage of agriculture lands in the Lewis County portion of WRIA 26, Lewis County was contacted and their Geographic Information Systems (GIS) department provided the Zoning Designation GIS layer from their recently adopted Comprehensive Plan (Fitzpatrick 2010). GIS analysis completed by LCFRB staff resulted in:

93,141 acres is zoned Agriculture Resource Lands in Lewis County<sup>1</sup>

51,566 acres is zoned Agriculture Resource Lands in the WRIA 26 portion of Lewis County

The above values may change in the upcoming years. A land use moratorium, which had been in effect in Lewis County, was rescinded by the Washington State Growth Management Hearings Board – allowing for changes land use designations (Lewis County 2010). Lands that had been categorized as Agricultural Resource Lands, may be taken out of the category in the future, and rezoned into another classification such as commercial or residential. Lands with commercial or residential zoning may utilize more or less water which would affect the water usage estimates in Lewis County. Demand estimates for commercial and residential lands are not addressed in this analysis, but will be considered elsewhere.

### **CURRENT WATER RIGHTS FOR IRRIGATION**

In Lewis County, the Census of Agriculture indicates that for a ten year period, between 11 and 15% of the farms irrigate some or all of their lands. State law requires that any use of surface water (after 1917) and groundwater (after 1945 –with some exceptions) receive approval from the state prior to using the water. The state approval is provided

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<sup>1</sup> According to the latest USDA Census, there was more “acreage in farms” than was zoned “agriculture resource lands”. This discrepancy could be because the Census includes land that may not be counted in zoning or included in a different zoning category (i.e. total acres operated including farmsteads, buildings, roads, livestock facilities, conservation lands, pasturelands and timber tracts).



in the form of a water right or certificate. Thus, it is helpful to have an understanding of existing water rights and how that relates to agriculture data.

To estimate the quantity of water currently available for irrigation under existing water rights in Lewis County, Washington Department of Ecology (Ecology) queried their water rights database and prepared a spreadsheet (Appendix A) of current irrigation water rights for WRIA 26 (permits and certificates) (Ecology 2010). From that spreadsheet, the following was tabulated for the Lewis County portion of WRIA 26:

- Total irrigated acres = 7,677 acres
- Total instantaneous withdrawal rate = 136 cubic feet per second (cfs)
- Total annual withdrawal quantity = 11,600 acre feet/year

These numbers cannot be reported without several qualifications. Not all the water rights are exclusively for irrigation (can also include stock and domestic use) and not all of the irrigation is for agriculture (can be for golf courses, schools, parks, etc.). Some water rights are limited with “low flow” provisions. It is not possible to determine the extent the current rights are being used. Delays in processing water rights may have discouraged the submission of additional applications. And finally, water used solely for agricultural production in this region is much less than other parts of the state with Table A indicating that only 5.5% of farm acreage was irrigated in 2007. For comparison, in Grant and Kittitas Counties, approximately 43% of the land in farms is irrigated, 30% in Chelan County and 29% in Benton County (USDA 2007).

In order to compare water rights to Census of Agriculture data, some assumptions need to be made. Lewis County’s Zoning Designation GIS layer indicates that approximately 55% of the County’s zoned agriculture resource lands are in WRIA 26. Since it is not known how many acres of the Census irrigated lands are in WRIA 26, for this paper, it is assumed that of the total acreage being irrigated, 55% lies in WRIA 26. The Census data is being used because it contains data on acres being irrigated which can then be easily compared to water rights which also tabulates irrigated acres. Applying the 55% percentage to land being irrigated from the Census, results in the following:

- 1997 – 3,171 acres land being irrigated in WRIA 26 (Lewis County)
- 2002 – 5,083 acres
- 2007 – 4,011 acres

Currently, there are active water rights for irrigation of 7,677 acres in comparison with the estimate of 4,011 acres being irrigated in 2007. However, as noted above, it is not possible to determine the extent the current water rights are being used.

#### **CURRENT WATER RIGHTS APPLICATIONS**

The Washington State Department of Ecology tracks water right applications via the Water Rights Application Tracking System (WRTS). The data is updated on a monthly basis. The WRTS database was queried (April 2011) to obtain information regarding the applications submitted for water withdrawals in the WRIA 26 portion of Lewis County and resulted in the following information:

- Total irrigated acres = 1,088 acres
- Total instantaneous withdrawal rate = 19 cfs
- 38 applications for irrigation water rights have been submitted over a 20 year period (since 1991)
- Water sources listed for irrigation include: wells (21), Curtis Creek (1), Davis Creek (2), Cowlitz River (3), “unnamed pond/spring/source” (10), Mayfield Lake (1)

These numbers cannot be reported without several qualifications. Applications should be viewed with care since requests are often for quantities greater than what is needed and/or greater than what Ecology will authorize. Not all water requests are exclusively for irrigation (i.e. stock watering) and not all irrigation water requests are exclusively for agriculture (i.e. golf courses, RV parks). Some applications may overestimate the amount of water needed and some may be for projects that are no longer being pursued. Acreage to be irrigated is not included in a few applications. And a few of the applicants have applied for duplicate rights to irrigate the same parcel of land from surface water and from ground water.

Census data indicates that from 1997 to 2007, 600 new farms were established in all of Lewis County. Using the assumption that 55% of the zoned agriculture resource lands are in WRIA 26, approximately 330 new farms would be in the WRIA 26 portion of Lewis County. For the same period of record, 25 new applications for irrigation water rights were submitted for this same area. Even though Census data indicates that approximately 33 new farms were established per year, less than 3 water rights applications were submitted per year. This may mean that (a) farms are being divided up from larger farms with existing water rights or (b) farms do not need to irrigate or (c) farms are using water without authorization or (d) Census data collection has become more or less accurate or (e) some combination of all of these.

**POTENTIAL FUTURE AGRICULTURE WATER DEMAND**

The annual growth rate in acreage being irrigated (Census of Agriculture) in Lewis County from 1997 to 2007 was approximately 2.4%. The annual growth rate in the acreage in farms was approximately 1.1%. Since agriculture is driven by the market for goods and is affected by climate, available labor and/or processing facilities, and growing season, it is difficult to determine with certainty how agriculture and its water needs will change over the 20 years. The Census of Agriculture data indicates that increases and decreases in agricultural lands have occurred. For this reason, several growth rates were used to explore the possible future water demands for associated irrigated agriculture lands (Table B and C).

<b>Table B: Increase in Irrigated Land at Various Growth Rates – WRIA 26 portion of Lewis County</b>								
	0.5% growth rate		1% growth rate		1.5% growth rate		2% growth rate	
	Irrigated Land	Increase from 2007	Irrigated Land	Increase from 2007	Irrigated Land	Increase from 2007	Irrigated Land	Increase from 2007
Year	(acres)		(acres)		(acres)		(acres)	
2010	4,072	61	4,132	121	4,194	183	4,256	245
2020	4,280	271	4,565	554	4,868	857	5,189	1,178
2030	4,499	488	5,042	1,031	5,649	1,638	6,325	2,314

Table B indicates that an additional 488 acres of land would be irrigated in 2030, assuming a constant annual growth rate of 0.5%. If the growth in irrigated lands occurred at a 2% annual rate, then 2,314 additional acres would be

irrigated in 2030. This is an estimated increase from the year of the last Census of Agriculture – 2007 – when an estimated 4,011 acres were irrigated in the WRIA 26 portion of Lewis County.

Irrigation water rights are defined by several parameters: number of acres, annual volume (Qa), maximum instantaneous withdrawal rate (Qi), and the length of the irrigation season. In setting the annual quantity of water (Qa) allowed by a water right, Ecology considers a number of factors including crop type, location, and irrigation efficiencies. To estimate the instantaneous rate of withdrawal (Qi) for irrigation, Ecology has long used a standard of 0.01-0.02 cfs/acre (surface water) and 5-10 gpm/acre (groundwater) (Ecology 1980). While exceptions exist, the use of this standard remains a generally accepted practice and has been affirmed by the Courts when adjudicating water rights (Crane, personal communication, June 2011).

For this estimation, using the potential increase in irrigated land for various growth rates (from Table B) and then applying 0.01 cfs/acre (an acceptable rate in Western Washington), results in the following water demands:

<b>Table C: Increase in Instantaneous Withdrawal at Various Growth Rates Assuming 0.01 cfs/acre Instantaneous Withdrawal Rate</b>				
Year	0.5% growth rate (cfs)	1% growth rate (cfs)	1.5% growth rate (cfs)	2% growth rate (cfs)
2010	0.6	1.2	1.9	2.5
2020	2.7	5.6	8.6	11.8
2030	4.9	10.3	16.4	23.2

Table C indicates that an additional 4.9 cfs would be needed to irrigate an additional 488 acres in 2030 (at a 0.05% annual growth rate). At a 2% annual growth rate, an additional 23.2 cfs would be needed to irrigate 2,314 acres.

These numbers should also be viewed with caution since agriculture demand is driven by many factors. Census data did show an increase in irrigated lands for five years but also a decrease (the next five years) – with the largest increase associated with pastureland and “other” land rather than harvested cropland. However, this information can be helpful in evaluating various options for planning purposes.

**SUMMARY**

Inquiries were sent out to numerous sources in an attempt to gain an understanding of the agricultural trends in the WRIA 26 portion of Lewis County. Little quantitative information was available, beyond what is provided by the USDA Census of Agriculture. In summary, the following information was collected:

- The number of farms in Lewis County has experienced an annual increase of approximately 4.4% while the total acreage in farms has increased 1.1% annually.
- Total irrigated acreage has fluctuated – increasing and decreasing, resulting in a net increase of 1,527 acres or 2.4% annually between 1997 and 2007.
- Fewer than 13% of the farms irrigate their land and less than 10% of the total acreage in farms was being irrigated in 2007.

- The largest value crop in the county is chickens – 74% of the market value was livestock in 2007.
- There have been observed increases in small farm production while dairies appear to be remaining constant.
- The number of Washington State certified organic producers has fluctuated since 2004 – with a total of 27 in Lewis County in 2010.
- It is estimated that in 2007, there were 4,011 acres of irrigated lands in the WRIA 26 portion of Lewis County.
- Current active irrigation water rights for the WRIA 26 portion of Lewis County (permits and certificates) equate to 7,677 irrigated acres and 136 cfs (withdrawal rate). It is unclear whether all of these water rights are being exercised to their maximum extent or whether any of these permits/certificates have fallen into disuse.
- 38 applications for irrigation water rights for WRIA 26 (Lewis County) have been submitted for 1,088 acres over a 20 year period
- If demand for irrigated land were to increase at an annual growth rate of 0.05%, then 4.9 cfs would be withdrawn to meet the demand. If demand for irrigated land were to increase at an annual growth rate of 2%, then 23.2 cfs would be withdrawn to meet the demand.

#### **NEXT STEPS**

Although this paper notes many caveats to using these demand estimates, the estimates can be helpful in providing some understanding of conditions. The Planning Unit should consider the trends in agriculture, existing water rights and their potential validity, pending water rights and their potential validity, and ways to meet future demand (including the transfer of existing water rights, establishing water reservations), when developing management options for meeting water demands for agriculture.

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**Appendix A:**

**Irrigated Lands Water Rights – WRIA 26 Lewis County –**

**Washington State Department of Ecology**

Report Date: 12/3/2010

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-24331CWRIS		Cert	10/28/1976	IR,DS	0.03	CFS	3	1	11.0N 01.0E 07	N2/NW	1	UNNAMED SPRING
S2-*08208CWRIS	3688	Cert	1/29/1948	IR	0.2	CFS		20	11.0N 01.0E 20	NE/NW	1	CEDAR CREEK
S2-*04179AMCWRIS	01530A	Cert	11/25/1935	PO,IR	9.32	CFS		5	11.0N 01.0E 30	SE/NW	1	CEDAR CREEK
S2-CV1P340		CertChg	1/2/1952	IR	0.68	CFS			11.0N 01.0E 30		1	CEDAR CREEK
S2-*06296CWRIS	2647	Cert	1/29/1945	IR	0.4	CFS		40	11.0N 01.0E 32	SW/NE	1	SALMON CREEK
S2-25849GWRIS		Cert	3/30/1981	IR,DM	1.78	CFS	103	50	11.0N 01.0W 01	S2/SE	1	UNNAMED SPRING
S2-20487CWRIS		Cert	9/11/1972	IR,DS	0.11	CFS	8.5	5	11.0N 01.0W 02		1	COWLITZ RIVER
S2-*08362CWRIS	3758	Cert	4/29/1948	IR	0.22	CFS		25	11.0N 01.0W 02	NW/NW	1	UNNAMED SPRING
S2-*10603CWRIS	5557	Cert	8/10/1951	ST,IR	0.06	CFS		5	11.0N 01.0W 07		1	UNNAMED SPRING
S2-*10473CWRIS	4839	Cert	7/9/1951	IR	0.2	CFS		20	11.0N 01.0W 07		1	UNNAMED SPRING
S2-23394CWRIS		Cert	11/27/1974	IR	0.01	CFS	1	0.5	11.0N 01.0W 08		1	BILL CREEK
S2-20886CWRIS		Cert	3/26/1973	ST,IR	0.2	CFS	21	10	11.0N 01.0W 08	SE/NE	1	UNNAMED SPRING
S2-*17493CWRIS	10599	Cert	9/4/1962	IR,FS	0.45	CFS	50	25	11.0N 01.0W 08		1	UNNAMED SPRING
S2-27098CWRIS		Cert	4/13/1987	IR	0.02	CFS	2	1	11.0N 01.0W 09	SW/NW	1	COWLITZ RIVER
S2-*10075CWRIS	5708	Cert	1/23/1951	IR	0.3	CFS		30	11.0N 01.0W 09		1	COWLITZ RIVER
S2-22526CWRIS		Cert	4/8/1974	IR,DS	0.03	CFS	3	1	11.0N 01.0W 12	NE/NE	1	UNNAMED SPRING
S2-22076CWRIS		Cert	3/20/1974	ST,IR	0.02	CFS	3	1	11.0N 01.0W 16	NE/NE	1	UNNAMED SPRING
S2-*19235CWRIS	9881	Cert	9/2/1965	IR,DS	0.02	CFS	2.5	0.75	11.0N 01.0W 16	SW/NW	1	UNNAMED SPRING

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-*15139CWRIS	7728	Cert	10/20/1958	IR	0.15	CFS	30	15	11.0N 01.0W 17	SE/SW	1	UNNAMED STREAM
S2-*11016CWRIS	5319	Cert	2/1/1952	ST,IR	0.1	CFS		9	11.0N 01.0W 17		1	UNNAMED STREAM
S2-*09171ALCWRIS	04322A	Cert	10/25/1949	IR	0.2	CFS		20	11.0N 01.0W 17	SE/NE	2	UNNAMED STREAM
S2-*06878CWRIS	2610	Cert	1/28/1946	IR	0.01	CFS		1	11.0N 01.0W 17	NW/NW	1	BILL CREEK
S2-*15233CWRIS	7773	Cert	1/6/1959	IR,DS	0.16	CFS	30	15	11.0N 01.0W 19	N2/SW	1	UNNAMED STREAM
S2-*07307CWRIS	3358	Cert	7/6/1946	IR,DS	0.1	CFS		100	11.0N 01.0W 19		1	COWLITZ RIVER
S2-*08025CWRIS	4526	Cert	9/13/1947	IR	0.1	CFS		16	11.0N 01.0W 20		1	UNNAMED STREAM
S2-*06972CWRIS	4393	Cert	3/14/1946	IR	0.3	CFS		30	11.0N 01.0W 20	SW/NW	1	SALMON CREEK
S2-*10999CWRIS	4729	Cert	1/25/1952	IR	0.01	CFS		1	11.0N 01.0W 22	NW/SW	1	LITTLE SALMON CRE
S2-27072GWRIS		Cert	3/13/1987	IR,FP	0.1	CFS	15	5	11.0N 01.0W 28	SE/NW	1	SALMON CREEK
S2-21258CWRIS		Cert	7/9/1973	IR,DS	0.02	CFS	3	2	11.0N 02.0E 04	SW/SE	1	UNNAMED SPRING
S2-22922CWRIS		Cert	7/1/1974	ST,IR	0.05	CFS	6	2	11.0N 02.0E 11	NW/NW	1	UNNAMED SPRING
S2-*13802CWRIS	11167	Cert	4/12/1956	IR	0.11	CFS	18	9	11.0N 02.0W 01		1	LACAMAS CREEK
S2-*11732CWRIS	5841	Cert	10/3/1952	IR	0.1	CFS		10	11.0N 02.0W 02		1	UNNAMED STREAM
S2-*08559CWRIS	3361	Cert	8/19/1948	IR	0.03	CFS		4	11.0N 02.0W 04	SW/NW	1	UNNAMED SPRING
S2-*08465AWCWRIS	03937A	Cert	6/11/1948	IR	0.15	CFS		15	11.0N 02.0W 05	NW/SE	2	OLEQUA CREEK
S2-*10020CWRIS	4117	Cert	12/8/1950	IR	0.15	CFS		15	11.0N 02.0W 08	S2/NW	1	OLEQUA CREEK
S2-*09220CWRIS	4135	Cert	11/22/1949	IR	0.5	CFS		50	11.0N 02.0W 08	NE/SW	1	OLEQUA CREEK



File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-*08210CWRIS	3561	Cert	1/31/1948	IR	0.01	CFS		1	11.0N 02.0W 08	NW/NE	1	FERRIER CREEK
S2-*06601CWRIS	4781	Cert	8/14/1945	IR	0.05	CFS		15	11.0N 02.0W 15	NE/NE	1	UNNAMED STREAM
S2-*09100CWRIS	3846	Cert	9/20/1949	IR	0.2	CFS		20	11.0N 02.0W 17	NE/NW	1	OLEQUA CREEK
S2-*08985CWRIS	3495	Cert	8/9/1949	IR	0.2	CFS		25	11.0N 02.0W 17	S2/NW	1	OLEQUA CREEK
S2-*06309CWRIS	2769	Cert	2/7/1945	IR	0.3	CFS		29.46	11.0N 02.0W 17	SE/NW	1	OLEQUA CREEK
S2-*09990CWRIS	4875	Cert	11/18/1950	IR	0.2	CFS		20	11.0N 02.0W 18	SE/SE	1	UNNAMED STREAM
S2-*04755CWRIS	1419	Cert	3/10/1939	IR,DS	0.03	CFS		2	11.0N 02.0W 18	SW/SE	1	UNNAMED STREAM
S2-*06566CWRIS	2448	Cert	8/1/1945	IR,FR	0.22	CFS		25	11.0N 02.0W 20	NW/NW	1	OLEQUA CREEK
S2-24777GWRIS		Cert	1/30/1978	IR,FR	0.15	CFS	16	8	11.0N 02.0W 22	SE/SW	1	BEAR CREEK
S2-*10737CWRIS	5577	Cert	9/17/1951	IR,DS	0.08	CFS		8	11.0N 02.0W 23	SE/NE	1	UNNAMED SPRING
S2-28809		Cert	4/13/1993	IR	0.04	CFS	5.5	4	11.0N 02.0W 24	SW/NW	1	UNNAMED SOURCE
S2-*14218CWRIS	8456	Cert	2/4/1957	IR	0.4	CFS	80	40	11.0N 02.0W 24		1	COWLITZ RIVER
S2-*11365CWRIS	6292	Cert	5/19/1952	IR	0.8	CFS		100	11.0N 02.0W 24		1	COWLITZ RIVER
S2-*08215CWRIS	9153	Cert	2/7/1948	IR	0.4	CFS	80	40	11.0N 02.0W 24		1	COWLITZ RIVER
S2-*05185CWRIS	2248	Cert	7/12/1940	IR	0.85	CFS		80	11.0N 02.0W 24		1	COWLITZ RIVER
S2-*05271CWRIS	2925	Cert	9/28/1940	ST,IR	0.07	CFS		6	11.0N 02.0W 25	N2/NW	1	COWLITZ RIVER
S2-22700CWRIS		Cert	5/27/1974	IR	0.1	CFS	10	5	11.0N 02.0W 26	N2/N2	1	COWLITZ RIVER
S2-20866CWRIS		Cert	3/20/1973	ST,IR	0.23	CFS	21.25	10	11.0N 02.0W 26	SE/SW	1	UNNAMED SPRING
S2-*21847CWRIS	11172	Cert	10/6/1969	IR,DS	0.06	CFS	11	4.5	11.0N 02.0W 26		1	COWLITZ

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc RIVER
S2-*14711CWCRIS	7230	Cert	3/21/1958	IR	0.1	CFS	20	10	11.0N 02.0W 26		1	COWLITZ RIVER
S2-*12123CWCRIS	5549	Cert	3/4/1953	IR	0.15	CFS		15	11.0N 02.0W 26		1	COWLITZ RIVER
S2-*12152ALCWCRIS	05759A	Cert	3/12/1953	IR	0.45	CFS		60	11.0N 02.0W 26		2	COWLITZ RIVER
S2-*09154CWCRIS	3924	Cert	10/14/1949	IR	0.25	CFS		25	11.0N 02.0W 26	N2/NE	1	COWLITZ RIVER
S2-24776GWRIS		Cert	1/30/1978	IR	0.5	CFS	60	30	11.0N 02.0W 27		1	COWLITZ RIVER
S2-00064CWCRIS		Cert	4/22/1971	IR	1	CFS	220	110	11.0N 02.0W 27	SW/NW	1	LACAMAS CREEK
S2-*20753CWCRIS	11199	Cert	2/16/1968	IR	0.8	CFS	160	80	11.0N 02.0W 27	SE/NW	1	UNNAMED STREAM
S2-*20974CWCRIS	11217	Cert	5/20/1968	IR	0.15	CFS	30	15	11.0N 02.0W 27	NW/NW	1	LACAMAS CREEK
S2-00293CWCRIS		Cert	1/6/1972	ST,IR	0.065	CFS	6.7	3	11.0N 02.0W 28	SW/SW	1	UNNAMED SPRING
S2-*09985CWCRIS	5048	Cert	11/15/1950	IR	0.1	CFS		15	11.0N 02.0W 29	NE/SW	1	MCMURPHY CREEK
S2-*06903CWCRIS	6214	Cert	2/15/1946	IR	0.25	CFS		25	11.0N 02.0W 29	SW/NW	1	OLEQUA CREEK
S2-*06023CWCRIS	2461	Cert	5/10/1944	IR,DS	0.02	CFS		1	11.0N 02.0W 29	NW/SE	2	MCMURPHY CREEK
S2-*06117CWCRIS	3948	Cert	8/21/1944	IR	0.56	CFS		56	11.0N 02.0W 30	SE/SE	1	STILLWATER CREEK
S2-27092CWCRIS		Cert	4/16/1987	IR	0.02	CFS	1	0.5	11.0N 02.0W 33	NW/NE	1	COWLITZ RIVER
S2-00247CWCRIS		Cert	11/23/1971	IR,FS	0.21	CFS	20.5	10	11.0N 02.0W 33	NW/NW	1	UNNAMED POND
S2-*13895CWCRIS	6941	Cert	5/28/1956	IR	0.25	CFS	50	25	11.0N 03.0W 24	SW/NW	1	BRIM CREEK
S2-*09466CWCRIS	5047	Cert	3/17/1950	IR,DS	0.16	CFS		15	11.0N 03.0W 24		1	BRIM CREEK
S2-*06799CWCRIS	4441	Cert	12/6/1945	IR	0.1	CFS		10	11.0N 03.0W 25		1	STILLWATER CREEK

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-*04740CWRIS	1296	Cert	2/11/1939	IR	0.22	CFS		25	11.0N 03.0W 34	SE/SW	1	STILLWATER CREEK
S2-*09444CWRIS	7876	Cert	3/8/1950	IR	2.5	CFS	500	250	11.0N 04.0E 03	SE/SE	1	STEEL CANYON CR
S2-*04875CWRIS	1787	Cert	6/15/1939	IR,DS	0.05	CFS		6	11.0N 07.0E 13	SE/NW	1	UNNAMED STREAM
S2-*06736CWRIS	2473	Cert	10/27/1945	IR,FR	0.1	CFS		1	11.0N 08.0E 19		1	COVEL CR *
S2-*07658CWRIS	3815	Cert	3/4/1947	IR	0.2	CFS		23	12.0N 01.0E 01	S2/SW	1	MILL CREEK
S2-*04968CWRIS	1324	Cert	9/12/1939	IR	0.01	CFS		0.25	12.0N 01.0E 07	SW/SW	1	LACAMAS CREEK
S2-24749CWRIS		Cert	11/18/1977	IR,DS	0.16	CFS	8	3.5	12.0N 01.0E 13	SE/SW	1	UNNAMED SPRING
S2-*20164CWRIS	10165	Cert	3/27/1967	IR	0.57	CFS	48	32	12.0N 01.0E 20	NW/SE	1	BLUE CREEK
S2-*13351CCWRIS	09042B	Cert	3/25/1955	IR	0.4	CFS	120	80	12.0N 01.0E 20	NW/SE	1	BLUE CREEK
R2-*13417CCWRIS	09042A	Cert	5/5/1955	IR		CFS	65	80	12.0N 01.0E 20	NW/SE	1	BLUE CREEK
S2-25871AAGWRIS		Cert	4/23/1981	IR,DM	0.05	CFS	7	3	12.0N 01.0E 24	W2/NE	1	MILL CREEK
S2-*06567CWRIS	3136	Cert	8/1/1945	IR	0.26	CFS		26	12.0N 01.0E 24	NW/NE	1	MILL CREEK
S2-*08619CWRIS	3664	Cert	10/13/1948	IR	0.35	CFS		35	12.0N 01.0E 31		1	BLUE CREEK
S2-*14190CWRIS	6889	Cert	1/11/1957	IR	0.06	CFS	12	6	12.0N 01.0W 06	NE/NW	1	UNNAMED POND
S2-00699CWRIS		Cert	3/10/1967	ST,IR	0.06	CFS	6	4	12.0N 01.0W 19		1	UNNAMED STREAM
S2-*04949CWRIS	1697	Cert	8/22/1939	IR,DS	0.01	CFS		2	12.0N 01.0W 19	SW/SE	1	UNNAMED STREAM
S2-20760CWRIS		Cert	2/16/1973	IR	0.35	CFS	48	24	12.0N 01.0W 21		1	LACAMAS CREEK
S2-20644CWRIS		Cert	11/20/1972	IR	0.02	CFS	1.5	1.5	12.0N 01.0W 36	NW/NW	1	SNOOK CR
S2-27080		Cert	3/26/1987	IR	0.4	CFS	80	40	12.0N 02.0E 01		1	UNNAMED POND

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-23673CWRIS		Cert	11/27/1974	IR,DM	0.02	CFS	3	1	12.0N 02.0E 01		1	UNNAMED SPRING
S2-20129CWRIS		Cert	4/3/1972	ST,IR	0.02	CFS	6.9	2	12.0N 02.0E 01		1	UNNAMED SPRING
S2-22158CWRIS		Cert	4/9/1974	ST,IR	0.05	CFS	3.5	1	12.0N 02.0E 02		1	UNNAMED SPRING
S2-21561CWRIS		Cert	10/19/1973	ST,IR	0.05	CFS	4.5	1	12.0N 02.0E 03	NW/SW	1	UNNAMED SPRING
S2-00603ALCWRIS		Cert	9/15/1965	RE,IR	0.06	CFS	10	5	12.0N 02.0E 08	NW/NE	2	UNNAMED STREAM
S2-*19874CWRIS	10104	Cert	9/7/1966	IR	0.53	CFS	120	60	12.0N 02.0E 08	NE/NE	1	SILVER CREEK
S2-*09493CWRIS	4900	Cert	3/29/1950	IR	0.2	CFS		20	12.0N 02.0E 08	SE/SE	1	SILVER CREEK
S2-00359CWRIS		Cert	9/16/1971	ST,IR	0.44	CFS	49.5	20	12.0N 02.0E 12	NW/SE	1	UNNAMED SPRING
S2-00877CWRIS		Cert	4/25/1967	ST,IR	0.33	CFS	142.8	70	12.0N 02.0E 17	W2/SE	2	SILVER CREEK
S2-*05858CWRIS	3770	Cert	6/25/1943	IR	0.2	CFS		20	12.0N 02.0E 17	SE/NE	1	SILVER CREEK
S2-21329CWRIS		Cert	7/30/1973	ST,IR	0.02	CFS	3	1	12.0N 02.0E 20	NE/NE	1	UNNAMED SPRING
S2-*05588CWRIS	5818	Cert	10/1/1941	IR	0.15	CFS		12	12.0N 02.0E 20	SE/NE	1	SILVER CREEK
S2-24132CWRIS		Cert	4/19/1976	IR	0.08	CFS	8	4	12.0N 02.0E 28	SE/NW	1	UNNAMED SPRING
S2-*06886CWRIS	3106	Cert	2/5/1946	IR	0.01	CFS		1	12.0N 02.0W 28	NW/NE	1	OLEQUA CREEK
S2-*06339CWRIS	2247	Cert	3/7/1945	IR	0.01	CFS		0.72	12.0N 02.0W 28	SE/SW	1	OLEQUA CREEK
S2-*05456CWRIS	1652	Cert	5/12/1941	IR	0.04	CFS		5.5	12.0N 02.0W 28	SW/NW	1	OLEQUA CREEK
S2-*08903CWRIS	4815	Cert	7/13/1949	IR	0.25	CFS		40	12.0N 02.0W 30	SE/NE	1	KING CREEK
S2-23363CWRIS		Cert	6/21/1974	ST,IR	0.02	CFS	2	0.5	12.0N 02.0W 33	SW/NW	1	OLEQUA CREEK
S2-*08545CWRIS	3405	Cert	8/9/1948	IR	0.03	CFS		2.5	12.0N 02.0W 33	NW/SW	1	OLEQUA CREEK
S2-*06358CWRIS	2257	Cert	3/20/1945	IR	0.01	CFS		1.25	12.0N 02.0W 33	SW/NW	1	OLEQUA CREEK

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-*04720CWRIS	1259	Cert	1/18/1939	IR	0.27	CFS		25	12.0N 02.0W 33		1	OLEQUA CREEK
S2-*14284AWCWRIS	07123A	Cert	4/8/1957	IR,DS	0.04	CFS	6	3	12.0N 03.0E 05	SE/SW	2	UNNAMED SPRING
S2-21003CWRIS		Cert	5/2/1973	IR	0.02	CFS	1	1	12.0N 03.0E 21	NW/NW	1	UNNAMED SPRING
S2-*14659CWRIS	7610	Cert	2/7/1958	IR,DS	0.04	CFS	6	4	12.0N 03.0E 23	SE/SE	1	SULPHUR CREEK
S2-*10749CWRIS	6076	Cert	9/24/1951	IR	0.2	CFS		20	12.0N 03.0E 25	SE/SW	1	SULPHUR CREEK
S2-*10995AWCWRIS	06830A	Cert	1/24/1952	IR,DS	0.2	CFS	40	20	12.0N 03.0E 25	SW/SE	2	UNNAMED SPRING
S2-*08466CWRIS	3913	Cert	6/11/1948	IR,DS	0.1	CFS		10	12.0N 04.0E 01	NE/SE	1	CHAPMAN CREEK
S2-*01642CWRIS	4897	Cert	3/13/1926	IR	0.3	CFS		55	12.0N 04.0E 02	NE/SW	1	LAKE CREEK
S2-*10255CWRIS	4365	Cert	4/19/1951	IR,DS	0.1	CFS		10	12.0N 04.0E 03	NW/SW	1	UNNAMED SPRING
S2-21284CWRIS		Cert	7/9/1973	ST,IR	0.02	CFS	3	2	12.0N 04.0E 07	NE/SE	1	UNNAMED SPRING
S2-26297GWRIS		Cert	2/28/1983	IR	0.25	CFS	60	30	12.0N 04.0E 08		1	HIGHLAND VALLEY C
S2-*12829CWRIS	7044	Cert	3/24/1954	IR	0.27	CFS	54	27	12.0N 04.0E 29	NW/SW	2	CATFISH LAKE
S2-00289CWRIS		Cert	5/27/1971	IR	0.01	CFS	1	0.5	12.0N 04.0E 31	N2/NW	1	SULPHUR CREEK
S2-*08007CWRIS	4144	Cert	8/27/1947	IR,DS	0.15	CFS		15	12.0N 04.0E 33	E2/SW	1	UNNAMED STREAM
S2-00912CWRIS		Cert	8/24/1970	IR	0.01	CFS	1	0.5	12.0N 05.0E 07	SW/SE	1	MINNIE CREEK
S2-*08764CWRIS	4200	Cert	4/26/1949	IR,DM	0.05	CFS		2	12.0N 05.0E 07	NE/SE	1	MINNIE CREEK
S2-*08170CWRIS	7354	Cert	1/5/1948	IR,DS	0.02	CFS	2	1	12.0N 05.0E 08	E2/SW	1	JOHNSON CREEK
S2-23277CWRIS		Cert	9/23/1974	ST,IR	0.07	CFS	14	3	12.0N 05.0E 12	SW/SW	1	UNNAMED SPRING
S2-*16259CWRIS	9439	Cert	8/11/1960	IR,DS	0.02	CFS	3	1	12.0N 05.0E 14	NW/NW	1	FROST CREEK

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-*13204CWRIS	6544	Cert	12/6/1954	IR,DS	0.03	CFS	4	2	12.0N 05.0E 20		1	UNNAMED STREAM
S2-23536CWRIS		Cert	6/26/1974	IR	0.02	CFS	2	1	12.0N 05.0E 22	NW/NE	1	FROST CREEK
S2-*05381CWRIS	2044	Cert	3/8/1941	IR,DS	0.01	CFS		1	12.0N 05.0E 22	NW/NW	1	STEFFEN CREEK
S2-*06248CWRIS	2209	Cert	11/28/1944	IR,DS	0.05	CFS		5	12.0N 05.0E 24		1	UNNAMED STREAM
S2-*09806CWRIS	6403	Cert	8/1/1950	IR,DS	0.02	CFS		1	12.0N 05.0E 25	SE/SW	1	UNNAMED STREAM
S2-*09116CWRIS	4130	Cert	9/27/1949	IR	0.4	CFS		40	12.0N 05.0E 27	SW/NW	1	RAINY CREEK
S2-*12919CWRIS	6515	Cert	5/14/1954	IR	0.01	CFS	1	0.5	12.0N 05.0E 28	NW/SW	1	STEFFEN CREEK
S2-*04976CWRIS	1496	Cert	9/20/1939	IR,DS	0.07	CFS		4	12.0N 06.0E 04	SE/SE	1	KIONA CREEK
S2-23700CWRIS		Cert	1/16/1975	IR	0.02	CFS	2	1	12.0N 06.0E 11	SE/SW	2	UNNAMED STREAM
S2-*15510CWRIS	9836	Cert	6/9/1959	IR,FR	0.07	CFS	14	7	12.0N 06.0E 12	NW/SE	1	OLIVER CREEK
S2-*10669CWRIS	5216	Cert	8/27/1951	IR,DS	0.04	CFS		3	12.0N 06.0E 12	SE/NE	1	OLIVER CREEK
S2-*19094CWRIS	10584	Cert	6/25/1965	IR,DM	0.4	CFS	23	10	12.0N 06.0E 13	SW/SE	1	UNNAMED SPRING
S2-00406CWRIS		Cert	11/15/1971	IR,FS	0.35	CFS	10.5	5	12.0N 06.0E 22	NW/SW	1	UNNAMED POND
S2-*14546ALCWRIS	08358A	Cert	10/16/1957	IR	1	CFS	200	100	12.0N 06.0E 25		2	COWLITZ RIVER
S2-*12103CWRIS	5888	Cert	2/27/1953	IR,DS	0.41	CFS		40	12.0N 06.0E 25	NW/SE	1	UNNAMED STREAM
S2-25895GWRIS		Cert	5/13/1981	IR	0.06	CFS	18	9	12.0N 06.0E 32		1	UNNAMED STREAM
S2-26479GWRIS		Cert	2/14/1984	PO,IR	0.22	CFS	7	5	12.0N 07.0E 07		1	UNNAMED SPRING
S2-25762CWRIS		Cert	12/2/1980	IR,DS	0.03	CFS	3	1	12.0N 07.0E 07	NE/NW	2	PETERS CREEK
S2-26019GWRIS		Cert	10/15/1981	IR,DM	0.03	CFS	2.5	1.5	12.0N 07.0E 07		1	UNNAMED STREAM

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-22708CWRIS		Cert	6/24/1974	IR,DM	0.04	CFS	3	1	12.0N 07.0E 07		1	PETERS CREEK
S2-*10358CWRIS	4622	Cert	5/23/1951	IR,DM	0.15	CFS		5	12.0N 07.0E 10	NW/SE	1	SILVER CREEK
S2-*06810CWRIS	5031	Cert	12/13/1945	IR	0.26	CFS		26	12.0N 07.0E 10	SW/SW	1	SILVER CREEK
S2-*06816CWRIS	5032	Cert	12/19/1945	IR	0.14	CFS		14	12.0N 07.0E 10	SW/SW	1	SILVER CREEK
S2-*12325ALCWRIS	06277A	Cert	5/6/1953	IR	0.8	CFS		80	12.0N 07.0E 13		2	COWLITZ RIVER
S2-20929CWRIS		Cert	4/13/1973	IR	0.75	CFS	140	70	12.0N 07.0E 17	NE/NW	1	COWLITZ RIVER
S2-*14336CWRIS	7373	Cert	5/17/1957	IR	0.05	CFS	10	5	12.0N 07.0E 17	SE/SE	1	MCMAHAM *
S2-*20267CWRIS	11285	Cert	5/26/1967	IR	1	CFS	200	100	12.0N 07.0E 18	SW/NE	1	PETERS CREEK
S2-*11097CWRIS	5643	Cert	2/26/1952	IR	0.25	CFS		25	12.0N 07.0E 18	S2/SE	1	KIONA CREEK
S2-*10533CWRIS	6009	Cert	7/25/1951	IR	0.5	CFS		60	12.0N 07.0E 19		1	COWLITZ RIVER
S2-*07922CWRIS	4463	Cert	7/5/1947	IR	0.3	CFS		30	12.0N 07.0E 19	S2/NW	1	UNNAMED SPRING
S2-*13021CWRIS	6441	Cert	7/13/1954	IR	0.2	CFS		40	12.0N 07.0E 20	NE/SW	2	SILER CREEK
S2-*06272CWRIS	3028	Cert	12/26/1944	IR	0.4	CFS		40	12.0N 07.0E 20		1	COWLITZ RIVER
S2-27779CWRIS		Cert	6/5/1990	IR	0.04	CFS	4	2	12.0N 07.0E 22	NW/SW	1	UNNAMED SPRING
S2-*17818AWCWRIS	09456A	Cert	3/29/1963	IR,DS	0.16	CFS	52	30	12.0N 07.0E 27	S2/NW	2	UNNAMED SPRING
S2-*14262AWCWRIS	09830A	Cert	3/14/1957	IR	0.134	CFS	48	40	12.0N 07.0E 27		3	SILER CREEK
S2-*04264CWRIS	1684	Cert	7/29/1936	PO,IR	3	CFS		10	12.0N 07.0E 27		1	SILER CREEK
S2-26686GWRIS		Cert	4/16/1985	IR	0.8	CFS	80	40	12.0N 07.0E 30		1	COWLITZ RIVER
S2-23209CWRIS		Cert	6/13/1974	ST,IR	0.01	CFS	3	1	12.0N 07.0E 30	SE/NE	1	UNNAMED

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc SPRING
S2-22407CWRIS		Cert	5/9/1974	IR,DS	0.07	CFS	7	3	12.0N 08.0E 02	SW/SE	1	UNNAMED STREAM
S2-00318CWRIS		Cert	10/3/1971	IR,DS	0.12	CFS	22	10	12.0N 08.0E 02		1	UNNAMED STREAM
S2-00318		SuperCert	10/3/1971	IR,DS		CFS			12.0N 08.0E 02		1	UNNAMED STREAM
S2-*09301CWRIS	4396	Cert	1/4/1950	IR	1	CFS		100	12.0N 08.0E 09		1	DAVIS CREEK
S2-CV2P779	4396	CertChg	1/4/1950	IR	1	CFS		100	12.0N 08.0E 09		1	DAVIS CREEK
S2-*04564CWRIS	3180	Cert	7/20/1938	IR,DS	0.03	CFS		2	12.0N 08.0E 12	SW/SE	1	BURTON CREEK
S2-*03408CWRIS	725	Cert	6/1/1931	IR,DS	0.08	CFS		10	12.0N 08.0E 12	NW/SE	1	UNNAMED SPRING
S2-26340CWRIS		Cert	5/3/1983	RE,IR	1	CFS	4	2	12.0N 08.0E 16	NE/NW	1	DAVIS CREEK
S2-*02684CWRIS	925	Cert	8/24/1929	PO,IR	1	CFS	0	5	12.0N 08.0E 17	NW/NW	1	PURCELL CREEK
S2-*20609CWRIS	10482	Cert	10/25/1967	IR,DS	0.03	CFS	5	2	12.0N 08.0E 22		1	UNNAMED SPRING
S2-*02355CWRIS	1423	Cert	7/3/1928	IR,DS	0.06	CFS		3	12.0N 09.0E 05	SE/NW	1	DRY CREEK
S2-26893CWRIS		Cert	4/15/1986	RE,IR	0.02	CFS	4	2	13.0N 02.0E 20		1	UNNAMED SPRING
S2-*13532CWRIS	10314	Cert	7/25/1955	IR	0.15	CFS	30	15	13.0N 02.0E 22	NE/NE	1	MILL CREEK
S2-*14936CWRIS	8251	Cert	7/25/1958	ST,IR	0.22	CFS	40	20	13.0N 02.0E 24	SE/NE	1	SCOTT CREEK
S2-*11228CWRIS	5561	Cert	4/8/1952	ST,IR	0.01	CFS		0.5	13.0N 02.0E 30	SW/NE	1	UNNAMED STREAM
S2-01107CWRIS		Cert	10/3/1969	IR	0.2	CFS	23	10	13.0N 02.0E 34	SW/SE	1	MAYFIELD LAKE
S2-26115GWRIS		Cert	3/19/1982	IR,DM	0.2	CFS	22	10	13.0N 03.0E 16	W2/SW	1	ALDER CREEK
S2-27676C		Cert	12/27/1989	IR,DM	6	CFS	5.5	2	13.0N 03.0E 19	NE/NW	4	UNNAMED SPRING



File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-25593GWRIS		Cert	5/12/1980	IR,DM	0.015	CFS	7	2.5	13.0N 03.0E 19		1	UNNAMED SPRING
S2-22298CWRIS		Cert	3/28/1974	ST,IR	0.04	CFS	4	1	13.0N 03.0E 19	NE/NW	1	UNNAMED SPRING
S2-*19493CWRIS	10961	Cert	3/4/1966	IR	0.2	CFS	40	20	13.0N 03.0E 20	NE/NW	2	UNNAMED SPRING
S2-CV1-2P5	10961	CertChg	11/3/1972	IR	0.2	CFS	40	20	13.0N 03.0E 20	NE/NW	2	UNNAMED SPRING
S2-*07579CWRIS	3027	Cert	12/16/1946	ST,IR	0.3	CFS		30	13.0N 03.0E 21	NW/SE	1	UNNAMED STREAM
S2-26066GWRIS		Cert	1/14/1982	ST,IR	0.111	CFS	10	1	13.0N 03.0E 22	SW/SW	1	UNNAMED SPRING
S2-26071GWRIS		Cert	1/22/1982	IR,DS	0.03	CFS	9	4	13.0N 03.0E 22	SE/SW	1	E SPOUT CR
S2-23907CWRIS		Cert	7/22/1975	ST,IR	0.1	CFS	8.25	3	13.0N 03.0E 22	SE/NW	1	COLD CREEK
S2-*12734CWRIS	6378	Cert	1/21/1954	IR,DS	0.06	CFS		5	13.0N 03.0E 22	SE/SE	1	UNNAMED SPRING
S2-*05851CWRIS	2336	Cert	6/17/1943	ST,IR	0.07	CFS		8	13.0N 03.0E 22		1	COAL CREEK
S2-*06758CWRIS	4782	Cert	11/14/1945	IR	0.08	CFS		16	13.0N 03.0E 27	NE/NE	1	UNNAMED STREAM
S2-*06794CWRIS	4383	Cert	11/30/1945	IR,DS	0.08	CFS		16	13.0N 03.0E 27	SE/NE	1	UNNAMED SPRING
S2-27422GWRIS		Cert	6/9/1988	IR,DS	0.11	CFS	20.5	10	13.0N 03.0E 35	SW/NE	1	STOUT CRK
S2-21883CWRIS		Cert	2/6/1974	IR	0.5	CFS	72	36	13.0N 03.0E 35	NE/NE	1	UNNAMED STREAM
S2-*21620CWRIS	11491	Cert	5/28/1969	IR	0.1	CFS	16	10	13.0N 03.0E 35	NE/NE	1	UNNAMED STREAM
S2-*20781CWRIS	11492	Cert	2/28/1968	IR	0.1	CFS	24	12	13.0N 03.0E 35	NE/NE	1	UNNAMED STREAM
S2-*10271CWRIS	5662	Cert	4/27/1951	IR	0.2	CFS		20	13.0N 03.0E 35	NW/NE	1	STOUT CR *

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-CV1-2P85	5662	CertChg	4/27/1951	IR	0.2	CFS		20	13.0N 03.0E 35	NW/NE	1	STOUT CR *
S2-*22112CWRIS	11778	Cert	4/3/1970	ST,IR	0.03	CFS	4	3	13.0N 05.0E 19	S2/NW	1	TILTON RIVER
S2-21673CWRIS		Cert	11/29/1973	IR,DS	0.04	CFS	2	0.5	13.0N 09.0E 15		1	UNNAMED SPRING
S2-*04882CWRIS	1720	Cert	6/21/1939	IR,FS	0.2	CFS		0.25	13.0N 09.0E 15	NE/SE	1	SNYDER CREEK
S2-27752		Cert	5/9/1990	IR	0.78	CFS		10	13.0N 09.0E 21	NW/SW	1	COWLITZ RIVER
S2-*09025CWRIS	6215	Cert	8/23/1949	IR,DM	0.1	CFS			13.0N 09.0E 22	NE/NE	1	JONATHAN CR *
S2-*05845CWRIS	2498	Cert	6/9/1943	IR,DS	0.06	CFS		5	13.0N 09.0E 33	NE/NW	1	HALL CREEK
S2-*18512CWRIS	9372	Cert	5/20/1964	IR,DM	0.04	CFS	5.8	2	15.0N 10.0E 28	SE/SW	1	FALLS CREEK
G2-00285CWRIS		Cert	1/11/1972	ST,IR	20	GPM	6.4	2	11.0N 01.0W 04		1	WELL
G2-*09370CWRIS	6630	Cert	4/8/1968	IR,DS	110	GPM	71	35	11.0N 01.0W 04		1	WELL
G2-24795GWRIS		Cert	2/1/1978	IR	850	GPM	260	130	11.0N 01.0W 05		1	WELL
G2-23584CWRIS		Cert	6/30/1974	IR	235	GPM	80	40	11.0N 01.0W 05	NE/SE	1	WELL
G2-*05302CWRIS	3523	Cert	6/26/1959	IR	50	GPM	10	5	11.0N 01.0W 05		1	WELL
G2-24796GWRIS		Cert	2/1/1978	IR	600	GPM	180	90	11.0N 01.0W 06		1	WELL
G2-23092CWRIS		Cert	8/26/1974	IR	100	GPM	20	10	11.0N 01.0W 07	SE/SE	1	WELL
G2-25010GWRIS		Cert	7/6/1978	IR	2292	GPM	187.9	24	11.0N 01.0W 10	NW/NE	1	WELL
G2-24911GWRIS		Cert	6/19/1978	IR	6300	GPM	420.4	105	11.0N 01.0W 10		1	WELL
G2-22664CWRIS		Cert	6/17/1974	IR,FP	6000	GPM	461	116	11.0N 01.0W 10		1	WELL
G2-00552CWRIS		Cert	4/14/1970	IR	120	GPM	68	30	11.0N 01.0W 11	SW/SE	1	WELL
G2-*07203CWRIS	5306	Cert	6/10/1964	IR	140	GPM	40	20	11.0N 01.0W 12		1	WELL
G2-24463GWRIS		Cert	3/10/1977	IR	500	GPM	100	50	11.0N 01.0W 17	N2/NE	1	WELL
G2-28118		Pmt	4/16/1991	IR,DM	60	GPM	20.2	8	11.0N 01.0W 17		1	WELL
G2-21963CWRIS		Cert	2/11/1974	IR	450	GPM	150	75	11.0N 01.0W 18		1	WELL

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
G2-*04273CWRIS	2888	Cert	4/4/1956	IR	510	GPM	200	100	11.0N 01.0W 18		1	WELL
G2-*10626CWRIS	7088	Cert	2/2/1970	IR,DS	12	GPM	5	1	11.0N 01.0W 19		1	WELL
G2-23928CWRIS		Cert	8/19/1975	ST,IR	100	GPM	62	40	11.0N 02.0W 02	NW/SW	1	WELL
G2-*09306CWRIS	6283	Cert	3/15/1968	IR,DS	350	GPM	81	40	11.0N 02.0W 03		1	WELL
G2-*02939CWRIS	2502	Cert	1/19/1953	IR	90	GPM	20	10	11.0N 02.0W 06	SE/NW	1	INFILTRATION TREN
G2-*05075CWRIS	3642	Cert	10/22/1958	IR,DS	30	GPM	24	12	11.0N 02.0W 07	NE/SE	1	WELL
G2-00307CWRIS		Cert	8/4/1970	IR,DS	30	GPM	21	9	11.0N 02.0W 09	SW/SW	1	WELL
G2-*06334CWRIS	4558	Cert	6/5/1962	IR	100	GPM	20	10	11.0N 02.0W 09	SW/SE	1	WELL
G2-*03438CWRIS	1887	Cert	11/23/1953	IR,DS	50	GPM	20	10	11.0N 02.0W 09	SE/SW	1	WELL
G2-*02314CWRIS	1136	Cert	2/1/1952	IR	100	GPM	40	20	11.0N 02.0W 11		1	WELL
G2-*01327CWRIS	486	Cert	1/3/1950	IR	100	GPM	38	30	11.0N 02.0W 15	NE/NE	1	WELL
G2-*09277CWRIS	6145	Cert	2/21/1968	IR	50	GPM	30	20	11.0N 02.0W 19		1	WELL
G2-*03672CWRIS	2122	Cert	6/11/1954	IR	30	GPM	24	20	11.0N 02.0W 23	SW/NE	1	WELL
G2-*04964CWRIS	3687	Cert	8/15/1958	IR	60	GPM	28	14	11.0N 02.0W 25	NE/SE	1	WELL
G2-*04879CWRIS	3607	Cert	6/9/1958	IR,DS	70	GPM	14	7	11.0N 02.0W 25	SE/SW	1	WELL
G2-22294CWRIS		Cert	4/29/1974	IR	600	GPM	360	180	11.0N 02.0W 27	SW/SW	1	INFILTRATION TREN
G2-*02129CWRIS	1534	Cert	9/10/1951	IR	45	GPM	10	5	11.0N 02.0W 34	SE/SE	1	WELL
G2-*08668BWCWRIS	06766B	Cert	4/20/1967	IR	60	GPM	36	18	11.0N 02.0W 34	NE/SE	1	
G2-*03682CWRIS	2510	Cert	6/21/1954	IR,DS	100	GPM	65.6	30	11.0N 02.0W 36	N2/NW	1	WELL
G2-CV2P566	2510	CertChg	6/21/1954	IR,DS	100	GPM	65.6	30	11.0N 02.0W 36	N2/NW	1	WELL
G2-24966GWRIS		Cert	7/24/1978	ST,IR	300	GPM	164.2	80	12.0N 01.0E 02	SW/SW	1	WELL
G2-*02578CWRIS	1775	Cert	6/5/1952	IR	180	GPM	60	30	12.0N 01.0E 02	SW/SW	1	WELL

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
G2-25516GWRIS		Cert	3/31/1980	ST,IR	150	GPM	71	35	12.0N 01.0E 08	NW/NE	1	WELL
G2-*09250CWRIS	6585	Cert	2/29/1968	IR	675	GPM	320	160	12.0N 01.0E 08	NE/SW	2	WELL
G2-*03561CWRIS	2821	Cert	3/29/1954	IR,DS	35	GPM	12	6	12.0N 01.0E 08	SE/SW	1	WELL
G2-*02668CWRIS	2411	Cert	8/6/1952	ST,IR	350	GPM	160	80	12.0N 01.0E 08	W2/SE	1	WELL
G2-*08365CWRIS	6068	Cert	10/26/1966	IR,DS	50	GPM	16	15	12.0N 01.0E 09	NW/NE	1	WELL
G2-21812CWRIS		Cert	1/23/1974	IR,DS	210	GPM	41	20	12.0N 01.0E 10	SW/SE	1	WELL
G2-*03602CWRIS	2341	Cert	5/4/1954	IR,DS	30	GPM	21.5	8	12.0N 01.0E 15	NE/SE	1	WELL
G2-21224CWRIS		Cert	7/2/1973	IR	200	GPM	40	20	12.0N 01.0E 17	SW/SW	1	WELL
G2-*02661CWRIS	1663	Cert	8/4/1952	IR	65	GPM	40	20	12.0N 01.0E 17	NE/NE	1	WELL
G2-*02046CWRIS	1235	Cert	7/24/1951	IR	100	GPM	80	40	12.0N 01.0E 17	SW/SW	1	WELL
G2-27773		Cert	5/23/1990	IR,DM	40	GPM	3	2	12.0N 01.0E 17	NE/NE	1	WELL
G2-*08050CWRIS	6342	Cert	4/19/1966	IR	50	GPM	35	35	12.0N 01.0E 30	SE/SW	1	WELL
G2-*08148CWRIS	6733	Cert	6/10/1966	IR,DS	90	GPM	27	13	12.0N 01.0W 04		1	WELL
G2-*03369ALCWRIS	01856A	Cert	9/9/1953	IR,DS	50	GPM	15	5	12.0N 01.0W 04		4	WELL
G2-23279CWRIS		Cert	10/11/1974	ST,IR	65	GPM	13	6	12.0N 01.0W 05	NW/SW	1	WELL
G2-*02134CWRIS	1070	Cert	9/12/1951	IR	100	GPM	60	30	12.0N 01.0W 05	SW/NW	1	WELL
G2-26919GWRIS		Cert	6/9/1986	ST,IR	300	GPM	30.5	15	12.0N 01.0W 06	NE/NW	1	WELL
G2-27846		Cert	8/28/1990	IR,DS	100	GPM	10.5	5	12.0N 01.0W 12	SW/SE	1	WELL
G2-*02075CWRIS	1260	Cert	8/13/1951	ST,IR	320	GPM	120	60	12.0N 01.0W 13	NE/SE	1	WELL
G2-*08593CWRIS	6197	Cert	3/10/1967	IR	45	GPM	12	10	12.0N 01.0W 20		1	WELL
G2-*03278CWRIS	2056	Cert	6/22/1953	IR,DS	40	GPM	25	10	12.0N 01.0W 20		1	WELL
G2-24147CWRIS		Cert	3/12/1976	IR	230	GPM	90	45	12.0N 01.0W 24	SW/NE	1	WELL
G2-*06144CWRIS	4823	Cert	1/3/1962	IR,DS	105	GPM	53.6	24	12.0N 01.0W 24	SW/NE	1	WELL
G2-*05072C	3653	Cert	12/2/1958	IR	100	GPM	40	20	12.0N 01.0W 24	N2/NE	1	WELL

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
G2-*08322CWRIS	5707	Cert	9/27/1966	IR,DS	300	GPM	121	60	12.0N 01.0W 32		1	WELL
G2-20720CWRIS		Cert	1/29/1973	IR,DS	25	GPM	7	3	12.0N 01.0W 34	SW/NW	1	WELL
G2-*10970CWRIS	7551	Cert	6/15/1970	IR	270	GPM	115	80	12.0N 01.0W 34		1	WELL
G2-*05227CWRIS	4242	Cert	4/27/1959	IR	50	GPM	30	15	12.0N 01.0W 35		1	WELL
G2-24528CWRIS		Cert	4/19/1977	IR,DS	50	GPM	11.5	5	12.0N 01.0W 36	NW/NW	1	WELL
G2-*05662CWRIS	4101	Cert	7/12/1960	ST,IR	35	GPM	20	10	12.0N 02.0E 09	NE/NW	1	WELL
G2-21724CWRIS		Cert	12/10/1973	IR	450	GPM	200	100	12.0N 02.0E 11		1	WELL
G2-*09219CWRIS	6268	Cert	2/14/1968	IR,FP	250	GPM	70	35	12.0N 02.0E 11		1	WELL
G2-25742GWRIS		Cert	11/6/1980	IR	200	GPM	200	100	12.0N 02.0E 13	NW/NW	1	WELL
G2-25513GWRIS		Cert	3/7/1980	IR,DS	10	GPM	3	1	12.0N 02.0E 13	SE/SE	1	WELL
G2-*02963CWRIS	2356	Cert	2/2/1953	IR	200	GPM	120	59	12.0N 02.0E 13	NE/NW	1	WELL
G2-21825		Cert	11/6/1980	IR	150	GPM	80	40	12.0N 02.0E 13	NW/NW	1	WELL
G2-21545CWRIS		Cert	10/12/1973	IR,DS	72	GPM	46	30	12.0N 02.0E 14	NW/NE	1	WELL
G2-*06106CWRIS	4477	Cert	11/16/1961	ST,IR	600	GPM	200	100	12.0N 02.0E 14		1	WELL
G2-*02119CWRIS	1293	Cert	8/31/1951	IR	225	GPM	60	30	12.0N 02.0E 14	NW/NE	1	WELL
G2-*02694CWRIS	2152	Cert	9/3/1952	IR,DS	100	GPM	32	16	12.0N 02.0W 01	SE/SW	1	WELL
G2-26370GWRIS		Cert	6/23/1983	IR,FR	150	GPM	83	40	12.0N 02.0W 09	SW/SW	1	WELL
G2-*01670CWRIS	696	Cert	9/18/1950	IR,DS	72	GPM	26	13	12.0N 02.0W 10	SW/SW	1	WELL
G2-27010		Pmt	10/23/1986	IR,DM	300	GPM	42.25	15	12.0N 02.0W 12		1	WELL
G2-27467CWRIS		Cert	1/18/1989	ST,IR	50	GPM	20.55	10	12.0N 02.0W 13	NW/NE	1	WELL
G2-26814CWRIS		Cert	10/22/1985	ST,IR	80	GPM	30.5	15	12.0N 02.0W 16	SW/NW	1	WELL
G2-*07062CWRIS	4911	Cert	3/9/1964	IR,DS	100	GPM	45.6	20	12.0N 02.0W 16	NE/SE	1	WELL
G2-CV1-2P62	4911	CertChg	3/9/1964	IR,DS	100	GPM	45.6	20	12.0N 02.0W 16	NE/SE	1	WELL
G2-*10397CWRIS	6868	Cert	9/9/1969	IR	90	GPM	7.5	15	12.0N 02.0W 23	NW/NE	1	WELL

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
G2-*08587CWRIS	6514	Cert	3/7/1967	IR,DS	45	GPM	23	11	12.0N 02.0W 23	NE/NW	1	WELL
G2-*10822CWRIS	7399	Cert	4/29/1970	ST,IR	200	GPM	45	19	12.0N 02.0W 24	SW/SE	1	WELL
G2-24210CWRIS		Cert	6/17/1976	IR,DS	50	GPM	9	4	12.0N 02.0W 26	NE/NE	1	WELL
G2-20540CWRIS		Cert	10/4/1972	ST,IR	80	GPM	62	30	12.0N 02.0W 26		1	WELL
G2-*07026CWRIS	4966	Cert	2/13/1964	IR,DS	100	GPM	45.6	20	12.0N 02.0W 26	SW/NW	1	WELL
G2-*05022ALCWRIS	04740A	Cert	9/29/1958	IR,DS	130	GPM	60	30	12.0N 02.0W 26		2	WELL
G2-24253CWRIS		Cert	7/29/1976	IR,DS	225	GPM	55	27	12.0N 02.0W 27	NE/SE	1	WELL
G2-*02889CWRIS	1470	Cert	12/31/1952	IR,DS	60	GPM	40	20	12.0N 02.0W 30	SW/NE	1	WELL
G2-*02222CWRIS	1084	Cert	11/16/1951	IR	75	GPM	30	15	12.0N 02.0W 31	NW/NE	1	WELL
G2-24982GWRIS		Cert	8/4/1978	IR,DM	100	GPM	62	30	12.0N 02.0W 33		1	WELL
G2-00707CWRIS		Cert	12/10/1971	ST,IR	250	GPM	66	35	12.0N 02.0W 34	NE/NW	1	WELL
G2-*02627CWRIS	5702	Cert	7/2/1952	IR	230	GPM	80	40	12.0N 02.0W 34		1	WELL
G2-*02415CWRIS	1385	Cert	3/25/1952	IR,DS	100	GPM	36	18	12.0N 02.0W 34		1	WELL
G2-00429CWRIS		Cert	7/28/1969	ST,IR	275	GPM	92	40	12.0N 02.0W 35		1	WELL
G2-*07710CWRIS	6329	Cert	7/22/1965	IR,DM	100	GPM	36.8	10	12.0N 02.0W 35		1	WELL
G2-*05837CWRIS	4529	Cert	2/17/1961	IR	275	GPM	120	60	12.0N 02.0W 35		1	WELL
G2-*02198CWRIS	1533	Cert	10/31/1951	IR	125	GPM	50	25	12.0N 02.0W 35		1	WELL
G2-*06447CWRIS	4412	Cert	8/24/1962	IR,DS	34	GPM	11.6	3	12.0N 02.0W 36		1	WELL
G2-25231		SuperCert	5/17/1979	IR,DM	90	GPM	66	26	12.0N 03.0E 15		1	Tcoma City light/
G2-22055CWRIS		Cert	2/25/1974	ST,IR	10	GPM	3	0.5	12.0N 03.0E 23	SW/SW	1	WELL
G2-21379CWRIS		Cert	8/22/1973	IR,DS	15	GPM	2	1	12.0N 03.0E 26	NW/NW	1	WELL
G2-25358GWRIS		Cert	9/5/1979	IR	20	GPM	3.2	1.6	12.0N 05.0E 14	SW/NW	1	INFILTRATION TREN
G2-26773CWRIS		Cert	8/26/1985	IR,DS	40	GPM	3.5	1	12.0N 05.0E 23		1	WELL

File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
G2-23754CWRIS		Cert	3/13/1975	IR,DS	15	GPM	2	1	12.0N 05.0E 23	SW/NW	1	WELL
G2-26504GWRIS		Cert	3/23/1984	IR,DS	150	GPM	29	14	12.0N 06.0E 22	NW/SW	1	WELL
G2-00555CWRIS		Cert	2/16/1971	IR,DS	10	GPM	5	2	12.0N 06.0E 24		1	WELL
G2-28429		Cert	3/20/1992	IR,DM	250	GPM	8.25	2	12.0N 06.0E 26		1	WELL
G2-00361CWRIS		Cert	2/25/1972	IR,DM	65	GPM	12.7	1	12.0N 07.0E 10	NE/SE	1	WELL
G2-21021CWRIS		Cert	5/9/1973	IR	320	GPM	160	80	12.0N 07.0E 11	E2/SW	1	WELL
G2-22050CWRIS		Cert	2/11/1974	IR,FP	50	GPM	7	3	12.0N 07.0E 20	NE/NE	1	WELL
G2-*01251CWRIS	1001	Cert	10/7/1949	IR	200	GPM	50	40	12.0N 09.0E 06	NE/SW	1	WELL
G2-00210CWRIS		Cert	6/29/1971	IR,DS	30	GPM	4.7	2.5	13.0N 02.0E 23	NW/NE	1	WELL
G2-22004CWRIS		Cert	3/12/1974	IR,DS	10	GPM	5	4	13.0N 02.0E 27		2	WELL
G2-26383CWRIS		Cert	7/1/1983	IR,DS	12	GPM	4.5	5	13.0N 02.0E 28	SW/SE	1	WELL
G2-*09243CWRIS	6466	Cert	2/28/1968	ST,IR	70	GPM	13	6	13.0N 03.0E 35	NE/NE	1	WELL
G2-*07515CWRIS	5874	Cert	3/12/1965	RE,IR	250	GPM	73	8	13.0N 09.0E 02	SW/SW	1	WELL
G2-25277NWRIS		Cert	4/10/1979	IR	35	GPM	6	3	13.0N 09.0E 10	W2/SW	1	WELL
G2-27751GWRIS		Cert	5/9/1990	IR	60	GPM	20	10	13.0N 09.0E 21	NW/SW	1	WELL

**Appendix B:**

**CURRENT WATER RIGHT & WATER RIGHT CHANGE APPLICATIONS PENDING WITH  
ECOLOGY– WRIA 26 Lewis County –**

**Washington State Department of Ecology**

*Note: Requests for irrigation water rights have irrigated acres associated with them and are highlighted in tan.*

Report Date: 4/4/2011



Control #	Name	Priority Date	Qi	UOM	Qa	Purpose <sup>a</sup>	Ir Acres	Source	TRS
G2-28210	William Lindeman	6/26/1991	600	gpm		DS, IR, ST	250	Well	T11 N/R01 W-12
G2-28303	D F Miller Inc	10/15/1991	70	gpm		DM		Well	T11 N/R02 W-11
G2-28365	Brian Mencke	12/20/1991	2,500	gpm		FS		Well	T13 N/R03 E-27
S2-28477	Randall Shipp	5/1/1992	0.11	cfs		DM		Johnson Creek	T13 N/R09 E-32
S2-28574	John L & Carolyn M Mullenix	7/1/1992	1	cfs		EN, IR	0	Davis Creek	T12 N/R08 E-16
R2-28575	John Luther Mullenix	7/1/1992	0	cfs	12	IR	0	Unnamed Pond	T12 N/R08 E-16
S2-28873	Robert Cunningham	6/21/1993	0.02	cfs		WL		Unnamed Stream	T12 N/R02 W-19
S2-28950	Lewis County Dept. of Comm. Services	9/23/1993	0.13	cfs		IR	8	Unnamed Pond	T11 N/R01 W-17
G2-28954	Northwest Vipassana Association	11/1/1993	62	gpm		DM		Well	T12 N/R01 E-04
G2-29034	Terrence May	4/29/1994	2.5	gpm		CI		Well	T12 N/R02 W-16
G2-29047	Andrew Noel Construction	5/20/1994	600	gpm		MI		Infiltration Trench	T12 N/R06 E-28
G2-29050	TPUD Acquisitions LLC	5/26/1994	100	gpm		DM		Well	T12 N/R01 W-04
G2-29054	Tacoma Orthotic & Prosyletic	6/3/1994	150	gpm		DM		Well	T13 N/R09 E-16
S2-29058	Morton City	6/24/1994	2	cfs		DM		Tilton River	T13 N/R04 E-35
G2-29073	DeGoede Bulb Farm Inc	7/7/1994	300	gpm		IR	135	Well	T12 N/R02 E-14

Control #	Name	Priority Date	Qi	UOM	Qa	Purpose <sup>a</sup>	Ir Acres	Source	TRS
S2-29088	Jeff Tornow	7/28/1994	0.06	cfs		WL		Coon Creek	T11 N/R02 W-14
S2-29107	Richard Fifer	8/23/1994	0.02	cfs		DS, IR	10	Unnamed Spring	T13 N/R03 E-22
G2-29113	Donald Brule	8/24/1994	600	gpm		IR	30	Well	T12 N/R02 E-21
S2-29111	Askin Land Co	9/6/1994	2.2	cfs		CI		Unnamed Pond	T11 N/R02 W-33
S2-29108	Donald Brule	9/14/1994	1.33	cfs		IR	30	Mayfield Lake	T12 N/R02 E-21
S2-29118	Timothy Stroup	9/28/1994	0.02	cfs		DS		Unnamed Spring	T13 N/R03 E-22
S2-29136	Tod Reichert	10/17/1994	0	cfs		DS		Unnamed Source	T12 N/R02 E-05
S2-29141	William Boston	10/28/1994	0.1	cfs		PO		Unnamed Stream	T12 N/R08 E-11
G2-29150	Farwest Industries Inc	11/7/1994	400	gpm		DM		Well	T13 N/R09 E-01
G2-29169	Donald Brule	12/23/1994	100	gpm		DM		Well	T12 N/R02 E-21
G2-29192	W D S Co	2/27/1995	50	gpm		DM		Well	T12 N/R03 E-25
S2-29196	Dirk Havlak	2/27/1995	4	cfs		DS		Siler Creek	T12 N/R07 E-23
G2-29214	Timberlane Mobile Home Park	3/8/1995	60	gpm		DM		Well	T12 N/R02 W-27
S2-29224	Leo Closner	5/10/1995	0.01	cfs		DS		Cowlitz River	T11 N/R02 W-24
G2-29234	Leisure Time Resorts	6/6/1995	58	gpm		DM		Well	T12 N/R02 E-05

Control #	Name	Priority Date	Qi	UOM	Qa	Purpose <sup>a</sup>	Ir Acres	Source	TRS
G2-29253	Baileys Nursery Inc	7/27/1995	300	gpm		DS, IR	5	Well	T12 N/R02 W-27
S2-29310	Jon Vigre	10/2/1995	0.04	cfs		DS, ST		Unnamed Spring	T12 N/R02 E-07
G2-29319	Toledo City	11/8/1995	200	gpm		MU		Well	T11 N/R01 W-08
S2-29333	Western International Development	12/19/1995	1.5	cfs		DM		Cowlitz River	T11 N/R02 W-26
S2-29351	William Jennings	2/8/1996	0.01	cfs		DS, ST		Otter Creek	T12 N/R01 E-32
G2-29366	Jackson Hwy. Mobile Homes Estates	3/15/1996	155	gpm		DM		Well	T12 N/R01 W-04
G2-29386	Winlock Waters Lake 3 Inc	5/8/1996	42	gpm		DM		Well	T11 N/R02 W-11
S2-29389	Jerry Walstad	5/20/1996	0.25	cfs		DM, IR, ST	10	Cowlitz River	T11 N/R02 W-24
S2-29426	Les Bridgewater	9/27/1996	0.01	cfs		IR	15	Unnamed Spring	T12 N/R01 E-13
G2-29444	Goat Rocks Community Association	12/9/1996	105	gpm		DM		Well	T13 N/R09 E-11
S2-29456	Stephanie Vermeff	1/24/1997	0.06	cfs		DS, PO		Unnamed Spring	T12 N/R08 E-10
G2-29514	Arnold Haberstroh	8/14/1997	33	gpm		DM		Well	T12 N/R02 W-13
G2-29511	Arnold Haberstroh	8/14/1997	63	gpm		DM		Well	T12 N/R01 W-20
G2-29515	Albert Justice	8/28/1997	75	gpm		DM		Well	T12 N/R06 E-07
S2-29551	Jerry Pogue	10/9/1997	0.06	cfs		DM, FS		Unnamed Spring	T13 N/R03 E-19

Control #	Name	Priority Date	Qi	UOM	Qa	Purpose <sup>a</sup>	Ir Acres	Source	TRS
G2-29606	Andrew Rausch	3/18/1998	20	gpm		DS, ST		Well	T12 N/R01 W-28
G2-29626	Robert Carter	3/20/1998	37	gpm		DM		Well	T12 N/R01 W-23
G2-29608	Dan Sparks	3/24/1998	30	gpm		IR	6	Well	T12 N/R02 W-23
G2-29609	Noble Estates	3/25/1998	43	gpm		DM		Well	T12 N/R02 W-12
S2-29803	Robert Thode	4/8/1998	0.22	cfs	10	IR	140	Unnamed Stream	T13 N/R02 E-20
G2-29632	American Water Resources	4/15/1998	30	gpm		DM		Well	T12 N/R02 E-01
S2-29644	Lewis County Dept Of Community Services	4/16/1998	6	cfs		FS		Unnamed Pond	T11 N/R01 W-17
G2-29643	Lewis County Dept. of Community Services	4/16/1998	675	gpm		FS		Well	T11 N/R01 W-17
G2-29732	Lewis County PUD 1	5/22/1998	90	gpm		CI, DM, IR, RE	27	Well	T13 N/R09 E-16
S2-29761	Grace Hoyt	5/29/1998	0.02	cfs		DS		Nineteen Creek	T13 N/R05 E-19
G2-29736	John Hadaller	6/16/1998	15	gpm		DS, ST		Well	T12 N/R01 E-07
G2-29738	Joe Maggard	6/16/1998	40	gpm		DS, IR, ST	4.8	Well	T12 N/R01 E-07
G2-29737	Dorothy Wade	6/19/1998	15	gpm		DS, IR	5	Well	T12 N/R01 E-07
G2-29740	Volana Gleason	6/23/1998	100	gpm		IR, ST	60	Well	T12 N/R05 E-18
S2-29773	Volana Gleason	6/23/1998	0.05	cfs		DM		Minnie Creek	T12 N/R05 E-07

Control #	Name	Priority Date	Qi	UOM	Qa	Purpose <sup>a</sup>	Ir Acres	Source	TRS
S2-29739	Volana Gleason	6/23/1998	0.03	cfs		DM, ST		Unnamed Spring	T12 N/R05 E-18
G2-29741	Ronald Hamilton	6/25/1998	60	gpm		IR	0	Well	T13 N/R01 E-25
S2-29742	Gerald Goble	6/26/1998	0.02	cfs		DS		Minnow Creek	T12 N/R05 E-07
S2-29743	Ruth Brooks	6/30/1998	0.02	cfs		DS		Unnamed Spring	T12 N/R04 E-04
S2-29784	Verona Campobasso	7/7/1998	0.13	cfs		DS, IR, ST	0	Davis Creek	T12 N/R08 E-16
G2-29770	Robert Remole	8/11/1998	20	gpm		DS		Well	T12 N/R07 E-24
G2-29771	American Water Resources	8/12/1998	30	gpm		DM		Well	T12 N/R02 W-15
G2-29772	Lakeview Terrace Water Group	8/21/1998	89	gpm		DM		Well	T12 N/R02 E-16
G2-29798	Jeffery Ainsworth	8/27/1998	2250	gpm		IR	5	Well	T12 N/R08 E-16
S2-29797	Jeffery Ainsworth	8/27/1998	5	cfs		IR, ST	5	Unnamed Pond	T12 N/R08 E-16
G2-29789	Central Pacific Timber Product	9/8/1998	50	gpm		CI, DM		Well	T12 N/R02 W-01
G2-29800	Ilmar Orni	9/15/1998	25	gpm		DS, IR, ST	32	Well	T11 N/R02 W-06
G2-29799	Phillip Boreen	9/17/1998	50	gpm		IR, ST	20	Well	T11 N/R02 E-33
S2-29796	Dilgin Water Association	10/1/1998	0.06	cfs		DM		Unnamed Spring	T11 N/R01 W-08
G2-29806	American Water Resources	10/16/1998	30	gpm		DM		Well	T12 N/R01 E-13

Control #	Name	Priority Date	Qi	UOM	Qa	Purpose <sup>a</sup>	Ir Acres	Source	TRS
S2-29848	Dean Hill	4/8/1999	0.02	cfs		DS		Unnamed Spring	T11 N/R03 W-33
G2-29899	Gloyd Neilson	1/25/2000	100	gpm		ST		Well	T13 N/R01 E-36
G2-29905	Kenneth Olsen	3/20/2000	150	gpm		DM, IR, ST	65	Well	T12 N/R01 E-07
G2-29906	Ralph Allender	3/21/2000	9	gpm		DS, ST		Well	T11 N/R01 E-08
G2-29912	Dennis Neilson	4/11/2000	400	gpm		IR	160	Well	T12 N/R01 E-04
G2-29964	Gee Cee's Truck Stop	1/3/2001	120	gpm		CI, DM		Well	T11 N/R02 W-35
G2-29985	Lewis County Water Sewer District	4/27/2001	150	gpm	39.5	DM		Well	T12 N/R02 E-28
G2-30011	Shady Firs RV Park	8/3/2001	44	gpm		DM		Well	T12 N/R07 E-15
S2-30021	Fred Jones	9/19/2001	0.02	cfs		IR	10	Curtis Creek	T12 N/R02 W-31
G2-30022	Fred Jones	9/19/2001	20	gpm		DS, IR, ST	10	Well	T12 N/R02 W-31
G2-30024	Sidney Beck	10/8/2001	30	gpm		CI, DM, IR, ST	8	Well	T12 N/R04 E-01
G2-30051	Cowlitz Valley Mobile Park	3/19/2002	50	gpm		DM		Well #1	T11 N/R01 W-09
S2-30052	K/M Resorts/Maple Grove RV Park	3/29/2002	0.38	cfs		IR	0	Cowlitz River	T12 N/R07 E-17
G2-30076	Timberland Mobile Home Park	9/30/2002	60	gpm		DM		Well	T12 N/R02 W-27
G2-30179	Cardinal Glass Industries	2/27/2004	300	gpm		CI		Well	T12 N/R02 W-10

Control #	Name	Priority Date	Qi	UOM	Qa	Purpose <sup>a</sup>	Ir Acres	Source	TRS
S2-30189	Jeff O'Connell	4/9/2004	0.2	cfs		DS, IR	15	Unnamed Spring	T12 N/R05 E-29
G2-30227	Hampton Lumber Mills	2/14/2005	350	gpm	213	CI		Well	T12 N/R07 E-15
G2-30240	Glacier Estates LLC	4/1/2005	20	gpm	2	DM		Well	T12 N/R05 E-12
G2-30258	Mark King	5/18/2005	40	gpm	25	DS, IR, ST	9.5	Well	T11 N/R02 W-17
S2-30259	Terry Willis	5/24/2005	0.01	cfs		DS, IR	1	Unnamed Spring	T12 N/R02 E-24
S2-30282	William Morin	9/14/2005	0.07	cfs	1	DS, ST		Unnamed Spring	T12 N/R02 E-24
S2-30294	Jim Steveson	11/13/2005	0.02	cfs		FR, IR	.5	Cowlitz River	T11 N/R02 W-24
CG2-26370	Long Bell Ventures LLC	1/3/2006	150	gpm	83	CI, IR		Well	T12 N/R02 W-09
S2-30320	Dennis Crow	3/31/2006	2.25	cfs		DS		Unnamed Spring	T12 N/R02 E-24
G2-30324	Lewis Cnty Water District	5/15/2006	700	gpm	400	MU		Well	T12 N/R07 E-08
S2-30333	Robert Whitlow	6/9/2006	0.1	cfs	3	DM		Unnamed Spring	T12 N/R04 E-06
S2-30334	Robert Whitlow	6/9/2006	0.33	cfs	45	IR	5	Unnamed Stream	T12 N/R04 E-06
S2-30338	Richard Krause	7/7/2006	0.01	cfs	1	IR	1	Unnamed Source	T12 N/R04 E-06
G2-30389	James Tucker	3/9/2007	20	gpm		DS, IR	5	Well	T12 N/R01 E-10
CG2-009163CL	Todd Reichert	6/20/2007	60	gpm	40	DM		Well	T12 N/R01 E-12

Control #	Name	Priority Date	Qi	UOM	Qa	Purpose <sup>a</sup>	Ir Acres	Source	TRS
G2-30423	Juanita Kandi	7/30/2007	90	gpm		DM		Well	T12 N/R06 E-27
S2-30467	Kevin Kallansrud	4/2/2008	0.01	cfs		DS		Unnamed Spring	T12 N/R03 E-20
CG2-160667CL	Mickelsen Dairy	8/25/2008	70	gpm	32.26	CI, MU		Well	T12 N/R02 W-35
G2-30513	Lewis Cnty Water Dist 1	3/5/2009	92	gpm		CO, DM		Well	T12 N/R07 E-15
CG2-GWC1011(A)	White Pass School Dist #303	4/17/2009	110	gpm	70	DM		Hampton Well	T12 N/R07 E-15
S2-30537	Mayfield Lake Youth Camp	12/24/2009	0.02	cfs		DM		Unnamed Spring	T12 N/R02 E-27
CG2-23928	Winlock City	3/11/2011	100	gpm	58	MU		Well	T12 N/R02 W-34
CG2-GWC1385	Winlock City	3/18/2011	100	gpm	18	IR, MU		Mower well	T12 N/R02 W-34
<i>Totals for Qi and irrigated acres for irrigation water rights requests</i>			<b>9.05</b>	<b>cfs</b>					
			<b>TOTALS 4,520</b>	<b>gpm</b>			<b>1087.8</b>	Irrigated acres	
			<b>19.12</b>	<b>cfs</b>					

<sup>a</sup> – Purpose Codes

CO - Cooling for industrial purposes	FS - Fish Propagation	OT - Other
CI - Commercial and industrial manufacturing	HE – Heat Exchange	PO - Power
GP - Groundwater preservation	HP – Heat Protection for Crops	RE – Recreation and beautification
DG - Domestic General	HW – Highway	RW - Railway
DM - Domestic Multiple	IR – Irrigation	ST – Stock Watering
DS - Domestic single	Iflow – Instream flow	SR – Storage of Water



DY - Dairy	IT – Municipal Intertie System	TW-P – Trust Water Permanent
EN - Environmental Quality	MI - Mining	UN - Unknown
FP - Frost Protection	MU – Domestic Municipal	WL – Wildlife Propagation
FR - Fire Protection	No ID'd – No purpose identified	

## WRIA 26 COWLITZ COUNTY AGRICULTURE LANDS AND WATER

### ANALYSIS OF CURRENT CONDITIONS, PENDING WATER RIGHTS, AND FUTURE NEEDS

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#### **INTRODUCTION:**

The Planning Unit for Water Resource Inventory Areas (WRIAs) 25 and 26 in Southwestern Washington is re-evaluating selected data, assumptions and methods used to develop the 2006 Watershed Plan and the proposed Grays-Elochoman and Cowlitz Water Management Rules. In the course of this review several questions have been raised with regard to agricultural water needs, specifically:

- How much water will be needed for agriculture over the next 20 years;
- To what extent are existing agricultural water rights help to meet future needs;
- How much water has been requested through pending water rights applications; and
- Is there a need to set aside water in the water reservations for future agricultural needs and, if so, how much?

This memorandum documents the organizations contacted, data collected and scenarios explored in an attempt to evaluate potential future agriculture water needs.

#### **ORGANIZATIONS CONTACTED:**

In order to obtain as much information as possible, organizations that are associated with farming or agriculture in the region were contacted, including:

- Cowlitz County Extension
- Cowlitz/Wahkiakum Conservation District
- Clark County Extension
- Clark-Cowlitz Farm Bureau
- Lewis County Conservation District
- U.S. Department of Agriculture
- Washington State Conservation Commission
- Washington State Department of Agriculture
- Washington State Department of Ecology
- Washington State University Extension

These organizations were asked for information specific to past, present and future conditions related to total acreage of land in farms, average farm size, water use/demand and crops. While several organizations were able to provide observations and professional opinions on agricultural trends within WRIAs 25 and 26, little quantitative information was available. The organizations contacted frequently referred to the U.S. Department of Agriculture (USDA) Census of Agriculture as the best overall compilation of information.

#### **AGRICULTURE TRENDS IN COWLITZ COUNTY:**

The USDA Census of Agriculture for 1997 to 2007 was used to develop a picture of trends in agriculture in Cowlitz County. The USDA conducts the Census every five years by mailing forms to every farmer and rancher – regardless of the size or type of operation. Participation in the Census is required by law, and the information provides data on U.S. farms, ranches and the people who operate them which is helpful to those who provide services to farmers and rural communities. Although the USDA Census of Agriculture appears to be the leading source of facts and figures about

agriculture, several individuals advised that the data should be reviewed with some caution. Participation in the Census, although required by law, may be variable. Small details may not be picked up by the Census, for example small farms and minority farmers have historically been overlooked or under represented. However the USDA, in its last Census in 2007, has reportedly made a significant effort to collect information from these groups.

For all of Cowlitz County, the following trend information (Table A) for 1997 to 2007 was obtained from the latest Census (USDA 2007):

<b>Table A: USDA Census of Agriculture Summary for 1997 – 2007 Cowlitz County</b>					
	<b>1997</b>	<b>2002</b>	<b>2007</b>	<b>% Diff. 1997-2002</b>	<b>% Diff. 2002-2007</b>
Total Acreage in farms (acres)	31,103	39,582	30,702	+27%	-22%
Median Size of farm (acres)	89	74	64	-17%	-14%
Number of farms	349	532	481	+52%	-10%
Number of farms with irrigated lands	36	80	78	+122%	-2.5%
Percent of farms with irrigated lands	10.3%	15.4%	16.2%		
Land being irrigated (acres)	3,231	3,093	2,980	-4%	-4%
<i>Harvested cropland being irrigated (acres)</i>	<i>n/a</i>	<i>3,006</i>	<i>2,627</i>	<i>n/a</i>	<i>-13%</i>
<i>Pastureland and other land being irrigated (acres)</i>	<i>n/a</i>	<i>87</i>	<i>353</i>	<i>n/a</i>	<i>+306%</i>
Percent of total acreage in farms being irrigated	10.4%	7.8%	9.7%		

The Census of Agriculture data (Table A) indicates an increase in the total acreage in farms from 1997-2002 but with an almost equal decrease from 2002-2007. The median size of a farm continues on a decreasing trend since 1997. The number of farms increased from 1997 to 2002 but then decreased. The number of farms with irrigated lands grew from 1997-2002 but then decreased slightly after 2002. However the land acreage being irrigated continues to decrease. Fewer than 17% of the farms have irrigated lands and less than 11% of the total acreage in farms is being irrigated. Land being irrigated as cropland has decreased since 2002 but the percent of pastureland and other land being irrigated has increased. In Cowlitz County in 2007, 60% of the market value of products was livestock – mostly poultry and their products. The top three crop items by acreage were forage (hay, haylage, grass silage and greenchop), field and grass seed crops and vegetables harvested for sales (in 2007).

In addition to the Census of Agriculture, other sources of information were pursued for trend information with respect to agriculture in the County. The Cowlitz/Wahkiakum County Conservation District has observed overall increases in

small farm production. From 1989-1995 there appeared to be a large loss of larger agriculture enterprises. Since 1995, the loss has leveled off and a few large operations are beginning to start up with some existing operations expanding. Small farms appear to be increasing with a shift to organic and locally grown labels. This is a similar trend that was also observed in Lewis County by the Lewis Conservation District. The Conservation District noted that demand for water could increase if (1) greenhouse/hoop house operations (targeted by USDA cost share programs) increase, (2) existing operations continue to expand, and/or (3) dairies need additional water to comply with nutrient management regulations. The Conservation District has also noted a trend for farm operators to change their water source from streams to other sources of water. In 2010, the Conservation District assisted four operators with transferring to alternative water sources, which were domestic wells (Haupt, personal communication, 2010).

According to the Washington State Department of Agriculture, there are few Washington State certified organic producers in Cowlitz County. One producer has been certified since 2004 (or earlier) and an additional producer was certified in 2009 (WSDA 2010) for a total of two in the County.

Although a Comprehensive Plan can provide important information on how a community chooses to grow and where agricultural lands will be protected and encouraged, Cowlitz County has not updated their Comprehensive Plan since 1972 so the data is not considered to be applicable.

#### **TAXED AGRICULTURE RESOURCE LANDS IN COWLITZ COUNTY**

To calculate the acreage of agriculture lands in Cowlitz County, the County’s tax assessor’s office was contacted. The assessor has data on the acreage of land being taxed as agriculture. To qualify for the agriculture land type, a property needs to operate as that type for 3 of the previous 5 years. The Cowlitz County tax assessor provided the following data:

<b>Table B: Land Taxed as Agriculture in Cowlitz County</b>	
<b>Year Assessed</b>	<b>Agriculture (acres)</b>
1999	14,006
2004	13,466
2011	12,558
<i>Average</i>	<i>13,342</i>

From 1999-2011, the total taxable acreage in agriculture has decreased (- 11.5%) (Cowlitz County Treasurer, 2011)<sup>1</sup>. In addition, it appears that only about a third of the total acreage in farms reported in the Census of Agriculture are taxed as agriculture in the County.

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<sup>1</sup> Information was requested for years 2000 and 2005. The Assessor’s office provided reports submitted to the Department of Revenue for taxes payable in 2000 and 2005 yet the report says the assessment years are 1999 and 2004.

## **CURRENT WATER RIGHTS FOR IRRIGATION**

In Cowlitz County, the Census of Agriculture indicates that for a ten year period; between 10 and 16% of the farms irrigate some or all of their lands. State law requires that any use of surface water (after 1917) and groundwater (after 1945 –with some exceptions) receive approval from the state prior to using the water. The state approval is provided in the form of a water right or certificate. Thus, it is helpful to have an understanding of existing water rights and how that relates to agriculture data.

To estimate the quantity of water currently available for irrigation as water rights in Cowlitz County, Washington Department of Ecology (Ecology) queried their water rights database and prepared a spreadsheet (Appendix A of this document) of current irrigation water rights for WRIA's 25 and 26 (permits and certificates) (Ecology 2010). From that spreadsheet, the following was tabulated for the Cowlitz County portion of WRIA's 25/26:

### **WRIA 25**

- Total irrigated acres = 1,415 acres
- Total instantaneous withdrawal rate = 14 cubic feet per second (cfs)
- Total annual withdrawal quantity = 884 acre feet/year

### **WRIA 26**

- Total irrigated acres = 2,347 acres
- Total instantaneous withdrawal rate = 36 cfs
- Total annual withdrawal quantity = 4,652 acre feet/year

### **Total for Cowlitz County – WRIA's 25 and 26**

- Total irrigated acres = 3,762 acres
- Total instantaneous withdrawal rate = 50 cfs
- Total annual withdrawal quantity = 5,536 acre feet/year

These numbers cannot be reported without several qualifications. Not all the water rights are exclusively for irrigation (can also include stock and domestic use) and not all of the irrigation is for agriculture (can be for golf courses, schools, parks, etc.). Some water rights are limited with “low flow” provisions. It is not possible to determine the extent the current rights are being used. Delays in processing water rights may have discouraged the submission of additional applications. And finally, water used solely for agricultural production in this region is much less than other parts of the state with Table A indicating that only 9.7% of farm acreage was irrigated in 2007. For comparison, in Grant and Kittitas Counties, approximately 43% of the land in farms is irrigated, 30% in Chelan County and 29% in Benton County (USDA 2007).

From Table A, the Census of Agriculture data indicates that:

- 1997 – 3,231 acres land being irrigated in Cowlitz County (WRIA's 25/26)
- 2002 – 3,093 acres
- 2007 – 2,980 acres

Currently, there are active water rights for irrigation of 3,762 acres in comparison with the estimate of 2,980 acres being irrigated in 2007. However, as noted above, it is not possible to determine the extent the current water rights are being used.

## **CURRENT WATER RIGHTS APPLICATIONS**

The Washington State Department of Ecology tracks water right applications via the Water Rights Application Tracking System (WRTS). The data is updated on a monthly basis. The WRTS database was queried (April 2011) to obtain information regarding the applications submitted for water withdrawals in the WRIA 25 and 26 portion of Cowlitz County and resulted in the following information:

### WRIA 25

- Total irrigated acres = 4 acres
- Total instantaneous withdrawal rate = 2.33 cfs
- 12 applications for irrigation water rights have been submitted over an 18 year period (since 1993 )
- Water sources listed for irrigation include: unnamed spring (7), unnamed pond (1), well (4)

### WRIA 26

- Total irrigated acres = 33.13 acres
- Total instantaneous withdrawal rate = 0.81 cfs
- 14 applications for irrigation water rights have been submitted over a 13 year period (since 1996)
- Water sources listed for irrigation include: wells (6), Owl Creek (1), Coweeman River (4), Silver Lake (1), Delameter Creek (1), Unnamed Spring (1)

### Total for Cowlitz County – WRIA's 25 and 26

- Total irrigated acres = 37.13 acres
- Total instantaneous withdrawal rate = 3.14 cfs

These numbers cannot be reported without several qualifications. Applications should be viewed with care since requests are often for quantities greater than what is needed and/or greater than what Ecology will authorize. Not all water requests are exclusively for irrigation (i.e. stock watering) and not all irrigation water requests are exclusively for agriculture (i.e. golf courses, RV parks). Some applications may overestimate the amount of water needed and some may be for projects that are no longer being pursued. Acreage to be irrigated is not included in a few applications. And a few of the applicants have applied for duplicate rights to irrigate the same parcel of land from surface water and from ground water.

Census data indicates that from 1997 to 2007, 132 new farms were established in all of Cowlitz County. For the same period of record, 16 new applications for irrigation water rights were submitted for this same area. Even though Census data indicates that approximately 13 new farms were established per year, less than 2 water rights applications were submitted per year. This may mean that (a) farms are being divided up from larger farms with existing water rights or (b) farms do not need to irrigate or (c) farms are using water without authorization or (d) Census data collection has become more or less accurate or (e) some combination of all of these.

## **POTENTIAL FUTURE AGRICULTURE WATER DEMAND**

The annual growth rate in land being irrigated (Census of Agriculture) in Cowlitz County from 1997 to 2007 was approximately -0.81%. The annual growth rate in the acreage in farms was approximately -0.13%. Since agriculture is driven by the market for goods and is affected by climate, available labor and/or processing facilities, and growing season, it is difficult to determine with certainty how agriculture and its water needs will change over the next 20 years. The Census of Agriculture data indicates a decrease in irrigated lands but increases and decreases in total

acreage in farms. For this reason, several growth rates were used to explore the possible future water demands for associated irrigated agriculture lands (Table B and C).

	0.02% growth rate		0.5% growth rate		1% growth rate		1.5% growth rate		2% growth rate	
	Irrigated Land	Increase from 2007	Irrigated Land	Increase from 2007	Irrigated Land	Increase from 2007	Irrigated Land	Increase from 2007	Irrigated Land	Increase from 2007
Year	(acres)		(acres)		(acres)		(acres)		(acres)	
2010	2,982	2	3,025	45	3,070	90	3,116	136	3,162	182
2020	2,988	8	3,180	200	3,392	412	3,616	636	3,855	875
2030	2,994	14	3,342	362	3,746	766	4,197	1,217	4,699	1,719

Table B indicates that an additional 14 acres of land would be irrigated in 2030, assuming a constant annual growth rate of 0.02%. If the growth in irrigated lands occurred at a 2% annual rate, then 1,719 additional acres would be irrigated in 2030. This is an estimated increase from the year of the last Census of Agriculture – 2007 – when an estimated 2,980 acres were irrigated in Cowlitz County.

Irrigation water rights are defined by several parameters: number of acres, annual volume (Qa), maximum instantaneous withdrawal rate (Qi), and the length of the irrigation season. In setting the annual quantity of water (Qa) allowed by a water right, Ecology considers a number of factors including crop type, location, and irrigation efficiencies. To estimate the instantaneous rate of withdrawal (Qi) for irrigation, Ecology has long used a standard of 0.01-0.02 cfs/acre (surface water) and 5-10 gpm/acre (groundwater) (Ecology 1980). While exceptions exist, the use of this standard remains a generally accepted practice and has been affirmed by the Courts when adjudicating water rights (Crane, personal communication, June 2011).

For this estimation, using the potential increase in irrigated land for various growth rates (from Table B) and then applying 0.01 cfs/acre (an acceptable rate in Western Washington), results in the following water demands:

**Table C: Increase in Instantaneous Withdrawal at Various Growth Rates Assuming 0.01 cfs/acre  
Instantaneous Withdrawal Rate**

Year	.02% growth rate (cfs)	0.5% growth rate (cfs)	1% growth rate (cfs)	1.5% growth rate (cfs)	2% growth rate (cfs)
2010	.02	.45	.9	1.4	1.8
2020	.08	2.0	4.1	6.4	8.8
2030	.14	3.6	7.7	12.2	17.2

Table C indicates that an additional 0.14 cfs would be needed to irrigate an additional 14 acres in 2030 (at a 0.02% annual growth rate). At a 2% annual growth rate, an additional 17.2 cfs would be needed to irrigate 1,719 acres.

These numbers should also be viewed with caution since agriculture demand is driven by many factors. Census data showed a decrease in irrigated lands but with an increase in irrigation for pastureland and “other” land rather than harvested cropland. However, this information can be helpful in evaluating various options for planning purposes.

**SUMMARY**

Inquiries were sent out to numerous sources in an attempt to gain an understanding of the agricultural trends in the WRIA 25 and 26 portions of Cowlitz County. Little quantitative information was available, beyond what is provided by the USDA Census of Agriculture. In summary, the following information was collected:

- The number of farms in Cowlitz County increased (+27%) from 1997-2002 and then decreased (-22%) from 2002-2007 with the acreage of land in farms also following this trend.
- Total irrigated acreage has slowly decreased resulting in a net decrease of 251 acres or -0.81% annually between 1997 and 2007.
- Fewer than 17% of the farms irrigate their land and less than 11% of the total acreage in farms was irrigated in 2007.
- The largest value crop in the county is chickens.
- There have been observed increases in small farm production with some existing operations expanding.
- The Conservation District noted that demand for water could increase if (1) greenhouse/hoop house operations increase, (2) existing operations continue to expand, and/or (3) dairies need additional water to comply with nutrient management regulations.
- There are 2 Washington State certified organic producers in the County - only 1 was added since 2004.
- It is estimated that in 2010, there were 2,980 acres of irrigated lands in the WRIA 25 and 26 portions of Cowlitz County.
- Current active irrigation water rights for the WRIA’s 25 and 26 portions of Cowlitz County (permits and certificates) equate to 3,762 irrigated acres and 50 cfs (withdrawal rate). It is unclear whether all of these water rights are being exercised to their maximum extent or whether any of these permits/certificates have fallen into disuse.



- 26 applications for irrigation water rights for Cowlitz County have been submitted for 37 acres over an 18 year period .
- If demand for irrigated land were to increase at an annual growth rate of 0.02%, then 0.14 cfs would be withdrawn to meet the demand. If demand for irrigated land were to increase at an annual growth rate of 2%, then 17.2 cfs would be withdrawn to meet the demand.

#### ***NEXT STEPS***

Although this paper notes many caveats to using these demand estimates, the estimates can be helpful in providing some understanding of conditions. The Planning Unit should consider the trends in agriculture, existing water rights and their potential validity, pending water rights and their potential validity, and ways to meet future demand (including the transfer of existing water rights), when developing management options for meeting water demands for agriculture.

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**Appendix A:**

**Irrigated Lands Water Rights – WRIA's 25 and 26 Cowlitz County –**

**Washington State Department of Ecology**

Report Date: 12/3/2010

WRIA 25 File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-20906CWRI		Cert	4/2/1973	ST,IR	0.03	CFS	2	1	08.0N 02.0W 07	NW/NW	1	CLARK CREEK
S2-25875CWRI		Cert	4/22/1981	IR,DS	0.044	CFS	3	1	08.0N 02.0W 08	NE/NE	1	UNNAMED SPRING
S2-*19499CWRI	10035	Cert	3/7/1966	IR,DS	0.03	CFS	5	2	08.0N 02.0W 17	S2/SW	1	UNNAMED STREAM
S2-*07637CWRI	4443	Cert	2/14/1947	IR	0.4	CFS		40	08.0N 02.0W 18		1	DIT NO 6
S2-*09451CWRI	3705	Cert	3/11/1950	IR	1.8	CFS		260	08.0N 02.0W 19	NE/SW	1	CUTOFF SL *
S2-*09450CWRI	3704	Cert	3/11/1950	IR	2.8	CFS		370	08.0N 02.0W 30		1	SOLO SL
S2-*13709CWRI	7292	Cert	1/23/1956	IR,DS	0.03	CFS	4	2	08.0N 03.0W 02		1	COAL CREEK
S2-28797		Cert	3/29/1993	IR	0.006	CFS	0.13	0.4	08.0N 03.0W 02		1	UNNAMED SPRING
S2-00986CWRI	21669	Cert	11/28/1973	ST,IR	0.08	CFS	7	2.5	08.0N 03.0W 03	SW/SE	1	UNNAMED SPRING
S2-21669CWRI		Cert	12/28/1965	ST,IR	0.08	CFS	7	2.5	08.0N 03.0W 03	SW/SE	1	UNNAMED SPRING
S2-21209CWRI		Cert	5/15/1973	IR,FR	0.14	CFS	8	3.5	08.0N 03.0W 04	SE/SW	1	UNNAMED SPRING
S2-*21723CWRI	11177	Cert	7/28/1969	IR	0.01	CFS	1	0.33	08.0N 03.0W 09	SE/NE	1	HARMONY CREEK
S2-*12528CWRI	5777	Cert	8/24/1953	IR	0.09	CFS		9	08.0N 03.0W 09	NE/NE	1	HARMONY CREEK
S2-*04414CWRI	1829	Cert	5/28/1937	PO,IR	0.12	CFS		1	08.0N 03.0W 09	SW/SW	1	UNNAMED STREAM
S2-22066CWRI		Cert	2/22/1974	IR	0.02	CFS	6	3	08.0N 03.0W 10	NW/NW	1	UNNAMED STREAM
S2-00997CWRI		Cert	2/26/1971	IR	0.05	CFS	5	5	08.0N 03.0W 10	SW/NE	1	UNNAMED STREAM
S2-*03662CWRI	1059	Cert	6/27/1932	IR,DS	0.04	CFS		1.5	08.0N 03.0W 10	NW/NE	1	UNNAMED STREAM

WRIA 25 File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-*19945CWRI	10375	Cert	10/24/1966	IR,DS	0.01	CFS	2	0.5	08.0N 03.0W 11		1	COAL CREEK
S2-*14714CWRI	7236	Cert	3/24/1958	IR,FR	0.01	CFS	2	1	08.0N 03.0W 11		1	STEWART CREEK
S2-22046CWRI		Cert	2/11/1974	ST,IR	0.07	CFS	6	2	08.0N 03.0W 12	SE/SE	1	UNNAMED STREAM
S2-23258CWRI		Cert	6/17/1974	IR,DS	0.06	CFS	5	2	08.0N 03.0W 13		1	UNNAMED SPRING
S2-22260CWRI		Cert	3/28/1974	IR	0.01	CFS	2	1	08.0N 03.0W 13	SW/NW	1	DIT NO 6
S2-*16226CWRI	7971	Cert	8/1/1960	IR	0.01	CFS	1	0.5	08.0N 03.0W 13		1	DIT NO 6
S2-*17312CWRI	8840	Cert	5/28/1962	IR	0.82	CFS	164	82	08.0N 03.0W 14	NE/SE	1	UNNAMED SLOUGH
S2-27188AWCWRI		Cert	9/11/1987	IR,DS	0.06	CFS	2.5	4	08.0N 03.0W 16		4	UNNAMED STREAM
S2-23240CWRI		Cert	5/22/1974	ST,IR	1	CFS	222.5	209	08.0N 03.0W 16		1	FISHER ISLAND SLO
S2-*14516ALCWRI	09154A	Cert	9/23/1957	IR,DS	0.06	CFS	10	5	08.0N 03.0W 16		2	MYERS CREEK
S2-*12239CWRI	6751	Cert	4/7/1953	IR	0.1	CFS	20	10	08.0N 03.0W 16	NE/NE	1	UNNAMED STREAM
S2-*04565CWRI	1686	Cert	7/21/1938	IR,DS	0.02	CFS		1	08.0N 03.0W 16		1	MYERS CREEK
S2-23201CWRI		Cert	6/3/1974	IR,DS	0.05	CFS	3	1	08.0N 03.0W 17		1	COAL CREEK SLOUGH
S2-23072CWRI		Cert	8/12/1974	IR	0.67	CFS	57	28.5	08.0N 03.0W 23	SE/SW	1	SOLO SL
S2-*19631CWRI	9885	Cert	4/29/1966	IR	0.5	CFS	25	12.5	08.0N 03.0W 23	SE/SW	1	SOLO SL
S2-*12024CWRI	6521	Cert	2/2/1953	IR	0.11	CFS	24	12	08.0N 03.0W 23	S2/NW	1	UNNAMED SLOUGH

WRIA 25 File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-*10489CWRI	4946	Cert	7/12/1951	IR	0.6	CFS		60	08.0N 03.0W 26		1	SOLO SL
S2-*07773CWRI	3071	Cert	4/22/1947	IR	0.15	CFS		15	08.0N 04.0W 02	SW/NW	1	ABERNATHY CREEK
S2-00268CWRI		Cert	5/22/1967	IR,DS	0.1	CFS	13	6	08.0N 04.0W 03	SE/NE	1	SLIDE CREEK
S2-25628CWRI		Cert	6/27/1980	IR,DS	0.01	CFS	1	0.5	08.0N 04.0W 05	SE/SE	1	UNNAMED STREAM
S2-20783CWRI		Cert	2/21/1973	IR,FR	0.03	CFS	4	2	08.0N 04.0W 05	NE/NW	1	UNNAMED STREAM
S2-*14751CWRI	8254	Cert	4/14/1958	IR,FS	0.085	CFS	10	6	08.0N 04.0W 05	SE/NW	1	UNNAMED STREAM
S2-20025CWRI		Cert	3/10/1972	IR,DS	0.06	CFS	6.7	3	08.0N 04.0W 08	SW/NW	1	SPRUCE CREEK
S2-20141CWRI		Cert	4/17/1972	IR,DS	0.02	CFS	2.9	1	08.0N 04.0W 08	SE/NW	1	SPRUCE CREEK
S2-*14422CWRI	7787	Cert	7/26/1957	RE,IR	0.1	CFS	10	5	08.0N 04.0W 08	SW/NE	1	UNNAMED SOURCE
S2-CV2P661	7787	CertChg	7/26/1957	RE,IR	0.1	CFS	10	5	08.0N 04.0W 08	SW/NE	1	UNNAMED SOURCE
S2-00992CWRI		Cert	2/13/1967	IR,DS	0.06	CFS	11	5	08.0N 04.0W 09		1	UNNAMED STREAM
S2-00993CWRI		Cert	4/11/1967	IR	0.1	CFS	20	10	08.0N 04.0W 09		1	UNNAMED STREAM
S2-*05311CWRI	1631	Cert	11/28/1940	IR,DS	0.02	CFS		1	08.0N 04.0W 11		1	UNNAMED STREAM
S2-*13710CWRI	7517	Cert	1/23/1956	IR,DM	0.07	CFS	12	6	09.0N 03.0W 26	SW/SW	1	HILL CREEK
S2-21116CWRI		Cert	6/1/1973	IR,DS	0.036	CFS	5	2	09.0N 03.0W 27	NE/SW	1	COAL CREEK
S2-23499CWRI		Cert	6/30/1974	IR	0.08	CFS	8	4	09.0N 03.0W 35	SE/NW	1	COAL CREEK
S2-22424CWRI		Cert	5/13/1974	IR	0.03	CFS	1	0.5	09.0N 03.0W 35	SE/NW	1	COAL CREEK

WRIA 25 File #	Cert #	Doc	Priority Dt	Purpose	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-20613CWRI		Cert	11/16/1972	IR	0.011	CFS	1	0.5	09.0N 03.0W 35	SW/SE	1	COAL CREEK
S2-*19149CWRI	9936	Cert	7/22/1965	ST,IR	0.04	CFS	5.5	2	09.0N 03.0W 36		1	CRINKLE CR *
S2-23333CWRI		Cert	6/25/1974	IR	0.075	CFS	6	3	09.0N 04.0W 23	S2/SE	1	GERMANY CREEK
S2-23256CWRI		Cert	6/14/1974	IR,DS	0.06	CFS	5	2	09.0N 04.0W 26		1	UNNAMED STREAM
S2-*09502CWRI	4508	Cert	4/1/1950	IR,DS	0.67	CFS		80	09.0N 04.0W 26		1	GERMANY CREEK
S2-*08321CWRI	5006	Cert	4/6/1948	IR	0.3	CFS		40	09.0N 04.0W 26	W2/NE	1	GERMANY CREEK
S2-23629CWRI		Cert	6/26/1974	IR,FS	0.02	CFS	4	3	09.0N 04.0W 35	NW/SW	1	UNNAMED SPRING
S2-23445CWRI		Cert	6/24/1974	IR	0.04	CFS	3	1.5	09.0N 04.0W 35	SW/NW	1	UNNAMED POND
S2-*13507CWRI	6669	Cert	7/1/1955	IR,DS	0.02	CFS	2	1	09.0N 04.0W 36		1	UNNAMED SPRING
G2-*08019CWR	5465	Cert	3/29/1966	IR	345	GPM	30	15	07.0N 02.0W 04		1	WELL
G2-27898		Cert	10/29/1990	IR	270	GPM	80	40	08.0N 03.0W 17	NW/SW	1	WELL
G2-21096CWRI		Cert	5/9/1973	IR,DS	12	GPM	3	1	08.0N 04.0W 08	SE/SE	1	WELL
G2-20330CWRI		Cert	6/22/1972	ST,IR	24	GPM	5.5	2	08.0N 04.0W 12		1	WELL
G2-*03092CWR	3529	Cert	3/17/1953	IR	150	GPM	30	15	09.0N 03.0W 26		1	WELL

**Appendix B:**

**CURRENT IRRIGATION WATER RIGHT & WATER RIGHT CHANGE APPLICATIONS PENDING  
WITH ECOLOGY– WRIA 26 Lewis County –**

**Washington State Department of Ecology**

Report Date: 4/4/2011



**WRIA 25 – Cowlitz County Applications**

File #	Person	Stat	Priority Dt	Purpose <sup>a</sup>	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-28755	Lauzon Edward	A	2/22/1993	ST,IR	0.01	CFS		0.5	08.0N 03.0W 08		2	UNNAMED SPRING
S2-28982	Huffman Richard	A	11/15/1993	DS	0.002	CFS			08.0N 03.0W 05		1	UNNAMED SPRING
S2-29105	Busack Lawrence	A	8/23/1994	IR	0.11	CFS		0	08.0N 04.0W 03		1	UNNAMED SPRING
S2-29417	Alger Robert	A	9/11/1996	ST,DS	0.03	CFS			08.0N 03.0W 08		1	UNNAMED SPRING
S2-29801	Baker Leslie	A	9/22/1998	DS	0.01	CFS			08.0N 04.0W 11		1	UNNAMED SPRING
S2-30034	Williams Charles	A	11/28/2001	DS	0.01	CFS			08.0N 04.0W 05		1	UNNAMED SPRING
S2-30495	Weyerhaeuser NR Company	A	10/10/2008	CI	1.11	CFS	30		07.0N 02.0W 03		1	UNNAMED POND
S2-30520	Workman Robert	A	5/8/2009	DS	0.02	CFS			09.0N 04.0W 36		1	UNNAMED SPRING
G2-29106	Busack Lawrence	A	8/23/1994	DM	40	GPM			08.0N 04.0W 03		1	WELL
G2-29490	Jones Lewis	A	6/2/1997	DS	5	GPM			09.0N 03.0W 36		1	WELL
G2-29719	Waddell Dale	A	7/6/1998	ST,IR	15	GPM		3.5	08.0N 04.0W 08		1	WELL
G2-30572	Pacific Lumber & Shipping LLC	A	5/11/2011	FR	400	GPM			07.0N 02.0W 09	NW/SE	1	well

**WRIA 26 – Cowlitz County Applications**

File #	Person	Stat	Priority Dt	Purpose <sup>a</sup>	Qi	UOM	Qa	Ir Acres	TRS	QQ/Q	Src's	1stSrc
S2-29378	Foster Robert	A	4/22/1996	IR	0.03	CFS		0.33	07.0N 01.0W 17		1	OWL CREEK
S2-29791	Miller Gary	A	4/30/1998	ST,IR	0.22	CFS		2.2	08.0N 01.0E 18		1	COWEEMAN RIVER
S2-29802	Nelson Richard	A	9/21/1998	IR	0.06	CFS		3	08.0N 01.0E 22		1	COWEEMAN RIVER
S2-29858	Trotter Marion	A	6/21/1999	IR	0.01	CFS		1.5	09.0N 01.0W 03		1	SILVER LAKE
S2-29927	Dimmitt Janis	A	7/17/2000	IR	0.02	CFS		0.5	09.0N 03.0W 23		1	DELAMETER CREEK
S2-30512	Smith Kevin	A	2/17/2009	ST,IR	0.06	CFS		4.5	08.0N 02.0W 01		1	UNNAMED SPRING
S2-30549	Berlin John	A	6/8/2010	IR,FR	0.08	CFS			08.0N 01.0E 21	SW/NE	1	COWEEMAN RIVER
S2-30550	Berlin John	A	6/8/2010	IR,FR	0.08	CFS			08.0N 01.0E 21	SW/NE	1	COWEEMAN RIVER
G2-28729	Braykovich Ambrose & Carol	A	1/4/1993	IR,DS	10	GPM		2	07.0N 01.0W 18		1	WELL
G2-29299	Matz David	A	9/11/1995	ST,IR	14	GPM		0	08.0N 01.0W 14		1	WELL
G2-29651	Horn Mark	A	5/27/1998	ST,IR	29	GPM		1.5	07.0N 01.0W 30		2	WELL
G2-29681	Horn Georgia	A	6/16/1998	IR,DS	12	GPM		1.1	07.0N 01.0W 30		1	WELL
G2-30438	Scott Jeffry	A	10/11/2007	IR,DS	15	GPM	2.5	12	09.0N 01.0W 17	SW/SW	1	WELL
G2-30511	Smith Kevin	A	2/17/2009	ST,IR	30	GPM		4.5	08.0N 02.0W 01		1	Well

Totals for Qi and irrigated acres for irrigation water rights requests:

1.86 cfs

37.13 irrigated acres

570 gpm

**3.14 cfs**

<sup>a</sup> – Purpose Codes

CO - Cooling for industrial purposes	FS - Fish Propagation	OT - Other
CI - Commercial and industrial manufacturing	HE – Heat Exchange	PO - Power
GP - Groundwater preservation	HP – Heat Protection for Crops	RE – Recreation and beautification
DG - Domestic General	HW – Highway	RW - Railway
DM - Domestic Multiple	IR – Irrigation	ST – Stock Watering
DS - Domestic single	Iflow – Instream flow	SR – Storage of Water
DY - Dairy	IT – Municipal Intertie System	TW-P – Trust Water Permanent
EN - Environmental Quality	MI - Mining	UN - Unknown
FP - Frost Protection	MU – Domestic Municipal	WL – Wildlife Propagation
FR - Fire Protection	No ID'd – No purpose identified	



# **WATER ANALYSIS AND DEMAND FORECAST**

DRAFT

**February 2010**

**Lewis County  
Department of Community Development**

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from the Washington Department of Ecology

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## **Lewis County Department of Community Development**

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This study was conducted under the direct supervision of the following professional engineer:

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## Glossary

**Adjudication:** The formal process to establish a water right.

**Allocation:** The designation of a specific amount of water for a specific beneficial use.

**Appropriation:** The beneficial use of water of the state as authorized by and consistent with all applicable laws and regulations.

**Certificate:** The ultimate documentation of a formal water right.

**Claim:** Water use prior to adoption of the State Water Code and not covered by water right permitting or certification so are not adjudicated and involve some uncertainty.

**Class 1 Stream:** A perennial or intermittent stream that is used by threatened or endangered fish or larger numbers of other fish, or that is used as a direct source of water for domestic use.

**Instream Flow:** A level of stream flow, established under chapters 90.03, 90.22, 90.54 and 90.82 RCW, necessary in perennial streams to preserve wildlife, fish, scenic, aesthetic, and other environmental and navigational uses.

**National Flood Insurance Program:** Federally funded program providing flood insurance to property owners in flood plains provided the local government meets certain criteria for management of flood damage risk.

**Perfected:** A water claim established through beneficial use.

**Permit:** A status granted by Ecology through a formal process towards a water right after meeting the four-part test with a seniority date, place of use, point of diversion, and quantity.

**Permit-exempt Withdrawal:** Ground water withdrawal exempt from permit requirements under RCW 90.44.050 and not to exceed 5,000 gallons per day.

**Public Water System:** Any system, excluding a system serving only one single-family residence and a system with four or fewer connections all of which serve residences on the same farm, providing piped water for human consumption, including any collection, treatment, storage or distribution facilities under control of the purveyor and used primarily in connection with the system; and collection or pretreatment storage facilities not under control of the purveyor but primarily used in connection with the system.

**Reservation:** A one-time finite allocation of water for future beneficial uses.

**Sensitive Area:** Area in which development potential is limited by environmental factors such as steep slopes, wetlands, and valuable natural habitat.

**Urban Growth Area:** Area in which urban development must be contained, as stipulated by the Growth Management Act.

**Water Right:** A right to make beneficial use of public water of the state.

**100-year flood:** The magnitude of a flood likely to occur, on average, once every 100 years.

## Abbreviations

<b>CFR</b>	Code of Federal Regulations
<b>CIP</b>	Capital Improvement Program
<b>CWA</b>	Clean Water Act
<b>CFS</b>	Cubic feet per second
<b>DOH</b>	Washington State Department of Health
<b>DOE</b>	Washington State Department of Ecology
<b>EPA</b>	United States Environmental Protection Agency
<b>ERU</b>	Equivalent residential unit
<b>ESA</b>	Endangered Species Act
<b>FEMA</b>	Federal Emergency Management Act
<b>FPS</b>	Feet per second
<b>FWPCA</b>	Federal Water Pollution Control Act (“The Clean Water Act”)
<b>GMA</b>	Growth Management Act
<b>GPCD</b>	Gallons per capita per day
<b>GPAD</b>	Gallons per acre per day
<b>GPD</b>	Gallons per day
<b>MGD</b>	Million Gallons per Day
<b>mg/L</b>	Milligrams Per Liter
<b>NEPA</b>	National Environmental Policy Act
<b>OCD</b>	Washington State Office of Community Development
<b>OFM</b>	Washington State Office of Financial Management
<b>RCW</b>	Revised Code of Washington
<b>SEPA</b>	State Environmental Policy Act
<b>SRF</b>	State Revolving Fund
<b>UGA</b>	Urban Growth Area
<b>USFWS</b>	United States Fish and Wildlife Service
<b>WAC</b>	Washington Administrative Code
<b>WRIA</b>	Water Resource Inventory Area

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City of Toledo Water System Plan 2009  
City of Toledo General Sewer Plan 2008  
City of Vader Comprehensive Plan 2005  
City of Vader Water System Plan 2006  
City of Vader General Sewer Plan 2006  
City of Winlock Comprehensive Plan 2005  
City of Winlock Water System Plan 2007  
City of Winlock General Sewer Plan 2007



# 1. Introduction

## 1.1 Purpose

This report documents a review of plans and studies undertaken to compile information describing water supply and demand conditions and to support the development of a Regional Water Supply Plan for the South Lewis County Subarea. Lewis County and the Cities of Toledo, Vader, and Winlock along with other stakeholders are drafting a plan for future growth and development in the Subarea. As part of that process, infrastructure planning for public utilities and transportation is being conducted in anticipation of producing a regional capital facilities plan.

During the course of this study, two related events have occurred which will impact further planning for water systems in the subarea. The City of Toledo's 2009 Water System Plan has been approved by the state Department of Health and the Department has ordered the City of Vader to put its water system into receivership in order for major water quality issues to be resolved.

Figure 1-1 shows the general vicinity of Lewis County in relation to southwest Washington and to the South County Subarea. Figure 1-2 shows the South County Subarea with the three included cities and the urban growth areas as well as the principal streams and topographic features.

## 1.2 Approach

The South Lewis County Subarea is within the Lower Cowlitz River basin. This drainage basin is administered by the State of Washington through the Department of Ecology as a part of Water Resource Inventory Area 26 (WRIA 26) by virtue of the Watershed Planning Act (90.82 RCW), Water Resources Act of 1971 (90.54 RCW), Minimum Water Flows and Levels Act (90.22 RCW), Water Code (90.03 RCW), and Regulation of Public Ground Waters (90.44 RCW). A Watershed Management Plan (WSP) for WRIA 26 was completed in 2006. WRIA 26 includes portions of Lewis, Cowlitz, Skamania and Pierce Counties. Although a Regional Water Supply Plan for the South Lewis County Subarea will encompass only a small portion of WRIA 26, the Regional Plan will be guided by the goals and policies of the Watershed Management Plan. Two underlying policies are:

### **Policy**

#### **WSP-1:**

Public and private water users throughout WRIA 26 should have access to water resources to meet new or expanded needs for water supply consistent with adopted land use plans. To facilitate coordinated planning and ensure consistency with adopted land use plans, decisions regarding water use and allocation should be coordinated between Department of Ecology and affected jurisdictions.

**Policy**

**WSP-2:**

Water resource development to meet new or expanded needs should avoid or minimize effects on stream flows or aquatic habitat in stream reaches where flow conditions are an important factor for sustaining aquatic life, including fish populations in their various life stages.

The Watershed Management Plan forms the basic reference for development of the Regional Water Supply Plan through two primary steps comprising this phase of work:

First, this report was prepared to document existing conditions including the present population for the Subarea, current water use and the quantity of water believed to be available.

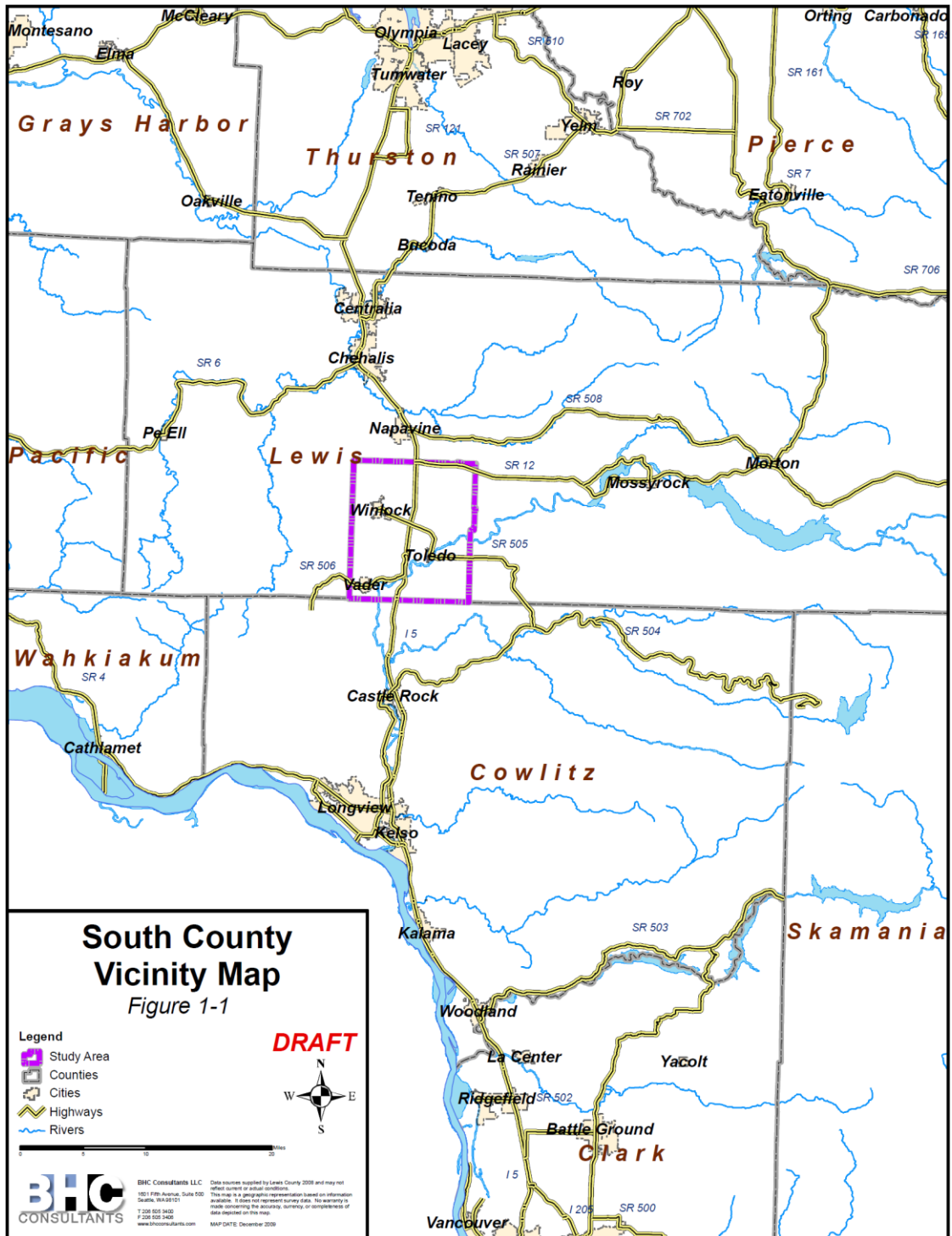
Second, future population and water use in the Subarea is projected to compare with the quantity of water believed to be available. Shortages and surpluses are identified and strategies are suggested to meet the projected demands.

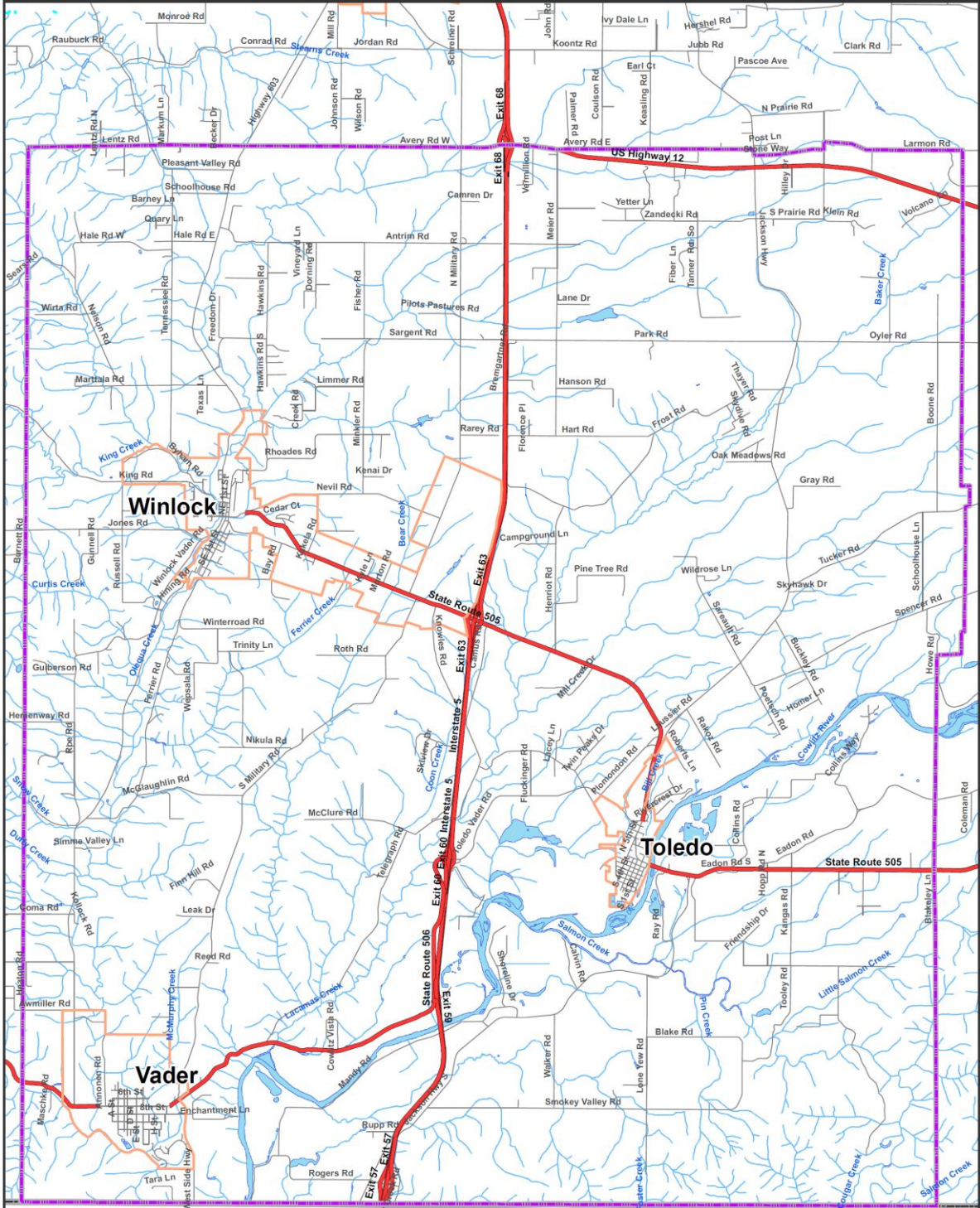
### **1.3 Objectives**

The subsequent Regional Water Supply Plan for the South Lewis County Subarea will set the stage for water right dedication, and necessary infrastructure improvements for the next 20+ years in the unincorporated County and the cities of Winlock, Toledo and Vader.

It will be consistent with the instream flow rule being promulgated by the Department of Ecology to implement the Watershed Management Plan for WRIA 25/26 through the Planning Unit of affected stakeholders.

The resulting Regional Plan will provide for the management of water resources to meet present and future needs of the South County communities, local economies as well as other non-municipal uses.








# South County Base Map

Figure 1-2

### Legend

-  SubArea
-  UGAs
-  Water Bodies
-  Streams

**DRAFT**



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## 2. Demographics

### 2.1 Background

The Washington State Office of Financial Management (OFM) develops annual population estimates for all counties, cities and selected special jurisdictions within the State of Washington. It also prepares 20-year growth management population projections for all counties. The Lewis County Planned Growth Committee uses the OFM projections to forecast and allocate population to the incorporated jurisdictions within the county as well as to the unincorporated portions of the county.

Population projections have also been developed for transportation, schools, and utility plans by the various jurisdictions and agencies within the South County Subarea. These include the following:

- Watershed Management Planning Unit
- Lewis County
- Cities of Toledo, Vader and Winlock

### 2.2 Population Trends

Table 2-1 summarizes a selection of OFM data relative to the South County Subarea.

**Table 2-1  
Historical Population in South County Subarea**

Year	Lewis County	Toledo	Vader	Winlock
2000 Census	68,600	653	590	1,166
2001	69,500	684	605	1,337
2002	70,200	685	605	1,335
2003	70,400	685	610	1,340
2004	70,700	685	595	1,340
2005	71,600	685	600	1,340
2006	72,900	685	615	1,350
2007	74,100	685	620	1,370
2008	74,700	690	625	1,360
2009	75,200	695	630	1,370
Percent Change	9.6 %	6.6 %	6.8 %	17.5 %

Generally speaking, the South County Subarea has grown at a slower pace than Lewis County as a whole. Much of the additional population shown in 2001 for Winlock resulted from an annexation.

### 2.3 Population Projections

OFM projections of future county population in a range of low, medium and high are summarized in Table 2-2. Note that the OFM estimated population for 2008 (Table 2.1) exceeds the Low Range projection for 2030.

**Table 2-2  
OFM Population Projections for Lewis County**

<b>Year</b>	<b>Low Range</b>	<b>Medium Range</b>	<b>High Range</b>
2000	68,600	68,600	68,600
2005	71,600	71,600	71,600
2010	69,596	77,544	87,858
2015	70,521	81,175	95,218
2020	72,230	85,988	104,304
2025	73,494	90,593	113,513
2030	74,100	94,696	122,443

These projections provide the basis for local decision-making with respect to countywide growth.

OFM does not provide projections for the individual cities comprising the Subarea. Table 2-3 summarizes some of the population projections prepared previously regarding the Subarea.

**Table 2-3  
Population Projections for South County Subarea**

	<b>Projected Year</b>	<b>Toledo</b>	<b>Vader</b>	<b>Winlock</b>
WRIA Watershed Mgt Plan	2020	1,280	905	1,907
County Planned Growth Committee	2025	1,131	885	4,550
City Comprehensive Plans	2025	1,102	1,406	4,561
Water System Plans for Cities	2025 to 2028	870	1,378	4,380
General Sewer Plans for Cities	2025 to 2028	880	953	4,113

Differences in projected populations in the planning documents do not mean the plans are inconsistent because each plan is prepared for a different purpose, resulting in a different service area and hence a different served population as described below:

- Comprehensive plans address the entire growth management area for a city and project the population for that area at the horizon date.
- Water system plans often address a service area extending beyond the UGA and may serve a larger population; however some parcels within the service area may remain served by private water systems.

- General sewer plans are restricted to serving within the UGA and should make sewers available to all parcels within the 20-year planning horizon; but many parcels may remain served by onsite systems and hence the served population may be less than the comprehensive planning population.

Table 2-3 shows the projected population in the comprehensive plans for all three cities exceeds the served population for both the city water and sewer systems. This may be because not all homes within the cities and UGAs are currently, or are not expected to be, served by municipal water or sewer utilities.

## **2.4 Reconciliations**

The Watershed Management Plan projects a 2020 population for Toledo that is 150 or more greater than all 2025 projections that were reviewed, although the Toledo Comprehensive Plan includes a projection using the UGA that is in line with the WRIA estimate.

The Watershed Management Plan population projection for Winlock is less than half the other forecasts for 2025 and 2030. The WRIA estimate was based on the smaller UGA in effect at the time that Plan projection was developed whereas the 2025 and 2030 Winlock projections are based on the current UGA demand. The projection for the smaller UGA would have been in line with the City's projected population prior to increasing the UGA. The only other projection that appears questionable is the population projection for the Vader Comprehensive Plan based on the sewer plan analysis, which is 1,406 for 2025 and is more than 500 higher than the Lewis County Planned Growth Committee's (LCPGC) allocation of 885 people. Both the water system and sewer plans contain estimates that include the UGA and Enchanted Valley Country Club that are similar to the Comprehensive Plan projection.

The annual growth rate between 2009 and the 2030 medium OFM projection is about 1.1 percent. Using the OFM high estimate, the annual growth rate would be about 2.35 percent. Comparatively, the annual growth rates for the three South County cities as indicated by the Watershed Management Plan is 4.3 percent while the rate reflected in the city comprehensive plans is about 4.7 percent.

Based on this analysis, it appears that a conservatively high 2030 estimate for the total population of the three cities should be in the range of 5,000 – 6,000. Since the remaining anticipated South County growth is expected to be predominantly commercial and industrial development, future water demand will not be based solely on population.

### 3. Water Sources

#### 3.1 Watershed Management Plan

The Gray-Elochoman and Cowlitz Watershed Management Plan, July 2006, addresses both WRIA 25 and WRIA 26. The Lower Cowlitz River is defined as a subbasin within WRIA 26 as encompassing an area of about 456 square miles as shown in Figure 3-1. The northern portion of this subbasin lies within the South Lewis County Subarea.

Policy WSP-1 as stated in Table ES-6 of the Plan includes the following recommendation:

*The Planning Unit views the Cowlitz River as a significant regional resource. Due to the abundant supply in the mainstem Cowlitz River, the Planning Unit recommends that it be considered over other water resources tributary to the Columbia River in meeting future water supply needs. Use of the Cowlitz River should be consistent with the reservation quantity established for the River.*

Communities and industries are encouraged to explore a range of water source options that do not affect surface waters. However, in cases where no reasonable and economic alternative is available, communities should still be able to meet their needs. The 'reservation' offers a last resort after other possibilities have been exhausted.

If a water reservation is to be tapped, the water right applicant must demonstrate responsible management of the resource through off-setting actions, water conservation or similar efforts and must meet the usual requirements for a water right:

1. The water will be put to beneficial use
2. There is no impairment to existing or senior water rights
3. Water is available for appropriation
4. The requested water right is not detrimental to the public welfare

Where surface water is used as the supply source for domestic, industrial, or irrigation consumption there is an obvious, direct reduction in stream flows. A similar relationship often exists between groundwater withdrawn from wells and surface waters. Connectivity relationships between ground and surface water may be complex; however, pumping wells can reduce the flows in nearby streams. Consequently water supplies and stream flows must be considered together, which is the role of the Watershed Management Plan.

Within the watershed, some soils and geologic terrain have more hydrogeologic significance than others. Figure 3-2 illustrates the approximate areas most important for augmenting stream flows with water percolating through the soils. Areas with



moderate or lower significance to stream flows are also indicated. These areas of lower significance are less likely to have wells influenced by surface waters. Instream flows for WRIA 25/26 are being developed as Chapter 173-526 WAC by the Planning Group of stakeholders within the WRIA. This process began by classifying major streams within the WRIA as either 'open' (meaning some water is available for new appropriations) or 'closed' (meaning stream flows are normally insufficient for existing water allocations and no new allocations can be made). None of the streams within the Lower Cowlitz subbasin are 'closed' so some additional water may be available for appropriation – how much depends on the instream quantity that must be reserved to support the natural habitat.

Instream flows have not been established by the Department of Ecology for all streams. The focus is on streams with significant habitat potential for listed or endangered species. Instream flow determination for significant streams starts with a walk of the stream to identify a location with defined banks and a stream bed that can be surveyed to define the 'normal' water level and hence the flow rate. Stream flow requirements have been identified for listed or endangered species by calendar month in relation to the life cycle of each species. Flows recorded at the surveyed location are then plotted as a Flow Exceedance Probability Hydrograph as shown in Figure 3-3 for the Cowlitz River below Mayfield Dam.

The 'instream flow' for that location is defined by the stream flow required for the relevant listed or endangered species by calendar month in relation to the life cycle of that species. That flow rate varies and is plotted on the Probability Hydrograph. Water allocations are identified when the '50% Exceedance Flow' is above the 'Instream Flow'. Figure 3-3 identifies such a period between November 16 through February 29 for 832 cfs and a second allocation period for 357 cfs from July 1 through August 14. The stream is 'closed' during the remainder of the year.

The available water allocations are distributed as 'reservations' based on applications. The date of the application is significant; however, demonstration of 'beneficial use' is an important element of the application process which will include the following:

- Be an 'eligible User'
- Demonstrate an alternative source does not have less stream flow impact
- Provide at least 50% flow mitigation upstream of the impact
- Mitigate remaining flow depletion through habitat improvements

It also needs to be understood that water reservations once approved from the identified water allocations are not equivalent to a water right. Chapter 173-526 WAC includes provisions to review instream flows when conditions change and to make necessary revisions. Such condition changes could include changes in stream flow rates, water quality (temperature), or habitat issues involving listed or threatened species. The resulting revisions could mean a change to the reserved water allocations too.

Very small flow depletions (under 0.2 cfs) may be allowed outside of the reservation allocation. Unused flow and mitigation credit can be banked and transferred. The water reservation is reduced only for the unmitigated flow depletion.

Water conservation importance was reaffirmed in a 2003 amendment to RCW 90.03 which established water efficiency requirements. All users of waters of the state are affected by these requirements including municipalities, domestic systems, industries and agriculture. Conservation techniques may include replacing old pipe to reduce leakage; installing more efficient water showers, toilets, and appliances; as well as improved industrial and irrigation practices.

Water reclamation and reuse is encouraged for wastewater treatment facilities. Industrial applications may exist for year-round use of reclaimed water. Agricultural and landscape irrigation are seasonal uses; however, the irrigation season is also the season of low stream flows and use of reclaimed water may have significant habitat benefits.

### 3.2 Surface Waters

#### 3.2.1 Cowlitz River

A limited amount of flow data is available for the Cowlitz River within the South Lewis County Subarea. The sample below was extracted from USGS Surface Water Annual Statistics.

**Table 3-1**  
**Cowlitz River at Toledo, WA**  
USGS 14238800

<b>Monthly Mean Discharge in Cubic Feet per Second</b>					
<b>Period</b>	<b>1977</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>Mean</b>
Jan			10,720	9,481	10,300
Feb			9,452	15,120	12,300
Mar			4,298	11,290	7,790
Apr			4,654	5,939	5,300
May		6,707	6,075	6,850	6,540
Jun	1,939	5,429	8,610	9,406	6,350
Jul	1,873	3,270	3,693	3,938	3,190
Aug	2,105	2,776	2,280	2,491	2,410
Sep	2,142	3,910	2,432	2,373	2,710
Oct	2,487	6,247	5,327		4,690
Nov	12,830	7,507	8,166		9,500
Dec		12,990	11,280		12,100

Calculation Period: 1 June 1977 through 30 September 1982  
Lewis County, Washington Hydrologic Unit Code 17080005  
Latitude 46°26'19", Longitude 122°50'35" NAD27

Drainage area = 1,461 square miles  
 Gage datum 85.84 feet above sea level NGVD29

Existing surface water rights, meaning both permits and certificates, were summarized in Table 4-1 of the August 2001 WRIA 25/26 inventory. An excerpt of this table is shown as Table 3-2 for the Lower Cowlitz River Subbasin.

**Table 3-2**  
**Summary of Surface Water Rights**  
 Lower Cowlitz River in South Lewis County Subarea

<b>Category of Use</b>	<b>Number of Records</b>	<b>Acre-Feet per Year</b>	<b>Max Gallons per Minute</b>
Domestic	90	116	1,123
Municipal	3	2,898	2,317
Commercial	5	2	539
Irrigation	113	2,748	12,927
Stock Watering	49	198	1,024
Fish Propagation	14	10	138,943
Recreation	8	83	2,317
Power	12	1,701	175,559
Other	14	7	691
Consumptive	274	5,969	18,620
Non-consumptive	34	1,794	316,819
Total-Primary	308	7,763	335,439
Supplemental	11	262	588
Irrigated Area	2,962 Acres		

Table ES-3 of the Watershed Management Plan summarizes the Water Right Reservations based on the instream flow determination, an excerpt of which for the Lower Cowlitz River is shown in Table 3-3 for the Subarea in Lewis County. The amount of water reserved for the various user classes is shown as the 'Depletion Allowance'. At least half of any stream flow depletion impacts must be offset through acquisition of active upstream water rights or other flow augmenting actions as shown by the 'Flow Augmentation Offset' quantities. All quantities are shown in cubic feet per second (cfs).

**Table 3-3**  
**Water Right Reservations for Lower Cowlitz River**  
 Flow in cubic feet per second

<b>Water User</b>	<b>Depletion Allowance</b>	<b>Flow Augmentation Offset</b>	<b>Target Depletion Allowance</b>
Winlock	0.33	0.165	0.165
Toledo	0.47	0.24	0.24
Vader	0.00	0.00	0.00
Small Community Systems	0.75	0.37	0.37
Domestic Wells	0.01	0.00	0.01
Other Beneficial Uses	6.60	3.30	3.30
Subtotal	8.16	4.075	4.075

Water right reservations are intended to provide for growth projected over the next 20 years. The reservations are over and above existing water rights.

As a comparison for the previous Table 3-1 regarding the Cowlitz River, Table 3-4 summarizes recent monthly flows downstream at Castle Rock.

**Table 3-4**  
**Cowlitz River Flow Record at Castle Rock**  
 Data in cfs for 1927 through 2007 (part)

<b>Month</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>Mean *</b>
Jan	11,230	13,140	9,903	25,750	14,670	14,200
Feb	15,210	11,770	6,077	15,500	10,330	12,800
Mar	15,760	9,412	6,721	9,195	15,340	10,800
Apr	12,690	6,772	7,734	8,188	13,340	10,200
May	7,149	5,615	7,029	7,455	6,957	10,500
Jun	4,718	5,764	5,625	7,204	5,039	9,440
Jul	3,699	4,209	3,593	4,580	3,334	5,350
Aug	3,178	4,263	3,337	3,402	3,106	3,000
Sep	3,205	6,121	3,368	3,684	3,158	2,860
Oct	4,313	7,432	4,158	3,886	---	4,710
Nov	8,117	8,839	11,390	26,000	---	11,000
Dec	12,080	11,000	12,080	16,540	---	15,300
Total	1,240,224	1,156,092	996,240	1,600,680	---	1,321,920

\*Note: Mean discharge encompasses flows recorded from 1927 through 2007

Table 3-4 indicates recent flows recorded for the Cowlitz River vary little from the mean of flows recorded over 80 years. However, past flow records are not necessarily indicative of future stream conditions. While some Washington rivers are reported to have experienced significant decreases in flow (the Yakima River being one example)

there is no suggestion in this record that significant change is expected for the Cowlitz River.

### 3.2.2 Creeks

A number of creeks exist within the Subarea, including Olequa, Lacamas and Salmon Creeks. All are tributary to the Cowlitz River. Instream flows have been established for three streams with potentially productive habitat for coho and steelhead as shown in Table 3-5 for the locations shown on Figure 3-4.

**Table 3-5**  
**Instream Flows for South Lewis County Subarea Creeks**  
(cubic feet per second)

Month	Olequa Creek	Lacamas Creek	Salmon Creek
January	129	93	145
February	160	118	178
March	160	118	178
April	160	118	178
May	160	118	178
June	107	79	118
July	107	79	118
August	48	33	55
September	193	140	217
October	193	140	217
November	193	140	217
December	129	93	145

Instream flows may be established for other creeks in the future, though no additions are currently intended.

### 3.3 Groundwater

Existing ground water rights, meaning both permits and certificates, were summarized in Table 4-3 of the August 2001 WRIA 25/26 inventory. An excerpt of this table is shown as Table 3-6 for the Lower Cowlitz River Subbasin and illustrated in Figure 3-5.

**Table 3-6**  
**Summary of Ground Water Rights**  
Lower Cowlitz River in South Lewis County Subarea

Category of Use	Number of Records	Acre-Feet per Year	Max Gallons per Minute
Domestic	48	442	2,021
Municipal	8	965	1,414
Commercial	4	2	539

Category of Use	Number of Records	Acre-Feet per Year	Max Gallons per Minute
Irrigation	90	6,321	28,291
Stock Watering	21	939	2,685
Fish Propagation	2	5,561	4,921
Consumptive	171	10,028	37,173
Non-consumptive	2	5,561	4,921
Total-Primary	173	15,589	42,094
Supplemental	10	9,658	6,766
Irrigated Area	3,312 Acres		

Water rights for non-municipal uses are required to be put to beneficial use within five years or the water reverts to the state. Water rights are issued for a specific use, or for multiple uses. Rights can be transferred to a different use through a process administered by the Department of Ecology. Each water right has an annual total withdrawal allotment expressed in acre-feet and a maximum instantaneous withdrawal rate expressed in gallons per minute.

Wells for small domestic systems withdrawing less than 5,000 gallons per day (gpd) or serving six or fewer residences are exempt from regulation and are not included in Table 3-6.

However, in closed watersheds with severe water shortages, courts have upheld the authority of the Department of Ecology to prohibit further water withdrawals and prohibit construction of further exempt wells. This condition does not presently apply to the South Lewis County Subarea.

### 3.4 Domestic Water Systems

#### 3.4.1 General

The Subarea contains four major water systems. The water systems for the Cities of Toledo and Vader serve the entire city limits and UGA. The water system for the City of Winlock serves the city limits and a portion of the UGA, and is planned to serve the large UGA that has been extended east to I-5. In addition to the Cities' water systems, there are a number of systems that serve residential and commercial developments in rural areas in the South Lewis County Subarea regulated by Washington Department of Health in the following classes:

- Group A includes community systems serving 15 or more residential customers for at least 180 days annually. In addition to cities, the systems may provide service to mobile home parks and subdivisions.
- Group A non-community systems provide water to the public other than residential, such as campgrounds, schools, and some commercial operations.
- Group B are smaller systems serving 2 to 14 residential customers

All of WRIA 26 includes approximately the following public water systems:

Group A community systems	39
Group A non-community systems	96
Group B systems	218

Available records are insufficient to determine how many of the above water systems are within the South Lewis County Subarea.

### 3.4.2 Toledo

Figure 3- 6 shows the approximate location of water rights and claims in relation to the City of Toledo, its' urban growth area and the immediate vicinity.

According to the December 2005 Comprehensive Land Use Plan for the City and March 2009 Water System Plan (WSP) update, the City water system has about 41,300 feet of water mains and a 250,000-gallon reservoir. Service began in 1929. The system presently serves 328 connections, including 12 outside the city limits, and about 720 people.

Two wells having a combined capacity of 255 gpm are the water source for the system. One entered service in 1974 and the other is older. The City has rights to 144-acre feet of water per year, which would be an average of about 128,000 gpd. The instantaneous demand right is 90 gpm. It is possible that the Department of Ecology may determine that one or both wells are influenced by surface water, which would require the City either to build a filtration plant or find a new water source, such as a new well not influenced by surface waters.

### 3.4.3 Vader

Figure 3- 7 shows the approximate location of water rights and claims in relation to the City of Vader, its' urban growth area and the immediate vicinity. The City has a water allocation from the Cowlitz River documented by Certificate 9616 with a priority date of 11 November 1972 for an instantaneous withdrawal rate of 0.5 cfs, which equals 244gallons per minute (gpm) or 323,000 gpd. No annual withdrawal quantity has been established, though the withdrawal rate equates to about 362 acre-feet annually.

A single 3 horsepower river pump delivers about 200 gpm to the water treatment plant as controlled by floats in the clear well. The water filtration system consists of dual 100 gpm units and a single backwash pump. Sodium hypochlorite is fed to the 60,000 gallon clear well for disinfection. The distribution system contains 5.5 miles of pipes and a 250,000 gallon reservoir.

The City of Vader provides water to the area residents. Recently, the City took over servicing the Enchanted Valley water system, which includes a 50,000 gallon reservoir. According to the Comprehensive Plan as amended in August 2005 and the 2006 WSP, there are 236 connections within the City to the water system, plus 9

outside the city and 99 in Enchanted Valley, for a system total of 344 connections. Only 10 of these total connections are non-residential.

The capital improvement program for Vader includes an estimated \$1.9 million for projects through 2025, although the recent State Department of Health order directing the Vader system into receivership may result in additional improvements.

#### 3.4.4 Winlock

Figure 3- 8 shows the approximate location of water rights and claims in relation to the City of Winlock, its' urban growth area and the immediate vicinity.

The City water supply and distribution system was privately developed beginning sometime prior to 1920. The City purchased the system in 1954 and has undertaken a number of subsequent improvements.

According to the 2005 amendment to the City of Winlock Comprehensive Growth Management Plan, the City water system has six wells. However, there is concern that the Ash Street well may be influenced by surface water and the Winolequa Park well is used exclusively for the park. The City currently has a water right allocation for 775 gpm and an annual allotment of 482 acre-feet, or about 430,000 gpd.

The October 2007 WSP Update states that the pumping capacity for the four operating wells totals 435 gpm. The distribution system totals about 11.6 miles of pipe. Two reservoirs are in service with a combined capacity of about 600,000 gallons.

Department of Ecology records indicate that water rights exist within the UGA expansion area totaling 557.4 acre-feet annually and 1,514 gpm for instantaneous withdrawal rights. However, these rights are not immediately available to the City. The process for transfer of water rights is lengthy, and the quantity transferred may be less than the existing water right.

Mount St. Helens High School is located on Military Road within the East UGA for the City. It currently has a separate water system.

#### 3.4.5 Exit 63

GIS information from Lewis County shows a water district located at Exit 63 of I-5 at S.R. 505, west of the freeway and south of the highway. No information describing this district is available. The Washington State Department of Health notes that there is a transient non-community well for the Winlock Shell service station (ID # 06226); however, there is no indication of a community water system serving other connections.



### 3.5 Conclusions

Existing water rights, meaning both permits and certificates for surface and ground water, were summarized in Table 4-3 of the August 2001 WRIA 25/26 inventory. An excerpt of this table is shown as Table 3-7 for the Lower Cowlitz River Subbasin.

**Table 3-7  
Summary of Water Rights for Lower Cowlitz River  
South Lewis County Subarea**

Category of Use	Number of Records	Acre-Feet per Year	Max Gal per Min
Domestic	138	558	3,143
Municipal	11	3,863	3,731
Commercial	9	1,363	3,300
Irrigation	203	9,069	41,218
Stock Watering	70	1,137	3,709
Fish Propagation	16	5,571	143,864
Recreation	8	83	2,317
Power	12	1,701	175,559
Other	14	7	691
Consumptive	445	15,997	55,793
Non-consumptive	36	7,355	321,740
Total-Primary	481	23,352	377,533
Supplemental	21	9,920	7,355
Irrigated Area	6,274 Acres		

Future development in the South Lewis County Subarea will focus on the three cities, their UGAs and potential economic development identified in the Draft Subarea Plan. Existing water rights for the cities as documented in their WSP are summarized in Table 3-8.

**Table 3-8  
Summary of Existing Municipal Water Rights**

Parameter	Toledo	Vader	Winlock	Total
Annual total in acre-feet	144	362 (1)	482	988
Annual Average Use in gpd	128,000	323,000	430,000	881,000
Average Annual Production gpd	81,000	95,000	374,000 (2)	470,000
Remainder Available gpd	47,000	228,000 (3)	56,000	411,000

- Notes:
1. Instantaneous withdrawal as an annual total
  2. Including Cardinal Glass at average 80,000 gpd
  3. Annual withdrawal allotment at 50% of instantaneous, or 323,200 GPD

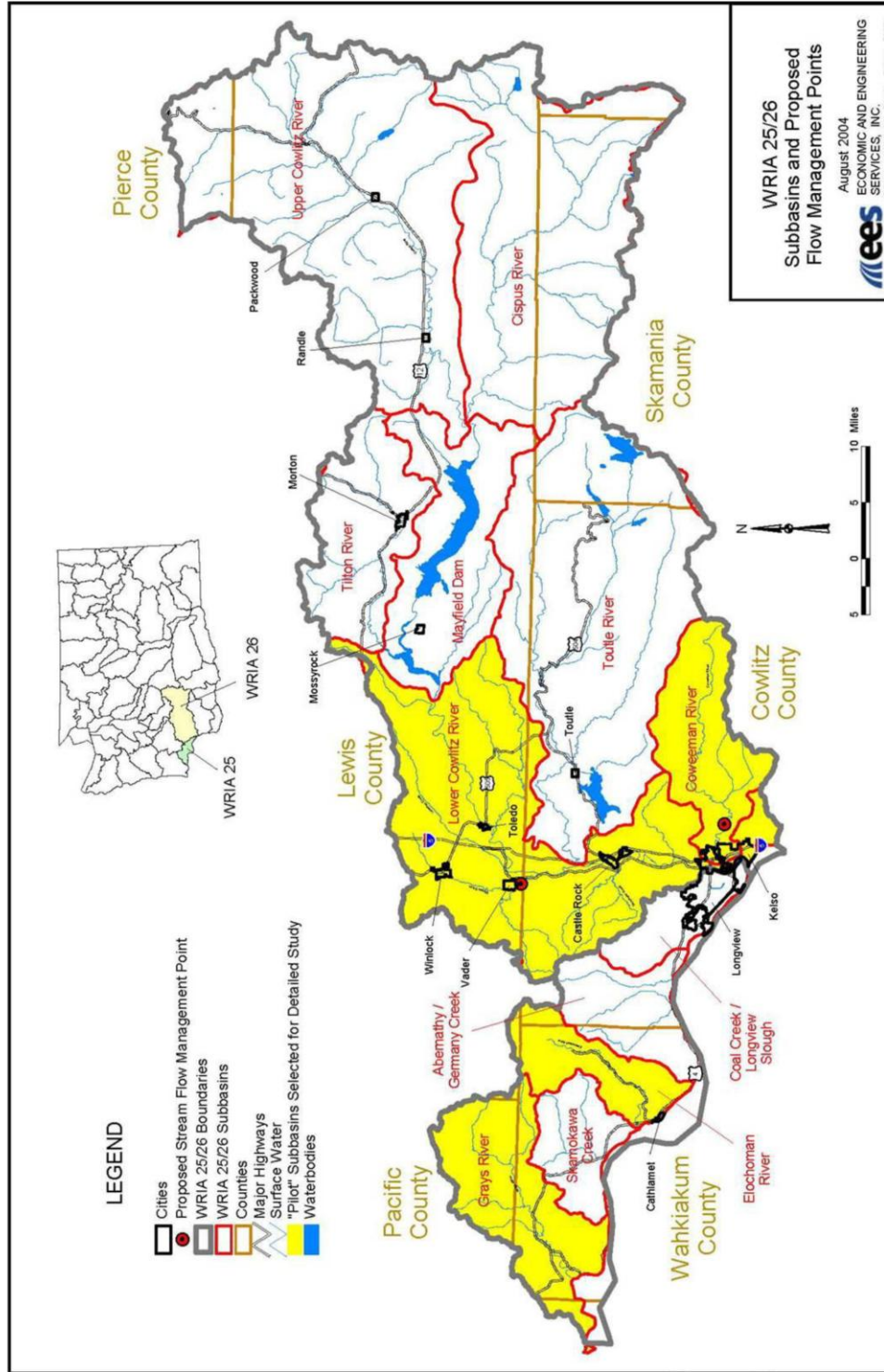
As noted in the Section 3.4 descriptions of each city's annual water production, water use, and projected future water use are not consistently for the same planning year. However, the data is sufficiently close in time for meaningful comparisons as shown

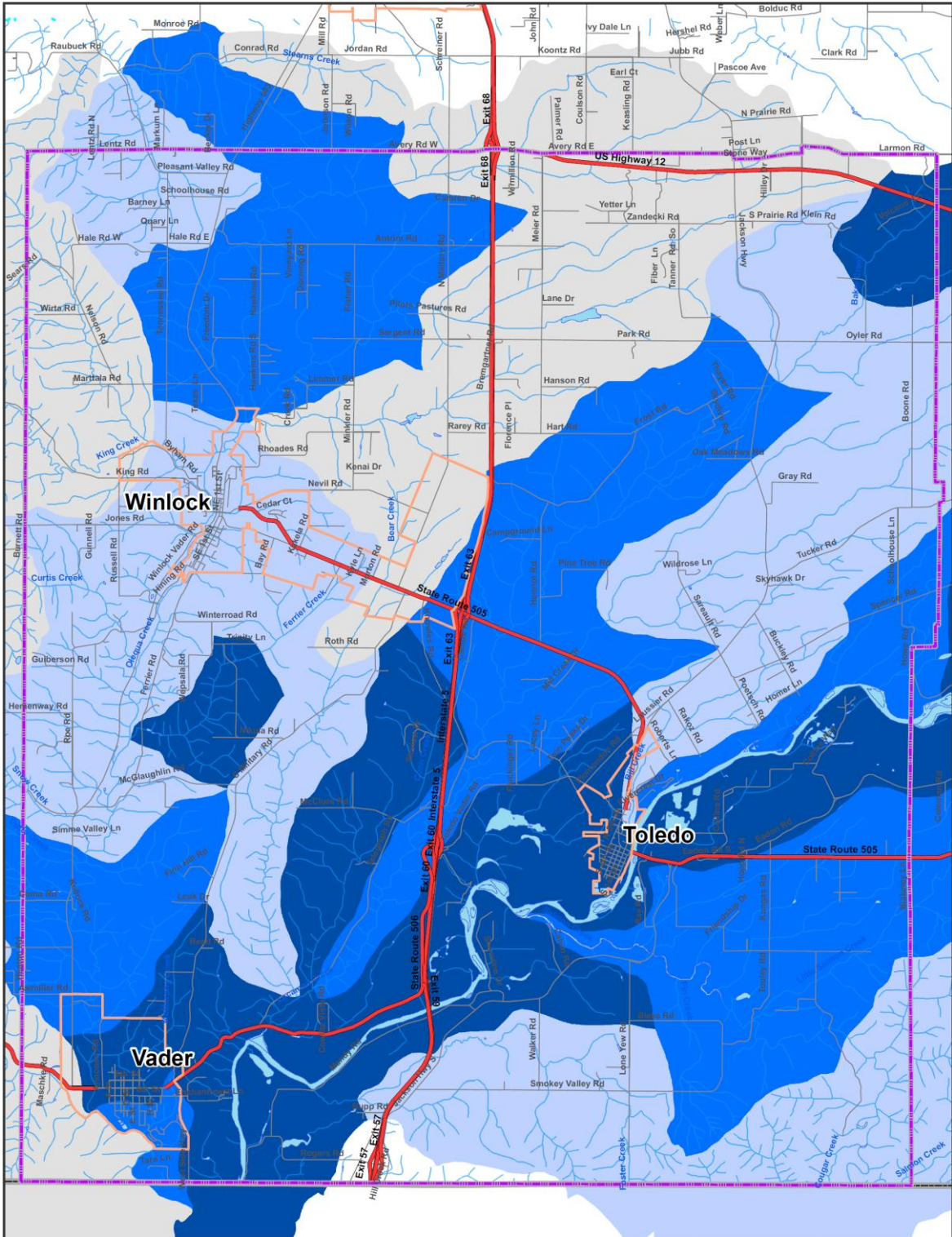
in Table 3-8. The comparisons indicate that the existing water rights available to the three municipalities will not be sufficient to meet the future demands projected by the cities.

Potential reservations for water allocations as summarized in Table 3-3 are additional to the actual water rights listed in Table 3-7. Water reservations potentially could add 0.80 cfs of available water to two of the three municipalities in the South Lewis County Subarea. Vader has not been assigned a reservation because the existing water right is adequate for projected needs. These reservations total about 517,000 gpd.

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Figure 3-1  
 WRIA 25 and WRIA 26  
 from WRIAs 25 and 26 Watershed Management Plan, Appendix G





# South County SubArea Importance for Hydrologic Process

Figure 3-2

- Legend**
- SubArea
  - UGAs
  - Water Bodies
  - Streams
  - Hydro Process Importance: Low
  - Hydro Process Importance: Moderate
  - Hydro Process Importance: Moderate-High
  - Hydro Process Importance: High

**DRAFT**



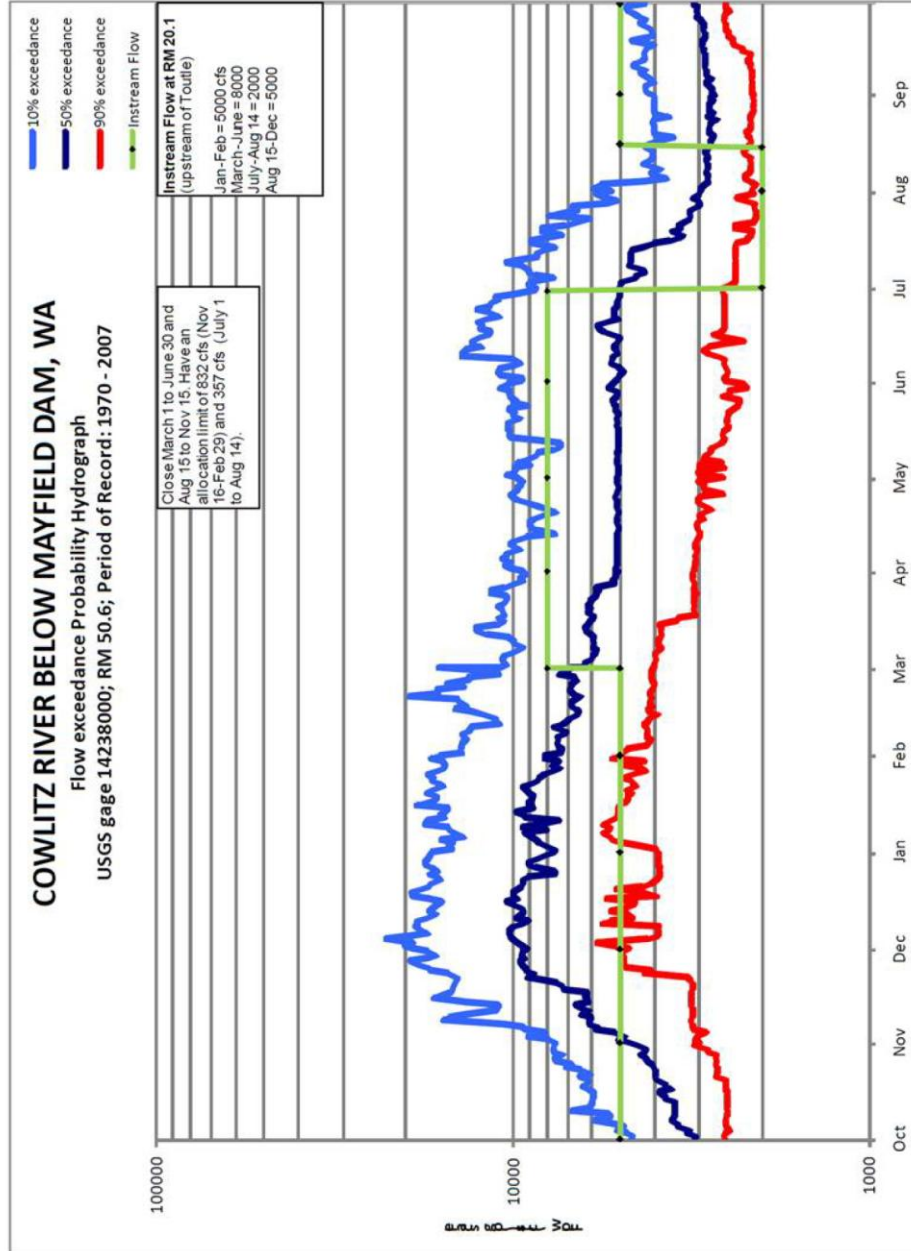
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 Seattle, WA 98101  
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 F 206 505 3406  
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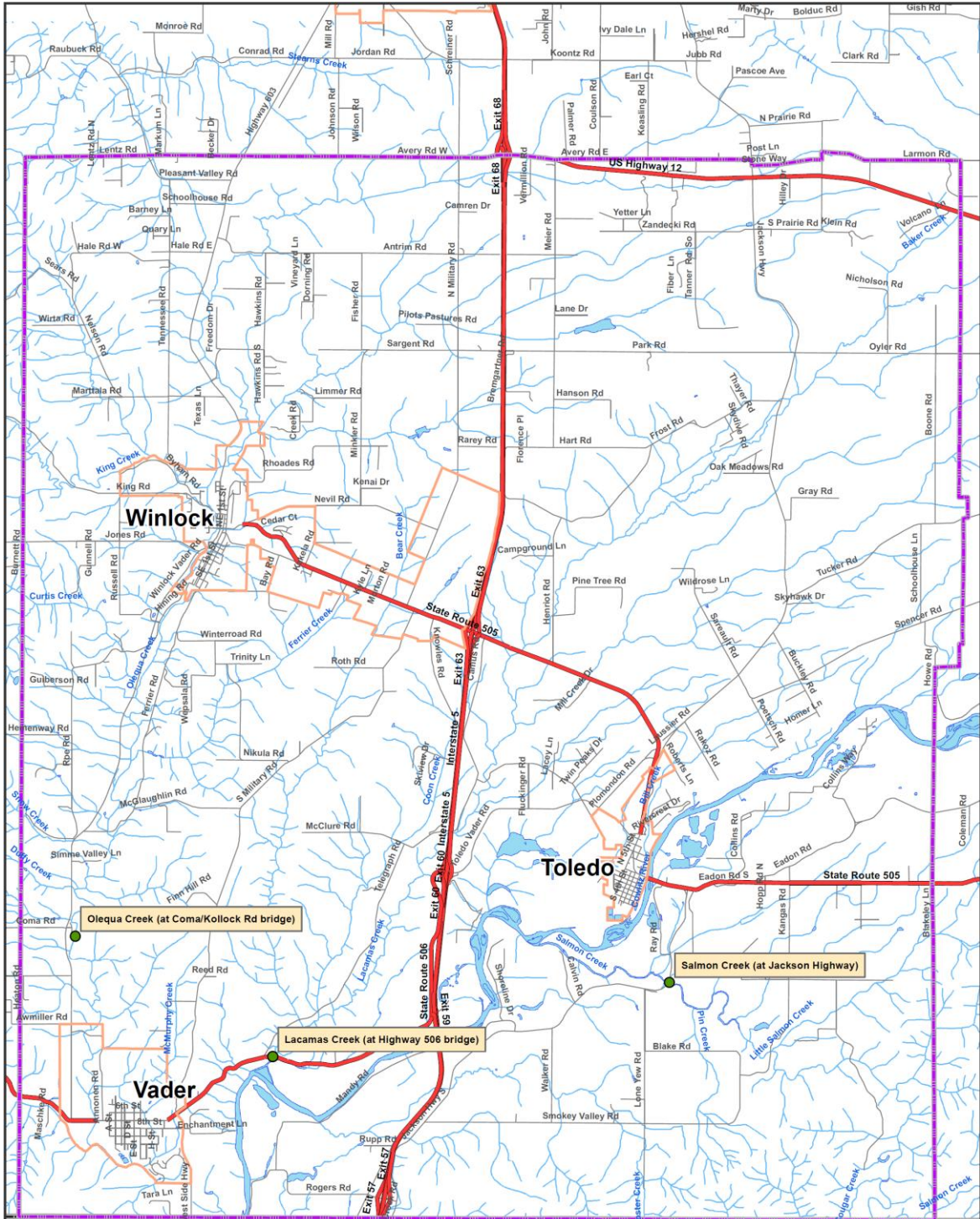
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MAP DATE: November 2009



Figure 3-3  
 Instream Flows and Allocation Limits  
 recommended by Lower Columbia Fish Recovery Board





# South County Stream Management Control Points

Figure 3-4

- Legend**
- Control Points
  - SubArea
  - UGAs
  - Water Bodies
  - ~ Streams

**DRAFT**

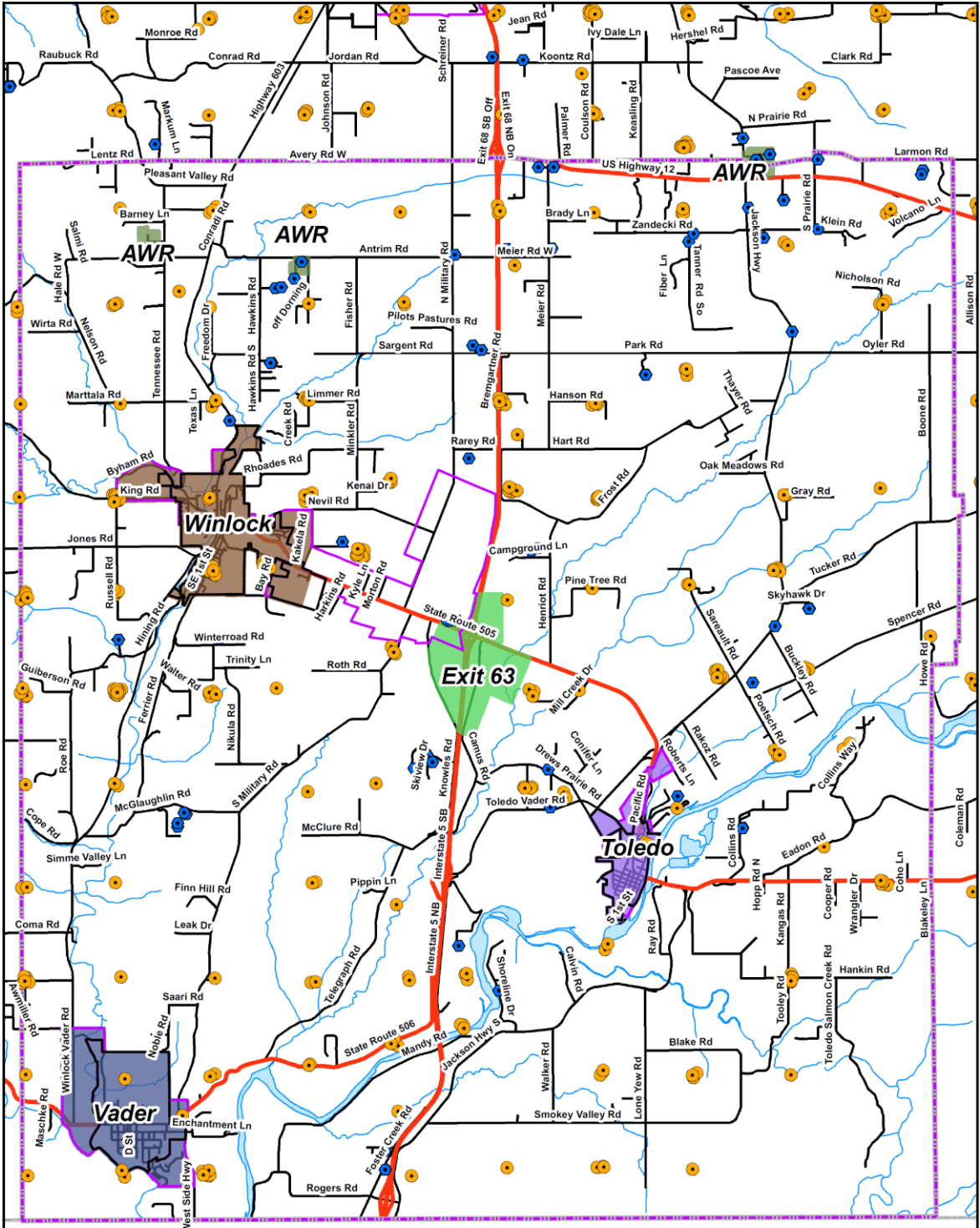


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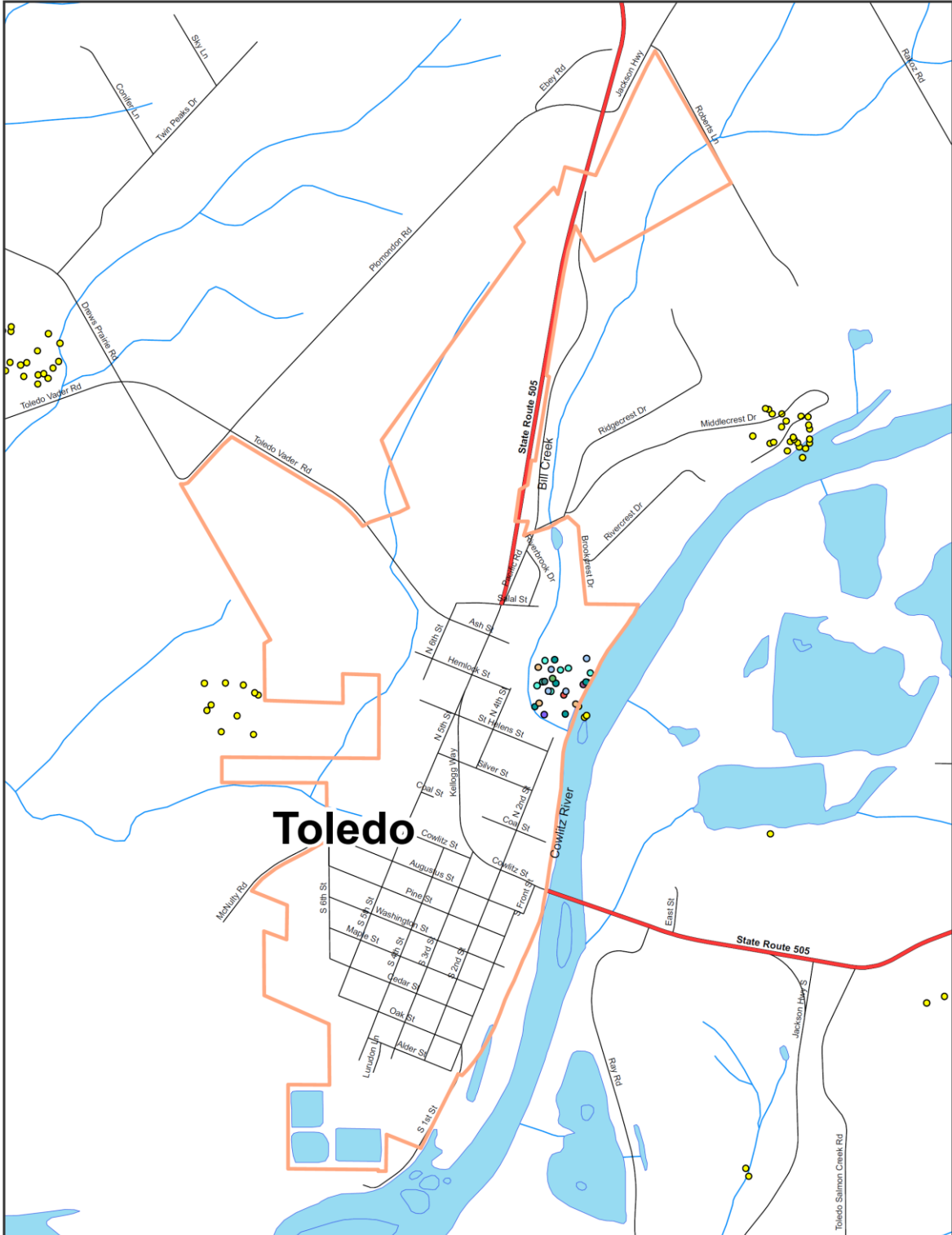
# South County SubArea Water Districts and Water Rights

Figure 3-5

- Legend**
- SubArea
  - UGA
  - City Limits
  - Water Rights
  - Wells
  - Water Bodies
  - Streams
  - Water Systems
  - AWR
  - Exit 63
  - Toledo
  - Vader
  - Winlock

**DRAFT**





**South County  
Toledo  
Water Rights**  
*Figure 3-6*

- Legend**
- UGAs
  - Not Identified
  - Bill Creek
  - Cowitz River
  - Infiltration Trench
  - Pond
  - Spring
  - Sump
  - Unnamed Stream
  - Well
  - Outside UGA

**DRAFT**



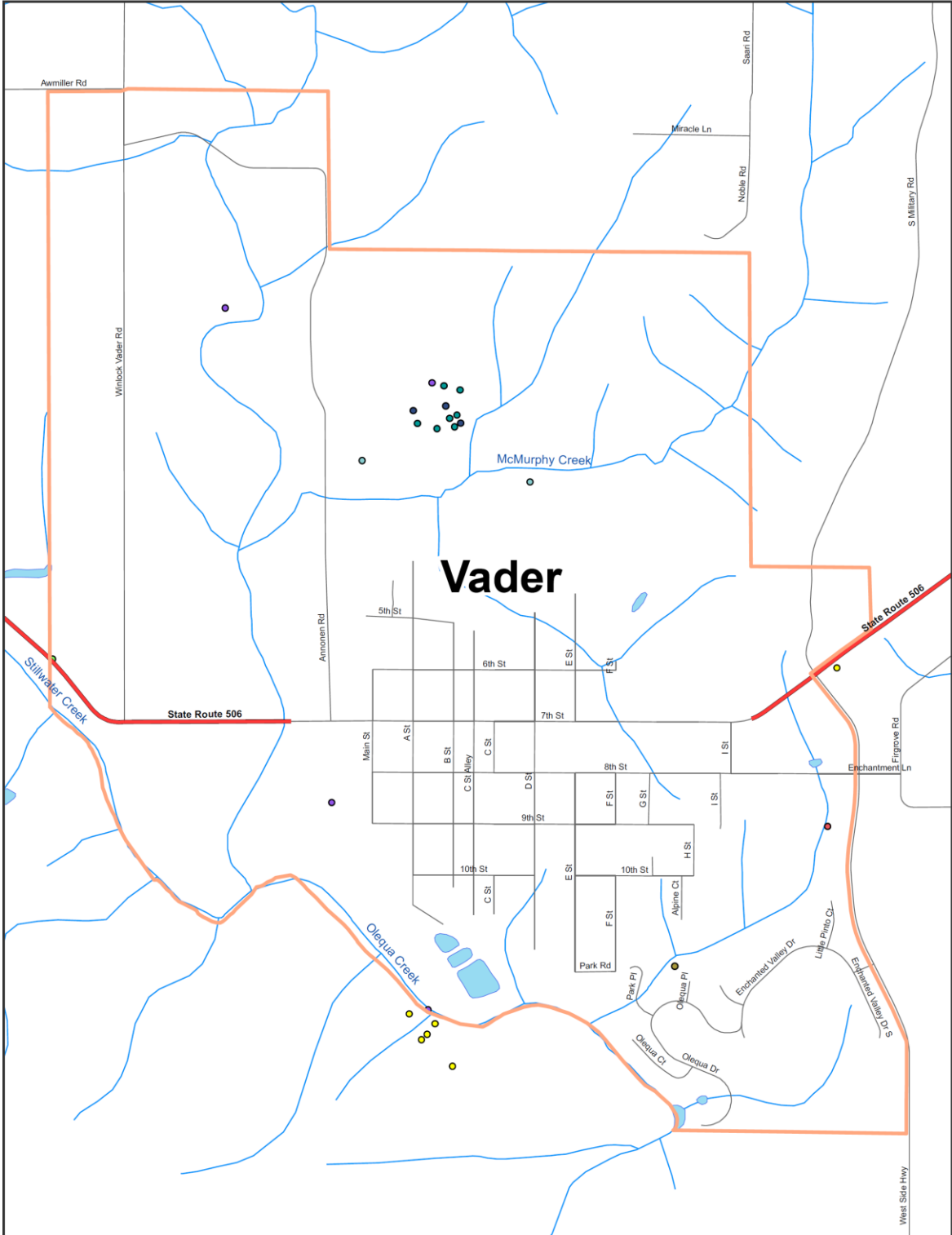
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MAP DATE: December 2009







# South County Vader Water Rights

Figure 3-7

- Legend**
- UGAs
  - Pond
  - Stillwater Creek
  - Unnamed Stream
  - Well
  - Outside UGA
  - Not Identified
  - McMurphy Creek

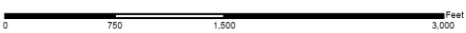
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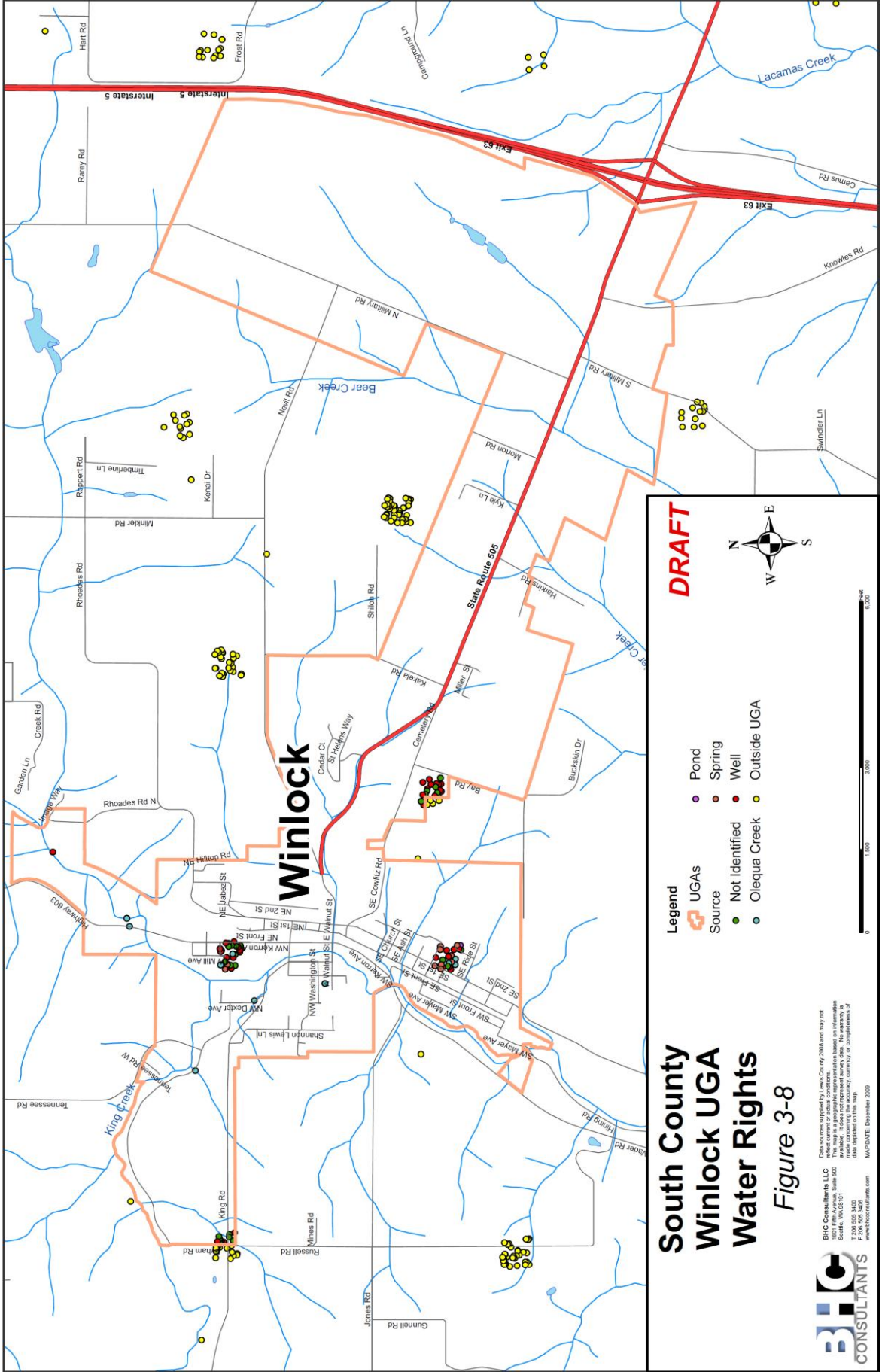


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MAP DATE: December 2009





**DRAFT**



- Legend**
- UGAs
  - Pond
  - Spring
  - Well
  - Outside UGA
  - Olequa Creek
  - Not Identified



# South County Winlock UGA Water Rights

Figure 3-8

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 MAP DATE: December 2008



## 4. Current Water Demand

### 4.1 Municipal Urban Growth Areas

#### 4.1.1 Toledo

Toledo has reported water consumption averaging approximately 70,100 gallons per day (gpd), or approximately 25.2 million gallons, or 77-acre feet, per year. Unaccounted water loss is reported in the 2009 WSP to have been reduced to an average about 13 percent.

Water production and consumption data from the 2009 WSP is summarized in Table 4-1 for three recent years.

**Table 4-1  
Toledo Water Production and Consumption**

<b>Parameter</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
Service Connections	328	328	331
Average Water Produced gpd	87,200	80,500	73,500
Average Water Billed gpd	68,030	69,680	63,700
Unaccounted Water gpd	19,170	10,820	9,800
Percent Unaccounted Water gpd	22 %	13 %	13 %
Water Billed per Service gpd	207	212	192

The 2007 average production of approximately 80,500 gallons per day (gpd), totaled approximately 29.4 million gallons, or about 90 acre-feet per year. Unaccounted water loss has been reduced to an average of about 13 percent. Additional conservation effort is desirable to achieve the state goal for unaccounted water to be less than 10 percent of production.

The 2009 WSP found single family residential units (ERU) averaged 266 services and used an average of 174 gpd. The remaining 62 non-residential connections totaled about 131 Equivalent Residential Units (ERU) for a total of 328 ERU.

#### 4.1.2 Vader

Water production and consumption data from the 2006 WSP is summarized in Table 4-2 for three recent years.

**Table 4-2  
Vader Water Production and Consumption**

<b>Parameter</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
Average Water Produced gpd	103,275	85,306	98,350
Average Water Billed gpd	55,327	56,326	61,571
Unaccounted Water gpd	47,948	28,980	36,779
Percent Unaccounted Water	46 %	34 %	37 %

The water system had an average daily demand of 95,000 gpd or 106 acre feet per year. This is an average water production of about 276 gpd per connection and about 168 gpd of actual water use per connection.

According to the State Department of Health, Vader loses about 40 percent of the total treated water volume, which is well above the State's standard of 10 percent. As a result, the Water system is operating at near-maximum capacity. The DOH order putting Vader's system in receivership will result in solutions to this problem.

#### 4.1.3 Winlock

Water production and consumption data as reported in the October 2007 Water System Plan for the City is summarized in Table 4-3.

**Table 4-3  
Winlock Water Production and Consumption**

<b>Parameter</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>
Average Water Produced gpd	255,285	293,627	343,686
Average Water Billed gpd	166,447	175,757	224,009
Unaccounted Water gpd	88,838	117,970	119,677
Percent Unaccounted Water	35 %	40 %	35 %

Note: 2007 data for January through August only

The water use data reported in the 2007 WSP Update listed 575 service connections totaling 1,198 equivalent residential units (ERU). The average day demand billed for the first 8 months during 2007 was about 187 gpd per ERU.

The City has begun supplying potable water to Cardinal Glass for industrial production. The agreement between the City and Cardinal provides for 154 acre-feet annually, averaging 137,000 gpd or 95 gpm. The peak instantaneous rated allowed is 125 gpm. The actual demand is reported to be averaging 50,000 to 90,000 gpd as the plant is more efficient than the typical glass plant used as the basis for the agreement.

However, the Department of Health email of 01/08/2008 states that the City does not have enough water to meet its 6-year goals and is unlikely to obtain additional water

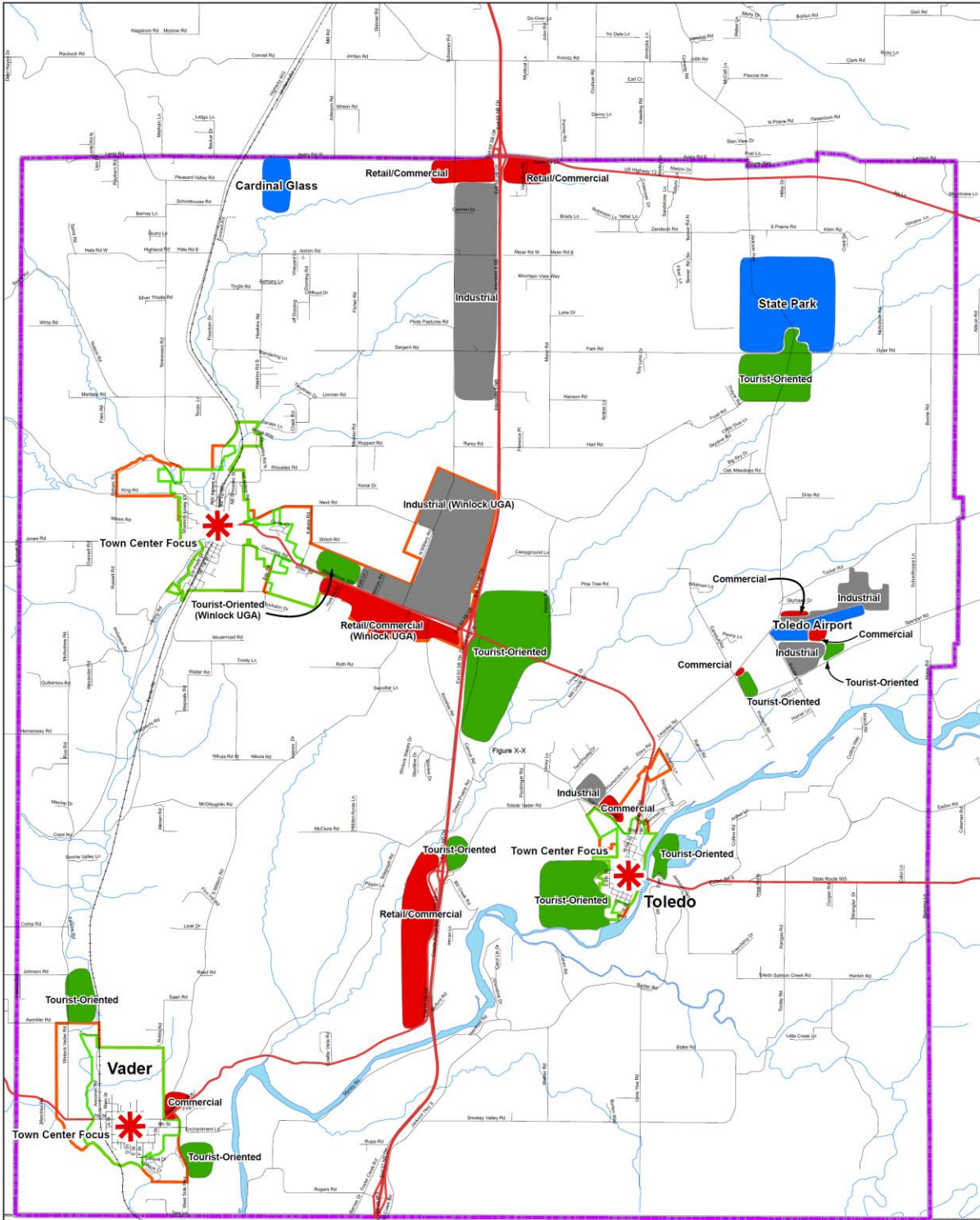
rights from Cardinal Glass. The email does note that the City has reduced unaccounted water to about 32 percent but this is still high and more conservation effort is needed.

#### **4.2 Non-Municipal Systems**

In addition to the three municipalities, the South Lewis County Subarea is served by other smaller water purveyors. These purveyors are not included in this analysis of water needs and availability; however, their presence is noted for future consideration:

- Class A water systems
- Class B water systems
- Toledo Airport
- Cowlitz Tribal Senior Housing

The South Lewis County Subarea planning process has identified potential locations for industrial, commercial, and tourism development that are being evaluated for potential adoption of comprehensive plan and zoning designations in 2010. The general areas conceptually envisioned are shown on Figure 4-1. None of this development currently exists so there are no current water demands.



# South County Phase 1 Draft Subarea Plan

Figure 4-1

Industrial Land: 1,500 - 1,600 acres  
 Tourism Land: 1,500 - 1,600 acres  
 Retail Land: 750 - 850 acres

### Legend

- Town Center Focus
- Existing Development
- Industrial Aggressive
- Retail Aggressive
- Tourism Aggressive
- SubArea
- Cities
- UGAs

**DRAFT**



## **5. Reliability**

### **5.1 Considerations**

Future water need projections are estimates based on forecasted changes in population, land use and economic development. Recognition that water is a finite resource that is becoming more expensive has encouraged conservation. Estimating water use per capita or in unit terms for economic development purposes for reliable long-term needs forecasting is complicated. At the same time, questions are rising regarding the reliability of water sources over time.

Climate change is a topic of intensive interest with considerable variations of opinion. Climate has never been a constant. It has always been changing; and reliable techniques to forecast long-term changes are unavailable.

It is generally accepted that human activities such as use of fossil fuels may affect surface runoff and groundwater recharge, and that the resulting pollution has water quality impacts to surface waters and groundwater. Various pollution control regulations and land use restrictions have been implemented to mitigate these impacts. However, population growth and economic development may add to pollutant totals even with increased treatment standards. The long-term consequences of human activity are not well understood.

### **5.2 Surface Waters**

The “Columbia Basin Climate Change Scenarios Project” of the University of Washington with funding from the Department of Ecology has used twenty different climate models to generate temperature and precipitation projections for a variety of watersheds in Washington. The results vary depending on the basin and the model; however, all show changes from the historic stream flow patterns. Generally speaking, rivers on the west slope of the Cascades, like the Cowlitz River, will have more rain during the winter with bigger, more frequent floods.

These models only address temperature and precipitation. More drastic change can be expected when land use within the watershed changes due to economic development, forest practices and population growth. These added changes will not only increase the peak and total runoff volumes but may also increase sediment and degrade water quality through added pollutant loads. These changes may lead to more regulatory requirements and increased treatment standards.

Increased temperature will affect habitat through warmer stream waters. Warmer temperatures will reduce the snowpack which will reduce the low stream flows during the summer months and further change the habitat.

These changes in stream flows may impair some junior water rights according to the ‘first in time, first in right’ basis incorporated into Washington water law.

Water quality sampling and testing technology is now able to detect minute concentrations of numerous extraneous materials in water samples. Humans continue to develop new and more complex pharmaceuticals, construction products and agricultural additives. These often show up as trace constituents in water samples. Future water production may require increased treatment to remove or neutralize these compounds.

### **5.3 Groundwater**

The Climates Impacts Group at the University of Washington released a report in February 2009 (mandated by House Bill 1303 in 2007) predicting a small increase in annual precipitation of 1 to 2 percent for the state. However, the precipitation is forecasted to occur as wetter autumns and winters with drier summers.

Increased population and economic development in urban growth areas and in rural areas are projected to need more water. Much of this may be withdrawn from groundwater and a higher quantity may be devoted to consumptive uses leaving less to return to the aquifers and streams. The result may lead to lower groundwater levels and declines in the water level observed in wells.

Since even rainwater often contains pollutants such as dust or acidity, many discharges into groundwater may carry pollutants. Some of these may appear in well water samples and may increase over time. As a result, the groundwater quality may change or degrade over time as well.



## 6. Future Water Demands

### 6.1 Municipal Demands

#### 6.1.1 Toledo

The March 2009 Water System Plan projected water demands through 2028 based on population increasing at an average of about 0.9 percent annually, which is higher than the 0.2 percent actually experienced in recent years. Water loss was initially projected to be 17 percent, was subsequently reduced to 13 percent. These projections are summarized in Table 6-1.

**Table 6-1  
City of Toledo Water Demand Forecast**

<b>Year</b>	<b>Population</b>	<b>ERU</b>	<b>GPD Billed</b>	<b>GPD Lost</b>	<b>GPD Demand</b>
2008	708	398	69,100	14,200	83,300
2010	724	405	70,500	14,400	84,900
2015	765	428	74,500	15,300	89,800
2020	808	453	78,800	16,100	94,900
2025	853	478	83,200	17,000	100,200
2028	870	493	85,800	17,600	103,400

Note: Water demands forecasted at 174 GPD per ERU

The adopted 2025 population projection for Toledo is 1,131. For 2030, we have used a population of 1,390. Assuming that each ERU continues to represent about 1.78 people, the projected water demand is revised as shown in Table 6-2.

**Table 6-2  
Revised Toledo Water Demand Projection**

<b>Parameter</b>	<b>2025</b>	<b>2030</b>
Projection Population	1,131	1,390
Equivalent Residential Units	638	785
Billed Water in GPD	111,000	136,600
Lost Water in GPD	16,500	20,300
Water Demand in GPD	127,500	156,900

6.1.2 Vader

The August 2006 Water System Plan for the City of Vader projects population growth and water demands through the 2025 as summarized in Table 6-3 at assuming 154 gpd per ERU, including the Enchanted Valley Country Club (EVCC).

**Table 6-3  
Water Demand Forecast for Vader**

<b>Parameters</b>	<b>2005</b>	<b>2011</b>	<b>2025</b>
Population	883	1,041	1,378
Equivalent Residential Units			
Residential in-city	242	288	406
Commercial	15	15	15
Church	1	1	1
Enchanted Valley CC	108	128	135
Total	366	432	557
Annual Average GPD Billed	61,600	66,500	85,800
GPD Lost	36,800	42,600	55,000
Average Annual GPD Demand	98,400	109,000	140,800

Note: Forecast assumes lost water continues to average about 39% of production

While the WSP indicates that the existing facilities are operating at near-maximum capacity, and the City will have to either analyze the system to identify and repair leaks and replace water meters; or build another water storage tank. The state DOH order putting the system in receivership will require further analysis of the system. This will likely require revising the capital improvement program that currently includes an estimated \$1.9 million for projects such as a third well, a new reservoir, and various repairs, upgrades, and replacements through 2025.

The South Lewis County Subarea planning process has estimated a 2030 population of 1,090 which is significantly less than shown in Table 6-3. The 2025 Planned Growth Committee allocation of 885 is less than the City’s Comprehensive Plan projection of 1,406 and the WSP projection of 1,000. Accordingly, water demand projections for Vader are revised as shown in Table 6-4 using the same 154 GPD per ERU and 39 percent for water loss with about 2.45 people per ERU.

**Table 6-4  
Revised Vader Water Demand Projection**

<b>Parameter</b>	<b>2025 WSP</b>	<b>2025 Subarea</b>	<b>2030 Subarea Plan</b>
Population	1,378	1,406	1,090
ERU	557	574	445
Water Billed GPD	85,800	88,400	68,500
Water Loss GPD	55,000	61,400	47,600
Water Demand GPD	140,800	149,800	116,100

Planning for water supply should consider the worst case projections, as well as those that may be more realistic.

6.1.3 Winlock

The October 2007 Water System Plan for the City includes population and employment projections for the east Urban Growth Area. It references the population projects for the main or existing City water system as unchanged from the June 2005 amendment to the August 2004 WSP using 2.95 people per ERU. These are summarized in Table 6-5.

**Table 6-5  
Winlock 2005 Projection of Population**

<b>Planning Period</b>	<b>Low Growth – 1.4%</b>	<b>Medium Growth – 1.8%</b>	<b>High Growth – 2.0%</b>
2003	1,448 people = 491 ERU		
2009	1,574 = 534 ERU	1,612 = 546 ERU	1,631 = 553 ERU
2023	1,912 = 648 ERU	2,069 = 701 ERU	2,152 = 729 ERU

The October 2007 WSP projects ERU to include the East UGA as shown in Table 6-6.

**Table 6-6  
Winlock Projection of Equivalent Residential Units**

	<b>Single Fam</b>	<b>Multi Fam</b>	<b>Commerc</b>	<b>Industrial</b>	<b>Public</b>	<b>Total</b>
<i>Existing in 2008</i>						
Main	465	59	132	612	12	1,280
East UGA	0	0	0	30	0	30
Total	465	59	132	642	12	1,310
<i>Six-Year Projection to 2014</i>						
Main	513	64	147	619	14	1,357
East UGA	0	0	59	324	5	388
Total	513	64	206	943	19	1,745

	Single Fam	Multi Fam	Commerc	Industrial	Public	Total
<i>Twenty-Year Projection to 2028</i>						
Main	677	81	193	641	18	1,610
East UGA	910	101	197	696	19	1,923
Total	1,587	182	390	1,337	37	3,533

Water demands were developed in the WSP through a series of water demand forecast worksheets for the years 2007 through 2027. Separate worksheets address the existing main system and the system proposed for the east urban growth area. Two scenarios are forecast for water losses from the main distribution system; and two levels of development for the east urban growth area. Water demands developed through the WSP were based on 2.57 persons per household and 216 GPD per ERU, 115 GPD per commercial employee and 65 GPD per industrial employee. These worksheets are summarized in Table 6-7 including 32 percent for water losses.

**Table 6-7  
Water Demand Forecast for Winlock**

Year	Main System		East UGA		Total System	
	ERU	GPD	ERU	GPD	ERU	GPD
<i>Low Scenario – water loss reduced to about 10 percent</i>						
2007	1,265	340,200	0	0	1,265	340,200
2027	1,610	347,300	1,923	454,200	3,533	801,500
<i>High Scenario – water loss remains at about 32 percent</i>						
2007	1,265	340,200	0	0	1,265	340,200
2027	1,610	507,900	2,139	459,000	3,749	966,900

Winlock expects high residential and industrial/commercial growth, which would increase the average daily demand from 340,000 gpd in 2007 to 967,000 gpd (1,080 acre-feet) in 2027. The City plans approximately \$14.1 million worth of capital improvement projects through 2013 to accommodate this projected development.

However, the Department of Health email of 01/08/2008 states that the City does not have enough water to meet the 6-year goals. No City water rights are currently available for the east UGA. The City has an agreement to obtain additional water rights from Cardinal Glass; however this is not likely to be accomplished in the foreseeable future.

The email also notes that the City has reduced unaccounted water to about 32 percent but this is still high and more conservation effort is needed. The high scenario shown in Table 6-7 for the Main System reflects a continuation of this loss rate. The low scenario forecasts reduction of the loss rate to about 10 percent.

## 6.2 Non-Municipal Water Demands

The conceptual locations of properties to be developed within the South County Subarea are shown on Figure 4-1. Development of these properties will require designation of additional urban growth areas. Aggregate land use for these areas is projected through the year 2030 in Table 6-8 for the approximate development types show on Figure 4-1.

**Table 6-8  
Projected Land Use in the Economic Development Area**

Land Use	Jobs	Acres	Square Feet
<b>Industrial</b>			
Manufacturing	2,000	365	2,445,000
Distribution	900	236	1,536,000
Subtotal	2,900	601	3,981,000
<b>Commercial</b>			
Retail	350	20	190,000
Office	1,590	80	866,000
Subtotal	1,940	100	1,056,000
<b>Tourism</b>			
Hotel	260	40	142,000
Entertainment	600	60	331,000
Subtotal	860	100	473,000
<b>TOTAL</b>	<b>5,700</b>	<b>801</b>	<b>5,510,000</b>

Economic development as projected in Table 6-8 is converted into a low range and a high range of water demands in Table 6-9.

**Table 6-9  
Range of Average Daily Water Demand  
for Non-Residential Economic Development  
(Draft South County Subarea Plan)  
Computed as Gallons per Day per 1,000 Square Feet**

	Low Range Average GPD		High Range Average GPD	
	GPD/1000 SF	Total GPD	GPD/1000 SF	Total GPD
<b>Industrial</b>				
Manufacturing	300	733,500	600	1,467,000
Distribution	30	46,080	50	76,800
Subtotal		779,580		1,543,800
<b>Commercial</b>				
Retail	100	19,000	300	57,000
Office	600	519,600	800	692,800
Subtotal		538,600		749,800

Tourism				
Hotel	300	42,600	600	85,200
Entertainment	500	165,500	1,500	496,500
Subtotal		208,100		581,700
TOTAL		1,526,280		2,875,300

As noted in Section 4.2, other water purveyors exist within the South Lewis County Subarea; however, they are not addressed in this study of Needs and Availability.

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## 7. Needs and Availability

### 7.1 Water Available

Table 3-8 is reproduced below with the inclusion of additional water sources that can potentially be developed within the South Lewis County Subarea as Table 7-1. Note the assumptions below the table which have been used for conservative estimating purposes.

**Table 7-1  
Summary of Projected Water Availability**

<b>Parameter</b>	<b>Toledo</b>	<b>Vader</b>	<b>Winlock</b>	<b>Lewis Co</b>	<b>Total</b>
Annual Total in acre-feet	144	362 (2)	482	0	988
Annual Total Average in GPD	128,000	162,000 (3)	430,000	0	720,000
Average Recent Production GPD	74,000	98,000	374,000 (4)	0	546,000
Remainder Available GPD	54,000	64,000	56,000	0	174,000
Reservations in CFS	0.47	0	0.33	3.3 (7)	7.4
WRIA Reservations in GPD	304,000	0	213,000	2,133,000	2,649,000
Potential Conservation in GPD	0	16,000 (5)	34,000 (6)	0	50,000
Reclamation and Reuse in GPD	0	0	50,000 (4)	0	50,000
Revised Availability in GPD	432,000	178,000	727,000	2,133,000	3,470,000

- Notes:
1. Revised Availability = Annual Total in GPD + Reservations + Conservation + Reuse
  2. Instantaneous withdrawal rate as annual total
  3. Annual withdrawal allotment at 50% of instantaneous or 323,200 GPD
  4. Including Cardinal Glass average 50,000 GPD supplied by reuse water
  5. Assume unaccounted water at 20 percent of production
  6. Assume unaccounted water at 15 percent of production
  7. Assume 50 percent of 6.6 CFS reservation total for Lewis County

### 7.2 2030 Water Demands

Water demands projections for the next 20 years developed in Chapter 6 are summarized in Table 7-2 using the high range of estimated water demands for non-residential economic uses derived in Table 6-9

**Table 7-2  
Summary of Projected Water Demand - 2030**

<b>Parameter</b>	<b>Toledo</b>	<b>Vader</b>	<b>Winlock</b>	<b>Lewis Co</b>	<b>Total</b>
Existing Demand GPD	74,000	98,000	374,000	0	546,000
Projected Future Demand GPD	83,000	18,000	593,000	2,875,000	3,569,000
Total 2030 Demand in GPD	157,000	116,000	967,000	2,875,000	4,115,000

Projected water demands show for the cities are interpreted from the tables shown in Chapter 6 based on the population projections used in the South County Subarea Plan.

### 7.3 Apparent Surpluses and Shortages

Comparison of Table 7-1 with Table 7-2 identifies water surpluses and shortages within the South County Subarea as summarized in Table 7-3.

**Table 7-3  
Comparison of Water Demand with Availability**

<b>Parameter</b>	<b>Toledo</b>	<b>Vader</b>	<b>Winlock</b>	<b>Lewis Co</b>	<b>Total</b>
Projected Future Demand GPD	157,000	116,000	967,000	2,875,000	4,115,000
Potential Supply in GPD	432,000	178,000	727,000	2,133,000	3,470,000
Revised Surplus/(Shortage)	275,000	62,000	(240,000)	(62,000)	(329,000)

Several conclusions can be drawn from Table 7-3 and the preceding tables:

1. There may not be sufficient water available in the South County Subarea to meet all of the possible development demands that are envisioned for the next twenty years.
2. The major potential water supply issue exists within the City of Winlock and its' urban growth area. The growth envisioned by Winlock and by the Draft South County Subarea Plan is dependent upon the market for industrial/commercial land. Development may happen at a slower pace; and water demands may be less than projected.
3. The results included in Table 7-1 are believed realistic. It may be possible to achieve even more reduction in unaccounted water within the Vader and Winlock systems.
4. Reuse is largely dependent on finding a year-round customer with significant demand for reclaimed water. The major potential customer included in Table 7-1 is Cardinal Glass. It is not clear that any others will be developed by 2030.
5. Appropriation of the water reservations included in the Watershed Plan for the WRIA will require efforts to offset the stream flow depletions before any water right is actually approved by Ecology, which may mean acquiring existing water rights that would be retired. These requirements introduce some uncertainty into future water availability projects.

Development of new groundwater sources in the areas shown on Figure 3-2 as of 'Low Hydro Process Importance' may be feasible with new wells. However, no evaluation has been conducted of the quantity of water that any well may produce or



of the potential water right that may be granted by the Department of Ecology. Lacking actual data, such potential new water sources are excluded from this assessment.

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## **8. Conclusions**

### **8.1 Data Limitations**

Conclusions reached in this Assessment are based on data readily available. No field explorations were conducted.

Water system plans for the three cities were developed at different dates with different assumptions that do not readily integrate into a fully-consistent assessment for the South Lewis County Subarea.

Water right records readily available indicate a number of wells exist within the South Lewis County Subarea; however, few are located precisely or with attributes quantifying the actual water right, or even if a water right actually exists as many may have lapsed due to non-use within the past 5 years.

### **8.2 Institutional Challenges**

Lewis County and the three cities have indicated a desire to promote economic development within the South Lewis County Subarea, although no formal structure or inter-governmental organization has yet been defined.

Lewis County currently does not plan, construct, operate or maintain public utilities as envisioned in the Subarea Plan.

### **8.3 Strategies**

At least three different strategies are available to the governmental jurisdictions to resolve water needs and availability challenges in the South County Subarea:

1. Individual utility systems can continue to be operated by the three cities through their existing public works departments using their existing water rights, assigned reservations, individually making further improvements as needed and financed.. Lewis County can decide whether to form a water utility to serve non-municipal economic development UGAs or to contract with Winlock or Toledo or both.
2. A cooperative regional partnership could be formed among some or all of the existing governments within the South Lewis County Subarea. Each jurisdiction would remain separate and participate in such joint programs as it deemed beneficial while declining to participate in others.
3. A regional utility could be formed within the South Lewis County Subarea. The utility would own and operate some facilities for general benefit, and could operate a distribution system with customer services and a billing

system. The utility could assume jurisdiction of all or part of a municipal water system if desired.

Advantages and disadvantages exist with each of these strategies. Evaluation of these strategies will take some time and necessarily involve more financial analysis and community discussion before the participating governments can reach decisions as to what is best.

Several variants are possible within each strategy as well. Some of these strategies could be implemented in phases, or could evolve over time.

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**Water Demand for Commercial, Industrial, Tourist, and Recreation Uses  
in Unincorporated Cowlitz County Portions of the Lower Cowlitz, Toutle, and Coweeman Subbasins**

**Table 1.**  
**Acreage Demand Estimates for Commercial/Industrial/Tourist/Recreation Use in Unincorporated Areas of Subbasins**  
Computed as a Proportion of Population and Number of Households

<b>Cowlitz County Portion of Subbasins</b>	<b>2009 Population Estimate for Unincorporated Areas</b>	<b># Households Estimate for Unincorporated Areas</b>	<b>Commercial/Industrial/Tourist/Recreation Acreage Estimate for Unincorporated Areas</b>	<b>2030 Population Projection for Unincorporated Areas</b>	<b>Increase (2009-2030) # Households Projection for Unincorporated Areas</b>	<b>Increase Demand Commercial/Industrial/Tourist/Recreation Acreage in Unincorporated Areas</b>
Lower Cowlitz	18,404	6,945	238	24,852	2,434	83
Toutle	1,704	631	643	2,324	230	234
Coweeman	2,288	877	46	3,084	305	16

**Table 2.**  
**Range of Increase for Average Commercial/Industrial/Tourist/Recreation Water Demand in Unincorporated Areas of Subbasins**  
Computed as a Conversion of Acreage to Total Gallons per Day per 1,000 Square Feet for a Range of Consumptive Use

<b>Cowlitz County Portion of Subbasins</b>	<b>Acreage Increase Demand Commercial/Industrial/Tourist/Recreation in Unincorporated Areas</b>	<b>Square Feet Increase Demand Commercial/Industrial/Tourist/Recreation in Unincorporated Areas</b>	<b>Low to High Range-30 to 600 GPD/1000 SF</b>	<b>CFS conversion Low-high range</b>
Lower Cowlitz	83	3,615,480	108,464 to 2,169,288	.16 to 3.4
Toutle	234	10,193,040	305,791 to 6,115,800	.47 to 9
Coweeman	16	696,960	20,909 to 418,176	.03 to .64

## Explanations

~Because Cowlitz County is not a GMA county, and does not have zoning throughout the county, an alternate method for estimating potential water demand from commercial/industrial/tourist/recreation land use was needed.

~The numbers in both tables are intended to represent potential consumptive water use and future demand for commercial/industrial/tourist/recreation land use in the unincorporated Cowlitz County portions of subbasins.

~2009 Population Estimates, 2030 Population Projections, and Increase (2009 -2030) # of Households are from the Lower Columbia Fish Recovery Board (LCFRB) September 30, 2011 draft *Cowlitz County WRIA 26 Subbasins Domestic Water Use in Unincorporated Areas from permit-exempt wells Potential Streamflow Depletion based on Population Growth Projections to 2030*.

~Population and People per Household Data for *Cowlitz County WRIA 26 Subbasins Domestic Water Use in Unincorporated Areas from permit-exempt wells Potential Streamflow Depletion based on Population Growth Projections to 2030* was prepared by the Office of Financial Management (OFM) Small Area Estimates Program (SAEP) and LCFRB; # Households Estimates used OFM's SAEP data and Increase (2009-2030) # Households was calculated from an average annual estimate of people per household (pph) in each subbasin from annual estimates between 2000 and 2009. The Lower Cowlitz had an average of 2.65 pph, The Toutle had an average of 2.7 pph, and the Coweeman had an average of 2.61 pph.

~ Commercial/Industrial/Tourist/Recreation Acreage Estimates were calculated from Cowlitz County Building and Planning GIS database static snapshot, December 27, 2011. Acreage total for Toutle subbasin was adjusted by removal of the Headquarters Landfill and the Mount St. Helens Visitor Center.

~Increase Demand Commercial/Industrial/Tourist/Recreation Acreage' was calculated by determining the ratio between current acreage for C/I/T/R uses to support the 2009 housing units (for example, 238 acres/6945 households in the Lower Cowlitz) and applying the same ratio to the projected number of housing units (Increase (2009-2030) # Households Projections) to estimate additional C/I/T/R acres needed to support the additional households.

~Thirty to Six Hundred Gallons per Day per 1000 Square Feet Range for Commercial/Industrial/Tourist/Recreation Uses is from the *South Lewis County Utility Water Analysis and Demand Forecast* prepared February 2010 by BHC Consultants.



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# Grays-Elochoman and Cowlitz Rivers Watershed Plan – Phase 4 Implementation

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## **Fish and Flow Work Group – Update on Progress and Methods for Identification of Tributaries of Concern**

### Background:

The WRIA 25/26 Planning Unit is reviewing information from the watershed management plan originally adopted in 2006. As part of that review, the Planning Unit is reviewing the management options originally proposed, including closures, instream flows, and water reservations, with the intent of making sure that recommendations will balance the needs of the communities for out-of-stream water uses, as well as provide adequate protection for in-stream water uses, including fish. The Planning Unit established a Fish and Flow Work Group to further evaluate the needs of fish in relation to flows and habitat in the streams in WRIA 26. Initially this group included staff from Ecology and WDFW, two citizen representatives from the Planning Unit, and an interested party. As the group made progress, additional participants included representatives from Cowlitz County, Cowlitz Conservation District, and Lewis County.

The Fish and Flow Work Group initially began by reviewing the water and habitat needed by local salmon populations for migration, spawning, and rearing. The Group then focused their analysis on identifying tributaries in WRIA 26 where conflicts might occur between habitat and flow needs for fish and potential out of stream uses for development.

In order to identify the particular areas of concern, all key tributaries in WRIA 26 were examined for importance to fish and current and potential development. Several sources were explored and information was compiled. The following steps outline the process followed to collect and analyze information gathered:

1. LCFRB staff compiled information on key tributaries using the 2010 WA Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan (Recovery Plan) and its associated Habitat Strategy. The Recovery Plan identifies high priority stream reaches based on the salmon and steelhead populations present, the importance of each population to recovery efforts, and the importance of that stream reach to that fish population. In addition, WDFW's SalmonScape program was used to document species presence where the Recovery Plan did not identify priority reaches. A spreadsheet was developed to document the information compiled for each stream or tributary system (Attachment A).
2. LCFRB staff used the Lewis County zoning GIS layer (provided by Lewis County 1/18/11) to identify zoning for each tributary system and to provide information on development potential. That information was also recorded in the spreadsheet in Attachment A.
3. WDFW biologists (Wolf Dammers, Hal Beecher, Bryce Glaser, John Serl, Chris Gleizes) met to review the Recovery Plan priorities and SalmonScape information, as well as record their local knowledge of

fish habitat and flow conditions in tributaries. In addition, they noted areas of high importance to fish based on past survey information.

4. In order to identify areas where development could potentially negatively impact flows and thus fish populations, WDFW biologists designated a 'Flow Impact Potential' for each tributary. This designation considered zoning (where available), local knowledge (where zoning was unavailable), importance to fish, and used the following general guidelines for reviewing streams in Lewis county:
  - If zoned STMU<sup>1</sup> or RRC – moderate/high flow impact potential (if not sure if it was served by a municipal system, a '?' was noted)
  - If zoned forest or RDD-20 – low flow impact potential
  - If zoned ARL, RDD-10, or RDD-5 – moderate flow impact potential
  - No information – moderate flow impact potential
  - Tributaries to those with high flow impact potential – high flow impact potentialIn Cowlitz County where zoning was not available, WDFW noted existing development patterns.
5. The Fish and Flow Work Group met to review the information generated by WDFW and add additional information based on local knowledge of conditions. The Work Group met four times between January and May, 2011 to review each tributary. The Work Group discussed existing conditions, importance to fish, flow observations, existing development, potential future development, current land use and ownership, and other factors.

Through these discussions, the Group developed the following categories to sort out areas of concern in the WRIA 26 streams:

- A – low concern
  - B – monitor/adaptive management (no immediate concern)
  - C – some protective measures should be considered (potential impacts)
  - D – define protective measures (impacts)
  - E – active protective measures in place (existing SWSL)
6. These Fish Flow categories were applied to each tributary system and a series of maps (Attachment B) were created to reflect those categories. In addition, the categories, assumptions made, and notes were compiled in the tributary prioritization spreadsheet (Attachment A).

The information developed by the Work Group is intended to assist the Planning Unit in assessing the need for and appropriate type of management action may be needed to ensure both instream and out-of-stream waters needs are satisfied.

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<sup>1</sup> Lewis County zoning codes include Small Town Mixed Use (STMU), Rural Residential Center (RRC), Agricultural Resource Lands (ARL), Rural Development District (RDD), and others.

## Calculating 1-2% of the low flow

In WRIAs 26, recommended maximum reserves were generally calculated using 1-2% of the low flow (defined as the 90% exceedance, described below) during the low flow month (usually August or September).

The data used to determine the recommended maximum reserve amounts in WRIA 26 are calculated directly from USGS stream gage statistics or in the case of Coweeman, from a composite of historic USGS data and recent Ecology gage data at the same location and analyzed to create statistics that mimic USGS statistics.

USGS provides their daily statistics in a “dvstat” file we save as a dvstat.txt file. For an example, see ([http://waterdata.usgs.gov/wa/nwis/dvstat?&site\\_no=14242580&agency\\_cd=USGS&por\\_14242580\\_20=1181412,00060,20,1981-03-24,2009-09-30&stat\\_cds=mean\\_va&referred\\_module=sw&format=rdb](http://waterdata.usgs.gov/wa/nwis/dvstat?&site_no=14242580&agency_cd=USGS&por_14242580_20=1181412,00060,20,1981-03-24,2009-09-30&stat_cds=mean_va&referred_module=sw&format=rdb)). USGS displays their statistics in the form of daily probability percentiles representing the probability that the flow will be below the given number on that day. We use the inverse of percentile, called Exceedance, to represent the chance stream flow will exceed the given number on that day. In other words, the 90% exceedance flow represents a flow that will be exceeded 90% of the time (or flows will be below this value 10% of the time). These are times when flow conditions are a critical stressor for fish.

From the dvstat file provided by USGS, we use the columns labeled p90, p50, and p10 (which stand for 90<sup>th</sup>, 50<sup>th</sup> and 10<sup>th</sup> percentile) and relabel them 10%, 50% and 90% exceedance respectively. We then calculate monthly averages of the different daily statistics. An example of a summary table is provided below.

### Toutle River at Tower Road

Monthly average of daily exceedance flows			
Water Year	Avg 10% Exceedance	Avg 50% Exceedance	Avg 90% Exceedance
October	1978	617	312
November	6045	2116	592
December	7213	2558	1217
January	7220	2818	1204
February	5924	2563	1097
March	4997	2525	1338
April	3961	2319	1593
May	3402	1921	1264
June	2760	1374	835
July	1316	718	477
August	696	451	346
September	767	398	288

Once the USGS or USGS/ECY information is organized and formatted with summary tables, we can easily use it to calculate a variety of hydrologic tools useful to watershed planning. The 1-2% flow number is one of these tools.

From Ecology’s 2008 Guidance for Setting Instream Flows document (currently being updated), recommended maximum reserves are calculated using the 90% exceedance flow during the low flow month. This usually occurs in August or September. Using the example table above, the low flow month occurs in September and the 90% exceedance flow in September is 288 cfs. Taking 1% to 2% of 288 results in a recommended maximum reserve of 2.88 to 5.76 cfs.



Cowlitz Hydrology Summary  
 9/29/2011  
 Pacheco

<b>Hwy 12 Streams</b>	Toe-Width			Habitat Study		10/10/2011 GPS coords	
	8/30-9/1	2C	9/13/2011	9/29/2011			
Mill Creek	29.8	3.72	2.73	0.00		46° 30.973' N	122° 38.228' W
Winston Creek	41.5	5.43	2.19	0.00		46° 29.929' N	122° 33.414' W
Sulphur Creek	17.5	0.43	0.33	0.00		46° 29.386' N	122° 22.93' W
Minnie Creek	4.0	0.05	0.05	0.00		46° 32.203' N	122° 13.852' W
Frost Creek		1.45		0.00		46° 30.172' N	122° 10.834' W
Rainey Creek	25.4	5.29	3.73	0.00		46° 30.463' N	122° 09.48' W
Siler Creek	20.3	3.46	3.46	0.00		47° 30.256' N	121° 55.527' W
Silver Creek	79.5	24.44	23.29	0.00		46° 32.046' N	121° 55.347' W
Hall Creek	14.6	12.41	9.86	0.00		46° 34.746' N	121° 41.301' W
Snyder Creek	5.5	0.66	0.51	0.00		46° 36.201' N	121° 39.535' W
<b>I-5 Streams</b>	Toe-Width		8/30/2011				
King Creek	27.6	0.57		0.79		46° 29.883' N	122° 56.717' W
Curtis Creek	11.2	0.13		0.22		46° 28.057' N	122° 57.431' W
Olequa Creek	54.3	9.18		8.76		46° 25.783' N	122° 58.15' W
Stillwater Creek		3.53		5.51		46° 24.25' N	122° 58.533' W
Brim Creek	20.9	0.86		1.07		46° 25.078' N	122° 59.637' W
McMurphy Creek	4	0.04		0.08		46° 24.433' N	122° 57.8' W
Lacamas Creek	42	3.59		4.50		46° 24.675' N	122° 55.579' W
Cedar Creek	26.8	0.50		1.55		46° 25.783' N	122° 42.567' W
Salmon Creek	59.8	1.86		4.47		46° 25.379' N	122° 50.384' W
Arkansas Creek		3.83		5.67		46° 16.307' N	122° 56.116' W
Delameter Creek		7.68		0.00		46° 15.912' N	122° 55.665' N
Monahan Creek		0.63			5.13	46° 15.802' N	122° 58.428' W
Leckler Creek	8.3	3.37		1.01		46° 12.317' N	122° 55.017' W
Ostrander Creek	33	0.42		4.37		46° 11.683' N	122° 53.283' W
Owl Creek	16.9			0.64		46° 05.493' N	122° 52.157' W